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## ***DATA FORMAT DEFINITION DOCUMENT***

### **SeaBat 7k Data Format, Volume I Version 2.31**

Teledyne RESON A/S  
Fabriksvangen 35  
DK-3550 Slangerup

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|-----------------------|
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**Revision History:**

| Date       | Author       | Rev  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|------------|--------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 04/09/2013 | HMS          | 2.31 | Record Type Definitions:<br>7027 – record type header modified<br>7052 – record type header modified<br>7200 – optional data added<br>7300 – record data added<br>7503 – record type header modified<br>7k Remote Control Definitions:<br>1045 – added<br>Appendix A – record 7400 modified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 05/07/2013 | MHA /<br>HMS | 2.3  | Chapter 10.1 – tables modified<br>Record Type Definitions:<br>1020 – record type header modified<br>2004 – added<br>7017 – record data modified<br>7019 – added<br>7021 – record data modified<br>7027 – record data modified<br>7041 – record type header modified<br>and record data modified<br>7050 – record data modified<br>7051 – record type header modified<br>7503 – record type header modified<br>7504 – record type header modified<br>7510 – text modified<br>7610 – text and record type header modified<br>7k Remote Control Definitions:<br>1002 – text and record data modified<br>1009 – record data modified<br>1019 – added<br>1040 – added<br>1041 – added<br>1038 – record data modified<br>1043 – added<br>1044 – added<br>1402 – added<br>7041 – record data modified<br>Appendix A – record 7400 added |

| Date       | Author | Rev  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------|--------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 07/05/2012 | MHA    | 2.22 | Record Type Definitions:<br>7000 – record type header modified<br>7001 – record data modified<br>7021 – record data modified<br>7036 – removed<br>7052 – record type header modified<br>7503 – record type header modified<br>7510 – added<br>7k Remote Control Definitions:<br>1021 – record data modified<br>1022 – record data modified<br>1037 – record data modified<br>1099 – note removed<br>7610 – record data modified<br>Appendix D – error code 28945 added                                                                  |
| 09/01/2012 | MHA    | 2.21 | Chapter 9 – text modified<br>Chapter 10.1 – table added<br>Record Type Definitions:<br>7007 – record type header modified<br>7008 – record type header modified<br>7011 – record type header modified<br>7012 – record type header modified<br>7017 – record type header modified<br>and record data modified<br>7027 – record type header modified<br>and record data modified<br>7057 – record type header modified<br>7k Remote Control Definitions:<br>1028 – removed, use record type 1020<br>1029 – removed; use record type 1020 |

| Date       | Author | Rev  | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| 25/11/2011 | MHA    | 2.20 | <p>Chapter 6 – data record frame modified</p> <p>Record Type Definitions:</p> <ul style="list-style-type: none"> <li>1020 – record type header modified</li> <li>7000 – record type header modified</li> <li>7007 – record type header modified</li> <li>7008 – record type header modified</li> <li>7011 – record type header modified</li> <li>7012 – record type header modified</li> <li>7017 – record type header modified and record data modified</li> <li>7027 – record type header modified and record data modified</li> <li>7041 – added</li> <li>7052 – record type header modified</li> <li>7055 – record type header modified</li> <li>7057 – record type header modified</li> <li>7503 – record type header modified</li> <li>7504 – record type header modified</li> </ul> <p>7k Remote Control Definitions:</p> <ul style="list-style-type: none"> <li>1002 – record data modified</li> <li>1010 – record data modified</li> <li>1033 – record data modified</li> <li>1035 – record data modified</li> <li>1037 – record data modified</li> <li>1038 – added</li> <li>1039 – added</li> <li>1118 – text adjusted</li> <li>7041 – added</li> </ul> |
| 17/06/2011 | MHA    | 2.11 | <p>Record Type Definitions:</p> <ul style="list-style-type: none"> <li>7005 – moved to Volume II</li> <li>7018 – modified, 7018 7111/7150 removed</li> <li>7026 – removed</li> <li>7058 – is now implemented</li> </ul> <p>Chapter 9 – Time Tagging – Text modified</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 26/05/2011 | MHA    | 2.10 | <p>Record Type Definitions:</p> <ul style="list-style-type: none"> <li>1016 – text adjusted</li> <li>1020 – added</li> <li>1209 – text and table modified</li> <li>7018 – extra information added</li> <li>7021 – table record data modified</li> <li>7027 – text adjusted</li> <li>7503 – table of record type header modified</li> </ul> <p>PDS2000 Optional Data:</p> <ul style="list-style-type: none"> <li>7027 – added</li> <li>7028 – modified</li> <li>7058 – modified</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| Date       | Author   | Rev         | Description                                                                                                                     |
|------------|----------|-------------|---------------------------------------------------------------------------------------------------------------------------------|
| 13/09/2010 | MHA      | 2.00        | The information updated with the latest information. The text checked and all the formats are now in line with the latest code. |
| 11/05/2006 | JM (MD)  | 1.00        |                                                                                                                                 |
| 08/11/2004 | MJF (MD) | 0.54        |                                                                                                                                 |
| 06/10/2004 | MJF (MD) | 0.53        |                                                                                                                                 |
| 19/07/2004 | MJF (MD) | 0.52        |                                                                                                                                 |
| 11/03/2004 | MD       | Preliminary |                                                                                                                                 |

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# **1 INTRODUCTION**

## **1.1 Purpose and Overview**

This document describes the data format used to log and transmit network data using the RESON Application titled “7k Center.” The 7k Center is the primary interface to the sonar and provides auxiliary sensor support. It is included as standard software on all production units.

The 7k Data Format Definition document (DFD) defines record types relevant to the 7k series sonar. It also provides record definitions for generic sensors. This provides a robust, highly expandable generic wrapper format for sonar data in general, which includes all auxiliary sensors and information needed to completely describe data logged during a survey.

This record-based protocol encapsulates data using frames and headers. All records have a unique type identifier, and each record is wrapped within a frame that identifies and describes the content of the record.

A record’s embedded synchronization pattern, combined with its checksum, is a powerful aid in real time record validation and recovery from file corruption.

The data format also defines 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.

Table 1: Terms and Acronyms

| Term           | Definition                                                                                                                 |
|----------------|----------------------------------------------------------------------------------------------------------------------------|
| 7k Data 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                                                                                   |
| BITE           | Built-In Test Environment                                                                                                  |
| COG            | Center of Gravity                                                                                                          |
| Depth          | Distance from the sea surface to the sensor                                                                                |
| DFD            | Data Format Definition (this document)                                                                                     |
| Heading        | True heading                                                                                                               |
| N/A            | Not applicable                                                                                                             |
| Pitch          | Rotation about the across-ship (X) axis                                                                                    |
| Roll           | Rotation about the along-ship (Y) axis                                                                                     |
| SeaBat™ 7k     | Generic term used to describe the SeaBat™ 7000 series of sonar systems, related software components and protocols          |
| TPE            | Total Propagated Error                                                                                                     |
| VRP            | Vessel Reference Point                                                                                                     |
| Yaw            | Rotation about the vertical (Z) axis                                                                                       |

## 2 CONVENTIONS

### 2.1 Overview

This section describes the conventions and definitions used within this document.

### 2.2 Sign Conventions

Unless otherwise stated, all offset measurements shall be relative to the vessel reference point (VRP). Distances shall be in meters, angles in radians, and headings in degrees. The convention used for 3-D coordinate rotation is roll, pitch then yaw. The following sign conventions shall be used:

Table 2: Sign Conventions

| Offset             | Sign | Description                                                                         |
|--------------------|------|-------------------------------------------------------------------------------------|
| X                  | +    | Starboard of the VRP                                                                |
|                    | -    | Port of the VRP                                                                     |
| Y                  | +    | Forward of the VRP                                                                  |
|                    | -    | Astern of the VRP                                                                   |
| Z                  | +    | Distance above the VRP                                                              |
|                    | -    | Distance below the VRP <sup>44</sup>                                                |
| Roll               | +    | Port Up                                                                             |
|                    | -    | Port Down                                                                           |
| Pitch              | +    | Bow up                                                                              |
|                    | -    | Bow down                                                                            |
| Yaw                | +    | Bow to Starboard                                                                    |
|                    | -    | Bow to Port                                                                         |
| Heave              | +    | Up                                                                                  |
|                    | -    | Down                                                                                |
| Heading            | +    | Heading is always positive – from 0 to 359.99°<br>It will never be a negative value |
| Altitude           | +    | Up                                                                                  |
|                    | -    | Down                                                                                |
| Depth              | +    | Up                                                                                  |
|                    | -    | Down                                                                                |
| Tide               | +    | High Tide (Height above a defined point)                                            |
|                    | -    | Low Tide (Height below a defined point)                                             |
| Projector steering | +    | Steer forward                                                                       |
|                    | -    | Steer backward                                                                      |

## 2.3 Vessel Axes

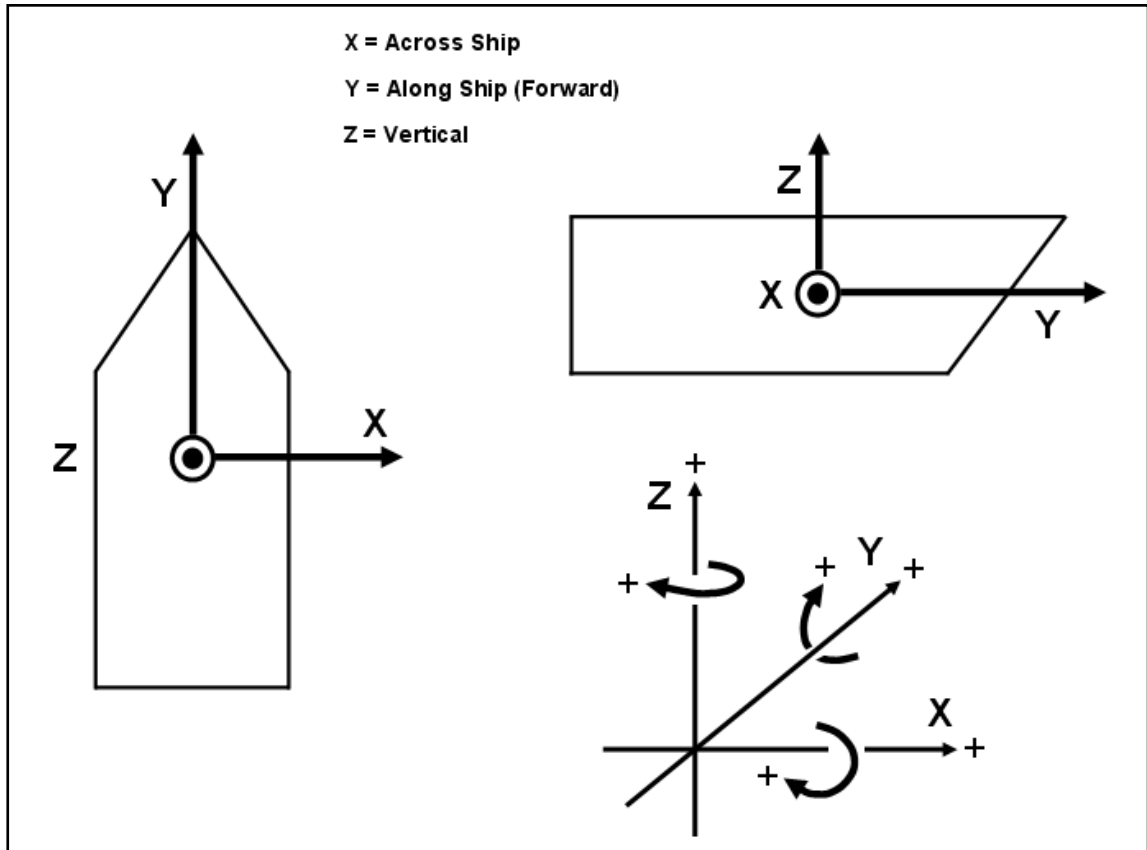


Figure 1: Vessel Axes

## 2.4 Beam Positions

In a standard installation, beam zero represents the first beam on the port side of the sonar array. A reversed head mount system requires the beam order be reversed by post processing software and may not need to be done in the 7k software.

Setting the "Projector Orientation" in the UI does NOT reorder beams in the data output.

## 2.5 Data Type Definitions, Bit Fields, and Byte Alignment

The following data type formats are defined by this document. Data shall be represented in little Endian (Intel) byte-order format unless stated otherwise.

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

Bit fields are frequently used in the data format. A bit field flag indicates whether a feature is activated or deactivated, or in some cases a value.

All Record Type Headers are of static size and shall use “struct member alignment” of 1 byte in memory, also called “Single Byte Alignment”.

## 2.6 Time Convention

Time tags shall be in UTC unless stated otherwise and use the following structure:

Table 3: 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                                                                         |

Also reference the 7KTIME definition in the Data Record Frame description as well as the general section regarding time stamping.

## 3 GETTING STARTED WITH 7K CENTER SOFTWARE

### 3.1 Establishing a Connection

Two communication methods are available to the 7k Center: TCP/IP and UDP/IP. Before sending and receiving records to and from the 7k Center, a socket must be created and a connection to the 7k Center must be established.

A TCP socket must be connected in the sense that it negotiates an error-checking interaction with the socket in the 7k Center. A UDP socket is simpler to create, however it has no error checking or guaranteed delivery. With UDP, a socket is created, and then a record is sent to the IP address and port for the 7k Center to create a connection. TCP/IP is the recommended choice for communicating to the 7k Center application.

**The standard port used by the 7k Center is 7000.** All clients must initiate communication on this port.

### 3.2 Retrieving Data Records

When communicating to the 7k Center, it is crucial that the Protocol field in the Data Record Frame and Network Frame be populated correctly. Refer to *Table 4: Version Concordance* to identify the correct protocol version for your system. Now only version 5 is used.

Table 4: Version Concordance

| Protocol Version<br>(DRF and NF) | DFD<br>Version | Record |
|----------------------------------|----------------|--------|
| 5                                | 0.54 +         | 1      |
| 4                                | 0.51 – 0.53    | -      |
| 3                                | 0.48 – 0.50    | -      |
| 2                                | 0.32 – 0.47    | -      |
| 1                                | 0.1 – 0.31     | -      |

There are two methods for retrieving data from the 7k Center:

- Request a single record
- Subscribe to records

A single record request will result in one record being returned. These are not available for certain data records to prevent system overloading.

In contrast, subscription requests provide streaming data records from the 7k Center for each ping or when newer data is available. For external sensor data, a subscription is updated when newer data is available from the source device or application.

The following list defines the most common single record requests:

- Configuration Data (7001)
- System State (7503)
- Data Storage Status (7052)
- 7k System Events (7050)

There are many records that can be subscribed to and requested. The following list provides some critical records needed for ping-to-ping logging and sonar data processing (this is system and user dependent):

- **7000** – Sonar settings
- **7004** – Beam geometry
- **7006** – Bottom detection results (bathymetric data)
- **7007** – Side-scan data
- **7018** – Beamformed data and snippet
- **7027** – Raw Bathymetry
- **7028** – Snippet
- **7051** – 7k System event messages

**NOTE**

If there are multiple devices attached to the 7k Center, you must subscribe to a specific set of records for each device using separate subscription requests.

### 3.3 Getting System State Information and Commanding

To obtain startup and system state information the client can request a single 7001. Because the requesting program is not expected to know what devices are attached until that record is received. The 7k Center will accept a device ID of 7000 and system enumerator 0 in the DRF/NF for this request.

When the 7001 record has been received, a listing of attached devices can be extracted from that record. The most important information for communication to the 7k Center is the device ID (such as “7101” or “7125”) and the system enumerator (always zero if there is only one device attached).

Following this client synchronization, a 7000 or 7503 (Sonar settings) record can be requested to get current system info for each attached device.

Record 7500 is the primary means of changing sonar settings (for a definition of the 7500 record, see *section 10.53 7500 – 7k Remote Control*). For a detailed description, see *section 11 7k Remote Control Definitions*. When commanding the sonar, you must supply a valid device ID and enumerator in the 7500’s Data Record Frame or the command will be rejected.

**NOTE**

It is possible to bypass the configuration process and hard code the device ID values when deemed appropriate, for instance when simple data logging is needed with little commanding of the sonar.

### 3.4 Terminating Communication

The 7500/1053 command to the 7k Center will stop all subscriptions that match the information provided in the command record. The 1053 command is specific for each device, so a separate 7500/1053 must be sent for each device. The 7500/1053 command should be sent so that the 7k Center is in a well-known state and not still trying to send data to the requesting program. In the case of TCP, closing the socket will stop the data preparation; but UDP does not do so. **UDP links must be explicitly terminated** (see section 11 *7k Remote Control Definitions*).

### 3.5 Record Fragmentation – Special Considerations

The maximum size of packets sent by the 7k Center has been set to 60,000 bytes. There are two reasons for this:

- UDP packet sizes are limited to an implementation-dependent size, usually 64KB.
- If the data is sent in a very large record, the error checking in TCP will require resending of the entire record should a transmission error occur.

For these reasons, the choice has been made to limit the size of packets in all cases. That means that the receiving program must reconstruct the full record from the fragments.

When a record is fragmented, each fragment is sent as a separate packet. The `NETWORK_FRAME` at the beginning of each data segment contains the information necessary to rebuild the record. Two separate numbering schemes are available for reconstruction.

**NOTE**

The `RECORD_FRAME` for the record is not repeated for each packet. It is only present for the first packet of a record.

#### 3.5.1 From Record Counts

In each `NETWORK_FRAME`, there is a `sequence_number` field and a `total_packets` field. All that is necessary is to join the data parts of each packet to the data segments of the preceding packets, stopping when the `sequence_number` is one less than the `total_packets` value (the latter is the same in every packet of a record). (While `total_packets` is the actual number of packets, `sequence_number` is zero-based.)

The data portion of each packet begins at the location specified in the `NETWORK_FRAME`'s `offset` field, which gives the position (in bytes) of the first data byte, relative to the beginning of the `NETWORK_FRAME`. Note that the size of each received packet is returned by the socket code that receives the packets, and the last packet will probably not be 60,000 bytes in length.

### **3.5.2 From Accumulated Packet Sizes**

Reconstructing records from packet sizes is much like using record counts. The data sections are located and appended into a complete record as they are received. The accumulated data byte count is kept and compared to the `total_size` field of the `NETWORK_FRAME` (the same in each packet of a record). The record is complete when the accumulated size equals the total size.

### **3.5.3 Error Checking**

Several error checks are possible on the incoming data. For TCP, there should be no transmission errors, but communications links could be dropped. For UDP, packets can be lost or appear out of order (but on small networks, that is extremely unlikely).

As each packet is received, the sequence numbers of the packets can be examined. Also, since all the packets except for the final one are of known size (data section 60,000 bytes less the size of the `NETWORK_FRAME`), the accumulated size that should be present for a given sequence number can be easily verified to see if packets have been lost.

These assume that the data are all present and are all in order and that no fragments of one fragmented record arrive interspersed between packets of another fragmented record. While this is a reasonable assumption on a small network, it is not necessarily true in general.

## **4 TCP AND UDP**

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.

## 5 7K RECORD DEFINITION

A 7k record consists of a data record frame, a record type header, an optional record data section, and an optional data section for extra information. The Record Data section is considered optional because some remote controls commands consist only of the RTH.

The optional data field typically holds sensor-specific data and third party developer embedded data.

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

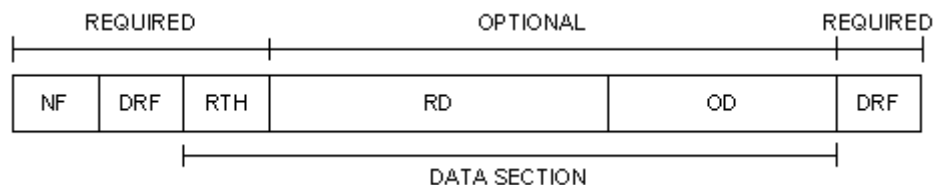
Please note that the Checksum is a required portion of the DRF, which occurs as the last four bytes of every record.

### 7k RECORD

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



Network prepared with the Network Frame (NF).



## 6 DATA RECORD FRAME

The Data Record Frame (DRF) is the 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.

The frame is defined as follows:

Table 5: Data Record Frame

| Name                     | Size    | Description                                                                                                                                                                                          |
|--------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Protocol Version         | u16     | Protocol version of this frame (see <i>Table 4: Version Concordance</i> )                                                                                                                            |
| Offset                   | u16     | Offset in bytes from the start of the sync pattern to the start of the Record Type Header (RTH). 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 Protocol version field to the end of the checksum field — including any embedded data                                                             |
| 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     | User defined                                                                                                                                                                                         |
| 7KTIME                   | u8 * 10 | Time tag indicating when data was produced                                                                                                                                                           |
| Reserved                 | u16     | Reserved                                                                                                                                                                                             |
| Record type identifier   | u32     | Identifier for record type of embedded data                                                                                                                                                          |
| Device identifier        | u32     | Identifier of the device to which this data pertains                                                                                                                                                 |
| System enumerator        | u32     | 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. |
| Reserved                 | u32     | Reserved                                                                                                                                                                                             |

| Name                                        | Size    | Description                                                                                                                                                                                                                                                                 |
|---------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags                                       | u16     | BIT FIELD:<br><u>Bit 0:</u> Checksum<br>0 – Invalid checksum<br>1 – Valid checksum<br><u>Bit 1:</u> Broadcast<br>1 – Enabled<br><u>Bit 2-14:</u> Reserved (must be zero)<br><u>Bit 15:</u><br>0 – Live data<br>1 – Recorded data                                            |
| 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 all byte values (treated as unsigned) 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 32 bit unsigned integer. |

## 7 TCP AND UDP NETWORK FRAME

Records will be packetized using the following prefixed header for both the TCP and UDP/IP protocols. Packet sizes may not vary in a sequence, except for the last packet.

When using UDP protocol, each packet shall be less than or equal to 64K bytes, including the network header.

The following header shall prefix the network packet:

Table 6: Network Frame

| Name                          | Size | Description                                                                                                                                                                                                             |
|-------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Protocol version              | u16  | Protocol version of this frame (see <i>Table 4: Version Concordance</i> )                                                                                                                                               |
| 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 (always 1)                                                                                                                                                     |
| Total records                 | u16  | Total number of records in network packets transmitted (helper field for parsing data). Max 128 records per transmission (always 1).                                                                                    |
| 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 (always 1). |
| 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)                                                                                                                                          |
| Sequence number               | u32  | Sequential packet number; allows correct ordering during reconstruction.<br>Range = 0 to n-1 packets                                                                                                                    |
| Destination device identifier | u32  | 0 – Unspecified<br>0xFFFFFFFF – Not used<br>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<br>0xFFFFFFFF – Not used<br>Any other number is a valid address                                                                                                                                         |

## 8 LOGGING FILE FORMAT

### 8.1 Overview

A valid 7k data file shall be a binary file consisting of a series of data records conforming to the conventions and definitions in this document.

Records must be complete and without the network frame.

A file header record (7200) is recommended to be the first record in each file. This file describes the file's contents.

### 8.2 File Nomenclature

It is recommended that file names be based on the UTC date and time when they are created and utilize an '.s7k' extension as follows:

"YYYYMMDD\_HHMMSS.s7k"

With:

YYYY = Year

MM = Month

DD = Day

HH = Hour

MM = Minutes

SS = Seconds

For example, 20100516\_102852.s7k (Created May 16, 2010 at 10:28:52)

When using third party logging tools, multiple files created at the same time can be differentiated by appending \_X to the filename (where "X" is an integer starting at zero and successively incremented for each file).

For example, 20100516\_102852\_0.s7k and 20100516\_102852\_1.s7k

### 8.3 7k Center Logged Files

The 7k Center logs data in order it is received. In the case of sonar data, this guarantees that the pings are logged in sequential (and therefore chronological) order. In general, however, the data in a log file cannot be guaranteed to be in chronological order.

Record 7052 (7K Data Storage Status) can be used to determine which records are available and current record logging filters. Remote command 1209 (Set Filtering) is used to set the record logging filters.

Complete files generated using RESON 7k Center software will always begin with a 7200 record and will usually be followed by a 7001 record and contain a 7300 record as the last record in the file. This record is for RESON diagnostic use only.

Incoming 7k Remote Controls (record 7500) are not logged in 7k files generated by the 7k Center. Remote controls activity is stored in a separate log file. These files are for RESON diagnostic use only. Network Frames are also not logged.

The default extension for 7k Center logged files is \*.s7k, where the '\*' represents the filename.

## **9 TIME TAGGING**

Through the IO Module the time of the system has to be synced with a PPS and a time message from a GPS (for instance a ZDA message).

Time tags reside in the DRF for each record. The time stamp in the record is always the time at which the data, contained in the record, was generated. It does not refer to the time that the record was formatted or sent.

For ping related records, the time stamp refers to the time when the sonar transmitter finishes a ping.

The time stamping for messages received from a sensor depends on the selected driver in the IO Module. In general, the position will use time in message and other sensors use time of arrival of the first character. For some sensors (e.g POS MV), the time will be time in message; the time as is defined in the message string.

## 10 RECORD TYPE DEFINITIONS

### 10.1 Overview

The following table summarizes the allocated record type identifiers for the RESON 7k sonar and generic sensors. This table is not necessarily a complete listing of allocated or reserved record types.

Table 7: Record Type Definitions

| Record Type       | Description                             |
|-------------------|-----------------------------------------|
| 1000 – 1999       | Reserved for generic sensor records     |
| 1000              | Reference point                         |
| 1001              | Sensor offset position                  |
| 1002              | Sensor offset position calibrated       |
| 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                                |
| 1017              | Pan tilt                                |
| 1020              | Sonar installation identifiers          |
| 1022              | Reserved for IOP motion                 |
| 1050              | Reserved for generic sensor calibration |
| 1200              | Reserved for generic side-scan sonar    |
| 1500 – 1599       | Reserved for future QC records          |
| 7000 – 7999       | Reserved for SeaBat™ 7k records         |
| 7000 <sup>1</sup> | 7k sonar settings                       |

<sup>1</sup> These records are available by subscription only.

| Record Type       | Description                                |
|-------------------|--------------------------------------------|
| 7001              | 7k configuration                           |
| 7002              | 7k match filter                            |
| 7003              | 7k firmware and hardware configuration     |
| 7004              | 7k beam geometry                           |
| 7005              | Reserved for 7k calibration data           |
| 7006              | 7k bathymetric data                        |
| 7007 <sup>1</sup> | 7k side-scan data                          |
| 7008 <sup>1</sup> | 7k generic water column data               |
| 7009              | Reserved for vertical depth                |
| 7010 <sup>1</sup> | TVG values                                 |
| 7011 <sup>1</sup> | 7k image data                              |
| 7012 <sup>1</sup> | 7k ping motion data                        |
| 7016              | Reserved for extended bottom detect info   |
| 7017 <sup>1</sup> | 7k detection data setup                    |
| 7018 <sup>1</sup> | 7k beamformed data                         |
| 7021              | 7k built-in test environment data          |
| 7022              | 7k Center version                          |
| 7023              | 8k wet end version                         |
| 7024              | Reserved for license information           |
| 7026 <sup>1</sup> | Reserved for 7k detection data             |
| 7027 <sup>1</sup> | 7k raw detection data                      |
| 7028 <sup>1</sup> | 7k snippet data                            |
| 7030              | Reserved for sonar installation parameters |
| 7037              | Reserved for raw I & Q data file header    |
| 7038 <sup>1</sup> | Reserved for raw I & Q data                |
| 7040              | Reserved for 7k Tx configuration files     |
| 7041 <sup>1</sup> | Compressed Beamformed Magnitude Data       |
| 7048              | 7k calibrated beam data                    |
| 7050              | 7k system events                           |
| 7051              | 7k system event message                    |
| 7052              | RDR recording status                       |
| 7053              | 7k subscriptions                           |

<sup>1</sup> These records are available by subscription only.

| Record Type       | Description                                                 |
|-------------------|-------------------------------------------------------------|
| 7055              | Normalization status                                        |
| 7057              | Calibrated side-scan data                                   |
| 7058              | Calibrated snippet data                                     |
| 7060              | Reserved for 7k target data                                 |
| 7068 <sup>1</sup> | Reserved                                                    |
| 7200              | 7k file header                                              |
| 7300              | 7k file catalogue record                                    |
| 7310              | Reserved for 7k trigger                                     |
| 7311              | Reserved for 7k trigger sequence setup                      |
| 7312              | Reserved for 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              | 7P sensor settings                                          |
| 7505              | Reserved                                                    |
| 7510              | SV Filtering                                                |
| 7511              | System lock status                                          |
| 7515              | Timestamp (not described in the documentation)              |
| 7610              | 7k sound velocity                                           |
| 7611              | 7k absorption loss                                          |
| 7612              | 7k spreading loss                                           |
| 7613              | Reserved                                                    |
| 7900 – 7999       | Reserved                                                    |
| 8012 <sup>1</sup> | Pitch, yaw, heave flag (not described in the documentation) |
| 8100              | 8k series sonar data (not described in the documentation)   |
| 11000 – 11299     | Reserved                                                    |
| 81000 – 87999     | Reserved                                                    |

Not all records shown in this section are available for all systems. Availability of certain records will depend on the specific installation. In most cases, only SeaBat™ relevant data is produced from the 7k Center.

<sup>1</sup> These records are available by subscription only.

The record types mentioned below in the table are the record types that are logged for the different 7k systems.

Table 8: Available Record Types per 7k System

| Record Types | 7k Systems |      |      |      |      |      |      |      |      |      |       |
|--------------|------------|------|------|------|------|------|------|------|------|------|-------|
|              | 7100       | 7101 | 7111 | 7112 | 7122 | 7123 | 7125 | 7128 | 7130 | 7150 | 8125H |
| 1000         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1001         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1002         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1003         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1004         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1005         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1006         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1007         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1008         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1009         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1010         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1011         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1012         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1013         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1014         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1015         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1016         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1017         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 1050         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 7000         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 7001         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 7002         | X          | X    |      | X    | X    | X    | X    | X    | X    |      | X     |
| 7004         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 7006         | X          | X    | X    |      |      |      | X    | X    | X    | X    | X     |
| 7007         | X          | X    | X    |      |      |      | X    | X    | X    | X    | X     |
| 7008         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 7010         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 7011         | X          | X    | X    | X    | X    | X    | X    | X    | X    | X    | X     |
| 7012         | X          | X    |      | X    |      |      | X    | X    | X    |      | X     |
| 7017         | X          | X    |      |      |      |      | X    | X    | X    |      | X     |

| Record Types | 7k Systems |      |      |      |      |      |      |      |      |      |       |
|--------------|------------|------|------|------|------|------|------|------|------|------|-------|
|              | 7100       | 7101 | 7111 | 7112 | 7122 | 7123 | 7125 | 7128 | 7130 | 7150 | 8125H |
| 7018         | x          | x    | x    | x    | x    | x    | x    | x    | x    | x    | x     |
| 7021         | x          | x    | x    | x    | x    | x    | x    | x    | x    | x    | x     |
| 7022         | x          | x    |      | x    |      |      | x    | x    | x    | x    | x     |
| 7027         | x          | x    |      |      |      |      | x    | x    | x    |      | x     |
| 7028         | x          | x    |      |      |      |      | x    | x    | x    | x    | x     |
| 7038         |            |      | x    |      | x    | x    |      |      |      | x    |       |
| 7039         |            |      | x    |      | x    | x    |      |      |      |      |       |
| 7041         |            |      | x    |      |      |      |      |      |      |      |       |
| 7048         |            |      | x    |      | x    | x    |      |      |      |      |       |
| 7057         |            |      | x    |      |      |      |      |      |      |      |       |
| 7058         |            |      | x    |      |      |      |      |      |      |      |       |
| 7068         |            |      |      |      | x    | x    |      |      |      |      |       |
| 7200         | x          | x    | x    | x    | x    | x    | x    | x    | x    | x    | x     |
| 7300         | x          | x    |      | x    | x    |      | x    | x    |      |      | x     |
| 7400         |            |      |      |      |      |      |      |      |      | x    |       |
| 7500         |            |      |      |      | x    |      |      |      |      |      |       |
| 7503         | x          | x    | x    | x    | x    | x    | x    | x    | x    | x    | x     |
| 7504         | x          | x    |      | x    |      |      | x    | x    | x    | x    | x     |
| 7505         |            |      |      |      | x    | x    |      |      |      |      |       |
| 7510         |            |      |      |      |      |      | x    |      |      |      |       |
| 7511         | x          | x    |      | x    | x    | x    | x    | x    | x    |      | x     |
| 7610         | x          | x    |      |      |      |      | x    | x    | x    |      | x     |
| 7611         | x          | x    |      |      |      |      | x    | x    | x    |      | x     |
| 7612         | x          | x    |      |      |      |      | x    | x    | x    |      | x     |

## 10.2 1000 – Reference Point

**Description:** Reference point Information.

**Data Definition:**

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

Table 9: 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. |

## 10.3 1001 – Sensor Offset Position

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

**Data Definition:**

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

Table 10: 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                     |

## 10.4 1002 – Sensor Offset Position Calibrated

**Description:** Sensor offset position information data (calibrated).

**Data Definition:**

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

Table 11: 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 radian                    |
| Sensor yaw angle offset   | f32  | Yaw angle offset in radians                     |

## 10.5 1003 – Position

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

**Data Definition:**

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

Table 12: 1003 – Record Type Header

| Name                               | Size | Description                                          |
|------------------------------------|------|------------------------------------------------------|
| Datum identifier                   | u32  | 0 – WGS84<br>>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<br>1 – Grid coordinates |
| UTM zone                           | u8   | UTM Zone                                             |
| Quality flag                       | u8   | 0 – Navigation Data<br>1 – Dead-Reckoning            |

| Name                       | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Positioning method         | u8   | 0 – GPS<br>1 – DGPS<br>2 – Start of inertial positioning system from GPS<br>3 – Start of inertial positioning system from DGPS<br>4 – Start of inertial positioning system from bottom correlation<br>5 – Start of inertial positioning from bottom object<br>6 – Start of inertial positioning from inertial positioning<br>7 – Start of inertial positioning from optional data<br>8 – Stop of inertial positioning system to GPS |
| Positioning method (cont.) | u8   | 9 – Stop of inertial positioning system to DGPS<br>10 – Stop of inertial positioning system to bottom correlation<br>11 – Stop of inertial positioning to bottom object<br>12 – Start of inertial positioning to inertial positioning<br>13 – Start of inertial positioning to optional data<br>14 – User defined                                                                                                                   |

## 10.6 1004 – Custom Attitude Information

**Description:** Attitude Data Record. The length of this record is dynamic and is based on the field mask. The bit field mask determines 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).

| <b>NOTE</b>                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------|
| 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 13: 1004 – Record Type Header

| Name       | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Field mask | u8   | BIT FIELD:<br><u>Bit 0:</u><br>0 – No pitch<br>1 – Pitch in radians<br><u>Bit 1:</u><br>0 – No roll<br>1 – Roll in radians<br><u>Bit 2:</u><br>0 – No heading<br>1 – Heading in radians<br><u>Bit 3:</u><br>0 – No heave<br>1 – Heave in meters<br><u>Bit 4:</u><br>0 – No pitch<br>1 – Pitch rate of change in radians per second<br><u>Bit 5:</u><br>0 – No roll rate<br>1 – Roll rate of change in radians per second<br><u>Bit 6:</u><br>0 – No heading rate<br>1 – Heading ate of change in radians per second<br><u>Bit 7:</u><br>0 – No heave rate<br>1 – Heave rate of change in meters per second |
| Reserved   | u8   | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| N          | u16  | Number of repeated fields in the record                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Frequency  | f32  | Sample rate in samples / second (required if multiple samples are used per record)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

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

Table 14: 1004 – Record Data

| Name      | Size | Description |
|-----------|------|-------------|
| FIELD 0   | f32  | Sensor data |
| ...       | ...  | ...         |
| FIELD N-1 | f32  | Sensor data |

## 10.7 1005 – Tide

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

| <b>NOTE</b>                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 15: 1005 – Record Type Header

| Name                               | Size | Description                                                                                                                                        |
|------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| Tide                               | f32  | Height correction above mean sea level in meters                                                                                                   |
| Source                             | u16  | 0 – Unspecified<br>1 – Table (predicted)<br>2 – Measured (gauge)                                                                                   |
| Flags                              | u8   | BIT FIELD:<br><u>Bit 0:</u><br>0 – Gauge ID invalid<br>1 – Gauge ID valid<br><u>Bit 1:</u><br>0 – Position info invalid<br>1 – Position info valid |
| Gauge identifier                   | u16  | User defined                                                                                                                                       |
| Datum identifier                   | u32  | 0 – WGS84<br>>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<br>1 – Grid coordinates |
| UTM zone           | u8   | UTM zone                                             |

## 10.8 1006 – Altitude

**Description:** Altitude data record.

**Data Definition:**

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

Table 16: 1006 – Record Type Header

| Name     | Size | Description                                                                |
|----------|------|----------------------------------------------------------------------------|
| Distance | f32  | Distance from seafloor in meters to sensor, positive up (0 at sea bottom). |

## 10.9 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 17: 1007 – Record Type Header

| Name      | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags     | u8   | <b>BIT FIELD:</b><br><u>Bit 0:</u> Speed in X, Y & Z directions (m/s); each an f32 if present<br><u>Bit 1:</u> Acceleration in X, Y & Z directions (m/s <sup>2</sup> ); each an f32 if present<br><u>Bit 2-7:</u> Reserved<br>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                                                                                                                                                                                                                                                                                                                                                                                                            |
| N         | u16  | Number of sensor readings                                                                                                                                                                                                                                                                                                                                                                                           |
| Frequency | f32  | Sample rate in sensor readings per second                                                                                                                                                                                                                                                                                                                                                                           |

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

Table 18: 1007 – Record Data

| Name        | Size                        | Description |
|-------------|-----------------------------|-------------|
| Reading 0   | Variable (3x f32 or 6x f32) | Motion data |
| ...         | ...                         | ...         |
| Reading N-1 | variable (3x f32 or 6x f32) | Motion data |

## 10.10 1008 – Depth

**Description:** Depth data record.

**Data Definition:**

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

Table 19: 1008 – Record Type Header

| Name             | Size | Description                                                                     |
|------------------|------|---------------------------------------------------------------------------------|
| Depth descriptor | u8   | 0 – Depth to sensor<br>1 – Water depth                                          |
| Correction flag  | u8   | 0 – RAW depth (as measured)<br>1 – Corrected depth (relative to mean-sea level) |
| Reserved         | u16  | Reserved                                                                        |
| Depth            | f32  | The deeper, the bigger (positive) this value becomes                            |

## 10.11 1009 – Sound Velocity Profile

**Description:** Sound velocity profile data record.

**Data Definition:**

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

Table 20: 1009 – Record Type Header

| Name          | Size | Description                                              |
|---------------|------|----------------------------------------------------------|
| Position flag | u8   | 0 – Invalid position fields<br>1 – Valid position fields |
| Reserved      | u8   | Reserved                                                 |
| Reserved      | u16  | Reserved                                                 |
| Latitude      | f64  | Latitude in radians (WGS84)                              |
| Longitude     | f64  | Longitude in radians (WGS84)                             |
| N             | u32  | Number of samples                                        |

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

Table 21: 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 |

## 10.12 1010 – CTD

**Description:** CTD Data Record

**Data Definition:**

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

Table 22: 1010 – Record Type Header

| Name                       | Size | Description                                                                                                                                                                                                                            |
|----------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Frequency                  | f32  | Frequency                                                                                                                                                                                                                              |
| Sound velocity source flag | u8   | 0 – Not computed<br>1 – CTD<br>2 – User computed                                                                                                                                                                                       |
| Sound velocity algorithm   | u8   | 0 – Not computed<br>1 – Chen Millero<br>2 – Del Grosso                                                                                                                                                                                 |
| Conductivity flag          | u8   | 0 – Conductivity<br>1 – Salinity                                                                                                                                                                                                       |
| Pressure flag              | u8   | 0 – Pressure<br>1 – Depth                                                                                                                                                                                                              |
| Position flag              | u8   | 0 – Invalid position fields<br>1 – Valid position fields                                                                                                                                                                               |
| Sample content validity    | u8   | BIT FIELD:<br>(Bit set means field is valid otherwise zero)<br><u>Bit 0</u> : Conductivity/Salinity<br><u>Bit 1</u> : Water temperature<br><u>Bit 2</u> : Pressure/Depth<br><u>Bit 3</u> : Sound velocity<br><u>Bit 4</u> : Absorption |
| Reserved                   | u16  | Reserved                                                                                                                                                                                                                               |
| Latitude                   | f64  | Latitude in radians (WGS84)                                                                                                                                                                                                            |
| Longitude                  | f64  | Longitude in radians (WGS84)                                                                                                                                                                                                           |

| Name        | Size | Description       |
|-------------|------|-------------------|
| Sample rate | f32  | Sample rate       |
| N           | u32  | Number of samples |

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

Table 23: 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     |

### 10.13 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. The optional data portion of the record is used to contain custom projection parameters.

**Data Definition:**

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

Table 24: 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                                                    |
| Datum name         | u8 * 32 | Datum name: e.g. "WGS84"                                    |

| Name                    | Size    | Description                                                                                                                                                      |
|-------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Data calculation method | u32     | 0 – Molodensky<br>1 – Bursa / Wolfe<br>2 – DMA MRE<br>3 – NADCON<br>4 – HPGN<br>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 (radians)                                                                                                                                             |
| RY                      | f64     | Y Rotation (radians)                                                                                                                                             |
| RZ                      | f64     | Z Rotation (radians)                                                                                                                                             |
| Scale                   | f64     | Device scaling                                                                                                                                                   |
| 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” (see APPENDIX C)                                                                                                          |
| Grid distance units     | u8      | 0 – Meters<br>1 – Feet<br>2 – Yards<br>3 – US Survey Feet<br>4 – Kilometers<br>5 – Miles<br>6 – US Survey Miles<br>7 – Nautical Miles<br>8 – Chains<br>9 – Links |
| Grid angular units      | u8      | 0 – Radians<br>1 – Degrees<br>2 – Degrees, minutes, seconds<br>3 – Gradians<br>4 – Arc-seconds                                                                   |
| Latitude of origin      | f64     |                                                                                                                                                                  |
| Central meridian        | f64     |                                                                                                                                                                  |
| False easting           | f64     | Meters                                                                                                                                                           |
| False northing          | f64     | Meters                                                                                                                                                           |
| Central scale factor    | f64     |                                                                                                                                                                  |

| Name              | Size    | Description                                                                                            |
|-------------------|---------|--------------------------------------------------------------------------------------------------------|
| Custom identifier | i32     | Used to define projection specific parameters<br>-2 – Custom<br>-1 – Not used<br>(Refer to APPENDIX C) |
| Reserved 3        | u8 * 50 | Reserved                                                                                               |

For a list of currently reserved Custom Identifiers, see *APPENDIX B Device Identifiers*.

## 10.14 1012 – Roll Pitch Heave

**Description:** Motion Data Record.

**Data Definition:**

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

Table 25: 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  |

## 10.15 1013 – Heading

**Description:** Vessel Heading Record.

**Data Definition:**

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

Table 26: 1013 – Record Type Header

| Name    | Size | Description               |
|---------|------|---------------------------|
| Heading | f32  | Vessel heading in radians |

## 10.16 1014 – Survey Line

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

**Data Definition:**

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

Table 27: 1014 – Record Type Header

| Name               | Size    | Description                                                             |
|--------------------|---------|-------------------------------------------------------------------------|
| Waypoint count (N) | u16     | Number of points in the line / route                                    |
| Position type      | u16     | 0 – Latitude/Longitude<br>1 – Grid coordinates                          |
| Radius             | f32     | Turn radius between line segments (meters)<br>0 – No curvature in turns |
| Line name          | u8 * 64 | Null terminated string – line name                                      |

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

Table 28: 1014 – Record Data

| Name                     | Size | Description                                                             |
|--------------------------|------|-------------------------------------------------------------------------|
| Latitude or northing 0   | f64  | Latitude (radians) or northing (meters)<br>$-\pi/2$ to $\pi/2$ , -south |
| Longitude or easting 0   | f64  | Longitude (radians) or easting (meters)<br>$-\pi$ to $\pi$ , -west      |
| ...                      | ...  | ...                                                                     |
| Latitude or northing N-1 | f64  | Latitude (radians) or northing (meters)                                 |
| Longitude or easting N-1 | f64  | Longitude (radians) or easting (meters)                                 |

## 10.17 1015 – Navigation

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

**Data Definition:**

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

Table 29: 1015 – Record Type Header

| Name               | Size | Description                                                                   |
|--------------------|------|-------------------------------------------------------------------------------|
| Vertical reference | u8   | 1 – Ellipsoid<br>2 – Geoid<br>3 – Chart datum                                 |
| Latitude           | f64  | Latitude of vessel reference point in radians<br>$-\pi/2$ to $\pi/2$ , -south |

| Name                         | Size | Description                                                                |
|------------------------------|------|----------------------------------------------------------------------------|
| Longitude                    | f64  | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , -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                              |

## 10.18 1016 – Attitude

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

**Data Definition:**

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

Table 30: 1016 – Record Type Header

| Name                         | Size | Description         |
|------------------------------|------|---------------------|
| Number of attitude data sets | u8   | Number of data sets |

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

Table 31: 1016 – Record Data

| Name                                        | Size | Description                     |
|---------------------------------------------|------|---------------------------------|
| Time difference from record timestamp 0     | u16  | Time difference in milliseconds |
| Roll [0]                                    | f32  | Roll measured in radians        |
| Pitch [0]                                   | f32  | Pitch measured in radians       |
| Heave [0]                                   | f32  | Heave measured in meters        |
| Heading [0]                                 | f32  | Heading of vessel in radians    |
| ...                                         | ...  | ...                             |
| Time difference from record timestamp [N-1] | u16  | Time difference in milliseconds |
| Roll [N-1]                                  | f32  | Roll measured in radians        |
| Pitch [N-1]                                 | f32  | Pitch measured in radians       |
| Heave [N-1]                                 | f32  | Heave measured in meters        |
| Heading [N-1]                               | f32  | Heading of vessel in radians    |

## 10.19 1017 – Pan Tilt

**Description:** This record is the pan tilt input from an external source.

**Data Definition:**

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

Table 32: 1017 – Record Type Header

| Name | Size | Description      |
|------|------|------------------|
| Pan  | f32  | Angle in radians |
| Tilt | f32  | Angle in radians |

## 10.20 1020 – Sonar Installation Identifiers

**Description:** This record gives the information on the MBES Linear and Angular Offsets and the wet-end configuration. XYZ offsets are measured from the Sonar Reference Point (SRP) to the acoustic center of the Tx array and to the acoustic center of the Rx array. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 33: 1020 – Record Type Header

| Name                                           | Size | Description                                                                                                                                                                                                                                       |
|------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System Identification Number                   | u32  | Sonar ID                                                                                                                                                                                                                                          |
| Transmitter Identification Number              | u32  | Tx Unit ID                                                                                                                                                                                                                                        |
| Receiver Identification Number                 | u32  | Rx Unit ID                                                                                                                                                                                                                                        |
| Standard Configuration Options <sup>(*)</sup>  | u32  | 0 = Custom<br>Otherwise this specifies system dependant standard installation parameters and all installation defined parameters below are ignored.                                                                                               |
| Configuration Fixed Parameters <sup>(**)</sup> | u32  | Defines configuration's defined parameters<br>BIT FIELD, 1 = fixed:<br><u>Bit 0-2:</u> Tx to Rx XYZ Linear Offsets<br><u>Bit 3-5:</u> Tx to Reference XYZ Linear Offsets<br><u>Bit 6-8:</u> Tx to Rx Angular Offsets<br><u>Bit 9-15:</u> Reserved |

| Name                         | Size    | Description                                                                                    |
|------------------------------|---------|------------------------------------------------------------------------------------------------|
| Tx Length (Y)                | f32     | Measured values of Tx hardware, in meters. Flat arrays set to 0.                               |
| Tx Width (X)                 | f32     |                                                                                                |
| Tx Height (Z)                | f32     |                                                                                                |
| Tx Radius                    | f32     |                                                                                                |
| SRP to Tx X Linear Offset    | f32     | XYZ linear offsets from the SRP to the acoustic center of the transmitter, in meters.          |
| SRP to Tx Y Linear Offset    | f32     |                                                                                                |
| SRP to Tx Z Linear Offset    | f32     |                                                                                                |
| Tx Roll Angular Offset       | f32     | Angular offsets are from array main axes to motion axes in Lagrange coordinates, in radians.   |
| Tx Pitch Angular Offset      | f32     |                                                                                                |
| Tx Yaw Angular Offset        | f32     |                                                                                                |
| Rx Length (Y)                | f32     | Measured values of Tx hardware, in meters. Flat arrays set to 0.                               |
| Rx Width (X)                 | f32     |                                                                                                |
| Rx Height (Z)                | f32     |                                                                                                |
| Rx Radius                    | f32     |                                                                                                |
| SRP to Rx X Linear Offset    | f32     | XYZ linear offsets from the SRP to the acoustic center of the transmitter, in meters.          |
| SRP to Rx Y Linear Offset    | f32     |                                                                                                |
| SRP to Rx Z Linear Offset    | f32     |                                                                                                |
| Rx to Rx Roll Angular Offset | f32     | Angular offsets are from array main axes to motion axes in Lagrange coordinates, in radians.   |
| Rx Pitch Angular Offset      | f32     |                                                                                                |
| Rx Yaw Angular Offset        | f32     |                                                                                                |
| Frequency                    | f32     | System frequency                                                                               |
| VRP to SRP Offset (X)        | f32     | XYZ linear offsets from the vessel reference to the sonar reference point, in meters.          |
| VRP to SRP Offset (Y)        | f32     |                                                                                                |
| VRP to SRP Offset (Z)        | f32     |                                                                                                |
| Reserved                     | u8 * 48 | This field is reserved for system specific parameters and will be defined on per system basis. |

(\*) When this record is received by 7k Center, all offset fields that are fixed for specified configuration are ignored and factory values are used. When this record is sent by 7k Center, all offset fields are filled in with the offsets in use, and configuration is set to the last received. All standard configurations will be defined on per system basis.

(\*\*) When this record is received by 7k Center, this field is ignored. When this record is sent by 7k Center, this field specifies which fields are fixed for the specified configuration.

## 10.21 2004 – Sonar Pipe Environment

**Description:** Sonar pipe environment from SeaBat UI Pipe Detection and Tracking system. This record is a five point description of a tracked pipe line. Pipe environment records are only available for finalized points of a tracked pipe line. The Cartesian coordinates are in sonar space and are for reference only. Points can be positioned between two sonar beams on the ping.

**Data Definition:**

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

Table 34: 2004 – Record Type Header

| Name                  | Size   | Description                                               |
|-----------------------|--------|-----------------------------------------------------------|
| Pipe number           | u32    | Pipe identifier                                           |
| Ping time             | 7kTime | Time                                                      |
| Ping number           | u32    | Sequential number                                         |
| Multi-ping sequence   | u32    | Sub number                                                |
| Pipe diameter         | f32    | Diameter of the pipe in meters                            |
| Sound velocity        | f32    | Sound velocity in m/s                                     |
| Sample rate           | f32    | Sonar's sampling frequency in Hz                          |
| Finished              | u8     | 0 – Pipe is still growing<br>Otherwise – Pipe is finished |
| Number of points      | u32    | Number of point sub records                               |
| Point sub record size | u32    | Size of sub record                                        |
| Reserved              | u32*10 | Reserved                                                  |

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

Table 35: 7001 – Record Data

| Name          | Size | Description                                |
|---------------|------|--------------------------------------------|
| X             | f32  | X coordinate in sonar space in meters      |
| Y             | f32  | Y coordinate in sonar space in ping number |
| Z             | f32  | Z coordinate in sonar space in meters      |
| Angle         | f32  | Point angle in radians                     |
| Sample number | f32  | Sample number                              |

## 10.22 7000 – 7k Sonar Settings

**Description:** This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the current sonar settings. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 36: 7000 – 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 is the sequence number of the ping in the multi-ping sequence. |
| Frequency                    | f32  | Transmit frequency in Hertz                                                                                                                                    |
| Sample rate                  | f32  | Sample rate in Hertz                                                                                                                                           |
| Receiver bandwidth           | f32  | In Hertz                                                                                                                                                       |
| Tx pulse width               | f32  | In seconds                                                                                                                                                     |
| Tx pulse type identifier     | u32  | 0 – CW<br>1 – Linear chirp<br>2 – Multi-ping 2<br>3 – Multi-ping 4                                                                                             |
| Tx pulse envelope identifier | u32  | 0 – Tapered rectangular<br>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                                                                                                                                        |
| Range selection              | f32  | Range selection in meters                                                                                                                                      |
| Power selection              | f32  | Power selection in dB re 1μPa                                                                                                                                  |
| Gain selection               | f32  | Gain selection in dB                                                                                                                                           |

| Name                                     | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Control flags                            | u32  | <p><b>BIT FIELD:</b></p> <p><u>Bit 0-3:</u> Auto range method</p> <p><u>Bit 4-7:</u> Auto bottom detection filter method</p> <p><u>Bit 8:</u> Bottom detection range filter enabled.</p> <p><u>Bit 9:</u> Bottom detection depth filter enabled</p> <p><u>Bit 10:</u> Receiver gain method Auto Gain</p> <p><u>Bit 11:</u> Receiver gain method Fixed Gain</p> <p><u>Bit 12:</u> Receiver gain method Reserved</p> <p><u>Bit 13-14:</u> Reserved</p> <p><u>Bit 15:</u></p> <ul style="list-style-type: none"> <li>0 – System inactive</li> <li>1 – Active</li> </ul> <p><u>Bit 16-21:</u> Reserved for bottom detection</p> <p><u>Bit 22:</u> Adaptive gate</p> <ul style="list-style-type: none"> <li>1 – Enabled</li> </ul> <p><u>Bit 23:</u> Adaptive gate depth filter</p> <ul style="list-style-type: none"> <li>1 - Enabled</li> </ul> <p><u>Bit 24:</u> Trigger out</p> <ul style="list-style-type: none"> <li>1 – Enabled</li> </ul> <p><u>Bit 25:</u> Trigger in edge</p> <ul style="list-style-type: none"> <li>0 – Positive</li> <li>1 – Negative</li> </ul> <p><u>Bit 26:</u> PPS edge</p> <ul style="list-style-type: none"> <li>0 – Positive</li> <li>1 – Negative</li> </ul> <p><u>Bit 27-28:</u> Timestamp State</p> <ul style="list-style-type: none"> <li>0 – Timestamp not applicable</li> <li>1 – Timestamp error / not valid</li> <li>2 – Timestamp warning / use caution</li> <li>3 – Timestamp ok / valid</li> </ul> <p><u>Bit 29-30:</u> Reserved</p> <p><u>Bit 31:</u></p> <ul style="list-style-type: none"> <li>0 – 7K</li> <li>1 – Simulator</li> </ul> |
| Projector identifier                     | 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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

| Name                                      | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Projector beam -3dB beam width horizontal | f32  | In radians                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Projector beam focal point                | f32  | In meters                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Projector beam weighting window type      | u32  | 0 – Rectangular<br>1 – Chebychev                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Projector beam weighting window parameter | f32  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Transmit flags                            | u32  | BIT FIELD:<br><u>Bit 0-3</u> : Pitch stabilization method<br><u>Bit 4-7</u> : Yaw stabilization method<br><u>Bit 8-31</u> : Reserved                                                                                                                                                                                                                                                                                                                                                                                           |
| Hydrophone identifier                     | u32  | Hydrophone selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Receive beam weighting window             | u32  | 0 – Chebychev<br>1 – Kaiser                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Receive beam weighting parameter          | f32  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Receive flags                             | u32  | BIT FIELD:<br><u>Bit 0</u> : Roll compensation indicator<br><u>Bit 1</u> : Reserved<br><u>Bit 2</u> : Heave compensation indicator<br><u>Bit 3</u> : Reserved<br><u>Bit 4-7</u> : Dynamic focusing method<br><u>Bit 8-11</u> : Doppler compensation method<br><u>Bit 12-15</u> : Match filtering method<br><u>Bit 16-19</u> : TVG method<br><u>Bit 20-23</u> : Multi-ping mode<br>0 – No multi-ping<br>If non-zero, this represents the sequence number of the ping in the multi-ping sequence.<br><u>Bit 24-31</u> : Reserved |
| Receive beam width                        | f32  | Angle in radians                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Bottom detection filter info              | f32  | Min range (if range filter is active)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Bottom detection filter info              | f32  | Max range (if range filter is active)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Bottom detection filter info              | f32  | Min depth (if depth filter is active)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Bottom detection filter info              | f32  | Max depth (if depth filter is active)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Absorption                                | f32  | Absorption in dB/km                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Sound velocity                            | f32  | Sound velocity in m/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Spreading                                 | f32  | Spreading loss in dB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Reserved                                  | u16  | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## 10.23 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 configuration can be found in the record's module info section (see

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

Table 38). 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 and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

The dynamic data section for each device is encoded using XML. A sample is provided below.

### Data Definition:

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

Table 37: 7001 – Record Type Header

| Name     | Size | Description               |
|----------|------|---------------------------|
| Sonar Id | u64  | Sonar serial number       |
| N        | u32  | Number of devices/sonar's |

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

Table 38: 7001 – Record Data

| Name                      | Size    | Description                                                                                                           |
|---------------------------|---------|-----------------------------------------------------------------------------------------------------------------------|
| Device 0 identifier       | u32     | Unique identifier number                                                                                              |
| Device 0 description      | u8 * 60 | ASCII string                                                                                                          |
| Device 0 AlphaData card   | u32     | Defines the type of the AlphaData card.<br>0x0400 – Virtex 2 card<br>0x0800 – Virtex 5 card<br>0x1000 – Virtex 6 card |
| Device 0 serial number    | u64     |                                                                                                                       |
| Device 0 info length      | u32     | In bytes                                                                                                              |
| Device 0 info             | dynamic | Varies with device type                                                                                               |
| ...                       | ...     | ...                                                                                                                   |
| Device N-1 identifier     | u32     | Unique identifier number                                                                                              |
| Device N-1 description    | u8 * 60 | ASCII string                                                                                                          |
| Device N-1 AlphaData card | u32     | Defines the type of the AlphaData card.<br>0x0400 – Virtex 2 card<br>0x0800 – Virtex 5 card<br>0x1000 – Virtex 6 card |
| Device N-1 serial number  | u64     |                                                                                                                       |

| Name                   | Size    | Description             |
|------------------------|---------|-------------------------|
| Device N-1 info length | u32     | In bytes                |
| Device N-1 info        | dynamic | Varies with device type |

## XML SAMPLE – 7125

```
<?xml version="1.0" encoding="US-ASCII"?>

<SB7125HF>
  <Name deviceid="7125" enumerator="1" xml_reson="8.1.2.3.1.1">7125 (400kHz)</Name>
  <SystemInfo auv="no" projectid="generic" systemrelease="SV3" name="7125">7125
    Sonar</SystemInfo>
  <SonarType type="0" unit="nb">Bathymetric sonar</SonarType>
  <ArrayType type="1" number="7216" unit="nb">Flat array</ArrayType>
  <RxElements min="0" max="255" spacing="0.0016" unit="meters" input_mux="1">Receive
    ceramics</RxElements>
  <RxBeamWidth uniformacross="yes" uniformalong="yes" across="0.008" along="0.471238898"
    unit="rad">Receiver beamspacing</RxBeamWidth>
  <RxBeamModeSet>
    <RxBeamMode max_beams="240" beam_spacing="EA" min_coverage="45.0"
      max_coverage="140.0" min_grazing="15.0" max_total_steering="85.0">Minimum
      Beams</RxBeamMode>
    <RxBeamMode max_beams="512" beam_spacing="ID" min_coverage="45.0"
      max_coverage="140.0" min_grazing="5.0"
      max_total_steering="85.0">Intermediate</RxBeamMode>
    <RxBeamMode max_beams="512" beam_spacing="ED" min_coverage="45.0"
      max_coverage="140.0" min_grazing="15.0" max_total_steering="85.0">Best
      Coverage</RxBeamMode>
    <RxBeamMode max_beams="512" beam_spacing="FL" min_coverage="45.0"
      max_coverage="140.0" min_grazing="15.0" max_total_steering="85.0">Flex</RxBeamMode>
    <RxBeamMode max_beams="512" beam_spacing="EA" min_coverage="45.0"
      max_coverage="165.0" min_grazing="15.0" max_total_steering="85.0">Wide</RxBeamMode>
  </RxBeamModeSet>
  <RxBeamStabilization type="0">Receiver beam stabilization</RxBeamStabilization>
  <TxType type="2181-400" number="2181" unit="nb">Standard</TxType>
  <TxBeams min="0" max="0" unit="nb">Transmit beams</TxBeams>
  <TxBeamSteering steerable="no" maxx="0.0" minx="0.0" maxz="0.0" minz="0.0" unit="rad">Transmit
    beam steering</TxBeamSteering>
  <TxBeamSpacing uniform="yes" angles="0.0" unit="rad">Transmit beamspacing</TxBeamSpacing>
  <TxBeamWidth variable="no" maxx="0.0174533" minx="0.0174533" maxz="2.094395102"
    minz="2.094395102" unit="rad">Transmit beamwidth</TxBeamWidth>
  <TxBeamStabilization type="0">Transmit beam stabilization</TxBeamStabilization>
  <TxPulseLength min="0.000030" max="0.000300" max_FM="0.020" unit="s" measured="1e-
    6">Transmit pulse length</TxPulseLength>
  <TxPulseEnvelope type="tukey" parameter="0.1"> TxPulseEnvelope </TxPulseEnvelope>
  <TxDelay trigger="999e-6" transmitter="999e-6" units="sec">Transmit Delay</TxDelay>
  <Frequency chirp_V2="no" chirp_V6="yes" min="381000.0" max="411000.0" center="396000.0"
    unit="hz">Transmit frequency</Frequency>
  <DualHead MasterStart="380000" MasterStop="400000" SlaveStart="420000" SlaveStop="400000"
    unit="Hz">Dual-Head FM frequencies</DualHead>
```

```

<FM_Parameters KaiserLevel_dB="3" GuardBand_dB="3.0" CorrelationIndex="0.5"
  NegativeSweep="yes">FM Tuning Parameters</FM_Parameters>
<SampleRate rate="34482.75862" unit="hz">Receiver sample rate</SampleRate>
<Power min="190.0" max="220.0" tx_power_tweak="0.0" shared="no" unit="dB/uPa">Transmit
  power</Power>
<Gain min="0.0" max="83.0" tvg_limit="83" unit="dB">Receiver gain</Gain>
<Range min="5.0" max="400.0" unit="m">Operating range</Range>
<RangeSet size="20" _1="5" _2="8" _3="10" _4="15" _5="20" _6="25" _7="30" _8="35" _9="40"
  _10="50" _11="75" _12="100" _13="125" _14="150" _15="175" _16="200" _17="250"
  _18="300" _19="350" _20="400" unit="m">Valid Range Set</RangeSet>
<PingRate min="0.0" max="50.0" ratio="1.0" freerun="no" unit="p/s">Ping rate</PingRate>
<Motion rollable="yes" pitchable="no" heavable="no" roll="1" pitch="0" heave="0" roll_ON="yes"
  pitch_ON="yes">Motion compensation factor</Motion>
<FWInfo type="single" pps="new" bite="new" bf_upm_level="3">Firmware Info</FWInfo>
<FWFiles bitfile_V6="v6_256_20120422.bit" bitfile_V2="bf256_20110808.bit"
  BITEfile="7K_Bite_7125_SV2.xml">Firmware Sonar Specific Files</FWFiles>
<FWFilterFiles_V6 size="4" _1="0.0000999,filter1_v5_7125_7130_20110814.dat"
  _2="0.000199,filter2_v5_7125_7130_20110814.dat"
  _3="0.000299,filter3_v5_7125_7130_20110814.dat"
  _4="999,filter4_v5_7125_7130_20110814.dat">Firmware Filter Sonar Specific
  Files</FWFilterFiles_V6>
<FWFilterFiles_V2 size="4" _1="0.0000999,bf_filter1_7125_20110705.dat"
  _2="0.000199,bf_filter2_7125_20110705.dat" _3="0.000299,bf_filter3_7125_20110705.dat"
  _4="999,bf_filter4_7125_20110705.dat">Firmware Filter Sonar Specific
  Files</FWFilterFiles_V2>
<FPGA TxRxDelayOffset="0" tx_skip="0" rx_skip="0" lo_if="600000.0" delay="471e-6" offset_size="4"
  _1="4860" _2="4860" _3="4860" _4="4860">FPGA Sonar Specific Values</FPGA>
<DownLink register="yes" remote="yes">Downlink Commands</DownLink>
<RDR defaultpath="D:\Data\" maxsize="1024000000" units="Bytes" format="short" buffer="10">Raw
  data recording</RDR>
<StartState maxpower="0.0" ping="yes" selected="yes" udp="on" calibrate="yes"
  swiorthrotlms="1000">Initial overwrite values</StartState>
<BottomDetection method="G2">BD Method (G1_Simple, G1_BlendFilt, G2)</BottomDetection>
<Warnings PPS="fatal" IOP="warning">Warning overrides</Warnings>
<GUIState wedgethrotlms="160">Initial overwrite values</GUIState>
<AutoPilot FactoryDefaultTable="7125_v6_400kHz_Default.apc">AutoPilot settings</AutoPilot>
<OutputBoost_dB Value="0">Beamformer Output Boost</OutputBoost_dB>
</SB7125HF>

```

## 10.24 7002 – 7k Match Filter

**Description:** This record is produced by the 7k Center. It contains the sonar's receive match filter settings. The 7-P processor updates this data for each ping. The record can be manually requested for the last ping or subscribed to from the 7k Center. For details about requesting and subscribing to records, see [section 10.53 7500 – 7k Remote Control](#) together with [section 11 7k Remote Control Definitions](#).

**Data Definition:**

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

Table 39: 7002 – Record Type Header

| Name            | Size     | Description                                                                                       |
|-----------------|----------|---------------------------------------------------------------------------------------------------|
| Sonar Id        | u64      | Sonar serial number                                                                               |
| Ping number     | u32      | Sequential number                                                                                 |
| Operation       | u32      | 0 – Off<br>1 – On                                                                                 |
| Start frequency | f32      | Hz                                                                                                |
| Stop frequency  | f32      | Hz                                                                                                |
| Window type     | u32      | 0 – Rectangular<br>1 – Kaiser<br>2 – Hamming<br>3 – Blackmann<br>4 – Triangular<br>5 – X (Taylor) |
| Shading value   | f32      |                                                                                                   |
| Reserved        | u32 * 14 |                                                                                                   |

## 10.25 7003 – 7k Firmware and Hardware Configuration

**Description:** This record is produced by the 7k Center series. It contains the configuration information about the sonar hardware and firmware. The record is created on system startup and does not change during operation. The record can be manually requested from the 7k Center. This record is not available for subscription.

For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

The dynamic data section is encoded using HTM. A sample is provided below.

**Data Definition:**

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

Table 40: 7003 – Record Type Header

| Name        | Size | Description             |
|-------------|------|-------------------------|
| Devices     | u32  | Hardware device count   |
| Info length | u32  | Varies with device type |

**HTM SAMPLE – 7101**
**HARDWARE TABLE**

| Name              | Hex Address | Frequency | Enumerator | UI   | M2  |
|-------------------|-------------|-----------|------------|------|-----|
| SYS1 8101 Wet End | 21          | 240000    | N/A        | 8101 | N/A |
| TX1               | 2A          | 240000    | N/A        | 0    | N/A |
| RX1               | 26          | N/A       | N/A        | 0    | N/A |
| LM                | 30          | N/A       | N/A        | 7101 | N/A |

**LM TABLE**

| Field | Bytes | Sensor Types | Name                                     | Min  | Max   |
|-------|-------|--------------|------------------------------------------|------|-------|
| 1     | 2     | 0            | Addresses Destination (MSB) Source (LSB) | 0    | 0     |
| 2     | 2     | 0            | Data Length                              | 0    | 0     |
| 3     | 2     | 0            | Type of Command                          | 0    | 0     |
| 5     | 2     | 2            | FPGA Die Temperature (°C)                | -5.0 | 95.0  |
| 8     | 2     | 4            | 5V                                       | 4.5  | 5.5   |
| 9     | 2     | 4            | 2.5Vref                                  | 2.4  | 2.6   |
| 10    | 2     | 4            | 1.5V                                     | 1.3  | 1.7   |
| 12    | 2     | 4            | 3.3V                                     | 3.0  | 3.6   |
| 13    | 2     | 4            | 2.5V                                     | 2.2  | 2.8   |
| 14    | 2     | 4            | 1.0V                                     | 0.9  | 1.1   |
| 23    | 2     | 5            | Controller CPLD                          | 0    | 0     |
| 24    | 2     | 5            | Controller FPGA                          | 0    | 0     |
| 25    | 2     | 5            | Controller DSP Boot                      | 0    | 0     |
| 26    | 2     | 5            | Controller DSP System                    | 0    | 0     |
| 32    | 2     | 1            | LM Downlink                              | 0    | 65535 |
| 33    | 2     | 1            | FPGA Status Field                        | 0    | 65535 |
| 35    | 2     | 1            | LM Uplink (from LM)                      | 0    | 65535 |

**SYS1 TABLE**

| Field | Bytes | Sensor Types | Name                                     | Min   | Max  |
|-------|-------|--------------|------------------------------------------|-------|------|
| 1     | 2     | 0            | Addresses Destination (MSB) Source (LSB) | 0     | 0    |
| 2     | 2     | 0            | Data Length                              | 0     | 0    |
| 3     | 2     | 0            | Type of Command                          | 0     | 0    |
| 4     | 4     | 6            | Head temperature (°C)                    | -20.0 | 70.0 |
| 5     | 4     | 7            | Leak V                                   | 3.8   | 6.0  |

| Field | Bytes | Sensor Types | Name      | Min   | Max   |
|-------|-------|--------------|-----------|-------|-------|
| 6     | 4     | 8            | -5V       | -5.5  | -4.5  |
| 7     | 4     | 9            | +12       | 11.0  | 13.0  |
| 8     | 4     | 9            | -12       | -13.0 | -11.0 |
| 9     | 4     | 10           | Dipswitch | 0     | 0     |

## 10.26 7004 – 7k Beam Geometry

**Description:** This record is produced by the 7k Center. It contains the receive beam widths and steering. The 7k Center updates this data for each ping. The record can be manually requested for the last ping or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

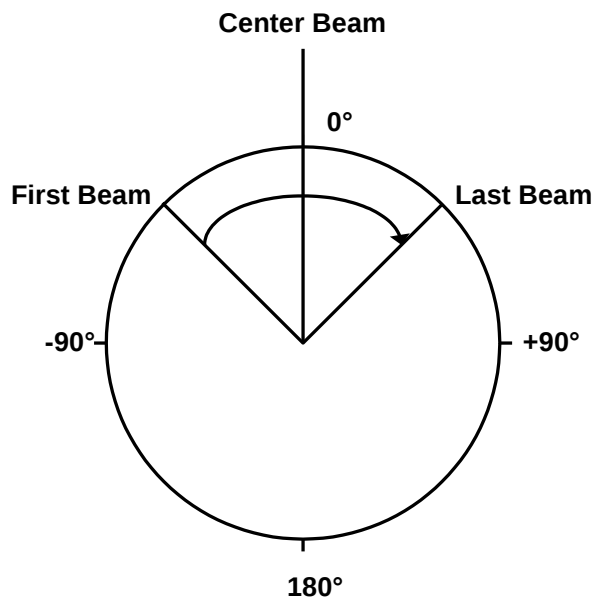


Figure 2: Sonar Beam Angle Convention

### Data Definition:

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

Table 41: 7004 – Record Type Header

| Name     | Size | Description              |
|----------|------|--------------------------|
| Sonar Id | u64  | Sonar serial number      |
| N        | u32  | Number of receiver beams |

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

Table 42: 7004 – Record Data

| Name                               | Size    | Description                                                                                                                                                                                                                                                                |
|------------------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Beam vertical direction angle[N]   | f32 * N | Angle in radians. The receiver beam steering angle (relative to nadir) applied in the along-track direction (typically 0).                                                                                                                                                 |
| Beam horizontal direction angle[N] | f32 * N | 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-angular mode, steering angles will vary. |
| -3dB Beam width Y[N]               | f32 * N | Angle in radians. The receiver along-track beam width measured at the -3dB points (typically <30°).                                                                                                                                                                        |
| -3dB Beam width X[N]               | f32 * N | Angle in radians. The receiver across-track beam width measured at the -3dB points (typically <5°).                                                                                                                                                                        |

## 10.27 7006 – 7k Bathymetric Data

**Description:** This record is produced by the 7k Center series. It contains the sonar bottom detection results. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

### Data Definition:

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

Table 43: 7006 – 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                   | u32  | Number of receiver beams                                                                                                                                               |

| Name                | Size | Description                                                                                                                                                       |
|---------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags               | u8   | BIT FIELD:<br><u>Bit 0:</u> Layer compensation<br>0 – Off<br>1 – On<br><u>Bit 1:</u> XYZ compensation<br>0 – Off<br>1 – On<br><u>Bit 2-7:</u> Reserved (always 0) |
| Sound velocity flag | u8   | Flag indicating if sound velocity is measured or manually entered<br>0 – Measured<br>1 – Manually entered                                                         |
| Sound velocity      | f32  | Sound velocity at the sonar in meters/second                                                                                                                      |

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

Table 44: 7006 – Record Data

| Name            | Size    | Description                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Range [N]       | f32 * N | Two-way travel time in seconds                                                                                                                                                                                                                                                                                                                                                                              |
| Quality [N]     | u8 * N  | BIT FIELD:<br><u>Bit 0:</u> Brightness<br>1 – Pass<br>0 – Fail<br><u>Bit 1:</u> Colinearity<br>1 – Pass<br>0 – Fail<br><u>Bit 2:</u> Bottom detection process (magnitude)<br>1 – Used<br>0 – Not used<br><u>Bit 3:</u> Bottom detection process (phase):<br>1 – Used<br>0 – Not used<br><u>Bit 4:</u> Used internally<br><u>Bit 5:</u> PDS nadir filter<br>1 – Fail<br>0 – Pass<br><u>Bit 6-7:</u> Reserved |
| Intensity [N]   | f32 * N | <u>Intensity:</u> Signal strength. Value at bottom detection. Not calibrated.                                                                                                                                                                                                                                                                                                                               |
| Min filter info | f32 * N | Minimum two-way travel time to filter point for each beam (minimum depth gate)                                                                                                                                                                                                                                                                                                                              |

| Name            | Size    | Description                                                                    |
|-----------------|---------|--------------------------------------------------------------------------------|
| Max filter info | f32 * N | Maximum two-way travel time to filter point for each beam (maximum depth gate) |

For information on optional data, see *APPENDIX A PDS2000 Optional Data*.

## 10.28 7007 – 7k Side Scan Data

**Description:** This record is produced by the 7k Center. It contains the non-calibrated side-scan type data. This record is typically not available in a forward-looking sonar configuration. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

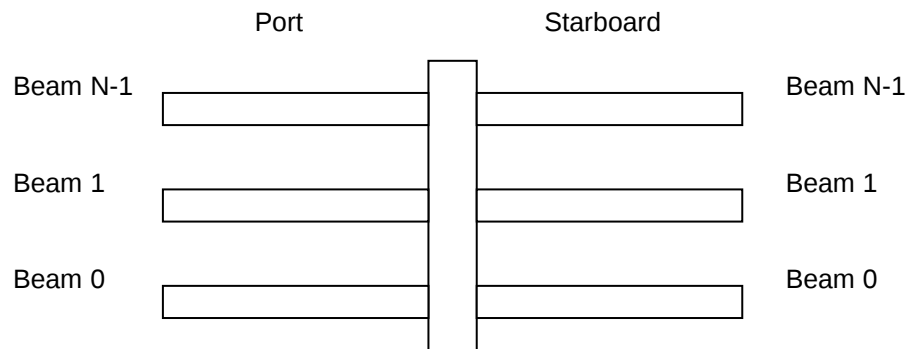


Figure 3: Beam Port and Starboard Numbering

### Data Definition:

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

Table 45: 7007 – 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. |
| Beam position       | f32     | Meters forward from position of beam 0                                                                                                                                 |
| Reserved            | u32     | BIT FIELD:<br><u>Bit 0-31:</u> Reserved                                                                                                                                |
| S                   | u32     | Samples per side (port/starboard)                                                                                                                                      |
| Reserved            | f32 * 8 | Reserved                                                                                                                                                               |
| N                   | u16     | Number of beams per side                                                                                                                                               |
| Current beam number | u16     | Beam number of this record's data (0 to N-1)                                                                                                                           |

| Name       | Size | Description                                                                   |
|------------|------|-------------------------------------------------------------------------------|
| W          | u8   | Number of bytes per sample                                                    |
| Data types | u8   | BIT FIELD:<br><u>Bit 0</u> : Reserved (always 0)<br><u>Bit 1-7</u> : Reserved |

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

Table 46: 7007 – Record Data

| Name            | Size  | Description                                                                            |
|-----------------|-------|----------------------------------------------------------------------------------------|
| Port beams      | W * S | Magnitude/Phase series. First sample represents range 0 meters (total bytes per side). |
| Starboards beam | W * S | Magnitude/Phase series. First sample represents range 0 meters (total bytes per side). |

For information on optional data, see *APPENDIX A PDS2000 Optional Data*.

## 10.29 7008 – 7k Generic Water Column Data

| NOTE                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Record 7008 is superseded by 7018 and 7028. It is mutually exclusive. The record is obsolete and will not be supported by Reson. It exists for the backwards compatibility only. |

**Description:** This record is produced by the 7k Center. It contains the sonar beam “I” and “Q” or magnitude and phase data. The 7k Center transmits this data for each ping. This record is available by subscription only.

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.

The Record Data portion is divided into two distinct parts:

- Beam Descriptors
- Sample Data

### Beam Descriptors:

This part of the Record Data section contains each beam descriptor, followed by the beginning and ending sample numbers for that beam. For example:

b0 s1 s100 b2 s1 s100 b3 s1 s100 ...

Where:

b = Beam

s = Sample

### Sample Data:

After all of the beams and their corresponding samples have been listed, the sample data will be output.

Sample data will be output in one of two ways:

- All samples for a beam followed by all samples for the next beam (Row Column Flag = 0)
- First sample for each beam followed by next sample for each beam (Row Column Flag = 1).

#### For example:

1. If the Row Column Flag = 0, the second part of the data would be:



where sd = sample data

2. If the Row Column Flag = 1, the second part of the data would be:



where b<sub>x</sub> = sample data for each beam

### 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.<br>Always 0 (zero) if not in multi-ping mode;<br>otherwise this represents the sequence number<br>of the ping in the multi-ping sequence. |
| N                   | u16  | Total number of beam descriptors or elements in<br>record                                                                                                                       |
| Reserved            | u16  | Reserved                                                                                                                                                                        |
| Samples             | u32  | Samples in ping. Only valid if all beams and<br>samples are in record.                                                                                                          |

| Name                | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Record subset flag  | u8   | <b>BIT FIELD:</b><br><u>Bit 0:</u><br>0 – All beams and samples in ping<br>1 – Beam and/or sample ping subset<br><u>Bit 1:</u><br>0 – Sample ping subset<br>1 – Beam ping subset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Row column flag     | u8   | 0 – All samples for a beam, followed by all samples for the next beam<br>1 – Sample 1 for all beams, followed by Sample 2 for all beams, etc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Reserved            | u16  | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Data sample type(s) | u32  | <b>BIT FIELD:</b><br>(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., magnitude is an u4 with possible values in range 0 to 16.)<br><u>Bit 0-3: Magnitude</u><br>0 – No magnitude<br>1 – Reserved<br>2 – Magnitude (16 bits)<br>3 – Magnitude (32 bits)<br><u>Bit 4-7: Phase</u><br>0 – No phase<br>1 – Reserved<br>2 – Phase (16 bits)<br>3 – Phase (32 bits)<br><u>Bit 8-11: I and Q</u><br>0 – No I and Q<br>1 – Signed 16 bit I and signed 16 bit Q<br>2 – Signed 32 bit I and signed 32 bit Q<br><u>Bit 12-14: Beamforming flag</u><br>0 – Beam formed data<br>1 – Element data |

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

Table 48: 7008 – Record Data (Part 1)

| Name                | Size | Description                                              |
|---------------------|------|----------------------------------------------------------|
| Descriptor 0        | u16  | First beam or element number                             |
| First sample number | u32  | First sample number in beam from transmitter and outward |
| Last sample number  | u32  | Last sample number in beam from transmitter and outward  |
| ...                 | ...  | ...                                                      |
| Descriptor N-1      | u16  | Last beam or element number                              |
| First sample number | u32  | First sample number in beam from transmitter and outward |
| Last sample number  | u32  | Last sample number in beam from transmitter and outward  |

Table 49: 7008 – Record Data (Part 2)

| Name             | Size    | Description                                                                                                                                               |
|------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| First column/row | dynamic | First sample header + Magnitude/Phase series. Array is populated with samples from transmitter and outward, or beams from low beam number and increasing. |
| ...              | ...     | ...                                                                                                                                                       |
| Last column/row  | dynamic | Last Sample header + Magnitude/Phase series. Array is populated with samples from transmitter and outward, or beams from low beam number and increasing.  |

For information on optional data, see *APPENDIX A PDS2000 Optional Data*.

### Additional SeaBat™ data settings (data reduction).

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

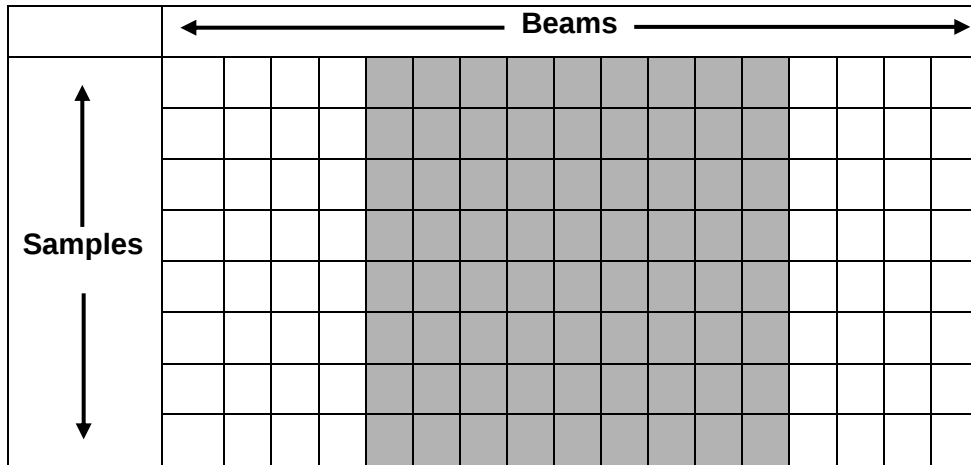


Figure 4: Beam Limits – Set Min and Max Beam

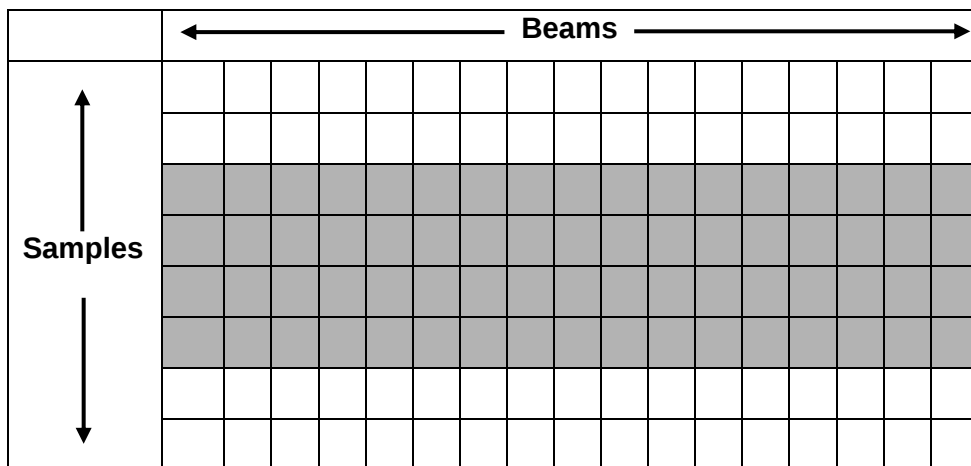


Figure 5: Sample Limits – Set Min and Max Sample

## 10.30 7010 – TVG Values

| NOTE                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------|
| This record requires the system to be calibrated. If calibration results are not available, all values are reported as -1. |

**Description:** This record provides the TVG values, one for each sample in the ping. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 50: 7010 – 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. Set to zero if not in multi-ping mode; otherwise, this represents the sequence number of the ping in the multi-ping sequence. |
| Samples (N)         | u32     | Number of gain values to follow (1 float per sample). Also the number of samples per beam in the ping.                                                              |
| Reserved            | u32 * 8 | Reserved                                                                                                                                                            |

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

Table 51: 7010 – Record Data

| Name           | Size | Description                  |
|----------------|------|------------------------------|
| Gain value [1] | f32  | Gain values – one per sample |
| ...            | ...  | ...                          |
| Gain value [N] | f32  |                              |

### 10.31 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 beamformed magnitude / phase data. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

The image data is arranged in bitmap format. The sample magnitude values set the pixel intensities.

**Data Definition:**

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

Table 52: 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. |

| Name                   | Size    | Description                           |
|------------------------|---------|---------------------------------------|
| W                      | u32     | Image width in pixels                 |
| H                      | u32     | Image height in pixels                |
| Color depth            | u16     | Color depth (bytes per pixel)         |
| Reserved               | u16     | Reserved                              |
| Compression algorithms | u16     | Reserved for future use               |
| Samples                | u32     | Original samples prior to compression |
| Reserved1              | u32 * 8 | Reserved                              |

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

Table 53: 7011 – Record Data

| Name      | Size               | Description             |
|-----------|--------------------|-------------------------|
| First row | Dynamic (1024 max) | All beams left to right |
| ...       | ...                | ...                     |
| Last row  | Dynamic (1024 max) | All beams left to right |

## 10.32 7012 – 7k Ping Motion Data

**Description:** This record is produced by the 7k Center series. It contains the description of various parameters used in detection computations. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

| NOTE                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| These are not actual steering angles. In order to get actual steering angles this data should be used in conjunction with base transmit and receive angles from record 7004 – 7k Beam Geometry. |

### Data Definition:

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

Table 54: 7012 – 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. |
| Samples (N)         | u32  | Number of samples                                                                                                                                                      |

| Name          | Size    | Description                                                                                                                                                                                                                                                                                                                                                                           |
|---------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags         | u16     | BIT FIELD:<br><u>Bit 0</u> : Pitch stabilization applied/pitch field present<br><u>Bit 1</u> : Roll stabilization applied/roll field present<br><u>Bit 2</u> : Yaw stabilization applied/heading field present<br><u>Bit 3</u> : Heave stabilization applied/heave field present<br><u>Bit 4-15</u> : Reserved                                                                        |
| Error flags   | u32     | BIT FIELD:<br><u>Bit 0</u> : PHINS reference<br>0 – Valid<br>1 – Invalid<br><u>Bit 1-3</u> : Reserved for PHINS<br><u>Bit 4</u> : Roll angle >15 degrees<br><u>Bit 5</u> : Roll angle >35 degrees<br><u>Bit 6</u> : Roll rate > 10 degrees per second<br><u>Bit 7</u> :<br>1 – External motion data not received (roll angle and rate are not reported)<br><u>Bit 8-31</u> : Reserved |
| Sampling rate | f32     | Sampling frequency in Hz                                                                                                                                                                                                                                                                                                                                                              |
| Pitch         | f32     | Pitch value at the ping time in radians (see note below)                                                                                                                                                                                                                                                                                                                              |
| Roll          | f32 * N | Roll value per sample in radians (see note below)                                                                                                                                                                                                                                                                                                                                     |
| Heading       | f32 * N | Heading value per sample in radians (see note below)                                                                                                                                                                                                                                                                                                                                  |
| Heave         | f32 * N | Heave value per sample in meters (see note below)                                                                                                                                                                                                                                                                                                                                     |

| NOTE                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The fields, Pitch, Roll, Heading, and Heave, are present only if corresponding flags are set. The new fields may be added (refer to the record size in the record header for the total size). For sign explanations, see <i>section 2.2 Sign Conventions</i> . |

## 10.33 7017 – 7k Detection Data Setup

**Description:** This record is produced by the 7k Center series. It contains the description of various parameters used in detection computations. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*. This record is available by subscription only.

### Data Definition:

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

Table 55: 7017 – 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                   | u32  | Number of detection points                                                                                                                                                                                                                                                                                                                                                                                                       |
| Data block size (S) | u32  | Size of detection information block in bytes                                                                                                                                                                                                                                                                                                                                                                                     |
| Detection algorithm | u8   | 0 – G1_Simple<br>1 – G1_BlendFilt<br>2 – G2<br>3 – G3<br>4 – IF1<br>5-255 – Reserved for future use                                                                                                                                                                                                                                                                                                                              |
| Flags               | u32  | BIT FIELD:<br><u>Bit 0:</u><br>1 – User-defined depth filter enabled<br><u>Bit 1:</u><br>1 – User-defined range filter enabled<br><u>Bit 2:</u><br>1 – Automatic filter enabled<br><u>Bit 3:</u><br>1 – Nadir search limits enabled<br><u>Bit 4:</u><br>1 – Automatic window limits enabled<br><u>Bit 5:</u><br>1 – Quality filter enabled<br><u>Bit 6:</u><br>1 – Multi-detection enabled<br>Bits 7-31: Reserved for future use |

| Name                    | Size     | Description                                                                |
|-------------------------|----------|----------------------------------------------------------------------------|
| Minimum depth           | f32      | Minimum depth for user-defined filter in meters                            |
| Maximum depth           | f32      | Maximum depth for user-defined filter in meters                            |
| Minimum range           | f32      | Minimum range for user-defined filter in meters                            |
| Maximum range           | f32      | Maximum range for user-defined filter in meters                            |
| Minimum nadir search    | f32      | Minimum depth for automatic filter nadir search in meters                  |
| Maximum nadir search    | f32      | Maximum depth for automatic filter nadir search in meters                  |
| Automatic filter window | u8       | Automatic filter window size in percent of the depth                       |
| Applied roll            | f32      | Roll value (in radians) applied to gates; zero if roll stabilization is ON |
| Depth gate tilt         | f32      | Angle in radians (positive to starboard)                                   |
| Reserved                | u32 * 14 | Reserved for future use                                                    |

| <b>NOTE</b>                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The following data section is repeated for each detection point as defined in RTH. The size of each field is always defined in RTH (S). If the size of this definition does not match the size specified in the record's header, the user must assume that there is an updated revision of this record and that new fields are added at the end. |

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

Table 56: 7017 – Record Data

| Name            | Size | Description                                                                                                                       |
|-----------------|------|-----------------------------------------------------------------------------------------------------------------------------------|
| Beam descriptor | u16  | Beam number the detection is taken from                                                                                           |
| Detection point | f32  | Beam steering angle with reference to receiver's acoustic center in the sonar reference frame, at the detection point; in radians |

| Name                               | Size    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags                              | u32     | <p>BIT FIELD:</p> <p><u>Bit 0:</u><br/>1 – Automatic limits valid</p> <p><u>Bit 1:</u><br/>1 – User-defined limits valid</p> <p><u>Bit 2-8:</u> Quality type, defines the type of the quality field</p> <p><u>Bit 9:</u><br/>1 – Quality passes user-defined criteria or no user-defined criteria was specified</p> <p><u>Bits 10-12:</u><br/>Detection type (1 or more of the following):<br/>           Bit 10 : Magnitude detect used<br/>           Bit 11 : Phase detect used<br/>           Bit 12 : Reserved</p> <p><u>Bit 13-15:</u><br/>Reserved for future use</p> <p><u>Bit 16-19:</u><br/>Detection priority number for detections within the same beam (Multi-detect only). Value zero is highest priority.</p> |
| Automatic limits minimum sample    | f32     | Minimum sample number for automatic limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Automatic limits maximum sample    | f32     | Maximum sample number for automatic limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| User-defined limits minimum sample | f32     | Minimum sample number for user-defined limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| User-defined limits maximum sample | f32     | Maximum sample number for user-defined limits                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Quality                            | 32 bits | Detection quality, see <i>Table 57</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Uncertainty                        | f32     | Detection uncertainty represented as an error normalized to the detection point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

The quality field above should be treated as follows, according to the quality type specified in the record data's flags (bits 2-8):

Table 57: 7017 – Detection Quality

| Name | Size | Description                                                                                                   |
|------|------|---------------------------------------------------------------------------------------------------------------|
| 0    | u32  | Quality is not available/not used                                                                             |
| 1    | u32  | BIT FIELD:<br><u>Bit 0:</u><br>1 – Brightness filter passed<br><u>Bit 1:</u><br>1 – Colinearity filter passed |
| 2-31 |      | Reserved for future use                                                                                       |

### 10.34 7018 – 7k Beamformed Data

**Description:** This record is produced by the 7k Center series. It contains the sonar beam magnitude and phase data. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*. This record is available by subscription only.

For details about subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Beams and samples are numbered from 0. Data is sample followed by beams.

**Data rates:**

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

$$\text{beams} * \text{data format bits} * \text{sample rate} * 10\% \text{ (header overhead)}$$

Example:

$$128 \text{ beams} * 32 \text{ bits (sonar setting 6)} * 34500 \text{ samples/s} * 1.1 = 155.4432 \text{ Mbits/s}$$

**Data Definition:**

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

Table 58: 7018 – 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. |
| Beams (N)           | u16  | Total number of beams in ping record                                                                                                                                   |
| Samples (S)         | u32  | Total number of samples in ping record                                                                                                                                 |

| Name     | Size    | Description             |
|----------|---------|-------------------------|
| Reserved | u32 * 8 | Reserved for future use |

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

Table 59: 7018 – Record Data

| Name                      | Size | Description                                                                                                                           |
|---------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------|
| Sample 0, Beam 0, Amp     | u16  | Amplitude value for first sample, first beam<br>(First sample represents range 0 meters)                                              |
| Sample 0, Beam 0, Phs     | i16  | Phase value for first sample, first beam<br>(First sample represents range 0 meters)<br>(Phase values are in radians scaled by 10430) |
| ...                       | ...  | ...                                                                                                                                   |
| Sample 0, Beam N-1, Amp   | u16  | Amplitude value for first sample, last beam                                                                                           |
| Sample 0, Beam N-1, Phs   | i16  | Phase value for first sample, last beam                                                                                               |
| ...                       | ...  | ...                                                                                                                                   |
| Sample S-1, Beam N-1, Amp | u16  | Amplitude value for last sample, last beam                                                                                            |
| Sample S-1, Beam N-1, Phs | i16  | Phase value for last sample, last beam                                                                                                |

## 10.35 7019 – Vernier Processing Data

**Description:** This record is produced by the 7kCenter series. It contains the output of the custom vernier processing stage for multi-ping forward looking sonar systems (eg. 7130). This record is not available on other system types. This record is available by subscription only.

### Data Definition:

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

Table 60: 7019 – Record Type Header

| Name               | Size | Description                                                    |
|--------------------|------|----------------------------------------------------------------|
| Sonar Id           | u64  | Sonar serial number                                            |
| Ping number        | u32  | Sequential number                                              |
| Multiping Sequence | u16  | Multi-ping sequence number<br>0 – single ping                  |
| Reference Array    | u8   | Index of reference array                                       |
| Pair 1, Array 2    | u8   | Index of second array for pair 1                               |
| Pair 2, Array 2    | u8   | Index of second array for pair 2                               |
| Decimation factor  | u8   | Data decimated by this factor, i.e. retain only 1 of X samples |
| Beams (N)          | u16  | Number of beams in record                                      |
| Samples (S)        | u32  | Number of samples in source data ('head samples')              |

| Name                  | Size    | Description                                                                                                   |
|-----------------------|---------|---------------------------------------------------------------------------------------------------------------|
| Decimated samples (D) | u32     | Number of samples in output angle data after filtering and decimation and clipping (where 'First Sample' > 0) |
| First sample          | u32     | Index of first sample (base-0)                                                                                |
| Reserved              | u32 * 2 | Reserved for future use                                                                                       |
| Smoothing win type    | u16     | Smoothing window type:<br>0 – rectangular<br>1 – hamming<br>99 – None                                         |
| Smoothing win length  | u16     | Smoothing window length [samples]                                                                             |
| Reserved              | u32 * 2 | Reserved for future use                                                                                       |
| Magnitude threshold   | f32     | Magnitude threshold for determination of data quality                                                         |
| Min QF                | f32     | Minimum quality factor (QF), default 0.5                                                                      |
| Max QF                | f32     | Maximum quality factor (QF), default 3.5                                                                      |
| Min angle             | f32     | Lower limit on possible elevation angles, normally -45° ( <u>in radians</u> )                                 |
| Max angle             | f32     | Upper limit on possible elevation angles, normally +45° ( <u>in radians</u> )                                 |
| Elevation coverage    | f32     | Normally 90° ( $\pi/2$ ) ( <u>in radians</u> )                                                                |
| Reserved              | u32 * 4 | Reserved for future use                                                                                       |

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

Table 61: 7019 – Record Data

| Name                        | Size | Description                                                                                                             |
|-----------------------------|------|-------------------------------------------------------------------------------------------------------------------------|
| <b>Part 1</b>               |      |                                                                                                                         |
| Sample 0, Beam 0, angle     | i16  | Vertical angle of arrival for first decimated sample, first beam (divide by <i>Angle scaling factor</i> to get radians) |
| Sample 0, Beam 1, angle     | i16  | Vertical angle for first sample, second beam                                                                            |
| ...                         | ...  | ...                                                                                                                     |
| Sample 0, Beam N-1, angle   | i16  | Vertical angle for first sample, last beam                                                                              |
| Sample 1, Beam 0, angle     | i16  | Vertical angle for second sample, first beam                                                                            |
| ...                         | ...  | ...                                                                                                                     |
| Sample D-1, Beam N-1, angle | i16  | Vertical angle for last sample, last beam                                                                               |
| <b>Part 2</b>               |      |                                                                                                                         |
| Sample 0, Beam 0, Mag       | u16  | Magnitude for first decimated sample, first beam.                                                                       |
| Sample 0, Beam 1, Mag       | u16  | Magnitude for first sample, second beam                                                                                 |

| Name                      | Size | Description                                                                  |
|---------------------------|------|------------------------------------------------------------------------------|
| ...                       | ...  | ...                                                                          |
| Sample 0, Beam N-1, Mag   | u16  | Magnitude for first sample, last beam                                        |
| Sample 1, Beam 0, Mag     | u16  | Magnitude for second sample, first beam                                      |
| ...                       | ...  | ...                                                                          |
| Sample D-1, Beam N-1, Mag | u16  | Magnitude for last sample, last beam                                         |
| <b>Part 3</b>             |      |                                                                              |
| Coherence                 | u16  | Coherence data, following format above.<br>Total size = D x N x 2 bytes      |
| <b>Part 4</b>             |      |                                                                              |
| Cross Power               | u16  | Cross Power data, following format above.<br>Total size = D x N x 2 bytes    |
| <b>Part 5</b>             |      |                                                                              |
| Quality Factor            | u16  | Quality factor data, following format above.<br>Total size = D x N x 2 bytes |
| <b>Part 6</b>             |      |                                                                              |
| Reserved field            | u16  | Reserved.<br>Total size = D x N x 2 bytes                                    |

Part 1 of the Record Data (RD) contains the angle estimate raw values (RV). These are signed 16 bit values. To convert to radians, use the following formula:

$$\text{Angle} = (\text{RV} / 65536) * \text{Elevation coverage}$$

Part 5 of RD contains the quality factor (QF) for each angle estimate normalized such that QF values from min QF to max QF (as defined in the RTH) map to the interval 0 to 65535. After undoing the mapping, the radian vertical angle uncertainty (standard deviation) can be computed as  $\sigma = 10^{-\text{QF}}$ .

## 10.36 7021 – 7k Built-In Test Environment Data

**Description:** This record is produced by the SeaBat™ 7k Sonar 7-P processor. It contains both the Built-In Test Environment (BITE) data and board request data (uplink/downlink). The 7k Center updates this record when any of the values have changed and publishes it every second. The record can be manually requested or subscribed to from the 7k Center.

For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

### Data Definition:

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

Table 62: 7021 – Record Type Header

| Name | Size | Description                |
|------|------|----------------------------|
| N    | u16  | Number of boards reporting |

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

Table 63: 7021 – Record Data for Each Device (N)

| Name                 | Size       | Description                                                                                                                                                                                                                              |
|----------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Source name          | u8 * 64    | Null terminated ASCII string, e.g. "TX1"                                                                                                                                                                                                 |
| Source address       | u8         | Source address                                                                                                                                                                                                                           |
| Frequency            | f32        | Frequency for transmitter or 0                                                                                                                                                                                                           |
| Enumerator           | u16        | Enumerator for transmitter or 0                                                                                                                                                                                                          |
| Downlink time sent   | 7kTime     | Downlink time sent                                                                                                                                                                                                                       |
| Uplink time received | 7kTime     | Uplink time received                                                                                                                                                                                                                     |
| BITE time received   | 7kTime     | BITE time received                                                                                                                                                                                                                       |
| Status               | u8         | BIT FIELD:<br><u>Bit 0:</u><br>0 – Uplink OK<br>1 – Uplink Error<br><u>Bit 1:</u><br>0 – Downlink OK<br>1 – Downlink Error<br><u>Bit 2:</u><br>0 – Bite OK<br>1 – Bite Error<br><u>Bit 3:</u><br>0 – No BITE Warning<br>1 – BITE Warning |
| NBF                  | u16        | Number of valid bite fields (BF) for this board                                                                                                                                                                                          |
| BITE status bits     | UINT64 * 4 | BIT FIELD:<br><u>Bit 0:</u><br>0 – BF #0 within range<br>1 – BF #0 out of range<br><u>Bit 255:</u><br>0 – BF #255 within range<br>1 – BF #255 out of range                                                                               |
| BF #0: Field         | u16        | Field Number (from Bite.htm file)                                                                                                                                                                                                        |
| BF #0: Name          | u8 * 64    | Null terminated ASCII string, e.g. "3.3V"                                                                                                                                                                                                |

| Name               | Size    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BF #0: Sensor Type | u8      | 1 – Error count<br>2 – FPGA die temperature<br>3 – Humidity<br>4 – Serial 8-channel ADC<br>5 – Firmware version<br>6 – Head Temp, 8K WetEnd<br>7 – Leak V, 8K WetEnd<br>8 – 5 Volt, 8K WetEnd<br>9 – 12 Volt, 8K WetEnd<br>10 – DipSwitch, 8K WetEnd<br>12 – Activity counter.<br>Release an alarm if it increments too slowly.<br>13 – Error counter.<br>Releases an alarm if it increments too much, too fast.<br>100 – Display 'Value' with 0 digits; scale 1<br>101 – Display 'Value' with 1 digit; scale 0.1<br>102 – Display 'Value' with 2 digits; scale 0.01<br>103 – Display 'Value' with 3 digits; scale 0.001<br>110 – Display as 4 hex digits<br>111 – Display as 8 bit Binary<br>112 – Display as Enumeration (literals defined in Bite.htm file)<br>200 – Display as part number<br>201 – Part revision<br>High order 8 bits is the revision number, Low order 8 bit is an ASCII character.<br>250 – Display as positive number |
| BF #0: Minimum     | f32     | Minimum value for alarm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BF #0: Maximum     | f32     | Maximum value for alarm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BF #0: Value       | f32     | Current value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| .....              |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| .....              |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| BF #NBF-1: Field   | u16     | Field Number (from Bite.htm file)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| BF #NBF-1: Name    | u8 * 55 | Null terminated ASCII string, e.g. "3.3V"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

| Name                   | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BF #NBF-1: Sensor Type | u8   | 1 – Error count<br>2 – FPGA die temperature<br>3 – Humidity<br>4 – Serial 8-channel ADC<br>5 – Firmware version<br>6 – Head Temp, 8K WetEnd<br>7 – Leak V, 8K WetEnd<br>8 – 5 Volt, 8K WetEnd<br>9 – 12 Volt, 8K WetEnd<br>10 – DipSwitch, 8K WetEnd<br>12 – Activity counter.<br>Release an alarm if it increments too slowly.<br>13 – Error counter.<br>Releases an alarm if it increments too much, too fast.<br>100 – Display 'Value' with 0 digits; scale 1<br>101 – Display 'Value' with 1 digit; scale 0.1<br>102 – Display 'Value' with 2 digits; scale 0.01<br>103 – Display 'Value' with 3 digits; scale 0.001<br>110 – Display as 4 hex digits<br>111 – Display as 8 bit Binary<br>112 – Display as Enumeration (literals defined in Bite.htm file)<br>200 – Display as part number<br>201 – Part revision<br>High order 8 bits is the revision number, Low order 8 bit is an ASCII character.<br>250 – Display as positive number |
| BF #NBF-1: Minimum     | f32  | Minimum value for alarm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BF #NBF-1: Maximum     | f32  | Maximum value for alarm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| BF #NBF-1: Value       | f32  | Current value                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| .....                  |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

### 10.37 7022 – 7k Center Version

**Description:** This record provides the 7k Center version as a NULL terminated string.

**Data Definition:**

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

Table 64: 7022 – Record Type Header

| Name           | Size    | Description                                   |
|----------------|---------|-----------------------------------------------|
| Version string | u8 * 32 | ASCII string, max length 31 characters + null |

### 10.38 7023 – 8k Wet End Version

**Description:** This record provides the 8k Wet End version as a NULL terminated string.

**Data Definition:**

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

Table 65: 7023 – Record Type Header

| Name           | Size    | Description                                   |
|----------------|---------|-----------------------------------------------|
| Version string | u8 * 32 | ASCII string, max length 31 characters + null |

### 10.39 7027 – 7k RAW Detection Data

**Description:** This record is produced by the 7k Center series. It contains non-compensated detection results. The 7k Center updates this record on every ping. This record is available by subscription only.

**Data Definition:**

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

Table 66: 7027 – Record Type Header

| Name                | Size | Description                                                                                                                                                         |
|---------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sonar Id            | u64  | Sonar serial number                                                                                                                                                 |
| Ping number         | u32  | Sequential number                                                                                                                                                   |
| Multiping sequence  | u16  | Flag to indicate multiping sequence. Always 0 (zero) if not in multiping mode; otherwise this represents the sequence number of the ping in the multiping sequence. |
| N                   | u32  | Number of detection points                                                                                                                                          |
| Data field size (S) | u32  | Size of detection information block in bytes                                                                                                                        |

| Name                | Size     | Description                                                                                                                                                                                                                                       |
|---------------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Detection algorithm | u8       | 0 – G1_Simple<br>1 – G1_BlendFilt<br>2 – G2<br>3 – G3<br>4 – IF1<br>5-255 – Reserved for future use                                                                                                                                               |
| Flags               | u32      | BIT FIELD:<br><u>Bit 0-3</u> : Uncertainty method<br>0 – Not calculated<br>1 – Rob Hare's method<br>2 – Ifremer's method<br>3-15 – Reserved for future use<br><u>Bit 4</u> : Multi-detection enabled<br><u>Bit 5-31</u> : Reserved for future use |
| Sampling rate       | f32      | Sonar's sampling frequency in Hz                                                                                                                                                                                                                  |
| Tx angle            | f32      | Applied transmitter steering angle, in radians                                                                                                                                                                                                    |
| Reserved            | u32 * 16 | Reserved for future use                                                                                                                                                                                                                           |

| <b>NOTE</b>                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The following data section is repeated for each detection point as defined in RTH. The size of each field is always defined in RTH. If the size of this definition does not match the size specified in the record's header, the user must assume that there is an updated revision of this record and that new fields are added at the end. |

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

Table 67: 7027 – Record Data

| Name            | Size | Description                                                                                                                       |
|-----------------|------|-----------------------------------------------------------------------------------------------------------------------------------|
| Beam descriptor | u16  | Beam number the detection is taken from                                                                                           |
| Detection point | f32  | Non-corrected fractional sample number with reference to receiver's acoustic center with the zero sample at the transmit time     |
| Rx angle        | f32  | Beam steering angle with reference to receiver's acoustic center in the sonar reference frame, at the detection point; in radians |

| Name            | Size    | Description                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags           | u32     | BIT FIELD:<br><u>Bit 0:</u><br>1 – Magnitude based detection<br><u>Bit 1:</u><br>1 – Phase based detection<br><u>Bit 2-8:</u> Quality type, defines the type of the quality field below<br><u>Bits 9-12:</u><br>Detection priority number for detections within the same beam (Multi-detect only). Value zero is highest priority.<br><u>Bits 13-31:</u><br>Reserved for future use |
| Quality         | 32 bits | Detection quality, see <i>Table 68</i>                                                                                                                                                                                                                                                                                                                                              |
| Uncertainty     | f32     | Detection uncertainty represented as an error normalized to the detection point                                                                                                                                                                                                                                                                                                     |
| Signal Strength | f32     | Signal strength of detection point                                                                                                                                                                                                                                                                                                                                                  |

For information on optional data, see *APPENDIX A PDS2000 Optional Data*.

| <b>NOTE</b>                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Transmit and receive steering angles provided in this record are total steering angles applied. Refer to record 7004 – <i>7k Beam Geometry</i> and/or record 7012 – <i>7k Ping Motion Data</i> in order to isolate steering components. For sign explanations, see <i>section 2.2 Sign Conventions</i> . |

The quality field above should be treated as follows, according to the quality type specified in the record data's flags (bits 2-8):

Table 68: 7027 – Detection Quality

| Name | Size | Description                                                                                                   |
|------|------|---------------------------------------------------------------------------------------------------------------|
| 0    | u32  | Quality is not available / not used                                                                           |
| 1    | u32  | BIT FIELD:<br><u>Bit 0:</u><br>1 – Brightness filter passed<br><u>Bit 1:</u><br>1 – Colinearity filter passed |
| 2-31 |      | Reserved for future use                                                                                       |

## 10.40 7028 – 7k Snippet Data

**Description:** This record is produced by the SeaBat™ 7k sonar. It contains the sonar snippet imagery data. The 7k Center updates this record on every ping. This record is available by subscription only. It is not available for forward-looking sonar.

For details about subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Beams and samples are numbered from 0. Data is beams followed by samples.

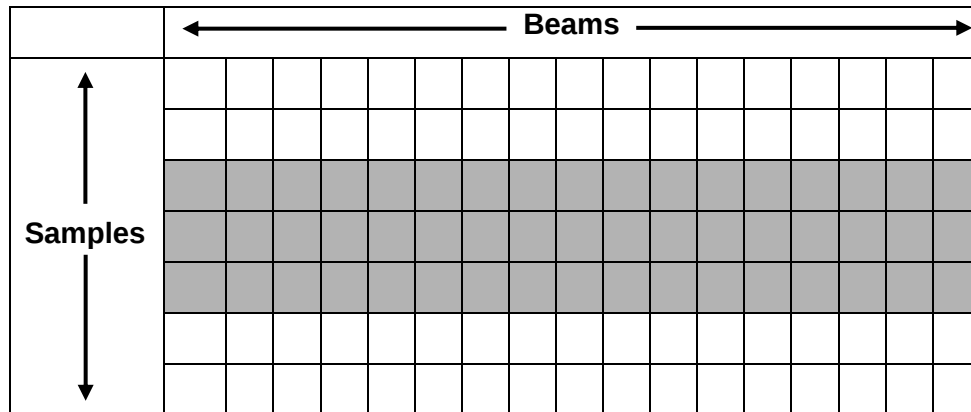


Figure 6: Sample Limits – Set Min and Max Sample

### Data rates:

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

$$\text{beams} * \text{data format bits} * \text{sample rate} * 10\% \text{ (header overhead)}$$

Example:

$$128 \text{ beams} * 32 \text{ bits (sonar setting 5)} * 34500 \text{ samples/s} * 1.1 \\ = 155.4432 \text{ Mbits/s}$$

Equation for sample limits:

$$\text{beams} * \text{ping rate} * \text{samples} * \text{data format bits} * 10\%$$

Example:

$$128 \text{ beams} * 7 \text{ ping/s} * 3000 \text{ samples} * 8 \text{ bits (sonar setting 1)} * 1.1 \\ = 23.6544 \text{ Mbits/s}$$

### Data Definition:

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

Table 69: 7028 – Record Type Header

| Name        | Size | Description         |
|-------------|------|---------------------|
| Sonar Id    | u64  | Sonar serial number |
| Ping number | u32  | Sequential number   |

| Name                | Size    | Description                                                                                                                                                                                         |
|---------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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     | Number of detection points                                                                                                                                                                          |
| Error flag          | u8      | If set, record will not contain any data. Flag itself will indicate an error.<br>0 – OK<br>1-5 – Reserved<br>6 – Bottom detection failed (R7006)<br>7-255 – Reserved                                |
| Control flags       | u8      | Control settings from RC 1118<br>0 – Automatic snippet window is used<br>1 – Quality Filter enabled<br>2 – Minimum window size is required<br>3 – Maximum window size is required<br>4-7 – Reserved |
| Reserved            | u32 * 7 | Reserved for future use                                                                                                                                                                             |

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

Table 70: 7028 – Record Data

| Name                | Size         | Description                                                                                                           |
|---------------------|--------------|-----------------------------------------------------------------------------------------------------------------------|
| Beam descriptor[1]  | u16          | Beam number                                                                                                           |
| Snippet start[1]    | u32          | First sample included in the snippet                                                                                  |
| Detection sample[1] | u32          | Detection point                                                                                                       |
| Snippet End[1]      | u32          | Last sample included in the snippet                                                                                   |
| ...                 | ...          | ...                                                                                                                   |
| Beam descriptor[N]  | u16          | Beam number                                                                                                           |
| Snippet start[N]    | u32          | First sample included in the snippet                                                                                  |
| Detection sample[N] | u32          | Detection point                                                                                                       |
| Snippet end[N]      | u32          | Last sample included in the snippet                                                                                   |
| First snippet       | Dynamic, u16 | Amplitude series for each sample. Array is populated with samples from the first sample to the last as defined above. |
| ...                 | ...          | ...                                                                                                                   |
| Last beam           | Dynamic, u16 | Amplitude series for each sample. Array is populated with samples from the first sample to the last as defined above. |

For information on optional data, see *APPENDIX A PDS2000 Optional Data*.

## 10.41 7041 – Compressed Beamformed Magnitude Data

**Description:** This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the compressed magnitude sonar beam data. The 7-P processor updates this record for each ping. The record can be subscribed to from the 7-P processor; it is not available by single request. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 71: 7041 – 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.                                                                                                                                                                                                                                                                                                            |
| Number of Beams (B)  | u16  | Total number of beams in ping record                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Down-sampling Method | u8   | 0 – No down-sampling<br>No down sampling is performed and magnitude data is recorded<br><br>1 – Nearest neighbor<br>For each new sample the nearest original sample within the same beam is picked<br><br>2 – Linear approximation<br>Each new sample is calculated as linear approximation of two original neighboring samples<br><br>3 – Averaging<br>Each new sample is an average of all original samples within half new sampling period<br><br>4+ – Reserved for future use |
| Filtering Method     | u8   | 0 – No filtering<br>1+ – Reserved for future use                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Name                                    | Size  | Description                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags                                   | u32   | <b>BIT FIELD:</b><br><u>Bit 0-3:</u> Data Encoding<br>0 – 16bit magnitude<br>1 – 8bit magnitude<br>2 – 16bit magnitude & phase<br>3 – 8bit magnitude & phase<br>4 – 32bit calibrated magnitude<br>5 – 16bit calibrated magnitude<br>6 – 8bit calibrated magnitude<br>7 – Reserved<br><u>Bit 4:</u> Beam identification method<br>0 – Beam number (u16)<br>1 – Beam angle (f32, in radians)<br><u>Bit 5-31:</u> Reserved (always zero) |
| Magnitude/Calibrated Magnitude Encoding | u8    | Magnitude Encoding Methods:<br>0 – 16 bit values<br>Magnitude is preserved in the original format<br>1 – 8 bit ½dB<br>Magnitude is encoded as $40 \cdot \log_{10}(\text{magnitude})$<br>2+ – Reserved<br>Calibrated Magnitude Encoding Methods:<br>0+ – Reserved                                                                                                                                                                      |
| Phase Encoding                          | u8    | Phase Encoding Methods:<br>0+ – Reserved                                                                                                                                                                                                                                                                                                                                                                                              |
| Sample Rate                             | f32   | Sampling rate for the data                                                                                                                                                                                                                                                                                                                                                                                                            |
| Reserved                                | 4*u32 | Reserved for future use                                                                                                                                                                                                                                                                                                                                                                                                               |

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

Table 72: 7041 – Record Data for Each Beam (B)

| Name                  | Size  | Description                                                                                                                              |
|-----------------------|-------|------------------------------------------------------------------------------------------------------------------------------------------|
| Beam                  | var   | Identification for the beam. (See “Beam identification method” above)                                                                    |
| Number of Samples (S) | u32   | Total number of samples recorded for this beam                                                                                           |
| Data                  | S*var | Data series for each sample. Either Magnitude, Magnitude & Phase or Calibrated Magnitude. See “Flags” above for identification and size. |

| <b>NOTE</b>                                                                                       |  |
|---------------------------------------------------------------------------------------------------|--|
| The flags Magnitude & Phase and Calibrated Magnitude are not implemented yet thus can be ignored. |  |

## 10.42 7048 – 7k Calibrated Beam Data

| <b>NOTE</b>                                                                                                                                                   |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| This record contains non-calibrated beam magnitude, if calibration is available but not run. (See Error flag in <i>Table 73: 7048 – Record Type Header</i> ). |  |

**Description:** This record is produced by the SeaBat™ 7k sonar series. It contains the calibrated sonar beam magnitude. The 7k Center updates this record for each ping.

Beams and samples are numbered from 0. Data is sample followed by beams.

### Additional SeaBat™ Data Settings (Data Reduction).

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

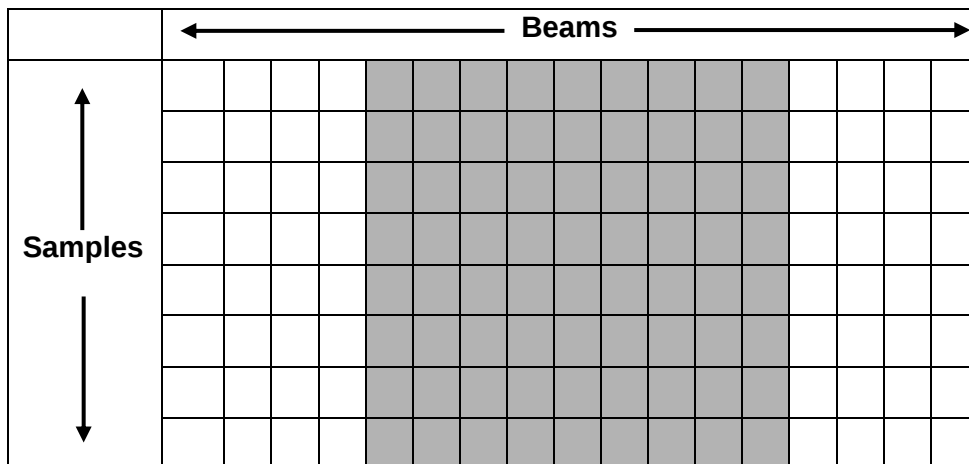


Figure 7: Beam Limits – Set Min and Max Beam

### Data Definition:

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

Table 73: 7048 – 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 |
| First beam          | u16  | Beam reduction initial beam                                                                                                                                           |
| N                   | u16  | Total number of beams in ping record                                                                                                                                  |

| Name                  | Size    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------------------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| S                     | u32     | Total number of samples in ping record                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Forward-looking sonar | u8      | FLS flag                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Error flag            | u8      | <p>If set, record contains original non-calibrated beamformed data. Flag itself will indicate an error.</p> <p>0 – OK</p> <p>1 – No calibration</p> <p>2 – TVG read error (R7010)</p> <p>3 – CTD not available (R1010)</p> <p>4 – Invalid or not available geometry (R7004)</p> <p>5 – Invalid sonar specifications (XML)</p> <p>6 – Bottom detection failed</p> <p>7 – No power (Power is set to zero)</p> <p>8 – No gain (Gain is too low)</p> <p>128-254 – Reserved for internal errors</p> <p>255 – System cannot be calibrated (c7k file missing)</p> |
| Reserved              | u32 * 8 | Reserved for future use                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

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

Table 74: 7048 – Record Data

| Name            | Size    | Description                                                             |
|-----------------|---------|-------------------------------------------------------------------------|
| First sample    | N * f32 | Amplitude series for each beam. First sample represents range 0 meters. |
| ...             | ...     | ...                                                                     |
| Last sample (S) | N * f32 | Amplitude series for each beam                                          |

## 10.43 7050 – 7k System Events

**Description:** This record is produced by the SeaBat™ 7k sonar series. It contains the 7k Center system events. The 7k Center updates this record when any event is added or removed in the system. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 75: 7050 – Record Type Header

| Name     | Size | Description         |
|----------|------|---------------------|
| Sonar Id | u64  | Sonar serial number |
| N        | u32  | Number of events    |

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

Table 76: 7050 – Record Data

| Name                     | Size    | Description                                                                 |
|--------------------------|---------|-----------------------------------------------------------------------------|
| Event type 0             | u16     | 1 – Information<br>2 – Warning<br>3 – Error<br>0 and >3 – Internal          |
| Event identifier         | u16     | 0 – Not defined                                                             |
| Device identifier        | u32     | Identifier of the device that this data pertains (or 7000 for system event) |
| System enumerator        | u16     | System enumerator for identical systems in one installation                 |
| Event message length (L) | u16     | Message length including termination character                              |
| 7KTIME                   | u8 * 10 | Time tag                                                                    |
| Event message            | u8 * L  | Fixed-width string                                                          |
| ...                      | ...     | ...                                                                         |
| Event type N-1           | u16     | 1 – Information<br>2 – Warning<br>3 – Error<br>0 and >3 – Internal          |
| 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                 |

| Name                     | Size    | Description                                    |
|--------------------------|---------|------------------------------------------------|
| Event message length (L) | u16     | Message length including termination character |
| 7KTIME                   | u8 * 10 | Time tag                                       |
| Event message            | u8 * L  | Fixed-width string                             |

## 10.44 7051 – 7k System Event Message

**Description:** This record is produced by the SeaBat™ 7k sonar series. It holds a single 7k event. The latest record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

### Data Definition:

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

Table 77: 7051 – Record Type Header

| Name             | Size | Description                                                        |
|------------------|------|--------------------------------------------------------------------|
| Sonar Id         | u64  | Sonar serial number                                                |
| Event Id         | u16  | 1 – Information<br>2 – Warning<br>3 – Error<br>0 and >3 – Internal |
| Message length   | u16  | Message length in bytes                                            |
| Event identifier | u16  | 0 – Undefined                                                      |

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

Table 78: 7051 – Record Data

| Name          | Size    | Description             |
|---------------|---------|-------------------------|
| Event message | dynamic | Null terminated string. |

## 10.45 7052 – RDR Recording Status

**Description:** This record is generated at every 1% drop in disk capacity and on any start or stop of recording or playback. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 79: 7052 – Record Type Header

| Name           | Size     | Description                                                                                                                              |
|----------------|----------|------------------------------------------------------------------------------------------------------------------------------------------|
| Position       | u32      | Seconds since start of recording                                                                                                         |
| Disk free      | u8       | Percentage of disk space free (0-100)                                                                                                    |
| Mode           | u8       | <b>BIT FIELD:</b><br><u>Bits 5-0:</u><br>0 – Stopped<br>1 – Recording<br>2 – Playing<br>3 – Deleting<br>4 – Stopping<br>5+ – Reserved    |
| FileRecords    | u32      | Total number of records in file at the time the request is processed                                                                     |
| FileSize       | u64      | File size in bytes                                                                                                                       |
| First 7KTIME   | u8 * 10  | Time tag first record time                                                                                                               |
| Last 7KTIME    | u8 * 10  | Time tag last record time                                                                                                                |
| Total time     | u32      | Time span between first and last record (in seconds)                                                                                     |
| Directory name | u8 * 256 | Current directory name. Null-terminated ASCII string.                                                                                    |
| File name      | u8 * 256 | Current file name. Null-terminated ASCII string.                                                                                         |
| Flags          | u32      | <b><u>BIT FIELD:</u></b><br><u>Bit 0:</u><br>If set, all active recording is stopped<br><u>Bit 1:</u><br>If set, RDR buffering is active |
| Reserved       | u32 * 7  | Reserved                                                                                                                                 |

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

Table 80: 7052 – Record Data

| Name                   | Size     | Description                             |
|------------------------|----------|-----------------------------------------|
| Threshold length (NT)  | u32      | Threshold array length                  |
| Threshold value array  | u32 * NT | Array of NT percentage threshold values |
| Included Records (IR)  | u32      | Number of included records              |
| Included Records Array | u32 * IR | Array of IR included records            |
| Excluded Records (ER)  | u32      | Number of excluded records              |
| Excluded Records Array | u32 * ER | Array of ER excluded records            |
| Included Devices (ID)  | u32      | Number of included devices              |
| Included Devices Array | u32 * ID | Array of ID included devices            |
| Excluded Devices (ED)  | u32      | Number of excluded devices              |
| Excluded Devices Array | u32 * ED | Array of ED excluded devices            |

## 10.46 7053 – 7k Subscriptions

**Description:** This record is produced by the SeaBat™ 7k sonar 7-P processor. It contains information about subscription connections and third-party data connections. The record can be manually requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

### Data Definition:

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

Table 81: 7053 – Record Type Header

| Name | Size | Description             |
|------|------|-------------------------|
| N    | i32  | Number of subscriptions |

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

Table 82: 7053 – Record Data for Each Subscription (N)

| Name        | Size      | Description                                   |
|-------------|-----------|-----------------------------------------------|
| Address     | u32       | IP Address (host byte data order)             |
| Port        | u16       | Port number                                   |
| Type        | u16       | 0 – UDP<br>1 – TCP                            |
| # records   | u32       | Number of records                             |
| Record list | u32 * 64  | Array of records ID<br>N – # of valid records |
| Reserved    | u32 * 128 | Reserved                                      |

## 10.47 7055 – Calibration Status

**Description:** This record is produced by the SeaBat™ 7k sonar series. It contains status of the system calibration. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 83: 7055 – Record Type Header

| Name                                                            | Size     | Description                                                                                                                                                                                                                                                                                                            |
|-----------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sonar Id                                                        | u64      | Sonar serial number                                                                                                                                                                                                                                                                                                    |
| Calibration status                                              | u16      | 0 – Calibration is not available<br>1 – Calibration was not done<br>8 – Calibration is in progress<br>16 – Calibration completed<br>>127 – Calibration failed                                                                                                                                                          |
| Percent complete                                                | u16      | If status is 8 (in progress) this field indicates percentage completed.<br>If calibration status is 16 (completed) this field indicates the following.<br>0 – Results of previous calibration used without validation<br>1-99 – Results of previous calibration validated and used<br>100 – Full calibration performed |
| Calibration time                                                | u8 * 10  | Completion time of most recent calibration (zero if none). TIME_7K format (UTC).<br>If calibration status is 1 (not done), calibration time other than zero indicates that previous calibration results are available but not validated.                                                                               |
| Status message                                                  | u8 * 800 | Status message text string (null terminated)                                                                                                                                                                                                                                                                           |
| Sub status                                                      | u32      | Status details<br>0 – Ok<br>1 – No license file<br>2 – License file corrupt<br>3 – Invalid version<br>10 – Failed – noise<br>11 – Failed – ceramics bad<br>12 – Failed – magnitude tolerance<br>13 – Failed – phase tolerance                                                                                          |
| <i>Fields below apply only for FP2+ multi-frequency systems</i> |          |                                                                                                                                                                                                                                                                                                                        |

| Name                       | Size    | Description                                                                                                   |
|----------------------------|---------|---------------------------------------------------------------------------------------------------------------|
| Calibration system         | u8      | Bitfield indicating which system(s) are being calibrated<br><u>Bit 0</u> : enum<br><u>Bit 1</u> : enum<br>Etc |
| Calibration system done    | u8      | Bitfield indicating which ones are already done                                                               |
| Current calibration system | u8      | Enum of system being calibrated                                                                               |
| Start-up calibration       | u8      | Non zero if start-up calibration is in progress                                                               |
| Status                     | u16     | Final status of each system calibrated                                                                        |
| Reserved                   | u32 * 2 | Reserved                                                                                                      |

## 10.48 7057 – Calibrated Side-Scan Data

**Description:** This record is produced by the 7k Center. It contains the calibrated side-scan sonar data. This record is typically not available in a forward-looking sonar configuration. This record is not available for subscription, if calibration is not available for the system. This record contains non-calibrated side-scan data, if calibration is available but not run.

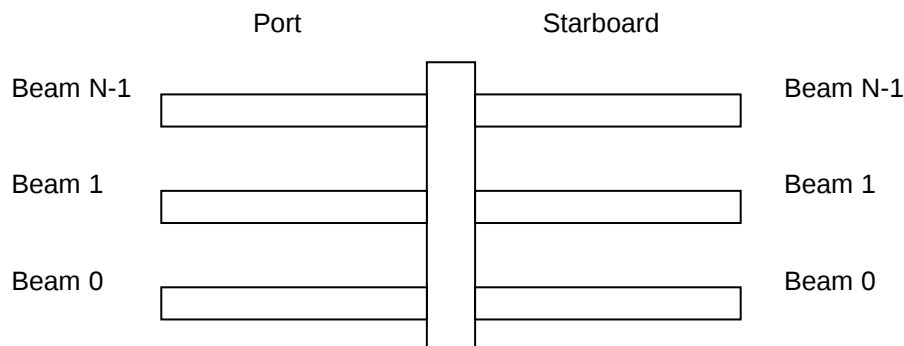


Figure 8: Beam Port and Starboard Numbering

### Data Definition:

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

Table 84: 7057 – 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. |
| Beam position       | f32  | Meters forward from position of beam 0                                                                                                                                 |

| Name                | Size    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reserved            | u32     | Controls BIT FIELD:<br><u>Bit 0-31</u> : Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| S                   | u32     | Samples per side (port/starboard)                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Reserved            | f32 * 8 | Reserved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 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<br>4 – Single precision (u32)                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Data types          | u8      | BIT FIELD:<br><u>Bit 0</u> : Reserved (always 0)<br><u>Bit 1-7</u> : Reserved                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Error flag          | u8      | If set, record contains original non-calibrated beamformed data. Flag itself will indicate an error.<br>0 – OK<br>1 – No calibration<br>2 – TVG read error (R7010)<br>3 – CTD not available (R1010)<br>4 – Invalid or not available geometry (R7004)<br>5 – Invalid sonar specifications (XML)<br>6 – Bottom detection failed<br>7 – No power (Power is set to zero)<br>8 – No gain (Gain is too low)<br>128-254 – Reserved for internal errors<br>255 – System cannot be calibrated (c7k file missing) |

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

Table 85: 7057 – Record Data

| Name                    | Size    | Description                                                                            |
|-------------------------|---------|----------------------------------------------------------------------------------------|
| Port beams              | W * S   | Magnitude/Phase series. First sample represents range 0 meters (total bytes per side). |
| Starboards beam         | W * S   | Magnitude/Phase series. First sample represents range 0 meters (total bytes per side). |
| Port beams number       | S * u16 | Indicates the beam number corresponding value was taken from                           |
| Starboards beams number | S * u16 | Indicates the beam number corresponding value was taken from                           |

| <b>NOTE</b>                                                                                                                    |  |
|--------------------------------------------------------------------------------------------------------------------------------|--|
| Calibrated side-scan data is returned as floating point values, either single (W = 4 bytes) or double (W = 8 bytes) precision. |  |

For information on optional data, see *APPENDIX A PDS2000 Optional Data*.

## 10.49 7058 – Calibrated Snippet Data

| <b>NOTE</b>                                              |  |
|----------------------------------------------------------|--|
| Snippet must be enabled in order to receive this record. |  |

**Description:** This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the calibrated sonar snippet magnitude and phase data. The 7k Center updates this record for each ping. This record is not available for subscription, if calibration is not available for the system. This record contains non-calibrated beam magnitude or phase, if calibration is available but not run.

Beams and samples are numbered from 0. Data is beams followed by samples.

### **Additional SeaBat™ Data Settings (Data Reduction).**

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

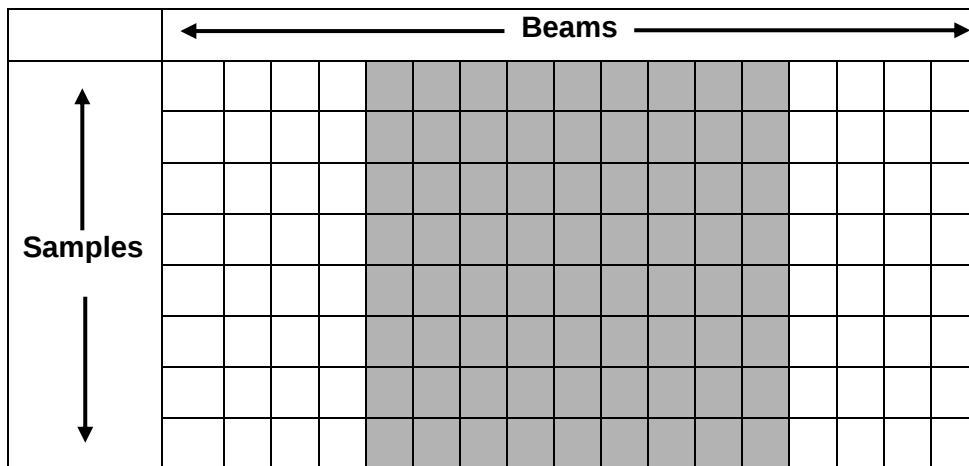


Figure 9: Beam Limits – Set Min and Max Beam

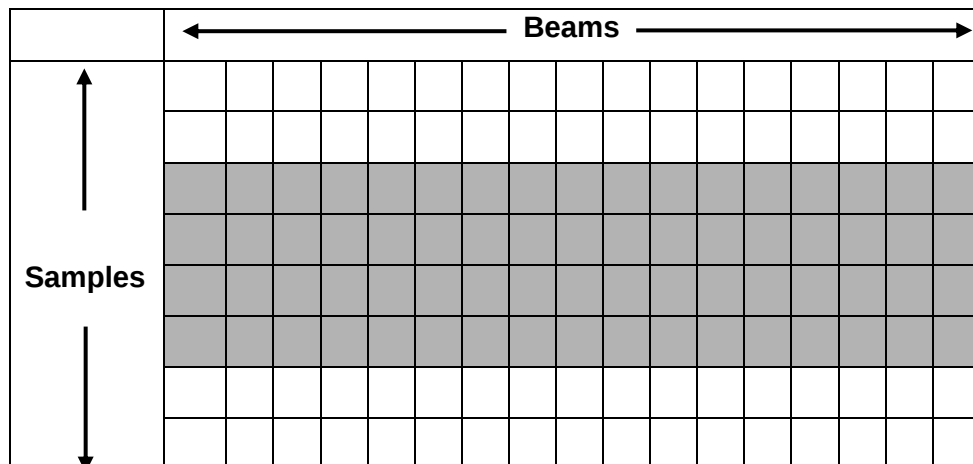


Figure 10: Sample Limits – Set in dB Around Bottom Detection Point

**Data Definition:**

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

Table 86: 7058 – 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.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Beams               | u16  | Number of beams in the record                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Error flag          | u8   | <p>If set, record contains original non-calibrated beamformed data. Flag itself will indicate an error.</p> <ul style="list-style-type: none"> <li>0 – OK</li> <li>1 – No calibration</li> <li>2 – TVG read error (R7010)</li> <li>3 – CTD not available (R1010)</li> <li>4 – Invalid or not available geometry (R7004)</li> <li>5 – Invalid sonar specifications (XML)</li> <li>6 – Bottom detection failed (R7006)</li> <li>7 – No power (Power is set to zero)</li> <li>8 – No gain (Gain is too low)</li> <li>128-254 – Reserved for internal errors</li> <li>255 – System cannot be calibrated (c7k file missing)</li> </ul> |

| Name          | Size    | Description                                                                                                                                                                                                                                                                                                                |
|---------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Control flags | u32     | Control settings from RC 1113 command<br>0 – Brightness is required to pass<br>1 – Colinearity is required to pass<br>2 – Bottom detection results are used for snippet<br>3 – Snippet display min. requirements are used<br>4 – Minimum window size is required<br>5 – Maximum window size is required<br>6-31 – Reserved |
| Reserved      | u32 * 7 | Reserved for future use                                                                                                                                                                                                                                                                                                    |

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

Table 87: 7058 – Record Data

| Name                    | Size                     | Description                                                                                            |
|-------------------------|--------------------------|--------------------------------------------------------------------------------------------------------|
| Beam descriptor         | u16                      | Beam number                                                                                            |
| Begin sample descriptor | u32                      | First sample number in beam from transmitter and outward                                               |
| Bottom detection sample | u32                      | Bottom detection point 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                                               |
| Bottom detection sample | u32                      | Bottom detection point in beam from transmitter and outward                                            |
| End sample descriptor   | u32                      | Last sample number in beam from transmitter and outward                                                |
| First beam              | Dynamic<br>(E-B+1) * f32 | Signal intensity series for each sample. Array is populated with samples from transmitter and outward. |
| ...                     | ...                      | ...                                                                                                    |
| Last beam               | Dynamic<br>(E-B+1) * f32 | Signal intensity series for each sample. Array is populated with samples from transmitter and outward. |

For information on optional data, see *APPENDIX A PDS2000 Optional Data*.

## 10.50 7200 – 7k File Header

**Description:** First record of 7k data file.

**Data Definition:**

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

Table 88: 7200 – Record Type Header

| Name                             | Size     | Description                                                                            |
|----------------------------------|----------|----------------------------------------------------------------------------------------|
| File identifier                  | u128     |                                                                                        |
| 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.<br>0 – If not present                                             |
| N                                | u32      | Number of devices ( $N \geq 0$ )                                                       |
| 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.                                                       |

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

Table 89: 7200 – Record Data

| Name                  | Size | Description                                 |
|-----------------------|------|---------------------------------------------|
| 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        |

This record may have optional data that contains information about the file catalog (7300 record) at the end of the log file. The optional data identifier (in the record frame) will be 7300.

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

Table 90: 7200 – Optiona Data

| Name | Size | Description                     |
|------|------|---------------------------------|
| Size | u32  | Size of the file catalog record |

|        |     |                                        |
|--------|-----|----------------------------------------|
| Offset | u64 | File offset of the file catalog record |
|--------|-----|----------------------------------------|

## 10.51 7300 – 7k File Catalog Record

**Description:** 7k file catalog record, placed at the end of log files.

**Data Definition:**

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

Table 91: 7300 – Record Type Header

| Name              | Size | Description                     |
|-------------------|------|---------------------------------|
| Size              | u32  | Size of this record type header |
| Version           | u16  | 1                               |
| Number of records | u32  | Number of records in the file   |
| Reserved          | u32  | Reserved                        |

The file catalog contains one entry for each record in the log file, including the 7200 file header record, but excluding the 7300 file catalog record. The information corresponds to the record frame, plus the offset in the file.

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

Table 92: 7300 – Record Data

| Name              | Size    | Description                                 |
|-------------------|---------|---------------------------------------------|
| Size              | u32     | Record size in bytes                        |
| Offset            | u64     | File offset                                 |
| Record type       | u16     | Record type identifier                      |
| Device identifier | u16     | Device identifier                           |
| System enumerator | u16     | System enumerator                           |
| 7KTIME            | u8 * 10 | Time                                        |
| Record count      | u32     | Total records in fragmented data record set |
| Reserved          | u16 * 8 | Reserved                                    |

## 10.52 7400 – 7k Time Message

**Description:** This record is used to time-sync the 7k Center. The leap second offset field can be used to flag for leap second inserts ahead of time. The current time is shown in the 7KTIME field of the DRF.

**Data Definition:**

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

Table 93: 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<br>1 – Message preceding hardware pulse<br>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.

## 10.53 7500 – 7k Remote Control

**Description:** This record is used to remotely control SeaBat™ 7k sonar 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 7k Center. For details about subscribing to records, see *section 10 Record Type Definitions*. 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 94: 7500 – Record Type Header

| Name              | Size | Description                                                                                    |
|-------------------|------|------------------------------------------------------------------------------------------------|
| Remote control ID | u32  | See separate remote control table for details. See <i>section 10 Record Type Definitions</i> . |
| Ticket            | u32  | Ticket number. Set by client for control packet matching ACK or NAK packets.                   |
| Tracking number   | u128 | Unique number. Set by client for packet tracking.                                              |

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

Table 95: 7500 – Record Data

| Name                | Size     | Description                                                                     |
|---------------------|----------|---------------------------------------------------------------------------------|
| Remote control data | variable | Value(s). See <i>section 11 7k Remote Control Definitions</i> for descriptions. |

## 10.54 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 96: 7501 – Record Type Header

| Name            | Size | Description                  |
|-----------------|------|------------------------------|
| Ticket          | u32  | Ticket number in record 7500 |
| Tracking number | u128 | Unique number in record 7500 |

## 10.55 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 was not accepted. This record cannot be manually requested or subscribed to.

### Data Definition:

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

Table 97: 7502 – Record Type Header

| Name            | Size | Description                               |
|-----------------|------|-------------------------------------------|
| Ticket          | u32  | Ticket number in record 7500              |
| Tracking number | u128 | Unique number in record 7500              |
| Error code      | u32  | See APPENDIX D 7k Error Codes for details |

## 10.56 7503 – Remote Control Sonar Settings

**Description:** This record is produced by the SeaBat™ 7k Sonar. It contains the remote control sonar settings. The 7k Center updates this record for each ping. For multi-ping only one record is produced for the whole sequence. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 98: 7503 – Record Type Header

| Name                         | Size | Description                                                        |
|------------------------------|------|--------------------------------------------------------------------|
| Sonar Id                     | u64  | Sonar serial number                                                |
| Ping number                  | u32  | Sequential number                                                  |
| 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<br>1 – Linear chirp<br>2 – Multi-ping 2<br>3 – Multi-ping 4 |
| Tx pulse envelope identifier | u32  | 0 – Tapered rectangular<br>1 – Tukey                               |
| Tx pulse envelope parameter  | f32  | Pulse envelop shading. 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                                            |
| Range selection              | f32  | Range selection in meters                                          |
| Power selection              | f32  | Power selection in dB/μPa                                          |
| Gain selection               | f32  | Gain selection in dB                                               |

| Name                                   | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Control flags                          | u32  | <p>BIT FIELD:</p> <p><u>Bit 0-3:</u> Auto range method</p> <p><u>Bit 4-7:</u> Auto bottom detection filter method</p> <p><u>Bit 8:</u> Bottom detection range filter enabled.</p> <p><u>Bit 9:</u> Bottom detection depth filter enabled</p> <p><u>Bit 10:</u> Receiver gain method Auto Gain</p> <p><u>Bit 11:</u> Receiver gain method Fixed Gain</p> <p><u>Bit 12:</u> Receiver gain method Reserved</p> <p><u>Bit 13-14:</u> Reserved</p> <p><u>Bit 15:</u></p> <p>0 – System inactive</p> <p>1 – Active</p> <p><u>Bit 16-20:</u> Reserved for bottom detection</p> <p><u>Bit 21:</u> Adaptive gate depth filter fixed</p> <p>0 – Follow seafloor</p> <p>1 – Fix depth</p> <p><u>Bit 22:</u> Adaptive gate</p> <p>0 – Disabled</p> <p>1 – Enabled</p> <p><u>Bit 23:</u> Adaptive gate depth filter</p> <p>0 – Disabled</p> <p>1 - Enabled</p> <p><u>Bit 24:</u> Trigger Out</p> <p>0 – Disabled</p> <p>1 – Enabled</p> <p><u>Bit 25:</u> Trigger In Edge</p> <p>0 – Positive</p> <p>1 – Negative</p> <p><u>Bit 26:</u> PPS Edge</p> <p>0 – Positive</p> <p>1 – Negative</p> <p><u>Bit 27:</u> Reserved</p> <p><u>Bit 28-29:</u> Reserved for Calibration</p> <p><u>Bit 30:</u> Reserved</p> <p><u>Bit 31:</u></p> <p>0 – 7K</p> <p>1 – Simulator</p> |
| Projector identifier                   | u32  | Projector selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Projector beam steering angle vertical | f32  | In radians                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Name                                      | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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<br>1 – Chebychev                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Projector beam weighting window parameter | f32  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Transmit flags                            | u32  | BIT FIELD:<br><u>Bit 0-3</u> : Pitch stabilization method<br><u>Bit 4-7</u> : Yaw stabilization method<br><u>Bit 8-31</u> : Reserved                                                                                                                                                                                                                                                                                                                                                                                           |
| Hydrophone identifier                     | u32  | Hydrophone selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Receive beam weighting window             | u32  | 0 – Chebychev<br>1 – Kaiser                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Receive beam weighting parameter          | f32  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Receive flags                             | u32  | BIT FIELD:<br><u>Bit 0</u> : Roll compensation indicator<br><u>Bit 1</u> : Reserved<br><u>Bit 2</u> : Heave compensation indicator<br><u>Bit 3</u> : Reserved<br><u>Bit 4-7</u> : Dynamic focusing method<br><u>Bit 8-11</u> : Doppler compensation method<br><u>Bit 12-15</u> : Match filtering method.<br><u>Bit 16-19</u> : TVG method<br><u>Bit 20-23</u> : Multi-ping Mode<br>0 – No multi-ping<br>If non-zero, this represents the sequence number of the ping in the multi-ping sequence<br><u>Bit 24-31</u> : Reserved |
| Bottom detection filter info              | f32  | Min range (if range filter active)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Bottom detection filter info              | f32  | Max range (if range filter active)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| Name                                    | Size | Description                                                                                                                                       |
|-----------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                | u8   | Reserved                                                                                                                                          |
| Automatic filter window                 | u8   | Automatic filter window size in percent of the depth                                                                                              |
| Tx array position offset X              | f32  | Offset of the transmitter 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 transmitter 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 transmitter 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 state                              | u32  | Ping state:<br>0 – Pinging disabled<br>1 – Pinging enabled<br>2 – External trigger                                                                |
| Beam spacing mode                       | u16  | 1 – Equiangle<br>2 – Equidistant<br>3 – Flex<br>4 – Intermediate                                                                                  |
| 7k Center mode                          | u16  | 0 – Normal<br>1 – Autopilot<br>2 – Calibration (IQ)<br>3+ – Reserved                                                                              |
| Adaptive gate bottom filter information | f32  | Min depth (if Adaptive Gate depth filter is active)                                                                                               |
| Adaptive gate bottom filter information | f32  | Max depth (if Adaptive Gate depth filter is active)                                                                                               |
| Trigger out width                       | f64  | Valid if control bit 24 is set                                                                                                                    |
| Trigger out offset                      | f64  | Valid if control bit 24 is set                                                                                                                    |

| Name                                    | Size    | Description                                                                                                                        |
|-----------------------------------------|---------|------------------------------------------------------------------------------------------------------------------------------------|
| 81xx series projector Selection         | u16     | 0 – Stick<br>1 – Main Array<br>2 – Extended Range<br>3+ – Reserved                                                                 |
| Reserved                                | u32 * 2 | Reserved                                                                                                                           |
| 81xx series alternate gain              | f32     | Gain in dB for Method not selected in Control flags bits 10 and 11                                                                 |
| Vernier filter                          | u8      | Vernier filter settings                                                                                                            |
| Reserved                                | u8      | Reserved                                                                                                                           |
| Custom beams                            | u16     | Custom number of beams                                                                                                             |
| Coverage angle                          | f32     | Coverage angle in radians                                                                                                          |
| Coverage mode                           | u8      | 0 – Reduce Spacing<br>1 – Reduce Beams                                                                                             |
| Quality filter flags                    | u8      | BIT FIELD:<br><u>Bit 0:</u><br>0 – Quality filter disabled<br>1 – Quality filter enabled<br><u>Bit 1-7:</u> Reserved, must be zero |
| Horizontal receiver beam steering angle | f32     | Steering angle in radians (positive to starboard)                                                                                  |
| Flex mode sector coverage               | f32     | Coverage sector in radians                                                                                                         |
| Flex mode sector steering               | f32     | Steering angle in radians (positive to starboard)                                                                                  |
| Constant spacing                        | f32     | Constant beam spacing on the seafloor in meters.                                                                                   |
| Beam mode selection                     | u16     | Zero based index number corresponding with the available beam modes in the sonar XML                                               |
| Depth gate tilt                         | f32     | Angle in radians (positive to starboard)                                                                                           |
| Reserved                                | u32 * 2 | Reserved                                                                                                                           |

## 10.57 7504 – 7P Sensor Settings

**Description:** This record is produced by the SeaBat™ 7k sonar series. It contains additional sonar settings. The 7k Center updates this record for each ping. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 99: 7504 – Record Type Header

| Name                    | Size | Description                                                                                                                       |
|-------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------|
| Sonar serial number     | u64  | Sonar serial number                                                                                                               |
| Ping number             | u32  | Sequential number                                                                                                                 |
| Sound velocity          | f32  | Sound velocity in m/s                                                                                                             |
| Absorption              | f32  | Absorption in dB/km                                                                                                               |
| Spreading loss          | f32  | Spreading loss in dB                                                                                                              |
| Sequencer control       | u32  | 0 – Off<br>1 – On                                                                                                                 |
| Motion sensor format    | u8   | 0 – TSS1<br>1 – SIMRAD EM1000<br>2 – SIMRAD EM3000<br>3 – NMEA \$PASHR<br>4 – OCTANS TAH<br>5+ – Reserved                         |
| Motion Sensor Baud Rate | u8   | 0 – 4800<br>1 – 9600<br>2 – 14400<br>3 – 19200<br>4 – 28800<br>5 – 38400<br>6 – 56000<br>7 – 57600<br>8 – 115200<br>9+ – Reserved |
| Motion Sensor Parity    | u8   | 0 – None<br>1 – Even<br>2 – Odd<br>3 – Space<br>4 – Mark<br>5+ – Reserved                                                         |

| Name                    | Size      | Description                                                                                                                                                                                                             |
|-------------------------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Motion Sensor Data Bits | u8        | 0 – 5 bits<br>1 – 6 bits<br>2 – 7 bits<br>3 – 8 bits<br>4+ – Reserved                                                                                                                                                   |
| Motion Sensor Stop Bits | u8        | 0 – 1 bit<br>1 – 2 bits<br>2+ – Reserved                                                                                                                                                                                |
| Orientation             | u8        | 0 – Port Up<br>1 – Port Down                                                                                                                                                                                            |
| Reserved                | u8        | Reserved                                                                                                                                                                                                                |
| Motion latency          | f32       | Motion sensor latency in seconds<br>Valid range 0 – 0.050                                                                                                                                                               |
| Reserved                | u8        | Reserved                                                                                                                                                                                                                |
| SV manual override      | u8        | Non-zero if manual override of SV in effect                                                                                                                                                                             |
| Active enumerator       | u16       | Enumerator of pinging system                                                                                                                                                                                            |
| Active device ID        | u32       | Device ID of pinging system                                                                                                                                                                                             |
| System mode             | u32       | 0 – Manual (normal) mode<br>1 – AutoPilot mode<br>2 – I&Q (normalization) mode<br>3 – Playback mode<br>4+ – Reserved                                                                                                    |
| Dual head mode          | u32       | 0 – Normal<br>1 – Master<br>2 – Slave                                                                                                                                                                                   |
| Tracker flags           | u32       | <u>Bit 0</u> : Enable range control<br><u>Bit 1</u> : Enable power & gain control<br><u>Bit 2</u> : Enable pulse length control<br><u>Bit 3</u> : Enable coverage angle control<br><u>Bit 4</u> : Use fixed swath width |
| Tracker swath width     | f32       | Tracker swath width in meters                                                                                                                                                                                           |
| Reserved                | u32 * 120 | Reserved                                                                                                                                                                                                                |

## 10.58 7510 – SV Filtering

**Description:** This record is generated every time a surface sound velocity value is received by the 7k Center either via record 7610 (see *section 10.60 7610 – 7k Sound Velocity*) or remote control command 7610 (see *section 11.65 7610 – Manual Sound Velocity*). A filtered sound velocity will be generated. If received via record 7610 and dispatcher is set for immediate broadcast, record 7510 will be broadcast immediately upon receiving record 7610, otherwise (throttled broadcast or receipt of remote control command 7610) it will be broadcast on dispatcher's external records update.

For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

### Data Definition:

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

Table 100: 7510 – Record Type Header

| Name        | Size | Description                                                                                                                                                                                                 |
|-------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sensor SV   | f32  | Surface sound velocity reported by sensor<br>If 'Filter' value is either 0 (no value) or 128 (manual), Sensor SV is set to 0 (zero).                                                                        |
| Filtered SV | f32  | Filtered sound velocity value used                                                                                                                                                                          |
| Filter      | u8   | 0 – No value; no sound velocity value was received by the 7k Center<br>1 – Transparent; no filtering<br>2 – Light filter<br>3 – Normal filter<br>4 – SVP70 Wizard<br>5-127 – Reserved<br>128 – Manual input |

### NOTE

Record 7510 is not generated if surface sound velocity value is received via record 7610 while 7k Center is in manual overwrite mode.

### NOTE

SV Filter is now reset every time a manual value is received via the remote control command 7610. Manual values are never filtered.

## 10.59 7511 – System Lock Status

**Description:** This record informs the clients about SeaBat™ 7k being used exclusively by single client. No other client will be able to change any parameters of the system while it is locked. The remote control commands will be not acknowledged with the error code 0x700B (Remote Command Denied). The 7k Center updates and publishes this record when the status has changed. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 101: 7511 – Record Type Header

| Name        | Size    | Description                                                                                                                                                                                                                                                                                      |
|-------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| System lock | u16     | 0 – System is not locked<br>1 – System is locked                                                                                                                                                                                                                                                 |
| Client IP   | u32     | IP Address of the client that has exclusive control of the system. 127.0.0.1 (0x7F000001) is reported for local clients (those that are running on the same host as 7k Center) regardless of the type of the connection (TCP or Shared Memory). This field is not valid if system is not locked. |
| Reserved    | u32 * 8 | Reserved for future use                                                                                                                                                                                                                                                                          |

| NOTE                                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| This record is unidirectional. See remote command 1503 in <i>section 11 7k Remote Control Definitions</i> for how to gain exclusive control of the system. |

## 10.60 7610 – 7k Sound Velocity

**Description:** This record can be used to set the SeaBat™ 7k sonar series systems current sound velocity value. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 102: 7610 – Record Type Header

| Name           | Size | Description       |
|----------------|------|-------------------|
| Sound velocity | f32  | In meters/second  |
| Temperature    | f32  | Kelvin (optional) |
| Pressure       | f32  | Pascal (optional) |

**NOTE**

The two fields Temperature and Pressure are for information only. They are not used in the 7k center. The 7k center simply passes the record along to subscribers and raw data recording with no source code changes.  
Both fields will not be present with a version of the Io Module older than V4.0.0.8. When the values are zero they are not valid.

**NOTE**

If filtering is enabled in record 7510 (see *section 10.58 7510 – SV Filtering*), record 7610 will contain filtered values used by 7k Center when broadcasted by 7k Center, except when in manual overwrite mode.

**NOTE**

Record 7610 is updated for single request, but not broadcast when manual value is received via remote control command 7610.  
Record 7610 is generated every time surface sound velocity value is received via record 7610 even if 7k center is in manual overwrite mode and the value was ignored. In this case, returned sound velocity value will be unfiltered.

## 10.61 7611 – 7k Absorption Loss

**Description:** This record can be used to set the SeaBat™ 7k sonar series systems current absorption loss value. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 103: 7611 – Record Type Header

| Name            | Size | Description |
|-----------------|------|-------------|
| Absorption loss | f32  | In dB/km    |

## 10.62 7612 – 7k Spreading Loss

**Description:** This record can be used to set the SeaBat™ 7k sonar 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 be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.53 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

**Data Definition:**

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

Table 104: 7612 – Record Type Header

| Name           | Size | Description      |
|----------------|------|------------------|
| Spreading loss | f32  | In dB (0.0-60.0) |

## 11 7K REMOTE CONTROL DEFINITIONS

### 11.1 Overview

This is a detailed discussion of the Record Data section of the 7500 record. The SeaBat™ 7k series system supports all commands or a subset of the below commands.

Table 105: 7k Remote Control Definitions

| Identifier | Description                                       | Possible Return Records |
|------------|---------------------------------------------------|-------------------------|
| 1000       | Shutdown                                          | 7501, 7502              |
| 1001       | Reboot                                            | 7501, 7502              |
| 1002       | Calibrate                                         | 7501, 7502              |
| 1003       | Range                                             | 7501, 7502              |
| 1004       | Max ping rate                                     | 7501, 7502              |
| 1005       | Transmit power                                    | 7501, 7502              |
| 1006       | Pulse length                                      | 7501, 7502              |
| 1007       | Pulse type                                        | 7501, 7502              |
| 1008       | Receiver gain                                     | 7501, 7502              |
| 1009       | Bottom detection mask                             | 7501, 7502              |
| 1010       | Bottom detection filter information               | 7501, 7502              |
| 1011       | Projector selection                               | 7501, 7502              |
| 1012       | Reserved for projector beam stabilization         |                         |
| 1013       | Reserved for receive beam stabilization           |                         |
| 1014       | Reserved for 7k Center mode selection             |                         |
| 1015       | Reserved for hydrophone selection                 |                         |
| 1016       | Bottom detection adaptive gate window and filters |                         |
| 1017       | Receiver gain type                                |                         |
| 1020       | Transmit pulse envelope identifier                |                         |
| 1021       | Projector beam steering                           | 7501, 7502              |
| 1022       | Projector beam widths                             | 7501, 7502              |
| 1023       | Reserved for projector beam focal point           |                         |
| 1024       | Reserved for projector beam weighting             |                         |
| 1025       | Reserved for receiver beam weighting              |                         |
| 1026       | Reserved for system center frequency              | 7501, 7502              |
| 1027       | Transmit frequencies for chirps                   | 7501, 7502              |
| 1028       | Head tilt                                         |                         |
| 1029       | Projector position relative to receiver           | 7501, 7502              |

| Identifier | Description                                          | Possible Return Records                                                                              |
|------------|------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 1032       | Reserved for beam spacing mode                       |                                                                                                      |
| 1033       | Motion compensation                                  |                                                                                                      |
| 1034       | Match filter parameters                              |                                                                                                      |
| 1035       | Coverage sector                                      |                                                                                                      |
| 1036       | Coverage mode                                        |                                                                                                      |
| 1037       | Motion sensor configuration                          |                                                                                                      |
| 1038       | Flex mode parameters                                 |                                                                                                      |
| 1039       | Beam mode selection                                  |                                                                                                      |
| 1050       | Single record request                                | 7503, 7001, 7002, 7005, 7050, 7051, 7052, 7600, 7611, 7612                                           |
| 1051       | Record subscription                                  | 7503, 7000, 7001, 7002, 7004, 7006, 7007, 7008, 7011, 7038, 7050, 7051, 7052, 7500, 7610, 7611, 7612 |
| 1052       | End all subscriptions                                | 7501, 7502                                                                                           |
| 1053       | Third party data connection                          | 7501, 7502                                                                                           |
| 1054       | Delete third party data connection                   | 7501, 7502                                                                                           |
| 1055       | Data feed, range of records                          | 7501, 7502, and all subscribed records                                                               |
| 1056       | Unsubscribe records on data feed                     | 7501, 7502                                                                                           |
| 1099       | Stop 7k Center                                       | 7501, 7502                                                                                           |
| 1100       | Start pinging                                        | 7501, 7502                                                                                           |
| 1101       | Stop pinging                                         | 7501, 7502                                                                                           |
| 1102       | Load factory parameters                              | 7501, 7502                                                                                           |
| 1103       | Snippet control                                      | 7501, 7502                                                                                           |
| 1106       | Reserved for sonar sequencer control                 |                                                                                                      |
| 1107       | Single ping request                                  | 7501, 7502                                                                                           |
| 1108       | Reserved for load factory parameters, specific sonar |                                                                                                      |
| 1109       | System health verification                           | 7501, 7502                                                                                           |
| 1111       | Multi-ping control enable                            |                                                                                                      |
| 1112       | Reserved for multi-ping projector focusing           |                                                                                                      |
| 1113       | Calibrated snippet control                           |                                                                                                      |
| 1114       | External trigger                                     |                                                                                                      |
| 1115       | Trigger out                                          |                                                                                                      |
| 1116       | PPS edge control                                     |                                                                                                      |

| Identifier | Description                                                                   | Possible Return Records |
|------------|-------------------------------------------------------------------------------|-------------------------|
| 1117       | Quality filter settings                                                       |                         |
| 1118       | Snippet control                                                               |                         |
| 1138       | Element limit control                                                         |                         |
| 1200       | Start recording                                                               | 7501, 7502              |
| 1201       | Stop recording/playback                                                       | 7501, 7502              |
| 1202       | Start playback                                                                | 7501, 7502              |
| 1203       | Reserved for data storage delete                                              |                         |
| 1204       | Data storage status request                                                   |                         |
| 1205       | Reserved for get catalog                                                      | 7502                    |
| 1206       | Set warning thresholds                                                        | 7501, 7502              |
| 1207       | Set recording directory                                                       | 7501, 7502              |
| 1209       | Set filtering                                                                 | 7501                    |
| 1300-1305  | Reserved                                                                      |                         |
| 1400       | Autopilot table update                                                        |                         |
| 1401       | Autopilot algorithm parameters update<br>(not described in the documentation) | 7501, 7502              |
| 1503       | Reserved for system lock                                                      |                         |
| 1509       | System health check<br>(not described in the documentation)                   | 7501, 7502              |
| 7041       | R7041 setup                                                                   |                         |
| 7610       | Manual sound velocity                                                         |                         |

## 11.2 1000 – Shutdown

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

*This command has no parameters.*

## 11.3 1001 – Reboot

Software and firmware reset.

*This command has no parameters.*

## 11.4 1002 – 7k Center Calibration Control

**Description:** Initiate system calibration, cancel calibration, control various aspects of calibration process, etc.. Record 7055 (7K Calibration Status Information) will indicate the ongoing calibration status and Record 7005 will be available when calibration is complete.

Table 106: 7500 Record Data – Command 1002

| Name                | Size     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Calibration Command | u16      | 0 – Start calibration process<br>1 – Cancel any calibration that's in progress<br>2 – Use results of last calibration (ignored if no calibration has been done)<br>3 – Verify existing calibration<br>4 – Revert to previous<br>5 – Clear to "not calibrated" state<br>6-10 – Reserved / internal<br>11 – Start calibration (Cal-tone OFF)<br>12 – Set Cal-tone frequency. <i>Optional Data</i> is 32 bit float specifying frequency in Hz.<br>13 – Manual Cal-tone control (on/off). <i>Optional Data</i> is 16 bit Boolean flag (0 = OFF, non-zero = ON)<br>14 – EM7218 amplitude and waveform control ('D' command)<br>15 – Manual Tx shading control (on/off). <i>Optional Data</i> is 16 bit Boolean flag (0 = OFF, non-zero = ON) |
| Optional Data       | variable | Depends on Calibration Commands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

## 11.5 1003 – Range

**Description:** System Range Setting

Table 107: 7500 Record Data – Command 1003

| Name  | Size | Description             |
|-------|------|-------------------------|
| Range | f32  | Range setting in meters |

## 11.6 1004 – Max Ping Rate

**Description:** Max ping setting

Table 108: 7500 Record Data – Command 1004

| Name          | Size | Description                               |
|---------------|------|-------------------------------------------|
| Max ping rate | f32  | Max ping rate setting in pings per second |

## 11.7 1005 – Transmit Power

**Description:** System transmit power setting

Table 109: 7500 Record Data – Command 1005

| Name           | Size | Description                     |
|----------------|------|---------------------------------|
| Transmit power | f32  | Transmit power in dB re 1μPa@1m |

## 11.8 1006 – Pulse Length

**Description:** System transmitter pulse length setting

Table 110: 7500 Record Data – Command 1006

| Name                 | Size | Description                      |
|----------------------|------|----------------------------------|
| Transmit pulse width | f32  | Transmit pulse length in seconds |

## 11.9 1007 – Pulse Type

**Description:** System transmitter pulse type.

***This command is only available for selected systems.***

Table 111: 7500 Record Data – Command 1007

| Name                | Size | Description                |
|---------------------|------|----------------------------|
| Transmit pulse type | u32  | 0 – CW<br>1 – Linear chirp |

## 11.10 1008 – Receiver Gain

**Description:** System receiver gain.

Table 112: 7500 Record Data – Command 1008

| Name          | Size | Description          |
|---------------|------|----------------------|
| Receiver gain | f32  | Gain selection in dB |

## 11.11 1009 – Bottom Detection Mask

**Description:** System bottom detection mask.

Table 113: 7500 Record Data – Command 1009

| Name                  | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Bottom detection flag | u32  | BIT FIELD:<br><u>Bit 0-3:</u> Reserved<br><u>Bit 4-7:</u> Reserved for bottom detection method<br><u>Bit 8:</u> Range filter<br>1 – Enabled<br>0 – Disabled<br><u>Bit 9:</u> Depth filter<br>1 – Enabled<br>0 – Disabled<br><u>Bit 10:</u> Adaptive gate<br>1 – Enabled<br>0 – Disabled<br><u>Bit 11:</u> Adaptive gate depth filter<br>1 – Enabled<br>0 – Disabled<br><u>Bit 12:</u> Adaptive gate depth filter fixed<br>1 – Fix depth<br>0 – Follow seafloor<br><u>Bit 13-31:</u> Reserved |

## 11.12 1010 – Bottom Detection Filter Information

**Description:** System bottom detection filter information. The minimum and maximum must differ by at least 2 meters.

Table 114: 7500 Record Data – Command 1010

| Name            | Size | Description                              |
|-----------------|------|------------------------------------------|
| Min range       | f32  | In meters                                |
| Max range       | f32  | In meters                                |
| Min depth       | f32  | In meters                                |
| Max depth       | f32  | In meters                                |
| Depth gate tilt | f32  | Angle in radians (positive to starboard) |

## 11.13 1011 – Projector Selection

**Description:** Selects an active projector.

| NOTE                                                                                                                                                                                                                                            |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| If any other transmitter is pinging (even if Max Ping Rate is zero), this command will fail. 1101 – Stop Pinging – should be issued prior to issuing this command. Reselecting current transmitter always succeeds regardless of pinging state. |  |

Table 115: 7500 Record Data – Command 1011

| Name            | Size | Description                                                                                                                                                                                                                              |
|-----------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Force projector | u32  | If set to -1 (0xffff) the projector selection will be forced, by issuing stop pinging command to all other projectors<br><u>8K wet ends – projector selection:</u><br>0 – Stick<br>1 – Main array<br>2 – Extended range<br>3+ – Reserved |

## 11.14 1016 – Bottom Detection Adaptive Gate Window and Filters

**Description:** Controls the bottom detection adaptive gate operation. The nadir search minimum and maximum values are used only if the Adaptive Gate Depth Filter option is enabled (See section 11.11 1009 – Bottom Detection Mask). The minimum and maximum must differ by at least 2 meters.

Table 116: 7500 Record Data – Command 1016

| Name           | Size | Description                                                                                      |
|----------------|------|--------------------------------------------------------------------------------------------------|
| Window size    | i32  | Bottom detection gate size as a percentage of the approximate nadir depth. Valid range is 1-100. |
| Search minimum | f32  | Minimum depth for initial bottom detection on nadir beam (meters)                                |
| Search maximum | f32  | Maximum depth for initial bottom detection on nadir beam (meters)                                |

## 11.15 1017 – Receiver Gain Type

**Description:** Sets the receiver gain type.

***This command is only available for selected systems.***

Table 117: 7500 Record Data – Command 1016

| Name      | Size    | Description                                                         |
|-----------|---------|---------------------------------------------------------------------|
| Gain type | u32     | 0 – TVG<br>1 – Reserved for auto gain<br>2 – Fixed<br>3+ – Reserved |
| Reserved  | u32 * 4 | Reserved                                                            |

## 11.16 1019 – Vernier Processing Parameters

**Description:** Sets parameters that control the vernier processing, which is output in the 7019 record. The command applies only to the 200kHz 7130 system at this time.

Table 118: 7500 Record Data – Command 1019

| Name                    | Size | Description                                                                                                                                                                                                                                                                                                       |
|-------------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Field flags             | u16  | Bitfield indicating which parameters are to be applied by this command.<br><u>Bit 0:</u> Operational mode<br><u>Bit 1:</u> Decimation<br><u>Bit 2:</u> First sample<br><u>Bit 3:</u> Smoothing window type<br><u>Bit 4:</u> Smoothing window length<br><u>Bit 5:</u> Reference array<br><u>Bit 6-15:</u> Reserved |
| Operational mode        | u32  | 0 – Vernier<br>1 – Single array Mag & Phase (power reduction - TBA)<br>3 – Triple array Mag & Phase (3 sets of records generated for each ping – one for each stave)                                                                                                                                              |
| Decimation factor       | u8   | Data decimated by this factor, i.e. retain only 1 of X samples)                                                                                                                                                                                                                                                   |
| First sample            | u32  | Index of first sample to include in output record. Allows for reduction of 7019 record size via elimination of near range data.                                                                                                                                                                                   |
| Smoothing window type   | u32  | 0 – Rectangular<br>2 – Hamming<br>99 – None                                                                                                                                                                                                                                                                       |
| Smoothing window length | u16  | Smoothing window length [samples]. Range = 3 to 63. Value must be odd.                                                                                                                                                                                                                                            |

| Name            | Size  | Description                                                                                                                                                                                                                                                                                                                    |
|-----------------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reference array | u8    | When <i>Operational Mode</i> is “Vernier” (0), this selects which array to use as reference array in Vernier processing.<br>When <i>Operation Mode</i> is “Single array” (1), this selects which of the three 200kHz arrays is to be active.<br>Valid values are 0, 1, or 2 in both cases.<br>(TBA - unsupported at this time) |
| Reserved        | 4*u32 | Reserved for future use                                                                                                                                                                                                                                                                                                        |

### 11.17 1020 – Transmit Pulse Envelope Identifier

**Description:** Sets the Transmit Pulse Envelope.

***This command is only available for selected systems.***

Table 119: 7500 Record Data – Command 1020

| Name          | Size    | Description                                             |
|---------------|---------|---------------------------------------------------------|
| Envelope type | u32     | 0 – Rectangular<br>1 – Tukey<br>2 – FFFFFFFF - Reserved |
| Shading value | f32     | Window shading value<br>Tukey (0.0-1.0)                 |
| Reserved      | u32 * 4 | Reserved                                                |

### 11.18 1021 – Projector Beam Steering

**Description:** Horizontal and vertical projector beam steering.

***This command is only available for selected systems.***

Table 120: 7500 Record Data – Command 1021

| Name                                     | Size | Description |
|------------------------------------------|------|-------------|
| Projector beam steering angle vertical   | f32  | In radians  |
| Projector beam steering angle horizontal | f32  | In radians  |

## 11.19 1022 – Projector Beam Widths

**Description:** Horizontal and vertical projector beam widths.

***This command is only available for selected systems.***

Table 121: 7500 Record Data – Command 1022

| Name                                      | Size | Description |
|-------------------------------------------|------|-------------|
| Projector beam –3dB beam width vertical   | f32  | In radians  |
| Projector beam –3dB beam width horizontal | f32  | In radians  |

## 11.20 1027 – Transmit Frequencies for Chirps

**Description:** Transmit pulse start and stop frequencies.

***This command is only available for selected systems.***

Table 122: 7500 Record Data – Command 1027

| Name            | Size | Description |
|-----------------|------|-------------|
| Start frequency | f32  | In Hz       |
| Stop frequency  | f32  | In Hz       |

## 11.21 1033 – Motion Compensation

**Description:** Sets motion compensation options. Roll compensation status is reported for each ping in the receive flags field of the 7000 and 7503 records. Pitch compensation status is reported for each ping in the transmit flags field of the 7000 and 7503 records. Motion compensation capability varies depending on system type.

Table 123: 7500 Record Data – Command 1033

| Name     | Size   | Description        |
|----------|--------|--------------------|
| Roll     | u8     | 0 – OFF<br>>0 – ON |
| Pitch    | u8     | 0 – OFF<br>>0 – ON |
| Heave    | u8     | N/A                |
| Speed    | u8     | N/A                |
| Reserved | u8 * 8 | Reserved           |

## 11.22 1034 – Match Filter Parameters

**Description:** Sets the match filter parameters.

***This command is only available for selected systems.***

Table 124: 7500 Record Data – Command 1034

| Name          | Size    | Description                                                                                                                                                                      |
|---------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Window type   | u32     | 0 – Rectangular<br>1 – Kaiser<br>2 – Reserved for Hamming<br>3 – Reserved for Blackmann<br>4 – Reserved for Triangular<br>5 – Reserved for X (Taylor)<br>6 – FFFFFFFF – Reserved |
| Shading value | f32     | Window shading value                                                                                                                                                             |
| Reserved      | u32 * 4 | Reserved                                                                                                                                                                         |

## 11.23 1035 – Coverage Sector

**Description:** Sets the current coverage sector.

***This command is only available for selected systems.***

Table 125: 7500 Record Data – Command 1035

| Name                                    | Size | Description                                       |
|-----------------------------------------|------|---------------------------------------------------|
| Coverage sector                         | f32  | Coverage sector in radians                        |
| Horizontal receiver beam steering angle | f32  | Steering angle in radians (positive to starboard) |

## 11.24 1036 – Coverage Mode

**Description:** Sets the current coverage mode.

***This command is only available for selected systems.***

Table 126: 7500 Record Data – Command 1036

| Name          | Size | Description                            |
|---------------|------|----------------------------------------|
| Coverage mode | u8   | 0 – Reduce spacing<br>1 – Reduce beams |

## 11.25 1037 – Motion Sensor Configuration

**Description:** Sets the motion sensor configuration.

***This command is only available for selected systems.***

Table 127: 7500 Record Data – Command 1037

| Name           | Size    | Description                                                                                                      |
|----------------|---------|------------------------------------------------------------------------------------------------------------------|
| Format         | u8      | 0 – TSS1<br>1 – SIMRAD EM1000<br>2 – SIMRAD EM3000<br>3 – NMEA \$PASHR<br>4 – OCTANS TAH                         |
| Baud           | u8      | 0 – 4800<br>1 – 9600<br>2 – 14400<br>3 – 19200<br>4 – 28800<br>5 – 38400<br>6 – 56000<br>7 – 57600<br>8 – 115200 |
| Parity         | u8      | 0 – None<br>1 – Even<br>2 – Odd<br>3 – Space<br>4 – Mark                                                         |
| Data Bits      | u8      | 0 – 5 bits<br>1 – 6 bits<br>2 – 7 bits<br>3 – 8 bits                                                             |
| Stop Bits      | u8      | 0 – 1 bit<br>1 – 2 bits                                                                                          |
| Orientation    | u8      | 0 – Port Up<br>1 – Port Down                                                                                     |
| Reserved       | u8      | Reserved                                                                                                         |
| Motion Latency | f32     | Motion latency in seconds<br>Valid range is 0 – 0.050                                                            |
| Reserved       | u8 * 20 | Reserved                                                                                                         |

## 11.26 1038 – Flex Mode Parameters

**Description:** Set the flex mode parameters.

Table 128: 7500 Record Data – Command 1038

| Name                      | Size | Description                                              |
|---------------------------|------|----------------------------------------------------------|
| Flex mode sector coverage | f32  | Coverage sector in radians                               |
| Flex mode sector steering | f32  | Sector steering angle in radians (positive to starboard) |

## 11.27 1039 – Beam Mode Selection

**Description:** Set the beam mode selection.

Table 129: 7500 Record Data – Command 1039

| Name                | Size | Description                                                                          |
|---------------------|------|--------------------------------------------------------------------------------------|
| Beam mode selection | u16  | Zero based index number corresponding with the available beam modes in the sonar XML |

## 11.28 1040 – System Bandwidth & IO Rate

**Description:** Sets system bandwidth and IQ rate parameters. Applicable only for systems using the EM7218 receiver.

Table 130: 7500 Record Data – Command 1040

| Name      | Size  | Description |
|-----------|-------|-------------|
| IQ Rate   | u32   | 0 – SR17K   |
|           |       | 1 – SR34K   |
|           |       | 2 – SR50K   |
|           |       | 3 – SR60K   |
|           |       | 4 – SR80K   |
|           |       | 5 – SR100K  |
| Bandwidth | u32   | Reserved    |
| Reserved  | u32*4 | Reserved    |

## 11.29 1041 – Manual IMUX Control

**Description:** Sets IMUX bits manually, overriding the value which is normally supplied in the system configuration XML file. Applicable only for systems using the EM7218 receiver.

Table 131: 7500 Record Data – Command 1041

| Name     | Size  | Description                                                                                                                                                  |
|----------|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| IMUX     | u32   | The valid range is 0 - 7.<br>NOTE: During normalization/calibration process the IMUX value is set to 4, regardless of any previous setting via this command. |
| Reserved | u32*2 | Reserved, set to zero                                                                                                                                        |

### 11.30 1043 – Custom Beams

**Description:** Set the number of beams for the beamformer.

Table 132: 7500 Record Data – Command 1043

| Name         | Size | Description                               |
|--------------|------|-------------------------------------------|
| Custom beams | u16  | Custom number of beams. Zero for default. |

### 11.31 1044 – Constant Spacing

**Description:** Set the constant beam spacing value on the seafloor in meters.

Table 133: 7500 Record Data – Command 1044

| Name             | Size | Description                                                                                                                                                                                                         |
|------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Constant spacing | f32  | Constant beam spacing on the seafloor in meters.<br><br>Used for equi-distant and flex modes.<br><br>The number of beams will vary depending on the seafloor depth. Setting this to zero will always use all beams. |

### 11.32 1045 – Multi-Detect Parameters

**Description:** Sets parameters that control the Multi-Detect bottom detection processing. Multi-detect allows for *up to five* detections for each beam. The command affects the output of the 7017 and 7027 bathymetry records. Multi-detect is a licensed feature. If the license is not present, then this command will produce a “NACK” response.

NOTE: Multi-Detect currently uses a version of the “G2” bottom detection algorithm as its basis. This may be changed in the future.

Table 134: 7500 Record Data – Command 1045

| Name           | Size    | Description                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enable         | u16     | Zero = Multi-detect OFF.<br>Non-zero = Multi-detect ON.                                                                                                                                                                                                                                                                                                                                            |
| Object Size    | u16     | Range of 1 to 100.<br>Controls the sensitivity of the algorithm to Object Size. This is a unit-less quantity.<br><i>Note: Increasing this parameter results in more detections on smaller objects. Decreasing this parameter results in fewer detections and only on larger objects.</i>                                                                                                           |
| Sensitivity    | u16     | Range of 1 to 100.<br>Controls the sensitivity of the algorithm to Amplitude. This is a unit-less quantity.<br><i>Note: Increasing this parameter causes more objects to be detected.</i>                                                                                                                                                                                                          |
| Max Detections | u16     | Range of 1 to 5.<br>Limits the number of detections produced per beam. The maximum number of detections per beam is five.<br><i>Note: If there are fewer clusters which are over the sensitivity threshold than the selected number of detections, only the number of valid detections shall be produced, i.e. detections will not be generated from clusters below the sensitivity threshold.</i> |
| Reserved       | 2 * u16 | Reserved, set to zero                                                                                                                                                                                                                                                                                                                                                                              |

### 11.33 1050 – Single Record Request

**Description:** Request latest record.

Table 135: 7500 Record Data – Command 1050

| Name        | Size | Description                                                                                                                                                                                                                                                                          |
|-------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Record type | u32  | Possible responses:<br>7501 – Followed by the requested record, will be one of the following: 1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009, 1010, 1011, 1012, 1013, 1014, 1015, 1016, 1050, 7001, 7002, 7004, 7005, 7022, 7050, 7052, 7400, 7503, 7610, 7611, 7612.<br>7502 (NACK) |

### 11.34 1051 – Record Subscription

**Description:** Subscribe to records. The host is responsible to keep this connection alive as well as re-establish a lost connection to the 7-P processor.

Table 136: 7500 Record Data – Command 1051

| Name                    | Size    | Description                                                                                                                                                                                        |
|-------------------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| N                       | u32     | Number of records                                                                                                                                                                                  |
| Array of record numbers | u32 * N | Possible responses:<br>7501 – Followed by the subscribed record(s), will be one or more of the following:<br>7503, 7000, 7002, 7004, 7006, 7007, 7008, 7011, 7050, 7051, 7052, 7055<br>7502 (NACK) |

### 11.35 1052 – End All Subscriptions

**Description:** Unsubscribe to all records.

*This command has no parameters.*

### 11.36 1053 – Third Party Data Connection

**Description:** Add UDP or TCP connection to 7k Center, with specification of records to subscribe to.

Table 137: 7500 Record Data – Command 1053

| Name        | Size    | Description                        |
|-------------|---------|------------------------------------|
| Address     | u32     | IP address (Host Byte Data Order)  |
| Port        | u16     | Port number                        |
| Type        | u16     | 0 – UDP<br>1 – TCP                 |
| # Records   | u32     | Number records                     |
| Record list | u32 * N | Array of record IDs, N = # Records |

### 11.37 1054 – Delete Third Party Data Connection

**Description:** Delete UDP or TCP connection to 7k Center. All three parameters must match those provided in the 1053 record for the connection to be deleted.

Table 138: 7500 Record Data – Command 1054

| Name    | Size | Description                       |
|---------|------|-----------------------------------|
| Address | u32  | IP address (Host Byte Data Order) |
| Port    | u16  | Port number                       |
| Type    | u16  | 0 – UDP<br>1 – TCP                |

### 11.38 1055 – Data Feed, Range of Records

**Description:** Create 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.

Table 139: 7500 Record Data – Command 1055

| Name            | Size | Description     |
|-----------------|------|-----------------|
| Start record ID | u32  | Start record ID |
| End record ID   | u32  | End record ID   |

### 11.39 1056 – Unsubscribe Records on Data Feed

**Description:** Remove specified records from the subscription list of a connection. The subscription list is set via the 1051 or 1055 records. The feed will be stopped if no records are left in the subscription list after this record is sent.

Table 140: 7500 Record Data – Command 1056

| Name                    | Size    | Description                                                      |
|-------------------------|---------|------------------------------------------------------------------|
| N                       | u32     | Number of records                                                |
| Array of record numbers | N * u32 | Any records that are subscription-enabled for the current system |

### 11.40 1099 – Stop 7k Center

**Description:** Causes 7k Center process to stop. Should always be acknowledged.

*This command has no parameters.*

### 11.41 1100 – Start Pinging

**Description:** Start continuous pinging. (Pinging will not start if the Max Ping Rate is set to zero.)

*This command has no parameters.*

### 11.42 1101 – Stop Pinging

**Description:** Stop pinging.

*This command has no parameters.*

### 11.43 1102 – Load Factory Parameters

**Description:** Load Factory Parameters from disk.

*This command has no parameters.*

## 11.44 1103 – Snippet Control

**Description:** Limit record 7028's sample range to a window around the bottom detection ranges.

| NOTE                                                                                                                            |  |
|---------------------------------------------------------------------------------------------------------------------------------|--|
| Have the same working as 7008 record (i.e. obsolete and will cause undefined behavior if used in conjunction with 7028 record). |  |

Table 141: 7500 Record Data – Command 1103

| Name        | Size | Description                                                                   |
|-------------|------|-------------------------------------------------------------------------------|
| Enable      | u32  | 0 – Disable snippet sample limitation<br>1 – Enable snippet sample limitation |
| Window size | u32  | Number of samples around bottom detection for each beam                       |

## 11.45 1107 – Single Ping Request

**Description:** Request for a single ping.

***This command has no parameters.***

| NOTE                                                              |  |
|-------------------------------------------------------------------|--|
| This request will halt continuous pinging if it has been started. |  |

## 11.46 1109 – System Health Verification

**Description:** Request System Health snapshot text file to be created. The file name is created according to *section 8.2 File Nomenclature* with a .txt extension.

File is named "7kSystemHealth. The file will be created in the 7k Center executable directory. For remote connections (UDP/TCP) with the SeaBat UI, an additional file will be created in the SeaBat executable directory.

***This command has no parameters.***

## 11.47 1111 – Multi-ping Control Enable

**Description:** Set multi-ping control parameters. Note that if the number of pings field is 0 or 1, then multi-ping mode is turned OFF, and the begin frequency and spacing fields are ignored. Multi-ping capability varies depending on system type.

Table 142: 7500 Record Data – Command 1111

| Name                        | Size | Description                                                     |
|-----------------------------|------|-----------------------------------------------------------------|
| Number of pings in sequence | u16  | 0, 1 – Single ping mode (default)<br>2 – 2 pings<br>4 – 4 pings |
| Begin frequency             | u32  | First ping frequency (Hz)                                       |

| Name    | Size | Description                             |
|---------|------|-----------------------------------------|
| Spacing | i32  | Frequency spacing (Hz, may be negative) |

| NOTE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Currently the Begin Frequency and Spacing fields are not used. Each ping in the multi-ping sequence is spaced evenly about the base (center) frequency, and the spacing is not adjustable. E.g. for 2 ping mode, frequency for ping #1 = center frequency – (fixed spacing / 2); frequency for ping #2 = center frequency + (fixed spacing / 2). For instance, the center frequency is 400kHz, the spacing is set at 30kHz then ping#1 is 385kHz and ping#2 is 415kHz.</p> <p>The actual frequency value for each ping is reported in the 7000 record, which is generated for each ping in the multi-ping sequence.</p> |

## 11.48 1113 – Calibrated Snippet Control

**Description:** Limit record 7058's sample range to a window around the bottom detection ranges.

Table 143: 7500 Record Data – Command 1113

| Name                | Size | Description                                                                                                                                                                                                                                                                         |
|---------------------|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enable              | u16  | 0 – Disable snippet sample limitation<br>1 – Enable snippet sample limitation                                                                                                                                                                                                       |
| Window size         | f32  | Number of samples around bottom detection for each beam                                                                                                                                                                                                                             |
| Flags               | u32  | BIT FIELD:<br><u>Bit 0</u> : Bottom detection window selected<br><u>Bit 1</u> : Snippet display window selected<br><u>Bit 2</u> : Quality control<br><u>Bit 3</u> : Minimum window size is required<br><u>Bit 4</u> : Maximum window size is required<br><u>Bit 6-31</u> : Reserved |
| Flag                | u8   | BIT FIELD:<br><u>Bit 0</u> : Require brightness quality to pass<br><u>Bit 1</u> : Require colinearity quality to pass<br><u>Bit 2-7</u> : Reserved                                                                                                                                  |
| Minimum window size | u32  | Minimum number of samples around bottom detection for each beam                                                                                                                                                                                                                     |
| Maximum window size | u32  | Maximum number of samples around bottom detection for each beam                                                                                                                                                                                                                     |

## 11.49 1114 – External Trigger

**Description:** Starts pinging on external trigger. Should always be acknowledged.

***This command has no parameters.***

## 11.50 1115 – Trigger Out

**Description:** Sets output trigger on ping command.

Table 144: 7500 Record Data – Command 1115

| Name   | Size | Description                                                                                            |
|--------|------|--------------------------------------------------------------------------------------------------------|
| State  | u32  | BIT FIELD:<br><u>Bit 0:</u><br>1 – Enabled<br>0 – Disabled<br><u>Bit 1-31:</u> Reserved (must be zero) |
| Length | f64  | Trigger length (in seconds)                                                                            |
| Offset | f64  | Trigger delay after ping command (in seconds)                                                          |

## 11.51 1116 – PPS Edge Control

**Description:** Sets PPS input edge control.

Table 145: 7500 Record Data – Command 1116

| Name     | Size | Description                                                                           |
|----------|------|---------------------------------------------------------------------------------------|
| PPS Edge | u32  | BIT FIELD:<br><u>Bit 0:</u><br>0 – Rising<br>1 – Falling<br><u>Bit 1-31:</u> Reserved |

## 11.52 1117 – Quality Filter Settings

**Description:** Sets the quality filter settings. Only points that pass the filter will be available in the 7026 (7k detection data; not implemented yet) and 7028 (7k snippet data) record.

Table 146: 7500 Record Data – Command 1117

| Name                 | Size     | Description                                                                                                                        |
|----------------------|----------|------------------------------------------------------------------------------------------------------------------------------------|
| Quality filter flags | u8       | BIT FIELD:<br><u>Bit 0:</u><br>0 – Quality filter disabled<br>1 – Quality filter enabled<br><u>Bit 1-7:</u> Reserved, must be zero |
| Reserved             | u8 * 255 | Reserved                                                                                                                           |

## 11.53 1118 – Snippet Control

**Description:** Limits snippet sample range.

| <b>NOTE</b>                                       |  |
|---------------------------------------------------|--|
| This command may affect old 7008 record's format. |  |

Table 147: 7500 Record Data – Command 1118

| Name        | Size | Description                                                                                                                                                                                                                                                                                    |
|-------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags       | u32  | BIT FIELD: (1 – Enabled)<br><u>Bit 0:</u> Use automatic snippet window<br><u>Bit 1:</u> Include at least samples around bottom detection (min. window size is valid)<br><u>Bit 2:</u> Include at most samples around bottom detection (max. window size is valid)<br><u>Bit 3-31:</u> Reserved |
| Min. Window | u32  | Min snippet window (Flags[2])                                                                                                                                                                                                                                                                  |
| Max. Window | u32  | Max snippet window (Flags[3])                                                                                                                                                                                                                                                                  |

Automatic snippet window, if enabled, is constructed to allow 3dB overlap between beams.

In snippet control command at least one of the three control flags has to be enabled; but they can be used all three together.

The “default” values are the following:

- Automatic window is enabled
- Minimum window size is enabled and equals to 10
- Maximum window size is enabled and equals to 150

## 11.54 1138 – Element Limit Control

**Description:** Limit the number of elements and/or samples in record 7038.

Table 148: 7500 Record Data – Command 1138

| Name        | Size | Description                                        |
|-------------|------|----------------------------------------------------|
| Sample type | u16  | 16, 12 or 8 bits                                   |
| Min sample  | u32  | Start sample number. 0 to samples – 1              |
| Max sample  | u32  | Stop sample number. 0 to samples – 1<br>0xffffffff |

| Name                   | Size    | Description                                                                                                                                                                       |
|------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Number of elements (E) | u16     | 0 – All elements<br>0xffff – If calibration is available, only “good” elements will be included. Otherwise, all elements are included.<br>Otherwise, number of elements to follow |
| Elements               | u16 * E | List of elements to include. Element numbers are zero based.                                                                                                                      |

## 11.55 1200 – Start Recording

**Description:** Start recording. The directory (see ID 1207) and file name combined must not exceed 256 characters.

Table 149: 7500 Record Data – Command 1200

| Name     | Size     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reserved | u32      | Reserved – must be 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Filename | u8 * 256 | Null terminated ASCII string. Maximum 256 characters, including null character.<br>If the filename is NULL (empty), the file name is created according to <i>section 8.2 File Nomenclature</i> (i.e., UTC time stamp). If the file name is not fully qualified (no drive and/or directory) or NULL, the file will be saved in the application directory, unless a different default directory has been selected with command 1207.<br>If a fully qualified path name – including drive (or UNC network resource), directory, and filename – is supplied, it will be used. The directory must exist. It will not be created. The .s7k extension will be added to the filename. The file name length + the directory path length cannot exceed 256 characters. |

## 11.56 1201 – Stop Recording / Playback

**Description:** Stop recording or playback (whichever is in progress).

***This command has no parameters.***

## 11.57 1202 – Start Playback

**Description:** Sets up playback mode and begins record output. A NACK is generated if the file name is NULL, or if the current state is PLAYBACK or RECORDING when this record is received.

Table 150: 7500 Record Data – Command 1202

| Name        | Size     | Description                                                                                                                                                                                                                             |
|-------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Start flag  | u16      | 1 – Time in seconds<br>2 – Record number                                                                                                                                                                                                |
| Start point | u32      | Seconds or record number                                                                                                                                                                                                                |
| Frequency   | i32      | Playback frequency<br>0 – Real Time<br><0 – As fast as possible<br>>0 – Records per second                                                                                                                                              |
| File name   | u8 * 256 | Null-terminated ASCII string. 256 characters maximum, including null character. The full path (drive and directory) must be specified with the file name. (The directory specified in the 1207 command record <b>will not</b> be used.) |

## 11.58 1204 – Data Storage Status Request

**Description:** Returns status of data recorder (Record 7052).

*This command has no parameters.*

## 11.59 1206 – Set Warning Threshold(s)

**Description:** Set the low-drive-space warning threshold values. The warning levels are specified as percentages. Whenever free drive space on the active volume drops from one level to another, a 7051 (System Event) record will be generated by the 7k Center.

Table 151: 7500 Record Data – Command 1206

| Name        | Size    | Description                                                                     |
|-------------|---------|---------------------------------------------------------------------------------|
| N           | u16     | Number of integer percentage threshold values to follow. Maximum number is 100. |
| Value array | u32 * N | Array of N percentage threshold values. Must be in descending order.            |

## 11.60 1207 – Set Recording Directory

**Description:** Set DR data file storage directory. The combined directory and file name cannot exceed 256 characters. Data cannot be recording or playing for this command to be accepted.

Table 152: 7500 Record Data – Command 1207

| Name      | Size     | Description                                                                                                                                                                                                                                                                     |
|-----------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Directory | u8 * 256 | New directory pathname. Null-terminated ASCII string. A trailing backslash ('\') will be appended if necessary.<br>Network paths should be specified as (for example): \\server\directory.<br>In the event that the directory does not exist, it will be created (if possible). |

## 11.61 1209 – Set Filtering

**Description:** Sets playback mode OR record mode filtering. Allows for inclusionary record filtering during playback or recording.

The 7k records available for recording are listed below:

|      |      |      |      |      |      |      |      |      |      |
|------|------|------|------|------|------|------|------|------|------|
| 1000 | 1001 | 1002 | 1003 | 1004 | 1005 | 1006 | 1007 | 1008 | 1009 |
| 1010 | 1011 | 1012 | 1013 | 1014 | 1015 | 1016 | 1017 | 1020 | 1050 |
| 7000 | 7002 | 7004 | 7006 | 7007 | 7008 | 7011 | 7012 | 7017 | 7018 |
| 7021 | 7026 | 7027 | 7028 | 7038 | 7039 | 7048 | 7057 | 7058 | 7068 |
| 7503 | 7504 | 7505 | 7511 | 7610 | 7611 | 7612 | 8012 |      |      |

However, since new records are defined from time to time, and others may become obsolete, it is recommended to use the 7052 “recording status” record, which is available as a single record request or via subscription, in order to obtain the list of records supported by your version of the software. The 7052 record will contain the complete list of available records if the “Filter Method” field of the most recent 1209 command record is set to 0 (No filtering).

The minimal record set should include 7000, 7004, and either 7011 + 7006 (bathymetry) or 7018 (FLS). Full reprocessing of .s7k files requires water column data record 7018 or 7008 (obsolete). The SeaBat UI enforces this minimal set via the 1209 command records it sends to the 7k Center.

Table 153: 7500 Record Data – Command 1209

| Name          | Size | Description                                                                                                                |
|---------------|------|----------------------------------------------------------------------------------------------------------------------------|
| Filter type   | u16  | 0 – By record                                                                                                              |
| Filter method | u16  | 0 – None, all records will be included<br>1 – Inclusionary, ‘Filter List’ is the list of records for playback or recording |
| N             | u16  | Number of record IDs in ‘Filter List’ (maximum 128)                                                                        |

| Name        | Size    | Description                                    |
|-------------|---------|------------------------------------------------|
| Filter list | u32 * N | List of N record IDs for filtering to act upon |

## 11.62 1400 – Autopilot Table Update

**Description:** Autopilot table to be loaded.

Table 154: 7500 Record Data – Command 1400

| Name                      | Size  | Description                                                                                             |
|---------------------------|-------|---------------------------------------------------------------------------------------------------------|
| Size                      | i32   | Table size                                                                                              |
| Version                   | i32   | Table version: currently set at 3                                                                       |
| Mode                      | u32   | 0 – Range based<br>1 – Depth based                                                                      |
| Rows                      | i32   | Number of rows in table, based on number of valid ranges/depth increments for sonar (Max 100)           |
| Range[0] sonar type       | u32   | 0 – 7101<br>1 – 7111<br>2 – 7125 200kHz<br>3 – 7125 400kHz<br>4 – 7150<br>5 – Default<br>6+ – Not valid |
| Range[0] Min power        | i32   | Min power for this range                                                                                |
| Range[0] Max power        | i32   | Max power for this range                                                                                |
| Range[0] Min gain         | i32   | Min gain for this range                                                                                 |
| Range[0] Max gain         | i32   | Max gain for this range                                                                                 |
| Range[0] Min pulse length | f32   | Min pulse length for this range                                                                         |
| Range[0] Max pulse length | f32   | Max pulse length for this range                                                                         |
| Range[0] Tuning           | u16*8 | Algorithm tuning parameters                                                                             |
| Range[0] Reserved         | u32*4 | Reserved                                                                                                |
| .... Range[Rows-1]        |       | Additional settings for each range/depth (row)                                                          |
| Row[0] Sonar type         | u32   | First row Sonar type (same as above)                                                                    |
| Row[0] Bottom depth       | f32   | First row Depth                                                                                         |
| Row[0] Range              | i32   | First row Range                                                                                         |
| Row[0] Tx Power           | i32   | First row Power                                                                                         |
| Row[0] Gain               | i32   | First row Gain                                                                                          |
| Row[0] Spreading          | i32   | First row Spreading                                                                                     |
| Row[0] Absorption         | i32   | First row Absorption                                                                                    |
| Row[0] Tx Pulse length    | i32   | First row Pulse length                                                                                  |
| Row[0] Reserved           | u32*4 | First row Reserved                                                                                      |

| Name             | Size | Description       |
|------------------|------|-------------------|
| .... Row[Rows-1] |      | Last row Settings |

## 11.63 1402 – Tracker Control

**Description:** Sets the state of the Tracker options.

Table 155: 7500 Record Data – Command 1402

| Name                | Size | Description                                                                                                                                                                     |
|---------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tracker flags       | u32  | Bit 0: Enable range control<br>Bit 1: Enable power & gain control<br>Bit 2: Enable pulse length control<br>Bit 3: Enable coverage angle control<br>Bit 4: Use fixed swath width |
| Tracker swath width | f32  | In meters                                                                                                                                                                       |

## 11.64 7041 – R7041 Setup

**Description:**

Table 156: 7500 Record Data – Command 7041

| Name                 | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                        | Startup |
|----------------------|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Down-sampling Method | u8   | 0 – No down-sampling<br>No down-sampling is performed and magnitude is recorded unchanged<br><br>1 – Nearest neighbor<br>For each new sample the nearest original sample within the same beam is picked<br><br>2 – Linear approximation<br>Each new sample is calculated as linear approximation of two original neighboring samples<br><br>3 – Averaging<br>Each new sample is an average of all original samples within half new sampling period | 1       |
| Filtering Method     | u8   | 0 – No filtering                                                                                                                                                                                                                                                                                                                                                                                                                                   | 0       |

| Name            | Size    | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Startup |
|-----------------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Flags           | u16     | <p><b>BIT FIELD:</b></p> <p><u>Bit 0-2:</u></p> <ul style="list-style-type: none"> <li>0 – Reduction relative to pulse length<br/>New sample period is calculated as <i>Pulse Length * Multiplier</i></li> <li>1 – Reduction relative to sample rate<br/>New sample period is calculated as <i>original Sample Period * Multiplier</i></li> <li>2 – Absolute reduction<br/>New sample rate is adjusted such as total number of samples would not exceed specified value in Multiplier/Size field</li> <li>3-7 – Reserved</li> </ul> <p><u>Bit 3:</u></p> <ul style="list-style-type: none"> <li>1 – Discard data beyond absolute gates<br/>If absolute gates are enabled, data series will be recorded only to maximum depth or range gate, whichever is less</li> </ul> <p><u>Bit 4:</u></p> <ul style="list-style-type: none"> <li>1 – Discard data beyond bottom detection point<br/>If bottom detection was successful (regardless of quality) for the beam, data series will be recorded only to detection point plus one full sample period</li> </ul> <p><u>Bit 5-6:</u></p> <ul style="list-style-type: none"> <li>0 – Magnitude only</li> <li>1 – Magnitude &amp; Phase</li> <li>2 – Calibrated Magnitude</li> <li>3 – Reserved</li> </ul> <p><u>Bit 7:</u> Beam identification method</p> <ul style="list-style-type: none"> <li>0 – Beam number (u16)</li> <li>1 – Beam angle (f32, in radians)</li> </ul> <p><u>Bit 8-15:</u> Reserved (always zero)</p> | 0x20    |
| Multiplier/Size | f32/u32 | <p>For relative reduction, this field contains floating point multiplier value</p> <p>For absolute reduction this field contains integer number for max samples</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1.0     |

| Name                            | Size | Description                                                                                                                                                                                                                                                  | Startup |
|---------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| (Calibrated) Magnitude Encoding | u8   | Magnitude Encoding Methods:<br>0 – 16 bit values<br>Magnitude is preserved in the original format<br>1 – 8 bit ½dB<br>Magnitude is encoded as $40 * \log_{10}(\text{magnitude})$<br>2+ – Reserved<br>Calibrated Magnitude Encoding Methods:<br>0+ – Reserved |         |
| Phase Encoding                  | u8   | Phase Encoding Methods:<br>0+ – Reserved                                                                                                                                                                                                                     |         |

| NOTE                                                                                              |
|---------------------------------------------------------------------------------------------------|
| The flags Magnitude & Phase and Calibrated Magnitude are not implemented yet thus can be ignored. |

## 11.65 7610 – Manual Sound Velocity

**Description:** Set SVP filtering manual sound velocity value, with optional ‘override’ flag. If override flag is set, then 7610 records received by the 7K Center from other clients (e.g. PDS2000) will be ignored.

Table 157: 7500 Record Data – Command 7610

| Name           | Size | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flags          | w16  | BIT FIELD:<br><u>Bit 0:</u> Manual Override<br>If set any subsequent 7610 record will be ignored, otherwise any subsequent 7610 record will change the Sound Velocity value<br><u>Bit 1:</u> Settings Only<br>If set the Sound Velocity value will not be updated and Sound Velocity field within this remote command will be ignored<br><u>Bit 2:</u> Filter Setting<br>If set SVP Filter type will be changed, otherwise SVP Filter field within this remote command will be ignored<br><u>Bit 3-15:</u> Reserved, must be zeros |
| Sound velocity | f32  | Sound velocity in m/s                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Name       | Size | Description                                                                                                                                                |
|------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SVP Filter | u8   | SVP Filter type<br>1 – No Filter<br>2 – Light Filter<br>3 – Normal Filter<br>4 – SVP70 Wizard<br>NOTE: to change the filter values Flags Bit 2 must be set |
| Reserved   | u8*3 | Reserved                                                                                                                                                   |

## APPENDIX A PDS2000 OPTIONAL DATA

The following tables show optional data that may be sent for compatibility with PDS2000.

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

Table 158: 7006 – Optional Data

| Name                                                               | Size | Description                                                                                                      |
|--------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------|
| Frequency                                                          | f32  | Ping Frequency in Hz                                                                                             |
| Latitude                                                           | f64  | Latitude of vessel reference point in radians<br>- $\pi/2$ to $\pi/2$ , south negative                           |
| Longitude                                                          | f64  | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , 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'.<br>0 – None<br>1 – RTK<br>2 – Tide |
| Tide                                                               | f32  | In meters                                                                                                        |
| Roll                                                               | f32  | Roll (in radians) at transmit time                                                                               |
| Pitch                                                              | f32  | Pitch (in radians) at transmit time                                                                              |
| Heave                                                              | f32  | Heave (in radians) at transmit time                                                                              |
| Vehicle depth                                                      | f32  | Vehicle depth at transmit time in meters                                                                         |
| <b>The following set of data items are repeated for each beam:</b> |      |                                                                                                                  |
| Beam 0 – Depth                                                     | f32  | Depth relative chart datum (or relative waterline if Height source = 0) (in meters)                              |
| Beam 0 – Along track distance                                      | f32  | Along track distance in vessel grid (in meters)                                                                  |
| Beam 0 – Across track distance                                     | f32  | Across track distance in vessel grid (in meters)                                                                 |
| Beam 0 – Pointing angle                                            | f32  | Beam pointing angle from vertical in radians                                                                     |
| Beam 0 – Azimuth angle                                             | f32  | Beam azimuth angle in radians                                                                                    |

Table 159: 7007 – Optional Data

| Name      | Size | Description                                                                            |
|-----------|------|----------------------------------------------------------------------------------------|
| Frequency | f32  | Ping Frequency in Hz                                                                   |
| Latitude  | f64  | Latitude of vessel reference point in radians<br>- $\pi/2$ to $\pi/2$ , south negative |

|           |     |                                                                                    |
|-----------|-----|------------------------------------------------------------------------------------|
| Longitude | f64 | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , west negative |
| Heading   | f32 | Heading of vessel at transmit time in radians                                      |
| Depth     | f32 | Depth for slant range correction in meters                                         |

Table 160: 7008 – Optional Data

| Name                                                          | Size | Description                                                                            |
|---------------------------------------------------------------|------|----------------------------------------------------------------------------------------|
| Frequency                                                     | f32  | Ping Frequency in Hz                                                                   |
| Latitude                                                      | f64  | Latitude of vessel reference point in Radians<br>- $\pi/2$ to $\pi/2$ , south negative |
| Longitude                                                     | f64  | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , west negative     |
| Heading                                                       | f32  | Heading of vessel at transmit time in radians                                          |
| <b>Following set of data items is repeated for each beam:</b> |      |                                                                                        |
| Beam – Along track distance                                   | f32  | Along track distance in vessel grid in meters                                          |
| Beam – Across track distance                                  | f32  | Across track distance in vessel grid in meters                                         |
| Center sample number                                          | u32  | Sample number at detection point of beam                                               |

Table 161: 7027 – Optional Data

| Name          | Size | Description                                                                                                      |
|---------------|------|------------------------------------------------------------------------------------------------------------------|
| Frequency     | f32  | Ping Frequency in Hz                                                                                             |
| Latitude      | f64  | Latitude of vessel reference point in radians<br>- $\pi/2$ to $\pi/2$ , south negative                           |
| Longitude     | f64  | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , 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'.<br>0 – None<br>1 – RTK<br>2 – Tide |
| Tide          | f32  | In meters                                                                                                        |
| Roll          | f32  | Roll (in radians) at transmit time                                                                               |
| Pitch         | f32  | Pitch (in radians) at transmit time                                                                              |
| Heave         | f32  | Heave (in radians) at transmit time                                                                              |
| Vehicle depth | f32  | Vehicle depth at transmit time in meters                                                                         |

| Name                                                               | Size | Description                                                                         |
|--------------------------------------------------------------------|------|-------------------------------------------------------------------------------------|
| <b>The following set of data items are repeated for each beam:</b> |      |                                                                                     |
| Beam 0 – Depth                                                     | f32  | Depth relative chart datum (or relative waterline if Height source = 0) (in meters) |
| Beam 0 – Along track distance                                      | f32  | Along track distance in vessel grid (in meters)                                     |
| Beam 0 – Across track distance                                     | f32  | Across track distance in vessel grid (in meters)                                    |
| Beam 0 – Pointing angle                                            | f32  | Beam pointing angle from vertical in radians                                        |
| Beam 0 – Azimuth angle                                             | f32  | Beam azimuth angle in radians                                                       |

Table 162: 7028 – Optional Data

| Name                                                          | Size | Description                                                                            |
|---------------------------------------------------------------|------|----------------------------------------------------------------------------------------|
| Frequency                                                     | f32  | Ping Frequency in Hz                                                                   |
| Latitude                                                      | f64  | Latitude of vessel reference point in radians<br>- $\pi/2$ to $\pi/2$ , south negative |
| Longitude                                                     | f64  | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , west negative     |
| Heading                                                       | f32  | Heading of vessel at transmit time in radians                                          |
| <b>Following set of data items is repeated for each beam:</b> |      |                                                                                        |
| Beam – Along track distance                                   | f32  | Along track distance in vessel grid in meters                                          |
| Beam – Across track distance                                  | f32  | Across track distance in vessel grid in meters                                         |
| Center sample number                                          | u32  | Sample number at detection point of beam                                               |

Table 163: 7057 – Optional Data

| Name      | Size | Description                                                                            |
|-----------|------|----------------------------------------------------------------------------------------|
| Frequency | f32  | Ping Frequency in Hz                                                                   |
| Latitude  | f64  | Latitude of vessel reference point in radians<br>- $\pi/2$ to $\pi/2$ , south negative |
| Longitude | f64  | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , west negative     |
| Heading   | f32  | Heading of vessel at transmit time in radians                                          |
| Depth     | f32  | Depth for slant range correction in meters                                             |

Table 164: 7058 – Optional Data

| Name                                                          | Size | Description                                                                            |
|---------------------------------------------------------------|------|----------------------------------------------------------------------------------------|
| Frequency                                                     | f32  | Ping Frequency in Hz                                                                   |
| Latitude                                                      | f64  | Latitude of vessel reference point in radians<br>- $\pi/2$ to $\pi/2$ , south negative |
| Longitude                                                     | f64  | Longitude of vessel reference point in radians<br>- $\pi$ to $\pi$ , west negative     |
| Heading                                                       | f32  | Heading of vessel at transmit time in radians                                          |
| <b>Following set of data items is repeated for each beam:</b> |      |                                                                                        |
| Beam – Along track distance                                   | f32  | Along track distance in vessel grid in meters                                          |
| Beam – Across track distance                                  | f32  | Across track distance in vessel grid in meters                                         |
| Center sample number                                          | u32  | Sample number at detection point of beam                                               |

Table 165: 7400 – Optional Data

| Name             | Size | Description                                                            |
|------------------|------|------------------------------------------------------------------------|
| UTC time         | f64  | Time since midnight in HHMMSS.SS format                                |
| External time    | f64  | UTC Time in milliseconds since 1 Jan 1970                              |
| T0               | f64  | T Null Time in milliseconds since 1 Jan 1970                           |
| T1               | f64  | T One Time in milliseconds since 1 Jan 1970                            |
| Pulse length     | f64  | Pulse length in milliseconds                                           |
| Difference       | f64  | Difference between computer clock and<br>External time in milliseconds |
| IO Module status | u16  | IO Module synchronization status                                       |

## APPENDIX B DEVICE IDENTIFIERS

The Data Record Frame (see *Table 5: Data Record Frame*) requires a Device Identifier parameter. The table below provides the list of valid Device Identifiers and their descriptions.

Table 166: 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 Side-scan Sonar             |
| 105        |                  | Generic Sub-bottom Profiler         |
| 1001       | TrueTime         | PCISG                               |
| 2000       | CDC              | SMCG                                |
| 2001       | CDC              | SPG                                 |
| 2002       | Empire Magnetism | YS2000 Rotator                      |
| 4013       | RESON            | TC4013                              |
| 6000       | RESON            | DiverDat                            |
| 7000       | RESON            | 7k Center                           |
| 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                        |
| 8101       | RESON            | SeaBat™ 8101                        |
| 8102       | RESON            | SeaBat™ 8102                        |
| 8111       | RESON            | SeaBat™ 8111                        |

| Identifier | Vendor   | Description                                  |
|------------|----------|----------------------------------------------|
| 8123       | RESON    | SeaBat <sup>™</sup> 8123                     |
| 8124       | RESON    | SeaBat <sup>™</sup> 8124                     |
| 8125       | RESON    | SeaBat <sup>™</sup> 8125                     |
| 8128       | RESON    | SeaBat <sup>™</sup> 8128                     |
| 8150       | RESON    | SeaBat <sup>™</sup> 8150                     |
| 8160       | RESON    | SeaBat <sup>™</sup> 8160                     |
| 10000      | TSS      | DMS 05                                       |
| 10001      | TSS      | 335B                                         |
| 10002      | TSS      | 332B                                         |
| 10010      | SeaBird  | SeaBird SBE37                                |
| 10200      | 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 C 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 167: 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                                                                  |
| 22                | Orthographic                                                               |
| 23                | Polar Azimuthal                                                            |
| 24                | Equal Area                                                                 |

| Custom Identifier | Projection                            |
|-------------------|---------------------------------------|
| 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                     |

## APPENDIX D 7K ERROR CODES

| Code           | Description                                                                                                   |
|----------------|---------------------------------------------------------------------------------------------------------------|
| 0x7000 (28672) | SYSTEM_NOT_READY<br>7kSystem is not ready for task requested                                                  |
| 0x7001 (28673) | PARAMETER_OUT_OF_RANGE<br>Data for this function is not within range specification for this sonar             |
| 0x7002 (28674) | RECORD_NOT_AVAILABLE<br>Requested record does not exist. Invalid record number.                               |
| 0x7003 (28675) | MEMORY_ALLOCATION_ERROR<br>Required memory allocation for task failed                                         |
| 0x7004 (28676) | FIRMWARE_NOT_AVAILABLE<br>Failure with AlphaData/Prpmc. Software not loaded, failed, or hardware failed.      |
| 0x7005 (28677) | EXTERNAL_RECORD_NOT_AVAILABLE<br>1000 series records must be received from external source                    |
| 0x7006 (28678) | FEATURE_NOT_AVAILABLE<br>Option not available or under development                                            |
| 0x7007 (28679) | REMOTE_COMMAND_NOT_FOUND<br>Not a valid command, i.e. an invalid 7500 ticket like 1483                        |
| 0x7008 (28680) | INVALID_PARAMETER<br>Data not within DFD specifications                                                       |
| 0x7009 (28681) | INVALID_DEVICE_ID<br>Invalid device identifier                                                                |
| 0x700A (28682) | RECORD_IS_SUBSCRIPTION_ONLY<br>Record is only available though subscription                                   |
| 0x700B (28683) | PARAMETER_VALUE_CLIPPED<br>Value passed has been clipped to stay within allowed range                         |
| 0x700C (28684) | REMOTE_COMMAND_DENIED<br>Valid command issued either under invalid condition or with insufficient permissions |
| 0x700D (28685) | REMOTE_BROADCAST_DENIED<br>Remote command cannot be broadcasted to multiple systems                           |
| 0x700E (28686) | REMOTE_ILLEGAL_BROADCAST<br>Broadcast notation is used with system identifier either zero or 7000             |
| 0x700F (28687) | REMOTE_BROADCAST_NO_SYSTEM<br>Some or all enumerators in broadcast notation are not valid systems             |

| Code           | Description                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------|
| 0x704F (28751) | REMOTE_BROADCAST_FAILED<br>While using RC Broadcast, several systems nacked with different error codes |
| 0x7050 (28752) | NETWORK_PROTOCOL_VERSION<br>Invalid network protocol version                                           |
| 0x7051 (28753) | NETWORK_OFFSET<br>Invalid network offset                                                               |
| 0x7052 (28754) | DATA_PROTOCOL_VERSION<br>Record frame protocol version not valid                                       |
| 0x7053 (28755) | DATA_SYNC_PATTERN<br>Record frame sync pattern not valid                                               |
| 0x7054 (28756) | DATA_CHECKSUM<br>Checksum invalid. Data or checksum corrupted.                                         |
| 0x7055 (28757) | SYSTEM_EVENT_NOT_LOGGED<br>Last system event did not get logged                                        |
| 0x7101 (28929) | RDR_BUSY<br>RDR system is already recording or in playback                                             |
| 0x7102 (28930) | RDR_STOPPED<br>RDR is already stopped                                                                  |
| 0x7103 (28931) | RDR_MEMORY_ALLOCATION_ERROR<br>RDR memory allocation failed                                            |
| 0x7104 (28932) | RDR_BUFFER_NULL<br>RDR allocated a null buffer                                                         |
| 0x7105 (28933) | RDR_BUFFER_TOO_SMALL<br>RDR buffer size is smaller than that needed                                    |
| 0x7106 (28934) | RDR_NO_FILENAME<br>File name given to RDR is invalid or no longer exists                               |
| 0x7107 (28935) | RDR_INVALID_PARAMETER<br>Parameter passed to RDR is not valid                                          |
| 0x7108 (28936) | RDR_BAD_RECORDFRAME<br>RDR data frame header not valid or corrupted                                    |
| 0x7109 (28937) | RDR_BAD_CHECKSUM<br>RDR checksum invalid. Data or checksum corrupted.                                  |
| 0x710A (28938) | RDR_BAD_EOF<br>End of file not reached                                                                 |
| 0x710B (28939) | RDR_FILE_CREATION_FAILED<br>RDR failed to create new file                                              |
| 0x710C (28940) | RDR_FILE_OPEN_FAILED<br>RDR unable to open requested file                                              |

| Code           | Description                                                                                             |
|----------------|---------------------------------------------------------------------------------------------------------|
| 0x710D (28941) | RDR_FILE_WRITE_ERROR<br>RDR unable to write to file                                                     |
| 0x710E (28942) | RDR_FILE_READ_ERROR<br>RDR unable to read file                                                          |
| 0x710F (28943) | RDR_FILE_DELETE_ERROR<br>RDR unable to delete file                                                      |
| 0x7110 (28944) | RDR_LOCK_FAILED<br>System could not lock file for recording/playback                                    |
| 0x7111 (28945) | RDR_FAILURE<br>RDR system stopped, thus and future RDR related remote control commands will be rejected |
| 0x7999 (31129) | UNKNOWN_ERROR<br>An unknown error has occurred                                                          |