DATA FORMAT DEFINITION DOCUMENT

7k Data Format
Version 3.12

Teledyne RESON A/S

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FOR PUBLIC USE

Revision History:

Modifications (text, new records etc.) are yellow highlighted in the document.

Date	Author	Rev	Description
23/04/2020	ALV	3.12	Export control disclosure added. Record type definitions: 7007 – textual changes.
05/03/2020	ALV	3.11	Chapter 2.4 Data Type Definitions, Bit Fields: Add IPV4 Address Chapter 2.5 Time Convention: Modified structure format. Table 8 Table 9, Table 10, Table 11: updated Chapter 9.4 7k Interface and SBES Echotrac E20: Add general description. Chapter 13 Frequently Asked Questions: Added numerous items. Record type definitions: 10000 – modified 10004 – modified 10018 – textual changes 10025 – added 10027 – textual changes 10038 – added 10039 – added 10060 – modified 10063 – added 3001 – modified 7021 – modified 7058 – textual changes 7504 – modified All records: Textual change; ASCII replaced by UTF-8 Remote control definitions: 10007 – added 10008 – modified 10016 – added 10020 – modified 10022 – added 10023 – added 10024 – added 1047 – modified

See Appendix J for a revision history of older versions.

The DFD is delivered with a ZIP file ‘Example 7k.zip’ This ZIP file includes all the source files of an example 7k program and uses the 7k header file. The 7k header file is also delivered separately for your convenience.

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1 INTRODUCTION

1.1 Purpose and Overview

The 7k Data Format Definition document (DFD) defines record types and data formats. This DFD is relevant to the Teledyne RESON 7k series, Teledyne Odom MB2, Teledyne BlueView ProScan software, HydroSweep 3rd generation (HS3) sonars, the Teledyne Odom Echotrack E20 and all other applications and sonars using 7K Data record formats.

The BlueView data format definition is described in a separate chapter.

The 7k DFD 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.

For Teledyne RESON sonars the application titled "7k Center" is used to log and transmit network data. 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.

This document consists of 13 chapters.

Chapter 2 to 8 describes the 7k data interface.

Chapter 9 describes specific systems related remarks to the 7k interface.

Chapter 10 includes the defined record type definitions.

Chapter 11 includes the defined remote control definitions.

Chapter 12 describes the BlueView data format definition.

Chapter 13 includes frequent asked questions.

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
Azimuth	Horizontal angle with respect to true North base line
BITE	Built-In Test Environment
COG	Center of Gravity
Cmean	Mean sound speed
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 VRP44
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˚ 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

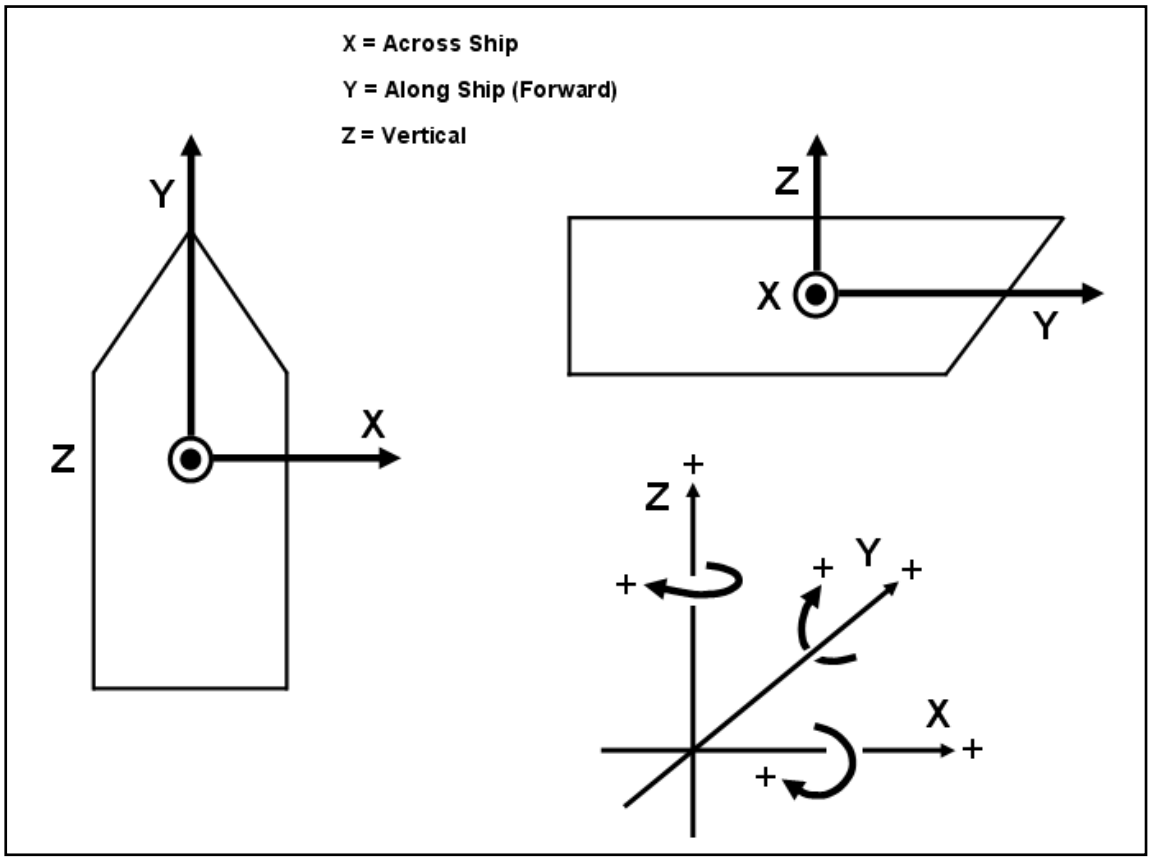


Figure 2-1: Vessel Axes

2.4 Data Type Definitions, Bit Fields

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.) Signed integers utilize two's complement notation.
- **Floating Points:** Either f32 or f64 (IEEE 1754-1994).
- **Character:** c8.
- **IPv4 Address:** u32 Field MSB is address MSB.

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.

2.5 Time Convention

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

Table 3: 7KTIME structure format

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	0.000000-60
Hours	u8	0-23
Minutes	u8	0-59

NOTE
If no time is available then all fields will be zero.

Also reference the 7KTIME definition in the Data Record Frame description as well as the general section regarding time stamping. Getting Started With 7k sonar source Software.

2.6 Establishing a Connection

Two communication methods are available to the 7k sonar source: TCP/IP and UDP/IP. Before sending and receiving records to and from the 7k sonar source, a socket must be created and a connection to the 7k sonar source 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 sonar source. The sonar will act as the server for the TCP/IP connection. 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 sonar source to create a connection. TCP/IP is the recommended choice for communicating to the 7k sonar source application.

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

2.7 Retrieving Data Records

When communicating to the 7k sonar source, 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	DFD Version	Record

(DRF and NF)		
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 sonar source:

- 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 sonar source 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):

- **7503** – Remote Control Sonar Settings
- **7004** – Beam Geometry
- **7007** – Side-scan data
- **7018** – Beamformed data
- **7027** – Raw Bathymetry
- **7028** – Snippet
- **7051** – 7k System event messages

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

2.8 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 sonar source 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 sonar source 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 10.62* 7500 – 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.

2.9 Terminating Communication

The 7500/1053 command to the 7k sonar source 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 sonar source 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).

2.10 Record Fragmentation – Special Considerations

The maximum size of packets sent by the 7k sonar source 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.

2.10.1 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.

2.10.2 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.

2.10.3 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.

3 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.

4 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.

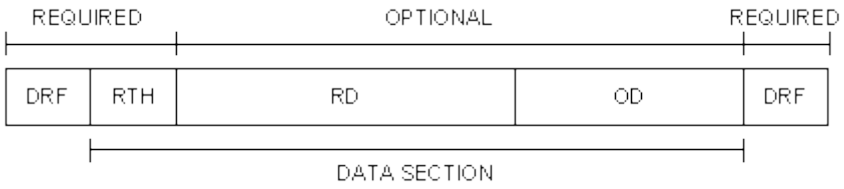
The optional data field typically holds sensor-specific data and third party developer embedded data.

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

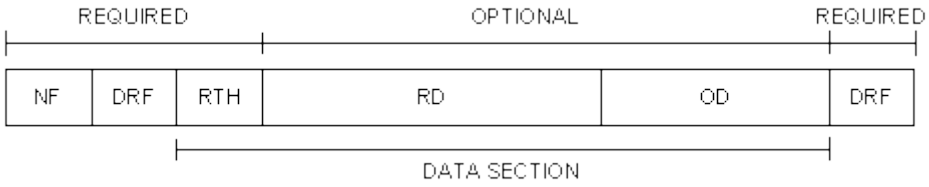
Please note that the Checksum is a required portion of the DRF, which occurs as the last four bytes of every record.

7k RECORD

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



Network prepared with the Network Frame (NF).



NOTE
When sonar software capabilities improve the need to modification / extension of the 7k protocol is mandatory. However, the 7k DFD will always be modified in such a way backwards compatibility is maintained as good as possible. This means reserved fields are used when available. When these are not available, fields will always be added to the end of a record section. It is therefore important to read / parse the protocol using the record size. **Because the protocol is backwards compatible, there is no need to included DFD version numbering in the records.**

5 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 *Table 4: Version* Concordance)
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
Record version	u16	Currently 1
Record type identifier	u32	Identifier for record type of embedded data
Device identifier	u32	Identifier of the device to which this data pertains. See appendix B for a overview.
Reserved	u16	Reserved
System enumerator	u16	The enumerator is used to differentiate between devices with the same device identifiers in one installation/system. For example, on 7125 200khz/400kHz dual-frequency systems, the enumerator will normally be zero (0) in 200khz mode, and one (1) in 400kHz mode.
Reserved	u32	Reserved

Name	Size	Description
Flags	u16	BIT FIELD: Bit 0: Checksum 0 – Invalid checksum 1 – Valid checksum Bit 1-14: Reserved (must be zero) Bit 15: 0 – Live data 1 – Recorded data
Reserved	u16	Reserved
Reserved	u32	Reserved
Total records in fragmented data record set	u32	Always zero
Fragment number	u32	Always zero
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.

6 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 *Table 4: Version* Concordance)
Offset	u16	Offset in bytes to the start of data from the start of this packet
Total packets	u32	Number of network packets for set of records transmitted
Total records	u16	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.
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. Range = 0 to n-1 packets
Destination device identifier	u32	0 – Unspecified 0xFFFFFFFF – Not used Any other number is a valid address
Destination enumerator	u16	Destination enumerator unless destination device identifier is unspecified or not used
Source enumerator	u16	Source enumerator unless Source Device Identifier is unspecified or not used
Source device identifier	u32	0 – Unspecified 0xFFFFFFFF – Not used Any other number is a valid address

7 LOGGING FILE FORMAT

7.1 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.

7.2 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

In case of a dual head system M_ for master and S_ for slave is added in front of the file name.

For example M_20100516_102852.s7k (Master file Created May 16, 2010 at 10:28:52).

7.3 7k Sonar Source Logged Files

The 7k sonar source 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 sonar source 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 sonar source. 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 sonar source logged files is *.s7k, where the '*' represents the filename.

8 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.

9 SENSORS AND 7K INTERFACE

9.1 7K Interface and MBES

9.1.1 MBES Reference Point

The following axis convention is applied for the sonar reference point convention:

X = across ship, points to starboard

Y= along ship points forward

Z = vertical, points up.

The sonar reference point is in the center of the receiver face in both X and Z directions and in the center of the projector in the Y direction.

The Tx offset is defined as the separation of the projector (Tx) reference point from the Receiver (Rx) point.

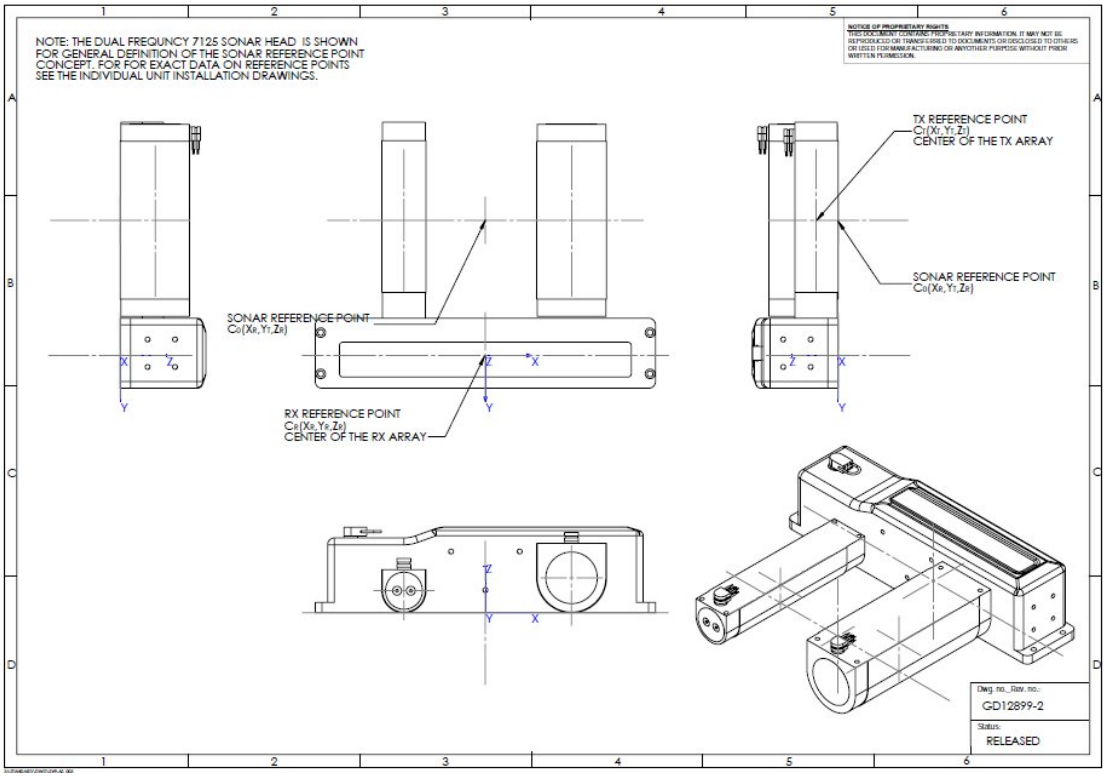


Figure 9-1: Sonar reference point (for reference only)

9.1.2 MBES 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 require 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.

9.2 7K Interface and Integrated Dual Head T50-R or T20-R

The 7k Interface works as follows for the integrated dual head system T50-R or T20-R

The XML file passed by the 7k sonar source in the 7001 – 7k Configuration message must contain a SystemInfo tag, with an attribute IDH set to “yes”.

For example:

<SystemInfo auv="no" IDH="yes" projectid="generic" systemrelease="SV3" name="T50-R">T50-R Sonar</SystemInfo>

This allows for identifying a dual head integrated system, such as the T50-R, when a 7001 - 7k Configuration message is received.

When IDH is set to “yes”, the System enumerator field on the Data Record Frame can be either 0, 1 or 2.

When a 0 is received the message should be processed for both sonars; port and starboard. When set to 1 the message should be processed for the port sonar only. When set to 2 it should be processed for the starboard sonar only.

The System enumerator can be used to separate messages with system wide information from messages containing sonar specific data.

Subscribe to enumerator 0 to receive data from both heads. Subscribe to enumerator 1 or 2 to receive data from only the port or starboard head.

Only IDH systems have IDH="yes". If the attribute is missing (like on 7125) then it should be treated as IDH="no".

9.3 7K Interface and HydroSweep Sonars

Also when connecting to a HydroSweep 3rd Generation (HS3) sonar the 7001 record needs to be requested to obtain the system XML files describing the system. The XML file contains next to other data the device ID and device enumerator together with the system description.

The sonar (remote) control messages are all done using enumerator 0.

Date need to be obtained by using a single record or data feed request using proper device ID and enumerator of the required data.

Table 7: Enumerator

Enumerator	Operation mode
0	Frequency band PHF (Bathymetry)
1	Frequency band SHF (Secondary High Frequency)
2	Frequency band SLF (Secondary Low Frequency)
3	Frequency band PLF (Primary Low Frequency)

(Refer also to chapter 2.8 Getting System State Information and Commanding)

9.3.1 Segments

Each segment has a delayed transmit pulse.

A higher transmit power level is achieved by using segmented transmit.

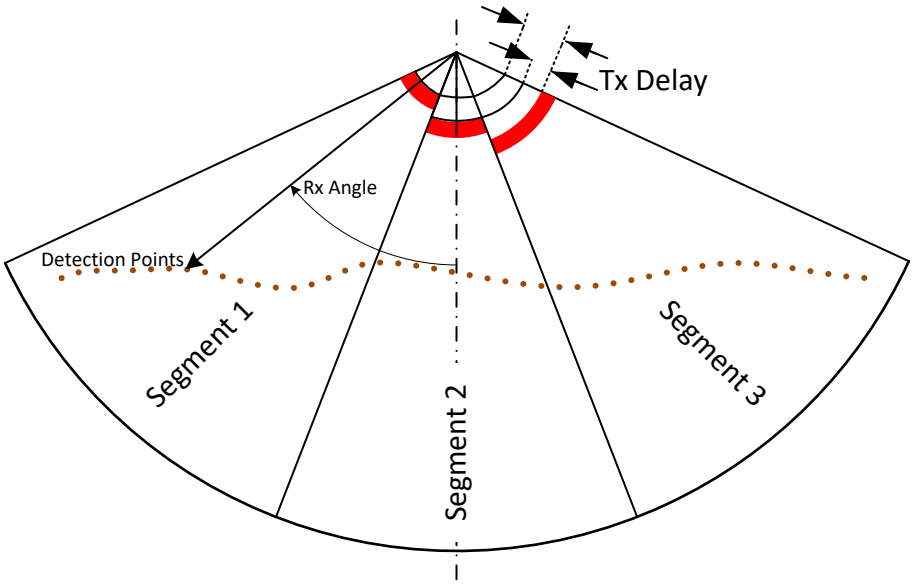


Figure 9-2: Segments

9.4 7k Interface and SBES Echotrac E20

9.4.1 General

The interface works as follows;

1. The 7001 record needs to be requested to obtain the system XML file which includes the supported Transducer type selection index.
2. The selected transducer index is revert back to the E20.
3. Again, the 7001 record needs to be requested to obtain the system XML which now contain the other settings belonging to the selected transducer index.

By means of the enumerator are the channels distinguished of the SBES. The System enumerator field on the Data Record Frame can be either 0, 1 or 2.

Enumerator	Operation mode
0	Dual channel
1	Channel 1
2	Channel 2

For specific details on use of enumerator 0 per parameter, see the respective record definitions.

Generally speaking, enumerator 0 is used for records with parameters (commands and feedback) which are system-wide, i.e. do not apply to one specific channel.

Records with parameters that are per channel cannot be set using enumerator 0. Doing so will result in a NACK reply.

Date need to be obtained by using a single record or data feed request using proper device ID and enumerator of the required data.

9.4.2 Time tagging

9.4.2.1 Data Record Frame timestamp

The timestamp in the data record frame (7KTIME u8 * 10 Time tag indicating when data was produced) designates when the data in the record was “produced”

The time reference is always the SBCenter “system time”.

NOTE
For ping related records: normal ping, multi ping and pulse train, this DRF timestamp in is set to the start of the (first) transmission.

9.4.2.2 Running without time synchronization between client and SBE

Some records include a time latency field. Using this field and ignoring network latency one can re-timestamp the record to Client time, even if the SBE is not synchronized to the client.

TS	Standard record timestamp is the time of validity in SBCenter time frame.
TT	Record transmission time in SBCenter time frame.
L	Latency field. L>=0.
TR	Record reception time in Client time frame.
TV	Record time of validity in Client time frame

SBCenter calculates L=TT-TS and puts it into the record.

Client calculates TV=TR-L

Note that because of inaccuracy in this process there is no guarantee that TV will be identical for records from the same ping although TS is (guaranteed to be) the same for those records.

9.4.3 SBES Depth definition

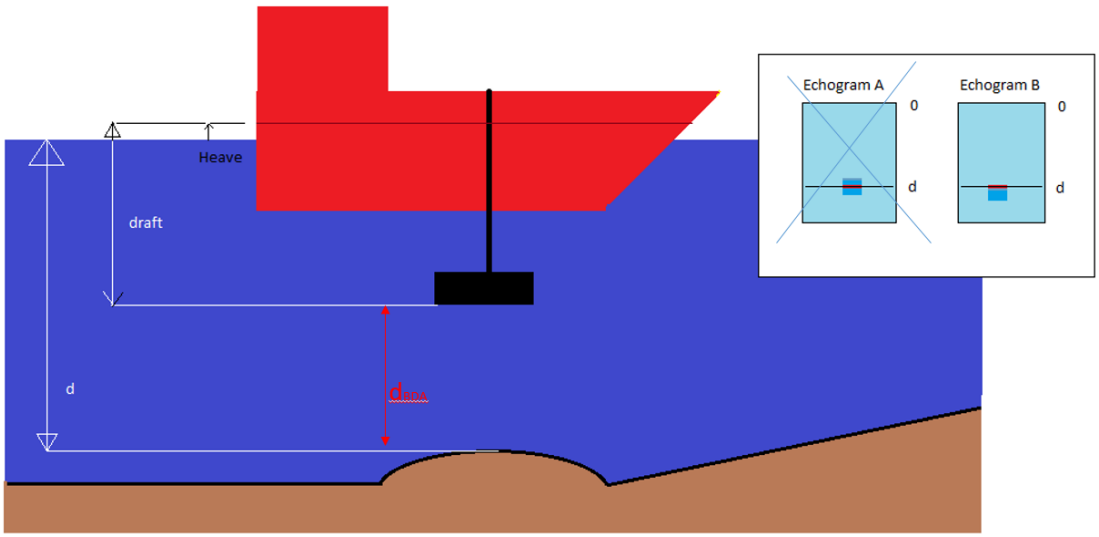


Figure 9-3: Measuring definitions

d	Hydrographic depth. Depth from mean sea level to the seabed
Heave	The displacement of the ship reference point above mean sea level
Draft	The vertical distance from the transducer surface (reference point) to the ship reference point
dBDA	The distance from the transducer surface to the seabed.

9.4.4 SBES Transducer offsets

Corrected Transducer Draft TD. TD is the depth in meters that an object is at, if it produces an echo detection in sample 0 of the Rx data. It is the depth of the transducer surface from the water line corrected for any shifts caused by processing.

IF configured by the user, for example after a bar check, then some records will include the value in the reported ranges, for example detection range.

9.4.5 SBES Range to sample count conversion

The singlebeam uses a nominal mean speed of sound (cmean) value for all conversions from two way travel time to range.

Cmean may change from ping to ping, but within a ping it is a constant value regardless depth/range to objects.

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 8: 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
1021	Reserved for IDH (Integrated Dual Head)
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
2004	Sonar Pipe Environment
3001	Contact Output
7000 – 7999	Reserved for SeaBat™ 7k records

Record Type	Description
7000[1]	7k sonar settings
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 Record 7006 is superseded by record 7027. The record is deprecated and will not be supported by latest 7k protocol based applications such as the Teledyne Odom MBCenter. It exists for backwards compatibility only.
7007[2]	7k side-scan data
7008[1]	7k generic water column data Record 7008 is superseded by 7018 and 7028. It is mutually exclusive. The record is deprecated and will not be supported by Teledyne RESON. It exists for backwards compatibility only.
7009	Reserved for vertical depth
7010[1]	TVG values
7011[1]	7k image data
7012[1]	7k ping motion data
7014	7k Adaptive gate
7016	Reserved for extended bottom detect info
7017[1]	7k detection data setup The record is deprecated and will not be supported by Teledyne RESON.
7018[1]	7k beamformed data
7021	7k built-in test environment data (BITE)
7022	7k sonar source version
7023	8k wet end version
7024	Reserved for license information
7026[1]	Reserved for 7k detection data
7027[1]	7k raw detection data
7028[1]	7k snippet data
7029	Vernier Processing Data (Filtered)

[1] These records are available by subscription only.

[2] These records are available by subscription only.

Record Type	Description
7030	Reserved for sonar installation parameters
7031	7k Built-In Test Environment Data (Summary)
7037	Reserved
7038[1]	Reserved
7040	Reserved for 7k Tx configuration files
7041[1]	Compressed beamformed intensity data
7042[1]	Compressed Water Column data
7047[1]	7k Segmented raw detection data
7048	7k Calibrated beam data
7049	Reserved
7050	7k system events
7051	7k system event message
7052	RDR recording status
7053	7k subscriptions
7055	Normalization status
7057	Calibrated side-scan data
7058	Snippet Backscattering Strength
7059	MB2 specific status
7060	Reserved for 7k target data
7068[1]	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

[1] These records are available by subscription only.

Record Type	Description
7511	System lock status
7515	Timestamp (not described in the documentation)
7610	7k sound velocity
7611	7k absorption loss
7612	7k spreading loss
7613	Profile average salinity
7614	Profile average temperature
7777	Reserved for filler records (used when repairing corrupt files)
7900 – 7999	Reserved
8012[1]	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
10000-11000	Reserved for SBES messages
10000	SBES Channel settings
10003	SBES Channel status
10004	SBES system settings
10007	
10018	SBES Echogram water column data
10025	SBES annotation
10027	SBES Raw detection data
10038	SBES RAW IQ data
10039	SBES Clipping data
10048	Reserved
10049	SBES Depth reading
10060	SBES Port Configuration
10061	SBES Port Status
10062	SBES Port QC
10063	UDP Port Configuration
10090	Reserved
10091	Reserved
10100	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 sonar source.

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

NOTE
✓: Record applies for specified 7k System. Empty field: This combination of 7k System and record is not supported by Teledyne RESON and thus it is not guaranteed that the data in the possible generated record is valid.

Table 9: Available Record Types per RESON SeaBat 7k series

Record Types	7K logger(See Note 1)	RESON SeaBat 71xx sonars and 8125-H												
		7100	7101	7111	7112	7122	7123	7125	7128	7130	7131	7150	7160	8125-H
1000		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1001		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1002		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1003		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1004		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1005		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1006		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1007		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1008		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1009		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1010		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1011		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1012		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1013		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1014		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1015		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1016		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1017		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1020														
1050	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1200														
1201														
1207														
1209														
1211														
2004								✓						
3001							✓		✓	✓	✓			
5835														
5836														
7000		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7001		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Record Types	7K logger (See Note 1)	RESON SeaBat 71xx sonars and 8125-H												
		7100	7101	7111	7112	7122	7123	7125	7128	7130	7131	7150	7160	8125-H
7002		✓	✓		✓	✓	✓	✓	✓	✓	✓			✓
7003														
7004		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7006 (See note 2)		✓	✓	✓				✓				✓	✓	✓
7007		✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
7008 (See note 3)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7010		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7011		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7012		✓	✓		✓			✓	✓	✓	✓			✓
7014														
7017 (See note 4)		✓	✓					✓	✓	✓	✓			✓
7018		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7019										✓	✓			
7021		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7022		✓	✓		✓			✓	✓	✓	✓	✓	✓	✓
7024														
7027		✓	✓					✓	✓	✓	✓			✓
7028		✓	✓					✓	✓	✓	✓	✓	✓	✓
7029										✓	✓			
7031						✓	✓		✓	✓	✓			
7038				✓		✓	✓					✓	✓	
7039				✓		✓	✓							
7040														
7041				✓								✓	✓	
7042														
7047														
7048				✓		✓	✓	✓	✓			✓	✓	
7050	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7051	✓													
7052														
7054	✓													

Record Types	7K logger (See Note 1)	RESON SeaBat 71xx sonars and 8125-H												
		7100	7101	7111	7112	7122	7123	7125	7128	7130	7131	7150	7160	8125-H
7057				✓										
7058				✓								✓	✓	
7059														
7068						✓	✓							
7200		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7300		✓	✓		✓	✓		✓	✓					✓
7400												✓	✓	
7500	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7503		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7504		✓	✓		✓			✓	✓	✓	✓	✓	✓	✓
7505						✓	✓							
7510								✓						
7511		✓	✓		✓	✓	✓	✓	✓	✓	✓			✓
7610		✓	✓					✓	✓	✓	✓			✓
7611		✓	✓					✓	✓	✓	✓			✓
7612		✓	✓					✓	✓	✓	✓			✓

Table 10 Available Record Types SeaBat T-series

RESON SeaBat T-series						
Record types		T20-P \-P\-R	T50-P/-R/-S	F20-R/-P/-S	F30-R/-P/-S	F50-R/-P/-S
1000		✓	✓	✓	✓	✓
1001		✓	✓	✓	✓	✓
1002		✓	✓	✓	✓	✓
1003		✓	✓	✓	✓	✓
1004		✓	✓	✓	✓	✓
1005		✓	✓	✓	✓	✓
1006		✓	✓	✓	✓	✓
1007		✓	✓	✓	✓	✓
1008		✓	✓	✓	✓	✓
1009		✓	✓	✓	✓	✓
1010		✓	✓	✓	✓	✓
1011		✓	✓	✓	✓	✓
1012		✓	✓	✓	✓	✓
1013		✓	✓	✓	✓	✓
1014		✓	✓	✓	✓	✓
1015		✓	✓	✓	✓	✓
1016		✓	✓	✓	✓	✓
1017		✓	✓	✓	✓	✓
1020						
1050		✓	✓	✓	✓	✓
1200						
1201						
1207						
1209						
1211						
2004		✓	✓			
3001				✓	✓	✓
5835						
5836						
7000		✓	✓	✓	✓	✓
7001		✓	✓	✓	✓	✓

RESON SeaBat T-series						
Record types		T20-P \-P\-R	T50-P/-R/-S	F20-R/-P/-S	F30-R/-P/-S	F50-R/-P/-S
7002		✓	✓	✓	✓	✓
7003						
7004		✓	✓	✓	✓	✓
7006 (See note 2)		✓	✓			
7007		✓	✓	✓	✓	✓
7008 (See note 3)		✓	✓	✓	✓	✓
7010		✓	✓	✓	✓	✓
7011		✓	✓	✓	✓	✓
7012		✓	✓	✓	✓	✓
7014						
7017 (See note 4)		✓	✓	✓	✓	✓
7018		✓	✓	✓	✓	✓
7019					✓	
7021		✓	✓	✓	✓	✓
7022		✓	✓	✓	✓	✓
7024						
7027		✓	✓	✓	✓	✓
7028		✓	✓	✓	✓	✓
7029				✓	✓	✓
7031		✓	✓	✓	✓	✓
7038						
7039						
7040						
7041						
7042		✓	✓			
7047						
7048		✓	✓			
7050		✓	✓	✓	✓	✓
7051						
7052						
7054						

RESON SeaBat T-series						
Record types		T20-P \-P\-R	T50-P/-R/-S	F20-R/-P/-S	F30-R/-P/-S	F50-R/-P/-S
7057						
7058		✓	✓			
7059						
7068						
7200		✓	✓	✓	✓	✓
7300		✓	✓			
7400						
7500		✓	✓	✓	✓	✓
7503		✓	✓	✓	✓	✓
7504		✓	✓	✓	✓	✓
7505						
7510		✓	✓			
7511		✓	✓	✓	✓	✓
7610		✓	✓	✓	✓	✓
7611		✓	✓	✓	✓	✓
7612		✓	✓	✓	✓	✓
7613						
7614						
10000						
10003						
10004						
10018						
10027						
10049						
10060						
10061						
10062						

Table 11 Available record types other systems using 7k data format

Other systems using 7k data format				
Record types	BlueView	MB2	HydroSweep 3	Echotrac E20
1000				
1001				
1002				
1003		✓	✓	✓
1004			✓	
1005			✓	
1006				
1007				
1008				
1009				
1010				
1011				
1012		✓	✓	✓
1013		✓	✓	
1014				
1015				
1016				
1017				
1020		✓		
1050				
1200		✓	✓	
1201		✓	✓	
1207		✓	✓	
1209		✓	✓	
1211		✓	✓	
2004				
3001				
5835	✓			
5836	✓			
7000	✓	✓	✓	

Other systems using 7k data format				
Record types	BlueView	MB2	HydroSweep 3	Echotrac E20
7001		✓	✓	
7002			✓	
7003		✓	✓	
7004	✓	✓	✓	
7006 (See note 2)	✓			
7007			✓	
7008 (See note 3)				
7010				
7011		✓	✓	
7012			✓	
7014			✓	
7017 (See note 4)		✓	✓	
7018				
7019				
7021		✓		✓
7022		✓	✓	
7024		✓	✓	
7027		✓	✓ 5	
7028		✓	✓	
7029				
7031				
7038				
7039				
7040		✓	✓	
7041				
7042		✓	✓	
7047			✓	
7048			✓	
7050	✓	✓	✓	✓
7051			✓	✓

Other systems using 7k data format				
Record types	BlueView	MB2	HydroSweep 3	Echotrac E20
7052		✓	✓	
7054			✓	
7057				
7058				
7059		✓		
7068				
7200				
7300				
7400				
7500				
7503		✓	✓	
7504		✓	✓	
7505				
7510				
7511				
7610		✓		
7611				
7612				
7613				
7614				
10000				✓
10003				✓
10004				✓
10018				✓
10027				✓
10038				✓
10039				✓
10049				✓
10060				✓
10061				✓
10062				✓

NOTE 1
Messages 7K logger via the 7K Center connected to the 7K Logger.

NOTE 2
Record 7006 is superseded by record 7027. The record is deprecated and will not be supported by latest 7k protocol based applications such as the Teledyne Odom MBCenter. It exists for backwards compatibility only.

NOTE 3
Record 7008 is superseded by 7018 and 7028. It is mutually exclusive. The record is deprecated and will not be supported by Teledyne RESON. It exists for backwards compatibility only.

NOTE 4
The record is deprecated and will not be supported by Teledyne RESON. It exists for backwards compatibility only.

NOTE 5
Record 7027 is for HydroSweep sonars only available until CM version 3.3.0.11. Higher CM versions only support record 7047.

10.2 1000 – Reference Point

Description: Reference point Information.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 12: 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 13: 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 14: 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.

NOTE
• 1003 record created by the 7k sonar source is using the sensor (GPS) data. 1003 created by Teledyne PDS is using reference point data. • Latency of 1003 created by Teledyne PDS and 7k sonar is always 0.

Data Definition:

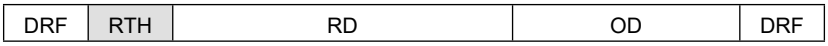


Table 15: 1003 – Record Type Header

Name		Size	Description
Datum identifier		u32	0 – WGS84 >0 – Reserved
Latency		f32	In seconds
Latitude or northing		f64	Latitude in radians or northing in meters
Longitude or easting		f64	Longitude in radians or easting in meters
Height relative to datum or height		f64	In meters
Position type flag		u8	0 – Geographical coordinates 1 – Grid coordinates
UTM zone		u8	UTM Zone
Quality flag		u8	0 – Navigation Data 1 – Dead-Reckoning

Name		Size	Description
Positioning method		u8	0 – GPS 1 – DGPS 2 – Start of inertial positioning system from GPS 3 – Start of inertial positioning system from DGPS 4 – Start of inertial positioning system from bottom correlation 5 – Start of inertial positioning from bottom object 6 – Start of inertial positioning from inertial positioning 7 – Start of inertial positioning from optional data 8 – Stop of inertial positioning system to GPS 9 – Stop of inertial positioning system to DGPS 10 – Stop of inertial positioning system to bottom correlation 11 – Stop of inertial positioning to bottom object 12 – Start of inertial positioning to inertial positioning 13 – Start of inertial positioning to optional data 14 – User defined 15 – RTK Fixed 16 – RTK Float
Number of Satellites		u8	Optional

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).

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 16: 1004 – Record Type Header

Name	Size	Description
Field mask	u8	BIT FIELD: Bit 0: 0 – No pitch 1 – Pitch in radians Bit 1: 0 – No roll 1 – Roll in radians Bit 2: 0 – No heading 1 – Heading in radians Bit 3: 0 – No heave 1 – Heave in meters Bit 4: 0 – No pitch 1 – Pitch rate of change in radians per second Bit 5: 0 – No roll rate 1 – Roll rate of change in radians per second Bit 6: 0 – No heading rate 1 – Heading ate of change in radians per second Bit 7: 0 – No heave rate 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 17: 1004 – Record Data

Name	Size	Description
FIELD 0	f32	Sensor data
…	…	...

Name	Size	Description
FIELD N-1	f32	Sensor data

10.7 1005 – Tide

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

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 18: 1005 – Record Type Header

Name	Size	Description
Tide	f32	Height correction above mean sea level in meters
Source	u16	0 – Unspecified 1 – Table (predicted) 2 – Measured (gauge)
Flags	u8	BIT FIELD: Bit 0: 0 – Gauge ID invalid 1 – Gauge ID valid Bit 1: 0 – Position info invalid 1 – Position info valid
Gauge identifier	u16	User defined
Datum identifier	u32	0 – WGS84 >0 – Reserved
Latency	f32	In seconds
Latitude or northing	f64	Latitude in radians or northing in meters
Longitude or easting	f64	Longitude in radians or easting in meters
Height relative to datum or height	f64	In meters
Position type flag	u8	0 – Geographical coordinates 1 – Grid coordinates
UTM zone	u8	UTM zone

10.8 1006 – Altitude

Description: Altitude data record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 19: 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 20: 1007 – Record Type Header

Name	Size	Description
Flags	u8	BIT FIELD: Bit 0: Speed in X, Y & Z directions (m/s); each an f32 if present Bit 1: Acceleration in X, Y & Z directions (m/s2); each an f32 if present Bit 2-7: Reserved Note: for bits 0 and 1, a set bit (1) indicates that the specified parameters are present in a field definition. If zero, then the field definition excludes the relevant parameters.
Reserved	u8	Reserved
N	u16	Number of sensor readings
Frequency	f32	Sample rate in sensor readings per second

DRF	RTH	RD	OD	DRF

Table 21: 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 22: 1008 – Record Type Header

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

10.11 1009 – Sound Velocity Profile

Description: Sound velocity profile data record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 23: 1009 – Record Type Header

Name	Size	Description
Position flag	u8	0 – Invalid position fields 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 24: 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 25: 1010 – Record Type Header

Name	Size	Description
Frequency	f32	Frequency
Sound velocity source flag	u8	0 – Not computed 1 – CTD 2 – User computed
Sound velocity algorithm	u8	0 – Not computed 1 – Chen Millero 2 – Del Grosso
Conductivity flag	u8	0 – Conductivity 1 – Salinity
Pressure flag	u8	0 – Pressure 1 – Depth
Position flag	u8	0 – Invalid position fields 1 – Valid position fields
Sample content validity	u8	BIT FIELD: (Bit set means field is valid otherwise zero) Bit 0: Conductivity/Salinity Bit 1: Water temperature Bit 2: Pressure/Depth Bit 3: Sound velocity Bit 4: Absorption
Reserved	u16	Reserved
Latitude	f64	Latitude in radians (WGS84)
Longitude	f64	Longitude in radians (WGS84)
Sample rate	f32	Sample rate
N	u32	Number of samples

DRF	RTH	RD	OD	DRF

Table 26: 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

Name	Size	Description
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:

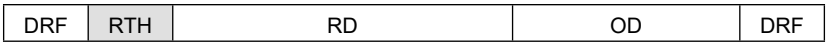


Table 27: 1011 – Record Type Header

Name	Size	Description
Spheroid name	c8 * 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	c8 * 32	Datum name: e.g. “WGS84”
Data calculation method	u32	0 – Molodensky 1 – Bursa / Wolfe 2 – DMA MRE 3 – NADCON 4 – HPGN 5 – Canadian National Transformation V2
Number of parameters	u8	Three (3), seven (7) and eight (8) parameter transformation is supported
DX	f64	X – Shift (m)
DY	f64	Y – Shift (m)
DZ	f64	Z – Shift (m)
RX	f64	X Rotation (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

Name	Size	Description
Grid name	c8 * 32	Name of grid system in use: e.g. “UTM” (see Appendix C)
Grid distance units	u8	0 – Meters 1 – Feet 2 – Yards 3 – US Survey Feet 4 – Kilometers 5 – Miles 6 – US Survey Miles 7 – Nautical Miles 8 – Chains 9 – Links
Grid angular units	u8	0 – Radians 1 – Degrees 2 – Degrees, minutes, seconds 3 – Gradians 4 – Arc-seconds
Latitude of origin	f64	
Central meridian	f64	
False easting	f64	Meters
False northing	f64	Meters
Central scale factor	f64	
Custom identifier	i32	Used to define projection specific parameters -2 – Custom -1 – Not used (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 28: 1012 – Record Type Header

Name	Size	Description
Roll	f32	Vessel roll in radians
Pitch	f32	Vessel pitch in radians

Name	Size	Description
Heave	f32	Vessel heave in meters

10.15 1013 – Heading

Description: Vessel Heading Record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 29: 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 30: 1014 – Record Type Header

Name	Size	Description
Waypoint count (N)	u16	Number of points in the line / route
Position type	u16	0 – Latitude/Longitude 1 – Grid coordinates
Radius	f32	Turn radius between line segments (meters) 0 – No curvature in turns
Line name	c8 * 64	Null terminated string – line name

DRF	RTH	RD	OD	DRF

Table 31: 1014 – Record Data

Name	Size	Description
Latitude or northing 0	f64	Latitude (radians) or northing (meters) $-\pi/2$ to $\pi/2$, -south
Longitude or easting 0	f64	Longitude (radians) or easting (meters) $-\pi$ to π, -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 32: 1015 – Record Type Header

Name	Size	Description
Vertical reference	u8	1 – Ellipsoid 2 – Geoid 3 – Chart datum
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, -south
Longitude	f64	Longitude of vessel reference point in radians -π to π, -west
Horizontal position accuracy	f32	Position accuracy in meters
Vessel height	f32	Height of vessel reference point above vertical reference in meters
Height accuracy	f32	In meters
Speed over ground	f32	Speed over ground at position time in m/s
Course over ground	f32	Course over ground at position time in radians
Heading	f32	Heading of vessel at position time in radians

10.18 1016 – Attitude

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 33: 1016 – Record Type Header

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

DRF	RTH	RD	OD	DRF

Table 34: 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

Name	Size	Description
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 35: 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11* 7k Remote Control Definitions.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 36: 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

Name	Size	Description
Standard Configuration Options(*)	u32	0 = Custom Otherwise this specifies system dependant standard installation parameters and all installation defined parameters below are ignored.
Configuration Fixed Parameters(**)	u32	Defines configuration's defined parameters BIT FIELD, 1 = fixed: Bit 0-2: Tx to Rx XYZ Linear Offsets Bit 3-5: Tx to Reference XYZ Linear Offsets Bit 6-8: Tx to Rx Angular Offsets Bit 9-15: Reserved
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 receiver, 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	
Cable length	u32	Cable length in meters for DMPA systems. 0 when not set.

Name	Size	Description
Reserved	u8 * 44	This field is reserved for system specific parameters and will be defined on per system basis.

(*) When this record is received by 7k sonar source, all offset fields that are fixed for specified configuration are ignored and factory values are used. When this record is sent by 7k sonar source, 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 sonar source, this field is ignored. When this record is sent by 7k sonar source, this field specifies which fields are fixed for the specified configuration.

10.21 2004 – Sonar Pipe Environment

Description: Sonar pipe environment from Sonar 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.

Due to the way of the pipe detection and tracking system works the five points records are outputted when the algorithm decides the pipe tracking is stable enough to have a proper five points output. That easy can be after a certain amount of pings.

Data Definition:

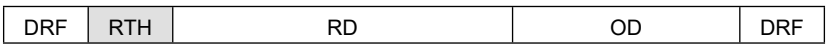


Table 37: 2004 – Record Type Header

Name	Size	Description
Pipe number	u32	Pipe identifier
Ping time	7kTime (u8*10)	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 Otherwise – Pipe is finished
Number of points	u32	Number of point sub records. Always 5 (five).
Point sub record size	u32	Size of sub record
Reserved	u32*10	Reserved

DRF	RTH	RD	OD	DRF

Table 38: 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

NOTE
The output is five in a sequence: seabed left, trench left, top, trench right and seabed right. (When multibeam X,Y,Z reference frame corresponds with vessel X,Y,Z reference frame.)

NOTE
Device identifier (in DRF) is the sonar .

10.22 3001 – Contact Output

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor. It contains information of a contact the operator creates / modifies / deletes in the Sonar UI.

Data Definition:

DRF	RTH	DRF

Table 39: 3001 – Record Type Header

Name	Size	Description
Target ID	u32	Contact unique ID
Ping number	u32	Sequential number
Operation time	7kTIME (u8 * 10)	Time of contact state operation applied to contact
Operator name	c8	Optional textual name of the operator
Contact state	u32	0 – Created 1 – Modified 2 – Deleted
Range	f32	Range from sonar to contact in meters
Bearing	f32	The bearing from sonar center to contact in +/- radians

Name	Size	Description
Information flags	u32	BIT FIELD: Bit 0: Set to 1 if Latitude and Longitude fields contain valid values Bit 1: Set to 1 if Azimuth field contains a valid value Bit 2: Set to 1 if Contact length field contains a valid value Bit 3: Set to 1 if Contact width field contains a valid value
Latitude	f64	Latitude of contact in radians -π/2 to π /2, south negative
Longitude	f64	Longitude of contact in radians -π to π, west negative
Azimuth	f32	Optional azimuth of contact in radians
Contact length	f32	Optional length of contact in meters
Contact width	f32	Optional width of contact in meters
Classification	c8	Optional textual classification given by the operator
Description	c8	Optional textual description given by the operator

NOTE
Device identifier (in DRF) is the sonar .

10.23 7000 – Sonar Settings

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the current sonar settings. The 7k sonar source updates this data for each ping. The record can be subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 40: 7000 – 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 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 1 – Linear chirp (FM)
Tx pulse envelope identifier	u32	0 – Tapered rectangular 1 – Tukey 2 – Hamming 3 – Han 4 – Rectangular
Tx pulse envelope parameter	f32	Some envelopes don't use this parameter
Tx pulse mode	u16	1 – Single ping 2 – Multi-ping 2 3 – Multi-ping 3 4 – Multi-ping 4
Tx pulse reserved	u16	Reserved
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
Control flags	u32	BIT FIELD: Bit 0-3: Auto range method Bit 4-7: Auto bottom detection filter method Bit 8: Bottom detection range filter enabled. Bit 9: Bottom detection depth filter enabled Bit 10: Receiver gain method Auto Gain Bit 11: Receiver gain method Fixed Gain Bit 12: Receiver gain method Reserved Bit 13: Reserved Bit 14: Trigger out High for entire RX duration 0 – Disabled 1 – Enabled Bit 15: 0 – System inactive

Name	Size	Description
		1 – Active Bit 16-19: Reserved for bottom detection Bit 20: Pipe gating filter 0 – Disabled 1 – Enabled Bit 21: Adaptive gate depth filter fixed 0 – Follow seafloor 1 – Fix depth Bit 22: Adaptive gate 0 – Disabled 1 – Enabled Bit 23: Adaptive gate depth filter 0 – Disabled 1 - Enabled Bit 24: Trigger out 0 – Disabled 1 – Enabled Bit 25: Trigger in edge 0 – Positive 1 – Negative Bit 26: PPS edge 0 – Positive 1 – Negative Bit 27-28: Timestamp State 0 – Timestamp not applicable 1 – Timestamp error / not valid 2 – Timestamp warning / use caution 3 – Timestamp ok / valid Bit 29: Depth filter follows seafloor 0 – Fix depth 1 – Follow seafloor Bit 30: Reduced coverage for constant spacing 0 – Always maintain swath coverage 1 – Allow swath coverage to be reduced Bit 31: 0 – 7K 1 – Simulator
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 Along track beam width
Projector beam -3dB beam width horizontal	f32	In radians Across track beam width
Projector beam focal point	f32	In meters
Projector beam weighting window type	u32	0 – Rectangular 1 – Chebychev 2 – Gauss
Projector beam weighting window parameter	f32	N/A
Transmit flags	u32	BIT FIELD: Bit 0-3: Pitch stabilization method Bit 4-7: Yaw stabilization method Bit 8-31: Reserved
Hydrophone identifier	u32	Hydrophone selection
Receive beam weighting window	u32	0 – Chebychev 1 – Kaiser
Receive beam weighting parameter	f32	N/A
Receive flags	u32	BIT FIELD: Bit 0: Roll compensation indicator Bit 1: Reserved Bit 2: Heave compensation indicator Bit 3: Reserved Bit 4-7: Dynamic focusing method Bit 8-11: Doppler compensation method Bit 12-15: Match filtering method Bit 16-19: TVG method Bit 20-23: Multi-ping mode 0 – No multi-ping If non-zero, this represents the sequence number of the ping in the multi-ping sequence. Bit 24-31: 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)

Name	Size	Description
Absorption	f32	Absorption in dB/km
Sound velocity	f32	Sound velocity in m/s
Spreading	f32	Spreading loss in dB
Reserved	u16	Reserved

NOTE
Pitch and yaw stabilization are not implemented. When the roll stabilization flag is not zero the beam pattern is roll stabilized; beam pattern is relative the vertical. Projector beam steering is pitch stabilization. Projector beam steering is not redundant when messages 7004 and 7006 are received; this value needs to take into account. (Unless the sonar does not have pitch steer capacity.)

10.24 7001 – 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

Table 42). 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 *10.62 7500 – 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:

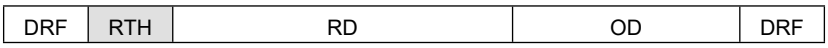


Table 41: 7001 – Record Type Header

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

Table 42: 7001 – Record Data

Name	Size	Description
Device 0 identifier	u32	Unique identifier number
Device 0 description	c8 * 60	UTF-8 string

Name	Size	Description
Device 0 AlphaData card	u32	Defines the type of the AlphaData card. 0x0400 – Virtex 2 card 0x0800 – Virtex 5 card 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	UTF-8 string
Device N-1 AlphaData card	u32	Defines the type of the AlphaData card. 0x0400 – Virtex 2 card 0x0800 – Virtex 5 card 0x1000 – Virtex 6 card
Device N-1 serial number	u64	
Device N-1 info length	u32	In bytes
Device N-1 info	dynamic	Varies with device type

A XML may differ depending of the sonar type.

Two samples of XML files are included in this document;

- XML sample T50-P
- XML sample MB2

XML SAMPLE – T50-P

```
<?xml version="1.0" encoding="US-ASCII"?>
- <T50P>
    <Name version="2016-02-22" enumerator="0" deviceid="50">T50-P</Name>
    <SystemInfo SystemTxDutyMax="3.0" name="T50-P" systemrelease="SV3" projectid="generic"
      auv="no">T50-P Sonar</SystemInfo>
    <SonarType unit="nb" type="0">Bathymetric sonar</SonarType>
    <ArrayType unit="nb" type="1" generation="2" number="7218">Flat array</ArrayType>
    <RxElements unit="meters" number="256" spacing="0.0016">Receive ceramics</RxElements>
    <RxBeamWidth unit="rad" along="0.471238898" across="0.00959931089" uniformalong="yes"
      uniformacross="yes">Receiver beamspacing</RxBeamWidth>
  - <RxBeamModeSet>
      <RxBeamMode max_total_steering="85.0" min_grazing="15.0" max_coverage="150.0"
        min_coverage="10.0" std_coverage="140.0" beam_spacing="ED" max_beams="512"
        min_beams="10" std_beams="512">Equi-Distant</RxBeamMode>
      <RxBeamMode max_total_steering="85.0" min_grazing="5.0" max_coverage="150.0"
        min_coverage="10.0" std_coverage="140.0" beam_spacing="ID" max_beams="512"
        min_beams="10" std_beams="512">Intermediate</RxBeamMode>
      <RxBeamMode max_total_steering="85.0" max_coverage="165.0" min_coverage="10.0"
        std_coverage="140.0" beam_spacing="EA" max_beams="512" min_beams="10"
        std_beams="512">Equi-Angle</RxBeamMode>
      <RxBeamMode max_total_steering="85.0" min_grazing="15.0" max_coverage="150.0"
        min_coverage="45.0" std_coverage="140.0" beam_spacing="FL" max_beams="512"
        min_beams="512" std_beams="512">Flex</RxBeamMode>
    </RxBeamModeSet>
    <RxBeamStabilization type="0">Receiver beam stabilization</RxBeamStabilization>
    <RxBeamDistributionSettings CSSThresholdPercent="4.0">Beam distribution control
      options</RxBeamDistributionSettings>
    <RxDelay unit="microseconds" rx_delay="1000">RX delay value</RxDelay>
    <TxHardware name="TX1">Transmitter BITE board</TxHardware>
    <TxType unit="nb" type="TC2181" number="2181">Standard</TxType>
    <TxSetup relay_position="Y" CableComp="surface" Droop="disabled" TVR="enabled" P0="70"
      DMPA="yes">Tx Additional Configuration</TxSetup>
```

```
<TxBeams unit="nb" max="0" min="0">Transmit beams</TxBeams>
<TxBeamSteering unit="rad" minz="0.0" maxz="0.0" minx="0.0" maxx="0.0" steerable="no">Transmit
    beam steering</TxBeamSteering>
<TxBeamSpacing unit="rad" angles="0.0" uniform="yes">Transmit beamspacing</TxBeamSpacing>
<TxBeamWidth unit="rad" minz="2.094395102" maxz="2.094395102" minx="0.0174533"
    maxx="0.0174533" variable="no">Transmit beamwidth</TxBeamWidth>
<TxBeamStabilization type="0">Transmit beam stabilization</TxBeamStabilization>
<TxPulseEnvelope type="tukey" parameter="0.1"> TxPulseEnvelope </TxPulseEnvelope>
<Frequency unit="Hz" max="400000.0" min="200000.0" center="400000.0" chirp_V6="yes"
    chirp="no" stepcw="10000" maxcw="420000" mincw="190000" cw_variable="yes">Transmit
    frequency</Frequency>
<FM_Parameters NegativeSweep="yes" CorrelationIndex="1.0" GuardBand_dB="3.0"
    KaiserLevel_dB="3">FM Tuning Paramters</FM_Parameters>
<PingModeSet>
    <PingMode mode="SP">Single Ping Mode</PingMode>
</PingModeSet>
<SampleRateSet_1>
    <SampleRate name="Standard (34k)" unit="hz" rate="34722.222222">Receiver sample
        rate</SampleRate>
    <FWFilterFiles_V6 _3="999,bf_filter_34K_300uS_20141017.dat"
        _2="0.000299,bf_filter_34K_120uS_20141017.dat"
        _1="0.000119,bf_filter_34k_0uS_20141017.dat" size="3">Firmware Filter Sonar Specific
        Files</FWFilterFiles_V6>
    <TxPulseLength unit="s" max="0.000300" min="0.000030" measured="1e-6" default_FM="0.001"
        max_FM="0.010" min_FM="0.000300" default="0.000060">Transmit pulse
        length</TxPulseLength>
    <TxDelay units="sec" transmitter="1025e-6" trigger="999e-6">Transmit Delay</TxDelay>
    <FM_Sweep max="30000" min="1000" default="30000" units="Hz" step="1000">FM Sweep
        Parameters</FM_Sweep>
    <DualHead unit="Hz" MasterDirection="positive" MasterFreq="low" Separation="6000"
        Sweep="20000">Dual-Head Settings</DualHead>
    <SSRange unit="m" max="750">Range Override</SSRange>
</SampleRateSet_1>
<SampleRateSet_2>
    <SampleRate name="High (66k)" unit="hz" rate="65789.473684">Receiver sample
        rate</SampleRate>
    <FWFilterFiles_V6 _3="999,bf_filter_66k_300uS_20130124.dat"
        _2="0.000299,bf_filter_66k_60uS_20130124.dat"
        _1="0.000059,bf_filter_66k_0uS_20130124.dat" size="3">Firmware Filter Sonar Specific
        Files</FWFilterFiles_V6>
    <TxPulseLength unit="s" max="0.000300" min="0.000015" measured="1e-6" default_FM="0.001"
        max_FM="0.005" min_FM="0.000300" default="0.000060">Transmit pulse
        length</TxPulseLength>
    <TxDelay units="sec" transmitter="1005e-6" trigger="999e-6">Transmit Delay</TxDelay>
    <FM_Sweep max="60000" min="1000" default="30000" units="Hz" step="1000">FM Sweep
        Parameters</FM_Sweep>
    <DualHead unit="Hz" MasterDirection="positive" MasterFreq="low" Separation="6000"
        Sweep="20000">Dual-Head Settings</DualHead>
    <SSRange unit="m" max="500">Range Override</SSRange>
</SampleRateSet_2>
<Power unit="dB//uPa" max="220.0" min="190.0" shared="no" tx_power_tweak="0.0">Transmit
    power</Power>
<Gain unit="dB" max="83.0" min="0.0" tvg_limit="83">Receiver gain</Gain>
<Range unit="m" max="750.0" min="3.0">Operating range</Range>
<RangeSet unit="m" _3="7" _2="5" _1="3" size="29" _29="750" _28="600" _27="500" _26="400"
    _25="350" _24="300" _23="250" _22="200" _21="180" _20="160" _19="140" _18="120"
    _17="100" _16="90" _15="80" _14="70" _13="60" _12="50" _11="45" _10="40" _9="35"
    _8="30" _7="25" _6="20" _5="15" _4="10">Valid Range Set</RangeSet>
<PingRate unit="p/s" max="50.0" min="0.0" freerun="no" ratio="1.0">Ping rate</PingRate>
<Motion pitch_ON="no" roll_ON="no" heave="0" pitch="0" roll="1" heavable="no" pitchable="no"
    rollable="yes">Motion compensation factor</Motion>
<FWInfo type="single" IQShift="0" bf_upm_level="4" bite="new" pps="new">Firmware Info</FWInfo>
<FWFiles BITEfile="7K_Bite_T50-P.xml" bitfile_V6="v6_256hr_20150922.bit">Firmware Sonar
    Specific Files</FWFiles>
<FPGA _3="0" _2="0" _1="0" offset_size="T3" delay="110e-6" lo_if="00000.0">FPGA Sonar Specific
    Values</FPGA>
```

```
    <DownLink remote="yes" register="yes">Downlink Commands</DownLink>
    <RDR units="MB" buffer="10" format="short" maxsize="1024" defaultpath="">Raw data
        recording</RDR>
    <StartState swiothrottlems="0" calibrate="yes" udp="on" selected="yes" pingmode="SP+CW"
        ping="yes" maxpower="0.0">Initial overwrite values</StartState>
    <Install_Defaults MaxPingRate="50">Installation Default Settings</Install_Defaults>
    <BottomDetection method="G2.5">BD Method (G1_Simple, G1_BlendFilt, G2)</BottomDetection>
    <Warnings IOM="error" PPS="fatal">Warning overrides</Warnings>
    <GUIState wedgethrottlems="160">Initial overwrite values</GUIState>
    <OutputBoost_dB Value="0">Beamformer Output Boost</OutputBoost_dB>
    <InputAttenuation_dB Value="3">BF input attenuation setting.</InputAttenuation_dB>
    <Display colordepth="1" bitshift="3">Display options</Display>
    <CalibrationHistory maxdays="180"/>
    <ComPorts time="COM1" motion="COM2" svp="COM3">Serial ports</ComPorts>
    <Saturation max="25000" min="18">Saturation magnitude</Saturation>
    <PingPong unit="seconds" delay="1.2e-3">Dual-head ping-pong delay</PingPong>
  - <CopyrightSet>
        <Copyright>This software includes the Armadillo library (http://arma.sourceforge.net) and
            LAPACK (http://www.netlib.org/lapack).</Copyright>
        <Copyright>LAPACK Copyright (c) 1992-2013 The University of Tennessee and The University
            of Tennessee Research Foundation. All rights reserved.</Copyright>
        <Copyright>LAPACK Copyright (c) 2000-2013 The University of California Berkeley. All rights
            reserved.</Copyright>
        <Copyright>LAPACK Copyright (c) 2006-2013 The University of Colorado Denver. All rights
            reserved.</Copyright>
    </CopyrightSet>
    <DepthGate min_window="1.0" min_value="-5.0">Depth gate limits</DepthGate>
    <RangeGate min_window="1.0" min_value="0.1">Range gate limits</RangeGate>
    <NadirGate min_window="1.0" min_value="0.1">Nadir gate limits</NadirGate>
</T50P>
```

XML SAMPLE - MB2:

```
<?xml version="1.0" encoding="US-ASCII"?>
- <MB2>
    <Name xml_reson="9.1.2.3.0.3" enumerator="0" deviceid="1002">1002</Name>
    <SystemInfo company="ODOM" name="Multibeam2" systemrelease="MB2" projectid="ODOM
      Multibeam">MB2 Sonar</SystemInfo>
    <SonarType unit="nb" type="0">Bathymetric sonar</SonarType>
    <ArrayType unit="nb" type="1" number="1002">Flat array</ArrayType>
  - <RxBeamModeSet>
      <RxBeamMode max_total_steering="70.0" min_grazing="5.0" max_coverage="140.0"
        min_coverage="90.0" std_coverage="140.0" beam_spacing="ED" max_beams="256"
        min_beams="64" std_beams="120">Equi-Distant</RxBeamMode>
      <RxBeamMode max_total_steering="70.0" min_grazing="5.0" max_coverage="140.0"
        min_coverage="90.0" std_coverage="140.0" beam_spacing="EA" max_beams="256"
        min_beams="64" std_beams="120">Equi-Angle</RxBeamMode>
    </RxBeamModeSet>
  - <CopyrightSet>
      <Copyright>The MBCenter.exe uses the Intel Math Kernel Library. MKL homepage:
        http://www.intel.com/software/products/mkl.</Copyright>
    </CopyrightSet>
    <TxPulseLength unit="s" measured="1e-6" max="0.001000" min="0.000020">Transmit pulse
      length</TxPulseLength>
    <PulseLengthSlider Mode="Release">Pulse Length Slider</PulseLengthSlider>
    <Frequency unit="Hz" Chirp="no" stepcw="10000" maxcw="420000" mincw="170000"
      cw_variable="yes">Transmit frequency</Frequency>
    <FrequencySet _12="460" _11="435" _10="420" _9="400" _8="390" _7="360" _6="330" _5="300"
      _4="270" _3="245" _2="230" _1="200" size="12">Valid Frequency Set</FrequencySet>
    <FrequencySlider Mode="Release">Frequency Slider</FrequencySlider>
    <SampleRate unit="hz" rate="36000">Receiver sample rate</SampleRate>
    <Power unit="" max="8" min="1" label="">Transmit power</Power>
    <PowerSlider Mode="Release">Power Slider</PowerSlider>
    <Range unit="m" max="250.0" min="2.0">Operating range</Range>
    <RangeSet step="2.0">Valid Range Set</RangeSet>
    <RecordableRecordSet _12="1011" _11="1010" _10="1009" _9="1008" _8="1007" _7="1006"
      _6="1005" _5="1004" _4="1003" _3="1002" _2="1001" _1="1000" size="37" _37="7613"
      _36="7612" _35="7611" _34="7610" _33="7511" _32="7504" _31="7503" _30="7042"
      _29="7028" _28="7027" _27="7021" _26="7017" _25="7012" _24="7010" _23="7004"
      _22="7002" _21="7001" _20="7000" _19="1050" _18="1017" _17="1016" _16="1015"
      _15="1014" _14="1013" _13="1012">7k Records Available for Recording</RecordableRecordSet>
    <RangeSlider Mode="Release">Power Slider</RangeSlider>
    <PingRate unit="p/s" max="60.0" min="0.0" freerun="no" ratio="1.0">Ping rate</PingRate>
    <PingRateSlider Mode="Release">Ping rate Slider</PingRateSlider>
    <Motion pitch_ON="no" roll_ON="no" heave="0" pitch="0" roll="1" heavable="no" pitchable="no"
      rollable="yes">Motion compensation factor</Motion>
    <RDR buffer="10" format="short" units="MB" maxsize="1024" defaultpath="C:\Data\">Raw data
      recording</RDR>
    <StartState ping="yes" maxpower="0.0">Initial overwrite values</StartState>
    <Saturation max="25000" min="100" indicator="off">Saturation magnitude</Saturation>
  </MB2>
```

10.25 7002 – Match Filter

Description: This record is produced by the 7k sonar source. 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 43: 7002 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Operation	u32	0 – Off 1 – On
Start frequency	f32	Hz
Stop frequency	f32	Hz
Window type	u32	0 – Rectangular 1 – Kaiser 2 – Hamming 3 – Blackmann 4 – Triangular 5 – X (Taylor)
Shading value	f32	
Effective Pulse Width	f32	Effective pulse width after FM compression (seconds) NOTE: Software versions prior to July 2015 (7k sonar source 5.9.0.1 or older) do not calculate this value. In this case the value will be a very large negative number.
Reserved	u32 * 13	Filled with 0xFB

10.26 7003 – Firmware and Hardware Configuration

Description: This record is produced by the 7k sonar source 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 sonar source. This record is not available for subscription.

For details about requesting and subscribing to records, see section *10.62 7500 – 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 44: 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

Field	Bytes	Sensor Types	Name	Min	Max
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
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

10.27 7004 – Beam Geometry

Description: This record is produced by the 7k sonar source. It contains the receive beam widths and steering. The 7k sonar source updates this data for each ping. The record can be manually requested for the last ping or subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

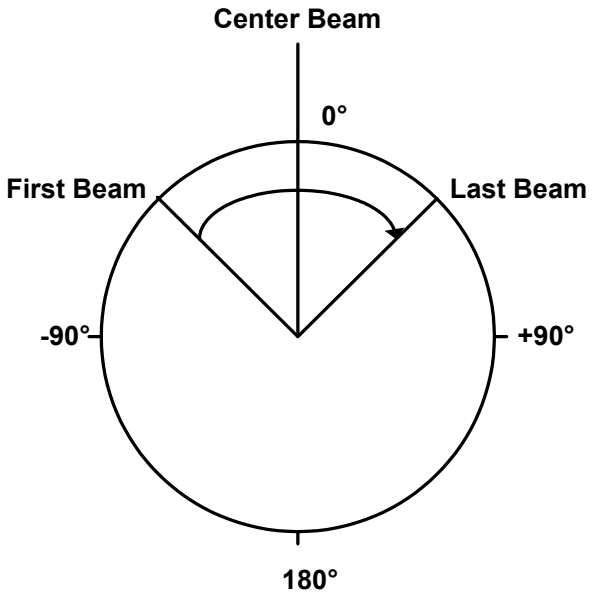


Figure 10-1: Sonar Beam Angle Convention

Data Definition:

DRF	RTH	RD	OD	DRF

Table 45: 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 46: 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.

Name	Size	Description
-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°).
Tx Delay[N]	f32 * N	Tx Delay for the beam in fractional samples, zero when not applicable. The Tx Delay is not existing on all sonar models. Up to now this is only supported for the HydroSweep sonars (see section 9.3). When the sonar does not has Tx Delay the item will not be in the Record Data, check record length in the Data Record Frame.

NOTE
Beam angles are relative to sonar frame when beam stabilization is switched off. When enabled it will be relative to the vertical. Beam vertical is always zero, angles are relative to sonar frame.

10.28 7006 – Bathymetric Data

NOTE
Record 7006 is superseded by record 7027. The record is depreciated and will not be supported by latest 7k protocol based applications such as the Teledyne Odom MBCenter. It exists backwards compatibility only.

Description: This record is produced by the 7k sonar source series. It contains the sonar bottom detection results. The 7k sonar source updates this data for each ping. The record can be subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 47: 7006 – 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	u32	Number of receiver beams
Flags	u8	BIT FIELD: Bit 0: Layer compensation 0 – Off 1 – On Bit 1: XYZ compensation 0 – Off 1 – On Bit 2-7: Reserved (always 0)
Sound velocity flag	u8	Flag indicating if sound velocity is measured or manually entered 0 – Measured 1 – Manually entered
Sound velocity	f32	Sound velocity at the sonar in meters/second

Table 48: 7006 – Record Data

Name	Size	Description
Range [N]	f32 * N	Two-way travel time in seconds
Quality [N]	u8 * N	BIT FIELD: Bit 0: Brightness 1 – Pass 0 – Fail Bit 1:Colinearity 1 – Pass 0 – Fail Bit 2: Bottom detection process (intensity) 1 – Used 0 – Not used Bit 3: Bottom detection process (phase): 1 – Used 0 – Not used Bit 4: Used internally Bit 5: PDS nadir filter 1 – Fail 0 – Pass Bit 6-7: Reserved

Name	Size	Description
Intensity [N]	f32 * N	Intensity: Bottom reflectivity. This is a relative value. (Not calibrated).
Min filter info	f32 * N	Minimum two-way travel time to filter point for each beam (minimum depth gate)
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 Teledyne PDS Optional Data.

NOTE

- The compensation flag in the 7006 record is valid for all sonars, it does not compensate the conical intersection, it only correct the range. (conical intersection is required for sonars with projector steering)
- 7006 record flags if it is compensated for sonar geometry.
- You cannot do conical intersection correction svc of the 7006 record flagged XYZ compensated since this is already corrected for the tx-rx offset.

  The correction is required for 7027 record and 7006 flagged XYZ compensation off.

NOTE

Since 7kCenter version 3.4.7.2 of the 7150 branch, the Intensity field of the 7006 record contains quality information and is therefore not useable for backscatter processing.

10.29 7007 – Side Scan Data

Description: This record is produced by the 7k sonar source. It contains the non-calibrated side-scan type data. This record is typically not available in a forward-looking sonar configuration. The 7k sonar source updates this data for each ping. The record can be subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

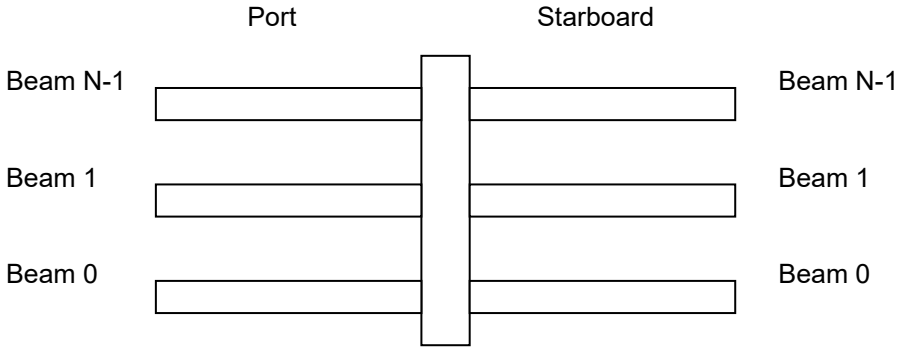


Figure 10-2: Beam Port and Starboard Numbering

Data Definition:

DRF	RTH	RD	OD	DRF

Table 49: 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
Control flags	u32	BIT FIELD: Bit 0: Nadir depth record field used. Bit 4: Reserved Bit 1, 2, 3, 5-31: Reserved
S	u32	Samples per side (port/starboard)
Nadir depth	u32	Nadir depth in samples. It is one way travel for the number of samples. (Convert the samples to one way travel time by dividing by the sample rate.)
Reserved	f32 * 7	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, 1, 2 or 4
Data types	u8	BIT FIELD: Bit 0: Reserved (always 0) Bit 1-7: Reserved

DRF	RTH	RD	OD	DRF

Table 50: 7007 – Record Data

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

For information on optional data, see Appendix A Teledyne PDS Optional Data.

10.30 7008 – Generic Water Column Data

NOTE
Record 7008 is superseded by 7018 and 7028. It is mutually exclusive. The record is depreciated and will not be supported by Teledyne RESON. It exists for backwards compatibility only.

Description: This record is produced by the 7k sonar source. It contains the sonar beam "I" and "Q" or magnitude and phase data. The 7k sonar source 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:

sd_0 ……. sd_N	sd_0 ……. sd_N
(beam 1)	(beam 2)

   where sd = sample data

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

b_0 ……. b_N	b_0 ……. b_N
(sample 1)	(sample 2)

   where b_x = sample data for each beam

Data Definition:

DRF	RTH	RD	OD	DRF

Table 51: 7008 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence.
N	u16	Total number of beam descriptors or elements in record
Reserved	u16	Reserved
Samples	u32	Samples in ping. Only valid if all beams and samples are in record.
Record subset flag	u8	BIT FIELD: Bit 0: 0 – All beams and samples in ping 1 – Beam and/or sample ping subset Bit 1: 0 – Sample ping subset 1 – Beam ping subset
Row column flag	u8	0 – All samples for a beam, followed by all samples for the next beam 1 – Sample 1 for all beams, followed by Sample 2 for all beams, etc
Reserved	u16	Reserved

Name	Size	Description
Data sample type(s)	u32	BIT FIELD: (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., intensity is an u4 with possible values in range 0 to 16.) Bit 0-3: Intensity (magnitude) 0 – No intensity 1 – Reserved 2 – Intensity (16 bits) 3 – Intensity (32 bits) Bit 4-7: Phase 0 – No phase 1 – Reserved 2 – Phase (16 bits) 3 – Phase (32 bits) Bit 8-11: I and Q 0 – No I and Q 1 – Signed 16 bit I and signed 16 bit Q 2 – Signed 32 bit I and signed 32 bit Q Bit 12-14: Beamforming flag 0 – Beam formed data 1 – Element data

Table 52: 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 53: 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 Teledyne PDS Optional Data

Additional SeaBat™ data settings (data reduction).

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

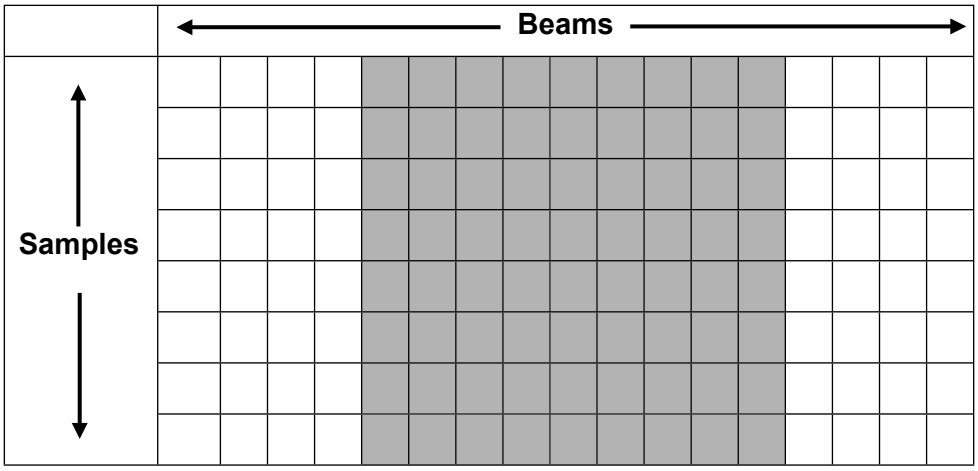


Figure 10-3: Beam Limits – Set Min and Max Beam

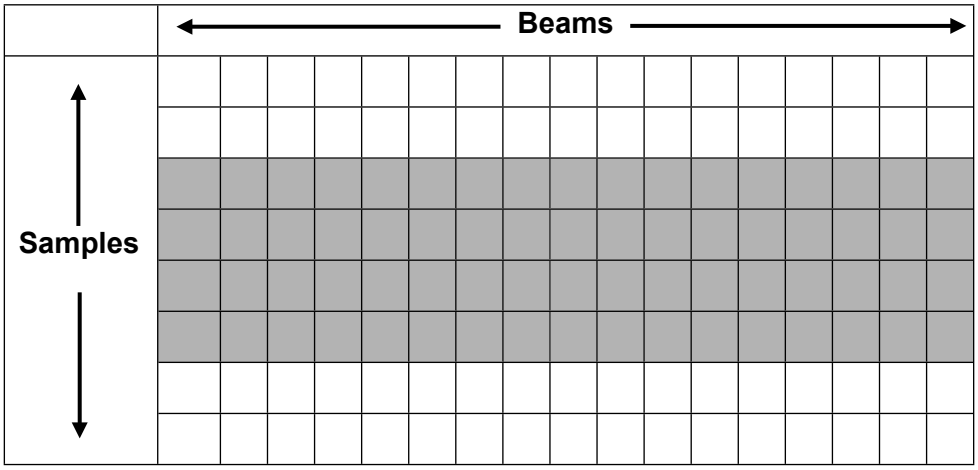


Figure 10-4: Sample Limits – Set Min and Max Sample

10.31 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 sonar source updates this data for each ping. The record can be subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 54: 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 55: 7010 – Record Data

Name	Size	Description
Gain value [1]	f32	Gain values – one per sample
…	…	…
Gain value [N]	f32	

10.32 7011 – 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 sonar source updates this data for each ping. The record can be subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – 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 56: 7011 – Record Type Header

Name	Size	Description
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence.
W	u32	Image width in pixels
H	u32	Image height in pixels
Color depth	u16	Color depth (bytes per pixel), 1, 2 or 4
Reserved	u16	Reserved
Compression algorithms	u16	Reserved for future use
Samples	u32	Original samples prior to compression
Flags	u32	BIT FIELD: Bit 0 - dB Visualization Bit 1 - Un-stabilized beams
Rx Delay	f32	Rx delay in fractional samples, zero when not applicable. The receiver starts listening after the Rx delay (in fractional samples).
Reserved	u32 * 6	Reserved

DRF	RTH	RD	OD	DRF

Table 57: 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

10.33 7012 – Ping Motion Data

Description: This record is produced by the 7k sonar source series. It contains the description of various parameters used in detection computations. The 7k sonar source updates this data for each ping. The record can be subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – 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 58: 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
Flags	u16	BIT FIELD: Bit 0: Pitch stabilization applied/pitch field present Bit 1: Roll stabilization applied/roll field present Bit 2: Yaw stabilization applied/heading field present Bit 3: Heave stabilization applied/heave field present Bit 4-15: Reserved

Name	Size	Description
Error flags	u32	BIT FIELD: Bit 0: PHINS reference 0 – Valid 1 – Invalid Bit 1-3: Reserved for PHINS Bit 4: Roll angle >15 degrees Bit 5: Roll angle >35 degrees Bit 6: Roll rate > 10 degrees per second Bit 7: 1 – External motion data not received (roll angle and rate are not reported) Bit 8-31: 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 *section 2.2 Sign Conventions*.

10.34 7014 – Adaptive gate

Description: This record is produced by the 7k sonar source. It contains the description of the current adaptive gate settings.

In the 7k sonar source the adaptive search window is used to initialize the adaptive gate, when the user interface sent a new search value the adaptive gate will reinitialized. To display this behavior properly a status flag will be added to indicate if the adaptive search window is active or in passive mode.

Additional information:

In the 7000/7503 record the control flags Bit 19 will be used for this, 0=depth filter active, 1=depth filter passive.

Remote control command 1016 is used to set the adaptive gate window.

The adaptive gate search window needs to be reported in the 7503 record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 59: 7014 – Record Type Header

Name	Size	Description
Record Header Size	u16	Size of record header in bytes
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 Gates	u32	Number of gate descriptors.
Gate descriptor size	u16	Size of gate descriptor information block in bytes

DRF	RTH	RD	OD	DRF

Table 60: 7014 – Record Data

	Name	Size	Description
N Gate descriptor	Angle	f32	Gate angle in radians
	Min limit	f32	Minimum sample number of gate limit
	Max limit	f32	Maximum sample number of gate limit

10.35 7017 – Detection Data Setup

NOTE
Record 7017 is obsolete. It exists for backwards compatibility only.

Reserved for 7k detection data setup.

Description: This record is produced by the 7k sonar source series. It contains the description of various parameters used in detection computations. The 7k sonar source updates this data for each ping. The record can be subscribed from the 7k sonar source. This record is available by subscription only.

Data Definition:

DRF	RTH	RD	OD	DRF

- Table 61: 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 1 – G1_BlendFilt 2 – G2 3 – G3 4 – IF1 5 – PS1 (beam detection) 6 – HS1 (beam detection) 7 – HS2 (pseudo beam detection) 8-255 – Reserved for future use
Flags	u32	BIT FIELD: Bit 0: 1 – User-defined depth filter enabled Bit 1: 1 – User-defined range filter enabled Bit 2: 1 – Automatic filter enabled Bit 3: 1 – Nadir search limits enabled Bit 4: 1 – Automatic window limits enabled Bit 5: 1 – Quality filter enabled Bit 6: 1 – Multi-detection enabled Bits 7-31: Reserved for future use
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

Name	Size	Description
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)
Nadir depth	f32	Nadir depth used by MB2
Reserved	u32 * 13	Reserved for future use

NOTE
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 62: 7017 – 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

Name	Size	Description
Flags	u32	BIT FIELD: Bit 0: 1 – Automatic limits valid Bit 1: 1 – User-defined limits valid Bit 2-8: Quality type, defines the type of the quality field Bit 9: 1 – Quality passes user-defined criteria or no user-defined criteria was specified Bits 10-12: Detection type (1 or more of the following): Bit 10 : Magnitude detect used Bit 11 : Phase detect used Bit 12 : Reserved Bit 13-15: Reserved for future use Bit 16-19: Detection priority number for detections within the same beam (Multi-detect only). Value zero is highest priority.
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 *Table 63*
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 63: 7017 – Detection Quality

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

10.36 7018 – Beamformed Data

Description: This record is produced by the 7k sonar source series. It contains the sonar beam intensity (magnitude) and phase data. The 7k sonar source updates this data for each ping. The record can be subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

This record is available by subscription only.

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

First sample 0 of all beams then sample 1 of all beams etc. The sampling continues until the set range is reached. (Every beam will have the same number of samples)

Data rates:

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

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

Example:

128 beams * 32 bits (sonar setting 6) * 34500 samples/s * 1.1 = 155.4432 Mbits/s

Data Definition:

DRF	RTH	RD	OD	DRF

Table 64: 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

Name	Size	Description
Samples (S)	u32	Total number of samples per beam in ping record
Reserved	u32 * 8	Reserved for future use

Table 65: 7018 – Record Data

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

10.37 7019 – Vernier Processing Data (Raw)

Description: This record is produced by the 7k sonar source series. It contains the output of the custom Vernier processing stage for multi-ping forward looking sonar systems (eg. 7130 and 7131). This record is not available on other system types. This record is available by subscription only.

Data Definition:

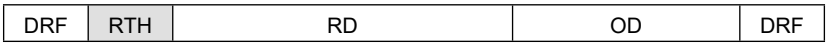


Table 66: 7019 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Multiping Sequence	u16	Multi-ping sequence number 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

Name	Size	Description
Samples (S)	u32	Number of samples in source data (‘head samples’)
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: 0 – Rectangular 2 – Hamming 99 – None
Smoothing win length	u16	Smoothing window length [samples]
Reserved	u32 * 2	Reserved for future use
Intensity threshold	f32	Intensity 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° (in radians)
Max angle	f32	Upper limit on possible elevation angles , normally +45° (in radians)
Elevation coverage	f32	Normally 90° (π/2) (in radians)
Reserved	u32 * 4	Reserved for future use

Table 67: 7019 – Record Data

Name	Size	Description
		Part 1
Sample 0, Beam 0, angle	i16	Vertical angle of arrival for first decimated sample, first beam (divide by *Angle scaling factor* 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
		Part 2
Sample 0, Beam 0, Mag	u16	Intensity for first decimated sample, first beam.

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

Angle = (RV / 65536) * *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 $\sigma = 10^{-QF}$.

10.38 7021 – 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 sonar source updates this record when any of the values have changed and publishes it every second. The 7021 record is available by subscription only.

For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

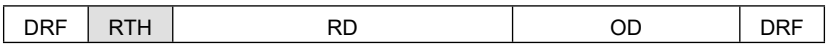


Table 68: 7021 – Record Type Header

Name	Size	Description
N	u16	Number of boards reporting

DRF	RTH	RD	OD	DRF

Table 69: 7021 – Record Data for Each board (N)

Name	Size	Description
Source name	c8 * 64	Null terminated UTF-8 string, e.g. “TX1”
Source address	u8	Source address
Reserved	f32	Reserved
Reserved	u16	Reserved
Downlink time sent	7kTime (u8 * 10)	Downlink time sent
Uplink time received	7kTime (u8 * 10)	Uplink time received
BITE time received	7kTime (u8 * 10)	BITE time received
Status	u8	BIT FIELD: Bit 0: 0 – Uplink OK 1 – Uplink Error Bit 1: 0 – Downlink OK 1 – Downlink Error Bit 2: 0 – Bite OK 1 – Bite Error Bit 3-4: 0 – OK 1 – Warning 2 – Error 3 - Fatal
NBF	u16	Number of valid bite fields (BF) for this board
BITE status bits	UINT64 * 4	BIT FIELD: Bit 0: 0 – BF #0 within range 1 – BF #0 out of range Bit 255: 0 – BF #255 within range 1 – BF #255 out of range
BF #0: Field	u16	Field Number (from Bite.htm file)

Name	Size	Description
BF #0: Name & value text, range text	c8 * 64	c8 * 64 One to three Null terminated UTF-8 strings sensor name, value text, range text. Format 1: Name only text • Example: “PA5V” Format 2: Name and value texts • Example “PA5V”“5.02\0” Format 3: Name, value and range texts • Example “PA5V”“5.02”“[4.9;5.1]”
BF #0: Sensor Type	u8	1 – Error count 2 – FPGA die temperature 3 – Humidity 4 – Serial 8-channel ADC 5 – Firmware version 6 – Head Temp, 8K WetEnd 7 – Leak V, 8K WetEnd 8 – 5 Volt, 8K WetEnd 9 – 12 Volt, 8K WetEnd 10 – DipSwitch, 8K WetEnd 12 – Activity counter. Release an alarm if it increments too slowly. 13 – Error counter. Releases an alarm if it increments too much, too fast. 100 – Display ‘Value’ with 0 digits; scale 1 101 – Display ‘Value’ with 1 digit; scale 0.1 102 – Display ‘Value’ with 2 digits; scale 0.01 103 – Display ‘Value’ with 3 digits; scale 0.001 110 – Display as 4 hex digits 111 – Display as 8 bit Binary 112 – Display as Enumeration (literals defined in Bite.htm file) 200 – Display as part number 201 – Part revision High order 8 bits is the revision number, Low order 8 bit is an ASCII character. 250 – Display as positive number
BF #0: Minimum	f32	Minimum value for alarm
BF #0: Maximum	f32	Maximum value for alarm

Name	Size	Description
BF #0: Value	f32	Current value
…..		
…..		
BF #NBF-1: Field	u16	Field Number (from Bite.htm file)
BF #NBF-1: Name & value text	c8 * 64	Null terminated UTF-8 string of sensor name, optionally followed by null terminated value text, e.g. “PA5V\0.5.02\0”
BF #NBF-1: Sensor Type	u8	1 – Error count 2 – FPGA die temperature 3 – Humidity 4 – Serial 8-channel ADC 5 – Firmware version 6 – Head Temp, 8K WetEnd 7 – Leak V, 8K WetEnd 8 – 5 Volt, 8K WetEnd 9 – 12 Volt, 8K WetEnd 10 – DipSwitch, 8K WetEnd 12 – Activity counter. Release an alarm if it increments too slowly. 13 – Error counter. Releases an alarm if it increments too much, too fast. 100 – Display ‘Value’ with 0 digits; scale 1 101 – Display ‘Value’ with 1 digit; scale 0.1 102 – Display ‘Value’ with 2 digits; scale 0.01 103 – Display ‘Value’ with 3 digits; scale 0.001 110 – Display as 4 hex digits 111 – Display as 8 bit Binary 112 – Display as Enumeration (literals defined in Bite.htm file) 200 – Display as part number 201 – Part revision High order 8 bits is the revision number, Low order 8 bit is an ASCII character. 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

Name	Size	Description
…..		

10.39 7022 – Sonar Source Version

Description: This record provides the 7k sonar source version as a NULL terminated string.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 70: 7022 – Record Type Header

Name	Size	Description
Version string	c8 * 32	UTF-8 string, max length 31 characters + null

10.40 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 71: 7023 – Record Type Header

Name	Size	Description
Version string	c8 * 32	UTF-8 string, max length 31 characters + null

10.41 7027 – Raw Detection Data

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

Refer to Appendix F on page 246 for a description of handling the 7027 record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 72: 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 1 – G1_BlendFilt 2 – G2 3 – G3 4 – IF1 5 – PS1 (beam detection) 6 – HS1 (beam detection) 7 – HS2 (pseudo beam detection) 8-255 – Reserved for future use
Flags	u32	BIT FIELD: Bit 0-3: Uncertainty method 0 – Not calculated 1 – Rob Hare's method 2 – Ifremer's method 3-15 – Reserved for future use Bit 4: Multi-detection enabled Bit 5: Reserved Bit 6: Has Snippets detection point flag Bit 7-31: Reserved for future use
Sampling rate	f32	Sonar's sampling frequency in Hz
Tx angle	f32	Applied transmitter steering angle, in radians This angle is used for pitch stabilization. It will be zero if the system doesn't have this feature. The value is the same as the Projector beam steering angle of the 7000 record. They are both filled from the same variable.
Applied roll	f32	Roll value (in radians) applied to gates; zero if roll stabilization is ON. This value is made available to be able to draw the gating lines in the real-time user interface wedge display.
Reserved	u32 * 15	Reserved for future use

NOTE
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 73: 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
Flags	u32	BIT FIELD: Bit 0: 1 – Intensity (Magnitude) based detection Bit 1: 1 – Phase based detection Bit 2-8: Quality type, defines the type of the quality field below Bits 9-12: Detection priority number for detections within the same beam (Multi-detect only). Value zero is highest priority. Bits 13: Reserved Bit 14: Snippet detection point flag 0 – Detection used in snippet 1 – Not used in snippet Bits 15-31: Reserved for future use
Quality	32 bits	Detection quality, see *Table 74*
Uncertainty	f32	Detection uncertainty represented as an error normalized to the detection point
Intensity	f32	Intensity of detection point
Min limit	f32	Minimum sample number of gate limit
Max limit	f32	Maximum sample number of gate limit

For information on optional data, see Appendix A Teledyne PDS Optional Data.

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

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 74: 7027 – Detection Quality

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

10.42 7028 – Snippet Data

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

For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

For information on optional data, see Appendix A Teledyne PDS Optional Data

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

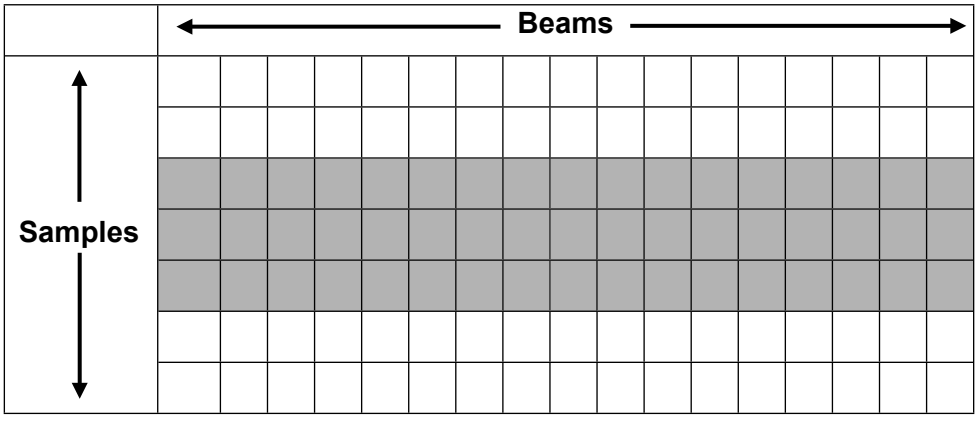


Figure 10-5: Sample Limits – Set Min and Max Sample

Data rates:

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

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

Example:

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

Equation for sample limits:

beams * ping rate * samples * data format bits * 10%

Example:

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

Data Definition:

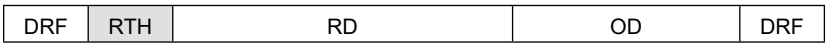


Table 75: 7028 – Record Type Header 7K and T-series sonar

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence.
N	u16	Number of detection points
Error flag	u8	If *set*, record will not contain any data. Flag itself will indicate an error. 0 – OK 1-5 – Reserved 6 – Bottom detection failed (R7006) 7-255 – Reserved
Control flags	u8	Control settings from RC 1118 0 – Automatic snippet window is used 1 – Quality Filter enabled 2 – Minimum window size is required 3 – Maximum window size is required 4-7 – Reserved
Flags	u32	BIT FIELD: Bit 0: 0:16 bit snippets 1: 32 bit snippets
Reserved	u32 * 6	Reserved for future use

DRF	RTH	RD	OD	DRF

Table 76: 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
Snippet of first detection	u16 or u32	Intensity series for each sample. Array is populated with samples from the first sample to the last as defined above.
…	…	…
Snippet of last detection	u16 or u32	Intensity 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 Teledyne PDS Optional Data.

10.43 7029 – Vernier Processing Data (Filtered)

Description: This record is produced by the 7k sonar source series. It contains the *filtered* output of the Vernier processing stage for multi-stave forward looking sonar systems (eg. 7130, 7131). This record is not available on other system types. This record is available by subscription only.

For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 77: 7029 – 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.

Name	Size	Description
Soundings (S)	u16	Number of soundings. There may be several soundings per beam.
Min Angle	f32	Minimum elevation angle in all soundings (radians).
Max Angle	f32	Maximum elevation angle in all soundings (radians).
Repeat Size	u16	Size of sounding repeat blocks following (bytes).

Table 78: 7029 – Record Data

	Name	Size	Description
Sounding #1	Beam Angle	f32	Sounding horizontal angle (radians).
	Sample	u32	Sounding sample number (convert to range using sample rate and sound velocity).
	Elevation	f32	Sounding vertical angle (radians).
	Reserved	f32	Reserved (zero).
Sounding #2			
....			
Sounding #S			

10.44 7030 – Sonar Installation Parameters

NOTE
Teledyne RESON Sonars will NOT generate this record. This record is generated by third-party software such as Teledyne PDS.

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

Data Definition:

Table 79: 7030 – Record Type Header

Name	Size	Description
Frequency	f32	Frequency in Hz
Length of firmware version info	u16	Length in bytes
Firmware version info	u8 [128]	
Length of software version info	u16	Length in bytes

Name	Size	Description
Software version info	u8 [128]	
Length of 7k software version info	u16	Length in bytes
7k software version info	u8 [128]	
Length of record protocol info	u16	Length in bytes
Record protocol version info	u8 [128]	
Transmit array X	f32	X offset in meters
Transmit array Y	f32	Y offset in meters
Transmit array Z	f32	Z offset in meters
Transmit array roll	f32	Radians
Transmit array pitch	f32	Radians
Transmit array heading	f32	Radians
Receive array X	f32	X offset in meters
Receive array Y	f32	Y offset in meters
Receive array Z	f32	Z offset in meters
Receive array roll	f32	Radians
Receive array pitch	f32	Radians
Receive array heading	f32	Radians
Motion sensor X	f32	X offset in meters
Motion sensor Y	f32	Y offset in meters
Motion sensor Z	f32	Z offset in meters
Motion sensor roll calibration	f32	Radians
Motion sensor pitch calibration	f32	Radians
Motion sensor heading calibration	f32	Radians
Motion sensor time delay	u16	Milliseconds
Position sensor X	f32	X offset in meters
Position sensor Y	f32	Y offset in meters
Position sensor Z	f32	Z offset in meters
Position sensor time delay	u16	Milliseconds
Water line vertical offset	f32	Vertical offset from reference point to waterline in meters

NOTE
Teledyne PDS Notes: • The device ID of record 7030 is not as record 7003. Record 7003 is used for all none sonar records in the file (e.g. sensor data). All sonar data exported do have the ID from the original sonar. (7160,20,7111, 7125 etc.) • Because of the PDS data source-switching feature, there are no offsets in the 7030 record. (Are all 0.) The data in the 1015 is compensated for the offsets (contains the vessel reference position). So they can be red and applied in automated system which also reads the 1015. • You do not need to use the Time Delay value, the time delay is already applied to the data timestamp.

10.45 7031 – Built-In Test Environment Data (Summary)

Description: This record is produced by the SeaBat™ 7k Sonar 7-P processor. It contains a summary of the Built-In Test Environment (BITE) warning, error and fatal level alert items. The 7k sonar source updates this record when any of the values have changed and publishes it every two seconds. The record can be manually requested or subscribed to.

For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

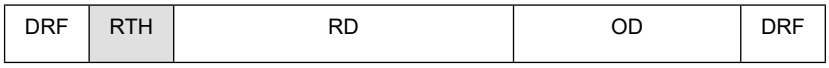


Table 80: 7031 – Record Type Header

Name	Size	Description
Total Items	u16	Total of all *warning*, *error* or *fatal* level BITE status items. If this field is not zero, then the following fields can be examined to determine severity and source of BITE alerts.
Warnings	u16*4	Index 0 = Overall number of warnings. Index 1 = Receiver related warnings. Index 2 = Transmitter related warnings. Index 3 = Other (system) related warnings.
Errors	u16*4	Index 0 = Overall number of errors. Index 1 = Receiver related errors. Index 2 = Transmitter related errors. Index 3 = Other (system) related errors.
Fatals	u16*4	Index 0 = Overall number of fatal status items. Index 1 = Receiver related fatal status items. Index 2 = Transmitter related fatal status items. Index 3 = Other (system) related fatal status items.

Name	Size	Description
RESERVED	u32*2	Zero. Reserved for future use

10.46 7041 – Compressed Beamformed Intensity Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the compressed intensity 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 *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

NOTE
The new 7042 record deprecates the 7041 record. The 7041 record is supported only for 7111 and 7150 systems. All other systems should use the 7042 record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 81: 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
Flags	u16	BIT FIELD: Bit 0-1: Reserved Always 1 for backward compatibility with 7111 systems Bit 2-4: Down –sampling method 0 – no down sampling 1 – nearest neighbor 2 – linear approximation 3-7 - reserved Bit 5-7: Filtering method 0 – no filtering 1-7 – reserved Bit 8: Beam identification method 0 – beam number (u16) 1 – beam angle (f32, in radians) Bit 9-15: Reserved

Name	Size	Description
Sample Rate	f32	Sampling rate for the data
Reserved	4*u32	Reserved for future use

Table 82: 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. (See ‘Data Size’ above)

10.47 7042 – Compressed Water Column Data

Description: This record is produced by the 7k sonar source series. It contains compressed water column data. The 7k sonar source updates this record on every ping. This record is available by subscription only. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

NOTE
Remote command 7500 sub7042 is used to configure this record.

NOTE
See Appendix I 7042 Compressed water column data for a description of the compression algorithms used to fill the 7042 record.

The Compressed Water Column record allows for the reduction in record data size (vs. the standard 7018 full magnitude/phase record) via the several possible options listed here. “Downsampling” means that only 1 of N mag/phase samples are kept. Where ‘N’ is the “downsampling factor” value. The “downsampling type” controls how that 1 value is determined. The three choices are:

1. Middle of window:
   The 1 sample value kept is the middle one in each “window” (e.g. if N = 5, then we keep sample 3, 8, 13, 18, …)
2. Peak:
   The 1 sample value kept is the largest of each “window” of N samples.
3. Average:
   The 1 sample value kept is the average of all N samples in each “window”.

For example, if the “Remove phase data” option and the Downsampling option (with factor 5) are selected, then the resulting Compressed Water Column record will be 1/2 * 1/5 = 1/10 the size of corresponding 7018 mag+phase Water Column Record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 83: 7042 - 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 (B)	u16	Number of beams.
Samples	u32	Number of samples (nominal, based on range)
Compressed Samples	u32	Number of samples (maximum over all beams if Flags bit 0 set [samples per beam varies]. Otherwise same as *Samples(N)*) When all beams come with the same number of samples 'Compressed Samples' is the same as 'Samples(N)' for each beam in the data section of the record. But if bit 0 is set in the 'Flags' the beams are individually cut based on bottom detection and thus have all different length. 'Compressed Samples' then gives you the maximum number of samples of the beam with the longest range. Same as the largest value of 'Samples(N)' in the data section.
Flags	u32	Bit field: Bit 0 : Use maximum bottom detection point *in each beam* to limit data. Data is included up to the bottom detection point + 10%. This flag has no effect on systems which do not perform bottom detection. Bit 1 : Include intensity data only (strip phase) Bit 2 : Convert mag to dB, then compress from 16 bit to 8 bit by truncation of 8 lower bits. Phase compression simply truncates lower (least significant) byte of phase data. Bit 3 : Reserved. Bit 4-7 : Downsampling divisor. Value = (BITS >> 4). Only values 2-16 are valid. This field is ignored if downsampling is not enabled (type = “none”). Bit 8-11 : Downsampling type: 0x000 = None

Name	Size	Description
		0x100 = Middle value 0x200 = Peak value 0x300 = Average value Bit 12: 32 Bits data. Bit 13: Compression factor available. Bit 14: Segment numbers available. Bit 15: First sample contains RxDelay value.
First Sample (F)	u32	First sample included for each beam. Normally zero, unless power saving mode "*Range Blank*" or absolute gate (bit 3) is in effect. See RC 1046 for details. Thus, the samples in each beam data section will run from F to F+N-1. Construction of a correct water column image must take this into account.
Sample Rate	f32	Effective sample rate after downsampling, if specified.
Compression factor	f32	Factor used in intensity (magnitude) compression.
RESERVED	u32*1	Zero. Reserved for future use

NOTE
If downsampling is used (Flags bit 8-11), then the effective Sample Rate of the data is changed and is given by the sample rate field. To calculate the effective sample rate, the system sample rate (provided in the 7000 record) must be divided by the downsampling divisor factor specified in bits 4-7.

NOTE
The following data section is repeated for each beam (B) as defined in RTH. The size may vary for each beam if bottom detection truncation is in effect (Flags bit 0 is set). **IMPORTANT:** This is "reversed" compared to the data ordering in the standard 7018 Water Column record!

NOTE
When 'Bit 2' is set in the flags of the 7042 record, the record contains 8 bit dB values. This should never combined with 'Bit 12' indicating that intensities are stored as 32 bit values.

Table 84: 7042 – Record Data

Name	Size	Description
Beam 0	u16	Beam Number for this data.

Name	Size	Description
Segment Number 0	u8	Segment number for this beam. Optional field, see 'Bit 14' of Flags.
Samples (N)	u32	Number of samples included for this beam.
Sample 0	Variable	Each "Sample" may be one of the following, depending on the *Flags* bits: A) 16 bit Mag & 16bit Phase (32 bits total) B) 16 bit Mag (16 bits total, no phase) C) 8 bit Mag & 8 bit Phase (16 bits total) D) 8 bit Mag (8 bits total, no phase) E) 32 bit Mag & 8 bit Phase(40 bits total) F) 32 bit Mag(32 bits total, no phase)
Sample 1	Variable	
…	Variable	
Sample N-1	Variable	
Beam 1	u16	
Segment Number 1	u8	Segment number for this beam.
Samples (N)	u32	
Sample 0	Variable	
Sample 1	Variable	
…	Variable	
Sample N-1	Variable	
…..		
Beam B-1	u16	
Segment Number B-1	u8	
Samples (N)	u32	
Sample 0	Variable	
Sample 1	Variable	
…	Variable	
Sample N-1	Variable	

10.48 7047 – Segmented Raw Detection Data

Description: This record is produced by the 7k sonar source series. It contains the sonar bottom detection results and segment specific parameters.

Refer to chapter 9.3.1 for a description of 'Segments'.

Data Definition:

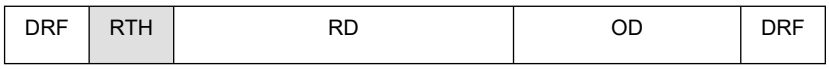


Table 85: 7047 – Record Type Header

Name	Size	Description
Record Header Size	u16	Size of record header in bytes
N Segments	u32	Number of Segment descriptors
Segment Field Size	u16	Size of transmitter descriptor block in bytes
N Rx	u32	Number of Rx detection points
Rx Field Size	u16	Size of detection information block in bytes
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
Sound Velocity	f32	Sound velocity at the transducer in meters/second
Rx Delay	f32	Delay between start of first Tx pulse and start of sample data recoding in fractional samples.

Table 86: 7047 – Record Data

	Name	Size	Description
nSegments	Number	u16	Number of the Segment descriptor
	Tx Angle Along	f32	Applied transmitter along steering angle, in radians
	Tx Angle Cross	f32	Applied transmitter across steering angle, in radians
	TxDelay	f32	Transmit delay in seconds
	Frequency	f32	Hz

	Name	Size	Description
	PulseType	u32	BIT FIELD Bit 0-7: 0=CW, 1=FM(chirp), 2-10=reserved 11=Barker11, 12=Barer11r, 13=Barker13, 14=Barker13r Bit8-9: 0=linear 1=Parametric Bit 10: Pilot Pulse
	Pulse Bandwidth	f32	"+"=up Chirp; "-"=down Chirp in Hz ChirpStartFrequency=Frequency-ChirpHeave/2
	Tx pulse width	f32	In seconds
	Tx beam width cross	f32	Tx -3dB beam width cross , in radians
	Tx beam width along	f32	Tx -3dB beam width along , in radians
	Tx pulse envelope	u32	0 = rectangular 1 = Tukey (rectangular->Hann, variable) 2 = Hamming 3 = Deconv
	Tx pulse envelope parameter	f32	eg: Tukey.Alpha value.
	Tx relative Src Level	f32	Tx relative Src Level In %.
	RxBeamWidth	f32	Rx -3dB beam width
	Detection algorithm	u8	0 – G1_Simple 1 – G1_BlendFilt 2 – G2 3 – G3 4 – IF1 5 – PS1 (beam detection) 6 – HS1 (beam detection) 7 – HS2 (pseudo beam detection) 8-255 – Reserved for future use

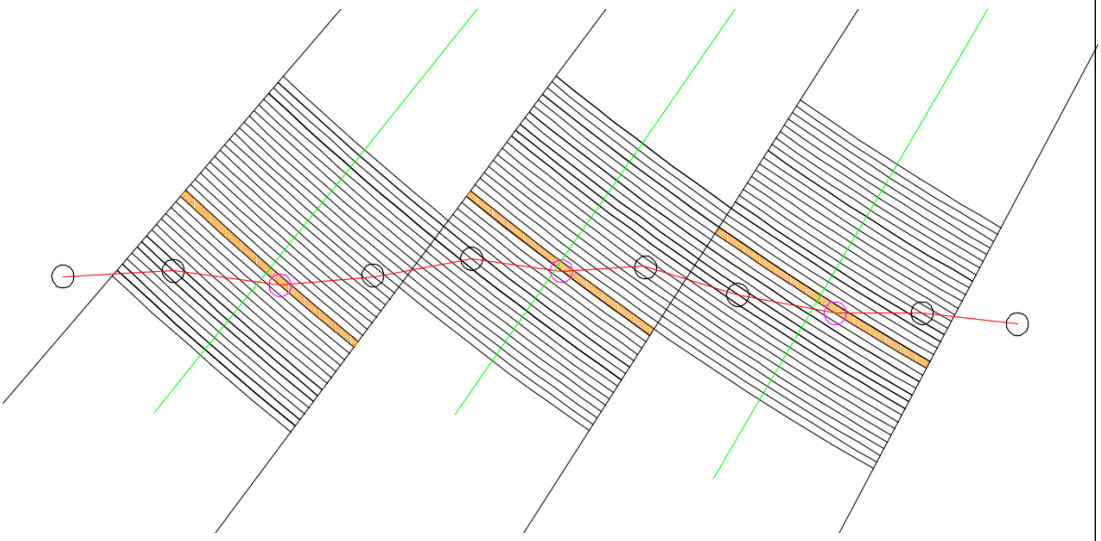
	Name	Size	Description
	Flags	u32	BIT FIELD: Bit 0-3: Uncertainty method 0 – Not calculated 1 – Rob Hare's method 2 – Ifremer's method 3 – Reserved for future use Bit 4: Multi-detection enabled Bit 5: Beam data is pulse correlated Bit 6: Has Snippets detection point flag. Indicates that Snippet detection point flags will be polulated. (Rx flag bit 14) Bit 7-31: Reserved for future use
	Sampling Rate	f32	Sonar's sampling frequency in Hz
	TVG	u8	Applied TVG value
	RxBandWidth	f32	In Hz
nRX	Beam Number	u16	Beam number the detection is taken from
	Used Segment	u16	Number of Segment descriptor.
	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 cross	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: Bit 0: 1 – Intensity (Magnitude) based detection Bit 1: 1 – Phase based detection Bit 2-8: Quality type, defines the type of the quality field below Bits 9-12: Detection priority number for detections within the same beam (Multi-detect only). Value zero is highest priority. Bit 13: Interferometry between beam point. Bit 14: Snippet detection point flag 0 – Detection used in snippets 1 – Not used in snippets Bits 15-31: Reserved for future use
	Quality	32 bits	Detection quality, see *Table 7047 – Detection Quality*
	Uncertainty	f32	Detection uncertainty represented as an error normalized to the detection point
	Signal Strength	f32	Signal strength of detection point
	SNRatio	f32	S/N ratio in dB

NOTE
Frequency band is determined by the enumerator. See chapter 9.4.1

Table 7047 – Detection Quality

Type	Format	Description
0	u32	Quality is not available / Not used
1	u32	Bit field: Bit 0: 1 = Brightness filter passed Bit 1: 1 = Co-linearity filter passed
3-31		Reserved for future use

NOTE
Drawing to clarify use of detection point and snippets bottom detection sample:  Green line is centre beam. Black circle is bottom detection point. Purple circle is bottom detection point nearest to centre beam. Black lines are snippets samples. Orange sample is Bottom detection sample for snippets.

NOTE
HydroSweep has especially in the outer beams (equal-angle water column data) multiple detections (equal-distance) with different angles and does not have only one bottom detection per beam. HydroSweep does not produce multiple detection for the same Rx angle and therefor has no Multi-detect function. Therefor you'll only find zeros for the "detection priority numbers" (Flags) in the 7047 from HydroSweep. HydroSweep produces multiple bottom (bathy) detection points with different across angles from the same beam-formed reception beam by advanced split beam processing. They all have to be used by default for the bathy processing. Only if the "detection priority number" would be nonzero the detection can be ignored or treated optional for advanced bathy post-processing. The beam number in 7047 points to the reception beamformed data (water column data) where the detection was taken from and has no meaning for the HydroSweep bathy processing. Actually, with no Multi-detect in HydroSweep it could be fully ignored.

10.49 7048 – Calibrated Beam Data

NOTE
This record contains non-calibrated beam intensity, if calibration is available but not run. (See Error flag in *Table 87: 7048 – Record Type Header*).

Description: This record is produced by the SeaBat™ 7k sonar series. It contains the calibrated sonar beam intensity. The 7k sonar source 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.

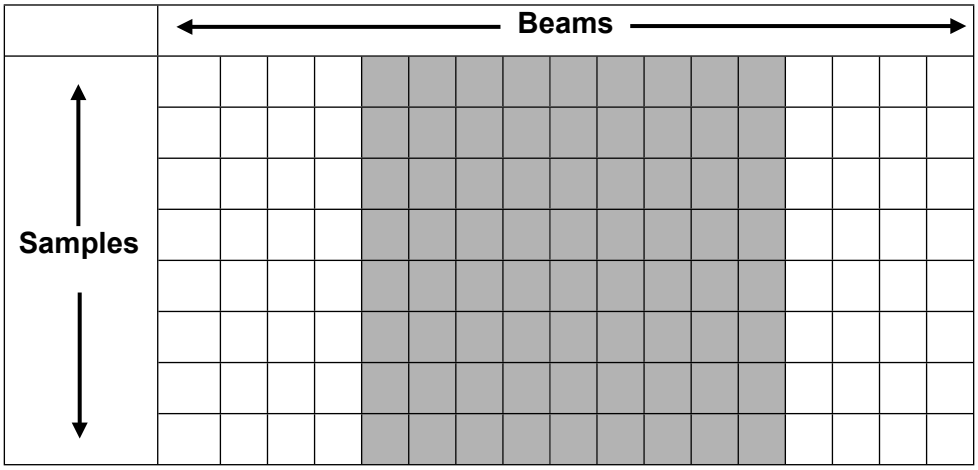


Figure 10-6: Beam Limits – Set Min and Max Beam

Data Definition:

DRF	RTH	RD	OD	DRF

Table 87: 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
S	u32	Total number of samples in ping record
Forward-looking sonar	u8	FLS flag

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

Table 88: 7048 – Record Data

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

10.50 7050 – System Events

Description: This record is produced by the SeaBat™ 7k sonar series. It contains the 7k sonar source system events. The 7k sonar source 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

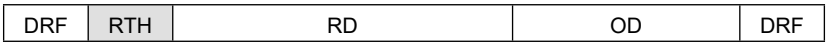


Table 89: 7050 – Record Type Header

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

DRF	RTH	RD	OD	DRF

Table 90: 7050 – Record Data

Name	Size	Description
Event type 0	u16	0 - Success 1 – Information 2 – Warning 3 – Error 4 - Fatal
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	0 - Success 1 – Information 2 – Warning 3 – Error 4 - Fatal
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
Event message length (L)	u16	Message length including termination character
7KTIME	u8 * 10	Time tag
Event message	u8 * L	Fixed-width string

10.51 7051 – 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 91: 7051 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Event Id	u16	0 - Success 1 – Information 2 – Warning 3 – Error 4 - Fatal
Message length	u16	Message length in bytes
Event identifier	u16	0 – Undefined

DRF	RTH	RD	OD	DRF

Table 92: 7051 – Record Data

Name	Size	Description
Event message	dynamic	Null terminated string.

10.52 7052 – RDR Recording Status - Detailed

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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 93: 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	BIT FIELD: Bits 5-0: 0 – Stopped 1 – Recording 2 – Playing 3 – Deleting 4 – Stopping 5+ – Reserved
FileRecords	u32	Total number of records in file at the time the request is processed

Name	Size	Description
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	c8 * 256	Current directory name. Null-terminated UTF-8 string
File name	c8 * 256	Current file name. Null-terminated UTF-8 string.
Error	u32	Error code (see appendix D)
Flags	u32	Bit 0: External logger supported Bit 1: External logger attached Bit 2: External logger confirmed Bit 3: Custom logger supported
Logger Address	u32	IP address of stand alone 7K logger when connected (little endian data order)
Single or multiple file	u8	Zero = Write logfiles of multiple 1GB files Non-zero = Write single 7K logfile
Ping data history	u8	Zero = No lead-in ping data Non-zero = Write 10 sec of lead-in ping data
Reserved	u16	Reserved
Reserved	u32 * 4	Reserved

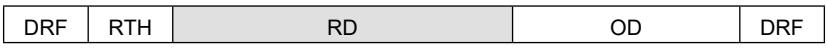


Table 94: 7052 – Record Data

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 (not used)
Excluded Records Array	u32 * ER	Array of ER excluded records (not used)
Included Devices (ID)	u32	Number of included devices (not used)
Included Devices Array	u32 * ID	Array of ID included devices (not used)
Excluded Devices (ED)	u32	Number of excluded devices (not used)
Excluded Devices Array	u32 * ED	Array of ED excluded devices (not used)

10.53 7053 – 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 *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 95: 7053 – Record Type Header

Name	Size	Description
N	i32	Number of subscriptions

DRF	RTH	RD	OD	DRF

Table 96: 7053 – Record Data for Each Subscription (N)

Name	Size	Description
Address	u32	IP Address (little endian data order)
Port	u16	Port number
Type	u16	0 – UPD 1 – TCP
# records	u32	Number of records
Record list	u32 * 64	Array of records ID N – # of valid records
Reserved	u32 * 128	Reserved

10.54 7054 – RDR Storage Recording – Short Update

Description: This record is produced by the SeaBat™ 7k sonar series. It contains info of the data recording (RDR) status. The record can be manually requested or subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 97: 7054 – Record Type Header

Name	Size	Description
Disk free percentage	u16	Percentage of free disk space
Number of records	u32	Number of records logged to record file
Size	u64	Size of recording file
Reserved	u32 * 4	Reserved
Mode	u8	RDR mode

Name	Size	Description
File name	c8 * 256	The name of the recording file
RDR error	u32	Current RDR error code
Data Rate	u64	Bytes written per second
Minutes space left	u32	Available time left to log in minutes (max 24 hours)

10.55 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

Table 98: 7055 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Calibration status	u16	0 – Calibration is not available 1 – Calibration was not done 8 – Calibration is in progress 16 – Calibration completed >127 – Calibration failed
Percent complete	u16	If status is 8 (in progress) this field indicates percentage completed. If calibration status is 16 (completed) this field indicates the following. 0 – Results of previous calibration used without validation 1-99 – Results of previous calibration validated and used 100 – Full calibration performed
Calibration time	u8 * 10	Completion time of most recent calibration (zero if none). TIME_7K format (UTC). If calibration status is 1 (not done), calibration time other than zero indicates that previous calibration results are available but not validated.
Status message	c8 * 800	Status message text string (null terminated)

Name	Size	Description
Sub status	u32	Status details 0 – Ok 1 – No license file 2 – License file corrupt 3 – Invalid version 10 – Failed – noise 11 – Failed – ceramics bad 12 – Failed – intensity tolerance 13 – Failed – phase tolerance
Fields below apply only for FP2+ multi-frequency systems		
Calibration system	u8	Bitfield indicating which system(s) are being calibrated Bit 0: enum Bit 1: enum 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 * 8	Final status of each system calibrated
Reserved	u32 * 2	Reserved

10.56 7057 – Calibrated Side-Scan Data

Description: This record is produced by the 7k sonar source. 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.

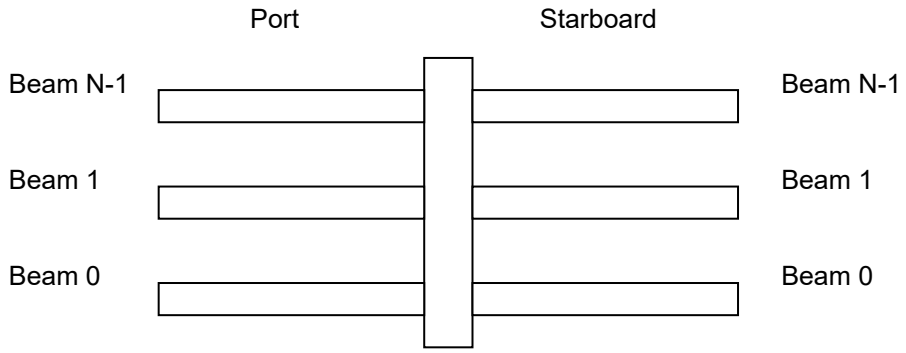


Figure 10-7: Beam Port and Starboard Numbering

Data Definition:

DRF	RTH	RD	OD	DRF

Table 99: 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
Reserved	u32	Controls BIT FIELD: Bit 0-31: 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 4 – Single precision (u32)
Data types	u8	BIT FIELD: Bit 0: Reserved (always 0) Bit 1-7: Reserved
Error flag	u8	If *set*, record contains original non-calibrated beamformed data. Flag itself will indicate an error. 0 – OK 1 – No calibration 2 – TVG read error (R7010) 3 – CTD not available (R1010) 4 – Invalid or not available geometry (R7004) 5 – Invalid sonar specifications (XML) 6 – Bottom detection failed 7 – No power (Power is set to zero) 8 – No gain (Gain is too low) 128-254 – Reserved for internal errors 255 – System cannot be calibrated (c7k file missing)

DRF	RTH	RD	OD	DRF

Table 100: 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

NOTE
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 Teledyne PDS Optional Data.

10.57 7058 – Snippet Scattering Strength

NOTE
Normalized backscatter (intensity) license must be enabled in order to receive this record.

Description: This record is produced by the SeaBat™ 7k sonar. This record is available by subscription only, and is only available if normalized backscatter is licensed on the system. It contains snippet data of the estimated backscattering strengths of the seabed, S_b. In the following it is just referred to as the "Scattering Strength". The scattering strengths have been obtained from snippet intensity data which have been compensated for sonar system parameters, propagation losses and geometric footprint as described in the record.

The 7k sonar source updates this record on every ping. Sonar system compensation can be based upon generic performance parameters for each component, or specific calibration parameters for individual units, as specified in the record.

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

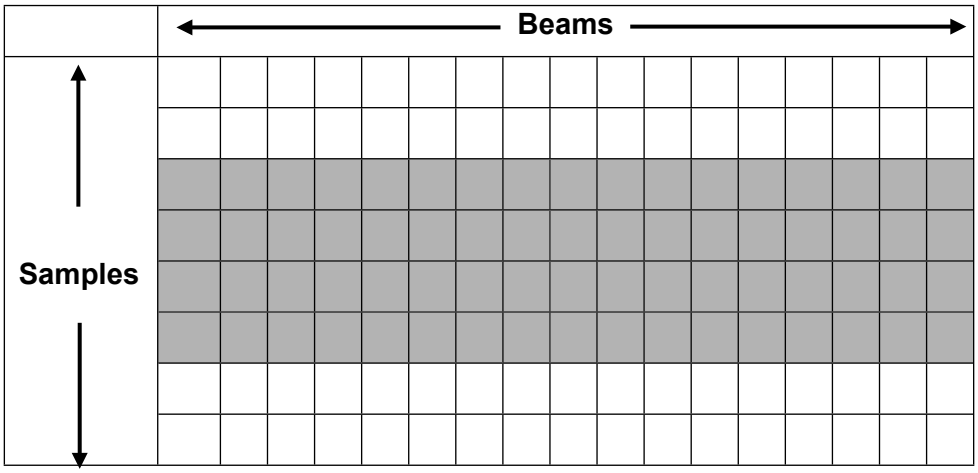


Figure 10-8: Sample Limits – Set in dB Around Bottom Detection Point

For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

For information on optional data, see Appendix A Teledyne PDS Optional Data

Data Definition:

DRF	RTH	RD	OD	DRF

Table 101: 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.
Detections	u16	Number of detections

Name	Size	Description
Error flag	u8	If set, record contains original non-calibrated beamformed data. Flag itself will indicate an error. 0 – OK 1 – No calibration 2 – TVG read error (R7010) 3 – CTD not available (R1010) 4 – Invalid or not available geometry (R7004) 5 – Invalid sonar specifications (XML) 6 – Bottom detection failed (R7006) 7 – No power (Power is set to zero) 8 – No gain (Gain is too low) 128-254 – Reserved for internal errors 255 – System cannot be calibrated (c7k file missing)
Control flags	u32	Control settings Bit 0 – Brightness is required to pass Bit 1 – Colinearity is required to pass Bit 2 – Bottom detection results are used for snippet Bit 3 – Snippet display min. requirements are used Bit 4 – Minimum window size is required Bit 5 – Maximum window size is required Bit 6: - Footprint areas are included Bit 7: - Generic compensation (not per unit) Bit 8: - Single absorption value used for the whole ping. Otherwise a CTD profile is used Bit 9-31: - Reserved
Absorption	f32	Absorption value in dB/km. Only valid when control flag bit 8 is set.
Reserved	u32 * 6	Reserved for future use

Table 102: 7058 – Record Data

Name	Size	Description
Beam descriptor of first detection	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

Name	Size	Description
End sample descriptor	u32	Last sample number in beam from transmitter and outward
…	…	…
Beam descriptor of last detection	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
S_b of first detection	Dynamic (E-B+1) * f32	Scattering Strength (S_b) for each sample. $S_b = 10 \cdot \log 10 (\sigma)$, where σ is the scattering cross section The snippet vector of each beam is ordered in samples of increasing range from the transmitter.
…	…	…
S_b of last detection	Dynamic (E-B+1) * f32	Scattering Strength (S_b) for each sample. $S_b = 10 \cdot \log 10 (\sigma)$, where σ is the scattering cross section. The snippet vector of each beam is ordered in samples of increasing range from the transmitter.
Footprints of first detection	Dynamic (E-B+1) * f32	Footprint area series for each sample in square meters. Only available when control flag bit 6 is set.
…	…	…
Footprints of last detection	Dynamic (E-B+1) * f32	Footprint area series for each sample in square meters. Only available when control flag bit 6 is set.

NOTE

The snippets for each beam, have a start and end sample. The record is not wrong when the start is bigger than the end snipped, its indicating that the there is no data for this beam.

The snippets length calculation should be done as follows: length = stop-start+1.

In the case that no calibrated backscatter can be calculated the start will index the first sample e.g. 1257 and the end will be 1256.

This is done this way because when you have only one sample of snippets data first sample would be e.g. 1257 and last sample would be 1257.

10.58 7059 – MB2 specific status

This record contain MB2 specific status information. This record can be retrieved by a single record request to obtain the initial value of the fields as requested by the remote control definitions 1211, 1600, 1601, 1602, 1603, 1604 and 1605 For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 103: 7059 Record Type Header

Name	Size	Description
Directory	c8 * 256	Full directory path name. Null terminated UTF-8 string. Maximum of 256 characters, including null character.
Header name	c8 * 256	Null terminated UTF-8 string. Maximum of 256 characters including null character.
Trailer name	c8 * 256	Null terminated UTF-8 string. Maximum of 256 characters including null character.
Prepend header	u8	When not zero: Prepend the file specified by the header name for each file.
Append trailer	u8	When not zero: Append the file specified by the trailer name for each record.
Storage	u8	When not zero: Enable custom recording.
Playback Path name	c8 * 256	Full directory path name. Null terminated UTF-8 string. Maximum of 256 characters, including null character.
Playback File name	c8 * 256	Null terminated UTF-8 string. Maximum of 256 characters including null character.
Playback Loop mode	u32	0 – Play file once 1 – Loop the file 2 – Advance to next file
Playback	u8	When not zero: Enable custom playback
RRIO address1	c8 * 256	RRIO IP address :port UTF-8 string, max length 255 characters + null.
RRIO address2	c8 * 256	RRIO IP address :port UTF-8 string, max length 255 characters + null.
RRIO address2	c8 * 256	RRIO IP address :port UTF-8 string, max length 255 characters + null.

Name	Size	Description
Use build in HPR	u8	0 – Use HPR sensor connected to RTA 1 – Use the build in HPR sensor
Use attached SVP sensor	u8	0 – Use SVP sensor connected to RTA 1 – Use attached SVP sensor
Enable stacking	u8	0 – Disable stacking mode 1 – Enable stacking mode
Stacking value	u8	Number of results to stack min = 1, max = 9
ZDA port baudrate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
ZDA port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
ZDA port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
ZDA port stop bits	u8	0 – 1 bit 1 – 2 bits

Name	Size	Description
GGA port baudrate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
GGA port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
GGA port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
GGA port stop bits	u8	0 – 1 bit 1 – 2 bits
SVP port baudrate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
SVP port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark

Name	Size	Description
SVP port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
SVP port stop bits	u8	0 – 1 bit 1 – 2 bits
HPR port baud rate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
HPR port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
HPR port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
HPR port stop bits	u8	
HDT port baud rate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200

Name	Size	Description
HDT port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
HDT port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
HDT port stop bits	u8	0 – 1 bit 1 – 2 bits
RRIO	u16	RRIO port used by SUI
Playback Time stamps	u8	0 – Set new timestamps 1 – Keep original timestamps when playing the file
Reserved	u8	Reserved
Reserved	u32	Reserved

10.59 7200 – File Header

Description: First record of 7k data file.

Data Definition:

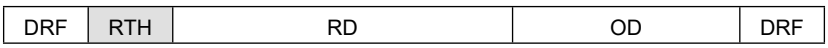


Table 104: 7200 – Record Type Header

Name	Size	Description
File identifier	u64*2	
Version number	u16	File format version number
Reserved	u16	Reserved
Session identifier	u64*2	User defined session identifier. Used to associate multiple files for a given session.
Record data size	u32	Size of record data. 0 – If not present
N	u32	Number of devices (N ≥ 0)
Recording name	c8 * 64	Null terminated UTF-8 string
Recording program version number	c8 * 16	Null terminated UTF-8 string
User defined name	c8 * 64	Null terminated UTF-8 string

Name	Size	Description
Notes	c8 * 128	Null terminated UTF-8 string.

DRF	RTH	RD	OD	DRF

Table 105: 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 106: 7200 – Optiona Data

Name	Size	Description
Size	u32	Size of the file catalog record
Offset	u64	File offset of the file catalog record

10.60 7300 – File Catalog Record

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 107: 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 108: 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

10.61 7400 – Time Message

Description: This record is used to time-sync the 7k sonar source. 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 109: 7400 – Record Type Header

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

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

The record can contain optional data. For information on optional data, see Appendix A Teledyne PDS Optional Data

10.62 7500 – 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 sonar source. 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.

NOTE
If a 7500 command is sent which requires no argument, an empty byte still needs to be packed into the command data.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 110: 7500 – Record Type Header

Name	Size	Description
Remote control ID	u32	See separate remote control table for details. See *section 10 Record Type Definitions*.
Ticket	u32	Ticket number. Set by client for control packet matching ACK or NAK packets.
Tracking number	u64*2	Unique number. Set by client for packet tracking.

DRF	RTH	RD	OD	DRF

Table 111: 7500 – Record Data

Name	Size	Description
Remote control data	variable	Value(s). See *section 11 7k Remote Control Definitions* for descriptions.

10.63 7501 – 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 112: 7501 – Record Type Header

Name	Size	Description
Ticket	u32	Ticket number in record 7500
Tracking number	u64*2	Unique number in record 7500

10.64 7502 – 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 113: 7502 – Record Type Header

Name	Size	Description
Ticket	u32	Ticket number in record 7500
Tracking number	u64*2	Unique number in record 7500
Error code	u32	See Appendix D 7k Error Codes for details

10.65 7503 – Remote Control Sonar Settings

Description: This record is produced by the SeaBat™ 7k Sonar. It contains the remote control sonar settings. The 7k sonar source 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

.**Data Definition:**

DRF	RTH	RD	OD	DRF

Table 114: 7503 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number (zero for single record request)
Frequency	f32	Center transmit frequency in Hertz
Sample rate	f32	Sample rate in Hertz

Name	Size	Description
Receiver bandwidth	f32	In Hertz
Tx pulse width	f32	Seconds of pulse
Tx pulse type identifier	u32	0 – CW 1 – Linear chirp (FM)
Tx pulse envelope identifier	u32	0 – Tapered rectangular 1 – Tukey
Tx pulse envelope parameter	f32	Pulse envelop shading. Some envelopes don't use this parameter.
Tx pulse mode	u16	1 – Single ping 2 – Multi-ping 2 3 – Multi-ping3 4 – multi-ping 4
Tx pulse reserved	u16	Reserved
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
Control flags	u32	BIT FIELD: Bit 0-3: Auto range method Bit 4-7: Auto bottom detection filter method Bit 8: Bottom detection range filter enabled. Bit 9: Bottom detection depth filter enabled Bit 10: Receiver gain method Auto Gain Bit 11: Receiver gain method Fixed Gain Bit 12: Receiver gain method Reserved Bit 13: Reserved Bit14: Trigger out HIGH for entire Rx duration 0 – Disabled 1 – Enabled Bit 15: 0 – System inactive 1 – Active Bit 16-18: Reserved for bottom detection Bit 19: To indicate if the adaptive search window is active or in passive mode. 0 – Filter active 1 – Filter passive Bit 20: Pipe gating filter 0 – Disabled

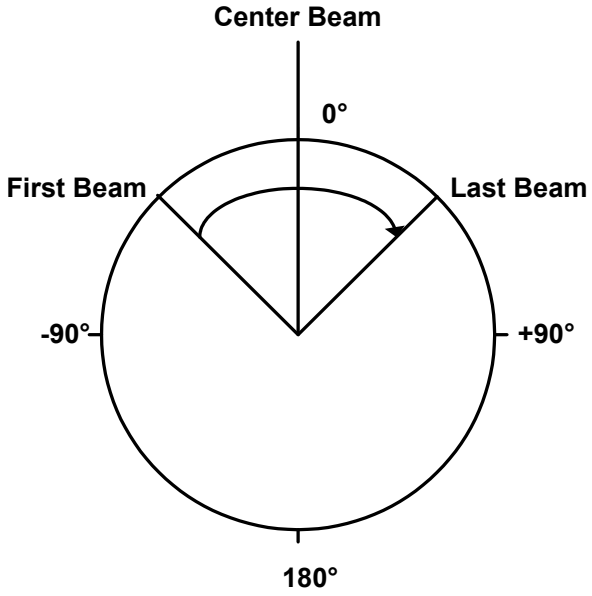
Name	Size	Description
		1 – Enabled Bit 21: Adaptive gate depth filter fixed 0 – Follow seafloor 1 – Fix depth Bit 22: Adaptive gate 0 – Disabled 1 – Enabled Bit 23: Adaptive gate depth filter 0 – Disabled 1 - Enabled Bit 24: Trigger Out 0 – Disabled 1 – Enabled Bit 25 Trigger In Edge 0 – Positive 1 – Negative Bit 26: PPS Edge 0 – Positive 1 – Negative Bit 27-28: Timestamp State 0 – Timestamp not applicable 1 – Timestamp error / not valid 2 – Timestamp warning / use caution 3 – Timestamp ok / valid Bit 29: Depth filter follows seafloor 0 – Fix depth 1 – Follow seafloor Bit 30: Reduced coverage for constant spacing 0 – Always maintain swath coverage 1 – Allow swath coverage to be reduced Bit 31: 0 – 7K 1 – Simulator
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
Projector beam -3dB beam width horizontal	f32	In radians

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

Name	Size	Description
Vernier operation mode	u8	0 – Vernier 3 – Triple array Mag & Phase (3 sets of records generated for each ping – one for each stave)
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 Refer to chapter 9.1.
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 Refer to chapter 9.1
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 Refer to chapter 9.1
Head Tilt X	f32	Radians
Head Tilt Y	f32	Radians
Head Tilt Z	f32	Radians. Typically zero.
Ping state	u32	Ping state: 0 – Pinging disabled 1 – Pinging enabled 2 – External trigger
Beam spacing mode	u16	1 – Equiangle 2 – Equidistant 3 – Flex 4 – Intermediate
7k sonar source mode	u16	0 –Normal 1 – Auto Pilot / Tracker 2 – Calibration (IQ) 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 1 – Main Array 2 – Extended Range 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 1 – Reduce Beams
Quality filter flags	u8	BIT FIELD: Bit 0: 0 – Quality filter disabled 1 – Quality filter enabled Bit 1-7: Reserved, must be zero
Horizontal receiver beam steering angle	f32	Steering angle in radians (positive to starboard)
FlexMode sector coverage	f32	Coverage sector in radians
FlexMode 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 bean modes in the sonar XML
Depth gate tilt	f32	Angle in radians (positive to starboard)
Applied frequency	f32	Transmit frequency for UI slider. Will be different from center frequency in full-rate dual-head.
Element number	u32	Selected receive element number for 7049 record

NOTE
The 7503 (settings) record is send with every ping. The ping number value 0 define the values as current settings instead of ping settings. Thus it works like this: 1. The user interface sends a single record request for the settings (7k 7503 record) to the 7kCenter after connection (for the initial settings). 2. The 7kCenter responds by sending a single 7k 7503 settings record with the **ping number set to zero**, which marks that the record values are current settings instead of settings at the time of the ping (ping count starts with 1). 3. 7k Commands send to the 7kCenter are echoed to all connected user interfaces, so when the settings are changed by another connected user interface, the first user interface will receive the same command and should handle this to update its user interface control.

NOTE
Head tilt uses same geometry as the beam numbering. This means port-up movement is negative and port down movement is positive. 

10.66 7504 – Common System Settings

Description: This record is produced by the SeaBat™ 7k sonar series. It contains additional sonar settings. The 7k sonar source updates this record on change only. The record can be manually requested or subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 115: 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 1 – On
Motion sensor format	u8	0 – TSS1 1 – SIMRAD EM1000 2 – SIMRAD EM3000 3 – NMEA $PASHR 4 – OCTANS TAH 5+ – Reserved
Motion Sensor Baud Rate	u8	0 – 4800 1 – 9600 2 – 14400 3 – 19200 4 – 28800 5 – 38400 6 – 56000 7 – 57600 8 – 115200 9+ – Reserved
Motion Sensor Parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 – Mark 5+ – Reserved
Motion Sensor Data Bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits 4+ – Reserved
Motion Sensor Stop Bits	u8	0 – 1 bit 1 – 2 bits 2+ – Reserved

Name	Size	Description
Orientation	u8	0 – Port Up 1 – Port Down
Record Version	u8	Record revision number
Motion latency	f32	Motion sensor latency in seconds Valid range 0 – 0.050
SVPFilter	u8	SVP Filter type 1 – No Filter 2 – Light Filter 3 – Normal Filter 4 – SVP70 Wizard
SV manual override	u8	Deprecated, use Sensor Manual Override flags field
Active enumerator	u16	Enumerator of pinging system
Active device ID	u32	Device ID of pinging system
System mode	u32	0 – Manual (normal) mode 1 – Auto Pilot / Tracker mode 2 – I&Q (normalization) mode 3 – Playback mode 4+ – Reserved
Master Slave Mode	u32	0 – Normal 1 – Master full (full rate) 2 – Slave 3 – Master half. Separate enumeration for ½ rate (“ping-pong”) mode vs. full rate.
Tracker flags	u32	Bit 0: Enable range control Bit 1: Enable power & gain control Bit 2: Enable pulse length control Bit 3: Enable coverage angle control Bit 4: Use fixed swath width Bit 5: Set maximum coverage angle
Tracker swath width	f32	Tracker swath width in meters
Multi-Detect Enable	u16	Zero = Multi-detect OFF. Non-zero = Multi-detect ON.

Name	Size	Description
Multi-Detect Object Size	u16	Range of 1 to 100. Controls the sensitivity of the algorithm to Object Size. This is a unit-less quantity. Note: Increasing this parameter results in more detections on smaller objects. Decreasing this parameter results in fewer detections and only on larger objects.
Multi-Detect Sensitivity	u16	Range of 1 to 100. Controls the sensitivity of the algorithm to Intensity. This is a unit-less quantity. Note: Increasing this parameter causes more objects to be detected.
Multi-Detect Max Detections	u16	Range of 1 to 5. Limits the number of detections produced per beam. The maximum number of detections per beam is five. 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.
Multi-Detect Reserved	u16 * 2	Reserved, set to zero
Slave IP Address	u8 * 4	Slave IP V4 Address (big endian data order). Only valid for record revision number 1 or greater.
Snippet Control Flags	u32	BIT FIELD: (1 – Enabled) Bit 0: Use automatic snippet window Bit 1: Include at least samples around bottom detection (min. window size is valid) Bit 2: Include at most samples around bottom detection (max. window size is valid) Bit 3-31: Reserved

Name	Size	Description
Snippet Control Min. Window	u32	Used as Minimum Window Size when bit 0 is set (automatic window) AND bit 1 is set. Used as Fixed Window Size when flags bit 0 is NOT set (fixed window).
Snippet Control Max. Window	u32	Max snippet window. Used when flags bit 2 is set.
Full Rate Dual Head Flag	u32	1 – Full-rate dual head enabled
Delay multiplier	f32	Master delay multiplier
Power Saving Mode	u8	0 : **None**. No power saving enabled at all. Can be used as reference. 1 : **Normal.** Components save power when possible. No effect on operation. 2 : **Range Blank**. Normal saving + "real" samples are not output from RX controller until X range is reached. X is controlled by the Flags and Range Blank Control fields. 3 : **Sleep.** Components will be put in sleep mode. Sleep mode has 0 to 50ms recovery time. All settings will be retained. NO DATA is produced in sleep mode. 4 : **Hibernate**. Components will be put in hibernate mode. Hibernate mode has 0 to 10 second recovery time. All settings will be retained. NO DATA is produced in hibernate mode.
Flags	u8	Bits 0 – 7 : Reserved, zero.
Range Blank Control	u16	Used only for power saving mode 2 ("*Range Blank" mode).* Controls size of range blanking interval. Ping data during this time interval will be zero. Only affects receiver component This value gives range blanking interval as a *percent of range scale* (0 – 100). The number of samples blanked will change with range settings in this case.
Startup Normalization	u8	Non-zero to enable normalization at startup.
Restore Ping Rate	u8	Non-zero to restore ping rate to previous setting (which was in effect when system was last shut down).

Name	Size	Description
Restore Power	u8	Non-zero to restore power to previous setting. Otherwise system starts with power OFF.
SV Interlock	u8	Non-zero to enable Sound Velocity Interlock safety feature (for system with integrated SV probe only).
Ignore PPS Errors	u8	Non-zero to suppress error messages due to PPS signal errors. Proper functioning of the PPS signal is normally required for accurate data time-stamping in bathymetry systems.
Restore Recording	u8	Non-zero to restore recording to previous setting (which was in effect when system was last shut down). Otherwise system starts with recording OFF.
Restore Tracker	u8	Non-zero to restore Tracker to previous setting (which was in effect when system was last shut down). Otherwise system starts with Tracker OFF.
Reserved	u8*13	Reserved. Zero.
Compressed Water Column (7042) record control flags	u32	Bit field: Bit 0 : Use maximum bottom detection point *in each beam* to limit data. Data is included up to the bottom detection point + 10%. This flag has no effect on systems which do not perform bottom detection. Bit 1 : Include magnitude data only (strip phase). Bit 2 : Convert mag to dB, then compress from 16 bit to 8 bit. Phase compression simply truncates lower (least significant) byte of phase data. Bits 31 – 3 : Reserved.
Deck Mode	u8	Deck mode. Non zero: Sonar is in deck mode.
Reserved	u8	Reserved. Filled with 0xFB.

Name	Size	Description
Power mode (of control Center PC) flags	u8	Bit field: Bit 0: Power mode supported by Control Center computer. Bit 1: Power mode status CPU throttled. Bit 2: Power mode status AC.
Power mode max	u8	Percentage on which the CPU is throttled between 0-100%.
Water Temperature	f32	Water Temperature (°C).
Sensor Manual Override	u8	Bit field: Bit 0: Manual override of sound velocity in effect. Bit 1: Manual override of temperature in effect.
Sensor Data Flags	u8	Bit field: Bit 0: Sound velocity sensor data stream detected. Bit 1: Temperature sensor data stream detected. (*Persistent* – bit set if sensor data stream was ever seen)
Sensor Active	u8	Bit field: Bit 0: Sound velocity sensor data stream active. Bit 1: Temperature sensor data stream active. (*Volatile* – bit set only if sensor input is active; timeout period = ~15 sec.)
Reserved	u8	Reserved. Filled with 0xFB.
Tracker max coverage	f32	In radians.
Duty cycle method	u16	0 – Ping rate. 1 – Power level. Bits 3 - 15 Reserved.
Reserved	u16	Reserved. Filled with 0xFB.
Reserved	u32 * 99	Reserved Filled with 0xFB.

10.67 7510 – SV Filtering

Description: This record is generated every time a surface sound velocity value is received by the 7k sonar source either via record 7610 (see *section 10.69 7610 – Sound Velocity*) or remote control command 7610 – Manual Sound Velocity (*see section 11.83 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 *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 116: 7510 – Record Type Header

Name	Size	Description
Sensor SV	f32	Surface sound velocity reported by sensor 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 sonar source 1 – Transparent; no filtering 2 – Light filter 3 – Normal filter 4 – SVP70 Wizard 5-127 – Reserved 128 – Manual input

NOTE
Record 7510 is not generated if the surface sound velocity value is received via record 7610 while the 7k sonar source 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.

10.68 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 sonar source updates and publishes this record when the status has changed. The record can be manually requested or subscribed to from the 7k sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 117: 7511 – Record Type Header

Name	Size	Description
System lock	u16	0 – System is not locked 1 – System is locked
Client IP	u32	IP Address of the client that has exclusive control of the system. 127.0.0.1 (little endian) is reported for local clients (those that are running on the same host as 7k sonar source) 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 *section 11 7k Remote Control Definitions* for how to gain exclusive control of the system.

10.69 7610 – 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 118: 7610 – Record Type Header

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

NOTE
The Pressure field is for information only. It is not used in the 7k sonar source. The 7k sonar source simply passes the record along to subscribers and raw data recording with no source code changes. The field is not present with a version of the IO Module older than V4.0.0.8. When the value is zero it is not valid.

NOTE
If filtering is enabled in record 7510 (see *section 10.67 7510 – SV Filtering*), record 7610 will contain filtered values used by 7k sonar source when broadcasted by 7k sonar source, 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 sonar source is in manual overwrite mode and the value was ignored. In this case, returned sound velocity value will be unfiltered.

10.70 7611 – 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 119: 7611 – Record Type Header

Name	Size	Description
Absorption loss	f32	In dB/km

10.71 7612 – 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 sonar source. For details about requesting and subscribing to records, see section *10.62 7500 – Remote Control* together with *section 11 7k Remote Control Definitions.*

Data Definition:

DRF	RTH	RD	OD	DRF

Table 120: 7612 – Record Type Header

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

10.72 7613 – Profile Average Salinity

Description: This message sets the salinity used for the attenuation compensation calculation in the TVG if Absorption is unspecified.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 121: 7613 – Record Type Header

Field Name	Type	Description
Average Salinity	f32	Average salinity [ppt]

10.73 7614 – Profile Average Temperature

Description: This message sets the temperature used for the attenuation compensation calculation in the TVG if Absorption is not specified.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 122: 7614 – Record Type Header

Field Name	Type	Description
Temperature	f32	Average water temperature vertically below the sensor. [deg Celcius]

10.74 10000 – SBES Channel Settings

Description: Singlebeam channel settings.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	Yes	No	Channel

Data Definition:

DRF	RTH	RD	OD	DRF

Table 123: 10000 – Record Type Header

Field Name	Type	Description
Ping number	u32	Sequential number (on single record request this field is zero).
Multiping sequence	u32	Number starting from 0 and incrementing by 1 for each pulse in a multi-ping sequence(on single record request this field is zero).
Reserved	u32	Reserved
Transport latency	u32	Time from first sample of ping –multiping sequence valid until this message is transmitted on the interface (Ethernet) [us] (on single record request this field is zero).
Frequency Center	f32	Center frequency for the transmitted signal. [Hz]

Sweep width	f32	Bandwidth of transmitted signal. [Hz] For FM it is the end frequency- start frequency, For CW it is 0 Hz.
Sample rate	f32	Sample rate the receiver [Hz]
Receiver bandwidth	f32	Nominal Receive filter 3 dB bandwidth. [Hz]
Absorption	f32	A [dB/km]. Sea water constant
Spreading loss	f32	S ["dB"]. Sea water constant
Initial gain	f32	G0 [dB]. Sea water constant
Range	f32	Commanded range [m]
Reserved	f32	Reserved
Power (SL)	f32	Nominal transmit power value. [dB re 1 uPa@1m]. Zero means no transmission at all on that channel.
Pulse length	f32	Time from start of transmit pulse to end of pulse. [Seconds].
Pulse type	u32	0 - CW
Pulse envelope type	u32	0 – Tapered rectangular 1 – Tukey 2 – Hamming 3 – Han 4 – Rectangular
Pulse envelope parameter	f32	For Tukey it is the percentage of start slope. Max 50%, which is triangular. 0..50%
Multi-ping count	u32	Total number of pings in the multi-ping setup
Reserved	u32	
Max ping rate	f32	One divided by the time between two pings. In ping pong each channel can ping up to half Max ping rate
Ping period	f32	Time since last ping. Pings of a multi-ping share the same ping period (that of the first multi-ping) [s]
Reserved	f32	
Projector ID	u32	Active transducer index in transducer table in record 7001
Transmit beam width across	f32	Nominal 3 dB beam width. [degrees]
Transmit beam width along	f32	Nominal 3 dB beam width. [degrees]
Receiver ID	u32	Active RX transducer index in transducer table in record 7001. One-transducer systems same as Projector ID
Receiver beam width across	f32	Nominal 3 dB beam width. [degrees]
Receiver beam width along	f32	Nominal 3 dB beam width. [degrees]
Corrected transducer draft.	f32	See Figure 9-3 on page 21 [m] (Same as the draft reported in record 10027)

Absorption tweak	f32	Additional additive absorption [dB/km] applied to the TVG
Pulse length tweak	f32	Additional multiplicative pulse length applied to the ping. 1=nominal.
Spreading loss tweak	f32	Additional additive spreading applied to the TVG
Initial gain tweak	f32	Additional additive gain [dB/km] applied to the TVG
Range tweak	f32	Additional multiplicative range applied to the range setting. 1=nominal.
Power tweak	f32	Additional additive Power(source level) [dB re 1 uPa @ 1m]
Min gate	f32	In meters
Max gate	f32	In meters
Gate mode	u32	0 - Disabled 1 - Enabled

NOTE
The nominal gain curve is G=G0+S*Log10(r)+2*A*r [dB], where A=absorption, S=spreading_loss and G=Initial_gain.

10.75 10003 - SBES Channel Status

Description: High level channel information which actual/realized values and not settings.

Examples (this record)

- Parameters derived from a number of settings,
- Parameters, which have a built in uncertainty/inaccuracy compared with the setting.
- Parameters, which are measured properties.
- Parameters which have an applied, varying correction

Examples not in this record:

- Data that is directly sample/detection related should NOT be in this record
- System monitoring and health. See BITE record 7021.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	Yes	No	Channel

NOTE
On subscription, the record will be emitted on each ping and every second if pings are not sent. It will always be sent faster than 0.5 Hz.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 124: 10003 – Record Type Header

Field Name	Type	Description
ping number	u32	On single record request and if no ping is available this field is zero.
Filtered ping rate	f32	Low pass filtered realized ping rate based on measurement of the ping-ping time distance per channel. [Hz] Filter type and parameters unspecified.

10.76 10004 – SBES System Settings

Description: Singlebeam system settings.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes (sent on change)	Yes	Yes	No

Data Definition:

DRF	RTH	RD	OD	DRF

Table 125: 10004 – Record Type Header

Field Name	Type	Description
Channels	u32	Each bit 1 for enable, 0 for disable. Bit n for channel n. Up to 32 channels.
Ping-pong	u32	0 for firing all channels simultaneously. 1 for cycling through enabled channels one at a time.
Mean Sound velocity	f32	[m/s]
Trigger Out Polarity	u32	0 - Active High 1 - Active Low
Trigger Out Mode	u32	0 - Disabled 1 - Fixed width 2 - Entire receive duration
Trigger In Enabled	u32	0 - Disabled 1 - Enabled Enabled trigger does not necessarily create pings. See the Ping Control records.
Trigger In Delay	f32	Delay from pin change to ping event in seconds [s]
Trigger In Active Edge	u32	0 - Rising 1 - Falling
Trigger Out Duration	f32	Active time in seconds. 0 for disabled and “entire RX duration” [s]

Trigger out delay	f32	Delay from ping start in seconds [s]
Reserved	u32 * 2	Reserved
Tracker Mode	u32	Index (ID) in the tracker table designating the active tracker mode.
Operation Mode	u32	ID for selected op mode
Tracker modes1	u32	0000:Tracker Control 1000:Client Direct Control 1001:Tracker control with Client Tweak 31..28: Power 27..24: Gain 22..20: Spreading 19..16: Pulse Length 15..12: Range 11..8: Pulse Type 7..4: Absorption 3..0: Max Ping rate
Operation State	u32	10 Configuration 20 Hydropgraphic State.
Current time synchronization source	u32	1=ZDA_PPS 2=NTP 4=UIPC This source is the one that is currently providing the time sync adjustments to the SBE internal time.
Enabled time sources	u32	1=ZDA_PPS 2=NTP 4=UIPC The SBE will automatically select the best one of the enabled and active sources. If both ZDA_PPS and UIPC are enabled the value will be 4-1=5
Active time sources	u32	1=ZDA_PPS 2=NTP 4=UIPC These sources produce time synchronization data. A source will be inactive if it is not configured. This is not an error.
Current NTP time source IP	u32	IPV4 address. Address of the PC, which is currently configured for NTP time sync, regardless if the system is using NTP mode.

		0 if NTP sync was never used.
Current NTP time source Name	32 x u8	The host name or other name to associate with the NTP Time Source. 0-terminated. Optionally an empty string.
Current UIPC time source IP	u32	IPV4 address Address of the PC which is currently configured for UIPC time sync, regardless if the system is using UIPC mode. 0 if UIPC sync was not used since last power on.
Current UIPC time source IP Name	32 x u8	The host name of the UIPC Time Source. 0-terminated

NOTE
1. Remote control record 10022 sets the value of "Enabled time sources" (one source at a time). 2. Remote control record 10023 sets the fields [Current NTP time source IP/Current NTP time source Name] or [Current UIPC time source IP/ Current UIPC time source IP Name], depending on the source ID. 3. All IP addresses are encoded as U32: For example IP address 10.11.0.2 is encoded as hexadecimal 0A0B0002

10.77 10018 – SBES Echogram Water Column Data

Description: Singlebeam echogram water column data.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	No	No	Channel

NOTE
This record will be extended with 8*u32 reserved fields just after Number of Samples in a subsequent release. It will not be backward compatible.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 126: 10018 – Record Type Header

Field Name	Type	Description
Ping number	u32	Sequential number (on single record request this field is zero).
Multi-ping sequence	u32	Number starting from 0 and incrementing by 1 for each pulse in a multi-ping

		sequence(on single record request this field is zero)
Mean sound velocity	f32	[m/s]
Not applied corrected transducer draft	f32	[meter]. Draft is not applied to data in this record. Clients may apply this value to display water depth echograms.
Sample rate (fs)	f32	[Hz]
Effective pulse length	f32	[seconds] . For CW this is the time duration of the transmitted pulse.
Start sample delay	f32	[seconds]. The TWT corresponding to the first sample in this record. Shift the echogram down by this amount.
Bits per sample (BPS)	u32	Number of bits per sample in the Sample data field. Allowed sizes 8, 16, 32.
Full scale	u32	Highest Value /echo strength possible.
Number of samples (n)	u32	The number of samples contained in this record.

DRF	RTH	RD	OD	DRF

Table 127: 10018 – Record Data

Actual echogram sample data follows in one of these forms depending on BPS.

Record data 8 bit

Field Name	Type	Description
Sample data	u32 * n/4	[31..24] Sample i+3 [23..16] Sample i+2 [15..8] Sample i+1 [7..0] Sample i

Record data 16 bit

Field Name	Type	Description
Sample data	u16 * n/2	[31..16] Sample i+1 [15..0] Sample i

Record data 32 bit

Field Name	Type	Description
Sample data	u32 * n	[31..0] Sample i

NOTE
To display the echogram data on an absolute depth axis (in meters) samples[i] in the record should be positioned at the depth di where sd=Sample Start Delay, natd=not applied transducer draft di=natd+(i/fs-sd)*(MSV/2) Typical echograms have a cut-off at di=0

NOTE
Sample data representation: Full scale: This is the highest value of sample data possible, even if a back scatter strength is infinitely high. Typical values are 2^k-1 where k=[8..32]. “clients” like “display software” or “remote control software” may use this value for normalization. Sample data with this value are 100% signal range. Sample data can never exceed this value. No change in SL or gain can change this value. Resolution: Sample data is represented with the resolution of 1 LSB. This means that by adjusting transmit power, gain and the target strength, Sample data will take any value in the range 0 to Full scale.

10.78 10025 – SBES annotation

Description: Annotation/events is a feature, which allows the UI or other E20 clients to place information in the s7k files and attach it to a specific ping or a time. This information can be displayed by any other connected client in real time and in replay-situations.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	No	All channels	Channel

Data Definition:

DRF	RTH	RD	OD	DRF

Table 128: 10025 – Record Type Header

Field Name	Type	Description
Device ID	u32	The software who initiates the annotation. for example SBES user interface Device ID=7002
Annotation number	u32	A sequential number provided by the client.
Ping Number	u32	Reference to a specific ping number
Time	7kTime	Time of validity. Same time as in 7KHeader.
Reserved	u16	
Position Latitude	f64	Latitude
Position Longitude	f64	Longitude
Position Height	f64	Height
ValidFlags	u32	Flags to indicate the validity of the following fields 0x0001 Text is valid

		0x0002 Depth is valid 0x0004 Latitude is valid 0x0008 Longitude is valid 0x0010 Position Height is valid 0x0020 Heave is valid 0x1000 Time is valid 0x2000 Ping number is valid
Depth	F32	Heave corrected depth in m
Heave	f32	Heave in m
Text	80 * c8	Any text up to 79 characters to be transferred from the client. 0 terminated (character no 80)

NOTE
The time of validity must be the time that is set as the 7K record transmit time.

10.79 10027 – SBES Raw Detection Data

Description: Singlebeam raw detection data.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	No	No	Channel

Data Definition:

DRF	RTH	RD	OD	DRF

Table 129: 10027 – Record Type Header

Field Name	Type	Description
Ping Number	u32	Sequential number (on single record request this field is zero).
Multi-ping sequence	u32	Number starting from 0 and incrementing by 1 for each pulse in a multi-ping sequence (on single record request this field is zero).
Detection count (n)	u32	Number of detection records following this header.
Data field size	u32	Number of bytes for one detection.
Mean sound velocity	f32	[m/s]
Sample rate	f32	[S/s] (samples per second)
Reserved	4xf32	
Not applied corrected transducer draft	f32	See Figure 9-3 on page 21 [m]

DRF	RTH	RD	OD	DRF

Table 130: 10027– Record Data

Detection Record. Parameters describing the detection

Field Name	Type	Description
Detection Method	u32	Enumerated type.
Range	f32	[m] Distance from transducer surface.
Not Applied Heave	f32	[m] Average of heave value at time of transmission and time of detection.
Amplitude	f32	[dB uPa] Received signal amplitude at the transducer front.
SNR	f32	[dB] Signal to noise ratio between received detection signal and background noise.
Seabed Confidence	f32	Currently confidence is the deviation in dB from the return that an average seabed would produce.
Co-linearity	f32	Along track compared to previous detections.
Classifier	u32	Bit 1..0: Seabed classifier 00 - Unlikely seabed 01 - Probably seabed 11 - Most likely seabed Bit 2: 0 - Regular detection 1 - The detection with highest probability of being the seabed This bit is always set for exactly one detection, if n>0 Bit 31..3: Reserved.

NOTE

1. Data is not compensated for motion, but the average heave value to use for correction is included with each detection.
2. The detections within one class will be sorted with the most shallow detection first.
3. The classes may be mixed.
4. If the detection count is zero, there are no detections.

NOTE

To re-create the depth that is reported in 10049.

Pick the detection with highest probability of being the seabed (See Classifier field – bit2) and then Depth = Draft – Heave + Range.

10.80 10038 – SBES Raw IQ data

Description: This record contains raw I and Q data.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	No	No	Channel

Data Definition:

DRF	RTH	RD	OD	DRF

Table 131: 10038 – Record Type Header

Field Name	Type	Description
Ping Number	u32	Sequential number (on single record request this field is zero)
Multi ping Sequence	u32	Number starting from 0 and incrementing by 1 for each pulse in a multi ping sequence(on single record request this field is zero)
Mean Sound velocity (MSV)	f32	In [m/s]
Not Applied transducer draft	f32	[meter]. Draft is Not applied to data in this record. Clients may apply this value to display water depth echograms.
Sample rate (fs)	f32	In [Hz]
Effective Pulse length	f32	[s] . For CW this is the time duration of the transmitted pulse. For FM this time which the Processing compresses the pulse to.
Start sample delay	f32	[seconds]. The TWT corresponding to the first sample in this record. Shift the echogram down by this amount.
Bits per sample	u32	Preferred 64
Full Scale	f32	Highest Value /echo strength possible.
Number of samples (n)	u32	The number of samples contained in this record.
RESERVED	u32 * 20	See below

DRF	RTH	RD	OD	DRF

Table 132: 10038– Record Data

Name	Size	Description
Real (first sample)	f32	Real (I)
Imaginary(first sample)	f32	Imaginary (Q)
…		
Real (range Samples-1)	f32	Real (I)
Imaginary(range Samples-1)	f32	Imaginary (Q)

10.81 10039 – SBES Clipping data

Description: This record includes clipping information for the raw samples and echogram (record 10018 and 10038).

Overflows in the echo sounder front end may result in a sample or a range of samples being more or less influenced or even invalid.

For example: If the sounder signal is clipped by a low frequency noise source, a range of samples will have low (or even zero) amplitude.

The first sample clipping in this record corresponds to the first sample in record 10038. The record always includes flags for all samples so number of samples in this record is equal to number of samples in record 10038.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	No	No	Channel

Data Definition:

DRF	RTH	RD	OD	DRF

Table 133: 10039 – Record Type Header

Field Name	type	Description
Ping number	u32	Sequential number (on single record request this field is zero)
Multiping sequence	u32	Number starting from 0 and incrementing by 1 for each pulse in a multi ping sequence(on single record request this field is zero)
Flag Field Count	U32	Number of flags fields in RD equals the number of samples divided by 32 and rounder UP. Unused flag bits are set to 0
Reserved	u32*20	

DRF	RTH	RD	OD	DRF

Table 134: 10039– Record Data

Name	Size	Description
Flags31..0	U32	Bit field for the first 32 samples. The flag for the first sample is in the LSB
Flags63..32	U32	Bit field for the next 32 samples. The flag for sample 32 is in the LSB
Flags31..0+32*k	U32	Bit field for groups of 32 samples. The flag for lowest sample numbers is in the LSB

Example:

If the 10018 record has 90 samples If RD contains

Hexadecimal representation	Binary representation
0xff	MSB 11000000000000000000000011111111 LSB
	MSB 11110000000000000000000000000011 LSB

	MSB 00000000001111111111111100001111 LSB

Then samples [0 to 7], [30 to 33], [60 to 67] and [72 to 85] are influenced by front-end signal overflow. In this example the last 6 samples are not representing samples and are always 0.

(Far) Sample 95	(near) Sample 0
00000000001111111111111100001111111100000000000000000000000000001111000000000000000000000011111111	

10.82 10049 – SBES Depth Reading

Description: Singlebeam raw detection data.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes	No	No	Channel

Data Definition:

DRF	RTH	RD	OD	DRF

Table 135: 10049 – Record Type Header

Field Name	Type	Description
Depth meter	f32	Depth in [m]
Depth feet	f32	Depth in feet [ft]

NOTE
Using current average sound speed and corrected for draft and heave.

10.83 10060 – SBES Port Configuration

Description: The system maintains a list of serial ports with their respective configurations. This message contains the configuration of all ports in the port list.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes on change	Yes	Yes	No

Data Definition:

DRF	RTH	RD	OD	DRF

Table 136: 10060 – Record Type Header

Field Name	Type	Description
N	u32	PortCount. Number of following single serial port configurations (Record Configuration Data)
S	u32	Data Field Size. size of this single port configuration in bytes.

Reserved	u32*10	

DRF	RTH	RD	OD	DRF

Table 137: 10060– Record Data

Record Data: Single Serial Port Configuration.

Field Name	Type	Description
Port index	u32	Index in the port list
Flags	u16	Bit 0: 0=Disabled 1=Enabled Bit 1: 0=Not Configured 1=Configured
Reserved	u16	
System function[See Note]	u64	Flag register each bit signals a sensor value retrieved from the port. Bit0 is LSB. Bits: 0 - Time 1 - Reserved 2 - Latitude 3 - Longitude 4 - Height 5 - Heading 6 - Roll 7 - Pitch 8 - Heave 56 - Channel 1 depth 57 - Channel 2 depth
Phy setting	u32	0 - RS232 1 - RS422 2 - RS485
Baud rate	u32	Only some values are valid. See “Baud” in system XML.
Data bits	u32	Valid values 7 and 8 bits
Stop bits	u32	1 - 1 stop bit 2 - 2 stop bits
Parity	u32	0 - None 1 - Odd 2 - Even
SentenceIndex0	u32	Index of sentence in the list of available decoders. 255 - no sentence.
Reserved	u32 * 3	
LabelOnBox	c8 * 32	Null terminated text on the label.

NOTE
The “Single port configuration” structure is identical to the remote command 7500, 10020, which is used for setting/changing the configuration for a specific port. System function: For serial input bit 56-63 must be set to 0 For serial output formats bit 0 to 32 must be set to 0 For serial output formats with just one depth, only bit 56 or bit 57 may be set to 1. For serial output formats with variable number of depths, bit 56, 57 or both may be set to 1. For serial output formats with fixed 2 depths, both bit 56 and bit 57 must be set to 1. Channels that are set up for serial output but not enabled or not producing detections will output 0-values.

10.84 10061 – SBES Port Status

Description: The system maintains a list of serial ports with their respective statuses. This message contains the status of all ports in the port list.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes on change	Yes	No	No

Data Definition:

DRF	RTH	RD	OD	DRF

Table 138: 10061 – Record Type Header

Field Name	Type	Description
N	u32	PortCount. Number of following single serial port statuses (Record Status Data).
S	u32	Data Field Size. size of this single port status in bytes.
Reserved	u32*10	

DRF	RTH	RD	OD	DRF

Table 139: 10061– Record Data

Record Data: Single Serial Port Status.

Field Name	Type	Description
Port index	u32	Index in the port list.
Current status	u32	0 - Disabled 1 - Enabled Data

		2 - Enabled No Data 3 - Enabled Wrong Data 4 - Enabled Error

10.85 10062 – SBES Port QC

Description: This message contains the port quality control.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
Yes on port input and at least every 2 seconds	No	Yes	No

Data Definition:

DRF	RTH	RD	OD	DRF

Table 140: 10061 – Record Type Header

Field Name	Type	Description
Port index	u32	Index in the port list
Byte count	u32	Accumulated number of bytes
Message count	u32	Accumulated number messages/telegrams
Error count	u32	Accumulated number of errors
Current status	u32	0 - Disabled 1 - Enabled Data, 2 - Enabled No data, 3 - Enabled Wrong data 4 - Enabled Error
Reserved	u32	64-bit alignment of 64 bit fields below.
Sentence start time	u64	Local timestamp (µs) for the port. First bit in first byte.
Sentence end time	u64	Local timestamp (µs) for the port. Last stop-bit of last byte.
Sentence byte count n	u32	The number of bytes in a sentence.
Sentence direction	u32	0 - Transmitted 1 - Received
Reserved	u32*8	
Sentence content	c8*512	Direct binary data as received in telegram.

NOTE
The “sentence fields” will be cleared when the record is sent from the SBE and no sentence was received/transmitted.

NOTE
If the sensor driver doesn't support precise timestamps, both start time and stop time will be set to the time for last byte received.

NOTE
The maximum size of the transferred sentence is 512 bytes. If the message is longer, sentence content will be truncated off at the end. Sentence byte count will NOT be truncated to 512.

NOTE
Enabled Error is used when the port is enabled but not configured and is sent in the periodic 10062 record transmitted every 2 seconds.

10.86 10063 – UDP Port Configuration

Description: This record contains configuration for all the single beam UDP ports used for sensor input/output.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
yes	yes	Yes	No

Field Name	Type	Description
Count	u32	Number of following port records
reserved	u32	
reserved	u32	

Port records

Field Name	Type	Description
Multicast index	u32	Corresponds to a port number. 256 to 258 is supported.
Group IP	u32	IP for the group. Little endian
Port	u16	UDP port
Flags	u16	Bit 0: 0=Disabled 1=Enabled Bit 1: 0=Not Configured 1=Configured

SentenceIndex0	u16	Index in sentence list.
Reserved	u16	write 0 for compatibility
Depth Channel;	u32	0: channel A, 1: Channel B

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 141: 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	System mode	
1015	Reserved for hydrophone selection	
1016	Bottom detection adaptive gate window and filters	
1017	Receiver gain type	
1019	Vernier Processing Parameters	
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	System center frequency	7501, 7502
1027	Transmit frequencies for chirps	7501, 7502
1028	Head tilt	

Identifier	Description	Possible Return Records
1029	Projector position relative to receiver	7501, 7502
1032	Reserved for beam spacing mode	
1033	Motion compensation	
1034	Match filter parameters	
1035	Coverage sector	
1037	Motion sensor configuration	
1038	FlexMode parameters	
1039	Beam mode selection	
1040	Sample rate parameters	
1041	Manual IMUX Control	
1043	Custom Beams	
1044	Constant spacing	
1045	Multi-Detect Parameters	
1046	Power Saving	
1047	AUV Configuration Options	
1048	Duty-Cycle Limitation Control Method	
1049	Reserved	7049
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 sonar source	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

Identifier	Description	Possible Return Records
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	
1117	Reserved for Quality filter settings	
1118	Snippet control	
1121	Ping a number of times	
1122	Start ping sequence	
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
1211	7k Logging settings	7501, 7502
1300-1305	Reserved	
1400	Auto Pilot table update	
1401	Auto Pilot algorithm parameters update (not described in the documentation)	7501, 7502
1402	Tracker Control	
1502	Full Rate Dual Head Control	
1503	Reserved for system lock	
1509	System health check (not described in the documentation)	7501, 7502
1600	Custom recording control	7501, 7502
1601	Custom playback control	7501, 7502
1602	Custom sensors	7501, 7502
1603	Stacking	7501, 7502

Identifier	Description	Possible Return Records
1604	Serial ports	7501, 7502
1605	RRIO addresses	7501, 7502
1606	Custom recording quick info	7501, 7502
1607	Head tilt angle	7501, 7502
1608	Deck mode	7501, 7502
7041	R7041 setup	
7042	Compressed Water column record options	7501, 7502
7610	Manual sound velocity	
7614	Manual Temperature Control	
10001	SBES Corrected transducer draft	
10002	Reserved	
10003	SBES Max ping rate control	
10004	SBES Channel enable mode	
10005	SBES Transducer selection index	
10006	Reserved	
10007	System state and operation mode	
10008	SBES tracker tweak modes	
10009	Reserved	
10010	Reserved	
10012	Reserved	
10013	Reserved	
10014	SBES tracker tweak value	
10016	Detection gate	
10020	SBES Serial port configuration command	
10021	SBES Sensor port list management command	
10022	TimeSync source enable	
10023	Ethernet Time source configuration	
10024	SBES UDP Port configuration command	

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 – Sonar Source 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 142: 7500 Record Data – Command 1002

Name	Size	Description
Calibration Command	u16	0 – Start calibration process 1 – Cancel any calibration that's in progress 2 – Use results of last calibration (ignored if no calibration has been done) 3 – Verify existing calibration 4 – Revert to previous 5 – Clear to "not calibrated" state 6-10 – Reserved / internal 11 – Start calibration (Cal-tone OFF) 12 – Set Cal-tone frequency. *Optional Data* is 32 bit float specifying frequency in Hz. 13 – Manual Cal-tone control (on/off). *Optional Data* is 16 bit Boolean flag (0 = OFF, non-zero = ON) 14 – EM7218 intensity and waveform control (‘D’ command) 15 – Manual Tx shading control (on/off). *Optional Data* 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 143: 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 144: 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 145: 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 146: 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 147: 7500 Record Data – Command 1007

Name	Size	Description
Transmit pulse type	u32	0 – CW 1 – Linear chirp

11.10 1008 – Receiver Gain

Description: System receiver gain.

Table 148: 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 149: 7500 Record Data – Command 1009

Name	Size	Description
Bottom detection flag	u32	BIT FIELD: Bit 0-3: Reserved Bit 4-7: Reserved for bottom detection method Bit 8: Range filter 0 – Disabled 1 – Enabled Bit 9: Depth filter 0 – Disabled 1 – Enabled Bit 10: Adaptive gate 0 – Disabled 1 – Enabled Bit 11: Adaptive gate depth filter 0 – Disabled 1 – Enabled Bit 12: Adaptive gate depth filter fixed 0 – Follow seafloor 1 – Fix depth Bit 13: Depth filter follows seafloor 0 – Fix depth 1 – Follow seafloor Bit 14-31: 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 150: 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 / Frequency Selection

Description: Selects an active projector (8k systems) or active frequency (7k systems). This command does not apply to T-Series sonars with variable CW capability.

NOTE
8k systems only: 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 151: 7500 Record Data – Command 1011

Name	Size	Description
Command	u32	8K wet ends – projector selection: 0 – Stick 1 – Main array 2 – Extended range 3+ – Reserved If set to -1 (0xffff) the projector selection will be forced, by issuing stop pinging command to all other projectors 7k systems: For multi-frequency systems where each XML configuration file defines operating parameters for one frequency, selects the active frequency configuration by system enumerator value. 0 – Enumerator 0 (e.g. 7125 400kHz) 1 – Enumerator 1 (e.g. 7125 200kHz). 2 – Enumerator 2 (e.g. 7131 635kHz) 3 – Enumerator 3 4+ - Reserved

11.14 1014 – System Mode

Description: Mode of the system: Normal, Auto Pilot / Tracker or Normalization.

Table 152: 7500 Record Data – Command 1014

Name	Size	Description
System mode	u16	0 – Manual (normal) mode 1 – Auto Pilot mode / Tracker 2 – I&Q (normalization) mode
Auto-pilot flags	u16	Bit 0 – 14: Reserved Bit 15: Use legacy Auto Pilot (if supported) instead of Tracker

11.15 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 153: 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).

11.16 1017 – Receiver Gain Type

Description: Sets the receiver gain type.

This command is only available for selected systems.

Table 154: 7500 Record Data – Command 1016

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

11.17 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 and the 200kHz 7131 system at this time.

Table 155: 7500 Record Data – Command 1019

Name	Size	Description
Field flags	u16	Bitfield indicating which parameters are to be applied by this command. Bit 0: Operational mode Bit 1: Decimation Bit 2: First sample Bit 3: Smoothing window type Bit 4: Smoothing window length Bit 5: Reference array Bit 6-15: Reserved
Operational mode	u32	0 – Vernier 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 2 – Hamming 99 – None
Smoothing window length	u16	Smoothing window length [samples]. Range = 3 to 63. Value must be odd.
Reference array	u8	Reserved for reference array selection (When *Operational Mode* is “Vernier” (0), this selects which array to use as reference array in Vernier processing. When *Operation Mode* is “Single array” (1), this selects which of the three 200kHz arrays is to be active. Valid values are 0, 1, or 2 in both cases.)
Reserved	4*u32	Reserved for future use

The mode settings allows the operator to switch between forward-looking bathymetry (normal mode) and imagery when operating the 7130 at 200kHz. The imagery mode can be useful for object analysis based on acoustic shadow for example.

The filter settings lets the operator choose whether a FIR (finite Impulse Response) low-pass filter is applied to the raw signal prior to elevation computation by Vernier processing. For bathymetry, a typical setting would be a rectangular filter of 19 taps. The longer the filter the smoother the output. For target detection, a short filter or no filter is the preferred setting. The Hanning filter favors the samples close to the center of the filter window. For a given length it will have less effect than a rectangular filter.

The filter length from 1 (no filter) to 63 (longest filter that can be implemented) determine the degree of smoothing performed on the raw data.

11.18 1020 – Transmit Pulse Envelope Identifier

Description: Sets the Transmit Pulse Envelope.

This command is only available for selected systems.

Table 156: 7500 Record Data – Command 1020

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

11.19 1021 – Projector Beam Steering

Description: Horizontal and vertical projector beam steering.

This command is only available for selected systems.

Table 157: 7500 Record Data – Command 1021

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

11.20 1022 – Projector Beam Widths

Description: Horizontal and vertical projector beam widths.

This command is only available for selected systems.

Table 158: 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

11.21 1026 – Transmit Center Frequency

Description: Center transmit frequency.

This command is only available for selected systems.

Table 159: 7500 Record Data – Command 1026

Name	Size	Description
Frequency	f32	In Hz

11.22 1027 – Transmit Frequencies for Chirps

Description: Transmit pulse start and stop frequencies.

This command is only available for selected systems.

Table 160: 7500 Record Data – Command 1027

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

11.23 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 161: 7500 Record Data – Command 1033

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

11.24 1034 – Match Filter Parameters

Description: Sets the match filter parameters.

This command is only available for selected systems.

Table 162: 7500 Record Data – Command 1034

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

11.25 1035 – Coverage Sector

Description: Sets the current coverage sector.

This command is only available for selected systems.

Table 163: 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)

11.26 1037 – Motion Sensor Configuration

Description: Sets the motion sensor configuration.

This command is only available for selected systems.

Table 164: 7500 Record Data – Command 1037

Name	Size	Description
Format	u8	0 – TSS1 1 – SIMRAD EM1000 2 – SIMRAD EM3000 3 – NMEA $PASHR 4 – OCTANS TAH
Baud	u8	0 – 4800 1 – 9600 2 – 14400 3 – 19200 4 – 28800 5 – 38400 6 – 56000 7 – 57600 8 – 115200

Name	Size	Description
Parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 – Mark
Data Bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
Stop Bits	u8	0 – 1 bit 1 – 2 bits
Orientation	u8	0 – Port Up 1 – Port Down
Reserved	u8	Reserved
Motion Latency	f32	Motion latency in seconds Valid range is 0 – 0.050
Reserved	u8 * 20	Reserved

11.27 1038 – FlexMode Parameters

Description: Set the FlexMode parameters.

Table 165: 7500 Record Data – Command 1038

Name	Size	Description
FlexMode sector coverage	f32	Coverage sector in radians
FlexMode sector steering	f32	Sector steering angle in radians (positive to starboard)

11.28 1039 – Beam Mode Selection

Description: Set the beam mode selection.

Table 166: 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

11.29 1040 – System Sample Rate

Description: Sets system sample rate parameters. Applicable only for systems using the EM7218 receiver.

Table 167: 7500 Record Data – Command 1040

Name	Size	Description
IQ Rate	u32	0 – SR17K 1 – SR34K 2 – SR50K 3 – SR60K 4 – SR80K 5 – SR100K

11.30 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 168: 7500 Record Data – Command 1041

Name	Size	Description
IMUX	u32	The valid range is 0 - 7. 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

11.31 1043 – Custom Beams

Description: Set the number of beams for the beamformer.

Table 169: 7500 Record Data – Command 1043

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

11.32 1044 – Constant Spacing

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

Table 170: 7500 Record Data – Command 1044

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

Flags	u32	Bit1:Reduce coverage 0 – Always maintain swath coverage 1 – Allow swath coverage to be reduced

11.33 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 use a version of the "G2" bottom detection algorithm as its basis. This may change in the future.

Table 171: 7500 Record Data – Command 1045

Name	Size	Description
Enable	u16	Zero = Multi-detect OFF. Non-zero = Multi-detect ON.
Object Size	u16	Range of 1 to 100. Controls the sensitivity of the algorithm to Object Size. This is a unit-less quantity. *Note: Increasing this parameter results in more detections on smaller objects. Decreasing this parameter results in fewer detections and only on larger objects.*
Sensitivity	u16	Range of 1 to 100. Controls the sensitivity of the algorithm to Intensity. This is a unit-less quantity. *Note: Increasing this parameter causes more objects to be detected.*
Max Detections	u16	Range of 1 to 5. Limits the number of detections produced per beam. The maximum number of detections per beam is five. *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.*
Reserved	u16*2	Reserved, set to zero.

11.34 1046 – Power Saving

Description: Sets overall system power saving mode. Only components which support power saving modes are affected by this command.

NOTE
Apply on the moment of writing to the T-20-S only until software updates are released for other systems.

Table 172: 7500 Record data – Command 1046

Name	Size	Description
Mode	u8	0 : **None**. No power saving enabled at all. Can be used as reference. 1 : **Normal.** Components save power when possible. No effect on operation. 2 : **Range Blank**. Normal saving + "real" samples are not output from RX controller until X range is reached. X is controlled by the Flags and Range Blank Control fields. 3 : **Sleep.** Components will be put in sleep mode. Sleep mode has 0 to 50ms recovery time. All settings will be retained. NO DATA is produced in sleep mode. 4 : **Hibernate**. Components will be put in hibernate mode. Hibernate mode has 0 to 10 second recovery time. All settings will be retained. NO DATA is produced in hibernate mode.
Flags	u8	Bits 0 – 7 : Reserved, zero.
Range Blank Control	u16	Used only for power saving mode 2 ("*Range Blank" mode).* Controls size of range blanking interval. Ping data during this time interval will be zero. Only affects receiver component. This value gives the range blanking interval as a *percent of the range scale* (0 – 100). The number of samples blanked will change with range settings in this case.

11.35 1047 – AUV Configuration Options

Description: Allows control of AUV / ROV focused system features. The initial (installation default) value for these options is determined by the system XML file. Thereafter the settings are remembered in the system parameter file, and changed via this remote command.

NOTE
Apply on the moment of writing to the T-20-S only until software updates are released for other systems.

Table 173: 7500 Record Data – Command 1047

Name	Size	Description
Startup Normalization	u8	Non-zero to enable normalization at startup.
Restore Ping Rate	u8	Non-zero to restore ping rate to previous setting (which was in effect when system was last shut down).
Restore Power	u8	Non-zero to restore power to previous setting. Otherwise system starts with power OFF.
SV Interlock	u8	Non-zero to enable Sound Velocity Interlock safety feature (for system with integrated SV probe only).
Ignore PPS Errors	u8	Non-zero to suppress error messages due to PPS signal errors. Proper functioning of the PPS signal is normally required for accurate data time-stamping in bathymetry systems.
Restore Recording	u8	Non-zero to restore recording to previous setting (which was in effect when system was last shut down). Otherwise system starts with recording OFF.
Restore Tracker	u8	Non-zero to restore Tracker to previous setting (which was in effect when system was last shut down). Otherwise system starts with Tracker OFF.
RESERVED	u8*13	Reserved. Zero.

11.36 1048 - Duty-Cycle Limitation Control Method

Description: System TX duty-cycle must be controlled (limited) to protect the sonar hardware. If the requested ping rate, power (source) level and pulse length result in a potentially damaging TX duty-cycle, then the system will automatically reduce either the ping rate or the power setting. This command controls which parameter (ping rate or power) is reduced in this case.

Table 174: 7500 record Data – Command 1048

Name	Size	Description
Method	u16	0 – Ping Rate 1 – Power (source) Level 2+ – Reserved

NOTE
When DC limitation via Power level is selected, the existing formula is applied that gives the MINIMUM ping period to satisfy a given duty cycle. If the MINIMUM ping period is greater than the existing ping period (inverse ping rate), then the power ("POWER_DB" in formula below) is iteratively reduced by 1dB until the minimum ping period meets the actual ping period. PING_PERIOD = PULSE_LENGTH * (pow(10, POWER_DB/10) / pow(10, MAX_POWER_DB/10))) / DUTY_CYCLE The resulting reduced power setting is set via internal remote command and echo'd so that the GUI/SUI slider is correctly updated to reflect the change.

11.37 1050 – Single Record Request

Description: Request latest record.

Table 175: 7500 Record Data – Command 1050

Name	Size	Description
Record type	u32	Possible responses: 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. 7502 (NACK)

11.38 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 176: 7500 Record Data – Command 1051

Name	Size	Description
N	u32	Number of records
Array of record numbers	u32 * N	Possible responses: 7501 – Followed by a subscribed record(s). In the record definitions is stated if a record can be subscribed. 7502 (NACK)

11.39 1052 – End All Subscriptions

Description: Unsubscribe to all records.

This command has no parameters.

11.40 1053 – Third Party Data Connection

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

Table 177: 7500 Record Data – Command 1053

Name	Size	Description
Address	u32	IP address (little endiand data order)
Port	u16	Port number
Type	u16	0 – UDP 1 – TCP
# Records	u32	Number records
Record list	u32 * N	Array of record IDs, N = # Records

11.41 1054 – Delete Third Party Data Connection

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

Table 178: 7500 Record Data – Command 1054

Name	Size	Description
Address	u32	IP address (Little endian data order)
Port	u16	Port number
Type	u16	0 – UDP 1 – TCP

11.42 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 179: 7500 Record Data – Command 1055

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

11.43 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 180: 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

11.44 1099 – Stop Sonar Source

Description: Causes 7k sonar source process to stop. Should always be acknowledged.

This command has no parameters.

11.45 1100 – Start Pinging

Description: Start continuous pinging.

(Pinging will not start if the Max Ping Rate is set to zero.)

(This command will change the triggering configuration of the sonar to internal; external triggering overruled)

This command has no parameters.

11.46 1101 – Stop Pinging

Description: Stop pinging.

This command has no parameters.

11.47 1102 – Load Factory Parameters

Description: Load Factory Parameters from disk.

This command has no parameters.

11.48 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 181: 7500 Record Data – Command 1103

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

11.49 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.

11.50 1109 – System Health Verification

Description: Request System Health snapshot text file to be created. The file name is created according to *section 7.2 File Nomenclature* with a .txt extension.

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

This command has no parameters.

11.51 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 182: 7500 Record Data – Command 1111

Name	Size	Description
Number of pings in sequence	u16	0, 1 – Single ping mode (default) 2 – 2 pings 4 – 4 pings
Begin frequency	u32	First ping frequency (Hz)
Spacing	i32	Frequency spacing (Hz, may be negative)

NOTE
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. The actual frequency value for each ping is reported in the 7000 record, which is generated for each ping in the multi-ping sequence.

11.52 1113 – Calibrated Snippet Control

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

Table 183: 7500 Record Data – Command 1113

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

11.53 1114 – External Trigger

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

This command has no parameters.

11.54 1115 – Trigger Out

Description: Sets output trigger on ping command.

Table 184: 7500 Record Data – Command 1115

Name	Size	Description
State	u32	BIT FIELDS: Bit 0: 1 – Enabled 0 – Disabled Bit 1: 1 - Trigger for entire Rx duration (depends on range setting) Length field is ignored. Not supported on all systems. 0 – Fixed length trigger, defined by *Length* field Bit 2-31: Reserved (must be zero)
Length	f64	Trigger length (in seconds)
Offset	f64	Trigger delay after ping command (in seconds)

11.55 1116 – PPS Edge Control

Description: Sets PPS input edge control.

Table 185: 7500 Record Data – Command 1116

Name	Size	Description
PPS Edge	u32	BIT FIELD: Bit 0: 0 – Rising 1 – Falling Bit 1-31: Reserved

11.56 1118 – Snippet Control

Description: Limits snippet sample range.

NOTE
This command may affect old 7008 record's format.

Table 186: 7500 Record Data – Command 1118

Name	Size	Description
Snippet Control Flags	u32	BIT FIELD: (1 – Enabled) Bit 0: Use automatic snippet window Bit 1: Include at least samples around bottom detection (min. window size is valid) Bit 2: Include at most samples around bottom detection (max. window size is valid) Bit 3-31: Reserved
Snippet Control Min. Window	u32	Used as Minimum Window Size when bit 0 is set (*automatic window*) AND bit 1 is set. Used as Fixed Window Size when flags bit 0 is NOT set (*fixed window*).
Snippet Control Max. Window	u32	Max snippet window. Used when flags bit 2 is set.

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.

11.57 1121 – Ping a Number of Times

Description: Ping a number of times.

NOTE
This command will halt continuous pinging if it has been started, and disable external triggering.

Table 187: 7500 Record Data – Command 1121

Name	Size	Description
Number	u32	Number of times to ping.

11.58 1122 – Start Ping Sequence

Description: Start pinging using a predefined sequence that has been loaded into 7kCenter.

NOTE
This command will halt continuous pinging if it has been started, and disable external triggering. The sequence is repeated until it is stopped via the 1101 command, or continuous pinging is started via the 1100 command

Table 188: 7500 Record Data – Command 1122

Name	Size	Description
Identifier	u32	Zero-based ping sequence identifier.

11.59 1200 – Start Recording

Description: Start recording. The directory (see command 1207) and file name combined must not exceed 256 characters. The string should be of the form <filename in u8></0><0 in u8 to fill to a total length of 256>

Table 189: 7500 Record Data – Command 1200

Name	Size	Description
Reserved	u32	Reserved – must be 0
Filename	c8 * 256	Null terminated UTF-8 string. Maximum 256 characters, including null character. If the filename is NULL (empty), the file name is created according to *section 7.2 File Nomenclature* (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. 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.

NOTE
Filename for a common dual head system is as follows. The filename as given by the 1200 command is slaved, the master will pass the filename to the slave. The master will prefix the files with 'M' and the slave with 'S'. New files are created included with additional numbering (1), (2) etc. when files exceed a defined limit.

11.60 1201 – Stop Recording / Playback

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

This command has no parameters.

11.61 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 190: 7500 Record Data – Command 1202

Name	Size	Description
Start flag	u16	1 – Time in seconds 2 – Record number
Start point	u32	Seconds or record number
Frequency	i32	Playback frequency 0 – Real Time <0 – As fast as possible >0 – Records per second
File name	u8 * 256	Null-terminated UTF-8 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 **will not** be used.)

11.62 1204 – Data Storage Status Request

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

This command has no parameters.

11.63 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 sonar source.

Table 191: 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.

11.64 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 192: 7500 Record Data – Command 1207

Name	Size	Description
Directory	c8 * 256	New directory pathname. Null-terminated UTF-8 string. A trailing backslash (‘\’) will be appended if necessary. Network paths should be specified as (for example): \\server\directory. In the event that the directory does not exist, it will be created (if possible).

11.65 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
2004	3001	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 + 7027 (bathymetry) or 7018 (FLS). Full reprocessing of .s7k files requires water column data record 7018 or 7008 (obsolete). The Sonar UI enforces this minimal set via the 1209 command records it sends to the 7k sonar source.

Table 193: 7500 Record Data – Command 1209

Name	Size	Description
Filter type	u16	0 – By record
Filter method	u16	0 – None, all records will be included 1 – Inclusionary, ‘Filter List’ is the list of records for playback or recording
N	u16	Number of record IDs in ‘Filter List’ (maximum 128)
Filter list	u32 * N	List of N record IDs for filtering to act upon

11.66 1211 – Logging Settings

Description: Set the 7K logger settings; single or multiple log file, lead-in or none lead-in ping data.

Table 194: 7500 Record Data – Command 1211

Name	Size	Description
Single or multiple file	u8	Zero = Write logfiles of multiple 1GB files Non-zero = Write single 7K logfile
Ping data history	u8	Zero = No lead-in ping data Non-zero = Write 10 sec of lead-in ping data

11.67 1400 – Auto Pilot Table Update

Description: Auto Pilot table to be loaded.

Table 195: 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 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 1 – 7111 2 – 7125 200kHz 3 – 7125 400kHz 4 – 7150 5 – Default 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

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

11.68 1402 – Tracker Control

Description: Sets the state of the Tracker options.

Table 196: 7500 Record Data – Command 1402

Name	Size	Description
Tracker flags	u32	Bit 0: Enable range control Bit 1: Enable power & gain control Bit 2: Enable pulse length control Bit 3: Enable coverage angle control Bit 4: Use fixed swath width Bit 5: Set maximum coverage angle
Tracker swath width	f32	In meters
Tracker max coverage	f32	In radians

11.69 1502 – Full Rate Dual Head Control

Description: System dual head mode.

This command is not acknowledged if FRDH is not licensed.

Table 197: 7500 Record Data – Command 1502

Name	Size	Description
Dual head mode	u32	0 – Ping pong mode 1 – Full rate dual head (FRDH)

11.70 1600 – Custom Recording Control

Description: Set custom recording control parameters.

Table 198: 7500 Record Data – Command 1600

Name	Size	Description
Path name	c8 * 256	Full directory path name. Null terminated UTF-8 string. Maximum of 256 characters, including null character.
Header name	c8 * 256	Null terminated UTF-8 string. Maximum of 256 characters including null character.

Name	Size	Description
Trailer name	c8 * 256	Null terminated UTF-8 string. Maximum of 256 characters including null character.
Prepend header	u8	When not zero: Prepend the file specified by the header name for each file.
Append trailer	u8	When not zero: Append the file specified by the trailer name for each record.
Record	u32	When not zero: Enable custom recording.

11.71 1601 – Custom Playback Control

Description: Set custom playback control parameters.

Table 199: 7500 Record Data – Command 1601

Name	Size	Description
Path name	c8 * 256	Full directory path name. Null terminated UTF-8 string. Maximum of 256 characters, including null character.
File name	c8 * 256	Null terminated UTF-8 string. Maximum of 256 characters including null character.
Loop mode	u32	0 – Play file once 1 – Loop the file 2 – Advance to next file
Play	u8	When not zero: Enable custom playback
Time stamps	u8	0 – Set new timestamps 1 – Keep original timestamps when playing the file

11.72 1602 – Custom Sensors

Description: Set HPR (heading, pitch roll) and SVP (sound velocity) sensors. The HPR sensor can optionally installed in the RTA and a SVP optionally connected to the sonar head.

Table 200: 7500 Record Data – Command 1602

Name	Size	Description
Use build in HPR	u8	0 – Use HPR sensor connected to RTA 1 – Use the build in HPR sensor
Use attached SVP sensor	u8	0 – Use SVP sensor connected to RTA 1 – Use attached SVP sensor

11.73 1603 – Stacking

Description: Set stacking

Table 201: 7500 Record Data – Command 1603

Name	Size	Description
Enable stacking	u8	0 – Disable stacking mode 1 – Enable stacking mode
Stacking value	u8	Number of results to stack min = 1, max = 9

11.74 1604 – Serial Ports

Description: Set serial ports

Table 202: 7500 Record Data – Command 1604

Name	Size	Description
ZDA port baudrate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
ZDA port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
ZDA port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
ZDA port stop bits	u8	0 – 1 bit 1 – 2 bits

Name	Size	Description
GGA port baudrate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
GGA port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
GGA port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
GGA port stop bits	u8	0 – 1 bit 1 – 2 bits
SVP port baudrate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
SVP port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark

Name	Size	Description
SVP port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
SVP port stop bits	u8	0 – 1 bit 1 – 2 bits
HPR port baud rate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200
HPR port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
HPR port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
HPR port stop bits	u8	
HDT port baud rate	u8	0 – 1200 1 – 2400 2 – 4800 3 – 9600 4 – 14400 5 – 19200 6 – 28800 7 – 38400 8 – 56000 9 – 57600 10 - 115200

Name	Size	Description
HDT port parity	u8	0 – None 1 – Even 2 – Odd 3 – Space 4 - Mark
HDT port data bits	u8	0 – 5 bits 1 – 6 bits 2 – 7 bits 3 – 8 bits
HDT port stop bits	u8	0 – 1 bit 1 – 2 bits

11.75 1605 – RRIO Addresses

Description: Set RRIO addresses.

Table 203: 7500 Record Data – Command 1605

Name	Size	Description
RRIO address1	c8 * 256	RRIO IP address :port UTF-8 string, max length 255 characters + null.
RRIO address2	c8 * 256	RRIO IP address :port UTF-8 string, max length 255 characters + null.
RRIO address2	c8 * 256	RRIO IP address :port UTF-8 string, max length 255 characters + null.

11.76 1606 – Custom Recording Quick Info

Description: Custom recording quick status information.

Table 204: 7500 Record Data – Command 1606

Name	Size	Description
Disk free	u16	Percentage free disk space
Number	u32	Number of records written
Size	u64	Size of recorded file
Record	u32	Non zero when recording is active
File name	c8 * 256	Name of current file being recorded UTF-8 string, max length 255 character + null
Error	u32	RDR error
Reserved	u32 * 30	Reserved

11.77 1607 – Head Tilt Angle

Description: Set Head tilt mounting angle.

Table 205: 7500 Record Data – Command 1607

Name	Size	Description
Head tilt	f32	In radians

11.78 1608 – Deck Mode

Description: Set deck mode; sonar is in degraded operation.

Table 206: 7500 Record Data – Command 1608

Name	Size	Description
Mode	u32	Deck mode Non zero: Sonar is in deck mode

11.79 1609 – Power Mode

Description: Give (windows) power mode of the sonar (Control Center) PC.

Table 207: 7500 Record Data – Command 1609

Name	Size	Description
Flags	u8	Bit 0: – Power mode is supported Bit 1: – Power mode CPU throttled Bit 2: – Power mode AC
Mode max	u8	Percentage on which the CPU is throttled between 0 – 100%

11.80 1610 – Power Built-In Applanix POS MV

Description: Power on the built-in Applanix POS MV.

This command has no parameters.

11.81 7041 – R7041 Setup

Description:

Table 208: 7500 Record Data – Command 7041

Name	Size	Description	Startup
Down-sampling Method	u8	0 – No down-sampling No down-sampling is performed and intensity is recorded unchanged 1 – Nearest neighbor For each new sample the nearest original sample within the same beam is picked 2 – Linear approximation Each new sample is calculated as linear approximation of two original neighboring samples 3 – Averaging Each new sample is an average of all original samples within half new sampling period	1
Filtering Method	u8	0 – No filtering	0
Flags	u16	BIT FIELD: Bit 0: - Discard data beyond absolute gates If absolute gates are enabled, data series will be recorded only to maximum depth or range gate, whichever is less Bit 1: - Reduction relative to pulse length New sample periods calculated as Pulse Length * Multiplier Bit 2: - Reduction relative to sample rate New sample period is calculated as *original Sample Period * Multiplier* Bit 3: - Absolute reduction New sample rate is adjusted such as total number of samples would not exceed specified value in Multiplier/Size field Bit 4-15: - Reserved (always zero) Only one of 1-3 bits could be set	3
Multiplier/Size	f32/u32	For relative reduction, this field contains floating point multiplier value For absolute reduction this field contains integer number for max samples	1.0

11.82 7042 – Compressed Water Column Data Setup

Description: Allows configuration of Compressed Water Column record (7042). Note that the current value of these flags are reported in the 'Flags' field of the 7042

Compressed Water Column record. The settings are retained between executions of the 7k sonar source.

NOTE
Apply until software updates are released for other systems, on the moment of writing only to the T20 and T50 series.

Table 209: 7500 Record Data – Command 7042

Name	Size	Description
Flags	u32	Bit field: Bit 0 : Use maximum bottom detection point *in each beam* to limit data. Data is included up to the bottom detection point + 10%. This flag has no effect on systems which do not perform bottom detection. Bit 1 : Include intensity data only (strip phase). Bit 2 : Convert mag to dB, then compress from 16 bit to 8 bit. Phase compression simply truncates lower (least significant) byte of phase data. Bit 3 : Exclude data outside of absolute gates. Only applicable if abolute gates in use. (UNSUPPORTED IN THIS RELEASE) Bit 4-7 : Downsampling divisor. Value = (BITS >> 4). Only values 2-16 are valid. This field is ignored if downsampling is not enabled (type = “none”). Bits 8-11 : . Downsampling type: 0x000 = None 0x100 = Middle value 0x200 = Peak value 0x300 = Average value

11.83 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 sonar source from other clients (e.g. Teledyne PDS) will be ignored.

Table 210: 7500 Record Data – Command 7610

Name	Size	Description
Flags	w16	BIT FIELD: Bit 0: Manual Override If set any subsequent 7610 record will be ignored, otherwise any subsequent 7610 record will change the Sound Velocity value Bit 1: Settings Only If set the Sound Velocity value will not be updated and Sound Velocity field within this remote command will be ignored Bit 2: Filter Setting If set SVP Filter type will be changed, otherwise SVP Filter field within this remote command will be ignored Bit 3-15: Reserved, must be zeros
Sound velocity	f32	Sound velocity in m/s
SVP Filter	u8	SVP Filter type 1 – No Filter 2 – Light Filter 3 – Normal Filter 4 – SVP70 Wizard NOTE: to change the filter values Flags Bit 2 must be set
Reserved	u8*3	Reserved

11.84 7614 – Manual Temperature Control

Description: Set Temperature, with optional 'override' flag. If override flag is set, then 7614 records received by the 7k sonar source from other clients (e.g. Teledyne PDS) will be ignored.

Table 211: 7500 Record Data – Command 7614

Name	Size	Description
Flags	u16	BIT FIELD: Bit 0: Manual Override If set any subsequent 7614 record will be ignored, otherwise any subsequent 7614 record will change the Temperature value. Bit 1: Settings Only If set the Temperature value will not be updated and Temperature field within this remote command will be ignored. Bit 2-15: Reserved, must be zeros
Temperature	f32	Temperature (°C)

Name	Size	Description
Reserved	u16*2	Reserved. Set to zero.

11.85 10001 – SBES Corrected Transducer Draft

Description: Transducer draft is the depth of the echo sounder transducer. Corrected transducer draft is transducer draft corrected for otherwise uncorrected residual range errors.

Good echo sounder depths readings can be output if corrected transducer draft is set to the distance from the sea surface to the transducer face measured with a tape measure.

Even better depths can be output by following this procedure known as bar check calibration:

- Set Corrected transducer draft to zero.
- Record some soundings to a bar at a known depth.
- Input the error that these readings have as Corrected transducer draft.

Table 212: 7500 Record Data – Command 10001

Field Name	Type	Description
Corrected transducer draft.	f32	[m].

11.86 10003 – SBES Max Ping Rate Control

Description: Set maximum ping rate in pings per second.

Table 213: 7500 Record Data – Command 10003

Field Name	Type	Description
Max ping rate	f32	Specifies the $\frac{1}{minimum\ time}$ between two transmissions on the channel (Hz). 0 will hold back pings indefinitely. The first ping created by the ping count command will not be held back by Max Ping Rate=0.

11.87 10004 – SBES Channel Enable Mode

Description: Enable channel.

NOTE
Broadcast (Enumerator 0) only.

Table 214: 7500 Record Data – Command 10004

Field Name	Type	Description
Channels	u32	Each bit 1 for enable, 0 for disable. Bit n for channel n. Up to 32 channels.
Ping-pong	u32	0 - For firing all channels simultaneously. 1 - For cycling through enabled channels one at a time.

NOTE
Each ping is performed with the ping mode parameters coming from record 7500, 10010 Ping mode control.

11.88 10005 – SBES Transducer Selection Index

Description: Transducer index.

Table 215: 7500 Record Data – Command 10005

Field Name	Type	Description
Transducer index	u32	Index in the transducer table originally sent to the client in the system XML (record 7001)

11.89 10007 – System State and Operation Mode

Description: System state and operation mode.

Table 216: 7500 Record Data – Command 10007

Field Name	Type	Description
System State	u32	10 Standby state. (Mobilization)[1] 20 Hydrographic state. (Survey) 30 Dredge state (reserved) 40 Water column State (reserved)
Operation mode	u32	10 Standby Configuration (setup) 11 Test (Deck mode) 12 Bar Check 20 Hydrographic (Automatic) 21 Hydrographic (Semi automatic) 22 Hydrographic (Manual) 31 Dredge Auto (reserved) 40 Water column (Manual) 41 Water column (Automatic)

NOTE
Most configuration has to take place in state 10, including selection of transducers. Most configuration changes are rejected outside the configuration state. In State *Test (Deck Mode)*, Power is off (or very low).

11.90 10008 – SBES Tracker Tweak Modes

Description: Tracker tweak mode. The tracker tweaks defines how the user/client and tracker can change parameters.
One or mere tracker tweaks can be sent to the tracker to change the mode. Tracker will report the current tweak mode of all parameters when any of these change.

NOTE
Broadcast (Enumerator 0) only.

Table 217: 7500 Record Data – Command 10008

Field Name	Type	Description
Number of tweak modes	u32	

NOTE
This record will be extended with 8*u32 reserved fields just after Number of tweak modes in a subsequent release. It will not be backward compatible.

1

OD

Field Name	Type	Description
Tweak ID	u32	0 – Unused 1 – Range 2 – Gain 3 – Spreading 4 – Absorption 5 – Pulse length 6 – Power 7 – Pulse type 8 – Max Ping rate
Current mode	u32	0 – Tracker Control 1 – Fixed 1000 – Client Direct Control 1001 – Tracker control with Client Tweak

11.91 10014 – SBES Tracker Tweak Value

Description: Tracker tweak value.

Table 218: 7500 Record Data – Command 10014

Field Name	Type	Description
Tweak ID	u32	0 – Unused 1 – Range 2 – Gain 3 – Spreading 4 – Absorption 5 – Pulse length 6 – Power
Tweak value	f32	Typically -5 to 5. The actual system effect is defined in the system XML in record 7001, so all the user needs to know is the tweaking direction.

11.92 10016 – Detection Gate

Description: This command sets the detection gate. The bottom detect will not find or return seabed outside the range from min to max. Only auto mode is supported.

Table 219: 7500 Record Data – Command 10016

Field Name	Type	Description
Min Gate	f32	In meters
Max Gate	f32	In meters
Gate Mode	u32	0 auto

11.93 10020 – SBES Serial Port Configuration

Description: This command sets the configuration of a single port in the systems internal port list.

Table 220: 7500 Record Data – Command 10020

Field Name	Type	Description
Port index	u32	Index in the port list
Flags	u16	Bit 1: 0=Not Configured 1=Configured Other bits must write as 0
Reserved	u16	
System function[See Note]	u64	Flag register each bit signals a sensor value retrieved from the port. Bit0 is LSB. Bits: 0 - Time 1 - RESERVED 2 - Latitude 3 - Longitude 4 - Height 5 - Heading 6 - Roll 7 - Pitch 8 - Heave 56 - Channel 1 depth 57 - Channel 2 depth
Phy setting	u32	0 - RS232 1 - RS422 2 - RS485
Baud rate	u32	Actual baud rate. See record 100061.
Data bits	u32	Valid values 7 and 8 bits
Stop bits	u32	1 - 1 stop bit 2 - 2 stop bits
Parity	u32	0 - No parity 1 - Odd 2 - Even
SentenceIndex0	u32	Index of sentence in the list of available decoders. 255 - no sentence. Up to 4 sentences can be associated with each port.
Reserved	u32 * 3	
LabelOnBox	c8 * 32	No effect. 0 terminated string.

NOTE
The current values can be read requesting record 10060. System function: For serial input bit 56-63 must be set to 0. For serial output formats bit 0 to 32 must be set to 0. For serial output formats with just one depth, only bit 56 or bit 57 may be set to 1. For serial output formats with variable number of depths, bit 56, 57 or both may be set to 1. For serial output formats with fixed 2 depths, both bit 56 and bit 57 must be set to 1. A configured port needs to be enabled to be included in record 10060.

11.94 10021 – SBES Sensor Port List Management

Description: This command manages the ports in the sensor port list. It contain simple management commands including the ability to get a port configuration. To set a port configuration use remote command 7500, 10020.

Table 221: 7500 Record Data – Command 10021

Field Name	Type	Description
Port index	u32	Index in the port list
Port command	u32	0 – Enable 1 – Disable 2 - Remove

11.95 10022 – TimeSync Source Enable

Description: Specify which time source that may be used for synchronizing the SBES. A time source will only be used if it is both configured (using 7500,10023) and works as a valid time source providing time corrections.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
No	No	Yes	No

Table 222: 7500 Record Data – Command 10022

Field Name	Type	Description
Source ID	u32	1=ZDA_PPS 2=NTP 4=UIPC
Command	u32	0=disable 1=enable.

11.96 10023 – Ethernet Time Source Configuration

Description: Configure an internet based time source (NTP or UI PC). In order to use a time source it must both be configured and enabled and provide actual time corrections.

Control			
Subscription:	Single Record Request	Enumerator 0	Enumerator 1..n
No	No	Yes	No

Table 223: 7500 Record Data – Command 10023

Field Name	Type	Description
Source ID	u32	Either: 2=NTP 4=UIPC
Source Name	32x u8	The host name or other string to designate the Time Source. 0-terminated.
Source IP	u32	IP v4 address of the source. 0 if not enabled.

11.97 10024 - SBES UDP Port Configuration Command

Description: This command sets the configuration of a single port in the systems internal port list.

Table 224: 7500 Record Data – Command 10024

Field Name	Type	Description
Port index	u32	Corresponds to a port number. 256 to 258 is supported.
Group IP	u32	IP for the group.
Port	u16	UDP port
Flags	u16	Bit 1: 0 - Not configured 1 - Configured Other bits must write as 0
SentenceIndex0	u16	Index of sentence in the list of available decoders. 255 - no sentence.
Reserved	u16	
DepthChan	u32	0 = Channel A 1 = Channel B

12 BLUEVIEW DATA FORMAT DEFINITION

The BlueView ProScan software uses the RESON 7K data format with the definitions and conventions as specified earlier in this document.

There are five types of network data records provided by the MB Sonar/ProScan software system. They are the Sonar Configuration record, the Multibeam Configuration record, the Bathymetry record, the Pan/Tilt Configuration record, and the Pan/Tilt Position record.

NOTE
The record definitions defined in this DFD version applies for ProScan version 3.12 and higher. Refer to DFD version 2.40 for the definition of records which applies for ProScan version 3.11 or lower.

There are small differences for the network frame as specified in section 7 and the Data Record Frame as specified in section 6 compared to BlueView.See the below sections for the BlueView frame specifications and the record definition.

12.1 BlueView Network Frame Format

The following table lays out the format for the Network Frame.

Name	Data Type	Description
Protocol version	u16	Identifies the version of this record.
Offset	u16	Offset in bytes to the start of the Data Type Header from the start of this Network Frame.
Reserved	u32	Reserved
Reserverd	u16	Reserved
Reserved	u16	Reserved
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).
Reserved	u32	Reserved
Reserved	u32	Reserved
Reserved	u16	Reserved
Reserved	u16	Reserved
Reserved	u32	Reserved

12.2 BlueView Data Record Frame

The following table lays out the format for the Data Record Frame

Name	Data Type	Description
Protocol version	u16	Identifies the version of this record.
Offset	u16	Offset in bytes from the start of the Sync Pattern to the start of the Data Container.
Sync Pattern	u32	0x0000FFFF
Data Size	u32	Size of the DTH and Data Container portion of the network record.
Reserved	u32	Reserved
Reserved	u32	Reserved
7KTIME	u8*10 (7K Time)	Timestamp indicating when data was generated.
Record version	u16	Version of the specified record
Record Type Identifier	u32	Identifies the kind of data stored in the Data Container. The legal values are: 7000: Sonar Configuration 7004: Multibeam Configuration 7006: Bathymetry 5835: Pan/Tilt Configuration 5836: Pan/Tilt Position
Device Identifier	u32	ProScan device identifier
Reserved	u16	Reserved
Reserved	u16	Reserved
Reserved	u32	Reserved
Flags	u16	BIT FIELD: Bit 0:Checksum 0 – Invalid checksum 1 – Valid checksum Bit 1-14: Reserved (must be zero) Bit 15: 0 – Live data 1 – Recorded data
Reserved	u16	Reserved
Reserved	u32	Reserved
Reserved	u32	Reserved

Name	Data Type	Description
Reserved	u32	Reserved
DATA SECTION	Variable	Payload of the network record.
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.

12.3 7000 Sonar Configuration Container format

Description: This record contains the current sonar settings. For every sonar ping, the Sonar Configuration record is transmitted.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 225: 7000 – Record Type Header

Name	Data Type	Description
Sonar Serial Number	u64	Identifies sonar.
Ping Number	u32	Identifies a particular ping.
Reserved	u16	Reserved
Frequency	f32	Transmit frequency in Hertz
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	u32	Reserved
Reserved	u32	Reserved
Reserved	f32	Reserved
Reserved	u32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Maximum Range	f32	Maximum Range setting in meters
Reserved	f32	Reserved
Reserved	f32	Reserved

Name	Data Type	Description
Reserved	u32	Reserved
Reserved	u32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	u32	Reserved
Reserved	f32	Reserved
Reserved	u32	Reserved
Reserved	u32	Reserved
Reserved	u32	Reserved
Reserved	f32	Reserved
Reserved	u32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	f32	Reserved
Reserved	u16	Reserved

12.4 7004 Multibeam Configuration Container Format

Description: This record contains the receive beam widths and steering. For every sonar ping, the Multibeam Configuration is transmitted.

Data definition:

DRF	RTH	RD	OD	DRF

Table 226: 7004 – Record Type Header

Name	Data Type	Description
Sonar Serial Number	u64	Identifies sonar.
Number of Beams	u32	Number of receiver beams.
Reserved	f32 * Number of Beams	Reserved
Beam Bearing Angle	f32 * Number of Beams	The bearing, in +/- radians, from the center of the sonar for each beam.
Reserved	f32 * Number of Beams	Reserved
Reserved	f32 * Number of Beams	Reserved

12.5 7006 Bathymetry Container Format

Description: This record contains the bottom detection results. For every sonar ping, the Bathymetry network record is transmitted.

Data definition:

DRF	RTH	RD	OD	DRF

Table 227: 7006 – Record Type Header

The following table lays out the format for the Bathymetry container.

Name	Data Type	Description
Sonar Serial Number	u64	Identifies sonar.
Ping Number	u32	Identifies a particular ping.
Mult-Ping Sequence	u16	If not zero, then this is the sequence number of the ping in the multi-ping sequence.
Number of Beams	u32	Number of receiver beams.
Reserved	u8	Reserved
Sound Velocity Source	u8	Identifies source of sound velocity. 0 = Measured

		1 = Manually Entered
Sound Velocity	f32	Sound velocity in meters/second
Range	f32 * Number of Beams	Two-way travel time in seconds
Range Quality	u8 * Number of Beams	Indicates where ranges are valid. 0x07 = Valid 0x06 = Invalid
Reserved	f32 * Number of Beams	Reserved
Start Range Window	f32 * Number of Beams	Two-way travel time in seconds
Stop Range Window	f32 * Number of Beams	Two-way travel time in seconds

12.6 5835 Pan/Tilt Configuration Container Format

NOTE
Refer to Appendix H - Data Transformations (BlueView) - for a description of how to populate the function coefficients and arguments based on the values in the PanTilt Configuration record and the PanTilt Position record.

Description: This record contains the pan/tilt configuration parameters. For every sonar ping, the Pan/tilt Configuration record is transmitted.

Data definition:

DRF	RTH	RD	OD	DRF

Table 228: Record Type Header

The following table lays out the format for the Pan/Tilt Configuration container. The size of the complete record, i.e., Network Frame, Data Record Frame, and PanTiltCalibration, is 323 bytes.

Name	Size	Description
Version Number	u16	Version number of this record format.
Sonar ID	u64	Sonar Serial number
Head ID	u16	Specific Head on the sonar
Manufacturer	u8 * 80	Pan/Tilt Manufacturer
Model	u8 * 80	Pan/Tilt Model
Tilt Elbow Offset	f32	Length in meters from tilt axis to sonar central axis (See Figure 13-2: Pan/Tilt Offsets

Name	Size	Description
Pan Arm Offset	f32	Length in meters from pan axis to sonar acoustic center (See Figure 13-2: Pan/Tilt Offsets
Tilt Axis Offset	f32	Length in meters from Pan/Tilt unit base to tilt axis (See Figure 13-2: Pan/Tilt Offsets
Head Roll Orientation	f32	Roll angle in degrees of the head about P/T Base Y axis. In most cases, a guide pin directs the head to the0 degree roll angle.
Pan Calibration Position	f32	Raw degrees reported by the pan/tilt base motor at "calibrate" position
Tilt Calibration Position	f32	Raw degrees reported by the pan/tilt elbow motor at "calibrate" position
Is Scanning	u8	If the Pan/Tilt is performing a scan 0 = Stationary 1 = Scanning 2+ = Reserved If 1 the following 4 fields are valid:
Scan Pan start Raw Angle	f32	Raw degrees reported by the pan/tilt base
Scan Pan Stop Raw Angle	f32	raw degrees reported by the pan/tilt base
Scan Tilt Start Raw Angle	f32	If a spherical scan*, the first tilt angle to use raw degrees reported by the pan/tilt elbow
Scan Tilt Stop Raw Angle	f32	If a spherical scan*, the last tilt angle to use raw degrees reported by the pan/tilt elbow

*The start and stop angles tilt angles will be the same if this is a single (i.e., non-sperical) scan.

12.7 5836 Pan/Tilt Position Container Format

NOTE
Refer to Appendix H - Data Transformations (BlueView) - for a description of how to populate the function coefficients and arguments based on the values in the PanTilt Configuration record and the PanTilt Position record.

Description: This record contains the position readings of the pan/tilt unit. For every sonar ping, the Pan/tilt Position record is transmitted.

Data definition:

DRF	RTH	RD	OD	DRF

Table 229: Record Type Header

The following table lays out the format for the Pan/Tilt Position container. The size of the complete record, i.e., Network Frame, Data Record Frame, and Pan/Tilt Position, is 132 bytes.

Name	Size	Description
Version Number	u16	Version number of this record format.
Sonar ID	u64	Sonar Serial number
Head ID	u16	Specific Head on the sonar
Ping number	u32	
Pan Position	f32	Degrees about P/T Base Z-axis (right handed)
Tilt Position	f32	Degrees about P/T Base X-axis (right handed)
Reserved	f32	Reserved

13 FREQUENTLY ASKED QUESTIONS

13.1 7kCenter

Q: How does 7kCenter handle connections from multiple clients?

A: If two clients connect on port 7000 then they get a different local port number, and will be handled separately by 7kCenter.

Q: Are Acknowledge / Not Acknowledge guaranteed to only be returned on the channel that requested them?

A: ACK and NAK are only sent to the client that issued the remote control command (7500 sub record).

Q: Is it a problem to send multiple commands before the first one has returns a reply, or are they just queued?

A: Commands are queued. You don't need to wait for the ACK/NAK reply.

Q: We often power on the sonar sub-sea and start sending commands; is there a particular initialization sequence we need to get through?

A: If you have normalization at start-up enabled then the system will be locked during normalization. All commands will fail with a NAK reply with error code REMOTE_COMMAND_DENIED.

Q: What can change the sonar's state other than a 7500 record from our interface software?

A: Only the normalization at start-up will temporarily change the state. After that, it will only react to external commands.

Q: It might help to lock out the sonar with a 1503 "Reserved for system lock" command, but it's undocumented. What are the semantics for that?

A: The system lock is currently only used internally to lock everyone out while the system is normalizing. This is so that nothing can change the sonar settings while the system is running through the various gain steps.

Q: If system A locks the sonar, can system B force-unlock it?

A: Only the client that locked the system can unlock it.

Q: Are there circumstances in which the sonar will spontaneously change max range, e.g., as a result of an error or something?

A: The Tracker can change the range when it is enabled.

Q: The legacy UI seems to update some parameters with a system ID of 7000, some with 7125 but always a system enumerator of 0, and some with the correct device ID and system enumerator for whichever system is pinging. Do some commands apply globally to all enumerated devices controlled by a given 7kCenter instance? Which ones?

A: ID 7000 addresses the 7kCenter itself (e.g. when single record requesting record 7001). It is not checked. You can always use the device ID of the system (7125 in your case). You should use the device ID from the 7001 record (XML configuration).

Enumerator 0 addresses all sub-systems (e.g. the dual frequencies 200 and 400 kHz on 7125). On an integrated dual head system (e.g. T50 IDH) it will address both heads. The enumerator can then be used to send commands to one specific head via enum 1 and 2.

Q: Is the idea of subscribing to 7007 vs 7018 vs 7027 vs 7028 independent of internal SSP processing? Will processing time be cut down internally if I only want 7027, or is all processing for all types always happening but only what I subscribe to (or individually query) is sent to me?

A: Only subscribed records are actually created. So yes, it would cut down on processing inside 7kCenter. Bottom detection is by far the heaviest thing to compute, though.

13.2 Records

Q: Can we instead of using the 'Beam horizontal direction angle[N]' field of the 7004 record he 'Horizontal receiver beam steering angle' field of the 7503 record?

A: The 7503 record with Beam Horizontal direction angle cannot be used instead of the Beam horizontal direction angle of the 7004. The 7004 contains an angle per beam while 7503 contains one angle for the array

Q: We have some data from Isis that only has 7006 and 7503 records, we cannot find any 7004 records. Why?

A: In the Triton Isis implementation the 7004 data is attached to 7006 record, you cannot find the 7004 record header.

Triton Isis description:

Bathy (Reson 7006):
XTFPingHeader
Reson 7006 record starting with the DRF:
Data Record Frame (DRF)
Record Type Header (RTH)
Record Data (RD) which consists of:
the array of 4 byte floating point travel times,
the array of 1 bytes quality flags
the array of 4 byte floating point intensity values
the array of 4 byte floating point Min TWT
the array of 4 byte floating point Max TWT

Appended to the 7006 data is the 7004 data:
SonarID 64 byte integer, N number of samples 32 byte integer followed by four arrays of N 4 byte floating point numbers.

Q: Can you send all reference data via UDP to port 7000?

A: Yes you can.

Q: Will the 7001 record telling me which configuration is used the 200 kHz (TC2163) or the 400 kHz (TC2160).

A: Yes, the 7001 record contains the configuration XMLs of all system enumerators detected by AutoConfig. E.g. 200 kHz and 400 kHz configurations.

Q: If I use Tracker, it seems it could be enabled by the 1014 or 1042 message. Is that true?

A: Use the 1402 command to configure which parts of Tracker you want to use. You can do this once (e.g. from the Sonar UI). Then use the 1014 command to enable the Tracker as a whole.

Q: Is the only way to verify that Tracker is enabled in the 7504 message? If it's enabled then if I query status for range, tx power, etc., will I see what Tracker is setting these to in real time?

A: Yes, the 7504 record contains the system mode field with the Tracker mode. The actually applied sonar settings are in the 7000/7503 record for each ping. If you subscribe to the 7500 record then you will receive the commands that Tracker sends to control range, power, gain, etc.

Q: In the 7125 we used 1100 to enable pinging. We want to synch pinging to the input trigger so would I send 1100 & 1114 together, or initially set 114 then later just use 1100/1101 to enable/disable pinging?

A: Send only the 1114 command to enable external trigger. Sending 1100/1101 will disable external trigger.

Q: If I just have the one 200 kHz projector installed, do I never need to use the Set Frequency (1011) command?

A: Yes, the 200 kHz projector does not have a variable frequency.

13.3 Sonar data collection

Q: Each file I save starts with record 7200. If I subscribe will it be sent to me very often? Should I just query once when I start a new file?

A: You cannot subscribe to the 7200 record. The raw data recorder automatically writes it at the start of each .s7k file.

Q: Each file I save is terminated with record 7300. If I subscribe will it be sent to me very often? Should I just query once when I start a new file?

A: You cannot subscribe to the 7300 record. The raw data recorder automatically writes it at the end of each .s7k file.

Q: If I want raw bathy data I'd subscribe to 7027, but 7011 is also required? I would put both of these into the file? Is 7011 (Image Data) the record that will contain segmented and sequence numbered data?

A: You only need 7027 for the bathy data. You only need 7011 to display a wedge image. It is rather large.

Q: Does 7004 also need to be stored to the data file? How often?

A: No, 7027 contains all the info needed for bathy. You only need 7004 in combination with 7011 to display a wedge image.

Q: I read that order of data stored in a file is not guaranteed. If I get sequence numbered segments out of order (maybe due to TCP retries), would I just store them to the file as I get them?

A: The order of the ping records is guaranteed to be in the correct sequence order. It might be that some navigation data records are inserted between the various ping records, though.

Q: If a sequence number is lost does it break how playback works at all? It will just look like a glitch in the playback?

A: Incomplete or missing ping data is skipped when playing back.

13.4 Simulation

Q: Can we use the 7kCenter for simulation instead of hardware?

A: Yes, the 7kCenter can generate simulated sonar data. All testing can be done except the BITE in simulation. Either interactively, or by playing back a .s7k file using -sim"filename.s7k" (no space). The 7kCenter simulator usage is associated with 7000 message's Control Flags field, bit 31.

13.5 System

Q: what systems support Doppler compensation?

A: The 7122 and 7123 systems supports Doppler compensation, the current sonars do not.

Q: Why is LAN2 IP address range so limited?

A: The possible fixed IP range is limited, to ensure that a system will revert to this IP setting after a power cycle, it is to ensure that the system can always be connected to, if the IP setup was incorrect, the IP can be in any range, if you have a DHCP service available, and set it up to pick automatic IP.

Q: What do I have to worry about if powering up the SSP in air for dev/test purposes?

A:

1. If the projector is connected (required for the AutoConfig routine during first power, will remember last detected valid configuration, until a reset to factory defaults/reset sonar settings is applied) the projector can overheat if any power is transmitted over a longer period of time.
2. SSP can run in deckmode for hours, but out of deckmode, it is only possible to run it for 45 minute to 1½ hours before it will do a graceful shutdown, due to the poor thermal transfer from the body of the SSP to the surrounding air.
3. Receiver unit will run hot after approximately 1½-2 hours, and stop producing sample data, thus stopping the system, from working. Same thermal reason as for the SSP.
4.

Q: If I should forward GPS messages directly to SSP (not converting to 7400 message), will the SSP align ZDA and/or RMC with 1PPS?

A: Only when you use IO Module for clock sync.

Q: If we do not send time messages (if we're submerged and getting no GPS time messages), will the SSP be in a free running mode, then adjust itself later when it again gets time information?

A: Yes, when using IO Module.

Appendix A TELEDYNE PDS OPTIONAL DATA

The following tables show optional data created by Teledyne PDS when the S7K file is logged by, or exported from Teledyne PDS.

NOTE
The information in an s7k file logged in 7k Center and an s7k file logged in acquisition software package (in this case PDS) is different. 7k Center is using the sensor data; PDS is using reference point data.

Use tables to maintain compatibility with Teledyne PDS.

NOTE
See the data record frame definition (page 11). The optional data is a standard feature of the data record frame, the optional data pointer is set when there is optional data.

A.1 Optional data 7006 record

Table 230: 7006 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, south negative
Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Height source	u8	Method used to correct to chart datum. If height source = 1, then Tide = '0'. 0 – None 1 – RTK 2 – Tide
Tide	f32	In meters
Roll	f32	Roll (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
The following set of data items are repeated for each beam:		
Beam 0 – Depth	f32	Depth relative chart datum (or relative waterline if Height source = 0) (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

A.2 Optional data 7007 record

Table 231: 7007 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, south negative
Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Depth	f32	Nadir depth for slant range correction in meters

A.3 Optional data 7008 record

Table 232: 7008 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in Radians -π/2 to π/2, south negative
Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Following set of data items is repeated for each beam:		
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

A.4 Optional data 7027 record

Table 233: 7027 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, south negative
Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Height source	u8	Method used to correct to chart datum. If height source = 1, then Tide = '0'. 0 – None 1 – RTK 2 – Tide
Tide	f32	In meters
Roll	f32	Roll (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
The following set of data items are repeated for each beam:		
Beam 0 – Depth	f32	Depth relative chart datum (or relative waterline if Height source = 0) (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

A.5 Optional data 7028 record

Table 234: 7028 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, south negative
Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Following set of data items is repeated for each beam:		
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

A.6 Optional data 7047 record

Table 235: 7047 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, south negative
Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Height source	u8	Method used to correct to chart datum. If height source = 1, then Tide = '0'. 0 – None 1 – RTK 2 – Tide
Tide	f32	In meters
Roll	f32	Roll (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
The following set of data items are repeated for each beam:		
Beam 0 – Depth	f32	Depth relative chart datum (or relative waterline if Height source = 0) (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

A.7 Optional data 7057 record

Table 236: 7057 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, south negative

Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Depth	f32	Depth for slant range correction in meters

Optional data 7058 record:

Table 237: 7058 – Optional Data

Name	Size	Description
Frequency	f32	Ping Frequency in Hz
Latitude	f64	Latitude of vessel reference point in radians -π/2 to π/2, south negative
Longitude	f64	Longitude of vessel reference point in radians -π to π, west negative
Heading	f32	Heading of vessel at transmit time in radians
Following set of data items is repeated for each beam:		
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

A.8 Optional data 7400 record

Table 238: 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 External time in milliseconds
IO Module status	u16	IO Module synchronization status

Appendix B DEVICE IDENTIFIERS

The Data Record Frame requires a Device Identifier parameter. The table below provides the list of valid Device Identifiers and their descriptions.

Table 239: Device Identifiers

Identifier	Vendor	Description
20	RESON	Single head SeaBat™ T20-P & SeaBat™ T20-S
22	RESON	Integrated dual head SeaBat™ T20-R
30	RESON	SeaBat™ F30
50	RESON	Single head SeaBat™ T50-P & SeaBat™ T50-R
52	RESON	Integrated dual head SeaBat™ T50-R
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
1000	Odom	Odom MB1
1001	TrueTime	PCISG
1002	Odom	Odom MB2
2000	CDC	SMCG
2001	CDC	SPG
2002	Empire Magnetics	YS2000 Rotator
4013	RESON	TC4013
6000	RESON	DiverDat
7000	RESON	7k sonar source
7001	RESON	7k User Interface
7002	RESON	SBES User Interface
7003	RESON	Teledyne PDS
7004	RESON	7k Logger
7005	BlueView	BlueView ProScan This ID is also used by Teledyne PDS when exporting a SON bathy / profile set to s7k format.
7012	RESON	SeaBat™ 7012
7100	RESON	SeaBat™ 7100
7101	RESON	SeaBat™ 7101
7102	RESON	SeaBat™ 7102

Identifier	Vendor	Description
7111	RESON	SeaBat™ 7111
7112	RESON	SeaBat™ 7112
7123	RESON	SeaBat™ 7123
7125	RESON	SeaBat™ 7125
7128	RESON	SeaBat™ 7128
7130	RESON	SeaBat™ 7130
7150	RESON	SeaBat™ 7150
7160	RESON	SeaBat™ 7160
8100	RESON	SeaBat™ 8100
8101	RESON	SeaBat™ 8101
8102	RESON	SeaBat™ 8102
8111	RESON	SeaBat™ 8111
8123	RESON	SeaBat™ 8123
8124	RESON	SeaBat™ 8124
8125	RESON	SeaBat™ 8125
8128	RESON	SeaBat™ 8128
8150	RESON	SeaBat™ 8150
8160	RESON	SeaBat™ 8160
9000	Teledyne Odom	Echotrac E20
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
13000	NORBIT	Reserved for NORBIT
13001	NORBIT	Reserved for NORBIT
13002	NORBIT	NORBIT WBMS FLS 400kHz
13003	NORBIT	NORBIT WBMS Bathy 400kHz
13004	NORBIT	NORBIT iWBMS
13005	NORBIT	NORBIT Bathy 400kHz Compact
13006	NORBIT	Reserved for NORBIT
13007	NORBIT	NORBIT WBMS Bathy 200kHz

Identifier	Vendor	Description
13008	NORBIT	NORBIT Bathy 400kHz
13009	NORBIT	NORBIT FLS DeepSea 400k
13010	NORBIT	NORBIT Bathy DeepSea 400k
13011	NORBIT	NORBIT Bathy DeepSea 200k
13012	NORBIT	NORBIT iLIDAR
13016	NORBIT	NORBIT Bathy STX 400kHz
13017	NORBIT	NORBIT Bathy STX 200kHz
13018	NORBIT	NORBIT iWBMSe
13019 - 13099	NORBIT	Reserved for NORBIT
14000	RESON	HydroSweep 3 DS
14001	RESON	HydroSweep 3 MD50
14002	RESON	HydroSweep 3 MD30
14003-14049	RESON	Reserved for HydroSweep 3
14050-14099	RESON	Reserved

NOTE
From DFD version 2.32 and higher has the T20-P a unique device identifier.

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 240: 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
25	Polar Azimuthal Equidistant

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

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

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

Appendix E EXAMPLE C++ SOURCE CODE

This appendix contains an example of C++ source code for interfacing with the 7k sonar source using the TCP/IP protocol. The below extract is from the example ZIP file delivered with this document.

```
// File: Example7k.cpp

#include "stdafx.h"
#include "Example7k.h"

#include <cstdio>
#include <cstdlib>
#include <cstring>


namespace
{
	const char NAME_START[] = "<Name";
	const char DEVID_START[] = "deviceid=\"";
	const char ENUM_START[] = "enumerator=\"";

#pragma pack(push, 1)
	struct R7500_1050
	{
		R7500 r7500;
		u32 record_type;
	};

	struct R7500_1051
	{
		R7500 r7500;
		u32 record_count;
		u32 record_types[2];
	};
#pragma pack(pop)
}


// The example connects to the sonar,
// request the XML configuration record (7001),
// subscribes to the raw detections record (7027) and image data (7011),
// and prints out the last detection and center pixel of each ping

void Example7k::Run(const char* host)
{
	if (!ConnectToCenter(host))
		return;

	RequestConfig();
	ReceiveLoop();
}
```

```
bool Example7k::ConnectToCenter(const char* host)
{
    return m_socket.Create() && m_socket.Connect(host);
}


void Example7k::RequestConfig()
{
    R7500_1050 r7500_1050 = {};
    r7500_1050.r7500.rc_id = 1050;  // Single Record Request
    r7500_1050.record_type = 7001;  // Configuration

    m_socket.SendRecord(7000, 0, 7500, &r7500_1050, sizeof(r7500_1050));
}


bool Example7k::ReceiveLoop()
{
    std::vector<u8> recordData;
    while (m_socket.ReceiveRecord(recordData))
    {
        const RECORD_FRAME* pFrame = GetFramePtr(recordData);
        if (!pFrame)
            break;

        size_t dataSize = 0;
        const u8* pData = GetDataPtr(recordData, dataSize);

        switch (pFrame->record_type)
        {
        case 7001:
            HandleConfig(pData, dataSize);
            break;

        case 7011:
            HandleImage(pData, dataSize);
            break;

        case 7027:
            HandleDetections(pData, dataSize);
            break;
        }
    }

    return true;
}


// Get device identifier and enumerator from the XML configuration,
// and subscribe to the raw detections (7027) record for each system
bool Example7k::HandleConfig(const u8* pData, size_t dataSize)
```

```
{
    size_t idx = 0;

    if (idx + sizeof(R7001) > dataSize)
        return false;
    const R7001* pR7001 = reinterpret_cast<const R7001*>(pData + idx);
    idx += sizeof(R7001);

    for (u32 i = 0; i < pR7001->systems; ++i)
    {
        if (idx + sizeof(R7001MODULEINFO) > dataSize)
            return false;
        const R7001MODULEINFO* pR7001Info =
            reinterpret_cast<const R7001MODULEINFO*>(pData + idx);
        idx += sizeof(R7001MODULEINFO);

        size_t infoLen = pR7001Info->info_length;

        if (idx + infoLen > dataSize)
            return false;
        const char* pInfo = reinterpret_cast<const char*>(pData + idx);
        idx += infoLen;

        if (infoLen == 0 || pInfo[infoLen - 1] != '\0')
            return false;

        // Get device id and enum from XML
        const char* pName = std::strstr(pInfo, NAME_START);
        if (!pName)
            continue;

        const char* pId = std::strstr(pName, DEVID_START);
        if (!pId)
            continue;
        u32 deviceId = (u32) std::atoi(pId + sizeof(DEVID_START) - 1);

        const char* pEnum = std::strstr(pName, ENUM_START);
        if (!pEnum)
            continue;
        u16 enumerator = (u16) std::atoi(pEnum + sizeof(ENUM_START) - 1);

        Subscribe(deviceId, enumerator);
    }

    return true;
}


void Example7k::Subscribe(u32 deviceId, u16 enumerator)
{
    R7500_1051 r7500_1051 = {};
    r7500_1051.r7500.rc_id = 1051;  // Record Subscription
    r7500_1051.record_count = 2;
```

```
    r7500_1051.record_types[0] = 7027;  // Raw Detections
    r7500_1051.record_types[1] = 7011;  // Image Data

    m_socket.SendRecord(deviceId, enumerator, 7500, &r7500_1051,
        sizeof(r7500_1051));
}


bool Example7k::HandleDetections(const u8* pData, size_t dataSize)
{
    size_t idx = 0;

    // The size of the 7027 header part is fixed
    if (idx + sizeof(R7027) > dataSize)
        return false;
    const R7027* p7027 = reinterpret_cast<const R7027*>(pData + idx);
    idx += sizeof(R7027);

    // The size of the 7027 data parts is specified in the header
    // so that fields may be added in the future
    // We have to be able to deal with shorter (older) versions,
    // and longer (newer) versions
    size_t r7027DataSize = p7027->data_size;
    size_t minSize = (std::min)(sizeof(R7027Data), r7027DataSize);

    R7027Data r7027Data = {};
    for (u32 i = 0; i < p7027->detections; ++i)
    {
        if (idx + r7027DataSize > dataSize)
            return false;
        const u8* p7027Data = pData + idx;
        idx += r7027DataSize;

        std::memcpy(&r7027Data, p7027Data, minSize);
    }

    // Print last detection of each ping
    std::printf("Ping %u, beam %u, sample %f\n",
        (unsigned) p7027->ping_number,
        (unsigned) r7027Data.beam_number,
        r7027Data.detection);

    return true;
}


bool Example7k::HandleImage(const u8* pData, size_t dataSize)
{
    size_t idx = 0;

    if (idx + sizeof(R7011) > dataSize)
        return false;
    const R7011* p7011 = reinterpret_cast<const R7011*>(pData + idx);
```

```
    idx += sizeof(R7011);

    size_t imageDataSize = p7011->width * p7011->height * p7011->color_depth;
    if (idx + imageDataSize > dataSize)
        return false;
    const u8* pImageData = pData + idx;

    if (p7011->color_depth != 1)
        return false;  // not supported

    // Print value of the center pixel
    size_t beamNo = p7011->width / 2;
    size_t sampleNo = p7011->height / 2;
    u8 pixel = pImageData[beamNo + p7011->width * sampleNo];
    std::printf("Ping %u, image center pixel = %u\n",
        (unsigned) p7011->ping_number,
        (unsigned) pixel);

    return true;
}




// File: TcpSocket7k.cpp

#include "stdafx.h"
#include "TcpSocket7k.h"

#include <cassert>

#include "7k.h"


namespace
{
    const int TCP_PORT_7K = 7000;
    const u32 MAX_PACKET_SIZE = 60000;
}


TcpSocket7k::TcpSocket7k()
    : m_socket()
    , m_nextTransmissionId(0)
{
}


bool TcpSocket7k::Create()
{
    return m_socket.Create(NetworkSocket::TYPE_TCP);
}
```

```
bool TcpSocket7k::Connect(const char* host)
{
    return m_socket.Connect(host, TCP_PORT_7K);
}


void TcpSocket7k::Close()
{
    m_socket.Close();
}


bool TcpSocket7k::SendRecord(u32 deviceId, u16 enumerator, u32 recordType,
        const void* pData, size_t dataSize)
{
    u32 recordSize = sizeof(RECORD_FRAME) + (u32) dataSize +
CHECKSUM_SIZE;
    u32 totalPackets = 1;
    u32 packetSize = sizeof(NETWORK_FRAME) + recordSize;

    // Splitting large records into multiple packets is not implemented here
    // because it is not needed for sending small commands
    assert(packetSize <= MAX_PACKET_SIZE);

    std::vector<u8> buffer(packetSize);
    u8* ptr = &buffer[0];

    NETWORK_FRAME* nf = reinterpret_cast<NETWORK_FRAME*>(ptr);
    nf->version = PROTOCOL_VERSION;
    nf->offset = sizeof(NETWORK_FRAME);
    nf->total_packets = totalPackets;
    nf->total_records = 1;
    nf->transmission_identifier = m_nextTransmissionId++;
    nf->packet_size = packetSize;
    nf->total_size = recordSize;
    nf->sequence_number = 0;
    nf->destination_device_identifier = 0;
    nf->destination_system_enumerator = 0;
    nf->source_system_enumerator = 0;
    nf->source_device_identifier = 0;
    ptr += sizeof(NETWORK_FRAME);

    RECORD_FRAME* rf = reinterpret_cast<RECORD_FRAME*>(ptr);
    rf->version = PROTOCOL_VERSION;
    rf->offset = sizeof(RECORD_FRAME) - SYNC_PATTERN_OFFSET;
    rf->sync_pattern = SYNC_PATTERN;
    rf->size = recordSize;
    rf->offset_optional = 0;
    rf->identifier_optional = 0;
    rf->time_stamp = TIME_7K();  // empty time stamp
    rf->records_version = RECORDS_VERSION;
```

```
    rf->record_type = recordType;
    rf->device_identifier = deviceId;
    rf->reserved1 = 0;
    rf->system_enumerator = enumerator;
    rf->record_count = 0;
    rf->flags = 0;  // no checksum
    rf->reserved2 = 0;
    rf->reserved3 = 0;
    rf->total_records = 0;
    rf->fragment_number = 0;
    ptr += sizeof(RECORD_FRAME);

    std::memcpy(ptr, pData, dataSize);
    ptr += dataSize;

    u32* pChecksum = reinterpret_cast<u32*>(ptr);
    *pChecksum = 0;

    ssize_t sentSize = m_socket.Send(&buffer[0], packetSize);
    return sentSize == (ssize_t) packetSize;
}


bool TcpSocket7k::ReceiveRecord(std::vector<u8>& recordData)
{
    NETWORK_FRAME nf;
    if (!ReceiveExact(&nf, sizeof(nf)))
        return false;

    if (nf.version != PROTOCOL_VERSION)
        return false;

    u32 totalPackets = nf.total_packets;
    u16 transmissionId = nf.transmission_identifier;
    u32 totalSize = nf.total_size;

    recordData.resize(totalSize);
    u8* pRecordData = !recordData.empty() ? &recordData[0] : 0;

    // Combine multiple packets into one large record
    size_t readSize = 0;
    for (u32 sequenceNo = 0; sequenceNo < totalPackets; ++sequenceNo)
    {
        if (sequenceNo > 0)
        {
            if (!ReceiveExact(&nf, sizeof(nf)))
                return false;

            if (nf.version != PROTOCOL_VERSION
                || nf.total_packets != totalPackets
                || nf.transmission_identifier != transmissionId
                || nf.total_size != totalSize)
            {
```

```
                return false;
            }
        }

        if (nf.sequence_number != sequenceNo || nf.offset != sizeof(nf))
            return false;

        size_t payloadSize = nf.packet_size - nf.offset;
        if (payloadSize > totalSize - readSize)
            return false;

        if (!ReceiveExact(pRecordData + readSize, payloadSize))
            return false;

        readSize += payloadSize;
    }

    if (readSize != totalSize)
        return false;

    return true;
}


bool TcpSocket7k::ReceiveExact(void* pBuffer, size_t size)
{
    char* pInBuf = static_cast<char*>(pBuffer);
    size_t toDo = size;

    while (toDo > 0)
    {
        ssize_t done = m_socket.Receive(pInBuf, toDo);
        if (done <= 0)
            return false;

        pInBuf += done;
        toDo -= (size_t) done;
    }

    return true;
}


const RECORD_FRAME* GetFramePtr(const std::vector<u8>& recordData)
{
    if (recordData.size() < sizeof(RECORD_FRAME))
        return 0;

    const RECORD_FRAME* rf =
        reinterpret_cast<const RECORD_FRAME*>(&recordData[0]);
    if (rf->sync_pattern != SYNC_PATTERN)
        return 0;
```

```
    if (rf->size != recordData.size())
        return 0;

    return rf;
}


const u8* GetDataPtr(const std::vector<u8>& recordData, size_t& dataSize)
{
    const RECORD_FRAME* rf = GetFramePtr(recordData);
    if (!rf)
        return 0;

    u16 dataOffset = rf->offset;
    u32 optionalOffset = rf->offset_optional;
    size_t recordSize = rf->size;
    if (recordData.size() < recordSize)
        return 0;

    size_t frameSize = SYNC_PATTERN_OFFSET + dataOffset;
    if (frameSize < sizeof(RECORD_FRAME))
        return 0;

    size_t optionalSize = 0;
    if (optionalOffset)
    {
        if (recordSize < optionalOffset - CHECKSUM_SIZE)
            return 0;
        optionalSize = recordSize - optionalOffset - CHECKSUM_SIZE;
    }

    if (recordSize < frameSize + optionalSize + CHECKSUM_SIZE)
        return 0;
    dataSize = recordSize - frameSize - optionalSize - CHECKSUM_SIZE;

    return &recordData[frameSize];
}
```

Appendix F HANDLING THE 7027 RECORD

F.1 USING THE 7K RAW DETECTION DATA

Refer to the 7027 record definition on page 90.

From sample number to range

The detection point is given as a sample number. Divide this value by the sampling rate to get the two way travel time from the sonar to the detection point. Use the applied soundvelocity for this ping (Record 7000 contains the sonar parameters) or a sv profile to convert the two way travel time to a range.

RX angle

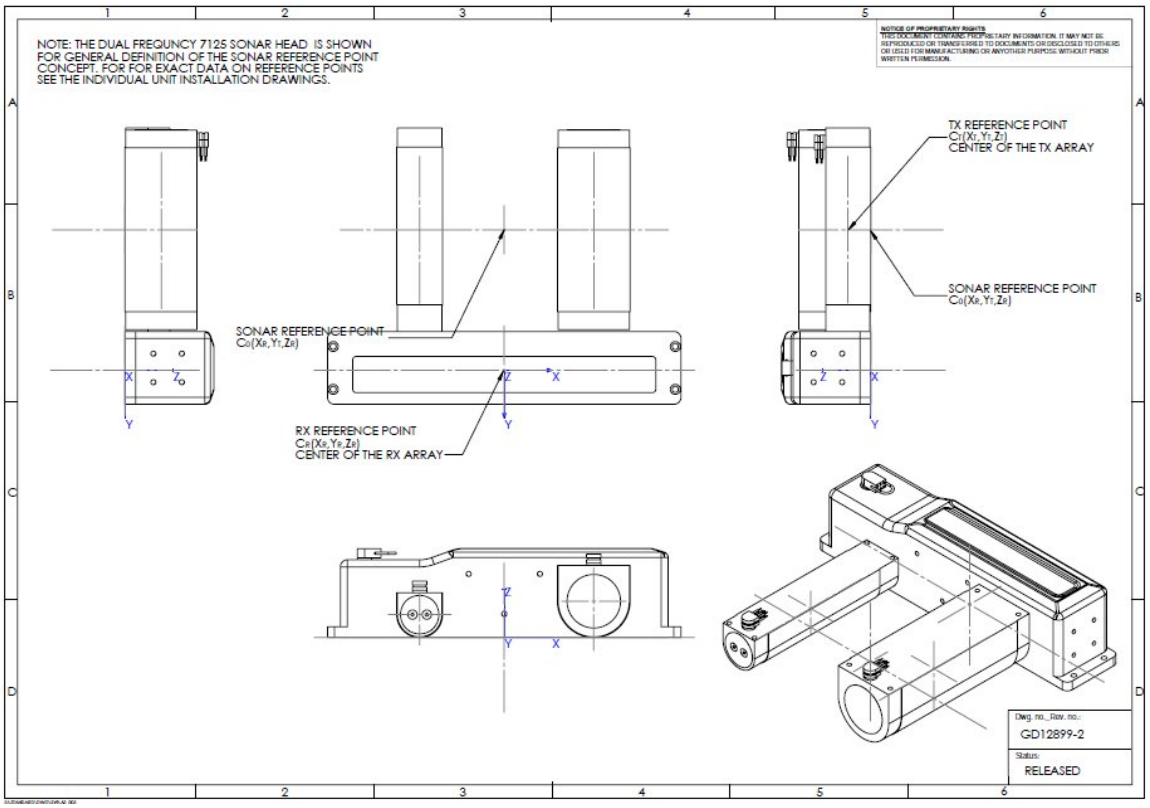
The receive steering angles are in the sonar reference frame and in that frame they represent the actual angle from the sonar reference point to the detection point. The steering applied for roll stabilization is included in the angle. This means that data processing software can use their ‘standard’ methods to convert the information to the vessel reference frame and subsequently to world coordinates. With standard methods referring to the handling of other RESON SeaBat systems outputting non roll stabilized data.

Beam uncertainty

This value is a real-time uncertainty and available per beam. These values can be used to feed into an error model instead of the a-priori error values typically used to compute a TPE. Will be available in MR7.2 release.

F.2 TX OFFSET CORRECTION

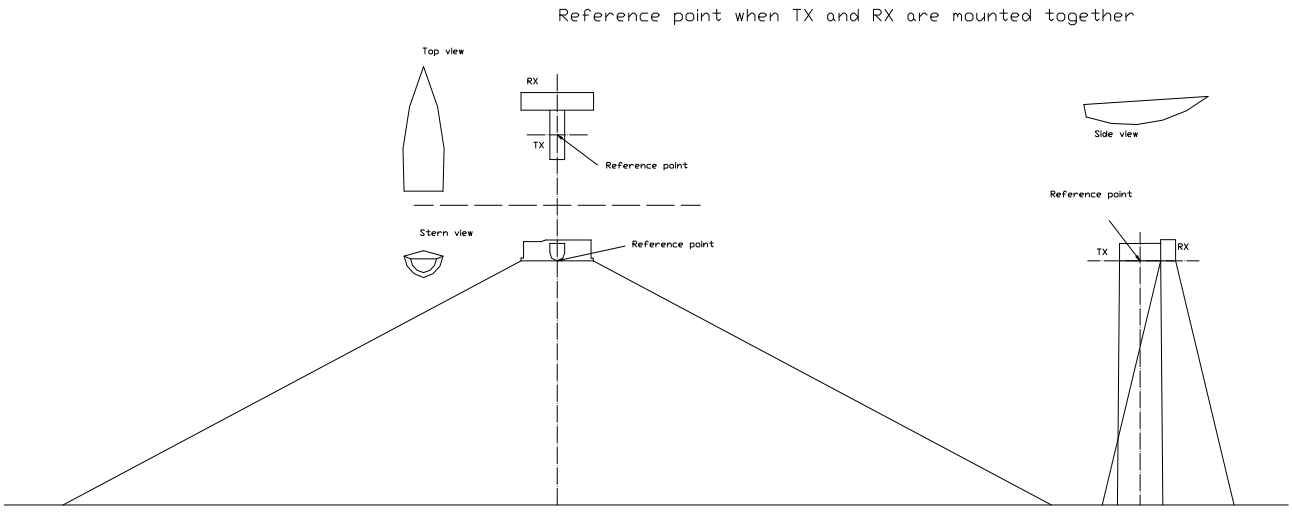
The sonar reference point is used to define the coordinate system to which sonar data is referred. The Sonar Reference Point X&Z coordinates are the same as the X&Z coordinates of the sonar receiver head reference point. The Y coordinate of the reference point is the same as the Y coordinate of the Tx array reference point. Thus the coordinates of the reference point of the sonar are C0(XR,YT,ZR).



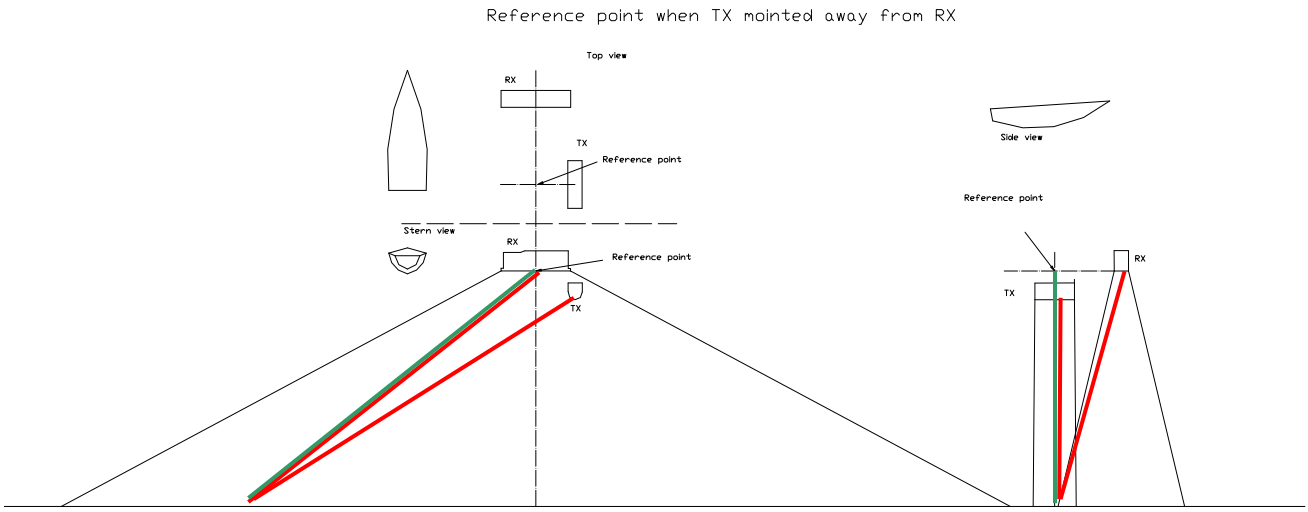
The Tx offset is defined as the separation of the projector (Tx) reference point from the receiver (Rx) reference point.

The Tx offset information is available from the sonar in a separate record (7503)

The along ship reference point (Y) of the sonar is determined by the Transmitter since this one illuminated the seafloor at the moment of the ping with a narrow across stripe of sound. The across (X) and height (Z) reference point is determined by the receiver because this one forms the narrow beam in a predetermined direction.



When we have a transducer configuration with separation between the RX and TX (bi-static configuration) we need to adjust the observed two-way travel time to the sonar reference point.

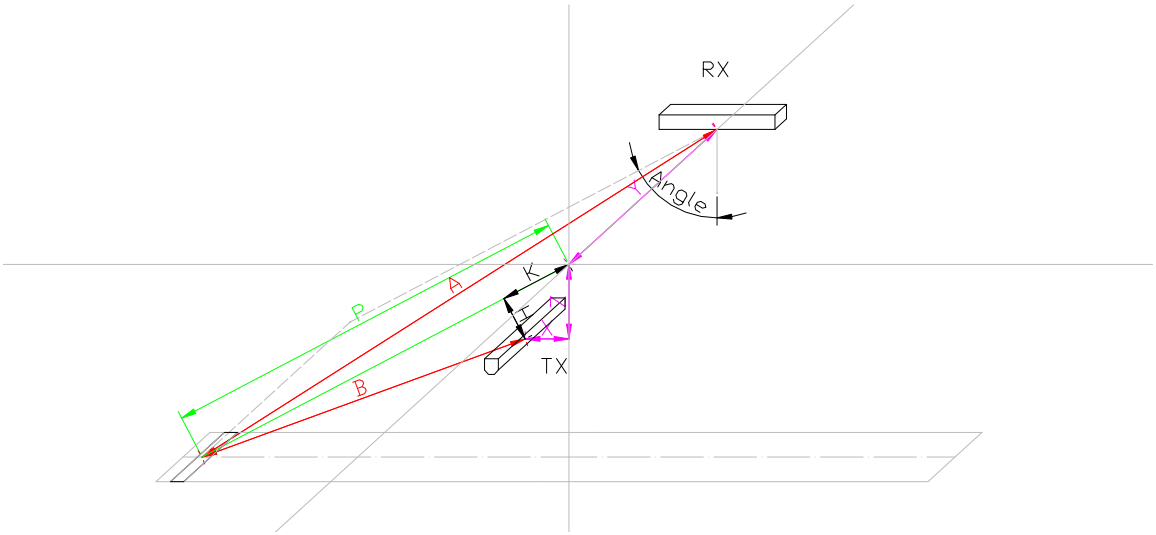


Red line: acoustic path of observation.

Green line: Reported two-way travel and beams angle relative reference point.

In the Teledyne PDS software the implementation of the Tx-offset correction is according the steps below.

- The Tx offset value is converted from sonar reference frame to vessel reference frame. Heave at transmit time is added.
- An Rx offset point in vessel reference frame is created using heave at receive time.
- From these two offset points a vector is created and split in a component in beam direction and a component perpendicular to the beam direction.
- An iteration method is used to compute a correction factor that is applied to the beam range (and two travel time).
- The iteration is illustrated in the diagram below



The algorithm description is based on range, and not two-way travel time.

Variable name	Description
X	X Offset of TX relative RX, positive when TX starboard of RX
Y	Y Offset of TX relative RX, positive when TX forward of RX
Z	Z Offset of TX relative RX, positive when TX above RX
Angle	Measured beam angle = 180 – 7K beam angle
R	Observed range (A+B)/2
A	RX to detection point
B	TX to detection point
K	Longitudinal offset of TX in beam direction relative ref.
H	Perpendicular offset of TX to beam
P	Corrected range

We want to compute the corrected range (P)

$H = X*\cos(angle)+Z*\sin(angle)$

$K = X*\sin(angle)-Z*\cos(angle)$

$\sqrt{(P^2 + Y^2)} + \sqrt{((P-K)^2 + H^2)} - 2*R = 0$

Since there is no direct solution to this equation we solve it with iteration.

The iteration will be started with best estimate

R = two-way travel time * Speed of sound / 2;

P=R

Only do the iteration when $\sqrt{(X^2+Y^2+Z^2)} < P$

D=0

Do

{

P = P-D/2

$$D = \sqrt{(P^2 + Y^2)} + \sqrt{((P-K)^2 + H^2)} - 2*R$$

}

While(|D| > 0.005)

Hereafter P will be the corrected range.

Corrected Two-way travel = P*2 / Speed of sound;

F.3 USING THE OPTIONAL DATA FROM 7027

The Optional data section of 7027 is the same as the optional data section of the 7006 record. The only difference being is that now only the valid beams are given.

The optional data is used in the CARIS version in use by Ifremer

The optional data is fully corrected for motion, sound velocity and Tx-offset. No additional corrections need to be applied to this data.

F.4 USING THE 'OLD' RECORDS WITH MR7

With the MR7 there is backwards compatibility for the 7006 bathymetry record. Third party software processing working according to SeaBat 7k DFD Version 0.54 will still be able to obtain that record.

Please be aware of the following:

- In case of roll stabilization it is not possible then to obtain the beam steering angles in the sonar reference frame. So the processing software should not perform a roll correction in that case. In situations where there is a sonar-IMU alignment error it will not be possible then to compensate for pitch induced roll.
- The Tx-offset correction also requires the beam steering angle in the sonar reference frame. The closest approximation is this situation is to apply the actual roll value to the beam angle based on the assumption that the sonar and the processing software work with the same roll values.

Appendix G WAKE ON LAN (WOL)

With wake on LAN (WOL), it is possible to switch on a remote computer by means of a special network package transmitted over a LAN network connection (not wireless). This package is known as ‘magic packet’.

The magic package consists of 102 bytes. It starts with 6 bytes of HEX 255 (FF FF FF FF FF FF) follows by 16 times the 48-bit MAC address of the remote computer.

The magic packet must be broadcasted.

The remote computer can be switched off; however, the network card should be ‘alive’ in order to wake up the computer.

Refer to external sources for more information about WOL such as Wikepedia. (http://en.wikipedia.org/wiki/Wake-on-LAN)

Appendix H DATA TRANSFORMATIONS (BLUEVIEW)

The Pan/Tilt base coordinate system, is the system that is used to report pan and tilt angles in record 5836. It is standardized on a right-handed coordinate system with a well-defined origin for this streaming spec. and for the pan/tilt SDK going forward.

Beam angles and detection ranges reported in the Multibeam Configuration record (7004) and the Bathymetric record (7006), respectively, are reported with respect to a two-dimensional polar axis system (i.e., R-Theta) fixed to the sonar head acoustic center. This axis system moves in space based on pan and tilt angle, vessel/tripod position and motion, sonar mounting configuration, and pan/tilt unit mounting configuration. The orientation contained in the PanTilt Configuration record and PanTilt Position record provides sufficient information to compute a function that maps a detection (beam angle and range) to a 3-dimensional point in an axis system fixed to the base of the pan/tilt unit. Once the transform function is produced, each detection may be mapped by a simple substitution of the detection's range and bearing into the function.

This section describes how to populate the function coefficients and arguments based on the values in the Pan/Tilt Configuration record and Pan/Tilt Position record. Note that the PanTilt Configuration record data entries are static throughout an entire scan, while the PanTilt Position record entries generally change per ping.

The following diagrams show the unit's base coordinate system and definition of lever arm offsets. In Figure 13-1, the sonar is oriented such that the Pan and Tilt positions would each be reported as 0° in the Pan/Tilt Position record

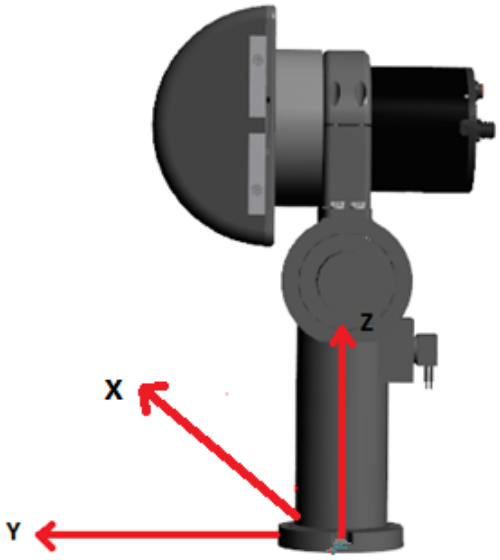


Figure 13-1: Pan/Tilt Unit Axes

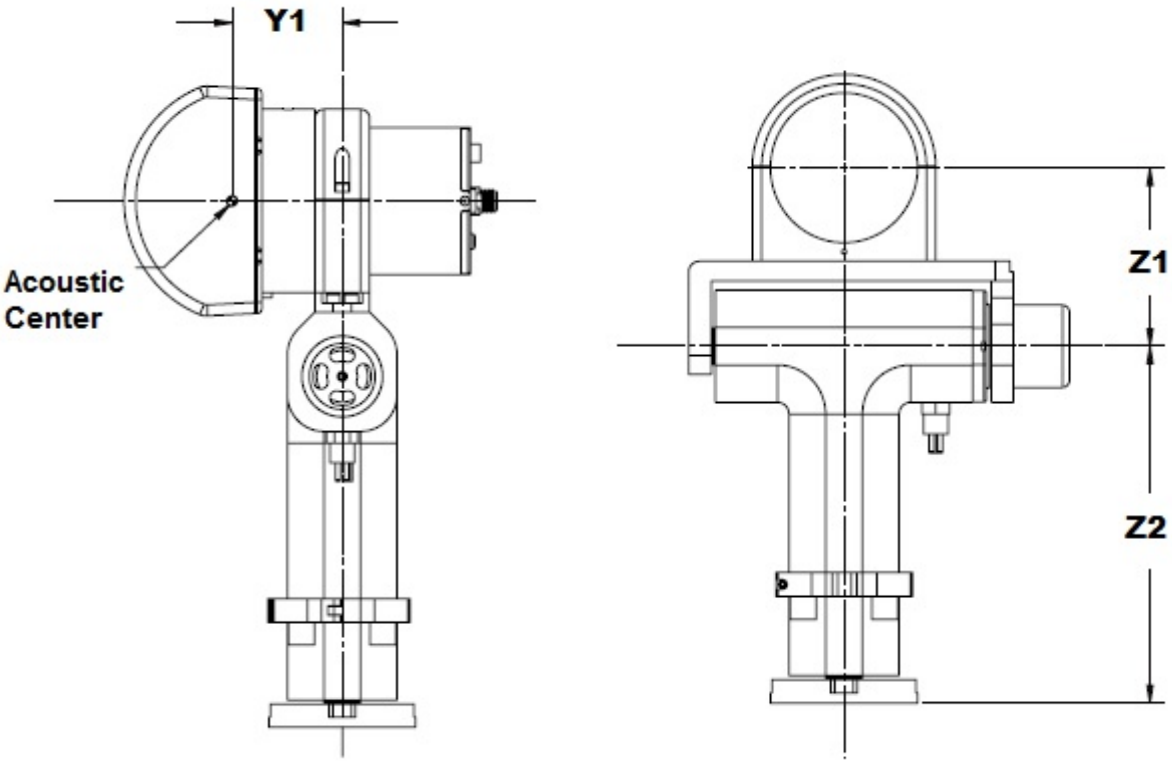


Figure 13-2: Pan/Tilt Offsets

NOTATION AND CONVENTIONS

The following table provides the notation and record data field names for all symbols in the output vector described below. All rotational axes have right-handed sign conventions with respect to the corresponding Pan/Tilt Base coordinate axes.

Table 241: Parameter Notation

Symbol	Description	Record ID	Record Field Name	Static/Dynamic over course of scan
c(·)	cosine	N/A	N/A	N/A
s(·)	sine	N/A	N/A	N/A
ϕ	Sonar head roll angle (typically 0° or 180°),	5835	Head Roll Orientation	Static
ψ_p	Pan angle	5836	Pan Position	Dynamic
ψ_t	Tilt angle	5836	Tilt Position	Dynamic
z_1	Length of tilt axis lever arm (see Figure 13-2)	5835	Tilt Elbow Offset	Static
z_2	Length from pan/tilt base to tilt axis (see Figure 13-2)	5835	Tilt Axis Offset	Static
y_1	Length of pan axis lever arm (see Figure 13-2)	5835	Pan Arm Offset	Static
r_i	Range to detection for beam *i*	7006	Range[i]	Dynamic
θ_i	Bearing to detection for beam *i*	7004	Beam Bearing Angle[i]	Static

DETECTION TRANSFORMATION EQUATION

The following equation provides a detection point in pan/tilt XYZ coordinates based on the static and dynamic geometric parameters provided in Table 241. The XYZ coordinate system is shown in Figure 13-1.

$$\begin{bmatrix} x_i \\ y_i \\ z_i \end{bmatrix} = \begin{bmatrix} c(\psi_t)s(\psi_p)(-r_i c(\theta_i) - y_1) + z_1 s(\psi_p)s(\psi_t) - r_i s(\theta_i)(s(\phi)s(\psi_p)s(\psi_t) - s(\phi)c(\psi_p)) \\ c(\psi_t)c(\psi_p)(r_i c(\theta_i) + y_1) - z_1 c(\psi_p)s(\psi_t) - r_i s(\theta_i)(c(\phi)c(\psi_p)s(\psi_t) - s(\phi)s(\psi_p)) \\ r_i(c(\theta_i)s(\psi_t) - c(\psi_t)c(\phi)s(\theta_i)) + z_1 c(\psi_t) + y_1 s(\psi_t) + z_2 \end{bmatrix}$$

Derivation details for the equation above are provided in the whitepaper *BlueView Pan/Tilt Kinematics*, which is available upon request.

COMPUTATIONAL EFFICIENCY

The vector equation above must be computed once for each detection in each ping, which quickly becomes a computational burden for systems with high ping rates and/or many detections per ping. Some simple optimizations can help computational efficiency to great effect. It is suggested that trigonometric functions of dynamic values are computed just once per sonar ping and cached as local variables since they each arise multiple times in the vector function. Similarly, multiplicative combinations appearing in many of the terms can be precomputed per ping for computational efficiency. Of course, the equation is executed in a loop over the entire set of detection ranges for a given ping, so it is a prime candidate for vectorization operations via a single-instruction-multiple-data (SIMD) coprocessor or similar parallelizing processor (e.g., GPU acceleration). Some combination of these types of optimization should allow real-time conversion capabilities on any modern hardware.

GEOREFERENCING DATA

Note that the transformation provided in the previous section places a detection point in a coordinate system fixed to the base of the pan/tilt unit. To georeference the detections, further transformation(s) are required, which take account of additional static and dynamic offsets, such as pan/tilt unit base axis offsets in the vessel coordinate system, vessel dynamic position, flexible mount points, etc. These additional transformations and any associated parameters are not provided by ProScan's network interface and are the responsibility of client applications.

Appendix I 7042 COMPRESSED WATER COLUMN DATA

This Appendix describes the compression algorithms used to fill the *7042 – Compressed Water Column Data* message.

The appendix is primarily written to support Sonar software developers in filling the 7042 message from a full set of Water Column sample data.

All fields described in this document refer to the fields defined in the 7042 message.

Currently the 7042 can store Intensity (Magnitude) and Phase values.

USE MAXIMUM BOTTOM DETECTION POINT LIMIT

When the *Use maximum bottom detection point limit* bit is set in the *Flags* field, the bottom detection points are used to limit the Water Column samples to create a subset of samples.

For each beam of Water Column samples, data is included up to the bottom detection point + 10%.

DOWN SAMPLING

One of the following down sampling methods can be selected using bits in the *Flags* field:

1. No down sampling.
2. Middle value down sampling.
3. Peak value down sampling.
4. Average value down sampling.

A down sampling divisor value can be stored in some bits of the *Flags* field. When the down sampling divisor is zero a down sampling divisor of 1 is assumed; meaning no down sampling was applied. The maximum down sampling divisor value is 15.

When down sampling was applied the samples provided in the 7042 message are a subset of the original set of water column samples. For each group of consecutive "*down sampling divisor"* samples one combined sample value is computed; middle, peak or average value depending on the selected down sampling method.

This computed value is optionally compressed before it is stored in the 7042 message. Compression of data is described below.

Notes:

- The selection No down sampling is equal to Middle value down sampling with a down sampling divisor value of 1.
- For Middle value based down sampling it is best to select an odd valued down sampling divisor.
- Peak value down sampling uses the Intensity of a sample to select a sample for output.
- Down sampling is applied after using maximum bottom detection point limit.
-

COMPRESSION

The following compression methods can be selected using bits in the Flags field:

1. Include Intensity (Magnitude) data only, strip Phase data.
2. Convert 16 bit values to 8 bit values.
3. Convert 32 bit intensity values to 8 bit values.

Method 1 does not need further explanation, the Phase data is simply not stored in the record.

Method 2 conversion from 16 bit values to 8 bit values is handled differently for Magnitude and Phase; both methods will be described below.

Method 3 conversion from 32 bit intensity to 8 bit values is described below and only affects intensity when 32 bits data needs to be reconstructed.

Phase Compression:

Phase compression simply truncates the lower (least significant) byte of the Phase value. Assume downSampledPhase is a WORD containing the Phase.

BYTE compressedPhase = (BYTE) (downSampledPhase >> 8)

16 Bit Intensity (Magnitude) Compression:

Convert Intensity to dB and store as a 8 bit value. Assume downSampledMagnitude is a WORD containing the 16 Bit Intensity value.

BYTE compressedMagnitude = (BYTE) floor(factor * log10(downSampledMagnitude) + 0.5)

When Bit 13 in the Flags field is set, factor must be taken from the *Compression factor* field of the 7042 record. When Bit 13 is not set a value of 40.0 is used.

32 Bit Intensity (Magnitude) Compression:

Convert Intensity to dB and store as a 8 bit value. Assume downSampledMagnitude is a DWORD containing the 32 Bit Intensity value.

BYTE compressedMagnitude = (BYTE) floor(factor * log10(downSampledMagnitude) + 0.5)

When Bit 13 in the Flags field is set, factor must be taken from the *Compression factor* field of the 7042 record. When Bit 13 is not set a value of 40.0 is used.

Notes:

- Compression is applied after down sampling; described above.
- When creating a 7042 record you can set Bit 13 to provide a custom *Compression factor*. When you do not set Bit 13 factor 40 must be used to compress intensities.

Appendix J AMENDMENT RECORD SHEET

Date	Author	Rev	Description
03/04/2019	ALV	3.10	SBES E20 Echotrac implemeted: Table 239: Device Identifiers: Add E20 Echotrac ID. Table 8: Record Type Definitions: Add SBES reserved range. Table 141: Updated. Add chapter 9.4.3 SBES Depth definition Add chapter 9.4.4 SBES Transducer offsets Add chapter 9.4.5 SBES Range to sample count conversion Chapter 2.4: Add note. Record type definitions: 7613 – Added 7614 – Added 10000 – Added 10003 – Added 10004 – Added 10018 – Added ..10027 – Added 10049 – Added 10060 – Added 10061 – Added 10062 – Added Remote control definitions: 10001 – Added 10003 – Added 10004 – Added 10005 – Added 10008 – Added 10014 – Added 10020 – Added 10021 – Added General:

Date	Author	Rev	Description
			Add chapter 9 Sensors and 7K Interface. This chapter includes system specific information related to the 7k interface. This information was previous described in chapter 2 and chapter 6 included. Record type definitions: 7007 – Add note Nadir Depth. 7030 – Add note. Unit time delay changed to msec. 1003 – Add note. 7058 – Add note start and end sample. Appendix A: Add optional record 7047. Split table 9 in a table for 7k series (Table 9) and a table for other systems using the7k data format (Table 10).
14/09/2018	ALV	3.09	Record type definitions: 7027 – Add note TX angle 7000 – Add note across and along track beam width 7019 – Modified 7503 – Modified and note ping number added Remote control definitions: 1138 – Removed to internal DFD Appendix B Device Identifiers: Add note to identifier 7005 Add identifier 30 Add note to remote control command 1200. Update Table 141: 7k Remote Control Definitions Minor textual changes to improve the consistency of the document. For example intensity and magnitude. (These changes are not tracked in yellow.)
27/03/2018	ALV	3.08	Record type definitions: 7052 – Record type header modified 7054 – Record type header modified

Date	Author	Rev	Description
			7004 – Add note Tx delay 7055 – Record type header modified Remote control definitions: 1121 – Added 1122 – Added Add note to 7027 record. Add items to chapter Frequently Asked Questions. Update Appendix B Device Identifiers
23/05/2017	ALV	3.07	Add chapter 13 Frequently Asked Questions. Updated Appendix E Sample code. Removed '7k' from all record descriptions. Character fields changed into c8 according to 7k header file. Appendix I textual changes. Record type definitions: 7042 – Textual change 7047 – Add notes 7052 – Record type header modified 7054 – Record type header modified 7504 – Record type header modified 7510 – Recovered text Remote control definitions: 1014 – Added 1026 – Added 1036 – Removed 1046 – Modified
01/05/2017	ALV	3.06	Record type definitions: 7006 – Add note 7028 – Minor textual changes 7027 – Record data modified 7047 – Record data modified – Text modified 7054 – Typo Remote control definitions:

Date	Author	Rev	Description
			1610 – Text modified Chapter 4 - 7k Record Definition: Text added Table 9 Modified
24/02/2017	ALV	3.05	Record type definitions: 7004 – Record data modified 7011 – Record type header modified 7047 – Record type header modified 7042 – Record type header modified Remote control definitions: 1610 – Added Minor textual changes Table 8 – Add record 7777
13/01/2017	ALV	3.04	 Table 8 – Modified Table 9 – Modified Record type definitions: 7014 – Record added 7027 – Record type header modified Record data modified 7047 – Record added 7503 – Record type header modified
20/12/2016	ALV	3.03	Record type definitions: 3001 – Record type header modified Chapter 2.4 – Text modified.
06/12/2016	ALV	3.02	Chapter 2.5 Time Convention - Text modified. Chapter 2.6 Establishing a Connection – Text modified. Table 8 – 7031 added. Table 9 – 7031 added.

Date	Author	Rev	Description
			Record type definitions: 3001 – Text modified. 7027 – Record type header modified. 7017 – Record type header modified.
09/11/2016	ALV	3.01	Record type definitions: 2004 – Note added 3001 – Note added 3001 – Record type header modified 7021 – Textual change Remote control definitions: 1051 – Textual change 1209 – Table updated Table 1 – Azimuth added Table 8 - Updated Table 9 - Updated Chapter “Data Record Frame” – Text modified
21/10/2016	ALV	3.00	Record type definitions: 3001 – record added 7000 – record type header modified 7001 – XML sample MB2 modified 7007– record type header modified 7011 – text modified 7021 – record type header modified 7027 – record type header and data modified 7028 – record type header modified 7042 – record modified 7504 – record type header modified Optional Data: Optional data 7007 record – text modified Table 8 – update Table 9 modified Chapter 7.2 – text modified Appendix B – modified Appendix I – added

Date	Author	Rev	Description
21/04/2016	ALV	2.44	Record Type Definitions: 7030 – text added 7052 – text modified 7054 – record added 7058 – text modified Remote Control Definitions: 1019 – text added 1048 – added 1502 – added Appendix B Device Identifiers – table modified Appendix A – text modified Section 2.7 – text modified Table 141 – update Table 8 – update Table 9 - update
26/10/2015	ALV	2.43	Record Type Definitions: 1003 – note added 7610 – text modified 7019 – text modified 7029 – record added 7042 – text modified 7058 – text modified 7503 – record type header modified (Added Applied frequency) 7504 – record type header modified (Added Tracker flags Bit 5 and Tracker max coverage) Remote Control Definitions: 1019 – text modified 1609 – added
29/08/2015	ALV	2.42	Record Type Definitions: 7000 – record type header modified 7042 – record type header modified 7058 – record type header modified – record type name changed – record type description changed – record data text modified 7503 – record type header modified 7610 – note modified Remote Control Definitions:

Date	Author	Rev	Description
			1044 – record data modified
17/08/2015	ALV	2.41	Record type definitions overview – Note added record 7006 and 7008 are depreciated. Added Appendix H Data Transformations (BlueView) Text - PDS2000 changed into Teledyne PDS Table 8 modified Table 9 modified: T50 added Table 239 modified – added BlueView identifier Remote Control Definitions: 1009 – record data modfied 1011 – record data & text modified 1118 – text modified 1040 – record data modified 7042 – record data modified 7614 - added Record Type Definitions: 1003 – record type header modified 2004 – text added 7000 – record type header modified 7001 – Sample XML MB2 and T20-P added 7002 – record type header modified 7006 – notes added 7041 – text modified 7042 – record type header and text modified 7052 – text modified 7058 – record type header and data modified 7503 – record type header modified 7504 – record type header and text modified BlueView: 7006 – record type header modified 5835 – record type header and text modified 5836 – record type header and text modified
24/03/2015	ALV	2.4	Table 8 modified Chapter 2.7 - note added Add chapter Sonar Reference Point Data record frame text modified Added 7K formats as used by the Odom MB2 Added appendix G - Wake On LAN

Date	Author	Rev	Description
			Added chapter including BlueView record definitions Chapter 6, Data Record Frame, system enumerator modified. Record Type Definitions: 1020 – record type header modified 2004 – text modified 7000 – record type header & text modified 7004 – text modified 7006 – text modified (depreciated record) 7017 – text modified 7018 – text modified 7021 – record data & text modified 7027 – text modified 7031 – record added 7041 – record type header modified 7042 – record type header modified 7050 – record type header modified 7051 – record type header modified 7052 – record type header modified 7059 – record added 7503 – text and record type header modified 7504 – record type header & text modified Added Appendix F Handling 7027 record 7K Remote Control Definitions: 1100 – text modified 1115 - record data modified 1117 – removed 1046 – added 1047 – added 1211 – added 1600 – added 1601 – added 1602 – added 1603 – added 1604 – added 1605 – added 1606 – added 1607 – added 1608 – added 7042 – added 7041 – record data modified Appendix B – device identifier 7k logger added.

Date	Author	Rev	Description
			Chapter 6 – text modified Chapter 7 – text modified
27/05/2014	ALV	2.33	Added appendix E – C++ source code example
27/05/2014	ALV	2.32	*(Internal release.)* Record Type Definitions: 7504 – record type header modified 7021 – record type header modified 7503 – record type header modified 7000 – record type header modified 2004 – description modified (always 5) 7030 – description of this record added. Available records T20-P added Table 8 modified. (7500 valid for all types) 7504 - record type header modified 7K Remote Control Definitions: 1200 – description modified. 1118 – description modified. Appendix A – Teledyne PDS optional data text modified. Data Record frame: Device identifier T20-P added in device identifier overview. **The T20-P has now a unique device identifier.**
04/09/2013	HMS	2.31	Record Type Definitions: 7027 – record type header modified 7052 – record type header modified 7200 – optional data added 7300 – record data added 7503 – record type header modified 7k Remote Control Definitions: 1045 – added Appendix A – record 7400 modified

Date	Author	Rev	Description
05/07/2013	MHA / HMS	2.3	Chapter 10.1 – tables modified Record Type Definitions: 1020 – record type header modified 2004 – added 7017 – record data modified 7019 – added 7021 – record data modified 7027 – record data modified 7041 – record type header modified and record data modified 7050 – record data modified 7051 – record type header modified 7503 – record type header modified 7504 – record type header modified 7510 – text modified 7610 – text and record type header modified 7k Remote Control Definitions: 1002 – text and record data modified 1009 – record data modified 1019 – added 1040 – added 1041 – added 1038 – record data modified 1043 – added 1044 – added 1402 – added 7041 – record data modified Appendix A – record 7400 added
07/05/2012	MHA	2.22	Record Type Definitions: 7000 – record type header modified 7001 – record data modified 7021 – record data modified 7036 – removed 7052 – record type header modified 7503 – record type header modified 7510 – added 7k Remote Control Definitions: 1021 – record data modified 1022 – record data modified 1037 – record data modified 1099 – note removed 7610 – record data modified Appendix D – error code 28945 added

Date	Author	Rev	Description
09/01/2012	MHA	2.21	Chapter 9 – text modified Chapter 10.1 – table added Record Type Definitions: 7007 – record type header modified 7008 – record type header modified 7011 – record type header modified 7012 – record type header modified 7017 – record type header modified and record data modified 7027 – record type header modified and record data modified 7057 – record type header modified 7k Remote Control Definitions: 1028 – removed, use record type 1020 1029 – removed; use record type 1020
25/11/2011	MHA	2.20	Chapter 6 – data record frame modified Record Type Definitions: 1020 – record type header modified 7000 – record type header modified 7007 – record type header modified 7008 – record type header modified 7011 – record type header modified 7012 – record type header modified 7017 – record type header modified and record data modified 7027 – record type header modified and record data modified 7041 – added 7052 – record type header modified 7055 – record type header modified 7057 – record type header modified 7503 – record type header modified 7504 – record type header modified 7k Remote Control Definitions: 1002 – record data modified 1010 – record data modified 1033 – record data modified 1035 – record data modified 1037 – record data modified 1038 – added 1039 – added 1118 – text adjusted 7041 – added
17/06/2011	MHA	2.11	Record Type Definitions: 7005 – moved to Volume II 7018 – modified, 7018 7111/7150 removed 7026 – removed 7058 – is now implemented Chapter 9 – Time Tagging – Text modified

Date	Author	Rev	Description
26/05/2011	MHA	2.10	Record Type Definitions: 1016 – text adjusted 1020 – added 1209 – text and table modified 7018 – extra information added 7021 – table record data modified 7027 – text adjusted 7503 – table of record type header modified Teledyne PDS Optional Data: 7027 – added 7028 – modified 7058 – modified
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	