DATA FORMAT DEFINITION DOCUMENT

SeaBat 7k Data Format, Volume I

Version 2.20

RESON A/S

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FOR PUBLIC USE

Revision History:

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

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1 INTRODUCTION

1.1 Purpose and Overview

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

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

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

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

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

1.2 Terms and Acronyms

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

Table 1: Terms and Acronyms

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

2 CONVENTIONS

2.1 Overview

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

2.2 Sign Conventions

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

Table 2: Sign Conventions

Offset	Sign	Description
X	+ -	Starboard of the VRP Port of the VRP
Y	+ -	Forward of the VRP Astern of the VRP
Z	+ -	Distance above the VRP Distance below the 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

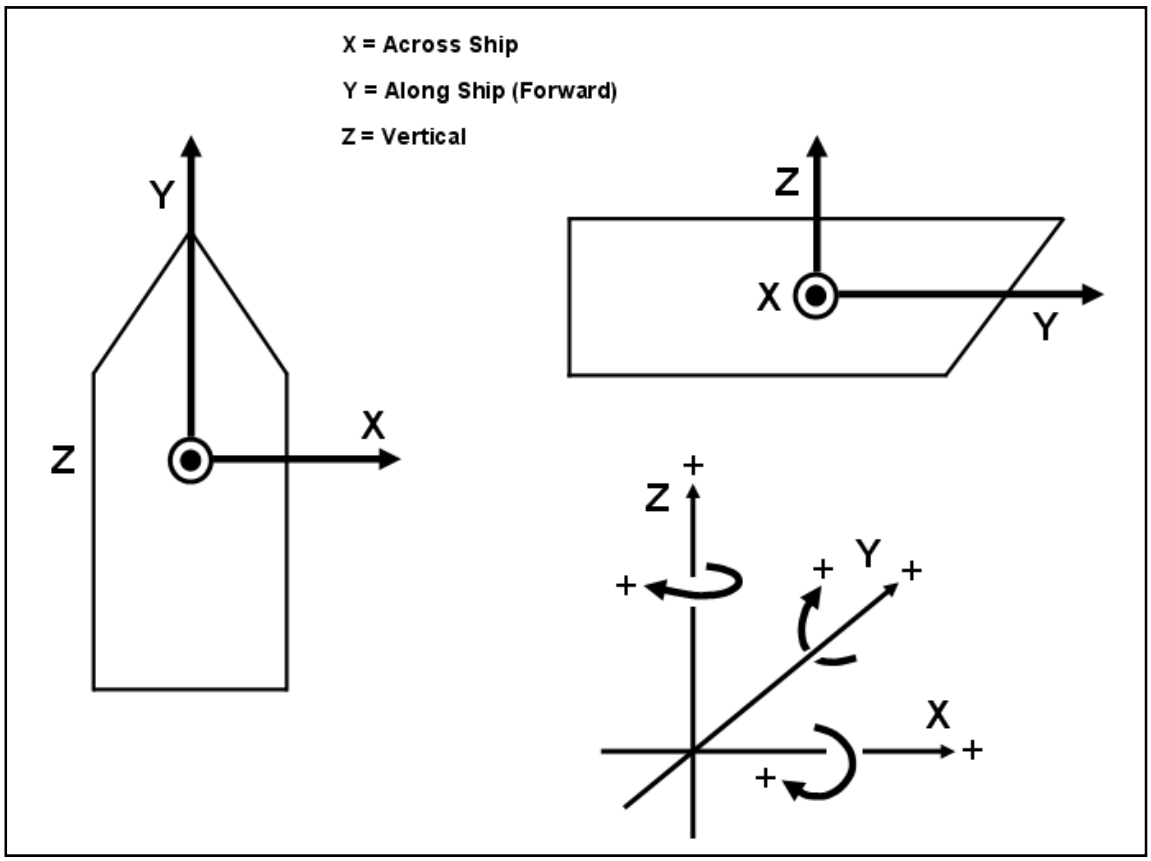


Figure 1: Vessel Axes

2.4 Beam Positions

In a standard installation, beam zero represents the first beam on the port side of the sonar array. A reversed head mount system 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.

2.5 Data Type Definitions, Bit Fields, and Byte Alignment

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

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

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

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

2.6 Time Convention

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

Table 3: Time Definition

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

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

3 GETTING STARTED WITH 7K CENTER SOFTWARE

3.1 Establishing a Connection

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

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

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

3.2 Retrieving Data Records

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

Table 4: Version Concordance

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

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

- Request a single record
- Subscribe to records

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

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

The following list defines the most common single record requests:

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

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

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

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

3.3 Getting System State Information and Commanding

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

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

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

Record 7500 is the primary means of changing sonar settings (for a definition of the 7500 record, see *section 10.52 7500 – 7k Remote Control*). For a detailed description, see *section 11 7k Remote Control Definitions*. When commanding the sonar, you must supply a valid device ID and enumerator in the 7500’s Data Record Frame or the command will be rejected.

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

3.4 Terminating Communication

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

3.5 Record Fragmentation – Special Considerations

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

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

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

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

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

3.5.1 From Record Counts

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

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

3.5.2 From Accumulated Packet Sizes

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

3.5.3 Error Checking

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

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

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

4 TCP AND UDP

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

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

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

5 7K RECORD DEFINITION

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

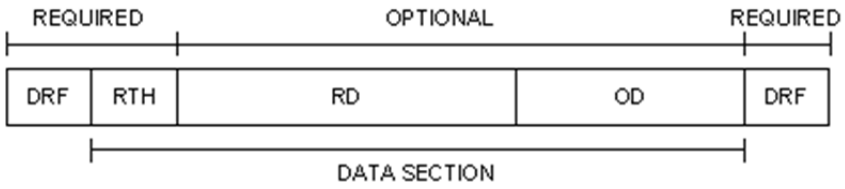
The optional data field typically holds sensor-specific data and third party developer embedded data.

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

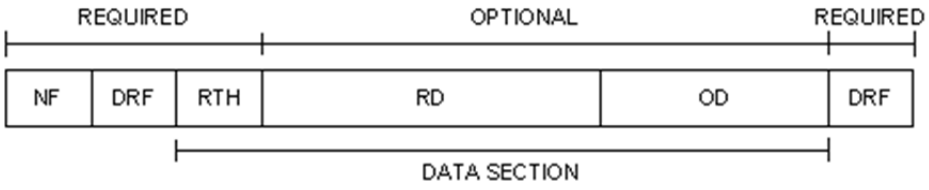
Please note that the Checksum is a required portion of the DRF, which occurs as the last four bytes of every record.

7k RECORD

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



Network prepared with the Network Frame (NF).



6 DATA RECORD FRAME

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

The frame is defined as follows:

Table 5: Data Record Frame

Name	Size	Description
Protocol Version	u16	Protocol version of this frame (see *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
Reserved	u16	Reserved
Record type identifier	u32	Identifier for record type of embedded data
Device identifier	u32	Identifier of the device to which this data pertains
System enumerator	u32	The enumerator is used to differentiate between devices with the same device identifiers in one installation/system. It is up to each application to decide what number to populate this field with.
Reserved	u32	Reserved

Name	Size	Description
Flags	u16	BIT FIELD: Bit 0: Checksum 0 – Invalid checksum 1 – Valid checksum Bit 1: Broadcast 1 – Enabled Bit 2-14: 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	Total records in fragmented data record set (if appropriate flag is set)
Fragment number	u32	Fragment number (if appropriate flag is set)
DATA SECTION	Dynamic	Data section
Checksum	u32	Sum of all byte values (treated as unsigned) in the record from the beginning of the version field to the end of the data section. The use of this field is optional and depends on bit 1 of the Flags field. The checksum should be computed as a 32 bit unsigned integer.

7 TCP AND UDP NETWORK FRAME

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

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

The following header shall prefix the network packet:

Table 6: Network Frame

Name	Size	Description
Protocol version	u16	Protocol version of this frame (see *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 (always 1)
Total records	u16	Total number of records in network packets transmitted (helper field for parsing data). Max 128 records per transmission (always 1).
Transmission identifier	u16	Transmission identifier (helper field for packet assembly). Must be the same number for each network packet in transmission. Adjacent transmissions in time from one source may not use the same identifier (always 1).
Packet size	u32	Size in bytes of this packet including the header and appended data
Total size	u32	Total size in bytes of all packets in transmission, excluding network frame(s)
Sequence number	u32	Sequential packet number; allows correct ordering during reconstruction. 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

8 LOGGING FILE FORMAT

8.1 Overview

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

Records must be complete and without the network frame.

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

8.2 File Nomenclature

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

"YYYYMMDD_HHMMSS.s7k"

With:

YYYY = Year
MM = Month
DD = Day
HH = Hour
MM = Minutes
SS = Seconds

For example, 20100516_102852.s7k (Created May 16, 2010 at 10:28:52)
When using third party logging tools, multiple files created at the same time can be differentiated by appending _X to the filename (where "X" is an integer starting at zero and successively incremented for each file).

For example, 20100516_102852_0.s7k and 20100516_102852_1.s7k

8.3 7k Center Logged Files

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

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

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

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

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

9 TIME TAGGING

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

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

For ping related records, the time stamp refers to the time when the sonar transmitter finishes a ping. For other data it refers to the time at which the info was received from the sensor, the time is then the computer clock. For some sensors (e.g POS MV), the time will be time in message; the time as is defined in the message string.

10 RECORD TYPE DEFINITIONS

10.1 Overview

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

Table 7: Record Type Definitions

Record Type	Description
1000 – 1999	Reserved for generic sensor records
1000	Reference point
1001	Sensor offset position
1002	Sensor offset position calibrated
1003	Position
1004	Custom attitude information
1005	Tide
1006	Altitude
1007	Motion over ground
1008	Depth
1009	Sound velocity profile
1010	CTD
1011	Geodesy
1012	Roll pitch heave
1013	Heading
1014	Survey line
1015	Navigation
1016	Attitude
1017	Pan tilt
1020	Sonar installation identifiers
1022	Reserved for IOP motion
1050	Reserved for generic sensor calibration
1200	Reserved for generic side-scan sonar
1500 – 1599	Reserved for future QC records
7000 – 7999	Reserved for SeaBat™ 7k records
7000[1]	7k sonar settings

[1] These records are available by subscription only.

Record Type	Description
7001	7k configuration
7002	7k match filter
7003	7k firmware and hardware configuration
7004	7k beam geometry
7005	Reserved for 7k calibration data
7006	7k bathymetric data
7007[1]	7k side-scan data
7008[1]	7k generic water column data
7009	Reserved for vertical depth
7010[1]	TVG values
7011[1]	7k image data
7012[1]	7k ping motion data
7016	Reserved for extended bottom detect info
7017[1]	7k detection data setup
7018[1]	7k beamformed data
7021	7k built-in test environment data
7022	7k Center version
7023	8k wet end version
7024	Reserved for license information
7026[1]	Reserved for 7k detection data
7027[1]	7k raw detection data
7028[1]	7k snippet data
7030	Reserved for sonar installation parameters
7036[1]	7k bathymetric uncertainty (TPE)
7037	Reserved for raw I & Q data file header
7038[1]	Reserved for raw I & Q data
7040	Reserved for 7k Tx configuration files
7041[1]	Compressed Beamformed Magnitude Data
7048	7k calibrated beam data
7050	7k system events
7051	7k system event message
7052	RDR recording status
7053	7k subscriptions

[1] These records are available by subscription only.

Record Type	Description
7055	Normalization status
7057	Calibrated side-scan data
7058	Calibrated snippet data
7060	Reserved for 7k target data
7068[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
7511	System lock status
7515	Timestamp (not described in the documentation)
7610	7k sound velocity
7611	7k absorption loss
7612	7k spreading loss
7613	Reserved
7900 – 7999	Reserved
8012[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

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

[1] These records are available by subscription only.

10.2 1000 – Reference Point

Description: Reference point Information.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 8: 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 9: 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 10: 1002 – Record Type Header

Name	Size	Description
Sensor position X offset	f32	X offset from vehicle reference point in meters
Sensor position Y offset	f32	Y offset from vehicle reference point in meters
Sensor position Z offset	f32	Z offset from vehicle reference point in meters
Sensor roll angle offset	f32	Roll angle offset in radians
Sensor pitch angle offset	f32	Pitch angle offset in radian
Sensor yaw angle offset	f32	Yaw angle offset in radians

10.5 1003 – Position

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 11: 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
Positioning method (cont.)	u8	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

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 12: 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 13: 1004 – Record Data

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

10.7 1005 – Tide

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

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 14: 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

Name	Size	Description
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 15: 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 16: 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 17: 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 18: 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 19: 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 20: 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 21: 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)

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

Table 22: 1010 – Record Data

Name	Size	Description
SAMPLE 0 Conductivity/Salinity	f32	In S/m or ppt
SAMPLE 0 Water temperature	f32	In Celsius
SAMPLE 0 Pressure/Depth	f32	In Pascal or meters
SAMPLE 0 Sound velocity	f32	In meters/seconds
SAMPLE 0 Absorption	f32	In dB/kilometer
…	…	...
SAMPLE N-1 Conductivity/Salinity	f32	In S/m or ppt
SAMPLE N-1 Water temperature	f32	In Celsius
SAMPLE N-1 Pressure/Depth	f32	In Pascal or meters
SAMPLE N-1 Sound velocity	f32	In meters/seconds
SAMPLE N-1 Absorption	f32	In dB/kilometer

10.13 1011 – Geodesy

Description: The Geodesy data record may be used to define the spheroid, datum, and grid definitions for navigational data; each sequentially embedded within the RTH. The optional data portion of the record is used to contain custom projection parameters.

Data Definition:

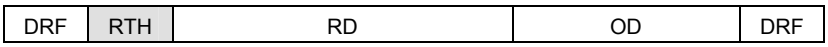


Table 23: 1011 – Record Type Header

Name	Size	Description
Spheroid name	u8 * 32	A short text description of the spheroid name: e.g. “WGS84”
Semi-major axis	f64	Semi-major axis in meters: e.g., 6378137.0 for WGS84
Inverse flattening	f64	Inverse flattening in meters: e.g. 298.257223563 for WGS84
Reserved 1	u8 * 16	Reserved
Datum name	u8 * 32	Datum name: e.g. “WGS84”

Name	Size	Description
Data calculation method	u32	0 – Molodensky 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
Grid name	u8 * 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	

Name	Size	Description
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 24: 1012 – Record Type Header

Name	Size	Description
Roll	f32	Vessel roll in radians
Pitch	f32	Vessel pitch in radians
Heave	f32	Vessel heave in meters

10.15 1013 – Heading

Description: Vessel Heading Record.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 25: 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 26: 1014 – Record Type Header

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

DRF	RTH	RD	OD	DRF

Table 27: 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 28: 1015 – Record Type Header

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

Name	Size	Description
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:

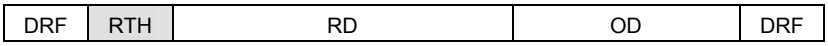


Table 29: 1016 – Record Type Header

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

Table 30: 1016 – Record Data

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

10.19 1017 – Pan Tilt

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 31: 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 is available as a single record request only.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 32: 1020 – Record Type Header

Name	Size	Description
System Identification Number	u32	Sonar ID
Transmitter Identification Number	u32	Tx Unit ID
Receiver Identification Number	u32	Rx Unit ID
Standard Configuration Options(*)	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

Name	Size	Description
Tx Length (Y)	f32	Measured values of Tx hardware, in meters. Flat arrays set to 0.
Tx Width (X)	f32	
Tx Height (Z)	f32	
Tx Radius	f32	
SRP to Tx X Linear Offset	f32	XYZ linear offsets from the SRP to the acoustic center of the transmitter, in meters.
SRP to Tx Y Linear Offset	f32	
SRP to Tx Z Linear Offset	f32	
Tx Roll Angular Offset	f32	Angular offsets are from array main axes to motion axes in Lagrange coordinates, in radians.
Tx Pitch Angular Offset	f32	
Tx Yaw Angular Offset	f32	
Rx Length (Y)	f32	Measured values of Tx hardware, in meters. Flat arrays set to 0.
Rx Width (X)	f32	
Rx Height (Z)	f32	
Rx Radius	f32	
SRP to Rx X Linear Offset	f32	XYZ linear offsets from the SRP to the acoustic center of the transmitter, in meters.
SRP to Rx Y Linear Offset	f32	
SRP to Rx Z Linear Offset	f32	
Rx to Rx Roll Angular Offset	f32	Angular offsets are from array main axes to motion axes in Lagrange coordinates, in radians.
Rx Pitch Angular Offset	f32	
Rx Yaw Angular Offset	f32	
Frequency	f32	System frequency
Reserved	60 bytes	This field is reserved for system specific parameters and will be defined on per system basis.

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

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

10.21 7000 – 7k Sonar Settings

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the current sonar settings. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 33: 7000 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this is the sequence number of the ping in the multi-ping sequence.
Frequency	f32	Transmit frequency in Hertz
Sample rate	f32	Sample rate in Hertz
Receiver bandwidth	f32	In Hertz
Tx pulse width	f32	In seconds
Tx pulse type identifier	u32	0 – CW 1 – Linear chirp 2 – Multi-ping 2 3 – Multi-ping 4
Tx pulse envelope identifier	u32	0 – Tapered rectangular 1 – Tukey
Tx pulse envelope parameter	f32	Some envelopes don't use this parameter
Tx pulse reserved	u32	Additional pulse information
Max ping rate	f32	Maximum ping rate in pings per second
Ping period	f32	Seconds since last ping
Range selection	f32	Range selection in meters
Power selection	f32	Power selection in dB re 1μPa
Gain selection	f32	Gain selection in dB

Name	Size	Description
Control flags	u32	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 13-14: Reserved Bit 15: 0 – System inactive 1 – Active Bit 16-23: Reserved for bottom detection Bit 24: Trigger out 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 29-30: Reserved 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
Projector beam focal point	f32	In meters

Name	Size	Description
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
Receive beam width	f32	Angle in radians
Bottom detection filter info	f32	Min range (if range filter is active)
Bottom detection filter info	f32	Max range (if range filter is active)
Bottom detection filter info	f32	Min depth (if depth filter is active)
Bottom detection filter info	f32	Max depth (if depth filter is active)
Absorption	f32	Absorption in dB/km
Sound velocity	f32	Sound velocity in m/s
Spreading	f32	Spreading loss in dB
Reserved	u16	Reserved

10.22 7001 – 7k Configuration

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the configuration information about the sonar capabilities. Each sonar configuration can be found in the record's module info section (see

Table 35). The record is created on system startup and does not change during operation. The record can be manually requested from the 7-P processor. This record is not available for subscription. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

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

Data Definition:

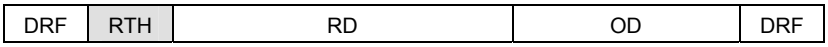


Table 34: 7001 – Record Type Header

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

Table 35: 7001 – Record Data

Name	Size	Description
Device 0 identifier	u32	Unique identifier number
Device 0 description	u8 * 64	ASCII string
Device 0 serial number	u64	
Device 0 info length	u32	In bytes
Device 0 info	dynamic	Varies with device type
…	…	…
Device N-1 identifier	u32	Unique identifier number
Device N-1 description	u8 * 64	ASCII string
Device N-1 serial number	u64	
Device N-1 info length	u32	In bytes
Device N-1 info	dynamic	Varies with device type

XML SAMPLE – 7125

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

<SB7125HF>
 <Name deviceid="7125" subsystemid="1" enumerator="0" xml_reson="6.1.0.2.1.24">7125
      (400kHzEA)</Name>
 <SystemInfo auv="no" projectid="generic" name="7125">7125 Sonar</SystemInfo>
 <SonarType type="0" unit="nb">Bathymetric sonar</SonarType>
 <ArrayType type="1" mounting="fixed" number="7200" unit="nb">Flat array</ArrayType>
 <RxElements min="0" max="255" reversed="no" spacing="0.0016" unit="meters"
      input_mux="1">Receive ceramics</RxElements>
 <RxBeams min="0" max="255" unit="nb" max_sin="75">Receive beams</RxBeams>
 <RxBeamSpacing uniform="yes">Receiver beamspacing</RxBeamSpacing>
 <RxBeamWidth center_beamwidth="0.5" uniformacross="yes" uniformalong="yes" across="0.008"
      along="0.471238898" unit="rad" proj_beamwidth="1.0">Receiver
      beamspacing</RxBeamWidth>
 <RxBeamWedge coverage="128.10" min_coverage="45.0" max_coverage="128.10"
      unit="deg">Receiver beam wedge info</RxBeamWedge>
 <RxBeamStabilization type="0">Receiver beam stabilization</RxBeamStabilization>
 <TxType type="standard" number="6948" unit="nb">Standard</TxType>
 <TxBeams min="0" max="0" unit="nb">Transmit beams</TxBeams>
 <TxBeamSteering steerable="no" maxx="0.0" minx="0.0" maxz="0.0" minz="0.0" unit="rad">Transmit
      beam steering</TxBeamSteering>
 <TxBeamSpacing uniform="yes" angles="0.0" unit="rad">Transmit beamspacing</TxBeamSpacing>
 <TxBeamWidth variable="no" maxx="0.0174533" minx="0.0174533" maxz="2.094395102"
      minz="2.094395102" unit="rad">Transmit beamwidth</TxBeamWidth>
 <TxBeamStabilization type="0">Transmit beam stabilization</TxBeamStabilization>
 <TxPulseLength min="0.000033" max="0.000300" type="Rectangular" unit="s" measured="10e-
      6">Transmit pulse length</TxPulseLength>
 <TxDelay base="0.697e-3" units="sec">Transmit Delay</TxDelay>
 <Frequency chirp="no" min="396000.0" max="396000.0" center="396000.0" unit="hz">Transmit
      frequency</Frequency>
 <SampleRate rate="34482.75862" unit="hz">Receiver sample rate</SampleRate>
 <Power min="170.0" max="220.0" tx_power_tweak="-17.0" shared="no" unit="dB//uPa">Transmit
      power</Power>
 <Gain min="0.0" max="83.0" tvg_limit="83" unit="dB">Receiver gain</Gain>
 <Range min="5.0" max="300.0" unit="m">Operating range</Range>
 <RangeSet size="18" _1="5" _2="8" _3="10" _4="15" _5="20" _6="25" _7="30" _8="35" _9="40"
      _10="50" _11="75" _12="100" _13="125" _14="150" _15="175" _16="200" _17="250"
      _18="300" unit="m">Valid Range Set</RangeSet>
 <xPingRateSet size="18" _1="50.0" _2="41.0" _3="36.2" _4="27.0" _5="21.8" _6="11.2" _7="11.0"
      _8="9.7" _9="8.3" _10="6.5" _11="4.3" _12="2.9" _13="2.3" _14="1.9" _15="1.5" _16="1.4"
      _17="1.1" _18="0.8" enable="no">Valid PingRate Set</xPingRateSet>
 <PingRate min="0.0" max="50.0" ratio="1.0" freerun="no" unit="p/s">Ping rate</PingRate>
 <Motion rollable="yes" pitchable="no" heavable="no" roll="1" pitch="0" heave="0" roll_ON="yes"
      pitch_ON="yes">Motion compensation factor</Motion>
 <FWInfo type="single" pps="new" bite="new" bf_upm_level="3">Firmware Info</FWInfo>
 <FWFiles bitfile="bf256x256x16_20090922.bit" BITEfile="7K_Bite_7125_400kHz.htm">Firmware
      Sonar Specific Files</FWFiles>
 <FWFilterFiles size="0">Firmware Filter Sonar Specific Files</FWFilterFiles>
 <FPGA TxRxDelayOffset="0" tx_skip="0" rx_skip="0" lo_if="600000.0" delay="471e-6" offset_size="3"
      _1="600" _2="800" _3="800">FPGA Sonar Specific Values</FPGA>
 <DownLink register="yes" remote="yes">Downlink Commands</DownLink>
```

```
<RDR limitsize="yes" maxsize="1024000000" units="Bytes" format="short"
      xxfilename="c:\somefile.s7k">Raw data recording</RDR>
<StartState APTable="7125_400kHz_Default.apc" maxpower="0.0" xxping="yes" selected="yes"
      xxrdr="off" udp="on" calibrate="apply" swiothrottlems="1000">Initial overwrite
      values</StartState>
<BottomDetection method="G2">BD Method (G1_Simple, G1_BlendFilt, G2)</BottomDetection>
<Warnings PPS="on">Warning overrides</Warnings>
<GUIState wedgethrottlems="160">Initial overwrite values</GUIState>
</SB7125HF>
```

10.23 7002 – 7k Match Filter

Description: This record is produced by the 7k Center. It contains the sonar's receive match filter settings. The 7-P processor updates this data for each ping. The record can be manually requested for the last ping or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 36: 7002 – Record Type Header

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

10.24 7003 – 7k Firmware and Hardware Configuration

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

For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 37: 7003 – Record Type Header

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

HTM SAMPLE – 7101

HARDWARE TABLE

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

LM TABLE

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

SYS1 TABLE

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

10.25 7004 – 7k Beam Geometry

Description: This record is produced by the 7k Center. It contains the receive beam widths and steering. The 7k Center updates this data for each ping. The record can be manually requested for the last ping or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

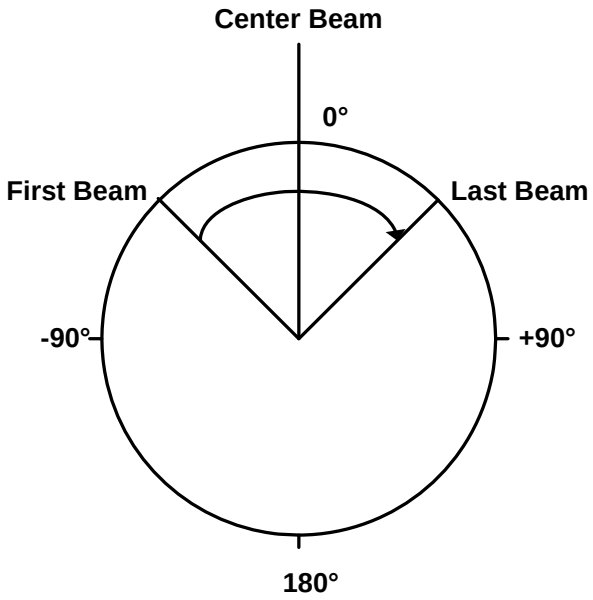


Figure 2: Sonar Beam Angle Convention

Data Definition:

DRF	RTH	RD	OD	DRF

Table 38: 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 39: 7004 – Record Data

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

10.26 7006 – 7k Bathymetric Data

Description: This record is produced by the 7k Center series. It contains the sonar bottom detection results. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 40: 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

DRF	RTH	RD	OD	DRF

Table 41: 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 (magnitude) 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
Intensity [N]	f32 * N	Intensity: Signal strength. Value at bottom detection. Not calibrated.
Min filter info	f32 * N	Minimum two-way travel time to filter point for each beam (minimum depth gate)
Max filter info	f32 * N	Maximum two-way travel time to filter point for each beam (maximum depth gate)

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

10.27 7007 – 7k Side Scan Data

Description: This record is produced by the 7k Center. It contains the non-calibrated side-scan type data. This record is typically not available in a forward-looking sonar configuration. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

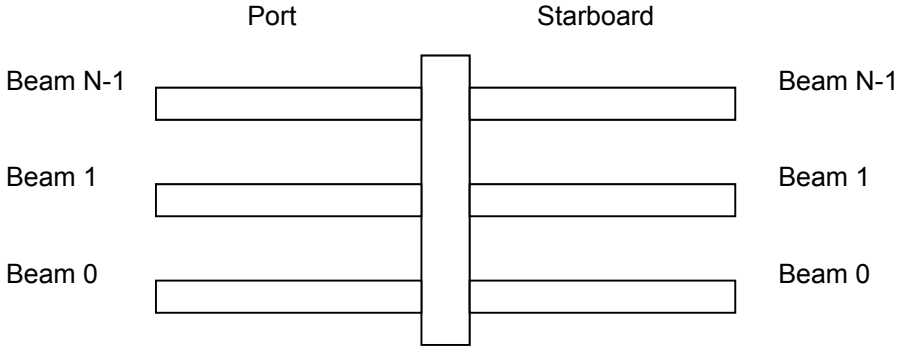


Figure 3: Beam Port and Starboard Numbering

Data Definition:

DRF	RTH	RD	OD	DRF

Table 42: 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	u32	Control
S	u32	Samples per side (port/starboard)
Port beam width y	f32	Beam width y on port side
Port beam width z	f32	Beam width z on port side
Star beam width y	f32	Beam width y on starboard side
Star beam width z	f32	Beam width z on starboard side
Port beam steer angle y	f32	Beam steer angle y on port side (in radians)
Port beam steer angle z	f32	Beam steer angle z on port side (in radians)
Star beam steer angle y	f32	Beam steer angle y on starboard side (in radians)
Star beam steer angle z	f32	Beam steer angle z on starboard side (in radians)

Name	Size	Description
N	u16	Number of beams per side
Current beam number	u16	Beam number of this record's data (0 to N-1)
W	u8	Number of bytes per sample
Data types	u8	BIT FIELD: Bit 0: Reserved (always 0) Bit 1-7: Reserved

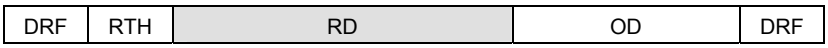


Table 43: 7007 – Record Data

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

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

10.28 7008 – 7k Generic Water Column Data

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

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

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

The Record Data portion is divided into two distinct parts:

- Beam Descriptors
- Sample Data

Beam Descriptors:

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

b0 s1 s100 b2 s1 s100 b3 s1 s100 …

Where:

b = Beam

s = Sample

Sample Data

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

Sample data will be output in one of two ways:

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

For example:

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

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 44: 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

Name	Size	Description
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
Sample header identifier	u16	Sample header identifier
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., magnitude is an u4 with possible values in range 0 to 16.) Bit 0-3: Magnitude 0 – No magnitude 1 – Reserved 2 – Magnitude (16 bits) 3 – Magnitude (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

DRF	RTH	RD	OD	DRF

Table 45: 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 46: 7008 – Record Data (Part 2)

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

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

Additional SeaBat™ data settings (data reduction).

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

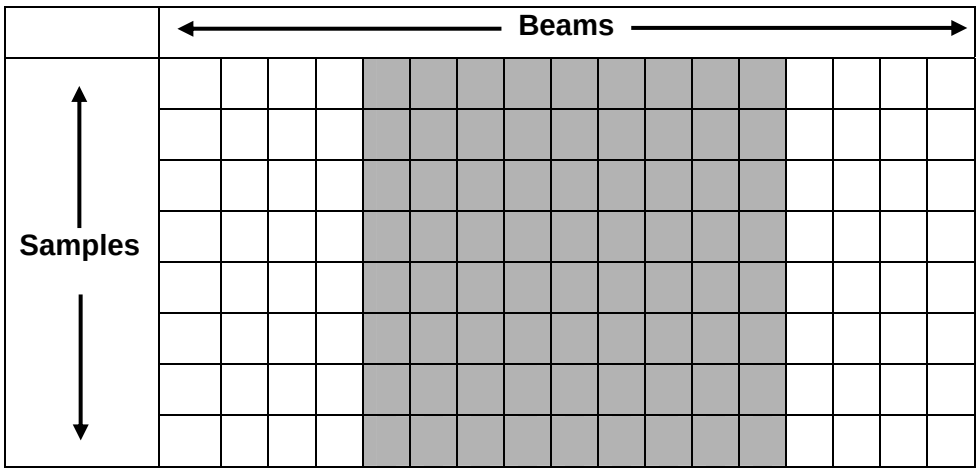


Figure 4: Beam Limits – Set Min and Max Beam

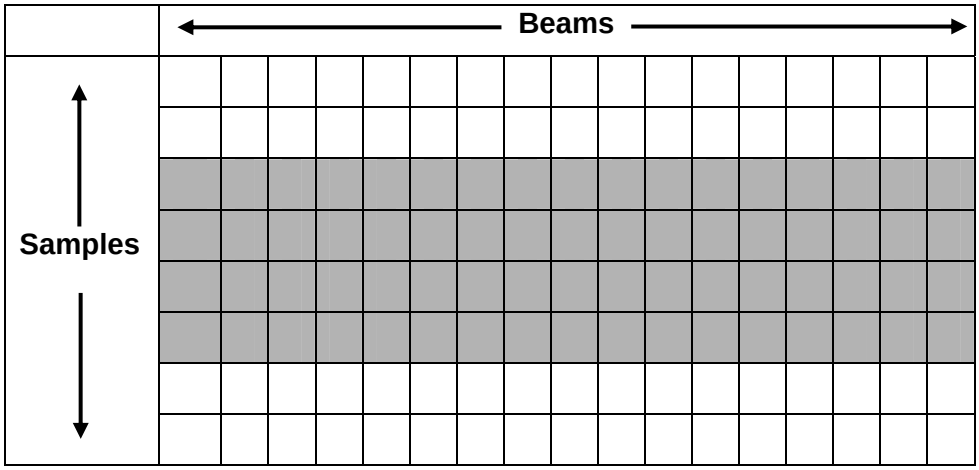


Figure 5: Sample Limits – Set Min and Max Sample

10.29 7010 – TVG Values

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

Description: This record provides the TVG values, one for each sample in the ping. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 47: 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 48: 7010 – Record Data

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

10.30 7011 – 7k Image Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the sonar image data. The image data is compressed RAW or beamformed magnitude / phase data. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 49: 7011 – Record Type Header

Name	Size	Description
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence.

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

Table 50: 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

10.31 7012 – 7k Ping Motion Data

Description: This record is produced by the 7k Center series. It contains the description of various parameters used in detection computations. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

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

Data Definition:

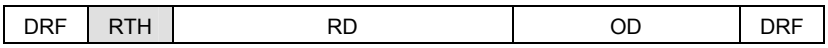


Table 51: 7012 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence.
Samples (N)	u32	Number of samples

Name	Size	Description
Flags	u32	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 4-7: Reserved for PHINS status Bit 8-10: Reserved for roll status Bit 11-15: Reserved
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 Bit 7: 1 – External motion data not received (roll angle and rate are not reported) Bit 8-15: Reserved
Sampling rate	f32	Sampling frequency in Hz
Pitch	f32	Pitch value at the ping time in radians
Roll	f32 * N	Roll value per sample in radians
Heading	f32 * N	Heading value per sample in radians
Heave	f32 * N	Heave value per sample in meters

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*.

10.32 7017 – 7k Detection Data Setup

Description: This record is produced by the 7k Center series. It contains the description of various parameters used in detection computations. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*. This record is available by subscription only.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 52: 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 3-255 – 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 is applied; only detections that pass the filter are outputted Bit 6-31: 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
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

Name	Size	Description
Automatic filter window	u8	Automatic filter window size in percent of the depth
Applied roll	f32	Roll value (in radians) applied to gates; zero if roll stabilization is ON
Depth gate tilt	f32	Angle in radians (positive to starboard)
Reserved	u32 * 14	Reserved for future use

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.

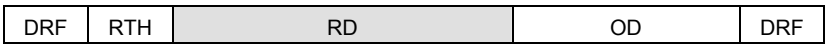


Table 53: 7017 – Record Data

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

Name	Size	Description
Flags	u32	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 Bit 10: 1 – Magnitude based detection Bit 11: 1 – Phase based detection Bit 12: 1 – Other detection 1 Note that bits 1-13 are not mutually exclusive. For example, bits 10 & 11 will both be set when the current 'blend' of magnitude and phase detection is used. Bit 13-31: Reserved for future use
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	u32	Detection quality, see *Table 54*
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 54: 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

10.33 7018 – 7k Beamformed Data

Description: This record is produced by the 7k Center series. It contains the sonar beam magnitude and phase data. The 7k Center updates this data for each ping. The record can be subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*. This record is available by subscription only.

For details about subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

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

Data rates:

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

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:

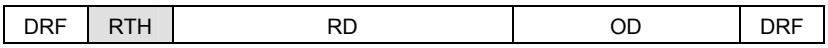


Table 55: 7018 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence.
Beams (N)	u16	Total number of beams in ping record
Samples (S)	u32	Total number of samples in ping record

Name	Size	Description
Reserved	u32 * 8	Reserved for future use

DRF	RTH	RD	OD	DRF

Table 56: 7018 – Record Data

Name	Size	Description
Sample 0, Beam 0, Amp	u16	Amplitude 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	Amplitude value for first sample, last beam
Sample 0, Beam N-1, Phs	i16	Phase value for first sample, last beam
…	…	…
Sample S-1, Beam N-1, Amp	u16	Amplitude value for last sample, last beam
Sample S-1, Beam N-1, Phs	i16	Phase value for last sample, last beam

10.34 7021 – 7k Built-In Test Environment Data

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

For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 57: 7021 – Record Type Header

Name	Size	Description
N	u16	Number of boards reporting

DRF	RTH	RD	OD	DRF

Table 58: 7021 – Record Data for Each Device (N)

Name	Size	Description
Source name	u8 * 64	Null terminated ASCII string, e.g. “TX1”
Source address	u8	Source address
Frequency	f32	Frequency for transmitter or 0

Name	Size	Description
Enumerator	u16	Enumerator for transmitter or 0
Downlink time sent	7kTime	Downlink time sent
Uplink time received	7kTime	Uplink time received
BITE time received	7kTime	BITE time received
Status	u8	BIT FIELD: Bit 0: 0 – Uplink OK 1 – Uplink Error Bit 1: 0 – Downlink OK 1 – Downlink Error Bit 2: 0 – Bite OK 1 – Bite Error
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)
BF #0: Name	u8 * 55	Null terminated ASCII string, e.g. “3.3V”
BF #0: Severity	u32	0 – Info 1 – Warning 2 – Error
BF #0: Info Category	u32	0 – Config 1 – Setup 2 – Performance 3 – Health
BF #0: Bytes	u8	Number of bytes that ‘Value’ was built from. (Alternatively just ‘Reserved’)

Name	Size	Description
BF #0: Sensor Type	u8	Guidance on display 'Value'. Valid when Device Type is 11 (Linear). 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, ignore upper 8 bits 112 – Display as Enumeration (literals defined in Bite.htm file) 200 – Display as part number with offset 1000000 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: Device 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 11 – Linear
BF #0: Minimum	f32	Minimum value for alarm
BF #0: Maximum	f32	Maximum value for alarm
BF #0: Value	f32	Current value
…..		
…..		
BF #NBF-1: Field	u16	Field Number (from Bite.htm file)
BF #NBF-1: Name	u8 * 55	Null terminated ASCII string, e.g. "3.3V"
BF #NBF-1: Severity	u32	0 – Info 1 – Warning 2 – Error

Name	Size	Description
BF #NBF-1: Info Category	u32	0 – Config 1 – Setup 2 – Performance 3 – Health
BF #NBF-1: Bytes	u8	Number of bytes that 'Value' was built from. (Alternatively just 'Reserved')
BF #NBF-1: Sensor Type	u8	Guidance on display 'Value'. Valid when Device Type is 11 (Linear). 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, ignore upper 8 bits 112 – Display as Enumeration (literals defined in Bite.htm file) 200 – Display as part number with offset 1000000 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: Device 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 11 – Linear
BF #NBF-1: Minimum	f32	Minimum value for alarm
BF #NBF-1: Maximum	f32	Maximum value for alarm
BF #NBF-1: Value	f32	Current value
…..		

10.35 7022 – 7k Center Version

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 59: 7022 – Record Type Header

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

10.36 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 60: 7023 – Record Type Header

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

10.37 7027 – 7k RAW Detection Data

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 61: 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
Detection algorithm	u8	0 – G1_Simple 1 – G1_BlendFilt 2 – G2 3-255 – 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 3-15 – Reserved for future use Bit 4-31: Reserved for future use
Sampling rate	f32	Sonar's sampling frequency in Hz
Tx angle	f32	Applied transmitter steering angle, in radians
Reserved	u32 * 16	Reserved for future use

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.

Table 62: 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 – Magnitude based detection Bit 1: 1 – Phase based detection Bit 2-8: Quality type, defines the type of the quality field below Bit 9-31: Reserved for future use
Quality	u32	Detection quality, see *Table 63*
Uncertainty	f32	Detection uncertainty represented as an error normalized to the detection point

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

NOTE
Transmit and receive steering angles provided in this record are total steering angles applied. Refer to record *7004 – 7k Beam Geometry* and/or record *7012 – 7k 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 63: 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

10.38 7028 – 7k Snippet Data

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

For details about subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

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

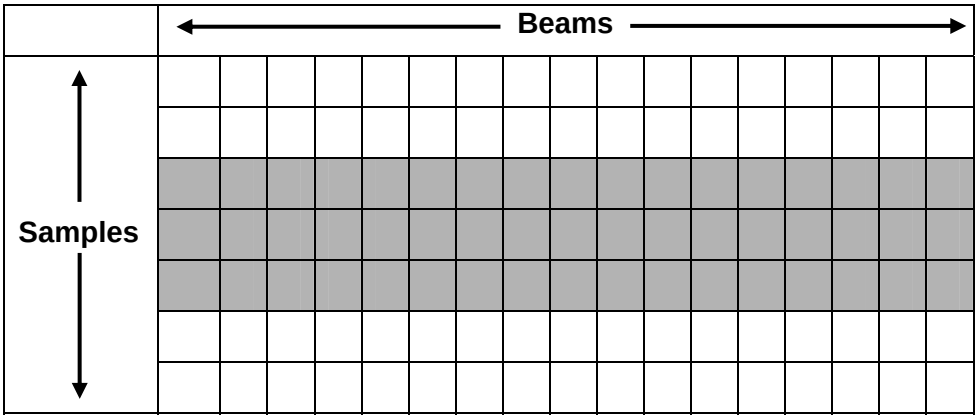


Figure 6: Sample Limits – Set Min and Max Sample

Data rates:

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

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:

DRF	RTH	RD	OD	DRF

Table 64: 7028 – 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	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
Reserved	u32 * 7	Reserved for future use

DRF	RTH	RD	OD	DRF

Table 65: 7028 – Record Data

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

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

10.39 7036 – 7k Bathymetric Uncertainty (TPE)

Description: This record is produced by the 7k Center series. It contains the sonar bottom detection result total propagated error values. The 7k Center updates this data for each ping. This record is available by subscription only.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 66: 7036 – 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

Name	Size	Description
Layer compensation flag	u8	Flag indicating if the layer compensation is on or off 0 – Off 1 – On
Sound velocity flag	u8	Flag indicating if sound velocity is measured or manually entered 0 – Measured 1 – Manually entered
Sound velocity	f32	Sound velocity at the sonar in m/s

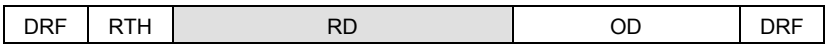


Table 67: 7036 – Record Data for Each Device (N)

Name	Size	Description
Magnitude uncertainty	f32 * N	Combined Magnitude & Phase uncertainty using Rob-Hare algorithm
Phase uncertainty	f32 * N	Phase uncertainty (not used, always zero)
Reserved	f32 * 8 * N	Reserved space

10.40 7041 – Compressed Beamformed Magnitude Data

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor series. It contains the compressed magnitude sonar beam data. The 7-P processor updates this record for each ping. The record can be subscribed to from the 7-P processor; it is not available by single request. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

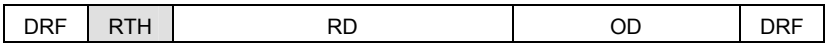


Table 68: 7041 – Record Type Header

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

Name	Size	Description
Down-sampling Method	u8	0 – No down-sampling 1 – Nearest neighbor 2 – Linear approximation 3 – Averaging 4+ – Reserved for future use
Filtering Method	u8	0 – No filtering 1+ – Reserved for future use
Flags	u32	BIT FIELD: Bit 0-3: Data Encoding 0 – 16bit magnitude 1 – 8bit magnitude 2 – 16bit magnitude & phase 3 – 8bit magnitude & phase 4 – 32bit calibrated magnitude 5 – 16bit calibrated magnitude 6 – 8bit calibrated magnitude 7 – Reserved Bit 4: Beam identification method 0 – Beam number (u16) 1 – Beam angle (f32, in radians) Bit 5-31: Reserved (always zero)
Magnitude/Calibrated Magnitude Encoding	u8	Magnitude Encoding Methods: 0 – 16 bit values 1 – 8 bit ½dB 2+ – Reserved Calibrated Magnitude Encoding Methods: 0+ – Reserved
Phase Encoding	u8	Phase Encoding Methods: 0+ – Reserved
Sample Rate	f32	Sampling rate for the data
Reserved	4*u32	Reserved for future use

Table 69: 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

Name	Size	Description
Data	S*var	Data series for each sample. Either Magnitude, Magnitude and Phase pairs or Calibrated Magnitude. See “Flags” above for identification and size.

10.41 7048 – 7k Calibrated Beam Data

NOTE
This record contains non-calibrated beam magnitude, if calibration is available but not run. (See Error flag in *Table 70: 7048 – Record Type Header*).

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

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

Additional SeaBat™ Data Settings (Data Reduction).

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

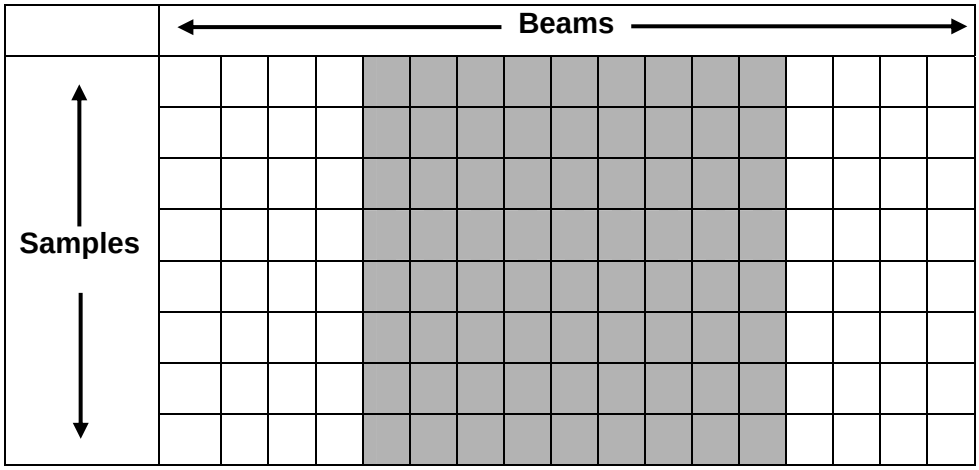


Figure 7: Beam Limits – Set Min and Max Beam

Data Definition:

DRF	RTH	RD	OD	DRF

Table 70: 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

Name	Size	Description
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
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

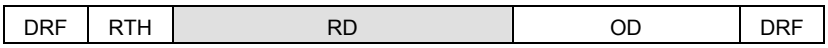


Table 71: 7048 – Record Data

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

10.42 7050 – 7k System Events

Description: This record is produced by the SeaBat™ 7k sonar series. It contains the 7k Center system events. The 7k Center updates this record when any event is added or removed in the system. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 72: 7050 – Record Type Header

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

DRF	RTH	RD	OD	DRF

Table 73: 7050 – Record Data

Name	Size	Description
Event type 0	u16	0 – Success 1 – Information 2 – Warning 3 – Error
Event identifier	u16	0 – Not defined
Device identifier	u32	Identifier of the device that this data pertains (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
Event identifier	u16	0 – Not defined
Device identifier	u32	Identifier of the device that this data pertains
System enumerator	u16	System enumerator for identical systems in one installation

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

10.43 7051 – 7k System Event Message

Description: This record is produced by the SeaBat™ 7k sonar series. It holds a single 7k event. The latest record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 74: 7051 – Record Type Header

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

DRF	RTH	RD	OD	DRF

Table 75: 7051 – Record Data

Name	Size	Description
Event message	dynamic	Null terminated string.

10.44 7052 – RDR Recording Status

Description: This record is generated at every 1% drop in disk capacity and on any start or stop of recording or playback. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

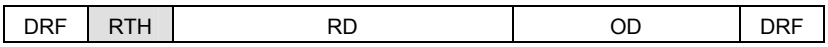


Table 76: 7052 – Record Type Header

Name	Size	Description
Position	u32	Seconds since start of recording
Disk free	u8	Percentage of disk space free (0-100)
Mode	u8	0 – Stopped 1 – Recording 2 – Playing 3 – Deleting 4 – Reserved for FF
FileRecords	u32	Total number of records in file at the time the request is processed
FileSize	u64	File size in bytes
First 7KTIME	u8 * 10	Time tag first record time
Last 7KTIME	u8 * 10	Time tag last record time
Total time	u32	Time span between first and last record (in seconds)
Directory name	u8 * 256	Current directory name. Null-terminated ASCII string.
File name	u8 * 256	Current file name. Null-terminated ASCII string.
RDR error	u32	Current RDR error code; see *APPENDIX D 7k Error Codes* for the RDR error codes (0x7101 – 0x7110)
Reserved	u32 * 7	Reserved

Table 77: 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

Name	Size	Description
Excluded Records Array	u32 * ER	Array of ER excluded records
Included Devices (ID)	u32	Number of included devices
Included Devices Array	u32 * ID	Array of ID included devices
Excluded Devices (ED)	u32	Number of excluded devices
Excluded Devices Array	u32 * ED	Array of ED excluded devices

10.45 7053 – 7k Subscriptions

Description: This record is produced by the SeaBat™ 7k sonar 7-P processor. It contains information about subscription connections and third-party data connections. The record can be manually requested or subscribed to from the 7-P processor. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

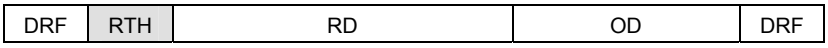


Table 78: 7053 – Record Type Header

Name	Size	Description
N	i32	Number of subscriptions

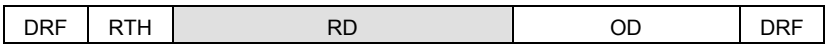


Table 79: 7053 – Record Data for Each Subscription (N)

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

10.46 7055 – Calibration Status

Description: This record is produced by the SeaBat™ 7k sonar series. It contains status of the system calibration. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 80: 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	u8 * 800	Status message text string (null terminated)
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 – magnitude 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

Name	Size	Description
Current calibration system	u8	Enum of system being calibrated
Start-up calibration	u8	Non zero if start-up calibration is in progress
Status	u16	Final status of each system calibrated
Reserved	u32 * 2	Reserved

10.47 7057 – Calibrated Side-Scan Data

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

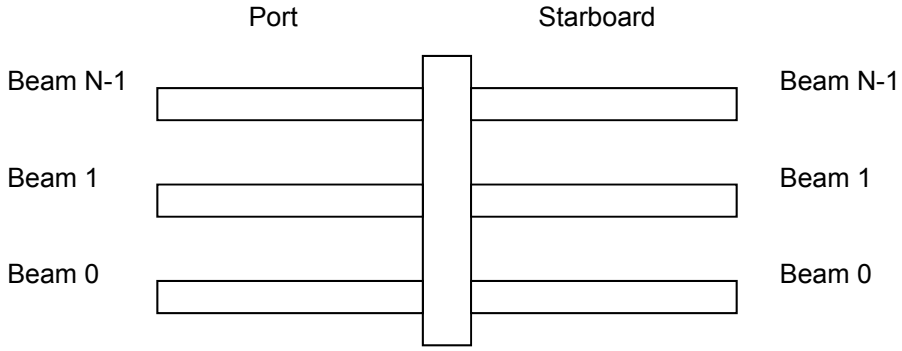


Figure 8: Beam Port and Starboard Numbering

Data Definition:

DRF	RTH	RD	OD	DRF

Table 81: 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)
Port beam width y	f32	Beam width y on port side
Port beam width z	f32	Beam width z on port side

Name	Size	Description
Star beam width y	f32	Beam width y on starboard side
Star beam width z	f32	Beam width z on starboard side
Port beam steer angle y	f32	Beam steer angle y on port side (in radians)
Port beam steer angle z	f32	Beam steer angle z on port side (in radians)
Star beam steer angle y	f32	Beam steer angle y on starboard side (in radians)
Star beam steer angle z	f32	Beam steer angle z on starboard side (in radians)
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)

Table 82: 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).

Name	Size	Description
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 PDS2000 Optional Data*.

10.48 7058 – Calibrated Snippet Data

NOTE
Snippet must be enabled in order to receive this record.

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

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

Additional SeaBat™ Data Settings (Data Reduction).

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

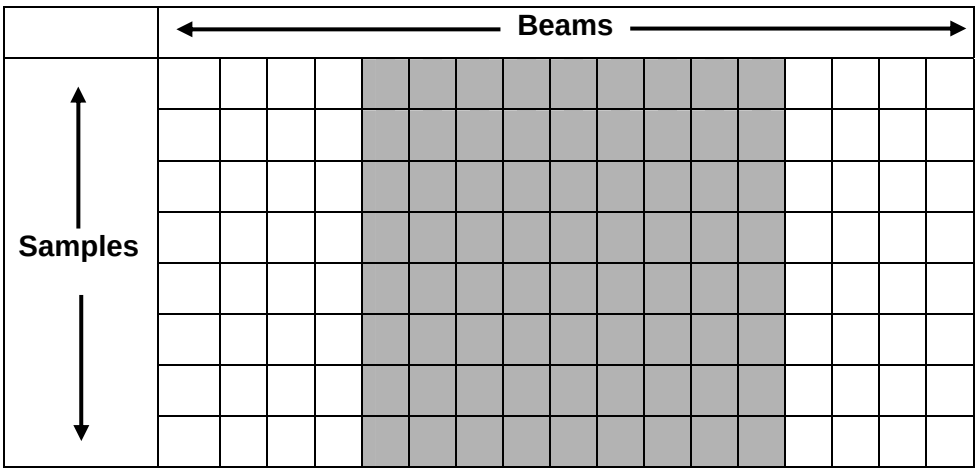


Figure 9: Beam Limits – Set Min and Max Beam

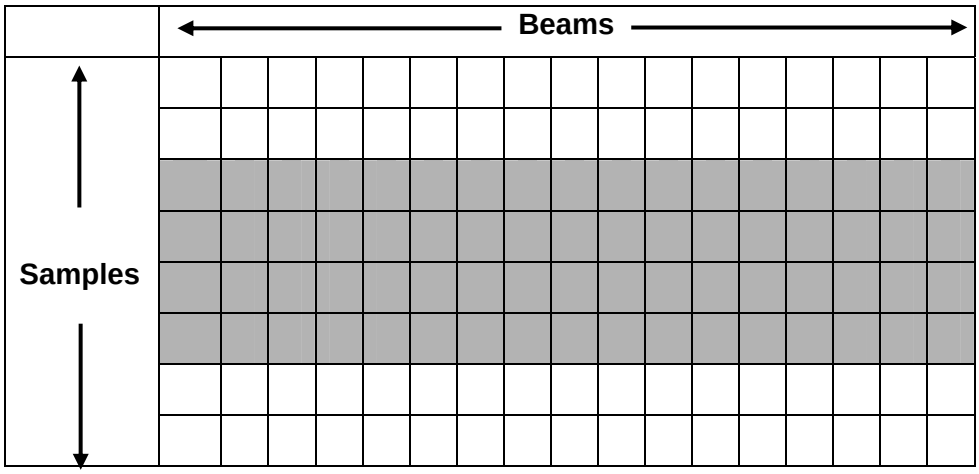


Figure 10: Sample Limits – Set in dB Around Bottom Detection Point

Data Definition:

DRF	RTH	RD	OD	DRF

Table 83: 7058 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Multi-ping sequence	u16	Flag to indicate multi-ping sequence. Always 0 (zero) if not in multi-ping mode; otherwise this represents the sequence number of the ping in the multi-ping sequence.
Beams	u16	Number of beams in the record
Error flag	u8	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)

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

Table 84: 7058 – Record Data

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

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

10.49 7200 – 7k File Header

Description: First record of 7k data file.

Data Definition:

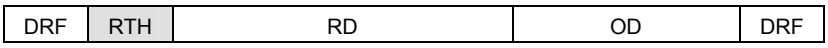


Table 85: 7200 – Record Type Header

Name	Size	Description
File identifier	u128	
Version number	u16	File format version number
Reserved	u16	Reserved
Session identifier	u128	User defined session identifier. Used to associate multiple files for a given session.
Record data size	u32	Size of record data. 0 – If not present
N	u32	Number of devices (N ≥ 0)
Recording name	u8 * 64	Null terminated US-ASCII string
Recording program version number	u8 * 16	Null terminated US-ASCII string
User defined name	u8 * 64	Null terminated US-ASCII string
Notes	u8 * 128	Null terminated US-ASCII string.

Table 86: 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

10.50 7300 – 7k File Catalog Record

Description: 7k RDR file index record, placed at the end of RDR files.

Data Definition:

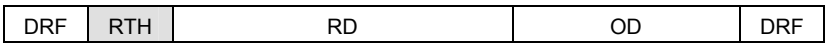


Table 87: 7300 – Record Type Header

Name	Size	Description
dwSize	u32	Size of this record
wVersion	u16	1

Name	Size	Description
dwNumRecords	u32	Number of records in RDR file
dwReserved	u32	Reserved

10.51 7400 – 7k Time Message

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 88: 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.

10.52 7500 – 7k Remote Control

Description: This record is used to remotely control SeaBat™ 7k sonar series. It contains the 7-P processor remote control commands. A remote control command is either acknowledged (record 7501) or not acknowledged (record 7502). The record can be subscribed to from the 7k Center. For details about subscribing to records, see *section 10 Record Type Definitions*. All remote control commands shall be sent to TCP or UDP port 7000 on the 7-P processor.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 89: 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.

Name	Size	Description
Tracking number	u128	Unique number. Set by client for packet tracking.

DRF	RTH	RD	OD	DRF

Table 90: 7500 – Record Data

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

10.53 7501 – 7k Remote Control Acknowledge

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 91: 7501 – Record Type Header

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

10.54 7502 – 7k Remote Control Not Acknowledge

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

Data Definition:

DRF	RTH	RD	OD	DRF

Table 92: 7502 – Record Type Header

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

10.55 7503 – Remote Control Sonar Settings

Description: This record is produced by the SeaBat™ 7k Sonar. It contains the remote control sonar settings. The 7k Center updates this record for each ping. For multi-ping only one record is produced for the whole sequence .The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 93: 7503 – Record Type Header

Name	Size	Description
Sonar Id	u64	Sonar serial number
Ping number	u32	Sequential number
Frequency	f32	Center transmit frequency in Hertz
Sample rate	f32	Sample rate in Hertz
Receiver bandwidth	f32	In Hertz
Tx pulse width	f32	Seconds of pulse
Tx pulse type identifier	u32	0 – CW 1 – Linear chirp 2 – Multi-ping 2 3 – Multi-ping 4
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 reserved	u32	Additional pulse information
Max ping rate	f32	Maximum ping rate in pings per second
Ping period	f32	Seconds since last ping
Range selection	f32	Range selection in meters
Power selection	f32	Power selection in dB/μPa
Gain selection	f32	Gain selection in dB

Name	Size	Description
Control flags	u32	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 13-14: Reserved Bit 15: 0 – System inactive 1 – Active Bit 16-23: Reserved for bottom detection Bit 24: Trigger Out 1 – Enabled Bit 25 Trigger In Edge 0 – Positive 1 – Negative Bit 26: PPS Edge 0 – Positive 1 – Negative Bit 27: Reserved Bit 28-29: Reserved for Calibration Bit 30: Reserved 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
Projector beam focal point	f32	In meters
Projector beam weighting window type	u32	0 – Rectangular 1 – Chebychev

Name	Size	Description
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
Reserved	u16	Reserved
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

Name	Size	Description
Tx array position offset Y	f32	Offset of the transmitter array in m, relative to the receiver array on the Y axis, positive value is forward, if the receiver faces forward
Tx array position offset Z	f32	Offset of the transmitter array in m, relative to the receiver array on the Z axis, positive value is up, if the receiver faces forward
Head Tilt X	f32	Radians
Head Tilt Y	f32	Radians
Head Tilt Z	f32	Radians. Typically zero.
Ping state	u32	Ping state: 0 – Pinging disabled 1 – Pinging enabled 2 – External trigger
Beam spacing mode	u16	1 – Equiangle 2 – Equidistant 3 – Flex 4 – Intermediate
7k Center mode	u16	0 –Normal 1 – Autopilot 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
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
Reserved	u32	Reserved
Coverage angle	f32	Coverage angle in radians
Coverage mode	u8	0 – Reduce Spacing 1 – Reduce Beams

Name	Size	Description
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)
Flex mode sector coverage	f32	Coverage sector in radians
Flex mode sector steering	f32	Steering angle in radians (positive to starboard)
Flex mode outside spacing	f32	Equidistant beam spacing in meters (at 1 meter depth)
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)
Reserved	u32 * 2	Reserved

10.56 7504 – 7P Sensor Settings

Description: This record is produced by the SeaBat™ 7k sonar series. It contains additional sonar settings. The 7k Center updates this record for each ping. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

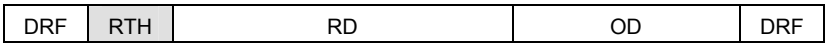


Table 94: 7504 – Record Type Header

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

Name	Size	Description
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
Orientation	u8	0 – Port Up 1 – Port Down
Reserved	u8	Reserved
Motion latency	f32	Motion sensor latency in seconds Valid range 0 – 0.050
Reserved	u8	Reserved
SV manual override	u8	Non-zero if manual override of SV in effect
Active enumerator	u16	Enumerator of pinging system
Active device ID	u32	Device ID of pinging system

Name	Size	Description
System mode	u32	0 – Manual (normal) mode 1 – AutoPilot mode 2 – I&Q (normalization) mode 3 – Playback mode 4+ – Reserved
Reserved	u32 * 123	Reserved

10.57 7511 – System Lock Status

Description: This record informs the clients about SeaBat™ 7k being used exclusively by single client. No other client will be able to change any parameters of the system while it is locked. The remote control commands will be not acknowledged with the error code 0x700B (Remote Command Denied). The 7k Center updates and publishes this record when the status has changed. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

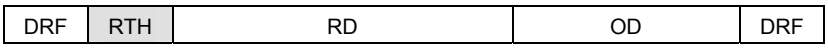


Table 95: 7511 – Record Type Header

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 (0x7F000001) is reported for local clients (those that are running on the same host as 7k Center) regardless of the type of the connection (TCP or Shared Memory). This field is not valid if system is not locked.
Reserved	u32 * 8	Reserved for future use

NOTE
This record is unidirectional. See remote command 1503 in *section 11 7k Remote Control Definitions* for how to gain exclusive control of the system.

10.58 7610 – 7k Sound Velocity

Description: This record can be used to set the SeaBat™ 7k sonar series systems current sound velocity value. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 96: 7610 – Record Type Header

Name	Size	Description
Sound velocity	f32	In meters/second

10.59 7611 – 7k Absorption Loss

Description: This record can be used to set the SeaBat™ 7k sonar series systems current absorption loss value. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 97: 7611 – Record Type Header

Name	Size	Description
Absorption loss	f32	In dB/km

10.60 7612 – 7k Spreading Loss

Description: This record can be used to set the SeaBat™ 7k sonar series systems current spreading loss value. This coefficient value is used in conjunction with the absorption loss value to re-compute the TVG curve that will be applied to amplify the returned signal. The record can be manually requested or subscribed to from the 7k Center. For details about requesting and subscribing to records, see *section 10.52 7500 – 7k Remote Control* together with *section 11 7k Remote Control Definitions*.

Data Definition:

DRF	RTH	RD	OD	DRF

Table 98: 7612 – Record Type Header

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

11 7K REMOTE CONTROL DEFINITIONS

11.1 Overview

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

Table 99: 7k Remote Control Definitions

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

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

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

11.2 1000 – Shutdown

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

This command has no parameters.

11.3 1001 – Reboot

Software and firmware reset.

This command has no parameters.

11.4 1002 – 7k Center Calibration Control

Description: Initiate system calibration. Record 7055 (7K Calibration Status Information) will indicate the ongoing calibration status and Record 7005 will be available when calibration is complete.

Table 100: 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+ – Reserved
Optional Data	variable	Depends on Calibration Commands

11.5 1003 – Range

Description: System Range Setting

Table 101: 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 102: 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 103: 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 104: 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 105: 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 106: 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 107: 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 1 – Enabled 0 – Disabled Bit 9: Depth filter 1 – Enabled 0 – Disabled Bit 10: Adaptive gate 1 – Enabled 0 – Disabled Bit 11: Adaptive gate depth filter 1 – Enabled 0 – Disabled Bit 12-31: 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 108: 7500 Record Data – Command 1010

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

11.13 1011 – Projector Selection

Description: Selects an active projector.

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

Table 109: 7500 Record Data – Command 1011

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

11.14 1016 – Bottom Detection Adaptive Gate Window and Filters

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

Table 110: 7500 Record Data – Command 1016

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

11.15 1017 – Receiver Gain Type

Description: Sets the receiver gain type.

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

Table 111: 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

11.16 1020 – Transmit Pulse Envelope Identifier

Description: Sets the Transmit Pulse Envelope.

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

Table 112: 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

11.17 1021 – Projector Beam Steering

Description: Horizontal and vertical projector beam steering.

This command is only available for selected systems.

Table 113: 7500 Record Data – Command 1021

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

11.18 1022 – Projector Beam Widths

Description: Horizontal and vertical projector beam widths.

This command is only available for selected systems.

Table 114: 7500 Record Data – Command 1022

Name	Size	Description
Horizontal projector beam –3dB beam width	f32	In radians
Vertical projector beam –3dB beam width	f32	In radians

11.19 1027 – Transmit Frequencies for Chirps

Description: Transmit pulse start and stop frequencies.

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

Table 115: 7500 Record Data – Command 1027

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

11.20 1028 – Head Tilt

Description: Sets receiver orientation. This command does not apply to all systems. Port-Starboard head tilt affects beam distribution in equidistant modes, as well as depth gates for bathymetry calculations.

Table 116: 7500 Record Data – Command 1028

Name	Size	Description
Head tilt X	f32	N/A
Head tilt Y	f32	Port-starboard head tilt (radians, maximum = +/- 45°)
Head tilt Z	f32	N/A

11.21 1029 – Projector Position Relative to Receiver

Description: These are the x, y, z offsets of the transmitter array relative to the position of the receiver array. Positive y is forward, positive x is to the right, and positive z is up, relative to the receiver facing forward.

Table 117: 7500 Record Data – Command 1029

Name	Size	Description
Offset X	f32	In meters
Offset Y	f32	In meters
Offset Z	f32	In meters

11.22 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 118: 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

11.23 1034 – Match Filter Parameters

Description: Sets the match filter parameters.

This command is only available for selected systems.

Table 119: 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

11.24 1035 – Coverage Sector

Description: Sets the current coverage sector.

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

Table 120: 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)

11.25 1036 – Coverage Mode

Description: Sets the current coverage mode.

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

Table 121: 7500 Record Data – Command 1036

Name	Size	Description
Coverage mode	u8	0 – Reduce spacing 1 – Reduce beams

11.26 1037 – Motion Sensor Configuration

Description: Sets the motion sensor configuration.

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

Table 122: 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
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

Name	Size	Description
Orientation	u8	0 – Port Up 1 – Port Down
Orientation inverted	u8	Orientation value sends to beam former. Can be different from the orientation setting. 0 – Normal 1 – Inverted
Reserved	u8	Reserved
Motion Latency	f32	Motion latency in seconds Valid range is 0 – 0.050
Reserved	u8 * 20	Reserved

11.27 1038 – Flex Mode Parameters

Description: Set the flex mode parameters.

Table 123: 7500 Record Data – Command 1038

Name	Size	Description
Flex mode sector coverage	f32	Coverage sector in radians
Flex mode sector steering	f32	Sector steering angle in radians (positive to starboard)
Flex mode outside spacing	f32	Equidistant beam spacing in meters (at 1 meter depth)

11.28 1039 – Beam Mode Selection

Description: Set the beam mode selection.

Table 124: 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 1050 – Single Record Request

Description: Request latest record.

Table 125: 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)

11.30 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 126: 7500 Record Data – Command 1051

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

11.31 1052 – End All Subscriptions

Description: Unsubscribe to all records.

This command has no parameters.

11.32 1053 – Third Party Data Connection

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

Table 127: 7500 Record Data – Command 1053

Name	Size	Description
Address	u32	IP address (Host Byte Data Order)
Port	u16	Port number

Name	Size	Description
Type	u16	0 – UDP 1 – TCP
# Records	u32	Number records
Record list	u32 * N	Array of record IDs, N = # Records

11.33 1054 – Delete Third Party Data Connection

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

Table 128: 7500 Record Data – Command 1054

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

11.34 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 129: 7500 Record Data – Command 1055

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

11.35 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 130: 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

11.36 1099 – Stop 7k Center

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

This command has no parameters.

NOTE
This command may cause all settings to be lost.

11.37 1100 – Start Pinging

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

This command has no parameters.

11.38 1101 – Stop Pinging

Description: Stop pinging.

This command has no parameters.

11.39 1102 – Load Factory Parameters

Description: Load Factory Parameters from disk.

This command has no parameters.

11.40 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 131: 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

11.41 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.

11.42 1109 – System Health Verification

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

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

This command has no parameters.

11.43 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 132: 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.

11.44 1113 – Calibrated Snippet Control

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

Table 133: 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

11.45 1114 – External Trigger

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

This command has no parameters.

11.46 1115 – Trigger Out

Description: Sets output trigger on ping command.

Table 134: 7500 Record Data – Command 1115

Name	Size	Description
State	u32	BIT FIELD: Bit 0: 1 – Enabled 0 – Disabled Bit 1-31: Reserved (must be zero)
Length	f64	Trigger length (in seconds)

Name	Size	Description
Offset	f64	Trigger delay after ping command (in seconds)

11.47 1116 – PPS Edge Control

Description: Sets PPS input edge control.

Table 135: 7500 Record Data – Command 1116

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

11.48 1117 – Quality Filter Settings

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

Table 136: 7500 Record Data – Command 1117

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

11.49 1118 – Snippet Control

Description: Limits snippet sample range.

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

Table 137: 7500 Record Data – Command 1118

Name	Size	Description
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
Min. Window	u32	Min snippet window (Flags[2])
Max. Window	u32	Max snippet window (Flags[3])

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

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

The “default” values are the following:

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

11.50 1138 – Element Limit Control

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

Table 138: 7500 Record Data – Command 1138

Name	Size	Description
Sample type	u16	16, 12 or 8 bits
Min sample	u32	Start sample number. 0 to samples – 1
Max sample	u32	Stop sample number. 0 to samples – 1 0xffffffff
Number of elements (E)	u16	0 – All elements 0xffff – If calibration is available, only “good” elements will be included. Otherwise, all elements are included. Otherwise, number of elements to follow
Elements	u16 * E	List of elements to include. Element numbers are zero based.

11.51 1200 – Start Recording

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

Table 139: 7500 Record Data – Command 1200

Name	Size	Description
Reserved	u32	Reserved – must be 0
Filename	u8 * 256	Null terminated ASCII string. Maximum 256 characters, including null character. If the filename is NULL (empty), the file name is created according to *section 8.2 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.

11.52 1201 – Stop Recording / Playback

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

This command has no parameters.

11.53 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 140: 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

Name	Size	Description
File name	u8 * 256	Null-terminated ASCII string. 256 characters maximum, including null character. The full path (drive and directory) must be specified with the file name. (The directory specified in the 1207 command record **will not** be used.)

11.54 1204 – Data Storage Status Request

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

This command has no parameters.

11.55 1206 – Set Warning Threshold(s)

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

Table 141: 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.

11.56 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 142: 7500 Record Data – Command 1207

Name	Size	Description
Directory	u8 * 256	New directory pathname. Null-terminated ASCII string. A trailing backslash ('\') will be appended if necessary. 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).

11.57 1209 – Set Filtering

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

The 7k records available for recording are listed below:

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

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

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

Table 143: 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

11.58 1400 – Autopilot Table Update

Description: Autopilot table to be loaded.

Table 144: 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

Name	Size	Description
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
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

11.59 7041 – R7041 Setup

Description:

Table 145: 7500 Record Data – Command 7041

Name	Size	Description	Startup
Down-sampling Method	u8	0 – No down-sampling 1 – Nearest neighbor 2 – Linear approximation 3 – Averaging	1

Name	Size	Description	Startup
Filtering Method	u8	0 – No filtering	0
Flags	u16	BIT FIELD: Bit 0-2: 0 – Reduction relative to pulse length 1 – Reduction relative to sample rate 2 – Absolute reduction 3-7 – Reserved Bit 3: 1 – Discard data beyond absolute gates Bit 4: 1 – Discard data beyond bottom detection point Bit 5-6: 0 – Magnitude only 1 – Magnitude and Phase 2 – Calibrated Magnitude 3 – Reserved Bit 7: Beam identification method 0 – Beam number (u16) 1 – Beam angle (f32, in radians) Bit 8-15: Reserved (always zero)	0x20
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
(Calibrated) Magnitude Encoding	u8	Magnitude Encoding Methods: 0 – 16 bit values 1 – 8 bit ½dB 2+ – Reserved Calibrated Magnitude Encoding Methods: 0+ – Reserved	
Phase Encoding	u8	Phase Encoding Methods: 0+ – Reserved	

11.60 7610 – Manual Sound Velocity

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

Table 146: 7500 Record Data – Command 7610

Name	Size	Description
Flags	u16	BIT FIELD: Bit 0: 0 – Manual override Off 1 – Manual override On Bit 1-15: Reserved
Sound velocity	f32	Sound velocity in m/s
Reserved	u32	Reserved

NOTE
Unless manual override bit is set (Flags = 0), any subsequently received 7610 (sound velocity) record will change the sound velocity value.

APPENDIX A PDS2000 OPTIONAL DATA

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

DRF	RTH	RD	OD	DRF

Table 147: 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
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

Table 148: 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	Depth for slant range correction in meters

Table 149: 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

Table 150: 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

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

Table 151: 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

Table 152: 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

Table 153: 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

APPENDIX B DEVICE IDENTIFIERS

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

Table 154: Device Identifiers

Identifier	Vendor	Description
100		Generic Position Sensor (e.g., GPS)
101		Generic Heading Sensor (e.g., Gyro)
102		Generic Attitude Sensor
103		Generic MBES
104		Generic Side-scan Sonar
105		Generic Sub-bottom Profiler
1001	TrueTime	PCISG
2000	CDC	SMCG
2001	CDC	SPG
2002	Empire Magnetics	YS2000 Rotator
4013	RESON	TC4013
6000	RESON	DiverDat
7000	RESON	7k Center
7001	RESON	7k User Interface
7003	RESON	PDS2000
7012	RESON	SeaBat™ 7012
7100	RESON	SeaBat™ 7100
7101	RESON	SeaBat™ 7101
7102	RESON	SeaBat™ 7102
7111	RESON	SeaBat™ 7111
7112	RESON	SeaBat™ 7112
7123	RESON	SeaBat™ 7123
7125	RESON	SeaBat™ 7125
7128	RESON	SeaBat™ 7128
7150	RESON	SeaBat™ 7150
7160	RESON	SeaBat™ 7160
8100	RESON	SeaBat™ 8100
8101	RESON	SeaBat™ 8101
8102	RESON	SeaBat™ 8102
8111	RESON	SeaBat™ 8111

Identifier	Vendor	Description
8123	RESON	SeaBat™ 8123
8124	RESON	SeaBat™ 8124
8125	RESON	SeaBat™ 8125
8128	RESON	SeaBat™ 8128
8150	RESON	SeaBat™ 8150
8160	RESON	SeaBat™ 8160
10000	TSS	DMS 05
10001	TSS	335B
10002	TSS	332B
10010	SeaBird	SeaBird SBE37
10200	Litton	Litton 200
11000	EdgeTech	FS-DW Sub-bottom Profiler (SBP)
11001	EdgeTech	FS-DW Low frequency side-scan sonar (LFSSS)
11002	EdgeTech	FS-DW High frequency side-scan sonar (HFSSS)
11100	BlueFin	BlueFin vehicle controller
11200	Ifremer	Techsas
12000	Simrad	Simrad RPT319

APPENDIX C PROJECTION IDENTIFIERS

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

Table 155: Projection Identifiers

Custom Identifier	Projection
-1	Not used
0	Universal Transverse Mercator (UTM)
1	Albers Equal-Area Conic
2	Azimuthal Equal Area
3	Azimuthal Equidistant
4	Bonne
5	Cassini
6	Double Stereographic
7	Equal-Area Cylindrical
8	Equidistant Conic
9	Equidistant Cylindrical
10	European Stereographic
11	Gnomic
12	Oblique Mercator (Rectified Skew Orthomorphic – with skew angle parameter)
13	Hotine
14	Hungarian National System (EOV)
15	Hungarian National System (EOV)
16	IMW Polyconic
17	Lambert Conformal Conic (1 parallel)
18	Lambert Conformal Conic (2 parallel)
19	Mercator
20	Miller Cylindrical
21	Mollweide
22	Orthographic
23	Polar Azimuthal
24	Equal Area

Custom Identifier	Projection
25	Polar Azimuthal Equidistant
26	Polar Stereographic
27	Polyconic
28	Robinson
29	Sinusoidal
30	Space Oblique Mercator
31	Stereographic
32	Stereographic 70
33	Transverse Mercator (Gauss-Kruger)
34	Two-Point Fit (polynomial projection)
35	Van der Grinten 1

APPENDIX D 7K ERROR CODES

Code	Description
0x7000 (28672)	SYSTEM_NOT_READY 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
0x7999 (31129)	UNKNOWN_ERROR An unknown error has occurred