Data Exchange Format (XSE)

TH 44 301 9001

Technical Description

Revision 1.8.4

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1 Format Description

1.1 Introduction

1.1.1 Overview

This document defines a new model for exchanging information between the HydroStar Software package and other software packages. The format description is not limited to a file format, although in the near future the main purpose is to introduce a more general file format than the older native ELAC file format.
The HydroStar Software can be seen as a server application that provides other software (clients) with specialized services like navigation information, multi beam or sidescan data or even status information. Data concerning ship's geometry, sound velocity and tide information can be inserted in the server application or requested from the server. Experiences in client/server data exchange communication have been collected. The client/server communication is discussed in an extra section of this document.
A section, listing and answering frequently asked questions, can be found in an extra section at the end of this documentation.

1.1.2 Document History

The following table summarizes the changes made to this document.

Version	Date	Changes
0.8	May 1998	only Navigation Group and Single Beam Groups specified and implemented
0.9	August 1998	second version of draft
0.9.1	November 1998	SeaBeam frame added
1.0	November 1998	tide groups changed; pressure group to sound velocity frame added; first sample files released
1.1	Dezember 1998	control frame specified; section about client/server communication added
1.2	January 1999	minor corrections; navigation frame extended; action group in control frame extended
1.3	April 1999	minor correction regarding multi beam frame; Figure 14 states document version with last changes and HydroStar version which implements the features; section “About the Format” updated;
1.4	May 14, 1999	groups of SeaBeam frame updated/extended
1.4.1	July, 1999	groups of SeaBeam frame finalized (team members: John Spitzak, Frank Ritters, Carsten Ziegenbein)
1.4.2	August, 1999	groups of product frame released (extended and finalized based on requirements from SeaBeam 2120 project) (team members: John Spitzak, Paul Cohen, Carsten Ziegenbein)
1.5	October, 1999	Client/Server Communication section reviewed and put under version control
1.6	November, 1999	group of SeaBeam frame changed/adjusted (team members: John Spitzak, Carsten Ziegenbein), FAQ section added
1.6.8	August, 2000	SeaBeam adjustments and minor corrections; synchronized to HydroStar Software Version 3.0.x
1.6.9	October, 2000	Adjustments and minor additions made during SeaBeam Integration meeting October 4-10, 2000 (team members: John Spitzak, Steve Zarenko, Carsten Ziegenbein)
1.7	January, 2001	Identity group in control frame added; requesting a new connection now needs to identify the client using the appropriate identity number, version number and sensor name in the identity group
1.7.1	March, 2001	Updated to HydroStar Software 3.2 beta; Third party software using the network access to HydroStar Software needs to log in with identity group included in control frame (obsolete log in procedure will be supported in version 3.2 for

Version	Date	Changes
		compatibility purposes)
1.7.2	Mai, 2001	Updated to cover Geomar project requirements; signals group in side scan frame added
1.8.0	July, 2001	Synchronized with Cesme project and HydroStar Software version 3.2.2
1.8.1	September, 2001	Updated to cover Geomar III project requirements; signals group in side scan frame corrected and ping type group in side scan frame added
1.8.2	December, 2001	Complex Signal Group added to side scan frame; Heading group in Navigation frame implemented
1.8.3	March, 2002	ShipFrame, general group, weighted group added to side scan frame
1.8.4	July, 2002	SeaBeam Frame: Description Beams Group extend, MotionReferenceUnitGroup Sidescan Frame: Complex Signal Group Units added ShipFrame new groups: NavigationAndMotion Group, Transducer Group added, Sensors Group expand and implemented Not supported since June 2002: Parameter Group

Figure 1: Document History

1.1.3 About the Format

The byte order is most significant byte (MSB) first and least significant byte (LSB) last. This is big endian or UNIX byte order style. The floating point format of the XSE data is IEEE FP standard (754). The items in the frames and groups are byte aligned.

Format	Bytes	Range		N/A or NaN
char	1	-127	+127	-128 (0x80)
uchar	1	0x00	254 (0xFE)	255 (0xFF)
short	2	-32767	32767	-32768 (0x8000)
ushort	2	0x0000	65534 (0xFFFE)	65535 (0xFFFF)
long	4	-2147483647	2147483647	-2147483648 (0x80000000)
ulong	4	0x00000000	4294967294 (0xFFFFFFFE)	4294967295 (0xFFFFFFFF)
float	4	-3.402823466e+38	3.402823466e+38	0xFFFFFFFF
double	8	-1.7976931348623158e+308	1.7976931348623158e+308	0xFFFFFFFFFFFFFFFF

Figure 2: Format Ranges (float and double are IEEE)

Format	Bytes	Range		Resolution
short	2	-32.767 m	32.767 m	1 mm
ushort	2	0.0 m	65.534 m	1 mm
long	4	-2147.5 km	2147.5 km	1 mm
ulong	4	0.0 km	4295 km	1 mm
float	4			6 digits; 0.1 rad = 40 cm
double	8			15 digits; 0.0001 rad = 5 mm

Figure 3: Distance Ranges

Format	Bytes	Range		Resolution
short	2	- 360.437 deg	360.437 deg	0.011 deg
ushort	2	0.0 deg	393.204 deg	0.006 deg
long	4	- 365.072 deg	365.072 deg	1.7e-7 deg
ulong	4	0.0 deg	360.777 deg	8.4e-8 deg
float	4			6 digits
double	8			15 digits

Figure 4: Angle Ranges

1.2 Items

As described in the following two sections the structure is given by the frames and group definition. However there are often sequences of items common to all frames and groups. To make the format description easier to read we introduce a number of predefined items that will be referenced in the frame and group description.

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	0x24485346		start of frame, $HSF
End	4	ulong	0x23485346		end of frame, #HSF
Start	4	ulong	0x24485347		start of group, $HSG
End	4	ulong	0x23485347		end of group, #HSG

Figure 5: Start and End Marker Item

Item	Bytes	Format	Value	Units	Description
Boolean	1	uchar	1 or 0	N/A	true or false

Figure 6: Boolean Item

Item	Bytes	Format	Value	Units	Description
Length	4	ulong	N	N/A	Text length
Text	N	char		chars	Text

Figure 7: String Item

Item	Bytes	Format	Value	Units	Description
X	8	double		m/radian	East/Longitude
Y	8	double		m/radian	North/Latitude
Z	8	double		m	Height/Ellipsoidal Height

Figure 8: Point Item

Item	Bytes	Format	Value	Units	Description
N	4	ulong	N	N/A	Description length
Description	N	char		chars	Geodetic Description
X	8	double		m/radian	East/Longitude
Y	8	double		m/radian	North/Latitude
Z	8	double		m	Height/Ellipsoidal Height

Figure 9: Geodetic Point Item

Item	Bytes	Format	Value	Units	Description
Seconds	4	ulong	N/A	sec	seconds since 00:00 1.1.1901 UTC
Micro	4	ulong	N/A	usec	micro seconds of seconds

Figure 10: Time Item

1.3 Frames

Each data frame is made up of several groups. Each frame header contains timing and status information that are common to all contained groups. The groups contained in a frame are frame specific. A frame must contain a specific group only once. The exceptions are documented along with the group description.
The Frame Id specifies the frame. Figure 12 shows the frame and there frame specific groups.

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Frame Start
Byte Count	4	ulong	N/A	bytes	between Byte Count & Frame End
Id	4	ulong	N/A	N/A	see Figure 12
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*N/A*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*	*N/A*	*usec*	*micro seconds of seconds*
…	…	…	…	…	frame specific groups
End	4	ulong	#HSF	N/A	Frame End

Figure 11: Basic Frame

Name	Id	Description
Navigation	1	Navigation, ship's motion and attitude information
Sound Velocity	2	Sound velocity profile and surface sound velocity
Tide	3	Tide
Ship	4	Ship parameter information
Side scan	5	Side scan
Multi beam	6	Multi beam
Single beam	7	Single beam
Control	8	Establishing connections and control HydroStar Software
Bathymetry	9	3D Bathymetry data from multi beam or single beam sensors
Product	10	Product (HydroStar Application) and Project information
Native	11	Framed data without knowing the true format
Geodetic	12	Ellipsoidal information, Datum information, Translation and Projections
SeaBeam	13	Handle SeaBeam 2100 multi beam sonar
Message	14	Id and/or text messages
<Reserved>	15	<Reserved>
<Reserved>	16	<Reserved>

Figure 12: Valid Frames (Examples)

1.3.1 Control Frame

A specialized frame is the Control Frame. When data exchange is done on-line by using LAN or serial ports the Control Frame serves as the base frame to exchange control data between HydroStar Software and one or more software programs.

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Frame Start
Byte Count	4	ulong	N/A	Bytes	between Byte Count & Frame End
Id	4	ulong	8	N/A	see Figure 12
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*N/A*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*	*N/A*	*usec*	*micro seconds of seconds*
Transaction	4	ulong	N/A	N/A	Transaction number
Address	4	ulong	N/A	N/A	Sender IP address
…	…	…	…	…	frame specific groups
End	4	ulong	#HSF	N/A	Frame End

1.4 Groups

The groups are wrapped in a frame structure which contains common timing and status information valid to all groups in the frame, followed by the groups themselves. The order that the groups appear in a frame at the output will be arbitrary (e.g. group 5 do not need to appear after group 4). The items in the frames and groups are byte aligned!

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Group Start
Byte Count	4	ulong	N/A	Bytes	between Byte Count & Frame End
Id	4	ulong	N/A	N/A	see Figure 14
…	…	…	…	…	Group specific data
End	4	ulong	#HSG	N/A	Group End

Figure 13: Basic Group

Figure 14 summarized all available frames with corresponding groups. The column labeled “Frame” states the name and the corresponding frame id. The Column labeled “Group” shows all group names with corresponding group ids which belong to the frame. The column labeled “Reference” gives the associated figure number. The Version column labeled “Version” indicates the latest program version of HydroStar Software and the latest document version of the XSE documentation which incorporates relevant changes of the given item. No version number implies

Frame		Group		Reference	Version	
Name	Id	Name	Id		HydroStar	Document
Navigation Motion Attitude	1	General	1	Figure 15		
		Point	2	Figure 16	2.8.1	0.8
		Accuracy	3	Figure 17		
		Motion Ground Truth	4	Figure 18	2.8.1	0.9
		Motion Trough Water	5	Figure 19	2.8.1	
		Current Track Steering Properties	6	Figure 20		1.2
		Heave Roll Pitch	7	Figure 21	3.1.7	1.4.1
		Heave	8	Figure 22		1.4.1
		Roll	9	Figure 23		1.4.1
		Pitch	10	Figure 24		1.4.1
		Heading	11	Figure 25	3.3.2	1.4.1
		Speed	12	Figure 26		1.4.1
Sound Velocity	2	General	1	Figure 27		0.9
		Depth	2	Figure 28	2.8.2	0.9
		Velocity	3	Figure 29	2.8.2	0.9
		Conductivity	4	Figure 30	2.8.2	0.9
		Salinity	5	Figure 31	2.8.2	0.9
		Temperature	6	Figure 32	2.8.2	0.9
		Pressure	7	Figure 33	2.8.2	1.0
		Surface	8	Figure 34		0.9.1
		Point	9	Figure 35		1.4
Tide	3	General	1	Figure 36		0.9
		Point	2	Figure 37		0.9
		Time	3	Figure 38		1.0
		Tide	4	Figure 39		1.0
Ship	4	General	1	Figure 40	3.3.2	0.9
		Time	2	Figure 41		
		Draft	3	Figure 42		
		Sensors	4	Figure 43	3.3.4	1.8.4
		Motion	5	Figure 44		
		Geometry	6	Figure 45		
		Description	7	Figure 46		
		Parameter (Not supported since June 2002)	8	Figure 47	2.8.2.	0.9
		NavigationAndMotion	9	Figure 48	3.3.4	1.8.4
		Transducer	10	Figure 49	3.3.4	1.8.4
Side scan	5	General	1	Figure 50	3.1.9	1.7.1
		Amplitude vs. Traveltime	2	Figure 51	3.2.2	0.9
		Phase vs. Traveltime	3	Figure 52		0.9
		Amplitude vs. lateral	4	Figure 53	3.1.9	1.7.1
		Phase vs. lateral	5	Figure 54		1.7.2
		Signal	6	Figure 55	3.2.2	0.9
		Ping Type	7	Figure 56	3.3.1	1.8.1
		Complex Signal	8	Figure 57	3.3.2	1.8.2
		Weighting	9	Figure 58	3.3.3	1.8.3
Multi beam	6	General	1	Figure 59	3.1.9	1.7.1
		Beam	2	Figure 60		
		Travel time	3	Figure 61	2.8.1	0.9
		Quality	4	Figure 62	2.8.1	0.9
		Amplitude	5	Figure 63	2.8.1	0.9
		Delay	6	Figure 64	2.8.1	0.9
		Lateral	7	Figure 65	3.1.7	0.9.1
		Along	8	Figure 66	3.1.7	0.9.1
		Depth	9	Figure 67	3.1.7	0.9.1
		Angle	10	Figure 68	2.8.1	0.9
		Heave	11	Figure 69	2.8.1	0.9
		Roll	12	Figure 70	2.8.1	0.9
		Pitch	13	Figure 71	2.8.1	0.9
		Gates	14	Figure 72	2.1.7	0.9.1
		Noise (signal to noise ratio)	15	Figure 73	3.1.7	0.9.1
		Echo length	16	Figure 74	3.1.7	0.9.1
		Hits	17	Figure 75	3.1.7	0.9.1
Single beam	7	General	1	Figure 76		0.8
Control	8	General	1	Figure 77		
		Change	2	Figure 78		
		Add	3	Figure 79		
		Delete	4	Figure 80		
		Action	5	Figure 81	2.8.1	1.1

Frame		Group		Reference	Version	
Name	Id	Name	Id		HydroStar	Document
		Continuous	6	Figure 82	2.8.1	1.1
		Request	7	Figure 83		1.1
		Connection	8	Figure 84	2.8.1	1.1
		Reply	9	Figure 85		1.1
		Identity	10	Figure 86	3.0.14	1.7
Bathymetry	9	General	1	Figure 87		
		Points	2	Figure 88		
		SwathBounderies	3	Figure 89		
Product	10	General	1	Figure 90		
		ExchangeServer	2	Figure 91		
		ProjectProperties	3	Figure 92		
		Sources	4	Figure 93		
Native	11	Collectable	1	Figure 94		
		Raw	2	Figure 95		
		ELAC	3	Figure 96		
		UNB	4	Figure 97		
Geodetic	12	General	1	Figure 98		
		Ellipsoid	2	Figure 99		
		Datum	3	Figure 100		
		Projection	4	Figure 101		
		System	5	Figure 102		
		Alias	6	Figure 103		
SeaBeam	13	Properties	1	Figure 104	3.1.7	1.4
		HeaveRollPitch	2	Figure 105	3.1.7	1.4
		Setup	3	Figure 106	3.1.7	1.4
		MotionReferenceUnit	4	Figure 107	3.1.7	1.4
		Settings	5	Figure 108	3.1.7	1.4
		Beams	6	Figure 109	3.1.7	1.4
		Gates	7	Figure 110	3.1.7	1.4
		Slice	8	Figure 111	3.1.7	1.4
		Signal	9	Figure 112	3.1.7	1.4
		Sidescan	10	Figure 113	3.1.7	1.4
		Shutdown	11	Figure 114	3.1.7	1.4
		Ping	12	Figure 115	3.1.7	1.4
		Calibrate	13	Figure 116	3.1.7	1.4
		Collect	14	Figure 117	3.1.7	1.4
		Surface	15	Figure 118	3.1.7	1.4
		Hydrophone	16	Figure 119	3.1.7	1.4
		Projector	17	Figure 120	3.1.7	1.4
		Bias	18	Figure 121	3.1.7	1.4
		Acknowledge	19	Figure 122	3.1.7	1.4
		Warning	20	Figure 123	3.1.7	1.6.9
		Message	21	Figure 124	3.1.7	1.6.9
		Error	22	Figure 125	3.1.7	1.6.9
		Transmit	23	Figure 126	3.1.7	1.4.1
		Transmitter	24	Figure 127	3.1.7	1.4.1
		Amplifier	25	Figure 128	3.1.7	1.4.1
		Update	26	Figure 129	3.1.7	1.4.1
		Firmware	27	Figure 130	3.1.7	1.4.1
		Generate	28	Figure 131	3.1.7	1.4.1
		TimeVaryingGain	29	Figure 132	3.1.7	1.4.1
		Process	30	Figure 133	3.1.7	1.4.1
		Processor	31	Figure 134	3.1.7	1.4.1
		Receive	32	Figure 135	3.1.7	1.4.1
		Receiver	33	Figure 136	3.1.7	1.4.1
		Calibration	34	Figure 137	3.1.7	1.4.1
		Echo	35	Figure 138	3.1.7	1.4.1
		Protocol	36	Figure 139	3.1.7	1.4.1
		SelectSignal	37	Figure 140	3.1.7	1.6
		TransducerAdvance	38	Figure 141		1.8.4
Message	14	Warning	1	Figure 142	3.2.2	1.4.1
		Message	2	Figure 143	3.2.2	1.4.1
		Error	3	Figure 144	3.2.2	1.4.1

Figure 14: Valid Groups

1.4.1 Navigation Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	24	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
End	4	ulong	#HSG	N/A	End Group

Figure 15: General Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	32+N	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Point Group
N	*4*	*ulong*	*Geodetic Point Item*	*N/A*	*Description length*
Description	*N*	*char*		*chars*	*Geodetic Description*
X	*8*	*double*		*m/radian*	*East/Longitude*
Y	*8*	*double*		*m/radian*	*North/Latitude*
Z	*8*	*double*		*m*	*Height/Ellipsoidal Height*
End	4	ulong	#HSG	N/A	End Group

Figure 16: Point Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	24	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Accuracy Group
End	4	ulong	#HSG	N/A	End Group

Figure 17: Accuracy Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	20	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Motion Ground Truth Group
Speed	8	double		m/s	Speed made good
Course	8	double		radian	Course made good (0..2*π)
End	4	ulong	#HSG	N/A	End Group

Figure 18: Motion Ground Truth Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	20	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	Motion Through Water Group
Speed	8	double		m/s	Speed
Course	8	double		radian	Heading (0..2*π)
End	4	ulong	#HSG	N/A	End Group

Figure 19: Motion Through Water Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	60	bytes	between Byte Count & Group End
Id	4	ulong	6	N/A	Current Track Properties Group
Offset Track	8	double		m	
Offset SOL	8	double		m	
Offset EOL	8	double		m	
Distance SOL	8	double		m	Distance to Start Of Line
Azimuth SOL	8	double		radian	Azimuth to Start Of Line
Distance EOL	8	double		m	Distance to End Of Line
Azimuth EOL	8	double		radian	Azimuth to End Of Line
End	4	ulong	#HSG	N/A	End Group

Figure 20: Current Track Steering Properties Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	28	bytes	between Byte Count & Group End
Id	4	ulong	7	N/A	HeaveRollPitch Group
Heave	8	double		m	heave
Roll	8	double		radian	roll
Pitch	8	double		radian	pitch
End	4	ulong	#HSG	N/A	End Group

Figure 21: HeaveRollPitch Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Heave Group
Heave	8	double		m	Heave
End	4	ulong	#HSG	N/A	End Group

Figure 22: Heave Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	9	N/A	Roll Group
Roll	8	double		radian	Roll
End	4	ulong	#HSG	N/A	End Group

Figure 23: Roll Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	10	N/A	Pitch Group
Pitch	8	double		radian	Pitch
End	4	ulong	#HSG	N/A	End Group

Figure 24: Pitch Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	11	N/A	Heading Ground Truth Group
Course	8	double		radian	Heading (0..2*π)
End	4	ulong	#HSG	N/A	End Group

Figure 25: Heading Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	12	N/A	Speed Group
Speed	8	double		m/s	Speed through water (Log)
End	4	ulong	#HSG	N/A	End Group

Figure 26: Speed Group (not implemented)

1.4.2 Sound Velocity Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
Length	*4*	*ulong*	*String Item*	*N/A*	*Text length*
Text	*N*	*char*		*chars*	*Description*
State	4	ulong	1: measured 2: calculated 3: mean	bits	
End	4	ulong	#HSG	N/A	End Group

Figure 27: General Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Depth Group
N	4	ulong		N/A	Number of values
Depth	8*N	double		meter	Depth values
End	4	ulong	#HSG	N/A	End Group

Figure 28: Depth Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Velocity Group
N	4	ulong		N/A	Number of values
Velocity	8*N	double		m/s	Velocity values
End	4	ulong	#HSG	N/A	End Group

Figure 29: Velocity Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Conductivity Group
N	4	ulong		N/A	Number of values
Conductivity	8*N	double		mmho/cm	Conductivity values
End	4	ulong	#HSG	N/A	End Group

Figure 30: Conductivity Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	Salinity Group
N	4	ulong		N/A	Number of depth values
Salinity	8*N	double		o/oo	Salinity values
End	4	ulong	#HSG	N/A	End Group

Figure 31: Salinity Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	6	N/A	Temperature Group
N	4	ulong		N/A	Number of values
Temperature	8*N	double		deg Celsius	Temperature values
End	4	ulong	#HSG	N/A	End Group

Figure 32: Temperature Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	
Id	4	ulong	7	N/A	Pressure Group

Item	Bytes	Format	Value	Units	Description
N	4	ulong		N/A	Number of values
Pressure	8*N	double		bar	Pressure values
End	4	ulong	#HSG	N/A	End Group

Figure 33: Pressure Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Surface Group
Velocity	8	double		m/s	Surface sound velocity
End	4	ulong	#HSG	N/A	End Group

Figure 34: Surface Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	32+N	bytes	between Byte Count & Group End
Id	4	ulong	9	N/A	Point Group
N	*4*	*ulong*	*Geodetic Point Item*	*N/A*	*Description length*
Description	*N*	*char*		*chars*	*Geodetic Description*
X	*8*	*double*		*m/radian*	*East/Longitude*
Y	*8*	*double*		*m/radian*	*North/Latitude*
Z	*8*	*double*		*m*	*Height/Ellipsoidal Height*
End	4	ulong	#HSG	N/A	End Group

Figure 35: Point Group (not implemented)

1.4.3 Tide Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+N	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
Length	*4*	*ulong*	*N*	*N/A*	*Text length*
Text	*N*	*char*		*chars*	*Description*
End	4	ulong	#HSG	N/A	End Group

Figure 36: General Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	32+N	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Point Group
N	*4*	*ulong*	*Geodetic Point Item*	*N/A*	*Description length*
Description	*N*	*char*		*chars*	*Geodetic Description*
X	*8*	*double*		*m/radian*	*East/Longitude*
Y	*8*	*double*		*m/radian*	*North/Latitude*
Z	*8*	*double*		*m*	*Height/Ellipsoidal Height*
End	4	ulong	#HSG	N/A	End Group

Figure 37: Point Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+4*N	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Time Group
N	4	ulong		N/A	Number of values
Time	4*N	ulong		UTC Time	Time values
End	4	ulong	#HSG	N/A	End Group

Figure 38: Time Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Tide Group
N	4	ulong		N/A	Number of values
Tide	8*N	double		meter	Tide values
End	4	ulong	#HSG	N/A	End Group

Figure 39: Tide Group

1.4.4 Ship Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	56+N	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
N	*4*	*ulong*		*chars*	*Length of ship name*
Name	*N*	*char*		*N/A*	*Ship name*
Length	8	double		m	total length
Beam	8	double		m	total width
Draft	8	double		m	maximum draft
Height	8	double		m	maximum height
Displacement	8	double		cubic m	
Weight	8	double		kg	
End	4	ulong	#HSG	N/A	End Group

Figure 40: General Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+4*N	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Time Group
N	4	ulong		N/A	Number of values
Time	4*N	ulong		UTC Time	Time where draft is valid
End	4	ulong	#HSG	N/A	End Group

Figure 41: Time Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Draft Group
N	4	ulong		N/A	Number of values
Draft	8*N	double		meter	Draft values
End	4	ulong	#HSG	N/A	End Group

Figure 42: Draft Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+12*N	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Sensors Group
N	4	ulong		N/A	Number of values
Sensor Ids	4*N	ulong		ids	Sensors id values
Sensor Type	4*N	ulong	1000: 2000: 2001: 3000: 8000:	SB1000 SB2100 SB2100 V-shaped SB3000 EdgeTech Sidescan	
Frequency	4*N	ulong		Hz	Frequency
End	4	ulong	#HSG	N/A	End Group

Figure 43: Sensors Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	Motion Group
End	4	ulong	#HSG	N/A	End Group

Figure 44: Motion Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	6	N/A	Geometry Group
End	4	ulong	#HSG	N/A	End Group

Figure 45: Geometry Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	7	N/A	Description Group
End	4	ulong	#HSG	N/A	End Group

Figure 46: Description Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	76	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Parameter Group
Roll	4	float		rad	HRP sensor roll offset
Pitch	4	float		rad	HRP sensor pitch offset
Heading	4	float		rad	heading sensor offset
Delay	4	float		sec	navigation time delay
PTrans. x	4	float		m	port transducer x position
PTrans. y	4	float		m	port transducer y position
PTrans. z	4	float		m	port transducer z position
STrans. x	4	float		m	starboard transducer x position
STrans y	4	float		m	starboard transducer y position
STrans z	4	float		m	starboard transducer z position
PTrans. Error	4	float		rad	port transducer rotation in roll direction
STrans. Error	4	float		rad	starboard transducer rotation in roll direction
Navigation x	4	float		m	navigation antenna x position
Navigation y	4	float		m	navigation antenna y position
Navigation z	4	float		m	navigation antenna z position
HRP x	4	float		m	HRP sensor x position
HRP y	4	float		m	HRP sensor y position
HRP z	4	float		m	HRP sensor z position
End	4	ulong	#HSG	N/A	End Group

Figure 47: Parameter Group (Not supported since June 2002)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	92	bytes	between Byte Count & Group End
Id	4	ulong	9	N/A	Parameter Group
Roll	8	double		rad	HRP sensor roll offset
Pitch	8	double		rad	HRP sensor pitch offset
Heave	8	double		M	HRP sensor heave offset
Gyro	8	double		rad	Gyro sensor offset
Delay	8	double		sec	navigation time delay
Navigation x	8	double		m	navigation antenna x position
Navigation y	8	double		m	navigation antenna y position
Navigation z	8	double		m	navigation antenna z position
HRP x	8	double		m	HRP sensor x position
HRP y	8	double		m	HRP sensor y position
HRP z	8	double		m	HRP sensor z position
End	4	ulong	#HSG	N/A	End Group

Figure 48: NavigationAndMotion Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+N*90	bytes	between Byte Count & Group End
Id	4	ulong	10	N/A	Hydrophone Group
Number N	4	ulong			Transducer Number
SensorID	4*N	ulong			Sensor Ids (SensorsGroup)
Transducer	1*N	uchar	0: Hydrophone 1: Projector		Kind of Transducer
Frequency	4*N	ulong		Hz	Frequency
Side	1*N	uchar	0: undefined 1: port 2: starboard 3: midship		Transducer Side
MountingRoll	8*N	Double		rad	array mounting angle (Roll)
MountingPitch	8*N	Double		rad	array mounting angle (Pitch)
MountingAzimuth	8*N	Double		rad	array mounting angle (Azimuth)
Distance	8*N	Double		m	Horizontal distance between the innermost transducer elements of the transducer arrays to the center ship line in a V-shaped ship configuration
X	8*N	Double		m	across track offset (transducer center)
Y	8*N	Double		m	along track offset (transducer center)
Z	8*N	Double		m	vertical offset (transducer center)
Roll Bias	8*N	Double		radian	roll bias value which should be used in beam forming (port up positive)
Pitch Bias	8*N	Double		radian	pitch bias value applied to beam forming (bow up positive)
Azimuth Bias	8*N	Double		radian	compass bias value applied to beam forming (projector axis clockwise with respect to compass positive)
End	4	ulong	#HSG	N/A	End Group

Figure 49: Transducer Group

1.4.5 Side scan Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	28	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
Ping	4	ulong			Ping number
Frequency	4	float		kHz	Transducer frequency
Pulse	4	float		s	Transmit pulse length
Power	4	float		dB	Transmit power
Bandwidth	4	float		Hz	Band width of receiver filter
Sample	4	float		s	Sample interval
End	4	ulong	#HSG	N/A	End Group

Figure 50: General Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+2*N	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	AmplitudeTraveltime Group
Interval	4	ulong		us	Sample interval
Offset	4	ulong			Time offset
N	4	ulong		N/A	Number of values
Amplitude	2*N	short		dB	Amplitude
End	4	ulong	#HSG	N/A	End Group

Figure 51: Amplitude vs. Traveltime Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+2*N	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	PhaseTraveltime Group
Interval	4	ulong		us	Sample interval
Offset	4	ulong		us	Time offset
N	4	ulong		N/A	Number of values
Phase	2*N	short		radian	Phase
End	4	ulong	#HSG	N/A	End Group

Figure 52: Phase vs. Traveltime Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+2*N	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	AmplitudeLateral Group
Size	4	ulong		mm	Bin size
Offset	4	ulong		mm	Lateral offset
N	4	ulong		N/A	Number of values
Amplitude	2*N	short		dB	Amplitude
End	4	ulong	#HSG	N/A	End Group

Figure 53: Amplitude vs. Lateral Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+2*N	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	PhaseLateral Group
Size	4	ulong		mm	Bin size
Offset	4	ulong		mm	Lateral offset
N	4	ulong		N/A	Number of values
Phase	2*N	short		radian	Phase
End	4	ulong	#HSG	N/A	End Group

Figure 54: Phase vs. Lateral Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	32+N*2	bytes	between Byte Count & Group End
Id	4	ulong	6	N/A	Signal Group
Number	4	ulong		N/A	Ping number
Channel	4	ulong		N/A	Channel id
Offset	8	double		N/A	Start offset
Interval	8	double		N/A	Bin size/sample interval
N	4	ulong		N/A	Number of Samples
Sample	2*N	short		N/A	Phase
End	4	ulong	#HSG	N/A	End Group

Figure 55: Signal Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	40+N	bytes	between Byte Count & Group End
Id	4	ulong	7	N/A	Ping Type Group
Frequency Mode	4	ulong	0 1	constant linear sweep	Pulse type
Start Frequency	8	double		Hz	Start frequency
End Frequency	8	double		Hz	End frequency
Duration	8	double		ms	Transmit pulse duration
Manufacturer Code	4	ulong	1 2	EdgeTech ELAC	Manufacturer code
Pulse Id	4	long			Pulse identifier (proprietary)
Name	4+N	string			Pulse name (proprietary)
End	4	ulong	#HSG	N/A	End Group

Figure 56: Ping Type Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	40+N	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Complex Signal Group
Number	4	ulong		N/A	Ping number
Channel	4	ulong		N/A	Channel id
Offset	8	double		us	Start offset
Interval	8	double		us	Bin size/sample interval
N	4	ulong		N/A	Number of Samples
Sample	4*N	short		N/A	Signal data, (1 short real, 1 short imaginary) N times
End	4	ulong	#HSG	N/A	End Group

Figure 57: Complex Signal Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	20	bytes	between Byte Count & Group End
Id	4	ulong	9	N/A	Weighting Group
FactorLeft	2	short			weighting factor for block floating point expansion -- defined as 2 -N volts for lsb
SamplesLeft	4	ulong			
FactorRight	2	short			weighting factor for block floating point expansion -- defined as 2 -N volts for lsb
SamplesRight	4	ulong			
End	4	ulong	#HSG	N/A	End Group

Figure 58: Weighting Group

1.4.6 Multi beam Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	32	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
Ping	4	ulong			Ping number
Frequency	4	float		Hz	Transducer frequency
Pulse	4	float		s	Transmit pulse length
Power	4	float		dB	Transmit power
Bandwidth	4	float		Hz	Band width of receiver filter
Sample	4	float		s	Sample interval
Swath	4	float		radians	
End	4	ulong	#HSG	N/A	End Group

Figure 59: General Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+2*N	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Beam Group
N	4	ulong		N/A	Number of values
Beam	2*N	ushort			Beam number
End	4	ulong	#HSG	N/A	End Group

Figure 60: Beam Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Traveltime Group
N	4	ulong		N/A	Number of values
Traveltime	8*N	double		s	Traveltime (two ways)
End	4	ulong	#HSG	N/A	End Group

Figure 61: Traveltime Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+N	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Quality Group
N	4	ulong		N/A	Number of values
Quality	N	uchar		N/A	
End	4	ulong	#HSG	N/A	End Group

Figure 62: Quality Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+2*N	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	Amplitude Group
N	4	ulong		N/A	Number of values
Amplitude	2*N	ushort		0.1 dB	Average of amplitudes
End	4	ulong	#HSG	N/A	End Group

Figure 63: Amplitude Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	6	N/A	Delay Group
N	4	ulong		N/A	Number of values
Delay	8*N	double		s	Time offset relative to frame
End	4	ulong	#HSG	N/A	End Group

Figure 64: Delay Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	7	N/A	Lateral Group
N	4	ulong		N/A	Number of values
Lateral	8*N	double		m	Lateral distance (negative starboard, positive port)
End	4	ulong	#HSG	N/A	End Group

Figure 65: Lateral Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Along Group
N	4	ulong		N/A	Number of values
Along	8*N	double		m	Along distance (negative stern, positive bow)
End	4	ulong	#HSG	N/A	End Group

Figure 66: Along Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	9	N/A	Depth Group
N	4	ulong		N/A	Number of values
Depth	8*N	double		m	Depth below transducer
End	4	ulong	#HSG	N/A	End Group

Figure 67: Depth Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	10	N/A	Angle Group
N	4	ulong		N/A	Number of values
Angle	8*N	double		radian	Beam angle (negative starboard, positive port) >>Launch Angle
End	4	ulong	#HSG	N/A	End Group

Figure 68: Angle Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	11	N/A	Heave Group
N	4	ulong		N/A	Number of values
Heave	8*N	double		m	
End	4	ulong	#HSG	N/A	End Group

Figure 69: Heave Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	12	N/A	Roll Group
N	4	ulong		N/A	Number of values
Roll	8*N	double		radian	
End	4	ulong	#HSG	N/A	End Group

Figure 70: Roll Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count & Group End
Id	4	ulong	13	N/A	Pitch Group
N	4	ulong		N/A	Number of values
Pitch	8*N	double		radian	
End	4	ulong	#HSG	N/A	End Group

Figure 71: Pitch Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	8+16*N	bytes	between Byte Count & Group End
Id	4		ulong	14	N/A	Gates Group
N	4		ulong		N/A	Number of values
Angle	8	16*N	double		radians	direction of beam
Start	4		float		s	Start gate
Stop	4		float		s	Stop gate
End	4		ulong	#HSG	N/A	End Group

Figure 72: Gates Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+4*N	bytes	between Byte Count & Group End
Id	4	ulong	15	N/A	Noise Group
N	4	ulong		N/A	Number of values
Noise	4*N	float		dB	Signal to noise ratio
End	4	ulong	#HSG	N/A	End Group

Figure 73: Noise Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+4*N	bytes	between Byte Count & Group End
Id	4	ulong	16	N/A	Length Group
N	4	ulong		N/A	Number of values
Length	4*N	float		s	Echo length
End	4	ulong	#HSG	N/A	End Group

Figure 74: Length Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+4*N	bytes	between Byte Count & Group End
Id	4	ulong	17	N/A	Hits Group
N	4	ulong		N/A	Number of values
Hits	4*N	ulong			Hits
End	4	ulong	#HSG	N/A	End Group

Figure 75: Hits Group

1.4.7 Single beam Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	44	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
Frequency	4	ulong		kHz	30/200 kHz transducer
Quality	4	ulong		N/A	0/1 invalid/valid
Traveltime	8	double	N/A	sec	not used (NaN)
Sound	8	double		m/s	used sound velocity
Depth	8	double		m	calculated depth
Amplitude	8	double	N/A	dB	not used (NaN)
End	4	ulong	#HSG	N/A	End Group

Figure 76: General Group

1.4.8 Control Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
End	4	ulong	#HSG	N/A	End Group

Figure 77: General Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Change Group
End	4	ulong	#HSG	N/A	End Group

Figure 78: Change Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Add Group
End	4	ulong	#HSG	N/A	End Group

Figure 79: Add Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Delete Group
End	4	ulong	#HSG	N/A	End Group

Figure 80: Delete Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	Action Group
Action	4	ulong	start actions: 0x01: record 0x02: playback 0x04: simulate 0x08: online stop actions: 0x11: record 0x12: playback 0x14: simulate 0x18: standby	bit	start and/or stop one of the following actions: storage record or play, simulate, sensor standby or online
End	4	ulong	#HSG	N/A	End Group

Figure 81: Action Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+4*N	bytes	between Byte Count & Group End
Id	4	Ulong	6	N/A	Continues Group
Frame	4	ulong			Requested frame id
Mode	4	ulong	1 2	enable disable	Enable/disable
N	4	ulong			Number of groups
Group	4	ulong			Requested group id
End	4	ulong	#HSG	N/A	End Group

Figure 82: Continuous Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N	bytes	between Byte Count & Group End
Id	4	ulong	7	N/A	Request Group
Frame	4	ulong			Requested frame id
N	4	ulong			Number of groups
Group	4	ulong			Requested group id
End	4	ulong	#HSG	N/A	End Group

Figure 83: Request Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	10	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Connection Group
Port	2	short			Port number
Command	4	ulong	1: open 2: close	bit	Open or close connection
End	4	ulong	#HSG	N/A	End Group

Figure 84: Connection Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	9	N/A	Reply Group
Transaction	4	ulong			transaction number to which this reply corresponds
Status	4	ulong	1: error 2: accepted 3: unavailable 4: processing	bit	error, accepted request or command, requested data unavailable, processing request or command
End	4	ulong	#HSG	N/A	End Group

Figure 85: Reply Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+N	bytes	between Byte Count & Group End
Id	4	ulong	10	N/A	Identity Group
Server	4	ulong	0..99: HydroStar Software 100: SeaBeam 2100 101: Isis2000 102: Hysweep 103: ISS2000 104: SMS 105: Helmsman1 106: Helmsman2 107: NaviBat 108: NAVICOURSE	number	Identity number of sensor (client or server)
Version	4	ulong		number	version of client or server
Name	4+N	string			name of client or server
End	4	ulong	#HSG	N/A	End Group

Figure 86: Identity Group

1.4.9 Bathymetry Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
End	4	ulong	#HSG	N/A	End Group

Figure 87: General Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N1+24*N2	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Points Group
Description	*4+N1*	*string*			*Geodetic Description*
Entries	4	ulong			Number of point items
Points	*24*N2*	*point*			*Point items*
End	4	ulong	#HSG	N/A	End Group

Figure 88: Points Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+N1+N2+N3	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	SwathBounderies Group
N1	*4*	*ulong*	*Geodetic Point Item*	*N/A*	*Valid Outermost Starboard Position*
Description	*N1*	*char*		*chars*	
X	*8*	*double*		*m/radian*	
Y	*8*	*double*		*m/radian*	
Z	*8*	*double*		*m*	
N2	*4*	*ulong*	*Geodetic Point Item*	*N/A*	*Valid Innermost Position*
Description	*N2*	*char*		*chars*	
X	*8*	*double*		*m/radian*	
Y	*8*	*double*		*m/radian*	
Z	*8*	*double*		*m*	
N3	*4*	*ulong*	*Geodetic Point Item*	*N/A*	*Valid Outermost Port Position*
Description	*N3*	*char*		*chars*	
X	*8*	*double*		*m/radian*	
Y	*8*	*double*		*m/radian*	
Z	*8*	*double*		*m*	
End	4	ulong	#HSG	N/A	End Group

Figure 89: SwathBounderies (not implemented)

1.4.10 Product Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	24+N1+N2+N3 +N4+N5	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
Product	4+N1	string			Product Name
Vendor	4+N2	string			Vendor Name
Copyright	4+N3	string			Copyright text
Version	4+N4	string			Version text
System	4+N5	string			Operating system
End	4	ulong	#HSG	N/A	End Group

Figure 90: Application Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	18+N1+N2	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	ExchangeServer Group
Machine	4+N1	string			IP Machine Name
Address	4+N2	string			IP Machine Address
Port	2	ushort			IP Port
Version	4	ulong			XSE Server Version
End	4	ulong	#HSG	N/A	End Group

Figure 91: ExchangeServer Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	9	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	ProjectProperties Group
Playback	1	boolean			true: Playback on
Recording	1	boolean			true: Recording
On-line	1	boolean			true: On-line (Pinging)
Simulation	1	boolean			true: Simulating
Surveying	1	boolean			true: Surveying
End	4	ulong	#HSG	N/A	End Group

Figure 92: ProjectProperties Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+N1*(12+N2+ N3)	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Source Group
N1	4	ulong			Number of sources
Id	4	ulong			Source Id
Version	4+N2	string			Source Version (e.g. version of sensor software)
Name	4+N3	string			Source Name
End	4	ulong	#HSG	N/A	End Group

Figure 93: Source Group (not implemented)

1.4.11 Native Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4+N	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	Collectable Group
Data	N	uchar			Collectable data
End	4	ulong	#HSG	N/A	End Group

Figure 94: Collectable Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Raw Group
Sensor	4	ulong			Sensor Id
N	4	ulong			Length of raw data
Data	N	uchar			Raw data
End	4	ulong	#HSG	N/A	End Group

Figure 95: Raw Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4+N	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	ELAC Group
Data	N	uchar			ELAC data
End	4	ulong	#HSG	N/A	End Group

Figure 96: ELAC Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4+N	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	UNB Group
Data	N	uchar			UNB data
End	4	ulong	#HSG	N/A	End Group

Figure 97: UNB Group (not implemented)

1.4.12 Geodetic Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	General Group
End	4	ulong	#HSG	N/A	End Group

Figure 98: General Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	28+N1+N2	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Ellipsoid Group
Code	4+N1	string			
Name	4+N2	string			
Major	8	double			Semi-major axis
Inverse Flattening	8	double			Inverse Flattening
End	4	ulong	#HSG	N/A	End Group

Figure 99: Ellipsoid (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Datum Group
Code	4+N1	string			
Name	4+N2	string			
RefCode	4+N3	string			Code of Reference Ellipsoid defined in Figure 100
Translation		point		m	translation
Rotation		point		rad	rotation angles
Scale				ppm	Rotation scale
End	4	ulong	#HSG	N/A	End Group

Figure 100: Datum Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	Projection Group
End	4	ulong	#HSG	N/A	End Group

Figure 101: Projection Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	4	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	System Group
End	4	ulong	#HSG	N/A	End Group

Figure 102: System Group (not implemented)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N1+N2	bytes	between Byte Count & Group End
Id	4	ulong	6	N/A	Alias Group
Name	4+N1	string			
Alias	4+N2	string			
End	4	ulong	#HSG	N/A	End Group

Figure 103: Alias Group (not implemented)

1.4.13 SeaBeam Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	52	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	Properties Group
Ping	4	ulong		number	Ping number
Gain	4	float		dB	currently used ping gain
Pulse	4	float		s	currently used pulse width
Power	4	float		dB	currently used transmit power level
Sidescan	4	float		m	currently used physical size of each pixel in side scan data
Swath	4	float		radians	currently used swath width
Interval	4	float		sec	time interval between slices (computed by the sonar based on pulse width)
Depth Mode	4	ulong	1 2 3	shallow intermediate deep	
Beam Mode	4	ulong	1 0	focused normal	focused beam mode
Sound	4	float		m/s	surface sound velocity
Frequency	4	float		kHz	frequency of sonar system
Bandwidth	4	float		kHz	receiver bandwidth
End	4	ulong	#HSG	N/A	End Group

Figure 104: Properties Group (Send with each Beams Group)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	28	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	HeaveRollPitch Group
Heave	8	double		m	sensor heave
Roll	8	double		radians	sensor roll
Pitch	8	double		radians	sensor pitch
End	4	ulong	#HSG	N/A	End Group

Figure 105: HeaveRollPitch Group (at sending time)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	28	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Setup Group
Frequency	4	float		kHz	Frequency of sonar
ShallowToIntermediate	4	ulong		us	the range at which the sonar should switch from deep (1-degree) to shallow (4-degree) beam forming
IntermediateToShallow	4	ulong		us	the range at which the sonar should switch from deep (1-degree) to shallow (4-degree) beam forming
IntermediateToDeep	4	ulong		us	the range at which the sonar should switch from shallow (4-degree) to deep (1-degree) beam forming
DeepToIntermediate	4	ulong		us	the range at which the sonar should switch from shallow (4-degree) to deep (1-degree) beam forming
Synchronizer	4	ulong		list entry number	tells the sonar what sort of external synchronizer it should use from a list of available devices (including “none”
End	4	ulong	#HSG	N/A	End Group

Figure 106: Setup Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	24	bytes	between Byte Count & Group End
Id	4	ulong	4	N/A	MotionReferenceUnit Group
Source	4	ulong	0: none 1: TSS1	list entry number	tell the MRU reader to read data from one of the devices it is familiar with
X	4	float		m	across track offset
Y	4	float		m	along track offset
Z	4	float		m	vertical offset
Latency	4	float		sec	device latency
End	4	ulong	#HSG	N/A	End Group

Figure 107: MotionReferenceUnit Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	64	bytes	between Byte Count & Group End
Id	4	ulong	5	N/A	Settings Group
Gain mode	4	ulong	2 3	auto manual	auto makes the sonar set the ping gain based on previous range measurement
Gain	4	float		dB	ping gain if gain mode is manual
Pulse mode	4	ulong	2 3	auto manual	auto makes the sonar set the pulse width based on previous range measurement
Pulse	4	float		s	pulse width if pulse mode is manual
Power mode	4	ulong	2 3	auto manual	auto makes the sonar set the power level based on previous range measurement
Power	4	float		dB	transmit power level if power mode is manual
Sidescan mode	4	ulong	2 3	auto manual	in auto the sonar will compute a sidescan pixel size which corresponds to the swath width
Sidescan size	4	float		m	physical size of each pixel in sidescan data
Swath mode	4	ulong	2 3	auto manual	
Swath width	4	float		radians	full swath width
Gates mode	4	ulong	2 3	auto manual	auto makes the sonar set the gates on previous range measurements
Gate Center	4	ulong		us	center depth (manual gate mode)
Gate Width	4	ulong		us	(manual gate mode)
Gate Slope	4	float		radians	angle of manual gates with port up positive
FocuedBeam	4	ulong	0 1 2	off on auto	
End	4	ulong	#HSG	N/A	End Group

Figure 108: Settings Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	24+40*N	bytes	between Byte Count & Group End
Id	4		ulong	6	N/A	Beams Group
Across	8		double		radians	beam width across track
Along	8		double		radians	beam width along track
Count N	4		ulong			number of beams
Number	4	40*N	ulong		number	beam number
Flag	4		ulong	0xFF00 0x8000 0xC000 0x00FF 0x0001 0x0002 0x0004 0x0008	bit masked BDI WMT bit masked good fair bad invalid	Algorithm: beam direction index (BDI) weighted mean time (WMT) Quality: good fair bad none, invalid
Range	4		ulong		us	travel time
Vertical	4		float		radians	launch angle
Forward	4		float		radians	Bearing angle
Heave	4		float		m	Heave at receiving time
Amplitude	4		float		dB	
Signal	4		float		dB	Signal to noise ratio
Length	4		ulong		pixel	Echo length
Hits	4		ulong		counter	Number of signals above threshold
End	4		ulong	#HSG	N/A	End Group

Figure 109: Beams Group (The Beams are corrected by roll and pitch)

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	12+12*N	bytes	between Byte Count & Group End
Id	4		ulong	7	N/A	Gates Group
Mode	4		ulong			auto or manual
Count N	4		ulong			number of gates
Angle	4	12*N	float		radians	beam angle
Start	4		ulong		us	range, travel time
Stop	4		ulong		us	range, travel time
End	4		ulong	#HSG	N/A	End Group

Figure 110: Gates Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	16+4*H	bytes	between Byte Count & Group End
Id	4		ulong	8	N/A	Raw Group
Slice	4		ulong			slice number
Roll	4		float			roll valid for each slice
HydrophonesH	4		ulong			number of hydrophones
Raw	4	4*H	ulong			sampled hydrophone data
End	4		ulong	#HSG	N/A	End Group

Figure 111: Slice Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	12+4*N	bytes	between Byte Count & Group End
Id	4		ulong	9	N/A	Center Group
Beam	4		ulong			beam number
Count N	4		ulong			number of samples
Signal	4	4*N	float		dB	amplitude data
End	4		ulong	#HSG	N/A	End Group

Figure 112: Signal Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	8+2*4*N	bytes	between Byte Count & Group End
Id	4		ulong	10	N/A	Sidescan Group
Count N	4		ulong			number of pixels
Amplitude	4	8*N	float		dB	amplitude
Along	4		float		m	distance along track
End	4		ulong	#HSG	N/A	End Group

Figure 113: Sidescan Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	11	N/A	Shutdown Group
State	4	ulong	1	trigger	causes sonar to shut down gracefully
End	4	ulong	#HSG	N/A	End Group

Figure 114: Shutdown Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	12	N/A	Ping Group
State	4	ulong	1/0	on/off	causes sonar cycle to ping
End	4	ulong	#HSG	N/A	End Group

Figure 115: Ping Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	13	N/A	Calibrate Group
State	4	ulong	1	trigger	calibrate receiver on next ping
End	4	ulong	#HSG	N/A	End Group

Figure 116: Calibrate Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	14	N/A	Collect Group
State	4	ulong	1/0	on/off	collect raw hydrophone data and send it to UI
End	4	ulong	#HSG	N/A	End Group

Figure 117: Collect Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	15	N/A	Surface Group
Velocity	4	float		m/s	Surface sound velocity
End	4	ulong	#HSG	N/A	End Group

Figure 118: Surface Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	40	bytes	between Byte Count & Group End
Id	4	ulong	16	N/A	Hydrophone Group
Number	4	ulong			number of hydrophones in the hydrophone array
Spacing	4	float		m	spacing between hydrophone elements
Mounting	4	float	Starbd: < 0 Port: > 0	rad	array mounting angle
Distance	4	float		m	horizontal distance between the innermost transducer elements of the transducer arrays to the center ship line in a V-shaped ship configuration
Sound	4	float		m/s	used to compute shading coefficients
Baffle	4	float		m	
X	4	float		m	across track offset
Y	4	float		m	along track offset
Z	4	float		m	vertical offset
End	4	ulong	#HSG	N/A	End Group

Figure 119: Hydrophone Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16	bytes	between Byte Count & Group End
Id	4	ulong	17	N/A	Projector Group
X	4	float		m	across track offset
Y	4	float		m	along track offset
Z	4	float		m	vertical offset
End	4	ulong	#HSG	N/A	End Group

Figure 120: Projector Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16	bytes	between Byte Count & Group End
Id	4	ulong	18	N/A	Bias Group
Roll Bias	4	float		radian	roll bias value which should be used in beam forming (port up positive)
Pitch Bias	4	float		radian	pitch bias value applied to beam forming (bow up positive)
Azimuth Bias	4	float		radian	compass bias value applied to beam forming (projector axis clockwise with respect to compass positive)
End	4	ulong	#HSG	N/A	End Group

Figure 121: Bias Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	19	N/A	Acknowledge Group
Group	4	ulong			Group to acknowledge
State	4	ulong	0x00000001 0x00000002 0x00000004 0x10000001 0x10000002 0x10000004		accepted accepted and processed accepted but pending rejected rejected unknown group rejected incorrect values
End	4	ulong	#HSG	N/A	End Group

Figure 122: Acknowledge Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N	bytes	between Byte Count & Group End
Id	4	ulong	20	N/A	Warning Group
Warning	4	ulong			Warning Id
Text	4+N	string			Warning text
End	4	ulong	#HSG	N/A	End Group

Figure 123: Warning Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N	bytes	between Byte Count & Group End
Id	4	ulong	21	N/A	Message Group
Message	4	ulong			Message Id
Text	4+N	string			Message text
End	4	ulong	#HSG	N/A	End Group

Figure 124: Message Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12+N	bytes	between Byte Count & Group End
Id	4	ulong	22	N/A	Error Group
Error	4	ulong			Error Id
Text	4+N	string			Error text
End	4	ulong	#HSG	N/A	End Group

Figure 125: Error Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	23	N/A	Transmit Group
State	4	ulong	1/0	on/off	collect transmitter/amplifier data and send it to UI
End	4	ulong	#HSG	N/A	End Group

Figure 126: Transmit Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	16+24*N	bytes	between Byte Count & Group End
Id	4		ulong	24	N/A	Transmitter Group
Result	4		ulong	0 1 2	fail pass working	
Progress	4		float	0.0 – 100.0	percentage	
Amplifiers N	4		ulong		number	number of amplifiers
Voltage	4	24*N	float		Volt	
Current	4		float		Ampere	
Phase	4		float		radian	
Impedance	4		float		Ohm	
Power	4		float		Watt	
State	4		ulong	0 1 2	fail pass working	
End	4		ulong	#HSG	N/A	End Group

Figure 127: Transmitter Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	8+4*N	bytes	between Byte Count & Group End
Id	4		ulong	25	N/A	Amplifier Group
Amplifiers N	4		ulong			number of amplifiers
Switch	4	4*N	ulong	1/0	on/off	switch the amplifier on or off
End	4		ulong	#HSG	N/A	End Group

Figure 128: Amplifier Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	12+N+S	bytes	between Byte Count & Group End
Id	4		ulong	26	N/A	Update Group
Length N	4		ulong	string item	N/A	File name length
Text	1	N	char		chars	File name
Size S	4		ulong		chars	File size
Data	1	S	char		chars	File content
End	4		ulong	#HSG	N/A	End Group

Figure 129: Update Group

Item	Bytes		Format	Value	Units	Description
Start	4		ulong	$HSG	N/A	Start Group
Byte Count	4		ulong	16+N	bytes	between Byte Count & Group End
Id	4		ulong	27	N/A	Firmware Group
Status	4		ulong	1 2 3	dead alive working	
Length N	4		ulong	string item	N/A	Version length
Text	1	N	char		chars	Version text
Progress	4		float	0.0 - 100.0	percentage	percentage of update complete
End	4		ulong	#HSG	N/A	End Group

Figure 130: Firmware Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16	bytes	between Byte Count & Group End
Id	4	ulong	28	N/A	Generate Group
Switch	4	ulong	1/0	on/off	
TravelTime	4	ulong		us	two-way travel time
Hydrophone	4	ulong		number	hydrophone number
End	4	ulong	#HSG	N/A	End Group

Figure 131: Generate Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	29	N/A	TimeVaryingGain Group
Gain mode	4	ulong	1 2	varying flat	use TVG function use manual gain
Gain	4	float		dB	manual gain if gain mode is flat
End	4	ulong	#HSG	N/A	End Group

Figure 132: TimeVaryingGain Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	30	N/A	Process Group
Trigger	4	ulong	1	trigger	start DSP test
End	4	ulong	#HSG	N/A	End Group

Figure 133: Process Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	12	bytes	between Byte Count & Group End
Id	4	ulong	31	N/A	Processor Group
Result	4	ulong	0 1 3	fail pass working	
Progress	4	float	0.0 - 100.0	percentage	
End	4	ulong	#HSG	N/A	End Group

Figure 134: Processor Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	32	N/A	Receive Group
Trigger	4	ulong	1	trigger	start receiver test
End	4	ulong	#HSG	N/A	End Group

Figure 135: Receive Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16	bytes	between Byte Count & Group End
Id	4	ulong	33	N/A	Receiver Group
Result	4	ulong	0 1 3	fail pass working	
Noise	4	float		dB	ambient noise level
Progress	4	float	0.0 - 100.0	percentage	
End	4	ulong	#HSG	N/A	End Group

Figure 136: Receiver Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+4*N	bytes	between Byte Count & Group End
Id	4	ulong	34	N/A	Calibration Group
Result	4	ulong	0 1 3	fail pass working	
Progress	4	float	0.0 - 100.0	percentage	
Projectors N	4	ulong			number of projectors
Coefficients	4 | 4*N	float			shading coefficients
End	4	ulong	#HSG	N/A	End Group

Figure 137: Calibration Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	44+N	bytes	between Byte Count & Group End
Id	4	ulong	35	N/A	Echo Group
Package	4	ulong			package number
Created	*8*	*double*	*N/A*	*sec*	*Creation time*
Send	*8*	*double*	*N/A*	*sec*	*Send time*
Received	*8*	*double*	*N/A*	*sec*	*Receive time*
Processed	*8*	*double*	*N/A*	*sec*	*Process time*
Length N	4	ulong			length of data
Data	1 | N	char			data
End	4	ulong	#HSG	N/A	End Group

Figure 138: Echo Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	36	N/A	Protocol Group
Trigger	4	ulong	1	test groups	test groups in this frame, do not interpret the groups
End	4	ulong	#HSG	N/A	End Group

Figure 139: Protocol Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	37	N/A	SelectSignal Group
Mode	4	ulong	1001 1002 1003	off center all	no beam signal signal from center beam beam signal of all beams
End	4	ulong	#HSG	N/A	End Group

Figure 140: SelectSignal Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	54	bytes	between Byte Count & Group End
Id	4	ulong	38	N/A	Hydrophone Group
Transducer	1	uchar	0: Hydrophone 1: Projector		Kind of Transducer
Frequency	4	ulong		Hz	Frequency
Side	1	uchar	0: undefined 1: port 2: starboard 3: midship		Transducer Side
Number	4	ulong			number of transducer in the transducer array
Spacing	4	float		m	spacing between transducer elements
MountingRoll	4	float		rad	array mounting angle
MountingPitch	4	float		rad	array mounting angle
MountingAzimuth	4	float		rad	array mounting angle
Distance	4	float		m	horizontal distance between the innermost transducer elements of the transducer arrays to the center ship line in a V-shaped ship configuration
Baffle	4	float		m	
X	4	float		m	across track offset (transducer center)
Y	4	float		m	along track offset (transducer center)
Z	4	float		m	vertical offset (transducer center)
Roll Bias	4	float		radian	roll bias value which should be used in beam forming (port up positive)
Pitch Bias	4	float		radian	pitch bias value applied to beam forming (bow up positive)
Azimuth Bias	4	float		radian	compass bias value applied to beam forming (projector axis clockwise with respect to compass positive)
End	4	ulong	#HSG	N/A	End Group

Figure 141: TransducerAdvance Group (not implemented)

1.4.14 Message Groups

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	Warning Group
Warning	4	ulong			Warning Id
End	4	ulong	#HSG	N/A	End Group

Figure 142: Warning Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Message Group
Message	4	ulong			Message Id
End	4	ulong	#HSG	N/A	End Group

Figure 143: Message Group

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8	bytes	between Byte Count & Group End
Id	4	ulong	3	N/A	Error Group
Error	4	ulong			Error Id
End	4	ulong	#HSG	N/A	End Group

Figure 144: Error Group

1.5 Example

1.5.1 Example One: Navigation and Single Beam Frames

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Start Frame
Byte Count	4	ulong	60+5	bytes	between Byte Count & Frame End
Id	4	ulong	1	N/A	Navigation Frame
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*N/A*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*	*N/A*	*usec*	*micro seconds of seconds*
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	28+5	bytes	between Byte Count & Group End
Id	4	ulong	2	N/A	Position Group
N	4	ulong	5	N/A	Name length
Description	N	char	WGS84	chars	Geodetic Description
X	8	double		radian	Longitude
Y	8	double		radian	Latitude
Z	8	double		m	Ellipsoidal Height
End	4	ulong	#HSG	N/A	End Group
End	4	ulong	#HSF	N/A	End Frame

Figure 145: Specialized Navigation Frame (WGS84 Position only)

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Start Frame
Byte Count	4	ulong	72	bytes	between Byte Count & Frame End
Id	4	ulong	7	N/A	Single beam Frame
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*N/A*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*	*N/A*	*usec*	*micro seconds of seconds*
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	40	bytes	between Byte Count & Group End
Id	4	ulong	1	N/A	
Frequency	4	ulong		kHz	30/200 kHz transducer
Quality	4	ulong		N/A	0/1 invalid/valid
Traveltime	8	double		sec	not used (NaN)
Sound	8	double		m/s	used sound velocity
Depth	8	double		m	calculated depth
Amplitude	8	double		dB	not used (NaN)
End	4	ulong	#HSG	N/A	End Group
End	4	ulong	#HSF	N/A	End Frame

Figure 146: Single beam Frame (Echosounder data)

2 Client/Server Communication

2.1 Handle Data Connection

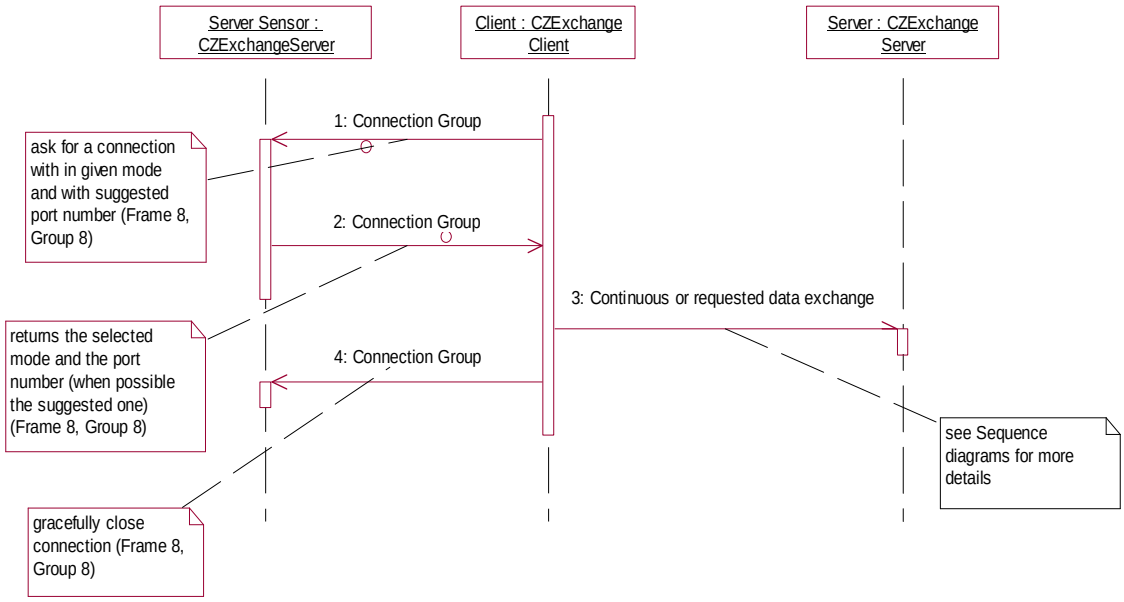

Figure 147: Create and shutdown connection to Exchange Server

To establish a new connection you have to send a request connection control command to the exchange server. The services supplied by the exchange server can be reached under port number 3400. As shown in Figure 147 send a control frame containing a connection group (frame 8, group 8) and a identity group (frame 8, group 10) to the server port 3400. To summarize you send the following bytes to the server with the given port number above:

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Frame Start
Byte Count	4	ulong	74+N	Bytes	between Byte Count & Frame End
Id	4	ulong	8	N/A	see Figure 12
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*time item*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*		*usec*	*micro seconds of seconds*
Transaction	4	ulong	1	N/A	Client transaction number
Address	4	ulong	19.16.84.21	N/A	e.g. sender IP address

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+6	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Connection Group
Port	2	short	1530		Requested port number
Command	4	ulong	1: open	bit	Request to open connection
End	4	ulong	#HSG	N/A	End Group
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	16+N	bytes	between Byte Count & Group End
Id	4	ulong	10	N/A	Identity Group
Server	4	ulong	99	number	Identity number of HydroStar client (example)
Version	4	ulong	1	number	version of client
Name	4+N	string	HydroStar Client	string	name of client
End	4	ulong	#HSG	N/A	End Group
End	4	ulong	#HSF	N/A	Frame End

As an reply (sequence 2 in Figure 147) to this request the servers answers with:

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Frame Start
Byte Count	4	ulong	70	Bytes	between Byte Count & Frame End
Id	4	ulong	8	N/A	see Figure 12
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*time item*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*		*usec*	*micro seconds of seconds*
Transaction	4	ulong	1234	N/A	Server transaction number
Address	4	ulong	19.16.84.20	N/A	e.g. server IP address
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+6	bytes	between Byte Count & Group End
Id	4	ulong	8	N/A	Reply Group
Port	2	short	3401		Requested port number is not available. Reply with given port number
Command	4	ulong	1: open	bit	Open connection
End	4	ulong	#HSG	N/A	End Group
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+N	bytes	between Byte Count & Group End
Id	4	ulong	9	N/A	Reply Group
Transaction	4	ulong	1		transaction number to which this reply corresponds
Status	4	ulong	2	bit	accepted request (connection group valid)
End	4	ulong	#HSG	N/A	End Group
End	4	ulong	#HSF	N/A	Frame End

We are dealing with a one-shot protocol so we can handle one or more clients connected to the server software. As a result from a one-shot protocol close the connection after the client receives the reply with the port number. The figure below uses the port number 3401 as an example. Now the server is ready to open a connection on port 3401. Communication in both directions takes place between the server with port number 3401 and the client. (sequence 3 in Figure 147). To shutdown the connection send a control frame with the close connection group to the server (port number 3400). This is represented as sequence 4 in Figure 147.

The connection which was established for future use between the client and server is used to exchange data and control commands in an bi-directional way.

2.2 Continuous Data Exchange

Which frames and groups are used in continuous data exchange is determined by the identity group, which was send within the control frame during the login phase.

2.3 On Request Data Exchange (not implemented)

If the client side is interesting in data on request, a request group within the control frame is send to the server. The server answers this request immediately. The reply group is used when data is not available or the request could not be understand by the server (e.g. asking for undefined frames or groups). Let's assume that the client side is interested in knowing the sound velocity profile, which is currently used for processing. By sending the following byte (sequence 1 in Figure 148) to the server the client asks for the currently used sound velocity profile:

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Frame Start
Byte Count	4	ulong	N/A	Bytes	between Byte Count & Frame End
Id	4	ulong	8	N/A	see Figure 12
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*N/A*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*	*N/A*	*usec*	*micro seconds of seconds*
Transaction	4	ulong	2	N/A	Transaction number
Address	4	ulong	19.16.84.20	N/A	e.g. server IP address
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+16	bytes	between Byte Count & Group End
Id	4	Ulong	6	N/A	Request Group
Frame	4	ulong	2		frame id
Count	4	ulong	2		Number of groups to enable or disable for continuous data exchange
Group	4	ulong	2		depth group id
Group	4	ulong	3		velocity group id
End	4	ulong	#HSG	N/A	End Group
End	4	ulong	#HSF	N/A	Frame End

To answer the request the server sends the following bytes (sequence 2 in Figure 148) to the client (assuming that a current sound velocity profile is available):

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSF	N/A	Frame Start
Byte Count	4	ulong	N/A	bytes	between Byte Count and Frame End
Id	4	ulong	N/A	N/A	see Figure 12
Source	4	ulong	N/A	N/A	id (e.g. sensor id)
Seconds	*4*	*ulong*	*N/A*	*sec*	*seconds since 00:00 1.1.1901 UTC*
Micro	*4*	*ulong*	*N/A*	*usec*	*micro seconds of seconds*

Item	Bytes	Format	Value	Units	Description
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count and Group End
Id	4	ulong	2	N/A	Depth Group
N	4	ulong	2	N/A	The sound velocity profile holds only two entries (values)
Depth	8	double	0.0	meter	first depth value
Depth	8	double	3.0	meter	second depth value
End	4	ulong	#HSG	N/A	End Group
Start	4	ulong	$HSG	N/A	Start Group
Byte Count	4	ulong	8+8*N	bytes	between Byte Count and Group End
Id	4	ulong	3	N/A	Velocity Group
N	4	ulong	2	N/A	Two velocity values follow
Velocity	8	double	1420.0	m/s	First velocity value
Velocity	8	double	1430.0	m/s	Second velocity value
End	4	ulong	#HSG	N/A	End Group
End	4	ulong	#HSF	N/A	Frame End

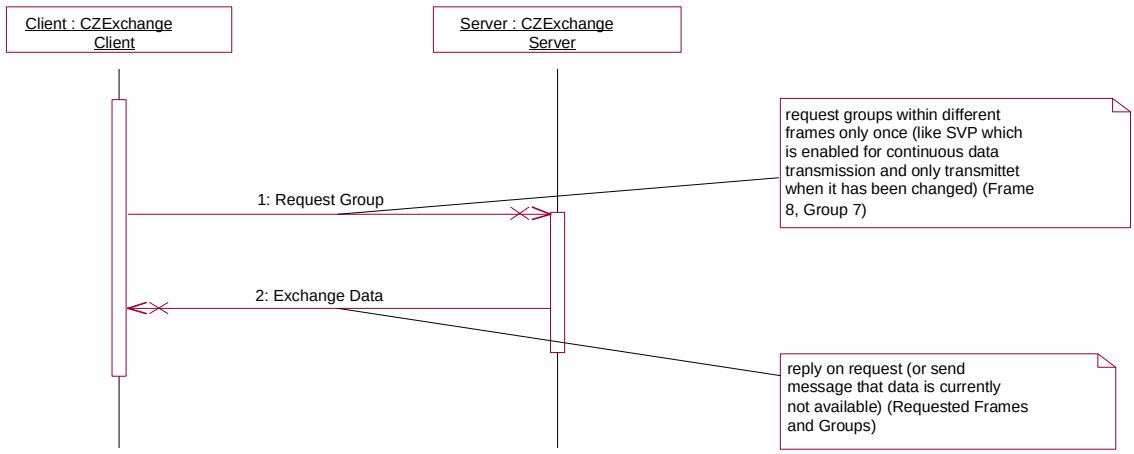

Figure 148: Sequence diagram

3 Frequently Asked Questions

Q: The navigation group indicates that storage could be northing/easting, or latitude/longitude. It does not say, however, how the 2 modes are differentiated.
A: The point group contains values for X, Y, Z and a geodetic description (a so called Geodetic Point Item). The geodetic description how to interpret the X, Y, Z values. If the geodetic description is WGS84 then the X, Y should be handled as longitude, latitude. Z is in this case a geodetic height.

Q: The heading seems to be stored in the navigation group, but our data files do not have the heading group within the navigation group. Can you tell me where we can get reliable heading information?
A: There are more than one place where heading information can be stored. One place is the Heading group, a second one in the navigation frame is the Motion Through Water group. Which group is used depends on the configuration of HydroStar, e.g. which sensors are connected to HydroStar Software.

Q: Heave/roll/pitch seems to be stored in both the navigation and multibeam groups. Why?
A: The heave, roll and pitch values stored in the multibeam group, are sampled/read by the multibeam sensor and than send to HydroStar Software. These values should be used when processing the multibeam data. The heave/roll/pitch stored in the navigation frame is read over the network or a serial line direct from the motion (HRP) sensor. The update rate of the two sources differs in normal operation. Whereas the update rate of the multibeam depends on the water depth, the update rate of the motion sensor should be constant in normal operation.

Q: The navigation group can contain a HeaveRollPitch group, as well as separate Heave, Roll and Pitch groups. Not all of these groups are present in our data files. Can you tell us which groups are always present and should be used?
A: Which groups are present depends on the configuration in which HydroStar Software is running. If there is a motion sensor which measures heave/roll/pitch at the same time (e.g. TSS DMS05) the HeaveRollPitch group is used. If the motion sensor measures only heave the Heave group is used.

Q: The documentation does not say the convention used for the sign of the heave/pitch/roll.
A: Positive roll is port up, positive pitch is stern up, positive heave is ship up.

Q: In the multibeam group, data can be stored as raw slant range (angle/traveltime), as well as computed (across/along/depth). In the data files that we have, I only see the slant range data. Can you tell me what data is always present? If we are going to use slant range, can you tell me what sound velocity should I be using to compute the initial set of across/along/depth?
A: For sure the traveltime is always be present, because this is a value which is measured by the multibeam sonar. The across/along/depth is calculated using a sound velocity profile the user has to select in post-processing. The sound velocity profile which was used during the data recording will be (but is probably not in your sample file) inserted at the beginning of the file or when the sound velocity profile will change (due to user interaction or using a tow fish).

Q: In the side scan group, data can be stored in raw (amplitude vs. time), or corrected (amplitude vs. distance). However, the documentation does not go into specific details about the values. For example, what does "Time Offset" mean? How are port and starboard values stored? The data files that we have store side scan data in the corrected mode, but the "Bin size" and "Lateral Offset" are zero, meaning we can't decode the range of imagery. I think a more thorough explanation of the values within the group is necessary. We also need to know how many of the 16 bits for each side scan amplitude is actually used to store data.
A: Up to now the amplitude vs. lateral distance in the side scan frame is implemented (and the General group). The "Bin size" means the grid size in lateral direction. If there is a gap between the port and starboard side (e.g. the side scan data of the innermost beams are omitted) the "Lateral Offset" holds this gap in direction of the lateral distance.