

SonarPro® User Datagram Protocol

Interface Specification

15300015

Rev 1.3

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Revision History

Revision	Date	Description
1.0	11-28-2006	Initial Release
1.1	6-05-2007	Add target classification, wing angle of attack, emergency switch state, layback fish position, fish heading offset, and pressure sensor offset
1.2	11-05-2007	Add tpuSwVersion and capabilityMask
1.3	4-21-2008	Added new bits definitions to capabilityMask. Added new fields txVersion and numSamplesExtra.

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1 Scope

This document defines the SonarPro® User Datagram Protocol (UDP) interface.

2 Applicable Documents

- OYO 17MSC System Requirements specification for order number S06-0958 and S06-0643 (July 3, 2006).
- SDF Data Page Definitions Specification, L-3 Klein Associates Document Number 15300018.

3 Software Overview

3.1 UDP Overview

The UDP protocol is a connectionless interface. UDP messages may arrive out of order or may not arrive at all (with no notice). UDP supports both client and server interfaces. UDP clients initiate UDP messages while UDP servers respond to UDP messages sent by UDP clients.

3.2 SonarPro® UDP Overview

The SonarPro® software will support a UDP “client” interface (SonarPro® is a UDP client since it initiates the UDP messages). The SonarPro® software will “broadcast” UDP messages over the Ethernet interfaces of the SonarPro® PC. The UDP output will support various message types. These messages contain information about the sonar data from the towfish as well as other system information. This message format is flexible enough such that it may be expanded to support a virtually unlimited amount of UDP messages for future expansion.

4 Software Interface Specifications

4.1 SonarPro® General UDP Requirements

The following is a summary of the requirements for the SonarPro® UDP interface.

- a) The SonarPro® UDP interface will be active during real-time data acquisition and during playback.
- b) SonarPro® will output a test message. This test message is temporary and may be used to help debug a UDP server implementation. The final version of SonarPro® will not output this message.
- c) SonarPro® will output all data in the SonarPro® Information Window and other data as required to generate the Navigation display window. This information will also include the wing “Angle of Attack” and the emergency switch state. Note: SonarPro must be collecting data from the TPU for the Angle of Attack and emergency switch state to be transmitted via UDP. This is because this message is only transmit when SonarPro is processing pings.

- d) SonarPro® will output a target message whenever a target is “marked” or saved.
- e)

4.2 UDP Message Types Overview

The SonarPro® UDP interface shall support the message types defined in this section.

4.2.1 Test Message

A Test message shall be supported. The Test message is a UNICODE text string that contains a message number. This test message may be utilized to debug a UDP server implementation. This message will not be supported in the final version of SonarPro®. This message shall be output once per ping during acquisition or playback.

4.2.2 Data Page Header Message

The Klein Data Page Header message shall be supported. This message contains all of the data that SonarPro® displays in the Information window as well as all of the data used to generate the SonarPro® Navigation display. This message shall be output once per ping during acquisition or playback.

4.2.3 Target Message

The Target message shall be supported. This message contains all of the target information that SonarPro® displays in the target window. This message shall be output whenever the user initially creates (marks) a target by double clicking in the Sonar Viewer window and whenever the target information is saved.

5 Detailed Interface Description

5.1 Network Byte Order

All message components will be converted to Network Byte Order before transmission from SonarPro®. Therefore, any UDP “server” receiving the message must convert the message components to host byte order before processing the message.

5.2 Port Number

The UDP messages are transmitted on port number 65000.

5.3 Data Types

Table 1 defines the data types used in the SonarPro® UDP Interface.

Table 1 – UDP Interface Data Types

Data Type	Number of Bytes	Description
S8	1	8 bit signed integer
U8	1	8-bit unsigned integer
S16	2	16-bit signed integer
U16	2	16-bit unsigned integer
S32	4	32-bit signed integer
U32	4	32-bit unsigned integer

F32	4	32-bit floating point value
F64	8	64-bit floating point value
wchar_t	2	16-bit unsigned character

5.4 General Message Format

The SonarPro® message format always contains two 32-bit values at the beginning of the message. The first 32-bit value is the message type. The second 32-bit value is the number of bytes to follow, i.e., the number of bytes in the specific message type excluding the message type word and the number of bytes work. Table 2 defines this general message format.

Table 2 – General SonarPro® UDP Message Format

Field Name	Data Type	Description
MessageType	U32	An integer value which defines the type of UDP message.
MessageSize	U32	An integer value which contains the number of bytes in the message (excluding the MessageType and MessageSize fields).
Message Specific	Message Specific	The message specific data of size MessageSize.

5.5 Specific Message Types

This section defines each message UDP message type. For each message field, the name, data type, value, and description is given. A blank value indicates the value is dynamic.

5.5.1 Test Message (MessageType = 0)

Table 3 – Test Message Format

Field Name	Data Type	Value	Description
MessageType	U32	0	message type 0: Test Message
MessageSize	U32		An integer value indicating the length of the test message string.
messageString	wchar_t		A UNICODE string. The string is as follows: “This is a SonarPro test message [number %d]”, where the %d is replaces with an incrementing message number. The initial message number is 1.

5.5.2 Data Page Header Message (MessageType = 1)

Table 4 – Test Message Format

Field Name	Data Type	Value	Description
MessageType	U32	1	Message Type 1 – Klein Data Page Header message
MessageSize	U32	256	An integer value indicating the size of the Klein Data Page Header.
numberBytes	U32		This field should be ignored. It is the total number of bytes in the TPU data page. This includes the number of bytes in this Klein data page header plus the number of bytes in the Sonar Data page.
pageVersion	U32	5000	Version of the Klein Data Page Header. Note: This value will vary depending on the towfish type and the Klein Data Page header version. See the “SDF Data Page Definitions Specification” for values.
configuration	U32		A bit mask indicating the configuration of the towfish as well as the connection type. See Table 5 and Table 6 for the specification of the mask bits. A logical OR of the bit mask values is performed in order to create the desired configuration word.
pingNumber	U32		The current ping number of the towfish.
numSamples	U32		The number of data samples in each channel.
beamsToDisplay	U32		5000 towfish only. A bit mask indicating which beams should be displayed by SonarPro®. See Table 7 for bit mask values. A logical OR of the bit mask values is performed in order to create the desired beamsToDisplay word.
errorFlags	U32		A bit mask indicating system errors. A zero indicates no errors. See Table 8 for bit mask values.

Field Name	Data Type	Value	Description
range	U32		towfish range value in meters.
speedFish	U32		towfish speed in cm/s
speedSound	U32		speed of sound in cm/s
resMode	U32		Resolution mode. 0 = normal, 1 = high.
txWaveform	U32		Pulse length. System 5000: See Table 9 for valid values. System 3000: Value is made up of two components that are logically OR'd together. The least significant 8 bits contain the Low Frequency pulse length. The most significant 24 bits contain the High Frequency pulse length. See Table 10 for values.
respDiv	U32		Responder divisor
respFreq	U32		Responder frequency. Value ignored for 17MSC as responder frequency set by divisor. For standard Klein responder, see Table 11 for values.
manualSpeedSwitch	U32		If this value is a 1, speedFish is set manually by TPU master. If this value is a 0, speedFish is set by a GPS message to the TPU.
despeckleSwitch	U32		See Table 12 for despeckle values.
speedFilterSwitch	U32		Controls whether the speed from the GPS has a 90/10 filter applied. 0 = filter off 1 = filter on
year	U32		Ping time stamp year value. For example, the year 2006 is returned as 2006.
month	U32		Ping time stamp month value.
day	U32		Ping time stamp day value.
hour	U32		Ping time stamp hour value (0 thru 23)
minute	U32		Ping time stamp minute value.
second	U32		Ping time stamp second value.
hSecond	U32		Ping time stamp hundredths of second value (0 thru 99).

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Field Name	Data Type	Value	Description
fixTimeHour	U32		Hour Time stamp of last GPS Navigation update.
fixTimeMinute	U32		Minute Time stamp of last GPS Navigation update.
fixTimeSecond	F32		Second Time stamp of last GPS Navigation update.
fishHeading	F32		fish heading in degrees.
pitch	F32		fish pitch in degrees.
roll	F32		fish roll in degrees.
depth	F32		fish distance from surface in meters.
altitude	F32		fish distance from sea floor in meters
temperature	F32		water temperature in degrees Celsius
speed	F32		speed of ship in meters/s
shipHeading	F32		ship heading from GPS in degrees.
magneticVariation	F32		magnetic variation from GPS
shipLat	F64		ship latitude in radians
shipLon	F64		ship longitude in radians
fishLat	F64		fish latitude in radians
fishLon	F64		fish longitude in radians
tvPage	U32		TVG page setting
headerSize	U32	256	The number of bytes in the Klein Data Page Header (including this field). Note: This is identical to the MessageSize field. It is included again as SonarPro® is reusing an existing data page header structure for the UDP message.
fixTimeYear	U32		Year Time stamp of last GPS Navigation update.
fixTimeMonth	U32		Month Time stamp of last GPS Navigation update.
fixTimeDay	U32		Day Time stamp of last GPS Navigation update.
auxPitch	F32		Auxiliary pitch value in degrees. Set by AUV message to TPU.
auxRoll	F32		Auxiliary roll value in degrees. Set by AUV message to TPU.
auxDepth	F32		Auxiliary depth value in meters. Set by AUV message to TPU.
auxAlt	F32		Auxiliary altitude value in meters. Set by AUV message to TPU.

Field Name	Data Type	Value	Description
cableOut	F32		Tow cable out distance in meters
fseconds	F32		Ping time stamp fractional seconds value.
altimeter	U32		Altimeter on/off setting 0 = Altimeter off 1 = Altimeter on
sampleFreq	U32		Sample frequency in samples/second
depressorType	U32		Depressor Type: 0 = None 1 = K-Wing 1 2 = K-Wing 2 3 = K-Wing 3
cableType	U32		Cable Type: 0 = 0.50 Armored 1 = 0.68 Armored 2 = lightweight 3 = 0.507 Armored (3 Fiber Optic + 3 coax)
shieveXoff	F32		Sheave X Offset in meters
shieveYoff	F32		Sheave Y Offset in meters
shieveZoff	F32		Sheave Z Offset in meters
GPSheight	F32		GPS height in meters
rawDataConfig	U32		5000 Towfish only. Bit mask which indicates the system raw data configuration. See Table 13 for bit mask values. A logical OR of the bit mask values is performed in order to create the desired rawDataConfig word.
header3ExtensionSize <small>Error! Reference source not found.</small>	U32	256	Size of only this header extension. Must be equal to 256 bytes.
sbpTxWaveform <small>Error! Reference source not found.</small>	U32		Tx waveform for Sub Bottom Profiler
sbpPreAmpGain <small>Error! Reference source not found.</small>	U32		0 = low 1 = high
sbpDataRaw <small>Error! Reference source not found.</small>	U32		0 = Processed SBP data, 1 = Raw SBP data.
sbpNumSamples <small>Error! Reference source not found.</small>	U32		Number of SBP samples in data page. May be different from Side Scan.
sbpSampleFreq <small>Error! Reference source not found.</small>	U32		Sample frequency of SBP channel.

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Field Name	Data Type	Value	Description
sbpTxWaveformVersion ^{Error!} Reference source not found.	U32		Tx waveform version of the SBP Tx board.
wingAngle ^{Error! Reference source not found.}	U32		Wing angle of attack in degrees.
wingEmergencySwitchState ^{Error!} Reference source not found.	U32		State of the wing emergency switch button. 0 = Switch Open, 1 = Switch Closed.
laybackMethod	U32		Method used by SonarPro® to calculate layback. 0 = Pythagorean Theorem
laybackFishLat	F64		fish latitude as determined by SonarPro® layback calculation (in radians)
laybackFishLon	F64		fish longitude as determined by SonarPro® layback calculation (in radians)
fishHeadingOffset	F32		Magnetic heading offset applied to towfish heading, in degrees
pressureSensorOffset	F32		Pressure sensor offset to be added to reading from pressure sensor, in psi
tpuSwVersion	U32		Version of the TPU s/w, 0xVVNNMMDD, where, * VV = Major version number * NN = Minor version number * MM = Month * DD = Day Added at tpuSwVersion 6.17.

Field Name	Data Type	Value	Description
capabilityMask	U32		Bit mask defining various system capabilities. Bit 0 = Configured for raw data (System 5000 only) Bit 1 = Configured for actuated wing Bit 2 = Configured with Sub Bottom Profiler option Bit 3 = Configured with header version 4 Bit 4 = Configured to allow a single oversampled frequency (3000 only) Bit 5 = Configured to allow dual frequency operation (3000 only) Added at tpuSwVersion 6.17. Bit 6 = 5000 (V1 or V2) system with V2 demux Bit 7 = 5000 V2 towfish
txVersion	U32		TPU Transmitter Version 0 = 5000 1 = 5000 V2 Added at tpuSwVersion 6.19
numSamplesExtra	U32		The extra number of samples included in each data channel to account for chirp Tx waveforms. This value is zero for other waveforms. Added at tpuSwVersion 6.22.

Notes:

1. This value only present for systems that have set the TPU header version greater than or equal to 4. This is indicated by a pageVersion or 3001 for a 3000 towfish or 5001 for a 5000 towfish.

Table 5 3000 Towfish Bit mask values for configuration Klein Data Page Header

Channel Configuration Bit Values	Hexadecimal Value
S3KCONF_CHAN1	0x00000001
S3KCONF_CHAN2	0x00000002
S3KCONF_CHAN3	0x00000004
S3KCONF_CHAN4	0x00000008
S3KCONF_SUBBOT1	0x00000010
S3KCONF_MASTER	0x80000000

Table 6 5000 Towfish Bit mask values for configuration Klein Data Page Header

Channel Configuration Bit Values	Hexadecimal Value
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Channel Configuration Bit Values	Hexadecimal Value
S5KCONF_CHAN1	0x00000001
S5KCONF_CHAN2	0x00000002
S5KCONF_CHAN3	0x00000004
S5KCONF_CHAN4	0x00000008
S5KCONF_CHAN5	0x00000010
S5KCONF_CHAN6	0x00000020
S5KCONF_CHAN7	0x00000040
S5KCONF_CHAN8	0x00000080
S5KCONF_CHAN9	0x00000100
S5KCONF_CHAN10	0x00000200
S5KCONF_BATHY1	0x00000400
S5KCONF_BATHY2	0x00000800
S5KCONF_BATHY3	0x00001000
S5KCONF_BATHY4	0x00002000
S5KCONF_BATHY5	0x00004000
S5KCONF_BATHY6	0x00008000
S5KCONF_BATHY7	0x00010000
S5KCONF_BATHY8	0x00020000
S5KCONF_BATHY9	0x00040000
S5KCONF_BATHY10	0x00080000
S5KCONF_BATHY11	0x00100000
S5KCONF_BATHY12	0x00200000
S5KCONF_ECHO1	0x00400000
S5KCONF_ECHO2	0x00800000
S5KCONF_SUBBOT1	0x01000000
S5KCONF_SUBBOT2	0x02000000
S5KCONF_ROLL	0x04000000
S5KCONF_YAW	0x08000000
S5KCONF_ACTUATOR_MASTER	0x40000000
S5KCONF_MASTER	0x80000000

Table 7 Bit mask for beamsToDisplay in Klein Data Page Header

Beam to Display	Hexadecimal Value
BEAM1	0x00000001
BEAM2	0x00000002
BEAM3	0x00000004
BEAM4	0x00000008
BEAM5	0x00000010
BEAM6	0x00000020
BEAM7	0x00000040
BEAM8	0x00000080
BEAM9	0x00000100
BEAM10	0x00000200

Table 8 Bit mask for errorFlags in Klein Data Page Header

Description	Hexadecimal Value
INVALID_SPEED	0x01
GPS_DATA_ERROR	0x02
TELEMETRY_ERROR	0x04
SENSOR_CHECKSUM_ERROR	0x08
TOWFISH_LEAK	0x10
BAD_DATA	0x20
WATCHDOG	0x40
COMPASS_ERROR	0x80

Table 9 – 5000 Towfish Tx waveform values for txWaveform in Klein Data Page Header

Description	Value
50 μ s chirp	0
100 μ s chirp	1
200 μ s chirp	2
200 μ s two-tone hop	3

Table 10 – 3000 Towfish Tx waveform values for txWaveform in Klein Data Page Header

High frequency Pulse Length	Hexadecimal Value	Low frequency pulse Length	Hexadecimal Value
25 μ s	0x00000000	50 μ s	0x00
50 μ s	0x00000100	100 μ s	0x01
100 μ s	0x00000200	200 μ s	0x02
Off	0x00000F00	400 μ s	0x03
		Off	0x0F

Table 11 – Standard Klein Responder frequency selections for respFreq in Klein Data Page Header

Frequency (kHz)	Value
24.0	0
24.5	1
25.0	2
25.5	3
26.0	4
26.5	5
27.0	6
27.5	7
28.0	8
28.5	9
29.0	10
29.5	11
30.0	12
30.5	13
31.0	14

31.5	15
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Table 12 Values for despeckleSwitch in Klein Data Page Header

Despeckle Type	Value	Description
Off	0	Despeckler is turned OFF.
Low	1	One-dimensional despeckling that is compatible with post-processing yaw correction.
Medium	2	Performs a two-dimensional despeckling of the data. This is the most eye pleasing yet does not allow for post-processing yaw correction.
High	3	A more aggressive two-dimensional despeckling.

Table 13 Bit mask for rawDataConfig in Klein Data Page Header

Raw Channel Configuration Values	Hexadecimal Value
Enable Port Channel 1	0x00000001
Enable Port Channel 2	0x00000002
Enable Port Channel 3	0x00000004
Enable Port Channel 4	0x00000008
Enable Port Channel 5	0x00000010
Enable Port Channel 6	0x00000020
Enable Port Channel 7	0x00000040
Enable Port Channel 8	0x00000080
Enable Port Channel 9	0x00000100
Enable Port Channel 10	0x00000200
Enable Port Channel 11	0x00000400
Enable Port Channel 12	0x00000800
Enable Port Channel 13	0x00001000
Enable Port Channel 14	0x00002000
Enable Starboard Channel 1	0x00010000
Enable Starboard Channel 2	0x00020000
Enable Starboard Channel 3	0x00040000
Enable Starboard Channel 4	0x00080000
Enable Starboard Channel 5	0x00100000
Enable Starboard Channel 6	0x00200000
Enable Starboard Channel 7	0x00400000
Enable Starboard Channel 8	0x00800000
Enable Starboard Channel 9	0x01000000
Enable Starboard Channel 10	0x02000000
Enable Starboard Channel 11	0x04000000
Enable Starboard Channel 12	0x08000000
Enable Starboard Channel 13	0x10000000
Enable Starboard Channel 14	0x20000000

5.5.3 Target Message (MessageType = 2)

Table 14 – Test Message Format

Field Name	Data Type	Size in Bytes	Value	Description
MessageType	U32	4	2	Message Type 2 –Target message
MessageSize	U32	4	288	An integer value indicating the size of the Target message structure.
version	U32	4	1	Version of the target message.
id	S32	4		Unique target ID. Value is number of seconds since midnight (00:00:00), January 1, 1970.
name	wchar_t	40		Unicode target name
notes	wchar_t	200		Unicode target notes
latitude	F64	8		Target latitude in radians
longitude	F64	8		Target longitude in radians
length	F32	4		Target length in meters. (A value less than zero indicates measurement is not valid).
width	F32	4		Target width in meters. (A value less than zero indicates measurement is not valid).
height1	F32	4		Target height1 in meters. (A value less than zero indicates measurement is not valid).
height2	F32	4		Target height2 in meters. (A value less than zero indicates measurement is not valid).
classification	U32	4		Output numerical value that operator has specified in SonarPro® target classification window. These values are controlled by the file SonarProClassification.ini.

5.5.4 Emergency Switch Message (MessageType = 3)

Table 15 – Test Message Format

Field Name	Data Type	Size in Bytes	Value	Description
MessageType	U32	4	3	Message Type 3 –Emergency switch message
MessageSize	U32	4	12	An integer value indicating the size of the Target message structure.
version	U32	4	1	Version of the emergency switch message.
messageCount	U32	4		Incrementing count each time this UDP message is sent
state	U32	4		Emergency Switch state. 1 = Switch Activated 0 = Switch Inactive



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