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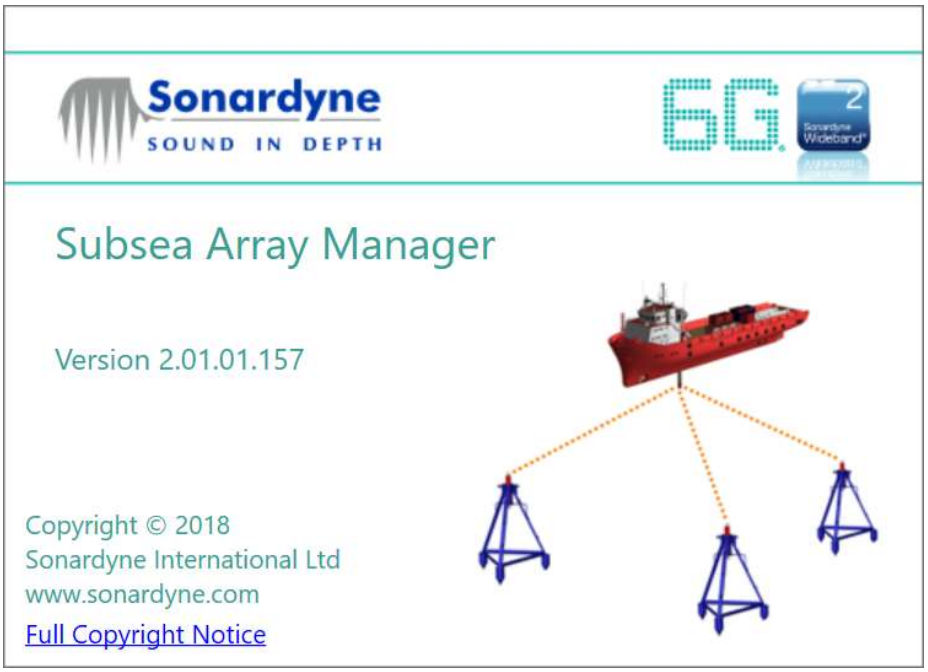
Export File Specification for logged data



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Amendment History

Issue	Date	Comments
1	18/05/16	Initial Issue for comment
2	31/05/16	Change pressure reporting from 3 to 5 decimal places (kPa). Filename restrictions added.
3	19/01/17	Changes to match first field data Change inclinometer units from radians to degrees, header line formats corrected
4	14/06/17	Correction to TSO record type AZA & AZS record type added
5	06/12/18	Added PIES record information
6	25/04/19	Add DCS record information Extend PIES parameters

Definitions

Abbreviation	Definition
Sonardyne	Sonardyne International Limited and its affiliates
AZA	Ambient-Zero-Ambient
CSV	Comma Separated Variables
DAS	Data Acquisition System
DCS	Doppler Current Sensor
PIES	Pressure Inverted Echo Sounder
PMT	Pressure Monitoring Transponder
SAM	Subsea Array Monitoring software package
SV	Sound Velocity
UID	Unique Identifier

Related Documents

Document Title	Document Reference
PMT Memory Storage format	Q:\DOCUMENT\83xx\8306_Pressure_Monitoring_Transponder\Design\Specifications\DAS\ Modular_DAS_memory_storage_format_xx.doc

1 Introduction

1.1 Purpose

This document defines the format of the output files generated by the Sonardyne software package Subsea Array Manager (SAM). SAM is used to control acoustic data harvest operations from Sonardyne Fetch seabed logging units.

1.2 Document Control

Control of this specification is held by Projects Group within Sonardyne, who will issue the document to customers on a per project basis.

The master document is stored in:-

\\snet\shared\Workgroups\DOCUMENT\83xx\8318 SAM software\Specifications\Export file spec

1.3 Context

The SAM software application is based on a previous software product known as Monitor, which has been developed over several years, with the primary purpose of controlling the acoustic upload of logged sensor data from seabed logging devices, and creation of logged data files that are then passed to the customer for processing.

The scope of the Monitor software has expanded over time to support an increasing number of subsea products, and the range of configuration options for the subsea logging units has also grown. One aim of this specification is to define a structure that will be future-proof, so that analysis of the logged data files can be performed more efficiently in future.

Previously, the addition of a new logged record type, or the addition of an extra sensor of an existing type required considerable rework to accommodate the change. Fetch units can now be built with a configurable sensor payload, which is achieved via a modular DAS system.

Data is collected as pages of binary data, each 512 bytes long, which is the native format used by the subsea instrument. SAM converts the raw data into an ASCII CSV file for export.

SAM software uses an xml job file to defines the output fields to be generated for each record type.

2 Requirements

2.1 File Type

The export file must be a CSV file type.

2.2 File Name

The filename must not include:

- spaces
- back slash \
- forward slash /
- arrows < >
- colon :
- ampersand &
- pipe |

The filename must include the following fields:

- Content type eg “Data”
- The start date and time of data export
- The node location reference (text string)
- The unit hardware identifier (UID)
- The unit acoustic address (AD)

Each of the fields must be separated by an underscore, with a minimum of four. Additional text can be added to the end of the filename.

2.2.1 Filename example

A sample filename is given below:

Data_170113210548_AB135_005326_2105_.csv

The date and time of the data export:	2017 Jan 13 21:05:48
The node location reference (text string)	AB135
The unit hardware identifier (UID)	005326
The unit acoustic address (AD)	2105

2.3 File Contents

Reported data should be consistent, with all data reported to a fixed number of decimal places. Any trailing zero values should be reported to ensure consistency with data formats.

2.3.1 Logged Record Data Type Identifier

Each logged sensor record must begin with a Logged Record type identifier.

The available identifiers are:

AZA	AZA averaged triple pressure sensor records
AZS	AZA starting point, simple triple pressure sensor record
BAS	Baseline Configuration
BAT	Battery
BSL	Baseline range
DCS	Doppler Current Sensor (Aanderaa model 4930R)
DQZ	Digiquartz Pressure & Temperature
INC	Inclinometer
KLR	Keller Pressure & Temperature
MOD	Module Settings
PAG	Page Record
PIES	PIES Record
PNS	Presens Pressure & Temperature
QDN	Quartzdyne Pressure & Temperature
REP	Log Repeat settings
SLG	Start Logging event
SSP	Sound Velocity
STP	Stop logging event
TIM	Time (RTC)
TMP	Temperature
TPS	TERPS Pressure
TSO	Time Sync Offset
WUL	Wake-Up Logging settings

2.3.2 Header Lines

The first lines in the file must contain header records for all logged record types included in the file. This comprises:

- the logged record data type identifier
- the record time (timestamp generated by the node)
- the acoustic retrieval time (timestamp generated by SAM)
- the Node Reference (eg location designator) a free text field up to 36 ASCII characters long (commas must not be used)

- the Unique hardware IDentifier (UID) reported as a fixed length ASCII hexadecimal string of 6 characters
- sensor index (module) number to identify multiple sensors of same type
- Sequence Time – time since the event start (AZA only)
- the data field identifiers for that record type including units in brackets
- the sensor serial number (SN) where applicable

AZA,Record Time,Retrieval Time,Node Ref,UID,Index,Sequence Time(s),Report,Status (hex),Transfer Pressure (kPa),Transfer Temperature (Deg C),Transfer SN,Ambient Pressure (kPa),Ambient Temperature (Deg C),Ambient SN,Low Pressure (kPa),Low Temperature (Deg C),Low SN,Mean Square Error (kPa),Rate of Change from settling (kPa/Sec)

AZS,Record Time,Retrieval Time,Node Ref,UID,Index,Sequence Time(s),Report,Status (hex),Transfer Pressure (kPa),Transfer Temperature (Deg C),Transfer SN,Ambient Pressure (kPa),Ambient Temperature (Deg C),Ambient SN,Low Pressure (kPa),Low Temperature (Deg C),Low SN

BAT,Record Time,Retrieval Time,Node Ref,UID,UsedPercentage %,Volts V

BSL,Record Time,Retrieval Time,Node Ref,UID,RangeNode Ref,RangeAddress,Range(ms),TAT(ms)

DCS,Record Time,Retrieval Time,Node Ref,UID,Index,Sensor,Error (hex),Absolute Speed cm/s,Current direction deg.min,Current speed North cm/s,Current speed East cm/s,Compass direction deg.min,Tilt x deg,Tilt y deg,Single ping SD,Ping strength dB,Ping count,Absolute tilt deg,Maximum tilt deg,Tilt SD,Internal DCS temperature degC

DQZ,Record Time,Retrieval Time,Node Ref,UID,Index,Pressure (kPa), Temperature (Deg C), SN

INC,Record Time,Retrieval Time,Node Ref,UID,Index,Pitch (degs),Roll (degs),SN

KLR,Record Time,Retrieval Time,Node Ref,UID,Index,Pressure (kPa), Temperature (Deg C), SN

PIES,Record Time,Retrieval Time,Node Ref,UID,Index,Sensor,Calculation Version,Log Time,Pressure (kPa),Time of Flight XCORR (s),Magnitude,Time of Flight RMLE (s),Halflife,Pretrigger Noise,RDIFF,Peak Position

PNS,Record Time,Retrieval Time,Node Ref,UID,Index,Pressure (kPa), Temperature (Deg C), SN

QDN,Record Time,Retrieval Time,Node Ref,UID,Index,Pressure (kPa), Temperature (Deg C), SN

SSP,Record Time,Retrieval Time,Node Ref,UID,Index,SoundSpeed (m/s),SN

TIM,Record Time,Retrieval Time,Node Ref,UID

TMP,Record Time,Retrieval Time,Node Ref,UID,Index,Temperature (Deg C), SN

TPS,Record Time,Retrieval Time,Node Ref,UID,Index,Pressure (kPa), Temperature (Deg C), SN

TSO,Record Time,Retrieval Time,Node Ref,UID,Device Time,UTC Time

2.3.3 Unit Information Records

Unit information records shall follow the header information when logging is started and stopped. These records include Baseline configuration, Module information, Repeat logging, Start & Stop logging events and Wake-up logging,

BAS,Record Time,Retrieval Time,Node Ref,UID,CIS(dec),WKT(dec),RXW(ms),Range Addr1,Range Addr2,....

MOD,Record Time,Retrieval Time,Node Ref,UID,Module Number,Module ID(hex),Cablibration State,Board Project,Drawing,Type,Firmware Version,Issue,Sub-Issue,Serial_WO,Serial_Batch,Sensor Serial,Warm-up (s)

PAG,Record Time,Retrieval Time,Node Ref,UID,Page Number

REP,Record Time,Retrieval Time,Node Ref,UID,Module Number,Repeat Sample,Repeat Value(s)

SLG,Record Time,Retrieval Time,Node Ref,UID,Event,Start Time,Repeat Period(s),Jitter(s),Event Mask(hex)

STP,Record Time,Retrieval Time,Node Ref,UID,Function,Event Number

WUL,Record Time,Retrieval Time,Node Ref,UID,Event Mask(hex),Repeat Time(s)

2.3.4 Data Delimiter

The header line(s) must be terminated by the sequence: -

```
# Data<cr><lf>
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This appears immediately before the first logged data record entry.

2.3.5 Index (Module) Number

Each sensor record shall contain an index value following the UID field. The index value is used to identify the sensor to which each record belongs. This can be useful when there are multiple sensors of the same type. The index typically refers to which module slot the sensor is fitted to on the DAS PCB and the possible values are 1-7.

2.3.6 Sensor Serial Number

The sensor serial number shall be included on the end of each logged record for all applicable sensors. This will include all pressure, inclinometer, temperature and sound speed records. If the sensing device does not have an electronic serial number that can be read by the host firmware, the sensor serial number will be left as a blank field.

2.3.7 Timestamp Format

Both record time and retrieval time shall be reported in each sensor record. The record time is reported from the DAS and retrieval time is added by the software.

The timestamp format for Record Time and Retrieval Time shall match the following:
YYYY/MM/DD HH:MM:SS

The timestamp format for the high precision Device Time and UTC Time shall match the following:
YYYY/MM/DD HH:MM:SS.SSSSSS

2.3.8 Sensor Data Format

The sensor data format for each log record shall be as follows:

2.3.8.1 AZA Averaged Ambient-Zero-Ambient

Three Pressure and Temperature readings (Averaged Values), from 3 sensors

2.3.8.2 AZS Single point Ambient-Zero-Ambient

Three Pressure and Temperature readings (Single Point Reading), from 3 sensors

2.3.8.3 BAT Battery

- UsedPercentage %, integer
- Volts V, battery voltage to 1 decimal place,

2.3.8.4 BSL Baseline

- RangeNode Ref, of target transponder
- RangeAddress, of target transponder
- Range(ms), Baseline Range in 2-way milli-seconds to 3 decimal places (~0.7mm resolution) to target transponder
- TAT(ms), used in the target transponder

2.3.8.5 DCS Doppler Current Sensor

- Sensor Error (hex),
- Absolute Speed cm/s,
- Current direction deg.min,
- Current speed North cm/s,
- Current speed East cm/s,
- Compass direction deg.min,
- Tilt x deg,
- Tilt y deg,
- Single ping SD,
- Ping strength dB,
- Ping count,
- Absolute tilt deg,
- Maximum tilt deg,
- Tilt SD,
- Internal DCS temperature degC

For a full description of these fields, refer to the Aanderaa 4930R instrument manual.

2.3.8.6 INC Inclination

- Pitch(degs), in degrees to 4 decimal places.
- Roll(degs), in degrees to 4 decimal places.

(Convention: Fwd up = pitch +ve, Port up = Roll +ve)

2.3.8.7 PIES Pressure Inverted Echo Sounder

- Sensor, pressure sensor used eg DQZ
- Calculation Version, version of PIES detection algorithm used
- Log Time, Measurement timestamp (generated by the CPU card)
- Pressure (kPa), to 5 decimal places
- Time of Flight XCORR (s), Two-way travel time in seconds to 6 decimal places

The following additional parameters are for diagnostic use only:-

- Magnitude, the amplitude of correlation peak that generated TOF above
- Time of Flight RMLE (s), Two-way travel time calculated using the statistical method of restricted maximum likelihood estimation
- Halflife, a statistical measure that relates to the rate of decay of the captured echo energy
- Pretrigger Noise, the average magnitude prior to the echo return
- RDIFF, RMLE Range
- Peak Position,

2.3.8.8 Pressure DQZ,PNS,QDN,KLR,TPS

- Pressure (kPa), to 5 decimal places (≈1µm resolution in water depth)

- Temperature (Deg C), to 3 decimal places
    - Note: some pressure sensor types may not provide a temperature reading in which case the T field will be empty or a fixed error code eg -9999

2.3.8.9 SSP Sound Speed

- SoundSpeed (m/s), to 3 decimal places

Values of 999X. indicate error codes

2.3.8.10 TMP Temperature

- Temperature Deg C, degrees Celsius to 4 decimal places

2.3.8.11 TSO Time Sync Offset

- Device Time, Time & date with seconds reported to 6 decimal places
- UTC Time, Time & date with seconds reported to 6 decimal places

2.3.9 End of File

There shall be no specific character to identify the end of the file.

3 Additional Record Data Type details

3.1 AZA

The AZA Fetch contains 3 pressure sensors, which are used to provide an in-situ calibration of the transfer sensor. The ambient sensor is always connected to sea-water pressure. The transfer sensor (typically a Digiquartz) is usually connected to sea-water pressure, except when running a calibration cycle. The low pressure sensor is never exposed to sea-water pressure and is only used when the transfer senor has been connected to internal pressure.

The calibration sequence starts by isolating the transfer sensor from sea-water pressure, then changing the internal pressure to about 1 bar and comparing its reading to a low range pressure sensor (barometer), and finally it is switched back to sea water pressure i.e. Ambient-Zero-Ambient.

A calibration sequence will generate one AZS status record when the sequence begins, consisting of immediate single point pressure readings from all 3 sensors, followed by three AZA records with pressure values recorded after a settling period and averaged over 30 seconds, and finally another AZS record at the end of the sequence. By this means, the bias of the transfer sensor relative to the reference sensor can be calculated, and also the bias of the ambient sensor relative to the transfer sensor, to ultimately estimate the bias of the ambient sensor.

A typical calibration sequence is given below:

Sequence Record #	Ambient P sensor	Transfer P sensor	Low P sensor	Comment	Record Type
1	Ambient	Ambient	Low	Normal state, Immediate single point reading	AZS
2	Ambient	Ambient	Low	Cal. start point (settled), Averaged pressure value	AZA
3	Ambient	Low	Low	Cal. zero point (settled), Averaged pressure value	AZA
4	Ambient	Ambient	Low	Cal. end point (settled), Averaged pressure value	AZA
5	Ambient	Ambient	Low	Normal state, Immediate single point reading	AZS

3.2 PIES

The PIES operation involves measuring the two-way travel time for an acoustic signal generated by the subsea instrument until the first echo of the signal is received back. In open water this will be the surface reflection.

The measurement process uses a pressure reading to range gate the expected arrival of the return signal, and a default average Sound Velocity value.

To convert the time-of-flight to an average water column sound speed through the water column, the following parameters will be needed:

- Atmospheric pressure
- Transducer offset between the pressure sensor and the acoustic transducer:

Product number	Transducer offset
8306-9913	0.478 m

- Mean density of the water column
- Local gravity
- Pressure offset in pressure sensor

Calculated depth = $\left(\left(P_{Pies} - P_{Offset} - P_{Atmos} \right) / (\text{MeanDensity} * \text{LocalG})\right) - \text{TransducerOffset}$

Calculated mean SV = Calculated depth $/$ (TwoWayTravelTime / 2)

END