H2O Acoustics
by ATS, Inc.

SR3001 *Trident* JSATS

Autonomous Node Receiver Manual

Version 5.0

ADVANCED TELEMETRY SYSTEMS

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1.0 Functionality

The autonomous node receiver is designed to be a self-sufficient, data-logging unit anchored to the bottom of marine and freshwater environments. The major components of the receiver are shown in Figure 1-1.

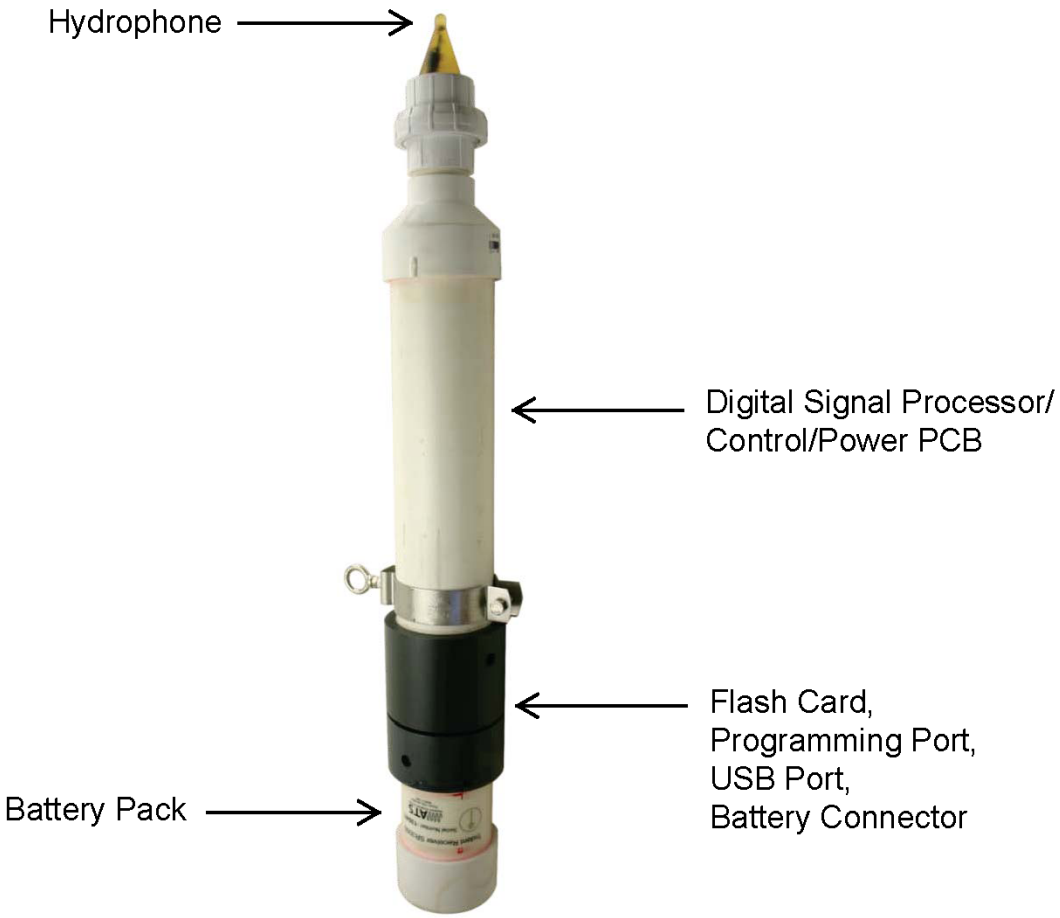

Figure 1-1

The hydrophone receives the high frequency mechanical vibrations sent through the water by the JSATS transmitter (in the fish) and converts them to weak electrical voltages. These weak voltages are amplified and filtered by the preamplifier of the Control circuit (to reduce noise) and then sent to the DSP circuit for processing.

The DSP circuit converts the incoming filtered signals to digital numbers for use by the DSP in its detection and decoding algorithm. The detection algorithm looks for the existence of a tag and the decoding algorithm determines what specific tag code is present.

When a valid code is verified by the DSP it sends the code and the time of decode to the supervisory processor for storage on the SDHC (High capacity SD flash memory) card. The supervisory processor on the board manages the clocks, sensor measurements, data storage and the communication with the external USB connection. The Power circuit supplies power for the many different voltage requirements of the system.

The receiver is optionally equipped with sensors for pressure, temperature, and tilt to obtain environmental information as well as the orientation of the receiver. If the optional sensor(s) are not included, the data read will be displayed as "N/A". The receiver is currently set to query the sensors and voltage every 15 seconds. If no tags are present this data will be saved to be written to the flash card as a dummy tag data once every minute.

The receiver is equipped with a USB port that can be used to see real-time data. This port can be accessed when the housing is open and uses a standard USB cable. The receiver software checks for a USB connection once every 30 seconds. **If the USB connection should hang up, unplug and re-plug the connection to reestablish communication.**

The receiver is powered through the means of an on-board battery pack. The battery pack yields approximately 3.6V and comes as either a rechargeable or non-rechargeable package.

Notes:

1. The power consumption of the receiver is approximately 80 milliamps during normal operation. Under normal operation the 6 D-cell battery pack will yield a theoretical life of 50 days.

2. The recommended SDHC flash card is the SanDisk with a capacity of 32GB or smaller. The maximum data that can be stored to the card by the receiver is 32GB. The maximum file size is ~1GB. Additional files will be created till the 32 GB limit is reached. **Important Note: Make sure the flash card has been formatted using the Default format options. The file system usually will be FAT32. DO NOT format using the quick format option.**

3. A card reader (not supplied) is required for the SDHC.

2.0 Start-up and LED Sequences

With the housing open, place a SDHC flash card in the slot. Connect the power by inserting the male end connector from the battery pack into the female end connector from the electronics on the top end of the receiver. The rechargeable battery pack requires an additional power cable. See Figure 2-1 for the location of the memory card and top end battery connection.

Observe the different status LEDs to understand what is taking place. There are a number of small LEDs located on the board. Only two can be seen while the board is placed in the tube.

There is a small yellow GPS status LED back behind the USB connector on the edge of the board.

The blue SDHC LED will turn on whenever the flash card is being read from or written to. It is located next to the USB connector on the corner of the board.

The main unit status LEDs in the hydrophone cone are located at the end of the receiver housing. See Table 2-1 below.

Sequence	Yellow LED	Green LED	Red LED	Event	Description
Initialization Sequence					
1	On	On	On	Power Up	Long solid pulse.
2	On	On	Off/On	Power Up	Flashing Red
3	On or On/Off	Off	On or On/Off	Clock calibration and time sync	
4	Off or On/Off	On or On/Off	On	DSP Reset scheduled	Flashing Yellow indicates the GPS sync pulse is present and will be used to sync the clocks. The green will flash as the reset happens.
Windows Interface Routines					
1	Off	On	Off	Clock Timing Routine. Entered and exited via user entered USB command	A solid Green LED remains on while in this loop. No logging is occurring at this time. Do a power reset to escape.
2	x	Off	On	Logging Routine. Entered via user entered USB command	A solid Red LED remains on while logging and sending that data via the USB to the ATS Trident PC software. Do a power reset to escape.
Main Routine					
1	On or Off	On	Off On/Off	Reading sensors and voltage values	This happens every fifteen seconds. The Red LED will flash during reading if there is one or more bad sensors. The yellow LED will appear if the current logging session was started using a GPS sync.
2	On/Off	On/Off	On/Off	SDHC flash card not inserted in slot	If the SDHC card is not inserted and ready to go the Yellow, Green and Red will flash together.
3	Off	Off	On	Tag detected	Flashes for the first 2400 detections then quits.

Table 2-1

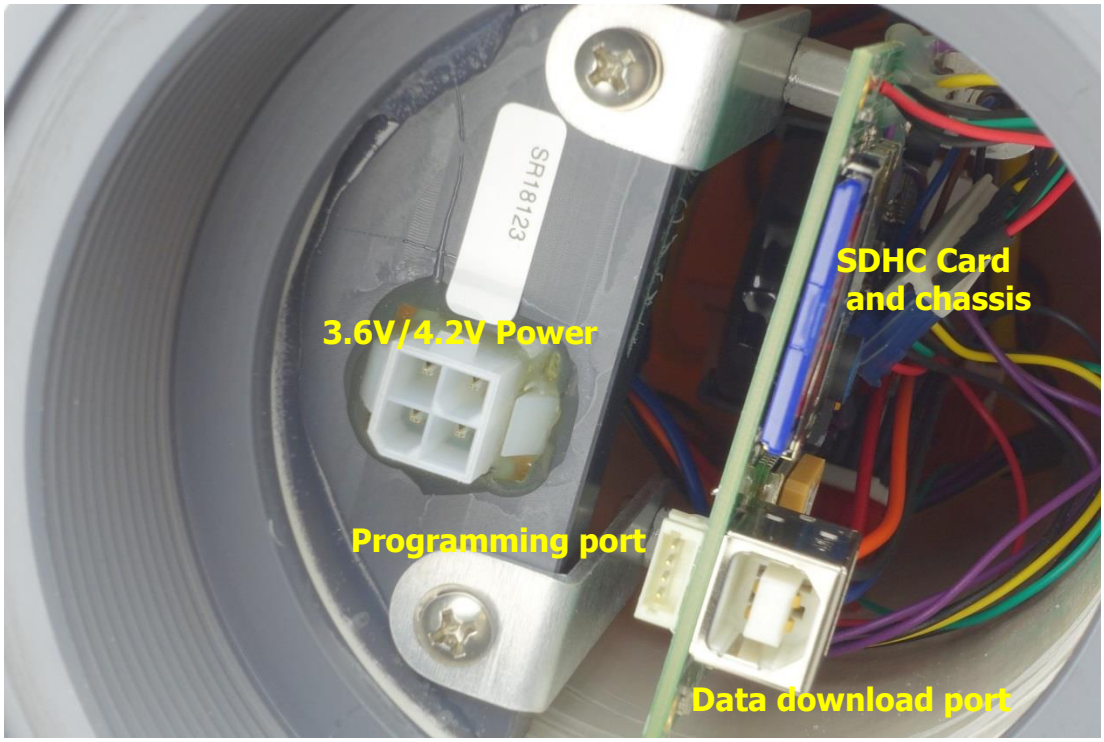

Figure 2-1

Note: The programming port can be used to update the firmware that is used in the Control circuit.

Secure the housing for deployment. **Ensure the #342 EPDM O-ring is seated in the flange groove and the sealing area is clean**. Use five inch spanner wrenches to firmly seat the O-ring. It should not be possible for the O-ring to squeeze from the groove.

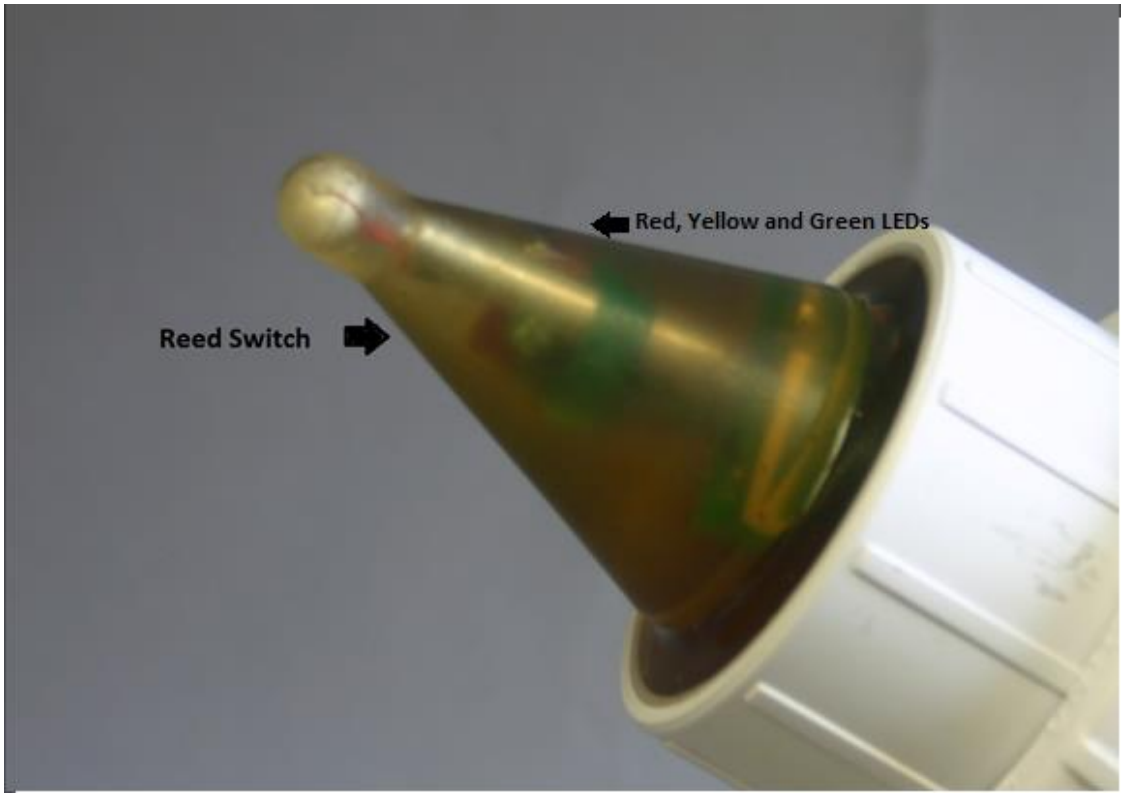

Figure 2-2

3.0 Status Check

While the housing is closed, a basic status check shown below can be initiated. To start place a magnet near the tip of the hydrophone cone near the location of the LEDs.

- Red and Yellow LEDs will turn on when the reed switch is triggered.
- Checks if it is logging to the SDHC card.
- Checks battery voltage.
- Checks basic sensor functionality.
- Attempts to acquire the GPS timing pulse and use that to check the system clocks.
- During the system check the Red and Yellow LEDs are on solid.
- During the sensor test the Green, Red and Yellow LEDs are on solid.
- If the test is a failure, it will turn the red LED on. If it is a pass, the Green LED will turn on. It will remain with the Red or Green LED slowly flashing until a magnet switch is activated. A system reset will be scheduled at the finish of the test and normal operation will proceed.

4.0 Data File Format

All tag detections are stored in ".csv" files that can be read directly by most text editors such as Microsoft's "Excel" and "Notepad". The receiver is set up to use one file. It will continuously append to the same file with footer and header breaks between logging sessions. If the file gets close to a GB in size, a new file will be created and written to. The filename consists of the serial number, creation timestamps and file partition number. The naming convention is listed below:

SR17036_yymmdd_hhmm##.csv

A snippet of an example data file is shown in Figure 4-1

Site Name: ATS	NC	2										
File Name: SR17035_170921_040103.csv												
Serial Number: 17035												
ATS Sonic Receiver SR3017 Firmware v20.04												
DSP v05.10												
File Format Version: 2.0												
File Start: 09/21/2017 04:01:03 *01C8+0921040046												
Internal	SiteName			DateTime	TagCode	Tilt	VBatt	Temp	Pressure	SigStr	Bit Perioc	Threshold
040145 13CE 00 10ED 1C 40	ATS	NC	2	09/21/2017 04:00:48.578702	G72554130	N/A	3.83	99.99	N/A	132	239 29/31	66
040145 13CE 00 10ED 1C 40	ATS	NC	2	09/21/2017 04:00:51.477038	G72554130	N/A	3.83	99.99	N/A	133	239 28/31	63
040145 13CE 00 10ED 1C 40	ATS	NC	2	09/21/2017 04:00:54.375859	G72554130	N/A	3.83	99.99	N/A	131	239 29/31	64
040145 13CE 00 10ED 1C 40	ATS	NC	2	09/21/2017 04:00:57.274015	G72554130	N/A	3.83	99.99	N/A	131	239 26/31	64
040145 13CE 00 10ED 2C 40	ATS	NC	2	09/21/2017 04:01:00.172292	G72554130	N/A	3.83	99.99	N/A	132	239 27/31	64
040145 13CE 00 10ED 2C 40	ATS	NC	2	09/21/2017 04:01:03.070854	G72554130	N/A	3.83	99.99	N/A	133	239 27/31	63
040145 13CE 00 00ED 2C 40	ATS	NC	2	09/21/2017 04:01:05.969612	G72554130	N/A	3.83	99.99	N/A	130	239 27/31	62
040145 13CE 00 00ED 2C 40	ATS	NC	2	09/21/2017 04:01:08.868385	G72554130	N/A	3.83	99.99	N/A	130	239 27/31	64
040145 13CE 00 00ED 3C 40	ATS	NC	2	09/21/2017 04:01:11.767031	G72554130	N/A	3.83	99.99	N/A	130	239 27/31	62
040145 13CE 00 00ED 3C 40	ATS	NC	2	09/21/2017 04:01:14.664952	G72554130	N/A	3.83	99.99	N/A	130	239 26/31	60
040145 13CE 00 00ED 3C 40	ATS	NC	2	09/21/2017 04:01:17.563173	G72554130	N/A	3.83	99.99	N/A	130	239 28/31	61
040145 13CE 00 00ED 3C 40	ATS	NC	2	09/21/2017 04:01:20.461623	G72554130	N/A	3.83	99.99	N/A	134	239 27/31	62
040145 13CE 00 00ED 4C 40	ATS	NC	2	09/21/2017 04:01:23.359617	G72554130	N/A	3.83	99.99	N/A	131	239 27/31	61
File End: 09/21/2017 05:00:32 *0420+0921050033												

Figure 4-1

4.1 Header Format

Table 4-1 gives a description of the information contained in lines 1-10 shown in Figure 4-1.

Line Contents	Description
Site/System Name	Descriptive name defined by the user and separated by two commas (e.g. “ATS, NC, 02).
File Name	8 character site name which consists of “SR” followed by the serial number then a “_”, ”H”, or “D” depending on whether it is a single, hourly or daily type file. This is followed by date, time of file creation and partition number. (e.g. “SRser##_yymmdd_hhmm##.csv”)
Receiver Serial Number	A five character serial number that designates the year of receiver production and three characters that designate sequential production number (e.g. “17035”)
Receiver Firmware Version	The name and version of the receiver supervisory firmware and the name.
DSP Firmware Version	The name and version of the DSP firmware.
File Format Version	Version number of the file format
File Start Date	Date and time signal acquisition began (*mm*/*dd*/*yyyy hh*:*mm*:*ss* hhz *nnnn+mmddhhmm) The 2-digit number proceeding the letter ‘z’ is the offset from Coordinated Universal Time (UTC). For example, Figure 3-1 has ‘-05z’ which is UTC-5 hours or Central Daylight Savings Time. The zone is followed by ‘nnnn’. This a measure of the DSP clock’s time drift from the GPS sync pulse. The ‘+mmddhhmm’ is the timestamp taken when the drift measurement was done. Finally, there will either be a ‘5Off’ or ‘5M’ which indicates 5-minute sync ups are turned on or off.
File End Date	Date and time signal acquisition ended (mm/dd/yyyy hh:mm:ss *nnnn+mmddhhmm) Appears at the end of the data set. ‘nnnn’ is a measure of the DSP clock’s time drift from the GPS sync pulse. The ‘+mmddhhmm’ is the timestamp taken when the drift measurement was done.

Table 4-1

4.2 Data Format

Table 4-2 gives a description of the columns listed in line 11 shown in Figure 4-1.

Column Name	Description
Internal	Diagnostic and timing information. Data here will vary depending on the version.
SiteName	Descriptive name defined by the user and separated by two commas (e.g. “ATS , NC, 02”).
DateTime	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss)
TagCode	9 digit tag code as decoded by receiver (e.g. “G720837eb”) G72ffffff is used as a dummy tag for data recorded when no tag is present. Also one line of text:“Old Clock” followed by a line of text: “New Clock” will appear in this field when the configuration window sends over a new time.
Tilt	Tilt of the receiver (degrees). This typically will appear as “N/A” since this sensor is normally not included.
VBatt	Voltage of the receiver batteries (V.VV).
Temp	Temperature (C.CC^{o}).
Pressure	Pressure outside of receiver (absolute PSI). This typically will appear as “N/A” since this sensor is normally not included.
SigStr	The logarithmic value for signal strength (in DB) “-99” signifies a signal strength value for an absent tag
BitPeriod	Optimal sample rate at 10 M samples per sec. To convert to frequency in kHz divide into 100,000.
Threshold	The logarithmic measurement of background noise used for tag detection threshold.

Table 4-2

Note: If the SDHC card (or the CF card on the older 3000 and 5000 Trident models) was formatted using the quick format option the flash card still will contain the previous file data. Only the file name(s) will have been removed. When this happens you will see some of the old data appearing after the file end footer and before the header of the next logging session. To avoid this avoid using the quick format option. Allow about an hour to format a 32GB SDHC SanDisk card.

5.0 Trident Receiver USB Interface and Filter Software

The H2O *Trident* Receiver Mobile SR3001 and SR3017 Series interface and filter software can be downloaded from our website. The software is compatible with Windows 10 and Windows 11 operating systems. After downloading the software to your PC, click on the setup executable and follow the instructions. It contains tools for real time logging, GPS location stamping while using the Mobile firmware and postprocessing filter and combine tools.

Driver Installations: The *Trident* software will walk you through installing the USB driver and GPS Log Function (Python) software on its first boot up. If it is not done here the software will need to be installed as a separate step. The driver installation can be initiated by going into **Setup** on the toolbar of the main command window and selecting **Install Driver and/or Install GPS Log Function**.

5.1 Main Command Window

The first screen that appears after the software is started is the Main Command window, shown in Figures 5-1 through 5-2.

The USB Communication mode allows for real-time data viewing while a computer is attached to the USB port. The USB connection takes a few seconds to initialize before indicating it is ready. When the serial number appears at the bottom of the screen and the **Ready** message appears as in figure 5-2, click **OK**. The serial number of the receiver can be found on the placard affixed to two labels. One on the exterior of the housing and one on the inside close to where the USB plug becomes attached along with the different firmware versions.

The USB connection allows you to update the receiver's configuration - **Edit Configuration** and view the tags as they are being decoded - **View Logging Data**.
If the USB connection should hang up, un-plug and re-plug the connection to reestablish communication.

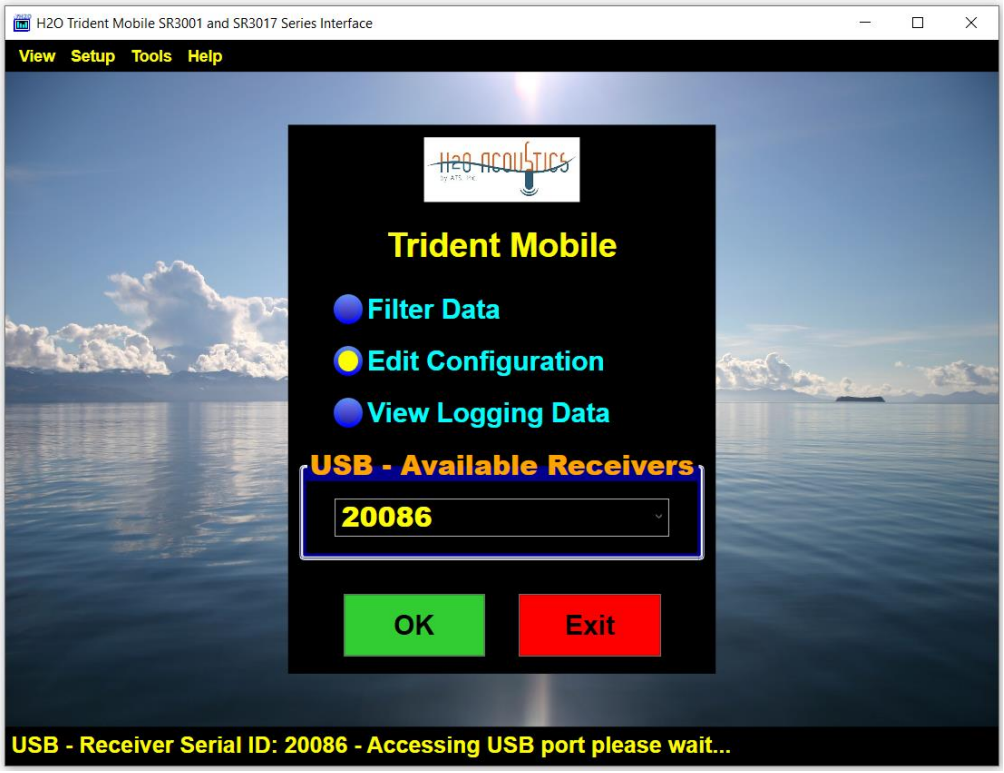

Figure 5-1

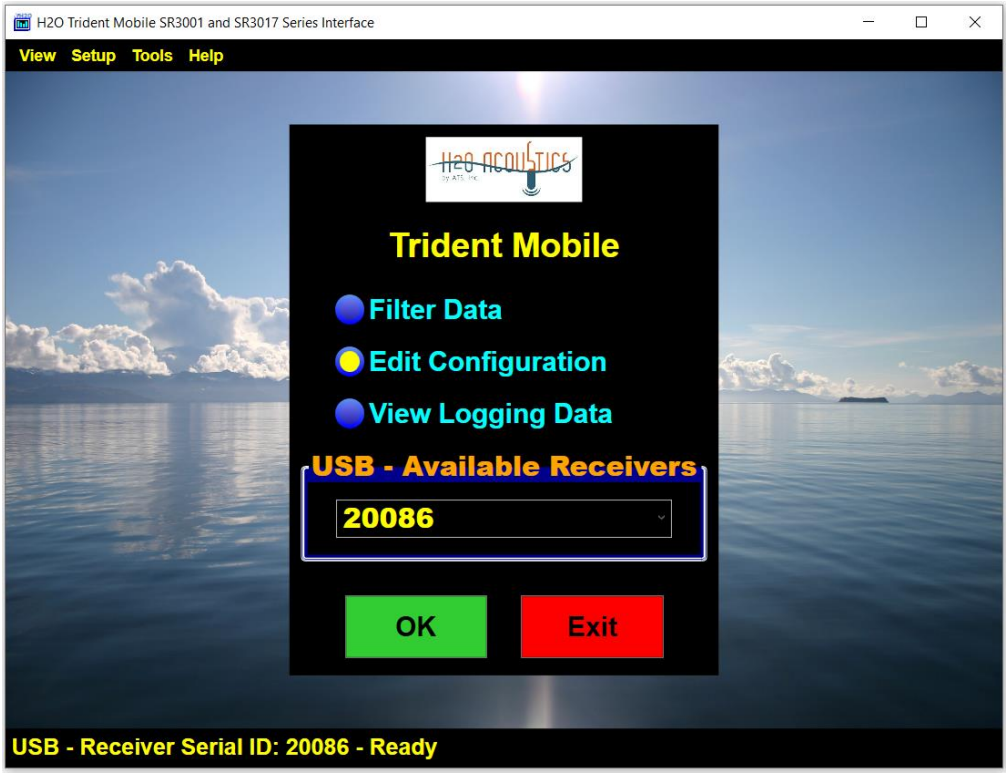

Figure 5-2

5.2 Edit Configuration

Figure 5-3

This function accessed by the USB connection allows access to the *Trident* receiver's configuration. Upon entering this screen, the receiver will also enter a special timekeeping mode so that it can continuously update the time portion of the display in realtime. While in this mode the green status LED will be lit continously.

To update the time and date on the receiver so it matches the PC's, click on the blue button **Set Receiver Clock to PC Clock**, and the PC time and date will be sent to the *Trident* receiver, synchronizing the two clocks.

The offset from Coordinated Universal Time (UTC) will also be sent and stored on the receiver but to set that click on the green button **Send to Receiver**. If the Local Time check box is not clicked UTC time will be used.

When the *Trident* receiver updates its clock it will send to the SDHC card two lines of data. The first represents the time of the update using the old time, and the second the time of the update using the newly corrected time. The **Site Name** for the SR3017 is fixed. It will be "SR" followed by the receiver serial number. The **Site/System Name** is customizable and will be sent over as it appears on the screen but is done as a separate step by clicking on the green button **Send to Receiver** located at the bottom of the screen. When finished, make sure to click on the red **Close** button so the receiver will get the command to exit the timekeeping mode. Otherwise, cycling the power on the receiver will accomplish the same thing.

Clicking on the blue **Perform GPS TimeSync** will turn on the GPS unit and trigger that functionality to set the time. Note: Make sure the external GPS antenna is plugged in and has a clear view of the sky. If you intend on using this function to set your clocks make sure to mention this when ordering the receiver so they come with a method of attaching an external GPS antenna along with the external GPS antenna.

5.3 View Real Time Logging

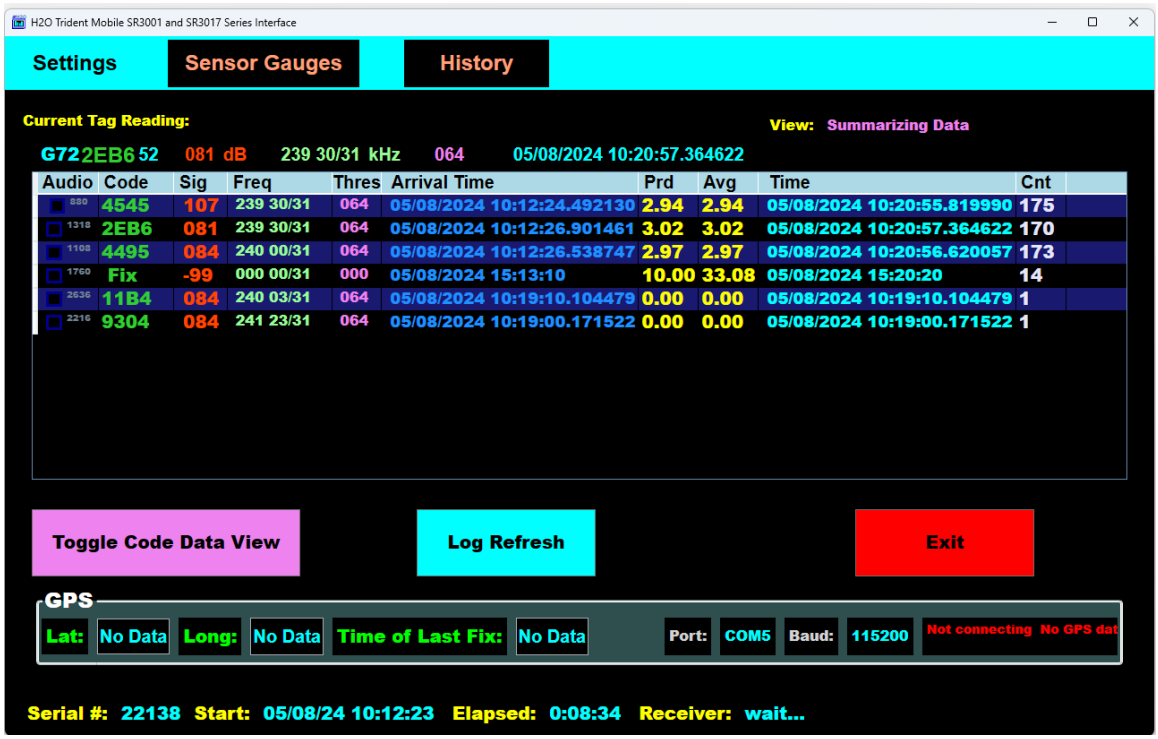

Figure 5-4

You may view real time datalogging of tag data using the USB connection by selecting the **View Realtime Logging** button. This displays the data as it is being captured by the *Trident* Receiver.

If the SDHC card is present in the SD card slot of the receiver, data will appear in blocks of fifteen seconds of accumulated data, with data appearing every 15 seconds on the screen.

If the SD card slot is empty, the data will be displayed immediately as it is detected.

Over time this data could develop a time lag depending on the amount of data being printed to the screen and the speed of the PC.

The **View Realtime Logging** function has two display options to facilitate viewing the incoming data. Clicking the Toggle Code Data View will change the display from **Summarizing Data** to **Single Detections** as shown in Figure 5-5.

The **Summarizing Data** option will display one data line per tag. The screen is refreshed for each new data point. The **Single Detection** option displays a new line for each detection.

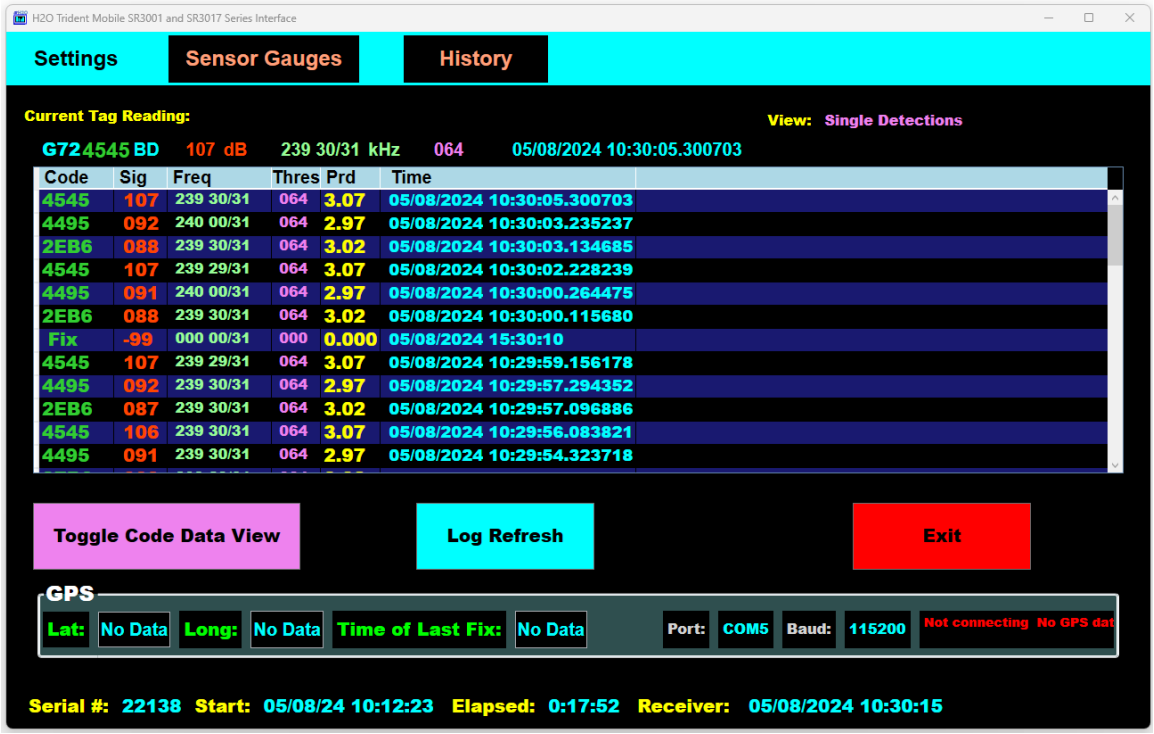

Figure 5-5

This screen also shows in the farthest left column a speaker icon followed by a column of check boxes. If a tag code is checked it will play a tone at a frequency specific to that tag code. The volume will be tied to it's last signal strength value. If tags are being detected close together you may only hear one of the tags. Ideally keep the number of boxes checked to a small number.

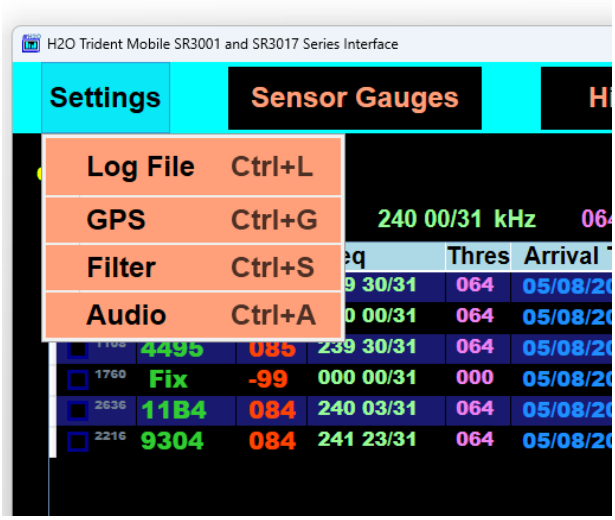

Figure 5-6

Options can be selected from the **Settings** drop-down menu at the top of the screen, as shown Figure 5-6. It can be selected to filter detections having periods too large or too small to be valid. This option is shown below in Figure 5-7.

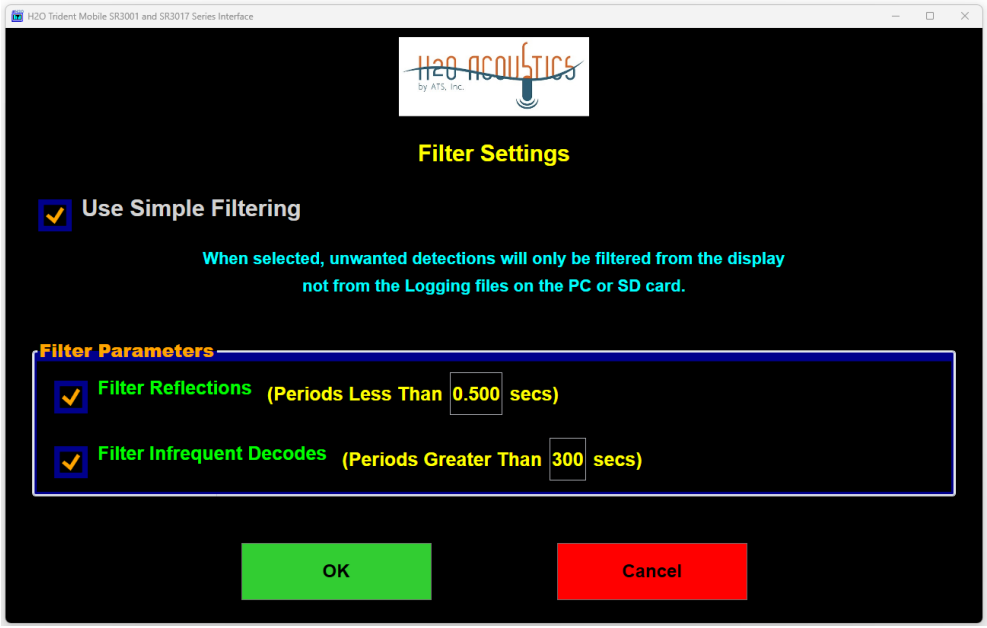

Figure 5-7

The frequency range played, for the audio tones, if enabled, can be adjusted to accomodiate people who have limited ability to pick up certain frequency ranges. Figure 5-8.

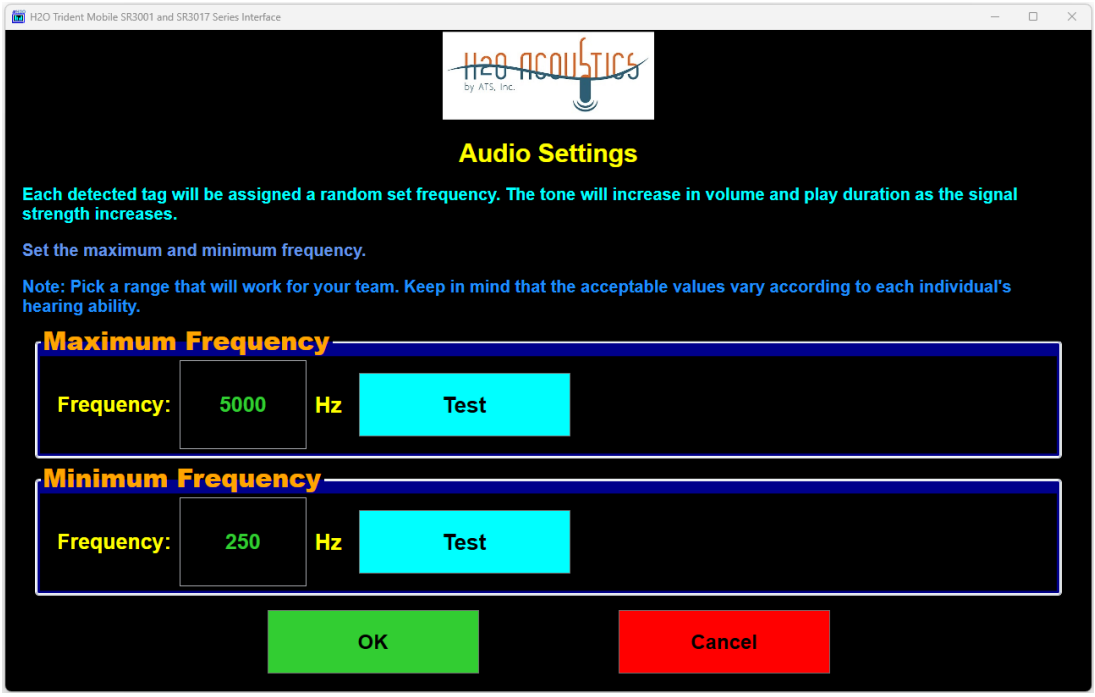

Figure 5-8

The **Sensor Gauges** shown in figure 5-9, display the values being picked up by the receiver sensors. The figure shown is for an SR3001 that is equipped with the tilt and temperature sensors.

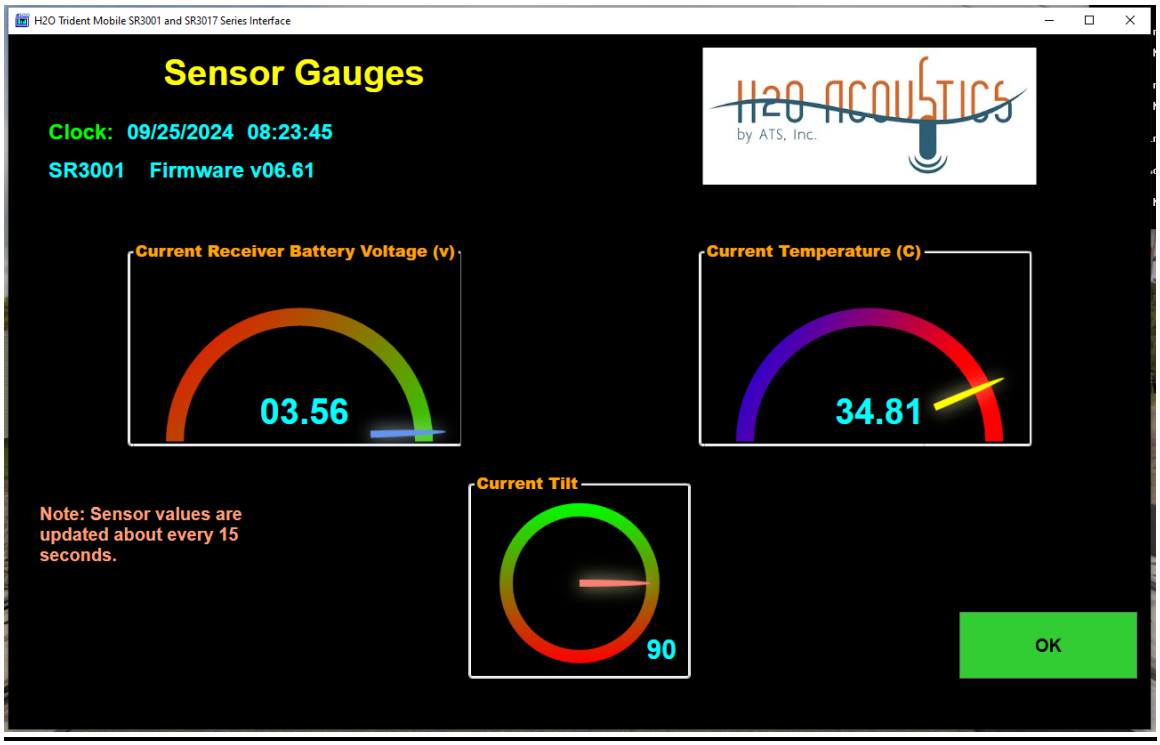

Figure 5-9

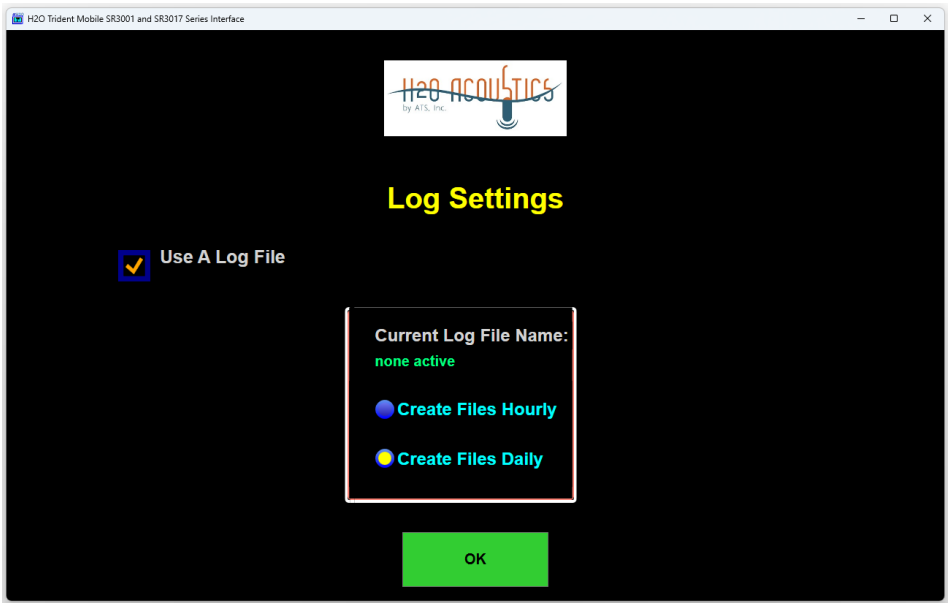

Figure 5-10

If the log file option is selected a new log file will be opened at the start of the logging session that saves a copy of the incoming data. These log files are kept in the 'C:\ Advanced Telemetry Systems, Inc\H2O Trident Receiver\Log' folder.

5.4 Filter Data

Figure 5-11

This option does not make use of an active USB connection. It takes as input one or more of the *Trident* Receiver files residing on your computer that have been copied over from the SDHC card(s). It post-processes the data by filtering out invalid data, splitting the files into smaller chunks and summarizing run data.

5.4.1 Standard JSAT's Coded Tags

For standard JSAT's coded tags, there are two filtering methods to choose from. They give slightly different results. Method "A-Default" and method "B-Minimum Mode".

Method "A" (Default - SVP) looks for tags with consecutive repeating periods that are within a certain range of the selected nominal period(s). These periods need to stay within a narrow range of each other.
Method B developed by Pacific Northwest National Laboratory (PNNL) uses a moving window. The window size is about 12 times the estimated pulse rate interval. In this window the tag period used is the minimum mode value close to the nominal. Both of these routines can take a while to process all the data. It does allow a number of files to be processed at a time. As it processes, the status will be displayed.

Before starting the routine, make sure to check the boxes next to the periods of the sonic transmitters you used. Figure 5-11 shows a period of 3 seconds checked.

Method B developed by Pacific Northwest National Laboratory (PNNL) uses a moving window. The window size is about 12 times the estimated pulse rate interval. In this window the tag period used is the minimum mode value close to the nominal.

Both of these routines can take a while to process all the data. It does allow a number of files to be processed at a time. As it processes, the data summary information will be displayed. Before starting the routine, make sure to check the boxes next to the periods of the sonic transmitters you used.

5.4.2 Temperature and Depth Tags

H2O Acoustics manufactures in addition to standard JSAT's coded tags, a variety of tags that transmit the JSATs ID along with the tag's current temperature and/or depth. This data can be retrieved and deciphered by clicking on the check box located at the bottom of the screen shown in Figure 5-11. This option is only available using Filter Method "A-Default".

Processing the temperature and depth tag data will require additional input into the filter program.

5.4.2.1 Sensor Tag Code List

A simple ".csv" file is needed for input containing a list of the temperature and/or depth tag codes that were deployed. Below is what the contents of a possible file would look like…

```
G724995A7
G724D5B49
G72453398
G72452BC7
G724A9193
G722A9375
G724BA92B
G724A2D02
```

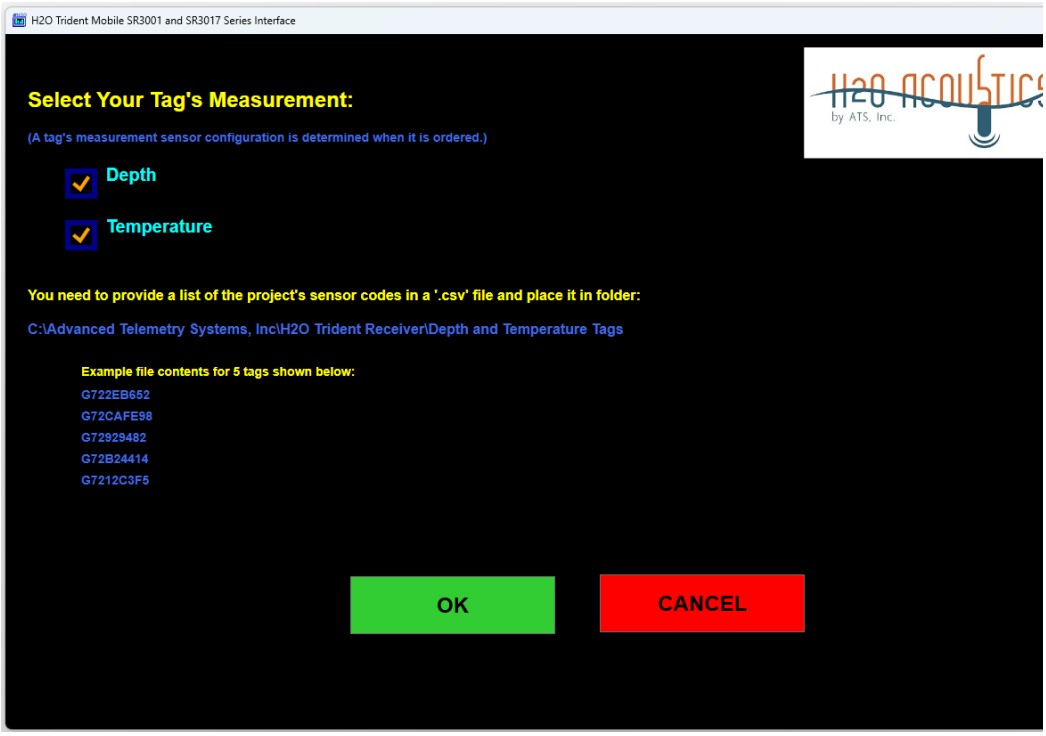

Figure 5-12

5.4.2.2 Barometric Pressure

Shown in Figure 5-12 is the entry screen used for Depth tags. The Depth tags can be purchased as depth only or as a combination temperature depth tag. Depth measurement is really a measurement of pressure. To calculate depth the local barometric pressure needs to be considered. This pressure frequently changes, but the filter can only use one value for its depth calculation. Pick a midrange value that is representative of the site's average barometric pressure during the time the data was collected.

The value entered can be designated in units of atmospheres (atm), mercurial inches (inHg), kilopascals (kPa), millibars (mBar), mercurial millimeters (mmHg), or pounds per square inch (psi). Ensure that the correct type of units is selected, or else incorrect results will be calculated.

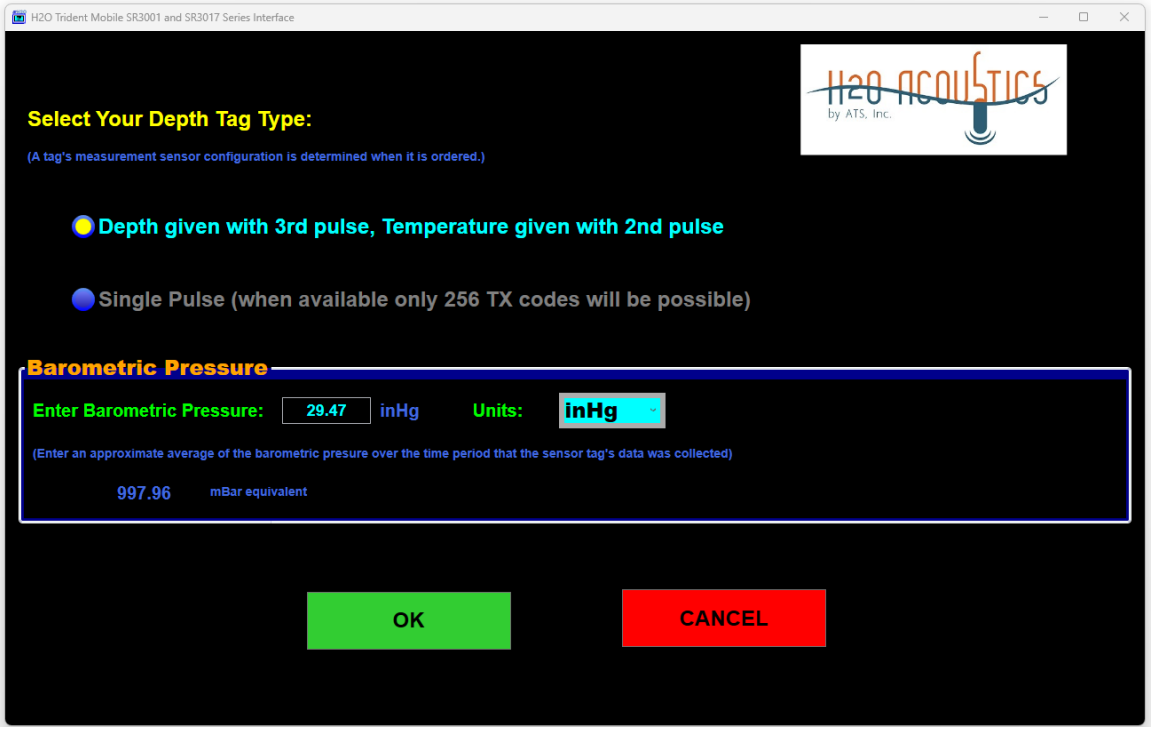

Figure 5-13

5.4.2.3 Temperature Only Tags

Shown in Figure 5-14 is the entry screen used for Temperature only tags. The default temperature only tag is the “Model SS400 (SB) Alternating Code ID/Temperature Acoustic Tag”.

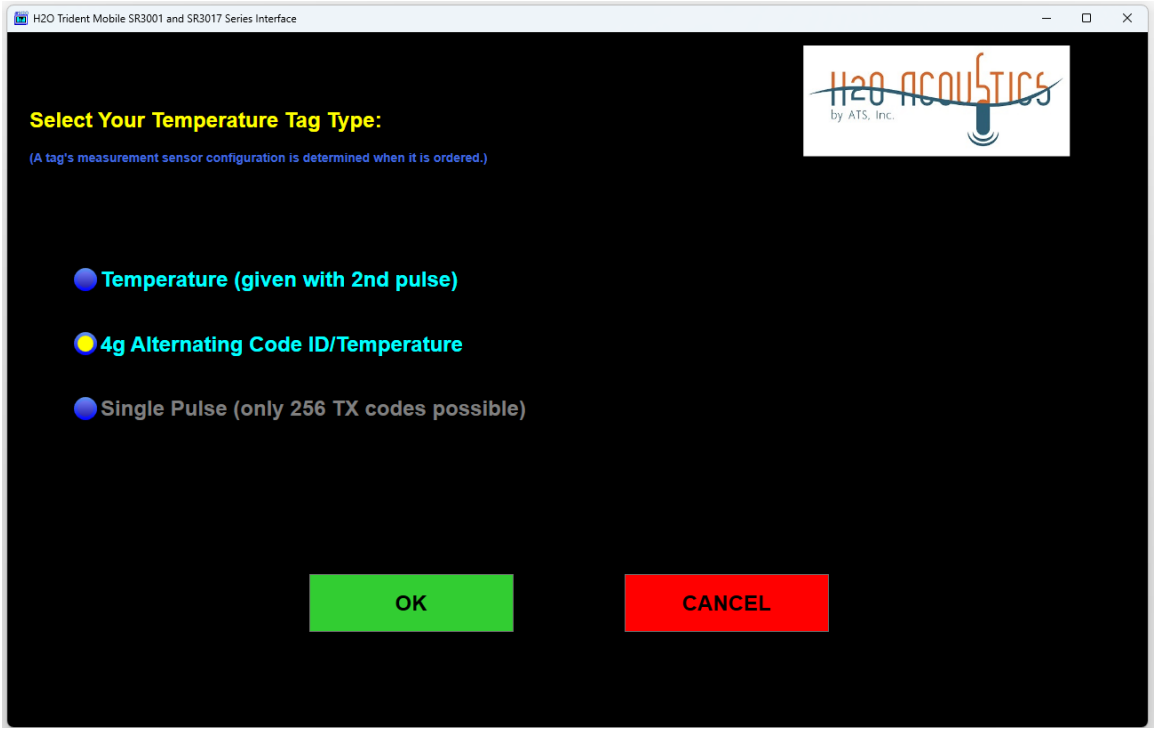

Figure 5-14

This is shown as selected in the figure. It works by transmitting its tag ID code every other ping. For example, a tag using a 3 sec PRI will ping every 3 seconds, but its ID code will only appear once every 6 seconds. The alternating ping will be a code that contains temperature information in Celsius (also only seen once every 6 seconds).

The Temperature Code is a 16-bit hexadecimal number with an 8-bit CRC suffix.

. Bits 15 – 6 will be the same as the ID code.

. Bit 5 will be the opposite of the ID code's bit 5. This guarantees that the alternate temperature code will always be different than the ID code.

. Bits 0 - 4 (5 bits total) will be the binary value of the temperature in Celsius (0C to 31C)

. The pulse code that appears just before the version (on power-up) and after the version will be the temperature code.

. The temperature value is measured every 8 pulses during normal operation (thus there will be a minimum of four temperature pulses for each temperature measured)

6.0 Filter Data File Format

After all the parameters have been selected a dialog box will prompt you for the file you want to process.

When the filter option from the **File Data** dialog is finished running there will be a number of new files created. They will consist of 5 different types.

Example input file name:

SR24102_241027_110701.csv

One example each of the 5 types of output files:

Type 1) SR24102_241027_110701_Log1_1027_1107_2.csv
Type 2) SR24102_241027_110701_DData_Log1_1027_1107_2.csv or
SR24102_241027_110701_MData_Log1_1027_1107_2.csv
Type 3) SR24102_241027_110701_RejectedTags_Log1_1027_1107_2.csv
Type 4) SR24102_241027_110701_Cleaned_Log1_1027_1107_2.csv
Type 5) SR24102_241027_110701_summary_Log1_1027_1107_2.csv

For Sensor Tags Only

Type 6) SR24102_241027_110701_SensorTagData_Log1_1027_1107_2.csv

6.1 Filter File Output Type 1

Example type 1 output file names:

SR24102_241027_110701_Log1_1.csv
SR24102_241027_110701_Log1_1027_1107_2.csv
SR24102_241027_110701_Log2_1027_1110_1.csv
SR24102_241027_110701_Log2_1027_1110_2.csv
.
.
.

The input file can contain multiple logging sessions which are defined to be a power on off or the insert and removal of a SDHC card. The input file can be larger than some programs like Excel can handle. Type 1 files are partitioned copies of the input file. These partitions isolate data into files according to the log session and they keep the files smaller than 50,000 lines of data.

6.2 Filter File Output Type 2

Example Type 2 output file names when the “A – Default” selection in the File Data dialog was selected:

SR24102_241027_110701_DData_Log1_1027_1107_1.csv
SR24102_241027_110701_DData_Log1_1027_1107_2.csv
SR24102_241027_110701_DData_Log2_1027_1110_1.csv
SR24102_241027_110701_DData_Log2_1027_1110_2.csv
.
.

Example Type 2 output file names when the “B – Minimum Mode” selection in the File Data dialog was selected:

SR24102_241027_110701_MData_Log1_1027_1107_1.csv
SR24102_241027_110701_MData_Log1_1027_1107_2.csv
SR24102_241027_110701_MData_Log2_1027_1110_1.csv
SR24102_241027_110701_MData_Log2_1027_1110_2.csv
.
.
.

Type 2 files have all the information of the Type 1 files with additional information added on. This file will not include rejected data if the filter was run with the **Remove Filtered Hits from Final Data** checkbox checked from the File Data dialog.

1	Detection Date/Time	TagCode	RecSerialNum	FirmwareVer	DspVer	FileFormatVer	LogStartDate	LogEndDate	FileName
2	10/30/2017 16:54:11.612030	G7222226F	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165400 0001 00 0007 F7 60
3	10/30/2017 16:54:15.485950	G72AAEE5F	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165415 003C 00 1007 F7 60
4	10/30/2017 16:54:32.748180	G7222226F	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165430 003C 00 1007 F7 60
5	10/30/2017 16:54:38.032094	G7222226F	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165430 003C 00 0007 F7 60
6	10/30/2017 16:54:43.315905	G7222226F	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165430 0001 00 0008 08 60
7	10/30/2017 16:54:47.509161	G72AB68CA	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165445 003C 00 1008 08 60
8	10/30/2017 16:54:57.655963	G72AB68CA	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165445 003C 00 0008 08 60
9	10/30/2017 16:56:13.108561	G7222226F	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165600 003C 00 1008 08 60
10	10/30/2017 16:57:27.026086	G7222226F	17102	6.06	5.1	2	10/27/2017 11:14	10/27/2017 11:12:13 *0000+1027110955	165715 003C 00 1008 18 60

Figure 6-1

Column Name	Description
Detection Date/Time	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss)
TagCode	9 digit tag code as decoded by receiver (e.g. "G7280070C") G72ffffff is used as a dummy tag for data recorded when no tag is present.
RecSerialNum	A five character serial number that designates the year of receiver production and three characters that designate sequential production number (e.g. "18035")
FirmwareVer	The version of the receiver supervisory firmware.
DspVer	The version of the DSP firmware.
FileFormatVer	Version number of the file format.
LogStartDate	Date and time signal acquisition began for this logging session (mm/dd/yyyy hh:mm:ss)
LogEndDate	Date and time signal acquisition finished for this logging session (mm/dd/yyyy hh:mm:ss *####+mmddhhmmss)
FileName	Diagnostic and timing information. Data here will vary depending on the version.

Table 6-1

	SitePt1	SitePt2	SitePt3	Tilt	VBatt	Temp	Pressure	SigStr	BitPrd	Threshold	ImportTime	TimeSince	Multipath	FilterType	Filtered	NominalPRI
2	ATS	9	14	24	3.35	2.36	13.8	203	240	153	1/3/2018 11:41	5.283731	No	SVP	No	5
3	ATS	9	14	24	3.36	2.36	13.8	196	240	154	1/3/2018 11:41	96.08753	No	SVP	Yes	5
4	ATS	9	14	24	3.36	2.36	13.8	200	240	153	1/3/2018 11:41	21.13615	No	SVP	No	5
5	ATS	9	14	24	3.36	2.36	13.8	205	240	152	1/3/2018 11:41	5.283914	No	SVP	No	5
6	ATS	9	14	24	3.36	2.36	13.8	217	240	151	1/3/2018 11:41	5.283811	No	SVP	No	5
7	ATS	9	14	24	3.36	2.36	13.8	207	240	154	1/3/2018 11:41	126.7838	No	SVP	Yes	0
8	ATS	9	14	24	3.36	2.36	13.8	206	240	154	1/3/2018 11:41	10.1468	No	SVP	Yes	0
9	ATS	9	14	24	3.35	2.36	13.8	180	240 2/31	154	1/3/2018 11:41	89.79266	No	SVP	No	5
10	ATS	9	14	24	3.35	2.36	13.8	200	240	152	1/3/2018 11:41	73.91752	No	SVP	No	5

Figure 6-2

SitePt1	Site name part 1. Descriptive name defined by the user.
SitePt2	Site name part 2. Descriptive name defined by the user.
SitePt3	Site name part 3. Descriptive name defined by the user.
Tilt	Tilt of the receiver (degrees). This typically will appear as "N/A" since this sensor is normally not included.
VBatt	Voltage of the receiver batteries (V.VV).
Temp	Temperature (C.CC°).
Pressure	Pressure outside of receiver (absolute PSI). This typically will appear as "N/A" since this sensor is normally not included.
SigStr	The logarithmic value for signal strength (in DB) "-99" signifies a signal strength value for an absent tag
BitPrd	Optimal sample rate at 10 M samples per sec (related to tag frequency)
Threshold	The logarithmic measurement of background noise used for tag detection threshold.
ImportTime	Date and time this file was created (mm/dd/yyyy hh:mm:ss)
TimeSince LastDet	Elapsed time in seconds since the last detection of this code.
Multipath	Yes/No value indicating if the detection was from a reflected signal.
FilterType	SVP (Default)/ MinMode value indicating the choice of filtering algorithm used on this data.
Filtered	Yes/No value indicating if this data has been rejected.
NominalPRI	The assumed programmed value for the tag's pulse rate interval.

Table 6-2

	DetNum	EventNun	EstPRI	AvePRI	ReleaseDate	Notes
2	8	1	5.283668	7.519982		
3	**	1	5.069434	233.6836		Removed on Final Filter Pass
4	9	1	5.283668	7.519982		
5	10	1	5.28375	7.519982		
6	11	1	5.283765	7.519982		
7	2*	0	0	8.85854		Invalid PRI
8	3*	0	0	8.85854		Invalid PRI
9	12	1	5.283765	7.519982		
10	13	1	5.283765	7.519982		

Figure 6-3

DetNum	The current detection number for this accepted code, or if followed by an asterisk, the count of previously rejected hits for this code.
EventNum	This count increases if there is a reacquisition of this code after an acquisition loss. For the SVP method this loss needs to be >= 30 minutes. For MinMode an acquisition loss happens if there are less than 4 hits contained within an acceptance window of 12 nominal PRIs.
EstPRI	The estimated PRI value.
AvePRI	The average PRI value.
ReleasedDate	
Notes	

Table 6-3

6.3 Filter File Output Type 3

Type 3 files have the detection data for rejected codes.

Example type 3 for the Default SVP filter output file names:

SR17102_171027_110701_RejectedTags_Log1_1027_1107_1.csv
SR17102_171027_110701_RejectedTags_Log1_1027_1107_2.csv
SR17102_171027_110701_RejectedTags_Log2_1027_1110_1.csv
SR17102_171027_110701_RejectedTags_Log2_1027_1110_2.csv
.
.
.

6.4 Filter File Output Type 4

Type 4 files are Type 1 files with the invalid tag detections removed**.**

Example type 4 output file names:

SR17102_171027_110701_Cleaned_Log1_1027_1107_1.csv
SR17102_171027_110701_Cleaned_Log1_1027_1107_2.csv
SR17102_171027_110701_Cleaned_Log2_1027_1110_1.csv
SR17102_171027_110701_Cleaned_Log2_1027_1110_2.csv
.
.
.

6.5 Filter File Output Type 5

Example type 5 output file names:

SR17102_171027_110701_summary_Log1_1027_1107_1.csv
SR17102_171027_110701_summary_Log1_1027_1107_2.csv
SR17102_171027_110701_summary_Log2_1027_1110_1.csv
SR17102_171027_110701_summary_Log2_1027_1110_2.csv
.
.
.

Type 5 files have the synopsis of data contained in the earlier files.

						Period Info							
									Accepted Range		Sig Str		
First Date/Time	Last Date/Time	Elapsed (secs)	Tag Code	Det Num	Nominal	Ave	Est	Smallest	Largest	Ave	Min Allowed	# Filtered
11/01/2017 13:06:21.099144	11/01/2017 13:32:59.375030	1611.19	G725B1CCA	277	2	5.79	2.14	1.967	4.306	217	130	2
11/01/2017 13:06:19.543759	11/01/2017 13:32:24.378066	1564.83	G72508686	261	2	6.01	2.22	2.21	4.439	208	130	2
11/01/2017 13:06:19.832399	11/01/2017 13:32:28.110076	1568.28	G72B2C0F9	208	3	7.58	3.07	2.069	3.084	220	130	0
11/01/2017 13:06:19.918855	11/01/2017 13:32:31.673986	1571.76	G7207F739	241	2	6.54	2.07	1.902	2.086	195	130	1
10/30/2017 16:52:34.328983	11/12/2017 01:09:10.138764	1066747.67	G726B5B22	3933*	5	233.74*	5.06	5	5.097	216	130	41
11/10/2017 19:39:09.111642	11/10/2017 19:39:09.111642	43977	G7204AF75	289	2	2.57	2.12	1.938	3.119	194	130	8
10/30/2017 16:52:36.498941	11/12/2017 01:09:18.338041	1066781.49	G7222226F	135344	5	7.52	5.22	3.337	5.284	218	130	945
10/30/2017 17:01:27.262194	11/12/2017 01:09:22.286429	1066794.26	G72AB68CA	108540	5	8.86	5.06	4.523	5.096	219	130	64
11/09/2017 17:14:22.885377	11/09/2017 17:40:30.429007	1567.54	G723F38E9	190	2	8.29	2.13	1.956	4.258	201	130	8
10/30/2017 16:52:33.319613	10/30/2017 17:18:28.108353	1562.91	G726B5B22	158	5	7.52	5.22	3.337	5.284	218	130	1
11/11/2017 23:47:25.919664	11/11/2017 01:13:28.307445	1562.39	G720F5402	125	2	12.6	2.22	1.988	4.354	210	130	0
11/10/2017 12:56:26.323365	11/10/2017 13:22:28.069979	1562.31	G72373103	246	2	6.38	2.11	1.966	2.119	193	130	0
11/10/2017 02:32:42.384258	11/10/2017 02:58:32.074902	1561.75	G72A9CF77	119	3	6.01	2.98	1.995	2.117	185	130	2
10/30/2017 16:50:34.236942	10/30/2017 17:16:32.686552	1558.45	G72517C48	179	2	3.41	2.11	1.938	2.062	181	130	4
11/11/2017 13:24:22.324372	11/11/2017 13:50:29.642380	1567.32	G72F9DF9D	288	2	5.46	2.14	2.127	4.297	216	130	1
11/11/2017 21:45:22.801260	11/11/2017 22:01:58.862047	1596.06	G7248905C	335	2	2.53	2.07	1.933	3.069	206	130	4

Figure 6-4

Column Name	Description
First Date/Time	Date and Time of first acquisition of the listed Tag Code. Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss)
Last Date/Time	Date and Time of last acquisition of the listed Tag Code. Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss)

Elapsed	Time difference in seconds between the first two columns.
Tag Code	9 digit tag code as decoded by receiver (e.g. “G7229A8BE”)
Det Num	The number of valid detections for the listed tag code. If an “*” is present the Tag Code was filtered out as a false positive.
Nominal	The assumed programmed value for the tag codes’ pulse rate interval.
Ave	The average PRI value. An adjacent “*” indicates it was > then 7 periods long.
Est	The estimated PRI value.
Smallest	The smallest PRI that was a valid value. The PRIs checked off in the File Data dialog are used to determine the set of acceptable PRIs.
Largest	The largest PRI that was a valid value. The PRIs checked off in the File Data dialog are used to determine the set of acceptable PRIs.
Sig Str Ave	The average signal strength of the valid data for the listed tag code.
Min Allowed	Lower Signal strength values are filtered out.
# Filtered	Number of acquisitions for the listed tag code that have been filtered out.

Table 6-4

6.6 Additional Output for Temperature and Depth Tags

When the filter is done running there will be the same output as with running without the temperature depth tag option selected with a few additions.

One additional file type:

Type 6) SR17102_171027_110750_SensorTagData_Log1_1027_1107_2.csv

And additions to the following file types:

Type 2) SR17102_171027_110701_DData_Log1_1027_1107_2.csv
Type 4) SR17102_171027_110701_Cleaned_Log1_1027_1107_2.csv
Type 5) SR17102_171027_110701_summary_Log1_1027_1107_2.csv

6.6.1 Data Appended to Filter File Output Type 2

The following is an example of the data appearing as additional columns appended to the dataset after the column labeled “Notes”.

	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN
1	Notes	SensorTag	TempDateTime	TempSensorCode	TagTemp(C)	DepthDateTime	DepthSensorCode	TagPress(mBar)	TagDepth(m)	SensorPrd
2		D			0	07/11/2017 05:55:25.226268	G720B60E6	1164.8	1.56	0.082
3		Y			0			0	0	0
4		T	07/11/2017 05:56:25.269162	G7209C264	24.98			0	0	0.082
5		Y			0			0	0	0
6		T	07/11/2017 05:56:49.998400	G7209C264	24.98			0	0	0.082
7		Y			0			0	0	0
8		D	07/11/2017 06:40:06.047076	G7209C5E7	25.01	07/11/2017 06:40:06.129138	G720B5CFB	1163.2	1.54	0.082
9		D	07/11/2017 06:52:42.785414	G7209C186	24.97	07/11/2017 06:52:42.867471	G720B77F8	1174	1.65	0.082
10		D			0	07/11/2017 06:52:46.402909	G720BDF95	1215.6	2.08	0.082
11		D			0	07/11/2017 06:53:57.151103	G720BF835	1225.6	2.18	0.082
12		Y			0			0	0	0
13		D			0	07/11/2017 07:07:44.832237	G726F39C0	11389.2	105.82	0.0825
14		Y			0			0	0	0
15		Y			0			0	0	0
16		D	07/11/2017 07:11:06.365193	G7209C605	25.02	07/11/2017 07:11:06.447265	G720ED175	1517.2	5.15	0.082
17		Y			0			0	0	0
18		D	07/11/2017 15:38:38.816182	G7209E778	25.35	07/11/2017 15:38:38.898222	G720F0587	1538	5.37	0.082
19		N								

Figure 6-5

Column Name	Description
SensorTag	Character denoting general sensor information as defined below… N - Detection information is for a non-sensor tag. Y - Detection information is for a sensor tag but no sensor data was paired with this detection. T – Detection information is for a sensor tag and is paired with temperature data only. D- Detection information is for a sensor tag and is paired with depth data and possibly temperature data.
TempDateTime	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss). This timestamp is for the received code imparting a tag's temperature information.
TempSensorCode	9 digit tag code as decoded by receiver (e.g. "G7207975C") representing the temperature information.
TagTemp(C)	The temperature (C.CCº) measured by the sensor tag.
DepthDateTime	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss). This timestamp is for the received code imparting a tag's depth information.
DepthSensorCode	9 digit tag code as decoded by receiver (e.g. "G720B3B1D") representing the depth information.
TagPress(mBar)	The pressure (PPPP.P) in mBar measured by the sensor tag.
TagDepth(m)	The converted depth position (DDD.DD) in meters measured by the sensor tag.
SensorPrd	The period of the sensor codes in seconds appearing after the primary code.

Table 6-5

6.6.2 Data Appended to Filter File Output Type 4

The following is an example of the data appearing as additional columns appended to the data after the column labeled “Threshold”.

L	M	N	O	P	Q	R	S	T
BitPrd	Threshold	Temperature Date/Time	Temp SensorCode	Tag Temp(C)	Depth Date/Time	Depth SensorCode	Tag Press(mBar)	Tag Depth(m)
239 28/31	168	07/01/2017 09:09:17.576490	G7207D71A	20.07				
239 29/31	172				07/01/2017 09:09:21.270645	G720BB1EF	1197.2	1.89
239 29/31	169	07/01/2017 09:09:46.501307	G7207DBB9	20.11	07/01/2017 09:09:46.583275	G720BC576	1205.2	1.97
239 28/31	162	07/01/2017 09:09:53.745308	G7207D85B	20.08	07/01/2017 09:09:53.827269	G720B3B1D	1150	1.41
240	164	07/01/2017 09:09:57.367835	G7207D85B	20.08	07/01/2017 09:09:57.449804	G720B4D38	1157.2	1.48
239 28/31	160	07/01/2017 09:10:22.701627	G7207D71A	20.07				
239 29/31	163	07/01/2017 09:10:29.937268	G7207DBB9	20.11	07/01/2017 09:10:30.019251	G720C3E4C	1253.6	2.47
240	161	07/01/2017 09:10:33.555154	G7207D905	20.09	07/01/2017 09:10:33.637132	G720C855E	1282	2.75
240	158	07/01/2017 09:10:37.174338	G7207D85B	20.08	07/01/2017 09:10:37.256328	G720C4AD5	1258.4	2.51
239 29/31	167	07/01/2017 09:10:44.416854	G7207D85B	20.08	07/01/2017 09:10:44.498843	G720C4AD5	1258.4	2.51
240	167	07/01/2017 09:10:48.035584	G7207D905	20.09	07/01/2017 09:10:48.117563	G720C030F	1230	2.22
239 29/31	162							
240	157	07/01/2017 09:20:44.334238	G7207D4F8	20.04	07/01/2017 09:20:44.416218	G720B3A43	1149.6	1.4
239 29/31	162	07/01/2017 09:24:45.814802	G7207D5A6	20.05				
240	164	07/01/2017 09:25:11.084643	G7207D5A6	20.05				
240	164	07/01/2017 09:25:14.716976	G7207D37B	20.03				
239 29/31	159				07/01/2017 09:25:18.423210	G72379D0F	5694.8	47.75
239 28/31	165	07/01/2017 09:25:29.188128	G7207D37B	20.03	07/01/2017 09:25:29.270095	G720A4460	1051.2	0.4
240	165				07/01/2017 09:25:32.885043	G720A4782	1052.4	0.41
240	162							
240	160							

Figure 6-6

Column Name	Description
Temperature Date/Time	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss). This timestamp is for the received code imparting a tag's temperature information.
Temp SensorCode	9 digit tag code as decoded by receiver (e.g. "G7207975C") representing the temperature information.
Tag Temp(C)	The temperature (C.CC^{o}) measured by the sensor tag.
Depth Date/Time	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss). This timestamp is for the received code imparting a tag's depth information.
Depth SensorCode	9 digit tag code as decoded by receiver (e.g. "G720B3B1D") representing the depth information.
Tag Press(mBar)	The pressure (PPPP.P) in mBar measured by the sensor tag.
Tag Depth(m)	The converted depth position (DDD.DD) in meters measured by the sensor tag.

Table 6-6

6.6.3 Data Appended to Filter File Output Type 5

This file has only one additional columns appended to it. It appears after the column labeled "# Filtered". It is labeled "Sensor Tag" and just indicates whether the code listed belongs to a sensor tag with the indicator "Y" or "N".

6.6.4 Additional Filter File Output Type 6

Example type 6 output file names:

SR17102_171027_110701_ SensorTagData _Log1_1027_1107_1.csv
SR17102_171027_110701_ SensorTagData _Log1_1027_1107_2.csv
SR17102_171027_110701_ SensorTagData _Log2_1027_1110_1.csv
SR17102_171027_110701_ SensorTagData _Log2_1027_1110_2.csv
.
.
.

Type 6 files have the just the code, temperature and depth data broken down by the time the data was received.

1	Depth Data File: Log1 Part1							
2								
3	Barometric Pressure (mBar): 1011.85277922							
4								
5	Tag Code Date/Time	Tag Code	Secs	Temperature Date/Time	TempCode	TempSecs	TempTimeSinceCode	Temp(C)
6	06/30/2017 01:16:41.600622	G724A2D02	15643002					
7	06/30/2017 01:17:14.086836	G724A2D02	15643034	06/30/2017 01:17:14.168803	G7207BC5F	15643034.17	0.081967	19.8
8	06/30/2017 01:24:16.680182	G724A2D02	15643457	06/30/2017 01:24:16.762180	G7207BA82	15643456.76	0.081998	19.78
9	06/30/2017 01:24:27.522386	G724A2D02	15643468	06/30/2017 01:24:27.604386	G7207B960	15643467.6	0.082	19.77
10	06/30/2017 01:24:52.805730	G724A2D02	15643493					
11	06/30/2017 01:25:03.638337	G724A2D02	15643504	06/30/2017 01:25:03.720328	G7207B31E	15643503.72	0.081991	19.71
12	06/30/2017 07:10:57.073049	G724BA92B	15664257					
13	06/30/2017 07:11:23.040679	G724BA92B	15664283					
14	06/30/2017 07:11:49.024947	G724BA92B	15664309	06/30/2017 07:11:49.103607	G7207F878	15664309.1	0.078659998	20.4
15	06/30/2017 07:12:08.513317	G724BA92B	15664329					
16	06/30/2017 09:38:28.186755	G724A2D02	15673108					
17	06/30/2017 09:38:42.649346	G724A2D02	15673123					
18	06/30/2017 09:38:57.129631	G724A2D02	15673137	06/30/2017 09:38:57.211621	G7207975C	15673137.21	0.08199	19.43
19	06/30/2017 20:58:43.964329	G724995A7	15713924	06/30/2017 20:58:44.045627	G72088E45	15713924.05	0.081297999	21.9
20	06/30/2017 20:58:50.780835	G724995A7	15713931	06/30/2017 20:58:50.862171	G72088B7A	15713930.86	0.081336001	21.87

Figure 6-7

Column Name	Description
Tag Code Date/Time	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss)
TagCode	9 digit tag code as decoded by receiver (e.g. "G7229A8BE")
Secs	A decimal representation in seconds of the time the primary code was decoded.
Temperature Date/Time	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss) . This timestamp is for the received code imparting a tag's temperature information.
TempCode	9 digit tag code as decoded by receiver (e.g. "G7207975C") representing the temperature information.
TempSecs	A decimal representation in seconds of the time the temperature code was decoded.
TempTimeSinceCode	The elapsed decimal time that has elapsed since the primary sensor tag's code was detected.
Temp(C)	The temperature (C.CC^{o}). measured by the sensor tag

Table 6-7

	Depth Date/Time	DepthCode	DepthTimeSinceCode	DepthTimeSinceTemp	Press(mBar)	Depth(m)
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11	06/30/2017 01:25:03.802324	G720FC12C	0.163987001	0.081996001	1613.2	6.13
12						
13						
14						
15						
16						
17	06/30/2017 09:38:42.813315	G720B2723	0.163969001		1142	1.33
18						
19	06/30/2017 20:58:44.126930	G720CDD47	0.162601	0.081303	1317.2	3.11
20	06/30/2017 20:58:50.943501	G720B3B1D	0.162666	0.081329999	1150	1.41

Figure 6-8

Column Name	Description
Depth Date/Time	Date recorded as mm/dd/yyyy. Time of detection, defined as the time the signal arrives at the hydrophone (TOA) and shall be recorded with microsecond precision (hh:mm:ss.ssssss) . This timestamp is for the received code imparting a tag's depth information.
DepthCode	9 digit tag code as decoded by receiver (e.g. "G720B3B1D") representing the depth information.
DepthTimeSinceCode	The elapsed decimal time that has elapsed since the primary sensor tag's code was detected.
DepthTimeSinceTemp	The elapsed decimal time that has elapsed since the temperature sensor tag's code was detected
Press(mBar)	The pressure (PPPP.P) in mBar measured by the sensor tag.
Depth(m)	The converted depth position (DDD.DD) in meters measured by the sensor tag.

Table 6-8

7.0 Addendum: Rechargeable Battery Pack (ATS PN 19421)

UN 38.3.5 certified

Battery pack size

Diameter:	2.9” Max (7.4 cm)
Length:	11.5” (29.2 cm)
Weight:	4.6 lbs (2.1 kg)

Operating Voltage range:	2.5VDC to 4.2VDC
Nominal Capacity:	140,800 mAh / 516.7 Wh
Maximum Discharge Current:	2 Amps DC
Maximum Charge Current:	30 Amps DC
Cycle Life (Charge/Discharge):	500

Connectors

Charge connector:	D-SUB PLUG 7Pos (2 Power, 5 Data)
SR3001 connector:	ATS PN 19420 (D-SUB connector to receiver 4 Pos connector)

Shelf Life: 12 Months*

*Note: If batteries are to be in storage longer than 12 months, it is recommended to cycle the battery in storage mode for another 12 months of shelf life.

Temperature Ratings

Charging:	0°C to +45°C* *Battery is not allowed to charge below 0°C
Operating (Discharge):	-20°C to +60°C
Storage:	-20°C to +60°C

8.0 Addendum: Battery Charger (ATS PN 18970)

ATS sells a battery charger that can charge up to 4 rechargeable battery packs at a time. The battery charger specifications are listed below:

Size (length x width x height):	13.5” x 6.5” x 13” (34.3cm x 16.5cm x 33cm)
Weight:	22.2 lbs (10 kg)
Voltage input:	90 ~ 132 VAC
Operating Temperature:	0°C to +45°C* *Battery is not allowed to charge below 0°C
Storage Temperature:	-40°C to +85°C*

Charging

Pre-Current Charge Current	2.5 Amp DC
Fast Charge Current	25 Amp DC

Operation

Automatically starts charging when battery is connected, and AC power is applied to charger.
Start; Pre-Current Charge to determine battery condition, then switches to Fast Charge Current.

Display Indicators

State of Charge Display
4 – LED display indicating battery state of charge
(See LED Display table on next page for complete details.)
Mode Display
Mode indicates if charge is optimal for storage or normal use.
Also serves as an error code.
(See LED Display Table on next page for complete details.)
LED Display Table operation/Fault table (see next page)

Storage Mode

With a discharged battery connected to charger, press Storage button.
Battery will only charge to 50% capacity for long term battery storage (12 months).
After 12 months, it is recommended to cycle Storage mode again if battery is to remain in storage.

Battery Charger LED Display Table:

State	SOC 1	SOC 2	SOC 3	SOC 4	MODE
No battery, Normal charge mode	OFF	OFF	OFF	OFF	OFF
No battery, Storage charge mode	OFF	OFF	OFF	OFF	ON
Battery detected, Evaluation in progress or Pre-charging (both modes)	FLASH	OFF	OFF	OFF	FLASH
Battery detected, Fast Charging Normal Mode, 0~25%	FLASH	OFF	OFF	OFF	OFF
Battery detected, Fast Charging Normal Mode, 26~50%	ON	FLASH	OFF	OFF	OFF
Battery detected, Fast Charging Normal Mode, 51~75%	ON	ON	FLASH	OFF	OFF
Battery detected, Fast Charging Normal Mode, 76~100%	ON	ON	ON	FLASH	OFF
Battery detected, Normal charge mode complete	ON	ON	ON	ON	OFF
Battery detected, Fast Charging Storage Mode, 0~25%	FLASH	OFF	OFF	OFF	ON
Battery detected, Fast Charging Storage Mode, 26~50%	ON	FLASH	OFF	OFF	ON
Battery detected, Storage charge mode complete, 26~50%	ON	ON	OFF	OFF	ON
Battery detected, Storage charge mode complete, 51~75%	ON	ON	ON	OFF	ON
Battery detected, Storage charge mode complete, 76~100%	ON	ON	ON	ON	ON
Battery detected, Fault detected	OFF	OFF	OFF	OFF	(see fault display)

Battery Charger Fault LED Display Table:

Display	Name	Description
1 x 250ms blink every 5 seconds	Pre-charge mode timeout	Battery has been charging at pre-charge current limit for more than 10 hours.
2 x 250ms blinks every 5 seconds	Fast charge mode timeout	Battery has been charging at fast charge current limit for more than 10 hours.
3 x 250ms blinks every 5 seconds	Battery over temperature	Battery temperature is too high to charge as measured by the thermistor.
4 x 250ms blinks every 5 seconds	Battery under temperature	Battery temperature is too low to charge as measured by the thermistor.
5 x 250ms blinks every 5 seconds	Over charge voltage	Charger output current is higher than control settings.
6 x 250ms blinks every 5 seconds	Over charge current	Charger output voltage is higher than control settings.