# **Aquarius**

## Free fall OBS with acoustic telemetry

## **Technical Manual**

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## 1 **Preliminary Notes**

### **1.1 Proprietary Notice**

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### 1.2 Warnings, Cautions and Notes

Warnings, cautions and notes are displayed and defined as follows:



**Warning**: A black cross indicates a chance of injury or death if the warning is not heeded.



**Caution:** A yellow triangle indicates a chance of damage to or failure of the equipment if the caution is not heeded.



Note: A blue circle indicates a procedural or advisory note.

### **1.3 Manuals and Software**

All manuals and software referred to in this document are available from the Güralp Systems website: www.Güralp.com unless otherwise stated.

### 1.4 Conventions

Throughout this manual, examples are given of command-line interactions. In these examples, a fixed-width typeface will be used:

Example of the fixed-width typeface used.

Commands that you are required to type will be shown in bold: Example of the fixed-width, bold typeface.

Where data that you type may vary depending on your individual configuration, such as parameters to commands, these data are additionally shown in italics:

Example of the fixed-width, bold, italic typeface.

Putting these together into a single example:

System prompt: user input with variable parameters

## 2 Introduction

Thank-you for purchasing a Güralp Aquarius.

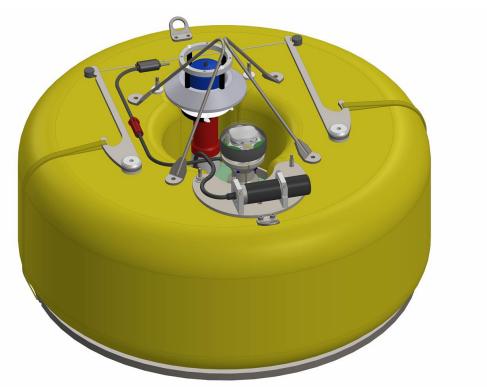
This manual describes the key components of an Aquarius system.

### 2.1 **Description**

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The Aquarius system is a state-of-the-art ocean bottom seismometer comprising:

Aquarius



- Güralp Aquarius Deck Unit
- Mini Dunker acoustic modem
- Ethernet and serial cable
- Güralp Aquarius Charger unit with charger cable

### 2.2 Applications

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Local and regional seismic research

### 2.3 Summary of key features

- Compact OBS equipped with an acoustic modem.
- Digital feedback triaxial broadband seismometer, operational at any angle, with a flat response between 120s and 100Hz.
- A three-axis magnetometer and a MEMS accelerometer calculates the seismometer's 3D position on the seabed.
- Transmission of sensor data and State of Health parameters from the seabed following installation.
- Up to 9000bps transmission of data between seabed and surface using acoustic communication.
- Dual redundant 128GB Micro-SD card.
- Single cable connection to the Güralp deck unit for Gigabit Ethernet data download, system configuration and external power.
- Acoustic Burn-Wire release mechanism with satellite tracking system.
- LED strobe light to guide recoveries, with location alerts sent via email, SMS and/or webpage.
- Operational depth 6000 meters.

## **3 Getting started**

### 3.1 Unpacking and packing

The Aquarius OBS is delivered in an environmentally-friendly, flat-packable, suspension packaging. The packaging is specifically designed for the Aquarius system and should be re-used whenever you need to transport the sensor. Please note any damage to the packaging when you receive the equipment and unpack on a clean surface.



**Caution**: The Aquarius OBS contains sensitive mechanical components which can be damaged by mishandling. If you are at all unsure about the handling or installation of the device, you should contact Güralp Systems for assistance.

- Do not bump or jolt any part of the equipment when handling or unpacking.
- Do not kink or walk on the data cable (especially on rough surfaces such as gravel), nor allow it to bear the weight of the sensor.
- Do not connect the instrument to power sources except where instructed.
- Never ground any of the output signal lines from the sensor.

**Warning:** The Aquarius OBS with ballast weighs around 350 kg in air and 26 kg in water. Improper storage or handling may cause injury, disability or death. Always follow recognised safety procedures for heavy equipment handling.

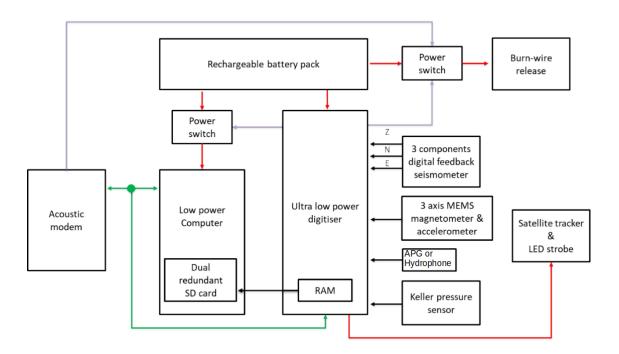
### 3.2 **System overview**

The heart of the system is the Aquarius Ocean Bottom Seismometer (OBS) unit, deployed on the seabed. This is a battery powered triaxial seismometer with ancillary multi-parametric sensors and data-logger. The unit may be additionally supplied with an absolute pressure gauge or a hydrophone. The Aquarius is equipped with an acoustic modem to provide data telemetry and status information to the surface and it is designed for deployments on the sea bed of the duration of over a year and with a working depth of 6000m. Also included are satellite tracker and LED strobe to aid location during recovery.

During deployment and recovery operations, it is possible to control and configure the Aquarius or offload the data using a PC or the Güralp waterproof deck unit. The Güralp deck unit can also be connected to a surface dunker acoustic modem providing data telemetry to the deck with the Aquarius in the water. Being equipped with lithium ion batteries, the Güralp deck unit can be operated on deck without the use of any mains electricity supply.

The Aquarius battery can be re-charged using the charger unit provided with the system.

#### 3.2.1 The Aquarius



The Aquarius is the sea-floor unit of the system. It includes a weak motion triaxial digital broadband velocity seismometer, which is operational at any angle, without the need of any gimbals system. A three-axis magnetometer and a MEMS accelerometer allow calculation of the main sensor's 3D position on the seabed.

Additional sensors included are: a Keller piezoresistive pressure transducer, used to measure the depth of the OBS and to automatically turn on the recovery aids when the system is rising back to the surface. Optionally the Aquarius may also include a Paroscientific Absolute Pressure Gauge (APG) used to measure accurate water column pressure variations or an ultra-low frequency pressure compensated hydrophone.

All the sensors transmit data to an Ultra Low Power Digitiser (ULPD), which monitors and controls the system. The ULPD is always running when power is provided. Seismic and environmental data is temporally stored in the volatile memory (RAM)

of the ULPD and flushed into the dual redundant Micro SD cards of a Low-Power Computer (LPC) every 45 minutes.

The LPC is mainly powered off and it can be waken up using the power switch activated by the ULPD when a data flush is needed or in case of activity of the integrated acoustic modem, for more details see Section 4.3.

The acoustic modem with directional or omni-directional transducer is installed to communicate with the deck unit during deployment and recovery. Most of the time the acoustic modem is in sleep mode and it wakes up when it receives an acoustic wakeup signal or when receiving data from the LPC serial.

The OBS is powered by rechargeable Lithium-ion batteries sized to last for up to 18months deployment.

The Burn-Wire release system can be activated either by the acoustic modem when receiving the related release command, or by a timer in the ULPD.

The ULPD also controls the satellite tracking system and the LED strobe, which are activated during the recovery procedure.

## 4 The Aquarius in detail

### 4.1 Seismic sensor

The seismometer installed in the Aquarius is a weak motion orthogonal three-axis digital feedback broadband velocity sensor, with flat response between 120s and 100Hz and sensitivity equivalent to an analogue 2000V/m/s sensor. The seismometer is operational at any angle, without the need of any gimbals, thus guaranteeing the end user the ability to record good data whichever way the OBS lands on the seabed. A three-axis magnetometer and a MEMS accelerometer are also included to allow calculation of the seismometer's 3D position on the seabed, allowing the end user to rotate the signals in post-processing. Raw data from the MEMS and from the magnetometer are sent to the surface only when a "Status" is requested from the surface via acoustic modem. These data are not stored in the SD card.

The seismometer is located at the bottom of the central part of the low-profile pressure canister for best coupling with the seabed sediments.

The components of the Aquarius seismometer do not need to be locked during transportation and deployment. The sensor will auto-centre the three components. If centring operation fails, the unit will wait and retry after a time interval. The time interval will double every time it fails to centre.

### 4.2 Ultra Low Power Digitiser (ULPD)

The core of the OBS is a 5-channel Ultra Low Power Digitiser (ULPD); with 24-bit resolution, it monitors and controls the systems including power distribution and storage of data, so it is always running when power is connected.

Three channels of the digitizer are used for the three components of the seismic sensor, a fourth for the (optional) hydrophone and the fifth channel is used for the Keller pressure sensor.

The ULPD has three main states:

- Undeployed
- Deployed and recording
- Deployed without recording.

The ULPD is in the "undeployed" state, only after a power cycle (when the off plug is removed, see Section 4.12) or after a system reset (see Section 7.1.3.2). In this state the system is in high power mode and is synchronising the clock with PTP.

Just before a deployment the user will have to bring the ULPD to the "Deployed and recording" state (see Section 7.2.7 and Section 7.1.3.2). In this state the system will be in low power mode and the clock is free running.

After the recovery the ULPD can be set to the "Deployed without recording" state following the procedure described in Section 10.3. In this state the system will be in high power mode, but clock synchronising is disabled.

In "Deployed and recording" state sensors data are stored in the volatile memory (RAM) before being offloaded to the LPC's Micro SD cards. What is stored is configured prior to deployment. To optimize the power consumption, all the recorded channels have a fixed sample rate and are called FR (Fixed Recording), see Section 7.2.4.

An offload of data will be triggered every 45 minutes. The ULPD will also calculate the STA, the LTA and their ratio stream. If required, a threshold trigger can be set on the ratio stream to force a data offload to the LPC when an event is detected. Whenever an offload occurs, the ULPD will boot up the LPC, enabling it to process the data and store them in the SD card after which the ULPD will power off the LPC.

The acoustic modem output is also monitored by the ULPD. This is used to turn on the LPC when data is received through the modem, allowing it to manage the acoustic communication.

A timer can be set in the ULPD for activation of the Burn-Wire release system. This is usually used as a back-up of the acoustic system: in the unlikely event that the release system cannot be activated via acoustic modem, the ULPD will release the ballast at the pre-set time.

The ULPD also monitors the PoE power supply, when this comes on, the LPC will boot up or re-boot, in full power mode with the LAN enabled.

The ULPD is equipped with a triaxial **M**icro **E**lectro-**M**echanical **S**ystems (MEMS) accelerometer with a measurement range of  $\pm 2g$  and a Magnetometer. These are used to calculate the orientation of the Aquarius when it is on the sea bed.

The ULPD clock is a double temperature compensated VCXO and at stable temperature is expected to drift less than a millisecond per day.

There is a serial console access to the ULPD, available when the OBS is on the surface, this is available through the Seacon Hummer series connector on the top of the Aquarius canister (see Section 12.2).

### 4.3 Low Power Computer (LPC)

The main computer in the unit is a Güralp Minimus, configured as an Aquarius. The operation principles of the LPC are largely identical to that of a Minimus, please refer to the Güralp Minimus manual MAN-MIN-0001 for non-OBS specific topics outside of this document.

This Low-Power Computer (LPC) has a much more powerful processor and it uses significantly more power than the Ultra Low Power Digitiser, this is why the LPC is powered off by the ULPD when not required.

When power is applied to the LPC it can boot in different modes, depending on the ULPD state. When the ULPD is "undeployed" the LPC will boot up in full power mode with the LAN enabled. If the LPC is booting up with the ULPC either in "deployed and recording" state or in "deployed without recording" state, the LPC will boot in low power mode with the LAN disabled. Turning the PoE on, whatever is the ULPC state, it will reboot the LPC with the LAN enabled. For this reason, when the ULPC is either in "deployed and recording" state or in "deployed without recording" state, the LPC web server will be accessible only by turning on the PoE.

The LPC firmware manages the acoustic communication, being able to perform operations requested via acoustic commands sent from the surface through Discovery software.

The LPC will also be turned on by the ULPD when the latter sees acoustic data transmission.

When the LPC boots in the Deployed state to offload data, it will be in low power mode so it will not only transfer the data to the SD cards.

When the OBS is first powered on, it is in a Pre-Deployment mode: LAN enabled, not recording and aiming to get a time lock from the PTP time server. When the LPC will be synchronized by PTP, the time will be passed to the ULPD.

Clicking the "Deploy" button starts data recording in the ULPD and will shut down the LPC. The "Deploy" state is also recorded in the ULPD and it is maintained until next power cycle. The ULPD clock will start free running when the "Deploy" button is pressed. When the LPC boots in "Deploy" mode it will be in low power mode and the LAN will be off.

At the recovery, the system will have to be powered by PoE to reboot the LPC in normal power mode, with the LAN on. Clicking the "Stop Recording" button will stop the recording in the ULPD, but will keep it in deployed state. The time offset between the LPC time, synchronized via PTP, and the ULPD free running clock should be noted down once PTP stability is close to 100%. Clicking the "Undeploy" button will reset to the "undeployed" state and reboot both LPC and ULPD **without saving the time offset**.

There is a serial connection to the LPC, when the Aquarius is on the surface, this is available on the Seacon Hummer connector (see Section 12.2).

### 4.4 Acoustic modem

The Aquarius is equipped with a directional or omni-directional acoustic modem to communicate with the deck unit during deployment and recovery. Most of the time the acoustic modem will be in sleep mode using very little power. The modem will

change to listen mode when it receives a wakeup signal acoustically or from the OBS. The modem will go back to sleep mode after 4 minutes of inactivity.

In sleep mode the modem has a nominal power consumption of 7.4mW and it is powered by 2S batteries (see Section 4.5). When it is awake the input voltage range is 11-16.8V and it is powered at 14V by the built-in power board installed in the Aquarius. The acoustic modem has a slant range >8,000m (typically 10,000m) and it uses a Lower Medium Frequency (LMF) rated for operations up to 6000m depth.

The acoustic modem can directly control the Burn-Wire for the ballast release and it is activated by the 14V supply.

### 4.5 The battery system

The unit is equipped with rechargeable Lithium-ion batteries sized for a 18-month deployment. Re-charge time is approximately 1-hour charge for 1-month deployment.

The batteries are arranged in groups of 39 cells, connected in parallel, referred to as a 1S. Each cell has a nominal capacity when fully charged of 3.5Ah. When flat the batteries will be at 2.5V, rising up to 4.25V when fully charged.

Within the OBS there are 6 compartments, each of which contains a battery pack. This battery pack is referred to as a 2S, as it is composed by 2 x 1S packs connected together in series.

The battery packs are connected back to the system as individual units to allow greater flexibility and to allow each 1S to be monitored independently, when charging. See Section 5 for details about the charging process.

The total capacity of the 6 x S2 packs (468 cells total) is 819Ah @ 7.27V nominal. The overall energy stored in the full pack of batteries is 5954.13Wh.



**Caution:** Lithium ion batteries can explode violently if incorrectly charged. Use only the supplied charging equipment and always follow the instructions when charging.



**Caution:** Air transport safety regulations limit the maximum battery wattage allowed when travelling on a passenger plane to 100Wh, making it illegal to transport these batteries on a passenger flight.

### 4.6 Accessory Devices

#### 4.6.1 APG

The Aquarius may be fitted with an 8CB4000-I Paroscientific Absolute Pressure Gauge (APG) with 400bar full scale and 0.01% accuracy. Resolution can go up to 10<sup>-8</sup> (nanoresolution), but in order to reduce its power consumption, the APG has been set

to work in standard mode (parts per million resolution). The APG provides the ultimate precision in water level measurements and is ideal for applications such as Tsunami detection, wave and tide gauges or as accurate depth sensor.

The APG is connected via RS-232 serial interface to the ULPD that records its data at a fixed sample rate of 5sps.

#### 4.6.2 Hydrophone

The Aquarius may be fitted with a HTI-04-PCA / ULF hydrophone with a 0.01Hz to 8kHz frequency response and -194dB ( $1V/\mu$ Pa) sensitivity.

The hydrophone is connected to the ULPD, which digitises and records its data at a fixed sample rate of 100 sps.

### 4.7 Keller pressure sensor

The Aquarius is fitted with a piezoresistive pressure transducer type Keller PA-10L with full scale 400bar and has an accuracy of 0.25%. The transducer can resolve water depth to 0.1m.

This sensor is used to calculated the depth of the OBS when a "status" is requested via acoustic link and it is also used to automatically turn on the recovery aids when the instruments comes back to the surface.

### 4.8 Buoyancy

The buoyancy of the Aquarius is provided by a syntactic foam block and allows it to come back to the surface when the ballast is released. The circular buoyancy block is placed over the Aquarius canister, with a central hole allowing access to the top of the sensor canister. The buoyancy is painted Signal Yellow to aid visibility.

### 4.9 Recovery aids

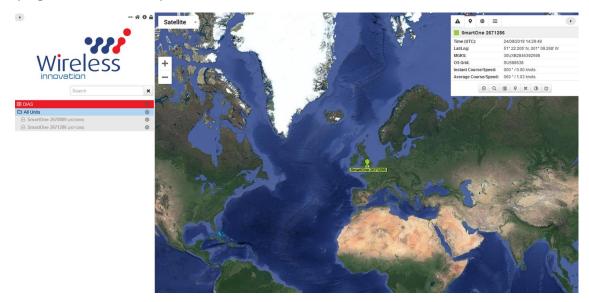
#### 4.9.1 Satellite Tracker

Aquarius includes a satellite asset tracker housed in a 4.5" Vitrovex glass sphere. The system is powered by the OBS internal battery pack.

When the OBS comes toward the surface and the reading of the Keller pressure sensor indicates a suitable depth (about 15m), the recovery system is switched on.

When the recovery system is on, the satellite tracking system will get a GPS fix and transmit the position using the satellite modem embedded in the system. The position is sent every 35 minutes via email and SMS or it is retrievable using a web portal.

An example of web portal is Wireless Innovation in the image below (https://wil.rock7.com).



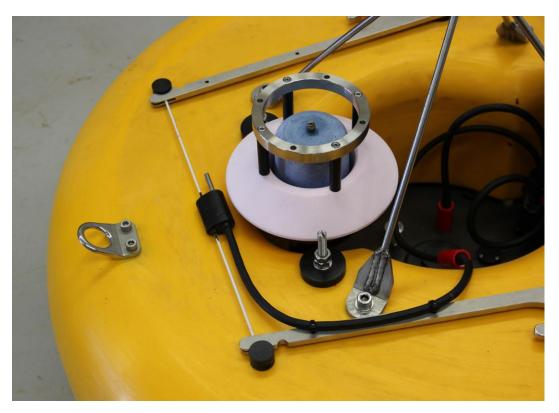
#### 4.9.2 LED strobe

The recovery system also includes a set of four bright LEDs, housed in the Vitrovex glass sphere. The LED strobe is switched on together with the satellite tracker by the pressure sensor.

To minimize power consumption, the LED strobe will be switched off during day by a phototransistor. The strobe will automatically turn on during night or in poor light conditions.

### 4.10 Ballast and release system

The ballast for the Aquarius is provided by a double-layer steel ring attached to the bottom of the Aquarius. The ballast is suspended from the Aquarius by two straps, one either side, which are held in tension by two arms on the top of the unit. These arms are held together by a single Burn-Wire.



To release the unit a current is passed between the Burn-Wire and a cathode, causing the Burn-Wire to corrode rapidly, thus breaking and releasing the unit. When the Burn-Wire has broken the unit will float to the surface thanks to the lifting force provided by the syntactic foam block.

The Burn-Wire release can be activated either by the acoustic modem or by the timer set in the ULPD. When the modem sends the command, the power to burn the wires is provided by the same switching supply used to power the acoustic modem and providing 14V. In this scenario, it takes approximately 10 minutes for the wire to break. In the other case, when the ULPD activates the sequence, only a 2S batteries voltage is sent to the Burn-Wire system and the release takes around 20 minutes. This time, being related to the voltage provided to the Burn-Wire system, will depend on the State of Charge of the batteries.

### 4.11 The Underwater Cable Loom



The underwater cable loom is composed by 3 cables and it is used to connected an accessory device (APG or hydrophone) to the Aquarius canister and also to activate the Burn-Wire.

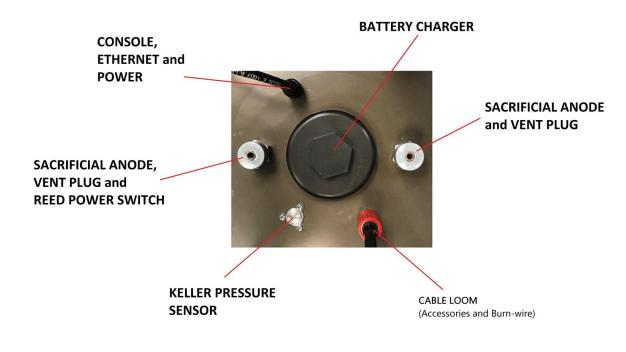
A 2-way Subconn connector provides power to the burn wire.

If fitted, a Burton 8-way connector is used to connect the APG sensor and it provides power and serial communication to the digital pressure sensor.

Alternatively and if fitted, a 4-way Subconn connector provides signal and power connections to the hydrophone.

The 8-way Subconn Micro series connector is connected to the Aquarius canister.

### 4.12 Connectors on the Aquarius canister



On the top half of the Aquarius canister the end user can identify the following parts:

- **Battery charger port**: used to recharge the Lithium-ion batteries housed inside the canister before any deployment (see Section 12.3).
- **Cable Loom**: used to power and communicate with the APG sensor or Hydrophone, and to activate the Burn-Wire (see Section 12.1).
- Keller pressure sensor.
- **Console, Ethernet and Power connector**: used to connect to the ULPD and LPC consoles, to access the LPC webpage and other functionalities via Ethernet and to eventually power up the system using an ROV compatible marine cable (see Section 12.2).
- Sacrificial anode and vent plug.
- **Reed power switch**: used to power off the system with an off plug during periods of storage and transport.

The system should be powered off using the off plug when it is not used to ensure the batteries are not drained while the unit is being transported or if the unit is put into storage for any length of time. The plug can also be used to reset the unit.



**Note:** The batteries can be charged when the off plug is inserted and the system powered off.

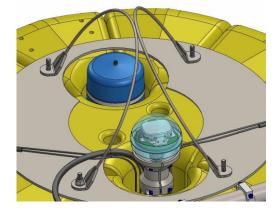


**Note:** The reed switch connector is located between the Keller pressure sensor and the Seacon connector the underwater cable loom.

### 4.13 Lifting frame

For deployment and recovery the Aquarius can be lifted using the stainless steel frame shown in the picture on the side.

The frame is attached to the top of four stainless steel rods. On the bottom side, the rods are attached to the flange of the Aquarius aluminium pressure canister.

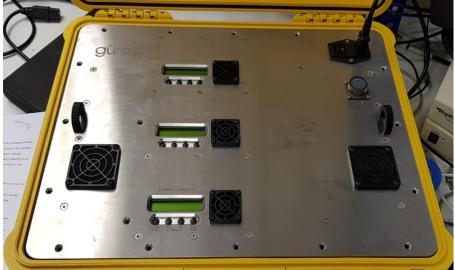


## 5 Battery changing

### 5.1 Charger box

The charger unit has been designed in conjunction with the OBS battery packs, so that it can charge the batteries in the shortest time possible. As mentioned in Section 4.5 on page 15, there are 12 x 1S battery packs in the OBS and, for the charging, they are connected as three packs with 4S configuration. Each 4S pack has its own charger circuit, this allows to charge all cells in the Aquarius in a third of the time. The chargers monitor temperature, voltage and current of each 1S battery pack during the charging cycle.





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Therefore, three battery chargers were installed in the charger unit, all three are connected to the OBS unit through the same cable described in Section 5.3 on page 23. The charger unit voltage input is 85V to 230V AC.

Each of the chargers is equipped with a display and 4 control buttons:

- Batt type / Stop
- Dec / Status Decrement
- Inc / Status Increment
- Start / Enter



The charger unit is built into a Peli case so when properly sealed it is fully waterproof (IP67).

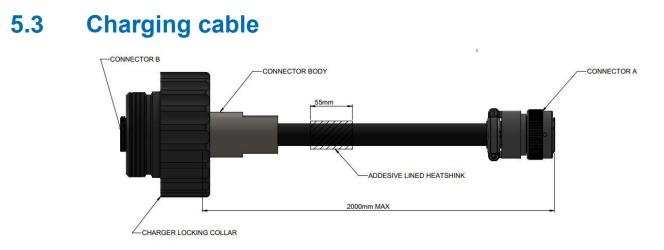


**Warning:** The charger unit is not waterproof when the lid is open. To dissipate the heat generated during the charging process, the unit was designed with ventilation fans and an outlet port.

Do not allow water into the unit when the lid is open.

### 5.2 Batteries charging specifications

Parameter	Value
Batteries arrangement	4S
Nominal voltage per cell	4.2V
Maximum charging voltage per 4S pack	16.8V
Max charging current	15A



A 2.5 m charging cable, specifically designed for charging the Aquarius has been provided with the system. The cable has a 32-way Mil-Spec connector on both ends, socket on the Aquarius canister side and plug on the charger unit side.

For details about the pin-out see Section 12.3.

The cable has a locking collar on the Aquarius end. When this is screwed down with the O-ring in place, the Aquarius canister will still be waterproof, allowing charge of the OBS under rain or sea salt sprays.

As warned in the previous paragraph, the charger unit will need to be sheltered while charging.

### 5.4 Charging the batteries

### 5.4.1 Connecting the charger

Using the special tool provided, undo and remove the cap in the centre of the OBS to reveal the charging connector.



**Caution:** It is important to use the tool provided to avoid damage to the protecting finish on the cap and cause corrosion.



The cable connector with the large black ring connects to the OBS canister. Check the alignment as the connector is pushed in and tightened by hand.

### 5.4.2 Operating the charger unit

Batteries should be charged according to the following steps:

- 1. Connect the cable as described in Section 5.4.1.
- 2. Power up the charger box using the IEC C13 mains power cable and press the

° switch.

- 3. In each of the chargers, press the "Batt type" button under the battery charger display. "PROGRAM SELECT Lithium Battery" is displayed on the LCD.
- 4. Press "Start/Enter" button once and use the "Dec" and "Inc" buttons to move across the program types until "FAST CHARGE" appears.
- 5. Press the "Start/Enter" button and use the "Dec" and "Inc" buttons to move across the battery types until "LiPo" (Lithium Polymer) appears.
- 6. Press the "Start/Enter" button and use the "Dec" and "Inc" buttons to move across the current value until "15 A" is selected.
- 7. Press the "Start/Enter" button and use the "Dec" and "Inc" buttons to move across the voltage value until "16.8 V (4S)" is selected.
- 8. Press the "Start/Enter" button.
- 9. Press and hold the "Start/Enter" button until the charging starts.

The battery charger notifies with a "beep" when the batteries are charged and shows

the message "DONE" on the display, this will happen when the current reaches 3 A ( $\frac{1}{5}$  of charging current equal to 15 A).

Push on the "Stop" button to interrupt the charging if required.

**Note:** Points 3 to 8 of the procedure above is required only if the battery charger loses its configuration. When the charger is switched off it maintains the configuration. Before shipment, the chargers were programmed with the correct settings. If no changes were applied to the original settings, you could execute steps 1 and 2 and then jump to step 9.

The complete user manual the battery charger is available at the link below

https://www.icharger.co.nz/assets/brochures/I208b.pdf

## 6 Deck unit and surface dunker

### 6.1 Deck unit block diagram

The core of the deck unit is a Single Board Computer, powered by a large lithium ion battery pack capable of supporting deck operations for multiple hours to days, depending on usage. The computer has two LAN interfaces. One is dedicated to the Aquarius connection and has a DHCP server available that will provide to the OBS an I.P. address. A PoE injector allows to provide power to the Aquarius from the deck unit on the same Ethernet port. This will also be used to reboot the LPC in normal power mode, with the LAN interface on. The other LAN interface is dedicated to connections to the external world.

A PTP server is installed inside the deck unit for time synchronization of the Aquarius prior to deployments.

The SBC is also connected to the ULPD and LPC serial consoles and drives the surface acoustic dunker using other two RS-232 connections, one for the Command line of the modem, one for the Data line of the modem.

The deck unit is waterproof and having a large battery pack allows to work on deck, also in rough conditions, without the use of any mains, increasing the safety of the operators.

### 6.2 Side connectors panel

The deck unit right panel contains all the connectors arranged as below



Starting from left, the connectors functions are

- Power in: input voltage 90-305V AC, 43-63Hz.
- GPS Antenna: connect RF cable to the PTP server's GNSS receiver.
- **Dunker:** connect cable to the two serials of the acoustic Dunker, when used.
- Aquarius Ethernet: Ethernet cable to Aquarius. PoE can be turned on and off only on this port.

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Aquarius RS-232: serial connections to the Aquarius ULPD and LPC consoles.

**Ethernet:** connection to external LAN.

### 6.3 Connect to the ULPD and to the LPC consoles

Connect a computer or the Güralp deck unit to the Aquarius Ethernet and RS-232 connector (see Section 12.2) using the provided cable.

A connection is then made using a terminal emulator, such as minicom under Linux or PuTTY under Windows. The appropriate COM/USB port should be entered as the "Serial line", and the "Speed" should be set to 115200 (baud rate).

Two COM/USB ports are used, one to connect to the ULPD console and one to the LPC.

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<pre>tr_to_cr = 0x21M9B03, sonardyne_state = 263 2583.49 (sonardyne.cr%parser: )[M01:MY_ACKS:8000] 2583.59 (sonardyne.cr%parser: )[M01:MY_ACKS:8000] 2583.55 (sonardyne.cr%parser: )[M01:MY_ACKS:8000] 2583.55 (sonardyne.cr%parser: )[M01:MY_ACKS:8000] 2583.55 (sonardyne.cr%parser: ][M01:MY_ACKS:8000] 2583.55 (sonardyne.cr%parser: ][M01:MY_ACKS:800</pre>		
<pre>2583.50 (sonardyne.c:777) sonardyne.rx_parser: 0x21498950, start_idx = 11386, p tr_to_c = 0x21498626, sonardyne.rx_parser: [Processed telemetry packet typ e13[0x05.3y877,10W-3][tr_t1152x5680/2200_Featomus:15c36a8f 4f0a3080 err:=6 m 03 0x388, 0x389 2583.53 (sonardyne.c:726) sonardyne_rx_parser: incoming_frames_tail = 20, inco ming_frames_head = 21 sending under[out] sonardyne_rx_parser: incoming_frames_tail = 87, idx = 11465, ptr_to_c = 0x2149864, sonardyne_rx_parser: 0x21498950, start_idx = 1150, inco mit_rx = 0x2149864, sonardyne_rx_parser: VMEFI:BUSY_OUELED:27.MMBR5608 ptr_to_c = 0x2149864, sonardyne_rx_parser: VMEFI:BUSY_OUELED:27.MMBR5608 ptr_to_c = 0x2149864, sonardyne_rx_parser: 1MEFI:BUSY_OUELED:27.MMBR5608 ptr_to_c = 0x</pre>		
<pre>tr_to_cr = 0x21498626, sonardyne_rx_parser: [Processed telemetry packet typ e 13[0x3,51 (sonardyne_rx_parser: )[Processed telemetry packet typ e 13[0x3,53 (sonardyne_rx_parser: )[Processed telemetry packet typ c 3x3,51 (sonardyne_rx_parser: )[Processed telemetry packet typ e 13[0x3,51 (sonardyne_rx_parser: )[Processed telemetry packet typ c 3x3,52 (sonardyne_rx_parser: )[Processed telemetry packet typ c 3x3,53 (sonardyne_rx_parser: )[Processed telemetry packet typ c 3x3,53 (sonardyne_rx_parser: )[Processed telemetry packet typ c 3x3,53 (sonardyne_rx_parser: incoming_frames_tail = 20, inco s 0x383, 0x358 sonardyne_rx_parser: incoming_frames_tail = 20, inco sonardyne_rx[5x3,54 (sonardyne_rx_parser: incoming_frames_tail = 20, inco sonardyne_rx[5x3,54 (sonardyne_rx_parser: incoming_frames_tail = 20, inco sonardyne_rx[5x3,54 (sonardyne_rx_parser: incoming_frames_tail = 20, inco sonardyne_rx[3x3] sonardyne_rx_parser: ov21498960, sonardyne_rx_parser: 0x21698950, start _idx = 11455, ptr_to_cr = 0x2149864A, sonardyne_rx_parser: 0x21698950, start _idx = 11455, ptr_to_cr = 0x2149864A, sonardyne_rx_parser: 0x21698950, start _idx = 11455, ptr_to_cr = 0x2149864A, sonardyne_rx_parser: 0x1698950, start _idx = 11456, ptr_to_cr = 0x2149864A, sonardyne_rx_parser: 0x1698950, start _idx = 11456, ptr_to_cr = 0x2149864A, sonardyne_rx_parser: 0x1698050, sonardyne_rx_parser: 11510, trice _ sonardyne_rx_parser: 11510, trice_rs 0x214985608 ptr_to_cr = 0x2149864A, sonardyne_rx_parser: 11510, trice_rs 0x214985608 ptr_to_cr = 0x2149864A, sonardyne_rx_parser: 11650, trice_rs 0x214985608 ptr_to_cr = 0x214986</pre>		
2885.51 (sonardyne.cr?85) sonardyne_rx_parser: )[Processed telemetry packet tup 6 13[DC65, WR77, BW-3.Tel.TIC52;PF8V22100-EECOV09090909010]] 2885.52 (sonardyne.cr?85) sonardyne_rx_parser: received frame 0x01 0x00 0x00 0x 2865.52 (sonardyne.cr?85) sonardyne_rx_serializer: outgoing_frames_tail = 20, inco arrife n 2865.73 (sonardyne.cr?85) sonardyne_rx_serializer: outgoing_frames_tail = 87, 2865.73 (sonardyne.cr?85) sonardyne_rx_parser: 0x21A98950, start 14 = 11465, ptr.to_cr = 0x21A98644, sonardyne_stat = 263 2868.17 (sonardyne.cr?85) sonardyne_rx_parser: NUETINUSY_UBUED227, NUER5608 pr.t.fo_cr = 0x21A98644, sonardyne_rx_parser: )[ND1:TW15:NT50] 2868.17 (sonardyne.cr?85) sonardyne_rx_parser: )[ND1:TW15:TS00 2868.17 (sonardyne.cr?85) sonardyne_rx_parser: )[ND1:TW15:TS00 2868.17 (sonardyne.cr?		
<pre>a 13(DX33/SMX7/JBV-3/LE1SC22/MSWX2/100/LEC090909090000)] string_trans_head = 21 sending_undeplog_73 sending_undeplog_73 sending_undeplog_73 sending_undeplog_73 sending_undeplog_73 sending_undeplog_73 sending_undeplog_73 sending_undeplog_74 sending_trans_head = 28 sending_trans</pre>		
<pre>03 0x3838 .vx383 2583.53 {sonardyne.r:1108} sonardyne_rx_worker: incoming_frames_tail = 20, inco ming_frames_head = 21 sending undeplog 73 2583.74 {sonardyne.r:1108} sonardyne_rx_worker: incoming_frames_tail = 20, inco sending undeplog 73 2583.74 {sonardyne.r:1311} sonardyne_rx_serializer: outgoing_frames_tail = 87, outgoing_frames_head = 88 2583.74 {sonardyne.r:2311} sonardyne_rx_parser: 0x2198930, start idx = 11485, ptr.to_cr = 0x21898644, sonardyne_rx_parser: 0x1898506 sonardyne_rx_parser: MHFT18USY,0UEUED:27,MADR5608 ptr_to_cr = 0x21898644, sonardyne_state = 263 2584.37 {sonardyne_rx_parser: 010017X115/15101 2584.31 {sonardyne_rx_parser: 010017X115/15101 2584.37 {sonardyne_rx_parser</pre>		
<pre>2583.53 {sonardyne.c:1108} sonardyne_rx_worker: incoming_frames_tail = 20, inco iming_frames_head = 21 sending undeploy 73 2583.71 {sonardyne.c:1311} sonardyne_tx_serializer: outgoing_frames_tail = 87, outgoing_frames_head = 88 2583.72 {sonardyne.c:1311} sonardyne_tx_serializer: outgoing_frames_tail = 87, outgoing_frames_head = 88 2583.73 {sonardyne.c:785} sonardyne_trx_parser: 0x21A98950, start jdx = 11465, ptrto_tcr = 0x21A98644, sonardyne_state = 263 2583.73 {sonardyne.c:785} sonardyne_trx_parser: 0HUFI:BUSY_OUEUED:27, HMER5008 prc.c:786} sonardyne_c:785} sonardyne_trx_parser: 0HUFI:BUSY_OUEUED:27, HMER5008 prc.c:786, 11 f5:04:272 2019 prc.c:786, 11 f5:</pre>		
<pre>ming_trames_head = 21 sending undeplog 73 2593.71 (sonardyne.c:1311) sonardyne_tx_serializer: outgoing_frames_tail = 87, outgoing_frames_head = 88 2593.72 (sonardyne.c:1311) sonardyne_tx_serializer: outgoing_frames_tail = 87, idx = 11465, ptrt_oc_r = 0x21498644, sonardyne_state = 263 2593.73 (sonardyne.c:786) sonardyne_tr_parser: NHFT:BUSY_OUEUED:27, MADRS600 ptr.to_cr = 0x2149864, sonardyne.c:777) sonardyne_tr_parser: NHFT:BUSY_OUEUED:27, MADRS600 ptr.to_cr = 0x2149864, sonardyne.c:777) sonardyne_tr_parser: NHFT:BUSY_OUEUED:27, MADRS600 ptr.to_cr = 0x2149864, sonardyne.c:786) sonardyne.c:777} sonardyne_tx_parser: NHFT:BUSY_OUEUED:27, MADRS600 ptr.to_cr = 0x2149864, sonardyne.c:786) sonardyne.c:777} sonardyne_tx_parser: NHFT:BUSY_OUEUED:27, MADRS600 ptr.to_cr = 0x2149864, sonardyne.c:786) sonardyne.c:777} sonardyne_tx_parser: NHFT:BUSY_OUEUED:27, MADRS600 ptr.to_cr = 0x2149864, sonardyne.c:786) sonardyne_tx_parser: NHFT:BUSY_OUEUED:27, MADRS600 ptr.to_cr = 0x2149854, sonardyne_tx_parser: NHFT:BUS</pre>	2583.53 {sonardyne.c;1108} sonardyne_rx_worker: incoming_frames_tail = 20, inco	
<pre>2583.71 {sonardgne.c:13:11} sonardgne_tx_serializer: outgoing_frames_tail = 87, outgoing_frames_head = 88 2583.72 {sonardgne.c:777} sonardgne_rx_parser: 0x21498950, start _idx = 11485, ptr_to_cr = 0x21498644, sonardgne_state = 263 2583.73 {sonardgne_rx_parser: NHFT:BUSY.OUEUED:27.MADR5608 ptr_to_cr = 0x21498644, 90 {sonardgne_rx_parser: 0x100000000000000000000000000000000000</pre>		
outgoing_frames_head = 88         2583.72 {sonardyne.c1777} sonardyne_rx_parser: 0x21498950, start         _idx = 11485, ptr_to_cr = 0x2149864A, sonardyne_state = 283         2583.72 {sonardyne.c1785} sonardyne_rx_parser: NUETISUSY_ULEUED;27, MADR5608         ptr_to_cr = 0x2149864A, sonardyn2584.90 {sonardyne.rx_parser: NUETISUSY_ULEUED;27, MADR5608         ptr_to_cr = 0x2149864B, sonardyne.rx_parser: NUETISUSY_ULEUED;27, MADR5608         ptr_to_cr = 0x2149864B, sonardyne.rx_parser: NUETISUSY_ULEUED;27, MADR5608         ptr_to_cr = 0x2149864B, sonardyne.rx_parser: NUETISUSY_ULEUED;27, MADR5608         ptr_to_cr = 0x21498668, sonardyne.rx_parser: NUETISUSY_ULEUED;27, MADR5608         ptr_to_cr = 0x21498668, sonardyne.rx_parser: NUETISUSY_ULEUED;27, MADR5608         ptr_to_cr = 0x21498668, sonardyne.rx_parser: NUETISUSY_ULEUED;27, MADR5608		
<pre>2863.72 {sonardgne,c:777} sonardgne_rx_parser: 0X21H3950, start jdx = 11465, ptrt_c_r = 0X21H39544, sonardgne_rx_parser: DHEFISUS7.0UEUED:27.MH3R5608 prt_c.2768} sonardgne.c:788} sonardgne_rx_parser: NHEFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39544, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39544, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39544, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39544, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39548, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39548, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39548, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39548, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.MH3R5608 ptr_to_cr = 0X21H39568, sonardgne_rx_parser: NHUFISUS7.0UEUED:27.0</pre>	outgoing_frames_head = 88	
2583.73 (sonardyne.cr?86) sonardyne.rx_parser: XMEFT:BUSY.QUEUED:27.MADR5608 yme.cr?86} sonardyne.rx_parser: XMEFT:BUSY.QUEUED:27.MADR5608 ptr_to_cr = 022149864A, sonardyne.grXparser: ptr_100:17X:15HR5608 2584.31 (sonardyne.cr?86) sonardyne.rx_parser: ptr_100:17X:15HR5608 2584.31 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR560 2584.31 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR560 2588.74 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR560 2588.73 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR560 2588.74 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR560 2588.74 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR560 2588.74 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR560 2588.74 (sonardyne.cr?77) sonardyne.rx_parser: ptr_100:17X:15HR570 2588.74 (sonardyne.cr?78) sonardyne.rx_parser: ptr_100:17X:15HR570 2		
<pre>une.cr366} sonardyne_rx_parser: &gt;HUFT:BUSY.0UELD:27.HNRE600 ptr_to_cr = 0x2149864A, sonardyne284.90 (sonardyne.crXTP) sonardyne_rx_parser: 0x21488950, start_idx = 11515, ptr_to_cr = 0x2149865C, sonardyne_state = 263 2684.31 (sonardyne.crX6} sonardyne_rx_parser: &gt;(HUD:TX157HST0] 2688.16 (sonardyne_state = 263 2688.17 (sonardyne_state = 263 2688.26 (sonardyne_rx_parser: &gt;(HUD:TX157HST0] 2688.27 (sonardyne_state = 263 2688.27 (sonardyne_rx_parser: &gt;(HUD:TX157HST0] 2688.27 (sonardyne_rx_parser) 27882.27 (sonardyne_rx_parser) 27882.28 (sonardyne_rx_parser)</pre>		
<pre>ptr_to_cr = 0/2149864, sonardyn2584.90 (sonardyne.cr/7/) sonardyne_rx_parser: 0/21498950, satr_ids = 11515, ptr_to_cr = 0/21498650, sonardyne_tx_parser: 2588.41 (sonardyne.cr/26}) sonardyne_rx_parser: 2(H00:TK:15:H1510) 2588.43 (sonardyne_rx_parser: 2(H00:TK:15:H1510) 2588.73 (sonardyne_rx_parser: 2(H00:TK:15:H1510) 2588.73</pre>		
2584.31 {sonardyne.cr?88} sonardyne.rx.parser: >[H00:TX:15:HST0] 2588.16 {sonardyne.cr?88} sonardyne.rx.parser: >[H00:TX:15:HST0] tr_to.pr = 0x21498688, sonardyne.state = 263 2588.37 {sonardyne.state = 263 2588.37 {so		
2588,16 {sonardyne.c:777} sonardyne_rx_parser: 0x21498950, start_idx = 11533, p tr_to_cr = 0x21498668, sonardyne_rx_parser: 2[MOD:DONE] 2588,77 {sonardyne.c:1277} sonardyne_tx_serializer: SONARDYNE_OPCODE_TX_CMD, ou sting time: Minimus:15c36a91 2c3c0e00 Featomus:15c36a91 2be00000 err:-6 m 2588,37 {sonardyne.c:1277} sonardyne_tx_serializer: SONARDYNE_OPCODE_TX_CMD, ou s = -Ned Sep 11 15:04:25 2019		gtting time: Minimus:15c36a90 b5067a00 Femtomus:15c36a90 b4aaec80 err:-6 m
tr_to_cr = 0x21898688, sonardyne_state = 265 2588,17 (sonardyne_state) = 265 2588,37 (sonardyne_st285) sonardyne_rx_parserializer: SONARDYNE_OPCODE_TX_CMD, ou 2588,37 (sonardyne_st277) sonardyne_tx_serializer: SONARDYNE_OPCODE_TX_CMD, ou serial for the	2588.16 {sonardyne.c;777} sonardyne_rx_parser: 0x21A98950, start_idx = 11533, p	s =>Wed Sep 11 15:04:25 2019 https://www.stl5c36a90.f0a14400.Featomust15c36a90.f0455590_acct+0.w
2588.1/ {sonardyne.c;//b} sonardyne_rx_parser: )[HUU:JUUME] 2588.37 {sonardyne.c;/27} sonardyne_tx_serializer: SONARDYNE_OPCODE_TX_CMD, ou statistic for a solution of the sol		
tasing frames tail = $99$ sutasing frames hard = $99$	2508.17 {sonardyne.c;/86} sonardyne_rx_parser: >[MUU:DUNE] 2588.37 {sonardyne.c:1277} sonardyne_tx_serializer: SONOPDYNE_OPCODE_TX_CMD_out	gtting time: Minimus:15c36a91 2c3c0e00 Femtomus:15c36a91 2be08080 err:-6 m
	zooo.o/ (sonarogne.c)iz/// sonarogne_cx_serializer: SowHkDIWE_OFCODE_IA_chD, ou tgoing_frames_tail = 88, outgoing_frames_head = 89	s ->Wed Sep 11 15:04:27 2019 atting time: Minimus:15c36a91 67d6d800 Femtomus:15c36a91 677b4a80 err:-6 m
2588,2588,38 {sonardyne_c;777} sonardyne_rx_parser: 0x21A98950, start_idx = 115 as solver the solver barboard by babbab by bab	2588.2588.38 {sonardyne.c;777} sonardyne_rx_parser: 0x21A98950, start_idx = 115	s ->Wed Sep 11 15:04:28 2019
45. ptr_to_cr = 0x2149860, sonardyme_state = 7 2508,33 (sonardyme_rx)estate = 7 2508,33 (sonardyme_rx)estate = 7 HDF1:0UEUE10.HADR5608		
230 (sonardyne.c/786) sonardyne.rx,parser: /hurrigUcccu/ormun5000 39 (sonardyne.c/786) sonardyne.rx,parser: /hURF10UECI		s ->Wed Sep 11 15;04;29 2019

## 7 Configuration and Control

### 7.1 Configuration and Control through Discovery

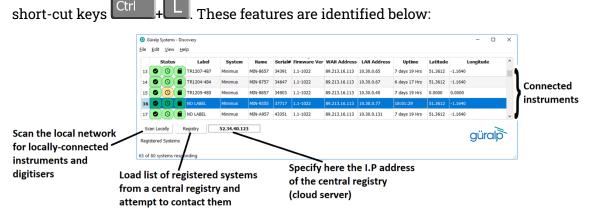
#### 7.1.1 How to connect to Aquarius

Note: A manual entirely dedicated to Discovery is now available! After downloading Discovery (<u>Güralp Support: Discovery Download Page</u> (<u>guralp.com</u>)) click on Help  $\rightarrow$  Help  $\rightarrow$  Discovery Manual. Please read the sections that mention the use of Discovery in conjunction with the Discovery manual.

To view live waveforms, to control and configure the Aquarius, you will need to use Güralp Discovery software provided with the unit.

Discovery will initially "listen" for connected instruments on your local network.

This mode can be refreshed by clicking the Scan Locally button or by pressing the



You can add instruments to the list by right-clicking in the blank area and selecting "Add device" or choosing this option from the Edit menu:

022         0.0.0.0         10.10.0.36         02:12:49         0.0000         0.0000           031         0.0.0.0         10.10.0.13         16 days 7 Hrs         51.3607         -1.1629
0.0.0.0 10.10.0.13 16 days 7 Hrs 51.3607 -1.1629

The following dialogue is displayed:

Add device - Discovery  Device IP address:	_		×					
Device IP address:			-1					
	Cancel	Add						
ter the IP address o	f the Aquarius	e to h	he a	led and	lolick	tha	Add	butto

**Note:** The newly added device will be removed from the list and not automatically re-added if a local network scan is performed.

You can choose which information is shown for each device in the main window. You can select which columns to display – and hide unwanted ones – by clicking on "Show" from the "View" menu.

		no sta ive Vie	ition selected )	+	tem	Name	Firmware Ver	WAN Address	LAN Address	Netmask	Uptime	Last Contact	Latitude	Longitude	Altitude	Timing qua
0		can Lo		1+L	us	MIN-0957	1.2-8138	89.213.16.113	10.30.0.131	255.255.0.0	7 days 18 Hrs	Just Now	51.3612	-1.1640	105.20	100
0		legistr			us	MIN-0558	1.1-1031	89.213.16.113	10.30.0.81	255.255.0.0	10 days 20 Hrs	Just Now	51.3612	-1.1640	110.80	100
	S	how		•	✓ st	atus	4779	89.213.16.113	10.30.0.5	255.255.0.0	67 days 5 Hrs	Just Now	0.0000	0.0000	0.00	100
	0		BGS string	Minir		abel	-8560	89.213.16.113	10.30.0.92	255.255.0.0	2 days 19 Hrs	Just Now	51.3612	-1.1640	113.30	100
	0		BK64	Minir		/stem ame	-8563	169.229.12.201	172.18.8.64	255.255.255.0	11:07:10	Just Now	37.8763	-122.2355	211.10	0
	0		CVTG	Minir		erial#	·1022	201.191.198.155	192.168.0.100	255.255.255.0	02:48:19	2018-04-05T19:45:34	9.9381	-84.0521	1206.19	100
Activ	e		EAM2243	EAM		rmware Ver	15695	89.213.16.113	10.10.0.27	255.255.0.0	8 days 16 Hrs	2018-04-06T09:58:20	0.0000	0.0000	0.00	0
0	0		EF00 Test	Minir	_	onnection Type /AN Address	-1031	166.247.216.249	192.168.2.2	255.255.255.0	6 days 14 Hrs	Just Now	29.1281	-98.3803	171.00	100
0	0		Eng_Test	Minir	_	AN Address	-1022	89.213.16.113	10.30.0.58	255.255.0.0	2 days 23 Hrs	Just Now	51.3611	-1.1642	113.20	100
0	0		Engineering Test	Minir		etmask ptime	-8563	89.213.16.113	10.30.0.39	255.255.0.0	22:13:05	Just Now	0.0000	0.0000	0.00	0
0	0		GSL Minimus	Minir		ast Contact	-8562	62.49.27.35	192.168.254.246	255.255.255.0	1 days 19 Hrs	Just Now	51.3613	-1.1635	88.70	100
0	0		HS	Minir		atitude ongitude	-1022	121.66.142.170	192.168.0.165	255.255.255.0	1 days 23 Hrs	Just Now	36.3676	127.3194	80.90	100
0	0		Horizontal Soak 2	Minir		ltitude	-1022	89.213.16.113	10.20.0.86	255.255.0.0	8 days 23 Hrs	Just Now	51.3610	-1.1639	110.60	100
0	0		Horizontal soak 1	Minir		ming quality	1022	89.213.16.113	10.20.0.232	255.255.0.0	14 days 0 Hrs	Just Now	51.3611	-1.1638	131.00	100
	0		IDL	Minir		2	-1022	194.117.40.80	10.101.80.77	255.255.255.0	91 days 15 Hrs	Just Now	38.7569	-9.1567	91.70	100
0	0		Murray	Minir		emperature	-8574	89.213.16.113	10.30.0.14	255.255.0.0	16:13:09	Just Now	51.3611	-1.1642	111.20	100
	0		NO LABEL	Minir	Y Fr	ee storage	-8555	89.213.16.113	10.20.0.88	255.255.0.0	00:08:50	Just Now	51.3609	-1.1634	108.70	0
	C C C cally	Reg	IDL Murray NO LABEL	Minir Minir	✓ V ✓ H ✓ Te ✓ Fr	oltage umidity emperature	-1022 -8574	194.117.40.80 89.213.16.113	10.101.80.77 10.30.0.14	255.255.255.0 255.255.0.0	91 days 15 Hrs 16:13:09	Just Now Just Now	38.7569 51.3611	-9.1567 -1.1642	91.70 111.20	1

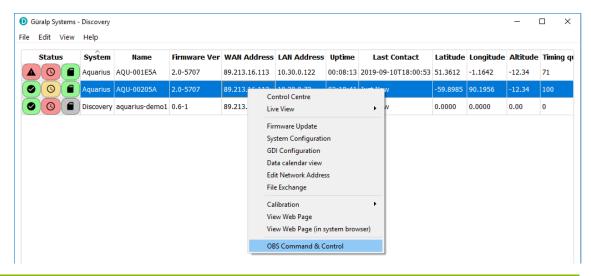
The "Status" column is composed of three icons that represent the Aquarius connectivity status (whether Aquarius is reachable/active or not), timing status (GNSS or PTP) and storage status (primary/secondary) respectively.

Hovering the mouse over any of these three icons will display tool-tips giving a brief description of the status including, for the timing indicator, details of which timing subsystems are operating:

	p Systems - Di lit <u>V</u> iew <u>H</u>	scovery elp					
	Status	Label	System	Name	Serial#	Firmware Ver	W/
		1.1-1022	0.0.				
2 Support Minimus MIN-C555 50517 1						1.1-1023	0.0.
	Timing (GNSS Storag (Storag Free sp	OK., PTP Eri e: <b>OK</b> je OK., Stora	ige free spa , Available	K.) ace is in GRE space: 6199			

The seabed unit (Aquarius) is identified with System type "Aquarius" and Name "AQU-XXXXXX".

Right-clicking on the Aquarius row in Discovery allows to access all the functionalities, including the web interface, "LiveView" and "OBS Command & Control".



#### 7.1.2 Live view

Discovery offers a versatile live waveform/data viewer. To open the Viewer, in Discovery's main window, select an instrument, right-click on it and select "Live View".

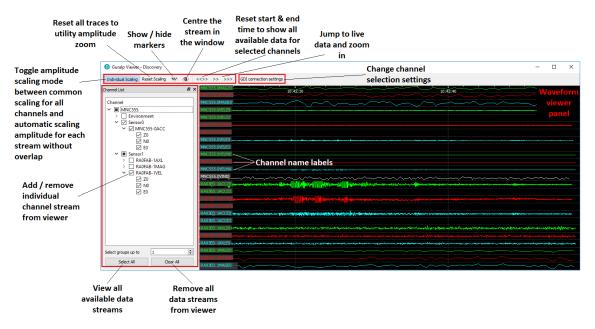
The menu will then present three options for data streaming:

- GDI and GCF channels
- GDI only
- GCF only

The GCF option uses the Scream! Protocol to stream data in GCF packets. The GDI protocol streams data sample-by-sample and also allows the sending of each instrument's calibration parameters so that data can be expressed in terms of physical units rather than digitiser counts.

Güralp recommends using the "GDI only" option for waveform viewing.

The main features of – and the key buttons within – the Live View window are shown in the following screen-shot. Basic amplitude and time zoom functions are given in the Window zoom controls panel and streams can be easily added to or removed from the window by using the check-boxes in the left panel.



The channels are divided in groups with different hierarchical importance. The most important are the velocity/acceleration channels with higher sample rates: these belong to group 1. The least important belong to group 6, which includes humidity, temperature, clock diagnostics *etc*. When the live view is launched, only the channels in group 1 are selected. It is possible to change this setting by selecting a different group number from the "Select group up to" box at the bottom of the channel list.

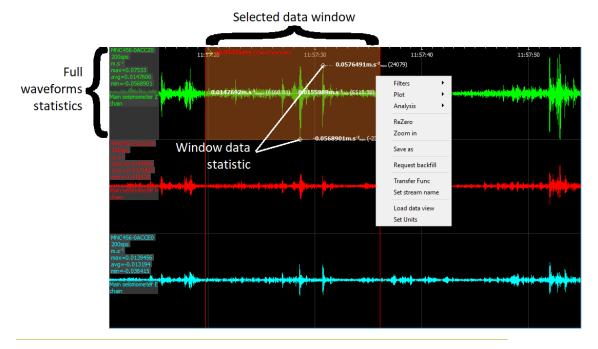


When only few channels are selected for viewing, the channel name labels also show data statistics, including the maximum, minimum and average amplitudes in physical units.

If too many channels are in view for this information to be visible, you can left-click on a label and the label and trace will then expand to half the height of the screen, revealing these statistics. The other channels will be compressed into the remaining space. Another left-click on the same channel will return the window to normal. Alternatively, a left-click on a different channel will shrink the original one and expand the newly-selected one.

By selecting and dragging the mouse over a window of waveform data, the viewer will display similar statistics for the data within the selected window. When a window of data is selected, use the the wey to subtract the ADC offset from the maximum, minimum and average values. Use the Alt key to calculate the integral

of the selected data. By right-clicking on the window, you can perform advanced analysis on the data, including plotting power spectral density graphs (PSDs), spectrograms and discrete Fourier transforms (DFTs), as shown below:



#### Window control short-cuts

You can change the display of the waveforms with based on a combination of keystrokes and mouse-wheel scrolling (or track- / touch-pad scrolling on a laptop).

These commands are shown in the table below:

Command	Window control
Amplitude control	
1	Increase/decrease amplitude of all traces
🕯 + hover cursor over channel label	Increase/decrease amplitude of individual trace
Ctrl + + + hover cursor over channel label	Shift individual trace offset up/down
Time control	·
Ctrl +	Pan time-scale right/left
Ê _ ↓	Zoom time-scale in/out
Trace focus	

on trace label	Focus on individual trace
Trace selection	
Del + hover cursor over on individual trace / trace label	Remove / de-select trace from Viewer window
Details control	
+ hover cursor over on individual trace / trace label	Reset the maximum and minimum values to the average value of the selected data

### 7.1.3 OBS Command & Control

This Discovery *OBS Command & Control* widget offers the end user a quicker way to go through the final steps of a pre-deployment procedure and allows to manage all the functionalities available through the acoustic communication, including the data retrieval and the ballast release.

	Connect 5110		
OBS On Deck	Acoustic Configuration Post-Deploy Trigger Parameters Data Recovery Error Messages		
Configure OB	G via direct network connection		
Flush to SD Ca	rds System Reset and Restart System		
Timing Status	PTP Locked 99% Offset: 0ms	For	ce Sync
SD Card Status	RECORDING Internal Card: USABLE External Card: NOT USABLE Total Capacity: 122814464 KiB Used: 14837828	F	ormat
Test Satellite			
15:26:35 04 Deployment Pro System Reset: SD cards Form Satalite Tracke	ngress No atted & Recording: No		
Burn Wire Test	: No		
Release Time S	iet: No		
Time Locked: I	0		
		kina D	eploy
	Deployment will disable networ	kiig c	repioy

The bar at the top of *OBS Command & Control* configures the acoustic modem. The first address is device which hosts the acoustic modem. In most cases this will be the local machine.

OBS Command & Control — Discovery				
localhost	Connect 5305 \$ Init			

The second address is the one of the acoustic modem in the Aquarius (seabed unit).

OBS Command & Control — Discovery –				
localhost Connect	5305 🗘	Init		

Click on "Connect" button to initiate the connection with the remote or local surface dunker driver and wait for the status at the bottom-left of the window to be **Ready**. After this, press the "Init" button. Only after these steps the end user can send commands through the surface acoustic dunker.



### 7.1.3.1 State of Health of the acoustic link

The "OBS Command & Control" shows the status of the acoustic link at the bottom window and it updates it every time an exchange of information with the modem occurs.

Re	dy				
•	Status: is the status of the acoustic communication and it can be <b>Ready, Busy</b> , <b>Not Ready</b> or <b>Network Error</b> .				
•	<ul> <li>Arrow: indicates the direction of the communication (  bottom→ surface or  surface → bottom).</li> </ul>				
•	• Range: is the slant range and it is calculated from the Turn-Around-Time.				
•	XC: Cross Correlation				
•	DBV: Degree of Voice Breaks.				
•	SNR: Signal to Noise Ratio.				
	<b>Note</b> : In certain situations (i.e. surface modem power cycle during acoustic activity), the status of the acoustic communication could get stuck in <b>Busy</b> . Click on the "Init" button, this operation should bring the status back to <b>Ready</b> .				

#### 7.1.3.2 **OBS On Deck**

The *OBS On Deck* tab of this widget connects to the Aquarius using the LAN. All the other tabs with acoustic functionalities utilise the acoustic modem connected to the Deck Unit.

OBS On Deck	Acoustic Configuration	Post-Deploy	Trigger Parameters	Data	Recovery	Error Messages	
Canfigure OBC	via direct network conr		55		,	3	
Flush to SD Ca	rds System Reset Rese	t and Restart Sys	tem				
Timing Status	PTP Locked 99% Offset: On	าร					Force Sync
SD Card Status	RECORDING Internal Card	: USABLE Externa	I Card: NOT USABLE Tota	al Capacity	: 122814464	(iB Used: 14837828 KiB	Format
Test Satellite							
Burn Wire Rel	ease Mechanism						
Test Burn Wire           15:26:35 04/02/20            Set Release Time							
Deployment Pro	gress						
System Reset: I	No						
SD cards Forma	atted & Recording: No						
Satalite Tracker Test: No							
Burn Wire Test:	Burn Wire Test: No						
Release Time Set: No							
Time Locked: No							
				D	eployment w	ill disable networking	Deploy
Test Aquarius [	10.30.0.103]						
Status: Deployed / Recording / Unlocked   BW: Off   Sat: Off   ULPD Build: 1539   Scheduled Release: 3h 0m							

#### Flush to SD Cards

*Flush to SD Cards* instructs an immediate offload of any buffered data to be stored to SD card. This prevents the loss of data immediately before undeploying an Aquarius.

#### System Reset

The ULPD can be reset to the "undeployed" state and the LPC rebooted pressing the *System Reset* button in the Pre-Deploy tab of the OBS Command & Control widget.

This button has the same effect as toggling the reed switch by screwing down and unscrewing the magnetic off plug.

Preparing the Aquarius to a deployment, click the "System Reset" button to start with a clean boot of both ULPD and LPC.

#### **Status Strings**

"Timing Status" and "SD Card Status" should appear to indicate the PTP status and offset, and the some useful SD Card information.

*Force Sync* may be used during deployment to force the system time of the ULPD to PTP time. This should happen automatically when PTP lock has occurred.

A quick format of the SD cards can be performed pressing the *Format* button.

#### **Test Recovery Aids**

The flashing LED beacons and satellite tracker may be switched on manually with the *Test Satellite* button.

Test Satellite On

Pressing this will cause the recovery aids to act as if the Aquarius has resurfaced: The LEDs will flash (as long as the ambient light level is low enough) and the satellite tracker will engage.

This feature should be switched off before deployment.

#### **Test Burn Wire**

The *Test Burn Wire* button will energise the Burn Wire. This allows the user to check that a voltage is apparent across the Burn Wire electrodes before deployment.

Burn Wire Release Mechanism					
Test Burn Wire On					
15:26:35 04/02/20	Set Release Time				

Whilst in air, this will have no effect on the Burn Wire itself.

This should be turned off before deployment.

## Setting the timed Burn-Wire in the ULPD

As a back recovery option, a timed Burn Wire burn may be set.

Use the Date & Time input box to select the desired back-up Burn Wire release time, then use *Set Release Time* to send it to the Aquarius.

Burn Wire Release Mecha	anism		
Test Burn Wire Off			
17:26:35 04/02/20	Set Release Time	Time until burn release: 3600 Seconds [1 Hours]	

When the command is correctly sent, the widget shows the countdown in hours (or seconds if less than one hour).

#### **Deployment Progress List**

Whilst not a replacement for the full deployment check-list found in this document, a reduced version is shown in the *OBS On Deck* widget to aid the user.

Each item in this list will turn green when the corresponding action has been carried out, or corresponding status becomes suitable for deployment.

Deployment Progress System Reset: Yes SD cards Formatted & Recording: Yes Satalite Tracker Test: Yes Burn Wire Test: Yes Release Time Set: Yes Time Locked: Yes

Some of these steps may not be required for every deployment.

It is the users responsibility to confirm that the Aquarius is ready for deployment before it leaves a vessel.

#### **Deploy Button**

Pressing the *Deploy* button will set the ULPD to a deployed state and switch off the LPC, therefore setting the Aquarius system into a deployed and recording state.

This will inherently prevent any further network communication with the Aquarius.

Loss of communication with the Aquarius following this procedure confirms the Aquarius as being in a deployed state.

# **Aquarius System Status String**

To provide further feedback as to the state of the system, a state of health/status string is provided in the *OBS On Deck* widget. This is automatically updated every few seconds to reflect the current state of the Aquarius system.

#### Deployment will disable network

Test Aquarius [10.30.0.103]

Status: Undeployed / Not-Recording / Locked | BW: Off | Sat: Off | ULPD Build: 1539 | Scheduled Release: 1h 0m

Above is an example of an Aquarius prior to deployment:

- It is undeployed
- It is not recording
- The internal clock is locked and external PTP time source
- The Burn Wire in not energised
- The Satellite tracking and LED beacon recovery aids are off
- The ULPD firmware version is 1539
- The Backup timed Burn Wire release is scheduled in roughly 1 hour

The user is not required to pay attention to this status string. It is provided for reassurance.

Should network connectivity with the Aquarius be lost, this status string will disappear.

If this occurs following the user pressing the *Deploy* button, this is confirmation that the system is in a deployed state.

Deployment will disable networking Deploy

Test Aquarius [10.30.0.103] No Network Connection to Aquarius

# 7.1.3.3 Acoustic Modem Configuration

The *Acoustic Configuration* tab of "OBS Command & Control" allows the user to configure acoustic modems at both ends of the acoustic link. Configuration of the local (surface) modem is performed via physical connection. Configuration of the Remote (ocean bottom, deployed Aquarius) modem is performed over the acoustic link itself.

# **Depth Configuration**

Use the drop-down menu to select the depth range at which the OBS is deployed. Click on  $Local \rightarrow Save \& Send$  to configure the acoustic modem attached to the deck-

unit or buoy unit via serial connection; click on  $Remote \rightarrow Send$  to configure the acoustic modem inside the Aquarius via acoustic link.

D	epth Configuration	
	Air Up to 1000m	Local Remote Send & Save Send
	Up to 3000m Up to 5000m	.66dB LG: 14dB RXW: 500ms
A		ettings
	These settings sho If set incorrectly, t Acoustic Baud Bat	uld not require alteration once set. these parameters can prevent the modems from communicating correctly.

# **Acoustic Baud Rate**

Use the drop-down menu to configure the acoustic modem transmission speed (baud rate). *Local* buttons are for the acoustic modem connected to the deck-unit, *Remote* ones for the acoustic modem in the Aquarius.

0 Retries   Read Send & Save Read Send		Local	Remote
	s s	Read Send &	Save Read Send
v UD 1024 v Local Remote	s	4 Jucal	Remote

The drop-down menu on the right in the *Acoustic Baud rate* section is used to set the "Master Retries" (*MR*). This parameter defines the number of times the master modem instrument will attempt to retrieve data that has been received in error. Only the data Sub Frames that were received in error are re-requested. Data Sub Frames will be pieced together automatically once they have all been received without errors. In a difficult acoustic environment this automatic re-request feature can be very powerful. However, it can result in latency in the data being delivered to the communications port.

		Local	Remote
100bps 👻	0 Retries	Read Send & Save	Read Send
	1 Retry	Send d Save	incod Schu
Indom Dolays	2 Retries		
odem Delays	3 Retries		
DD 1024	4 Retries	- Local	Remote
MD 2048	▼ ICT 2048	Read Send &	Save Read Send

The "Modem Delays" parameters in the *Acoustic Configuration* tab are set at the factory and none of them should require alteration. In case of necessity, only an experienced user with guidance from Güralp should modify them. A detailed description of these parameters can be found in Section 15.1.1.2 on page 107.

	Local	Remote
00bps 🔹 0 Retries 👻	Read Send & Save	Read Send
D 1024 VD 102	4 Juccal	Remote

All changes in any of the remote modem parameters produced with the *Acoustic Configuration* tab can be saved, permanently, in non-volatile memory using the button *Save* at the bottom right corner of the window. If not saved, the changes will be lost at the next modem power cycle.

# 7.1.3.4 Post Deployment – Acoustic Interaction

The *Post-Deploy* tab of "OBS Command & Control" provides an interface for general configuration, control and status observation of an Aquarius via acoustic modem.

All operations in this widget require the acoustic modems to have been configured correctly.

OBS On Deck	Acoustic Configuration	Post-Deploy	Trigger Parameters	Data	Recovery	Error Mes
Modem Rang	e Modem Ping					
Get Aquarius I	Get SEED ID					
Perform Re	centre Get Rece	ntring Status				
12:25:29 05/02	2/2021 🗘 Set Release T	ime				
Flush Data	Status					
Acoustic Moder	m connection required					

# Modem Range and Modem Ping

Two methods of making initial acoustic contact with a deployed Aquarius are available.

Pre-Deploy	Acoust	ic Configuration	Post-Deploy	Trigger Params	Data	Recovery	Error Messages	Advanced
Modem Ra	ange	Modem Ping	Last Ping:	320494 uS				
Get Aquarius	ID	Get SEED ID						
Perform	n Recenti	re Ge	t Recentring S	tatus				

The *Modem Range* button is used to measure an individual range to a remote instrument. This is the shortest message that could be sent to the bottom modem, useful for diagnosing acoustic communication issues in challenging scenarios for the acoustic link, as explained in Section 15.3.1.

In the presence of a good acoustic link, *Modem Ping* may be used to verify the connection with the acoustic modem. The last ping in "uS" will be printed. This is the Turn-Around-Time reported by the acoustic modem.

**Note:** The Turn-Around-Time (TAT) is the time in milliseconds that the remote instrument takes to respond to an interrogation signal, starting from when the interrogation is sent until the acknowledgement is received.

# Get Aquarius ID and SEED ID

Further verification of the acoustic link with an Aquarius is available through the *Get Aquarius ID* and *Get SEED ID* buttons.

These interrogate the LPC (if awake) for the respective IDs, which will be displayed if received.

# **Perform a Seismometer Centring**

Click on *Perform Recentre* to start the centring of the main sensor's components. When centring is ongoing the status is Centring.

Modem Range	Mo	dem Ping	]		
Get Aquarius ID	Get S	EED ID			
Perform Rec	Perform Recentre Get R		lecentring Status	Centering	
17:17:57 16/12/2	019 🗘	Set Release	Гime		

Click on Get Recentring Status to verify at what stage the centring is.

Modem Range	Мо	dem Ping	]	
Get Aquarius ID	Get SI	EED ID		
Perform Rece	Perform Recentre Get R		Recentring Status	Z1 1 N1 1 E1 0
17:17:57 16/12/20	19 🗘	Set Release	Time	

Z, N and E are the three components Vertical, N/S and E/W respectively.

- The first number indicates the status of the electrical centring (1 = centring, 0 = centred).
- The second number indicates the status of the mechanical centring (1 = centring, 0 = centred).



**Note:** The mechanical centring is the first stage and takes only a few seconds if the sensor is not moving. The electrical centring follows and takes around 10 minutes.

# Flush Data to the LPC

Click on *Flush Data* to flush data from the ULPD memory to the LPC microSD card. This operation is needed when the end user needs to retrieve last minutes data acoustically.

Pre-Deploy	Acoustic Configuration	Post-Deploy	Trigger Params	Data	Recovery	Error Messages	Advanced
Modem R	Modem Ping						
Get Aquariu	s ID Get SEED ID						
Perform	n Recentre G	iet Recentring S	tatus				
17:17:57 16	/12/2019 🗘 Set Relea	ase Time					
	[						
Flush Data	Status						

# Get Data with a certain timestamp

Once data is flushed into the LPC, the *Request OBS Data* window appears. Select the starting data and time and click on "Request Data" button to proceed.

Pre-Deploy Acoust	ic Configuration	ost-Deploy	Trigger Params	Data	Recovery	Error Messages	Adv	anced
Modem Range	Modem Ping							
Get Aquarius ID	Get SEED ID	]						
Perform Recent 17:17:57 16/12/2019		Recentring SI	tatus					
ſ			Request OBS Da	ta — Di	scovery	-		×
Flush Data	Data Source • Location 01		Channel CHZ		] [ О Тар	UID 0x		
	Start Date/Time	11 Sep 201	19 👻 2:33:12 PM	1				
	Request Data							
	Ready	Rang	ge: <b>Om</b> XC:	83 SNR:	61 DBV:	-20		
Acoustic Modem conn	ection required							
Ready	Range: <b>Om</b>	(C: <b>82</b> SNR:	61 DBV: -19					

# **Set timed Burn-Wire**

In the Post-Deploy tab of "OBS Command & Control", it is possible to update the Burn-Wire timer in the ULPD via acoustic commands. Select the date and time at which the Burn-Wire should be released. Once the time is configured, click on "Set Release Time" to send the command to the OBS via acoustic.

Pre-Deploy Acoustic Configuration	Post-Deploy	Trigger Params	Data	Recovery	Error Messages	Advanced
Modem Range Modem Ping						
Get Aquarius ID Get SEED ID	]					
Perform Recentre Get	Recentring St	atus				
17:17:57 16/12/2019 🗘 Set Release	e Time					
Flush Data Status	iken					

If the command is sent correctly the status notifies with the message "Taken".

# 7.1.3.5 Recovery - Ballast Release

The *Recovery* tab of "OBS Command & Control" allows the user to recover a deployed Aquarius via the acoustic link.

To activate the Burn Wire and begin a recovery: Click on *Get the remote modem's unique ID* to obtain the seabed modem hard-coded address.

Set the amount of time for the Burn Wire activation. 900 Seconds is adequate and further activations are possible.

re-Deploy	Post-Deploy	Trigger Params	Data Recovery	Error Messages	Advanced	
Are you sur	e you want to re	lease the ballast of	remote modem 5304	?		
Step 1:		Get the remote r	nodem's unique ID	U0060F	7	
Step 2: Set	the burn time t	0	900 🔹 sec	onds		
Step 3:		Activate the remo	te modem's burn wire	2		
						Undeploy

Finally, click on *Activate the remote modem's burn wire* button to send the command to the Aquarius via acoustic. Once the command is correctly sent, the countdown is showed on the window.

Step 3:	Activate the remote modem's burn wire	<b>BBH</b> s remaining	
			Undeploy
Ready			

# 7.1.3.6 Error messages

In the *Error Messages* tab of "OBS Command & Control", errors that occur during the data retrieval via acoustic link are listed. This tool is useful to identify the cause of the issue.

-	у	ontrol — Discover	mmand & C	OBS Co	empty -		
				Init	5304 🗘	Connect	ocalhost
	Advanced	Error Messages	Recovery	Data	Trigger Params	Post-Deploy	Pre-Deploy
09-11 19:03:01 (Curren	81F] at 2019- 82F] at 2019-	Ind for 01.CHZ [0x0	ed: No file fou	quest Fail	SMT : MiniSEED Ree	14:54:12 2019 14:56:52 2019	Wed Sep 11 Wed Sep 11
							4

# 7.2 Configuration and Control through Web Interface

Discovery offers access to the Aquarius web interface for configuration and control of the instrument. To open the web page, in Discovery's main window, select an instrument, right-click on it and select "View Web Page" or "View Web Page (in system browser)".

# 7.2.1 Network configuration

Once the web page is open either in Discovery or web browser, navigate to the "Network" tab.

The LPC inside the Aquarius and the one-board computer in the deck-unit use DHCP (Dynamic Host Configuration Protocol) to acquire their network configuration.

The dynamically obtained I.P. address is listed in Discovery main window under "LAN Address" column.

🕩 Gü	iralp Systems -	Discovery									- 0	×
<u>F</u> ile	<u>E</u> dit <u>V</u> iew	<u>H</u> elp										
	Status	System	Name	Firmware Ver	WAN Address	LAN Address	Uptime	Last Contact	Latitude	Longitude	Altitude	Timing
	0	Aquarius	AQU-00205A	2.0-5707	89.213.16.113	10.30.0.73	03:13:31	Just Now	-59.8985	90.1956	-12.34	100
Ø	0	Discovery	aquarius-demo1	0.6-1	89.213.16.113	10.30.0.122	00:40:02	Just Now	0.0000	0.0000	0.00	0

# 7.2.2 PTP

The Aquarius system supports timing provided through PTP when LAN is switched on.

		M~~~~W	Mmm	L	g	j <b>üralp</b>	IDERSTAND PTIMISE OTECT
							Aquariu
	Network Set					orage Logout	Help
System type: Aquarit System Status	is   Host label: D	IAS-AQUARIUS   Host na	ime: AQU-00205A (	10.30.0.73)   Serial num	1ber: 00205A		
System Status			General inf				
Host name	AQU-00205A	Host label	DIAS-AQUARIUS	System type	Aquarius	Product type	Aquarius
Serial number	00205A	Firmware version	2.0-5707	IPv4 address	10.30.0.73 (DHCP)	SEED network and station	DG.TEST (No site)
Digitiser temperature	29.212 °C	Digitiser humidity	33.68%	Input voltage	2.510 V	Power over Ethernet voltage	0.000 V
Uptime	3h 30m 47s					_	
-			GNSS S	tatus			
GNSS connection statu	s Disconnected	Last timestamp	0000-00-00 00:00:00				
Last lock time	Never	GNSS stability	Disconnected	1 +			
Latitude	-59.899	Longitude	90.1957	1			
Altitude	-12.34	Horizontal dilution of precision	Undefined		V	r	
GNSS PPS status	Not Trusted No Pulse	GNSS NMEA stream	Bad input	]			
GNSS Lock state	No lock	Number of satellites	Used: 0 In view: 0		Re	port a problem   © OpenStr	eetMap contributor
			PTP St	tatus			
PTP state	Phase Locked	Last PTP timestamp	2019-09-11 11:04:18Z	Last PTP lock time	2019-09-11 11:02:30Z	PTP stability	99%
Master IPv4 address	10.30.255.35	Master clock class	PRI_REF_PTP	Master clock accuracy	< 100ns (0x21)	Master time source	GPS
Network path delay	32.7 us	Network jitter estimate	-	Network outliers	1%		
			Data recor	d status			
microSD status	Recording	microSD total	60686336 KiB	microSD used	67928 KiB	microSD free	99%
			Sens	ors			
Number of sensors detected	2						
Senso	or0	Serial number (0)		Firmware ver (0)	0.1		
		Integrator Z (0)	0	Integrator N (0)	0	Integrator E (0)	0
		Seismometer Z (0)	-5559061	Seismometer N (0)	3261771	Seismometer E (0)	2680823
Senso	or1	Serial number (1)		Firmware ver (1)	0.1	Temperature (1)	33.57 °C
		Yaw (1)	0.000°	Pitch (1)	0.000°	Roll (1)	0.000°
		Integrator Z (1)	-21691	Integrator N (1)	12752	Integrator E (1)	10480

The IEEE 1588 Precision Time Protocol is used to synchronise clocks across a computer network. It is significantly more accurate than NTP but generally requires specialised hardware support. PTP can be configured for multicast or unicast mode. In unicast mode, the server IP address must be specified.

This is available in the "Status" tab of the Aquarius web page. A number of reporting parameters are given, including:

• PTP state.

- Last PTP time-stamp and last PTP lock date/time.
- PTP Stability:
  - Standby  $\Rightarrow$  PTP is running but timing is provided by GNSS;
  - No Master  $\Rightarrow$  PTP not available;
  - \* 1-100%  $\Rightarrow$  PTP locking process indicator. 100% indicates a time accuracy of better than 200ns.
- Master IPv4 address.
- Master clock class and accuracy.
- Master time source.
- Network path delay.
- Network jitter estimate: quality indicator.
- Network outliers.

In the Aquarius PTP is the only source of timing available. To configure its settings, visit the "Network" tab in web page.

	M	~~~~~	— gür	alp UNDERSTAND OPTIMISE PROTECT
				Aquarius
Status Network Setu	p Power Trigger Data S	ream Data Record Trai	nsforms Storage	e Logout Help
System type: Aquarius   Host label: DI	AS-AQUARIUS   Host name: AQU-00	205A (10.30.0.73)   Serial numbe	er: 00205A	
Network Config				
DHCP Enabled ~				
DNS1 209 244 0 3	DNS2 84 200 69 80			Reboot
Web Login Not Required 🗸	Username admin	Password	••••	Port 80
SeedLink Enabled, 65536 records ~	Send status.txt Every 300 secon	ds SeedLink Data Packet Format		SeedLink Packet 0 deciseconds
TFTP Server 10 30 255 197	TFTP File			
Network Timing				
PTP Mode Run always - Override GPS 🗸	PTP Offset Correction 0 nanosecor	ds PTP Transmission Mode	Multicast 🗸	
NTP S Disabled			,	
Run if needed - Offline backup				
Run always - Online backup Regist Run always - Override GPS	Registry Address 52 34 40 123	Group ID	obs-dev	

Under the heading "Network config" are four options:

- **Disabled** ⇒ PTP is never used (default settings).
- **Run if needed Offline backup** ⇒ PTP is automatically enabled whenever the GNSS signal is lost. It is disabled while GNSS is available. This mode is used to minimise network traffic when GNSS is the primary timing source.
- **Run always Online backup** ⇒ PTP is always running but GNSS is used as the primary timing source. This mode is useful for faster fall-back from GNSS to PTP timing and for validation that PTP is available.

•

**Run always – Override GPS** = PTP is always running and takes priority over GNSS. This mode is useful in a system where PTP is the primary timing source, but GNSS may occasionally be connected for validation purposes.

Select the option "**Run always – Override GPS**" before the deployment of Aquarius OBS.

# 7.2.3 Setting up streamed data

The monitoring and configuration of transmitted data is handled using the "Data Stream" tab in the web page. Data streaming is only included for testing purposes prior to the deployment.

		~~~	Markam	V	güralp UNDERSTAND OPTIMISE PROTECT
					Aquarius
Status	Notwork C	otur	- Dowor Trigger Data Street	n Data Dagard Transforms	
Status	Network S	etup	o Power Trigger Data Strea	m Data Record Transforms	Storage Logout Help
System type: Aquar	ius   Host label:	DIA	S-AQUARIUS   Host name: AQU-00205A	(10.30.0.73)   Serial number: 00205A	
Data Stream					
Disable All Stream	ms		Restore default	The "Disable All" and "Restore default" button will ALSO affect settings of any other sensors	Reboot
Copy to Data Rec	ord		"Copy to Data Record" will apply settings from this page to recording configuration of all of the sensors.		
Display Streams	All	$\sim$	Apply configuration for tap groups	Try to NOT change any SEED names	Display On Page Sensor 1 ~
Channels config	guration				
Channel sar	mpling rate		Data transform	SEED name - please use check-box to modify the default	RESPonse file - if available
			Seismic	channels	
1AUXX0	100 Hz	$\sim$	Transforms Disabled for this tap $ \sim$	DG.TEST. 01 .HDF	RESP file 54
1VELZ0	250 Hz	<	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST. 01 .CHZ	RESP file 57
1VELN0	250 Hz	<	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST. 01 .CHN	<u>RESP file 62</u>
1VELE0	250 Hz	<	Transforms Disabled for this tap $ \sim$	DG.TEST. 01 .CHE	RESP file 67
1VELZ2	5 Hz	$^{\prime}$	Transforms Disabled for this tap $ \sim$	DG.TEST. 01 .MHZ	RESP file 58
1VELN2	5 Hz	<	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST. 01 .MHN	RESP file 63
1VELE2	5 Hz	<	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST. 01 .MHE	RESP file 68
			Mass positi	on channels	
1INTZ0	5 Hz	$\sim$	Transforms Disabled for this tap $$	DG.TEST. 01 .MMZ	
1INTN0	5 Hz	$\sim$	Transforms Disabled for this tap $$	DG.TEST. 01 .MMN	
1INTE0	5 Hz	$\sim$	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST. 01 .MME	
				ometer channels	
1AXLZ0	5 Hz	~	Transforms Disabled for this tap $\sim$	DG.TEST.01 .MNZ	RESP file 87
1AXLN0	5 Hz	~	Transforms Disabled for this tap ∨	DG.TEST. 01 .MNN	RESP file 92
1AXLE0	5 Hz	~	Transforms Disabled for this tap $$	DG.TEST. 01 MNE	RESP file 97
		_		ter channels	
1MAGZ0	5 Hz	~	Transforms Disabled for this tap ~	DG.TEST. 01 MFZ	RESP file 102
1MAGN0	5 Hz	~	Transforms Disabled for this tap $\smallsetminus$	DG.TEST. 01 MFN	RESP file 105
1MAGE0	5 Hz	$\sim$	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST. 01 .MFE	RESP file 108

This page allows to configure the transmitted channels for each of the connected sensors. The names and contents of each channel are described in Section 11.1.



**Note:** When changing a setting in the Aquarius web page, ensure that you wait until the page refreshes before changing another setting. This allows time for the previous change to take effect.

The drop-down box at the top-left of the page named "Display Streams" filters out visible channels among Enabled and Disabled. The option "Apply configuration for tap groups" automatically apply the same configuration to three streams that belong to the same tap, e.g. IVELZO, IVELNO, IVELEO. The drop-down box at the top-right of the page named "Display On Page" allows to move from different instruments, e.g. Sensor 1.



**Note:** The most relevant streams for the Aquarius are located on Sensor 1. Other sensor's streams could be ignored by the end user.

The page is divided in four columns:

- in most-left column, drop-down boxes are available for each channel to either select a sample rate or to exclude the channel from streaming (by selecting the "Disabled" option). All streaming can be stopped by clicking the Disable All button. Same configuration can be applied to recorded channels by clicking the Copy to Data Record button. Default channel configuration can be applied by clicking the Restore default button.
- second column from the left is not relevant for the Aquarius OBS;
- in third column from left, Location and Channel SEED codes can be configured. Cells are greyed out by default (default values applied) and they can be edited by clicking on the check-box;
- in most-right column contains links to the RESP files associated to each of the seismic channels (see Section 7.2.8).

Upon changing the sample rate or changing Location and Channels codes, the Aquarius will need to be restarted for the changes to come into effect; this can be done by pressing the Reboot button.

Once the Aquarius has successfully restarted, the full web browser display and controls will be available for use again.

# 7.2.4 Setting up recorded channels

The main panel of the "Data Record" tab in the web interface is shown here:

		M	V	güralp UNDERSTAND OPTIMISE PROTECT
				Aquarius
St	atus Network Setu	p Power Trigger Data Strea	m Data Record Transforms	Storage Logout Help
		AS-AQUARIUS   Host name: AQU-00205A	A (10.30.0.73)   Serial number: 00205A	
Data Reco	ora	[	The "Disable All" and "Restore default"	[
Disab	ble All	Restore default	button will ALSO affect settings of any other sensors	Reboot
Copy to Da	ata Stream	Copy FR to all	Recording status Recording	For more information about microSD cards status please visit "Storage" tab
Display Streams	Low Power Recording $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	Apply configuration for tap groups	Try to NOT change any SEED names	Display On Page Sensor 1 🗸
Channels	configuration			
Cha	nnel sampling rate	Data transform	SEED name - please use check-box to modify the default	RESPonse file - if available
		Seismic	channels	
S1 SeisXFR	100 Hz $$ $$ $$	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST. 01 .HDF	<u>RESP file 56</u>
S1 SeisZFR	250 Hz 🗸 🗸	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST. 01 .CHZ	RESP file 61
S1 SeisNFR	250 Hz 🗸 🗸	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST. 01 .CHN	RESP file 66
S1 SeisEFR	250 Hz 🗸	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST. 01 .CHE	RESP file 71
		Mass positi	on channels	1
S1IntZFR	5 Hz 🗸	Transforms Disabled for this tap $$	DG.TEST. 01 .MMZ	
S1IntNFR	5 Hz 🗸	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST. 01 .MMN	
S1IntEFR	5 Hz 🗸	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST. 01 .MME	
			ometer channels	
		<b>_</b>	ter channels ismic channels	
			channels	
S1PresFR	5 Hz ~	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST.01 .MDI	RESP file 113
S1HumidBFR	5 Hz ~	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST. 01 .MIO	RESP file 116
S1ExtPresFR	5 Hz 🗸	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST.01 .MDO	RESP file 119
S1APGFR	5 Hz 🗸	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST. 01 .MDU	RESP file 122
S1 STAZFR	1 Hz ~	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST.01 .LZ0	RESP file 125
S1LTAZFR	1 Hz ~	Transforms Disabled for this tap $\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!\!$	DG.TEST.01 .LZ1	RESP file 128
S1RatioZFR	1 Hz v	Transforms Disabled for this tap $ \smallsetminus $	DG.TEST.01 .LZ2	RESP file 131

This page allows to configure the recording channels for each of the connected sensors. The names and contents of each channel are described in Section 11.2 .



**Note:** Only the taps with name ending in FR (Fix Recording) should be enabled.

**Note:** When changing a setting in the Aquarius web page, ensure that you wait until the page refreshes before changing another setting. This allows time for the previous change to take effect.

The drop-down box at the top-left of the page named "Display Streams" filters out visible channels among Enabled and Disabled. The option "Apply configuration for tap groups" automatically apply the same configuration to three streams that belong to the same tap, e.g. S1SeisZFR, S1SeisNFR, S1SeisEFR. The drop-down box at the top-

right of the page named "Display On Page" allows to move from different instruments, e.g. Sensor 1.

The page is divided in four columns:

in most-left column, drop-down boxes are available for each channel to either enable the recording or to exclude the channel from recording (by selecting the "Disabled" option). All streaming can be stopped by clicking the

Disable All button. Same configuration can be applied to recorded channels by clicking the Copy to Data Record button. Default channel configuration can be applied by clicking the Restore default button.

**Note:** The sample rates for FR channels are fixed:



- main seismic channel: 250 sps
- mass position, PLL offset, pressure, humidity, internal temperature and input voltage: 5 sps
- STA/LTA channels, power and external temperature: 1 sps.
- second column from the left is not relevant for the Aquarius OBS;
- in third column from left, Location and Channel SEED codes can be configured. Cells are greyed out by default (default values applied) and they can be edited by clicking on the check-box;
- in most-right column contains links to the RESP files associated to each of the seismic channels (see Section 7.2.8).

Upon changing enabling/disabling channels or changing Location and Channels codes, the Aquarius will need to be restarted for the changes to come into effect; this can be done by pressing the Reboot button.

Once the Aquarius has successfully restarted, the full web browser display and controls will be available for use again.

MicroSD cards need to be specifically formatted to operate with the Aquarius. The cards shipped with the Aquarius are supplied pre-formatted.

Data are stored on the microSD cards in miniSEED format. Each channel is saved as a series of 128 MiB files. Instrument and station meta-data (e.g. instrument response, coordinates, compression type etc.) are stored in "Dataless SEED" format.

The MicroSD card and data recording status can be monitored in the upper panel of the "Storage" tab.

The left-hand column provides details of the primary microSD card and the righthand column shows the status of the backup card.

SD Cards status			
External microSD card present	PRESENT	Number of 128-MiB miniSEED files	452
External microSD card usable	USABLE	Internal microSD card usable	USABLE
External microSD card init count	1	Internal microSD card init count	1
External microSD card is primary microSD card	PRIMARY	Internal microSD card is primary microSD card	BACKUP
Primary microSD card is recording samples	RECORDING	Backup microSD card is recording samples	RECORDING

Sections of this panel indicate the status of the following:

- Whether a card is inserted;
- Whether an inserted card is usable (i.e. correctly formatted); and
- Whether the card is recording data.

Note: If the recording status of the cards is marked NOT RECORDING, clicking on Outchformat cards or Fulfformat Cards may solve the issue. Note that the quick format simply moves the write-pointer to the beginning of the recording space, hence overwriting any existing data. The full format, in contrast, erases all the existing data (and can take several hours).

The card re-formatting process fills the card with 128 MiB files containing zeroes. Each file is given a temporary, place-holder name. When data are written, these files are renamed and then over-written with data.

There are two methods for card reformatting: "Quick format" and "Full format". The quick format mode should be used for pre-deployment tests (e.g. stomp/huddle tests) to ensure that the instruments are operating properly. This mode simply marks the existing files as empty without deleting their contents. Full formatting should be used prior to a long-term deployment to ensure that all headers are included and files are fully clean before writing.

The formatting process formats both fixed and removable cards, sequentially.

**Note:** A series of tests separated only by quick formats can leave some files with residual data in them. This is not normally a problem because a deployment will typically create data-sets longer than any test, over-writing any data remaining from the tests.

To quick-format the cards, click the <u>Quickformat Cards</u> button in the "Storage" tab: a

dialogue box will appear to confirm the formatting operation – click on OK button to continue.

🕖 Java	script Confirm - http://10.10.0.13/tab7.html - Discovery	×
1	Are you sure? Quickformat will erase the data from all of the installed cards. Please make sure that no important data will get destroyed before continuing.	
	OK Cancel	

The instrument web page will refresh and return to the "Status" tab. The reformatting operation is now complete.

To full-format the cards, click the **Fullformat Cards** button in the "Storage" tab and a dialogue box will appear to confirm the formatting operation – click on **OK** button to continue.

D Java:	script Confirm - http://10.10.0.13/tab7.html - Discovery	×
1	Are you sure? Fullformat will erase the data from all of the installed cards. Pleas make sure that no important data will get destroyed before continuing.	se
	OK Cancel	

The process takes several hours: check the status countdown indicators on the topright of "Storage" tab.

SD Card control			
Unmount Cards	Quickformat Cards	Fullformat Cards	Formatting progress: 0% ~196 minutes remaining

# 7.2.5 Download recorded data

The "Storage" tab of the web browser interface displays the miniSEED files stored on the microSD card:

~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		WWW		— güralþ	UNDERSTAND OPTIMISE PROTECT
						Aquariu
	Status Network	Setup Power	Trigger Data Stream Da	ata Record Trar	nsforms Storage Loo	gout Help
	Status Network	Coctup Tower	ngger Data Stream Da			gour help
Syste	em type: Aquarius   Host	label: DIAS-AQUARIUS   H	ost name: AQU-00205A (10.30.0	0.73)   Serial numbe	er: 00205A	
SD	Card control					
	Unmount Cards	Quickformat	Cards	llformat Cards	Formatting st	atus: idle
SD	Cards status					
	nal microSD card present	PRESENT	Numbe	r of 128-MiB miniSEED	) files 463	
	nal microSD card usable	USABLE	Interna	I microSD card usable	USABLE	
Exter	nal microSD card init coun	t <b>1</b>	Interna	I microSD card init co	unt 1	
Exter	nal microSD card is prima	ry microSD card PRIMARY	Interna	l microSD card is prin	nary microSD card BACKUF	2
Prima	ary microSD card is record	ing samples RECORDI	NG Backup	microSD card is reco	ording samples <b>RECORE</b>	DING
SD	Card files					
¢		Filename	♦ Size	(bytes) 🜲	Last data ti	mestamp
- <b>•</b>	00C95A S1SeisEFR	00250 00000.mseed	18337792		2019-09-11 07:16:58.0000	-
	00C95A S1SeisXFR	00100 00001.mseed	3272704		2019-09-11 07:16:58.0000	
	00C95A S1PresFR	00005 00002.mseed	483328		2019-09-11 07:16:58.0000	
	00205A S0TemprA	00010 00003.mseed	454656		2019-09-11 07:10:30:0000	
	00205A SOHumidA	00010 00004.mseed	450560		2019-09-11 11:26:30.2000	
	00205A SOVoltage	00010 00005.mseed	491520		2019-09-11 11:27:22.3000	
	00C95A S1TemprSeaFR	00001 00006.mseed	204800		2019-09-11 07:16:58.0000	
	00C95A S1PowerFR	00001 00007.mseed	204800		2019-09-11 07:16:58.0000	
	00C95A S1RatioZFR	00001 00008.mseed	225280		2019-09-11 07:16:58.0000	
	00C95A S1LTAZFR	00001 00009.mseed	204800		2019-09-11 07:16:58.0000	
	00C95A S1STAZFR	00001 00010.mseed	204800		2019-09-11 07:16:58.0000	00000
	00C95A S1IntEFR	00005 00011.mseed	319488		2019-09-11 07:16:58.0000	00000
	00C95A_S1IntNFR	00005_00012.mseed	299008		2019-09-11 07:16:58.0000	00000
	00C95A_S1IntZFR_	00005_00013.mseed	356352		2019-09-11 07:16:58.0000	00000
	00C95A_S1ExtPresFR_	00005_00014.mseed	331776		2019-09-11 07:16:58.0000	00000
	00C95A_S1APGFR	00005_00015.mseed	339968		2019-09-11 07:16:58.0000	00000
	00C95A_S1VoltageFR_	00005_00016.mseed	356352		2019-09-11 07:16:58.0000	00000
	00C95A_S1HumidBFR	00005_00017.mseed	368640		2019-09-11 07:16:58.0000	00000
	00C95A_S1TemprBFR	_00005_00018.mseed	356352		2019-09-11 07:16:58.0000	00000
	00205A SOSeisXFR	00100 00019.mseed	3235840		2019-09-11 07:16:58.0000	

Clicking on the file from the list automatically starts a download using your browser's standard mechanism:

Opening Sensor0SeismoZSm_000000200_00003.mseed	×
You have chosen to open:	
Sensor0SeismoZSm_0000000200_00003.mseed	
which is: mseed File (128 MB)	
from: http://10.10.0.36	
What should Firefox do with this file?	
O Open with Browse	
Save File	
Do this automatically for files like this from now on.	
OK Cancel	

Multiple files can be downloaded simultaneously by ticking the boxes on the left of each link and clicking on Download selected files button.

Data for a single stream spanning a specific time-interval can be downloaded from the Storage page of the web interface. To do this, start by selecting the desired stream from the drop-down menu:

		www.	····		güralþ	UNDERSTAND OPTIMISE PROTECT
						Fortimus
Status Network	Setup Power	r Trigger Data	a Stream Data Reco	ord Transforms	Storage Logout	Help
System type: Fortimus   Host	label: NO LABEL   Ho	et name: EMUS 8859	(10 10 0 29)   Serial nu	mber: 3/1905		
	Filename	\$	Size (bytes)	<b>\$</b>	Last data timest	amp 🔶
Sensor0AccelZRou_000000010 Sensor0AccelERou 000000010			458752 487424		12:26:24.900000000 12:25:02.750000000	
Sensor0AccelNRou 000000010	DG.TEST.0K.HCA ^		528384		12:28:54.98000000	
Sensor0SeismoESm 000000020			2060288	2018-08-15	12:26:40.360000000	
Sensor0SeismoNSm 000000020	DG.TEST.OR.HNZ		2060288		12:26:45.410000000	
status.log system.log	DG.TEST.0S.HNZ		8624 11425		12:20:28.000000000 12:14:46.000000000	
init.log	DG.TEST.OR.HNN		11425		12:14:46.000000000	
table_of_events.bin	DG.TEST.0S.HNN		1024	1969-12-31	23:59:42.000000000	
Auxiliary files	DG.TEST.0R.HNE					
Auxiliary mes	DG.TEST.0S.HNE					
Filename			D	escription		÷
DG.dataless	DG.TEST.0U.MFZ	less SEED file		-		
fram.log	DG.TEST.0V.MFZ	log file				
calvals.txt	DG.TEST.0U.MFN	AM! calibration va				
polezero.txt calib.txt	DG.TEST.0V.MFN	AM! zeros, poles a bration text file	nd gains			
CULLD. UND	DG.TEST.0U.MFE	STUCION CEAU TILE				
Channel data download by	DG.TEST.OV.MFE 🗸					
Channel:	DG.TEST.0K.HCA 🗸	rom: dd / mm / yyy	y: To: dd	i/mm/yyyy	: Download	

... then select the start and end dates and times using the pop-up calendars:

Sensor@MagnetERo_0000000100_00022.mseed	12288							2018-08-15 12:27:56.800000000	
SensorOMagnetNRo_0000000200_00023.mseed	12288							2018-08-15 12:27:27.000000000	
status.log				86	24				2018-08-15 12:20:28.000000000
system.log				11	425				2018-08-15 12:14:46.000000000
init.log									2018-08-15 12:14:46.000000000
table_of_events.bin		<		Augu	ust 20	18 ~		>	1969-12-31 23:59:42.000000000
Auxiliary files		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
		30	31	1	2	3	4	5	
Filename 💠		6	7	8	9	10	11	12	pription 🔶
DG.dataless	Dataless			_					
fram.log	FRAM log	13	14	15	16	17	18	19	
calvals.txt	SCREAM! c	20	21	22	23	24	25	26	
polezero.txt	SCREAM! 2								
calib.txt	Calibrati	27	28	29	30	31	1	2	
Channel data download by time selection		3	4	5	6	7	8	9	
Channel: DG.TEST.0K.HCA	↓ ~ <mark>From:</mark>	dd / mr	n / y	YYY		:	То	dd /	mm / yyyy: Download

Lastly, click the **Download** download button to initiate a file transfer using your browser's standard mechanism.



**Note**: The pop-up calendars are not supported by Discovery's built-in browser and Explorer. The required dates can simply be typed in or the entire operation can be performed in an external web browser.

The "Storage" tab also shows links to five auxiliary files, which are either saved in the Aquarius flash RAM, in the microSD card or are dynamically generated:

The root directory of the SD card contains:

- a file named init.log. This contains the first 32MiB of system log information since the card was last formatted;
- a file named system.log. This contains the last 64MiB of the system log'
- a file named status.log. This contains the last 32MiB of damps of system state of health information. A new dump is generated every 20 minutes.
- a file named table\_of\_events.bin. This is not human readable: it is used by the Seismic Events Table in the "Trigger" tab

status.log	42205	2019-09-11 11:13:19.000000000
system.log	45406	2019-09-11 11:32:05.000000000
init.log	45311	2019-09-11 11:32:05.000000000
table_of_events.bin	39936	2019-09-11 06:54:55.000000000

The remaining files are listed in the Auxiliary files section:

- *network*.DATALESS: where *network* is the two-character Network code defined in the "Setup" tab (e.g. GU.DATALESS). This file is a Dataless SEED volume that contains meta-data including instrument responses, coordinates, compression type etc. The Dataless SEED volume is generated from the .RESP files for each channel;
- fram.log: FRAM log file (stored in FRAM);
- calvals.txt: calibration values in the format compatible with the Scream!
   Software package (dynamically generated);

- polezero.txt: poles, zeros and normalising factors in the format compatible with the Scream! software (dynamically generated);
  - calib.txt: calibration text file with poles, zeros and gains expressed in hexadecimal (stored in FRAM);

init.log		3710	2018-04-04 14:34:36.000000000	
Auxiliary files				
Filename	\$		Description	
DG.dataless	Dataless	s SEED file		
fram.log	FRAM log	file (		
calvals.txt	SCREAM!	calibration values		
polezero.txt	SCREAM!	zeros, poles and gains		
		ion text file		

#### 7.2.5.1 Bulk data extraction via network

Files stored on the SD card can be downloaded using HTTP. The example bash script below can be used from a Linus PC or from the WSL shell on a Windows PC: It extracts all files from the SD Card into a directory named after the date and the network address of the instrument.

```
#!/bin/bash
# Invoke with one argument: the network
# address of the instrument
set -x
if [ "$#" -ne 1 ] ; then
  echo "Usage: $(basename $0) network address"
  exit 1
fi
NET ADDRESS=$1
DATE = $ (date --iso-8601)
SAVEDIR = \{DATE\} \{NET ADDRESS\}
echo Saving to $SAVEDIR
mkdir $SAVEDIR
cd $SAVEDIR
wget -rnp http://$NET ADDRESS/tab9.html
cd ..
```

echo Done

## 7.2.5.2 Time based data extraction via network

The example Python script below will extract seismic data from the SD card based on a specified time interval. This is similar to the FDSN data archive retrieval service: https://www.fdsn.org/webservices/fdsnws-dataselect-1.1.pdf

Channel names are as given on the "Recording" tab of the web interface and the times are specified as UNIX Epoch seconds since 1970 (UTC). The resulting file is in MiniSeed format.

```
The script forms an http request to the instrument in the form
http://192.168.254.101/data?channel=DG.TEST.01.CHZ&from=1605810714&to=160581081
4
import os
import wget
from obspy import read, read inventory, UTCDateTime
from obspy.signal import PPSD
temp = os.environ["TEMP"]
sensor = "192.168.254.101"
channel = "DG.TEST.01.HHZ"
start = UTCDateTime("2020-10-19T00:00:00.0")
end = UTCDateTime("2020-10-19T06:00:00.0")
startUNIX = UTCDateTime(start).timestamp
#We use the 'start'&'end' to cut the data using Obspy
endUNIX = UTCDateTime(end).timestamp
# We use the 'startUNIX'&'endUNIX' to pull the
# data from the instrument
if os.path.exists(r"{0}\tt.mseed".format(temp)):
# See if temp file exists, if so delete.
os.remove(r"{0}\tt.mseed".format(temp))
print(r"http://{0}/data?channel={1}&from={2}&to={3}".format(sen
sor, channel, startUNIX, endUNIX))
wget.download(r"http://{0}/data?channel={1}&from={2}&to={3}".fo
rmat(sensor, channel, startUNIX, endUNIX),
r"{0}\tt.mseed".format(temp))
st = read(r'{0}\tt.mseed'.format(temp), starttime=start,
endtime=end, format='MSEED')
print(st)
st.plot()
dataless =
read inventory(r'http://{0}/DG.dataless'.format(sensor))
ppsd = PPSD(st[0].stats, metadata=dataless)
ppsd.add(st)
ppsd.plot()
```

The following example in bash allows you to extract from the SD card the three seismic components at a given date and time, and specify the length of the miniSEED files. It then combines the three component in an individual miniSEED file, which name includes the network code, station code, start date and time :

#! /bin/bash
# Invoke with one argument: the IP address
set -x

```
MAN-AQU-0002
```

```
# enter your network details
net code=DG
station code=04D67
location code=0L
# choose the day
day=2024-04-28
# choose the start time in 24-hours format (e.g. 16 = 4pm)
start hour=16
# choose the length of the miniSEED in hours (e.g. 1 = 1-hour-long
miniSEED)
step=1
utc=(date --date (day) +s)
start utc=$(expr $utc + 3600 \* ${start hour})
end utc=(expr ${start utc} + 3600 \* ${step})
echo $utc
echo $start utc
echo $end utc
wget -v -Oz component.mseed
http://$1/data?channel=${net code}.${station code}.${location code}
.HNZ\&from=${start utc}\&to=${end utc}
wget -v -On component.mseed
http://$1/data?channel=${net code}.${station code}.${location code}
.HNN\&from=${start_utc}\&to=${end_utc}
wget -v -Oe component.mseed
http://$1/data?channel=${net code}.${station code}.${location code}
.HNE\&from=\{start utc\}
# Convert from Unix timestamp to date and time
date string=`date -d @${start utc} +'%Y.%m.%d-%H.%M.%S'`
# In this example, the 3-components miniSEED file will be named
"DG.04D67-2024.04.28-16.00.00.mseed"
cat z component.mseed n component.mseed e component.mseed >
${net code}.${station code}-${date string}.mseed
```

# 7.2.6 Acoustic modem set-up

The acoustic modems addresses can be configured from the "Network" tab in the Aquarius webpage.

Acoustic Modem						
Local modem address	5304	Remote modem address	5308	Power Levels & Gain	Suitable in air	WARNING: Non-default settings are in effect
Tunnel (ppp/l2tp sett	ings) - Test				TODO: Auto based on depth	
LNS url		LNS Username		LNS Pass	Min power levels & Max gain	Start Test
No check has been perform	ned vet	Update Connection			Suitable in air	
no encer nuo been periorn	iou jot	opuace connection			Suitable down to 1000m	
Tunnel (ppp/l2tp sett	ings) - Perr	nanent Connection			Suitable down to 3000m	
LNS url_ip gc	:01.guralp.com	Connection status n	Connection has lot started let		Suitable down to 5000m Suitable down to 6000m	off

- "Local modem address" is the address of the acoustic modem in the seabed unit.
- "Remote modem address" is the address of the acoustic modem at the surface.
- The drop-down menu "Power Levels & Gain" allows to automatically set the appropriate acoustic modem power levels selecting the relevant deployment scenario.

# 7.2.7 Deploying the Aquarius

Before deployment the Aquarius will need to be set in "Full Power Save" mode.

"Full Power Save" mode makes a number of configuration changes in order to reduce the unit's power consumption and it is meant to be used any time the Aquarius is going to be deployed on the seabed.

The "Full Power Save" mode can be specified using the "Deploy mode" drop-down menu in the "Setup" tab of the Aquarius web page. Changes are not applied immediately.

	güralp Understand Optimise PROTECT											
							Aquarius					
Status	Network Setup	Power Trigger	Data Stream	Data Record	Transforms	Storage Logo	out Help					
System type: Aquari	us   Host label: DIAS-A	QUARIUS   Host nam	ne: AQU-00205A (	10.30.0.73)   Serial	number: 00205A							
Digitizer Control	s											
Reboot				Reset All Setti	ngs	The "Reset All Sett affect settings on c	ings" button will ALSO other pages					
Digitizer Config						,						
Date	Wed 11 Sep 2019	Time	12:57:28 PM	Auto Refresh	1	Auto Reboot	On Error 🗸					
Host Label	DIAS-AQUARIUS	Station Code	TEST	Network Code	DG	Site Name	No site					
Bluetooth PIN	0000	Bluetooth	Enabled $\smallsetminus$	Filter quality	High ~							
Deploy Mode	Normal 🗸	Deploy		Time Offset	-2ms	Undeploy						
Flush to SD	Normal											
Applied Rotation	Power Save											

The final step is to click on the Deploy button and confirm or cancel the operation from the pop-up window that appears.

Digitizer Contro	ols						
Reboot						The "Reset All Settings" button will ALSO affect settings on other pages	
<b>Digitizer Config</b>	l.						
Date	Wed 11 Sep 2019	Time	System is about to be deployed. Are you	1	Auto Reboot	On Error 🗸	
Host Label	DIAS-AQUARIUS	Station Code			DG	Site Name	No site
Bluetooth PIN	0000	Bluetooth	OK Canc	2	High $\checkmark$		
Deploy Mode	Power Save $$	Auto Center Di	OK Callo		Time Offset	-3ms	
Undeploy		Flush to SD	Perform deploy	rment.			

A thirty-second count-down will start before the system enters power-save mode. The screen changes and a new button is added:

Digitizer Config							-	
Date	Wed 11	Sep 2019	Time 1	:02:04 PM	Auto Refresh	1	Auto Reboot	On Error $ \sim $
Host Label	DIAS-AG	UARIUS	Station Code	TEST	Network Code	DG	Site Name	No site
Bluetooth PIN	0	000	Bluetooth	Enabled ${\scriptstyle \lor}$	Filter quality	High 🗸		
Deploy Mode	Powe	r Save 🗸	Auto Center Disable(hr)	1	Deploy		Abort deployment	
You can abort deployment within	26s		Time Offset	3ms	Undeploy		Flush to SD	

You can cancel the operation before the countdown is complete by clicking the Abort deployment button.

When the Aquarius is set in "Full Power Save" mode and it has been deployed the LPC's LAN interface is switched off and the ULPD starts recording the FR channels.

At the recovery, the LPC can be rebooted with its LAN on turning on the PoE. Recording in the ULPD can be stopped pressing the Stop Recording button. As stated in Section 4.3 even pressing the Stop Recording button the ULPD will stay in its deployed state until next reboot (see Section 6.3 ) or power cycle (see Section 4.12 ).

# 7.2.8 Calibration data

Calibration is a procedure used to verify or measure the frequency response and sensitivity of a sensor. It establishes the relationship between actual ground motion and the corresponding output voltage. Calibration values, or response parameters, are the results of such procedures.

Response parameters typically consist of a sensitivity or "gain", measured at some specified frequency, and a set of poles and zeroes for the transfer function that expresses the frequency response of the sensor. A full discussion of poles and zeroes is beyond the scope of this manual.

The gain for a seismometer is traditionally expressed in volts per ms<sup>-1</sup> and, for an accelerometer, in volts per ms<sup>-2</sup>. Other instruments may use different units: an electronic thermometer might characterize its output in mV per °C.

A calibration procedure is also used to establish the relationship between the input voltage that a digitiser sees and the output, in counts, that it produces. The results are traditionally expressed in volts per count. Each Aquarius is programmed at the factory so that it knows its own calibration values. When transmitting miniSEED data, the responses of the instruments and digitisers are encoded in a message called a "Dataless SEED" volume. The contents of these volumes can be displayed in human-readable form, known as RESP, by clicking on the "RESP file" link of each channel in the "Data Stream" and "Data Record" tab in the web page.

		güralp UNDERSTAND OPTIMISE PROTECT								
				Minimus						
Status	Network Setu	p Power Trigger Data Strea	am Data Record Transforms	Storage Logout Help						
System type: Minim	us   Host label: PG 1	Fest   Host name: MIN-009355 (10.30.0.)	77)   Serial number: 009355							
Data Stream										
Disable All Stream	ms	Restore default	The "Disable All" and "Restore default" button will ALSO affect settings of any other sensors	Reboot						
Copy to Data Rec	ord	"Copy to Data Record" will apply settings from this page to recording configuration of all of the sensors.								
Display Streams	All ~	Apply configuration for tap groups	Try to NOT change any SEED names	Display On Page Sensor 0 🗸						
Channels confi	guration									
Channel sar	mpling rate	Data transform	SEED name - please use check-box to modify the default	RESPonse file - if available						
	Seismic channels									
0AUXX0	200 Hz 🗸	Transforms Disabled for this tap $\!$	XX.09355.00 .HDF	RESP file 5						
0VELZ0	200 Hz 🗸	Transforms Disabled for this tap $\!$	XX.09355.00 .HHZ	RESP file 7						
OVELNO	200 Hz 🗸	Transforms Disabled for this tap $\!$	XX.09355.00 .HHN	RESP file 11						
OVELE0	200 Hz 🗸	Transforms Disabled for this tap $\!$	XX.09355.00 .HHE	RESP file 15						

Clicking on a RESP file link produces a page like this:

# #	<< Guralı	p SEED response file builder v1.2-8615 >>	
#		CHANNEL RESPONSE DATA ======	
B050F03	Station:	TEST	
B050F16	Network:	DG	
B052F03	Location:	OK	
B052F04	Channel:	HNZ	
B052F22	Start date:	2018,214,11:26:48	
B052F23	End date:	No Ending Time	
#		-	
#	+	++	+
#	+	Channel Sensitivity, TEST ch HNZ	+
#	+	++	+
#			
B058F03	Stage sequend	ce number: 0	
B058F04	Sensitivity:	2.131148E+05	
		sensitivity: 1.000000E+00 HZ	
B058F06	Number of cal	librations: 0	
#			
#	+		+
#	+	······	+
#	+	++	+
#			
		ction type: A [Laplace Transform (Rad/sec)]	
B053F04			
B053F05	Response in u	units lookup: M/S**2 - Acceleration in Metres Per Second 3	Squared
	-	units lookup: V - Volts	
B053F07	A0 normalizat	tion factor: 3.022955E+12	
B053F08	Normalization	n frequency: 1.000000E+00	

Right-click anywhere and select "Back" to return to the Aquarius web-page.

MIN-C45	56 Discovery	
+	<< Güralp SEED response file bui	
+		
+	NNEL RESPONSE DATA =	
B050F03	Back T	
B050F16	Forward	
B052F03		
B052F04	Reload	
B052F22	View Page Source 8,045,14:56:59	
B052F23	Ena aate: 2018,046,12:03:06	
+		
+	+ +	
*	+ Channel S	

To save a RESP file, right click on it in the main list and select "Save Link":

ED Location	Display on page	Sensor0 =	
	The "Reset All Settings" button will ALSO affect settings on other pages		
0K	<u>RESP fil</u>	Follow Link	
0 <b>K</b>	RESP file	Save Link	
0L	RESP file	Back 63	
0 <b>K</b>	RESP file	Forward	
0L	RESP file	Reload View Page Source	
0 <b>K</b>	RESP_file	Copy Link URL	
0L	RESP file 10	<u>6</u>	

# 8 Pre-deployment procedures

# 8.1 Charging batteries

Follow the instruction in Section 5.4 on page 23 to charge the batteries correctly before the deployment.

# 8.2 Attach Ballast and Burn-Wire System

# 8.2.1 Locate System on Ballast

The Aquarius system (comprising of pressure vessel, buoyancy and ancillaries) sits in/on-top-of twin steel ballast rings. The Aquarius system is lowered (by the lifting frame) down on to new ballast rings.



The easiest way to approach this task is to raise the plates off the ground with suitable blocks first, to ensure the lowered Aquarius system sits down on to the ballast plates directly rather than resting on the ground. This can make aligning the circular ridge on the Aquarius buoyancy with the inner circle of the ballast easier, and reduces the force required by the burn-wire tensioning tool (which would otherwise be required to lift the ballast plates before tensioning occurred).

The ballast plates each have three pairs of opposing slots cut into their perimeters at equal intervals, each with a different slot depth. These allow for three different pre-

tension settings for the straps suspending the ballast plates, to account for manufacturing variances in the straps and buoyancy.



It is essential to ensure that the slots are correctly aligned between the two ballast plates before proceeding.

Select an opposing pair of slots in the ballast plates (if in doubt, pick the middle pair) and insert the two strap loops into these slots.



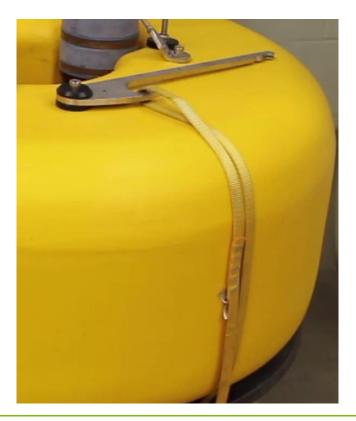
Ensure that the strap loops are located as far into the slots as possible, so they cannot slip out when tension is applied.



Now carefully lower the Aquarius system onto the ballast plates.

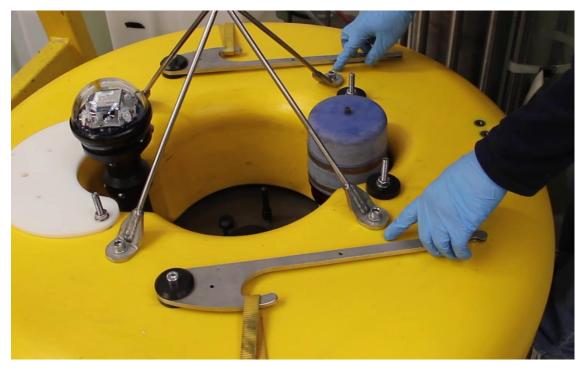
As the system is being lowered, observe that the protruding circular rim in the underside of the buoyancy aligns and locates properly into the inner circle of the ballast plates. Therefore, the buoyancy is permitted to sit down fully into the ballast plates.

In addition, ensure that the Aquarius system is rotationally aligned with the chosen slots in the ballast plates, such that the straps will travel vertically from the ballast plate slots to the hooks in the burn-wire arms.



# 8.2.2 Tension Burn-Wire

With the Aquarius system located on ballast plates, ensure that the two strap loops are hooked securely over the burn-wire arms. When brought together, the arms should rest equidistantly from the lifting frame (and the centre of the Aquarius) as shown below.



MAN-AQU-0002

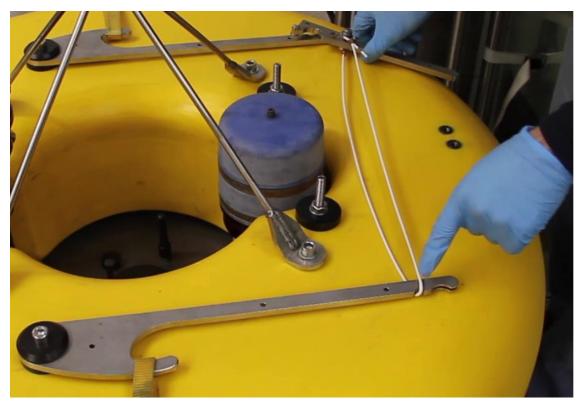
If the arms are not equidistantly spaced, this indicates that either;

- the buoyancy is not properly located into the ballast plates
- the Aquarius is not rotationally aligned with the chosen strap slots on the ballast rings.

In either case, the Aquarius and ballast arrangement must be adjusted.

The arms must be tensioned to permit the burn-wire to be installed. Use the supplied burn-wire tensioning tool to achieve this.

Locate the white wire loop around the smaller/inner notch in one of the arms as shown below:



Then align the tip of tensioning tool into the smaller/inner notch in the opposing arm as shown below. Ensure that the retaining washers straddle the arm to prevent the tensioning tool slipping.



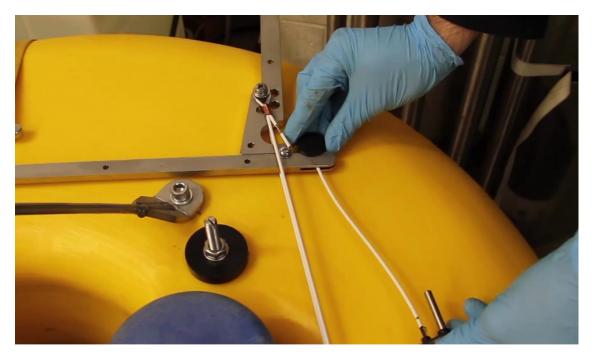
Now pivot the tensioning tool around the inner/smaller notch to bring the two arms together. Take care the ensure that the wire loop passes around the arm and pivot point.



With the arms tensioned with the tensioning tool, insert each end of a new burnwire into the larger/outer notch of each of the arms.



Ensure that the burn-wire itself passes through the slots cut into the arms.



With the burn-wire in place, now release the tensioning tool to transfer the tension of the ballast release system from the tool to the burn-wire itself.

As tension is transferred, ensure that the tensioning tool wire loop passes cleanly around the burn-wire ends and does not force them from the arm notches.



As the tensioning tool is removed, the burn-wire passes completely through the tensioning tool wire loop, including the central potted junction node and electrical cable.



Finally, after cleaning and applying grease as required the two way Subconn burnwire connector may be mated with the cable loom. The electrical operation of the burn-wire should be verified by manually activating the burn-wire from Discovery and assessing the anode to cathode voltage with a multimeter.



# 8.3 Time synchronization and configuration

Follow the instruction in Section 7.2.2 to configure the PTP settings. If using the deck unit, PTP must be set in unicast mode, with I.P. 192.168.0.10.

Use the "OBS Command & Control" widget (see Section 7.1.3.2) to obtain the time offset when the PTP reaches a good stability. Offset should be 0ms before deployment.

Follow the procedure in Section 13 when configuring the Aquarius using the web page (see Section 7.2) and the "OBS Command & Control" widget (see Section 7.1.3). This procedure also check all sensors in the Aquarius and the Burn-Wire, so the APG and the Burn-Wires need to be connected using the relevant cable.

# 8.4 Acoustic communication check

It is important the verify the operation of the acoustic modems before deployment. Although not optimal, it is possible operate the modems out of water with the use of a suitable acoustic coupler. One such aluminium coupler is supplied with your system.

By placing the coupler on the Aquarius modem transducer, the topside Dunker modem may then be stacked on top and temporarily held or secured in place.

Set both modems to power levels suitable for operation in air, refer to Section 7.1.3.3.



**Caution**: Remember to set the acoustic settings of both modems appropriately for the intended operational depth before deployment.

Follow the instruction in Section 7.1.3.4 on page 40 to verify whether the acoustic link is properly working. Note that only low data transfer speeds will be possible and the failure rate of acoustic transactions may be high. This is normal when out of water.

# 8.5 Final assembling

When time synchronization, configuration and test of the Aquarius has been completed, the Ethernet and serial cable can be disconnected from the OBS top lid. Place the Seacon Hummer series dummy cap and screw the locking sleeve down. Check also connection of the accessory and Burn-Wire cable by the 8 way Subconn Mini series connector.

Check that all the other caps have been properly screwed down with all the O-rings in place.



# 9 Post Deployment procedure

# 9.1 Checking seismometer's data

If working with the deck unit and a local surface dunker, open Discovery and start the "OBS Command & Control" widget from the menu "View"  $\rightarrow$  "OBS"  $\rightarrow$  "Command & Control".

Verify in the "OBS Command & Control" widget the correctness of the I.P. address ("localhost" if working in local) and use the "Connect" button on top of the window to establish the connection.

Follow the instructions in Section 7.1.3.4 on page 44 to download the desired set of data.

# 9.2 OBS Locator

This widget can be used to determine the location of the Aquarius once it reaches the seabed or to monitor its drift during its free fall, monitor the trajectory of the boat as it travels, load and visualize previous data.

Open Discovery and the "OBS Command & Control" widget. Verify the correctness of the I.P. address and use the "Connect" button on top of the window to establish the connection. Keeping the "OBS Command & Control" window open, click on menu "View"  $\rightarrow$  "OBS"  $\rightarrow$  "Locator" to open the "OBS Locator" widget.

Stati	ive View		System	Name	Serial#	WAN Address	LAN Address	Uptime
ctive	can Locally Ctrl+L		Affinity	DAS-40554C	40554C	0.0.0.0	10.30.0.10	636 days 1 Hrs
ctive	egistry Ctrl+R		Affinity	DAS-405552	405552	0.0.0.0	10.30.0.59	342 days 6 Hrs
	how >	Command 8	 Control	AQU-001E5A	7770	0.0.0.0	10.30.0.85	00:20:01
	NO LABEL	Data Calend		AQU-315B	12635	0.0.0.0	10.30.0.32	05:23:13
	6000m 2	Status		AQU-3B5C	15196	0.0.0.0	10.30.0.136	01:15:32
	FXM	Locator		AQU-755C	30044	0.0.0.0	10.30.0.88	4 days 3 Hrs
	6000m 1		Aquarius	AQU-555C	21852	0.0.0.0	10.30.0.103	01:13:56
	Phil K CERT PhosB NiSpa	nC	Certimus	CERT-CC5A	52314	0.0.0.0	10.30.0.102	3 days 4 Hrs
	Phil K CERT PhosB NiSpa	n	Certimus	CERT-F85C	63580	0.0.0.0	10.30.0.62	2 days 23 Hrs
	pgrabalski@0jczysta.gur	alp.local	Discovery	Ojczysta	3417EBDFD616	0.0.0.0	10.30.0.33	10 days 4 Hrs
	unknown@aquarius-demo1.	guralp.local	Discovery	aquarius-demol	4C5262264CEC	0.0.0.0	10.30.0.41	00:21:12
tive	Platinum		EAM	eam3467	3467	0.0.0.0	10.30.0.47	468 days 6 Hrs
tive	Platinum		EAM	eam2887	2887	0.0.0.0	10.30.0.42	27 days 6 Hrs
	NO LABEL		Fortimus	FMUS-165A	5722	0.0.0.0	10.30.0.121	00:50:07
	Shawn USGS Testing		Fortimus		35673	0.0.0.0	10.30.0.65	
	NO LABEL		Fortimus	FMUS-004E5A	20058	0.0.0.0	10.30.0.107	5 days 22 Hrs
	NO LABEL		Fortimus	FMUS - 9059	36953	0.0.0.0	10.30.0.58	01:13:31

### 9.2.1 Overview

The "OBS Locator" widget can:

- Ping (manually or automatically) the acoustic modem and automatically calculate the slant range from the ping return time.
- Request the depth of the Aquarius, resolved by the Keller pressure sensor.
- Automatically plot surface circles indicating the area of location of the Aquarius.
- Track boat movements by plotting its relative position every 5 seconds.
- Manually adjust the depth of the Aquarius, if correction is needed.
- Set the value for the speed of sound in water.
- Save data log files.
- Load and visualise previous log files.

## 9.2.2 Locating Aquarius

Before you continue, make sure a successful connection has been established (see Section 7.1.3), i.e. the modem state in the status bar says "Ready".

File Help	File Help
Mouse Position: Latitude(°): - Longitude(°): -	Mouse Position: Latitude(°): - Longitude(°): -
Get Range Get Depth from OBS Auto Ping Interval (s): 60	Get Range Get Depth from OBS Auto Ping Interval (s): 60
Depth (m):	Depth (m):
Speed of Sound (m/s) 1500.00 Overview	Speed of Sound (m/s) 1500.00 Overview
Clear All Not Ready Range: N/A XC: O SNR: O DBV: -1:	Clear All           28         Ready         Range: N/A         XC: O SNR: O DBV: -128

# 9.2.2.1 Pinging the bottom unit

Pinging the acoustic modem could be done either manually or automatically. For manual control, click on "Get Range" button. Alternatively, a timer can be set, on which timeout a ping will be sent. The slant range between the boat and the unit is calculated from the Turn-Around-Time.

If "Get Depth from OBS" box is checked when a ping is sent, the pressure value from the Keller pressure sensor is also requested. The value of the depth will automatically get updated in the "Depth (m)" spin-box.

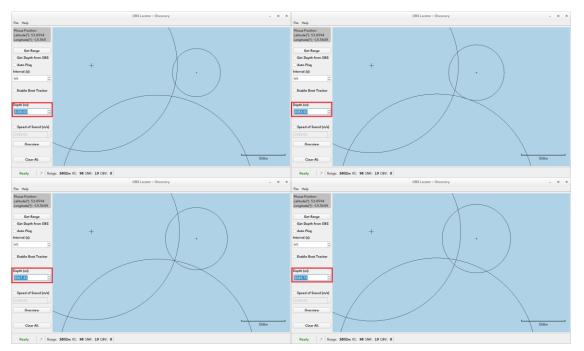
**Note:** Requesting and transmitting data from the Keller pressure sensor uses more power than pinging the acoustic modem. Uncheck the box once the unit reaches the sea bed.

Once the slant range and depth are calculated, a circle with a radius equal to the surface distance between the boat (*black* cross) and the Aquarius is plotted.

	OBS Locator - Discovery -	o x
File Help		
Mouse Position: Latitude(°): 51.3613 Longitude(°): -1.16417		
Get Range		
✓ Get Depth from OBS		
Auto Ping		
Interval (s):		
60	$\frown$	
Enable Boat Tracker	$\left( \begin{array}{c} \cdot \end{array} \right)$	
Depth (m):		
Speed of Sound (m/s)		
1500.00		
Overview		
Clear All	2000m	
Ready 🛛 🖉 Ran	age: 3142m XC: 98 SNR: 19 DBV: 0	

# 9.2.2.2 Recording Aquarius location

Use the "Depth (m)" to manually adjust the depth of the unit, if the circles fail to intersect in a single point. All circles will be dynamically replotted with a radius corresponding to the new depth.



Mark the Aquarius location (*blue* cross) by zooming IN and double-clicking on the intersection point of the circles.

	OBS Locator - Discovery -	o x
File Help		
Mouse Position: Latitude(°): 53.0553 Longitude(°): -15.5789		
Get Range		
Get Depth from OBS		
Auto Ping		
Interval (s):		
60 ‡		
Enable Boat Tracker		
Depth (m):		
3067.25		
Speed of Sound (m/s)		
1500.00		
Overview		
Clear All	125m	
Ready [ ↗ [ Ran	ige: 3802m XC: 99 SNR: 19 DBV: 0	

### 9.2.2.3 Boat Tracker

The boat tracking feature is activated when "Enable Boat Tracker" is checked. It plots the relative location of the boat (*red* triangle) and its trajectory every 5 seconds. It is intended to provide an overview of the boat movement when travelling during the triangulation process.



Note: None of these locations are recorded in the log file.



**Caution:** This tool is not intended for navigation use.

	OBS Locator – Discovery – G	×
File Help		
Mouse Position: Latitude(°): 51.3598 Longitude(°): -1.14715		
Get Range		
Get Depth from OBS		
Auto Ping		
Interval (s):		
60 ‡		
✓ Enable Boat Tracker		
Depth (m):		
Speed of Sound (m/s)		
1500.00		
Overview		
Clear All	1000m	
Ready Rar	nge: 3802m XC: 98 SNR: 19 DBV: 0	

# 9.2.2.4 Speed of Sound

The default value for the speed of sound used to calculate the slant range from the ping return time is 1,500m/s.

To change it, check the "Speed of Sound (m/s)" box and enter a different value. The change will also effect the already plotted circles.

	OBS Locator - Discovery	- 0	×
File Help			
Mouse Position: Latitude(°): - Longitude(°): -			
Get Range			
Get Depth from OBS			
Auto Ping			
Interval (s):			
60 ‡			
Enable Boat Tracker			
Depth (m):			
0.00			
✓ Speed of Sound (m/s)			
1500.00			
Overview			
Overview			
Clear All		0	L
Clear All	2000		
Ready Ran	ge: N/A XC: O SNR: O DBV: -128		

### 9.2.2.5 Map Navigation

"Mouse Position" indicates the location on the map under the centre of the cursor. It is disabled by default until an event is recorded and plotted.

Use the "Overview" button to zoom the current view of the map to fit all graphical items.

Use the "Clear All" button to clear all graphical items from the map.

The bar in the bottom right corner of the map indicates the current map scale.

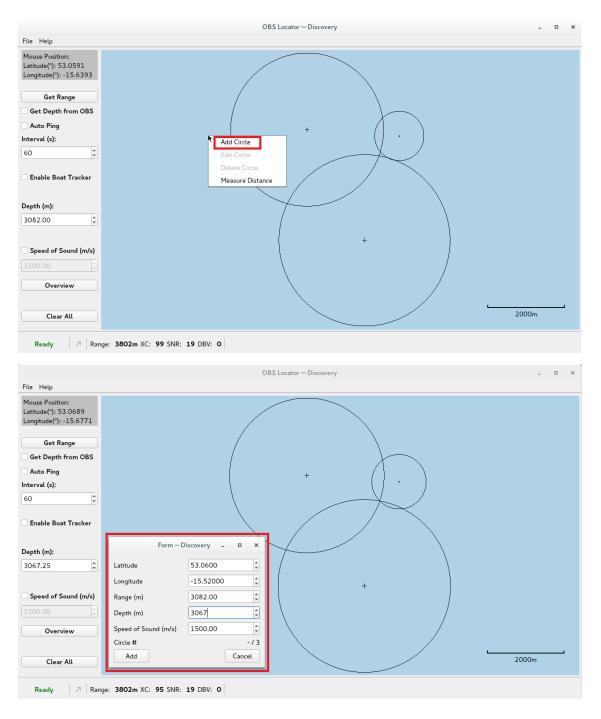
	OBS Locator – Discovery –	×
File Help		
Mouse Position: Latitude(°): - Longitude(°): -		
Get Range		
Get Depth from OBS		
Auto Ping		
Interval (s):		
60		
Enable Boat Tracker		
Depth (m):		
Speed of Sound (m/s)		
Overview		
Clear All	4000m	-
Ready Ran	ge: N/A XC: O SNR: O DBV: -128	

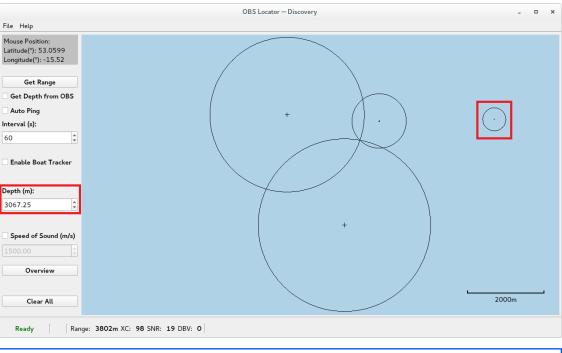
## 9.2.3 Data processing

Note: None of the modifications described below are automatically saved. Once finished, save the changes to a log file via "Save As" button in the "File" menu or Ctrl+S.

## 9.2.3.1 Add Circle

To add a new circle manually, right-click and select "Add Circle". In the "Add/Edit" box, enter the desired location (latitude and longitude), range, OBS depth and speed of sound and click on "Add".

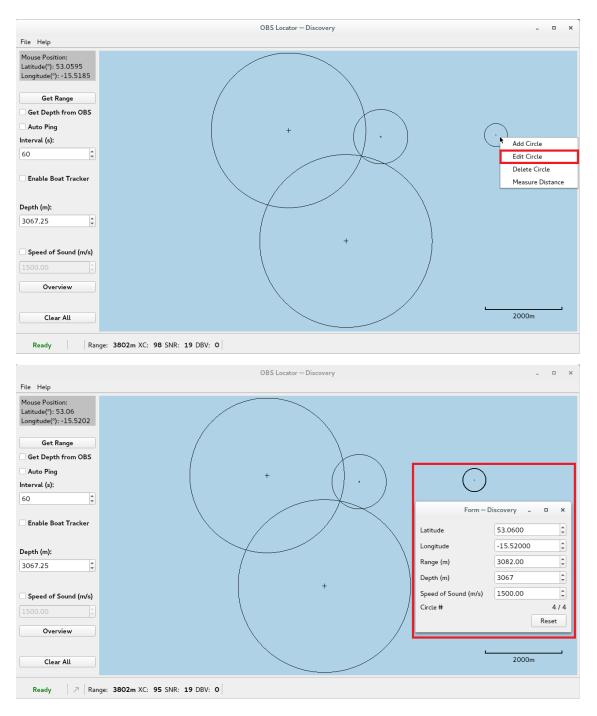




**Note:** Manually added circles will be automatically painted using the value of the current depth rather than their own depth. In cases when the value of the current depth is greater than the value of the slant range, this circle will not be visible until the current depth is less than the range.

### 9.2.3.2 Edit Circle

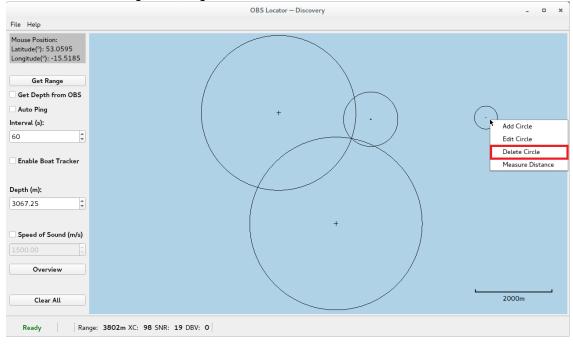
To edit an existing circle, right-click on it and select "Edit Circle". The circle to be edited will get highlighted and an "Add/Edit" box will open with the current parameters of this circle. To change any of them, simply use the spin-box arrows or the keyboard. Changes apply immediately.



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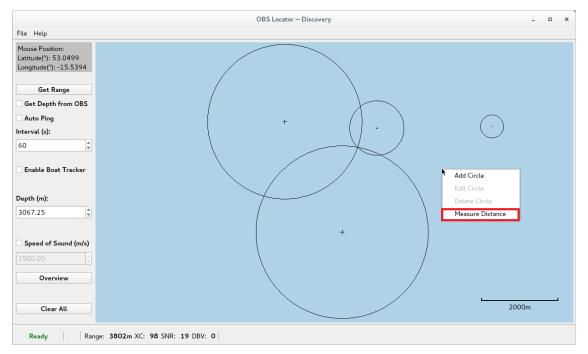
### 9.2.3.3 Delete Circle

To delete an existing circle, right-click on it and select "Delete Circle".

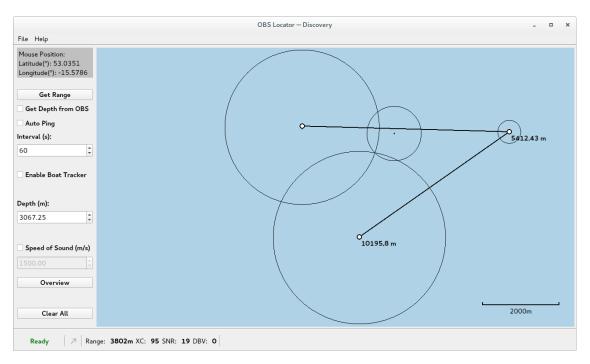


## 9.2.3.4 Measure Distance

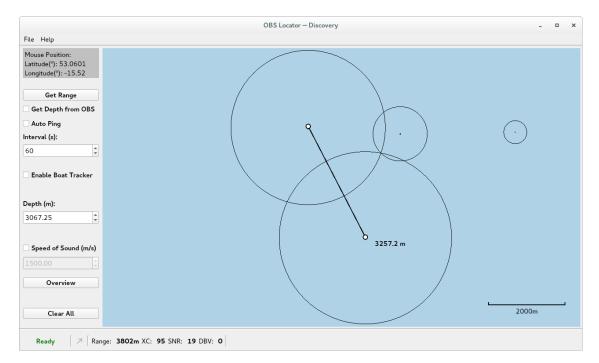
"Measure Distance" tool is useful for measuring the distance between two or multiple points on the map. To use it, right-click on the map and select "Measure Distance".



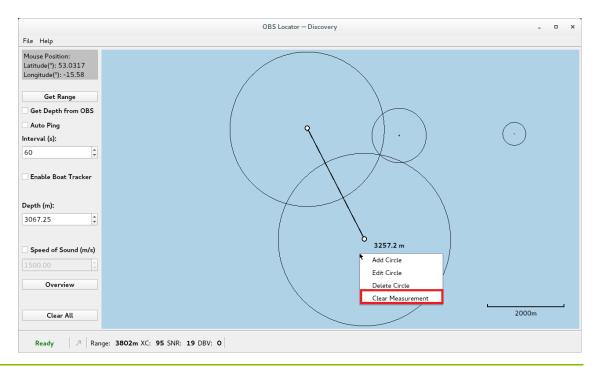
To add a new point, double-click on the map and a white dot will mark it. The distance next to each dot indicates the total distance between that point and the first one.



To delete an existing point, click on it. If it is a middle point, the distance between its neighbours is measured instead and the total distance for each point gets updated. If it is the last point, the last distance segment is removed. The first point cannot be deleted unless all other points are deleted first.



To delete all points at once, right-click on the map and select "Clear Measurement"



### 9.2.4 Log Files

There are two types of data files generated by the OBS Locator – standard log file (.log) and "Boat Tracker" log file (.btr). The former file stores the parameters of each circle or the location of the OBS, while the latter file stores the location of the boat while the "Boat Tracker" is enabled. Both files are automatically generated and updated, and could be loaded at the same time later on.

## 9.2.4.1 File Formats

The file name of either file type is the \**current date*\* in *dd-mm-yyyy* format and is saved in the application configuration directory:

MacOS	"~Library/Preferences/Guralp Systems/Discovery/obs_locator/"
Windows	"C:/Users/ <user>/AppData/Local/Guralp Systems/Discovery/obs_locator/"</user>
Linux	"~.config/Guralp Systems/Discovery/obs_locator/"

The data in the standard (.log) file has the following formats:

*Date (dd-mm-yyyy), Time (hh:mm:ss), Boat Location (Lat,Lon), Turn-Around-Time (us), Slant Range (m), OBS Depth (m), Speed of Sound (m/s)* 

Date (dd-mm-yyyy), Time (hh:mm:ss), OBS Location: Lat,Lon, Depth: xxxx (m)

Open 🕶 🗔	12-10-2019.log Save = ×
· · · · · · · · · · · · · · · · · · ·	"/workspace
	file in which data for each ping is recorded. The file starts with the header 'Date e Depth SoS', which indicates the format of the recorded data on each line. Date (dd-mm-
/yyy), Time (hh:mm:ss),	Location (xxx.xxxx,xxx.xxxx), Turn-Around-Time (us), Range (m), OBS Depth (m), Speed
	location (once triangulated) is also recorded in .log file on a separate line with the n and Depth. The name of each .log and .btr file should start with a date with dd-mm-
	allow the two files from the same deployment to be loaded simultaneously. If the header
	not hold the specified formats, an error message will be printed.
Date Time Lat,Lon TAT Ra	ande Denth SoS
	0594,-15.5649 3877760 3148.32 3076 1500
	349,-15.5781 4753320 3804.99 3085 1500
	507,-15.6008 4574546 3670.91 3082 1500 Docation: 53.0549,-15.5723 Depth: 3069m
	·
	Plain Text ▼ Tab Width: 8 ▼ Ln 1, Col 749 ▼ INS
The data in the "B	oat Tracker" (.btr) file has following format:
	oat fracker (.btf) me nas fonowing format.
Date (dd_mm_vvv	y), Time (hhːmmːss), Location (Lat,Lon)
Date (uu-iiiii-yyy	y), 1111E (1111.11111.55), EUCATION (EALEDN)
	*16-12-2019.btr
Open 🔻 📭	*/.config/Guralp Systems/Discovery/obs_locator
	the boat location while the 'Boat Tracker' function is enabled. Each .btr file starts
	ime Lat,Lon' which indicates the format of the recorded data on each line. Date (dd-mm-

# .Dt is a tog file of the boat took to boat to act of the boat file of the boat file starts with the header 'Date Time Lat,Lon' which indicates the format of the recorded data on each line. Date (dd-mm-yyyy), Time (hh:mm:ss), Location (xxx.xxxx,xxx.xxxx). If at any point the 'Boat Tracker' is disabled and later on enabled again, this breakpoint will be recorded as '#break' which would act as an identifier to distinguish the different trajectories. The name of each log and .btr file should start with a date with dd-mm-yyy format. That will allow the two files from the same deployment to be loaded simultaneously. If the header or any of the data does not hold the specified formats, an error message will be printed.

	Plain Text 🔻	Tab Width: 8 🔻	Ln 1, Col 700	-	INS
#Diean					
16-12-2019 11:42:10 51.3605,-1.16162 #break					
16-12-2019 11:42:5 51.3595,-1.14676					
16-12-2019 11:42:0 51.3495,-1.1369					
16-12-2019 11:41:55 51.3486,-1.13539					
16-12-2019 11:41:50 51.3487,-1.1365					
16-12-2019 11:41:45 51.3492,-1.1376					
16-12-2019 11:41:40 51.346, 1.14843					
16-12-2019 11:41:35 51.3473,-1.15255					
16-12-2019 11:41:30 51.3471,-1.1554					
16-12-2019 11:41:10 51.3473,-1.15654					
16-12-2019 11:41:5 51.3455,-1.15886					
16-12-2019 11:41:0 51.3442,-1.16198					
16-12-2019 11:40:55 51.34431.16323					
16-12-2019 11:40:48 51.35,-1.16627 16-12-2019 11:40:53 51.3463,-1.16379					
16-12-2019 11:40:43 51.3531,-1.16891					
16-12-2019 11:40:38 51.3564,-1.16582					
16-12-2019 11:40:33 51.3587,-1.16354					
16-12-2019 11:40:28 51.3605,-1.16163					
Date lime Lat,Lon					

**Note:** Additional comments could be added to either of the files. Comments should be added before the header of the file (" Data Time Lat, Lon....") and should start with #.

### 9.2.4.2 Save As

Modifications of the data made via any of the methods described in Section 9.2.3 will not be automatically saved. To save any changes, navigate to the menu bar and click "File"  $\rightarrow$  "Save As" or press Ctrl+S.

MAN-AQU-0002



**Note:** Always make sure that the name of either of the data type files starts with a date in *dd-mm-yyyy* format.

### 9.2.4.3 Load

To load a data file, navigate to the menu bar and click "File"  $\rightarrow$  "Open" or press Ctrl+O. Only files with (.log) and (.btr) extension can be loaded.

All the data from a (.log) file will be loaded and visualised except for the Aquarius location (if present).

It is possible to load both (.log) and (.btr) at the same time. To do so, simply select them together when loading the files. The only condition is that the two files are from the same deployment, i.e. the date in the name of the files is the same.

# **10** Recovery procedure

# **10.1** Releasing the ballast

Follow the instructions in Section 7.1.3.5 on page 45 to initiate the release of the ballast.

In case the ballast is not released via acoustic command, the Aquarius releases it when the timer in ULPD, configured in the "OBS Command & Control" expires (see Section 35 on page 37).

# **10.2** Locating the Aquarius on the sea surface

Once the Aquarius reaches the sea surface, the recovery aids (satellite tracker and LED strobe) will be automatically activated by the pressure sensor. Follow the instructions in Section 4.9.1 to locate the OBS.

# **10.3** Recover the Aquarius and check the time drift

Once the Aquarius is recovered, connect the OBS to the deck unit using the Ethernet cable and switch on the PoE on the deck unit to start powering up the OBS from the deck unit rather than internal batteries. This procedure will reboot the LPC in normal mode with the LAN interface on.

Open the Aquarius webpage and monitor the "PTP Stability" in the "Status" tab. Wait until the stability has a "green" status (>90%).

	PTP Status							
PTP state	Phase Locked	Last PTP timestamp	2019-08-14 12:41:59Z	Last PTP lock time	2019-08-12 07:47:06Z	PTP stability	100%	
Master IPv4 address	10.30.255.35	Master clock class	PRI_REF_PTP	Master clock accuracy	< 100ns (0x21)	Master time source	GPS	
Network path delay	28.6 us	Network jitter estimate	± 559 ns	Network outliers	3%			

Go to the "Setup" tab and click on "Flush to SD" button to save in the LPC storage the data still in the ULPD buffer. Click on "Stop Recording" button to stop recording in the ULPD.

Deploy Mode	Power Save $$	Auto Center Di	sable(hr)	1	Deploy	Time Offset	-6ms
Undeploy		Flush to SD					

Wait until the status shows a good stability for the PTP. Check the calculated offset in either the "Setup" tab of the webpage, or the "Pre-Deploy" tab of the "OBS Command & Control" widget in Discovery, and <u>take note of it</u>.



**Caution:** The offset information is not recorded in the microSD cards.

OBS Command & Control — Discovery	_ ×
localhost Connect 5305 🗘 Init	
Pre-Deploy Acoustic Configuration Post-Deploy Trigger Params Data Recovery Error Messages	Advanced
Configure OBS via direct network connection	
Timing Status PTP Locked 100% Offset: -475ms	Force Sync
SD Card Status ING Internal Card: USABLE External Card: USABLE Total Capacity: 122814464 KiB Used: 115048 KiB	Format
Test Satellite	
Burn Wire Release Mechanism	
Test Burn Wire	
9/20/19 2:06 PM 🗘 Set Release Time	
	Deploy
DIAS-AQUARIUS [10.30.0.73]	
Ready Range: N/A XC: 73 SNR: 58 DBV: -2	

# **10.4** Download the data

In the "Storage" tap of the Aquarius web browser are listed all the miniSEED files recorded during the deployment. Follow the instructions in Section 7.2.5 to download them.

# **11** Appendix A – Channel names

# **11.1 Data streaming**

The table in this section shows the names and codes of the streamed channels. The first character "x" in miniSEED channel code represents the sample rate. The possible values are shown in the table below:

F	≥ 1000Hz to < 5000Hz
С	≥ 250 Hz to < 1000Hz
Н	≥ 80Hz to < 250Hz
В	≥ 10Hz to < 80Hz
Μ	> 1Hz to < 10Hz
L	≈ 1Hz
v	≈ 0.1Hz
U	≈ 0.01Hz
R	≥ 0.0001 Hz to < 0.001

		Data streaming				
Sensor	Component	Digital filter mode	Live stream name	Live Stream code	miniSEED channel code	
		Acausal	S1SeisZ	1VELZ0	xHZ	
	Vertical	Acausai	S1SeisZ	1VELZ2	xHZ	
		Causal	S1SeisZLowLat	1VELZC	xHZ	
Seismometer		A	S1SeisN	1VELN0	xHN	
(velocity	North	Acausal	S1SeisN	1VELN2	xHN	
response)		Causal	S1SeisNLowLat	1VELNC	xHN	
	East	Acausal	S1SeisE	1VELE0	xHE	
			S1SeisE	1VELE2	xHE	
		Causal	S1SeisELowLat	1VELEC	xHE	
Digital seismic	Vertical	Acausal	S1IntZ	1INTZ0	xMZ	
sensor mass	North	Acausal	S1IntN	1INTN0	xMN	
position	East	Acausal	S1IntE	1INTE0	xME	
MEMS accelerometer	Vertical	Acausal	S1AccZ	1AXLZ0	xNZ	
		Causal	S1AccZLowLat	1AXLZC	xNZ	
	North	Acausal	S1AccN	1AXLN0	xNN	

		Data streaming				
Sensor	Component	Digital filter mode	Live stream name	Live Stream code	miniSEED channel code	
		Causal	S1AccNLowLat	1AXLNC	xNN	
	East	Acausal	S1AccE	1AXLE0	xNE	
	EdSI	Causal	S1AccELowLat	1AXLEC	xNE	
	Z	Acausal	S1MagZ	1MAGZ0	xFZ	
	Ν	Acausal	S1MagN	1MAGN0	xFN	
	E	Acausal	S1MagE	1MAGE0	xFE	
Magnetometer	Yaw	Acausal	S1RotYaw	1ROTY0	хҮҮ	
	Pitch	Acausal	S1RotPitch	1ROTP0	хYР	
	Roll	Acausal	S1RotRoll	1ROTR0	xYR	
	Sea temperature chain	Acausal	S1TemprSea	1TSEA0	хКО	
Temperature	Sensor temperature	Acausal	S1TemprB	1TMPB0	хКО	
Humidity within sensor enclosure		Acausal	S1HumidB	1HUMB0	xIO	
	Within sensor enclosure	Acausal	S1Pressure	1PRSR0	xDI	
Pressure	External sea	Acausal	S1ExtPressure	1PRSR1	xDO	
	ParoScientific	Acausal	S1APG	1PRSR2	xDU	
PLL clock offset		Acausal	S1PLLOffset	1PLL0	хҮО	
Sensor power		Acausal	S1Power	1PWR0	xE0	
Sensor input voltage		Acausal	S1Voltage	1VOLT0	xE1	
	STA	Acausal	SISTAZ	1STAZ0	xZ0	
STA/LTA	LTA	Acausal	SILTAZ	1LTAZ0	xZ1	
	Ratio	Acausal	S1RatioZ	1RatZ0	xZ2	

# 11.2 Data recording

		Data recording			
Sensor Component		Digital filter mode	Data Record name	miniSEED channel code	
Seismometer (velocity response)	Vertical	Acausal	S1SeisZFR	CHZ	
	North	Acausal	S1SeisNZFR	CHN	
	East	Acausal	S1SeisEFR	CHE	

		Data recording				
Sensor	Component	Digital filter mode	Data Record name	miniSEED channel code		
Digital seismic	Vertical	Acausal	S1IntZFR	MMZ		
sensor mass	North	Acausal	S1IntNFR	MMN		
position	East	Acausal	S1IntEFR	MME		
Temperature	Sea temperature chain	Acausal	S1TemprSeaFR	LKO		
-	Sensor temperature	Acausal	SITemprBFR	МКО		
Humidity within sensor enclosure		Acausal	SlHumidBFR	МІО		
	Within sensor enclosure	Acausal	S1PresFR	MDI		
Pressure	External sea	Acausal	S1ExtPresFR	MDO		
	ParoScientifi c	Acausal	SIAPGFR	MDU		
PLL clock offset		Acausal	SIPLLOffsetFR	МҮО		
Sensor power		Acausal	S1PowerFR	LE3		
Sensor input voltage		Acausal	SIVoltageFR	ME4		
	STA	Acausal	SISTAZFR	LZO		
STA/LTA	LTA	Acausal	S1LTAZFR	LZ1		
	Ratio	Acausal	S1RatioZFR	LZ2		

# **12** Appendix B – Connector pin-outs

# 12.1 OBS – APG/Hydrophone and Burn-Wire

This is an SubConn Micro Circular 8-way socket connector.



Pin	Function
1	Burn-Wire DC+
2	Burn-Wire DC-
3	APG FRQ Temperature
4	APG FRQ Pressure
5	APG RS-232 Tx / Hydrophone Signal +
6	APG RS-232 Rx / Hydrophone Signal -
7	APG RS-232 Gnd / Hydrophone Gnd
8	APG V+ / Hydrophone Power



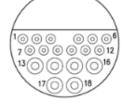
Wiring details for the compatible plug, as seen from the cable end (*i.e.* when assembling).

# 12.2 OBS – Ethernet and Serial RS-232

This is an Seacon Hummer 18-way socket connector.



	and any second se
Pin	Function
1	Ethernet C+
2	Ethernet C-
3	Ethernet D+
4	Ethernet D-
5	Ethernet A+
6	Ethernet A-
7	Ethernet B+
8	Ethernet B-
9	LPC RS-232 Tx
10	ULPD RS-232 Tx
11	ULPD RS-232 Rx
12	LPC RS-232 Rx
13	External power+
14	External power+
15	External power+
16	External power-
17	External power-
18	External power-



Wiring details for the compatible socket, as seen from the cable end (*i.e.* when assembling).

# 12.3 OBS – Battery charger

These are standard 32-way military-specification bayonet plug.



	•				
Pin	Function	Pin	Function	Pin	Function
A	P1 T4 CHARGE (PACK 1 4S MAIN + CONNECTION)	М	P0 T4 CHARGE (PACK 0 4S MAIN +CONNECTION)	Z	P0 T1 SENSE LINK CONNECTION (PACK 0 1S+)
в	P1 T4 CHARGE (PACK 1 4S MAIN + CONNECTION)	N	P0 T4 CHARGE (PACK 0 4S MAIN +CONNECTION)	a	P0 T2 SENSE LINK CONNECTION (PACK 0 2S+)
с	TEMPERATURE SENSE POSITIVE	Р	P2 T2 SENSE LINK CONNECTION (PACK 2 1S+)	b	P0 T4 SENSE LINK CONNECTION (PACK 0 4S+)
D	P2 T0 CHARGE (PACK 2 1S MAIN - CONNECTION)	R	P1 T0 CHARGE (PACK 1 1S MAIN - CONNECTION)	с	P0 T0 SENSE LINK CONNECTION (PACK 0 1S-)
E	P2 T0 CHARGE (PACK 2 1S MAIN - CONNECTION)	S	P1 T0 CHARGE (PACK 1 1S MAIN - CONNECTION)	d	P2 T1 SENSE LINK CONNECTION (PACK 2 1S+)
F	P2 TO SENSE LINE CONNECTION (PACK2 1S-)	Т	P1 T2 SENSE LINK CONNECTION (PACK 1 1S+)	e	P1 T1 SENSE LINK CONNECTION (PACK 1 1S+)
G	P2 T4 CHARGE (PACK 2 4S MAIN + CONNECTION)	U	P1 T4 SENSE LINK CONNECTION (PACK 1 4S+)	f	P1 T3 SENSE LINK CONNECTION (PACK 1 3S+)
н	P2 T4 CHARGE (PACK 2 4S MAIN + CONNECTION)	v	P1 T0 SENSE LINK CONNECTION (PACK 1 1S-)	g	P2 T3 SENSE LINK CONNECTION (PACK 2 3S+)
J	P0 T0 CHARGE (PACK 0 1S MAIN - CONNECTION)	w	TEMPERATURE SENSE NEGATIVE	h	24 V DC CHARGE ENABLE +
к	P0 T0 CHARGE (PACK 0 1S MAIN - CONNECTION)	х	TEMPERATURE SENSE SIGNAL	j	24 V DC CHARGE ENABLE -
L	P0 T3 SENSE LINK CONNECTION (PACK 0 3S+)	Y	P2 T4 SENSE LINK CONNECTION (PACK 2 4S+)		



Wiring details for the compatible socket, as seen from the cable end (*i.e.* when assembling).

# **13** Appendix C – Deployment check-list

This deployment checklist is provided for information only. Refer to Section 9 for full details of the deployment procedure.

Aquarius S/N:
Acoustic modem address:
Acoustic modem UID:
Deployment location: Latitude, Longitude:
Deployment date://

Operation	Check
Fully charge the batteries inside the Aquarius (see Section 5.4 on page 23).	
Screw the charger pressure cap back in.	
Attach the ballast to the Burn-Wire system (see Section 8.2 page 65).	
Connect the Seacon Hummer series connector on the Aquarius and the Ethernet and console connectors to the Deck Unit.	
Remove the magnetic off plug and fit the vent cap <u>with the O-ring</u> and the sacrificial anode / If the cap with the O-ring is already in place and the system is already on, switch PoE on, reset it using the <i>System Reset</i> button in the <i>OBS On Deck</i> tab of <i>OBS Command &amp; Control</i> widget.	
In the Deck Unit, switch the PoE on.	
Check PTP lock either from the LPC web page ( <i>Status</i> tab, <i>PTP status</i> section, <i>PTP stability</i> cell) or from the <i>OBS Command &amp; Control</i> widget / <i>Pre-Deploy</i> tab / <i>Timing Status.</i> If <i>No Master</i> is shown in the above fields, check PTP network configuration in the LPC (see Section 7.2.2 on page 48) or GPS fix in the PTP server.	
Check whether recording of non FR channels for Sensor 0 and Sensor 1 are disabled in the LPC web page / <i>Data Record</i> tab (see Section 7.2.4 on page 52).	
Select all the FR channels on Sensor1 to be recorded from the LPC web page / <i>Data Record</i> tab.	

Operation	Check
If changes were made in the LPC web page / <i>Data Record</i> tab, reboot the LPC.	
In the LPC web page / <i>Trigger</i> tab, set as trigger source <i>S1RatioZFR</i> and choose appropriate values for STA/LTA parameters. Set the Whalesong Sender as trigger destination. Set the threshold to 0 (see Section 7.2). This will disable triggering until the OBS is on the seabed. At that point this parameter can be modified via acoustics, if a buoy unit is present.	
Download the Dataless file from the <i>Storage</i> tab of the LPC web page.	
Set the bottom acoustic modem address in the <i>Network</i> tab of the LPC web page ( <i>Local modem address</i> ) and take note of it. In case of an installation with a buoy unit on the surface, set also the surface acoustic modem address ( <i>Remote modem address</i> in the LPC web page, see Section 7.2.6 on page 60).	
In the LPC web page, <i>Network</i> tab, set temporarily the acoustic modem <i>Power level &amp; gain</i> to <i>Suitable in air</i> (see Section 7.2.6 on page 60)	
Test the Burn-Wires via acoustic command from the <i>Recovery</i> tab in the <i>OBS Command &amp; Control</i> widget (see Section 7.1.3.5 on page 45).	
In the LPC web page, <i>Network</i> tab, set the acoustic modem <i>Power level &amp; gain</i> to a depth suitable for the specific installation (see Section 7.2.6 on page 60).	
<i>Quick format</i> the SD cards either from the LPC web page ( <i>Storage</i> tab) or from the <i>Pre-Deploy</i> tab of the Discovery <i>OBS Command &amp; Control</i> widget ( <i>Format</i> button).	
Check live data from sensors in the Discovery <i>Live View</i> (see Section 7.1.2 on page 30).	
Test Burn-Wires from ULPD using the Discovery <i>OBS Command &amp; Control</i> widget, <i>OBS On Deck</i> tab, <i>Test Burn Wire</i> button (see Section 7.1.3.2 on page 36).	
Test the satellite tracker and LED strobe activating them from the Discovery <i>OBS Command &amp; Control</i> widget, <i>OBS On Deck</i> tab, <i>Test Satellite</i> button.	
Set the time for the backup Burn-Wires that would be activated by the ULPD timer. Use the Discovery <i>OBS Command &amp; Control</i> widget, <i>OBS On Deck</i> tab for this task (see Section 7.1.3.2 on page 37).	

Operation	Check
If the <i>Offset</i> in <i>OBS Command &amp; Control / OBS On Deck</i> tab / <i>Timing Status</i> is not 0ms force a time synchronization using the button <i>Force Sync</i> .	
Wait until the message Good to go is displayed in the <i>OBS On Deck</i> tab in <i>OBS Command &amp; Control</i> (see Section 7.1.3.2 on page 35).	
DEPLOY the Aquarius either from the LPC web page (see Section 7.2.7 on page 61) or from the Discovery <i>OBS Command &amp; Control</i> widget, <i>OBS On Deck</i> tab, <i>Deploy</i> button.	
Switch off the PoE in the Deck Unit and unplug the Seacon Hummer series connector.	
Plug the Seacon Hummer series dummy cap.	
Fit the central block of buoyancy and mount the lifting frame.	
Deploy the Aquarius in the water.	
Range the Aquarius while is descending towards the seabed. For this task, you could either use the <i>Modem Ping</i> button in the <i>OBS Command &amp; Control</i> widget / <i>Post-Deploy</i> tab or the <i>OBS location</i> widget (see Section 9.2.2.1 on page 78).	
Click on the <i>Status</i> button in the <i>OBS Command &amp; Control</i> widget / <i>Post-Deploy</i> tab to show the Aquarius depth (inferred from the Keller pressure sensor data) and other SoH info.	
When the Aquarius will have reached the seabed, wake up the LPC asking for the Aquarius ID or for the SEED ID using the <i>OBS Command &amp; Control</i> widget, <i>Post-Deploy</i> tab.	
Force a centring via acoustics using the button <i>Perform Recentre</i> in the <i>Post-Deploy</i> tab of the <i>OBS Command &amp; Control</i> widget (see Section 40 on page 43).	
Check re-centring status using the button <i>Get Recentring Status</i> in the <i>Post-Deploy</i> tab of the <i>OBS Command &amp; Control</i> widget.	
When centring is completed, flush data from the ULPD to the LPC microSD cards using the <i>Flush Data</i> button in <i>Post-Deploy</i> tab of the <i>OBS Command &amp; Control</i> widget.	
Retrieve data via acoustic comms to check sensor performance (see Section 7.1.3.4 on page 44).	

# 14 Appendix D – Recovery check-list

This recovery checklist is provided for information only. Refer to Section 10 for full details of the recovery procedure.

Aquarius S/N:	
Acoustic modem address:	
Acoustic modem UID:	
Deployment location: Latitude, Longitude:,	
Recovery date://	
Time offset at the recovery:ms	
Operation	
Release the ballast using the <i>Recovery</i> tab in the <i>OBS Command &amp; Control</i> widget. 900 seconds, as burning time, should be sufficient.	1
Check the <i>Status</i> in the <i>OBS Command &amp; Control</i> widget / <i>Post-Deploy</i> tak to monitor the power going into the Burn-Wire release system.	)
<i>Status</i> can also be used to check the Aquarius depth while ascending to the surface.	
When on the surface, LED will start working if it's dark. The satellite tracker will send messages with its position to the first responders set in the web portal.	
Bring the Aquarius on board.	
Connect the Seacon Hummer series connector on the Aquarius and the Ethernet and console connectors to the Deck Unit.	
In the Deck Unit, turn the PoE on.	
Open the <i>OBS Command &amp; Control</i> widget, <i>Pre-deploy</i> tab, to check the clock offset and <u>take note of it</u> .	
<b>Note:</b> The offset will be correct only when the PTP stability is close to 100%. <b>The offset is not stored in the SD cards</b> .	

Download data from the Aquarius the *Storage* tab in the LPC web server (see Section 7.2.5 on page 55).

Check

Operation	Check
Before storing back the Aquarius for long time, charge batteries at least at 50% and plug the magnetic switch.	

# **15** Appendix E – Acoustic Modem link

# **15.1 Description of Operation**

The acoustic data transmission link between an Aquarius and the surface comprises of two nodes; referred to here as a *Surface* (Ship based Deck Unit or Buoy System) and *Bottom* (Aquarius or Aquarius) modems. The *Bottom* modem type and capability varies between Aquarius and Aquarius, but the principles of operation and fault finding are the same.

Each modem, *Surface* or *Bottom*, has a unique identification number which is set at the factory; this is rarely used directly. Acoustic modems have a more convenient user configurable *Acoustic Modem Address* which is used to direct communications to correct nodes.



**Caution:** It is essential to know the *Acoustic Modem Address* of the modem you wish to communicate with. **Be sure to note the Address of an Aquarius before deployment.** 

Each communication node has the concept of *Local* and *Remote*. The *Local Acoustic Modem Address* is the address of the modem at node you are directly interacting with; the *Remote Acoustic Modem Address* is the address of the modem you wish to communicate with acoustically.

There are two types of acoustic transmission; *Commands* and *Data. Commands* are modem only communications pertaining to the operation, configuration and status of the acoustic modems themselves. The system (*e.g.* Aquarius, Buoy system or Deck unit) attached to a modem that has a *Command* directed at it is not aware that an acoustic transmission has taken place (and will not wake up if asleep, for example). *Data* transmissions are acoustic transmissions that require interaction with, or a response from the attached *Surface* or *Bottom* systems. Setting a time for the backup burn wire operation, commanding an OBS to perform re-centring, obtaining seismic data from an OBS and an OBS informing a *Surface* system of a seismic event are all examples of acoustic *Data* transmissions.

*Commands* are shorter and more robust acoustic transmissions than *Data* transmissions. Therefore, it is good practice to make first contact with a deployed OBS with a *Command* to verify the quality of an acoustic link.

*Data* transmissions (sent with the *MDFT* command) are typically much longer than *Commands*. Each *Data* transmission frame is split up into multiple sub-frame transmissions, up to 16 per frame. The number of sub-frames required to send a given packet of data depends on the bitrate. Data packets to be transferred between *Surface* and *Bottom* nodes are always sized to fit within one acoustic transfer frame,

regardless of bitrate. Larger transmissions are split into smaller packets to ensure this.

## 15.1.1 Modem Configuration

This manual is not intended to serve as a reference for the acoustic modem protocol; a subset of possible configuration options and parameters is included, limited to those which are most likely to require alteration during the operation of the Aquarius and associated systems.

These parameters fall into three categories; Power & Gain, Delay and Bitrate & Retries.

### 15.1.1.1 Power & Gain

In order for two acoustic modem nodes to communicate, the strength of the acoustic signals they transmit and the sensitivity to incoming signals being received must be appropriate for the parameters of the installation.

### Power

There are two relevant configuration parameters for setting power levels of acoustic transmission in a modem: *Start Power Level (SPL)* and *Telemetry Power Level (TPL)*. These must be set at an appropriate level for the particular depth of water. It is important to note that more power does not always result in a stronger acoustic link, especially in shallow water scenarios. Higher transmission power increases the likelihood of destructive acoustic reflections and saturation at the receiving node. Instead a sufficient power level should be chosen.

The selection of power parameters should be performed using the *OBS Command & Control* window for the *Surface* modem, and the *Bottom* modem if the OBS has already been deployed. The *Acoustic Configuration* tab contains controls for setting power, gain and other parameters dependent on depth under *Depth Configuration* (see Section 7.1.3.3 on page 38).

The depth related power and gain settings should be set *Locally* in the *Bottom* OBS node before deployment via the LPC web interface, "Network" tab (see Section 7.2.6).

It is also possible to read and set these parameters manually using the *Configuration Status (CS)* command (see Section 15.2). This should only be attempted with support from Güralp.

### Gain

In addition, it is possible to set the gain of acoustic signals as they are received at a modem. This is known as the *Linear Gain (LG)* parameter. It is desirable to set *LG* as low as possible yet as high as necessary. Too high a gain setting will result in saturation and increased noise (lower signal to noise ratio). Too low a gain will result in a weak acoustic link and, in the worst case, loosing communication with an OBS *Bottom* node altogether.



**Warning**: While most acoustic parameters can be corrected if incorrectly set; setting *Linear Gain (LG)* too low for a given depth may result in **permanently** loosing communications with a deployed OBS. <u>Exercise</u> special caution when setting or changing *LG*.

The selection of *LG* should be performed using the Discovery *OBS Command & Control* window for the *Surface* modem, and the *Bottom* modem if the OBS has already been deployed. The *Acoustic Configuration* tab contains controls for setting power, gain and other parameters dependent on depth under *Depth Configuration* (see Section 7.1.3.3 on page 38).

The depth related power and gain settings should be set *Locally* in the *Bottom* OBS node before deployment via LPC web interface. This is especially important for *LG*, "Network" tab (see Section 7.2.6).

It is also possible to read and set these parameters manually using the *Configuration Status (CS)* command (see Section 15.2). This should only be attempted with support from Güralp.

## 15.1.1.2 Delays

### **Receiver Wait**

The primary delay parameter, that has the most impact on the success of acoustic transmissions, is *Receiver Wait* or *RXW*. *RXW* defines the amount of time an acoustic modem will wait for a response from the receiving node for.

The correct delay setting depends exclusively on the distance between two communicating acoustic modems (slant range). This is dictated by the installation depth of the OBS, apart from situations which require a large ratio of lateral distance to depth (these should be avoided as much as possible).

The depth related *RXW*, along with *NPL*, *TPL* and *SPL*, should be set *Locally* in the *Bottom* OBS node before deployment via LPC web interface, "Network" tab (see Section 7.2.6).

In the surface modem *RXW* should be set, along with *NPL, TPL* and *SPL*, in the depth configuration section of the *Acoustic Configuration* tab of the Discovery *Command & Control* window (see Section 7.1.3.3 on page 38). Using the same tab of the *OBS Command & Control* widget it is also possible to change *RXW* in the bottom modem via acoustic command.

## **Local Modem Delays**

Local modem delays define the timings of the interactions between a modem and the attached system (*Surface* or *Bottom*/OBS). These delays only impact *Data* transmissions with the *MDFT* command. None of the local modem delays should require alteration during the deployment, operation or recovery of an Aquarius. Changing these parameters should only be attempted with guidance from Güralp.

*Data Delay* or *DD* defines the time delay between the end of one sub-frame transmission and the beginning of the next.

*Modem Delay* or *MD* defines the maximum time that the recipient modem of a request for data will wait before sending a reply. This allows the attached system to provide data to the modem for the response. It takes effect when the responding modem does not already have data to send.

*Uplink Delay* or *UD* defines the time that the recipient modem of a request for data will wait before sending a reply in the case of data having already been loaded for the response.

*Inter Character Time* or *ICT* is the timeout implemented by the recipient modem of a request for data before automatically sending the response. It is applied after the first character is sent serially from the associated system.

All of the local modem delays for the *Surface* and *Bottom* modems can be read and set via the *Modem Delays* section of the *Acoustic Configuration* tab in the *OBS Command & Control* window in Discovery.

It is also possible to read and set these parameters manually using the *Modem Status (MS)* command (see Section 15.2). This should only be attempted with support from Güralp.

## 15.1.1.3 Bitrate & Retries

### **Bitrate**

For *Data* transmissions it is possible to define the bitrate (*TS*) that data sub-frames will be transmitted at. Higher bitrates allow a given packet of data to be transferred faster and with fewer sub-frames, but in certain conditions it increases the risk of the recipient modem not successfully receiving the sub-frame and discarding it.



Note: The setting of bitrate does not affect Commands

The *Data* transmission bitrate should be set in via the *Acoustic Baud Rate* section in the *Acoustic Configuration* tab of the *OBS Command & Control* window (see Section 7.1.3.3 on page 39). The optimal bitrate setting is the highest value that only infrequently causes lost sub-frames.



**Warning**: Decreasing the bitrate in the OBS modem, when it is not needed, wastes energy. The user should always aim to the highest bit rate possible to optimize the energy per bit during acoustic data transfer.

It is also possible to set the bitrate manually by changing the *Telemetry Scheme* or *TS* parameter using the *MS* command (see Section 15.2).



**Note**: It is possible, and sometimes desirable, to set different bitrates (*TS*) in the *Surface* and *Bottom* modems, usually with the surface modem set to a slower bitrate.

## **Master Retries**

In the case of *Data* transmission sub-frames not successfully received following a request for data, the requesting modem can re-request specific failed sub-frames. This feature allows the data bitrate to be increased without loss of connectivity.

This is set via the *Master Retries (MR)* parameter (not to be confused with the *MR* or *Measure Range* command) using the MS command (see Section 15.2). It is set to an appropriate value by default and should not require alteration.

# 15.2 Sonardyne Debugger

Discovery offers a useful tool for troubleshooting called "Sonardyne Debugger". It allows to test the functionalities of the acoustic modem.

In Discovery select the Aquarius and click on "Edit"  $\rightarrow$  "Sonardyne Debugger" to launch the interface.

dit <u>V</u> iew <u>H</u> elp							
OBS Command & Control Power board control OBS Locator	۶ <b>۱</b>	System • Aquarius	Name AQU-755C	<b>Serial#</b> 30044	Connection Type (AQU-755C)	LAN Address 10.30.0.88	4
testplot Quaternion Calculator	-	Aquarius Aquarius	AQU-315B AQU-555C	12635 21852	(AQU-315B) (AQU-555C)	10.30.0.32 10.30.0.103	1
Binder Interface Data Viewer	liferent	Aquarius Certimus	AQU-001E5A	7770 52314	(AQU-001E5A) (CERT-CC5A)	10.30.0.85	
Exercise Springs CAP Receiver	liSpanC liSpan	Certimus	CERT-F85C	63580	(CERT-F85C)	10.30.0.62	
Add Device	.guralp.local	Discovery	Ojczysta	3417EBDFD616	(DISC-3417EBDFD616)		
miniSEED Extractor Database Entry Form Power board control	mol.guralp.local	EAM	aquarius-demol eam3467	4C5262264CEC 3467	(eam3467)	10.30.0.41	
Sonardyne Debugger	g	EAM Fortimus	eam2887 FMUS-545A	2887 21594	(eam2887) (FMUS-545A)	10.30.0.42	
O O NO LABEL		Fortimus	FMUS-9059	36953	(FMUS-9059)	10.30.0.58	

The "Sonardyne Debugger" can be used either in a Discovery installed in a PC or a Deck Unit connected via serial to a surface modem or in a remote Discovery, connected via TCP/IP to the Discovery connected via serial to the surface modem (i.e. Discovery onshore that connects via satellite link to the Discovery installed on the buoy PC).

Sonardyne Debugger — Discovery										
ttyUSB1 ~ ttyUSB2	✓ localhost		Conne	ect 5607 🗘	Init	- + -	<fft:a16< td=""><td>5,F0,N25</td><td>6</td><td>Cmd</td></fft:a16<>	5,F0,N25	6	Cmd
		0	Hello	, World!		Dbg	Msg	Try	/ to push da	ata now
Local modem	Test FV FS	VS	CS		SC	PORT	ALS	US	MS	OPT
Remote modem	Test MR FS	VS	CS		SC	PORT	ALS	US	MS	OPT
(DISC-4C5262264CEC) "New loop T " <diag:5608,fec,tel,xc,mod1,rx1 C "&gt;DIAG:5608,FEC,TEL,DBV,SNF T "<mdft:rs3\r" C "&gt;MDFT:QUEUED:0,MADR5607 T "<ms:5607;w1\r" C "&gt;MS:5607;W1\7D2048,MD4( T "<ms:5607;w1,dd2048,md4(< td=""><td>\r" R,XC,P0,DEV0,SYS0,MOD1 '\r\n" D96,UD2048,TS7,P0,MR1,S</td><td>,RX1,T GM1,TH</td><td>X0,ERR</td><td>0\r\n" L024,FQ0,MST0,M</td><td></td><td>, .</td><td>-</td><td></td><td></td><td>L;TCS1;RPSK</td></ms:5607;w1,dd2048,md4(<></ms:5607;w1\r" </mdft:rs3\r" </diag:5608,fec,tel,xc,mod1,rx1 	\r" R,XC,P0,DEV0,SYS0,MOD1 '\r\n" D96,UD2048,TS7,P0,MR1,S	,RX1,T GM1,TH	X0,ERR	0\r\n" L024,FQ0,MST0,M		, .	-			L;TCS1;RPSK
				ſ						÷.
Ready Range:	0m XC: 82 SNR:	61 DB	V: <b>-19</b>							

The top section of the window is used to establish the serial connection to the modem and the TCP/IP connection to the Discovery physically connected to the modem. The following screenshot shows a configuration in a Discovery in a deck unit, so connected by serial to the surface modem. The hostname used in this case is "localhost". Press the "Connect" button to establish a connection to the local Discovery at IP 127.0.0.1. Wait for the status at the bottom-left of the window to be **Ready**.

Sonardyne Debugger — Discovery _ >											×	
ttyUSB1 - ttyUSB2	▼ loca	lhost		Connect	5607 🗘	Init		<fft:a16< td=""><td>,F0,N25</td><td>5</td><td>Cmd</td><td></td></fft:a16<>	,F0,N25	5	Cmd	
	-	-	Ω	Hello, Wo	rld!		Dbg	Msg	Try	to push	n data now	
Local modem	Test	FV FS	VS	CS		SC	PORT	ALS	US	MS	OPT	
Remote modem	Test	MR FS	VS	CS		SC	PORT	ALS	US	MS	OPT	
(DISC-4CS262264CEC) "New loop T " <diag:5608,fec,tel,xc,mod1,rx1) C "&gt;DIAG:5608,FEC,TEL,DBV,SNR T "<mdft:queued;0,madr5607 T "<ms:5607,w1 t"<br="">C "&gt;MS:5607,W1,D2048,MD40 T "<ms:5607,w1,d2048,md40 C "&gt;MS:5607,MV1,DD2048,MD40</ms:5607,w1,d2048,md40 </ms:5607,w1></mdft:queued;0,madr5607 </diag:5608,fec,tel,xc,mod1,rx1) 	r" ,XC,P0,D (r/n" 96,UD20 96,UD20	EV0.SYS0,MOD: 48,TS7,P0,MR1, 48,TS2,P0,MR2,	1,RX1,T SM1,TH SM1,TH	X0,ERR0\r\n R0,ICT1024, R0,ICT1024,	, FQ0,MST0,M						9,TEL;TCS1;RPS	
Ready Range:	0m	XC: 82 SNR:	61 DB	V: <b>-19</b>								

Use the drop down menus at the top-left to select the PC serial ports connected to the "Command" and "Data" ports of the surface modem. These ports are used in the modem for console commands and data transmission respectively.

Sonardyne Debugger — Discovery											_ ×				
ttyUSB1 👻	ttyUSB2	✓ local	lhost			Connect	5607	•	Init		<fft:a16< th=""><th>,F0,N25</th><th>6</th><th>Cmd</th></fft:a16<>	,F0,N25	6	Cmd	
		-	-		0	Hello, W	orld!			Dbg	Msg	Try	r to push da	to push data now	
Local m	odem	Test	FV	FS	VS	CS			SC	PORT	ALS	US	MS	OPT	
Remote n	nodem	Test	MR	FS	VS	CS			SC	PORT	ALS	US	MS	OPT	
C ">MDFT:QUEUE " <ms:5607;w1\ C "&gt;MS:5607,MVI T "<ms:5607,mvi C "&gt;MS:5607,MVI <b>Ready</b></ms:5607,mvi </ms:5607;w1\ 	r" L,DD2048,MD4 TS2,MR2\r"	4096,UD204	48,TS2,F	P0,MR2,	SM1,TH	IR0,ICT1024									

**Note:** In Windows use the Device Manager to determine the ports. In Linux use command dmesg | grep ttyS or dmesg | grep ttyUSB (in case you are using USB to serial converters) to show available ports.

The pre-selected ports are saved in the config.ini file (see Section 16).

In case of a Sonardyne Debugger in a remote Discovery, insert the WAN or LAN IP address of the PC where the Discovery, physically connected to the surface modem, is installed and click the "Connect" button. As shown in the screenshot below, both the serial ports drop down menu will be blanked.

С.	10.3	0.0.41		Con	nnect 5607 🔹 I	nit	<fft:a16,f< th=""><th>0,N256</th><th></th><th></th><th>Cmd</th></fft:a16,f<>	0,N256			Cmd
18 584056	61 -a	20		0	Hello, World!		Dbg I	Msg	т	ry to push data	a now
Local modem	Test	FV	FS	VS	cs	SC	PORT	ALS	US	MS	OP
Remote modem	Test	MR	FS	VS	CS	SC	PORT	ALS	US	MS	OP
"\1\x13\xa0\32019-10-01 09:06:50 ">[MOD:RX;15;RF0M;5607[XC82; ">[MOD:STATUS;16;ID;13]\r\n" ">[MOD:THEIR,ACKS;8000]\r\n" ">[MOD:DONE]\r\n" ">MDFT:5607,LDA0,RDA0,DC27\	DP\x8b\xc1" SNR61,DBV-1 \n"	9,TEL;TCS	52;RPSKV	2_400,FE			ed CRC == 0	xC18B5044	calculate	ed CRC)	
">[MOD:RX;15,FROM;5607[XC82, ">[MOD:STATUS;16,ID;13]\r\n" ">[MOD:THEIR_ACKS;8000]\r\n" ">[MOD:DONE]\r\n"	DP\x8b\xc1" SNR61,DBV-1 \n" et connectior DBV-20,TEL;1 DBV-20,TEL;1 XC81,SNR61,	9, TEL; TCS I from IP a NONE]\r\r NONE]\r\r DBV-20, TI	52;RPSKV address 1 n"	2_400,FE	EC0;0;0;0],MY_ACKS;8000] 25 port 54281"		ed CRC == 0	xC18B5044	calculate	ed CRC)	

Type in the acoustic address of the remote acoustic modem.

Sonardyne Debugger — Discovery											_ ×	
ttyUSB1 * ttyUSB2	• local	host			Connect	5607 🗘	Init	]   [	<fft:a16< td=""><td>,F0,N25</td><td>6</td><td>Cmd</td></fft:a16<>	,F0,N25	6	Cmd
	-	-		0	Hello, W	orld!		Dbg I	Msg	Try	r to push da	ta now
Local modem	Test	FV	FS	VS	CS		SC	PORT	ALS	US	MS	OPT
Remote modem	Test	MR	FS	VS	CS		SC	PORT	ALS	US	MS	OPT
(DISC-4C5262264CEC) "New loop] T " <diag:5608,fec,tel,xc,mod1,rx1\ C "&gt;DIAG:5608,FEC,TEL,DBV,SNR T "<mdft:r33\r" C "&gt;MDFT:QUEUED:0,MADR5607\ T "<ms:5607;w1\r" C "&gt;MS:5607;W1\r" C "&gt;MS:5607;W1r" C "&gt;MS:5607,MV1,DD2048,MD40</ms:5607;w1\r" </mdft:r33\r" </diag:5608,fec,tel,xc,mod1,rx1\ 	r" ,XC,P0,D8 r\n" 96,UD204	EV0,SYS 48,TS7,P	0,MOD1, 20,MR1,S	RX1,T) M1,TH	K0,ERR0\r\ R0,ICT102	n" 4,FQ0,MST0,ML						L;TCS1;RPSK
Ready Range:	0m	XC: 82	SNR:	51 DB\	V: <b>-19</b>							►

After this, press the "Init" button to initialise the surface acoustic modem. Only after these steps the end user can start sending commands.

Manual commands can be sent using the field at the top-right. Click on "Cmd" button to send the command.

Sonardyne Debugger — Discovery										- ×					
ttyUSB1 -	ttyUSB2	- local	nost			Conne	ect 5607	\$	Init		<fft:a1< td=""><td>6,F0,N25</td><td>6</td><td></td><td>Cmd</td></fft:a1<>	6,F0,N25	6		Cmd
		-	-		0	Hello	, World!			Dbg	Msg	Try	to push	data n	ow
Local mod	em	Test	FV	FS	VS	CS			SC	PORT	ALS	US	MS		OPT
Remote mo	dem	Test	MR	FS	VS	CS			SC	PORT	ALS	US	MS		OPT
(DISC-4C5262264CE T " <diag:fec,telx C "&gt;DIAG:5608,FEC T "<mdft:r53\r" C "&gt;MFT:QUEUED; T "<ms:5607;w1,t C "&gt;MS:5607;W1,T C "&gt;MS:5607;W1,T C "&gt;MS:5607,W1,L C "&gt;MS:5607,W1,L</ms:5607;w1,t </mdft:r53\r" </diag:fec,telx 	(C,MOD1,RX1) ,TEL,DBV,SNR ;0,MADR5607) ;0D2048,MD40 ;2,MR2\r"	r" ,XC,P0,DE ,r\n" 96,UD204	V0,SYS0 8,TS7,P(	),MOD1	,RX1,T) 6M1,TH	KO,ERR	0\r\n" 1024,FQ0,MS	T0,MU0,F		, .	-				
Ready         Range: 0m         XC: 82 SNR: 61 DBV: -19															

For quick access to most common commands use the buttons below:

Sonardyne Debugger — Discovery										_ ×
ttyUSB1 * ttyUSB2	✓ localhost		Conne	ct 5607 ‡	Init		<fft:a16< td=""><td>,F0,N25</td><td>6</td><td>Cmd</td></fft:a16<>	,F0,N25	6	Cmd
		0	Hello	, World!		Dbg I	Msg	Try	to push da	ta now
Local modem	Test FV	FS VS	CS		SC	PORT	ALS	US	MS	OPT
Remote modem	Test MR	FS VS	CS		SC	PORT	ALS	US	MS	OPT
(DISC-4C5262264CEC) "New loop T " <diag:5608,fec,tel,xc,mod1,rx1\ C "&gt;DIAG:5608,FEC,TEL,DBV,SNR T "<mdft:rs3\r" C "&gt;MDFT:QUEUED;0,MADR5607\ T "<ms:5607;w1\r" C "&gt;MS:5607,W1,DD2048,MD40 T "<ms:5607,w1,dd2048,md40< td=""><td>r" ,XC,P0,DEV0,SY ,r\n" 96,UD2048,TS7,</td><td>50,MOD1,RX1,T P0,MR1,SM1,TH</td><td>X0,ERRO</td><td>)\r\n" 024,FQ0.MST0,MU0,</td><td></td><td></td><td></td><td></td><td></td><td></td></ms:5607,w1,dd2048,md40<></ms:5607;w1\r" </mdft:rs3\r" </diag:5608,fec,tel,xc,mod1,rx1\ 	r" ,XC,P0,DEV0,SY ,r\n" 96,UD2048,TS7,	50,MOD1,RX1,T P0,MR1,SM1,TH	X0,ERRO	)\r\n" 024,FQ0.MST0,MU0,						
Ready Range:	0m XC: 8	2 SNR: 61 DB	V: <b>-19</b>	[						

- MR: Measure Range.
- CS: Configuration Status.
- MS: Modem Status.



**Note:** The remaining buttons are used in the factory by the manufacturer for development reasons only.

The bottom panel shows commands sent and received. Each line is marked with a letter that distinguishes the type of instruction:

- T: Command transmitted to the "Command" port.
- C: Answer from the surface modem received on the "Command" port.
- D: Data received on "Data" port.

Sonardyne Debugger — Discovery											_ ×			
ttyUSB1 *	ttyUSB2	• local	nost			Connec	t 5607	•	Init		<fft:a1< th=""><th>5,F0,N25</th><th>6</th><th>Cmd</th></fft:a1<>	5,F0,N25	6	Cmd
		-	-		0	Hello,	World!			Dbg	Msg	Try	to push d	ata now
Local m	odem	Test	FV	FS	VS	CS			SC	PORT	ALS	US	MS	OPT
Remote r	nodem	Test	MR	FS	VS	CS			SC	PORT	ALS	US	MS	OPT
T " <diag:fec.tei C "&gt;DIAG:5608,FI T "<mdft:rs3\r" C "&gt;MDFT:QUEU T "<ms:5607,mv: C "&gt;MS:5607,MV: T "<ms:5607,mv: C "&gt;MS:5607,MV:</ms:5607,mv: </ms:5607,mv: </mdft:rs3\r" </diag:fec.tei 	EC,TEL,DBV,SN D;0,MADR560 r <sup>r</sup> 1,DD2048,MD4 TS2,MR2\r"	R,XC,P0,DE 7\r\n" 096,UD204	8,TS7,P	0,MR1,9	5M1,TH	R0,ICT10	24,FQ0,M			, .	-			
Ready	Range	: <b>0m</b> )	KC: 82	SNR:	<b>61</b> DB	V: <b>-19</b> [								Þ

More details on console output are available in Section 15.3.

# 15.3 Troubleshooting

In the case of a suspected poor acoustic link, a methodical approach is required to ascertain the cause and any potential remedies. This section assumes that the *Bottom* modem is attached to a deployed OBS and the *Surface* modem is attached to a suitable deck/topside unit and suspended in water.

Before beginning to troubleshoot, first confirm that the *Surface* modem/transducer can be communicated with. To verify the connection to the *Surface* modem:

- Ensure the acoustic modem driver IP address is correct ("localhost" if the Surface modem is physically connected) and click "Connect". This connects to the driver which will directly interact with the acoustic modem. If the status bar indicates Network Error then ensure the correct acoustic modem driver address before proceeding.
- 2. Ensure the serial port configuration for the two acoustic modem connections is correct (see Section 15.2).
- 3. Ensure the *Remote* acoustic modem address of the OBS modem is shown correctly in the remote modem address field. If it is not, correct it.
- 4. Click the "Init" button. This will initialise, or reinitialise, the *Local Surface* modem. At this point the status bar should display **Ready**. If it does not, verify all relevant physical connections, network connections, serial ports and addresses.

In order to confirm the operation of the *Surface* modem, set its power parameters to suitable for air and initiate acoustic transmissions. It should be possible to hear the transducer. If no audible signal can be detected from the *Surface* modem transducer,

verify all relevant physical connections, power, network connections, serial ports and addresses.

If the *Surface* modem appears to operate correctly, lower it into the water to circa 10 meters and attempt to communicate with the OBS *Bottom* modem.

## 15.3.1 Send a short Command

When a suspected acoustic transmission problem occurs, start by attempting to send a short and simple *Command*. These are significantly more likely to succeed than *Data* transmissions.

The *MR* command (Measure Range) is recommended as the shortest and most likely acoustic transmission to successfully complete a round trip. This removes dependence on correctly set *Modem Status* Parameters (including *TS, DD, MD, ICT* and *UD*) and simplifies configuration efforts to *Configuration Status* Parameters (such as *SPL, TPL, LG* and *RXW*). *MR* is not the sole *Command* that serves this purpose.

A *MR* command can be sent from the *Sonardyne Debugger* found in Discovery (see Section 15.2). It can be sent by typing the following command string into the custom command field:

#### <MR:aaaa;W1

[where **aaaa** is the *remote modem acoustic address* of the node you are attempting to communicate with]

Alternatively, for convenience, the *Remote* modem "MR" button is provided in the *Sonardyne Debugger* interface to send an *MR* command to the *Remote Modem Address* set and initialised in the *Local* acoustic modem driver.

If successful, the *MR* command will return with the round-trip time (in microseconds) as a parameter:

>MR:aaaa;R123456

If you do not receive a response containing a valid, <u>non-zero</u>, round-trip time, then the *MR* command has failed (even if no explicit error is given).

It is possible that the recipient modem may be in a low power sleep mode. If this is the case, the very first (and only the first) *Command* sent may fail. The addition of **w1** in a command instructs the modem to wake up.



**Note:** Early versions of Discovery do not correctly parse acoustic diagnostic/status information from received *MR* commands. In this case the *VS* command should be used for debugging. The *VS* command can be sent using the *Modem Ping* button in the *Post-Deploy* tab of *OBS Command* & *Control* widget.

## **Command Failure**

If this lightweight *Command* has failed to yield a successful reply, the *TPL, SPL, NPL, LG,* and *RXW* parameter values should be verified as correct for the deployment depth.

If the acoustic link state of health bar at the bottom of the *Command & Control* window (or elsewhere) is displaying recent values for *SNR* and *DBV*, these can indicate whether the depth related parameters require alteration. It also implies that the *Bottom* modem is receiving a transmission and responding. If *DBV* is high, this indicates the transmission power of the *Bottom* modem is too high or the *LG* of the *Surface* modem is too high, or both. These can be changed with the *Depth Configuration* section in the *Acoustic Configuration* tab of the *Command & Control* window. Experiment by changing parameters in the *Remote/Bottom* or *Surface/Local* modems individually and, if necessary, change the parameters in both.

**Note:** Assuming that before the deployment the bottom modem was correctly configured from the LPC web page, we recommend to try to fix the communication issues, trying first to change the parameters in the surface modem. This will avoid to risk to increase the power consumption in the OBS or to compromise permanently the acoustic link (thing that could happen if by mistake a too shallow setting is chosen, bringing *LG* parameter too low).

If the acoustic link state of health bar indicates low signal *DBV* or does not indicate any recent state of health information, then it is likely that the depth related parameters are set too shallow. Experiment by increasing the depth configuration in the *Remote/Bottom* or *Surface/Local* modems individually and, if necessary, change the parameters in both.

In the case where *DBV* acoustic diagnostic values appear to be healthy yet *SNR* values appear low, it is possible that noise from the ship is interfering. Try to lower the *Surface* modem lower to reduce noise or move to a less noisy area of the ship (i.e. far from the engine), or if other acoustic devices are on, ask to switch them off.

If, after increasing/decreasing depth parameters in both modems, it is still not possible to successfully send and receive an *MR* (or other lightweight) *Command*, it is likely that the distance between the two modems is too great. If the depth of the OBS is not believed to be the problem, then the lateral distance away from the position of the OBS is likely to be the cause. All acoustic modem transducers have an operating cone (±40° for the directional transducers, ±120° for the omnidirectional transducers), outside of which their effectiveness is diminished. Attempt to move closer to the OBS and retry.



**Note:** The maximum permissible lateral distance between acoustic modems depends on depth; the deeper the water the further the lateral distance may be, the shallower the water the closer they must be. Always try to position a vessel as close to the estimated position of the OBS as possible.

## 15.3.2 Read Modem Status

If a lightweight *Command* is successfully transmitted and received, then the next step is to obtain more detailed information from the *Bottom* acoustic modem. This will further test the viability of the acoustic link whilst still limiting the range of relevant configuration parameters.

From the *Sonardyne Debugger* window, send a request for the *Configuration Status* parameter values by either clicking the *Remote* modem "CS" button, or sending the following *Command*:

#### <CS:aaaa;W1

[where **aaaa** is the *remote modem address* of the node you are attempting to communicate with]

#### Correct responses will follow this format:

```
>CS:aaaa,TATnnn,BLKnnn,RXWnnnn,TXWnnn,NPLnnn,TPLnnn,LGnn,CISn,ATn,
ECn,MEn,RSPn,PPRn,Rnnnnnnn
[XCnn,SNRnn,DBV-n,TEL;TCSn;RPSKVn_nnn,FEC0;0;0]
```

Erroneous responses may contain "NO\_REPLY":

>CS:aaaa,NO\_REPLY

This indicates that no acoustic signal was received from the other/*Bottom* acoustic node within the *Receiver Wait Time* (*RXW*). It is not possible to infer whether the original transmission was received by the *Bottom* or whether the *Bottom* modem attempted to transmit. Therefore, the configuration of both acoustic modems must be investigated.

Erroneous responses may also contain "NO\_DATA":

>CS:aaaa,NO\_DATA OT >CS:aaaa,TATnnn,NO\_DATA,RXWnnnn,TXWnnn,etc...

In this case the *Bottom* acoustic modem has received the initial *CS* command and attempted to respond. However, the acoustic transmission from *Bottom* to *Surface* was not successful. The most likely cause is improper configuration of the *Bottom* acoustic modem.

The procedure for improving the strength of the acoustic link is the same as for the lightweight command example given above. Ensure that appropriate power, gain, *RXW* values are set in both modems.

## 15.3.3 Get OBS System Information

If the previous troubleshooting procedures have succeeded, it is known that the acoustic link is strong enough to allow the two modem nodes to communicate. The parameters relevant to both *Command* and *Data* transmissions have been validated. From here, the next step is ensuring that the acoustic link is viable for transmitting

longer *Data* frames. There is a subset of acoustic modem parameters that affect *Data* transmissions specifically.

From the *Post Deploy* tab of the *OBS Command & Control* window, click either the "Get Aquarius ID" or "Get SEED ID" buttons. These will send an *MDFT* frame with a request for data (the Host Name or the SEED network and station codes respectively). The requested information should be returned by the OBS system in an *MDFT* frame.



**Note**: The LPC of an Aquarius system may be asleep. Sending a *Data* transmission instructs the system to wake up, but the first *Data* transmission sent to a sleeping Aquarius system will not return any data.

Following a successful "Get ID" operation, an identification string should be shown in the *Post Deploy* tab. If an ID is obtained, it is advisable to carry the operation a further 5 – 10 times to ensure that the acoustic link is performing adequately with minimal failed transmissions.

## **System Information Request Failure**

If it not possible to retrieve a system identifier (or there is an unacceptable failure rate), then begin verifying relevant parameters. There are a number of acoustic modem parameters that directly impact on the success of *Data* transmissions.

If the preceding *Command* based troubleshooting procedures have been followed, *MDFT* "NO\_REPLY" and "NO\_DATA" responses should not occur. If they do, the preceding troubleshooting sections should be repeated to verify correct power, gain and Receiver Wait parameter values.

#### Successful *MDFT* response without data:

The *MDFT* transmission may complete successfully (as far as the modems are concerned) without transmitting the anticipated data payload. In the modem debugging window (*Sonardyne Debugger*) this would look like:

```
<MDFT: aaaa;W1
>[MOD:TX;15;MST1]
>[MOD:RX;15,FROM;5110
[XC86,SNR15,DBV-11,TEL;TCS1;RPSKV2_100,FEC0;0;0;0;0]
,MY_ACKS;8000]
>[MOD:STATUS;16,ID;11]
>[MOD:THEIR_ACKS;8000]
>[MOD:THEIR_ACKS;8000]
>[MOD:DONE]
>MDFT:5110,LDA0,RDA0,DC0
```

Here the transmission completes without any acoustic link errors, but identifying information may not be shown in the *Post Deploy* tab.

In this case, it is likely that the *Remote Bottom* modem attached to the OBS is not waiting long enough for the OBS system to process and collate the data payload before the modem send its response.

In this case it is necessary to increase one or more Local Modem Delays (*DD*, *UD*, *MD* or *ICT*) to force the *Bottom* modem to give enough time to the OBS to process a request for data.

The correct Local Modem Delay parameter values depend on the data processing operation that the OBS must carry out. They should be set correctly from factory and should not require alteration. If they require alteration, contact Güralp in the first instance.

If it is not possible to contact Güralp, then trial and error should be employed to identify which Local Modem Delay parameter value requires alteration. Increase each delay parameter in turn by single steps as required to regain communication with the OBS.

## *MDFT* response missing subframe:

The *MDFT* command may be received by the OBS *Bottom* modem and subsequently by the *Surface* modem, however the data payload may be lost. This would look like the following in the modem debugging window:

```
<MDFT:aaaa;W1
```

```
>[MOD:TX;15;MST1]
```

- >[MOD:RX;NO\_DATA[XC98,SNR15,DBV-11,TEL;TCS1;RPSKV2\_100, FEC0;0;-1;0;0]]
- >[MOD:RX;NO REPLY[XC0,SNR0,DBV0,TEL;NONE]]
- >[MOD:STATUS;16,ID;11]
- >[MOD:THEIR\_ACKS;8000]
- >[MOD:DONE]

Here the modems can communicate *Commands* but struggle to transmit payload data.

Assuming that correct parameters values for power, gain and receiver wait have been set in the previous troubleshooting procedures; it is most likely that the data bitrate is set too high for the deployment scenario. The *Telemetry Scheme(TS)* parameter should be reduced in single steps until the *MDFT Data* transmission is reliably successful.

If *TS* is set to the lowest setting but data transmission is still failing, revisit earlier troubleshooting steps to validate other modem parameters.

## 15.3.4 Get Seismic Data

The most arduous test of the acoustic link is the transfer of seismic data from OBS to the surface. Seismic data is retrieved as individual 4KiB miniSEED records.

Using one of the methods outlined in this manual, identify and attempt to retrieve a miniSEED record. If successful, the following can be observed in the modem debugging window:

<MDFT:aaaa;W1

>[MOD:TX;15;MST1]

- >[MOD:RX;13,FROM;5110[XC98,SNR18,DBV-8,TEL;TCS1;HDR\_SE\_3500, FEC0;0;0;0;0;0;0;0;0],MY\_ACKS;E000]
- >[MOD:STATUS;16,ID;10]

```
>[MOD:THEIR ACKS;8000]
```

>[MOD:DONE]

The number of frames and sub-frames required to transmit 4 KiB depends on the value of the *Telemetry Scheme* parameter; the higher the *TS* value, the fewer sub-frames required.

At the end of the *Data* transmission, the data viewer window should open to display the seismic data.

## **Seismic Data Transmission Failure**

If the data viewer window fails to open, it is likely that one or more sub-frames were lost leading to an incomplete miniSEED record. This can be confirmed in the modem debugger window with the presence of:

```
>[MOD:RX;NO_DATA[XC98,SNR15,DBV-11,TEL;TCS1;RPSKV2_100,
FEC0;0;-1;0;0]]
```

And/or:

```
>[MOD:RX;NO_REPLY[XC0,SNR0,DBV0,TEL;NONE]]
```

*FEC* is the number of telemetry code symbol errors corrected by the forward error correction algorithm. *-1* indicates that the correction power has been exceeded, so the error could not be corrected. The number of reported *FEC* values and the number of correctable errors is dependent on the telemetry type.

*FEC* values <4 are indicating a reasonable acoustic link, while *FEC* values between 4 and 6 are indicating a difficult acoustic link.

The number of permitted dropped sub-frames depends on the value of the *Modem Retries* or *MR* parameter. The higher the value for *MR*, the more sub-frames may be dropped with a successful data transfer.

In any case, the procedure for reducing the number of missing sub-frames is the same as the case of short *Data* transmissions. Revisit the previous section, or prior

sections if necessary, to verify correct parameter values. Starting by lowering *TS* in the bottom modem.

# 16 Appendix F – config.ini file

The config.ini file contains configuration parameters used by Discovery when launched.

#### In Linux config.ini is located at

/.config/Güralp Systems/Discovery

In Windows the file is located at

C:\Users\user\_name\AppData\Local\Guralp Systems\Discovery

In order to edit the configuration file Discovery application has to be fully closed and no instance of it should be running in the system. The reason of this restriction is that Discovery application is overwriting the configuration file when closed so any file modifications done while the application is running will be lost.

The configuration file is divided in to multiple sections containing key-value type of entries. Every entry has a name/key and value assigned using '=' symbol.

# **16.1 Sections list**

Name	Description
Settings	General settings group of entries.
Calibration	Calibration related group of entries.
Instruments	Instrument settings group.
DataStream	Settings used in data streaming
DataStream	configuration.
Viewer	Data viewer group.
AnaloguePowerBoar	Power board configuration group of entries.
d	

## 16.1.1 Section "Settings"

Section:	Entry:	Value type:	Accepted values:				
[Settings]	Experimental	Boolean	true/false				
Description:							
This entry enables	or disables experin	nental mode for Disc	covery application.				
Experimental mod	e is not advised to b	e used since it enal	oles functionalities				
that were not fully	tested.						
Example:							
Experimental=tr	rue	e					

Default:

Experimental=false

Section:	Entry:	Value type:	Accepted values:
[Settings]	CloudRegistryGroupIdentifier	String	text
Description	1.		
This entry	is used as cloud registry group	identifier for	devices lookup in
Discovery "	registry" mode. This entry is mod	ified by Discov	ery during runtime
through Fil	e/Settings.		
Example:			
CloudRegi	stryGroupIdentifier=public		
Default:			
CloudRegi	.stryGroupIdentifier=		

ralues:						
as text						
Description:						
This entry provides IP address of a cloud registry server. This value will be						
modified if registry server hostname entry translates to different IP address.						
Example:						
CloudRegistryIP=10.20.30.123						
2						

CloudRegistryIP=52.34.40.123

Section:	Entry:	Value type:	Accepted values:				
[Settings]	CloudRegistryHostname	String	hostname as text				
Description:							

This entry provides hostname of a cloud registry server. This value will be used for translation in to an IP address.

Example:

CloudRegistryHostname=myhost.domain.com

Default:

CloudRegistryHostname=ec2-52-34-40-123.us-west-

2.compute.amazonaws.com

Section:	Entry:	Value type:	Accepted values:
[Settings]	CloudSelfGroupIdentifier	String	text

#### Description:

This entry is used when Discovery is configured in self cloud server registering mode as a group identifier to where the computer belongs to.

Example:

CloudSelfGroupIdentifier=public

Default:

CloudSelfGroupIdentifier=

Section:	Entry:	Value type:	Accepted values:			
[Settings]	CloudSelfRegistering Boolean true/f					
Description:						
This entry enables or disables self cloud server registering mode.						
Example:						
CloudSelf	CloudSelfRegistering=true					

Default:

CloudSelfRegistering=false

Section: [Settings]						
Description	l.:					
This entry	enables or disables sending	broadcast disc	overy packet to other			
computers	in the network. With this m	ode enabled, Di	scovery instance will			
notify all ot	her computers in the networ	k about its existe	ence and current state			
of health.						
Example:						
BroadcastDiscoveryPing=true						
Default:						
Broadcast	DiscoveryPing=false					

Section:	Entry:	Value type:	Accepted values:			
[Settings]	ReplyToDiscoveryPing	Boolean	true/false			
Description	Description:					
This entry specifies if Discovery should respond to responder PING.						
Example:						
ReplyToDiscoveryPing=true						
Default:						
ReplyToDis	coveryPing=false					

<i>Entry:</i> DefaultHTTPPort	<i>Value type:</i> Integer	Accepted values: Numbers				
	meger	Numbers				
<i>Description:</i> This entry specifies the default HTTP port used for accessing the webpages.						
Example:						
DefaultHTTPPort=81						
Default:						
DefaultHTTPPort=80						
	<b>DefaultHTTPPort</b> constrained by the default HTTP port TPPort=81	DefaultHTTPPort Integer				

Section: [Settings]	<i>Entr</i> MainWindov		IS	<i>Value type</i> List of integ		Con	<i>ceptee</i> nma s t of n	epa	rated
Description	1.:								
This entry :	should not be e	dited ma	nua	ally – contain	s list	of disp	olaye	d col	lumns
in Discover	y application n	nain win	dov	V.		_	-		
Example:									
MainWindc	wColumns=0,	3, 1,	8,	12, 13, 18,	, 17,	, 16,	10,	9,	11,
19, 15, 1	4, 2, 4, 5,	6, 7,	20						
Default:									
MainWindc	wColumns=0,	1, 2,	3,	4, 7, 8, 10	), 12	2, 13			

Section:	Entry:	Value type:	Accepted values:			
[Settings]	MainWindowSort	Integer	Numbers			
Description:						

This entry should not be edited manually – contains index of a column to sort against.

<i>Example:</i> MainWindowSort=3	
Default:	
MainWindowSort=	

Section: [Settings]	<i>Entry:</i> StorageDir	Value type: String	Accepted values: Directory path as text			
Description:						
This entry specifies the path to Discovery storage root folder.						
Example:						
StorageDir=C:/data						
Default:						
StorageDir=C:/Users/user/AppData/Local/Temp/Guralp Storage/						

Section:	Entry:	Value type:	Accepted values:				
[Settings]	SonardyneCmdPort	String	Serial port as text				
Description	1.'						
Defines ser	ial port name used for cor	nmunicating with	the command port of				
the acousti	the acoustic modem.						
Example:							
SonardyneCmdPort=ttyUSB0							
Default:							
Sonardyne	CmdPort=COM1						

Section:	Entry:	Value type:	Accepted values:			
[Settings]	SonardyneDataPort	String	Serial port as text			
Description	:					
Defines ser	Defines serial port name used for communication with the data port of the					
acoustic mo	odem.					
Example:						
SonardyneDataPort=ttyUSB1						
Default:						
SonardyneDataPort=COM2						

Section:	Entry:	Value type:	Accepted values:			
[Settings]	SonardyneServerAddr	String	Hostname as text			
Description	Description:					
This value	This value defines the location of the whalesong slave host. This entry can be					
configured	as hostname or IP address					
Example:						
Sonardyne	SonardyneServerAddr=hostname.domain.com					
Default:						
SonardyneServerAddr=localhost						

Section:	Entry:	Value type:	Accepted values:		
[Settings]	SonardyneModemAddr	Integer	Numbers		
Description:					
This value defines the remote/ocean bottom acoustic modem address.					

*Example:* SonardyneModemAddr=9999 *Default:* SonardyneModemAddr=5607

Section: [Settings]	<i>Entry:</i> <b>TimeMachineIpAddres</b>	<i>Value type:</i> <b>String</b>	Accepted values: IP address as text		
	S				
Description:					
Defines IP address of PTP server used for time source and GNSS location.					
Example:					
TimeMachi	neIpAddress=10.20.30.	123			
Default:					
TimeMachineIpAddress=N/A					

Section:	Entry:	Value type:	Accepted values:		
[Settings]	WhalesongStoragePath	String	Location as text		
Description:					
This value	specifies the storage location	on for data received	l through Whalesong		
protocol.					
Example:					
WhalesongStoragePath=					
Default:					
WhalesongStoragePath=C:/Users/user/AppData/Local/Temp/Whale/					

Section:	Entry:	Value type:	Accepted values:			
[Settings]	NetworkActivityLogfile	String	File path as text			
Description:	Description:					
This value specifies the path to a file that will be used for network traffic log.						
Example:						
NetworkActivityMonitor=true						
Default:						
NetworkActivityMonitor=false						

Section:	Entry:	Value type:	Accepted values:		
[Settings]	NetworkActivityMonitor	Boolean	true/false		
Description:					
This value determinates if network activity monitor is enabled or disabled.					
Example:					
NetworkActivityMonitor=true					
Default:					
NetworkAct	NetworkActivityMonitor=false				

Section:	Entry:	Value type:	Accepted values:		
[Settings]	LogEnabled	Boolean	true/false		
Description:					
Defines if Discovery application logging is enabled or not.					
Example:					
LogEnabled	LogEnabled=true				
Default:					
LogEnabled	LogEnabled=false				

Section:	Entry:	Value type:	Accepted values:		
[Settings]	LogFile	String	File path as text		
Description:					
Defines file path and file name of Discovery application log file.					
Example:					
LogFile=C:/discovery.log					
Default:					
LogFile=C:/Users/user/AppData/Local/Temp/Discovery.log					

Section:	Entry:	Value type:	Accepted values:		
[Settings]	LogFileSize	Integer Numbers			
Description:					
Defines maximum size in bytes of Discovery application log file.					
Example:					
LogFileSize=12345678					
Default:					
LogFileSize=2147483648					

Section:	Entry:	Value	Accepted		
[Settings]	ResponderPreferredNetworkInterfaceNa	type:	values:		
	me	String	text		
Description:					
Specifies pre	eferred network interface to be used for resp	onder broad	lcast ping.		
Example:					
ResponderPreferredNetworkInterfaceName=ethernet 0					
Default:					
< <not specified="">&gt;</not>					

Section:	Entry:	Value type:	Accepted values:			
[Settings]	DoNotCreateCrashDump	Boolean	true/false			
Description:	Description:					
Switches of	Switches off or on the crash dump generation when Discovery application					
crashes.	crashes.					
Example:	Example:					
DoNotCreat	DoNotCreateCrashDump=true					
Default:						
DoNotCreat	DoNotCreateCrashDump=					

Section:	Entry:	Value	Accepted			
[Settings]	ShowUnknownSystemsInMainWi	type:	values:			
	ndow	Boolean	true/false			
Description:						
This entry s	pecifies if unknown (or nameless) sys	stems should	l be displayed in			
Discovery M	ain Window.					
Example:						
ShowUnknow	ShowUnknownSystemsInMainWindow=true					
Default:						
ShowUnknownSystemsInMainWindow=false						

Section:	Entry:		Value	Accepted	
[Settings	AcceptBroadcastDevicesWithIP	Startin	type:	values:	
]	gWith		String	Text pattern	
Description	n:				
If specified	d Discovery main table will cont	ain syste	ms with	the start of IP	
address ma	atching the entered value.				
Example:					
AcceptBroadcastDevicesWithIPStartingWith=192.168.0.					
Default:					
AcceptBroadcastDevicesWithIPStartingWith=					
Section:	Entry:	Value type	e: Acc	cepted values:	

Section:	Entry:	Value type:	Accepted values:			
[Settings]	FileBasedWatchdogFile	String	File path as text			
Description:	Description:					
Specifies the	e file path for a watchdog file.					
Example:						
FileBasedW	<pre>NatchdogFile=C:/Users/us</pre>	er/AppData/L	ocal/Temp/DiscoW			
atchdog	atchdog					
Default:						
FileBasedW	NatchdogFile=					

Section:	Entry:	Value type:	Accepted values:
[Settings]	FileBasedWatchdogTimeou	String	File path as text
	t		

## Description:

Specifies the timeout (in seconds) used to update the file-based watchdog file. *Example:* 

FileBasedWatchdogTimeout=300

Default:

FileBasedWatchdogTimeout=

Section:	Entry:	Value type:	Accepted values:		
[Settings]	LoggingPowerBoardFileNa	String	File path as text		
	me				
Description.					
Specifies a p	bath to file that will be used for	logging power	board information.		
Example:					
LoggingPowerBoardFileName=C:/Users/user/AppData/Local/Temp/Po					
werBoard.log					
Default:					
LoggingPowerBoardFileName=					

Section: [Settings]	<i>Entry:</i> LoggingPowerBoardFileSiz	<i>Value type:</i> Integer	Accepted values: Number		
	е				
Description:	Description:				
Specifies a r	naximum size that the power l	board logging fi	le can use (in bytes).		
Example:					
LoggingPov	LoggingPowerBoardFileSize=1000000				
Default:					
LoggingPow	verBoardFileSize=				

Section: [Settings]	<i>Entry:</i> LoggingPowerBoardInterv	<i>Value type:</i> <b>Integer</b>	Accepted values: Number		
[Settings]		integer	Number		
	al				
Description:					
Specifies the	e length of interval between p	ower board inf	ormation logging (in		
miliseconds			55 5 (		
Example:					
LoggingPov	LoggingPowerBoardInterval=30000				
<i>Default:</i>					
LoggingPow	verBoardInterval=				

Section: [Settings]	<i>Entry:</i> LoggingTimeMachineFileN ame	Value type: String	<i>Accepted values:</i> File path as text		
Description:					
Specifies a path to file that will be used for logging time machine (PTP server)					
information	information.				

Example:

LoggingTimeMachineFileName=C:/Users/user/AppData/Local/Temp/P
owerBoard.log

#### Default:

LoggingTimeMachineFileName=

Section: [Settings]	<i>Entry:</i> LoggingTimeMachineFileS ize	<i>Value type:</i> Integer	Accepted values: Number		
<i>Description:</i> Specifies a maximum size that the time machine (PTP server) logging file can use (in bytes).					
<i>Example:</i> LoggingTimeMachineFileSize=1000000 <i>Default:</i>					
LoggingTir	neMachineFileSize=				

Section: [Settings]	<i>Entry:</i> LoggingTimeMachineInter val	<i>Value type:</i> <b>Integer</b>	Accepted values: Number		
Description:					
Specifies tl	ne length of interval betw	een time ma	chine (PTP server)		
information logging (in miliseconds)					
Example:					
LoggingTimeMachineInterval=30000					
Default:					
LoggingTir	neMachineInterval=				

# 16.1.2 Section "Calibration"

Section:	Entry:	Value	Accepted values:			
[Calibration]	RadianTiltTableConnected	type:	true/false			
		Boolean				
Description:						
Defines if radia	an tilt table is connected to t	he compute	r that Discovery is			
running on.						
Example:						
RadianTiltTa	RadianTiltTableConnected=true					
Default:						
RadianTiltTa	bleConnected=false					

Section:	Entry:	Value	Accepted values:		
[Calibration]	BijouTiltTableConnected	type:	true/false		
		Boolean			
Description:					
Defines if bijou	tilt table is connected to the com	nputer that D	iscovery is running		
on.					
Example:					
BijouTiltTableConnected=true					
Default:					
BijouTiltTab	leConnected=false				

Section:	Entry:	Value	Accepted		
[Calibration]	AccelerometerCalibrationEnabled	type:	values:		
		Boolean	true/false		
Description:					
Defines if radi	an accelerometer calibration function	ality is ena	bled in the		
application.					
Example:					
Acceleromete	AccelerometerCalibrationEnabled=true				
Default:					
AccelerometerCalibrationEnabled=false					

Section:	Entry:	Value	Accepted		
[Calibration]	MagnetometerCalibrationEnabled	type:	values:		
		Boolean	true/false		
Description:					
Defines if radia	Defines if radian magnetometer calibration functionality is enabled in the				
application.	application.				
Example:					
Magnetometer	MagnetometerCalibrationEnabled=true				
Default:					
MagnetometerCalibrationEnabled=false					

Section: [Calibration]	<i>Entry:</i> CalibrationShakeTable	<i>Value</i> <i>type:</i> <b>Boolean</b>	<i>Accepted</i> <i>values:</i> <b>true/false</b>
Description: Defines if sen application. Example:	or calibration shake table functiona	lity is enal	bled in the

```
CalibrationShakeTable=true Default:
```

CalibrationShakeTable=false

Section: [Calibration]	Entry: CalibrationRadianBalancing	<i>Value type:</i> <b>Boolean</b>	<i>Accepted</i> <i>values:</i> <b>true/false</b>
application. <i>Example:</i> CalibrationRad <i>Default:</i>	nsor calibration balancing functional lianBalancing=true lianBalancing=false	lity is enat	oled in the

Section:	Entry:	Value type:	Accepted values:			
[Calibration]	DbEntry	Boolean	true/false			
Description:	Description:					
Defines if calib	ration values database cor	nnectivity is enabl	ed.			
Example:						
DbEntry=true						
Default:						
DbEntry=fals	е					

Section:	Entry:	Value	Accepted		
[Calibration]	CalibrationPageEditorEnabled	type:	values:		
		Boolean	true/false		
Description:					
Defines if calibi	ration editor widget is enabled in tl	he applicatio	n.		
Example:					
CalibrationP	ageEditorEnabled=true				
Default:					
CalibrationPageEditorEnabled=false					

Section:	Entry:	Value	Accepted			
[Calibration]	MinimusADCCalibrationEnabled	type:	values:			
		Boolean	true/false			
Description:	Description:					
Defines if Mini	mus ADC calibration functionality is e	nabled in th	e application.			
Example:						
MinimusADCCalibrationEnabled=true						
Default:						
MinimusADCCalibrationEnabled=false						

Section: [Calibration]	<i>Entry:</i> MinimusADCCalibrationDBEnabled	<i>Value type:</i> Boolean	Accepte d values: true/ false
Description:			

Defines if Minimus ADC calibration database interface is enabled in the application.

## Example:

MinimusADCCalibrationDBEnabled=true

Default:

MinimusADCCalibrationDBEnabled=false

Section:	Entry:	Value type:	Accepted
[Calibration]	SpringExerciseEnabled	Boolean	values:
			true/false

Description:

Defines if spring exercise functionality is enabled in the application.

Example:

SpringExerciseEnabled=true

Default:

SpringExerciseEnabled=false

Section:	Entry:	Value	Accepted values:		
[Calibration]	CalibrationMeterHostname	type:	Hostname or IP		
		String	address as text		
Description:					
Specifies host	Specifies hostname or IP address of ADC calibration meter used in				
 Minimus/Minimus+ calibration widget.					
Example:					
CalibrationM	CalibrationMeterHostname=meter.hostname.domain.com				
Default:					
CalibrationM	CalibrationMeterHostname=meter1				

Section:	Entry:	Value	Accepted		
[Calibration]	CalibrationSignalGeneratorHostna	type:	values:		
	me	String	Hostname or		
		_	IP address as		
			text		
Description:					
Specifies host	name or IP address of ADC calib	ration n	neter used in		
Minimus/Minimus+ calibration widget.					
Example:					
CalibrationSignalGeneratorHostname=siggen.hostname.domain.com					
Default:					
CalibrationS	ignalGeneratorHostname=sig1				

CalibrationSignalGeneratorHostname=sigl

Section:	Entry:	Value	Accepted		
[Calibration]	FortisNoiseToleranceThreshold	type:	values:		
		Float	Numbers		
Description:					
Example:					
FortisNoiseToleranceThreshold=0					
Default:					
FortisNoiseToleranceThreshold=0.019999999552965164					

Section:	Entry:	Value type:	Accepted values:			
[Calibration]	FortisCalArmCurrent	Integer	Numbers			
Description:						
-						
Example:						
FortisCalArmCurrent=2						
Default:						
FortisCalArm	Current=3					

Section:	Entry:	Value type:	Accepted values:			
[Calibration]	FortisCalArmSerial	Integer	Numbers			
Description:						
-						
Example:						
FortisCalArmS	Serial=1					
Default:						
FortisCalArmS	Serial=0					

Section:	Entry:	Value type:	Accepted values:			
[Calibration]	FortisCalSpinnerSerial	Integer	Numbers			
Description:						
-						
Example:						
FortisCalSpinnerSerial=1						
Default:						
FortisCalSpi	nnerSerial=0					

Section: [Calibration]	<i>Entry:</i> FortisCalSpinnerCurrent	<i>Value type:</i> Integer	Accepted values: Numbers
Description:			
Default:	nnerCurrent=1 nnerCurrent=2		

Section: [Calibration]	<i>Entry:</i> FortisCaldocSaveFolder	<i>Value type:</i> <b>String</b>	Accepted values: Directory path as text
Description:			
<i>Example:</i> FortisCaldoc <i>Default:</i> FortisCaldoc	SaveFolder=C:/caldoc SaveFolder=		

Section: [Calibration]	<i>Entry:</i> IMSDatabase	<i>Value type:</i> Boolean	Accepted values: true/false		
Description:					
Defines if IMS database connectivity is available.					

Example:

IMSDatabase=true *Default:* 

IMSDatabase=false

Section:	Entry:		Value	type:	Accepted	
[Calibration]	EnableDigitalSensorCalibr	ation	Boole	ean	values:	
					true/false	
Description:						
Defines if digita	al sensors calibration values	in Calibr	ation I	Editor o	can be edited	
by the user. If th	nis value is set to false, calibra	tion edit	or (if e	nabled	) will display	
digital sensor c	alibration values as read-onl	y.	•			
Example:						
EnableDigitalSensorCalibration=true						
Default:						
EnableDigitalSensorCalibration=false						
Section:	Entry:	Value i	type:	Acce	epted values:	
[Calibration]	FortimusCurveFitting	Boole	an	t	rue/false	

[Calibration]FortimusCurveFittingBooleantrue/falseDescription:Defines if Fortimus curve fitting data processing functionality is available in<br/>the application.Example:FortimusCurveFitting=trueDefault:FortimusCurveFitting=false

# 16.1.3 Section "Instruments"

Section:	Entry:	Value type:	Accepted values:			
[Instruments]	InstrumentsDebug	Boolean	true/false			
Description:						
Specifies if instru	uments debug widget is av	ailable in Disco	very device control			
centre.	centre.					
Example:						
InstrumentsDebug=true						
<i>Default:</i>						
InstrumentsDe	bug=false					

# 16.1.4 Section "DataStream"

Section: [DataStream]	<i>Entry:</i> GDI\ListenerEnabled	<i>Value type:</i> <b>Boolean</b>	Accepted values: true/false		
Description:					
Specifies if GDI listener is enabled in the application.					
Example:					

GDI\ListenerEnabled=true *Default:* GDI\ListenerEnabled=false

Section:	Entry:	Value type:	Accepted values:			
[DataStream]	<b>GDI\ListenerPort</b>	Integer	Numbers			
Description:						
Specifies the list	Specifies the listening port for GDI TCP/IP listener.					
Example:						
GDI\ListenerPort=1234						
Default:						
GDI\ListenerPort	=4567					

Section: [DataStream]	Entry: GDI\MaximumRAMAllowance	<i>Value type:</i> Integer	Accepted values: Numbers
Example:	imum RAM allowance for GDI data AMAllowance=2048	pool (in bytes	).

Section: [DataStream]	<i>Entry:</i> GDI\AutoInit	<i>Value type:</i> List	Accepted values: List of system		
[DataStream]	GDI (AutoIIIIt	LISU	List of system		
			names		
Description:					
Specifies a list o	Specifies a list of system that the connection will be automatically initiated				
when one appear	rs in Discovery list.				
Example:					
GDI\AutoInit=	GDI\AutoInit=				
Default:					
GDI\AutoInit=					

## Section "viewer"

Section:	Entry:	Value type:	Accepted values:		
[viewer]	SelectionMenu				
Description:					
Example:					
SelectionMenu=@Invalid()					
Default:					
SelectionMenu=@	)Invalid()				

# 16.1.5 Section "AnaloguePowerBoard"

Section:	Entry:	Value type:	Accepted values:		
[AnaloguePowerB	Enabled	Boolean	true/false		
oard]					
Description:					
Defines if the analogue power board control functionality is enabled in the					
application.					
Example:					
Enabled=true					
Default:					
Enabled=false					

Section: [AnaloguePowerB	<i>Entry:</i> SerialConnection	<i>Value type:</i> Boolean	Accepted values: true/false	
oard]				
Description:				
Defines if the analogue power board is connected locally through serial port.				
Example:				
SerialConnection=true				
Default:				
SerialConnection=false				

Section: [AnaloguePowerB	<i>Entry:</i> SerialPortName	<i>Value type:</i> <b>String</b>	Accepted values: Serial port name	
oard]	Serial of traine	String	as text	
Description:				
Defines the name of serial port that analogue power board is connected to.				
Example:				
SerialPortName=ttyUSB0				
Default:				
SerialPortName=				

Section:	Entry:	Value type:	Accepted values:
[AnaloguePowerB	SerialBaudRate	Integer	Numbers
oard]			

Description: Defines the baud rate of serial port connection to the analogue power board. Example: SerialPortName=9600 Default: SerialPortName=115200

Section:	Entry:	Value type:	Accepted values:			
[AnaloguePowerBoard]	LabelJ08	String	Text			
Description:						
Specifies text label used for graphical user interface to describe analogue power board connector J08. Note that if the label is not configured information and controls for this connector are not going to be displayed in graphical						
interface.						
Example:						
LabelJ08=MINHI	LabelJ08=MINHI					
Default:						
LabelJ08=						

Section:	Entry:	Value type:	Accepted values:
[AnaloguePowerBoard]	LabelJ09	String	Text
Description:			
Specifies text label used f power board connector J09 and controls for this conn interface. <i>Example:</i> LabelJ09=MINLO <i>Default:</i>	. Note that if the l	label is not conf	figured information
LabelJ09=			

Section:	Entry:	Value type:	Accepted values:	
[AnaloguePowerBoard]	LabelJ10	String	Text	
Description:				
Specifies text label used for graphical user interface to describe analogue power board connector J10. Note that if the label is not configured information and controls for this connector are not going to be displayed in graphical interface. Example: LabelJ10=RADHI Default:				
LabelJ10=				

Section:	Entry:	Value type:	Accepted values:	
[AnaloguePowerBoard]	LabelJ11	String	Text	
Description:				
Specifies text label used for graphical user interface to describe analogue				
power board connector J11. Note that if the label is not configured information				

and controls for this connector are not going to be displayed in graphical interface. *Example:* LabelJ11=RADLO *Default:* LabelJ11=

Section:	Entry:	Value type:	Accepted values:		
[AnaloguePowerBoard]	LabelJ12	String	Text		
Description:					
Specifies text label used for graphical user interface to describe analogue power board connector J12. Note that if the label is not configured information and controls for this connector are not going to be displayed in graphical					
interface.					
Example:					
LabelJ12=HOLEH					
Default:					
LabelJ12=					

Section:	Entry:	Value type:	Accepted values:	
[AnaloguePowerBoard]	LabelJ13	String	Text	
Description:				
Specifies text label used f power board connector J13. and controls for this conn interface. <i>Example:</i> LabelJ13=HOLEL	Note that if the	label is not conf	figured information	
Default:				
LabelJ13=				

<i>Section:</i> [AnaloguePowerBoard]	<i>Entry:</i> ControlsJ08	<i>Value type:</i> Boolean	Accepted values: true/false	
	CONTINUESDO	Dooleall	tiue/faise	
Description:				
Specifies whether control	s for analogue	power board	connector J08 are	
available in the graphical user interface.				
Example:				
ControlsJ08=true				
Default:				
ControlsJ08=false				

Section:	Entry:	Value type:	Accepted values:
[AnaloguePowerBoard]	ControlsJ09	Boolean	true/false
Description:			
Specifies whether control	s for analogue	power board	connector J09 are
available in the graphical user interface.			
Example:			
ControlsJ09=true			
Default:			
ControlsJ09=false			

Section:	Entry:	Value type:	Accepted values:
[AnaloguePowerBoard]	ControlsJ10	Boolean	true/false
Description:			
Specifies whether controls for analogue power board connector J10 are			
available in the graphical user interface.			
Example:			
ControlsJ10=true			
<i>Default:</i>			
ControlsJ10=false			

Section: [AnaloguePowerBoard]	<i>Entry:</i> ControlsJ11	<i>Value type:</i> Boolean	Accepted values: true/false	
Description:				
Specifies whether control available in the graphical u	•	power board	connector J11 are	
Example:				
ControlsJ11=true				
Default:				
ControlsJ11=false				

Entry:	Value type:	Accepted values:
ControlsJ12	Boolean	true/false
s for analogue	power board	connector J12 are
ser interface.		
	ControlsJ12 s for analogue	ControlsJ12Booleans for analogue power board

Section:	Entry:	Value type:	Accepted values:
[AnaloguePowerBoard]	ControlsJ13	Boolean	true/false
Description:			
Specifies whether control	s for analogue	power board	connector J13 are
available in the graphical u	ser interface.		
Example:			
ControlsJ13=true			
Default:			
ControlsJ13=false			

Entry:	Value	Accepted values:	
FuseMonitoringJ0	type:	true/false	
8	Boolean		
Description:			
Specifies whether fuse monitoring label should be displayed in the Power			
Board UI.			
<i>Default:</i> true			
	FuseMonitoringJ0 8	FuseMonitoringJ0type:8Boolean	

Section:	Entry:	Value	Accepted values:
[AnaloguePowerBoard]		type:	true/false

	FuseMonitoringJ0 9	Boolean		
<i>Description:</i> Specifies whether fuse monitoring label should be displayed in the Power				
Board UI.				
<i>Default:</i> true				

Section:	Entry:	Value type:	Accepted values:	
[AnaloguePowerBoar	FuseMonitoringJ1	Boolean	true/false	
d]	0			
Description:				
Specifies whether fuse monitoring label should be displayed in the Power				
Board UI.				
<i>Default:</i> true				

Section:	Entry:	Value type:	Accepted values:	
[AnaloguePowerBoar	FuseMonitoringJ1	Boolean	true/false	
d]	1			
Description:				
Specifies whether fuse monitoring label should be displayed in the Power				
Board UI.				
<i>Default:</i> true				

Section: [AnaloguePowerBoar	<i>Entry:</i> <b>FuseMonitoringJ1</b>	<i>Value type:</i> <b>Boolean</b>	Accepted values: true/false	
d]	2			
Description:				
Specifies whether fuse monitoring label should be displayed in the Power				
Board UI.				
<i>Default:</i> true				

Section: [AnaloguePowerBoar d]	Entry: FuseMonitoringJ1 3	<i>Value type:</i> <b>Boolean</b>	Accepted values: true/false
<i>Description:</i> Specifies whether fus Board UI. <i>Default:</i> true	e monitoring label s	hould be displ	ayed in the Power

Section: [AnaloguePowerBoar d]	<i>Entry:</i> NextSwitchOnJ10	<i>Value type:</i> <b>QDateTime</b>	Accepted values: QDateTime value		
	<i>Description:</i> This entry should not be modified manually. Specifies timestamp of the next power-on configured for connector J10.				

Section:	Entry:	Value type:	Accepted values:
[AnaloguePowerBoar	NextSwitchOnJ11	QDateTime	QDateTime value
d]			

Description:

This entry should not be modified manually. Specifies timestamp of the next power-on configured for connector J11.

Section: [AnaloguePowerBoar d]	<i>Entry:</i> NextSwitchOnJ12	<i>Value type:</i> QDateTime	Accepted values: QDateTime value
Description:			

This entry should not be modified manually. Specifies timestamp of the next power-on configured for connector J12.

Section: [AnaloguePowerBoar d]	<i>Entry:</i> NextSwitchOnJ13	<i>Value type:</i> QDateTime	Accepted values: QDateTime value
Description:			

This entry should not be modified manually. Specifies timestamp of the next power-on configured for connector J13.

Section:	Entry:	Value	Accepted
[AnaloguePowerBoar	NextSwitchOnTimeoutJ	type:	values:
d]	10	Integer	Numbers
Description:			

This entry should not be modified manually. Specifies timeout configured for next switch on of connector J10.

Section:	Entry:	Value	Accepted
[AnaloguePowerBoar	NextSwitchOnTimeoutJ	type:	values:
d]	11	Integer	Numbers
Description:			

This entry should not be modified manually. Specifies timeout configured for next switch on of connector J11.

Section:	Entry:	Value	Accepted
[AnaloguePowerBoar	NextSwitchOnTimeoutJ	type:	values:
d]	12	Integer	Numbers
Description:			

This entry should not be modified manually. Specifies timeout configured for next switch on of connector J12.

Section:	Entry:	Value	Accepted	
[AnaloguePowerBoar	NextSwitchOnTimeoutJ	type:	values:	
d]	13	Integer	Numbers	
Description:				
This entry should not be modified manually. Specifies timeout configured for				
next switch on of connector J13.				

Section:	Entry:	Value	Accepted
[AnaloguePowerBoar	AutoSwitchOffTimeoutWhenPS	type:	values:
d]	UOn		Numbers

	Intege	
	r	
<b>D</b> 1.11		

Description:

Specifies timeout in seconds of when the system is going to be switched off if the reason of analogue power board power on is "power supply switch on". Please note that minimal timeout is 5 minutes (300 seconds) and any value lower than 300 will be overwritten in the application to 300 seconds.

Example:

AutoSwitchOffTimeoutWhenPSUOn=600

Default:

AutoSwitchOffTimeoutWhenPSUOn=

Section:	Entry:	Value	Accepted		
[AnaloguePowerB	AutoSwitchOffTimeoutWhen	type:	values:		
oard]	AcousticComms	Integer	Numbers		
Description:					
Description:					

Specifies timeout in seconds of when the system is going to be switched off if the reason of analogue power board power on is "acoustic modem communication". Please note that minimal timeout is 5 minutes (300 seconds) and any value lower than 300 will be overwritten in the application to 300 seconds.

Example:

AutoSwitchOffTimeoutWhenAcousticComms=600

Default:

AutoSwitchOffTimeoutWhenAcousticComms=

Section:	Entry:	Value	Accepted	
[AnaloguePowerB	AutoSwitchOffTimeoutWhen	type:	values:	
oard]	PowerBoardTimer	Integer	Numbers	
Description:				
Specifies timeout in	seconds of when the system is g	going to be s	witched off if	
the reason of analog	the reason of analogue power board power on is "internal power board timer".			
Please note that minimal timeout is 5 minutes (300 seconds) and any value				
lower than 300 will be overwritten in the application to 300 seconds.				
Example:				
AutoSwitchOffTimeoutWhenPowerBoardTimer=600				
Default:				
AutoSwitchOffTin	neoutWhenPowerBoardTimer=			

Section: Entry: Value Accepted [AnaloguePowerB] AutoSwitchOffTimeoutWhen values: type: PulseFromShore Numbers oard] Integer Description: Specifies timeout in seconds of when the system is going to be switched off if the reason of analogue power board power on is "pulse from shore". Please note that minimal timeout is 5 minutes (300 seconds) and any value lower than 300 will be overwritten in the application to 300 seconds. Example: AutoSwitchOffTimeoutWhenPulseFromShore=600

#### Default:

AutoSwitchOffTimeoutWhenPulseFromShore=

Section:	Entry:	Value	Accepted	
[AnaloguePowerB	SwitchOffSystemWhenPowerO	type:	values:	
oard]	ffConnector	Integer	Numbers	
Description:				
Determinates based on which connector power off request to switch off the				
operating system cleanly – issue system power down command.				
Example:				
SwitchOffSystemWhenPowerOffConnector=11				
Default:				
Delaull.				

ctionPort		Accepted		
	type:	values:		
	Integer	Numbers		
Description:				
Specifies server connection port. This port is used to open the connection to				
the power board server from a client.				
Example:				
ServerConnectionPort=25002				
Default:				

Section:	Entry:	Value	Accepted	
[AnaloguePowerB	ServerListeningPort	type:	values:	
oard]		Integer	Numbers	
Description:				
Specifies server listening port. This port is used to listen for any incoming				
connections from remote power board client.				
Example:				
ServerListeningPort=25002				
Default:				
ServerListeningPort=17789				

Section:	Entry:	Value	Accepted	
[AnaloguePowerB	SwitchOnSequenceWhenPSUO	type:	values:	
oard]	n	QList of	Comma	
		integers	separated	
			numbers	
Description:				
Specifies a list of connector numbers to switch on when power board power on				
reason is "power supply on". Other connectors will get switched off.				
Example:				
SwitchOnSequenceWhenPSUOn=11, 13, 10				
Default:				
SwitchOnSequence	eWhenPSUOn=11, 13			

Section:	Entry:	Value type:	Accepted
			values:

[AnaloguePowerB oard]	SwitchOnSequenceWhenA cousticComms	QList of integers	Comma separated numbers
Description:			
Specifies a list of connector numbers to switch on when power board power on			
reason is "acoustic modem communication". Other connectors will get			
switched off.			
Example:			
-	WhenAcousticComms=11, 1	3, 10	
Default:			
SwitchOnSequenceWhenAcousticComms=			
Variant(000)t000x1000x2000v)			

Section:	Entry:	Value	Accepted
[AnaloguePowerB	SwitchOnSequenceWhenPowerB	type:	values:
oard]	oardTimer	QList of	Comma
		integers	separated
			numbers
Description:			
Specifies a list of connector numbers to switch on when power board power on			
reason is "power board timer". Other connectors will get switched off.			
Example:			

SwitchOnSequenceWhenPowerBoardTimer=11, 13, 10

Default:

SwitchOnSequenceWhenPowerBoardTimer=11, 13

Section: [AnaloguePowerB oard]	<i>Entry:</i> SwitchOnSequenceWhenP ulseFromShore	<i>Value type:</i> QList of integers	Accepted values: Comma separated numbers	
<i>Description:</i> Specifies a list of connector numbers to switch on when power board power on reason is "pulse from shore". Other connectors will get switched off.				
Example: SwitchOnSequenceWhenPulseFromShore=11, 13 Default: SwitchOnSequenceWhenPulseFromShore=11, 13, 10				

# 17 Appendix G – Glossary

- APG : Absolute Pressure Gauge
- **CS** : Configuration Status
- DBV : Degree of Voice Breaks
- DD : Data Delay
- DHCP : Dynamic Host Configuration Protocol
- FEC : Forward Error Correction
- **GPS** : Global Positioning System
- HDPE : Hyper-Density PolyEthylene
- ICT : Inter Character Time
- IP : Internet Protocol
- LAN : Local Area Network
- LED : Light-Emitting Diode
- LG : Linear Gain
- LMF : Lower Medium Frequency
- LPC : Low Power Computer
- LTA : Long Term Average
- MD : Modem Delay
- **MDFT** : Modem Data Frame Transfer
- MEMS : MicroElectroMechanical System
- **MPPT** : Maximum Power Point Tracking
- MR : Master Retries
- MR (command) : Measure Range
- MS : Modem Status
- NPL : Navigation Power Level
- **OBS** : Ocean Bottom System
- **PoE** : Power over Ethernet
- **PTP** : Precision Time Protocol

**RAM** : Random-Access Memory

**ROV** : Remotely Operated underwater Vehicle

**RXW** : Receiver Wait

**SBC** : Single Board Computer

SoH : State of Health

**SPL** : Start Power Level

# **SNR** : Signal to Noise Ratio.

**STA** : Short Term Average

**TAT** : Turn-Around-Time

**TPL** : Telemetry Power Level

**TS** : Telemetry Scheme

**UD** : Uplink Delay

**UID** : Unique IDentification

# **ULPD** : Ultra Low Power Digitiser

 $\boldsymbol{XC}$  : Cross Correlation

# **18 Revision history**

- A 07/12/2020 Initial Release
- B 10/08/2021 System/ballast assembly procedure added
- C 20/08/2021 References tidied up