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# Radio Buoy User Guide

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Version 2.1



**OCEAN SONICS**  
Giving Our Oceans A Voice

# Table of Contents

1. Buoy Introduction.....	4
Important Notes.....	4
Specifications.....	5
Features.....	5
2. Buoy Mechanical Overview.....	5
Included Hardware and Tools.....	5
Main Assemblies.....	6
Module Terminology.....	6
Buoy Connections.....	6
3. Replacing the Batteries.....	8
4. Replacing the Battery Module.....	10
5. Assembling and Extending the Mast.....	11
6. Installing the Weight Fixture.....	13
7. Buoy Control GUI Application Overview.....	15
Buoy Control GUI Getting Started.....	16
8. Buoy Server IP Address Setup.....	16
Server IP Address Update via Web Interface.....	17
Server IP Address Update using IP Setup Tool.....	18
9. Recording GPS Data on an icListen Hydrophone.....	19
10. Using Buoy with PAMGUARD.....	20
11. Radio Introduction and Web Interface.....	23
Ubiquiti Radio Wireless Settings.....	24
Ubiquiti Radio Network Settings.....	24
Other Information.....	25
12. Ocean Sonics Pre-Deployment Sequence.....	25
Radio Buoy Setup and Verification.....	25
Radio Bridge Setup and Verification.....	27

13. Access Point Radio Installation.....27

14. Assembling Buoy for Deployment.....28

    Deployment.....29

15. Recovery of the Buoy.....29

16. GPS Position Data Retrieval.....30

    FTP Client (FileZilla).....30

17. Maintenance.....30

18. Contact Ocean Sonics Ltd.....30

19. Appendix A.....31

20. Appendix B.....33

    Marco Settings - DHCP.....33

21. Appendix C.....34

    Confirming Voltages.....34

22. Appendix D.....35

23. Appendix E.....36

    Technical Drawing.....36

24. Appendix F.....37

## 1. Buoy Introduction

The Ocean Sonics Radio Buoy provides a way to deploy one or more synchronized icListen Smart Hydrophones and stream data remotely. The buoy is small, lightweight, and can be deployed from a small vessel by 2 people. This solution combines power, radio communication, and time synchronization with a hydrophone array.

The buoy has been tested to achieve data transfer speeds of greater than 20Mbps at 2 km using omnidirectional antennas at both ends of the link. Environmental conditions and differing radio setups will produce differences in connection speed. RF interference will also reduce connection speeds; it is recommended to limit other in-band RF sources as much as possible. Radio link speed will decrease with distance but can be improved by elevating the receiver end.

The buoy includes 3 network connected devices: the icListen, the radio, and the buoy server. The server allows for control of the hydrophone power state, and for distribution of the buoy GPS signal to the hydrophone and/or the network connected computer running the Buoy Control GUI software. There are preset IP addresses for the Buoy Server, Buoy Radio, and Access Point radio.

The preset IP addresses are:

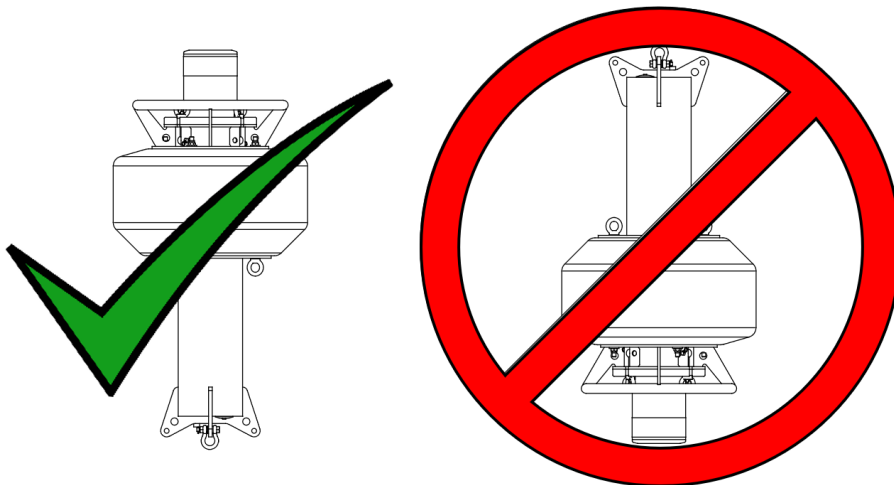
**Buoy Server: 172.16.8.50**

**Buoy radio: 172.16.8.21**

**Access Point Radio: 172.16.8.20**

### Important Notes

- Buoy battery life will depend on set-up of deployment, number of hydrophones and smart cables.
- Turn the buoy OFF when not in use.
- Stand the buoy upright or lay on its side.
- Do NOT flip the buoy or turn upside down.
- Radio link quality will degrade with increased wave height. The buoy is not intended for use in higher sea states.
- Battery positioning is ballasted for upright position.
- Turning the buoy upside down could result in damage to batteries.



## Specifications

WEIGHT	25 kg in air (without the ballast)
DIMENSIONS	1 m x 0.5 m

## Features

<ul style="list-style-type: none"> <li>• Replaceable 1500 Wh/4500 Wh batter bank (Alkaline/Lithium)</li> </ul>	<ul style="list-style-type: none"> <li>• ON/OFF plug</li> </ul>
<ul style="list-style-type: none"> <li>• GPS Time Synchronization &amp; Logging (re-mote and internal)</li> </ul>	<ul style="list-style-type: none"> <li>• Hydrophones Synchronized within 1us</li> </ul>
<ul style="list-style-type: none"> <li>• Selectable cable lengths</li> </ul>	<ul style="list-style-type: none"> <li>• Radion link for real-time Set Up, Status, and Spectral Display</li> </ul>
<ul style="list-style-type: none"> <li>• Buoy and Moorings are designed to be acoustically quiet</li> </ul>	

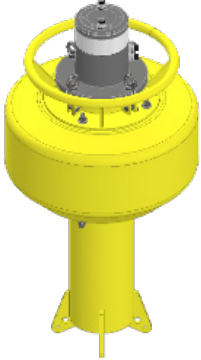



## 2. Buoy Mechanical Overview

The Radio Buoy consists of four main components: the Buoy Body, which includes the battery pack, the TopHat which contains the electronics and connection points, the Ballast assembly, and the Radio Mast and radio.

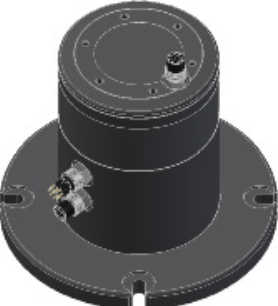

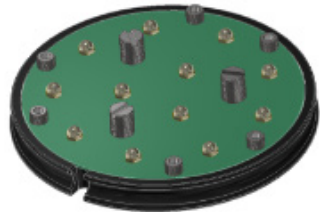
### Included Hardware and Tools

ITEM	QUANTITY	PURPOSE
M6 x 25mm Flat Head Screws Titanium Grade 2	9	6x Securing the mast support to the top hat 3x Spares
M8 x 25mm Socket Head Screw	6	3x Mast Clamp 2x Spares
M8 Hex Nut	6	3x Mast Clamp 3x Spares
Connector Lubricant	1 Tube	Maintaining MCBH Connectors
O-Ring Lubricant	1 Tube	Maintaining O-Rings
Marine Anti seize	6 mL	Lubricating bolted joints
Gloves	4	Anti Seize Application
Metric Hex Key Set	1	Antenna Bracket, Mast Set Screw,
Wrench, 7/16in	2	Ballast support assembly spacers
Wrench, 3/4in	1	Ballast assembly

## Main Assemblies

BOS-W BUOY	ANTENNA AND MAST (DISASSEMBLED)	BALLAST FRAME ASSEMBLY	BALLAST ASSEMBLY
			

## Module Terminology

TOPHAT	BATTERY MODULE	LOWER BATTERY PLATE
<p>Contains electronics. Do not open unless instructed. Ships installed in Buoy assembly.</p> 	<p>Contains D-Cell batteries. Do not disassemble except lower battery plate removal. Ships installed in Buoy assembly.</p> 	<p>Retains D-Cell batteries in Battery Module. Do not disassemble further. Ships installed in Battery Module.</p> 

## Buoy Connections

The buoy has 4 external connectors, three of which are located on the Top-Hat. The Top-Hat also has two internal connectors that are accessed when replacing the batteries. Below is an image of the buoy Top-Hat with connectors marked A through E and their descriptions. There is one additional port on the base of the buoy body for connecting the hydrophone or hydrophone(s) to the buoy that is not shown here.



### Buoy TopHat connectors

A – Radio Cable Port

B – Auxiliary Port for communication via laptop and test cable

C – Power Enable Port

D – Hydrophone cable through connector

E – battery power connector

### 3. Replacing the Batteries

- The BOS-W uses 72 D-Cell batteries for their large capacity and universal availability.
- Batteries must be removed when depleted and replaced with new or recharged cells.
- Begin by unscrewing the three captive panel screws until the lower cover is free.

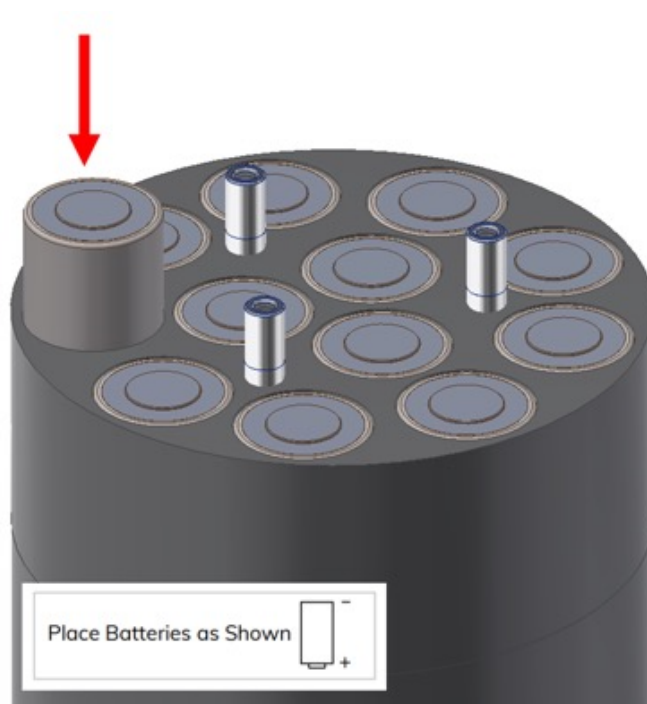


- To remove old batteries, it is easiest to remove foam spacers as you progress, but make sure you place them somewhere safe (they are light and can blow away!).
- When all the batteries are removed, the foam spacers may be reinstalled for safekeeping.





- When all the old batteries have been removed, insert 72 new batteries.



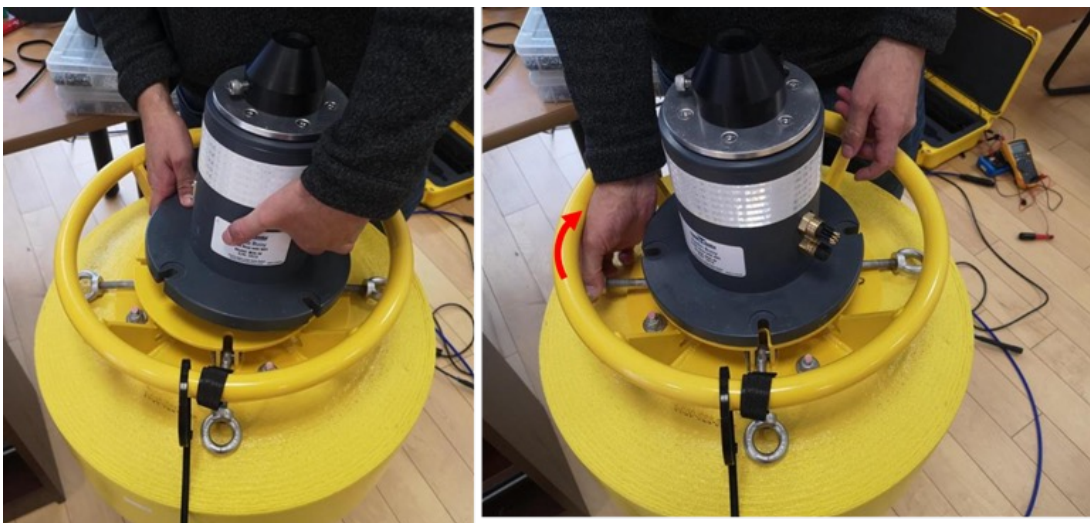
- With the new batteries loaded, replace the lower tray and tighten the three captive screws.
- You will feel tension as the battery springs are compressed.

## 4. Replacing the Battery Module

- When the D-Cell batteries are loaded, the battery module may be returned to the hull of the buoy.
- Feed the two cables through the handle as shown.
- Verify that the lower cable is in the notch at the bottom of the battery module and orient the battery module so the cable will fall into the notch at the bottom.



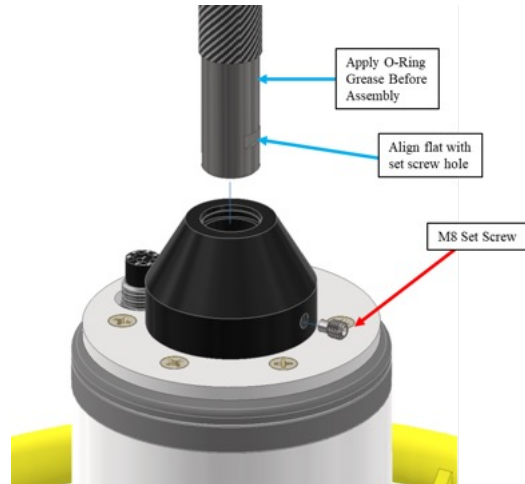
- Carefully lower the battery module into the hull.
- When the battery module is seated, thread the two cables through the two foam inserts and plug them in.
- Push the foam inserts down and install the Top-Hat. Ensure the O-ring and mating surfaces are properly cleaned and lubricated using lint-free wipes and O-ring lubricant.
- The Top-Hat is a snug fit – make sure it is seated properly.
- Swing the retaining bolts back into the slots and tighten until snug.



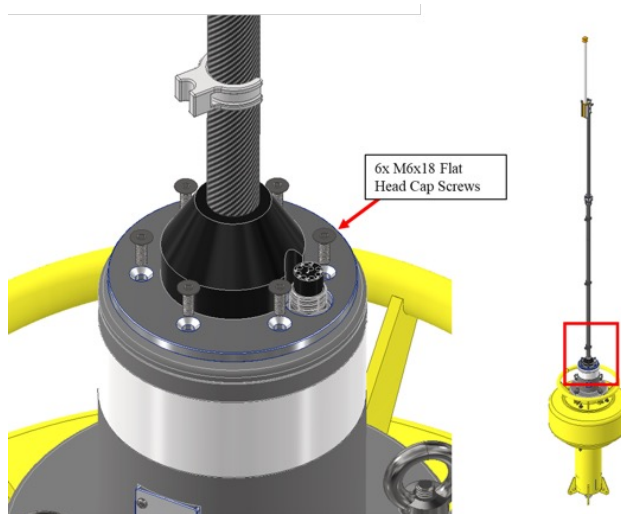
## 5. Assembling and Extending the Mast

The buoy mast is attached to the top of the buoy and is used for mounting the buoy radio and antenna. It is carbon fiber and extensible. Do not lift the buoy by the mast.

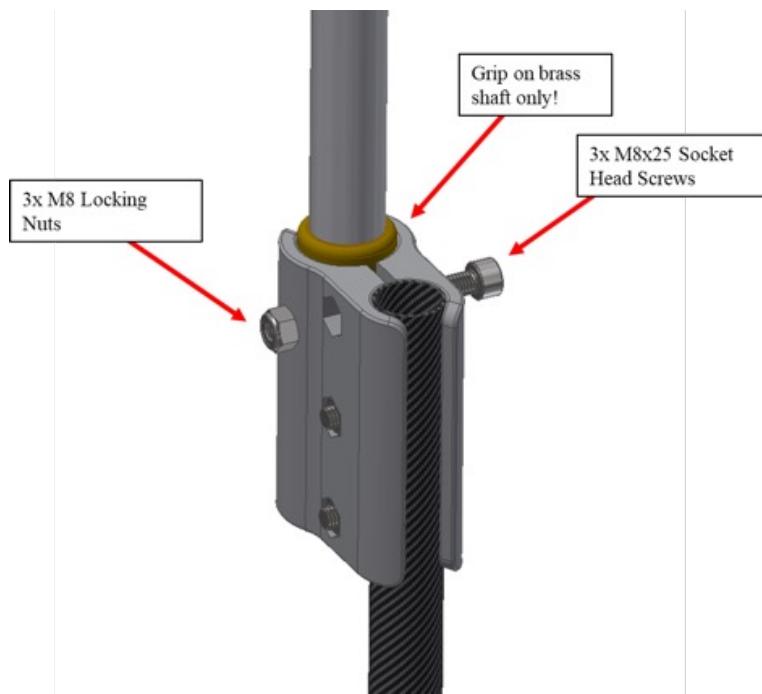
- The mast will ship disassembled and detached from the body of the buoy.
- The mast base will be installed, however if it needs to be removed and reinstalled, this can be accomplished by loosening the set screw and pulling the stem of the mast out of the base. Note that the mast base does NOT need to be removed to install the mast.
  - Before reassembly, apply O-ring grease to the stem to protect it from corrosion.
  - Tighten the set screw snugly and pack the hole with grease.



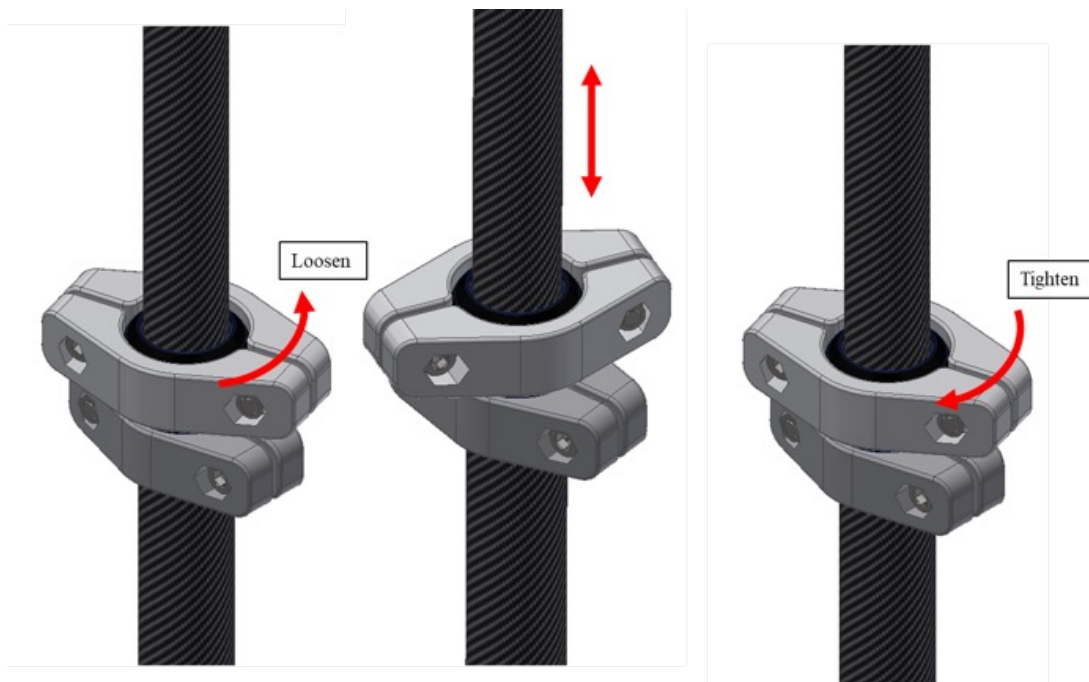
- The mast base can now be installed on the top hat.
  - Align the MCBH connector with the hole in the mast mounting plate and screw the assembly in place using the 6 M6x18 flat head Phillips screws provided.



- Attach the antenna to the mast using the included bracket and hardware.



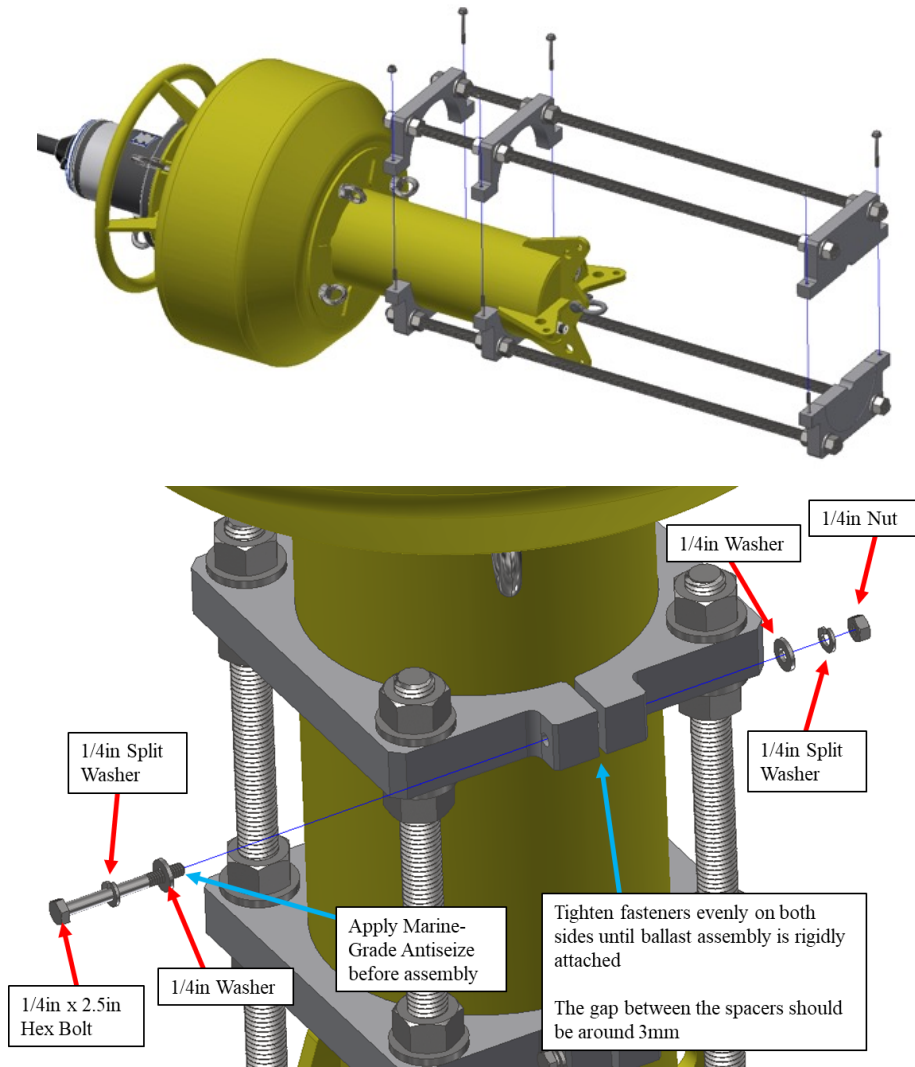
- Tighten the three M8 screws snugly and equally until neither the antenna nor mast move inside the bracket. Do not over tighten.
- The two halves of the mast are connected using a collet system. Two handles were added to reduce hand strain.
- To loosen locking collet, turn the upper handle counterclockwise (looking down on the buoy).
- Once the mast is at the desired height, tighten the collet by turning the upper handle clockwise.
- **Note that attainable mast height depends on the payload and ballast of the buoy. For shorter distance deployments, a lower mast height may be used if desired, which will reduce the ballast required.**



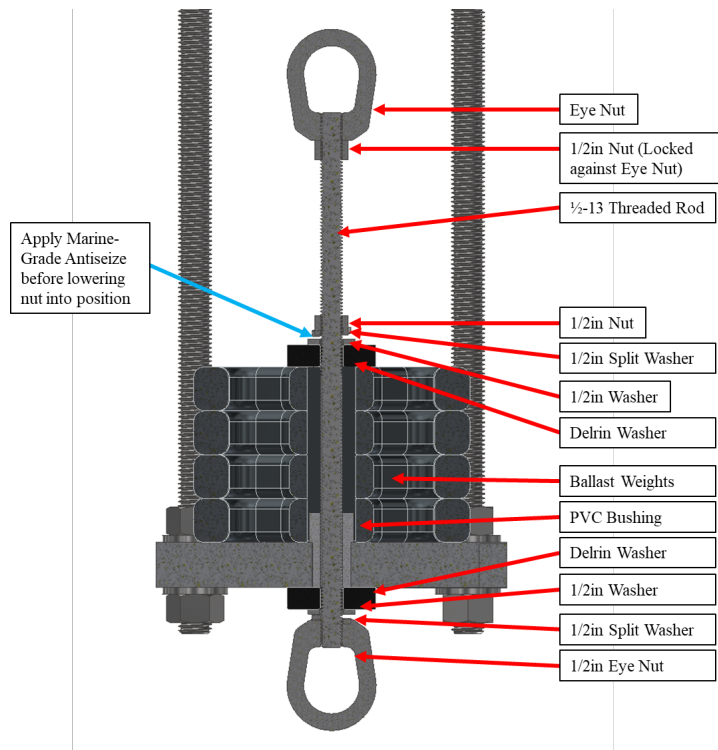
## 6. Installing the Weight Fixture

The weight fixture/ballast system is added to increase buoy stability and allow for greater mast heights. **Note that the weight fixture ships in two halves that should not be disassembled further.**

- The fixture will be shipped in two halves.
- To install the weight fixture, lay the buoy on its side over one half of the weight fixture.
- Using the included  $\frac{1}{4}$ -20 screws, nuts, and washers, screw the upper half over the lower half.
- Use the two included  $\frac{7}{16}$ " wrenches to tighten the fasteners.

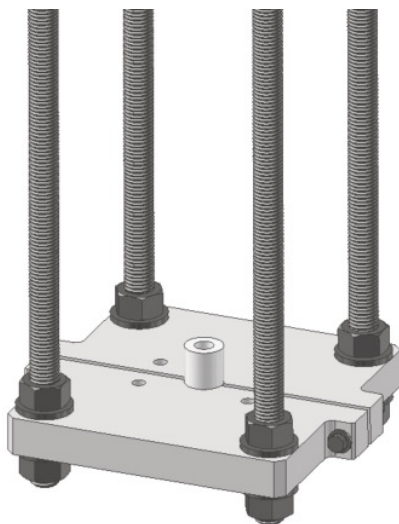


- Install the ballast weights as shown below before deployment.
- Note that the PVC bushing should fit between the lowest two structural plates – the  $\frac{1}{4}$ -20 screws may need to be loosened before it can be inserted and retightened afterwards.

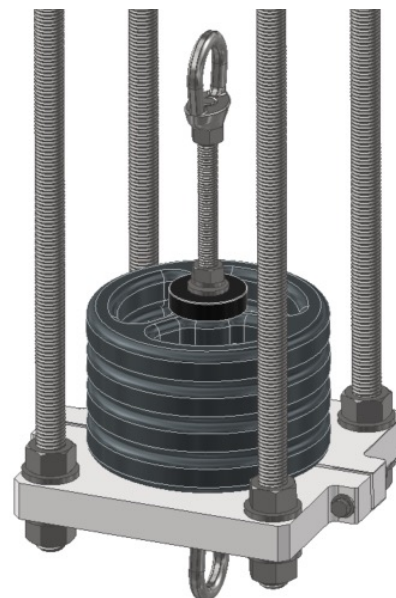


- Up to 12.5 kg (20lb) of additional ballast plates may be added. **Testing with 12.5kg of ballast and the mast fully extended showed acceptable stability.**
- The system accepts weight plates with a <165mm outer diameter and a >25mm bore.
  - The threaded rod can be used to compensate for different numbers of weight plates.
  - A PVC bushing is included to assist with centering the first weight plate.
- **NOTE: If no extra ballast is required, the PVC bushing must still be installed to constrain the two lower spacers.**
  - With No added ballast, the threaded rod assembly may be omitted.

EMPTY BALLAST ASSEMBLY



BALLAST ASSEMBLY WITH WEIGHTS



## 7. Buoy Control GUI Application Overview

The Buoy Control GUI has several basic functions to interface with the radio buoy:

- Turn battery power to the hydrophone(s) on/off.
- Shutdown (Reverse bias) the hydrophone(s) to power them off.
- Start/Stop GPS data streaming.
- Enable/Disable GPS data logging on the connected computer.
- View/log buoy internal sensor data.
- Enable/Disable buoy internal sensor logging.

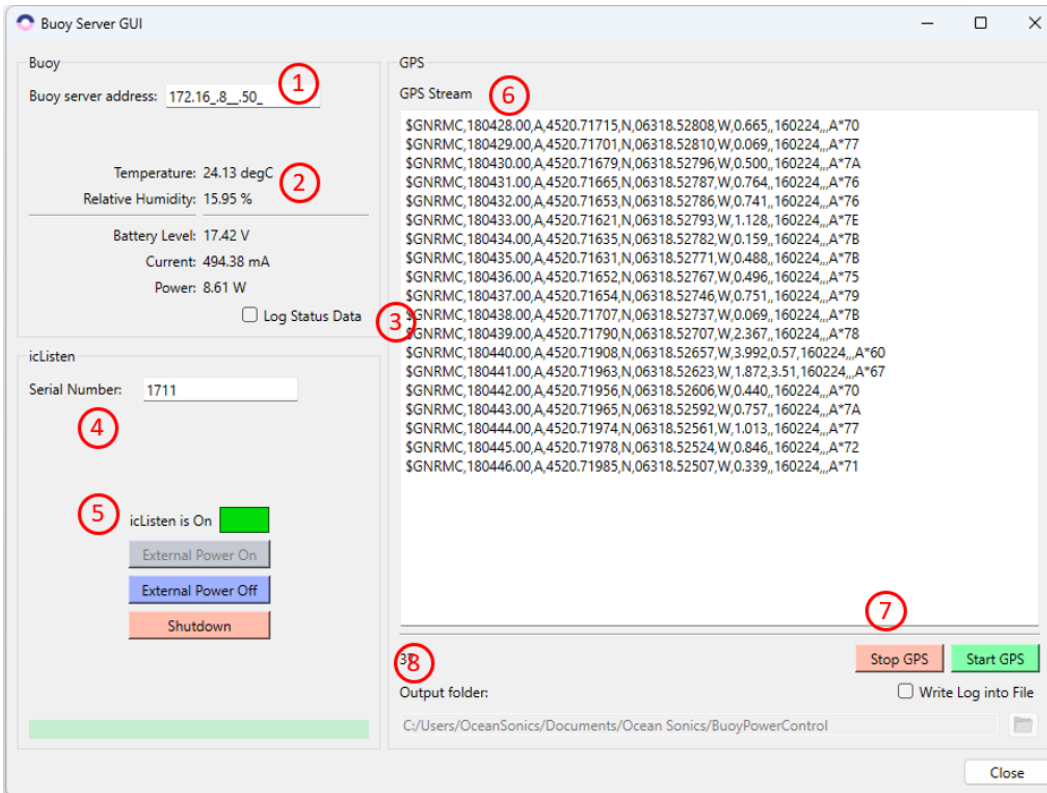


Figure 1: Buoy Control GUI overview.

### Buoy Control GUI controls overview:

1. Buoy Server IP address
2. Buoy sensor outputs
3. Buoy sensor logging control
4. Hydrophone serial number
5. Controls for icListen hydrophone power
  - a. External Power On
  - b. External Power Off
  - c. Shutdown
6. GPS data stream
7. Controls for GPS streaming and logging
8. Logging file location

## Buoy Control GUI Getting Started

To begin using the Buoy Control GUI, take the following steps:

1. Download the application, installation file here:
  - Buoy Control GUI Application Download.
2. Open the application and type in the Buoy Server IP address in the Buoy server address: Field.
3. Type in the hydrophone serial number in the “icListen Serial Number Field”.

You should now be able to use the application to interface with the Buoy Server.

The current state of the hydrophone power will be greyed out. The “Shutdown” control reverse biases the hydrophone which turns it off. This should always be done before retrieving the hydrophones to help preserve their internal batteries. It can also be done during deployments to save power when not using the hydrophones. To see additional information about the power controls, hover over each button.

**Logging the internal sensor data will allow estimates of buoy power consumption and remaining battery life.**

Notes:

- Only one computer can connect to the buoy server address through the Buoy Server GUI. If the connection is not working on your computer, ensure no other connections have been made on a Buoy Server GUI.
- If using the Shutdown Power Control, ensure all hydrophones have logging turned off prior to shutting down.

## 8. Buoy Server IP Address Setup

The buoy server allows GPS steaming and control of power to the hydrophones. It uses a Serial Server to distribute the GPS output over the network. It comes with a pre-configured IP address, but this may need to be changed depending on user network configurations. There are two ways to do this, through the Server web interface or with the Netburner IPSetup tool. Instructions on using both options are detailed here.



## Server IP Address Update via Web Interface

1. Open the Buoy Server web interface using the default IP address provided by Ocean Sonics
  - Username: OceanSonics
  - Password: OceanSonics!
2. Update the Static IP address on the Network Page if required. **Other settings should not require updates. Changing them may prevent the buoy and the Buoy Control GUI from functioning properly.**



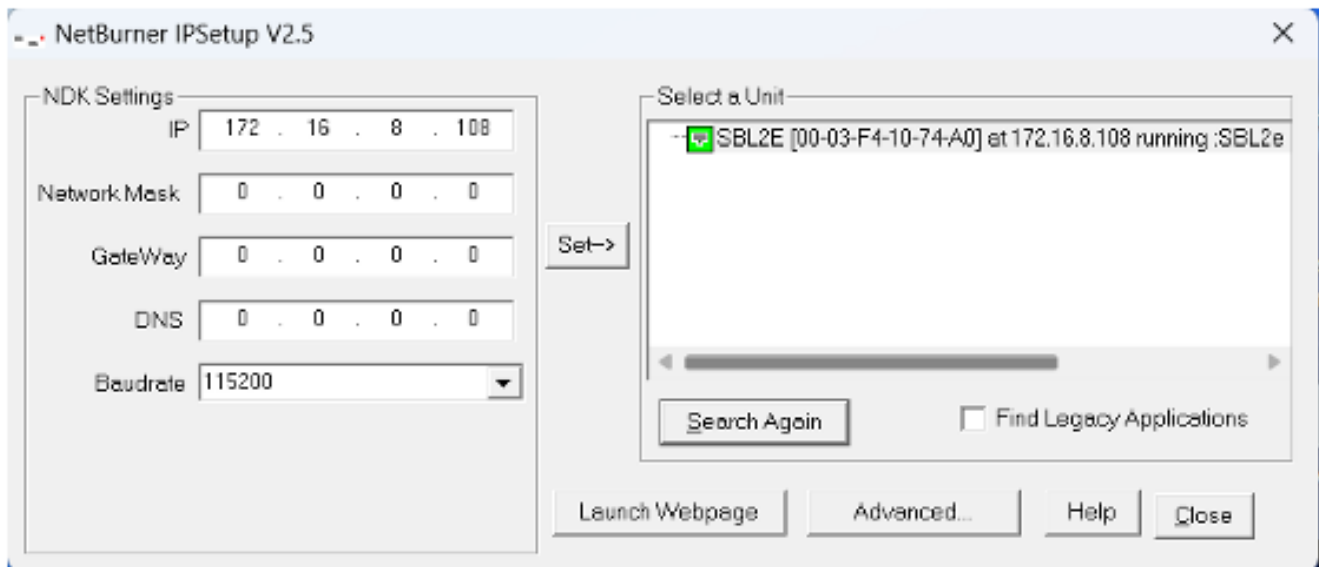
Network | [Serial](#) | [GPIO](#) | [Password](#)

Network		
Device name for DHCP:	<input type="text" value="SBL2E-751C"/>	
Addressing mode:	<input type="text" value="Static"/>	
<hr/>		
<b>IP Settings</b>	<b>Static Settings</b>	<b>Current Values</b>
Device IP address:	<input type="text" value="172.16.8.108"/>	172.16.8.108
Device subnet mask:	<input type="text" value="0.0.0.0"/>	0.0.0.0
Device gateway:	<input type="text" value="0.0.0.0"/>	0.0.0.0
DNS server:	<input type="text" value="0.0.0.0"/>	0.0.0.0
Ethernet link:	<input type="text" value="Normal"/>	Physical power cycle required after change
<hr/>		
<b>Incoming TCP Settings</b>	<b>PORT 0</b>	<b>PORT 1</b>
Listen for incoming network connections:	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Listening network port:	<input type="text" value="23"/>	<input type="text" value="24"/>
Timeout and disconnect after this many seconds of inactivity:	<input type="text" value="0"/>	<input type="text" value="0"/>
Allow new connection if the existing connection has been idle for this many seconds:	<input type="text" value="0"/>	<input type="text" value="0"/>
<hr/>		
<b>Outgoing TCP Settings</b>		
Make outgoing connections:	<input type="text" value="Never"/>	<input type="text" value="Never"/>
Connect on network port:	<input type="text" value="1000"/>	<input type="text" value="1001"/>
Connect/send to this address:	<input type="text" value="(Enter IP address)"/>	<input type="text" value="(Enter IP address)"/>
Timeout and disconnect after this many seconds of inactivity:	<input type="text" value="60"/>	<input type="text" value="60"/>
Retry failed outgoing connections after this many seconds:	<input type="text" value="10"/>	<input type="text" value="10"/>
<hr/>		
<b>GPIO TCP Effects</b>		
Set the following GPIO pin on connect (the pin must be set as GPIO out):	<input type="text" value="NA"/>	<input type="text" value="NA"/>
Make a connection when the following GPIO pin is true (the pin must be set as GPIO in):	<input type="text" value="NA"/>	<input type="text" value="NA"/>

## Server IP Address Update using IP Setup tool

NetBurner provides a tool for searching the local network for any NetBurner devices and configuring their IP addresses. This may be found at: (<https://www.netburner.com/download/ip-setup/>). This is also useful if the NetBurner IP address is lost.

To use the IP Setup tool, first download and install it. Searching for devices should return a result like in the below image with the currently set IP address. A new IP address may be configured by entering the desired value in the “IP” field on the left and clicking “Set”. The “Baudrate” and “Advanced” settings should not be needed.



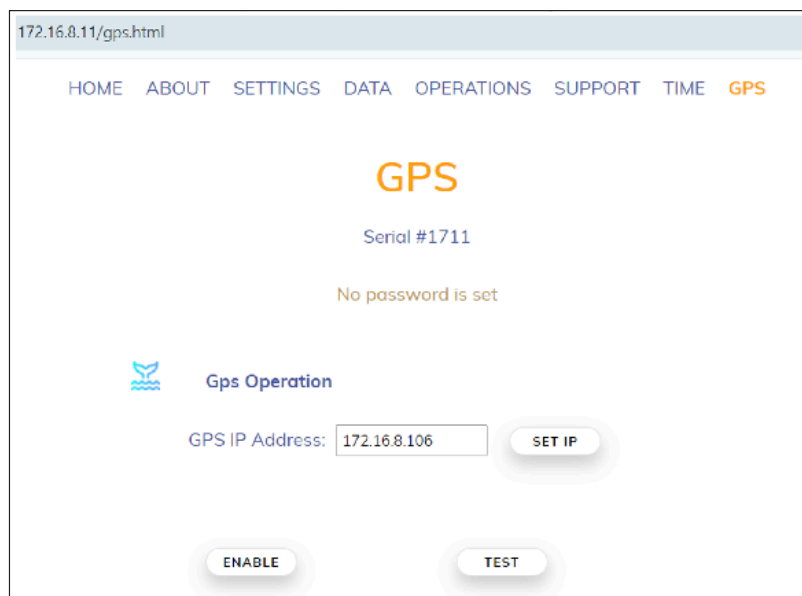
## 9. Recording GPS Data on an icListen Hydrophone

The GPS data can be recorded in a text file log on the icListen internal memory. To begin the log, follow the instructions below.

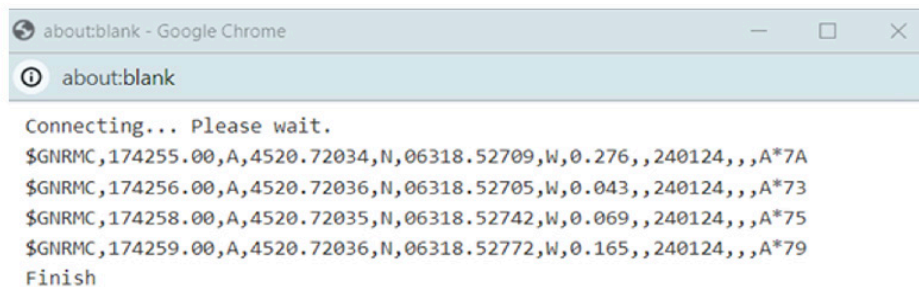
1. Ensure the icListen is connected to the buoy.
2. Connect to the buoy network on the computer.
3. Open the Marco application.
  - a. Double Click on the icListen IP address to open in a web browser.

Note: if the hydrophone shows up yellow, update IP address to work with the static IP from the Buoy Server.

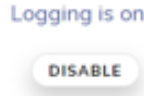
4. On a web browser, go to the address bar and type /gps.html after the icListen IP. example: <http://172.16.8.11/gps.html>



5. Enter the IP address of the buoy server.
6. Click SET IP.
7. Click the TEST button to ensure the GPS is working. The results should be: Connecting ...Please wait, 4 NMEA strings, followed by Finish.



8. Click **ENABLE** to begin the GPS text file log.
  - a. When you Enable logging, the “Logging is on” text will be displayed and the button changes to **DISABLE**.



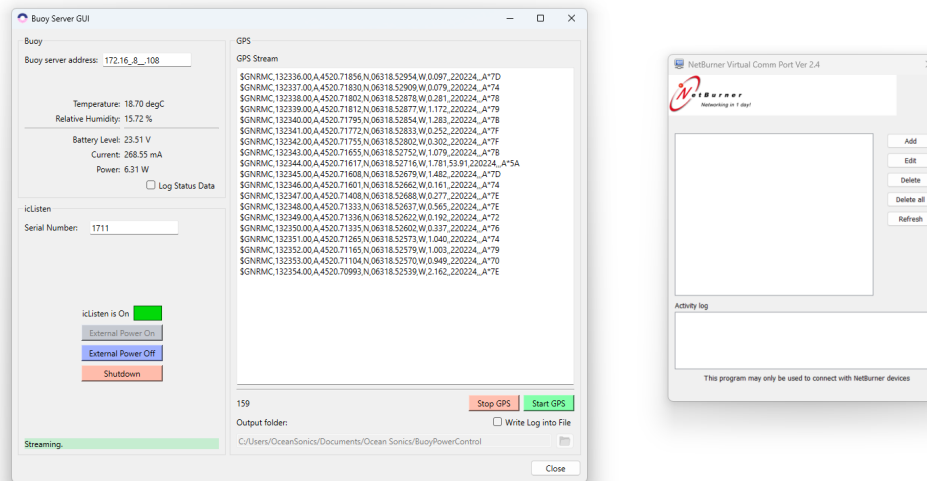
- b. To stop or turn off logging the GPS data, click the '**DISABLE**' button.

Go to the Retrieve Page to ensure the file is logging on the icListen. This is where the log may be retrieved from when logging is complete.

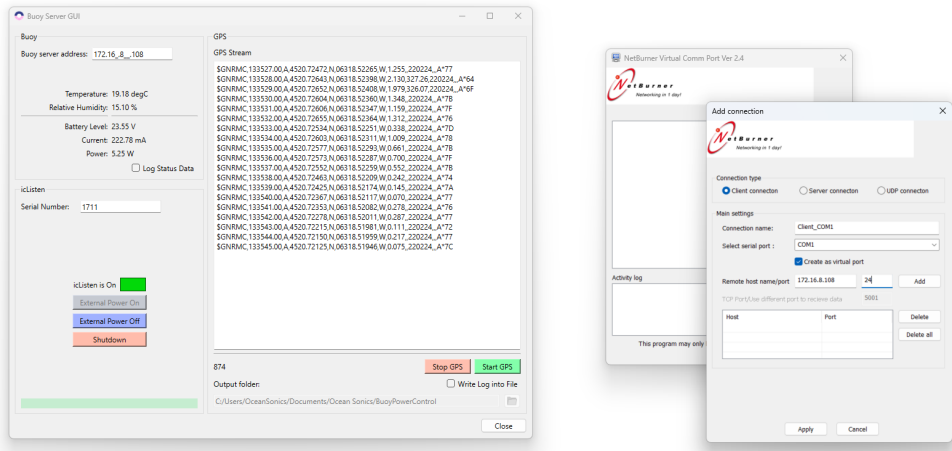
## 10. Using Buoy with PAMGUARD

The buoy GPS stream can be sent to Pamguard instead of the Buoy Control GUI. To do this, the [Netburner Virtual COMM Port](#) is needed. Download and install the software and then follow the below steps:

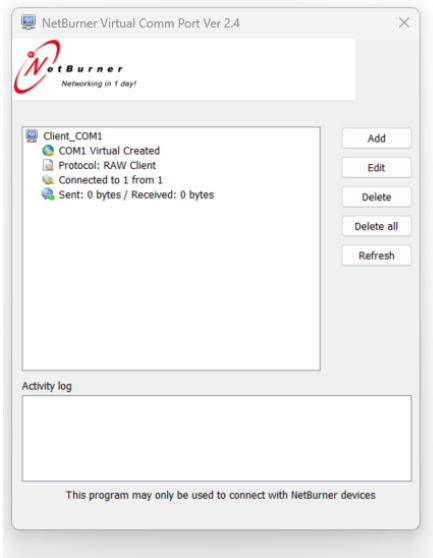
1. Open the Buoy Server GUI, click start GPS to make sure the NMEA messages are coming through.
2. Uncheck “Write Log into file” and click on “Stop GPS”.
3. Open Netburner Virtual Comm Port.



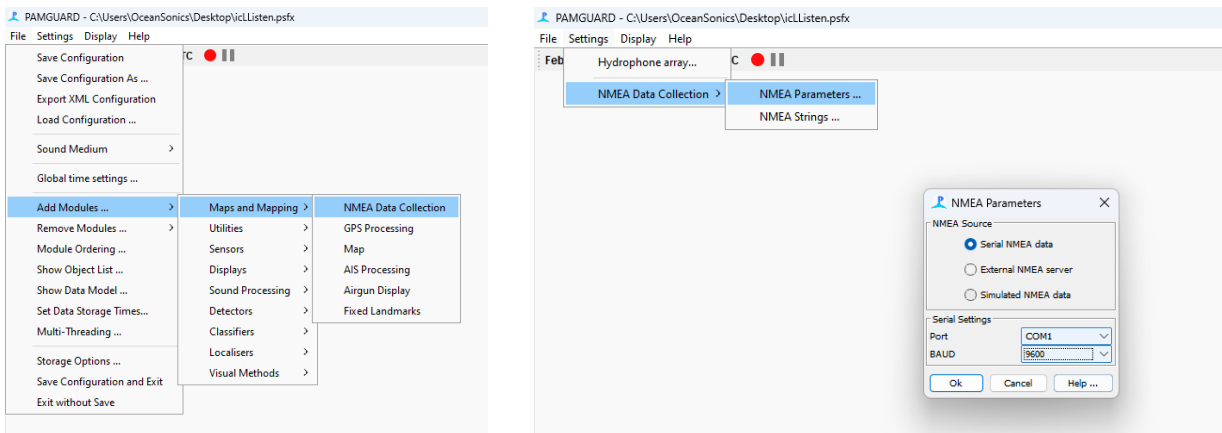
4. The first time it is used, the configuration will be empty.
  - a. Select Connection Type” as “Client”. The serial port number will depend on availability on the host PC but will default to COM1 if it available.
  - b. Type the buoy server IP address into the “Remote host name/port” field and use port 24. Click “Add” and then “Apply”



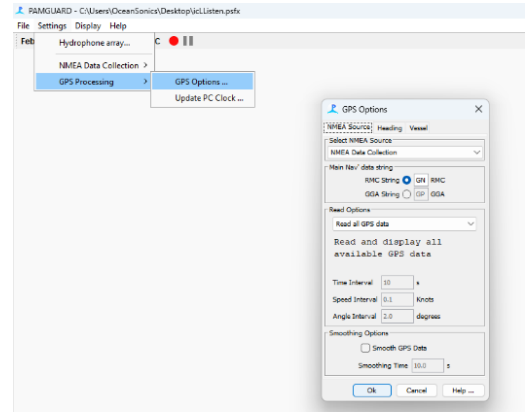
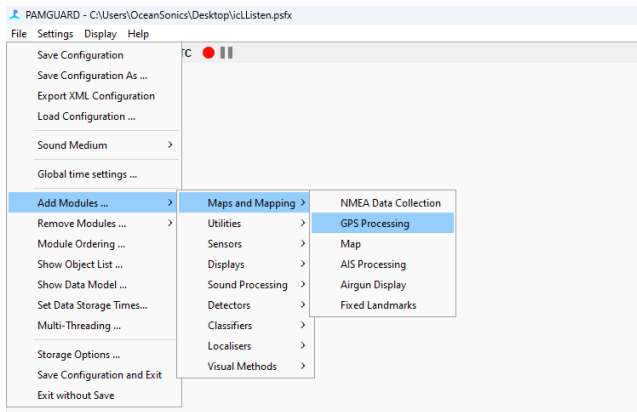
- Once the virtual COM port is set up, it should look like the image below. GPS data will be redirected to port COM1 and not be available from the Buoy Control GUI.



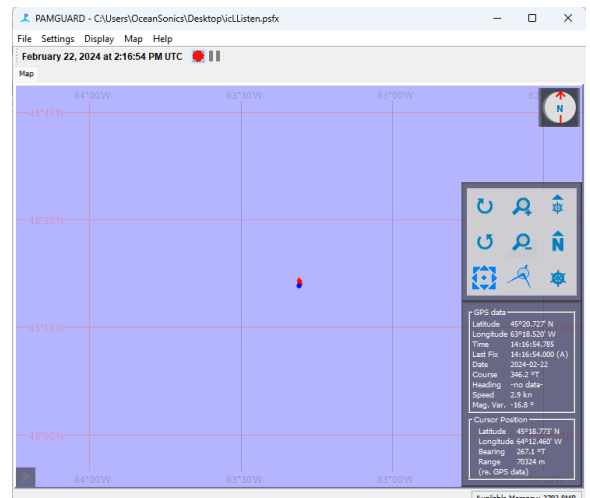
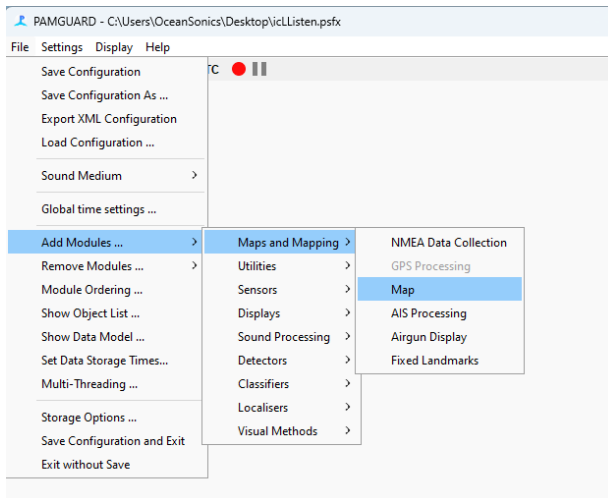
- Go to Pamguard and add the NMEA Data Collection Module. Set it up so it collects real NMEA data on serial port COM1 at 9600 baud.



7. Add the GPS Processing Module. Under Settings -> GPS Options, set the data string to "RMC String" starting with "GN" and click OK.



8. Add the Map module. The current coordinates from the GPS will show on the bottom right corner of the map.

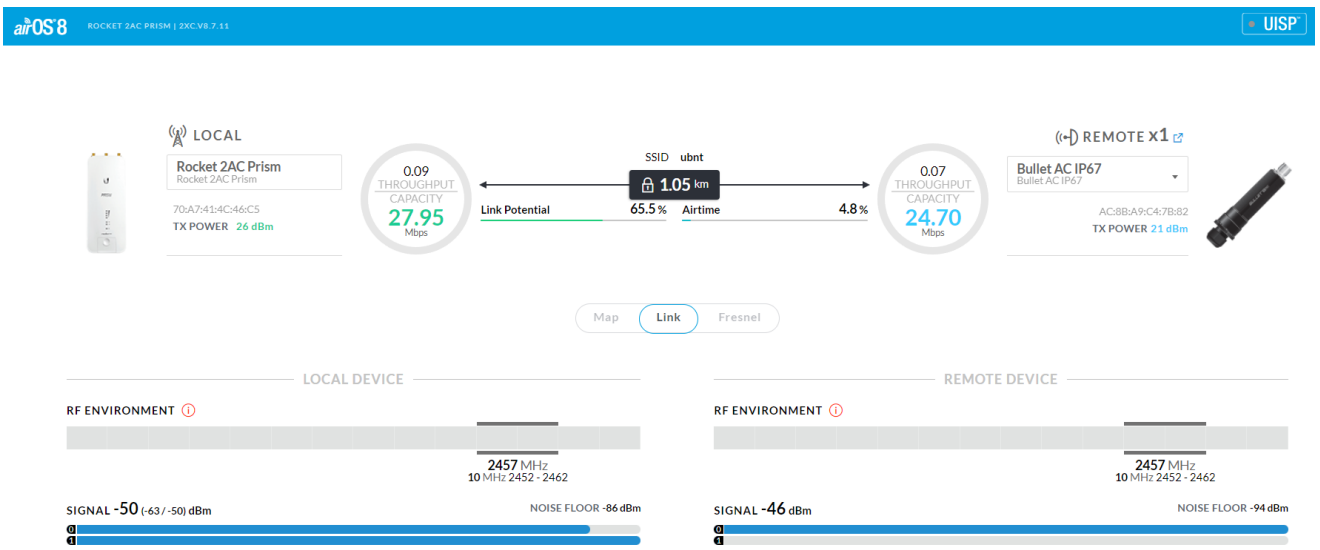
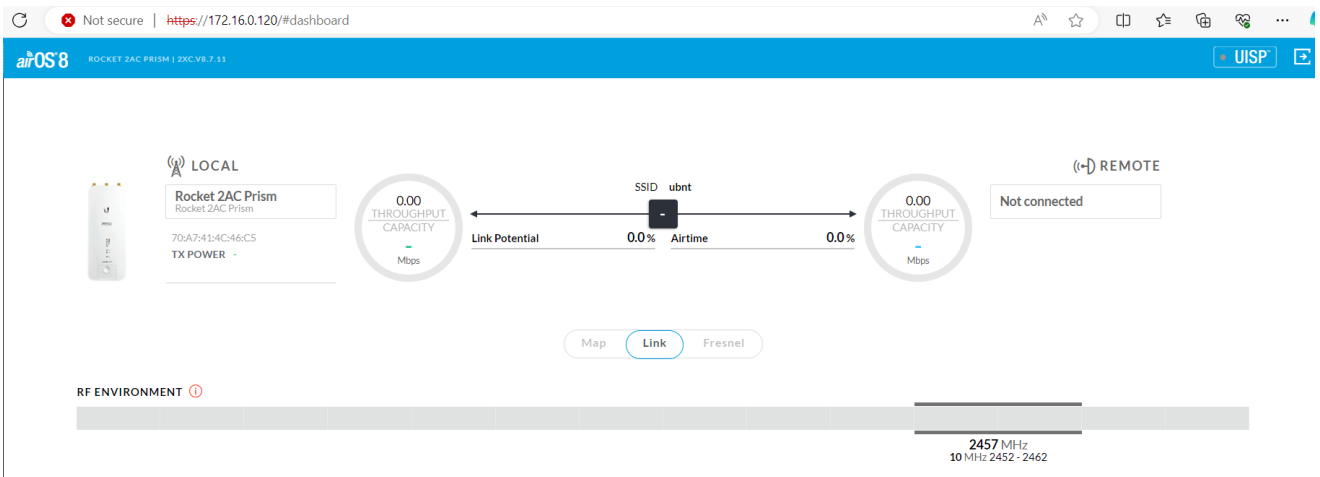


# 11. Radio Introduction and Web Interface

The Radio Buoy uses a Ubiquiti Bullet AC IP67 and 8 dB omnidirectional antenna. The Shore Side/ Access Point uses a Ubiquiti Rocket 2AC Prism with a 13 dBi omnidirectional antenna. Setup of the Access Point is straightforward, a shielded network cable should connect the radio to the PoE power supply and then the LAN port on the PoE supply should be connected to the computer or network.

For the radio network configuration, they will come with preset static IP addresses which should allow them to work immediately by plugging a computer directly into the network cable to the Access Point and configuring the computer IP address to be 172.16.8.X with net mask 255.255.255.0. If the Access Point is instead plugged into a network, the Access Point and Buoy Radio will work with an appropriately set up network. Their IP addresses may be changed or set to DHCP mode though the Buoy Server IP address may need to be changed for the buoy work in a different configuration.

When the Access Point is initially plugged in, the dashboard should look like the first screen grab below where it is showing no connection to the Buoy Radio. Once the Buoy Radio is plugged in and powered, it should automatically connect and the dashboard will look like the second image below.



## Ubiquiti Radio Wireless Settings

The Wireless settings can be accessed from the “Wireless” tab on the left of the main panel. This is where the Radio mode and frequency parameters may be changed.

The screenshot shows the 'Basic Wireless Settings' interface. On the left, there are several settings: 'ACCESS POINT' is a toggle switch set to 'ON' (green); 'PTP MODE' is a toggle switch set to 'OFF' (grey); 'CHANNEL WIDTH' is a dropdown menu set to '10 MHz'; 'FRAME DURATION' is a dropdown menu set to 'Flexible'; 'CONTROL FREQUENCY LIST, MHz' is a toggle switch set to 'OFF'; 'CENTER FREQUENCY, MHz' is a dropdown menu set to '2457'; 'CONTROL FREQUENCY, MHz' is a dropdown menu set to '2457'; and 'SSID' is a text input field containing 'ubnt'. On the right, there are more settings: 'COUNTRY' is a dropdown menu set to 'Canada'; 'ANTENNA' is a dropdown menu set to 'AMO-2G13 - 13 dBi'; 'ANTENNA GAIN' is a dropdown menu set to '13 dBi'; 'CABLE LOSS' is a dropdown menu set to '3 dB'; and 'OUTPUT POWER' is a slider set to '26 dBm'.

**ACCESS POINT** - On for the Rocket which is used as the Access Point here, off for the Bullet which is mounted on the Buoy and is the Station.

**PTP MODE** – Off for both radios

**CHANNEL WIDTH** – A narrower channel width can be useful in noisier RF environments but a wider channel will offer greater theoretical capacity. Optimal settings for Channel Width and Center Frequency will give the best connection speeds. It should be set to AUTO on the Buoy Radio and a defined value on the Access Point.

**CENTER FREQUENCY** – Defines central frequency of communication band. If there are other networks in the area using the same band, selecting a quieter area of the spectrum can improve connection speeds.

The settings on the right-hand side are for the antenna and should be correctly configured on receipt of the system.

## Ubiquiti Radio Network Settings

The Network Settings can be accessed from the “Network” tab on the left of the main panel.

The screenshot shows the 'Network Settings' interface. Under 'Network Role', 'NETWORK MODE' is a dropdown menu set to 'Bridge'. Under 'Configuration Mode', 'CONFIGURATION MODE' is a dropdown menu set to 'Simple'. Under 'Management Network Settings', 'MANAGEMENT IP ADDRESS' has radio buttons for 'DHCP' (selected) and 'STATIC'; 'DHCP FALLBACK IP' is a text input field containing '172.16.8.20'; 'DHCP FALLBACK NETMASK' is a text input field containing '255.255.0.0'; 'MTU' is a text input field containing '1500'. On the right side, there are several toggle switches: 'STP' is set to 'OFF'; 'MANAGEMENT VLAN' is set to 'OFF'; 'AUTO IP ALIASING' is set to 'ON'; 'DHCP OPTION 82' is set to 'OFF'; 'IPV6' is set to 'ON'; and 'IPV6 ADDRESS' has radio buttons for 'LOCAL' (selected) and 'STATIC', with 'SLAAC' also listed below.



**NETWORK MODE** – The Network Mode should be set as “Bridge”

**MANAGEMENT IP ADDRESS** – Will be set as Static on receipt of the system.

**DHCP FALLBACK IP** – Will be set to a predefined value.

Screenshots of the Network and Wireless settings for both radios are shown in Appendix F.

## Other Information

Other useful aspects of the web interface:

**Airmagic** – For helping determine the best settings for the Center Frequency and Channel Width. Note that the Management Wifi for both radios must be turned off to use it.

**Tools: Site Survey** – Gives an overview of the other networks and sources of in-band RF interference in the area.

**Tools: Speed Test** – Testing connection speed.

**Tools: Alignment** – Used for verifying the alignment of the antennas.

## 12. Ocean Sonics Pre-Deployment Sequence



**OSL Tip:** For a quick setup install Ocean Sonics' Software Programs *Marco, Lucy*, and Buoy Control GUI on your PC prior to setting up your Ocean Sonics Buoy.

The following steps should be followed when receiving a new system to verify functionality and prior to buoy deployment. The preconfigured IP addresses for the Buoy server, Access Point radio, and Buoy radio are given in Section 1, Buoy Introduction.

### Radio Buoy Setup and Verification

Note that the following tests may also be done as a benchtop test with the Tophat only and powering it from the hydrophone test cable and power supply. To do this, simply ensure that the Battery enable plug is removed and/or the Tophat is fully removed and disconnected from the buoy body and then skip to Step 5. **External power should not be applied to the buoy if the batteries are connected but there is protection in place should that happen. The buoy should continue to function normally.**

1. Open Buoy and install batteries in battery cap. Follow the process outlined in Appendix A – Buoy battery install. **It is critical that the o-ring and o-ring sealing surfaces be properly cleaned and lubricated.**
2. Ensure that the battery and hydrophone connections to the tophat are completed when reinstalling it.
3. Before tightening tophat lifting eye nuts, measure the battery voltage at the MCBH8F Auxiliary

Port to confirm battery charge and operation. Fresh alkaline batteries should give a voltage of 26V. First install Power Enable plug. See Appendix C for 8-pin port pinout. Battery voltage should be measured between pins 1 and 7. **Remove the Power Enable plug any time the buoy is not in use to preserve battery life.**

4. If the battery voltage is good, tighten the lifting eye nuts and insert the Power-Enable plug.
5. At this point you may install the buoy mast or you may choose to leave the mast uninstalled and simply plug in the Buoy Radio cable.
6. Connect a test cable from the Auxiliary Port to a laptop Ethernet port. The laptop should be set to a static IP 172.16.8.X (unless the buoy and radio IP addresses have been reconfigured by the user).
7. Open the Buoy Control GUI software and enter the Buoy Server IP. Click on “Start GPS” and the current GPS module output should begin streaming on the GUI. See the “Buoy Control GUI Introduction” section for an overview of the application.
8. Check that the Bullet radio is powered and operational by accessing the radio browser interface with the pre-set radio IP address into a browser. The username and password for the radio should be “ubnt”, and “OceanSonics!”.
9. Connect a hydrophone with an extension cable to the Hydrophone Port. Open Marco and refresh to check for connected hydrophones. If the hydrophone is off it should take approximately 20 seconds to power on and be visible in Marco. See Appendix B if the hydrophone network settings need to be configured.
10. Open the hydrophone web interface and check the battery level. Confirm that it is full or charging. **Note that hydrophones should be fully charged before deployment to maximize buoy battery life.**
11. Go to the Buoy Control GUI and click the “External Power Off” button. Go back to the hydrophone web interface and confirm that the battery status has changed from “Charging” or “Not Charging” to “Discharging”.
12. Go to the spectrogram and do a tap test (tap gently on the hydrophone element with your finger and check that you see a response in the spectrograph and FFT plots).
13. Click “External Power On” if ready for deployment, or else click “Shutdown” to power down the hydrophone.
14. Disconnect the Power Enable plug unless deploying immediately.

That completes the buoy functionality test. Next, the radio communication should be tested when receiving a new system or preparing for a deployment.

## Radio Bridge Setup and Verification

The radios are provided with a pre-set configuration that should allow them to work out of the box. To test them, find a location with direct line of sight between the buoy and base station radio. The access point should be mounted to a post (or set somewhere stable if this is just a quick test of functionality) and a computer or mobile phone is needed. A parking lot or even a large indoor space should be sufficient.

1. Review the radio quick-start guides that come packaged with the radios.
2. Connect the Access Point radio and the PoE box with a shielded network cable. Plug the PoE box into a power supply and confirm that the Access Point “Power” light comes on.
3. Connect a second network cable from the PoE box to a computer and configure the computer’s IP address as 172.16.8.XX and the network mask as 255.255.255.0.
4. Enter the Access Point IP address in a browser window. The radio may take 1-2 minutes to fully boot up and for the browser interface to be accessible.
5. The browser interface should show an image of the Rocket Access Point and state that there is no connection.
6. Place the buoy on a flat surface and install the antenna mounting post, antenna, radio, and cable. Apply power to the buoy by installing the RED “Power Enable” plug.
7. Connect a hydrophone to the available topside port using an extension cable.
8. In 1-2 minutes time, the Access Point should find the buoy and the web interface will show it has made a connection with the buoy. At this point, the web interface for the buoy side radio should be available from the laptop as well. It should look similar to the Access Point, but with the connection direction reversed.
9. At this point, both radios should be visible on the UISP app. A basic version of the web interface is accessible in the app which can be useful for confirming radio functionality in the field.
10. With the connection made, the hydrophone should be accessible at the IP address previously set up. It should also be visible using the Marco lookup tool or using Lucy software. If there are significant interfering RF signals in the area the connection speed could be limited which could make streaming .wav data difficult but .fft data should work even with very limited connection speeds.

## 13. Access Point Radio Installation

The Access Point radio is a Ubiquiti R2AC-PRISM that operates at 2.4 GHz. It is used with either a Sector or Omnidirectional antenna. The antenna comes with adjustable clamps and should be mounted on a post of approximately 1.5” (40mm) diameter. Ubiquiti recommends using two ethernet surge protectors to guard against ESD events: one at the antenna end, and one near where the cable enters the interior area. Follow Ubiquiti’s installation instructions for the install of the radio, shielded cabling, and PoE adapter. Having a direct line of sight to where the buoy will be located is important and mounting the antenna on a high point will improve the radio bridge reliability and speed.

Once the radio and antenna are installed and powered on, the UISP mobile app may be used to quickly confirm the radio operation. The radio will create a management wifi network when it turns on which the app can find and connect to. The app provides a slightly limited version of the web interface for the radio setup and control.

## 14. Assembling Buoy for Deployment

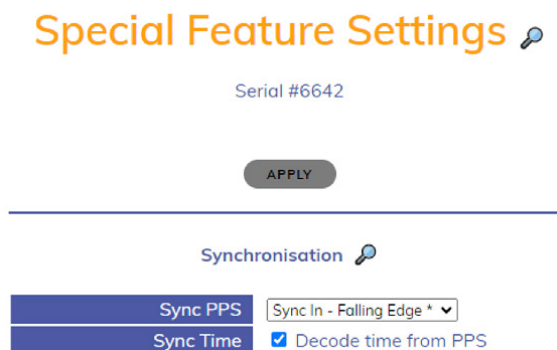
Deployment of the Buoy involves first preparing the hydrophone(s), cabling, strength member, buoy, heave plate, and anchor.

Buoy assembly and deployment should be performed by an experienced professional, with knowledge on deploying oceanographic equipment. Strain relief on cable connections and securing hydrophones should be done with care. Failure to follow best practices could result in damage.

1. Place fresh batteries in buoy or ensure that current battery state is known if they have been previously used.
2. Attach cables and hydrophones in configuration for deployment (see **Appendix F** for example).
3. Install Buoy Mast and Buoy Radio.
4. Complete the tests in the **Ocean Sonics Pre-Deployment Sequence**.
5. Confirm that all components are functional (Buoy Server, Radio, Hydrophone).
6. Configure Hydrophone(s) settings for deployment. **(Note that the hydrophone settings may also be checked/changed once the buoy is deployed and the radio link is active).**

a. Set icListen to Synchronise to GPS.

- i. Under Special Features ensure **Sync In – Falling Edge** is selected and **Decode Time from PPS** is checked.



- ii. If the buoy is in a location where it can receive a GPS signal, the Home Page should indicate the hydrophone is synchronising or is Synchronised to PPS (see below).

**PPS Sync:** Synchronised to PPS (Offset = 0.00  $\mu$ s)

- iii. When it has a GPS sync, the time will indicate it was set by PPS. (This can take up to 5 minutes for a hydrophone to obtain GPS synchronisation. Ensure the correct date and time are displayed.)

**icListen Time:** Thu, 22 Mar 2018 14:13:19 GMT (Set by PPS)

b. Set up Sampling Rates for icListen

- i. Under Settings Tab -> Data Collection, select the settings for deployment -

## Deployment

**Note: For safe deployment ensure the vessel engine is stopped during deployment.**

1. Once the buoy is prepared for deployment, verify from the shore side that the radio link is operational, and that the Buoy Server and Hydrophone are accessible over the network. It may not be possible to do this in all deployment scenarios.
2. Start deployment with bottom of array cables.
  - a. Lower the bottom weight on end of cables into water.
  - b. Slowly feed in the hydrophones and cables of the array.  
Special care should be taken with the heave plate and hydrophones.
  - c. The Buoy should be the last component lowered into the water.
3. With the buoy in the water, test from the shore side that the radio link is functional. Test data streaming and file downloading to get an estimate of radio link speed.

With the buoy deployed, the hydrophone should be accessible from the shore side computer or network to stream or change settings.

## 15. Recovery of the Buoy

The Buoy recovery requires 2-3 individuals. It is best to have 1-2 people retrieving the equipment from the water while another person is laying the equipment out on the deck as it is retrieved taking care of hydrophones and minimizing tangling of the array.

1. Before retrieving the buoy, use the Buoy Control GUI to reverse bias the hydrophones to preserve their batteries for when the buoy is powered off and they are removed.
2. Transit to buoy.
3. Use a gaff to hook the buoy by its top ring. Tie a rope around the top ring to secure the buoy.
4. Retrieve the buoy from the water.
  - a. If you wish, you may remove the buoy mast to make more space on deck for the hydrophone retrieval.
  - b. Lay the buoy on deck while holding onto the rope attached to the cabled array below. A winch can be used to allow easier retrieval of buoy on deck.
  - c. Slowly pull out the heave plate and recover the remaining array by hand, with special care handling hydrophones.
5. Plug a Test Cable into the Auxiliary Port and check if the hydrophones are off. If they are not:
  - a. Turn off recording on all hydrophones- using the Web Browser or Lucy.
  - b. Use the Buoy Control GUI to reverse bias the hydrophones.
6. If a laptop is not available when retrieving hydrophones, they may alternatively be powered down by using the hydrophone reset tool:
  - a. Attach test cable to the hydrophone.
  - b. Insert the reset tool into the test cable power jack.

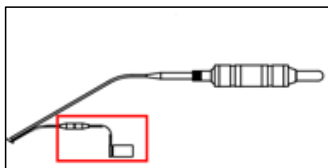


Figure 2: Plugging power off tool into test cable.

7. Turn off the Ocean Sonics Buoy by removing the Power Enable plug.
8. Rinse the Buoy, hydrophones, and equipment with fresh water.

## 16. GPS Position Data Retrieval

If GPS data was being logged locally on a connected computer, the log will be in the folder specified in the Buoy Control GUI. If GPS data was being logged on the hydrophone, it may be retrieved by connecting the hydrophone to a computer or network, using Marco to access the interface, and downloading the file from the file retrieval page (Data dropdown -> Retrieve). If the IP address is known, the log file may also be retrieved using an FTP client such as FileZilla.

### FTP Client (FileZilla)

1. Fill out the fields as shown below with the password being root.

Host	<input type="text" value="192.168.1.1"/>	Username:	<input type="text" value="root"/>	Password:	<input type="password" value="••••"/>	Port	<input type="text" value="22"/>	<input type="button" value="Quickconnect"/>	<input type="button" value="▼"/>
------	--	-----------	-----------------------------------	-----------	---------------------------------------	------	---------------------------------	---	----------------------------------

2. Choose a destination folder on your computer and copy over the log files in the log folder following the steps outlined for downloading hydrophone data.

## 17. Maintenance

- The buoy should be thoroughly rinsed with fresh water after each deployment to remove saltwater and debris.
- The buoy should only be opened when it is safe to do so in a clean environment without chance of water entering the inside.
- **Logging the buoy status gives information on the battery voltage state and current draw. They can be used to estimate the remaining battery life if tracked for each deployment. If this is not used, keeping a record of the powered on hours and estimating a power consumption of 10W should give a reasonable and slightly conservative estimate of the battery capacity usage.**

## 18. Contact Ocean Sonics Ltd.

**To download Ocean Sonics Software please visit:** <https://sites.google.com/a/oceansonics.com/ocean-sonics-resource-site/>

### Service

To request an RMA or technical support  
Email: [support@oceansonics.com](mailto:support@oceansonics.com)  
Phone: 1-902-655-3000

### Sales

For general sales inquiries  
Email: [sales@oceansonics.com](mailto:sales@oceansonics.com)  
Phone: 1-902-655-3000

### Website

<https://OceanSonics.com>

### Mailing and Shipping Address

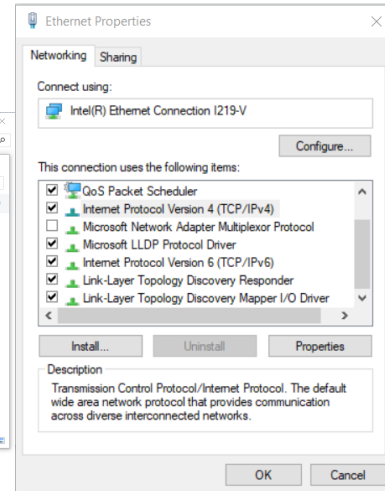
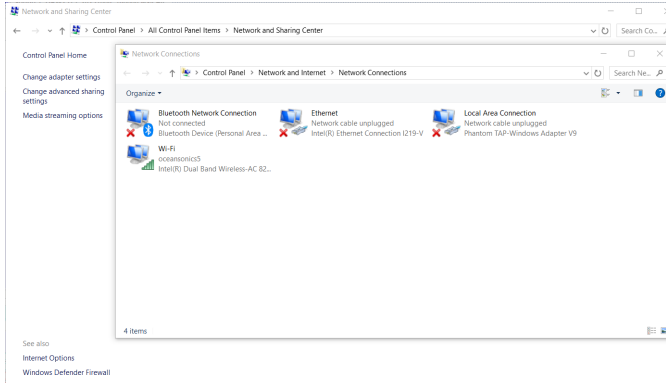
Ocean Sonics  
110 Parkway Dr.  
Truro Heights, NS Canada  
B6L 1N8

## 19. Appendix A

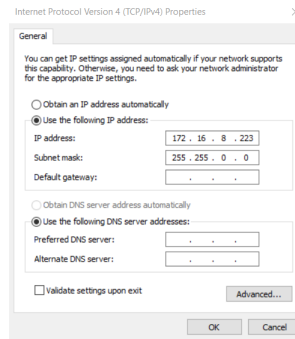
If you are having trouble accessing the Buoy Control GUI and the radio, plug the buoy Auxiliary Port directly into a computer using an ethernet test cable and follow the below steps to ensure your computer network settings are set up correctly.

Set up your computer to access the Buoy Server Network [default settings]

1. On the computer Open Control Panel App.
2. Go to Network and Sharing Center.
3. Change adapter settings: Click on Ethernet.



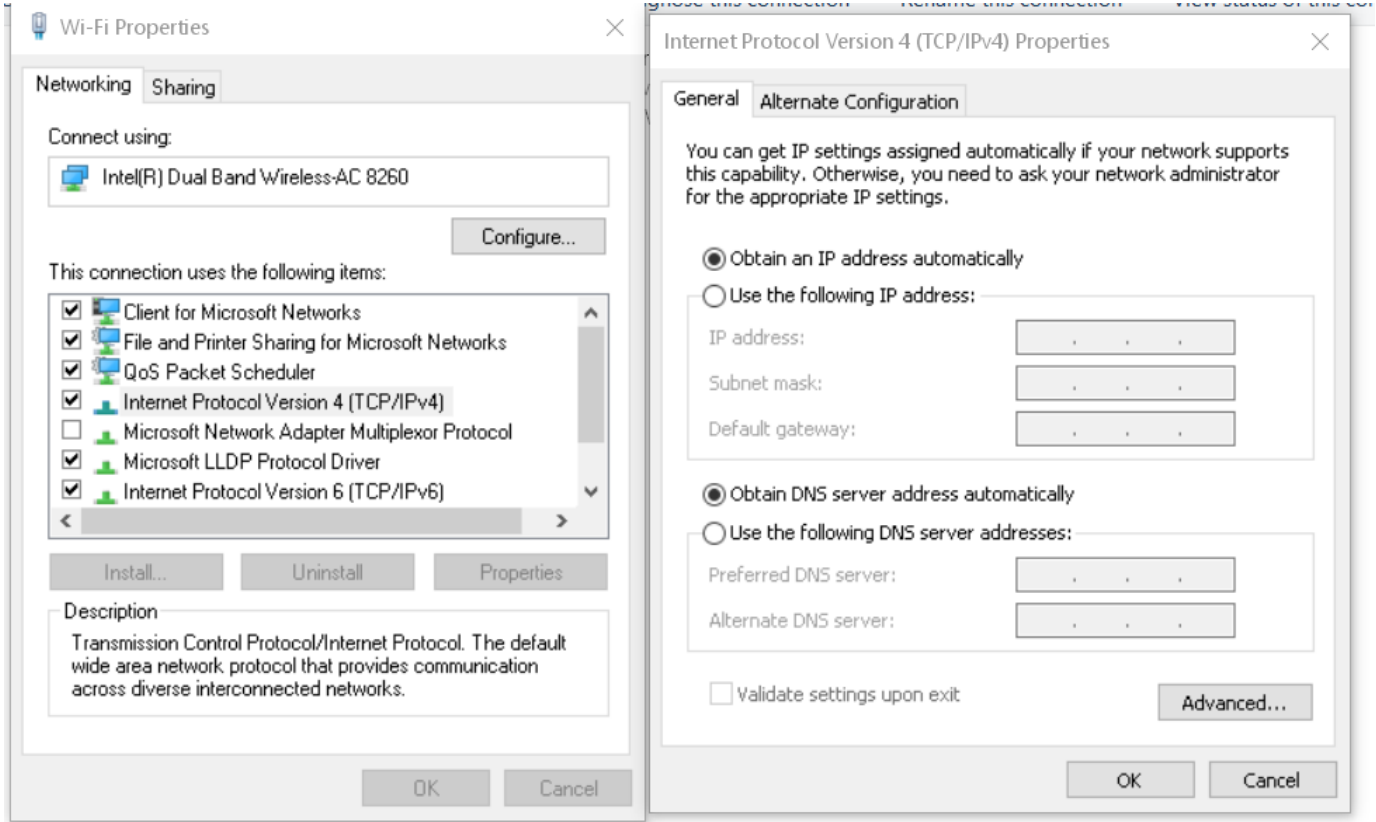
- a. Under Ethernet Properties
- b. Choose Internet Protocol Version 4 (TCP/IPv4)
- c. Click on Properties
- d. Choose Use the following IP address:
  - i. IP address: 172.16.8.223 (Assuming the preset buoy IP address has not been changed)
  - ii. Subnet mask: 255.255.255.0
- e. Click OK



4. Go to Network Connections: Control Panel\Network and Internet\Network Connections.
5. Right Click on Wi-Fi.



6. Choose Properties.
7. Click on Internet Protocol Version 4 (TCP/IP4).
8. Click on Properties.

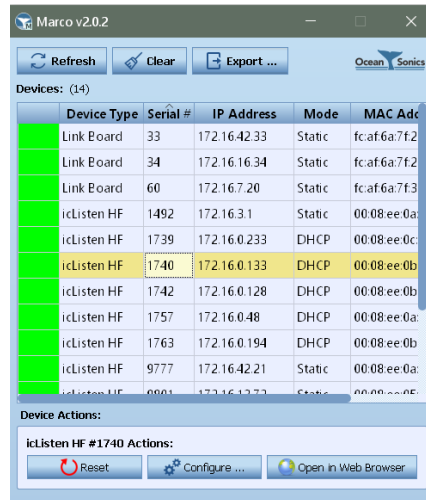




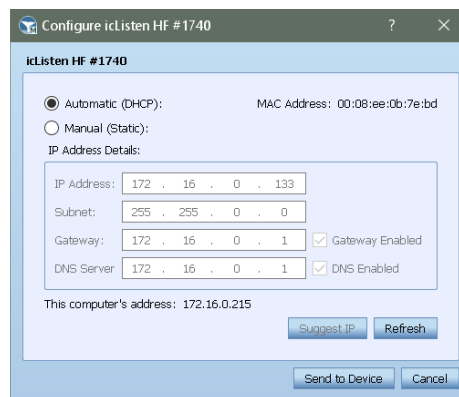
## 20. Appendix B

### Marco Settings - DHCP

a. Click on the hydrophone serial number.



b. Click **Configure...**



c. Choose **Automatic (DHCP)**.

d. Click **Send to Device** and wait for settings to be successfully sent to the unit.

e. Continue this for each unit so they are all set to DHCP IP addresses.

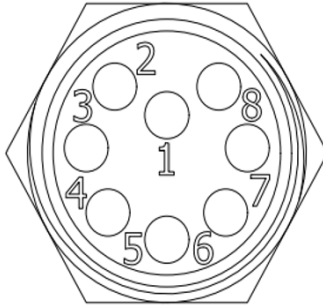
f. Units should all show up green indicating they are ready.

## 21. Appendix C

### Confirming Voltages

A voltmeter can be used to confirm the proper voltage is being supplied to the array on the buoy.

1. Place the negative voltmeter lead (black) into pin 1 of the MCBH8F bulkhead connector on the battery pack end cap for the common connection (pinout below).
2. Place the positive voltmeter lead (red) into pin 7 (pinout below).



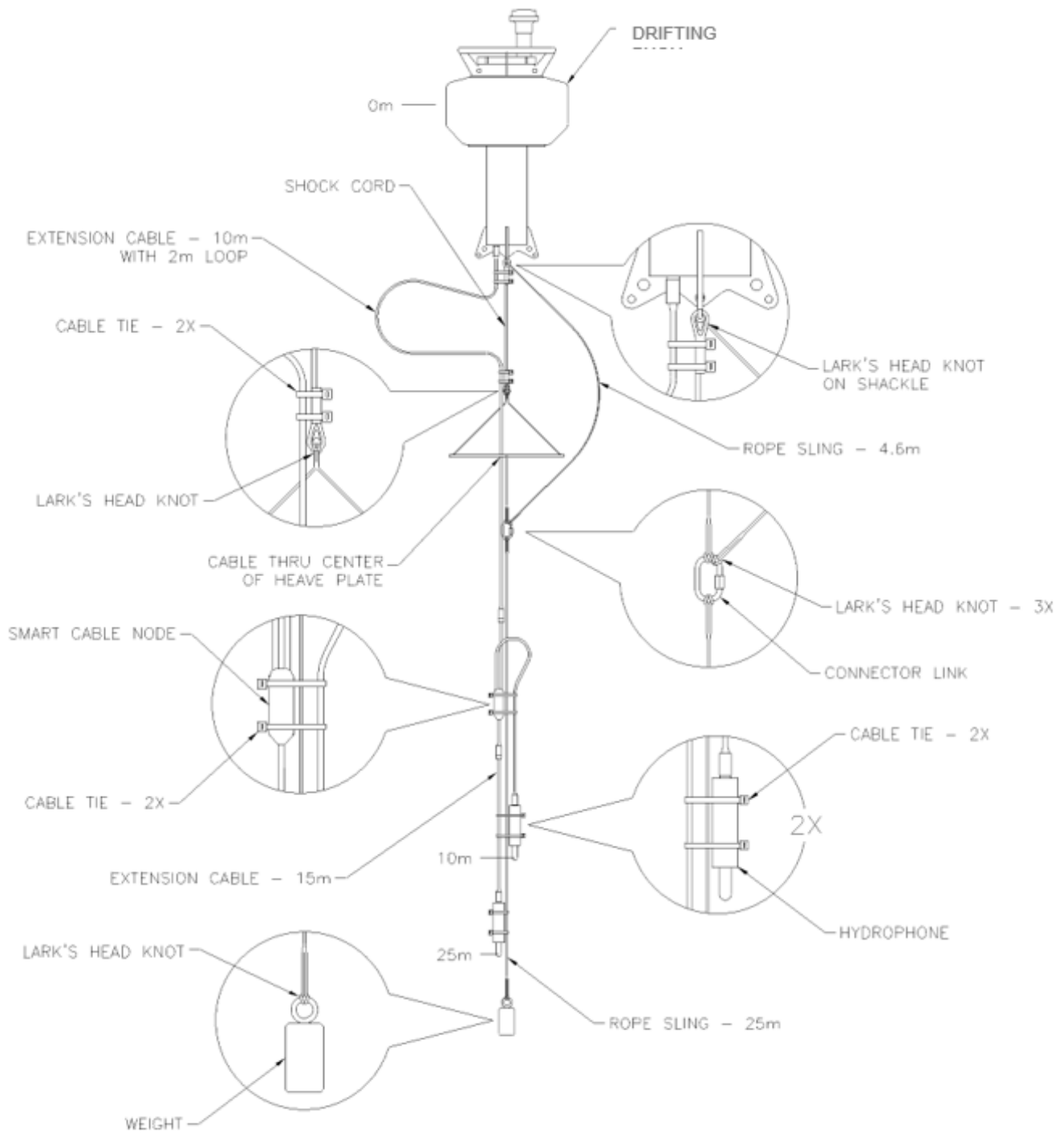
#### MCBH8F Bulkhead Connector Pinout

Fully Charged Batteries should measure approximately ~ 25 V.

**Batteries should not be discharged past 21 V.**

## 22. Appendix D


### Sample Buoy Assembly



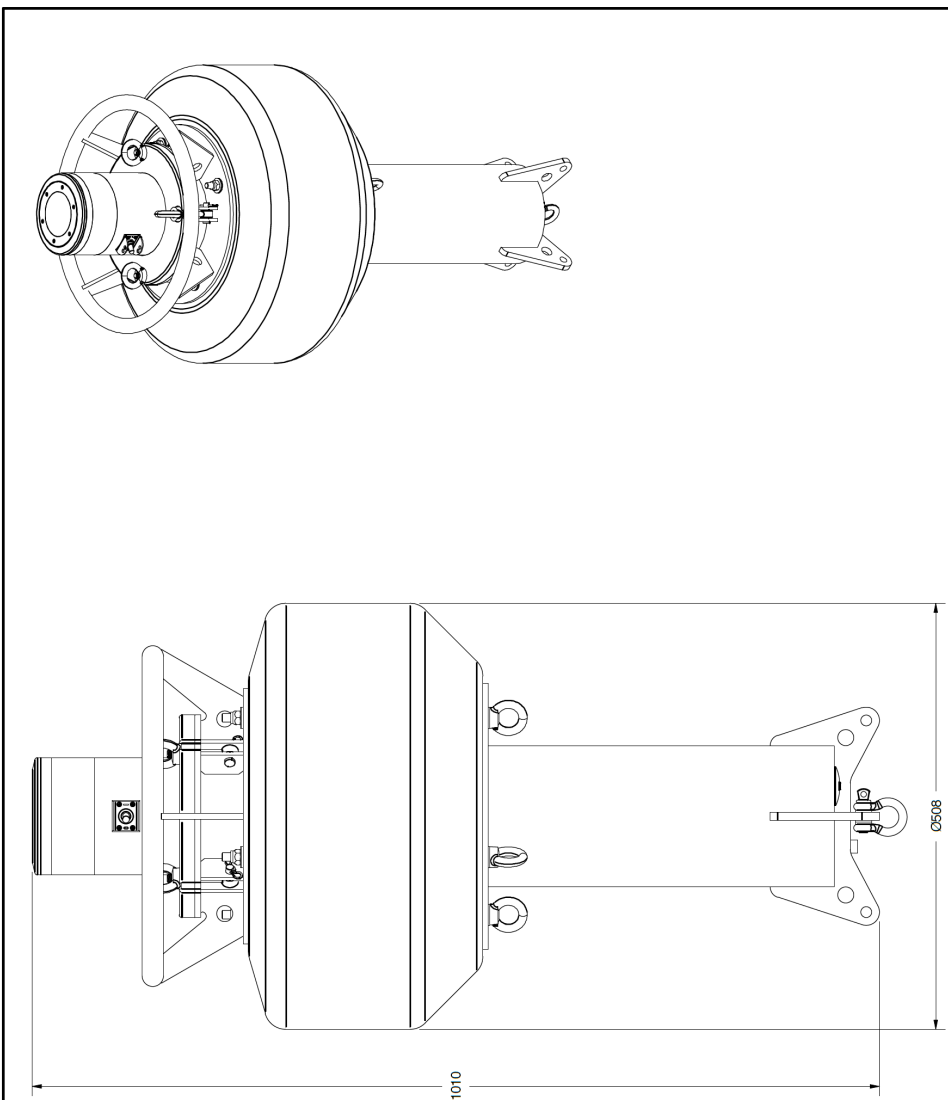
# 23. Appendix E

## Technical Drawing

PIN ASSIGNMENT	
PIN	SIGNAL
1	DC RTN
2	GND
3	TX-
4	TX+
5	RX-
6	RX+
7	DC PWR
8	SYNC



FEMALE SOCKETS  
FACE VIEW




**NOTES:**

- CONNECTOR: SUBCONN MCBH-8M
- MATERIAL - HULL: ALUMINIUM
- MATERIAL - FLOAT COLLAR: IONOMER FOAM
- RESERVE BUOYANCY: 25 Kg
- NOMINAL BATTERY VOLTAGE: 24.0
- NOMINAL BATTERY CAPACITY: 10 Ah

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UNLESS OTHERWISE NOTED:  
 1. DIMS IN MILLIMETRES  
 2. XX ± 0.05  
 3. XX ± 0.25  
 4. MAX. 0.05  
 5. MAX. 0.25  
 6. ECCENTRICITY 0.075 MAX  
 7. SURFACE FINISH: 125



**Ocean Sonics Limited**  
 NOVA SCOTIA, CANADA  
 WWW.OCEANSONICS.COM

**WiFi RADIO BUOY**  
 PUB-BOS-W

REV. SCALE SHEET  
 A 1:1 1 OF 1

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## 24. Appendix F

Radio settings as shipped to customer for Access Point (Rocket) and Station (Bullet).

Rocket settings:

**Basic Wireless Settings**

---

ACCESS POINT	<input checked="" type="checkbox"/> ON	COUNTRY	Canada
PTP MODE	<input type="checkbox"/> OFF	ANTENNA	AMO-2G13 - 13 dBi
CHANNEL WIDTH	20 MHz	ANTENNA GAIN	13 dBi
FRAME DURATION	Flexible	CABLE LOSS	2 dB
CONTROL FREQUENCY LIST, MHz	<input type="checkbox"/> OFF	OUTPUT POWER	<input type="range" value="22"/> 22 dBm
CENTER FREQUENCY, MHz	2447		
CONTROL FREQUENCY, MHz	2447		
SSID	ubnt		

**Wireless Security**

---

WPA2 SECURITY	<input checked="" type="radio"/> PERSONAL <input type="radio"/> ENTERPRISE [?]	WIRELESS NETWORK PROTECTION [?]	<input type="checkbox"/> OFF
WPA2 PRESHARED KEY	•••••••• <input type="button" value="SHOW"/>	MAC ACL	<input type="checkbox"/> OFF

**Signal LED Thresholds**

---

THRESHOLDS, dBm: [?]	LED0	LED1	LED2	LED3
	- 94	- 80	- 73	- 65

---

**Network Role**

---

NETWORK MODE	Bridge
--------------	--------

**Configuration Mode**

---

CONFIGURATION MODE	Simple
--------------------	--------

**Management Network Settings**

---

MANAGEMENT IP ADDRESS	<input type="radio"/> DHCP <input checked="" type="radio"/> STATIC	STP	<input type="checkbox"/> OFF
IP ADDRESS	172.16.8.20	MANAGEMENT VLAN	<input type="checkbox"/> OFF
NETMASK	255.255.255.0	AUTO IP ALIASING	<input checked="" type="checkbox"/> ON
GATEWAY IP	172.16.0.1	DHCP OPTION 82	<input type="checkbox"/> OFF
PRIMARY DNS IP		IPV6	<input checked="" type="checkbox"/> ON
SECONDARY DNS IP		IPV6 ADDRESS	<input checked="" type="radio"/> LOCAL <input type="radio"/> STATIC <input type="radio"/> SLAAC
MTU	1500		

Traffic Shaping

---

## Bullet settings:

### Basic Wireless Settings

ACCESS POINT	<input type="checkbox"/> OFF	COUNTRY	Canada <input type="button" value="CHANGE"/>
PTP MODE	<input type="checkbox"/> OFF	ANTENNA	Custom.. <input type="button" value="v"/>
BAND	2.4 GHz <input type="button" value="v"/>	ANTENNA GAIN	8 dBi
CHANNEL WIDTH	Auto <input type="button" value="v"/>	CABLE LOSS	2 dB
SSID	ubnt <input type="button" value="SELECT..."/>	OUTPUT POWER	<input type="range" value="14"/> 14 dBm
LOCK TO AP MAC	<input type="text"/>	AUTO ADJUST DISTANCE	<input checked="" type="checkbox"/> ON
		DISTANCE [?]	<input type="range" value="0.6"/> 0.6 km.

### Wireless Security

WPA2 SECURITY  PERSONAL  ENTERPRISE [?]

WPA2 PRESHARED KEY

Secondary SSID

### + Advanced

#### Network Role

NETWORK MODE

#### Configuration Mode

CONFIGURATION MODE

### Management Network Settings

MANAGEMENT IP ADDRESS	<input type="radio"/> DHCP <input checked="" type="radio"/> STATIC	STP	<input type="checkbox"/> OFF
IP ADDRESS	<input type="text" value="172.16.8.21"/>	MANAGEMENT VLAN	<input type="checkbox"/> OFF
NETMASK	<input type="text" value="255.255.255.0"/>	AUTO IP ALIASING	<input checked="" type="checkbox"/> ON
GATEWAY IP	<input type="text" value="172.16.0.1"/>	DHCP OPTION 82	<input type="checkbox"/> OFF
PRIMARY DNS IP	<input type="text"/>	IPV6	<input checked="" type="checkbox"/> ON
SECONDARY DNS IP	<input type="text"/>	IPV6 ADDRESS	<input checked="" type="radio"/> LOCAL <input type="radio"/> STATIC
MTU	<input type="text" value="1500"/>		<input type="radio"/> SLAAC

Traffic Shaping

IP assignment:	Manual
IPv4 address:	172.16.8.100
IPv4 mask:	255.255.255.0