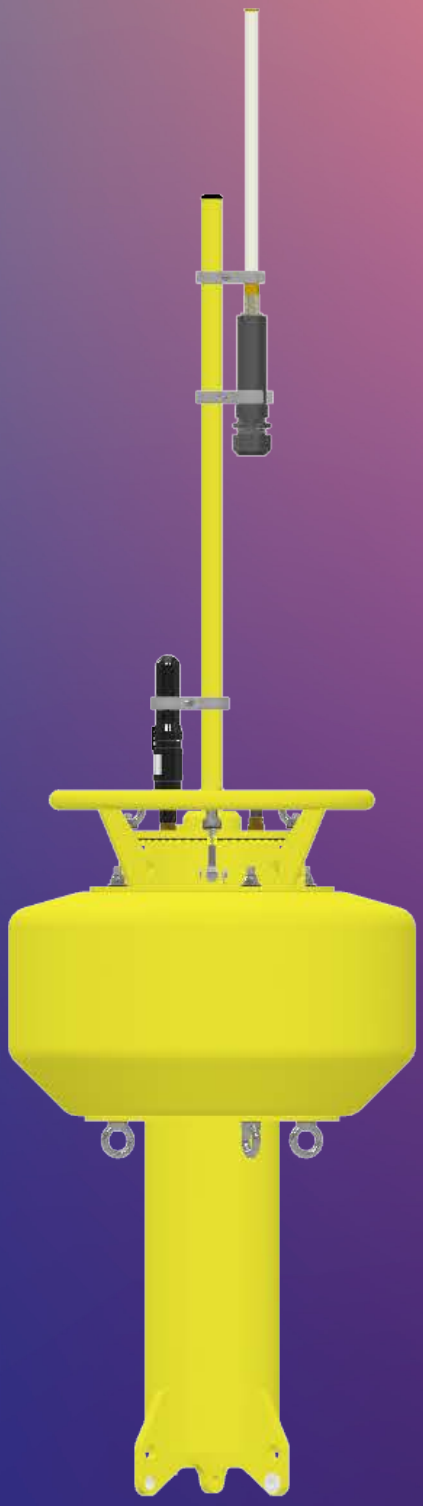
110 Parkway Drive, Truro Heights
Nova Scotia, Canada, B6L 1NB
support@oceansonics.com
www.OceanSonics.com

# Acoustic Buoy User Guide

Version 3.0



OCEAN SONICS

Giving Our Oceans A Voice

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# 1. Introduction

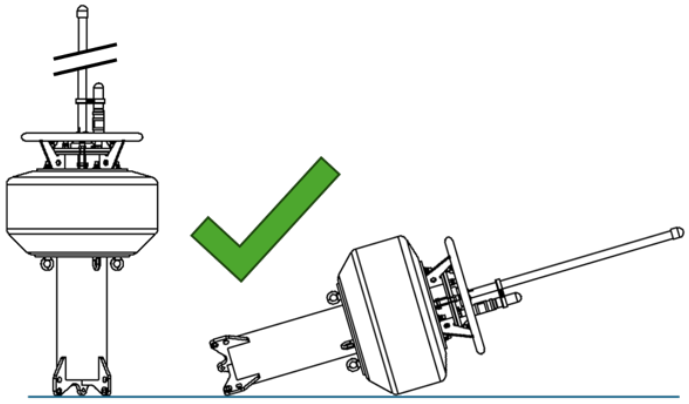
The Ocean Sonics Acoustic Buoy provides a way to deploy one or more synchronized icListen Smart Hydrophones and stream data remotely. The buoy is small, lightweight, and can be deployed from a small vessel by two people. This solution combines power, wireless communication, and time synchronization with 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 (long range version only). Environmental conditions and differing radio setups will produce differences in connection speed. Interferences will also reduce connection speeds; it is recommended to limit other in-band RF sources as much as possible. The link speed will decrease with distance but can be improved by elevating the receiver end.

The buoy includes three network connected devices: the icListen, the radio/WiFi, 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 software. There are preset IP addresses for the Buoy Server, Buoy radio/WiFi, and Access Point radio/WiFi.

Important Notes

- Store the buoy upright or laying down on side
- Do NOT flip the buoy or turn upside down



## 1.1. Safety

Handling and deploying the Ocean Sonics Acoustic Buoy should only be performed by trained professionals. The buoy contains sensitive electronic components and requires precise handling to ensure proper operation and data collection.

Improper handling can result in damage to the equipment, personal injury, or environmental impact. Always follow the manufacturer's guidelines, use appropriate personal protective equipment (PPE), and ensure the deployment is conducted in safe weather and water conditions.

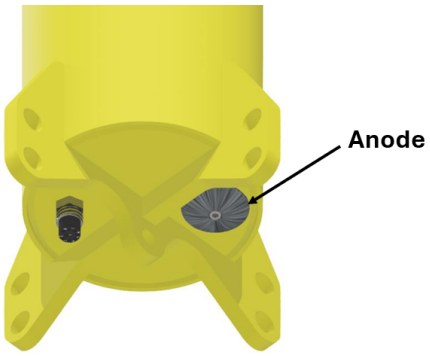
For optimal safety and performance, consult Ocean Sonics-certified personnel for setup, deployment, and maintenance.

## 1.2. Maintenance

**Fresh water rinse:** After a deployment, thoroughly rinse the sealed buoy with fresh water. Only open the buoy in a clean, dry environment.

**Conserve Battery:** Shut the buoy and hydrophones down when not in use to conserve battery. 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.

**Check Anode:** There is a zinc anode on the bottom of the hull. Replace it when it has corroded to half it's original size (OSL PN 11012). This should occur after approximately 6 months of submersion in seawater.



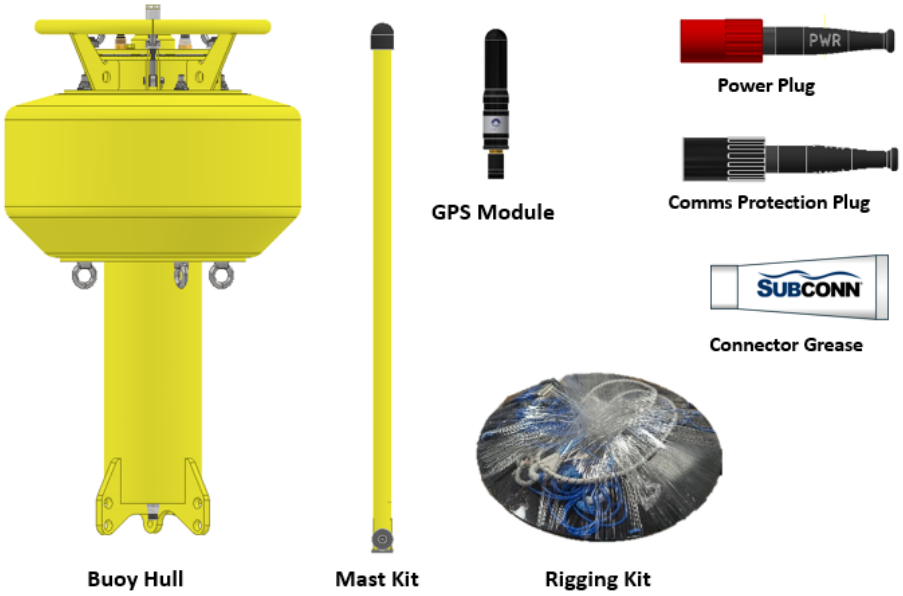

**Connector Protection:** Grease all external connectors with supplied dielectric grease. This will protect the pins from corrosion and ensure the connector can be mated fully. Apply a small amount of marine-grade anti seize to all threaded connections.

# 2. Mechanical Parts & Assembly

The buoy is made up of several mechanical sub-assemblies. The following section outlines the unboxing and assembly of the buoy.

## 2.1. Packing List

The buoy crate should contain the following subassemblies. Note that the mast will have the WiFi or radio module attached.




## 2.2. Crate Unboxing

The BOS ships in a wooden crate with foam inserts to protect it and its accessories during shipping. To unpack:

1. Open the crate by removing the marked screws from the top of the crate and lifting the lid off.
2. Grip the buoy by the handling ring and lift it straight out of the crate. This should be done with two people.

3. Place the buoy on hard, level ground, either standing on its feet or resting on its side.
4. Remove the remaining accessories from the crate.

## 2.3. Initial Assembly

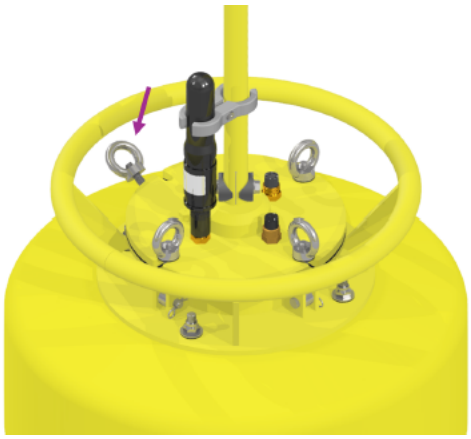
The buoy assembly involves the following steps:

- Battery installation
- Mast installation
- Antenna installation
- GPS installation

### 2.3.1. Battery Installation

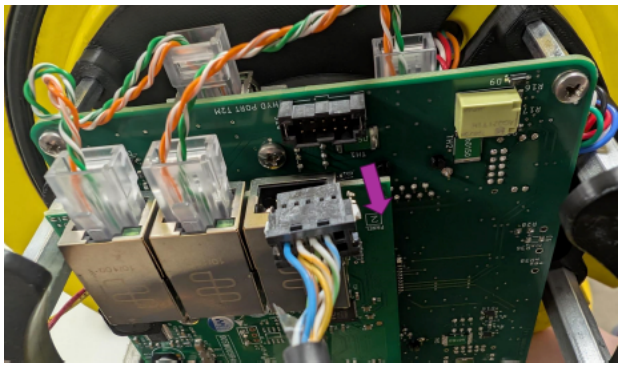
To install the batteries, follow the below instructions:

1. Ensure Buoy is OFF (Power plug removed)
2. The entire top plate can be removed with the mast, antenna and GPS installed. This will allow access to the battery module, where individual cells can be inserted.
3. To remove the top plate, loosen the eye nuts and swing them down



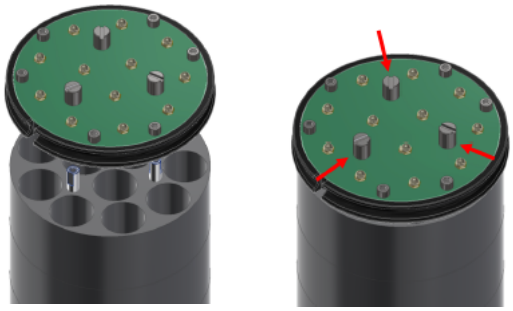
4. Slowly lift the top plate straight up. The top plate is tethered to the hull and battery module with a wire harnesses, so lift carefully.

5. Carefully unplug the hull connector from the circuit board. Note that the connector is a locking connector. Depress the latches on both sides before pulling.
6. Carefully unplug the power connector from the top of the battery pack.

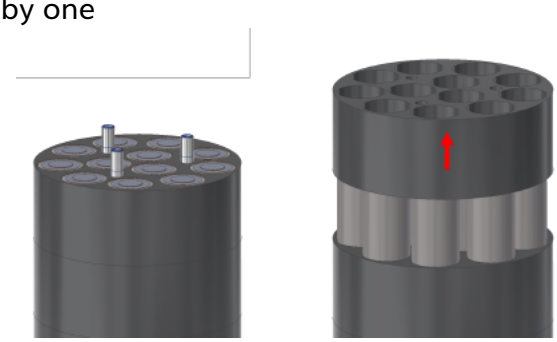


7. Remove the O-ring from the groove in the bottom of the top plate and store in a clean area.
8. Gently set the top plate aside. It can be stood up vertically.
9. Grip the handle at the top of the battery module and pull the module straight upward
    a. Allow the cable to pass through the handle as you pull the module out
10. Place the battery module upside down on level, dry ground

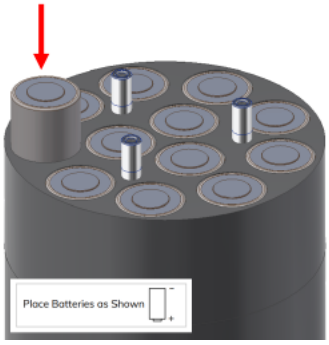
11. Unscrew the three captive panel screws and remove the bottom tray.
    a. Note that the screws should be tight, so a tool will be required to assist unscrewing the fasteners



12. To remove the batteries, slide the foam spacers up off the standoffs and remove the batteries one by one

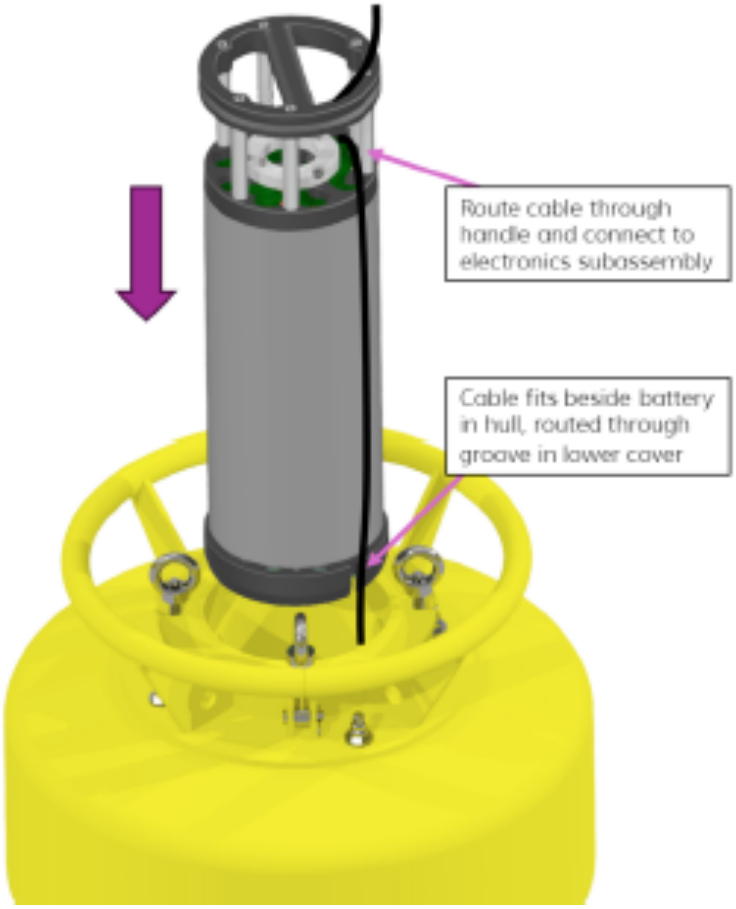


13. When all batteries have been removed, the foam spacers may be reinstalled for safekeeping.
14. With all the foam spacers back in place, insert 72 new batteries as shown below

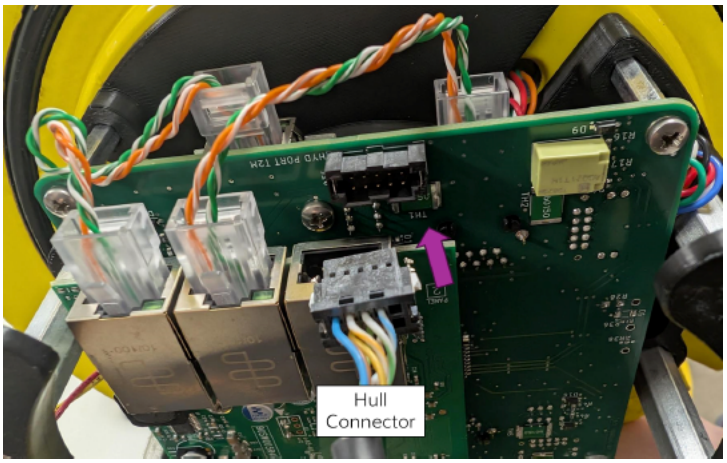



15. When all columns are full, replace the lower tray and tighten the screws firmly
16. There will be some resistance as the battery springs are replaced

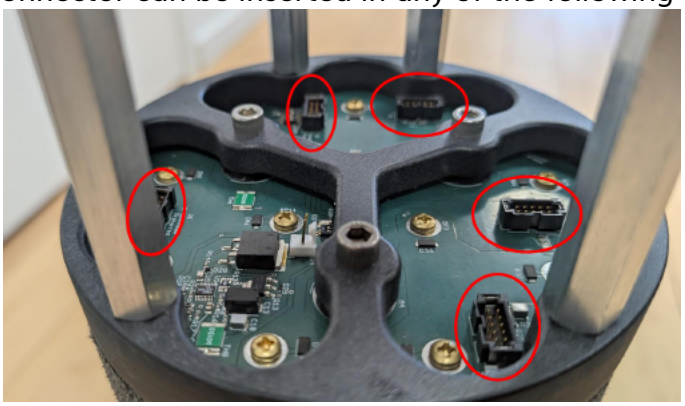
17. Ensure the lower tray is tightened all the way down and is close to parallel with the floor
18. Slowly lower the reloaded battery module into the hull of the buoy
19. Pass the cable through the handle as shown below



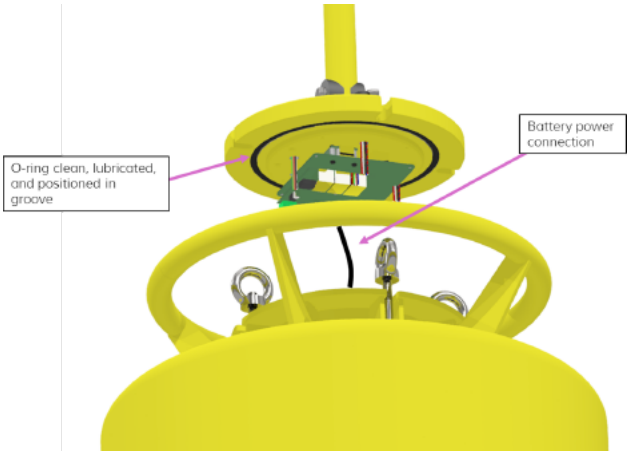

20. Clean, grease, and replace the O-ring in the groove under the top plate
21. Connect the battery and hull connectors as shown below




22. The battery connector can be inserted in any of the following connectors



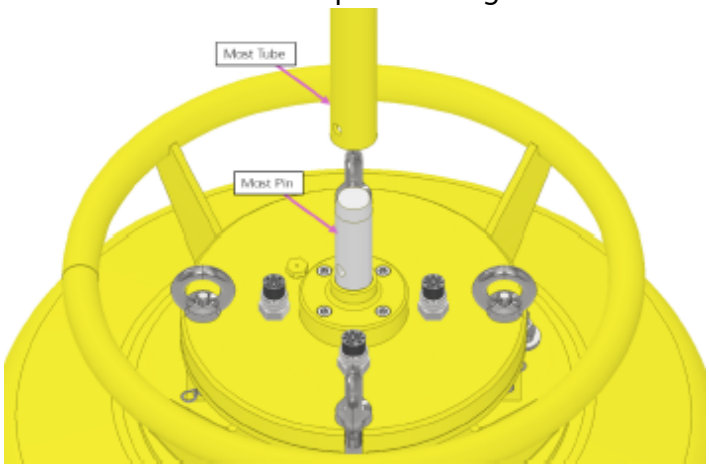
23. Clean the O-ring and reinstall in the groove in the bottom of the top plate.



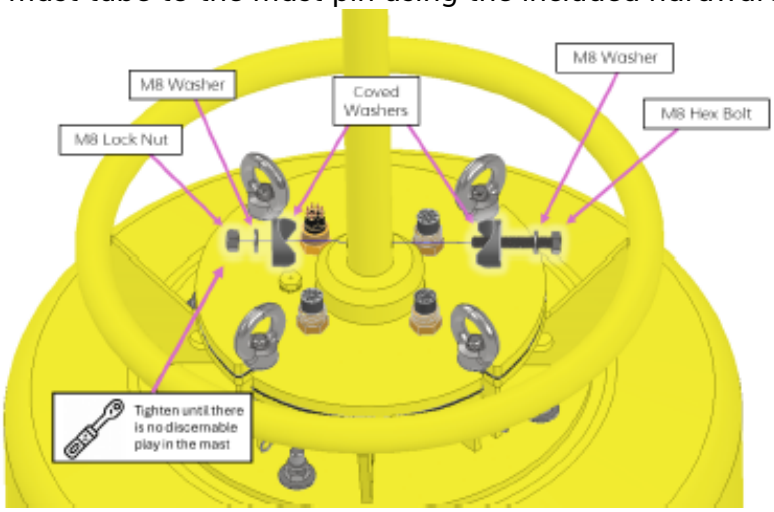

24. Return the top plate to the hull and tighten in place with eye nuts.
25. Ensure the top plate is fully seated.

### 2.3.2. Installing the Mast

1. The mast can be removed for transport and storage.
2. Install the mast tube onto the mast pin and align the cross holes.



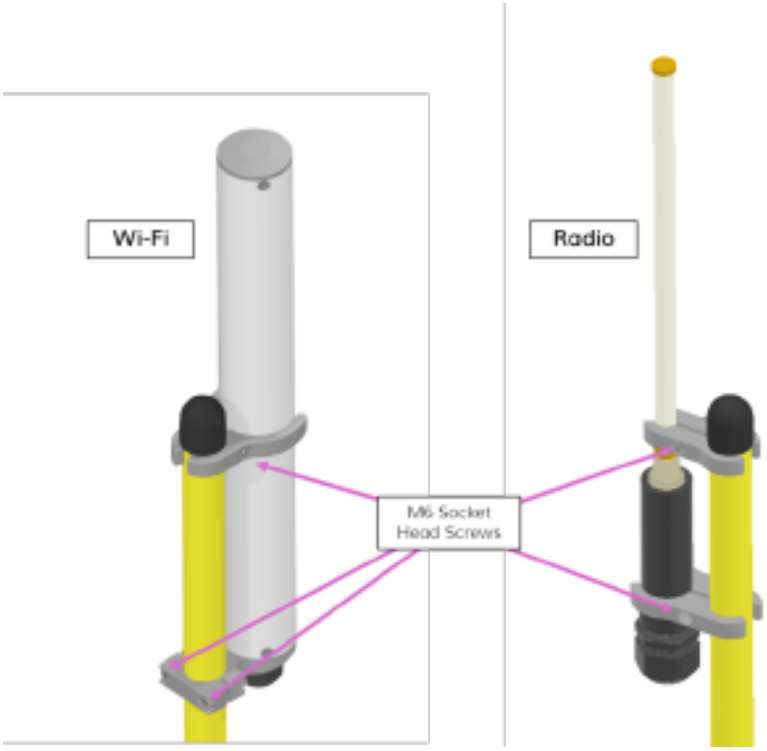

3. Screw the mast tube to the mast pin using the included hardware shown below.




### 2.3.3. Installing Antennas

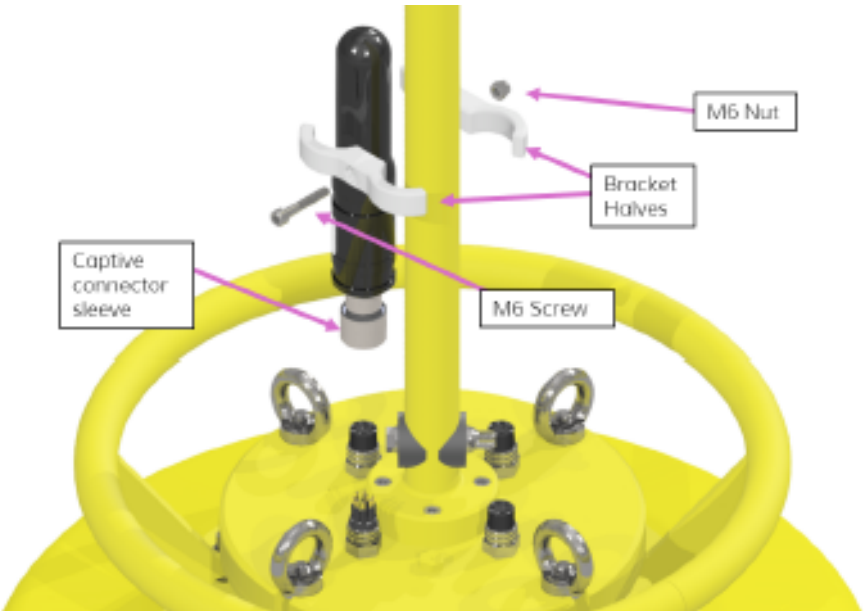
Ocean Sonics offers the option for either a Long-Range Radio or WiFi module. Depending on your order you may have one or both of these. The mechanical installation is the same.

1. Install either the radio or WiFi module onto the mast at the desired heigh as shown below.
2. Coil the wire around the mast to keep it secure and minimize the excess length.
3. Apply a small amount of Molykote to the pins of the GPS/Radio connector and insert into the connector labeled “RADIO” and tighten the connector sleeve.



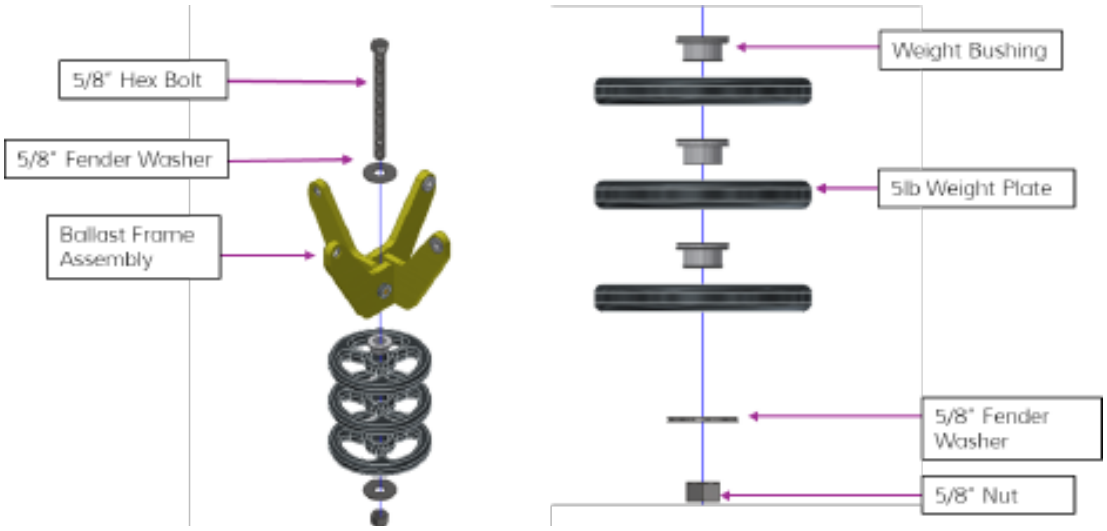

### 2.3.4. Installing the GPS

1. Screw the captive connector sleeve onto the bulkhead on the GPS.
2. Apply a small amount of Molykote grease to the pins on the GPS connector, and insert into the connector marked “GPS” on the top plate.
3. Screw the other side of the captive connector sleeve firmly onto the connector on the top plate. As this is tightened, it will pull the connector into place. Ensuring the male and female connectors are well-greased will make this easier. Plug the GPS into the mating connector 2-3 times before attaching with the connector sleeve to ensure the full lubrication.
4. Secure the GPS module with the included clamps and fasteners as shown below.




### 2.3.5. Configuring External Ballast Frame

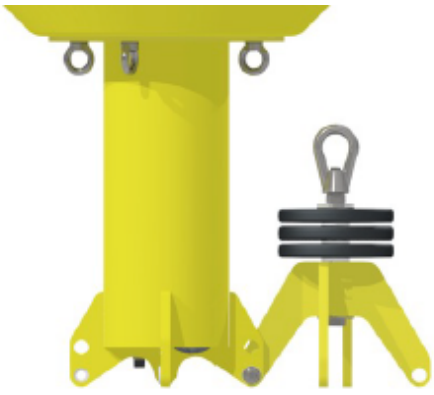
The external ballast frame is an optional accessory that enables the use of taller masts. It will be shipped assembled with 15lbs of weight, however this can be configured with different weights by removing the central bolt.

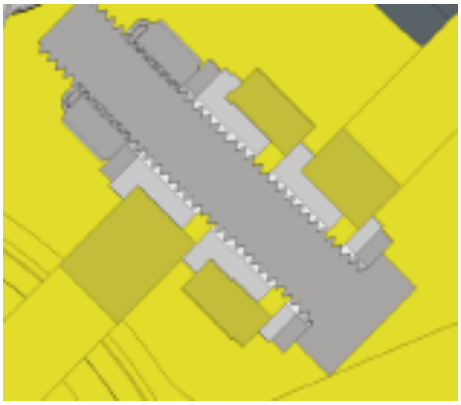



1. It is recommended that any weight used for ballast be constrained to be coaxial to the frame using a bushing.
2. Any weight that is used must also be held tightly to prevent loosening and rattling.

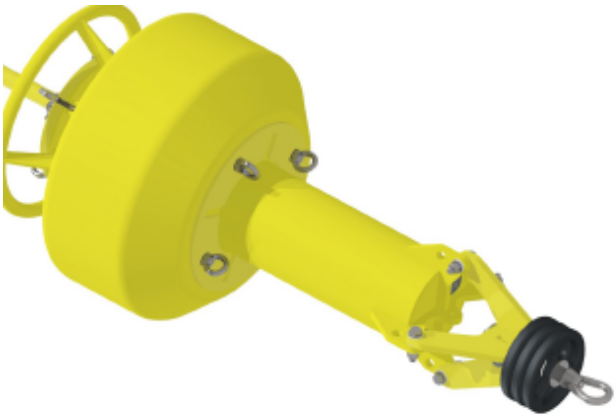
### 2.3.6. Installing Ballast Assembly

1. Install the eye with the rigging onto the ballast assembly before installing the ballast assembly
    a. The allows you to easily twist the ballast assembly to screw the eye nut on.
2. Position the ballast assembly next to the buoy and install the hardware as shown below.

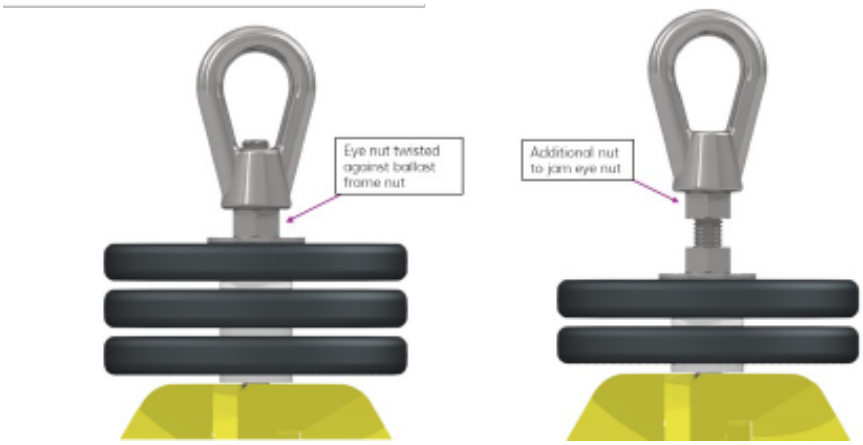




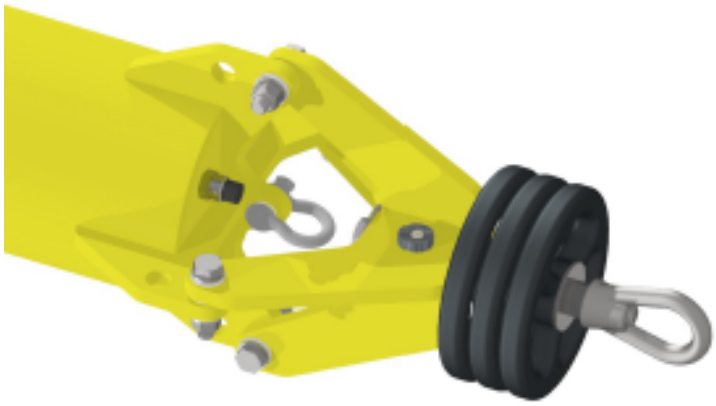
3. Gently rest the buoy on its side and pivot the ballast frame so the holes come into alignment
4. Insert the remaining hardware in the same configuration
5. When the hardware has been installed, tighten the nuts in place with two 19mm wrenches.



6. Screw the eye nut which is the rigging connection point to the bottom of the ballast frame bolt
    a. NOTE: Jam the eye nut firmly against the 5/8" Nut that retains the weights
    b. If fewer than three weights are used, an additional nut should be added to jam against the eye nut




7. Finally, use the shackle to attach the safety sling to the welded eyelet on the buoy.
    a. Nylon washers must be placed on either side of the shackle to prevent rattling. The provided washers should be a tight fit.



# 3. Software Install and Test

There is a PC application for controlling the buoy and interacting with the hydrophone and GPS module, called the Buoy Control GUI.

## 3.1. Initial Power Up with Test Cable and External DC Power

Before beginning to set up the Buoy Control GUI, it is recommended to do a check of the basic buoy power and networking functionality. The below test will not show complete functionality of the buoy but will demonstrate that the buoy has power and the networking is functioning.

1. Connect the icListen Test Cable to the 'COMM' port on the buoy top plate.
2. Connect the 8P8C (RJ45) connector of the Test Cable to a PC or Network.
3. Connect the 30 V / 36 W power supply barrel plug, included with icListen hydrophones, to the barrel jack of the Test Cable.
    a. This power supply might not have enough power if multiple hydrophones, smart cables, and long extension cables are connected to the Downstream Port of the buoy.
    b. For the purposes of checking buoy functionality simply connect only 1 hydrophone on your shortest extension cable to the downstream MCBH-8F connector for now.
4. Listen for the 1 buzz, 2 buzz, power up confirmation of the icListen.
5. If the test cable is connected to a network or computer, the hydrophone should now be discoverable using Marco or Lucy2.

## 3.2. Buoy Control Software Overview

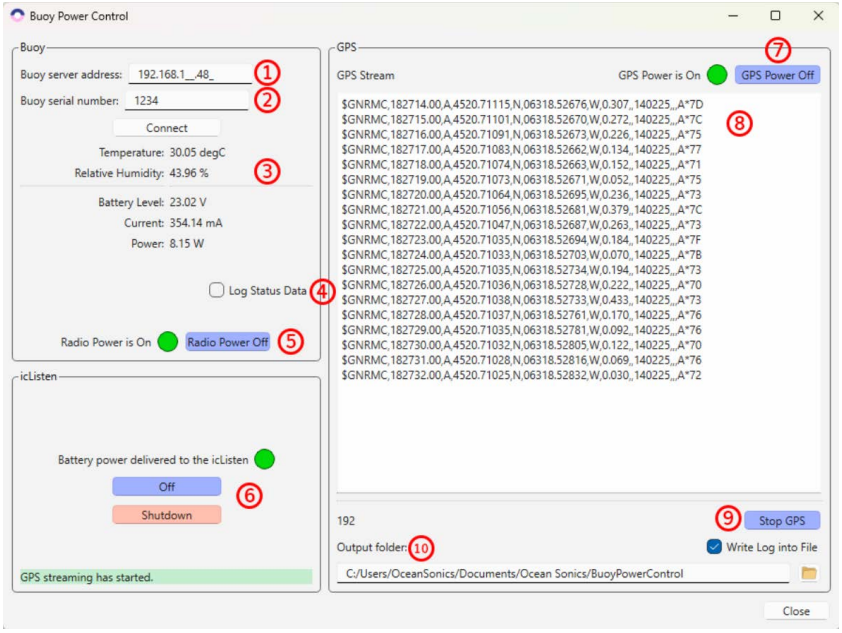
The Buoy Control Software has several basic functions to interface with the radio buoy:

- Connect/Disconnect battery power to the downstream MCBH-8F connector.
- Shutdown (Reverse bias) the hydrophone(s) to power them off.
- Connect/Disconnect battery power to the GPS Timing Module.
- Start/Stop GPS NMEA message streaming.
- Enable/Disable GPS NMEA message logging on the connected computer.
- View/log buoy internal sensor data.
    - Temperature, Humidity, Battery Voltage, Battery Current, Power
- Enable/Disable buoy internal sensor logging on the connected computer.

### 3.2.1. Buoy Power Control Software Interface

Below is an overview of the Buoy Control GUI interface.

1. Buoy Server IP address
2. Buoy Serial Number
3. Buoy Sensor Outputs
4. Buoy Sensor Logging Control
5. Radio Power Toggle Button (on/off)
6. Controls for icListen Hydrophone Power
7. External Battery (buoy) Delivered to the icListen (on/off)
8. Shutdown the icListen Hydrophone
9. GPS Power Toggle Button (on/off)
10. GPS NMEA Message Stream
11. Control for GPS Streaming and Logging
12. Logging File Location




## 3.3. Buoy Power Control Getting Started

To begin using the Buoy Power Control Software, take the following steps:

1. Download the application, installation file here
2. Install the application by following the on-screen directions
3. Open the application and type in the Buoy Server IP address in the Buoy Server Address Field
    a. By default, this is set to: 192.168.0.SNN
4. Type in the buoy serial number in the “Buoy Serial Number” field
5. Check that this IP Address is compatible with your PC IPv4 settings and/or your Network settings.
6. Refer to Buoy Server IP Address Setup for more information. Firewalls: “IPSetup.exe” uses UDP and TCP port number 20034. If your computer’s firewall is blocking this port number, then you will need to either disable the firewall or add a rule to the firewall to allow communication through this port number.
7. Continue with the Buoy Power Control software to test buoy functionality.

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.

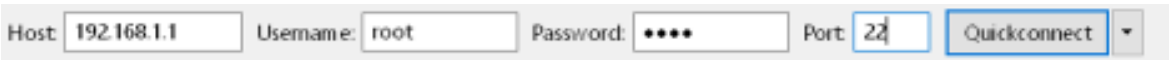
*Note: Only one computer can connect to the buoy server address through the Buoy Power Control. If the connection is not working on your computer, ensure no other connections have been made on a Buoy Power Control Software.*

## 3.1. 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 Power Control software. 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.

### 3.1.1. FTP Client (FileZilla)

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




## 3.2. Buoy Server IP Address Setup

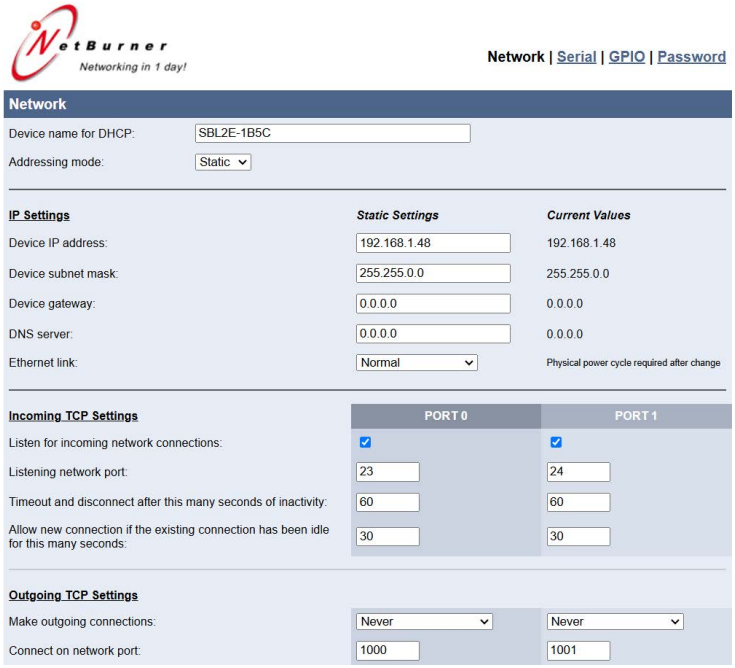
The buoy server allows GPS steaming and control of power to the hydrophones. It uses a Serial Server to distribute the GPS output over the network. It comes with a pre-configured IP address, but this may need to be changed depending on user network configurations. There are two ways to do this, through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

### 3.2.1. 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!

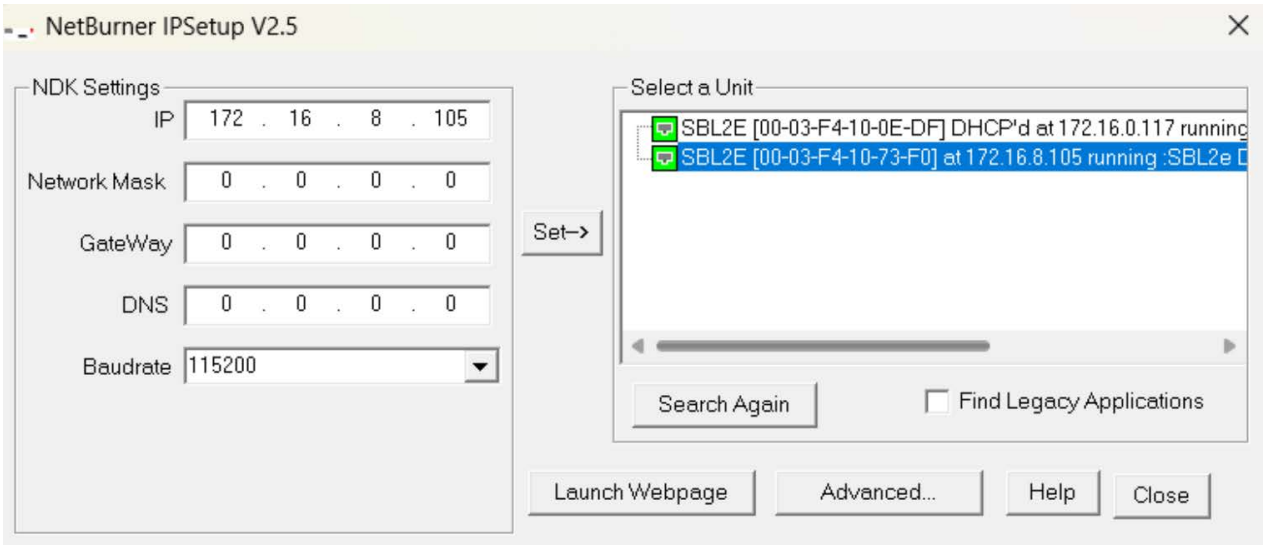
2. Update the Static IP address on the Network Page if required. Other settings should not require updates. Changing them may prevent the buoy and the Buoy Power Control from functioning properly.




### 3.2.2. 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.

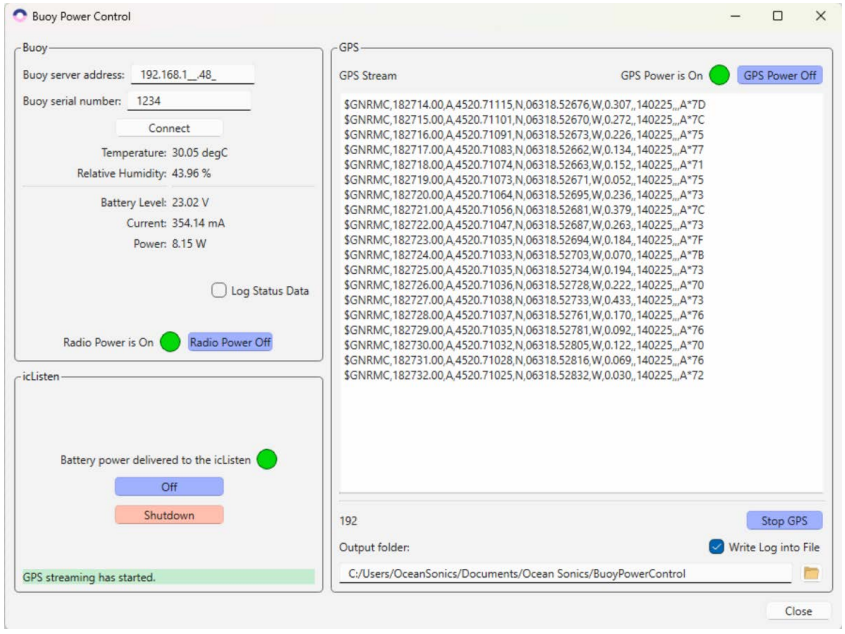
To use the IP Setup tool, first download and install it. Searching for devices should return a result like in the below image with the currently set IP address. A new IP address may be configured by entering the desired value in the “IP” field on the left and clicking “Set”. The “Baudrate” and “Advanced”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




## 3.3. Buoy and PAMGUARD

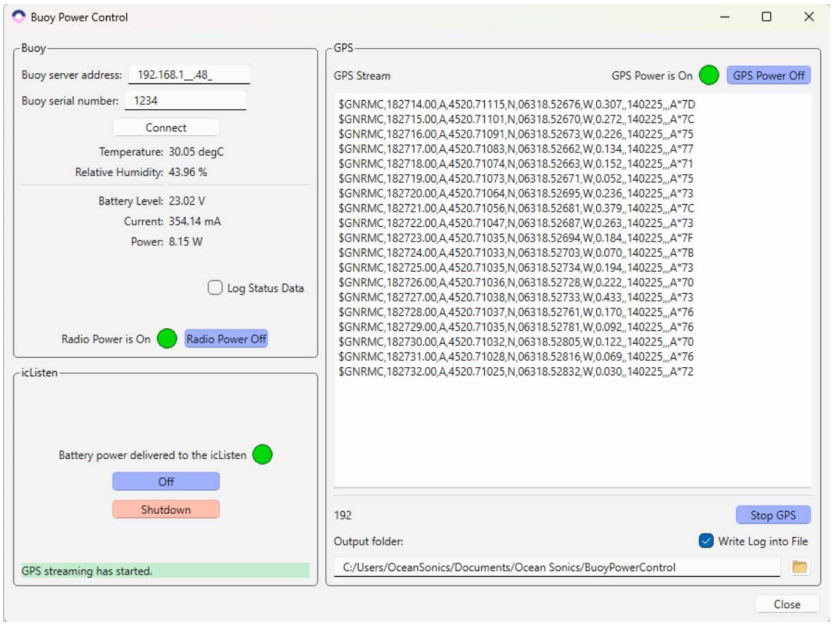
The buoy GPS stream can be sent to Pamguard instead of the Buoy Power Control Software. To do this, the Netburner Virtual COMM Port is needed. Download and install the software and then follow the below steps:

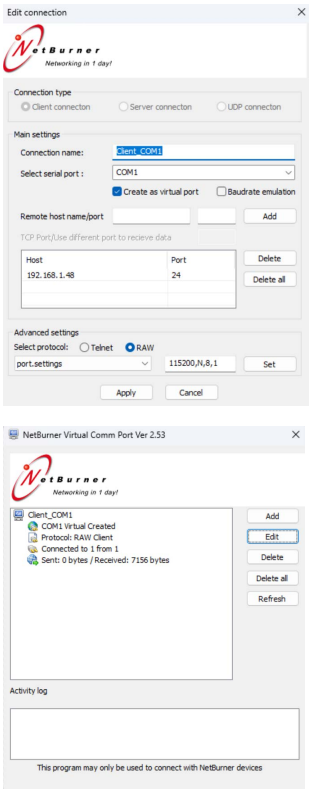
1. Open the Buoy Power Control Software, click start GPS to make sure the NMEA messages are coming through.
2. Uncheck “Write Log into file” and click on “Stop GPS”
3. Open Netburner Virtual Comm Port



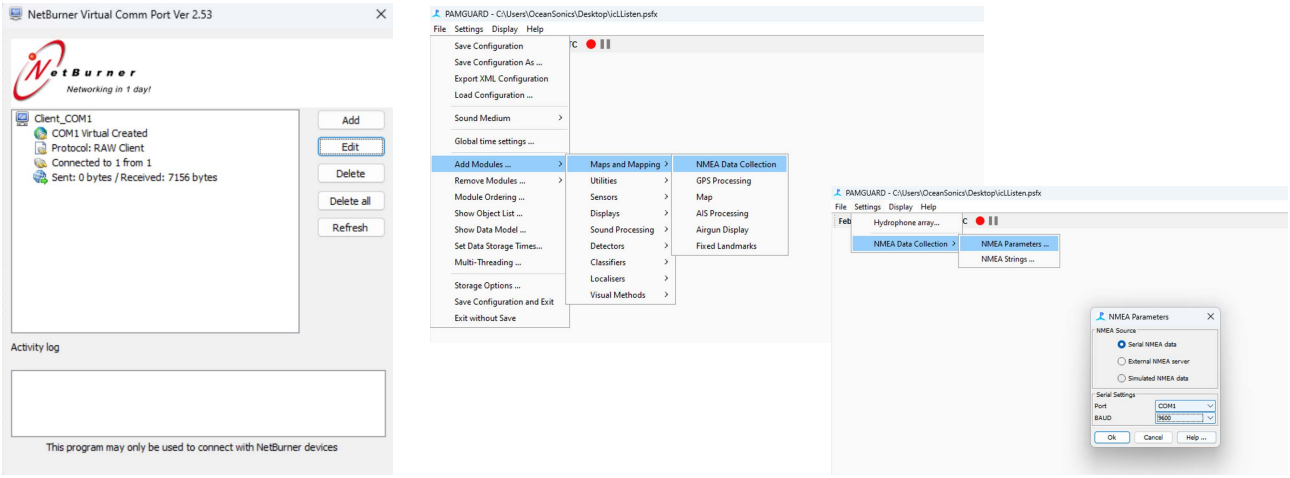


4. The first time it is used, the configuration will be empty.
    a. Click on the “add” button and select “Connection Type” as “Client”. The serial port number will depend on availability on the host PC but will default to COM1 if it’s available.
    b. Type the buoy server IP address into the “Remote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

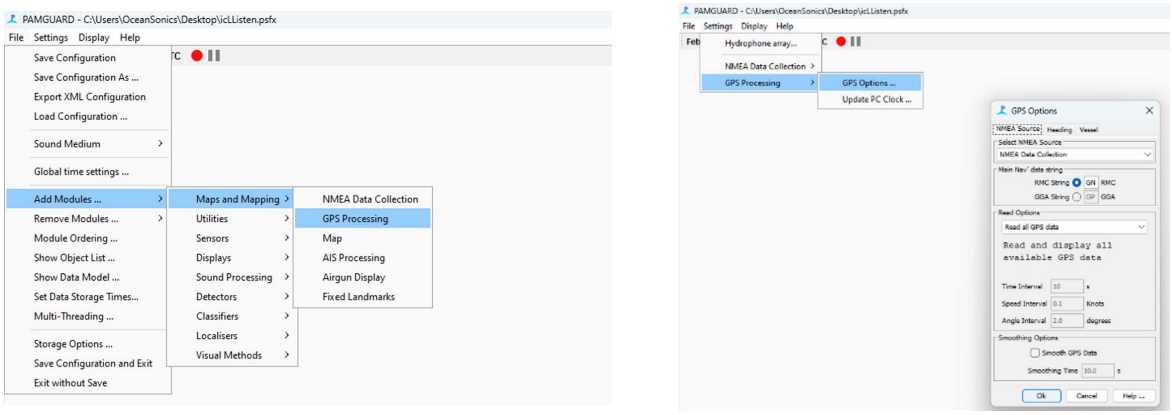


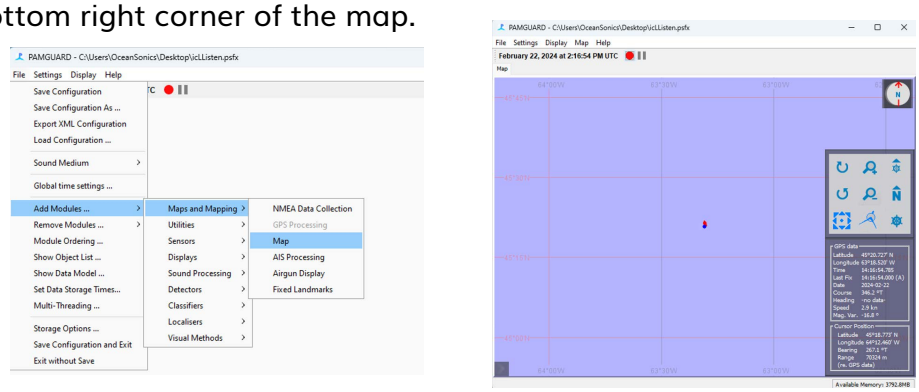
5. Once the virtual COM port is set up, it should look like the image below. GPS data will be redirected to port COM1 and not be available from the Buoy Power Control Software.




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




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



## 3.4. Pre-Deployment Functionality Checks

It is recommended that the buoy is tested with deployment settings before the deployment. To prevent wasting battery power during testing the buoy can be powered through a 30V adapter plugged into a wall outlet. This power adapter attaches to the test cable (MCBH8 to ethernet cable) that is used for setup.

It is also recommended to perform a short test (10 minutes) on battery power to ensure there are no problems with the complete setup of system running on buoy battery power.

### 3.4.1. Power through Wall Outlet


1. Plug power cord into the wall outlet.
2. Plug the power cord into the 36V power adapter.
3. Plug the power adapter barrel connector into the serial cable.
4. Plug the serial cable USB end into a computer USB port.
5. Connect the serial cable to the MCBH8 connector on the Recorder Buoy.
6. Setup for deployment, record and review data on hard drive.

### 3.4.2. Power with Buoy Batteries

1. Setup the buoy with the field deployment configuration.
2. Allow the buoy to record a total of 10 minutes.

3. Retrieve the data.
4. Review the data to ensure all data recorded properly.

# 4. Radio Introduction and Web Interface

### 4.1.1. Long Range Radio Version

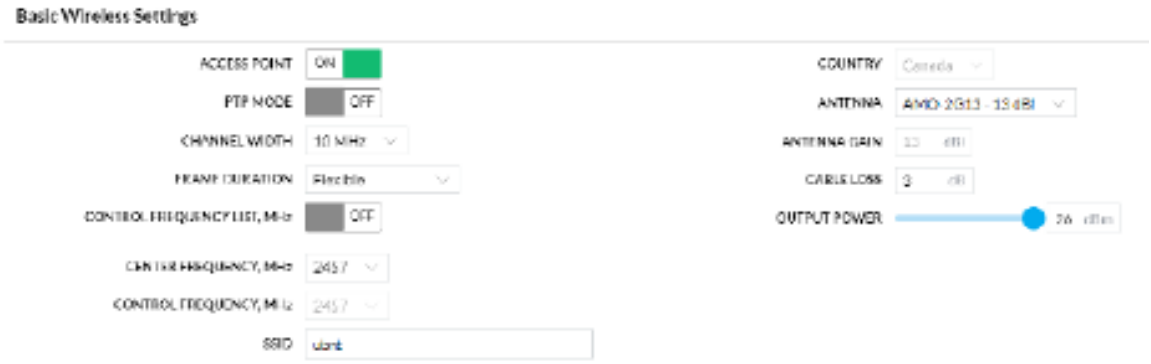
The Radio Buoy is equipped with an Ubiquiti Bullet AC IP67 and 8 dBi omnidirectional antenna. The Shore Side / Access Point (AP) provided is an Ubiquiti Rocket 2AC Prism with antenna depending on the user-specific application. Ubiquiti provides a PoE module with the Rocket 2AC Prism AP. Connect a shielded network cable between the AP and the PoE module. Another network cable connects the LAN port of the PoE module to a network or computer.

Before shipping from Ocean Sonics, the network configuration of the Bullet AC and Rocket 2AC Prism are configured with static IP compatible with the Netburner SB2LE. The Bullet AC is configured to 192.168.0.(SNN+1) and the Rocket 2AC Prism is configured to 192.168.0.(SNN+2). These settings might need to change for compatibility with the User's network or computer.

When the Access Point is initially plugged in, the dashboard should look like the first screen grab below where it shows 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.

### 4.1.2. 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.




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

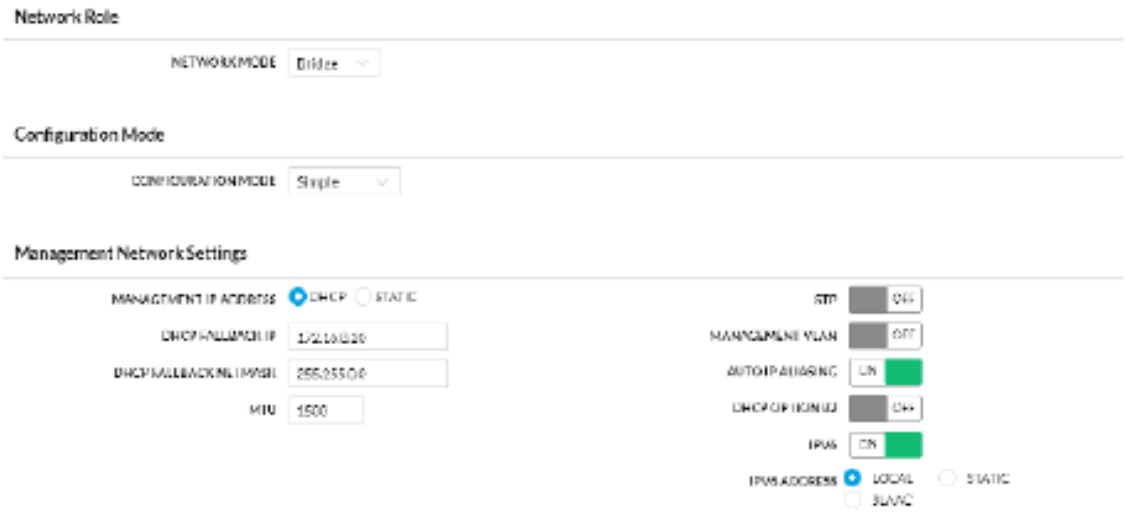
CHANNEL WIDTH – A narrower channel width can be useful in noisier RF environments, but a wider channel will offer greater theoretical capacity. Optimal settings for Channel Width and Center Frequency will give the best connection speeds. It should be set to AUTO on the Buoy Radio and a defined value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

### 4.1.3. Ubiquiti Radio Network Settings

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




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.

### 4.1.4. 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 192.168.0.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, or connect and test cable and supply power from a 30V power adapter.
7. Connect a hydrophone to the available bottom 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.

11. If the buoy is in a location where it can receive a GPS signal, the Home Page should indicate the hydrophone is synchronizing or is Synchronized to PPS (see below).
    a. 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 synchronization. Ensure the correct date and time are displayed.)
12. Set up Sampling Rates for icListen.
    a. Under Settings Tab -> Data Collection, select the settings for deployment - Sampling rates of WAV and FFT data.

## 4.2. Access Point Radio Installation

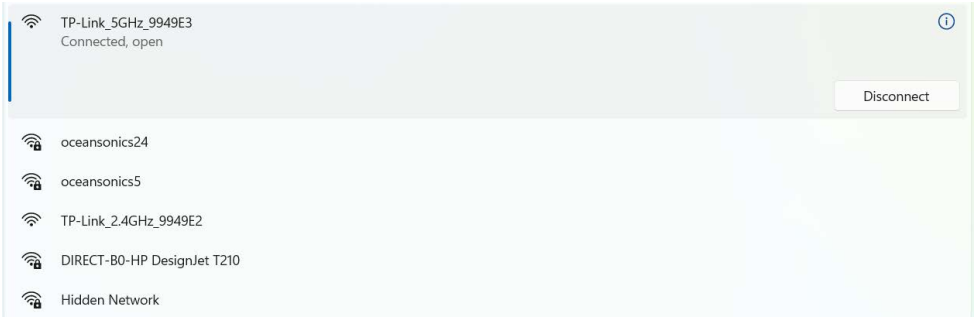
The Access Point radio is a Ubiquiti R2AC-PRISM that operates at 2.4 GHz. It is used with either a Sector or Omnidirectional antenna. The antenna comes with adjustable clamps and should be mounted on a post of approximately 1.5" (40mm) diameter. Ubiquiti recommends using two ethernet surge protectors 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.

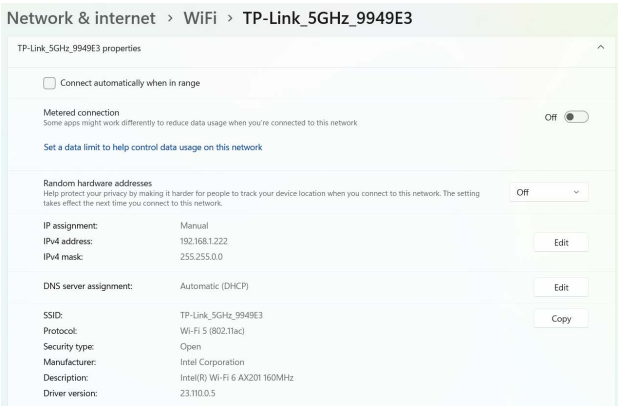
## 4.3. Wi-Fi Module Introduction and Web Interface

The Wi-Fi buoy is equipped with a TP-LINK EAP225-Outdoor access point, providing a reliable wireless connection. Before shipping from Ocean Sonics, the network configuration of the EAP225-Outdoor units is set with static IPs compatible with the Netburner SB2LE. The buoy-side access point is configured to 192.168.0.(SNN+1). These settings might need to be changed for compatibility with the User's network or computer.

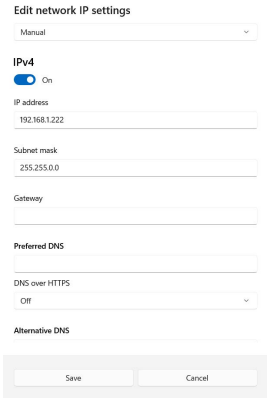
To connect to the buoy's Wi-Fi network, use your computer to search for a Wi-Fi SSID called "TP-LINK_5GHz_9949E3" and "TP-LINK_2.4GHz_9949E2"




After connecting to any of these two, you should change the properties from your computer's Wi-Fi adapter to a static IP address compatible with the IP address used in your Buoy and the TP-LINK.

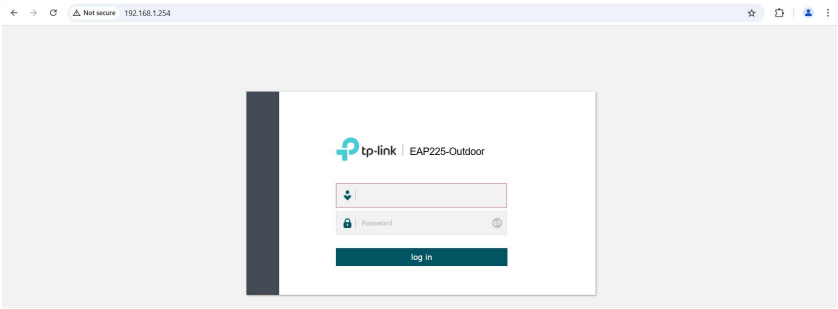



In this example, we are setting the computer IP address as follows:

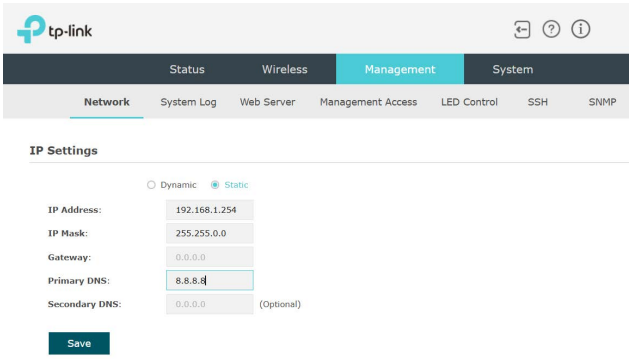



Once you change your computer's IP address, you can open Marco to check if the hydrophone(s) you have attached to your buoy are showing in Marco's device list


If you need to change the network settings on the TP-LINK EAP225-Outdoor you first need to connect to the TP-LINK access point. ("TP-LINK_5GHz_9949E3" and "TP-LINK_2.4GHz_9949E2"). Type the TP-LINK EAP225-Outdoor in your browser




Type the username (oceansonics) and password (oceansonics) and click in "Log In"
Go to the "Management" tab, then "Network". You should have this set as "Static" and enter an IP address that will be compatible with the Netburner module (Buoy's IP Address) so they can be in the same network.




Remember, if you're required to change the TP-LINK IP Address, you should do the same for the Netburner module in case the IP class is different than the default. **You should only change the IP address from the Buoy or the TP-LINK if it's extremely necessary**.

# 5. Deployment

Deployment of the Acoustic 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
3. Install Buoy Mast and buoy radio/WiFi antenna
4. Complete the tests in the Ocean Sonics Pre-Deployment Checklist (Section 5.1).
5. Confirm that all components are functional (Buoy Server, Radio/WiFi, 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 wireless link is active).
    a) Set icListen to Synchronize to GPS.
        i. Under Special Features ensure Sync In – Falling Edge is selected and Decode Time from PPS is checked.

## 5.1. Pre-Deployment Checklist

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.

The intention of this test is to confirm buoy and system functionality before deployment into the water. Ideally, the buoy is assembled, with fresh D-cells installed, and the

MCBH-5M power switch removed to prevent unnecessary discharge before deployment. A test cable, with suitable power supply, connected to the COMM port can be used to test power the system with the power switch still removed. Internal protection diodes prevent any interaction between the internal D-cells and power applied to the COMM port.

1. Disconnect all equipment from the buoy before making changes to the internals and/or changing the D-cells.
    a. Remove the MCBH-5M power switch from the POWER port on the buoy top plate.
    b. Disconnect the system from the downstream MCBH-8F connector at the bottom of the hull.
    c. Note: it is easier to remove the top plate if the added mass of the mast is disconnected from the top plate pin.
2. Open the buoy and install batteries in battery cap. Follow the process outlined in Section 14 – Battery Replacement.
    a. Ensure that the battery and hydrophone connections to the top plate electronics are securely mated.
    b. It is critical that the O-ring sealing surfaces be properly cleaned and lubricated.
3. Once the top plate is sealed again confirm successful battery connection and voltage.
    a. Keep the hydrophone disconnected from the downstream connector.
    b. Connect a test cable to the COMM port (without providing power) and connect it to your computer.
    c. Connect the MCBH-5M power switch to the POWER port.
    d. Open the Buoy Power Control Software and connect to the Buoy.
    e. Click on the “ON” button in the “icListen” section in the Buoy Control Software.
    f. With a DMM measure expected battery voltage across pins 7 and 1 of the MCBH-8F downstream connector (see Appendix B)
    g. Fresh Alkaline D-cells should measure near 29 V
    h. ii. Fresh Lithium D-cells should measure near 25 V
    i. Click on the “OFF” button in the “icListen” section in the Buoy Control Software.

    j. This confirms the battery connection is good. Disconnect the MCBH-5M power switch again to prevent unnecessary discharge of the battery until deployment.
4. All the equipment can be reconnected, and their functionality tested using the test cable, with suitable power supply, and COMM port.
    a. See page 4 for unboxing the buoy steps to reconnect the equipment.
5. Use the test cable, connected power supply, and Buoy Power Control Software to reconnect to the Buoy.
6. Click 'Start GPS' and confirm that the GPS NMEA messages are displaying on the software.
    a. Confirm logging of the GPS files is working.
7. In the "icListen" box section, click on the "ON" button
    a. Listen for the 1 buzz, 2 buzz confirmation that the icListen hydrophones connected to the downstream MCBH-8F connector are powering on.
    b. Use the Marco software to access the web servers of the hydrophones and confirm they are working as expected.
    c. Check the home page to confirm that the hydrophones are fully charged and not discharging. This will maximize deployment endurance.
    d. On the Buoy Power Control Software click on the "OFF" button in the "icListen" box section
    e. Confirm that the home page of the icListen's change from 'Charging' or 'Not Charging' to 'Discharging'.
    f. Click on the "Shutdown" button in the "icListen" box section to turn the hydrophones off so they are ready for the deployment.
8. Test the wireless communications between the Bullet radio and Rocket Prism 2AC (Radio Version) or between your computer and the WiFi access point (WiFi version)
    a. Leave the test cable, with connected power supply, connected to the COMM port but disconnect the 8P8C (RJ45) connector from the PC or Network.
    b. This is to leave the buoy, GPS, and radio powered without using the internal batteries.
    c. With a different Ethernet cable, or WiFi connection, connect the PC directly to the Rocket Prism 2AC or the TP-Link access point LAN port or to the network the Rocket or TP-Link access point is connected to.
    d. Follow to confirm the wireless communications are working.

9. Once wireless communications are confirmed working the buoy is ready for deployment.
10. Remain connected to the buoy over wireless communication.
11. In the Buoy Power Control Software turn everything on:
    a. In the “icListen” box section, click on the “ON” button
    b. Confirm the hydrophones are operational using Marco, Lucy II, or their web servers
    c. Click ‘GPS Start’
12. Connect the MCBH-5M power switch.
13. Disconnect the test cable from the COMM port.
14. Cover the MCBH-8M connector with the MCOM-8F dummy plug
    a. Apply Molykote grease.
15. Check rigging and heave plate before deployment (if heave plate is being used).
16. Confirm wireless communications are still working and the hydrophones are workings.
17. Deploy the buoy.

## 5.2. Deployment Checklist

1. Install buoy antennas. Connect antenna and GPS to the corresponding buoy connectors if they were removed.
2. Transfer equipment to vessel.
3. Arrange moorings on vessel, connect anchors, buoys, float collars. Make sure shackles are tight.
4. Plug in buoys, hydrophones.
5. Test radio/WiFi buoy then turn off.
    a. Connect test cable to comms connector on top of buoy (do not power though).
    b. Install red buoy power plug to turn on buoy using its batteries.
    c. Make sure laptop WIFI is turned off. Make sure laptop has ethernet ivp4 address of the form and netmask.
    d. Connect to buoy in BuoyPowerControl (IP, SN).
    e. Check GPS. Press “GPS power on” and then “start GPS”. Should see lines appearing.
    f. Check icListen. Press “On” and check that icListen appears in Marco. If not, try turning “Off”, waiting a few seconds, then turning “On”, waiting a few seconds.

g. Once connected to icListen, check its webpage. Make sure it is synced to PPS and that data in the spectrum charts looks okay.
h. Turn “Off” icListen. “Shutdown” icListen.
i. “Stop GPS”. Then “GPS power off”.
j. Remove test cable. Install dummy plug on buoy’s comms connector.
k. Remove red buoy power plug.

6. Test buoy’s connectivity and leave on.
    a. Install dummy plug on buoy’s comms connector.
    b. Install red buoy power plug to turn on buoy using its batteries.
    c. Connect laptop to buoy’s WIFI (make sure you don’t have “automatically connect” selected for any other networks).
    d. Open BuoyPowerControl and connect (IP, SN).
    e. Turn on GPS: “GPS power on” and then “start GPS”. Should see lines appearing.
    f. Turn on icListen: “On”. Check for icListen in Marco.
    g. Connect to icListen’s webpage.
    h. Check that icListen is synced to PPS.
    i. Turn recording on.
    j. Check that recording is working. Open Filezilla, connect to icListen, and check Data folder for files.
7. Set up and testing complete.

## 5.3. 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 Power Control software 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.
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 Power Control software 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.

# 6. 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.

Review the radio quick-start guides that come packaged with the radios.

13. 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.
14. 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.
15. 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.
16. The browser interface should show an image of the Rocket Access Point and state that there is no connection.
17. 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.

18. Connect a hydrophone to the available topside port using an extension cable.
19. 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.
20. 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 ca be useful for confirming radio functionality in the field.
21. 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.
22. If the buoy is in a location where it can receive a GPS signal, the Home Page should indicate the hydrophone is synchronizing or is Synchronized to PPS (see below).
    a. 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 synchronization. Ensure the correct date and time are displayed.)
23. Set up Sampling Rates for icListen.
    a. Under Settings Tab -> Data Collection, select the settings for deployment - Sampling rates of WAV and FFT data.

# 7. Appendix

## 7.1. Appendix A – Battery Measurements

Note: Ensure you are performing measurements while the recorder is set to RECORD. If the buoy is setup to duty cycle and is in the rest/off state, you will be unable to take a measurement.

A voltmeter can be used to confirm the proper voltage is being supplied to the exterior bulkhead connector on the bottom of the buoy where the cable is attached.
This should be done before a deployment and after replacing batteries to ensure the batteries are in good condition.

1. Turn on Recorder Buoy running solely on interior batteries (not plugged into 36 V wall adapter)
2. 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).
3. Place the positive voltmeter lead (red) into pin 7 (pinout below).
4. When new batteries are placed in buoy the voltage should be ~33 to 35.2 V
5. (full capacity of long-life alkaline batteries).

## 7.2. Appendix B – Technical Drawing