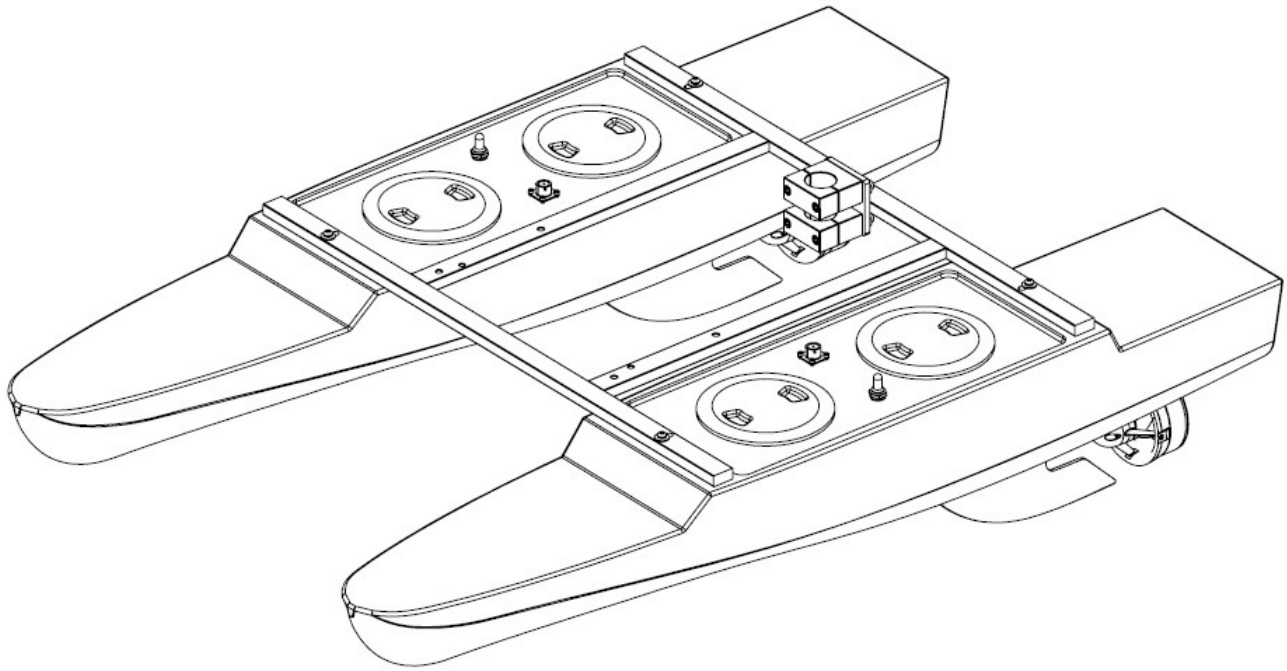
Hydrone™ RCV

User and Technical Manual

Seafloor Systems, Inc



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1 Introduction

1.1 System Overview

Welcome to the Seafloor Systems Hydrone™ RCV manual. This document provides an overview of the key features and functionalities of our cutting-edge Uncrewed Survey Vessel (USV) designed for hydrographic surveying and marine mapping applications. The Hydrone™ RCV offers advanced hydrographic surveying capabilities, flexible payload options, and real-time data viewing. The Hydrone™ RCV features a robust hull and propulsion system, and reliable communication system. This manual is for hydrographic surveyors, marine scientists, and technical personnel involved in underwater mapping and surveying tasks using the Hydrone™ RCV.

1.2 Terms And Acronyms

ANP	AutoNav Plus
ASV	Autonomous Survey Vessel
Bow	Front or forward part of the vessel
BHSC	Button Head Socket Cap Screw
CAA	Collision Avoidance Assist
CCW	Counter-Clockwise
CW	Clockwise
ESC	Electronic Speed Controller
FAQ	Frequently Asked Questions
GND	Ground (Voltage)
GNSS	Global Navigation Satellite System
GPS	Global Position Satellites
HDPE	High Density Polyethylene
HLP	Hydrolite Plus
HUD	Heads Up Display
LED	Light Emitting Diode
LiPo	Lithium Polymer Battery
Motor	Center electronic part of the Thruster
MBES	MultiBeam Echosounder
NMEA	National Marine Electronics Association
PoE	Power over Ethernet
Port	Left side of vessel - facing towards bow
Prop	Propeller
RCU	Remote Control Unit
RCV	Remote Controlled Vessel
RDP	Remote Desktop Protocol, Remote Desktop Connection
Receiver, RCVR	Receiver for the Transmitter
RSSI	Received Signal Strength Indicator
RTK	Real Time Kinematic
RTL	Return to Launch
Rx	Receive
SBES	Single Beam Echosounder
Servo Thruster	Servo Thruster Assembly
SOC	State of Charge
Starboard	Right side of vessel - facing towards the bow
Stern	Rear or aft part of the vessel
SVP	Sound Velocity Profiler
SVS	Sound Velocity Sensor
Thruster	Thruster assembly with prop
Transmitter	Transmitter also known as Radio Control Unit
Tx	Transmit
USV	Uncrewed Survey Vessel
VDC	Voltage - Direct Current
VAC	Voltage - Alternating Current

Information

Information banner is to notify useful information for operator.

Caution

Caution banner is provide important information that if disregarded may result in accidental misuse or damage to the system.

Important Alert

Important Alert is to provide important information that if disregarded may prove harmful to personnel or equipment.

1.3 System Specifications

Survey Speed	2 knots (1m/s)
Max Speed	4 knots (2m/s)*
Length	45.6in (1.2m)
Pontoon Width	8.37in (0.21m)
Overall Width	29.25in (0.74m)
Hull Material	High-Density Polyethylene (HDPE)
Hardware	316 Stainless Steel
Weight	25lbs (9.8kg)
Payload	35lbs (15kg)
Power	14.8VDC Nominal
Battery Endurance	5.5 Hours At Survey Speed With 16Ah Batteries
Thruster	2x Electric Thrusters
Steering	Skid Steer
Remote Control Range	Up To 0.6 Miles (1km) (Conditions Dependent)
Remote Control Voltage Range	6-8.5VDC
Sea State	Beaufort Sea State 2 and Below (Figure 70)
Operating Air Temperature	14°F – 113°F (-10°C – 45°C)
Operating Water Temperature	28.4°F – 96.8°F (-2°C – 36°C)

*Speed in ideal conditions. 8 hour operational endurance (with 4 batteries). Refer to Survey Duration Chart. 3.4

1.4 System Limitations

To limit potential damage to the Hydrone™ RCV, it is not recommended to use the USV in the following conditions:

- Colder environments can lead to decreased battery capacity and shorter endurance compared to what is indicated on the endurance chart. (Refer to 3.4)
- Range outside of 0.6mi (1km) line of sight.
- Charging: On land only. No equipment leakage circuit interrupter (ELCI) protections for on water charging.
- Weather Conditions: Do not use USV in adverse weather. Thunderstorms, lightning, hurricanes, monsoons, extreme heat, strong current, strong wind, heavy rain, etc.

1.5 Warranty

Seafloor Systems, Inc. is committed to upholding the highest standards of quality, reliability, and durability in its products. We provide a warranty to the original purchaser or purchasing agency, guaranteeing that each Hydrone™ RCV will be free from defects in materials or workmanship for a duration of one year from the date of shipment.
The warranty provided does not cover defects resulting directly or indirectly from misuse, negligence, accidents, repairs, or alterations conducted outside of our facilities. It also does not cover the utilization of the Hydrone™ RCV for purposes other than water measurements, or pairing it with instruments exceeding a weight of 35lbs (15.9kg).
Seafloor assumes no responsibility for the loss of boats, instruments, damage to property, or any injury or fatality associated with the utilization of its products or any products that may be included or utilized in conjunction with Seafloor products. Seafloor's warranty does not extend to third-party products sold by Seafloor, which may encompass items such as GPS devices, depth sounders, and other supplementary equipment.
All warranty-related services are carried out from Seafloor's facility in El Dorado Hills, California, U.S.A.

1.6 Technical Support

Seafloor Systems, Inc. provides comprehensive customer support through an online support system during regular business hours. For assistance outside of standard business hours, support is available by appointment.

If your Hydrone™ RCV was purchased through an authorized dealer, we kindly request that you contact your dealer's designated point of contact for immediate support and assistance.

To submit a support request, please fill out our support form on our website www.seafloorsystems.com via the big green button. Please include as much information as possible:

- Your Name and Company
- Where you purchased the system
- Purchase Order number
- Serial number of the system
- In-depth explanation of the issue
- Any helpful pictures of the issue

Upon submitting your support request through our website, a case will be automatically generated in our support system. One of our support representatives will reach out to you to assist with your inquiry or issue within 48 hours. Please note that this response time does not include weekends.

- Website: www.seafloorsystems.com
- Phone (PST/PDT): +1 530-677-1019 (Business Hours: Monday - Thursday, 0700-1730)

2 Safety

2.1 Battery Safety

Please read through these instructions carefully before you operate the Hydrone™ RCV.

Important Alert

Danger to life from electric shock. Contact with uninsulated or damaged parts can result in severe physical injuries.

- Before and after every use of a LiPo battery, carefully inspect the pack to ensure no physical damage, swelling or "ballooning" is visible.
- If at any time you have an accident with your Hydrone™ RCV, or if the battery swells, "balloons", or feels too hot to the touch, immediately stop use and carefully follow these safety steps:
  - Using electrical protective gloves, remove the battery pack from your Hydrone™ RCV or charger.
  - Place the battery in a LiPo safety sack or other fireproof container, away from flammable materials and in a well-ventilated area.
  - Observe the battery from a safe distance for at least 30 minutes.
  - If after 30 minutes the pack appears stable, follow the battery disposal instructions below.
  - Under no circumstances should you return a battery to operation that has "ballooned" or been damaged in any way.
- Always handle LiPo batteries with extreme care and take all necessary precautions to avoid battery packs and cells being dinged, dented, punctured, or otherwise damaged.
- Keep battery packs out of the reach of children and pets.
- Do not disassemble, modify, or attempt any form of repair of a LiPo battery.
- Do not allow exposed battery wires to touch each other.
- Always disconnect your battery from any device when not in use. All devices continue to draw power even when turned off.
- Store your batteries in a cool, dry place between 40°F - 80°F (4°C - 26°C). All battery packs should be stored away from any flammable materials in a LiPo safety sack or other fireproof container (not included) with the plugs/connectors covered.
- Batteries should be stored at 3.75-3.85V per cell. Failure to maintain these levels could result in a loss of battery capacity. Do not store batteries with voltage above or below this range for longer than one week. Check cell voltage with a voltage tester, following the included instructions. (Refer to 3.6)
- LiPo batteries must be fully charged and returned to the recommended storage voltage range (3.75-3.85V per cell) at least once a month. Max voltage of a 4S battery is 16.8VDC. (4.2VDC/Cell)
- Always take precautions to cover the battery plugs/connectors while not in use.
- Always transport LiPo batteries in LiPo safety sack or other fireproof container with the battery plugs/connectors covered.
- Never leave LiPo battery packs in an automobile. Temperatures within a vehicle can quickly reach unsafe levels.
- Always keep a class D chemical fire extinguisher nearby, in case of fire when storing, handling, charging, or using LiPo battery packs.
- Make sure the battery connections are connected in the proper polarity. Battery packs should be properly secured within the vehicle to prevent movement and damage to the battery while in use.

- If the battery exceeds temperatures of 140°F (60°C) immediately discontinue charging and isolate the battery pack. Refer to point number two above from the Safety Warnings for further instruction.
- Do not, under any circumstances, heat up a battery pack to increase pack performance. Doing so greatly increases the risk of fire.
- Never allow your Hydrone™ RCV to discharge a LiPo battery pack at more than the recommended continuous discharge rate. Refer to the label of your specific battery to determine the proper continuous discharge rate. You must also refer to your specific vehicle user manual to ensure your batteries' continuous discharge rate is not exceeded.
- Damaged or ruptured battery packs or cells may leak electrolytes which can cause moderate to severe irritation including burning and dryness of the skin and eyes. For contact with the skin, thoroughly wash the affected area with soap and warm water. For contact with the eyes, rinse thoroughly with cool water. Seek immediate medical attention for any burns.

Important Alert

Never open the batteries.

2.2 Battery Charging Safety

Important Alert

Failure to follow any of the instructions and safety warnings contained within this document may cause irreversible damage to the battery pack.

Information

Due to shipping regulations, batteries are not shipped fully charged. All battery packs should be fully charged prior to first use.

Lithium Polymer Battery (LiPo):

- LiPo batteries, 2S and greater, feature a separate balancing plug that isolates each cell in a pack and allows each to be charged and monitored independently. This ensures that all cells charge equally and discharge at the same rate during use. Never charge a 2S or greater LiPo battery without connecting the balance lead to the charger. Always balance charge a 2S or greater LiPo battery.
- Charge each battery pack individually. Never charge battery packs in series. Charging packs in series may result in improper charger cell recognition, improper charging rate, and overcharging that may lead to a fire. We recommend using a LiPo balance charge when charging your LiPo batteries.
- Always check to make sure that your LiPo charger settings match those listed on the battery pack label. Refer to the battery label for the proper cell count and 1C charging amperage settings.
- Always use a charger specifically designed for LiPo batteries. Never use NiCD or NiMH chargers to charge LiPo batteries.
- Do not charge LiPo batteries to more than 4.2V per cell.
- Never leave batteries unattended while charging, even when using a LiPo safety sack or another fireproof container. Batteries on charge MUST remain under constant observation so that you may react quickly should any problems arise.

2.3 Vessel Safety

Important Alert

Working with electricity in water environments requires utmost caution and adherence to safety protocols. Here are some important safety guidelines when using the Hydrone™ RCV:

- Electrical Safety: Exercise extreme caution when dealing with electricity in water. Avoid exposed wires and electrical circuits to prevent electrical shock hazards.
- Propeller (Prop) Safety: Keep body parts away from the thruster inlet and outlet to prevent injuries.
- Operating Conditions: Avoid operating the thrusters for extended periods outside of the water. The thrusters rely on water for cooling and running them dry can result in increased heat build up and potential damage.
- Environmental Considerations: While the thrusters can handle saltwater and sandy environments, it's crucial to avoid sucking debris into the thruster. Steer clear of plants, weeds, and other aquatic debris to prevent damage.
- Battery Safety: Never leave batteries powered on while the Hydrone™ RCV is unattended. Always disconnect all batteries immediately after use.

Adhering to these safety guidelines is crucial for the safe and effective operation of the Hydrone™ RCV and to prevent accidents or damage to the equipment. Always prioritize safety when working with water-based electrical equipment.

3 System Operation

3.1 What's Included

Item	Quantity	Description	Image*
Pontoons	2	Hydrone™ RCV USV	
Frame	1	Frame with Pole Mounts	
Fins	2	Seafloor Fins	
Frame Bolts	4	M5x25mm BHSC, Washer, and Lock Washer	
Remote Control Unit (RCU)	1	Remote Control Unit for Hydrone™ RCV	

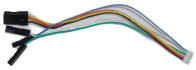
USB Charging Cable	1	Charging Cable for RCU. USB A to USB Mini Cable.	
LiPo Charger with Power Cable	2	Charger for the 4s LiPo Battery	
Velcro	4	For pontoon batteries(Not included)	
Allen Driver: 5mm	1	For Pole Mount	
Allen Driver: 3mm	1	For Frame Bolts	
Allen Driver: 2.5mm	1	For Fin Set Screws	
Hatch Wrench	1	For Pontoon Hatches	
Voltage Tester	1	To measure the 4S LiPo voltage	
USB Drive	1	Loaded with software, drivers, and manuals	
Programming Card	1	To Program the ESC	
Receiver Programming Cable	1	For Firmware Flashing	

Table 3: What's Included

*Please note that images provided are for illustrative purposes only and may not precisely represent the delivered product. Seafloor Systems reserves the right to modify any product at its discretion.

3.2 System Overview Diagram

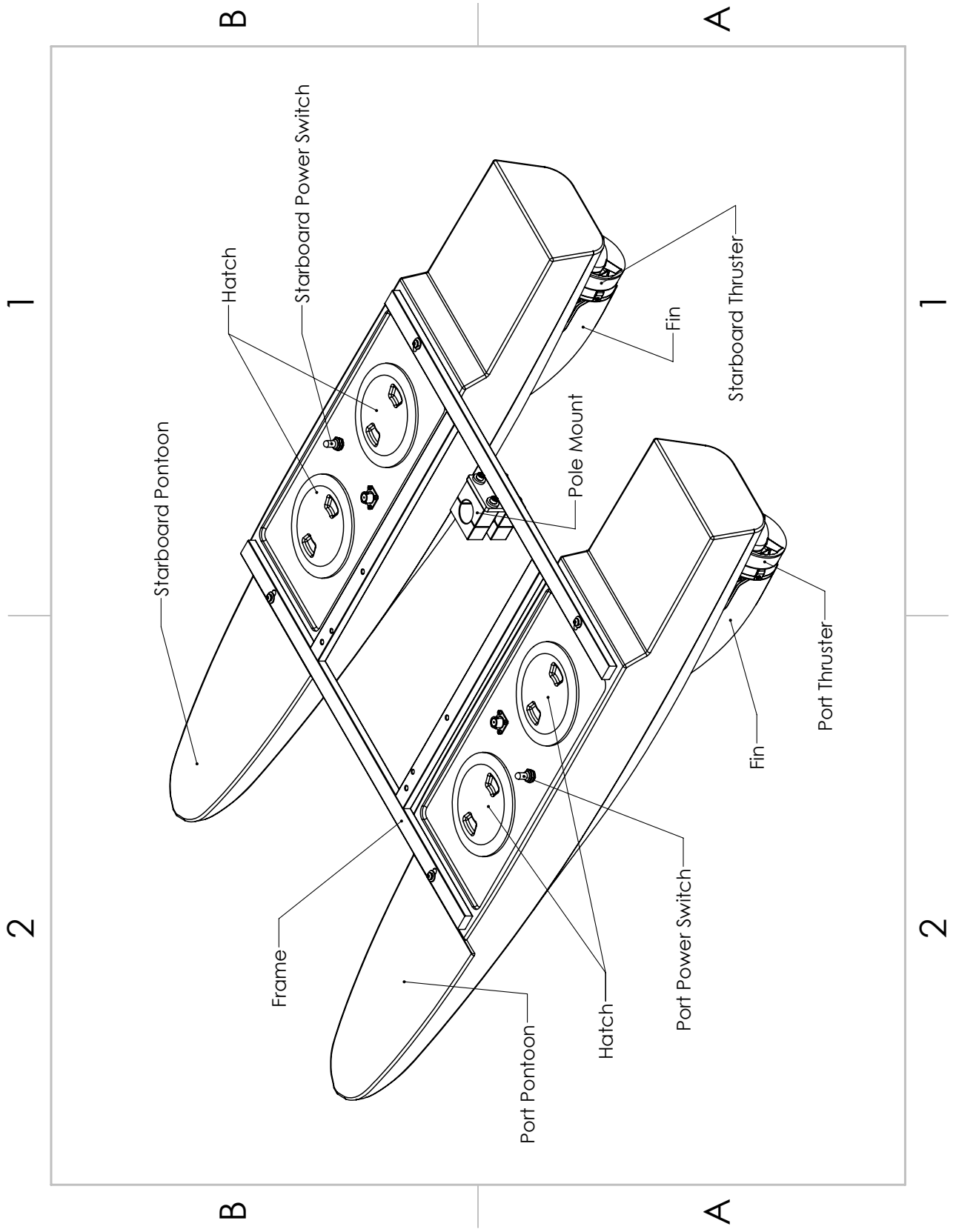


Figure 1: Hydrone™ RCV System Overview

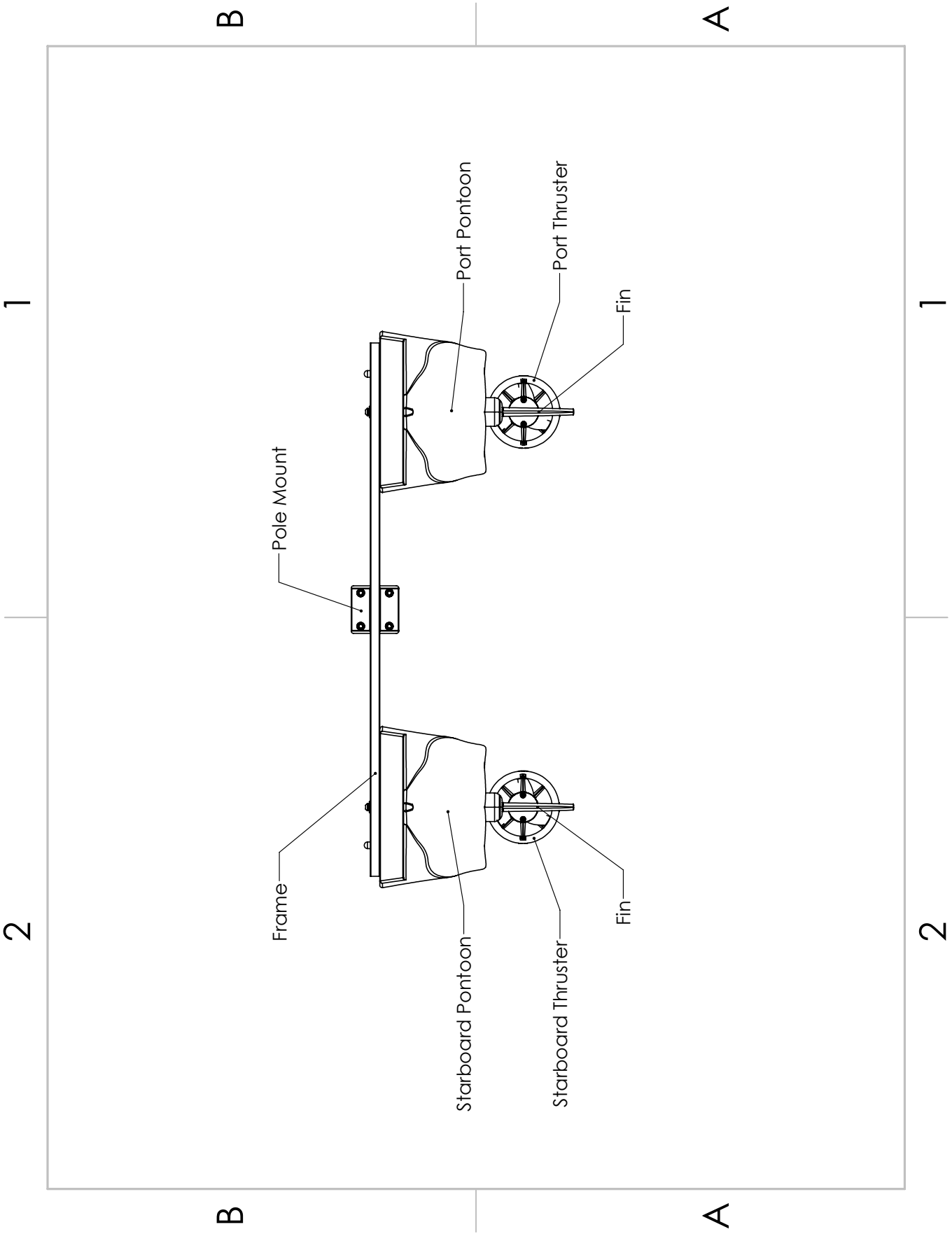


Figure 2: Hydrone™ RCV Front View

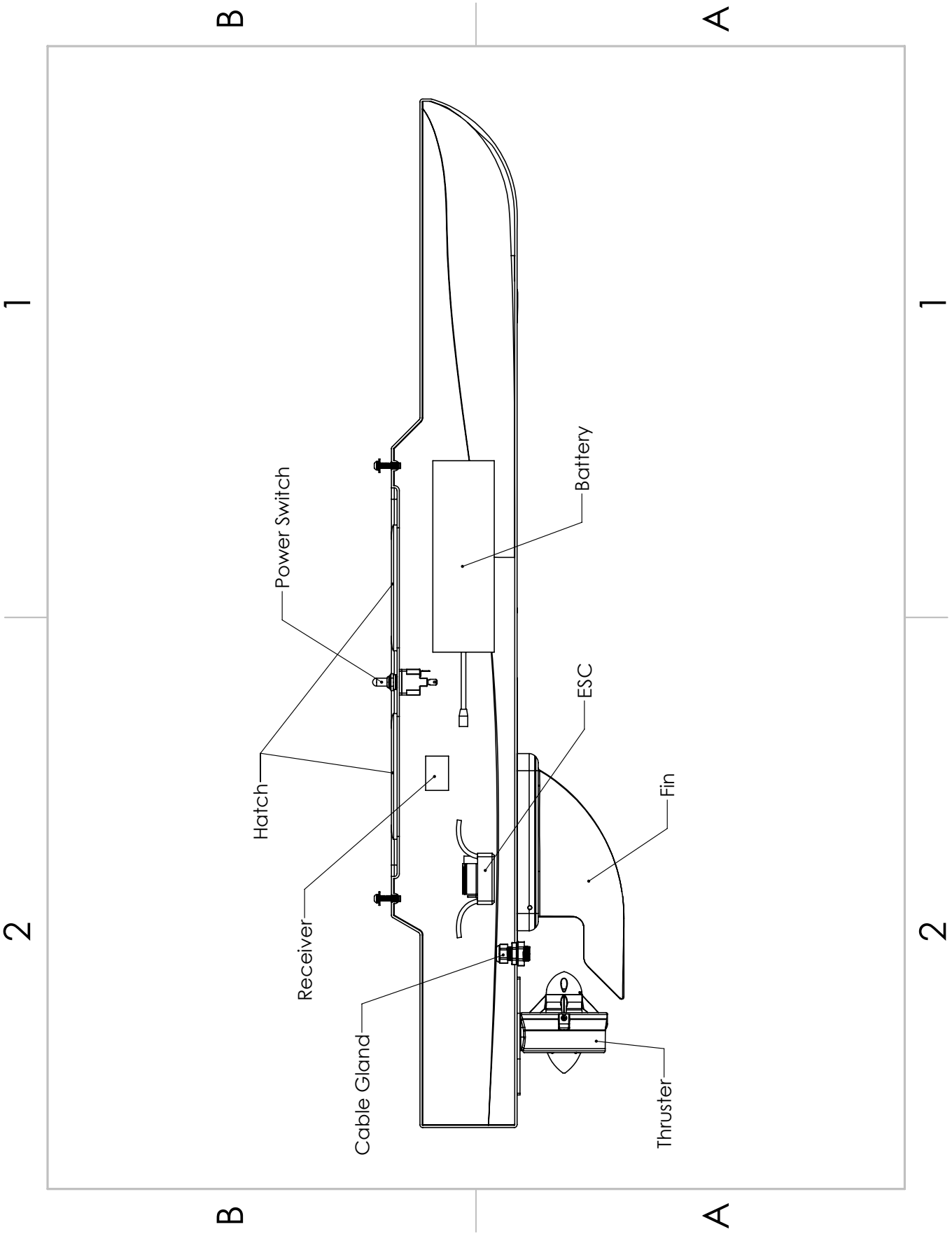


Figure 3: Hydrone™ RCV Side View

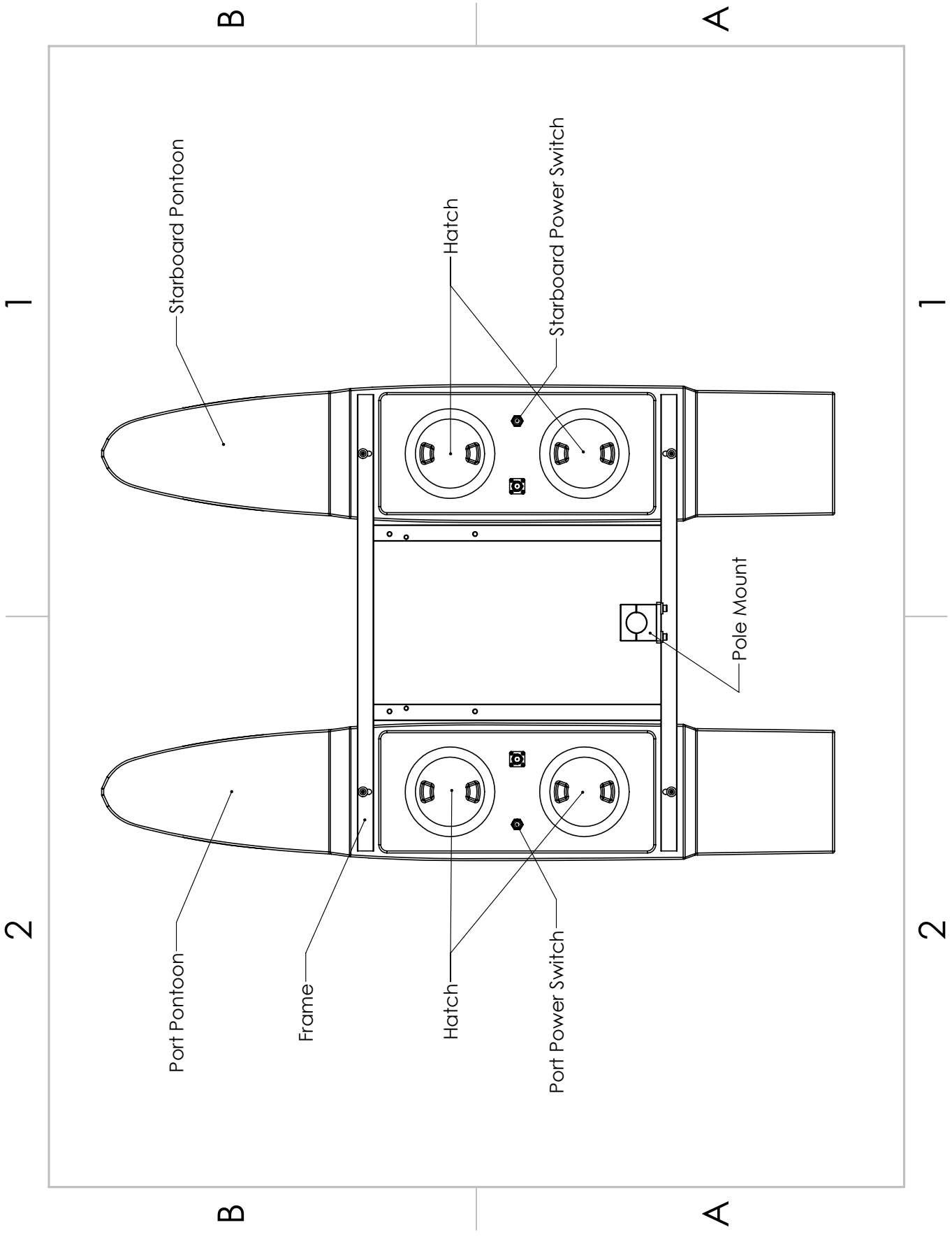


Figure 4: Hydrone™ RCV Top View

3.3 Assembling Your Hydrone™ RCV

Hydrone Pontoons:

1. Open the Hydrone™ RCV case.
2. The top section that houses the frame, fins, and other components can be removed and set aside.

Figure 5: Opening Hydrone™ RCV Case

Figure 6: Removing Top Layer

3. Arrange an elevated platform for positioning the Hydrone™ RCV pontoons, ensuring sufficient clearance for fins and thrusters.

Figure 7: Port(Left) Pontoon

4. Space the pontoons roughly 1' (30.4cm) apart.
5. Verify the port pontoon and starboard pontoon are on their correct sides.

Figure 8: Left And Right Pontoons

- Power switches and Hydrone Stickers should be facing outward
- Using the stickers at the stern. Port is left. Starboard is right.

6. Remove the frame from the top section of foam and lay it across the two pontoons. The pole mount should be on the back half of the vessel.

Figure 9: Pontoons Not Spaced Correctly

7. Loosely install all the supplied stainless steel frame hardware.

Figure 10: Frame Hardware

8. Tighten them with the supplied 3mm Allen driver.

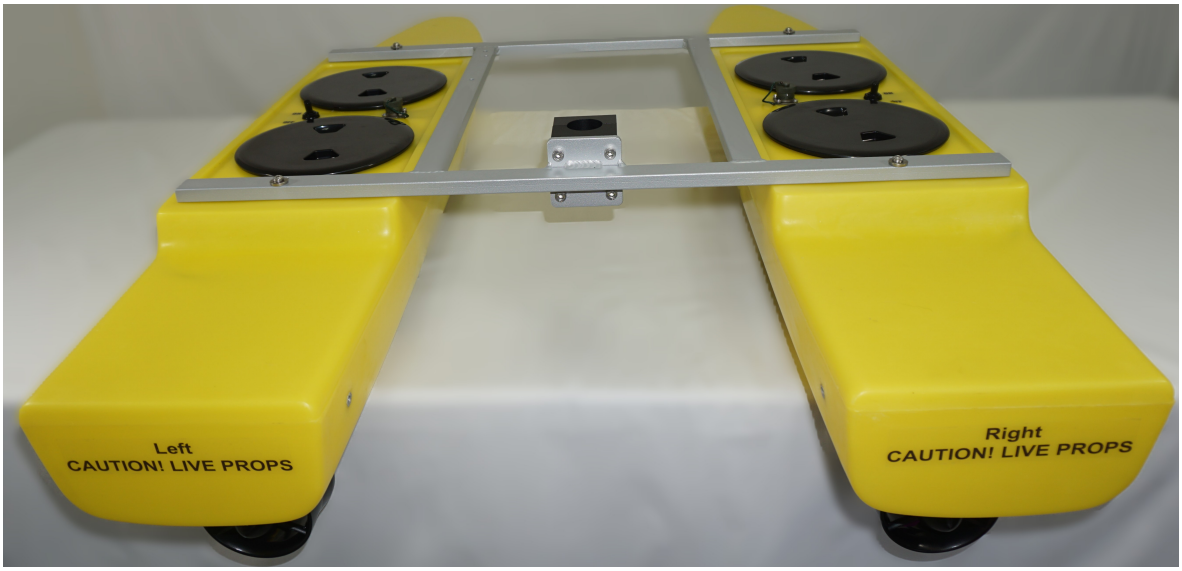


Figure 11: Frame Attached

9. Flip the Hydrone™ RCV upside down to gain access to the fin mount channel.
10. Slide the fin with the notch facing the bow into the fin mount channel.
11. Using the supplied 2.5mm Allen driver, tighten the set screw to hold the fin in place.

Figure 12: Fin Installation

12. Flip the Hydrone™ fin side down.

3.4 Hydrone™ RCV Endurance Chart

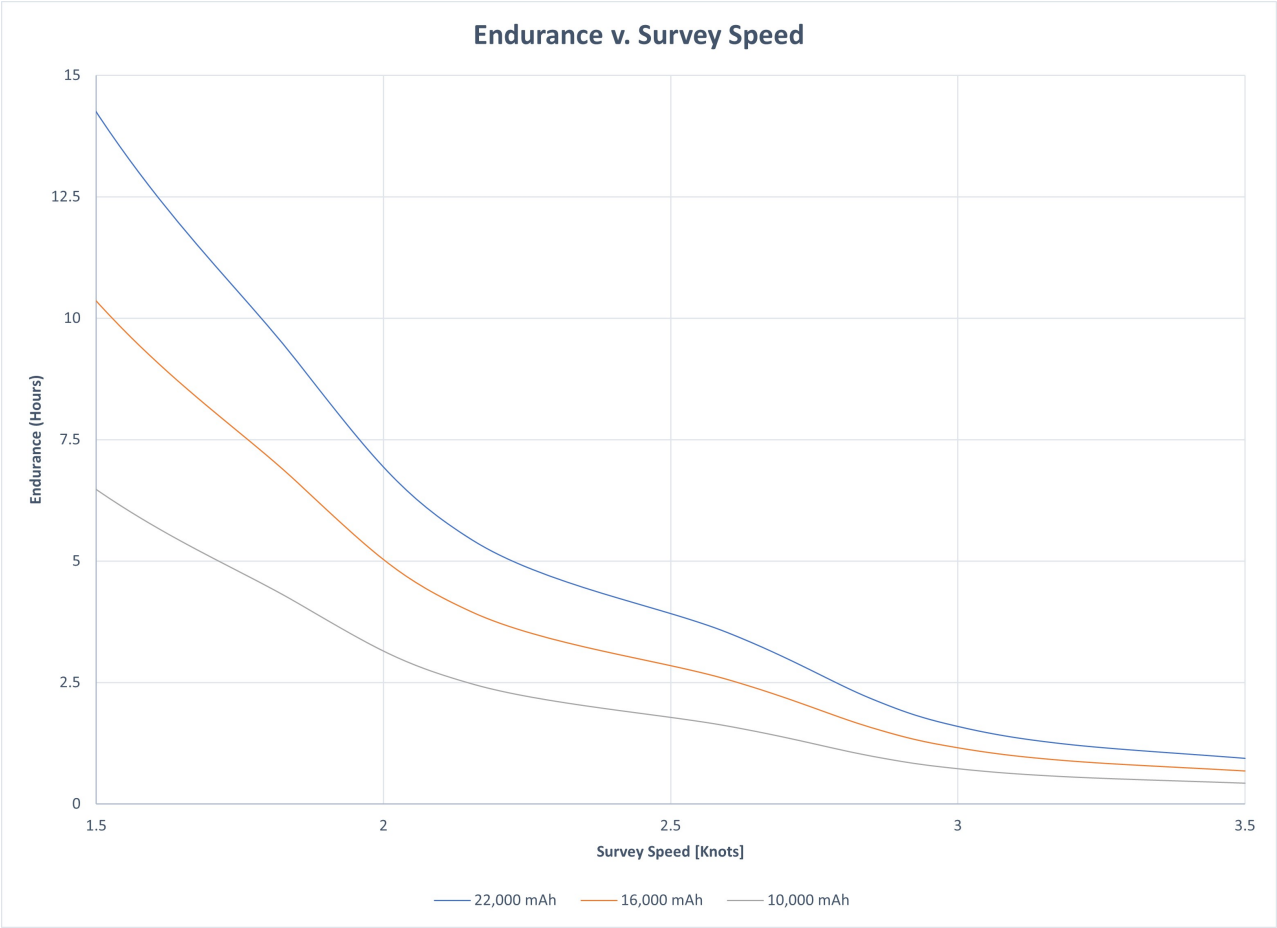


Figure 13: Hydrone™ RCV Endurance Chart

3.5 Remote Control Unit (RCU)

The Hydrone™ RCV is controlled by a Taranis Q-X7 Access Transmitter.

Information

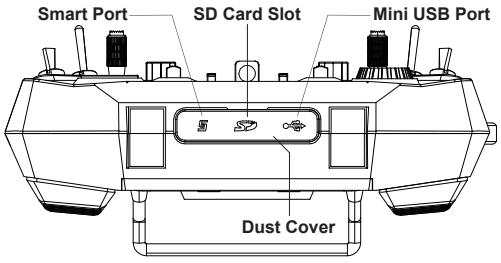


Figure 14: RCU Bottom View

To charge the battery:

- Open bottom dust cover to reveal Mini USB port.
- Connect supplied USB mini cable.
- Connect USB A into a suitable charger source. (5VDC at 2amps)

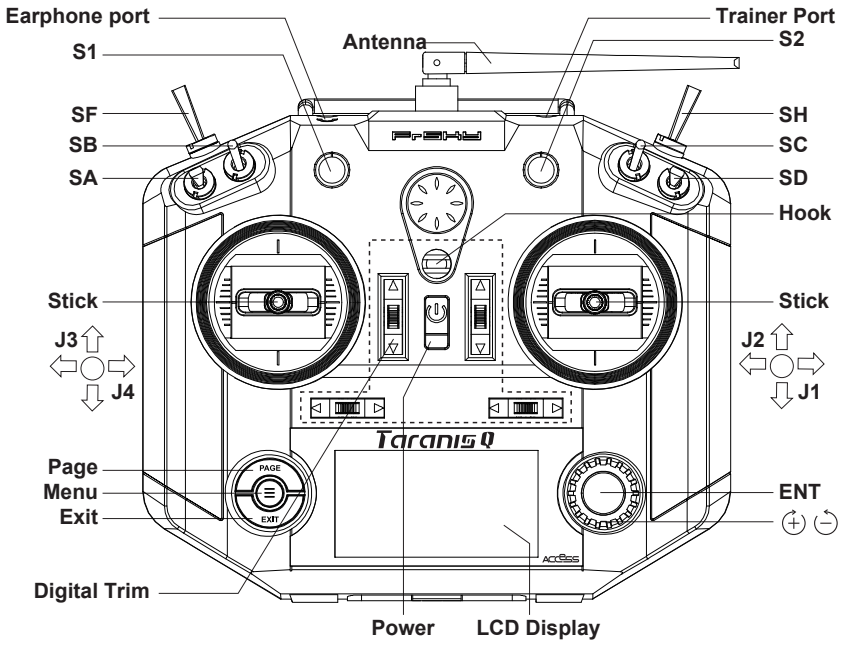


Figure 15: RCU Front View

Remote Control Unit Functions

Power	Press and hold Release when the fourth loading dot appears - to power on Release when the last loading dot shows - to power off
J1/J2	Starboard Throttle (Up/Down) Left/Right - Unused
J3/J4	Port Throttle (Up/Down) Left/Right - Unused
S1	Volume Clockwise to turn up Counter-Clockwise to turn down
S2	Unused
SA	Unused
SB	Unused
SC	Unused
SD	Unused
SF	Unused
SH	Unused
Digit Trims	Unused
Earphone Port	Unused
Trainer Port	Unused
Module Bay	Unused
Battery Cover	RCU Internal Battery Location (Refer to Fig 16)

Table 4: RCU Functions

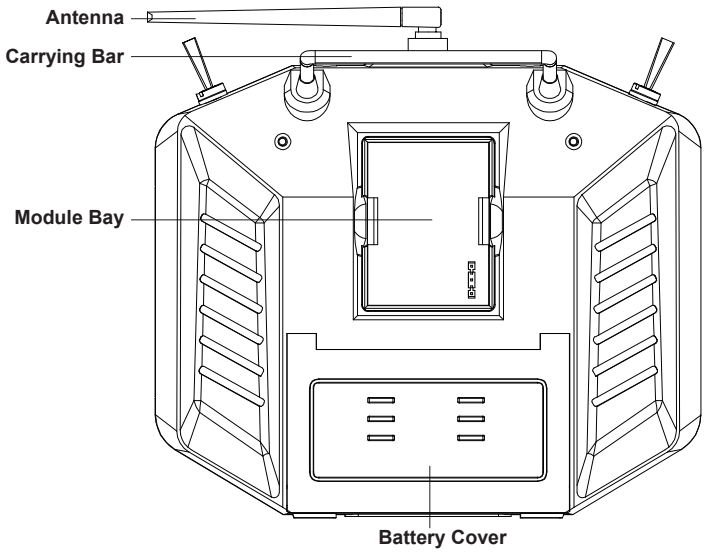


Figure 16: RCU Back View

3.6 Voltage Tester

Information

Max voltage of a 4S battery is 16.8VDC. (4.2VDC/Cell)

Connecting to a Voltage Tester:

1. Connect the balance cable connector to the voltage tester.
2. Due to the versatile nature of the voltage tester, it may take a few configurations to connect correctly.

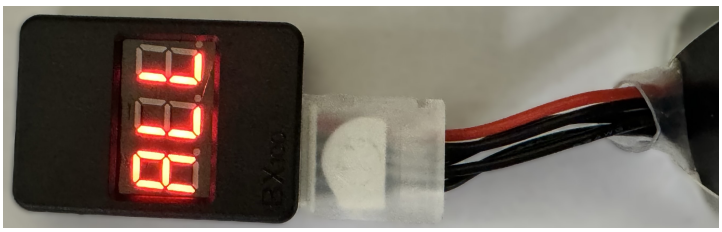


Figure 17: LiPo Voltage Tester

3. The voltage tester will cycle from overall voltage to each cell voltage.
4. It is recommended to check every battery prior to operation.

3.7 Battery Charging

3.7.1 E4 Cube Charger

Important Alert

Never leave batteries unattended while charging. Batteries on charge MUST remain under constant observation so that you may react quickly should any problems arise.

Caution

Max voltage of a 4S battery is 16.8VDC. (4.2VDC/Cell)

Caution

Charging LiPo Battery: with E4 Cube Balance Charger

1. Using the supplied voltage tester, verify each cell is above 3.2V, below 4.2V, and within 10% of each other.
2. Plug the E4 Cube charger into an AC 100-240VAC/50-60Hz outlet. Note that the battery is not connected to the charger currently.

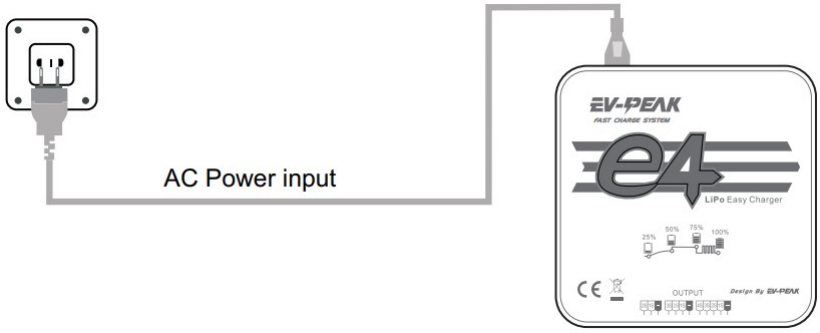


Figure 18: Cube Balance Charger Power

3. Charger will run a self-check. Wait for LED 1, 3 and LED 2, 4 to blink alternately before proceeding.
4. Connect the 4S 14.4V LiPo battery balance cable to the 4S (right) port.

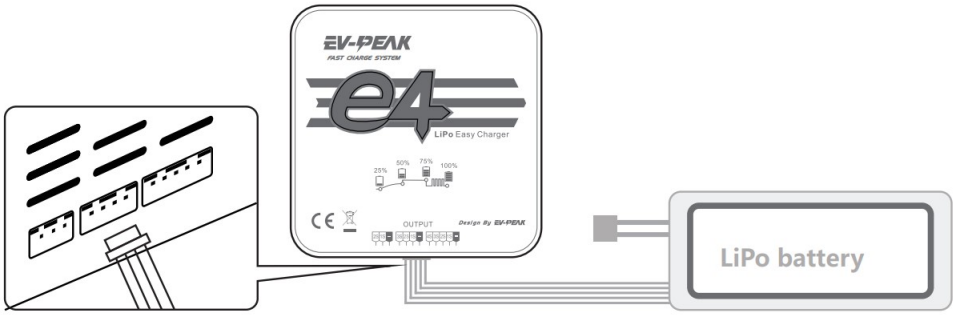


Figure 19: Cube Balance Charger Connection

5. After connecting the battery, the LED will blink and indicate the battery capacity percentage.
   - First LED indicates 25% capacity
   - Second LED indicates 50% capacity
   - Third LED indicates 75% capacity
   - Fourth LED indicates 100% capacity
   - Four LEDS will always be on when the battery is fully charged
6. When the battery is fully charged, disconnect the AC power first. Then disconnect the LiPo battery.

Technical Data

Property	**Value**
AC Input	100-240VAC
Rated Voltage	2S - 4S
Maximum charge current	4A
Charge Mode	Balance

Table 6: E4 Cube Balance Charger Technical Data

3.7.2 Optional - Spektrum Charger

Important Alert

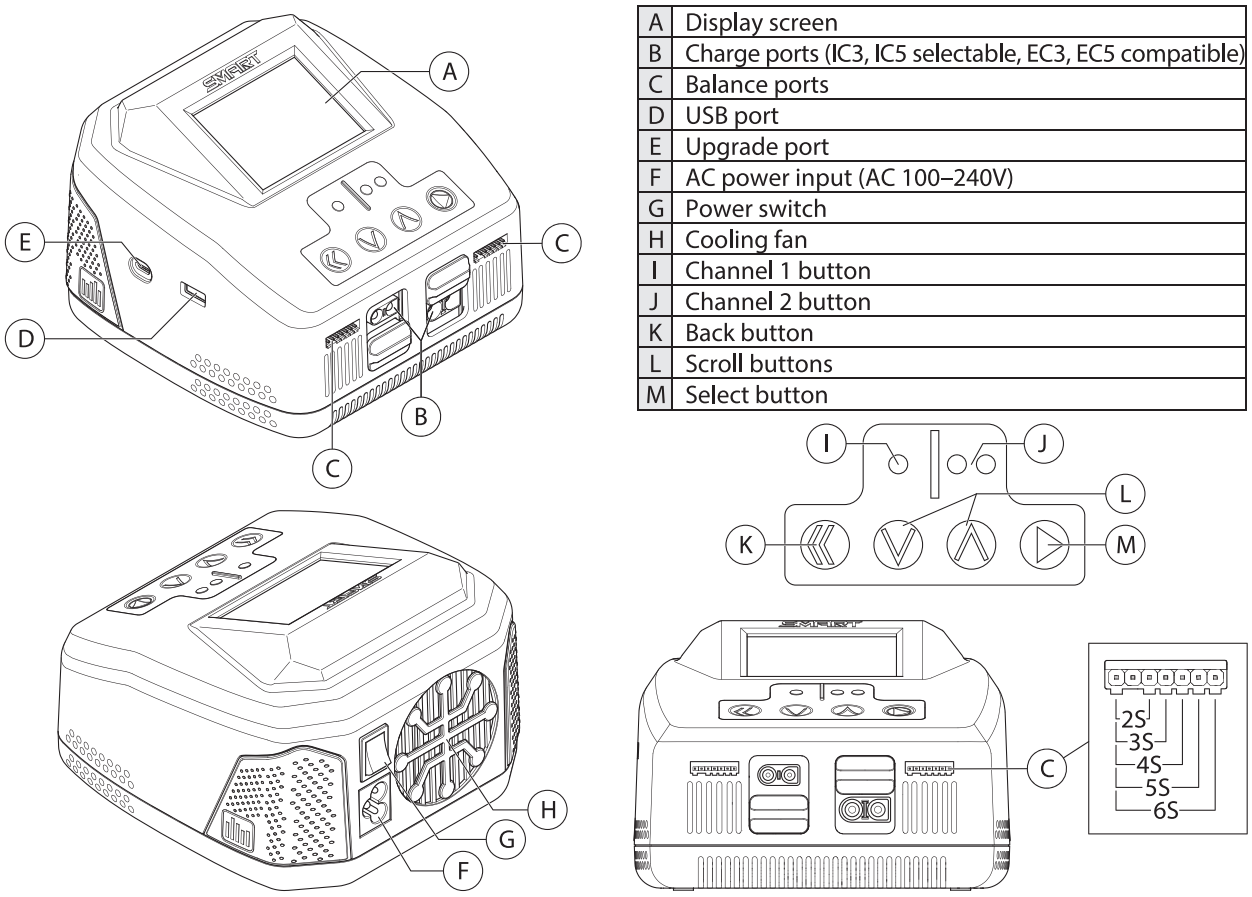
Never leave batteries unattended while charging. Batteries on charge MUST remain under constant observation so that you may react quickly should any problems arise.

Caution

Max voltage of a 4S battery is 16.8VDC. (4.2VDC/Cell)

Caution

Charging LiPo Battery: with Spektrum Charger



A	Display screen
B	Charge ports (IC3, IC5 selectable, EC3, EC5 compatible)
C	Balance ports
D	USB port
E	Upgrade port
F	AC power input (AC 100–240V)
G	Power switch
H	Cooling fan
I	Channel 1 button
J	Channel 2 button
K	Back button
L	Scroll buttons
M	Select button

Figure 20: Spektrum Charger Layout

1. Using the supplied voltage tester, verify each cell is above 3.2V, below 4.2V, and within 10% of each other.
2. Plug the S2200 G2 Smart Charger into an AC 100-240VAC outlet. Note that the battery is not connected to the charger currently.
3. The charger will initialize and display the home screen, which indicates that the charger is ready to be used.
4. Locate the charger adapter cables. Female IC5 connector to male XT90.
5. Connect male IC5 into the charger. Slide the port cover down to access the female IC5 connector.

6. Connect the female XT90 from the 4S LiPo into the male XT90 on the adapter cable. Then, connect the balance lead into the charger.

7. Press and release the menu/select button to display the charger settings list.

Task	Select Charge, Discharge, or Storage
Battery (Type)	Select LiPo
Cells (Cell Count)	Select 4 cells for 4S LiPo battery
Current	Select **10A** for 10,000mAh, **16A** for 16,000mAh and **20A** for 22,000mAh batteries
Start	Start the charger cycle
Smart Battery Settings	N/A
System Settings	Charger Settings
Charger History	Displays number of charger cycles per day, total number of cycles, charger temperature, and input power

Table 7: Spektrum Charger Settings

8. Select the 'Charge Task' option to charge the battery.

9. Confirm the settings are correct for the battery.

Important Alert

WARNING: Always check charging parameters before initiating the charge process. Charging any battery with improper settings, including charging a battery in the wrong mode, can result in property damage and fire.

10. Scroll to the 'Start' menu item. Press and release the 'Select' button to begin charging.

11. During the charging process the main screen will provide the following information:

    (a) Charge percentage

    (b) Battery data

    (c) Charge rate

    (d) Capacity rate

    (e) Total charge time

12. To view additional cell voltage (scroll to the next screen)

    (a) To stop the charging cycle, press and release the 'Back' button during charge or press and hold the 'Menu' button.

    (b) Select the 'Stop' menu item. The charger will then return to the home screen.

13. When charging is complete the charger will beep once to indicate fast charging is done. When the charger is finished balancing the battery it will double beep twice.

    (a) The main screen will display a green battery bar at the top to indicate the battery is full and the charging process has finished.

    (b) The total capacity charged and total charge time will be displayed.

14. Disconnect the battery from the charger.

Information

Charger error – If the charger displays an error, follow the on-screen prompts to remedy the error. If necessary, disconnect the battery from the output and balance ports, disconnect the power supply, and then restart the charger.

Technical Data

Input Voltage	100-240 VAC
Charge Current	0.1 - 20.0A
Discharge Current	0.1 - 1.5A
USB Output	5V / 2A
Max Charge Power	2x200W
Max Discharge Power	10W
Balance Current	1.5A/cell
Balance Cells	1-6s

Table 9: Spektrum Charger Technical Data

3.7.3 Optional - Tattu Charger

Important Alert

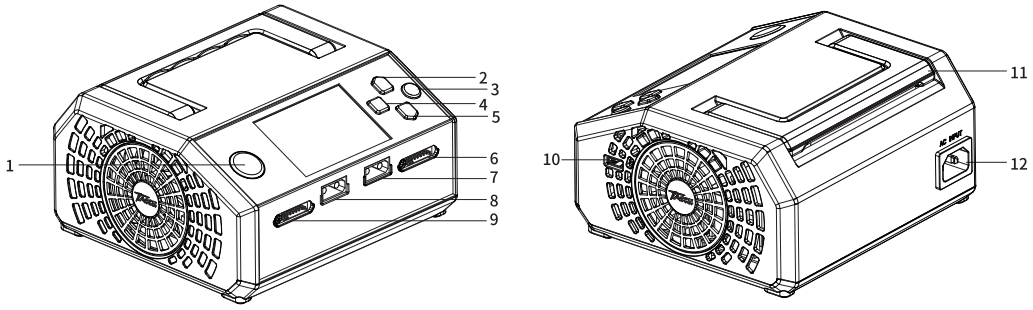
Never leave batteries unattended while charging. Batteries on charge MUST remain under constant observation so that you may react quickly should any problems arise.

Caution

Max voltage of a 4S battery is 16.8VDC. (4.2VDC/Cell)

Caution

Charging LiPo Battery: with Tattu Charger

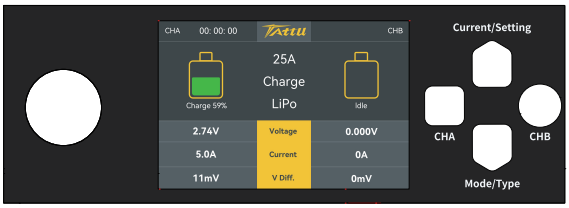


NO.	Description	NO.	Description
1	Power Switch	2	Current/Settings
3	CHB	4	CHA
5	Mode/Type	6	Balance Port B
7	Channel B	8	Channel A
9	Balance Port A	10	USB Upgrade Port
11	Handle	12	AC Input Port

Figure 21: Tattu Charger Layout

1. Using the supplied voltage tester, verify each cell is above 3.2V, below 4.2V, and within 10% of each other. Please refer to 2.1.
2. Plug the Tattu TA1000 Charger into an AC 100-240VAC outlet. Note that the battery is not connected to the charger currently.
3. Short press the Power Switch to power on the charger. The screen will display the start-up interface.
4. After powering on, the internal self-test interface displays for 5 seconds. After a successful self-test it will automatically switch to the main interface.
5. Connect the female XT90 from the LiPo battery into the male XT90 connector on the charger. Then, connect the balance lead into the charger.
   (a) Charging G-Tech Smart Batteries:
      i. If communication between the battery and charger is successful, the charger will automatically set charge settings and start after 6 seconds.
   (a) Charging Non G-Tech Smart Batteries:
      i. Using the up and down button, select the appropriate current, operation mode, and battery type.

ii. Press and hold the CH A or CH B button to start charge operation.



Button	Mode	Function
Power Switch	Short Press/Long Press	Short press to turn on/Long press to turn off
Current/Settings	Short Press/Long Press	Short press to select current/ Long press to enter the setting interface
Mode/Chemistry	Short Press/Long Press	Short press to select Charge/storage mode/ Long press to select battery chemistry Lipo/LiHV
CHA	Short Press/Long Press	Short press to return or view the interface of a single cell/Long press to start or pause the process of CHA
CHB	Short Press/Long Press	Short press to confirm or view the interface of a single cell/Long press to start or pause the process of CHB

Figure 22: Tattu Charger Operation

6. Press and hold the corresponding channel button to pause the charging operation.
7. During the charging process the main screen will provide the following information:
   (a) Charge time
   (b) Charge percentage
   (c) Status
   (d) Voltage
   (e) Current
   (f) Real-time voltage difference

Important Alert

WARNING: Always check charging parameters before initiating the charge process. Charging any battery with improper settings, including charging a battery in the wrong mode, can result in property damage and fire.

8. When charging is complete, two beeps will be heard and the display will read "Done 100 %" with a full green battery indicator.
9. Disconnect the battery from the charger.
10. Long press the Power Switch for 3 seconds to power off the charger.

Important Alert

WARNING: For safety, please do not disconnect the battery while charging. If you need to remove, please pause or cancel charging first.

Technical Data

Input Voltage	100-240 VAC
Max Charge Current	25.0A
Discharge Current	6.0A
Max Charge Power	2x500W
Max Discharge Power	2x70W
Balance Cells	1-7s
Operating Temperature	0°C - 60°C
Storage Temperature	-20°C - 60°C

Table 11: Tattu Charger Technical Data

3.8 Pre-Launch Check List

- Check all RCU switches and knobs are in correct positions for power on. **Ensure volume knob is fully clockwise**. (Refer to 3.9)
- Check that no warnings are displayed when RCU is powered on. Determine cause of any warning and correct.
- Check that no alarms are heard (**See volume knob note above**) or felt (Haptic Vibration Feedback System).
- Check model displayed on main screen is correct. (Figure 45)
- Check RCU battery voltage level is sufficient to perform lake test. 6-8.5VDC
- Check pontoon battery voltage level is sufficient to perform lake test. 13.6-16.8VDC (3.4-4.2VDC/Cell)
- Check propulsion system functions properly with manual control.
- Check the thruster cable gland is tightened to the cable. (Figure 3)

3.9 Hydrone™ RCV Power On Procedure

Caution

- Disconnect the batteries of the Hydrone™ RCV at 12.8VDC (3.2VDC/Cell) to avoid irreversible damage. (Refer to 1.4)
- To extend the battery life of the Hydrone™ RCV, it is advisable to power it off when the voltage reaches 13.6VDC (3.4VDC/Cell). (Refer to 1.4)

Information

1. Power on the RCU. (Refer to 3.5)
2. Verify the joysticks are centered.
3. Install fully charged 4S 16.8VDC (4.2VDC/Cell) batteries into each pontoon. Connect the female XT90 connector of the battery to the male XT90 connector of the power switch.
4. Power on both pontoon switches (Figure 1), wait 15 seconds for the ESCs to initialize with a series of beeps.
5. Verify throttle functions correctly. (Refer to 5.1)
6. Secure all hatches before launching vessel with the hatch wrench.

Caution

Do not run thrusters for more than a few seconds out of the water.

3.10 Manual Operation

Hydrone™ RCV is a skid steered vessel. The left joystick controls the port throttle. The right joystick controls the starboard throttle.

- Adjust speed using the RCU's throttle control: push forward for forward motion, pull back for reverse, and center for neutral.
- To steer left, pull back on the port throttle the same amount you push forward on the starboard throttle. To steer right, pull back on the starboard throttle the same amount you push forward on the port throttle.
- Familiarize yourself with the controls in a safe area to get a feel for the boat's responsiveness.
- Be mindful of the apparent opposite steering when the Hydrone™ RCV is headed toward you.

3.11 Hydrone™ RCV Power Off Procedure

1. Upon retrieval of the Hydrone™ RCV, center the joysticks. (Refer to 3.5)
2. Power off both pontoon switches. (Figure 1)
3. Disconnect each 4S battery. Disconnect the female XT90 connector of the battery to the male XT90 connector of the power switch..
4. Power off RCU by holding the power button until the 4 dots on the screen count down. Release at one dot. (Refer to 3.5)

3.12 Fail-Safe

Information

If there's a failure, the Hydrone™ RCV is equipped with a built-in fail-safe.

- Outside of RCU range if loss of comms: The receivers will go into fail-safe mode.
  - The vessel will drift with no input. Move towards the Hydrone™ RCV to attempt to reconnect with the RCU.

3.13 Voltage Monitoring

Hydrone™ RCV has a built-in real-time voltage monitor of the system and RCU.

To view RCU battery voltage:

1. Power on the RCU. (Refer to 3.5)
2. Press EXIT to get to the main screen.

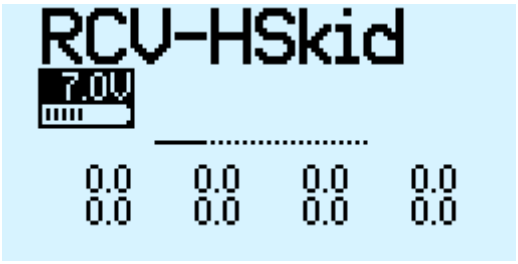


Figure 23: Main Screen

3. Battery icon and percentage is the RCU battery.
   - Battery Range is 6-8.5VDC.

To view Hydrone™ RCV battery voltage:

1. Power on the RCU. (Refer to 3.5)
2. Power on a pontoon(Archer Plus R6 only).
   (a) Must power on starboard pontoon for older vessels (Archer R4 and older).
3. Hold down PAGE button to access the DISPLAY screen.

Figure 24: Display Page

- Left voltage(A2) is the starboard pontoon battery.
- Right number(Received Signal Strength Indicator (RSSI)) is the RCU signal strength.
- Top left name is the RCU model.
- Top right voltage is the RCU battery.

4 Frequently Asked Questions (FAQ)

- Why does the prop not spin in reverse?
  - The ESC is not programmed to "Forward and Reverse" running mode. Refer to 6.5 for ESC Programming.

- Why does the thruster motor not respond while the Hydrone™ RCV is powered? Alert tone of beep-, beep- (1 second interval) is heard.
  - There is no signal from the receiver. Verify that the RCU is powered and that the RCU and receiver are bound. Verify all connections are clean and fully seated.
- Why is the hatch leaking?
  - Verify the condition of the hatch seal. Lubricate or replace as necessary.
- Why is the prop spinning without engaging the throttle?
  - Verify that the throttle trim is centered. Calibrate if necessary, refer to 6.4.
- Why is the Hydrone™ RCV still powered when the main switch is in the off position?
  - Disconnect the battery.
- Why does the Hydrone™ RCV have a limited turning radius or only turns in one direction?
  - Verify that the props are clean of debris. If issue still persists, calibrate ESC. (Refer to 6.4)
- Why is the pontoon not powering on?
  - Power switch on ESC is off or not fully seated in the on position.
- Why is the receiver not powered?
  - Connector is not fully seated or inadvertently disconnected.
- Why do I need to keep programming the ESC?
  - RCU joysticks are not in the neutral position when the pontoon is powered up.

5 Troubleshooting

5.1 Propeller Orientation And Rotation

If the propellers on a Hydrone™ RCV are rotating in the wrong direction, it will cause the boat to move in circles when attempting to go forward. Similarly, installing the wrong propeller will also lead to same issue. If you recently installed a new thruster or propeller, please use the below information to check proper orientation and rotation.

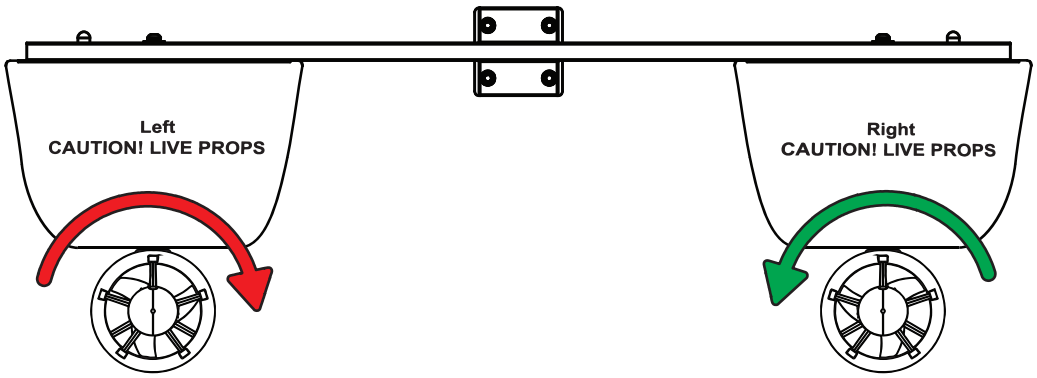


Figure 25: Hydrone™ RCV Prop Rotation
(Colors Illustrate Maritime Navigation Lights)

- Port Thruster:
  - Motor must rotate clockwise(CW) (Figure 25)
  - Prop is CCW

Figure 26: W30 CCW Prop

- Starboard Thruster:
  - Motor must rotate counter-clockwise(CCW) (Figure 25)
  - Prop is CW

Figure 27: W30 CW Prop

5.2 Receiver Connections

Hydrone™ RCV Port(Left) Pontoon Receiver:

- ESC connected to Channel 1.

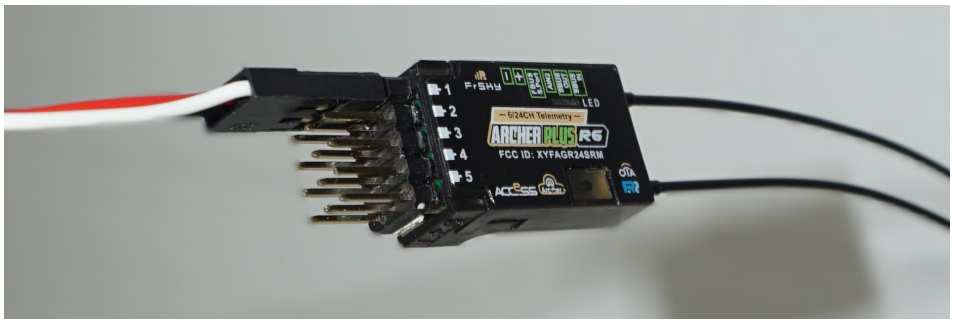


Figure 28: Channel 1

- Telemetry power cable connected to AIN2. (Figure 35)

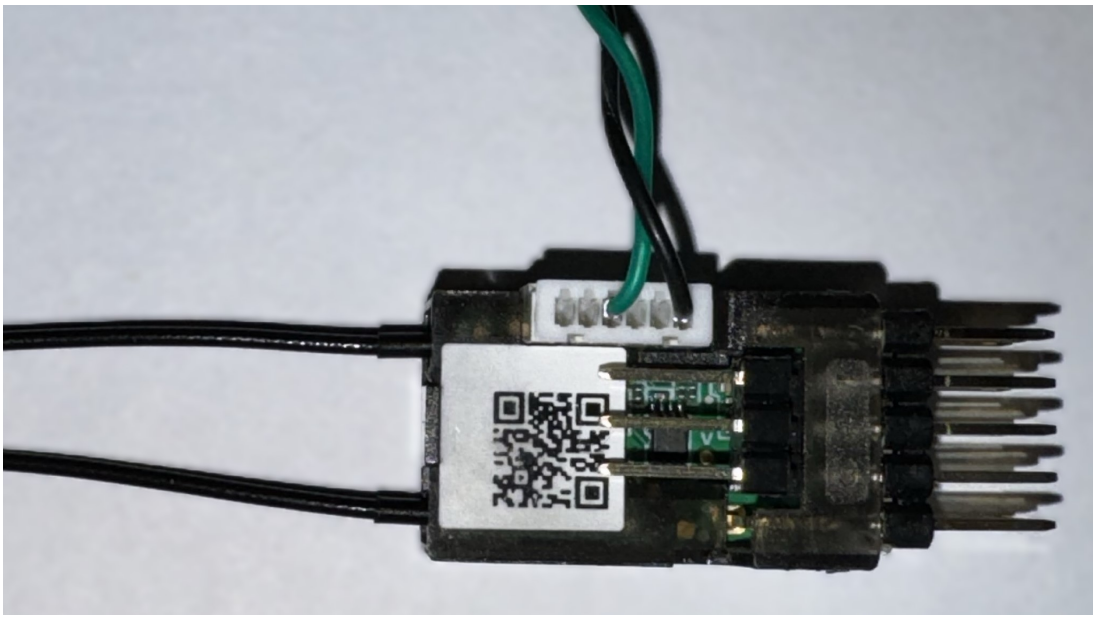


Figure 29: Receiver AIN2 Connection

Hydrone™ RCV Starboard(Right) Pontoon Receiver:

- ESC Connected to Channel 2.

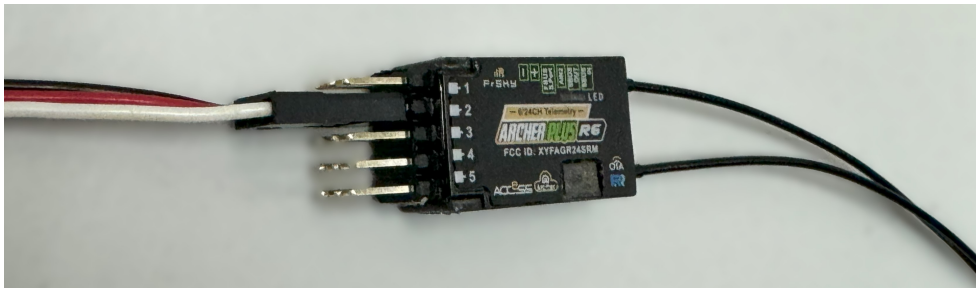


Figure 30: Channel 2

- Telemetry power cable connected to AIN2. (Figure 35)

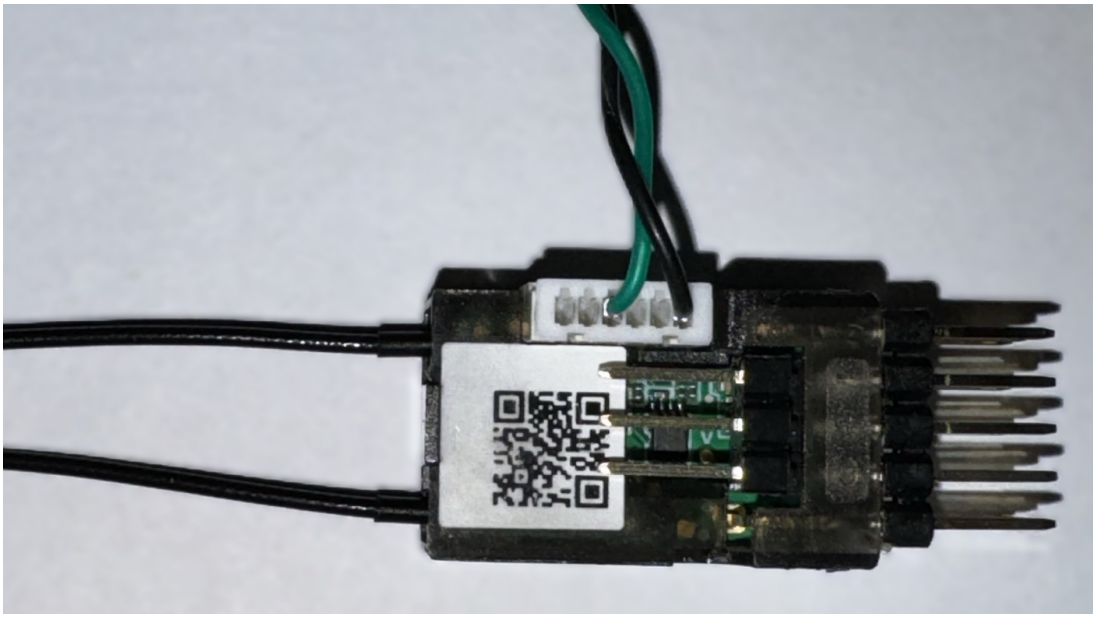


Figure 31: Receiver AIN2 Connection

6 Configure Procedure

6.1 RCU Receiver Binding Procedure

Archer Plus R6 Binding:

Registration is only required if the RCU or Receiver (RCVR) was replaced. Skip to step 7 to bind for either receivers.

1. Refer to 3.5 for button or switch location on RCU.
2. Power on the RCU, power off the Archer Plus R6.
3. Quick press 'Menu' on the RCU.

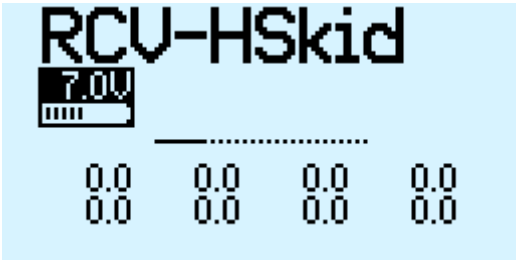


Figure 32: Model Select Screen

4. Quick press 'Page' to switch to SETUP Page 2/13.

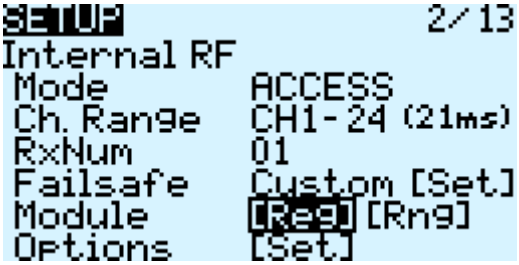


Figure 33: Internal RF

5. Using the ENT knob, scroll down to INTERNAL RF. (Figure 33)
   (a) Archer Plus R6 Registration: (Registration ID is the vessel serial number)
      i. Under Internal RF, Click Reg. A menu will pop up with 'Waiting...'
         - **If you are changing to a new RCU and know the REG ID, you can scroll up and change ID. Once changed, skip to Step 7 below.**

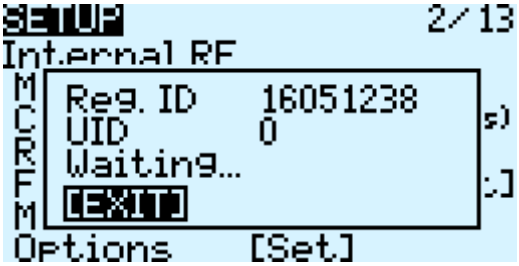


Figure 34: Waiting To Register

      ii. On the Archer Plus R6, hold down the receiver button while powering up the Archer Plus R6. (Figure 35)

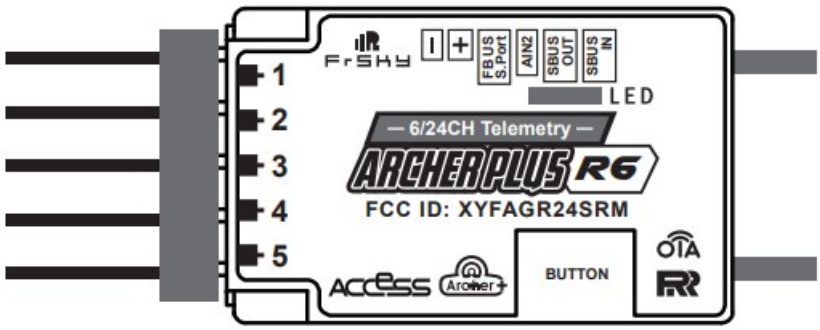


Figure 35: Archer Plus R6

         - It is suggested to disconnect the main cable to remove power and reconnect when power is needed.
      iii. On the RCU, 'Waiting...' will be replaced with the model name.
      iv. Press Enter to confirm, registration complete.
      v. Power off the receiver.

6. Scroll to Receiver 1 and select Bnd.

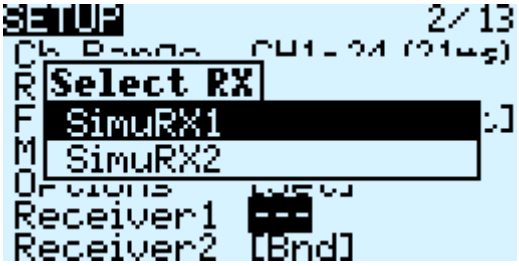


Figure 36: Binding Screen - SimuRX1/2 Is Only Used For Simulation

7. Power on the Archer Plus R6
8. Press OK once bind is successful.

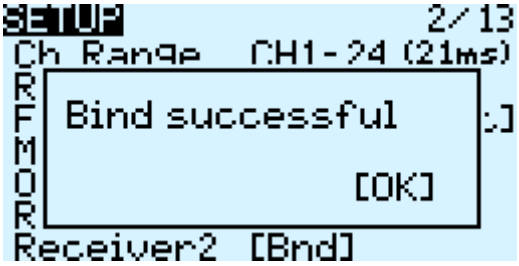


Figure 37: Bind Successful

6.2 RCU Telemetry Configuration Procedure

Information

Telemetry configuration is only required if the RCU or Receiver (RCVR) was replaced. RCU and Receiver must be bound.

1. Refer to 3.5 for button or switch location on RCU.
2. Power on the RCU, power on the Hydrone™ RCV.
3. Quick press 'Menu' on the RCU.

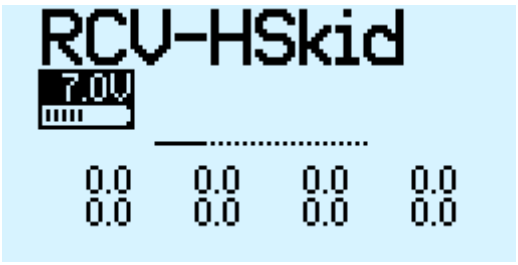


Figure 38: Model Select Screen

4. Quick press 'Page' to switch to TELEMETRY Page 12/13.

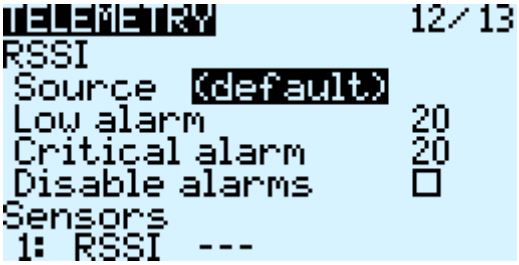


Figure 39: Telemetry Page

5. Scroll down and select "Delete all sensors".

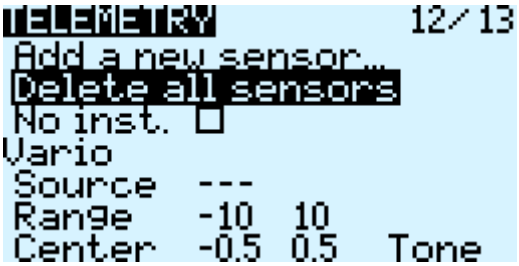


Figure 40: Delete All Sensors

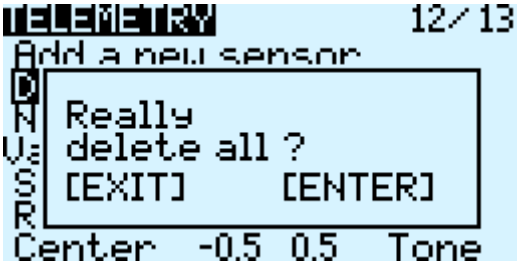


Figure 41: Delete All Sensors Pop-Up

6. Scroll up and select "Discover new sensors".

Figure 42: Discover New Sensors

7. A2 sensor will be active.

8. Select the A2 sensor.

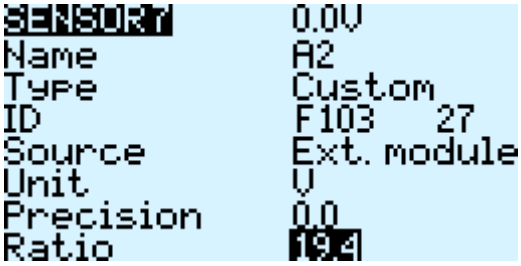


Figure 43: A2 Sensor Page

9. At the top of the screen is the pontoon voltage.
10. Scroll down to the Ratio. Modify the value to set the pontoon voltage. Use the supplied Voltage Checker to check the pontoon voltage.
11. Press 'Exit' and the A2 sensor is setup.
12. Quick press 'Page' to switch to DISPLAY page 13/13.

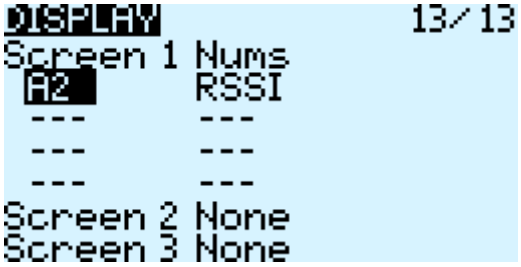


Figure 44: Display Page

13. The A2 will be removed when the sensors were deleted. Select the empty spot and scroll to A2. Do not use A2+ or A2- as they will show higher or lower voltages.
14. Press 'Exit' to complete the configuration.

6.3 RCU Calibration Procedure

Calibrations should only be initiated if the Hydrone™ RCV demonstrates a delayed response or excessively quick response, while the remainder of the joystick throw remains unchanged.

Information

All calibrations must be done in the correct order. Please refer to 3.5 to familiarize yourself with the RCU controls.

1. **Hydrone™ RCV must be powered off.**
2. Power on the RCU. (Refer to 3.5)

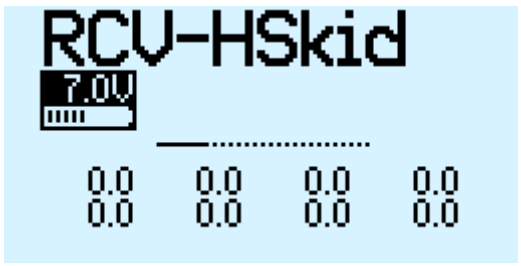


Figure 45: Main Screen

3. Hold down 'Menu' button.

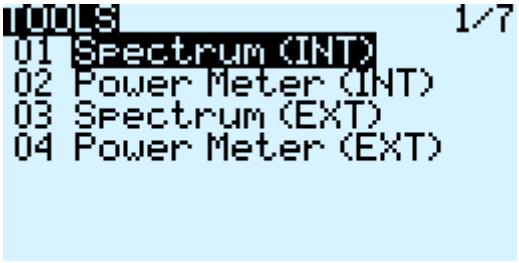


Figure 46: RCU Settings

4. Quick press 'Page' to switch to HARDWARE to Page 6/7.

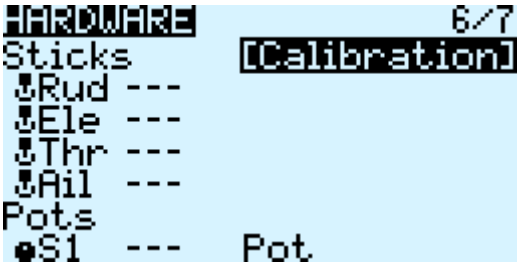


Figure 47: Hardware Page

5. Highlight 'Calibration' and select.
6. Follow the onscreen instructions.

Figure 48: Start Of Calibration

7. Once calibration is complete, screen will cycle back to start of calibration page.
8. Press Exit twice to exit back to main screen.

6.4 ESC Calibration Procedure

1. Calibrate one ESC at a time.
2. Power on the RCU. (Refer to 3.5)
3. Push the Throttle Control to full throttle on the pontoon you are calibrating.
4. Power on the Hydrone™ RCV.
5. Two short Beep- Beep- tones will be heard, confirming the full throttle position.
6. Immediately release the Throttle Control to the neutral position.

7. A steady and long beep— can be heard, confirming the neutral position.

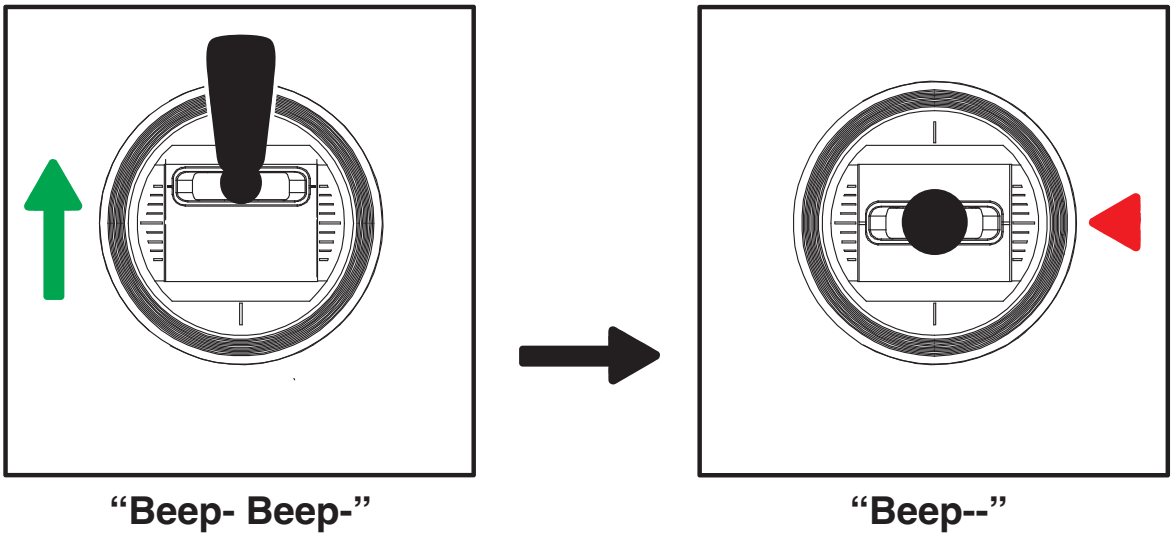


Figure 49: Joystick Position

8. Finalization tones can be heard. Calibration complete.
9. Repeat for the opposite side.

6.5 ESC Programming Procedure

LED Indications

Solid Red	Throttle
Solid Red and Green	Full throttle
Flashing Red	Low Voltage Cutoff Protection is activated
Flashing Green	Overheat protection is activated

ESC Programming

1. Connect the included ribbon cable into the programming slot on the programming card.

Figure 50: ESC Programming Card Ports

2. Connect the ribbon cable to the ESC. Pay attention to the connector orientation.

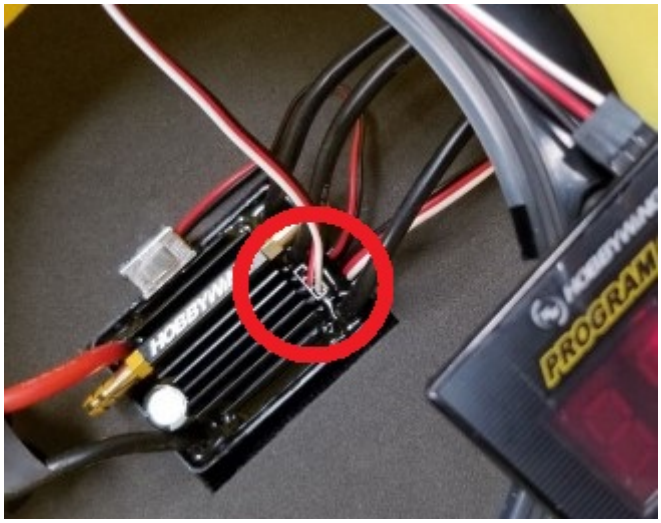


Figure 51: ESC Programming Card Connection

3. Power on the Hydrone™ RCV. The Programming Card will power on.
4. Using the chart below, match the Items with the Values.
5. Press Item to cycle Items. Press Value to cycle Values. Press 'OK' to save for each Item.

Item	Value	Description
1	2	Forward & Reverse Mode
2	1	Auto Calc LiPo Cells
3	4	3.2V/cell Low Voltage Cut Off
4	5	15° Timing
5	4	100% Reverse

Table 12: ESC Programming Values

7 Service And Maintenance

7.1 Maintaining Your Investment

Maintaining your Hydrone™ RCV asset is essential for its reliable performance. Regular maintenance includes routine checks of propulsion system, sensor, and electronics to ensure they are in optimal working condition. Keeping the hull clean as well as verifying the integrity of communication links and power sources, is crucial. By adhering to a proactive maintenance regimen, the USV remains mission-ready, maximizing its effectiveness and longevity.

7.2 Storage

- Store indoors with all hatches open for air circulation.
- LiPo batteries stored at 3.75-3.85V a cell - check every month.
- Pontoon internals are dry

7.3 Service

7.3.1 Thruster Replacement

1. Remove the 2x M5 nyloc with a 8mm wrench.

Figure 52: Thruster Removal

2. Disconnect the 3 motor wires from the ESC. (Figure 72)
3. Remove the cable gland nut and seal off the thruster wires.
4. Slide 1 of the 3 motor wires through the cable gland at a time until it's fully removed.
5. Install thruster adapter plate to new thruster, if required.

Figure 53: Thruster Adapter Plate

6. Install new thruster motor wires through cable gland.
7. Install the cable gland seal and nut.
    - Ensure the seal sits in it's notched location for proper sealing.
8. Install new thruster onto the pontoon mating plate.
9. Install the 2x M5 nyloc.

7.3.2 Propeller Replacement

Caution

Use Vibra-tite with all hardware. Plastic may become damaged if Vibra-tite instructions are not properly followed.

1. Remove the 2x M5 nyloc with a 8mm wrench.

Figure 54: Thruster Removal

2. Remove the 4x M3x6 bolts with a 2mm Allen driver.

Figure 55: Thruster Adapter Plate Removal

3. Remove the 5x screws with a #3 Philips driver.

Figure 56: Thruster Housing Removal

4. Remove the 2x screws with a #3 Philips driver.

Figure 57: Prop Removal

5. Remove the prop. The prop may be suctioned to the motor housing. Use care when removing.

Figure 58: Prop Removed

6. Install the replacement W30 prop.
7. Follow the instructions in reverse order for reassembly.

7.3.3 Motor Cleaning

Caution

Use Vibra-tite with all hardware. Plastic may become damaged if Vibra-tite instructions are not properly followed.

1. Remove the 2x M5 nyloc with a 8mm wrench.

Figure 59: Thruster Removal

2. Remove the 4x M3x6 bolts with a 2mm Allen driver.

Figure 60: Thruster Adapter Plate Removal

3. Remove the 5x screws with a #3 Philips driver.

Figure 61: Thruster Housing Removal

4. Remove the 2x screws with a #3 Philips driver.

Figure 62: Prop Removal

5. Remove the prop. The prop may be suctioned to the motor housing. Use care when removing.

Figure 63: Prop Removed

6. Remove the 2x M3 bolts with a 2.5mm Allen Driver

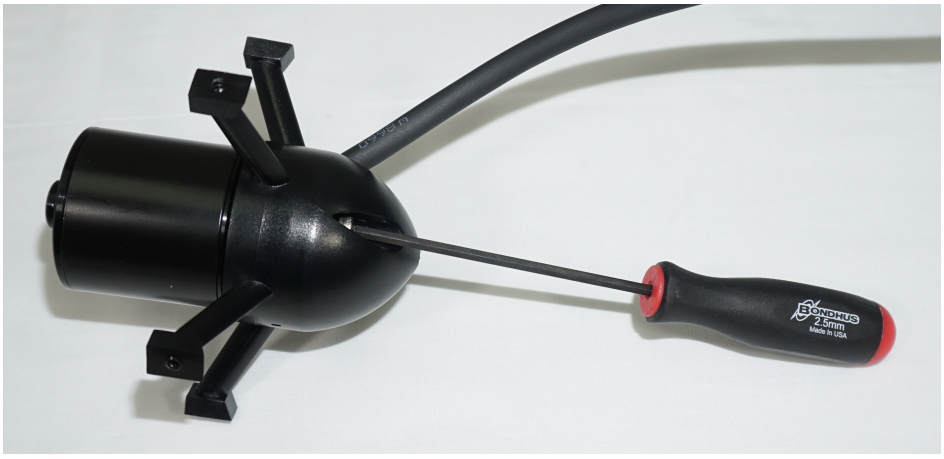


Figure 64: Motor Housing Removal

7. Loosen the 2x set screws on the collar towards the bow using a 1.5mm driver(not supplied).

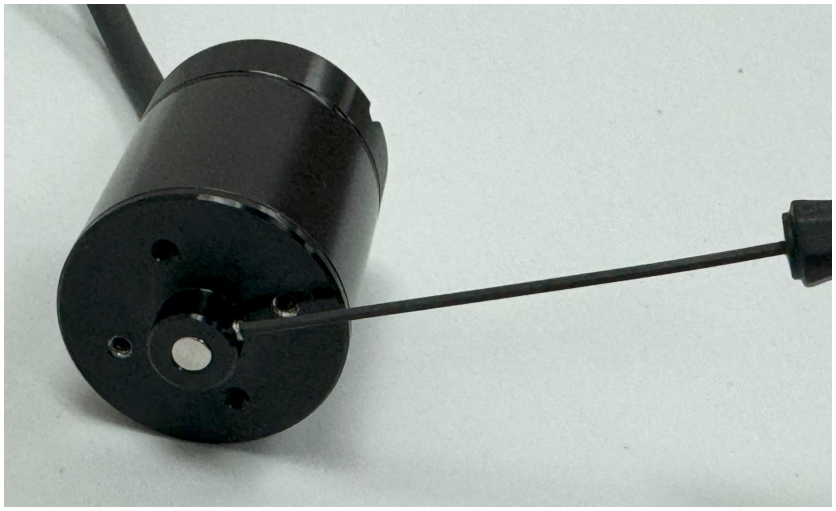


Figure 65: Rotor Removal

8. The motor rotor and stator are magnets. To remove, pull on the motor rotor to slide off.

Figure 66: Stator And Rotor

9. Inspect the magnets and protective coverings. Clean with mild soap and water.
10. Follow the instructions in reverse order for reassembly.

7.3.4 RCU RTC Battery Replacement

Replace the RTC battery when you receive "Battery Warning: RTC Battery Low".
Part Required:

- CR21220 Coin Battery

Tool Required:

- Phillips Screwdriver

1. Power off and flip over the RCU.
2. Remove the two visible Phillip screws.

Figure 67: RCU 2x Screw Locations

3. Remove the module bay cover.
4. Remove the battery cover. (Figure 16)
5. Disconnect the battery.

Figure 68: RCU Additional Screw Locations

6. Remote the additional two Phillip screws.
7. Carefully split case of the RCU.

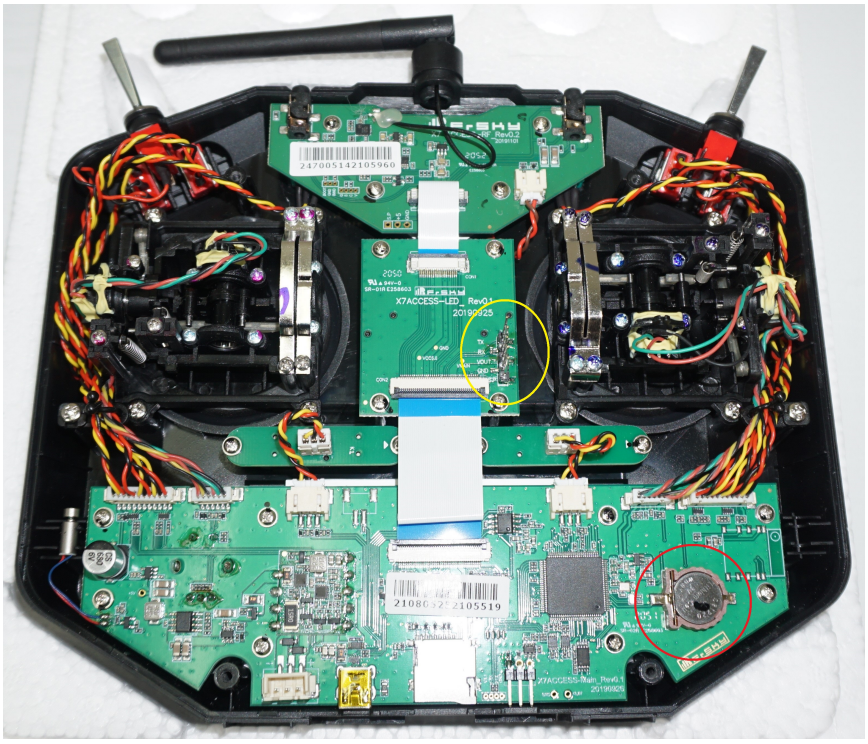


Figure 69: RCU RTC Location

8. Locate the RTC battery(circled red in Figure 69) and remove it.
9. Replace it with a new CR1220 battery.

10. Carefully put the two case halves together. Verify the module bay pins (circled yellow in Figure 69) slide through the slot (Figure 16).
11. Screw in the four Philip screws.
12. Connect the battery.
13. Install battery spacing foam.
14. Install the battery and module bay covers.

7.4 Maintenance Schedule

7.4.1 Pre-launch

- Hull inspection for damage, cracks, or signs of wear.
- Seals are lubricated with silicone-based lubricants.
- Anti-seize on hardware.
- Electronics are functioning.
- Batteries are fully charged.
- Check all hardware is tight.
- Check that cable connections are screwed tight.
- Confirm full insulation of all cables.

7.4.2 After Recovery

- Hull inspection for damage, cracks, or signs of wear.
- Seals are lubricated with silicone-based lubricants.
- Anti-seize on hardware.
- Electronics are functioning.
- Batteries are fully charged.
- Check all hardware is tight.
- Cleaned with fresh water and mild soap.
- Dried off.
- Stored with hatches open for circulation.

7.4.3 Monthly

- Hull inspection for damage, cracks, or signs of wear.
- Check for loose or corroded electrical connections.
- Lubricate seals with silicone-based lubricants.
- Anti-seize on hardware.
- Electronics are functioning.
- Battery maintenance.
  - LiPo batteries should be stored at 3.6V a cell.
- Replenish any parts that were pulled from the spares kit.
- Stored with hatches open for circulation.

8 Technical Diagrams

8.1 Beaufort Sea State Chart

Estimating Wind Speed and Sea State with Visual Clues				
Beaufort number	Wind Description	Wind Speed	Wave Height	Visual Clues
0	Calm	0 knots	0 feet	Sea is like a mirror. Smoke rises vertically.
1	Light Air	1-3 kts	< 1/2	Ripples with the appearance of scales are formed, but without foam crests. Smoke drifts from funnel.
2	Light breeze	4-6 kts	1/2 ft (max 1)	Small wavelets, still short but more pronounced, crests have glassy appearance and do not break. Wind felt on face. Smoke rises at about 80 degrees.
3	Gentle Breeze	7-10 kts	2 ft (max 3)	Large wavelets, crests begin to break. Foam of glassy appearance. Perhaps scattered white horses (white caps). Wind extends light flag and pennants. Smoke rises at about 70 deg.
4	Moderate Breeze	11-16 kts	3 ft (max 5)	Small waves, becoming longer. Fairly frequent white horses (white caps). Wind raises dust and loose paper on deck. Smoke rises at about 50 deg. No noticeable sound in the rigging. Slack halyards curve and sway. Heavy flag flaps limply.
5	Fresh Breeze	17-21kts	6 ft (max 8)	Moderate waves, taking more pronounced long form. Many white horses (white caps) are formed (chance of some spray). Wind felt strongly on face. Smoke rises at about 30 deg. Slack halyards whip while bending continuously to leeward. Taut halyards maintain slightly bent position. Low whistle in the rigging. Heavy flag doesn't extended but flaps over entire length.
6	Strong Breeze	22-27 kts	9 ft (max 12)	Large waves begin to form. White foam crests are more extensive everywhere (probably some spray). Wind stings face in temperatures below 35 deg F (2C). Slight effort in maintaining balance against wind. Smoke rises at about 15 deg. Both slack and taut halyards whip slightly in bent position. Low moaning, rather than whistle, in the rigging. Heavy flag extends and flaps more vigorous.
7	Near Gale	28-33 kts	13 ft (max 19)	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of wind. Necessary to lean slightly into the wind to maintain balance. Smoke rises at about 5 to 10 deg. Higher pitched moaning and whistling heard from rigging. Halyards still whip slightly. Heavy flag extends fully and flaps only at the end. Oilskins and loose clothing inflate and pull against the body.
8	Gale	34-40 kts	18 ft (max 25)	Moderately high waves of greater length. Edges of crests begin to break into the spindrift. The foam is blown in well-marked streaks along the direction of the wind. Head pushed back by the force of the wind if allowed to relax. Oilskins and loose clothing inflate and pull strongly. Halyards rigidly bent. Loud whistle from rigging. Heavy flag straight out and whipping.
9	Strong Gale	41-47 kts	23 ft (max 32)	High waves. Dense streaks of foam along direction of wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.
10	Storm	48-55 kts	29 ft (max 41)	Very high waves with long overhanging crests. The resulting foam, in great patches is blown in dense streaks along the direction of the wind. On the whole, the sea takes on a whitish appearance. Tumbling of the sea becomes heavy and shock-like. Visibility affected.
11	Violent Storm	56-63 kts	37 ft (max 52)	Exceptionally high waves (small and medium-sized ships might be for time lost to view behind the waves). The sea is completely covered with long white patches of foam lying along the direction of the wind. Everywhere, the edges of the wave crests are blown into froth. Visibility greatly affected.
12	Hurricane	64+ kts	45+ ft	The air is filled with foam and spray. The sea is completely white with driving spray. Visibility is seriously affected.

Figure 70: Beaufort Sea State

8.2 Block Diagrams

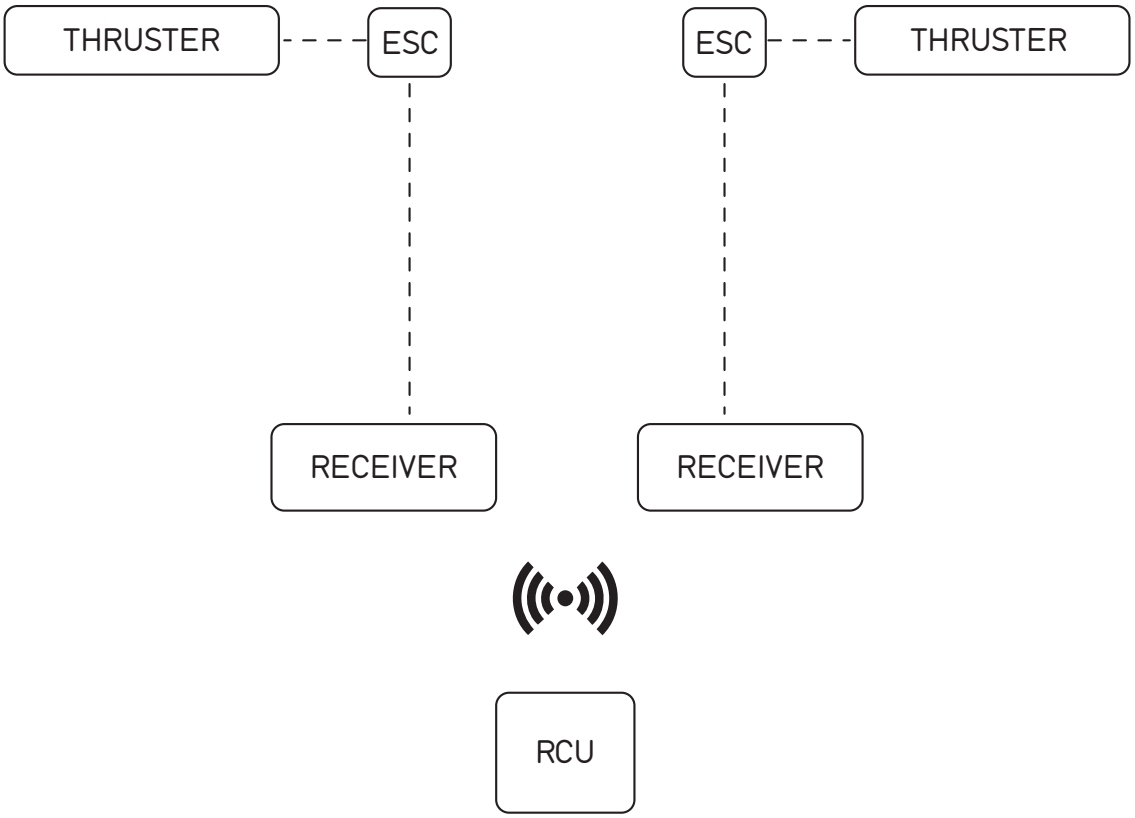


Figure 71: Block Diagram

8.3 Electrical Diagrams

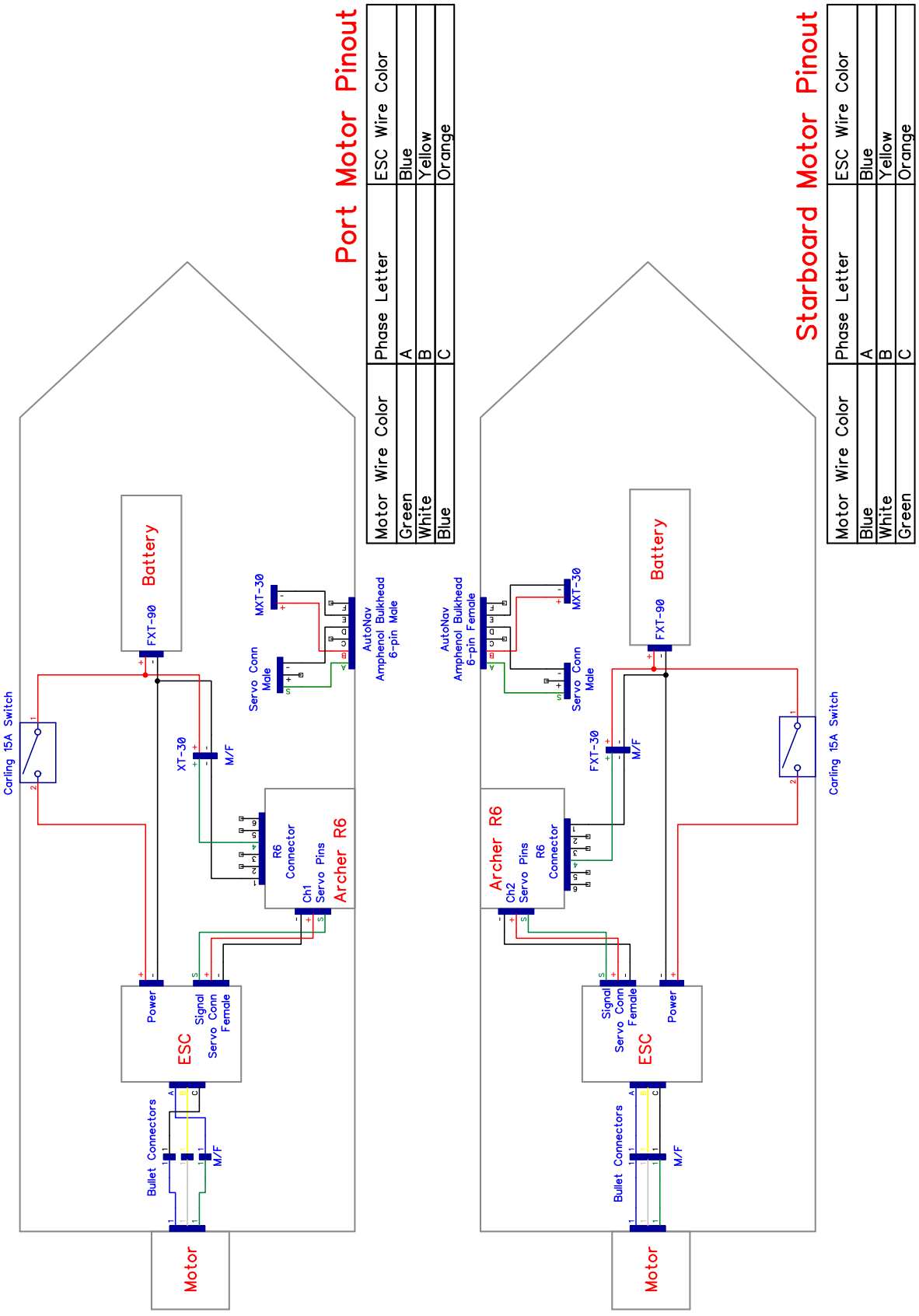


Figure 72: Hydrone™ RCV Electrical Diagram

8.4 Mechanical Diagrams

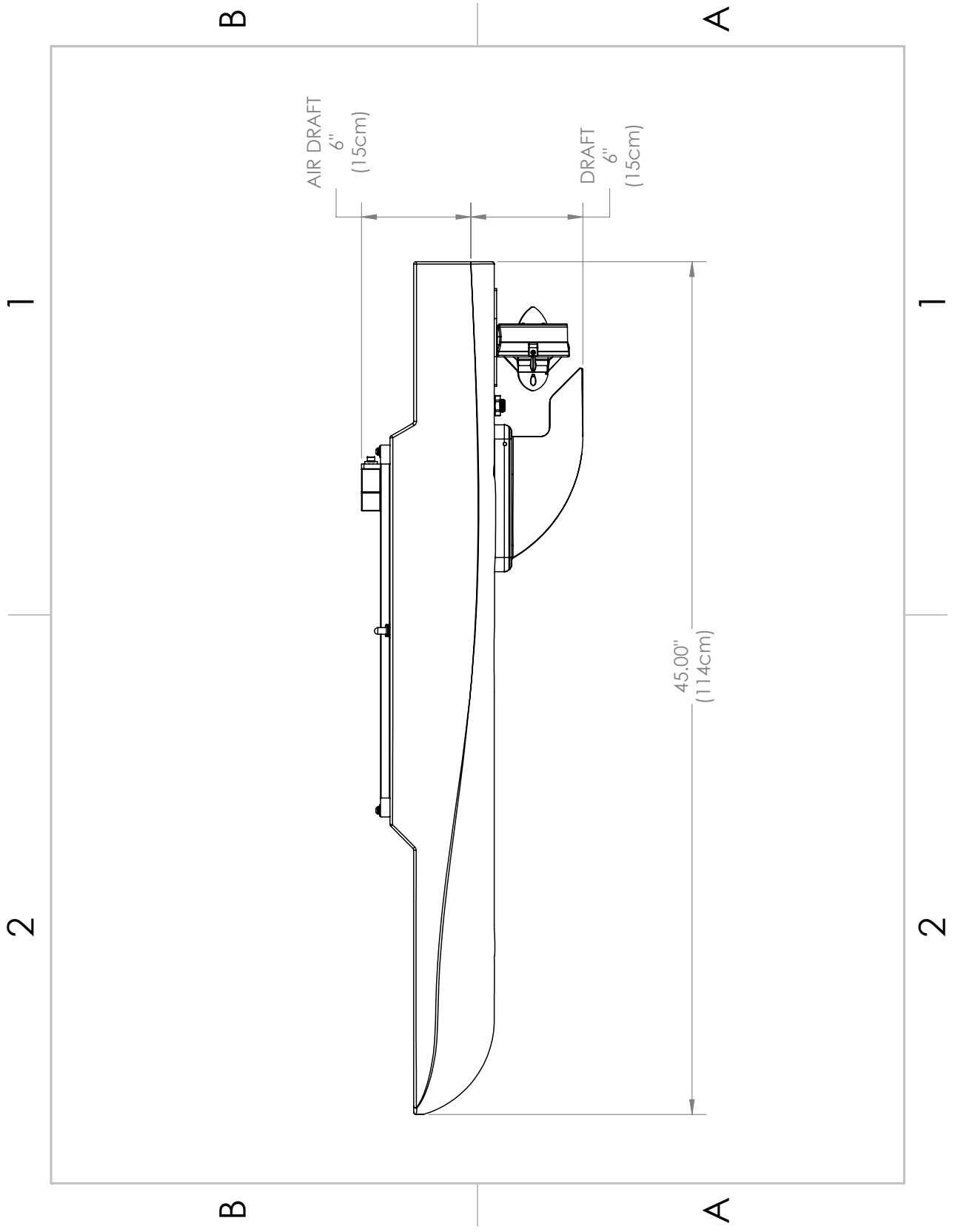


Figure 73: Side View Diagram

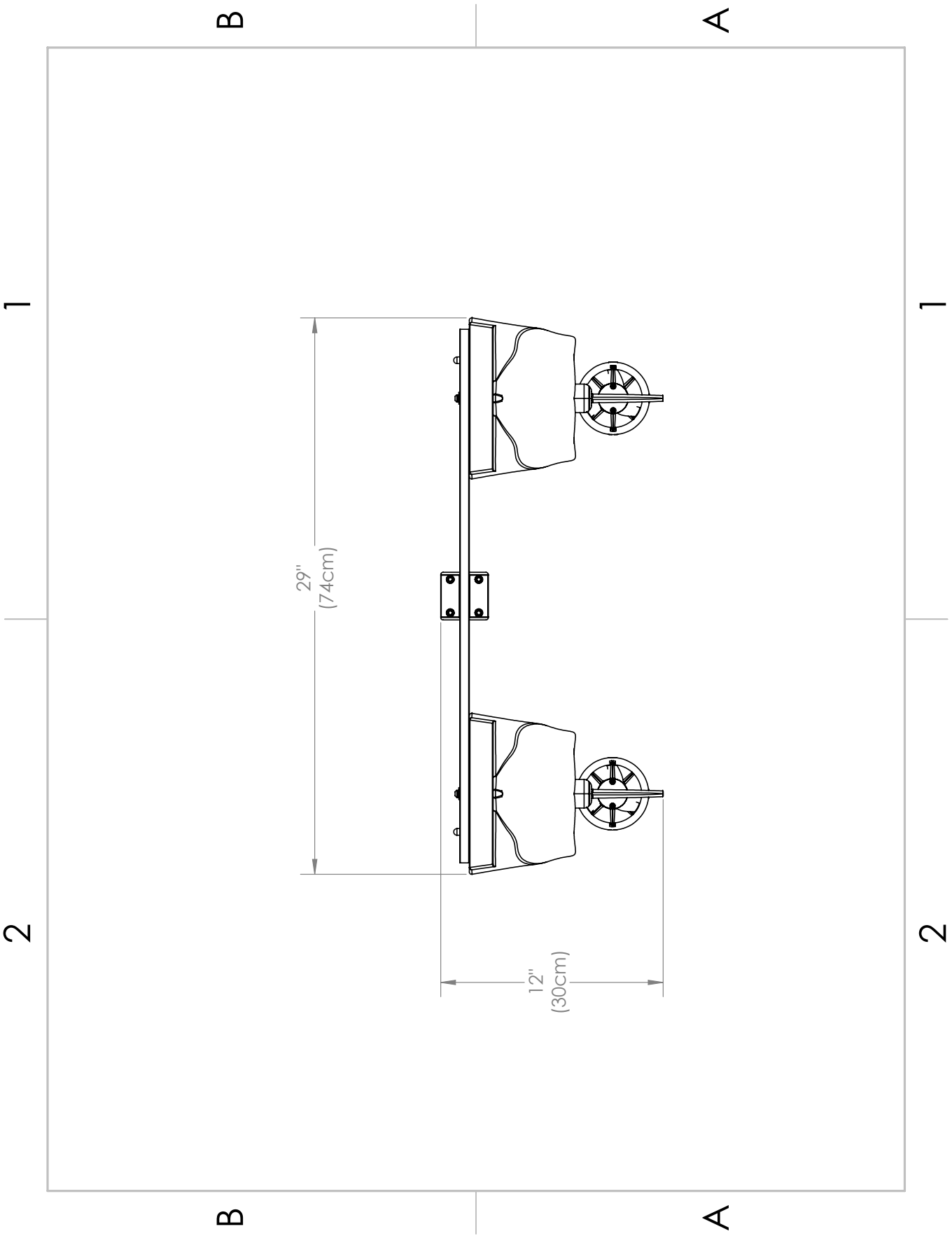


Figure 74: Front View Diagram

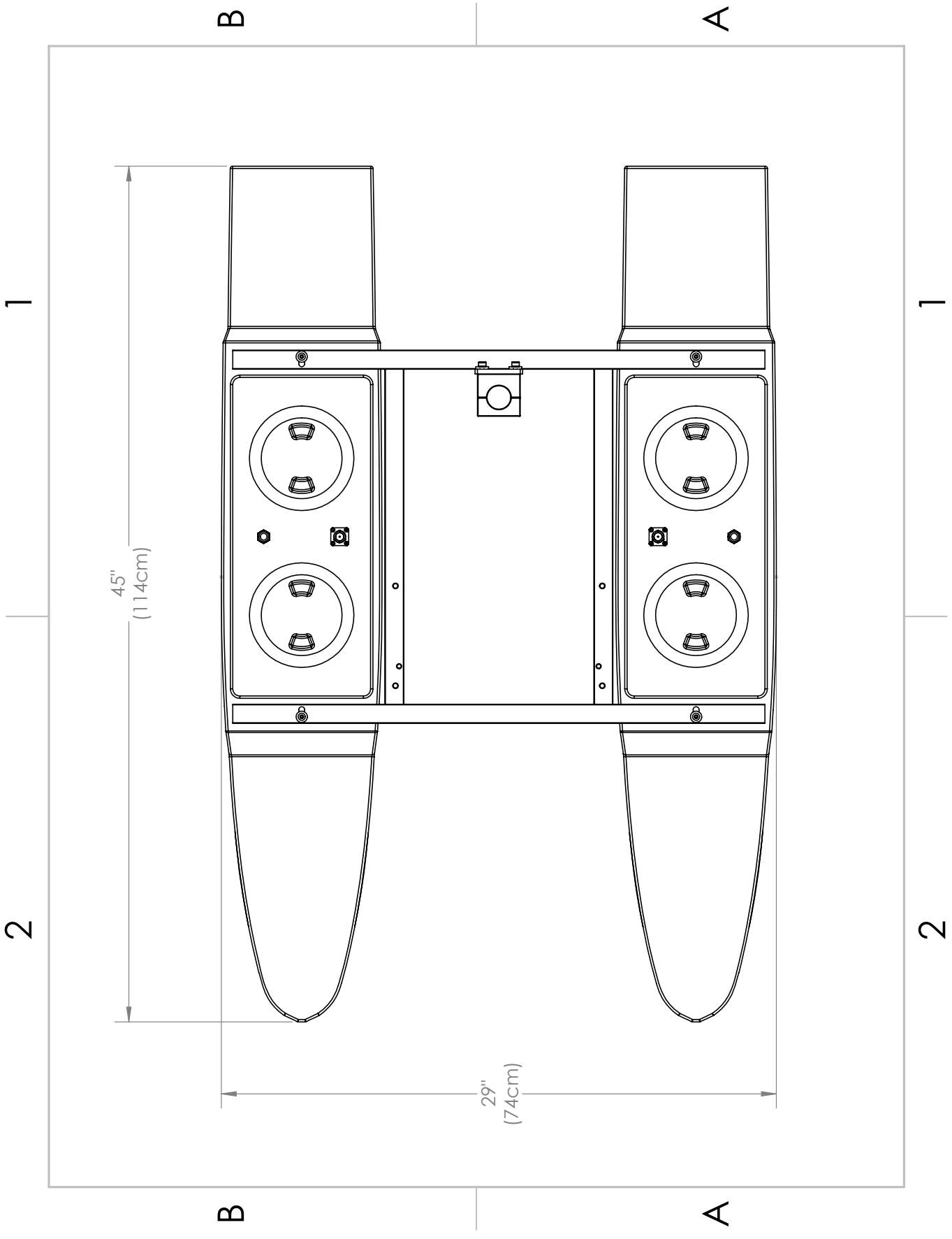


Figure 75: Top View Diagram

Revision History

Revision	Date	Author(s)	Description
1.0	3.7.2024	BA	Created
1.1	6.17.2024	RQ	Revised
1.2	7.29.2024	RQ	Revised Operating Hours, Added Tattu Charger