Troubleshooting Guide

OUTLAND ROV 3000

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REVISION TABLE		
REV.	DESCRIPTION	DATE
B	INITIAL RELEASE.	3/16/2023

Introduction

The following guide can be used for basic troubleshooting of Outland ROV 3000. Read all pages carefully before beginning to troubleshoot any equipment.

> ## Warning
> **Troubleshooting described in this manual is to be done only by qualified service personnel. To avoid electrical shock or equipment damage, do not troubleshoot or service any components unless you are qualified to do so.**
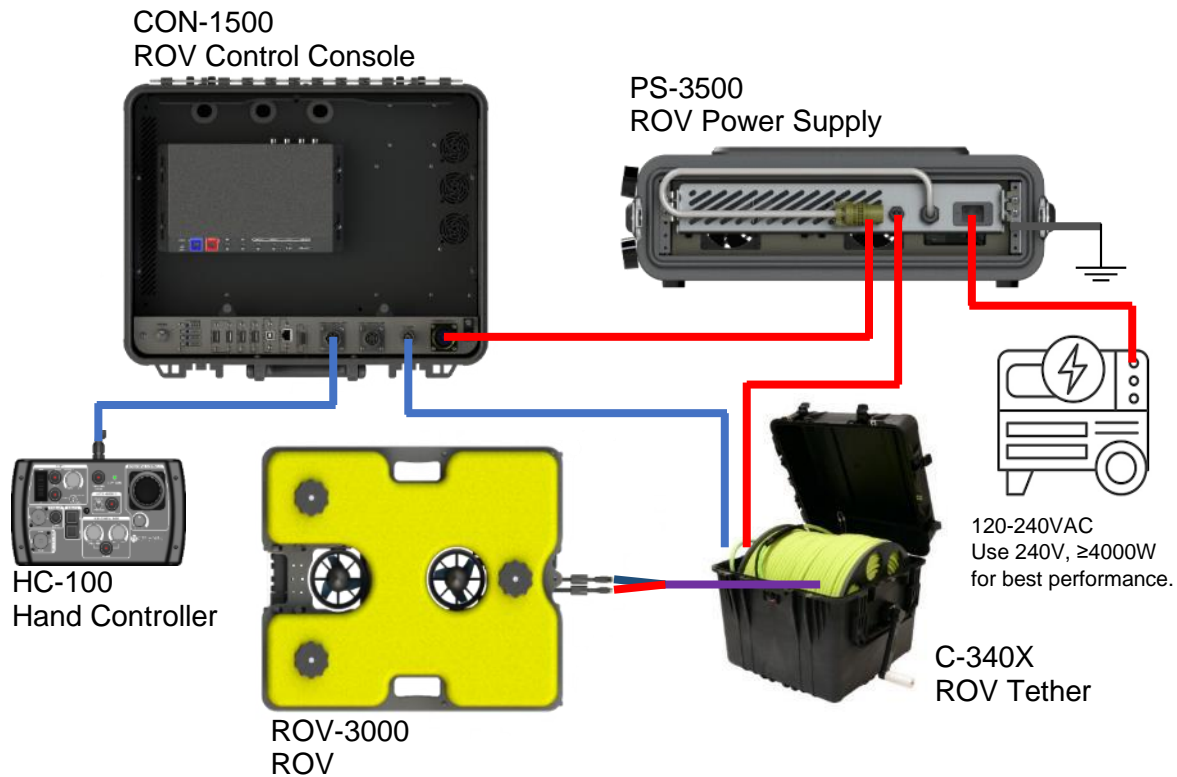
> ## Caution
> **NEVER PLUG OR UNPLUG ELECTRONICS WITH POWER ON!**
> **Damage or personal injury may result.**

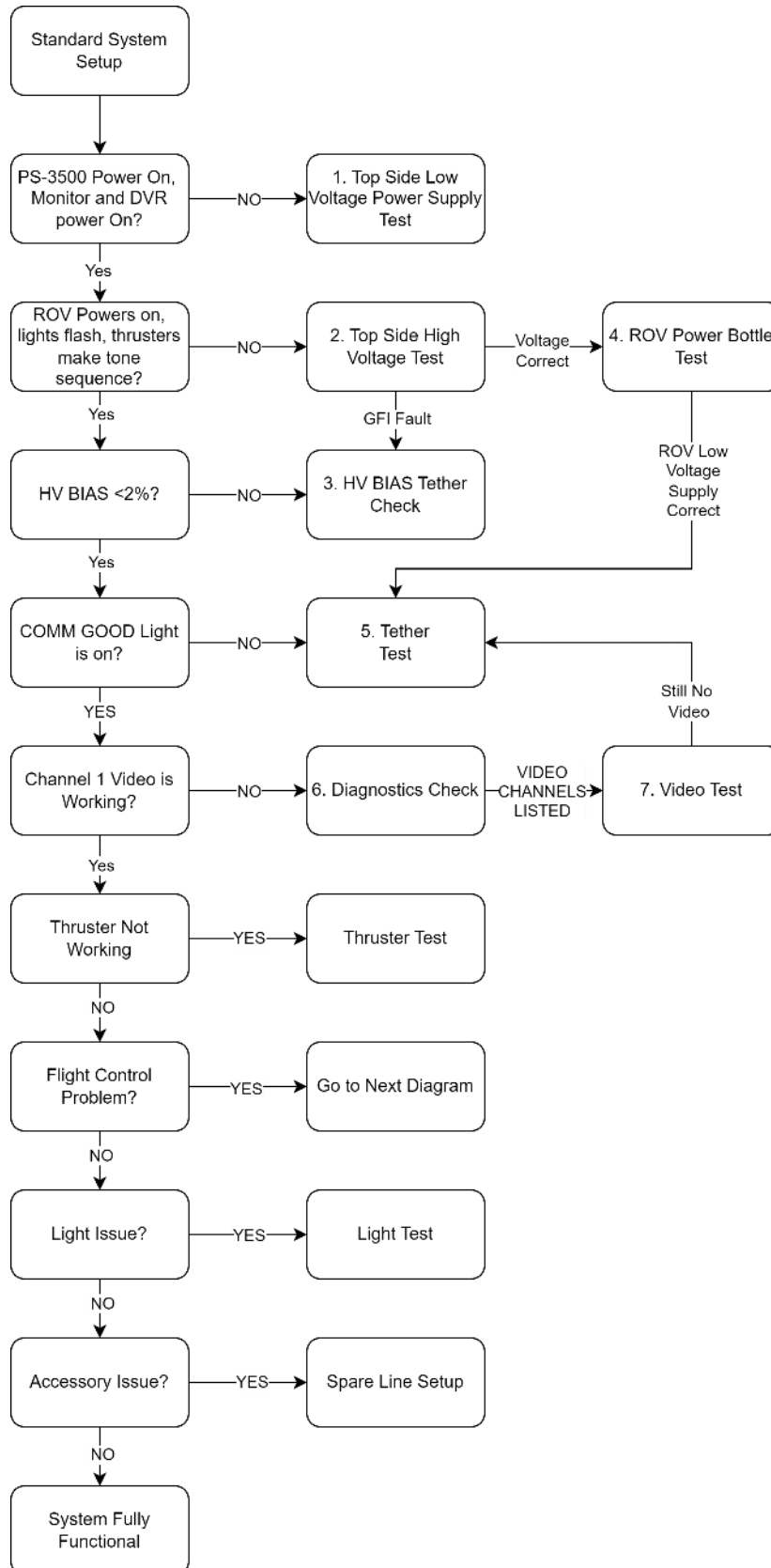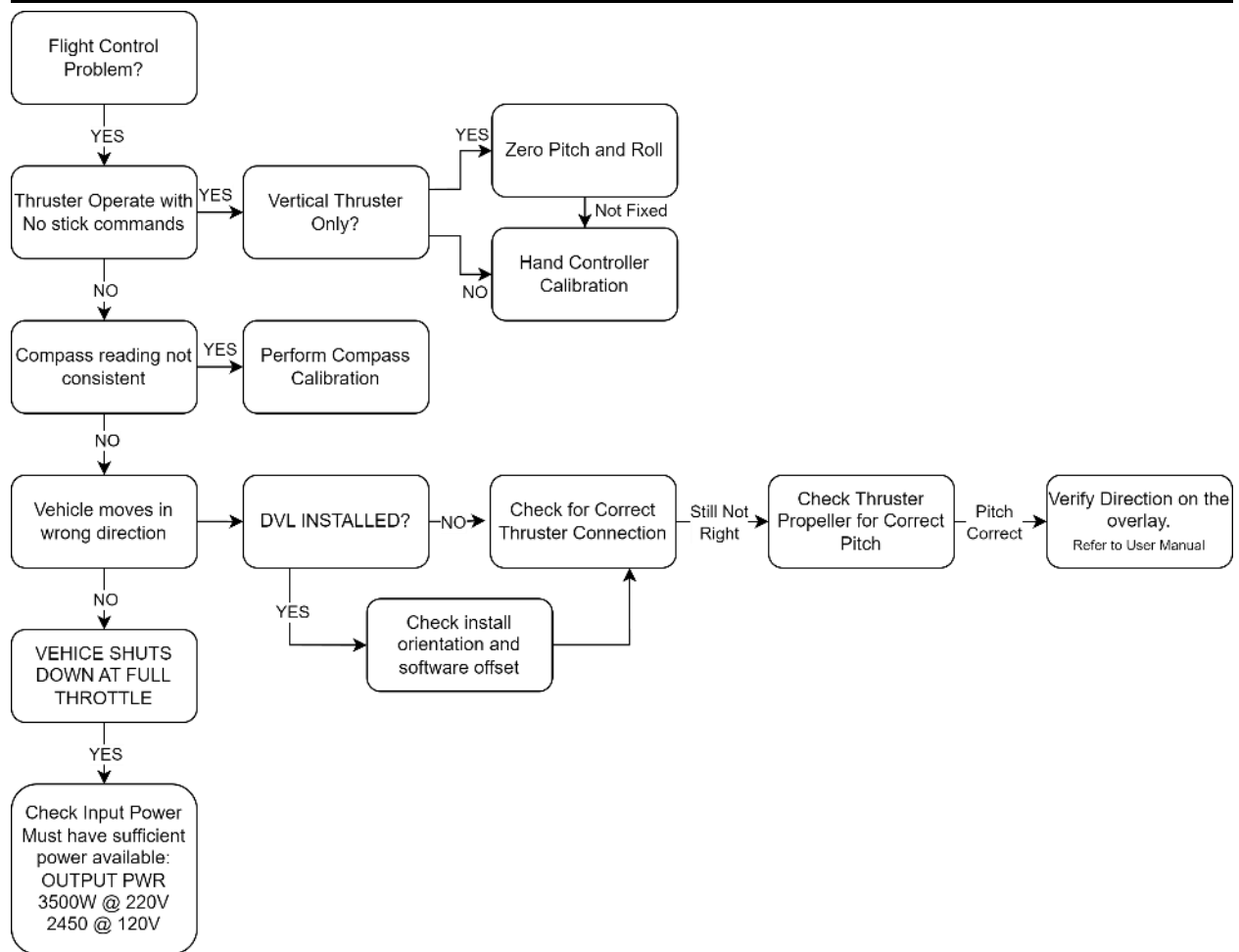## System Setup

Refer to the Manual or Quick Start guide for complete setup details.

CON-1500
ROV Control Console

PS-3500
ROV Power Supply

HC-100
Hand Controller

ROV-3000
ROV

C-340X
ROV Tether

120-240VAC
Use 240V, ≥4000W
for best performance.

Decision Matrix

```
┌──────────────────┐
│ Standard System  │
│      Setup       │
└──────────────────┘
          │
          ▼
┌──────────────────┐          ┌──────────────────────┐
│ PS-3500 Power On,│          │ 1. Top Side Low      │
│ Monitor and DVR  │──NO────▶ │ Voltage Power Supply │
│    power On?     │          │        Test          │
└──────────────────┘          └──────────────────────┘
          │ Yes
          ▼
┌──────────────────┐          ┌──────────────────┐   Voltage    ┌──────────────────┐
│ ROV Powers on,   │          │ 2. Top Side High │   Correct    │ 4. ROV Power     │
│ lights flash,    │──NO────▶ │ Voltage Test     │───────────▶  │ Bottle Test      │
│ thrusters make   │          │                  │              │                  │
│ tone sequence?   │          └──────────────────┘              └──────────────────┘
└──────────────────┘                 │ GFI Fault                        │
          │ Yes                       ▼                          ROV Low Voltage
          ▼                   ┌──────────────────┐               Supply Correct
┌──────────────────┐          │ 3. HV BIAS Tether│                       │
│  HV BIAS <2%?    │──NO────▶ │    Check         │                       │
└──────────────────┘          └──────────────────┘                       │
          │ Yes                                                            │
          ▼                   ┌──────────────────┐ ◀────────────────────┘
┌──────────────────┐          │ 5. Tether        │ ◀──┐
│ COMM GOOD Light  │──NO────▶ │    Test          │    │ Still No Video
│     is on?       │          └──────────────────┘    │
└──────────────────┘                                   │
          │ YES                                         │
          ▼                   ┌──────────────────┐  VIDEO   ┌──────────────────┐
┌──────────────────┐          │ 6. Diagnostics   │ CHANNELS │ 7. Video Test    │
│ Channel 1 Video  │──NO────▶ │    Check         │ LISTED──▶│                  │
│ is Working?      │          └──────────────────┘          └──────────────────┘
└──────────────────┘
          │ Yes
          ▼
┌──────────────────┐          ┌──────────────────┐
│ Thruster Not     │──YES───▶ │ Thruster Test    │
│ Working          │          └──────────────────┘
└──────────────────┘
          │ NO
          ▼
┌──────────────────┐          ┌──────────────────┐
│ Flight Control   │──YES───▶ │ Go to Next       │
│ Problem?         │          │ Diagram          │
└──────────────────┘          └──────────────────┘
          │ NO
          ▼
┌──────────────────┐          ┌──────────────────┐
│ Light Issue?     │──YES───▶ │ Light Test       │
└──────────────────┘          └──────────────────┘
          │ NO
          ▼
┌──────────────────┐          ┌──────────────────┐
│ Accessory Issue? │──YES───▶ │ Spare Line Setup │
└──────────────────┘          └──────────────────┘
          │ NO
          ▼
┌──────────────────┐
│ System Fully     │
│ Functional       │
└──────────────────┘
```

1. Top Side Low Voltage Power Supply Test

The low voltage (12VDC) test is to determine if the top side is malfunctioning due to a faulty device or faulty power supply.

1.1. Disconnect the ROV Tether from the Power Supply PS-3500 and Control Console CON-1500.
1.2. Verify the gray cable from the Power Supply to the Control Console is properly connected. This connection is required for the system to work.
1.3. Verify the AC input to the power supply is plugged into the power supply.
1.4. The DVR and monitor should power up at this time.
1.5. Turn the power switch on and verify the High Voltage Supply Turns on by observing the voltage displayed on the LDC screen.
1.6. If the HV supply turns on the 12V supply is functioning.
1.7. Look for the Power LED on the DVR (RED) and the Monitor (Green).
1.8. If the HV supply does not power on, unplug the barrel plugs from the DVR and monitor and use a multimeter to measure the voltage between the center pin and chassis. +12VDC should be measured on each barrel plug. If one plug does not measure 12V there may be an internal issue. Please contact Outland for assistance.

1.9. If +12VDC is not measured on both barrel plugs and HV Supply don't not power on, check the AC input. Check the source power outlet. Check circuit breakers and/or fuses that power that outlet.

1.10. If AC power is correct, the 12V power supply in the CON-1500 may have failed. The 400V power supply unit requires the $12V_{DC}$ power supply to operate. Return unit for diagnostics and repair.

2. High Voltage Test

Use this test to determine if the top side power supply is operating within normal parameters. The PS-3500 unit has a built in GFI circuit that continuously monitors the HV+ and HV- lines for any leakage. If leakage is detected the GFI will switch a relay, turning off the high voltage lines.

2.1. Turn on the power switch located on the Control Console.

2.2. The thrusters will make a tone sequence and the lights should flash when power is supplied.

- If lights flash and go out this indicates power supplies are correct and communications are functioning. Check for HV Bias by proceeding to **HV BIAS Tether Check.**
- If lights flash and stay on, there is a communications issue. Proceed to **Tether Test**

The COMM GOOD light located on the Hand Controller indicates there are communications present between the ROV and Control Console. If the light is illuminated, you have a communications failure. Communications between ROV and Control Console/Hand Controller is required for ROV diagnostic data to be displayed on the video overlay. Communications failures typically occur due to Tether faults. Follow the steps below to troubleshoot:

2.3. Turn off power to the ROV.

2.4. Check that the Tether is properly connected on both the ROV and Control Console.

2.5. If nothing on the ROV is working, other than video, then the Tether could have a problem.

2.6. Turn off power to the ROV, disconnect Tether at both ends and test continuity and for short circuits between conductors. Refer to Table *5* for pinout.

2.7. If no issue with continuity and no short circuits are found reconnect Tether and test again. If COMM GOOD illuminates you may have a damaged bulkhead connector on either the ROV bottle or Control Console.

2.8. If problem continues there may be an issue in the ROV bottle or Control Console that requires repair or replacement. Please contact Outland for further assistance.

- Diagnostics Check**.**
- If lights do not flash and no thruster tone is heard, proceed to step below.

2.9. Verify the **HV ON** light is illuminated on the Power supply. Using the LCD screen on the power supply, verify the following:

- Output voltage is 400V
- Current is 0A (Lights OFF)
- HVBias is <2%
- No faults in the fault log (other than test trips)

- If the HV ON light is flashing, this indicates the GFI has tripped. Refer to **HV BIAS Tether Check**.

If all parameters above are correct proceed to **Tether Test**.

High Voltage Power Light
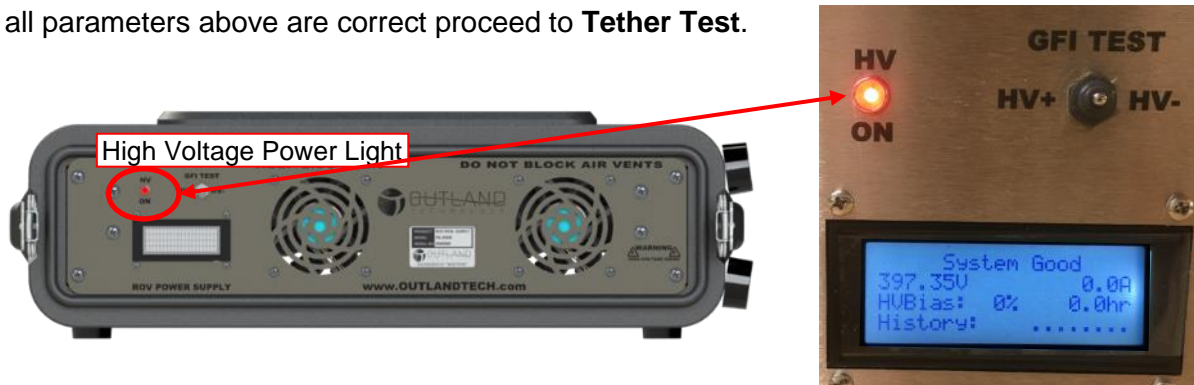
2.10.   Turn off the power switch located on the Control Console. Unplug the Tether from the ROV and turn on the power. Verify HV light illuminates with no ROV, this indicates a potential issue with the ROV. Inspect the ROV 3-pin extension cable, power bottle input bulkhead, and Tether 3 pin for any signs of damage.

2.11.   If problems persist, continue to the **ROV Power Bottle Test**.

3. HV BIAS Tether Check

Used this test to check an HV Bias present that is below the trip threshold and if the GFI is tripping. If the system (Overlay or LCD on the power supply) shows an HV Bias, this indicates there is high voltage leakage in the system. The following steps should be taken to find the general fault location. Potential fault locations:

- Tether: damaged jacket or worn 3-pin connector (typical failure)
- Power Tether Extension Cable (3-pin MCIL male to female)
- Bottle bulkhead connector damage
- Internal power supply failure (rare)

3.1. Power off unit and remove the extension cable between the power bottle and the tether. Plug the tether directly into the power bottle.

3.2. Power unit and check for bias.

3.3. If the bias goes to zero, power the system down. The extension cable may be faulty. Disconnect the tether from the power bottle and connect the to the extension cable. Do not reconnect the extension cable to the vehicle.

3.4. Power unit and check the bias.

3.5. If bias goes to zero, power down, dummy plug 3-pin and place in water (bucket, overboard, etc.) and repeat test.

3.6. Repeat without extension cable.

3.7. If bias is present only with the extension cable, replace the extension cable.

3.8. If bias in present with tether only, find issue and repair. If you are unable to perform the repair, return to Outland for repair.

3.9. If a second tether is available repeat test with second tether.

3.10. If only present with the full system, there may be a damaged 3-pin bulkhead on the power bottle. Contact Outland for repair. **Do not attempt to open power bottle.**

4. ROV Power Bottle Test

4.1. Setup system in standard configuration.

4.2. Power system – ROV lights should flash, and thrusters play a tone.

4.3. Check the power bottle for a solid red light and a flashing green light. Red indicates power and green flashing light indicates communications between HV Power Bottle and Control Bottle.

4.4. If no lights are illuminated, power the system down, disconnect the 3-pin power cable to the ROV Power bottle. Once removed from the vehicle, power the system and measure the voltage. It should read 400VDC.

4.5. If 400V is not measured, power the system down, remove the extension cable and measure the voltage at the end of the tether.

4.6. If the voltage is correct, power down and connect the tether directly to the Power Bottle and repeat the steps above.

4.7. If the green light is not flashing this indicates there is no communication between the high voltage bottle and the control bottle. Check the Hand Controller for COMM GOOD light and the ROV lights should be ON. If COOM GOOD is off and ROV Lights are on proceed to **Error! Reference source not found.**

4.8. If the ROV lights are not on and COMM GOOD light is off, power down the system, remove the 4-pin interconnect cable from the control bottle. Power Unit and use multimeter to measure the voltage between pins 1 and 2. Pin 1 is the 24V return and Pin 2 is the +24V line.

4.9. If the ROV Lights flash and stay off and the COMM GOOD light is on perform quick thruster check to ensure the power bottle is fully functional.

4.10. Ensure all Thrusters are clear of any objects.

4.11. Press the Thruster Enable button on the hand controller.

4.12. Check that the thrusters operate. If the thrusters operate, there is a faulty indicator. This will not affect system performance. Proceed with use as normal.

4.13. If 24V is measured on pin 2 to 1, power down the system and check the continuity of pins 3 to 3 and 4 to 4 to ensure comms are connected.

4.14. If any open connections are found replace the interlink cable.

4.15. If comms cannot be established contact Outland for further assistance.
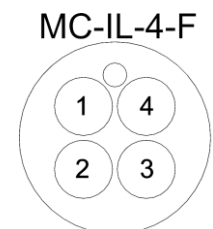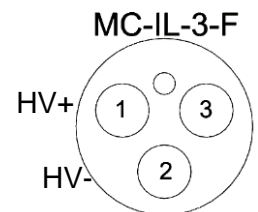
5. Tether Test

The COMM GOOD light located on the Hand Controller indicates there are communications present between the ROV and Control Console. If the light is illuminated, you have a communications failure. Communications between ROV and Control Console/Hand Controller is required for ROV diagnostic data to be displayed on the video overlay.

Communications failures typically occur due to Tether faults. Follow the steps below to troubleshoot:

5.1. Turn off power to the ROV.
5.2. Check that the Tether is properly connected on both the ROV and Control Console.
5.3. If nothing on the ROV is working, other than video, then the Tether could have a problem.
5.4. Turn off power to the ROV, disconnect Tether at both ends and test continuity and for short circuits between conductors. Refer to Table *5* for pinout.
5.5. If no issue with continuity and no short circuits are found reconnect Tether and test again. If COMM GOOD illuminates you may have a damaged bulkhead connector on either the ROV bottle or Control Console.
5.6. If problem continues there may be an issue in the ROV bottle or Control Console that requires repair or replacement. Please contact Outland for further assistance.

6. Diagnostics Check

The Diagnostics screen can be used to check that systems are functioning properly.

6.1. Setup System in standard setup and ensure Hand Controller is connected.
6.2. Depending on the vehicle setup a few options may be different than what is pictured. Communications should show the following in **all** ROV-3000 setups:
- Topside Components
  o Overlay
  o Hand Controller
  o Demux
  o GFI
- ROV Control Bottle Components
  ▪ COMM
  ▪ MUX
  ▪ LAMP (1)
  ▪ NAV
  ▪ DVL (this only indicates the process that communicates with the DVL and does not guarantee the DV is functioning.

        ○ ROV Power Bottle Components
- PWM (Power Bottle)
        ○ External Components
- LAMPS (2)
- Camera (Only controllable cameras are listed)

6.3. If any of the above boards are not found contact Outland for support.

6.4. Check the Video Channels Detected under the Video Channels section. There should be video on CH1 for front camera and CH8 for rear camera. If not video channels are listed contact Outland For support.

6.5. Check the Voltage for the Top Side and ROV Voltage. These values should be within a few volts with no load.

6.6. Check the fault History. This section shows the last 8 power cycles fault history. Check the log for any Plus or Minus symbols. If you have any faults besides testing, proceed to **HV BIAS Tether Check**.

Check that the compass is displayed. If the Depth Rating is populated, this indicates that the depth sensor is communicating. For more compass information refer to the **Compass Calibration** section.

7. Video Test

7.1. Setup system in standard use configuration.

7.2. The DVR and monitor are powered when the console is plugged to power outlet.

7.3. Ensure DVR is set to Quad Screen View. Refer to DVR manual for setup instructions.

7.4. Verify correct video setup per ROV Manual.

7.5. Unplug and plug unit from power source. Verify the DVR displays Outland logo upon startup. If no video check DVR connections and setup. Note DVR and monitor are always powered when power supply is connected to power outlet.

7.6. Turn on power to the Control Console. The ROV lights should flash and video should be displayed on the monitor.

7.7. Verify the video overlay is displayed on channel 1 of the quad screen display.

7.8. Check the video amp lights on the control console. If video is present the lights will be green for that channel. Channel 1 is the primary video channel.

7.9. Switch between the Front and Rear cameras on the ROV by pushing the Camera select button on the hand controller.

7.10. If the lights indicate video and you see nothing on the monitor, then check the DVR cables are connected and are working properly.

7.11. Check the monitor by pressing the menu button on the DVR to see if the menu appears. If not, check the monitor source input that it is properly set.

7.12. If the video amplifier lights are not green on either the front or rear camera check that all other functions of the ROV are working.

7.13. Adjust video amplifier per ROV manual and see if video starts working.

7.14. If only the cameras are not working, there could be a problem with the Tether.

7.15. Check the Tether for continuity and or shorts using the **Tether Test**

7.16. If only one camera is not working, it is most likely the cable going to the camera or the camera has failed. Call Outland for more detailed help.

8. Thruster Test

8.1. Verify the thruster is turned on in the thruster menu. Refer to the Thruster Options section of the User Manual.

8.2. Power Down system and check that the thruster in question freely turns.

8.3. If the thruster does not freely spin remove propeller and check for fouling and damage.

   8.3.1. Remove the 4 screws that hold on the nozzle, then remove the nozzle.

   8.3.2. Remove the three screws holding on the prop and remove the prop (3)

   8.3.3. Remove the 2 screws from the end cap and remove. When removing pull up the end cap side opposite of the wire exit and push away from the wire (5). The cap has two small retention clips built in on the side near the cable (6).

   8.3.4. Loosen the screw from the shaft collar.

   8.3.5. Remove the magnet assembly and check for fouling.

   8.3.6. Reassemble the thruster in the opposite order. Take note of the D shaft and align with the shaft with collar set screw.
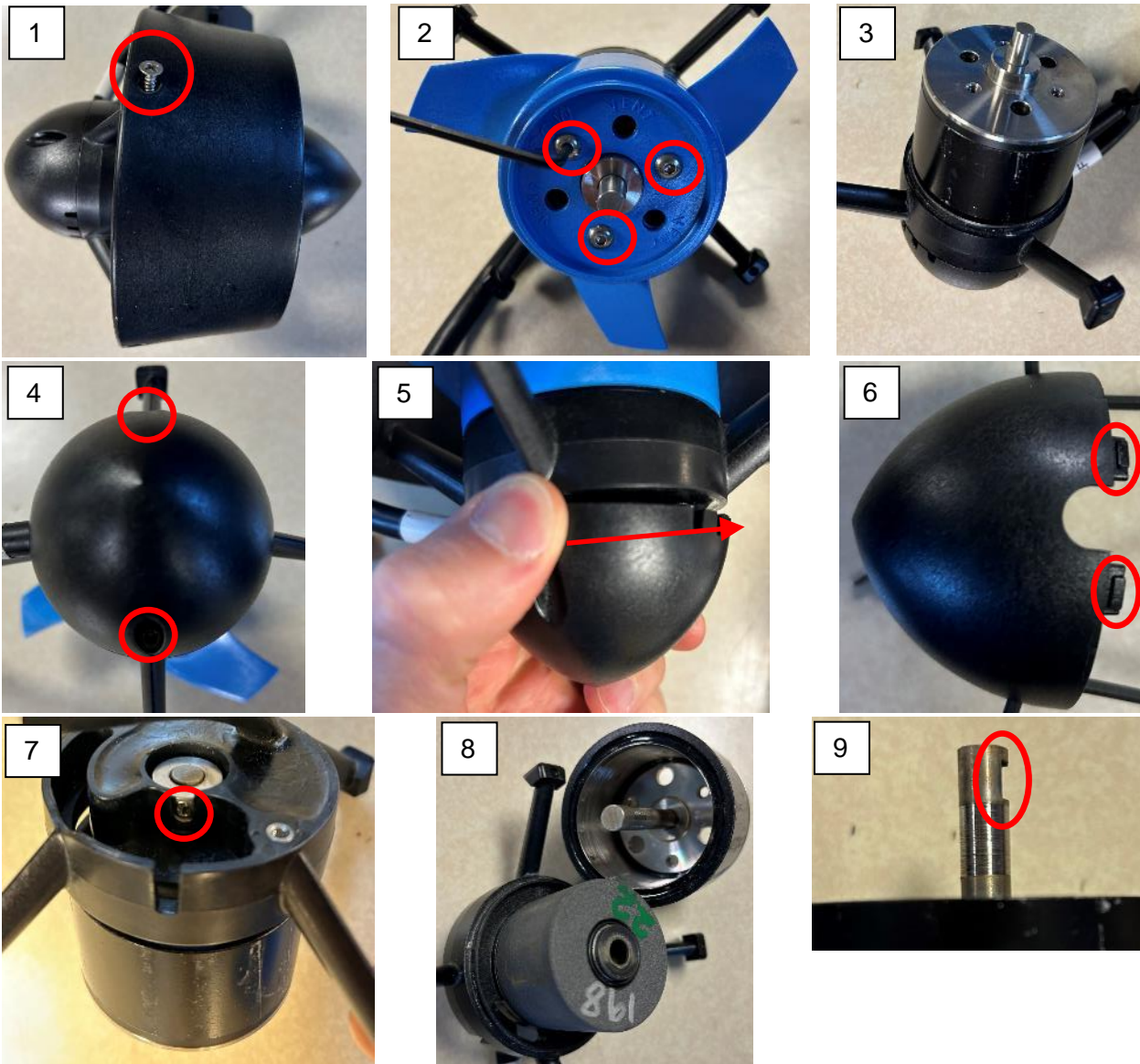
⚠️ WARNING: Thruster will be active during test. Keep hands, feet and objects away from propellers.

8.4. Swap thruster to another port to verify functionality and verify the motor driver is properly functioning.

8.5. If motor does not function, check continuity between each pin of the MCIL-3M Thruster connector. The resistance using a multimeter should appear as a short (<0.5 Ohms) between each pin (Note: this does not guarantee functional motor, a multimeter cannot show internal motor winding shorts). If there is an open circuit the motor must be replaced. Contact Outland for replacement.

8.6. If the motor functions on a different port, first verify the original port is turned on in the overlay. If the port is turned on and still does not function contact Outland for support.

9. Zero Pitch and Roll

9.1. On the overlay move the mouse to the upper left corner to show the 3 lines icon.
9.2. Click on the 3 lines icon
9.3. Click the Senor Options Button
9.4. Make sure vehicle is level
9.5. Click the Zero Pitch and Roll Button

Note: If the ROV is rear or front heavy and not level in the water, move weights to get vehicle as close to level as possible. Once satisfied, repeat steps above floating on the surface.

Move Mouse Here

This appears when icon is clicked

Click Sensor Options

Click Zero Pitch and Roll
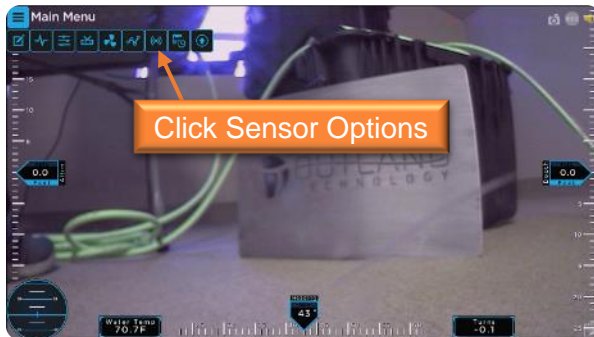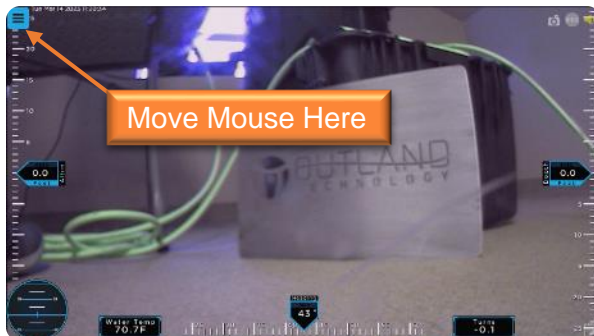
10. Hand Controller Calibration

10.1. Power off system

10.2. Press and hold Light Dim and Light Bright buttons (1)

10.3. Power on system and verify all lights on Hand Controller are flashing. This indicates the Hand Controller is in calibration mode.

10.4. Release the Light Buttons

10.5. Place the Depth Trim knob, Lateral Trim Know and Rev/FWD trim knob (2) to their center positions by turning the knob such that the indicator faces straight up.

10.6. Do not move Horizontal Control joystick, stick gain or Depth Thumbwheel.

10.7. Press the Thruster enable button (3). LED's should stop flashing indicating calibration is completed**.**
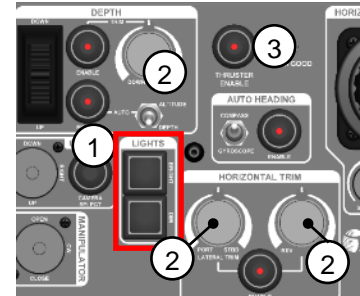
11. Compass Calibration

11.1. On the overlay move the mouse to the upper left corner to show the 3 lines icon.

11.2. Click on the 3 lines icon

11.3. Click the Senor Options Button

Move Mouse Here

This appears when icon is clicked

Click Sensor Options

Confidence

Click Calibrate Compass
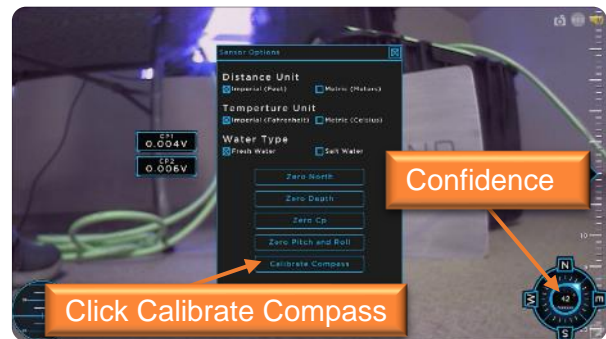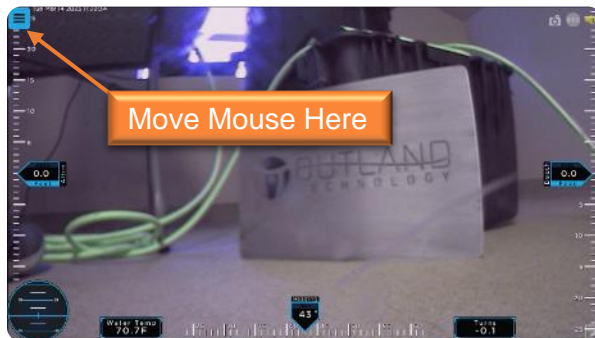
11.4. Position the vehicle in a clean magnetic environment and press the Calibrate Compass

11.5. The compass rose will stop displaying the compass output and will display the confidence scaled. The Calibrate Compass Button will also show the confidence.

Confidence Value	Compass Reading
0	0
1	57.3
2	114.6

3	171.9
4	229.2

11.6. Perform accelerometer calibration.

    11.6.1. Picture the ROV as a cube in the image below.
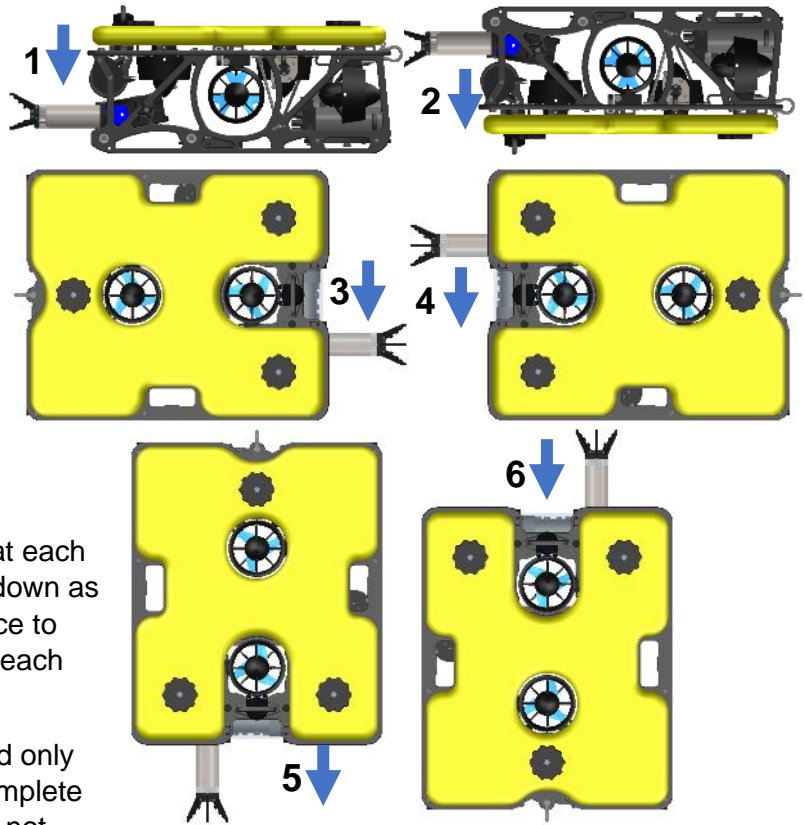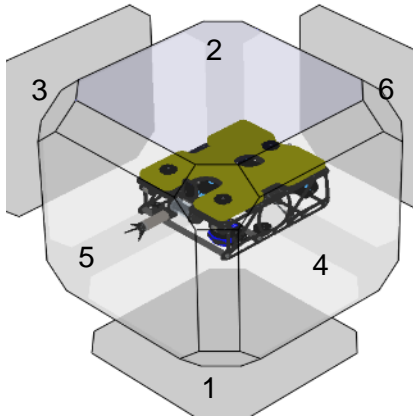
    11.6.2. Orient the ROV such that each face of the cube is facing down as seen in the image sequence to the right. Hold the ROV in each position for 1-2 seconds.
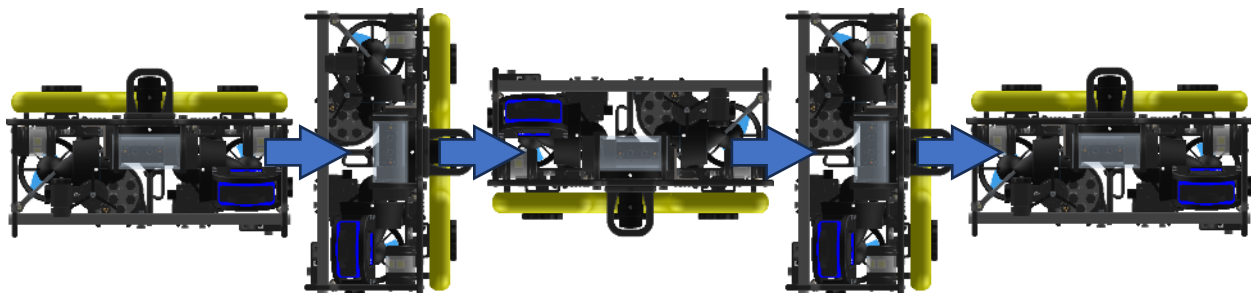
Note: Order does not matter and only 4-5 positions are needed for complete calibration. Also, the ROV does not have to be perfectly aligned in each orientation.
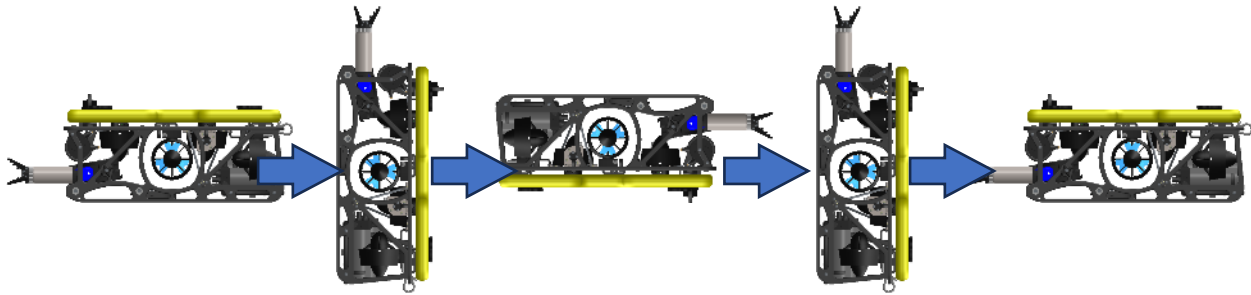
11.7. Perform Gyro Calibration

    11.7.1. Set ROV in normal orientation (position 1) and keep stationary for 2-3 seconds.

11.8. Perform Magnetometer Calibration

    11.8.1. Rotate ROV in Roll plane 180° and back.

11.8.2. Rotate ROV in Pitch Plane 180° and back.

11.8.3. Rotate ROV in YAW Plane 180° and Back

11.8.4. Continue rotating until the confidence reads 3.
11.8.5. Press the Calibrate Compass Button Again

Note: Keep phone away from vehicle what calibrating the compass and setting North. There is a potential for incorrect reading due to magnets in the phone.

11.8.6. Set Vehicle such that it is facing North and Press the Zero North Button
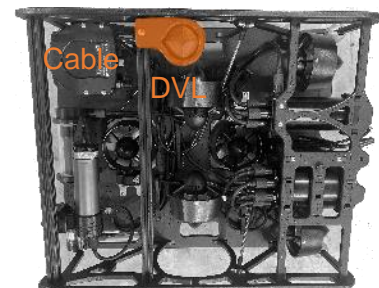11.8.7. Press the zero Pitch and Roll button.
11.8.8. Calibration is now completed.
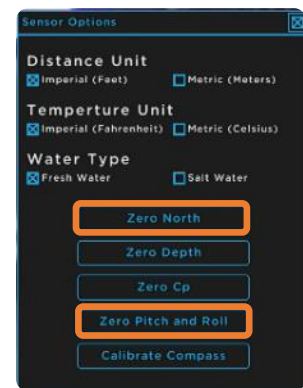
12. DVL Setup
12.1. Install DVL with cable facing the front of the vehicle.
12.2. Navigate to the DVL Options Menu and verify the DVL Rotation Offset is set to 180 Degrees

13. Light Issue
13.1. One Light Not Working. This indicates an issue within that light assembly.
  13.1.1. Turn off power to the Control Console.
  13.1.2. Disconnect working light and Manipulator (if installed).
  13.1.3. Turn on power and verify that light does not work.
  13.1.4. If light continues to not work, return to Outland for service.
13.2. Both Lights Not Working
  13.2.1. If both lights are out, then the resettable fuse may have tripped inside the electronics bottle, indicating a short. The fuse will reset once the short has been removed.

13.2.2. Turn off power and disconnect one light. Power ROV and verify if connected light works.

13.2.3. Turn off power and disconnect tested light. Connect the untested light. Turn on power and verify if light works.

13.2.4. If the lights are still not working, turn off power and unplug the Manipulator if connected. Repeat Steps 13.2.1-13.2.2.

13.2.5. If all lights begin to work, this indicates there is a problem inside the Manipulator. Please return Manipulator to Outland for service.

14. Accessory Issue

Outland ROV's can communicate with many different manufacturers and types of Sonars. Please refer to the sonar manufacturers manual for sonar setup.

Device with RS-485 Output (Sonar)

The Outland Control Console, CON-1500, provides an RS-485 serial port pass-through to a DB9 connector or to USB using a USB 2.0 B connector. Refer to

Table *3* for DB9 Connector pinout.

14.1.1. Verify the device connection port and pins. The ROV has 3 RS-485 inputs.

14.1.2. Set Spare Line to correct port. Use Table 1 and 2 below to determine which port your device is connected.

Table 1: BTL-350 Connector D (MC-BH-8-F)

Pin	Signal	Function	Spare Line Setting
1 5	GND +24V	Power	NA
2 8	Port 1+ Port 1-/CPG	RS-485+ RS-485-	Spare Line 1 Port 1
3 4	Port2+ Port2-	RS-485+ RS-485-	Spare Line 1 Port 2
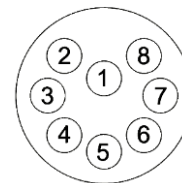
MC-BH/IL-8-F

Table 2 BTL-350 Connector J (MC-BH-8-F)

Pin	Signal	Function	Spare Line Setting
1 5	GND +24V	Power	NA
6 7	Port 3+ Port 3-	RS-485+ RS-485-	Spare Line 2 Port 3

Table 3: Spare Connector Pinout, Connector DB9

Pin	Signal	Function	Description
1 2	Spare1 - Spare1 +	Bi-directional	Spare twisted pair output. Selectable between CP Ground/differential signal or video
3,4,6,7	NC	NA	No Connection
5	GND	Power	Chassis ground
8 9	Spare2 - Spare +	Bi-directional	Spare twisted pair output. Selectable between differential signal (Sonar) or video

14.2. Ethernet based device (Sonar)

14.2.1. Verify the connection of the RJ-45 from CON-1500 to computer.

14.2.2. Verify Device is connected to connection A or E on the BTL-350.

14.2.3. Verify Computer is set up properly.

14.2.3.1. Many devices are blocked by virus protection installed on the computer. Turn off all virus protection and firewalls.

14.2.3.2. Verify IP address of computer is on same network as the device. Consult device manual for proper network IP address. Tritech devices operate on 192.168.2.xxx.

14.2.3.3. Setting Static IP address on Windows

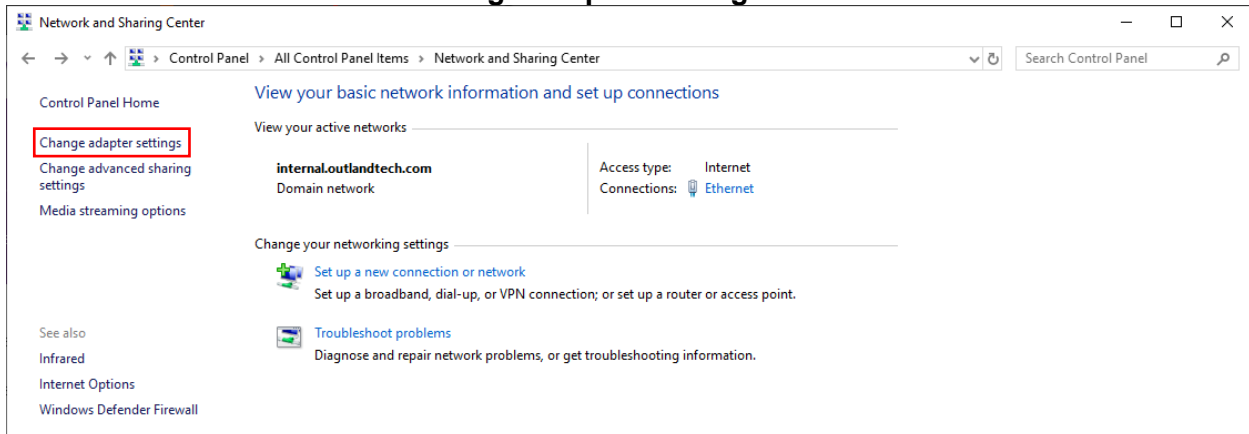14.2.3.3.1. Open the start menu (or Windows button) and type **Control Panel**. Press enter to open.

14.2.3.3.2. If in Category View click **View network status and tasks**
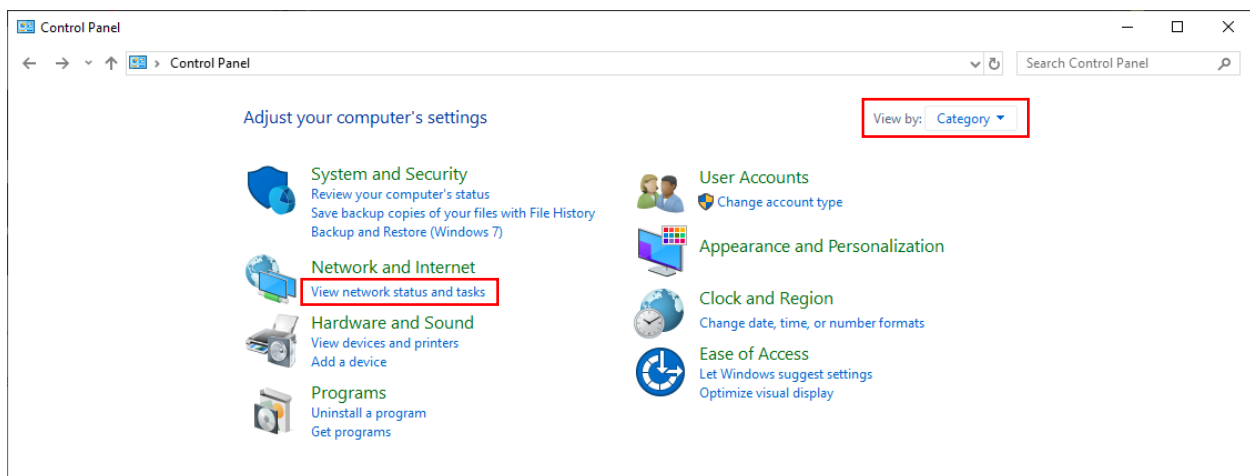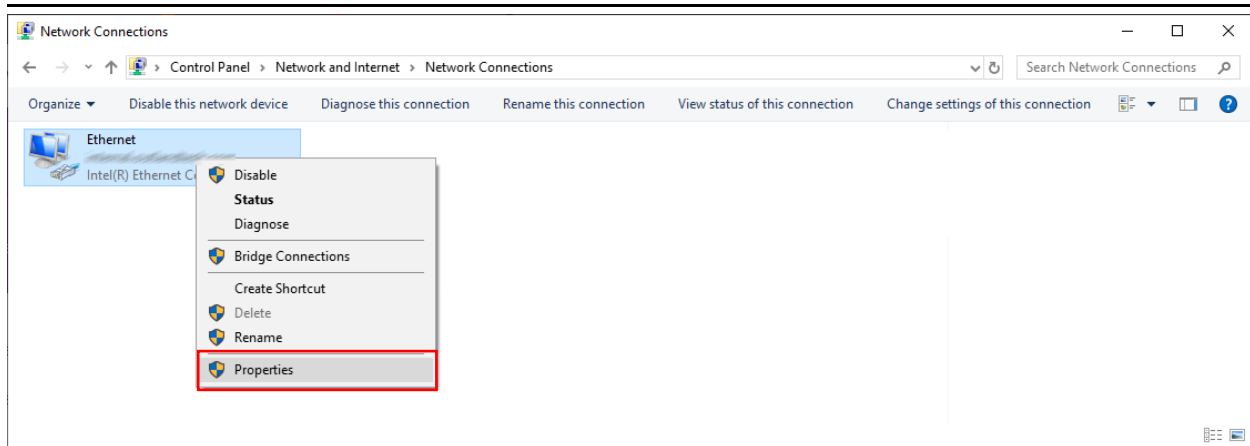
14.2.3.3.3. If in Icon view click **Network and Sharing Center**
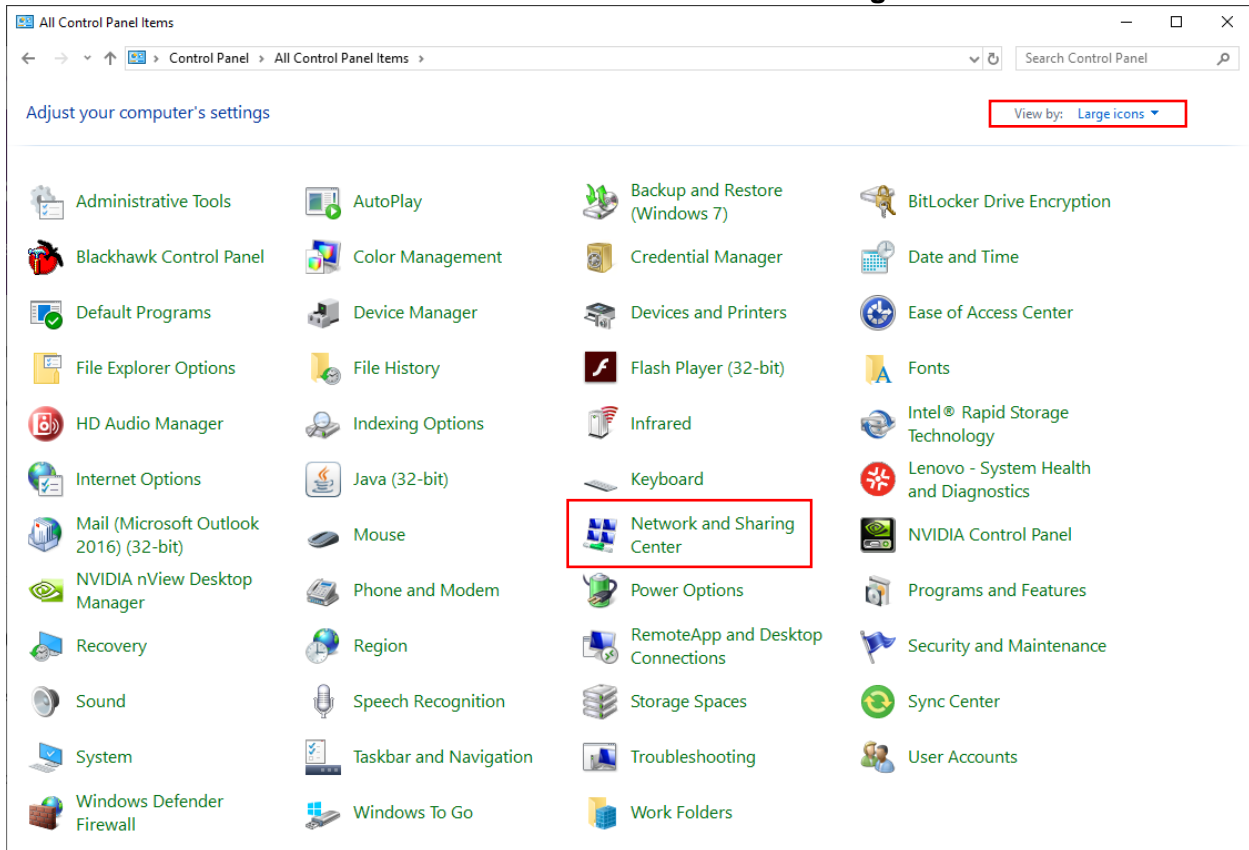
14.2.3.3.4. Click **Change Adapter Settings**

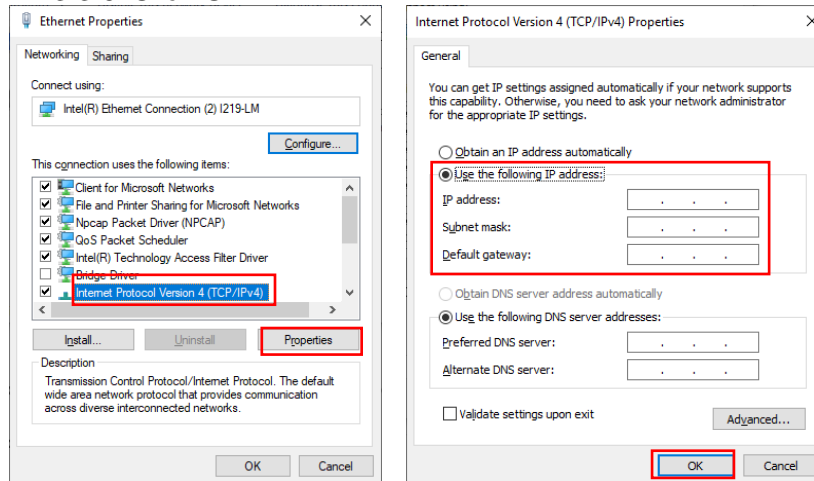### 14.2.3.3.5. Right-click on **Ethernet** or **Local Area Connection** and click **Properties**

14.2.3.3.6. Select **Internet Protocol Version 4 (TCP/IPv4)** and click **Properties**.

14.2.3.3.7. Select **Use the following IP address**.

14.2.3.3.8. Enter the **IP address (192.168.2.4 for Tritech)** and **Subnet mask (255.255.255.0)**

14.2.3.3.9. Click **OK**

14.2.4. Verify Device is now working by opening the application software.

14.2.5. If problem persists contact Outland for additional support.

15. Manipulator Issue

15.1. Any Manipulator mounted on an Outland ROV will be using a 4-pin connector.

15.2. Check Manipulator communication.

15.3. Navigate to the Diagnostics menu.

15.4. Verify the manipulator is listed. If it is not listed, this indicates a communications failure. Contact Outland for support.

15.5. Refer to Table *4* and the figure below for pinout of lights and manipulator.

15.6. If your lights are working properly the Manipulator should be as well. If the lights have quit working properly refer to the Light Issue section.

15.7. If the lights are working with the Manipulator disconnected, then there is a potential problem with the Manipulator and should be returned to Outland for repair.

Table 4: Lights & Manipulator Pinout

Pin	Signal
1	GND
2	+24V$_{DC}$
3	COMM+
4	COMM-

MC-IL-4-F   MC-IL-4-M
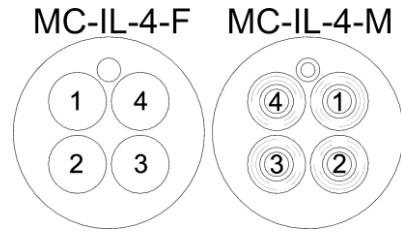
Lights and Manipulator Connectors

16. ROV Power and Data Pinout

Table 5: ROV, Tether and Console Data and
Power Connector Pinout

ROV Data

Pin	Signal
1	Video +
2	Video -
3	COMM +
4	COMM -
5	SPARE1 +
6	SPARE1 -
7	SPARE2 +
8	SPARE2 -

ROV Power

Pin	Signal
1	HV + (+200V)
2	HV – (-200V)
3	ROV Chassis

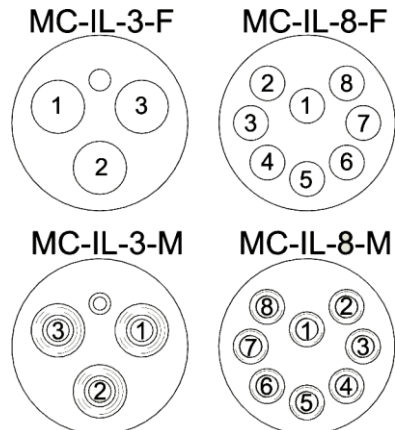MC-IL-3-F   MC-IL-8-F

MC-IL-3-M   MC-IL-8-M

Figure 1: Umbilical Connections

Note: Bulkhead (BH) and Inline (IL) connectors have the same pinout.