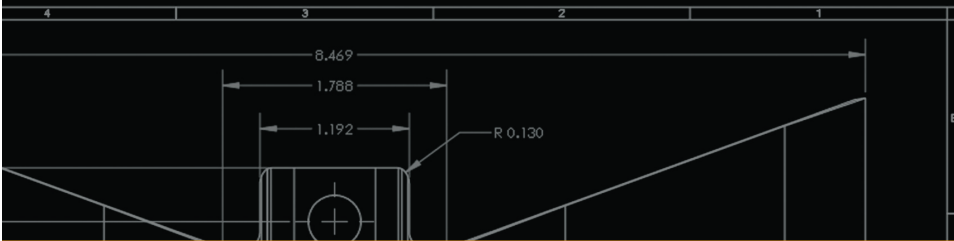
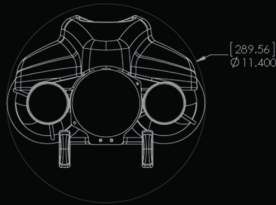
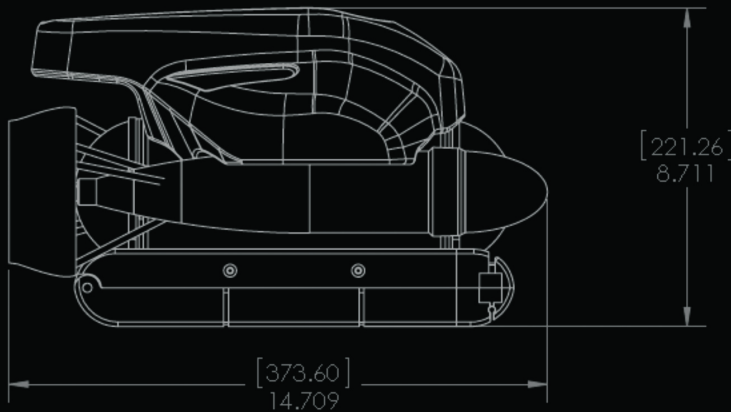
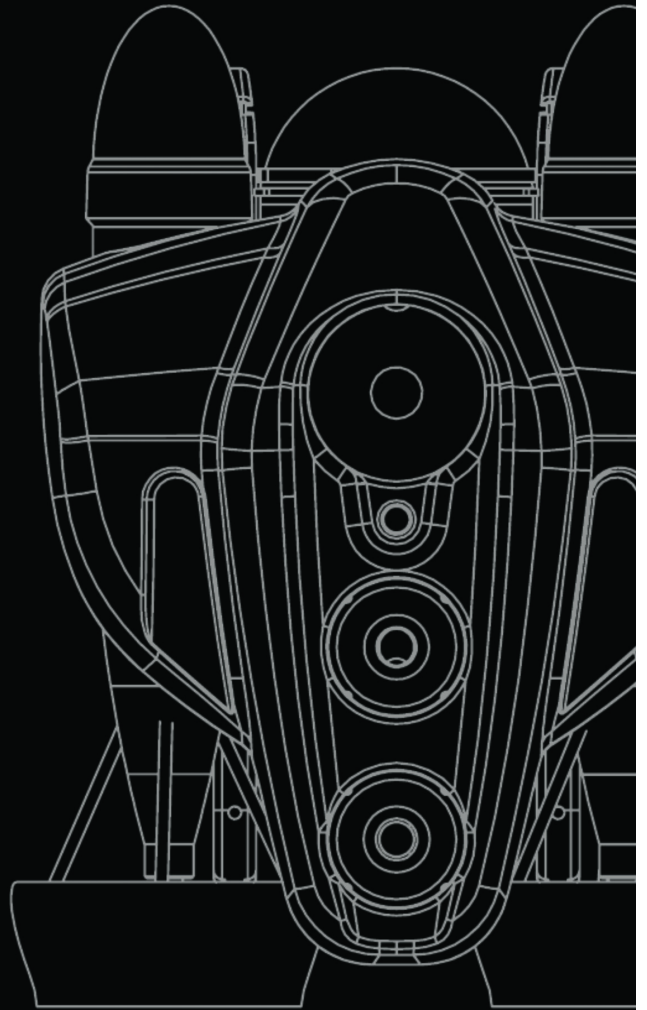




PRO 4



MAINTENANCE MANUAL

VideoRay SUPPORT email: support@videoray.com phone: +1 (610) 458-3000



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About this Document

Document Conventions

Several symbols are used throughout this documentation to add emphasis and to assist in relocating important information. The following table describes these symbols and their uses.

SYMBOL	DESCRIPTION
	The Danger icon is used to indicate there is a potential risk of personal injury or death. Extra care should be taken to understand the risks, and all personnel should exercise caution. It may also be appropriate to warn others in the immediate vicinity.
	The Caution icon is used to indicate there is a potential risk of damage to the equipment or surrounding property. Personnel should receive training in the appropriate procedures before attempting to operate or maintain the equipment.
	The Do Not icon is used to indicate that an action or activity should NOT be performed.
	The Note icon is used to highlight a specific detail or point of information.
	The Tip icon is used to highlight a suggestion or recommendation.

Beyond this Document

There is no substitute for experience and/or training, especially with respect to the real purpose for which you plan to use this equipment. We encourage you to explore options beyond the scope of these materials to expand your knowledge and skills necessary to support your applications. In addition to this documentation, VideoRay offers training and technical support and hosts a general user discussion forum and user image gallery.

We also realize that collectively, users of our products spend considerably more time operating our systems than we do ourselves. Users also encounter more diverse operating environments across an extremely broad range of applications. We highly value this vast experience base, and invite and encourage you to share your experiences and suggestions with us. Please feel free to contact us by any of the methods listed below.

Quality Commitment

VideoRay strives to design, manufacture, deliver and support the highest quality products and services, including this documentation. We have made every effort to ensure that this documentation is accurate and provides you with the most up-to-date information.

If you find any errors in this documentation or have suggestions for improvements, each page contains a "Help us improve this document" feedback link in the left margin (you must be connected to the Internet to use this link).

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Disclaimer

This document is deemed accurate at the time of its writing, however it is not a legal contract and the information contained herein should not be construed to represent any form of commitment. This document as well as the associated products and services are subject to change without notice.

Online Manual

The full version of this manual is available online in the following formats:

- http://download.videoray.com/documentation/_pro_4_mntmaster for viewing the HTML online.
- http://download.videoray.com/documentation/mnt/pdf/videoray_doc__pro_4_mntmaster.pdf for viewing the PDF online.
- http://download.videoray.com/documentation/mnt/zip/videoray_doc__pro_4_mntmaster.exe for downloading the HTML and PDF files.

How to Get Help

Help for your Pro 4 is available through several channels.

All Hours Self-Service / Crowd-Source Tools

Operator's Manuals and Standard Operating Procedures	www.videoray.com/support/manuals.html
Software Downloads	www.videoray.com/support/downloads.html
Frequently Asked Questions	www.rovfaq.com
ROV User Forum	www.rovinfo.com

Global Support

Email	support@videoray.com
Phone	+1 610-458-3000 (<i>select option 1</i>)
Skype	videoray.support (<i>by appointment</i>)
Remote Sessions	www.videoray.com/support/remote-support.html (<i>by appointment</i>)

Regional Support

VideoRay Authorized Service Centers and Dealers	www.videoray.com/dealer.html
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Training

Operator Training	www.videoray.com/learn-more/training.html
Advanced Maintenance Training	www.videoray.com/learn-more/advanced-maintenance-courses.html

Operational Strategies and Tactics Support

If you need help understanding how to apply your system to a specific project, contact VideoRay or your local VideoRay dealer. We can provide guidance or help you find a certified consultant.

User Maintenance Policy


Users are ultimately responsible for the safe operation and longevity of their VideoRay equipment by minimally following best practices outlined in the Operator's / Maintenance Manual, recognized industry standards and using common sense.


 VideoRay strongly recommends that all service and repair of VideoRay equipment owned by users be carried out by VideoRay Certified Technicians at VideoRay Authorized Service Centers. Equipment leased from VideoRay **MUST** be returned to a VideoRay Authorized Service Center for service and repair.

VideoRay also understands that logistics and other issues may make it difficult and costly to return the equipment to a Factory Authorized Service Center for completion of some of the simpler procedures. The following procedures are considered acceptable for the owners and lessees to complete without impact on the warranty. Note that cleaning components is a required condition for continued warranty protection and that failure to exercise reasonable care during these procedures may result in warranty claims being denied.

- Cleaning components
- Lubricating connectors
- Removing and replacing:
 - Front Dome Protector
 - Float Block
 - Skid
 - Propellers
 - Cartridge Seals
 - Vertical Thruster Splitter
 - Horizontal Thruster Nozzle

Instructions for performing these procedures are included in the Operator's / Maintenance Manual. Users who do not feel comfortable completing these procedures are invited to contact VideoRay for assistance.

 Removing other components of the ROV or opening the control panel may void the warranty.

 For users who want to complete service and repair procedures beyond the scope of the above list on their own, VideoRay offers Advanced Maintenance courses and Factory Service manuals for additional fees. These may be valuable for situations where the equipment will be used for mission critical applications or in remote locations. However, the best advice in these situations is to maintain spare equipment on-site for instant resumption of operations in the event of failure.

Maintenance Best Practices

DANGER CAUTION To avoid injury or damage to the VideoRay, disconnect the system power and tether before commencing any maintenance and/or repairs.

The best maintenance programs begin before trouble occurs, and preventative maintenance should be your first step on the road to reliable system performance.

Inspections

Inspections should be carried out before and after every dive as part of the pre- and post-dive procedures. Be observant for signs of loose parts, wear or impending failure - catch small problems before they become big problems. A

CAUTION Failure to inspect and replace thruster cartridge seals regularly is one of the most common reasons for systems to be returned to VideoRay for repair. Water ingress through the thruster cartridge seals typically leads to major internal component damage, which is expensive to repair. View example [cartridge seals](#).

Trained Operators

Do not subject equipment to accidental or inadvertent abuse by someone who is not trained in its proper use.

Trained Technicians

Maintenance should be completed by trained and certified technicians, and using factory authorized parts. VideoRay recommends that you create and maintain a system logbook. The logbook entries can include details of missions (date, location, conditions, dive time, etc.) and maintenance performed (date, procedure, parts replaced, etc.). The logbook may help identify possible causes of problems and systemic issues that should be reported to VideoRay for further investigation.

Service

Follow recommended periodic maintenance schedules, documented procedures and use the proper tools. Work in a clean environment. For any service or repair procedure beyond the scope of the simpler procedures defined in the [User Maintenance Policy](#), contact VideoRay for assistance.

Well Equipped Shop

A well equipped shop is organized, clean, and well lit. Ideally all work can be conducted in such an environment, however there may be times when maintenance or repairs must be completed in the field. For those occasions,

Maintenance Tools Required

VideoRay is designed with ease of maintenance in mind, and only a few tools are required to service the system. In fact, many maintenance procedures, such as changing light modules can be done without tools. VideoRay also includes a small tool and spares kit with each system delivered that contains most of the required tools. The following list of tools is recommended:

TOOL	TYPICAL USE
O-ring lubricator	Lubricating O-rings and O-ring grooves and landings.
Multi-tip screwdriver with 1/4" and 5/16" nut drivers	Miscellaneous screws and main hull rods
5/16" Open end wrench	Main hull rods
7/16" Open end wrench	Propeller locking nuts
Rubber tipped pipe pliers*	Thruster cones
11/16" Open end wrench*	Termination block (tether connection)
13/16" Open end wrench*	Termination block (tether connection)
3/4" Open end wrench*	Pressure sensor
7/8" Open end wrench*	Pressure sensor (required for old style black aluminum housing pressure sensors only)
1-1/4" Open end wrench*	Vertical thruster
Multi-meter*	Electrical circuit testing
Soldering iron*	Electrical circuit repair
Flashlight*	Internal inspections

* - These items are not included in the standard tool kit that comes with the Pro 4.

Additionally, small trays to hold parts and fasteners are recommended.

Field Tool Kit

Ideally all work can be conducted in a workshop environment, however there may be times when maintenance or repairs must be completed in the field. For those occasions, it is recommended that you carry a well stocked tool kit, and a clean mat that can be used as a clean workspace for maintenance.

Basic Equipment Care

Do not abuse the VideoRay and be careful not to damage the system's components through normal use. For example, avoid letting the tether connectors come in contact with the ground where rough surfaces or dirt can damage the contacts.

Cleaning

VideoRay systems should always be cleaned after use. When used in salt water or contaminated environments, make sure to thoroughly rinse and then soak all wet components. It is especially important that you rinse the pressure sensor and allow it to drain. You must remove the float block to do this.

CAUTION Use care when cleaning the pressure sensor to avoid damaging the sensor. Do not insert anything into the pressure sensor cavity, and do not apply high pressure spray to the sensor.

Storage and Transport

Always pack the system securely to make sure it is not damaged in transport.

Special Handling

CAUTION VideoRay ROVs and their components can be damaged by improper care and handling. The following sections provide guidelines and procedures for working with these components.

O-Ring Care and Handling

O-Ring Rule of Thumb - If in doubt, throw it out! Generally, when compared to the equipment they are protecting, O-rings are very inexpensive. Should an incorrectly sized or damaged O-ring be installed, the result can be catastrophic. If there is any doubt as to the suitability or condition of an O-ring it should be replaced.

O-rings and other components with sealing surfaces should never be handled with dirty or gritty hands. A small amount of dirt trapped next to an O-ring will cause leakage, which could result in serious damage to the ROV's internal components. The most common situation is a single strand of hair or lint, so care should be taken to ensure a clean work area. Should an O-ring or sealing surface become dirty, wash it with mild soap and water, and then rinse it with clean water. Avoid scratching the surfaces of the O-ring grooves and landings. Do not use sharp objects such as a knife or screwdriver to pry apart sealed assemblies or remove O-rings. Serious damage to the O-ring or the seat may result.

O-ring Lubrication - VideoRay recommends the use of pure silicone spray or the O-ring lube kit that comes in the standard tool kit. Other lubricants can lead to deterioration and failure of the O-rings and components. Do not use other lubricants! Other lubricants may cause deterioration or attract dirt and lead to leaks or premature failure.

O-ring Inspection - O-rings wear out over time. Inspect all O-rings whenever a sealed assembly is apart. "Healthy" O-rings are soft, flexible and have not been pinched or nicked. Should an O-ring appear brittle, or have apparent cracks, nicks, or evidence of being pinched or permanently compressed, it should be replaced. Sealing surfaces should also be inspected while an assembly is apart. The surfaces should be examined to determine that they are free of dirt, nicks, scratches, or damage, which may result in seal failure once reassembled.

O-ring Storage - O-rings should be stored in clean plastic bags to protect them from dust when not in use. Avoid prolonged storage in direct sunlight as this may result in deterioration of the O-ring material. Stored O-rings should be sorted with regard to type and size with that information noted on the storage bag. Use of an incorrect O-ring can result in an ineffective seal.

Cartridge Seals

View example [cartridge seals](#).

CAUTION Cartridge seals must be checked before every dive and must be replaced with new ones before the air bubble reaches 1/2 of the volume of the seal. Cartridge seals must also be replaced with new ones if they contain contamination or look milky instead of clear. On long duration dives, the cartridge seals should be checked at hourly intervals during the dive unless this is impossible (for example, continuous extended video is required). Any cartridge seal that shows a high rate of air bubble growth or increasing contamination should be replaced (if unable to be replaced on-site, it must be checked more frequently until it is replaced). When replacing seals that are worn, the shaft must be checked for scoring or other signs of wear that could lead to premature seal failure. The shaft must also be checked for wobble (bent), which could also lead to premature seal failure. Thrusters should not be run for more than a minute in air, which could also result in premature seal failure. Cartridge seals must be replaced in a clean environment to ensure a good water tight fit of the O-ring and seals.

If these recommendations are followed, the ROV should NEVER experience a flood through the cartridge seal unless the seal itself suffers a catastrophic failure. VideoRay's warranty does not cover damage due to flooding of the ROV through a cartridge seal unless the customer can demonstrate that they have followed the above recommendations and there is reasonable evidence that the seal failed catastrophically due to a manufacturing defect.

Cartridge Seal Storage Recommendations:

- Cartridge seals should be stored in a sealed plastic bag so they do not attract dirt.
 - Recommended storage temperature is between 2 to 15 degrees C (35 to 60 degrees F) to keep the storage gel from softening and allowing the oil to drain.
 - Storage or transport at low air pressure (checked baggage in an unpressurized cabin) is not recommended.
-

Example Cartridge Seals

New cartridge seal.



Cartridge seal with an acceptable bubble - this seal is okay to use.



CAUTION Nearly empty cartridge seal - this seal should have been replaced when the oil level reached 1/2 of the original volume.



Cartridge seals like this should not be used.



CAUTION Cartridge seal with contamination - this seal should be replaced.



Cartridge seals like this should not be used.

Electronics Components Care and Handling

Electronic components (circuit boards) are susceptible to damage from ESD (Electro-Static Discharge). Numerous sources are available that provide background information and recommend procedures for handling these components. These procedures should be followed when directly handling VideoRay's electronic components.

ESD is caused by the build up of static electricity. Steps to reduce the build up of static electricity or drain off any static build up are encouraged in order to prevent ESD damage.

General Guidelines for handling electronic components include:

- Avoid static build up in the work area
 - Avoid carpet in work areas
 - Maintain proper humidity levels: 40 - 60%
- Implement practices to prevent static build up
 - Provide ground points in the work area
 - Wear a grounded wrist strap
 - Provide grounded static dissipative mats on work surfaces and floors
 - Wear static dissipative outer clothing
 - Work standing rather than sitting
- Use ESD protective packaging

If you cannot work in a properly equipped ESD safe area, there are some general precautions you can follow in addition to the above.

- Always touch a metal ground to dissipate any static charge build up before handling circuit boards.
- When transferring a circuit board to another person or work surface, touch the person or surface with your free hand to dissipate and static charge build up.

Hull Materials Care and Handling

Aluminum Hull Components

VideoRay's aluminum parts are protected by anodizing and/or ceramic coatings. The use of metal tools can scratch these coatings leading to corrosion. Be careful when working with with metal tools near hull parts. Use only wood or plastic tools when the tool must contact an aluminum hull component.

Main Dome and Light Dome

The domes should be cleaned with mild soap and water. They are acrylic and small scratches can be buffed out.

CAUTION Do not use cleaners that contain alcohol or other solvents. Solvents can make the domes brittle.


Galvanic Corrosion

Galvanic corrosion results from dissimilar metals being in contact when exposed to a conductive medium like salt water. Make sure all stainless steel fasteners are not in direct contact with aluminum hull parts. VideoRay uses nylon spacers for these contact points to keep the materials separated. Always make sure to use these spacers when reassembling parts after routine maintenance or a repair.

Periodic Maintenance

The following tables provide information for periodic inspection and maintenance. All users should follow these guidelines, however, some repair / replacement procedures require advanced training.

Action	Frequency	Skill Level for Repair / Replacement	Reference / Notes
External Visual Inspection	Before and after every dive.	All Users	See the Quick Start Guide in the Operator's Manual.
Fresh Water Soak	After every dive.	All Users	See the Quick Start Guide in the Operator's Manual.
Cartridge Seal Replacement	When the cartridge seal oil level is less than 1/2 the volume of the cartridge. When the cartridge seal oil looks cloudy or contaminated. When you notice a significant change in the cartridge seal oil level over a short period of time or use.	All Users	See the horizontal or vertical cartridge seal removal and replacement instructions in the Maintenance Manual.
Propeller Replacement	When the propeller blade is cracked, chipped or excessively worn.	All Users	See the horizontal or vertical propeller removal and replacement instructions in the Maintenance Manual.
Float Block Replacement	If the ROV is used in environments where the float block is routinely scraped, such as in ship hull inspections, the float block should be replaced if the outer shell is significantly worn. The float block should be replaced before the outer shell is worn through to the core material.	All Users	See the float block removal and replacement instructions in the Maintenance Manual.
Main Dome Replacement	When the dome is scratched or marred within the camera's view. When the dome has deep scratches or cracks.	Advanced Training Required	See the front or rear dome removal and replacement instructions in the Maintenance Manual. Note: The main domes are interchangeable and the rear dome can be used on the front of the ROV to replace a mildly scratched or marred dome that affects camera image quality.
Light Dome Replacement	When the dome has deep scratches or cracks.	Advanced Training Required	See the light dome removal and replacement instructions in the Maintenance Manual.
Desiccant Pack Replacement	When condensation appears on the inside of the domes and a leak has been ruled out.	Advanced Training Required	See the desiccant pack removal and replacement instructions in the Maintenance Manual. Note: The desiccant pack can be dried and reused. To dry the desiccant pack, remove it and heat it in a low temperature oven (150-200 F or 65-95 C) for about 1/2 hour.
O-ring Replacement	Annually. When an O-ring looks cracked or suffering from dry rot.	Advanced Training Required	See the specific instructions for each component in the removal and replacement section of the Maintenance Manual.
Hull Component Replacement	With proper maintenance and cleaning, most hull components have life expectancy of many years. If you notice corrosion or deep pitting, you may need to replace that component.	Advanced Training Required	See the specific instructions for each component in the removal and replacement section of the Maintenance Manual.

 Procedures with a skill level of "Advanced Training Required" require knowledge and skill levels beyond what is presented in this user manual. VideoRay offers training courses for operators and technicians to address these needs. Contact VideoRay for more information.

Procedures for removing and replacing common wear items can be found in the [Removal and Replacement](#) section of the [Maintenance Manual](#).

Diagnostics and Repair

Are you having a bad day with your Pro 4? You have come to the right place.

Solving problems requires either a methodical diagnostics approach, or lots of luck. If you don't like to gamble, the following may help you overcome challenges that inevitably present themselves from time to time.

Before providing the specific details of diagnosing and repairing the Pro 4, some basic troubleshooting guidelines are in order. Following these practices should make your efforts much more efficient and successful.

- Suspect and check the obvious first - It's easy to get distracted and overlook something obvious.
- Recheck the obvious - Have someone verify your work. If you're helping someone, verify what you've been told. Sometimes, just talking through the details can help you realize you missed a step or fact.
- Understand correct operation and expected results - How should it work and what should happen? Does it?
- Learn and recognize symptoms - What are the results telling you? What are the most likely suspects and what can be ruled out?
- Isolate, Divide and Conquer - Classify the problem to sub-systems, remove what you can and substitute known working parts if possible. Or, try suspect parts with a known working system.
- One step at a time - Be logical and make each test provide results you can use to narrow down the problem.

The Pro 4 is a collection of relatively simple components, but when something goes wrong, it's easy to get overwhelmed. The following steps should be your first response to a general system malfunction, especially if the power and communications warning indicators in the ROV Health instrument are lit.

1. Power down the system, check the connections and restart using the recommended procedures.
2. USB problems can be the root of several basic system malfunctions. Disconnect the USB cable from the back of the computer, wait a few seconds and then reconnect it. Sometimes the USB controller can be locked up. Try connecting the USB cable to a different port on the computer or rebooting the computer.
3. To identify whether the tether is a possible source of the problem, connect the ROV directly to the control panel to see if the symptoms persist.
4. Remove all attached accessories to eliminate the possibility that an accessory is the source of the problem.

If the problem is more isolated to a specific function, or these steps fail to resolve a general problem, it's time for a closer look at the symptoms and subsystems.

Sub-System Diagnostics

- [Power](#)
- [Communications](#)
- [Control](#)
- [Controller](#)
- [Video](#)

Diagnostics and Repair - System Start Up

When VideoRay Cockpit starts up, it checks the hardware configuration to detect three required items:

- Video Interface
- Communications Interface
- Hand Controller

If any of these items are not detected, VideoRay Cockpit will display an error message and will not operate correctly until the configuration issues are corrected.



In each case, the first thing to check is that the appropriate cable is plugged in. For the first two, the USB cable from the computer to the control panel must be plugged in. For the hand controller, its USB cable must be plugged into the computer or one of the ports at the rear of the control panel.

Additional details about diagnosing each one of these items are provided in the following sections.

Diagnostics and Repair - Power

When the ROV powers up, you will hear a series of tones, the lights will flash, and you should be able to see some internal LEDs light up. If none of these occur a power problem is possible. Power problems can occur on the AC side or DC side. If some, but not all of the start-up indicators work, a power problem is less likely, and a communications or other ROV internal problem is possible.

AC Power Problems

If the control panel will not turn on, the first place to check is the power cord and power source. Press the GFCI test button. The GFCI will not trip without power being applied to it. If the system does not trip, either there is no power (more likely) or the GFCI has malfunctioned (less likely). If you confirm there is power and the power cord is plugged in, but the GFCI will not trip, a faulty GFCI is possible.

If the system passes the GFCI test, then the 2 IEC outlets on the rear of the panel should have power when the GFCI is turned on - the computer should show it is operating on AC power and not its battery. If the GFCI is on, and there is no power at the IEC outlets, a faulty GFCI switch or wire fault in the panel is possible.

DC Power Problems

When you turn on the power switch, you should hear the fans turn on, and the green power LED should light. You should also be able to measure 75 Volts DC in the tether connector between pins 3 and 5. If any of these do not work, it could be a faulty power switch, power supply failure or wiring problem (loose or disconnected connector).

If you measure 75 Volts DC in the tether connector, but the ROV still does not have power, it could be a fault in the tether or ROV. Connect the ROV directly to the panel without the tether. If the ROV works, it could be a problem in the tether or its connectors. If the ROV does not work, it could be a problem in its tether connector, or it could be a board failure in the ROV.

The Pro 4 includes a DC LIM (Line Insulation Monitor) protection circuit that is similar to a GFCI. If the LIM is tripped, a yellow LED alarm light on the control panel will illuminate. The LIM can be tested and reset using the buttons on the control panel. If the LIM alarm does not clear after pressing the reset button for at least 30 seconds, eliminate the tether and try again. If the LIM alarm still does not clear, the ROV or control panel must be serviced. See the [LIM](#) section of the Operator's manual for more information.

Test Points

Test	Procedure / Location	Expected Result
Measure tether Ohms for continuity	Tether pin 3 male to pin 3 female	Continuity
Measure tether Ohms for continuity	Tether pin 5 male pin 5 female	Continuity
Test tether for a short	Tether pin 3 male/female to any other pin	No short
Test tether for a short	Tether pin 5 male/female to any other pin	No short
Measure control panel voltage	With the control panel on, measure 74 V DC on control panel tether pin 3 female (+) to tether pin 5 (- ground)	74 V DC +/-
Measure ROV accessory port voltage	With the ROV connected and the system on, measure 24 V DC on ROV accessory port pin 3 female (+) to accessory port pin 5 female (- ground)	24 V DC +/-
Measure ROV accessory port voltage	With the ROV connected and the system on, measure 12 V DC on ROV accessory port pin 9 female (+) to accessory port pin 5 female (- ground)	12 V DC +/-

Diagnostics and Repair - Communications

Communications problems can result in loss of control of the ROV. Communications in the Pro 4 occurs at several levels.

The computer has to communicate with the control panel via the USB cable. First verify that the cable is connected. The computer must also recognize the control panel devices, specifically the RS-485 interface. The RS-485 device will only be recognized while the control panel is turned on. To check the status of the communications with the RS-485 device, the control panel must be turned on. The RS-485 interface can be confirmed by checking the Ports in Device Manager. To access device manager, open the Windows Control Panel, and in the Classic View, click on System. Next, click on the Hardware tab, and then the Device Manager button. Click on the plus sign (+) next to Ports and confirm that the SeaLevel RS-485 port is listed as one of the ports. If the RS-485 device is not listed, unplug the USB cable, wait a few seconds and plug it back in. If the RS-485 device is still not listed, power down the control panel and reboot the computer. If the RS-485 device is not listed after a shut down, restart and reboot, a problem with the USB cable, RS-485 device, or internal USB hub or controller is possible.

The control panel must communicate with the ROV through the tether. Communications occur via pins 7 and 8. verify the continuity of the tether to ensure all conductors are intact. The tether conductors are straight through - pin 1 to pin 1, pin 2 to pin 2, etc. You can also connect the ROV directly to the control panel without the tether to either rule out or confirm whether the tether is the problem.

Test Points

Test	Procedure / Location	Expected Result
Communications device present	Verify "SeaLINK +485Isolated USB to RS-422/485 Converter (COMx)" is visible in Device Manager under "Ports"	Device recognized and no warnings
Measure tether Ohms for continuity	Tether pin 7 male to pin 7 female	Continuity
Measure tether Ohms for continuity	Tether pin 8 male pin 8 female	Continuity
Test tether for a short	Tether pin 7 male/female to any other pin	No short
Test tether for a short	Tether pin 8 male/female to any other pin	No short
Measure control panel Ohms	Control panel tether pin 7 female to control panel tether pin 8 female	120 kOhm +/-
Measure ROV Ohms	ROV tether pin 7 male to ROV tether pin 8 male	120 Ohm +/-
Measure ROV Ohms	ROV tether pin 7 male to ROV accessory port pin 7 female	120 Ohm +/-
Measure ROV Ohms	ROV tether pin 8 male to ROV accessory port pin 8 female	120 Ohm +/-
Measure ROV Ohms for continuity	ROV tether pin 7 male to ROV accessory port pin 8 female	Continuity
Measure ROV Ohms for continuity	ROV tether pin 8 male to ROV accessory port pin 7 female	Continuity

Diagnostics and Repair - Control

Control problems can occur due to a communications problem, a hand controller problem, a problem with an ROV subsystem, poorly adjusted buoyancy, or a physical problem like a stuck tether or fouled propeller.

VideoRay Cockpit instruments can confirm that a hand controller input is being received. If the instrument does not indicate a controller input, such as the camera indicator does not move when you press the camera tilt button, then check to make sure the hand controller is plugged in. You can also check whether the hand controller is recognized by Windows. You can check if the hand controller is recognized by Windows using the Game Controller application in the Windows Control Panel.

If the hand controller is working, but you cannot pilot the ROV, check for a loose or fouled propeller. If the propellers are clear, the problem could be a thruster motor or motor controller. If the problem is vertical control, then you might need to adjust the ballast.

If the ROV can be piloted, but another subsystem, like camera tilt, is not functioning, verify the hand controller function as listed above, and then suspect the subsystem.

 See the [Control Sensitivity](#) and [Systems Tuning](#) section of the [VideoRay Cockpit Guide](#) for more information about adjusting the responsiveness and power settings of the thrusters.

Diagnostics and Repair - Hand Controller

Directional control and other ROV functions result from a series of operations, configuration settings, wiring and functions. Normally, pressing forward on the joystick results in the ROV moving forward, pulling the joystick in reverse reverses the ROV, and left and right joystick inputs result in the ROV turning left and right respectively. If the behavior is not as expected, one of the following can be the problem. It is important to correct the situation in the right place, otherwise it may compound the problem and make components (controller, computer, ROV) incompatible with other systems.

Holding the joystick inverted

The VideoRay hand controller should be held so that the joystick and the wire to the control panel are to the right.

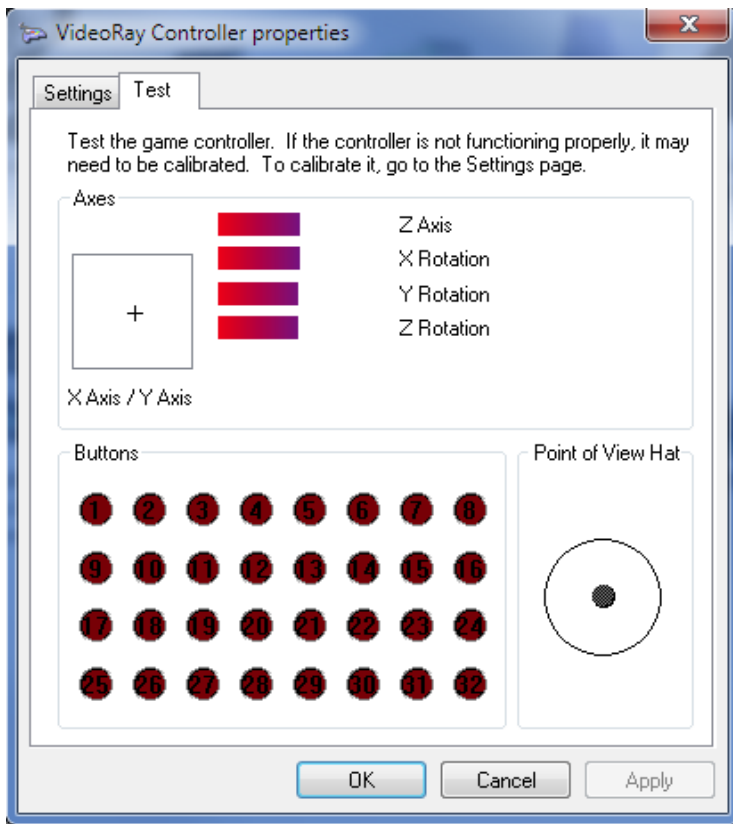
Broken joystick

If the joystick does not "feel" right, it might be broken. If there is no response (as opposed to an incorrect response) the joystick might be broken. This may also result from a wire failure in the hand controller or between the hand controller and the computer. The joystick can be checked using the Windows game controller properties found in the Windows Control Panel. Also, when you move the joystick, you should see the corresponding thruster indicator(s) moving in VideoRay Cockpit.

Mis-wired joystick

If the joystick is mis-wired it may not operate as expected. The joystick wiring can be checked using the Windows game controller properties found in the Windows Control Panel.

The default joystick and knob response for the VideoRay Industrial Hand Controller is shown in the following image:



Move joystick to the right (J1 +X) = The crosshair should move to the right

Move joystick away (forward) (J1 +Y) = The crosshair should move down

Rotate the joystick clockwise (J1 CW) = the bar size should decrease

Rotate controller knob on upper left clockwise (RX CW) = the bar size should decrease

Rotate controller knob on lower left clockwise (RY CW) = the bar size should decrease

Rotate controller knob on the side clockwise (RZ CW) = the bar size should decrease

Default Button Mapping

1. Manipulator Close
2. Manipulator Open
3. Focus Out
4. Tilt Up
5. Help
6. Snapshot
7. Lights Bright
8. Lights Dim
9. Tilt Down
10. Focus In
11. Camera Select
12. Record/Stop

Error in the joystick configuration file

The configuration file maps joystick inputs to specific ROV functions. If these are not mapped correctly, a different response can be expected. This is not always a problem - changing the configuration file is required in order to create a custom configuration. Configuration files are XML. They require manual edit, but a future version of VideoRay Cockpit will include a joystick mapping user interface.

Modified Thruster Direction Setting in the main configuration file

There is a setting in the main VideoRay Cockpit configuration file to change the port thruster direction. <InvertPortThrusterDirection>. If this value is set to true, the port thruster direction will operate in the reverse direction from normal operation. This setting is for legacy support and should not normally be changed.

Mis-wired thruster motors

If the thruster motor wires are incorrect, the thruster motor may rotate in the wrong direction. Swapping any two of the three thruster motor wires should correct this problem.

Improper propeller installation

The propellers on a Pro 4 are counter rotating (reverse pitch) and should be installed so that the top blade curves towards the center when viewed from behind. Do not install the propellers on the wrong shaft, and do not install two propellers with the same directional pitch.

Diagnostics and Repair - Video

Understanding the video circuit can help in diagnosing and solving video problems. Typical video problems include complete loss of video, video noise, image quality (focus, color, inverted image) and video frame rate (stutter).

Overview

Composite video (in NTSC or PAL format depending upon country standards) originates in the primary, or external, camera and passes through a switching circuit in the ROV. The switching circuit determines which camera source signal is displayed, and is controlled by VideoRay Cockpit software on the topside. From the ROV, the video is passed via the tether to the control panel. Within the control panel the video is either passed through a Llyn visual enhancement system, if one is installed, or directly to a video splitter. The video splitter provides video feeds to both a digital and analog display circuits.

Digital Circuit

The digital circuit includes a USB video capture device, which is connected to a USB hub within the control panel and then to a computer via a USB cable. Within the computer, VideoRay Cockpit software can display the video, in real time with or without video overlay text or graphics. If a second monitor is attached to the computer, the video window can be displayed on either or both display devices. VideoRay Cockpit software can also record the video to disk. Other software can also use the digital video source, and this can be helpful for diagnostic purposes.

Analog Circuit

The analog circuit passes from the splitter directly to a Video Out RCA style connector on the rear of the control panel. From this connection, a cable can be connected to a monitor or video recording device. If the video is split at this point to two or more devices, a video amplifier/splitter is recommended. Splitting the video without an active amplifier is likely to result in poor video quality.

Note: Video overlay text and graphics are supported on the digital circuit, but not the analog circuit.

Summary of Video Circuit Components

- Camera
- Switching circuit within the ROV
- Wiring within the ROV, tether or control panel
- Video capture device
- USB system
- Software
- Display component
- Power

When diagnosing video problems, the divide and conquer method is recommended. See the other FAQs about video problems for more specific instructions.

Video problems are widely variable. It could be a faulty cable, signal problem, video noise, improper camera setting for the conditions, or even lighting.

If there is no video signal, first verify that rest of the system is functional. If the rest of the system is functional, verify that the video circuit in the control panel is recognized by the computer. The video circuit can be verified by checking the Sound, video and game controllers section in Device Manager. To access device manager, open the Windows Control Panel, and in the Classic View, click on System. Next, click on the Hardware tab, and then the Device Manager button. Click on the plus sign (+) next to Sound, video and game controllers and confirm that the DVD Maker 2 (or USB 2861 Device) is listed. If the DVD Maker 2 device is not listed, unplug the USB cable, wait a few seconds and plug it back in. If the DVD Maker 2 is still not listed, power down the control panel and reboot the computer. If the DVD Maker 2 is not listed after a shut down, restart and reboot, a problem with the USB cable, DVD Maker 2 device, or internal USB hub or controller is possible.

If video noise seems to be a problem, it could be local interference, a mismatched ground, or a poor connection somewhere in the system. If you are operating off a local power source such as a generator, make sure the ground is the same as the water in which the ROV is being used. Also, check that each connection in the tether is clean and well seated.

If you do not have video on the second monitor, make sure the monitor is powered on, the cable connected and computer configured to display on two screens.

If the video image is poor, check the camera focus and the camera settings. You may also need to adjust the lights.

Test Points

Test	Procedure / Location	Expected Result
Video capture device present	Verify "DVD Maker" or "USB 2861 Device" is visible in Device Manager under "Sound video and game controllers"	Device recognized and no warnings
Verify video presence on analog video out	Connect a monitor to the analog video out connector	Video displayed on external monitor
Measure tether Ohms for continuity	Tether pin 1 male to pin 1 female	Continuity
Measure tether Ohms for continuity	Tether pin 2 male pin 2 female	Continuity
Test tether for a short	Tether pin 1 male/female to any other pin	No short
Test tether for a short	Tether pin 2 male/female to any other pin	No short
Measure control panel Ohms for continuity	Control panel tether pin 1 female to Video Out RCA ground	Continuity
Measure control panel Ohms for continuity	Control panel tether pin 2 female to Video Out RCA signal	Continuity
Measure ROV Ohms for continuity	ROV Tether pin 2 male to ROV accessory port pin 2 female	No continuity

Component Removal and Replacement

This documentation guides users through removal and replacement of the primary components of the ROV. These components are categorized as requiring Novice, Intermediate or Advanced knowledge and skills, and versions of this document have been created to include only up to one of these levels. At the Advanced level, all Intermediate and Novice components are included, so all three versions are not needed to have the full set. This Novice version is included with product documentation. The Intermediate and Advanced versions are included with the appropriate training courses.

The instructions for each component consist of two sections:

1. Removal
2. Replacement

Each section consists of:

1. A one page overview that includes
 - a. Skill level requirement
 - b. Estimated time to complete the overall removal or replacement process
 - c. A list of the tools required
 - d. A list of the other components that need to be removed/replaced
2. Pages that outline the steps for each component that needs to be removed or replaced that include
 - a. Skill level requirement for the specific component
 - b. Estimated time to complete the steps for the specific component
 - c. A list of the tools required for the specific component
 - d. A detailed list of parts that are considered part of the specific component, such as screws, washers, and/or other miscellaneous hardware items.

In addition, there is a "Comprehensive Parts List," page that lists all of the parts that have to be removed or replaced for the specific component and all of the associated components that must be removed or replaced.

Main Hull

The Main Hull section includes removal and replacement steps for the following components:

1. [Float Block Kit](#)
 2. [Strain Relief Cable Kit](#)
 3. [Skid Kit](#)
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Horizontal Thrusters

The Horizontal Thrusters section includes removal and replacement steps for the following components:

1. [Horizontal Thruster Propeller Kit \(Left and Right\)](#)
 2. [Horizontal Thruster Cartridge Seal](#)
 3. [Horizontal Thruster Nozzle Kit](#)
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Vertical Thruster

The Vertical Thruster section includes removal and replacement steps for the following components:

1. [Vertical Thruster Propeller Kit](#)
2. [Vertical Thruster Splitter](#)
3. [Vertical Thruster Cartridge Seal](#)