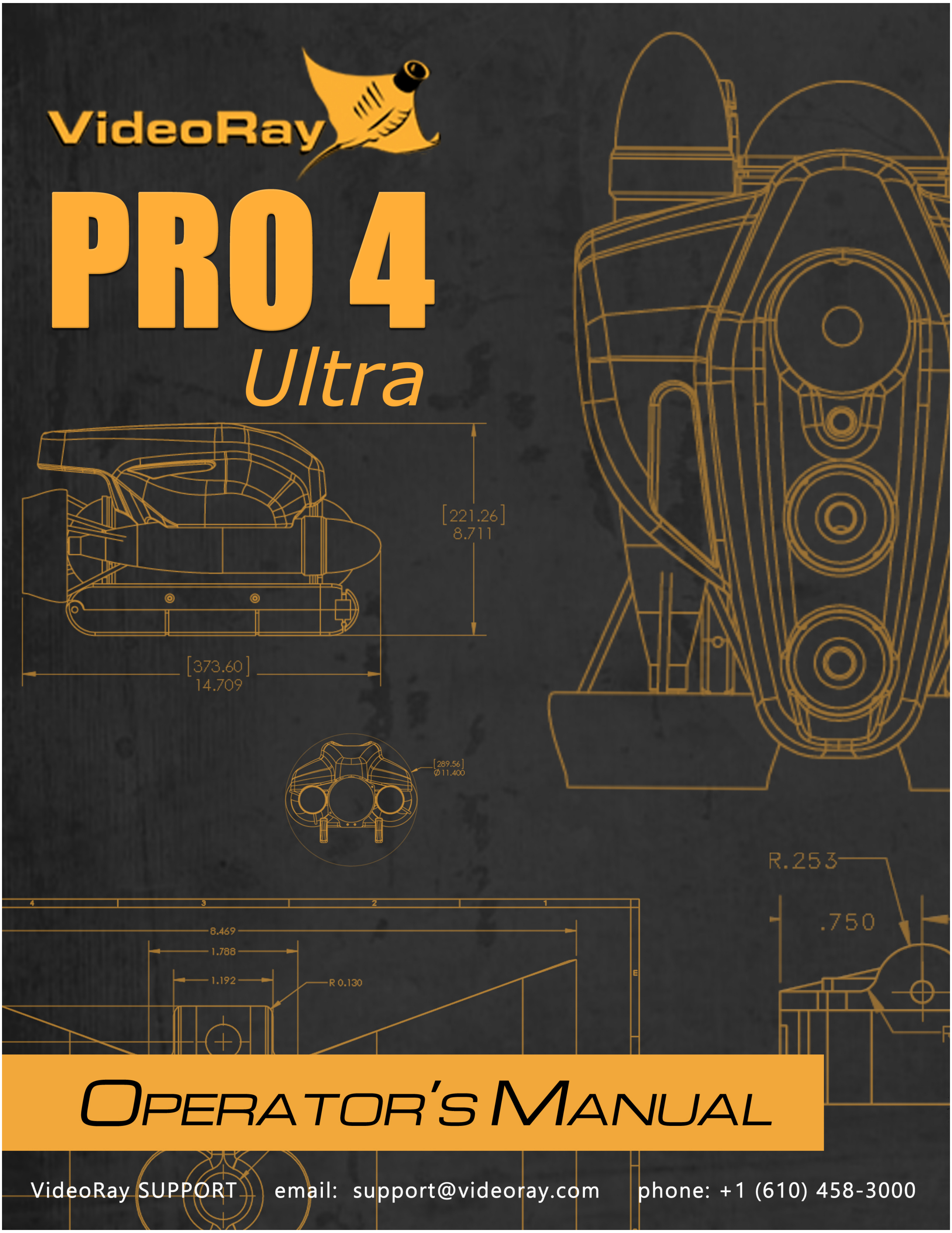
VideoRay PRO 4 Ultra



Operator's Manual

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Maintenance Manual

About this Document

The VideoRay Pro 4 Ultra has sophisticated features, but is easy to use and maintain once you learn its capabilities and the proper operating techniques. This documentation will guide you through your first dive and provide additional details to help you learn all aspects of its operation.

Document Organization

This documentation is organized into several guides.

- The Quick Start Instructions provide the basic steps to get you operational as quickly as possible while keeping you and the equipment safe.
- The Equipment Guide provides details about each component and its function.
- The VideoRay Cockpit Guide explains the software features and operation in detail.
- The Operations Guide provides tips on how to use the system most effectively.
- The Maintenance Guide provides procedures for routine maintenance, diagnostics and repair.
- The Customization Guide provides information about customizing the system to better meet your specific needs.
- The Upgrader's Guide provides information about the latest improvements and comparative information for people who are familiar with the VideoRay Pro 3.

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
DANGER	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.
CAUTION	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_ultra for viewing the HMTL online.
- http://download.videoray.com/documentation/pro_4/pdf/videoray_doc_pro_4_ultra.pdf for viewing the PDF online.
- http://download.videoray.com/documentation/pro_4/zip/videoray_doc_pro_4_ultra.exe for downloading the HTML and PDF files.

How to Get Help

Help for your Pro 4 Ultra 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 (*select option* 1)
Skype	videoray.support (*by appointment*)
Remote Sessions	www.videoray.com/support/remote-support.html (*by appointment*)

Regional Support

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

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 you local VideoRay dealer. We can provide guidance or help you find a certified consultant.

Pro 4 Ultra Overview

VideoRay is pleased to present the latest model in its top-of-the line professional series Micro-ROVs - the VideoRay Pro 4 Ultra. Like the Pro 3, the Pro 4 Ultra was designed for performance and maintainability, but has entirely new internal electronics, including camera, LED lights, processor, and added sensors. With powerful brushless motors, the Pro 4 Ultra further extends VideoRay's position as the fastest and most powerful tether pulling vehicle. Additional improvements include deeper depth rating, hydrodynamic streamlining, and optimized ballast adjustment. Topside control is based on industry standard computers, with new software that integrates several functions while dynamically reconfiguring for ease of use.

The Pro 4 Ultra submersible builds on VideoRay's strengths with more than twice the vertical thrust of the Pro 3, and 50% greater horizontal thrust. A depth rating of 300 meters (1000 feet) is standard. Improvements in the electronics allow for both greater total tether length up to 600 meters (2000 feet) and much better power transmission over longer tethers. Existing VideoRay tethers can be used with the Pro 4 Ultra - and different tether types can still be combined to meet different operational requirements. New sensors, including 3 axes compass and accelerometers and MEMS gyro improve navigational capabilities. The primary video camera features ultra low light and Wide Dynamic Range imaging capability, with a wide range of user controllable parameters for demanding imaging situations. Coupled with the very high intensity LED lighting, the images and video that can be captured are far clearer, particularly in difficult lighting conditions. An optional external camera can be rotated 360 degrees to provide lateral views as needed.

The topside control configuration replaces inflexible and limited switches and knobs with context-sensitive controls that go beyond simply controlling the submersible to controlling navigation, sonar, image and video capture, and other sensors and accessories in addition to the submersible. This "systems approach" significantly reduces operator workload and distraction caused by separate systems for sonar, navigation, video capture, and vehicle control.

Additionally, VideoRay recognizes that technology is only as good as the people who use it. Successful organizations focus on training and systematic procedures for operations and maintenance. The VideoRay Pro 4 Ultra package includes features that help owners and operators develop, implement and execute ROV operations and maintenance programs more efficiently and effectively. These features include customizable documentation, online interactive operating checklists and knowledge and skill assessment tools. Companies with one system or an entire fleet can leverage these capabilities to ensure that their investment in VideoRay equipment continues to return value throughout its life.

Quick Start Instructions

These Quick Start Instructions are streamlined to cover just the essentials of operating your Pro 4 Ultra system. They are provided to get you started as quickly as possible, while keeping you and the equipment safe. They cover the equipment set up and basic operation, but are not intended to result in a comprehensive base of knowledge or set of operational and piloting skills. The remaining sections of this documentation should be referenced for a complete understanding of the features, capabilities, operating procedures and maintenance requirements of your Pro 4 Ultra system.

While you will likely find the Pro 4 Ultra easy to pilot, we strongly recommend that your first dive be conducted in a controlled environment such as a small tank or pool. As you gain experience with your system and confidence in using it, you will be able to operate in more challenging conditions that might include low visibility, currents and potential hazards that could snag your tether or trap your ROV.

Topics in this Section

Safety First

DANGER CAUTION Operating electrical devices in and near the water can be dangerous. There is always a risk of drowning or electrocution in such an environment. Reduce these risks by using common sense and observing safety regulations and recommended safe practices including the following:

- Never handle power cords while in contact with water or allow power cord connectors or the control panel to enter the water. The only components that can safely be placed in water are the submersible, any onboard accessories and tether, and only after making sure the connections are secure.
- Always test the safety components, such as GFCI switches and interlock devices, before beginning operations. Follow the procedures described in this manual for.
- Have proper safety equipment, such as PFDs (Personal Flotation Devices), on hand and make sure you know how to use them before you need them.
- Keep fingers, hair, loose clothing and other objects away from VideoRay's propellers and other pinch points.
- Monitor weather and sea conditions and heed any warnings or alerts.
- Be aware of and follow any legal ordinances or regulations in your area regarding operation of vessels and underwater equipment in the water.

Before setting up for or commencing any dive, it is a good practice to make sure there are no hazards to people or the equipment on land or in the water. If there are other people in the water nearby, you should advise them that you are going to be operating the ROV. As the owner/operator, it is your responsibility to ensure the safety of those around you as well as that of the equipment and nearby property.

How Safe Is Safe Enough?

Addressing all aspects of safety while working in a water environment is beyond the scope of this documentation. VideoRay encourages you to participate in safety training appropriate for your industry and applications, including such topics as vessel operations, first aid, survival and other relevant topics.

Introduction to the System Components

Unpack the system and familiarize yourself with the components.

Unpack the system and familiarize yourself with the components.

ROV

The ROV, or Remotely Operated Vehicle, carries the cameras, lights and sensors or accessories to the underwater places you want to observe. Thrusters provide mobility and these systems are controlled from the surface using the control panel and hand controller.

See the ROV section of the Equipment Guide for more information.

Control Panel

The control panel includes the system's power and communications modules, computer and hand controller, and serves as the operator's console and video display. Open the control panel and familiarize yourself with the components and primary controls on the hand controller. See the Control Panel and Hand Controller sections of the Equipment Guide for a complete description of all of the controls and connections.

See the Control Panel section of the Equipment Guide for more information.

Hand Controller

The hand controller is used to pilot the VideoRay and operate other features like the lights, camera controls and manipulator. The hand controller is pre-programmed, but can be customized to meet specific user or operational needs.

See the Hand Controller section of the Equipment Guide for more information.

Tether / TDS (Tether Deployment System)

The tether connects the ROV to the control panel. It delivers power and control signals to the ROV, and returns video and sensor data (optional) from the ROV to the surface. Some systems come with a TDS (Tether Deployment System), that makes the work of managing the tether easier. The tether is also often referred to as the umbilical.

See the Tether section of the Equipment Guide for more information.

Additional Items

Additional items may be supplied with your system including tools, spare parts and other items. If included, these items are described in other sections of this documentation.

Some items shown may be optional and not included with your configuration.

Pre-Dive Preparations

Select a safe and preferably level area to set up the control panel. See the On-site Operations section of the Project Management Guide for more information about site selection and set up.

The pre-dive preparations consist of three parts, a visual inspection before setting up the system, setting up the system including making connections, and power on tests of the system's safety circuits and primary functions.

VideoRay Cockpit includes an online interactive Pre-Dive checklist. See the Pre-Dive Checklist section of the VideoRay Cockpit Guide

Conduct a Visual Inspection

Assuming this is your first time using the VideoRay, everything should be in proper working order and ready to go, but it is good practice to perform a pre-dive inspection before every dive, even your first. If any problems are noticed, refer to the Diagnostics and Repair section of the Maintenance Guide and take appropriate corrective action, or contact VideoRay for assistance before commencing the dive.

1. Inspect the ROV and other system components to make sure there are no visible signs of damage or loose or worn parts. Also check for water inside the ROV hull by holding it with the front facing downward and look for signs of water in the main dome or light domes.

2. Check the horizontal thrusters to make sure that the shafts are not bent and the propellers are free to spin and are not fouled, loose or binding on the thruster guards. Check the thruster cartridge seals - they are filled with oil and there should be no signs of leaking or contamination. A small air bubble in a thruster cartridge seal is acceptable. See the Maintenance Guide for warnings, replacement criteria, examples and replacement procedures.

3. Check the vertical thruster to make sure the shaft is not bent and the propeller is not fouled or loose or binding on the float block. Also, check the thruster cartridge seal following the same guidelines used to check the horizontal thruster cartridge seals. Make sure the accessory port at the rear of the ROV is sealed with either a connector from an attached accessory or an accessory port terminator plug. Removal of the float block by loosening the retaining screw may facilitate this process.

Make the Connections

CAUTION Connecting or disconnecting cables while the system is powered on is not recommended.

Most of the cables have been connected at the factory. See the appropriate sections of the Equipment Guide for detailed information about each of the connections.

You will typically need to connect only the hand controller, tether and power cord.

1. Connect the hand controller to one of the USB ports on the back of the control panel or directly to one of the USB ports on the computer.

2. Connect the female end of the tether connector to the ROV. The connectors have one pin that is offset towards the center of the connector. Make sure the connectors are clean, align the pins, and push the connectors together - do not twist the connectors. Secure the locking collar by screwing the halves together, and connect the strain relief cable from the ROV to the braided strap on the tether.

3. Connect the male end of the tether to the control panel. When not in use, keep the tether connectors clean and

protected for the best performance and reliability.

4. Plug the control panel power cord into a conventional power source (100-240 Volts AC, 50,60 Hz). Power can be supplied through a land-based power outlet, generator or battery and inverter. See the Control Panel section of the Equipment Guide for power source requirements.

Power On Tests

DANGER CAUTION If the system does not pass any of the following tests, it should not be used until the problem is identified and corrected. See the Diagnostics and Repair section of the Maintenance Guide for more information.

The VideoRay Pro 4 Ultra includes one circuit safety component.

- The GFCI (Ground Fault Circuit Interrupter) / Circuit Breaker

Testing the Circuit Safety Components

Test the GFCI / Circuit Breaker switch (The system must be connected to a working power source to perform this test.)

1. Set the GFCI / Circuit Breaker switch to the On position.
2. Press the test switch on the GFCI. The GFCI / Circuit Breaker switch should turn off.
3. Set the GFCI / Circuit Breaker switch to the On position.

Set the Power switch to the On position. The green Power On indicator light should turn on. If the green Power On indicator light is not on, make sure the system is connected to a working power source and the GFCI / Circuit Breaker switch is turned on.

Starting VideoRay Cockpit Control Software

Make sure the system is connected to a working power source and the GFCI / Circuit Breaker and Power switches are turned on.

1. Turn on the computer and wait for the system to complete the boot up process.
2. After the computer has started, start VideoRay Cockpit using the desktop icon, or by selecting it from the Start->All Programs->VideoRay menu.
3. When VideoRay Cockpit starts, you will see the Video Window, the Control Instruments and the Control Bar. For now, you will only need to focus on the video window. See the VideoRay Cockpit Guide for details about using VideoRay Cockpit.

VideoRay Cockpit screen with simulated video image - your image will likely be different.

Testing the System's Functions

The next step is to ensure that the essential features of the ROV are functioning properly. Use the hand controller to perform the following tests. See the Hand Controller section of the Equipment Guide for more information about using the hand controller.

Test the thrusters

CAUTION For the next two steps, do not operate horizontal thrusters out of water for more than 30 seconds to avoid overheating or premature wear of the cartridge seals.

1. Gently move the joystick forward and backward and left and right - the horizontal thruster motors should turn the propellers. Release the joystick - it will return to center on its own, and the propellers will stop turning.
2. Rotate the Depth Control knob - the vertical thruster motor should turn the propeller. Return the Depth Control knob to center to cease the vertical propeller rotation.

Test the lights

CAUTION For the next two steps, do not leave the lights on bright for more than 30 seconds while the ROV is out of water to avoid overheating.

1. Press and hold the Lights Bright button to increase the intensity of the lights - the lights should get brighter.
2. Press and hold the Lights Dim button to dim the lights - the lights should dim.

Test the camera functions

1. Press and hold the Camera Tilt Up button - the camera should tilt up smoothly through its entire range.
2. Press and hold the Camera Tilt Down button - the camera should tilt down smoothly through its entire range.
3. Press and hold the Camera Focus In button - the camera should focus in smoothly through its entire range.
4. Press and hold the Camera Focus Out button - the camera should focus out smoothly through its entire range.

If a manipulator or other accessories are attached, these items should be checked at this time.

Good Advice

The time to catch small problems before they become big problems is during the pre-dive inspection.

CAUTION The thruster cartridge seals are designed to prevent water intrusion along the thruster shafts. Based on service records at VideoRay, the most frequent repair (as well as the most expensive) is the failure of the operator to inspect the thruster cartridge seals and replace them as necessary.

View example cartridge seals

Dive Operations

After all of the pre-dive checks and tests have been completed successfully, you are almost ready to commence the dive. But, there is one more issue to address that could affect the performance of the ROV. The ROV is designed to be operated in a near neutrally buoyant configuration, so the last step before launching your VideoRay is to check the buoyancy, and adjust the ballast if necessary. For most operations, the buoyancy is optimal when the top of the float block is even with the water surface and the ROV is level. If the ROV is too buoyant or too heavy, the vertical position may be hard to maintain or control.

Buoyancy will need to be adjusted for use in fresh water versus salt water and depending upon whether accessories are used with the ROV.

Buoyancy Check and Adjustment

To determine if the buoyancy is correct, lower the ROV and at least 3 meters (10 feet) of tether into the water. You can lower the ROV by the tether - it will not hurt the tether because there is Kevlar in it. Observe the ROV in the water - it should not be floating too high or sink. It should also be floating level and not tipped to one side or pitched up or down. If the ROV floats too high, you will need to add some ballast weights. If the ROV sinks, you will need to remove some ballast weights. If the ROV is not floating level, you can change the locations of the weights.

The buoyancy can be adjusted by opening the skid pods and adding or removing the supplied ballast weights. To open the skid pods, turn the ROV upside down. Press on the buttons on the sides of the pod, and lift up on the pod shell. The weights can be added to or removed from the slots by hand. For most operations, the weights should be evenly distributed.

Commence the Dive

Once the buoyancy has been adjusted the ROV is ready to launch. Lower it into the water and operate the controls to maneuver it.

- Start with the ROV on the surface and push the joystick forward slightly to make the ROV move forward. Move the joystick to the left or right to make it turn left or right. Get a feel for how agile the ROV is.
- Observe the video display as well as the ROV to become acquainted with the camera's wide angle lens and its affect on depth perception underwater.
- Once you feel comfortable with the horizontal maneuverability of the ROV, rotate the depth control knob to dive the ROV. Tilt the camera down as you dive so you can see towards the bottom. Rotate the depth control knob to bring the ROV back to the surface. Tilt the camera up as you surface so you can see towards the surface.
- Change the lights settings, and adjust the camera focus. If you have a manipulator, tilt the camera down so you can see it and open and close the jaws.
- As you get familiar with maneuvering the ROV, you can start to observe some of the on-screen displays including

the depth, heading, camera settings and other data.

For your first dives, practice until you are comfortable operating the controls without looking at them and you are able to control the ROV with some precision.

See the Hand Controller section of the Equipment Guide for complete information about using the hand controller and see the Piloting section of the Operations Guide for more advanced tips on piloting the Pro 4 Ultra.

Practice Makes Perfect

Developing the skills to operate your Pro 4 Ultra like an expert may take some time. Practicing on a regular basis is highly recommended.

Post-Dive Operations

At the conclusion of your dive, retrieve the VideoRay and power down the system by closing VideoRay Cockpit, shutting down the computer and turning off the Power switch. Make sure the ROV is secure before disconnecting the tether. After disconnecting the tether, keep the tether connectors clean and do not let them drag on the ground.

Proper maintenance of your VideoRay system ensures a long service life and that it will be ready to operate when you are. After each dive, you should visually inspect the system for damage that might have occurred during your operation.

VideoRay Cockpit includes an online interactive Post Dive checklist. See the Post Dive Checklist section of the VideoRay Cockpit Guide

Keeping the ROV clean is one of the most important aspects of good preventative maintenance practices, especially after using it in salt water. If you use your ROV in salt water, or water with contaminants, you should first rinse it, and then soak it in clean fresh water for at least one-half hour. After cleaning the ROV and tether, they should be allowed to air dry before being put away for storage.

CAUTION Failure to properly maintain the ROV by thoroughly cleaning it after use may dramatically reduce its service life.

Debriefing

Congratulations! You are well on your way to becoming an accomplished micro-ROV operator, but there are still many things to learn and skills to master. Continue learning about the system by reviewing the additional sections of this documentation and, most importantly, practice, practice, practice.

If you encountered any difficulties or have any questions, review these Quick Start Instructions and the other documentation that came with your system, including the Equipment Guide and Maintenance Manual. If you still have difficulty or questions, contact VideoRay. Your success is our success, and we are here to help you get the most out of your VideoRay.

VideoRay contact information is available on the About this Documentation page.

Ready to Learn More?

To accelerate your learning and receive recognition for your knowledge and skills, VideoRay offers in-person classes and online training as well as the Micro-ROV User Certificate program. Training can be delivered at your site and customized to your needs. To learn more about these opportunities, click on the training link above to visit the VideoRay Educational Resources website.

Requirements

Specifications

Pro 4 Ultra features and specifications are subject to change without notice.

Product News

See www.videoray.com for the most up-to-date product information.

Pro 4 Ultra Glossary

Accelerometer - A device used to measure acceleration - used to determine pitch and roll of the ROV

Accessory - An optional device that can be used with the VideoRay system to augment its features and capabilities

Accessory Port - ROV connection for ROV mounted accessories that provides access to power and data circuits

Acoustic - Using sound as a method of communicating underwater - often used to measure distance

AGC - See Automatic Gain Control

Altitude - The height of the ROV off of the bottom

Analog Video Out - Video connector on the control panel for interfacing composite analog displays

APIC - (Auxiliary Pair of Independent Conductors) Also called the Spare Pair (See AUX, AUX Port and Spare Pair)

Artificial Horizon - See Attitude Indicator

Attitude Indicator - Instrument that provides an indication of the pitch and roll of the ROV

ATW - (Automatic White Balance) color corrects an image - See also White Balance

Audio - In VideoRay context, the ability to record verbal annotation along with the video recording

Auto Depth - Control Feature that maintains the depth of the ROV at a constant value

Auto Heading - Control Feature that maintains the heading (compass direction) of the ROV at a constant value

Automatic Gain Control - Used to manage the intensity of the image - can be adjusted for lighter or darker images

AUX - Circuit provided for accessories or custom applications (See APIC)

AUX Port - Connector on the control panel that provides access to the AUX circuit (See APIC)

Back Light Compensation - Intentional overexposure to minimize the effects of a bright area in an image

Ballast - Weights used to decrease buoyancy of the ROV to achieve desired buoyancy

Black and White - Image quality using black white or shades of gray only

BLC - See Back Light Compensation

Buoyancy - The tendency to float, sink or remain at a constant depth

Bypass - The Bypass switch allows the system to be used in the event of a Line Insulation Monitor alarm state (See LIM)

Camera - The camera provides a video image from the ROV

Camera Focus - Method to control image focus or the current state of image focus

Camera Menu - Method to control camera functions

Camera Switch - Method to select whether the internal or external camera is active

Camera Tilt - Method to control the vertical angle of the camera or the current state of camera tilt

Cartridge Seal - Component used to lubricate the thruster shaft and seal it from water intrusion

Celsius - Unit of measure of temperature

Checklist - Method to ensure all operations are completed as planned or functions perform as expected

Close - The Close button exits VideoRay Cockpit

Color - Image quality that uses all colors

Compass - Instrument that provides an indication of the heading of the ROV

Compatibility - The state or being able to work together

Computer - Primary topside component required to run VideoRay Cockpit

Control Bar - A VideoRay Cockpit feature that provides access to several functional areas of the software

Control Panel - The surface component that provides power and communications with the ROV

Control Sensitivity - The ability to change the responsiveness of the ROV to the amount of joystick input

Current - The flow of water or electricity

Customization - The ability to change the operation or behavior of the system to make it more suitable for specific applications

Cutter - An optional ROV mounted device for cutting objects

Data Export - Allows data from the ROV to be exported to external applications

Data Import - Allows data from external applications or sensors to be displayed on the video as overlay text

Date - Calendar Date

DB-15 - Connector style with 15 contacts commonly used for VGA connections

DB-9 - Connector style with 9 contacts commonly used for serial data connections

Deinterlace - Display a video image as two successive scans of alternate rows of the image

Depth - Vertical location of the ROV within the water measured from the surface

Depth Control Knob - Method of controlling the depth of the ROV

Depth Gauge - Display that indicates the current depth of the ROV

Depth Rating - Maximum depth for operation of the ROV

Diagnostics - Method for identifying the cause of a problem

Digital Slow Shutter - Camera feature to improve image in low light situations

Edit - The process of modifying data

ELC - Lens type setting required for optimal image from the VideoRay Pro 4 Ultra camera

Engine Room - VideoRay Cockpit interface to access advanced status information and settings

Ethernet - Data Protocol and connector style

Exit - Close the camera menu or VideoRay Cockpit

Export - Method to communicate data from the ROV to other systems

Exposure - Method to control the amount of light captured by the camera

Factory Default - Initial state of a variety of parameters

Fahrenheit - Unit of measure of temperature

Fault - Indication of a problem

Feet - Unit of measure of length or distance

Fine - Low power control mode

Firmware - Software that resides on the ROV

Float Block - Required ROV component used to increase buoyancy of the ROV - counteracted by ballast to achieve desired buoyancy

Gain - Setting to control the level of some parameter

Generator - AC power source that typically runs on gasoline or diesel fuel

GFCI - (Ground Fault Circuit Interrupter) A safety circuit

GPS - (Geographic Positioning System) Device that provides location

Hand Controller - Input device to control the ROV's operation

Heading - The compass direction the ROV is facing

Help - Information intended to provide assistance

Hot Plug - A VideoRay Update procedure where the device is disconnected and reconnected while the power is turned on

Hull Inspection Stabilizer - External device designed to help stabilize the ROV while inspecting ships' hulls

Humidity - Qualitative measure of the amount of moisture in the air

IEC - (International Electrotechnical Commission) Power cord connector standard

Import - Method to receive and process data from other systems

Instrument - VideoRay Cockpit interface feature to display information or control features

Instrument Display - The ability to set an instrument's opacity or turn it on or off

Inverter - AC power source that runs on battery

Joystick - Input device for controlling the surge and yaw of the ROV

Lens - Camera element used to capture and focus light to create an image

Lights - ROV component that provides lights for scene illumination in dark areas

Light Dome - Protective covering over the lights

LIM - (Line Insulation Monitor) A safety circuit

Main Dome - Protective covering over the camera

Manipulator - An optional ROV mounted device for grabbing objects

Meter - Unit of measure of length or distance

Mission Planning - A method to prepare for a successful ROV operation

Monitor - Device used for the display of the video or computer image

Mute - The ability to silence the audio recording

My_Note - Feature of the documentation that allows users to add personal notes to the online pages

Negative - A state of buoyancy in which the ROV will sink and a type of tether

Neutral - A state of buoyancy in which the ROV will maintain it's vertical location and a type of tether

O-Ring - Sealing device

Opaque - Unable to see through

Overlay - Text or logo superimposed on the video

PAM - (Protocol Adapter Multiplexer) A programmable interface device

Pitch - The nose-up or nose-down attitude or motion of the ROV

Positive - A state of buoyancy in which the ROV will float and a type of tether

PPT - (Professional Performance Tether) A type of tether

Pressure Sensor - A device to measure pressure - used to calculate ROV depth

Propeller - ROV component with pitched blades that generate thrust when rotated

RCA - Connector style commonly used for composite analog video

Record - Command to initiate video capture to a storage media

Remotely Operated Vehicle - The underwater vehicle

RJ-45 - A connector Style with 8 contacts commonly used for Ethernet connections

Roll - The left or right leaning attitude or motion of the ROV

ROV - See Remotely Operated Vehicle

ROV Health - An instrument that provides feedback on the status of several critical ROV systems

RS-485 - Data Protocol

Safety - State of, or application of, safe practices

SDK - (Software Developer's Kit) A program and a set of software libraries and utilities to aid custom program development

Sensitivity - The amount of output based on a specific level of input, particularly for the joystick

Sensor - An instrument for measuring a specific property of an object or the environment

Service Bay - VideoRay Cockpit interface that provides diagnostic information and checklists

Settings - The values of specific controls or parameters, or the ability to manage these

Skid - The base of the ROV and often used to mount accessories

Software Developer's Kit - See SDK

Snapshot - A still image captured from the video image

Spare Pair - Extra pair of conductors in the tether - See also APIC

Strain Relief - An ROV and tether component that reduces the load on tether connections

Sun Shade - Device used to shade the display for better visibility in direct sunlight

Surge - The forward and backward motion of the ROV

TDS - (Tether Deployment System) A reel for storing tether

Temperature - Qualitative measure of hot or cold

Termination Block - ROV component that connects the ROV to the tether

Tether - The cable that connects the ROV to the control panel

Tether Deployment System - See TDS

Text Overlay - Ability to superimpose text over a video image

Third Axis - Rotational motion of the joystick - can be used as an alternate control method of the joystick

Thruster - ROV propulsion system including a motor and propeller

Thruster Cartridge Seal - Seals the thruster shaft from water intrusion

Thruster Nozzle - Shroud around the propeller

Tilt Arm - Control panel component to adjust the angle of the optional second monitor

TINA - (Tether Interface Node Adapter) A device that allows accessories to be connected directly to the tether without the ROV

Transparent - Ability to see through

Turbo - High power control mode

Turns Indicator - An instrument that keeps track of the number of rotations of the ROV about its vertical axis and provides information on which direction to turn to unwind the tether

Umbilical - See also Tether

Upgrade - A newer version or the process of installing a newer version

USB - (Universal Serial Bus) Data protocol and connector style

User Settings - VideoRay Cockpit interface to access operating parameters

VGA - Video Graphics Array) Video format and connector style

Video - In VideoRay context, the image from the ROV's camera or the ability to record this image

Video Encoder - Defines a method of storing a video image within a file format

Video Window - Display component that displays the video image from the camera

VideoRay Cockpit - VideoRay ROV control program

VideoRay Data Folder - Destination folder for video recordings and snapshots

VideoRay Update - Software program to upload new firmware to the ROV and other devices

Virtual COM Port - A software feature that allows two applications on the same computer to communicate without requiring physical ports

Visibility - Measure of the clarity of water

WDR - See Wide Dynamic Range

Whip - A short length of tether attached to the ROV or control panel

White Balance - Camera feature to color correct images from the camera

Wide Dynamic Range - Camera feature to improve image in high contrast lighting situations

Yaw - The left or right turning attitude or motion of the ROV

Zoom - Camera image magnification

Equipment Guide



Understanding the features and capabilities of the Pro 4 Ultra equipment is essential to get the most value out of using the system. The sections within this Equipment Guide provide details about each of the components.

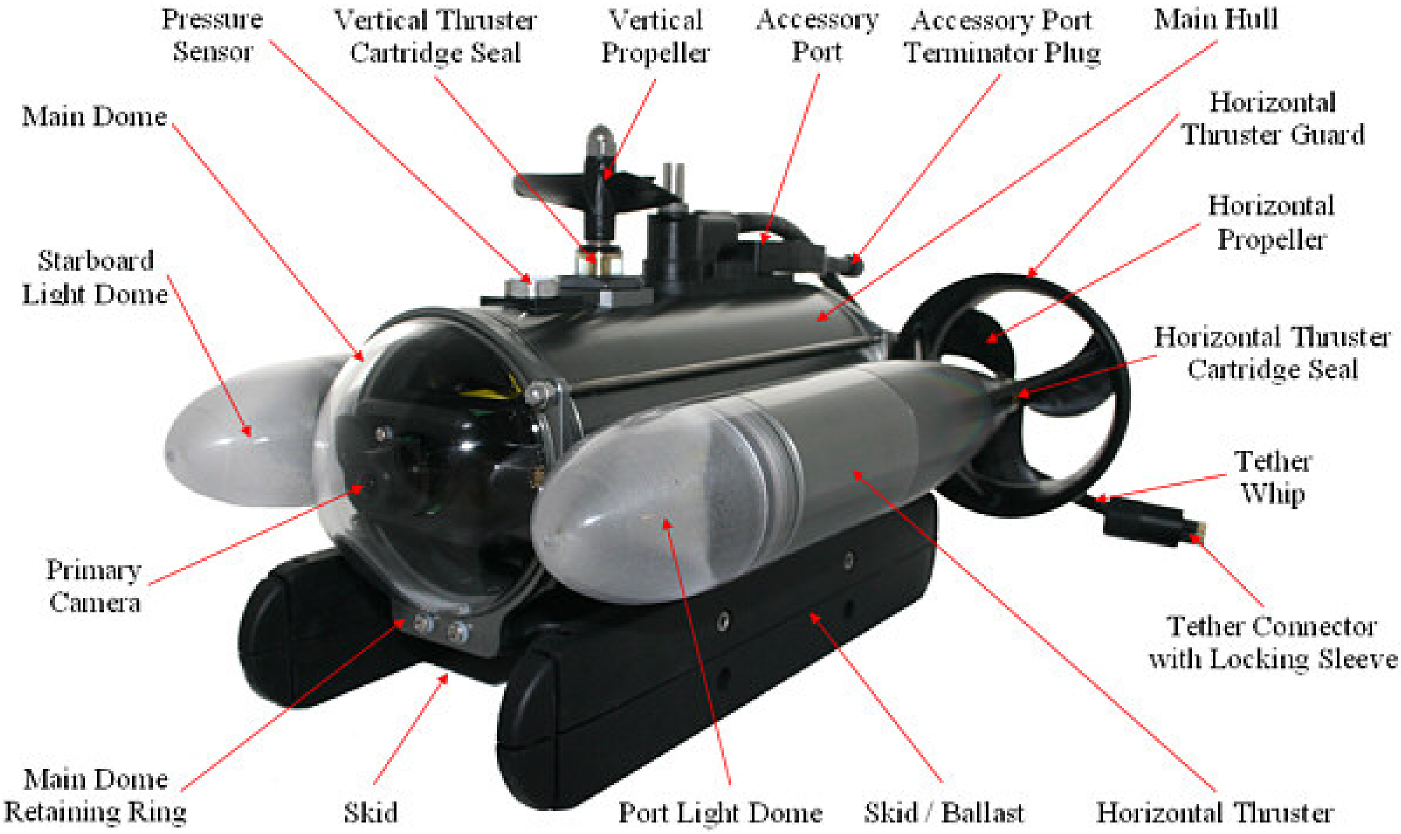
Topics in this Section

ROV

The Pro 4 Ultra ROV (Remotely Operated Vehicle) is depth rated to 300 meters (1000 feet).

Thrusters provide mobility and are controlled from the surface using the hand controller. The ROV carries cameras, lights and other sensors to the underwater locations being searched, explored or inspected.

The primary ROV components are illustrated below. Note that the yellow float block and clear vertical thrust splitter have been removed from the top of the ROV.



Control Panel

The control panel provides power, communications and a video interface between the surface and the ROV through the tether. The computer, which runs VideoRay Cockpit software to control the ROV, is housed in the control panel along with an second display monitor .

⚠ Computer models may vary depending upon purchased configuration, and the second monitor is optional.

Control Panel Power Specifications

The VideoRay Pro 4 Ultra operates on typical residential power in the range of 100-240 Volts AC, 50,60 Hz. This can be provided from the land-based grid, a generator, or a battery with an inverter (optional). The typical power requirements for operating from a generator or inverter are 800 Watts continuous minimum.

The system includes a GFCI (Ground Fault Circuit Interrupter) / Circuit Breaker to protect the operator.

There is one universal IEC power outlet on the back of the control panel. this outlet is protected by the GFCI. The GFCI must be on to use this outlet, but the control panel power switch does not need to be on.

The power in the tether is 48 Volts DC.

The procedures for testing the circuit safety component can be found in the Pre-Dive Preparations section of the Quick Start Instructions.

CAUTION Do not block the fans. Blocking the fans can lead to overheating and component failure.

Safety Circuit

The Control Panel includes circuit safety component.

- GFCI (Ground Fault Circuit Interrupter) / Circuit Breaker

See the Pre-Dive Preparations section of the Quick Start Instructions for information on testing this component.

GFCI (Ground Fault Circuit Interrupter) / Circuit Breaker

The GFCI / Circuit Breaker protects the operator from shock from the AC circuit of the power source, and protects the equipment from a current overload. The GFCI has two operating switches and a test button. To energize the control panel, both switches need to be turned on. If the GFCI detects a differential current between the supply and ground poles of the power source, it will trip, or open the circuit. If the circuit breaker detects a current greater than it's rating, it will trip. The test button can be used to simulate these conditions and pressing and holding the test button should cause the switches to open, or turn off. If the GFCI continues to trip, the system should be inspected for a fault before being used.

Hand Controller

The hand controller is used to operate the VideoRay and its features. Several types of hand controllers are supported. The default control mapping is shown below:

GamePad Style Controller

Hand Controller Connection

CONNECTION	TYPE	FUNCTION
USB	Type A male	Used to connect the hand controller to a USB port on the control panel or the computer.

Tether

Tether connects the ROV to the surface and provides power, communications, video and an APIC (Auxiliary Pair of Independent Conductors) for accessory use. The tether consists of conductors, a Kevlar® strength member, flotation (for Neutral and Performance tethers) and an outer jacket. It is available in three types: Negative, Neutral and Performance (often called PPT). Neutral and Performance are neutrally buoyant in fresh water because they have a specially designed foam jacket.

While larger conductors provide the best power transmission capacity, they lead to thicker tethers, which results in higher drag. Negative tether has the largest conductors (best power transmission capacity), followed by Neutral, and then Performance. Negative and Performance tether have the smallest diameter (least drag), while Neutral tether has the largest diameter.

The tether connectors are wet mateable and can be connected while they are wet. One of the pins in the connector is offset. To connect the tether to the ROV, control panel or another tether, align the offset pin of the connectors and press the two connectors together until the base surface of each connector are touching each other. Then, connect the tether locking sleeves by screwing them together to secure the connection.

Multiple tethers can be connected in series like conventional power extension cords. See the Tether Management section of the Operations Guide for recommended tether configurations.

CAUTION For the ROV and tether to tether connections, there is a strain relief system that consists of a cable and carabineer. The strain relief system should be used to avoid separation and loss of the ROV.

The strain relief carabineer can get hooked on something underwater and cause the ROV to become trapped. To avoid this possibility, tape over the carabineer with electrical or duct tape.

Tether Specifications

Strength - while the Kevlar is rated at 450 kilograms (1000 pounds), the connectors are rated 80 kilograms (175 pounds).

CAUTION These values are breaking strength. The tether should not be subjected to a working strength greater than one half of the breaking strength. The ROV and tether are equipped with a strain relief cable and connectors, which are rated at 136 kilograms (300 pounds). The strain relief cable should be used to avoid separation of the tether connectors and loss of the ROV.

The maximum tether length is limited by the ability of the tether to transmit power and data signals. The maximum tether length of the Pro 4 Ultra is about 600 meters (2,000 feet).

Tether Diameter

Units \ Type	Negative	Neutral	Performance

mm	8.51 +/- 0.38	11.18 +/- 0.50	8.18 +/- 0.50
inches	0.335 +/- 0.015	0.440 +/- 0.020	0.322 +/- 0.020

Tether Connector Pin Configuration and Wire Gauge (AWG)

Pin	Function	Negative	Neutral	Performance
1	Video -	24	24	28
2	Video +	24	24	28
3	48 VDC +	16 (x2)	20 (x2)	24 (x2)
4	Aux + (APIC)	24	28	28
5	Ground	16 (x2)	20 (x2)	24 (x2)
6	Aux - (APIC)	24	28	28
7	RS-485 +/B	24	28	28
8	RS-485 -/A	24	28	28

All conductors are straight through, such that pin 1 in the male connector is connected to socket 1 in the female connector, and so on for all eight pins / sockets. Tether pin numbering in the connector is as follows. When looking at the mating surface of the connector, Pin 1 is the offset pin / socket. For male connectors, pins 2-8 proceed in a clockwise direction. For female connectors, sockets 2-8 proceed in a counter-clockwise direction.

CAUTION Always secure the tether connectors using the locking sleeves and strain relief system to avoid separation and loss of the ROV.

CAUTION The tether connectors should be kept clean to avoid abrasion and corrosion on the electrical contacts and damage to the rubber insulation. Tether connectors should not be lubricated with petroleum products or grease. Petroleum will degrade the rubber and grease will attract dirt and lead to abrasion and corrosion. VideoRay recommends lubricating the tether connectors with pure silicone spray.

Smart Tether

KCF Technologies manufactures the Smart Tether, which can be used to track and record the location of the ROV. See the Smart Tether Guide for more information

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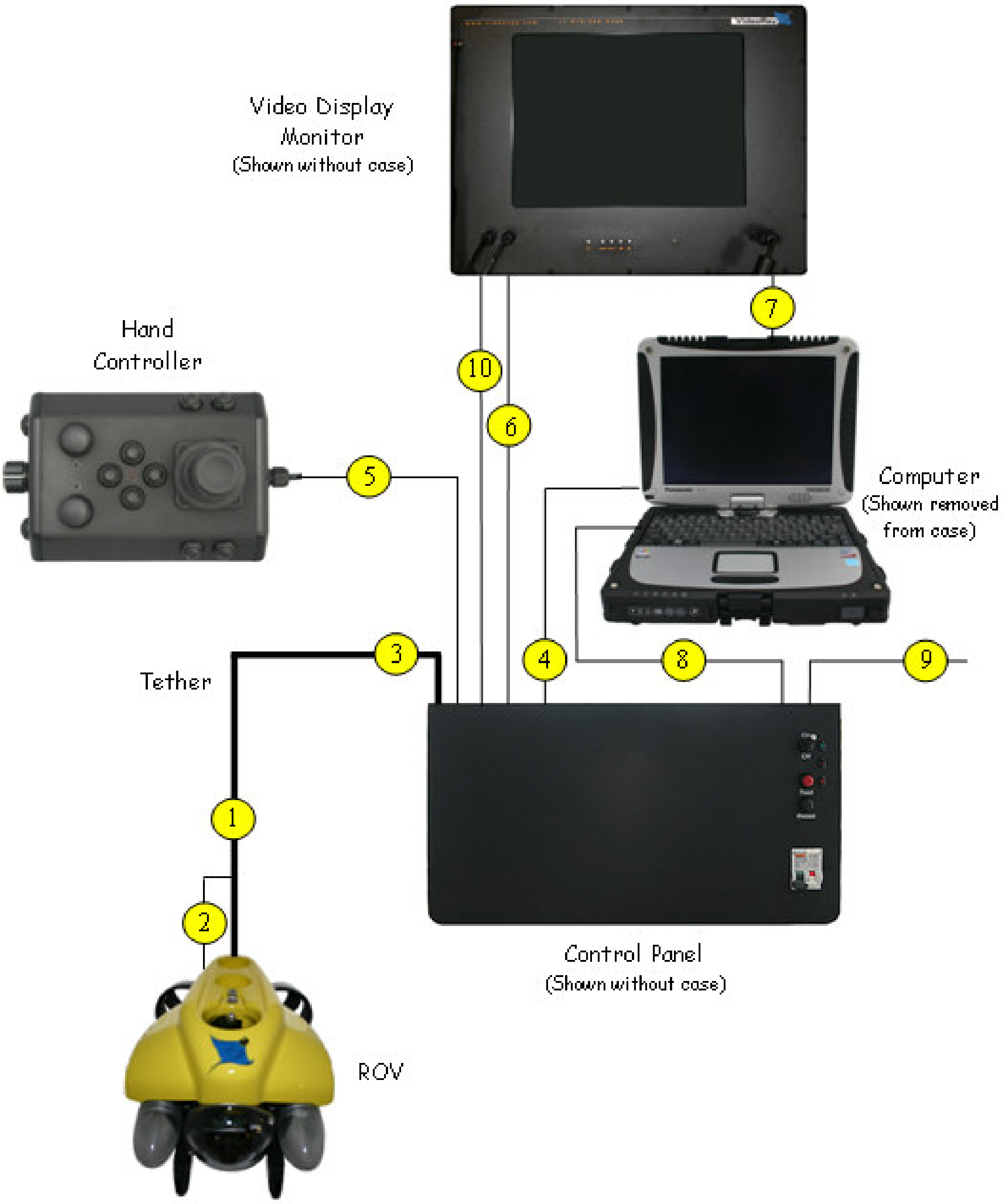
Connections Summary

Connections Summary - see the descriptions below the figure for each numbered connection.



1. The male tether connector on the ROV is connected to the female connector on the tether.
2. The ROV strain relief cable is connected to the strain relief webbing on the tether.
3. The male tether connector is connected to the female tether connector on the control panel.
4. The USB connection on the computer is connected to the USB PC connection on the control panel using the supplied USB cable.
5. The hand controller is connected to one of the USB ports on the computer or control panel.
6. The computer power cord is connected from the computer power cord receptacle to the GFCI protected IEC outlet on the control panel using the supplied country specific adapter cable.
7. The control panel power cord is connected from the control panel IEC power cord receptacle to a suitable power source (100-240 Volts AC, 50, 60 Hz) using the supplied country specific power cord.
8. The Analog Video Out connector on the control panel can be connected to another video display using the supplied cable. Some monitor models may have a permanently attached RCA composite male cable, or may not have this connection at all. If this cable is not used, do not leave it connected to only one side. This could result in poor video quality.

VideoRay Cockpit Guide

Program Start-up Procedure

VideoRay Cockpit can be started using the desktop icon, or by selecting it from the Start->All Programs->VideoRay menu.

Interface Overview

VideoRay Cockpit is the Pro 4 Ultra's control software. It communicates your control inputs to the ROV, and provides feedback from the ROV's video and sensor systems. VideoRay Cockpit consists of a Video Window, the Control Instruments and the Control Bar. Each of these items will be described in more detail in the following sections.

VideoRay Cockpit screen with simulated video image - your image will likely be different.

If you encounter any problems starting VideoRay Cockpit, see the Diagnostics section of the Maintenance Guide for more information.

Topics in this Section

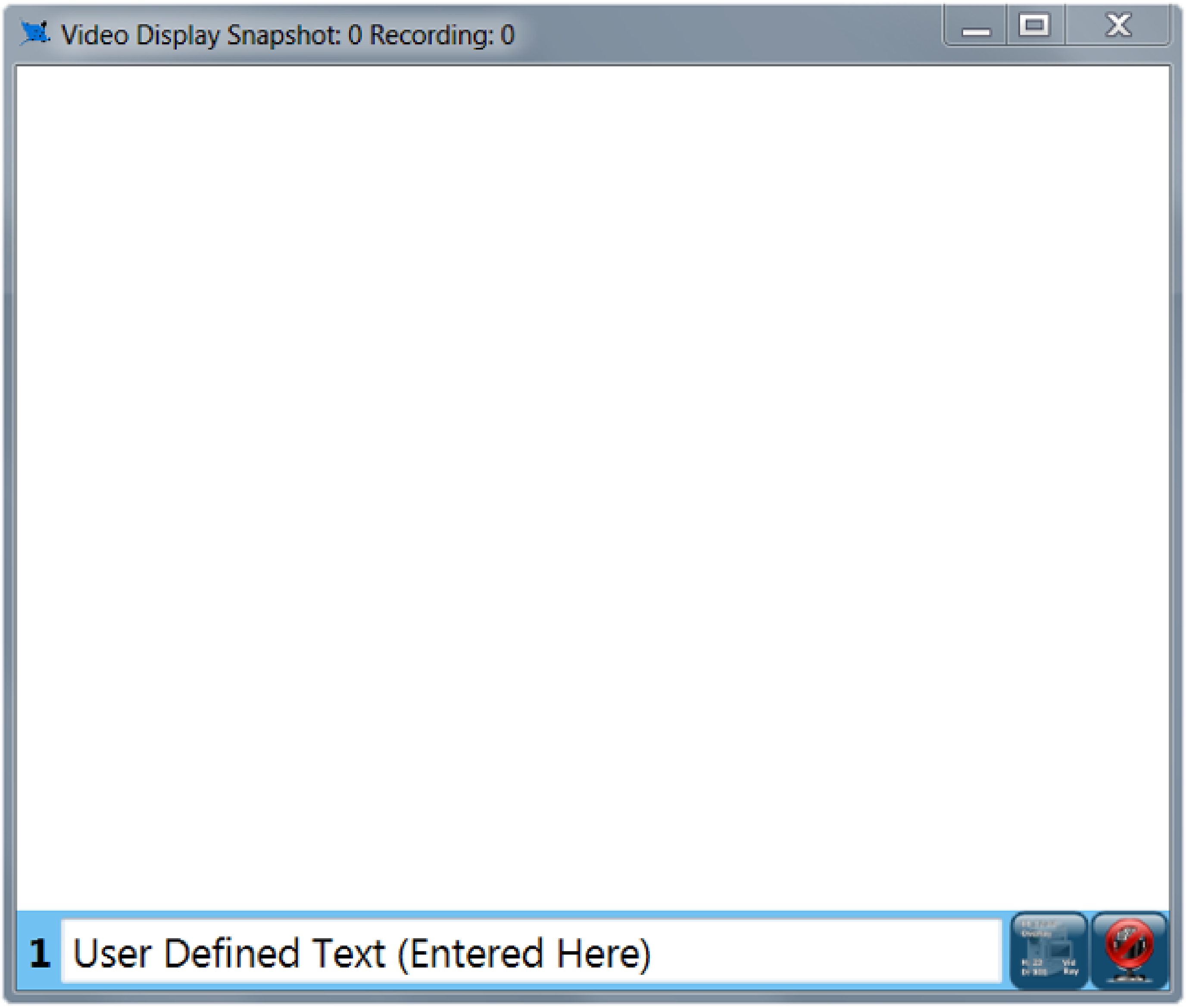
- Video Window
- Instruments
- Control Bar

Video Window

The video window consists of four parts:

- Title Bar

- Video Display Area
- Text Overlay Control
- Audio Mute Button



Video Window Title Bar

The video window title bar displays the number of snapshots and video recordings captured during the current session. When video is being recording the word "Active" and the current video file size is also displayed. These numbers are not retained when you close VideoRay Cockpit. If there are no snapshots or recordings, no information is displayed.

Video Display Area

The video display area displays the video from the active camera, which can also include the text overlay. When video is being recorded, a flashing red dot is displayed in the upper right. When audio is being recorded (not muted), the word "Audio" appears under the flashing red dot. The flashing red dot and the word "Audio" are for information only and are not recorded.

Video Text Overlay

The video text overlay controls enable the display of the date, time, ROV sensor data, and digital on-screen graphic (logo) to be overlaid on the video image.

Audio Recording and Muting

Recorded audio can be used to add narration to the video in real time. Whenever video is being recorded, audio is also being recorded to the same file. The audio can be muted to eliminate background noise or unwanted conversations. The Audio Mute button can be found in the lower right corner of the video window. Microphone selection can be made using the Video Settings section of the System Settings tab of the User Settings. Microphone volume adjustments can be made using the standard Microsoft Windows audio settings and properties.

Instruments

In addition to controlling the Pro 4 Ultra and displaying video, VideoRay Cockpit provides numerous feedback and control instruments. These instruments float on the desktop and can be moved, resized, turned on or off or made transparent. You can also restore their sizes and positions to their default locations.

VideoRay Cockpit Display with Instruments Highlighted

Toggling Instruments between Opaque and Transparent Individually

To make an instrument transparent, double click on it with the right mouse button. To restore an instrument to opaque, double click on it again with the right mouse button.

Closing Instruments

To close an instrument, hover the mouse over the instrument, and then move the cursor toward a border. When the cursor reaches the border, the border will highlight and an "X" will appear in the upper right. Click on the "X" to close the instrument. See the section below and the User Settings and Instrument Display sections for more information about how to close and reopen instruments.

Additional Control Methods

In addition to the operations above that work directly on individual elements, there are other methods to control instruments individually or as a group.

User Settings

The Instruments tab within User Settings allows you to turn instruments on or off individually. The Instruments tab also has a button to restore all of the instruments to their default sizes and locations. See the User Settings Section of the VideoRay Cockpit Guide.

Control Bar Tools

The Control Bar has three tools that allow you to close all instruments, make them all transparent, or make them all opaque. See the Instrument Display Control Section of the VideoRay Cockpit Guide.

Instruments Display Control Hierarchy

Some settings methods take precedence over other settings methods.

- The User Settings Off setting for an individual instrument overrides the Control Bar Opaque and Transparent settings for all instruments.
- The Control Bar Instruments Off setting for all instruments overrides the User Settings On setting for an individual instrument.
- The Control Bar Transparent and Opaque settings will override the current state of an open instrument.

Factory Default Sizes and Locations

Instruments sizes and locations can be reset to the original factory setting. See the User Settings section for more information.

ROV Health Indicator

The ROV Health Indicator provides status information for several key operational parameters, including the power management system, power, communications, internal humidity and internal temperature.

Display

The ROV Health Indicator displays the following information (from left to right):

- Power Management Status Indicator Bar
- Power Status Indicator
- Communications Status Indicator
- Humidity Status Indicator
- Temperature Status Indicator

Use

The status indicators are green if the status is okay, but change to red if a problem is detected.

Sample ROV Health Indicator displaying a communications fault.

If a problem is detected, corrective action should be taken. See the Diagnostics and Repair section of the Maintenance Guide for more information.

The size and display of the ROV Health Indicator can be adjusted. See the Instruments section of this guide for more information.

Control Sensitivity

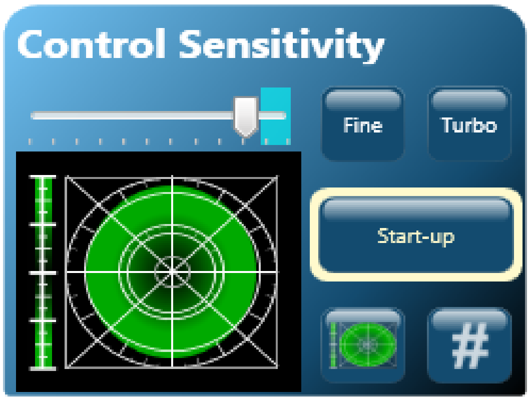
The Control Sensitivity Instrument allows you to adjust how responsive the ROV is to joystick and depth control inputs.

The control sensitivity is determined by the values of control gains, which range from 0 to 100. The control input applied by the operator is multiplied by the gain before being sent to the ROV as a command to drive the thrusters. A gain setting of 100 and maximum control input will result in the thrusters operating at full available power. If the gain is reduced, the same maximum control input will result in correspondingly less thruster power. Lower gain settings allow the operator to have more precise control over the vehicle at the expense not having the maximum power available. For example, new users may find it easier to pilot the ROV using lower gain settings until they get used to the handling characteristics of the vehicle. A gain setting of 0 will result in no thrust for any level of control input, and a boost mode allowing numbers of up to 110 is available - see the boost mode below.

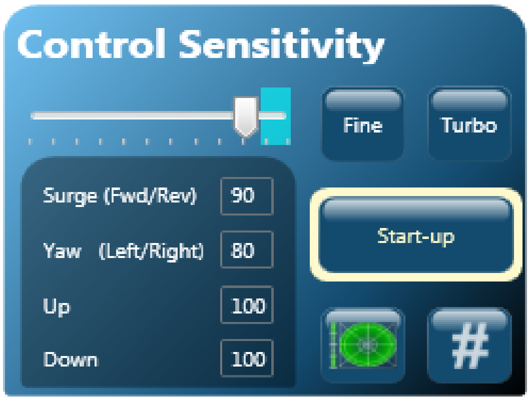
The Pro 4 Ultra is a very responsive vehicle. The gain settings can be adjusted at any time according to the piloting requirements. New users may find it easier to learn how to pilot the ROV by decreasing the Yaw gain.

Display

Visual Input Mode



Text Input Mode



Use

You can independently control the sensitivity of the following control parameters:

  left joystick)
- Vertical Down (usually mapped to theleft joystick)

There are two ways to set the sensitivity, visually or numerically. In addition you can save three favorite settings for easy recall.

Adjusting the Sensitivity Visually

To adjust the control sensitivity visually, click on the graph button in the lower right hand corner of the control sensitivity instrument. The left hand side of the instrument will display a vertical bar on the left for Vertical Up and Down gains, and a polar grid area on the right for the Surge and Yaw gains. The green shaded region in both areas gives a visual indication of the gain settings. Left click and drag the vertical bar to set the Vertical gain symmetrically for up and down. Right click and drag to set the up and down gain independently. The top of the bar is for Vertical Up thrust and the bottom for Vertical Down thrust. Likewise, left click and drag in the polar region to set the Surge gain (indicated by the top and bottom values) and Yaw gain (indicated by the left and right values). When you left click and drag, the gains are adjusted symmetrically as indicated by the circular green shaded area. Right click and drag in the polar region to adjust the Surge independent of the Yaw. The top and bottom of the polar area are for Surge and the left and right are for Yaw. You can also move the slider above the graph area to decrease or increase all of the gain settings uniformly. Moving the slider to the left decreases the gains and moving it to the right increases the gains.

For the surge and Yaw, when clicking and dragging with the left button, the gains are set to the radius of the circle at the point of release.

Adjusting the Sensitivity Numerically

To adjust the control sensitivity numerically, click on the number (#) button in the lower right hand corner of the control sensitivity instrument. The left hand side of the instrument will list the control parameters and display input fields for the gains. You can enter a number from 1 to 100 in each of the input fields.

Adjusting the Sensitivity Using the Slider

You can also move the slider at the top to decrease or increase all of the numbers uniformly. Moving the slider to the left decreases the gains and moving it to the right increases gains.

Saving Favorite Settings for Recall

The Control Sensitivity Instrument also has three buttons for quickly setting the gains to preset or saved values.

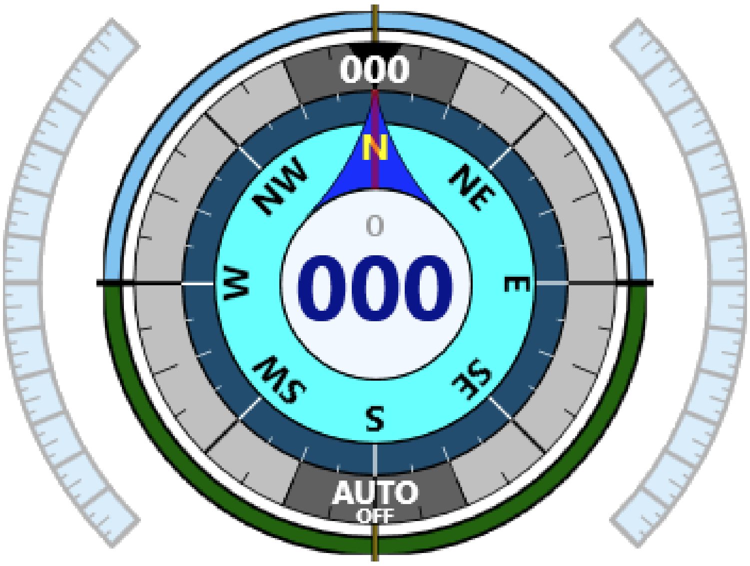
Advanced Settings

For maximum power availability when needed, the gains should be set to the boost mode.

Compass and Attitude Indicator

The Compass Instrument displays a variety of information, including the heading of the ROV, the Auto Heading status, an artificial horizon to indicate the attitude of the ROV, and the horizontal thruster settings. The Compass Instrument is also used to engage and set Auto Heading.

Display



The Compass and Attitude Indicator displays the following information:

- The Compass Rose is in the center
- The outer blue and green area is the Artificial Horizon
- The bands on the left and right are the Horizontal Thruster Settings Indicators

Use

The central portion of the Compass displays the heading of the ROV. The heading in degrees clockwise from North is listed at the center of the dial. The compass uses a "heading up" display so that the heading of the ROV is always displayed under the reference indicator at the top center of the compass dial. For example, if the ROV is heading SE, the South indicating arrow will be displayed to the right of the heading indicator, as shown above. Turning the ROV to the right towards South will cause the compass dial to rotate counter-clockwise so that South will move towards the indicator.

The small number above the heading is the Variation entered in the User Settings and represents the local magnetic declination. The declination is set by the user - see the section below about Compass Declination.

The blue and green ring around the Compass/Auto Heading is the Attitude Indicator, which acts like an artificial horizon. It indicates the pitch and roll of the ROV. The horizon is represented by the horizontal interface line between the top blue section (sky) and the bottom green section (earth). When the ROV pitches down to a nose low attitude, the amount of green increases and the interface line moves up within the circle. The reverse is true when the ROV pitches up. When the ROV rolls to the starboard (right), the interface line rotates to the left indicating that the starboard side is closer to the sea floor. The reverse is true when the ROV rolls to the port (left).

The outer bands on the left and right of the Compass are the horizontal thrusters settings indicators. The left side displays the port thruster setting, and the right side displays the starboard thruster setting. When there is no thrust applied, these indicators become transparent. When thrust is applied a green shaded section appears within the bands. The length of the green shading from the horizontal centerline indicates the amount of user input applied for that thruster. Forward thrust is indicated by a green shading above the horizontal centerline. Reverse thrust is indicated by a green shading below the horizontal centerline.

Compass Declination and Calibration

The compass declination can be set to match the local magnetic declination. See the Compass section under User Settings for more information.

The compass is calibrated at the factory. For most operations, the compass should not need to be calibrated. If you are doing precise survey work or using VideoRay CoPilot's autonomous piloting products, you may need to calibrate the compass. See the Compass Calibration section under Engine Room for more information.

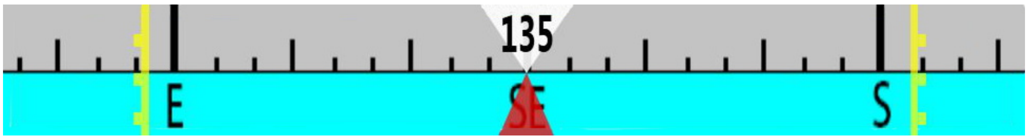
Notes

The feedback of the thrusters settings is based upon the status of the hand controller input, not the thruster action.

Ribbon Compass

The Ribbon Compass Instrument displays the heading of the ROV in a compact horizontal scrolling format and provides reference indicators that mark the field of view for the standard camera.

Display



The Compass displays the following information:

- The Heading Indicator and Heading Digital Display is in the center
- The field of view reference indicators are on the left and right towards the ends.

Use

The Compass displays the heading of the ROV. The heading in degrees clockwise from North is listed at the center of the instrument. The compass uses a "heading up" display so that the heading of the ROV is always displayed above the heading reference indicator at the bottom center of the compass instrument. For example, if the ROV is heading SE, the South indicating arrow will be displayed to the right of the heading indicator, as shown above. Turning the ROV to the right towards South will cause the ribbon compass background to slide to the left so that South will move towards the indicator.

The camera field of view indicators can be used to estimate the bearing offset from the current heading to any object in the camera's view.

Compass Declination and Calibration

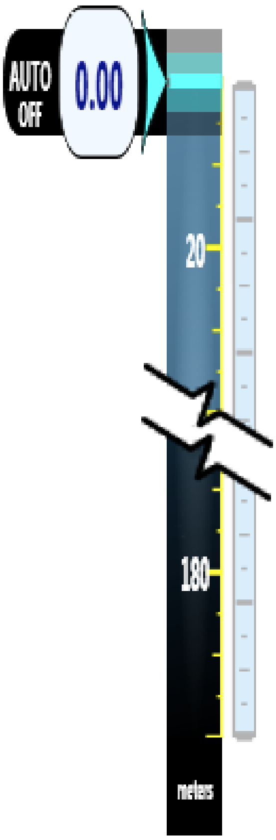
The compass declination can be set to match the local magnetic declination. See the Compass section under User Settings for more information.

The compass is calibrated at the factory. For most operations, the compass should not need to be calibrated. If you are doing precise survey work or using VideoRay CoPilot's autonomous piloting products, you may need to calibrate the compass. See the Compass Calibration section under Engine Room for more information.

Depth Gauge

The Depth Gauge displays the depth of the ROV and the Auto Depth status. The Depth Gauge is also used to engage and set Auto Depth.

Display



The Depth Gauge displays the following information:

- The Depth Scale

- The Depth Indicator Flag
- The Vertical Thruster Setting Indicator
- The Auto Depth Control / Indicator

Use

The depth of the ROV is indicated as a number in the flag, which moves along the scale proportionally to the depth. As the ROV moves deeper, the flag moves down the scale. As the ROV moves towards the surface, the flag moves up the scale.

The vertical thruster setting indicator is on the right side of the Depth Gauge. When there is no thrust applied, this indicator becomes transparent. When thrust is applied, a green shaded section appears within the indicator. The length of the green shading from the horizontal centerline indicates the amount of user input applied for the vertical thruster. Vertical up thrust (to move the vehicle towards the surface) is indicated by a green shading above the horizontal centerline. Vertical down thrust is indicated by a green shading below the horizontal centerline.

The Auto Depth control/indicator is to the left of the Depth flag. Auto Depth can be used to make the ROV hover at the current depth or surface or dive to a user specified depth. See the Auto Depth section of the Operations Guide for details on using Auto Depth.

The size and display of the Depth Gauge can be adjusted. See the Instruments section of this guide for more information.

⚠ The feedback of the thruster setting is based upon the status of the hand controller input, not the thruster action.

Depth Units

The Depth units can be set to meters or feet in the User Settings dialog box. You can also adjust the low and high values of the range as well as the grid spacing.

(Pseudo) Altimeter Gauge

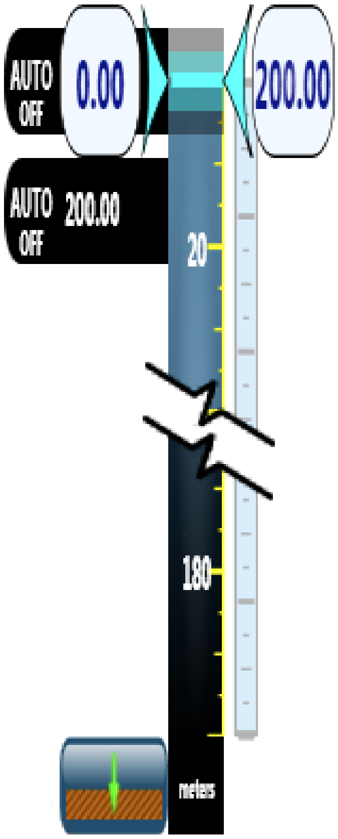
The Altimeter Gauge displays the altitude of the ROV and the Auto Altitude status. The Altimeter Gauge is also used to engage and set Auto Altitude.

Pseudo Altimeter

Normally, an altimeter (optional accessory) is required to use the Altitude Gauge, but in some situations an altimeter is not required. If the bottom is flat and the depth is known, such as in a tank, the pressure sensor / Depth Gauge (and a little math) can be used to determine the altitude. See below and the Depth Gauge section of the User Settings for information about using the Pseudo Altimeter.

Display

⚠ By default, the Altimeter Gauge is not enabled. The Altimeter Gauge can be enabled in the Depth Gauge section of the User Settings.



The Altimeter Gauge displays the following information:

- The Altitude Scale
- The Altitude Indicator Flag
- The Vertical Thruster Setting Indicator
- The Auto Altitude Control / Indicator

Use

The altitude of the ROV is indicated as a number in the flag, which moves along the scale proportionally to the altitude. As the ROV moves higher, the flag moves up the scale. As the ROV moves towards the bottom, the flag moves down the scale.

The vertical thruster setting indicator is on the right side of the Altimeter Gauge. When there is no thrust applied, this indicator becomes transparent. When thrust is applied, a green shaded section appears within the indicator. The length of the green shading from the horizontal centerline indicates the amount of user input applied for the vertical thruster. Vertical up thrust (to move the vehicle towards the surface) is indicated by a green shading above the horizontal centerline. Vertical down thrust is indicated by a green shading below the horizontal centerline.

The Auto Altitude control/indicator is below the Auto Depth control/indicator. Auto Altitude can be used to make the ROV hover at the current altitude or surface or dive to a user specified altitude. See the Auto Altitude section of the Operations Guide for details on using Auto Altitude.

The size and display of the Altitude Gauge can be adjusted. See the Instruments section of this guide for more information.

⚠ The feedback of the thruster setting is based upon the status of the hand controller input, not the thruster action.

Altimeter Units

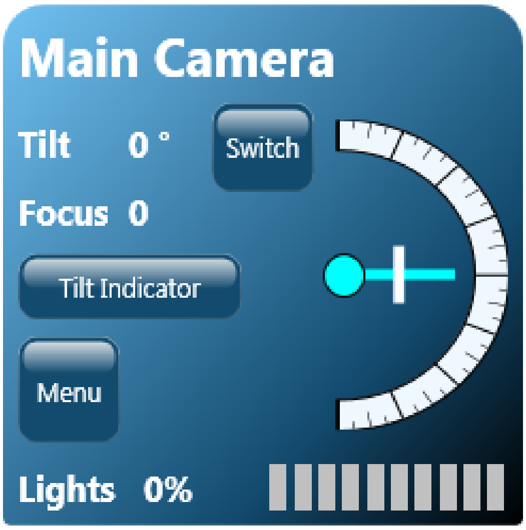
The Altimeter units can be set to meters or feet in the User Settings dialog box. You can also adjust the low and high values of the range as well as the bottom depth and grid spacing.

Camera and Lights Indicator

The Camera and Lights Indicator displays information about the ROV's camera and the lights. The Camera and Lights Indicator Instrument is also used to select the active camera when an external camera is in use, and activate the camera menu system for the front camera.

Display

Tilt Indicator Mode **Camera Menu Mode**



Use

The Camera and Lights Indicator provides feedback on the camera tilt position, camera focus and intensity of the lights.

The Camera Tilt angle relative to the horizontal centerline of the ROV is indicated by the light blue pointer and curved scale, and the tilt angle is also displayed as a number. The tilt indicator pointer rotates about the central circle to represent the tilt position of the camera. The tilt angle is displayed as positive number when the camera tilted about the horizontal, and negative when the camera is tilted below the horizontal.

The Camera Focus position is indicated by the white line, and the focus position is also displayed as a number. When the focus changes from near to far, the focus line moves from the center of the tilt indicator to the outside end of the tilt indicator. The focus position number ranges from 0 for full near focus to 100 for full far focus. The scale is not a linear indication of the focus distance. It is a measure of the focus motor position.

The Camera Switch button can be used to select whether the front or external camera is active. Click the Camera Switch button to switch from the front camera to the external camera. Click the Camera Select button again to switch back from the external camera to the front camera. The title of the Camera Indicator changes to reflect which camera is active

The Camera Menu button can be used to activate the camera menu to make adjustments to the camera settings. See the Camera Menu section of this guide for more information.

The Camera Tilt Indicator button can be used to activate the camera tilt and focus indicator after using the camera menu.

The Lights Indicator provides feedback on the intensity of the lights as a bar scale and a number. As the lights intensity increases more bars light up. The range of the lights indicator number is from 0% for Off to 100% for full On.

The size and display of the Camera and Lights Indicator can be adjusted. See the Instruments section of this guide for more information.

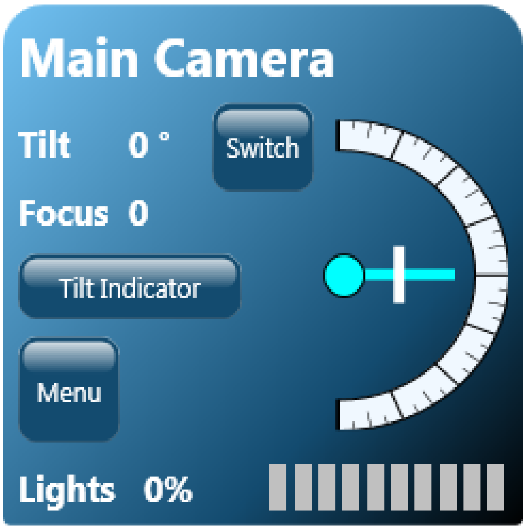
⚠ The feedback is based upon the status of the hand controller input, not the camera action or light intensity.

Camera Menu Operation and Default Settings

The VideoRay Pro 4 Ultra camera includes sophisticated features that can be used to enhance the image quality in various lighting conditions. These features are controlled through the camera menu system.

The camera menu can be accessed by clicking on the Menu button on the VideoRay Cockpit camera instrument. This will display the menu as text overlaid on the video window. Each menu item represents a sub-menu where settings can be adjusted.

Tilt Indicator Mode



Camera Menu Navigation

After clicking on the Menu button, the camera menu displays in the video window and the camera instrument displays menu navigation buttons. Click on the up and down arrow buttons to navigate from one sub-menu to the next. Once the desired sub-menu is highlighted, activate the sub-menu by clicking on the left or right arrow buttons. You can also use the keyboard arrow keys to navigate the menu.

Camera Menu Navigation Mode **Keyboard Arrow Keys**

Within a sub-menu, use the up and down buttons or keys to navigate from one feature to the next. Features can be changed by using the left or right buttons or keys. To exit a sub-menu, navigate to the Return sub-menu item and activate it using the left or right buttons or keys. To exit the main menu, navigate to the Exit menu item and activate it using the left or right buttons or keys.

Menu and Menu Button Synchronization

1. After exiting the camera menu, the menu navigation buttons may be visible in the Camera Instrument. Click on the menu button again to restore the tilt and focus indicators.

2. If you click on the menu button while the menu is active, the menu navigation buttons will be replaced by the tilt and focus indicators. The menu will still be displayed. Click on the menu button to restore the menu navigation buttons, or use the keyboard arrow keys to exit the menu.

Camera Menu Defaults

⚠ Be aware that VideoRay Pro 4 Ultra does not use the same defaults as the camera manufacturer's Factory Default settings. For VideoRay Pro 4 Ultra the Lens Type must be set to "ELC," the ELC Level to "6" and the DSS must be set to "1X" and WB Mode set to "PUSH." To quickly restore the camera to the recommended VideoRay Pro 4 Ultra camera menu default settings, first restore the factory default settings, and then change the Lens Type to "ELC" and the Level to "6" in the Lens sub-menu, and change the DSS setting to "1X" in the Exposure sub-menu and change the WB Mode to "PUSH" in the White Balance sub-menu.

Additional Notes

Quick Tip to Restore Defaults

To quickly restore the camera to the recommended VideoRay Pro 4 Ultra camera menu default settings, first, restore the factory default settings, and then change the Lens Type to "ELC" and the Level to "6" in the Lens sub-menu, and change the DSS setting to "1X" in the Exposure sub-menu and change the WB Mode to "PUSH" in the White Balance sub-menu.

Menu Button Focus

If the camera menu is active and you click on some other window element, such as the instrument transparency feature, the camera menu will lose focus. To restore focus to the camera menu, click on the camera instrument.

Control Bar

The Control Bar can be used to control various settings, launch integrated applications, access this user documentation and close VideoRay Cockpit.

Display

Use

The control bar is displayed at the bottom of the primary monitor. It contains a series of buttons. Moving from right to left, the buttons are as follows:

- Close VideoRay Cockpit
- Open the VideoRay Cockpit Help File
- Open the Service Bay
- Open the Engine Room
- Access Images and Videos
- Open the User Settings
- Launch VideoRay CoPilot Software (optional)
- Launch BlueView ProViewer Software (optional)
- Launch KCF Smart Tether Software (optional)
- Launch Tritech SeaNet Software (optional)
- Launch Tritech Micron Software (optional)
- Lock/Unlock Instruments Sizes and Locations
- Set Instruments Display Opaque
- Set Instruments Display Transparent
- Set Instruments Display Off
- Remote Connect

Each of these controls will be described in the following sections.

The version number of the software is displayed in the lower left of the control bar. Only the primary version number is displayed. Hover your mouse over the version number for the full version and build number.

Close VideoRay Cockpit

Close VideoRay Cockpit

The Close button can be used to close, or stop, VideoRay Cockpit.

You can also click on the traditional Windows® Close button in the upper right hand corner of the video window to stop VideoRay Cockpit.

⚠ The Close button does not turn off power to the ROV or control panel.

Windows is a registered trademark of Microsoft.

Open the VideoRay Cockpit Help File

Open the VideoRay Cockpit Help File

The Help button opens this documentation in a browser window.

Should you need help beyond the scope of this manual, additional online resources exist and are accessible via the links at the bottom of each page, and you can contact VideoRay directly. See the About this Documentation page for VideoRay Contact Information.

Open the Service Bay

Open the Service Bay

The Service Bay provides access to diagnostic and routine maintenance information. It also includes interactive Pre-Dive and Post Dive checklists that can be logged to a file.

On the left hand side of the Service Bay window are buttons to activate the interactive Pre-Dive and Post Dive checklists and the scheduled maintenance utility. See the next sections for more information.

The main section of the Service Bay window provide system status of the computer and software. Below this window are buttons to save and print this information. A third button displays the log file from the last time VideoRay Cockpit was run. The information in the report and log can help diagnose VideoRay Cockpit problems or computer problems that might affect the ability to run VideoRay Cockpit. A fourth button opens the VideoRay Cockpit configuration folder. The button on the far left opens the Communications Status window.

Open the VideoRay Cockpit Configuration Folder

VideoRay Cockpit Configuration Folder

VideoRay Cockpit stores operating information in various configuration files. These files can be accessed by clicking on the Open the VideoRay Cockpit Configuration Folder button.

Show the Error Log

Error Log

Each time VideoRay Cockpit is run, it writes a log file. The information in this file can be used for diagnostics purposes if the program execution is interrupted for any reason.

Print the Diagnostics Report

Print Diagnostics

The diagnostics report can be printed for review by other parties.

Save the Diagnostics Report

Save Diagnostics

The diagnostics report can be saved for logging or transmission via email for technical support purposes.

View the Diagnostics Console

Show the Diagnostics Console

The diagnostics console displays program activity in real time. See Diagnostics Console for more information.

View the Communications Status

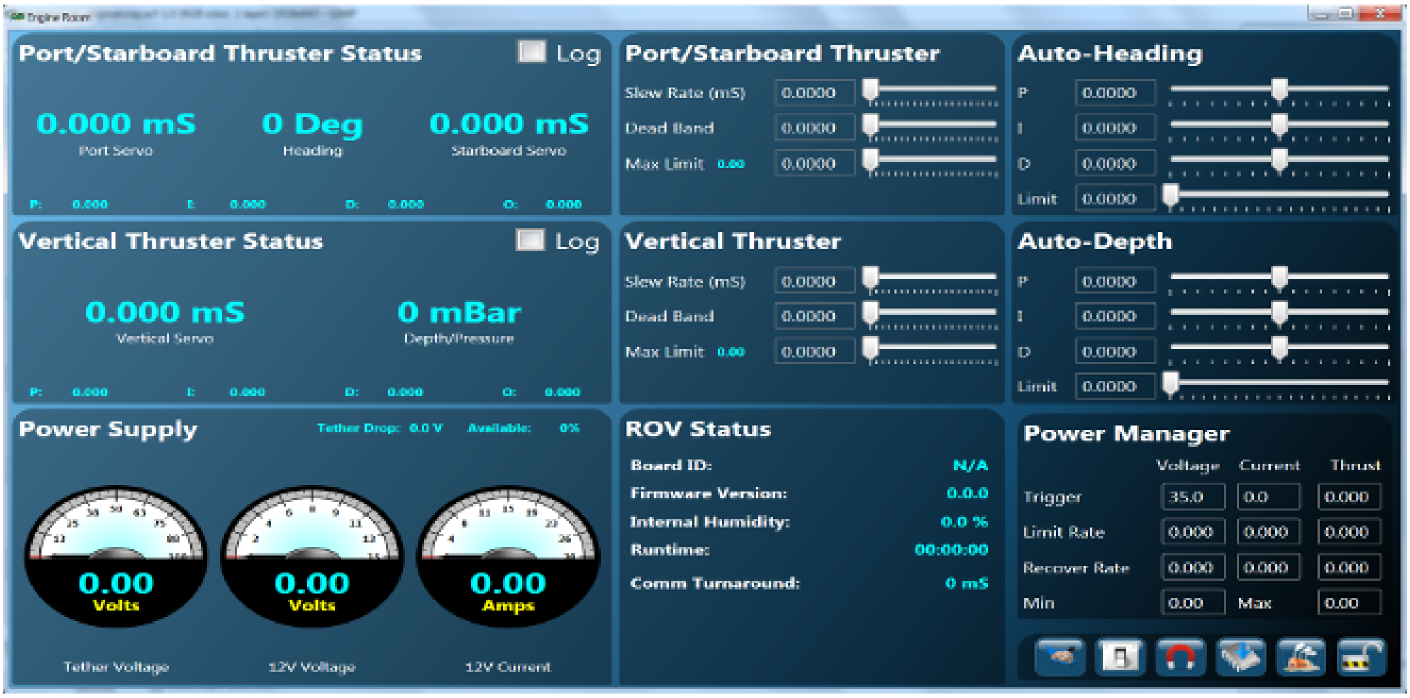
Communications Status

The communications status of the ROV and other devices can be displayed in real time. See Communications Status for more information.

Engine Room

Engine Room

The Engine Room button opens the engine room window. The engine room provides diagnostics information, firmware management and advanced systems tuning.



Access Images and Videos

Access Images and Videos

The Access Images and Videos button opens the folder that contains VideoRay data including digitally recorded images and videos.

Recorded images and videos are stored in the VideoRay\Imagery\ folder, which can be found in the computer account user's documents folder (Documents\ for Windows 7, or My Documents\ for Windows XP).

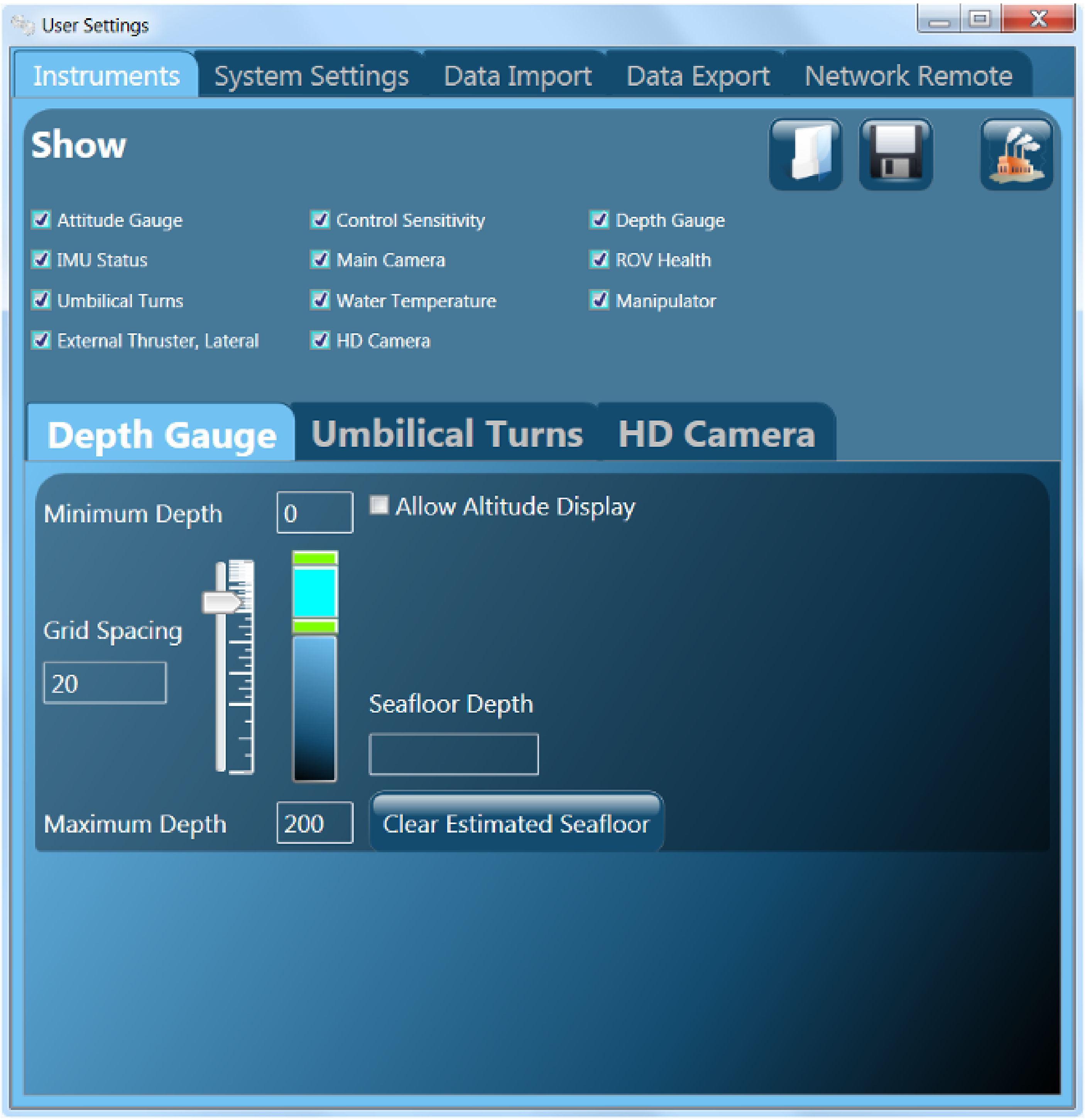
⚠ Images and videos recorded via the analog Video Out connection will not be stored on the computer. When using an analog recording device, check the manufacturer's instructions for details.

⚠ Sensor accessories may store their data in other locations. Check the manufacturer's instructions for details.

Open the User Settings

Open the User Settings

The User Settings button opens the User Settings window. Within the User Settings, users can control the instruments display, systems settings, data import and export, and network remote connections.

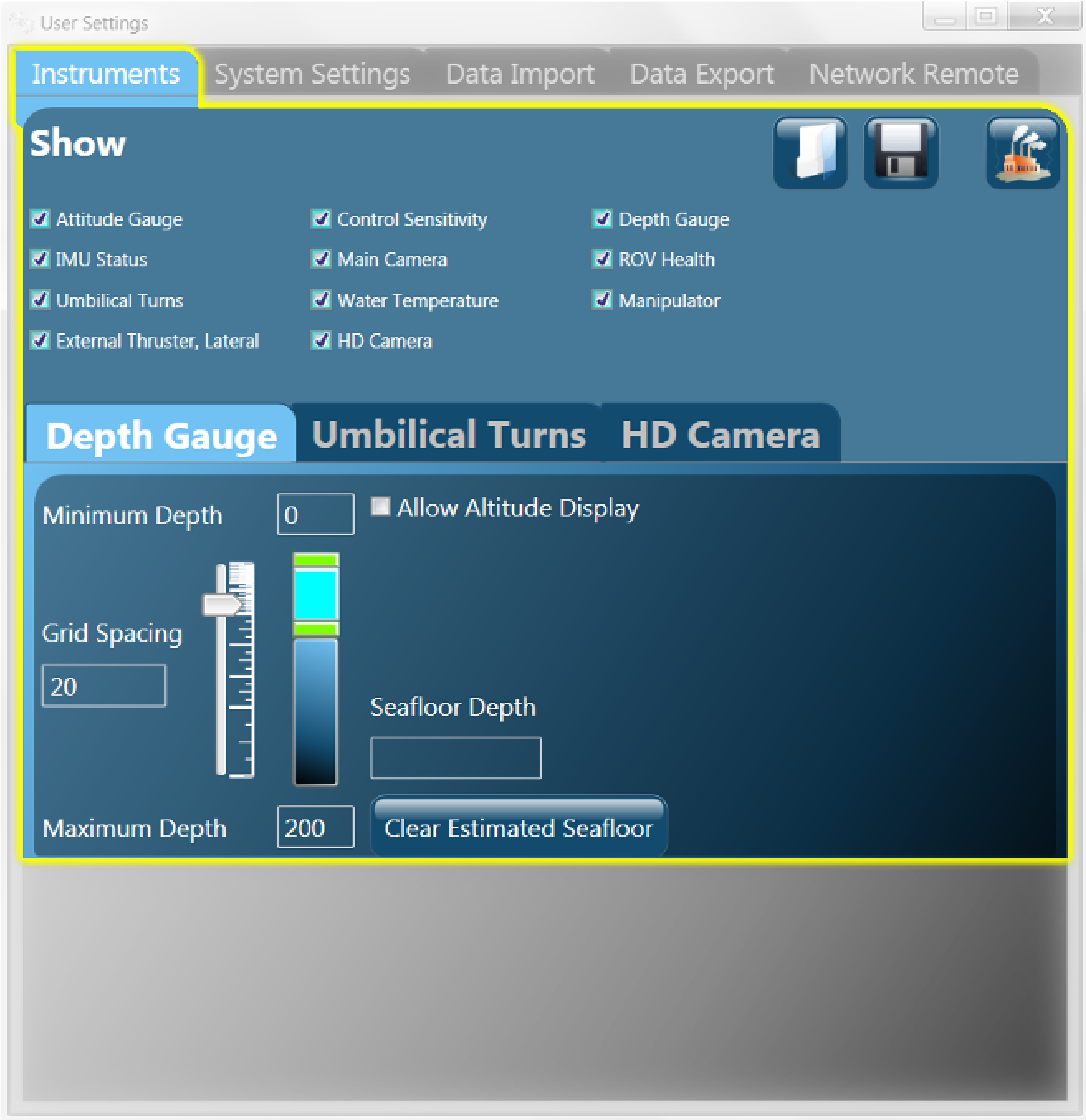


Topics in this Section

- Instrument Settings
- System Settings
- Data Import Settings
- Data Export Settings
- Network Remote Settings

Instruments Settings

The Instruments Settings tab allows you to control the display and other properties of the instruments.



Topics in this Section

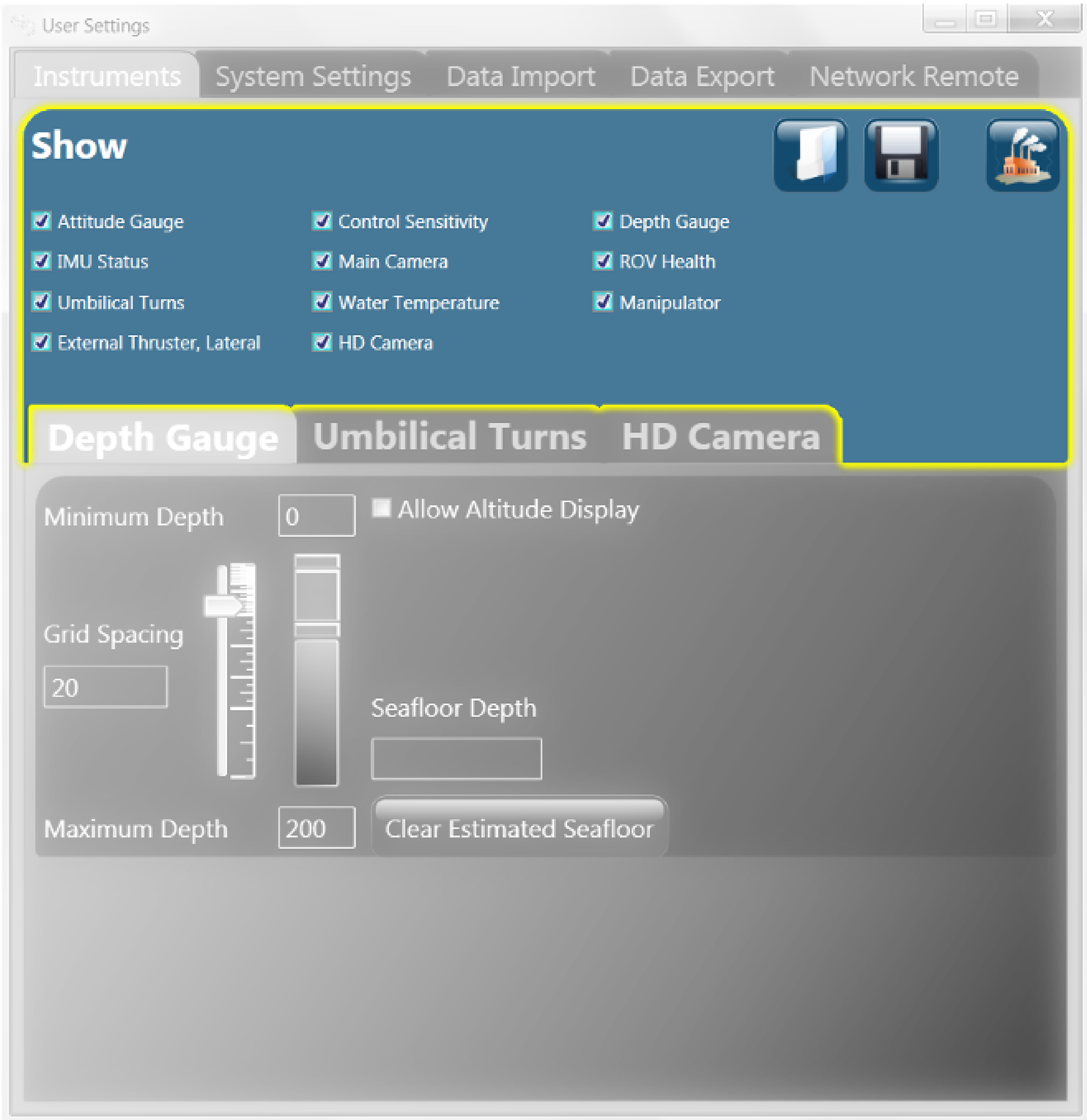
- Instruments Display
- Depth Gauge
- Umbilical Turns Counter
- HD Camera (optional accessory)

Alternate Methods

There are other methods to control the display of instruments. They can be controlled individually or through the Control Bar.

See the Instruments and the Control Bar sections of the VideoRay Cockpit Guide for more information.

Instruments Display



Turning Instruments On and Off

The top section of the Instruments Settings tab allows you to turn On or Off the display of instruments individually. Check the box next to the instrument to turn its display On. Uncheck the box next to the instrument to turn its display Off.

⚠ Instruments that are turned On individually will turn Off when using the Control Bar Off button.

⚠ Instruments that are turned Off individually will not turn On when using the Control Bar Transparent or Opaques buttons.

Saving Instruments Settings

The sizes, locations and On / Off state of instruments can be saved. Instruments settings are stored by name, so you can have multiple saved sets and switch according to job type or user preference.

⚠ Instruments settings are stored as a group. Instrument settings cannot be saved for each instrument individually.

⚠ Instruments settings are preserved from session to session. You only need to save an instrument settings if you want to be able to recover the arrangement later. The factory default instrument settings are also stored automatically, so you do not need to save the original out-of-the-box settings.

Load Instruments Settings

Use the Load Instruments Settings button to select a saved instruments set. Click on the Load Instruments Settings button and browse to select the desired saved instruments set and restore it. See the Save Instruments Settings next for information about to save an instruments set.

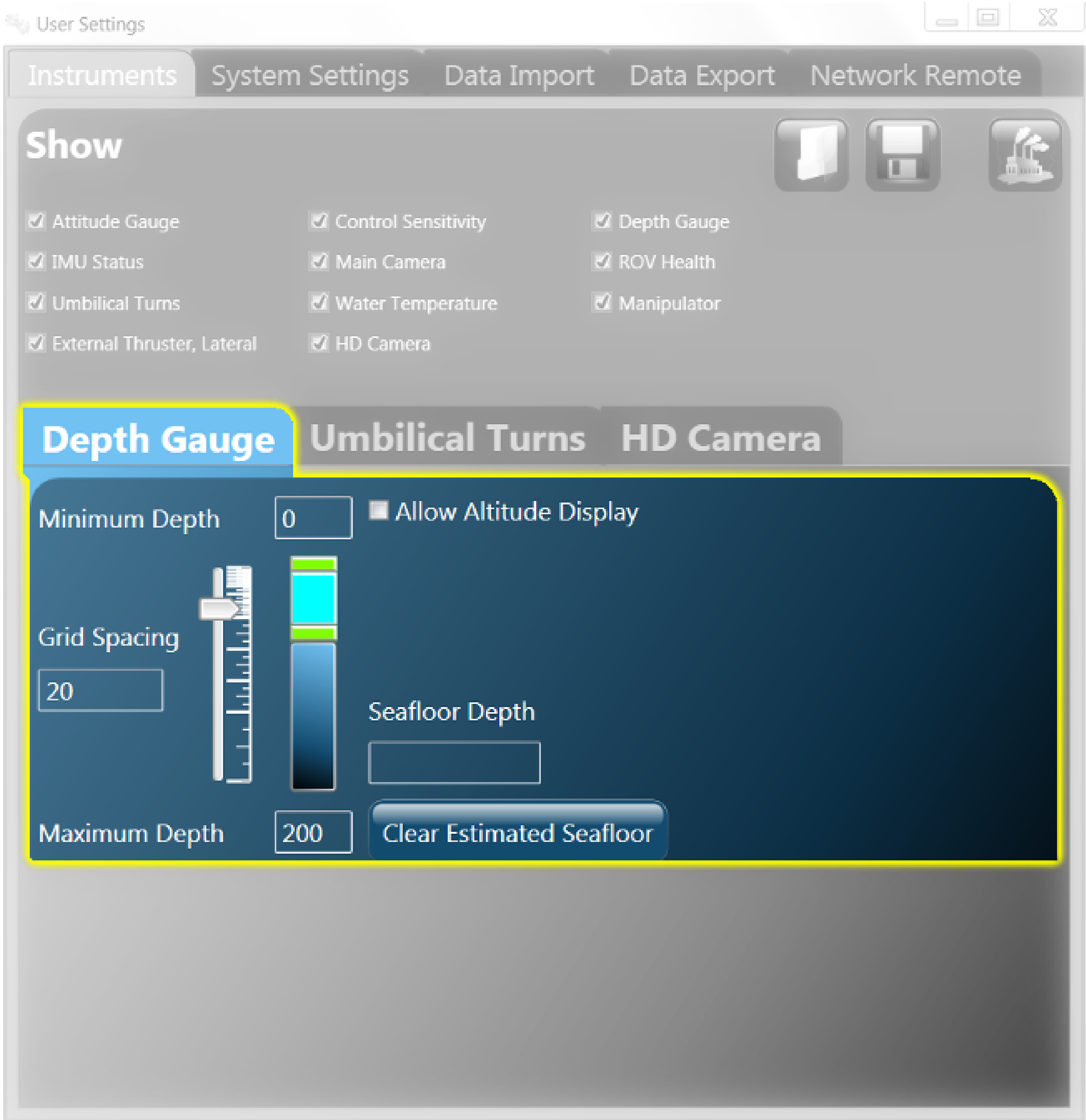
Save Instruments Settings

When the instruments are arranged as desired, click on the Save Instrument Settings button to store the arrangement. Enter a file name and click on the Save button.

Restore Instruments Settings to Factory Default Values

The Restore Instruments Settings to Factory Default Values button restores all instruments to their default size and location.

Depth Gauge Settings



The Depth Gauge tab of the Instrument Settings tab allows you to adjust the depth gauge scale and altimeter settings. You can set the minimum depth, the maximum depth and the grid spacing displayed on the depth gauge. These properties can be set by entering values or by clicking with the left mouse button and dragging the sliders. You can drag the grid slider to adjust the grid spacing. You can drag the top green bar to set the minimum depth, you can drag the bottom green bar to set the maximum depth, or you can drag the blue bar to change both ends of the range simultaneously

The Depth scale values can not be set to less than 0, or greater than 1000, and the grid spacing cannot be set to less than 1 or greater than 100.

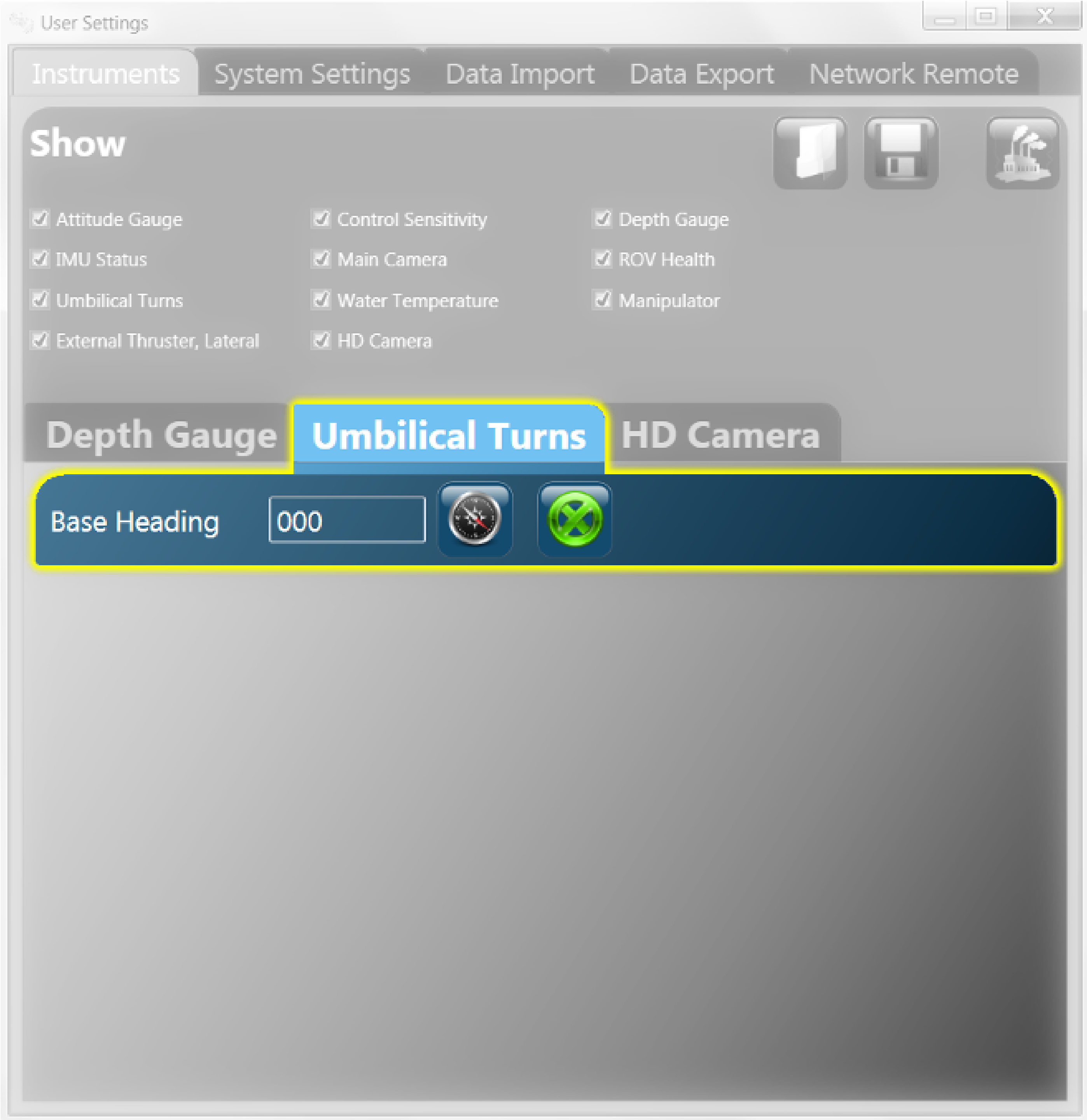
If the ROV surfaces or dives outside of the range defined for the depth gauge, the depth flag will stop at the end of the gauge, but the depth number will continue to update to provide an accurate indication of the depth of the ROV.

Restoring Factory Defaults

The factory default settings for instruments can be restored by clicking on the Restore Factory Defaults button in the upper right hand corner of the Instruments Settings window.

Turns Indicator Settings

The base orientation of the Turns Indicator can be adjusted.



Setting the Turns Indicator Base Orientation

To adjust the base orientation of the Turns Indicator arrow use either of the following methods:

- Manual Entry - Key in the desired offset in the Base Heading field. Values entered in the Base Heading field will be subtracted from the ROV's compass heading so that when the ROV's heading matches the value entered, the arrow will point straight up.
- Use the Current ROV Heading - to use the current heading of the ROV as the base orientation, click on the compass button. The Turns Indicator arrow will point straight up when the ROV heading matches that direction.

Clearing the Turns Indicator Base Orientation

To clear the base orientation of the Turns Indicator arrow, either key in 0 in the Based Heading field, or click on the clear Base Heading button.

Additional Information

See the sections on the Turns Indicator instrument and Relative Heading for more information about using the Turns Indicator settings.

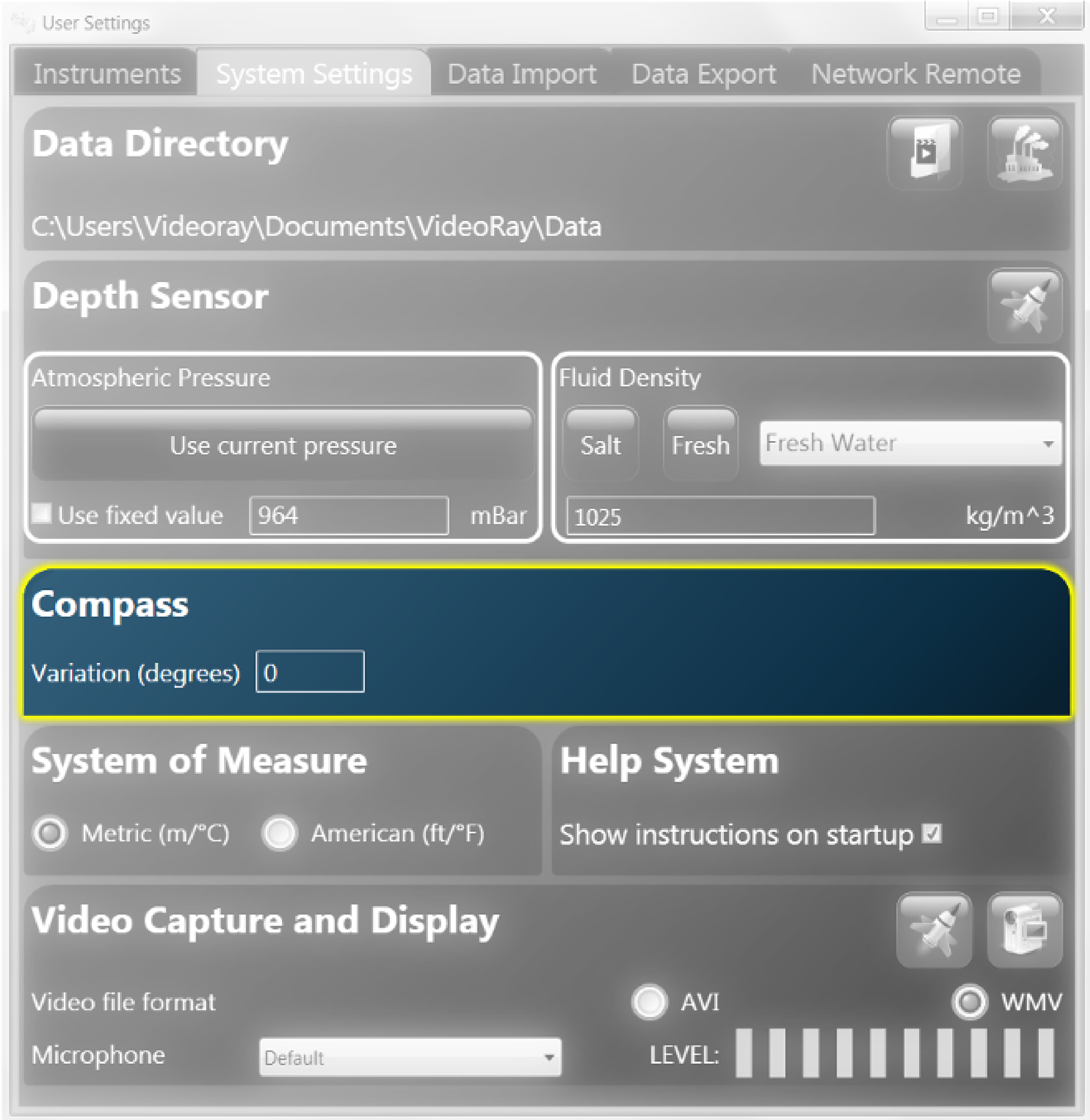
System Settings

The System Settings tab allows you to adjust various system parameters.

The Systems Settings tab allows you to adjust system parameters in the following areas.

- Data Directory Settings
- Depth Sensor Settings
- Compass Settings
- System of Measure Settings (Units)
- Help Settings
- Video Capture and Display Settings

Compass



The ROV compass system is designed to display headings relative to Magnetic North. You can enter a local compass variation to account for magnetic declination. The declination is considered positive when the Magnetic North is East of True North.

The value you enter is numerically added to the heading from the ROV. For example, if you are in an area with a declination of 15 degrees West, the ROV heading will read +15 degrees when the ROV is facing True North (assuming no variation has been entered). You should therefore enter -15 for the variation, which would result in a correct True North reading of 0 when the ROV is pointed True North.

⚠ The declination is saved from session to session. Be sure to clear it or change it at the start of each session if necessary.

⚠ Beginning with version 1.8 of VideoRay Cockpit, the behavior of the Compass Variation has been reversed. In prior versions, the variation was subtracted from the ROV heading.

You can use the Turns Indicator instrument to facilitate easier navigation with respect to a fixed reference such as a dock. See the sections on the Turns Indicator instrument and Relative Heading for more information about using the Turns Indicator settings.

Finding Declination

Several websites can be used to find the declination at a particular location. magnetic-declination.com allows you to click on a zoomable world map and view the declination of that location.

System of Measure

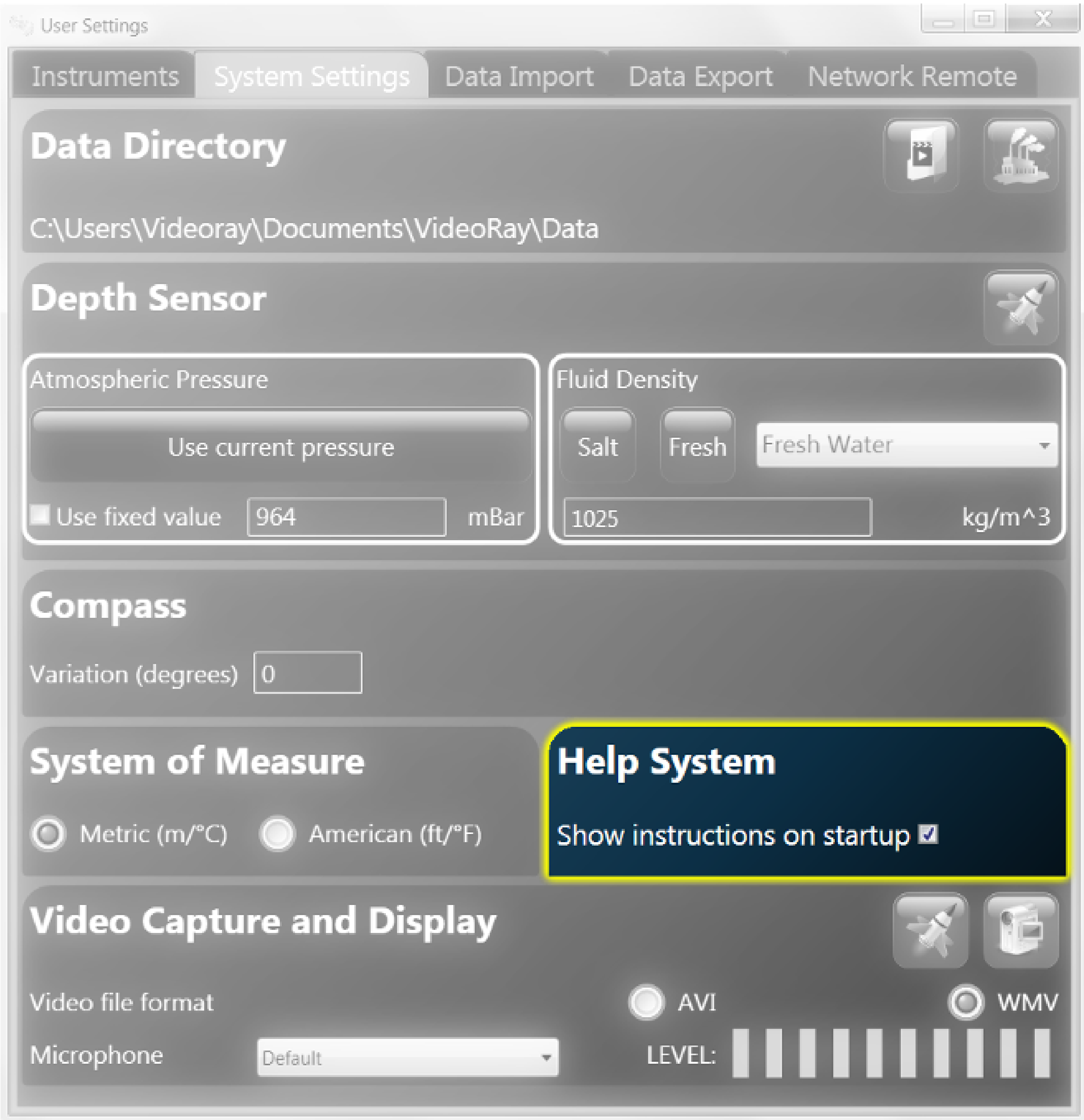
You can select the units used for display, choosing between either Metric or American. Click on the radio button preceding the desired system of units.

Converting Units

For an exact conversion from meters to feet, divide the number of meters by 0.3048. To convert feet to meters, multiply by 0.3048.

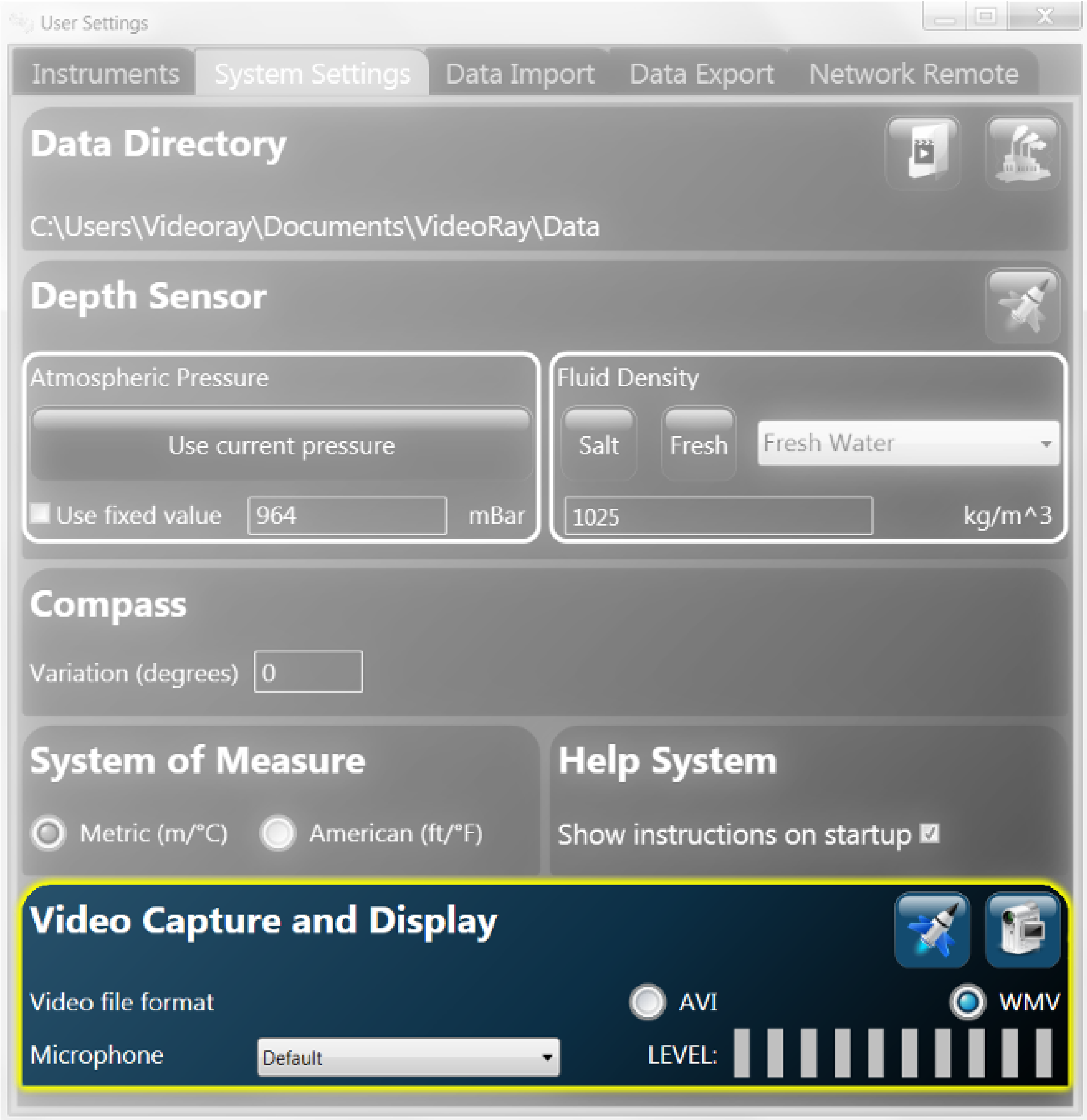
To convert from degrees Celsius to degrees Fahrenheit, multiple the temperature in Celsius by 9/5 and add 32. To convert Fahrenheit to Celsius, subtract 32 and multiply by 5/9.

Help System



By default, the Help system is designed to open when VideoRay Cockpit is started. If you do not want the Help system to open when you start VideoRay Cockpit, uncheck the "Show instructions on startup" checkbox. You can always access the Help system from Help button on the Control Bar.

Video Capture and Display



The Video Capture and Display settings allow you to select the video format and adjust advanced video settings.

Video File Format for Recording

The video file format can be one of the following:

- AVI
- WMV
- MP4*

* - MP4 recording requires a separate video codec that can be purchased separately.

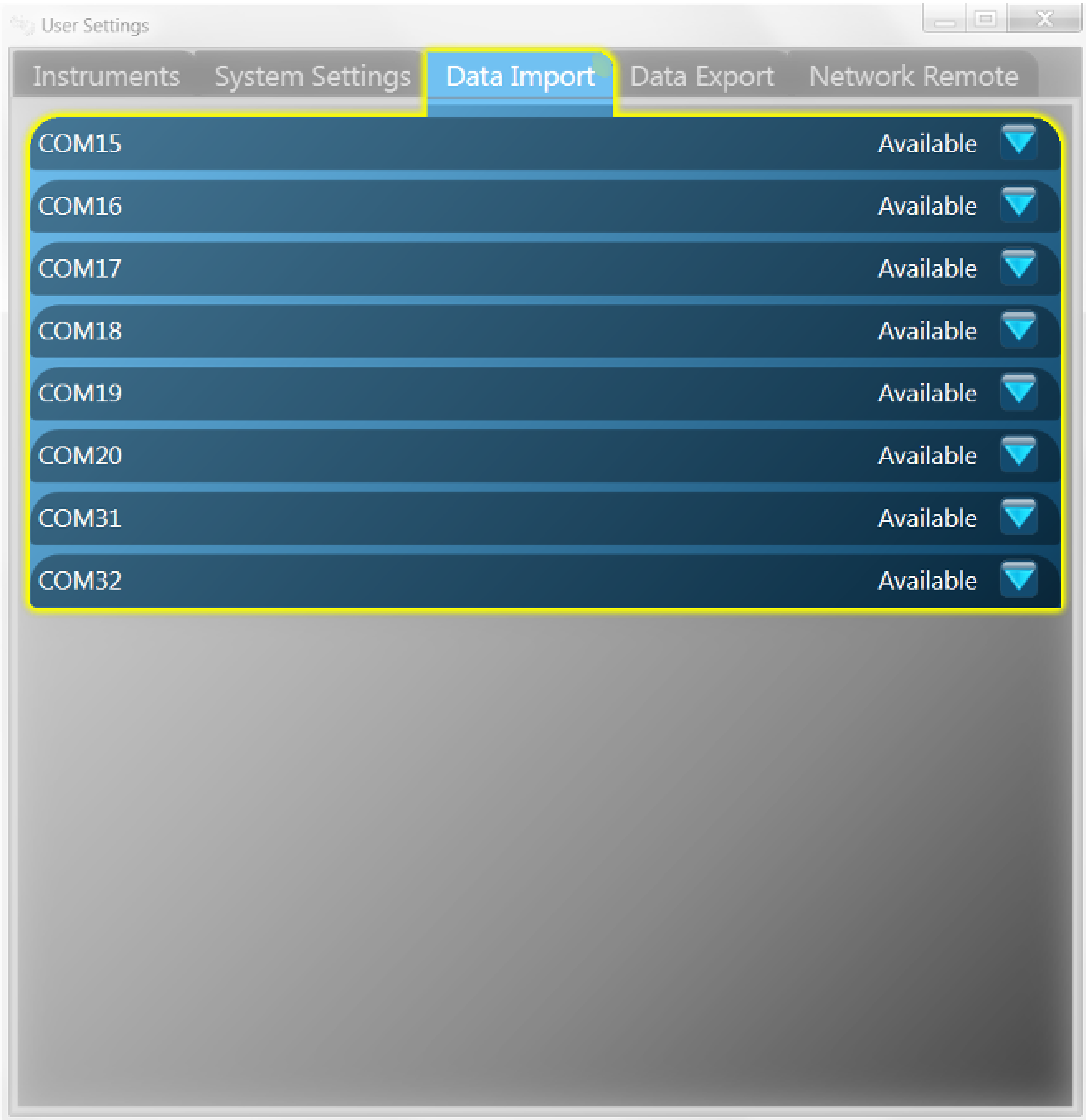
Audio Settings

This section also includes audio microphone selection and microphone input level meter.

Data Import

Data Import can be used to read data from sensors or other applications and display the information on the VideoRay Cockpit video as overlay text.

CAUTION Improperly setting up COM ports for Import can cause problems with basic ROV communications. If you are not sure how to set up COM ports, contact VideoRay support for assistance.



Data Import reads data from a COM port. Either a physical COM port or virtual COM port can be used. Virtual COM ports can be used to allow two programs on the same machine to talk to each other. An example might be to have the KCF Smart Tether send the ROV position data to VideoRay Cockpit, so that the position of the ROV can be recorded as overlay text on the video image. See the Application Integration section for more information about virtual COM ports.

Support is provided for NMEA* formatted text data. NMEA data is automatically parsed to find Position (typically from GPS) or Distance (typically from a tether payout sheave).

Use

To use Data Import, you must select the port from which you want to import data and then configure the port. Ports are selected by clicking on the drop down arrow on the right hand side.

Once the port has been selected, you must configure the following items:

- Designation - A text field that allows you to enter a description. This is optional and for reference only, it is not displayed.
- Function - The purpose for the import.
  - Not Used for Import
  - ROV Position
  - Other Platform Position
  - Tether Payout
- Baud Rate - The baud rate to match the device settings or requirements.

After configuring the port, the background will be green if the port is open and receiving data, red if the port cannot be opened, and brown if the port is operating properly, but no data is being received.

Examples

1. Direct from a GPS Antenna to indicate the position of the operating station (this would be for the topside location, not the ROV position, and can be used from a boat when only an approximate position of the ROV is required).

   - To read and display position data from a GPS antenna, connect the antenna to the computer and determine the port on which it is recognized. Then, in the Data Import window, click on the expand arrow on the right hand side for that port number. Select the data type from the pull down selection (Other Platform Position), and then set the baud rate to match the device (typically 4800). The data stream should start to display in the area on the right and the position should be displayed on the video as overlay text.

2. From a positioning system that supports COM port output of the ROV location. For this example, we will use the KCF Smart Tether and the virtual COM port pair 31 and 32.

    - To read and display position data from the Smart Tether, connect the Smart Tether and begin operation as normal. From the Smart Tether software menu, select "Tools->Communication Settings". Select the desired COM port for output. Typically, this will be a virtual COM port. Select Port 31, and set the Baud rate to 4800. Check the Enable Real Time Output and click the OK button to close the Settings window. Next, in VideoRay Cockpit, click on the User Settings icon in the Control Bar, and then click on the Data Import tab. Click on the expand arrow on the right hand side for COM port 32. Select the data type from the pull down selection (ROV Position), and then set the baud rate to match the Smart Tether setting (4800). The data stream should start to display in the area on the right and the position should be displayed on the video as overlay text.

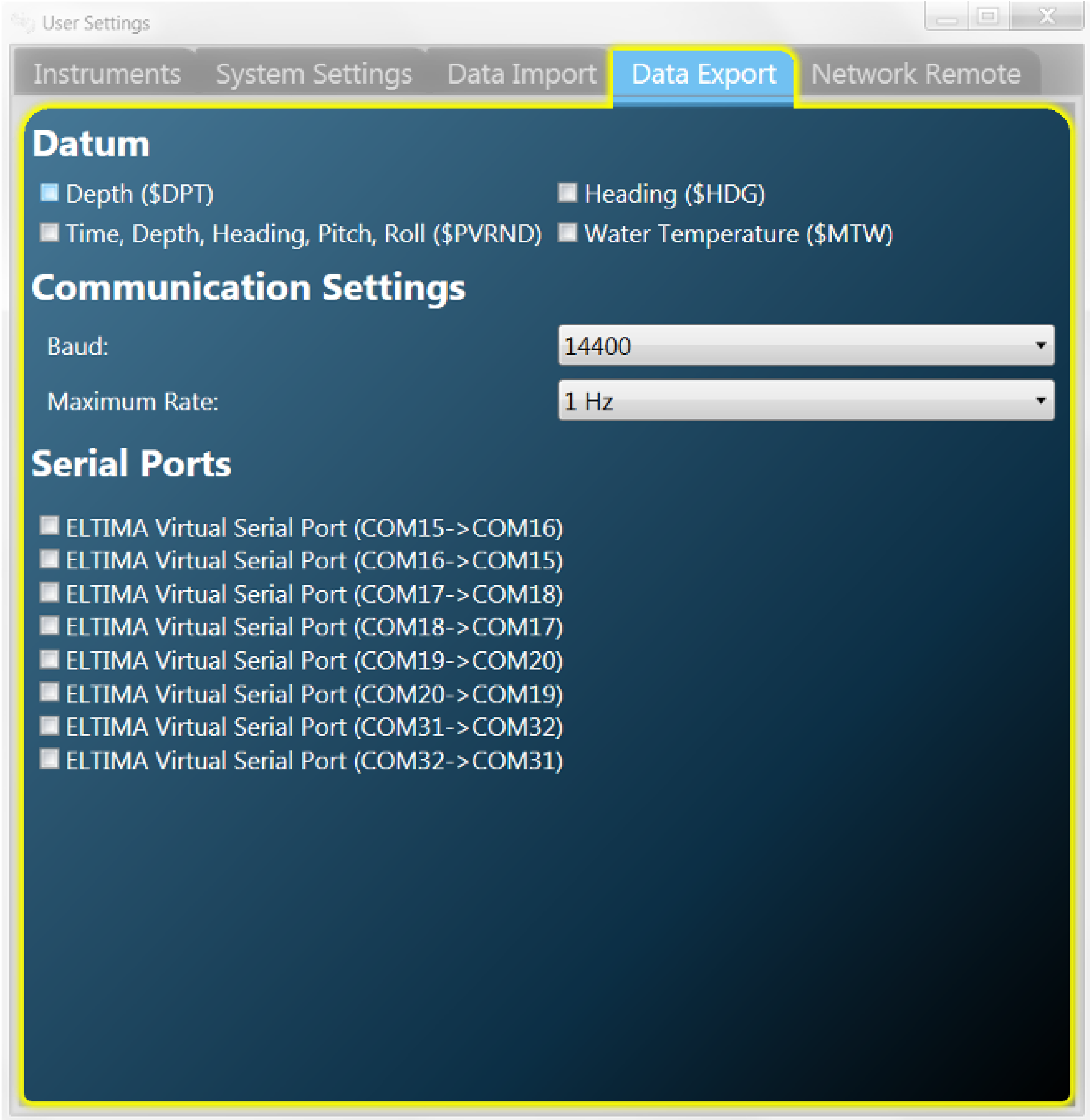
When a port is set up, the setup background will turn green when communications have been established and data is being received. If communications have been established with the selected COM port, but no data is being received, then background will turn light brown. If no communications have been established with the selected COM port, the background will turn red.

* - For more information about NMEA and NMEA data standards, see http://www.nmea.org.

Data Export

Data Export can be used to send VideoRay Cockpit and ROV data to other applications.

CAUTION Improperly setting up COM ports for Export can cause problems with basic ROV communications. If you are not sure how to set up COM ports, contact VideoRay support for assistance.



The Serial Ports list may be different based on the computer's configuration.

Data Export sends data as NMEA* formatted text strings and supports four different types of output strings:

1. Depth ($DPT)
2. Heading ($HDG)
3. Water Temperature ($MTW)
4. Time, Depth, Heading, Pitch, Roll ($PVRND)

Data Export sends data to a COM port. Either a physical COM port or virtual COM port can be used. Virtual COM ports can be used to allow two programs on the same machine to talk to each other. An example might be to have VideoRay Cockpit send the ROV Depth to a program that could log and/or graph the depth profile of the mission. See the Application Integration section for more information about virtual COM ports.

To use Data Export, you must configure the data type, Baud rate and frequency of output (Maximum Rate) and then select the port to which you want to export data.

To save data to a file, you can use a terminal emulation program, such as or Tera Term or PuTTY, as the receiving application and save the session data to a log file.

Data Export Format

The prototypical format conforms to NMEA standards and can be expressed in general terms as:

$IDSEN,DD,DD,...*CS<CR><LF>

Segment	Information Represented
$	Start
ID	Talker Identifier, which is "VR"
SEN	Sentence Type, which defines the type of data in the string
DD,DD,...	Data field(s), fields are separated by commas
*	Separator
CS	Checksum
<CR>	Carriage Return
<LF>	Line Feed

Example Output

Depth - $VRDPT,d.d,o.o*cs

Segment	Information Represented
$VRDPT	Depth Record Identifier String
d.d	Depth in meters
o.o	Transducer offset (set to zero) Positive means distance from transducer to water line Negative means distance from transducer to keel
cs	Checksum

Heading - $VRHDG,h.h,d.d,a,v.v,b*cs

Segment	Information Represented
$VRHDG	Heading Record Identifier String
h.h	Magnetic sensor heading in degrees
d.d	Magnetic deviation in degrees
a	Magnetic deviation direction, E = Easterly, W = Westerly
v.v	Magnetic variation in degrees
b	Magnetic variation direction, E = Easterly, W = Westerly
cs	Checksum

Water Temperature - $VRMTW,x.x,u*cs

Segment	Information Represented
$VRMTW	Water Temperature Record Identifier String
x.x	Degrees
u	Unit of measurement
cs	Checksum

ROV Attitude - $PVRND,mm/dd/yyyy,hh:mm:ss.s,d.d,h.h,p.p.r.r*cs

Segment	Information Represented
$PVRND	ROV Attitude Record Identifier String
mm/dd/yyyy	Month/Day/Year
hh:mm:ss.s	Hours:Minutes:Seconds (UTC)
d.d	Depth in meters
h.h	Magnetic sensor heading in degrees
p.p	Pitch in degrees
r.r	Roll in degrees
cs	Checksum

You can select more than one output string. Each string will be written in sequence.

You can select more than one COM port and export to several applications simultaneously.

* - For more information about NMEA and NMEA data standards, see http://www.nmea.org or http://www.tronico.fi/OH6NT/docs/NMEA0183.pdf.

Launch Companion Applications

Several companion applications can be launched from the control bar. Currently, the applications that are integrated include VideoRay CoPilot, BlueView ProViewer, KCF Smart Tether, Tritech SeaNet and Tritech Micron.


Launch VideoRay CoPilot Software


Launch BlueView ProViewer Software


Launch KCF Smart Tether Smart Tether


Launch Tritech SeaNet Software for the Micron Nav (and Micron Sonar and Echosounder)


Launch Tritech Micron Software for the Micron Sonar (and Micron Echosounder)

Additional software can be used with VideoRay Cockpit, but at this time, these are the only applications that are integrated through the VideoRay Cockpit interface.

Companion application launch buttons will only display if the associated software is installed on the computer in the standard location. If the application is not installed, or not in the standard location, the application launch button for that application will not display.

By default, BlueView ProViewer support has been limited to version 4.2 and support for BlueView ProViewer 3.6 has been discontinued. Legacy support for BlueView ProViewer 3.6 can be restored. Contact VideoRay Support for more information.

Instruments Display

The Control Bar includes several buttons that can be used to modify the behavior of the instruments and their display.

Lock/Unlock Instruments Sizes and Locations

The Pro 4 Ultra Instruments are Locked by default and cannot be moved or resized.


Lock Instruments Sizes and Locations


Unlock Instruments Sizes and Locations

The button displays the current state of the Lock/Unlock Setting. If the button shows the lock icon, the instruments are locked and clicking on the Lock/Unlock Instruments Sizes and Locations will unlock the instruments.

The sizes and locations of instruments can be locked so that you don't accidentally resize or move them. If the Lock Instruments Sizes and Locations button shows the lock icon, the instruments sizes and locations will be locked. If the Lock Instruments Sizes and Locations button shows the unlock icon, the instruments can be resized and moved.

The lock or unlock state applies to all instruments, but does not affect the visibility settings of the instruments.

See the Instruments section for more information about resizing and moving instruments.

Set Instruments Display Opaque


Set All Instruments Display Opaque

There are three buttons on the control bar to manage the display properties of instruments. You can turn off all instruments, make them all transparent, or make them all opaque. These buttons work on all instruments as a group rather than individually.

All Instruments Opaque - Turns the display of all instruments opaque.

Alternate Methods

There are other methods to control the display of instruments. They can be controlled individually or through User Settings.

See the Instruments and the User Settings sections of the VideoRay Cockpit Guide for more information.

Set Instruments Display Transparent


Set All Instruments Display Transparent

There are three buttons on the control bar to manage the display properties of instruments. You can turn off all instruments, make them all transparent, or make them all opaque. These buttons work on all instruments as a group rather than individually.

All Instruments Transparent - Turns the display of all instruments transparent.

Alternate Methods

There are other methods to control the display of instruments. They can be controlled individually or through User Settings.

See the Instruments and the User Settings sections of the VideoRay Cockpit Guide for more information.

Set Instruments Display Off

Set All Instruments Display Off

There are three buttons on the control bar to manage the display properties of instruments. You can turn off all instruments, make them all transparent, or make them all opaque. These buttons work on all instruments as a group rather than individually.

All Instruments Off - Turns off the display of all instruments.

Alternate Methods

There are other methods to control the display of instruments. They can be controlled individually or through User Settings.

See the Instruments and the User Settings sections of the VideoRay Cockpit Guide for more information.

Operations Guide

This Operations Guide is provided to go beyond the Equipment and VideoRay Cockpit Guides to describe not just how the Pro 4 works, but how to work with the Pro 4. There are numerous topics and tips that are outside of the scope of conventional system documentation that focuses only on the hardware and software. You will find recommendations and best practices, but you are also encouraged to use your best judgment and apply all of the information in this documentation and your experiences to your specific applications.

In addition to this guide, there are other sources of information about ROV operations that you might consider. These include training, support and user forums. There are links to these resources at the bottom of each page. The Community Link at the bottom of the page provides access to http://www.rovinfo.com, which is a great resource to meet other VideoRay and ROV operators and exchange information and tips with them.

Topics in this Section

- Emergency Situations
- Project Management
- Universal Practices
- Piloting
- Using Network Remote

Project Management

While the differences between conducting a recreational dive, an inspection of an offshore well riser, and a drowning victim recovery are quite dramatic, each of these dive missions usually consist of the following phases:

1. Establish the need, objectives and acceptable outcomes of the mission
2. Plan the mission
3. Prepare for the mission
4. Execute the mission
5. Conclude the mission
6. Compile and deliver project reports

Of course, how critical a successful outcome is deemed and how much lead time and how many resources are available will dictate how much effort can or will be afforded to each phase.

The essential knowledge and skills required for a consistent ability to "get the job done" go well beyond just being able to set up and pilot an ROV. In this section, the following topics will be discussed to help broaden your understanding of the scope of practical ROV applications.

- Mission Planning
- General Logistics
- On-site Operations
- Project Completion

Mission Planning

Once the basic objectives for an ROV mission have been established, there are several additional, and critical, requirements that need to be identified before rushing off to the dive site. Each of these additional requirements can be defined by developing a list of questions and thinking through the answers. Some of the answers may lead to more questions. With the information gathered by answering the questions, appropriate decisions can be made and your plan developed.

Below is a representative list of requirements and corresponding questions. This list is not comprehensive, and is only intended to serve as a guide for you to develop your own list of appropriate requirements and questions.

- **Define the safety requirements**
  - How many PFDs are needed?
  - Are there any known hazards in the operating area?
    - Is the water contaminated or potentially contaminated?
- **Define the ROV equipment requirements**
  - How much tether will you need?
    - How deep do you plan to dive?
    - How far is the dive target from the set up location?

- Are accessories needed?
    - What is the water visibility?
    - Will you need to retrieve anything?

- **Define the additional equipment requirements**
  - What are the site conditions?
    - Will you have power available or need to supply your own?
    - Will you need insect repellent?

  - What will the weather be?
    - Will you need to bring extra clothes or rain gear?
    - Will you need to bring sun screen?

  - How long do you expect the mission to last?
    - Will you need to bring food?
    - Will you need extra staff for multiple shifts?

- **Define the time-frame requirements**
  - How long do you think it will take to accomplish your goals?

  - How long do you have to accomplish your goals?

  - Are there any schedule constraints?

- **Define the staff skill requirements**
  - Will you need extra staff to transport the equipment?

  - Will you need someone to liaise with the public on-site?

- **Define the transportation requirements**
  - Will you be operating from the shore or a vessel?

  - How much equipment and how many people will you bring?

- **Define any unique requirements**
  - Is the area of operation under any jurisdiction that requires you to get a permit for access or ROV operations?

Additional Notes

The use of checklists can facilitate the execution of the planning, logistics and operating phases of ROV missions. Consider using the ones provided with this documentation, or customize them or create your own to better meet your specific needs.

General Logistics

In addition to the ROV system and its accessories, you will typically need to provide other equipment to support your mission. The first items on your list should be those required for safety of the crew, such as personal flotation devices and a first aid kit. Depending upon your specific requirements that should have been identified in the planning phase, recommended equipment might also include:

- Items for personal comfort including appropriate clothing, chairs, tables, pop-up tents for shade
- Tools and spare parts to make field repairs
- Items to document the mission including topside cameras
- Short and long range communications equipment including cell phones and/or two-way radios
- Lights for night time operations
- Code "A" flag (similar to the "Diver Below" flag) to indicate to those around you that the ROV is deployed and they should exercise caution when entering your area

VideoRay Power Requirements

The VideoRay Pro 4 operates on 100-240 Volts AC, 50,60 Hz. This can be provided from the land-based grid, a generator, or a battery with an inverter.

Transportation

Land or water transportation will likely be required and you will need to ensure that you have enough space for your crew and equipment. You may also want to bring maps or charts of the operating area, and you should try to ascertain access points and plan your route accordingly. Carts to transport equipment while at the site may be helpful if the terrain is accommodating.

Site-specific Requirements

Often, river or shoreline sites have steep banks. For these locations, you might want to bring rappelling equipment or at a minimum some ropes to assist in climbing or transporting equipment up and down.

Sea sickness remedies for vessel operations can make the difference between a successful mission and an aborted attempt.

Unequal Grounds

⚠ All power grounds are not created equal... It is more common than you would imagine that the power ground is not at the same potential as the water. This will create a ground loop that can cause noise on the video signal or even lead to a shock if you touch a grounded part of the system and water at the same time. VideoRay includes a ground lift adapter cord that can be used to isolate the control panel ground. All connected devices must be connected through this adapter. For example, a monitor connected directly to the power source and to the computer via a monitor cable, will reintroduce the bad ground into the system.

On-site Operations

On-site operations can be hectic and demanding. The following information can help maintain order and productivity.

Site Selection and System Set Up

The following recommendations should be considered when selecting a site and setting up the equipment:

- Select a level site if possible
- Orient the panel for best visibility (avoid glare), and piloting reference (directions on the screen match real world directions)
- Watch for tripping hazards from the tether or power cord
- When operating from a vessel, make sure the system is physically secure in case of rough seas
- Watch for tether pinch points hazards around docks or chaffing hazards around rocks or coral

The ROV Team, Their Roles and Responsibilities

While one person can operate a VideoRay, having multiple people participate can be valuable or may even be required in some situations. The following roles and responsibilities are suggested to assist in developing an efficient and effective ROV team.

Role	Responsibility and Tips
Pilot	Pilots are responsible for operating the ROV in a safe manner while navigating the ROV to achieve the mission objectives. Pilots should wear dark colored shirts to avoid brightly colored glare in the monitor.
Tether Handler	The tether handler, also affectionately called the "Tether Monkey," supports the pilot by managing the tether, including: making sure the right amount is deployed, keeping it away from surface hazards like a propeller, keeping loose tether on the surface neat and communicating with the pilot. The Tether handler should wear gloves to assist in gripping the tether, to keep their hands warm and dry, or for protection when operating in contaminated water.
Accessory Operator	On some missions the pilot must focus intently on navigating the ROV. Trying to have the pilot operate an accessory at the same time may be counter productive. Having an accessory operator will reduce the burden on the pilot and allow the accessory operation to be conducted with more attention to its requirements.
Supervisor	The supervisor should manage the team, and make sure the objectives of the project are being met. On long duration missions, supervisors should consider rotating shifts or rotating roles to keep the crew at peak performance levels. Supervisors are often called upon to log the operations to maintain a record of the dive.
Technician	Technicians maintain the equipment and repair it as necessary. They should also maintain maintenance and repair logs. Technicians can also serve as equipment and logistics managers.

Additional Notes

The use of operations logs is highly recommended to track operations and develop historical profiles of the equipment, operators and missions. Consider using the ones provided with this documentation, or customize them or create your own to better meet your specific needs.

Project Completion

On-site, the system should be cleaned as best as possible and stowed for transport. Be careful when closing lids to avoid pinching any cables or damaging the video display components of the computer or the control panel.

Upon return to the home base, other tasks that should be considered before stowing the equipment include:

- Clean and inspect the equipment.
- Make any necessary repairs so system is ready to go next time.
- Complete any operations and maintenance logs.
- Produce and deliver the project reports.

Project Deliverables

Often, the completion of a project means delivering a product, such as images or videos of an inspection, or retrieval of an item. These can be delivered as isolated products or as part of a formal report. See the Images and Videos section of the Operations Guide for more information about still image and video post-processing and production.

Universal Practices

Several practices are common to almost all ROV operations. This section provides some guidelines for the practices.

Deployment Platforms

VideoRay ROVs can be deployed from land, vessels, remotely or even some very unique situations. Power can be provided by a shore based system, a generator or a battery with an inverter.

Height above Water Surface

VideoRays can be deployed from a significant height above the water surface by lowering the vehicle by its tether.

Land

For land-based deployments using shore power the biggest issue is usually how close can you get to the water. When operating in tanks, beware of active inlets or discharges and avoid using the ROV or tether near these areas. Many tanks also have cathodic protection systems, which can become a snare and entrapment hazard to the ROV.

Vessels

When operative from vessels, it is important to be aware of potential risks to personnel or the equipment. Whenever possible, conduct ROV operations when the vessel is at anchor or adrift without the propulsion system engaged. When the vessel's propulsion system must be engaged during ROV deployment, tether management is critical to ensure the tether or the ROV do not come in contact with the vessel's propulsion systems. Water intakes and discharges can also be hazardous to the ROV and should be locked out or the ROV and tether kept a safe distance.

Remote Operations

VideoRays can be operated remotely using Internet technologies. See the section on Using Network Remote for more information.

Other

Other unique deployment platforms include:

- Air - from a helicopter
- Underwater - as a fly-out vehicle
- Under Ice

Tether Management

Tether management can have a significant affect on the ability to pilot the ROV and achieve the objectives of the mission.

Tether Management includes selecting the appropriate type of tether and managing the deployment and retrieval of it during operations.

Choosing the right tether and managing it can have a very significant impact on the outcome of an ROV dive.

Tether is available in neutral or negative buoyancy. Negative tether sinks but has larger conductors, which means longer lengths can be used without affecting the power available at the ROV. Neutral tether is neutral in fresh water (slightly buoyant in salt water), but has thinner conductors. Neutral tether is available in standard diameter and performance diameter (also called PPT), which is thinner. Thinner tether has less drag, but also has smaller conductors and less power transmission capacity. Selecting the right tether is a balancing act between performance and handling characteristics.

General Tether Use Recommendations

- Make sure tether connections are secure.
- Use the shortest amount of tether required to operate in the target area.

- Use Performance or Neutral tether at the ROV and if more tether is needed use Negative at the control panel.
- If possible, select a deployment site that aids in ROV piloting and tether management. Usually, this means up-current from the zone of operations and with a direct line of sight to avoid snags.
- Only deploy what is needed - too little will affect piloting - too much may result in snags, tangles or propeller cuts.

Tether Storage

Tether should be stored on a TDS or coiled using an over/under or figure eight technique. Coiling the tether in one direction will result in twists that are hard to remove.

Piloting

Piloting a VideoRay ROV requires a combination of understanding the system's operating principles, features and capabilities, situational awareness (which is much more challenging when you cannot see the vehicle), personal skills and experience.

The VideoRay Pro 4 has several pilot assist tools that provide auto control of the vehicles functions and other sensors that help with situational awareness. Several optional accessories can provide even further situational awareness, such as sonars and position tracking systems. Autonomous operation is also possible through the CoPilot series of applications, including CoPilot Survey, CoPilot Sonar and CoPilot RI (Reacquire and Identify).

The following sections provide information about built in pilot-assist tools and piloting tactics for specific situations.

Piloting Tools

VideoRay Cockpit provides several tools to assist the operator when piloting the ROV. These include:

- Auto Depth
- Auto Altitude
- Auto Heading
- Relative Heading

Auto Depth

Auto Depth can be used to maintain an existing depth, or surface or dive to a specified depth. Auto Depth is designed to be as seamless as possible so that you can pilot without having to constantly engage and disengage it when alternating between hovering and changing depths.

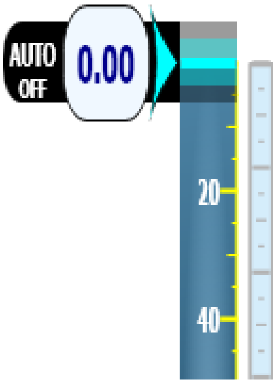
How Auto Depth Works

When Auto Depth is engaged, the ROV will automatically respond to changes in depth (measured by the pressure sensor) by applying vertical thrust to maintain the current depth (pressure). If the Auto Depth Indicator is moved to a new depth, the ROV will automatically respond by applying vertical thrust until the depth of the ROV matches the new depth indicated by the Auto Depth Indicator.

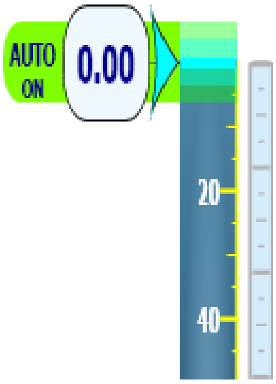
⚠ See the Depth Gauge section in the VideoRay Cockpit Guide for information about the Depth Gauge.

Using Auto Depth to Hover

To hover at the current depth, center the depth control knob and click and drag the Auto Depth Indicator on the depth gauge to the current depth. The Auto Depth Indicator should change from black to green and the text from "Auto Off" to "Auto On." The ROV will hover at the current depth. To move to a new depth while Auto Depth is engaged, rotate the Depth control knob to apply thrust in the desired direction. You do not need to disengage Auto Depth, and when you center the Depth control knob, Auto Depth will take over and maintain the new depth.



Auto Depth Off



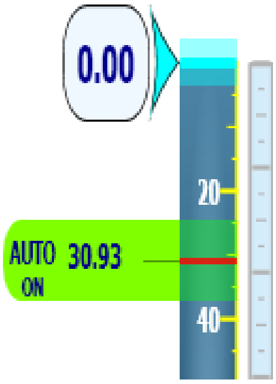
Auto Depth Engaged

Using Auto Depth to Automatically Surface or Dive to a Specified Depth

To surface or dive the ROV to a specified depth, center the depth control knob and click and drag the Auto Depth Indicator to the desired depth. The Auto Depth Indicator should change from black to green and the text from "Auto Off" to "Auto On." The ROV will surface or dive to the specified depth. You can override the Auto Depth manually by using the Depth Control knob to pilot the ROV. When you re-center the knob, Auto Depth will take over and maintain the new current depth.

Using Auto Depth to Dive to a Specified Depth

To dive to a specified depth, drag the Auto Depth Control / Indicator flag to the desired depth.



Disengaging Auto Depth

While the depth control knob is rotated from its centered position, Auto Depth will temporarily suspend itself until the depth control knob is centered again. The Auto Depth indicator will change from green to black and display the word "Manual" to indicate that the depth is being controlled manually.

To disengage Auto Depth completely, click on the Auto Depth Indicator. It will turn from green to black when the Auto Depth is disengaged.

For most operations, you can engage Auto Depth and leave it engaged, because it will hold the ROV at the depth you want, but you can manually override Auto Depth to move to a new depth without having to disengage it.

Additional Notes

Auto Depth can only be engaged while the depth control knob is centered. Center the depth control knob before engaging Auto Depth. When the depth control knob is centered, the vertical thruster setting indicator is transparent. When you apply thrust, the vertical thruster setting indicator becomes opaque to provide a visual indication that Auto Depth cannot be engaged.

When Auto Depth is Off and the depth control knob is centered, there will be no vertical thrust. When Auto Depth is On and the depth control knob is centered, the system will apply thrust as necessary to maintain a constant depth.

DANGER When Auto Depth is On, the vertical thruster may spin on its own. Keep fingers, hair and objects away from the vertical thruster when Auto Depth is On.

Auto Altitude

Auto Altitude can be used to maintain an existing altitude off of the bottom, or surface or dive to a specified altitude. Auto Altitude is designed to be as seamless as possible so that you can pilot without having to constantly engage and disengage it when alternating between hovering and changing altitude.

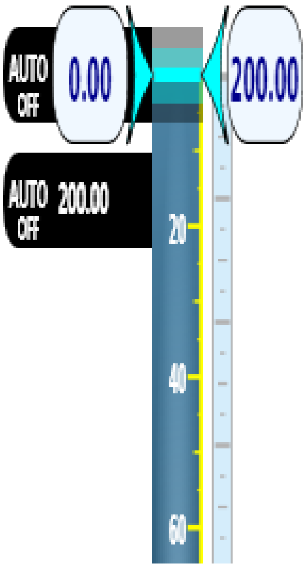
How Auto Altitude Works

When Auto Altitude is engaged, the ROV will automatically respond to changes in altitude (measured by an altimeter (optional accessory) or the pseudo altimeter) by applying vertical thrust to maintain the current altitude. If the Auto Altitude Indicator is moved to a new altitude, the ROV will automatically respond by applying vertical thrust until the altitude of the ROV matches the new altitude indicated by the Auto Altitude Indicator.

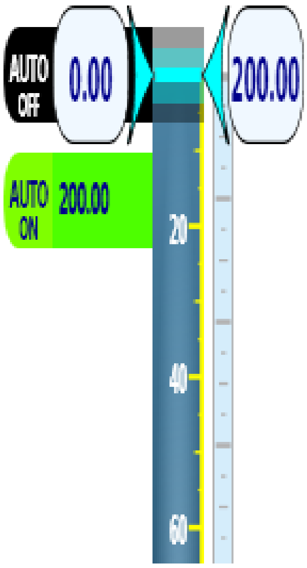
⚠ See the Altitude Gauge section in the VideoRay Cockpit Guide for information about the Depth Gauge.

Using Auto Altitude to Hover

To hover at the current altitude, center the depth control knob and click and drag the Auto Altitude Indicator on the altitude gauge to the current altitude. The Auto Altitude Indicator should change from black to green and the text from "Auto Off" to "Auto On." The ROV will hover at the current altitude. To move to a new depth while Auto Altitude is engaged, rotate the Depth control knob to apply thrust in the desired direction. You do not need to disengage Auto Altitude, and when you center the Depth control knob, Auto Altitude will take over and maintain the new altitude.



Auto Depth Off



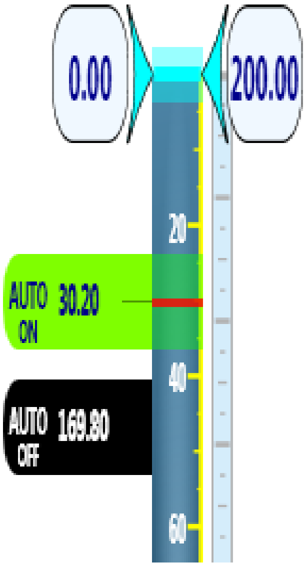
Auto Depth Engaged

Using Auto Altitude to Automatically Surface or Dive to a Specified Altitude

To surface or dive the ROV to a specified altitude, center the depth control knob and click and drag the Auto Altitude Indicator to the desired altitude. The Auto Altitude Indicator should change from black to green and the text from "Auto Off" to "Auto On." The ROV will surface or dive to the specified altitude. You can override the Auto Altitude manually by using the Depth Control knob to pilot the ROV. When you re-center the knob, Auto Altitude will take over and maintain the new current altitude.

Using Auto Altitude to Dive to a Specified Altitude

To dive to a specified altitude, drag the Auto Altitude Control / Indicator flag to the desired depth.



Disengaging Auto Altitude

While the depth control knob is rotated from its centered position, Auto Altitude will temporarily suspend itself until the depth control knob is centered again. The Auto Altitude indicator will change from green to black and display the word "Manual" to indicate that the depth is being controlled manually.

To disengage Auto Altitude completely, click on the Auto Altitude Indicator. It will turn from green to black when the Auto Altitude is disengaged.

For most operations, you can engage Auto Altitude and leave it engaged, because it will hold the ROV at the altitude you want, but you can manually override Auto Altitude to move to a new altitude without having to disengage it.

Additional Notes

Auto Altitude can only be engaged while the depth control knob is centered. Center the depth control knob before engaging Auto Altitude. When the depth control knob is centered, the vertical thruster setting indicator is transparent. When you apply thrust, the vertical thruster setting indicator becomes opaque to provide a visual indication that Auto Altitude cannot be engaged.

When Auto Altitude is Off and the depth control knob is centered, there will be no vertical thrust. When Auto Altitude is On and the depth control knob is centered, the system will apply thrust as necessary to maintain a constant altitude.

DANGER When Auto Altitude is On, the vertical thruster may spin on its own. Keep fingers, hair and objects away from the vertical thruster when Auto Altitude is On.

Auto Heading

Auto Heading can be used to maintain an existing Heading, or turn the ROV to a specified Heading. Auto Heading is designed to be as seamless as possible so that you can pilot without having to constantly engage and disengage it when alternating between holding a course and changing directions.

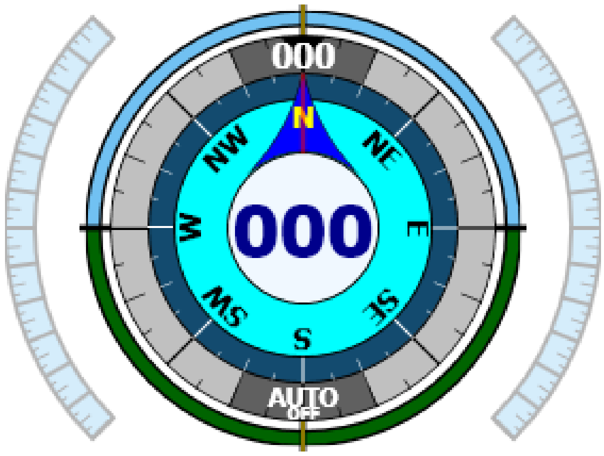
How Auto Heading Works

When Auto Heading is engaged, the ROV will automatically respond to changes in heading (measured by the compass) by applying horizontal thrust to maintain the current heading. If the Auto Heading Indicator is moved to a new heading, the ROV will automatically respond by applying horizontal thrust until the heading of the ROV matches the heading indicated by the Auto Heading Indicator.

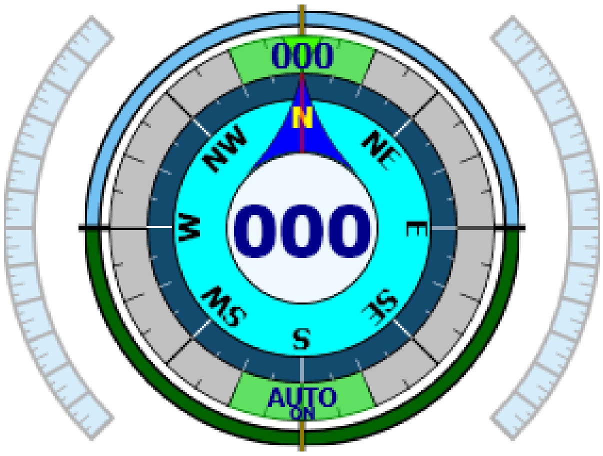
See the Compass section in the VideoRay Cockpit Guide for information about the Compass.

Using Auto Heading to Hold a Heading

To hold the current Heading, center the joystick and click and drag the Auto Heading Indicator on the Compass to the current heading. The Auto Heading Indicator should change from gray to green and the text from "Auto Off" to "Auto On." The ROV will hold the current heading. You can apply forward or backward thrust to move in the direction of the heading. To turn to a new heading while Auto Heading is engaged, displace the joystick laterally to apply thrust in the desired direction. You do not need to disengage Auto Heading, and when you center the joystick, Auto Heading will take over and maintain the new heading.



Auto Heading Off

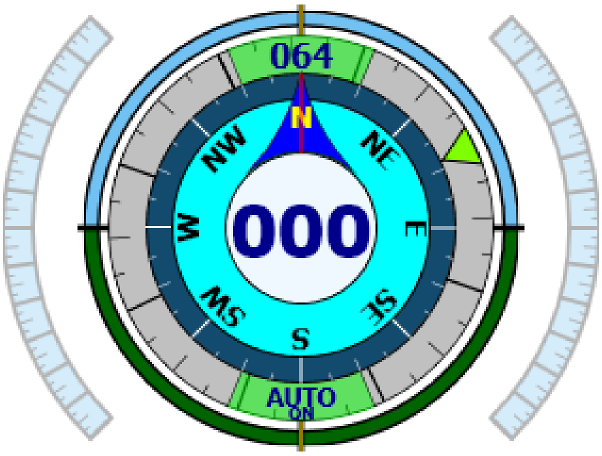


Auto Heading Engaged

Using Auto Heading to Automatically Turn to a Heading

To rotate the ROV to a specified heading, center the joystick and click and drag the Auto Heading Indicator to the desired heading. The Auto Heading Indicator should change from black to green and the text from "Auto Off" to "Auto On." The ROV will turn to the heading. Note that the heading to which you want to turn is displayed in the Auto Heading Indicator at the top of the compass. You can override the Auto Heading to pilot the ROV manually by used the joystick. When you center the joystick, Auto Heading will take over and turn the ROV to the specified heading.

Using Auto Heading to Turn to a Specified Heading



Disengaging Auto Heading

While the joystick is displaced laterally from its center position, Auto Heading will temporarily suspend itself until the joystick is centered again. The Auto Heading indicator will change from green to gray and display the word "Manual" to indicate that the heading is being controlled manually.

To disengage Auto Heading completely, click on the Auto Heading Indicator. The Auto Heading Indicator turns from green to gray when Auto Heading is disengaged.

For most operations, you can engage Auto Heading and leave it engaged, because it will hold the ROV at the heading you want, but you can manually override Auto Heading to turn to a new heading without having to disengage it.

Additional Notes

Auto Heading can only be engaged while the joystick is centered. Center the joystick before engaging Auto Heading. When the joystick is centered, the horizontal thrusters settings indicators are transparent. When you apply thrust, the horizontal thrusters settings indicators become opaque to provide a visual indication that Auto Heading cannot be engaged.

When Auto Heading is Off and the joystick is centered, there will be no horizontal thrust. When Auto Heading is On and the joystick is centered, the system will apply thrust as necessary to maintain a constant heading.

DANGER When Auto Heading is On, the horizontal thrusters may spin on their own. Keep fingers, hair and objects away from the horizontal thrusters when Auto Heading is On.

Relative Heading

Relative heading uses the Turns Indicator instrument to represent the directional orientation of the ROV relative to an arbitrary reference direction. For example, the pilot can adjust the turns indicator so that when the ROV is facing away from the pilot, the turns indicator arrow will point straight up. When the ROV turns to the right, the arrow will spin to the right by the same amount.

Set up

To set up the turns indicator for relative heading use, follow these steps:

- Position the ROV so that its forward direction is aligned with the direction you want the Turns Indicator arrow to point straight up. Typically, this will be with the ROV facing in the same direction the pilot is facing, but it could also be aligned with a local landmark such as a pier or a ship.
- Open the Turns Indicator settings and click on the compass icon.
- The Turns Indicator arrow will be rotated so that is it straight up.

Use

The Turns Indicator arrow will now be aligned with the ROV's direction relative to the pilot or selected land mark.

The Base Heading value will be displayed at the top of the Turns Indicator dial and a small blue mark indicating the magnetic heading of 0 will be displayed just inside the perimeter of the dial.