



ROTATING MANIPULATOR



OPERATOR'S MANUAL

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About this Document

Online Manual

This Quick Start Guide is a subset of the full version of this manual, which is available on the Rotating Manipulator control panel and online in the following formats:

- Installed on the Rotating Manipulator control panel at: rotating_manipulator for viewing the HTML locally.
- http://download.videoray.com/rotating_manipulator for viewing the HTML online.
- http://download.videoray.com/documentation/rotating_manipulator/pdf/videoray_doc_rotating_manipulator.pdf for viewing the PDF online.
- http://download.videoray.com/documentation/rotating_manipulator/zip/videoray_doc_rotating_manipulator.exe for downloading the HTML and PDF files.

The VideoRay Rotating Manipulator is an easy to use accessory tool for the Pro 4. This documentation will aid you in learning how to operate the Rotating Manipulator.

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 [Software Guide](#) explains the software features and operation in detail.
- The [Operations Guide](#) provides tips on how to use the equipment most effectively.
- The [Maintenance Guide](#) provides procedures for routine maintenance, diagnostics and repair.
- The [Compatibility Guide](#) provides information about the Rotating Manipulator's compatibility with other accessories.

Document Conventions

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

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

Beyond this Document

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

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

Quality Commitment

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

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

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Disclaimer

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

How to Get Help

Help for your Rotating Manipulator is available through several channels.

All Hours Self-Service / Crowd-Source Tools

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

Global Support

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

Regional Support

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

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

Operational Strategies and Tactics Support

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

Rotating Manipulator Overview



The VideoRay Rotating Manipulator is an accessory tool for use with the VideoRay Pro 4. Its features include full 360° head rotation and five interchangeable jaws.



These jaws allow the Rotating Manipulator to be used in a number of different applications. The operator can use the Rotating Manipulator to grasp, scoop up, cut, and retrieve submerged objects. See the Interchangeable Jaws page for more information.

Quick Start Instructions

These Quick Start Instructions are streamlined to cover just the essentials of operating your Rotating Manipulator 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 Rotating Manipulator system.



Topics in this Section

- [Safety First](#)
- [System Components](#)
- [Pre-Dive Preparations](#)
- [Dive Operations](#)
- [Post-Dive Operations](#)

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.

The Rotating Manipulator has pinch points and the cutter has a sharp blade. Caution should be used when handling the Rotating Manipulator.



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.

The Rotating Manipulator includes a primary body, five interchangeable jaws, skid plate, float, and counterbalance weight. See the Equipment Guide for more information.



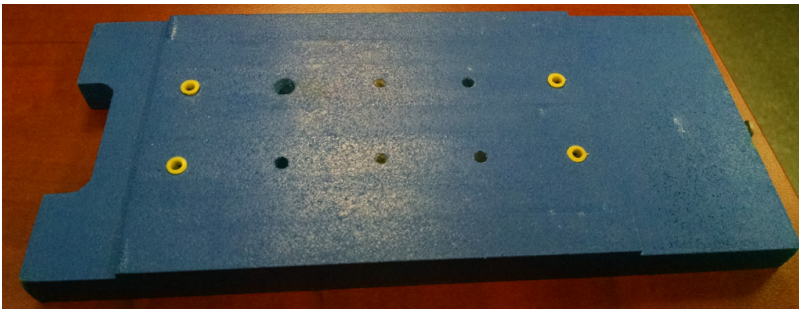
Rotating Manipulator Body



Rotating Manipulator Jaws



Rotating Manipulator Skid



VideoRay Center Float



Counterbalance Weight

The Rotating Manipulator also includes miscellaneous attachment hardware, software, a tool kit and an alternate center float designed to be used with the BlueView sonar.

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

The Rotating Manipulator requires installation before use. Follow the steps below to prepare the Rotating Manipulator for operation:

1. Install the Rotating Manipulator software (one time only). See the Software Installation page for more information.
 2. Configure the system for the desired use (each time there is a change which device is being used). See the Software Guide for more information.
 3. Select the desired jaw and mount it on the actuator of the Rotating Manipulator body. See the Changing Jaws page for more information.
 4. The Rotating Manipulator includes two buoyancy compensation floats. A standard VideoRay float is provided for use on the ROV without a BlueView sonar, and a BlueView float is provided for use on the ROV with a BlueView sonar. Select the desired float and mount in on the Rotating Manipulator body. If using the standard VideoRay float, also mount the counterbalance weight on the rear of the Rotating Manipulator body. See the Mounting page for more information.
 5. Mount the Rotating Manipulator on the Rotating Manipulator skid. See the Mounting page for more information.
-  The Rotating Manipulator skid has additional mounting holes that are not included in the standard Pro 4 skid.
6. Remove the standard skid from the ROV. See the Mounting page for more information.
 7. Mount the Rotating Manipulator on the ROV. See the Mounting page for more information.
 8. Attach the interface cable to the Rotating Manipulator connector. See the Mounting page for more information.
 9. Connect the interface cable to the ROV's Accessory Port. See the Mounting page for more information.
 10. Check to make sure all components are secured tightly and perform a functions test to ensure the Rotating Manipulator is working properly before diving. See the Operations Guide for more information.

Good Advice

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

Dive Operations

Prior to launching the VideoRay, check the buoyancy and adjust the ballast weights as necessary to achieve the desired buoyancy and trim. See the Pro 4 Operator's Manual for more information.

When diving with the Rotating Manipulator, the Pro 4 Hand Controller (See the Pro 4 Hand Controller page for more information). is used to activate the open, close, and rotation functions of the Rotating Manipulator. See the Operations Guide for more information.

Practice Makes Perfect

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

Post-Dive Operations

Make sure to clean and rinse all equipment in fresh water after use. Allow the components to dry before storage. For optimal results, remove the Rotating Manipulator before attempting to clean the equipment. See the Mounting page for more information.

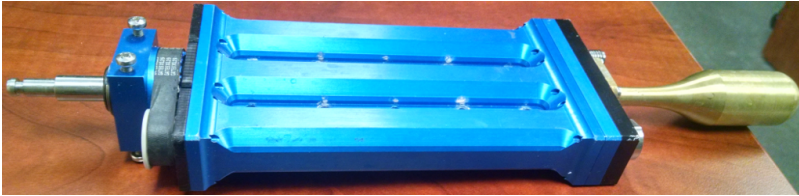
Ready to Learn More?

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.

Equipment Guide

Rotating Manipulator Body

The Rotating Manipulator body houses the motor and electronics. The actuator drives the opening, closing and rotation of the attached jaw.



Rotating Manipulator Body

Rotating Manipulator Jaws

The five interchangeable jaws offer different capabilities of operation for the Rotating Manipulator. See the Interchangeable Jaws page for more information.



Rotating Manipulator Jaws

Rotating Manipulator Skid

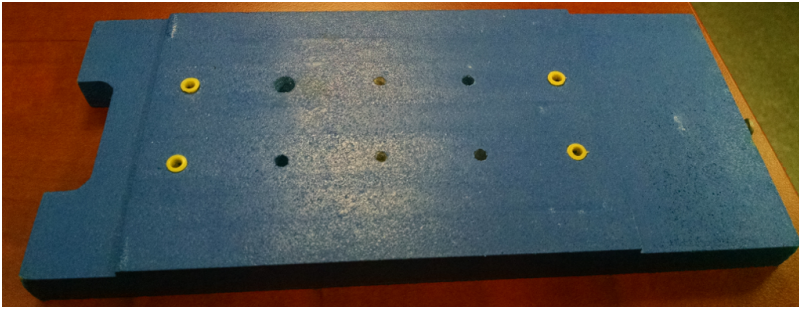
The Rotating Manipulator Skid is used to attach the Rotating Manipulator to the Pro 4 ROV.



Skid Plate

VideoRay Center Float

The VideoRay Center Float is used to provide buoyancy for the Rotating Manipulator when it is attached to the ROV without a BlueView sonar.



VideoRay Center Float

Counter Balance Weight

The Counter Balance Weight is used to provide stability to the ROV in water. The Counter Balance Weight remains below the water level to counteract the effects of weight on the ROV.

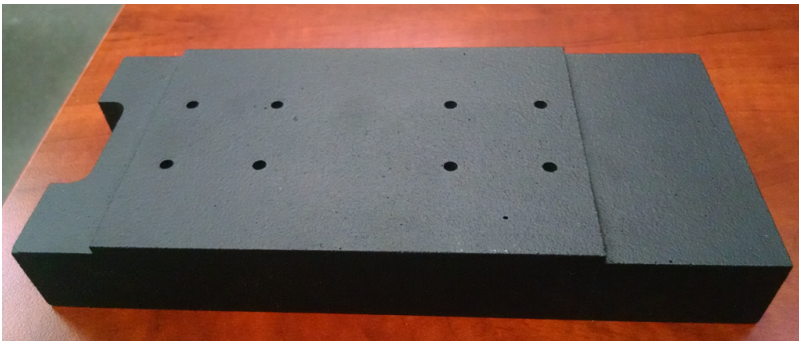


Counter Balance Weight

⚠ The Counterbalance Weight should not be used when the Rotating Manipulator is being used with a BlueView sonar. When the Rotating Manipulator and BlueView sonar are used together, there is no flotation capacity for any other accessories.

Blueview Center Float

The BlueView Center Float is used to provide buoyancy for the Rotating Manipulator when it is attached to the ROV with a BlueView sonar.



BlueView Center Float

Additional Equipment

Additional equipment provided with the Rotating Manipulator includes mounting screws and tool kit, and software.

Interchangeable Jaws

There are five different interchangeable jaws - Parallel jaw, V-jaw, Sampler jaw, Trident jaw, and Cutter. Each jaw has a different purpose and is tailored to a specific situation, which gives the user an array of options when using the Videoray Pro 4.

DANGER CAUTION The Rotating Manipulator jaws have pinch points or cutting blades and should be used with caution.

Parallel Jaw

The jaws of the Parallel Jaw move parallel to each other allowing it to grasp cylindrical objects such as pipes without slipping. This makes it ideal for untangling tether. The Parallel Jaw has a closing strength of 25 PSI, which is the



maximum of any of the jaws.



V-Jaw

The V-Jaw can open wider than the Parallel jaw, allowing it to grasp larger objects. The V-Jaw also has overlapping jaws that make it ideal for picking up bulky objects, especially netting.



Sampler

The Sampler Jaw allows operators to gather samples up to 45 ml. The sampler has a rubber gasket seal which prevents samples from escaping the jaw.



Trident

The Trident Jaw works like a "claw", which allows the Rotating Manipulator arm to pick up much larger objects than the VideoRay standard manipulator. The trident is able to grab objects that are circular. These objects can be difficult to grasp for the Parallel and V- Jaws.



Cutter

The Cutter has a cutting force of 36 kg (80 pounds) can slice through rope or cord up to 1.9 cm (0.75 inches).



The Cutter is a potent slicing tool and if not used with care, can do serious harm to the operator or other individuals.

Installation and Removal

Installation consists of installing the desired jaw on the Rotating Manipulator (See the Changing Jaws page for more information) and mounting the Rotating Manipulator on the ROV. See the Mounting page for more information.

 Software installation is required before using the Rotating Manipulator. See the Software Installation page for more information.

Installing and Removing Jaws

 The ROV should be turned off before installing or removing a jaw.

Jaw Installation

1. Select the desired jaw.
2. Remove the actuator interlocking screws and clips from the actuator linkage of the jaw.
3. Align the actuator interlocking linkage of the jaw with the actuator, and the sides of the jaw with the Rotating frame.
4. Slide the jaw onto the Rotating frame until the screw holes align. Make sure to keep the interlocking linkage of the jaw aligned with the actuator.
5. Install the screws that hold the jaw to the Rotating frame.
6. Manually open or close the jaw until the slot in the actuator protrudes through the actuator linkage.
7. Replace the actuator interlocking clips to engage the slot and secure the clips with the screws.

Jaw Removal

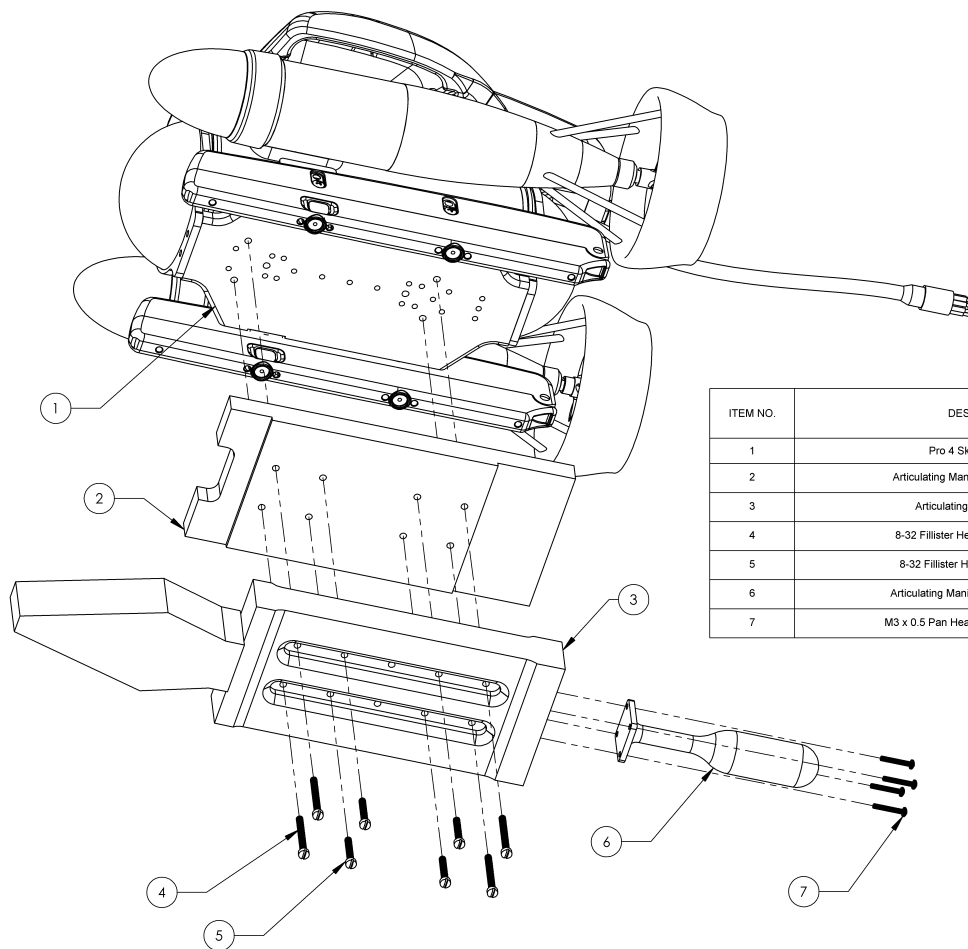
1. Remove the actuator interlocking screws and clips from the actuator linkage of the jaw.
 2. Remove the screws that hold the jaw to the Rotating frame.
 3. Remove the jaw from the actuator and Rotating frame.
 4. Replace the actuator interlocking screws and clips.
-

Mounting the Rotating Manipulator on the ROV

The procedures for mounting the Rotating Manipulator on the ROV use different components depending upon whether the Rotating Manipulator is to be used with or without a BlueView sonar. Use the appropriate mounting instructions below.

 The ROV should be turned off before installing or removing the Rotating Manipulator.

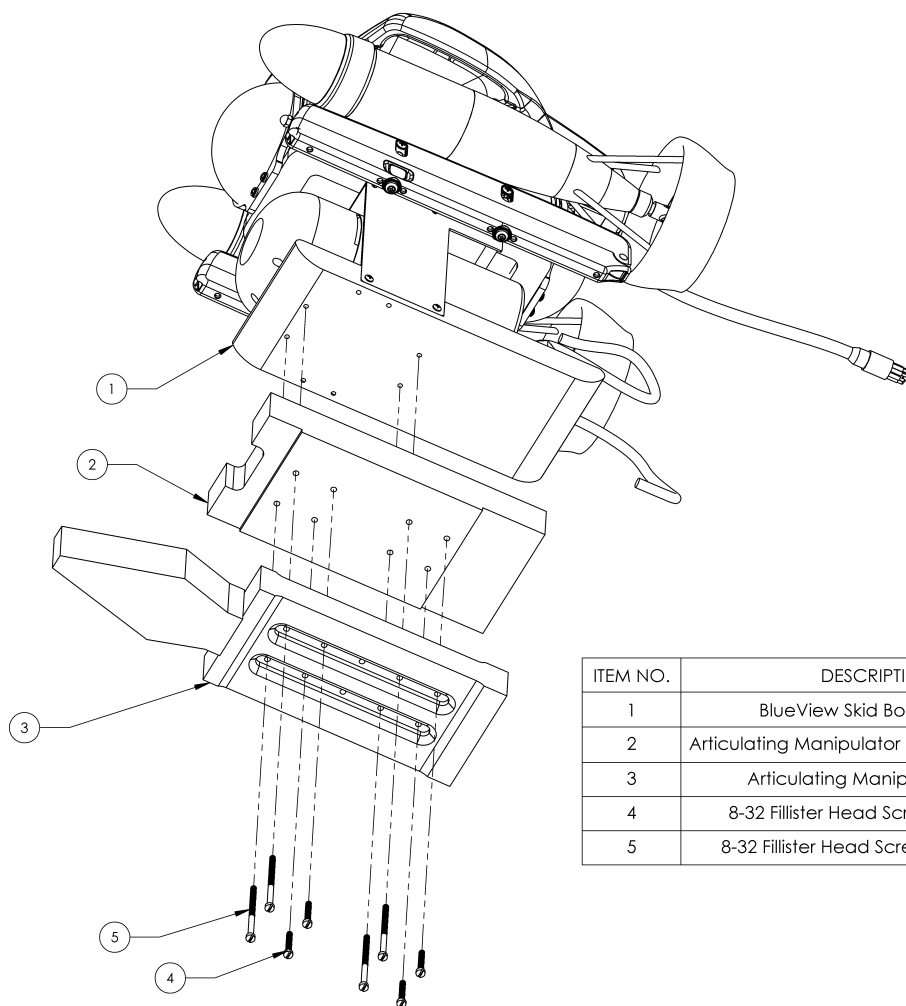
Installation on an ROV without a BlueView Sonar



ITEM NO.	DESCRIPTION	QTY.
1	Pro 4 Skid Center Plate	1
2	Articulating Manipulator Standard Float	1
3	Articulating Manipulator Body	1
4	8-32 Fillister Head Screw, 1.5" Length	4
5	8-32 Fillister Head Screw, 1" Length	4
6	Articulating Manipulator Counter weight	1
7	M3 x 0.5 Pan Head Screw, 20 mm Length	4

1. If attached, remove the strain relief from the skid of the ROV.
2. Remove the standard skid from the ROV.
3. Attach the Rotating Manipulator skid to the ROV using the standard screws and washers through the dome rings.
4. Attach the strain relief to the Rotating Manipulator skid.
5. Attach the VideoRay Center Float to the Rotating Manipulator using the four 8-32 x 1 inch screws in the center holes of the float. Note the orientation of the float relative to the Rotating Manipulator in the diagram above.
6. Attach the counterbalance weight to the rear of the Rotating Manipulator body using the four M3x0.5 20 mm screws.
7. Attach the Rotating Manipulator to the Rotating Manipulator skid using the four 8-32 x 1.5 inch screws through the outer holes of the float.
8. Connect the cable to the Rotating Manipulator connector at the rear of the manipulator and to the ROV's accessory port. Make sure to seal the female end of the 9 pin connector with a terminating dummy plug.

Installation on an ROV with a BlueView Sonar



ITEM NO.	DESCRIPTION	QTY.
1	BlueView Skid Bottom Plate	1
2	Articulating Manipulator Float for BlueView	1
3	Articulating Manipulator Body	1
4	8-32 Fillister Head Screw, 1" Length	4
5	8-32 Fillister Head Screw, 2.5" Length	4

1. Attach the BlueView Center Float to the Rotating Manipulator using the four 8-32 x 1 inch screws in the second and fourth sets of holes from the front of the float. Note the orientation of the float relative to the Rotating Manipulator in the diagram above.
2. Attach the Rotating Manipulator to the skid using the four 8-32 x 2.5" screws in the first and third sets of holes from the front of the float.
3. Attach the skid to the ROV using the standard screws and washers through the dome rings.
4. Connect the cable to the Rotating Manipulator connector at the rear of the manipulator and to the ROV's accessory port. The sonar cable should be connected to the ROV's accessory port first. Make sure to seal the female end of the 9 pin connector with a terminating dummy plug.

⚠ The Counterbalance Weight should not be used when the Rotating Manipulator is being used with a BlueView sonar.

Removal of the Rotating Manipulator from the ROV

1. Remove the cable from the ROV's accessory port and the connector at the rear of the Rotating Manipulator. Make sure to replace the terminating dummy plug in the ROV's accessory port.
2. Remove the Rotating Manipulator and skid from the ROV.
3. Replace the standard skid on the ROV.
4. Remove the Rotating Manipulator from the skid by removing the four long screws.
5. Remove the float from the Rotating Manipulator by removing the four short screws.
6. If the counterbalance weight was used, remove it from the Rotating Manipulator.
7. Remove the jaw and check to make sure that it is free from debris. See the Changing Jaws page for more information.
8. Check to make sure the rotation belt is free from debris.
9. Rinse all of the components and lubricate the cable connections with silicone spray.
10. Allow the components to dry.
11. Store the components in the case.

Additional information about VideoRay Pro 4 parts can be found in the Pro 4 Equipment Guide. See the Pro 4 Equipment guide for more information.

Software Guide

Prior to using the Rotating Manipulator, the software must be installed and configured. Once installed and configured, the Rotating Manipulator software is fully integrated with VideoRay Cockpit. See the Software Management page for more information.

Rotating Manipulator Instrument

The software interface includes a Rotating Manipulator instrument that provides feedback on the manipulator status.

The instrument displays information about the action of the effector (jaw or cutter), rotation, and power consumption.



Manipulator Instrument

When opening, the instrument displays an indication that the effector (jaw or cutter) is opening.



Manipulator Instrument Displaying Open

When closing, the instrument displays an indication that the effector (jaw or cutter) is closing.



Manipulator Instrument Displaying Close

When Rotating clockwise (as determined by the hand controller motion and when viewed from the ROV's camera), the instrument displays an indication that the effector (jaw or cutter) is Rotating in an clockwise direction.



Manipulator Instrument Displaying Clockwise Rotation

When Rotating counter-clockwise (as determined by the hand controller motion and when viewed from the ROV's camera), the instrument displays an indication that the effector (jaw or cutter) is Rotating in a counter-clockwise direction.



Manipulator Instrument Displaying Counter Clockwise Rotation

The bar indicator in the upper right displays the power consumption while the manipulator is being activated.

 The rotational feedback is based upon the status of the hand controller input, not the actual manipulator action.

Software Management

The Rotating Manipulator includes software that modifies VideoRay Cockpit to recognize the Rotating Manipulator, Rotating Cutter or standard VideoRay manipulator. You can switch the active configuration as often as necessary to match the manipulator in use, but only one configuration may be active at any time. The configurations and instructions for selecting the desired configuration are included below.



VideoRay Cockpit software must be stopped to change configurations.

1. Rotating Manipulator - use this configuration when using the Rotating Manipulator with any jaw except the cutter. To select this configuration, double click on the Use Rotating Manipulator shortcut on the desktop.
2. Rotating Cutter - use this configuration when using the Rotating Manipulator with the cutter. To select this configuration, double click on the Use Rotating Cutter shortcut on the desktop.
3. Standard Manipulator - use this configuration when using the standard manipulator. This is the default configuration installed on all Pro 4s. To select this configuration, double click on the Use Standard Manipulator shortcut on the desktop.



The software is pre-installed on the Pro 4 computer if the manipulator is purchased as part of a Pro 4 ROV system. If the manipulator is purchased separately, the software must be installed. The software is included on a flash drive and can be downloaded from VideoRay's [software download](#) page.

Software Installation

To install the Rotating Manipulator software, follow these instructions:

1. Use the flash drive included with the Rotating Manipulator, or download the software from VideoRay's [software download](#) page.
2. Double click rotating_manipulator.exe. This will copy the files to your local hard drive.



Prior to using the Rotating Manipulator, you need to configure the software to specify whether you are using the Rotating Manipulator, Cutter or standard manipulator. See the Software Management page for more information.



The software is pre-installed on the Pro 4 computer if the manipulator is purchased as part of a Pro 4 ROV system. If the manipulator is purchased separately, the software must be installed. The software is included on a flash drive and can be downloaded from VideoRay's [software download](#) page.

Software Updates

Software updates can be downloaded from VideoRay's [software download](#) page. Instructions will be delivered with the update.

Operations Guide

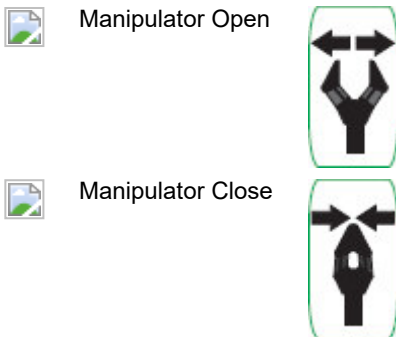
Prior to using the Rotating Manipulator the following steps are necessary:

1. Install the Rotating Manipulator software (one time only). See the Software Installation page for more information.
 2. Configure the system for the desired use (each time there is a change which device is being used). See the Software Guide for more information.
 - and
 3. Select the desired jaw and mount it on the actuator of the Rotating Manipulator body. See the Changing Jaws page for more information.
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 5. Mount the Rotating Manipulator on the Rotating Manipulator skid. See the Mounting page for more information.
-  The Rotating Manipulator skid has additional mounting holes that are not included in the standard Pro 4 skid.
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 7. Mount the Rotating Manipulator on the ROV. See the Mounting page for more information.
 8. Attach the interface cable to the Rotating Manipulator connector. See the Mounting page for more information.
 9. Connect the interface cable to the ROV's Accessory Port. See the Mounting page for more information.
 10. Check to make sure all components are secured tightly and perform a functions test to ensure the Rotating Manipulator is working properly before diving. See the Operations Guide for more information.
 11. Check the buoyancy and adjust the ballast weights as necessary to achieve the desired buoyancy and trim. See the Pro 4 Operator's Manual for more information.

Operating the Jaws or Cutter

The Rotating Manipulator is operated by use of the Pro 4 Hand Controller. See the Hand Controller page for more information.

Open and Close Button Locations and Labels



Press the desired button to activate that function of the Rotating Manipulator

Rotation Control

Manipulator Rotate

There is no label for rotation.



Rotate the joystick to activate the rotation of the Rotating Manipulator. Clockwise rotation of the joystick activates clockwise rotation (when viewed from the ROV's camera) of the manipulator. Counterclockwise rotation of the joystick activates counter clockwise rotation (when viewed from the ROV's camera) of the manipulator.

GamePad Style Controller



Operating Tactics

When operating the manipulator, tilt the Pro 4's camera down to focus on the jaw to provide a clear view of the manipulator.

Retrieving heavy objects that the ROV cannot lift under its own thrust can be achieved by grasping the object and pulling the tether. Do not exceed 45 kg (100 pounds). Another solution for even heavier objects is to feed subsequently larger and larger "messenger" lines through an attachment point on the object until the line can support the load.

When trying to turn an object using the rotation of the manipulator, the ROV must be positioned so that it is immobilized to resist the torque. Adding a homemade lever arm may provide a workable solution.

Maintenance Guide

Always rinse and soak all submerged equipment in fresh water after use. After use, the Rotating Manipulator should be inspected for anything that may have gotten stuck in the jaw mechanism or rotation frame and pulley system.

All screws that are used to attach the jaw should be lubricated with Tef-Gel to prevent corrosion or seizure.

A silicon spray lubricant should be used periodically to lubricate the moving linkages of the jaws.

Compatibility Guide

ROV Models

ROV	Notes
Pro 4	Yes
Pro 4 Ultra	No
Deep Blue / Pro 3 GTO	No*
Pro 3	No*
Explorer / Scout	No

CAUTION * The Pro 3 is not compatible with the Rotating Manipulator. Attaching one may damage your equipment!

Weight

Medium	Weight Kg (pounds)
Air	2.4 kg (5.25 lbs)
Fresh Water	0.97 kg (2.1 lbs)

Dimensions

Dimension	cm (inches)
Length	47 (18)
Width	10.2 (4)
Height	5.00 (2)

Accessory Compatibility

The Rotating Manipulator is compatible with the BlueView and Tritech Micron sonars and Micron Nav positioning system.

Questions?

For questions of compatibility, contact [VideoRay](#) for more information.