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About this Document

The VideoRay Articulating Manipulator is an easy to use accessory tool for the Pro 4. This documentation will aid you in learning how to operate the Articulating 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 Articulating 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 Note icon is used to emphasize a specific detail or point of information.
	The Tip icon is used to highlight a suggestion.

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/articulating_manipulator for viewing the HMTL online.
- http://download.videoray.com/documentation/articulating_manipulator/pdf/videoray_doc_articulating_manipulator.pdf for viewing the PDF online.
- http://download.videoray.com/documentation/zip/videoray_doc_articulating_manipulator.exe for downloading the HTML and PDF files.



How to Get Help

Help for your Articulating 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.

Articulating Manipulator Overview



The VideoRay Articulating 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 Articulating Manipulator to be used in a number of different applications. The operator can use the Articulating Manipulator to grasp, scoop up, cut, and retrieve submerged objects. For more information about the Articulating Manipulator jaws and their uses see the [Interchangeable Jaws](#) page.

Quick Start Instructions

These Quick Start Instructions are streamlined to cover just the essentials of operating your Articulating 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 Articulating 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 Articulating Manipulator has pinch points and the cutter has a sharp blade. Caution should be used when handling the Articulating 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 Articulating Manipulator includes a primary body, float, skid plate, and five interchangeable jaws.



Articulating Manipulator Body



Articulating Manipulator Jaws



VideoRay Center Float



Counterbalance Weight



Articulating Manipulator Skid

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



See the [Equipment Guide](#) for more information about each component.

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 Articulating Manipulator requires installation before use. Follow the steps below to prepare the Articulating Manipulator for use:

1. Install the Articulating Manipulator software. 
 2. Select the desired jaw and mount it on the actuator of the Articulating Manipulator body. 
 3. The Articulating 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 it on the Articulating Manipulator body. If using the VideoRay float, also mount the counterbalance weight on the rear of the Articulating Manipulator body. 
 4. Mount the Articulating Manipulator on the Articulating Manipulator skid. 
- ⚠** The Articulating Manipulator skid has additional mounting holes that are not included in the standard Pro 4 skid. 
5. Mount the Articulating Manipulator on the ROV and attach the cable to the ROV Accessory Port. 
 6. Check to make sure all components are secured tightly and perform a functions test to ensure the Articulating Manipulator is working properly before diving. 

Good Advice

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

Dive Operations

When diving with the Articulating Manipulator, the Pro 4 [Hand Controller](#) is used to activate the open, close, and rotation functions of the Articulating Manipulator. For more details on operating the Articulating Manipulator, see the [Operations Guide](#).

Practice Makes Perfect

Developing the skills to operate your Articulating 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 instructions on how to remove the Cygnus Ultrasonic Thickness Gauge, please see the [Removal](#) section in the [Operations Guide](#).

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

The following items are necessary to use the Articulating Manipulator:

Hardware

- A VideoRay Pro 4 ROV system

Software

- VideoRay Cockpit version 1.10.2.3 or newer

User Knowledge and Skills

Users should be familiar with the basic operations of a Pro 4 ROV system and software installation procedures.

Specifications

The maximum depth rating for the Articulating Manipulator is 300 meters (1,000 feet).

The Articulating Manipulator uses 12 Volts with a maximum current draw of approximately 1 Amp. This equates to 12 Watts of power consumption.

Jaw Specifications



	Parallel	V-Jaw	Sampler	Trident	Cutter
Depth Rating	305 m (1,000 ft)				
Head Rotation	360° / 12 RPM				
Size (w/ mount)	47 x 10.2 x 5.0 cm (18.5 x 4.0 x 2.0 in)	47 x 10.2 x 5.0 cm (18.5 x 4.0 x 2.0 in)	47 x 10.2 x 5.0 cm (18.5 x 4.0 x 2.0 in)	47 x 10.2 x 5.0 cm (18.5 x 4.0 x 2.0 in)	47 x 10.2 x 5.0 cm (18.5 x 4.0 x 2.0 in)
Weight in Air	2.4 kg (5.25 lbs)				
- w/ Submersible	7.3 kg (16 lbs)				
Weight in Water - w/ Submersible	.97 kg (2.1 lbs) 0 kg (0 lbs)				
Breaking Strength	45 kg (100 lbs)				
Maximum Opening	5.7 cm (2.25 in)	17.5 cm (6.875 in)	16.5 cm (6.5 in)	15.2 cm (6 in)	2.3 cm (.91 in)
Closing Force	25 PSI	22 PSI	10 PSI	18 PSI	30+ PSI
Max. Sample Size	N/A	N/A	45 mL (1.5 oz)	N/A	N/A
Max. Cut Diameter	N/A	N/A	N/A	N/A	1.9 cm (.75 in)

 Articulating Manipulator features and specifications are subject to change without notice.

Product News

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



Articulating Manipulator Glossary

Actuator - The part of the Articulating Manipulator that causes the jaws or cutter to open and close.

Articulating - The ability of a joint to move. In this case, the Articulating Manipulator is able to rotate the actuator.

Center Float - A float designed specifically for the Articulating Manipulator to provide addition buoyancy to counter the weight of the manipulator.

Counterbalance Weight - A weight designed to help maintain an even pitch of the ROV when the Articulating Manipulator is installed on the ROV.

Effector - Another name for the jaws or cutter.

Rotating Frame - The part of the Articulating Manipulator that causes the jaws or cutter to rotate.

Equipment Guide

Articulating Manipulator Body

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



Articulating Manipulator Body

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

Articulating Manipulator Jaws

Five interchangeable jaws offer different capabilities of operation for the Articulating Manipulator. For more information about each jaw, see the [Interchangeable Jaws](#) page.



Articulating Manipulator Jaws

VideoRay Center Float

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



VideoRay Center Float

Blueview Center Float

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



BlueView Center Float

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

Articulating Manipulator Skid

Articulating Manipulator Skid is used to attach the Articulating Manipulator to the Pro 4 ROV.



Skid Plate

⚠️ The Articulating Manipulator skid has additional mounting holes that are not included in the standard Pro 4 skid.

Additional Equipment

Additional equipment provided with the Articulating 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 jaw. 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. Product specifications for each jaw can be viewed on the [Specifications](#) page.



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

When operating the Cutter, the open and close controls are inverted from the behavior of the other jaws.



The Articulating Manipulator jaws have pinch points or cutting blades and should be used

with caution.

Installation and Removal

Installation consists of [installing the desired jaw on the Articulating Manipulator](#) and [mounting the Articulating Manipulator on the ROV](#). These procedures are described in the following sections.

Software installation is required before using the Articulating Manipulator. See the [Software Installation](#) section 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

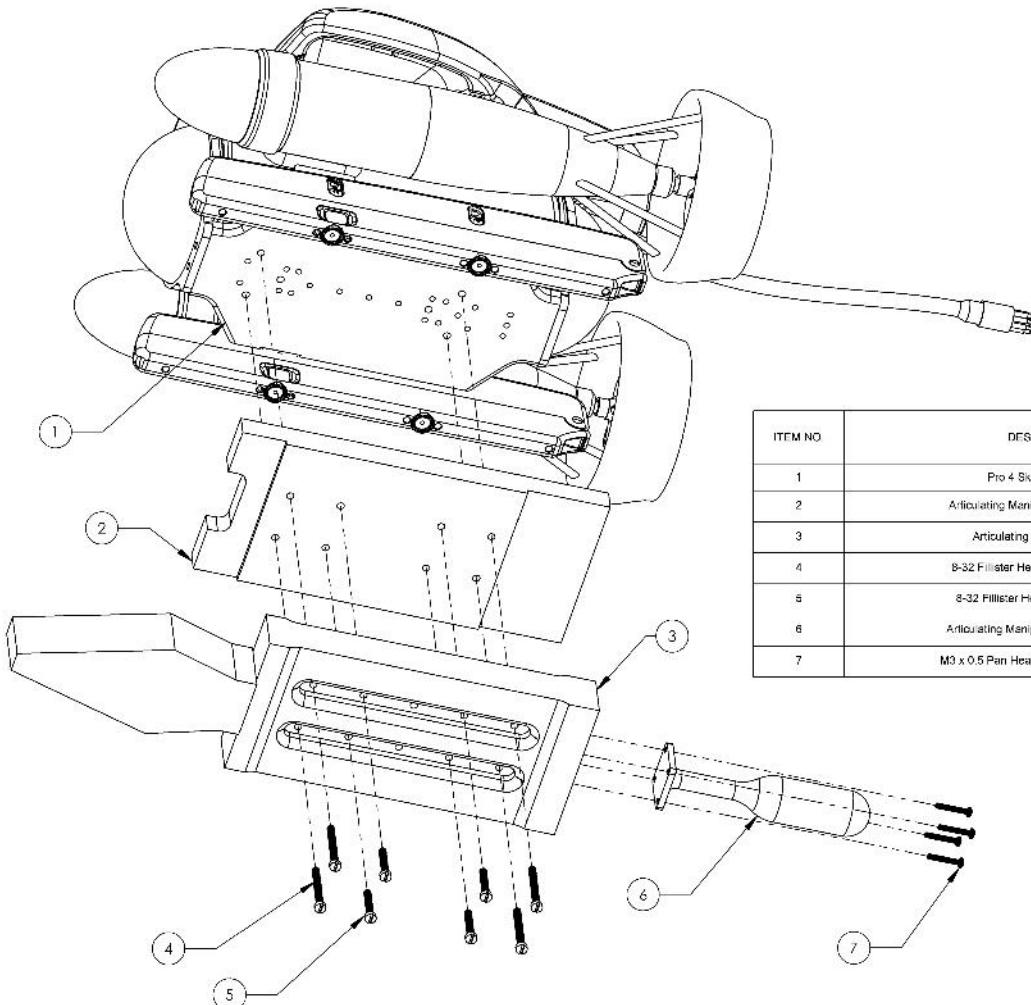
1. Remove the actuator interlocking screws and clips from the actuator linkage of the jaw.
2. Remove the screws that hold the jaw to the rotating frame.
3. Remove the jaw from the actuator and rotating frame.
4. Replace the actuator interlocking screws and clips.

Mounting the Articulating Manipulator on the ROV

The procedures for mounting the Articulating Manipulator on the ROV use different components depending upon whether the Articulating 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 Articulating 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 Phillips 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. Attach the VideoRay Center Float to the Articulating 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 Articulating Manipulator in the diagram above.
2. Attach the counterbalance weight to the rear of the Articulating Manipulator body using the four M3x0.5 20 mm screws.
3. Attach the Articulating Manipulator to the skid using the four 8-32 x 1.5 inch screws through the outer holes of the float.
4. Attach the skid to the ROV using the standard screws and washers through the dome rings.
5. Connect the cable to the Articulating 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

