

**VR3-UWM RECEIVER**  
**OPERATING MANUAL**

**9-12-2011**

**VEMCO**, a Division of AMIRIX Systems Inc.

## **AMIRIX Systems Inc. Warranty and Disclaimer**

### **WARRANTY**

AMIRIX Systems Inc., doing business under its trade name VEMCO, provides a one (1) year warranty period for the Product from date of shipment.

VEMCO warrants that on the date of shipment all Products manufactured by VEMCO are free from defects in material and workmanship under normal use and service. This warranty applies to the components necessary for equipment upgrades, i.e. the VR1/VR2 to VR2W upgrade. With respect to transmitter products, while VEMCO is able to predict battery life with some certainty, VEMCO cannot guarantee that these Products will remain functional while submerged for extended periods of time. This warranty does not apply to any equipment, materials or design supplied by Buyer or a third party; re-battery services provided by VEMCO; Products for which VEMCO has not received payment; problems that results from: external causes such as accident, abuse, misuse; servicing not authorized by VEMCO; usage not in accordance with Product instructions; failure to follow the Product instructions or failure to perform preventative maintenance; usage of accessories, parts or components not supplied by VEMCO.

This warranty shall survive delivery only on the conditions and subject to the limitations set forth below.

### **NOTICE PERIODS**

To receive a warranty remedy for a Product, Buyer must contact VEMCO's Customer Support Department during the warranty period to receive the Return Material Authorization ("RMA") instructions. Each defective Product returned for warranty remedy must be shipped at the Buyer's expense according to the RMA instructions and must include reasonable proof that the claimed defect is due to a matter embraced within the warranty set forth above and that such defect did not result from any act or omission of Buyer, including but not limited to any failure to operate and maintain the Product in accordance with VEMCO's applicable written instructions.

### **REMEDY**

VEMCO's liability, and the Buyer's exclusive remedy under this warranty, as to a defect in material or workmanship, is limited to the repair of such defect in the accessory, equipment or part in which the defect appears or, at VEMCO's option, to the replacement of such accessory, equipment or part with a similar item free from defect. As to any item repaired by VEMCO or furnished as a replacement by VEMCO, VEMCO's liability and the Buyer's exclusive remedy to the repair or replacement of such item for any further defect in material or workmanship, provided VEMCO receives written notice at Halifax, Nova Scotia, of such further defect from BUYER within ninety (90) days after the repaired or replaced item is shipped to BUYER and provided that BUYER returns same to VEMCO as provided under "Notice Periods".

### **RETURNED ITEMS**

All repairs, replacements and corrections described above shall be performed by VEMCO at its plant at Halifax, Nova Scotia, or at such other place as may be mutually agreeable, and with reasonable care and dispatch in order that the Product, accessory, equipment or part will not be kept out of service longer than necessary. Return to BUYER of a repaired, replacement, or corrected accessory, equipment, part or Product shall be at VEMCO's expense. Title to and risk of loss of the Product, accessory, equipment, or part returned to VEMCO pursuant hereto shall at all times remain with the BUYER, except that title to a returned accessory, equipment, part, or Product shall pass to VEMCO concurrently with shipment to BUYER of any item furnished by VEMCO to BUYER as a replacement therefore. VEMCO shall have only such responsibility for any Product, accessory, equipment, or part owned by the BUYER and in the possession of VEMCO as is chargeable by law to a bailee for hire, but shall not be chargeable for loss of use thereof.

### **WEAR AND TEAR**

Normal wear and tear and the need for regular maintenance shall not constitute a defect under this warranty.

### **DISCLAIMER AND RELEASE**

THE WARRANTIES, OBLIGATIONS AND LIABILITIES OF VEMCO AND THE REMEDIES OF BUYER SET FORTH HEREIN ARE EXCLUSIVE AND IN SUBSTITUTION FOR, AND BUYER HEREBY WAIVES AND RENOUNCES, ALL OTHER WARRANTIES AND OBLIGATIONS OF VEMCO AND ANY ASSIGNEE OF VEMCO AND ALL RIGHTS, CLAIMS AND REMEDIES OF BUYER AGAINST VEMCO, EXPRESS OR IMPLIED, ARISING BY LAW OR OTHERWISE, WITH RESPECT TO ANY NON-PERFORMANCE OR DEFECT IN THE PRODUCT OR IN ANY OTHER THING DELIVERED UNDER THIS AGREEMENT, INCLUDING BUT NOT LIMITED TO:

- (A) ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE;
- (B) ANY IMPLIED WARRANTY ARISING OUT OF COURSE OF PERFORMANCE, COURSE OF DEALING OR USAGE OF TRADE;
- (C) ANY OBLIGATION, LIABILITY, CLAIM OR REMEDY IN TORT, WHETHER OR NOT ARISING FROM THE NEGLIGENCE OF VEMCO OR ANY ASSIGNEE OF VEMCO, ACTUAL OR IMPUTED;
- (D) ANY OBLIGATION, LIABILITY, RIGHT, CLAIM, OR REMEDY FOR LOSS OF OR DAMAGE TO THE PRODUCT, FOR LOSS OF USE, REVENUE, OR PROFIT WITH RESPECT TO THE PRODUCT; OR FOR ANY OTHER DIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES; AND
- (E) VEMCO MAKES NO REPRESENTATION THAT THE PRODUCT WILL NOT INFRINGE ANY PATENT OR OTHER RIGHTS OF ANY PERSON AND BUYER AGREES TO INDEMNIFY VEMCO AND HOLD VEMCO HARMLESS FROM ANY AND ALL CLAIMS AND LIABILITIES WITH RESPECT TO SAME TOGETHER WITH ANY CLAIMS AND LIABILITIES WITH RESPECT TO ANY INFRINGEMENT OF ANY PATENT OR OTHER RIGHTS OF ANY PERSON ARISING AS A RESULT OF BUYER'S PRODUCTS, TECHNOLOGY, ACTIVITIES, OR OTHERWISE.

### **LICENSE AGREEMENT**

VEMCO grants to the Buyer a limited, personal license, with no right to sub-license, to use the Intellectual Property ("IP") and Embedded Software in the manner set out in the Documentation. The Embedded Software and IP are not sold to Buyer. All property rights, including Intellectual Property Rights, remain with VEMCO. All rights related to the Embedded Software not expressly licensed to the Buyer are reserved to VEMCO. BUYER shall not permit any person other than BUYER and its employees to use or make use of the Embedded Software and/or IP. BUYER shall not, and shall not permit any third party to, modify, adapt, translate, reverse engineer, decompile, disassemble, or create derivative works based on the Embedded Software and/or IP. This license is assigned to the Product with which you have acquired the Embedded Software and/or IP. If the Product purchased is a Transmitter product, be advised that the license life is equal to the operational life.

### **EXPORT**

Products and associated materials supplied or licensed hereunder may be subject to various export laws and regulations. It is the responsibility of BUYER to comply with such laws and regulations.

### **NEGOTIATED AGREEMENT**

It is fully understood by the parties that the price of the Product and other mutual agreements of the parties set forth in this agreement were arrived at in consideration of this warranty, SPECIFICALLY INCLUDING THE WAIVER, RELEASE AND RENUNCIATION BY BUYER SET FORTH ABOVE (DISCLAIMER AND RELEASE).

© (2011) AMIRIX Systems Inc. All rights reserved. The information contained herein includes information which is confidential and proprietary to AMIRIX Systems Inc. and may not be used or disclosed without prior written consent of AMIRIX Systems Inc.

# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b> .....	<b>1</b>
1.1	ABOUT VEMCO .....	1
1.2	SYSTEM REVIEW .....	1
1.3	USING THIS MANUAL .....	2
<b>2</b>	<b>APPLICATIONS</b> .....	<b>3</b>
2.1	QUICK SETUP .....	3
2.2	HOW DO I ... ..	4
2.2.1	Deploy a VR3-UWM .....	4
2.2.2	Locate a deployed VR3-UWM.....	4
<b>3</b>	<b>VR3-UWM HARDWARE</b> .....	<b>6</b>
3.1	HARDWARE FEATURES .....	6
3.1.1	Underwater Modem.....	7
3.1.1.1	Modem Communication .....	7
3.1.2	Resume Recording .....	8
3.1.3	Flash Memory .....	9
3.1.4	Battery Pack .....	9
3.2	HARDWARE MAINTENANCE .....	10
3.2.1	Opening VR3-UWM case .....	10
3.2.2	Removing battery pack.....	11
3.2.3	Inserting battery pack .....	11
3.2.3.1	Lithium battery pack.....	11
3.2.3.2	Alkaline battery pack.....	13
3.2.4	Closing VR3-UWM case .....	14
3.2.5	Setting Up Surface Modem .....	16
3.3	DEPLOYING THE VR3-UWM SYSTEM.....	17
3.3.1	Deploying the VR3-UWM receiver .....	17
3.3.2	Deploying the Surface Modem.....	21
<b>4</b>	<b>TESTING</b> .....	<b>22</b>
4.1	IN-AIR TESTING.....	22
<b>5</b>	<b>APPENDICES</b> .....	<b>24</b>
5.1	O-RING CARE .....	24
5.2	TROUBLE-SHOOTING .....	24
5.2.1	Communication Problems .....	24
5.2.2	VR3-UWM Communication Utility.....	25
5.3	GLOSSARY .....	27
5.4	INDEX .....	28



# 1 INTRODUCTION

## 1.1 ABOUT VEMCO

VEMCO, a division of AMIRIX Systems Incorporated, is a leader in the design and manufacture of oceanographic research tools and systems since 1979. Located in Halifax, Nova Scotia, VEMCO's product line ranges from miniature acoustic transmitters and data loggers to large tracking, positioning, and monitoring systems.

For more information on our products, please visit us at [www.vemco.com](http://www.vemco.com).

## 1.2 SYSTEM REVIEW

The VR3-UWM (Underwater Modem) is a submersible, multi-channel acoustic receiver capable of identifying VEMCO coded transmitters. The receiver is housed in a corrosion-resistant plastic high-pressure case with an integral transducer and acoustic modem on the top of the case. The VR3-UWM receiver features include eight megabytes of data storage, underwater retrieval of stored data, a resume study feature, and a replaceable battery pack.

The VR3 receiver records the pinger code number and date/time of valid detections. This information is stored in the receiver's internal memory until it's downloaded to a computer at the surface using the underwater modem and the VR3HS software.

The VR3-UWM software augments the VR3-UWM receiver by having the following features: tilt angle display, range to receiver indication, sensor tag management, data retrieval, and comma delimited data files.

The VR3-UWM detects coded tags but not continuous tags.

The VR3-UWM is useful for data studies in which the receiver won't be retrieved for a long period of time but the data still needs to be collected during the study. The term "study" is used in this manual to refer to the gathering of data for a particular purpose and for a set period of time. The user determines a study's purpose and length of time.

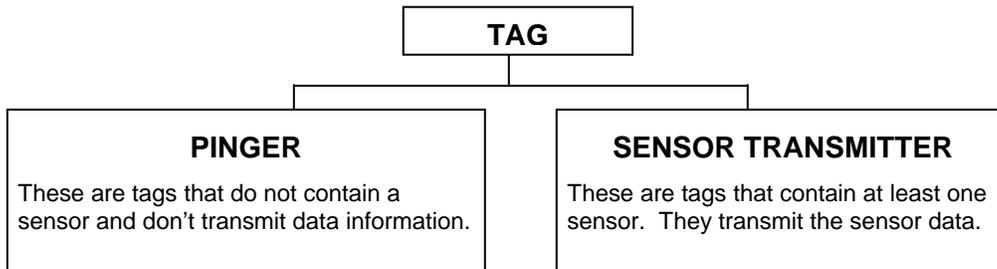
## 1.3 USING THIS MANUAL

This manual contains the necessary information needed to use the VR3-UWM receiver. This includes how to install the battery pack; open and close the case; deploy the VR3-UWM receiver; locate the deployed VR3-UWM, and perform in-air tests.

This manual is broken into major sections for easier use of the information found in the manual. These sections, with a brief explanation, are listed in Table 1.

Section	Description
Introduction	Introduction to the VR3-UWM and this manual.
Applications	Details on how to use the VR3-UWM receiver.
Hardware	Maintenance and deployment information.
Testing	How to perform an in-air test before deployment.
Appendix	Glossary and additional information.

The manual refers to tags, pingers, and sensor transmitters. The relationship these three terms have with each other is shown in the diagram below. Basically, a tag is a general term referring to either a pinger or a sensor transmitter.



## UPDATE

(May 2008)

It's ***strongly suggested*** that sensor transmitter information (including slope and intercept) is entered in ***VUE software instead of in VR3HS*** software. Without the slope and intercept in VR3HS, the created VR3 data files are compatible with VUE and can be imported to the VUE database (see *Importing "Old" VR2 and VR3-UWM Text data files* in VUE manual). If desired, the sensor transmitter information can be used in the VR3HS software but the VR3 data files will not contain the proper formatting to correctly interface with the VUE database.

Don't enter sensor transmitter information in VR3HS – use **VUE** instead.

Load data from VR3-UWM and import it in VUE software.

For more information about VUE software, and to obtain a copy, see [www.vemco.com/support](http://www.vemco.com/support)

## 2 APPLICATIONS

This section of the manual explains how to use the VR3-UWM by tasks, or applications. The Hardware section of the manual explains how to use the receiver by section.

### 2.1 QUICK SETUP

The list below gives the order of actions needed to setup and use the VR3-UWM receiver. The steps may reference sections in this manual that contain more details about that step.

1. Install the VR3-UWM software on the computer, if not already installed (see the VR3HS Software manual).
2. Set properties in software: (only needs to be done on first use and if information has changed)
  - a. Select the data directory to be used to store the files (see the VR3HS Software manual).
  - b. Select the colours to be used for the software display and the times for Status Update Period (see the VR3HS Software manual).
3. Install the battery in VR3-UWM receiver if applicable (see section 3.2). The receiver starts recording data as soon as it is powered.
4. Power the surface modem and physically connect it to the serial port on the computer (see section 3.2.5).
5. Perform an in-air test (see section 4.1).
6. Deploy the surface modem (see section 3.3.2).
7. Deploy the VR3-UWM receiver (see section 3.3.1).
8. Use the *UWM Tilt Display* command to watch the tilt angle of the receiver as it is deployed (see the VR3HS Software manual).
9. Record the physical location of the receiver with its ID number.
10. Leave the VR3-UWM to collect data from transmitters.
11. Return to the general location of the VR3-UWM.
12. Deploy the surface modem (see section 3.3.2).
13. Send a “Connect” command to wake the VR3-UWM modem (see the VR3HS Software manual). This may take a few minutes.
14. Use the *UWM Range Display* command to locate the VR3-UWM (see the VR3HS Software manual).
15. Load the data from the VR3-UWM receiver with the *Upload Logs* button (see the VR3HS Software manual).
16. If the study is continuing, repeat steps 11 to 16 until the study is completed.
17. When the study is complete, retrieve the VR3-UWM and remove the battery pack to stop the recording.

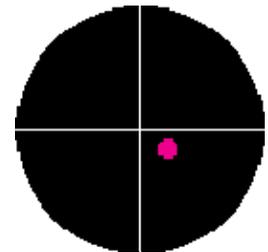
## 2.2 HOW DO I ...

The “How Do I ...” section of the manual lists the steps necessary to perform particular actions with the VR3-UWM and the VR3HS software. The actions are listed alphabetically for easier referencing. Use the Quick Setup (section 2.1) to use the VR3-UWM software in a step-by-step manner.

### 2.2.1 Deploy a VR3-UWM

This information is also available in the VR3HS Software manual.

1. Physically connect the surface modem to the computer running the VR3HS software.
2. Suspend the VR3-UWM from ropes so it hangs vertically with the transducer pointing up.
3. Select the VR3 ID number from the list of receivers at the bottom of the software window. If the correct receiver number is not in the pull-down list, highlight an ID number in the box, enter the number on the computer keyboard, and press Enter.
4. Click the “Connect” button in the bottom left corner of the software window. The surface modem will then request the status of the receiver and will numerically report the slant range, surface distance, and receiver’s tilt angle on the right side of the window.
5. Select the *UWM Tilt Display* command from either the speed buttons or from the Tools menu. The software window will display the circular level display as shown here.
6. Verify that the dot (shown here as magenta) is in the center of the circle or very close to it. The center of the circle represents the vertical. Movement of the dot indicates the receiver is now at an angle and gives the general direction in which the receiver has tipped.
7. Deploy the VR3-UWM receiver (see the VR3-UWM Operating manual).
8. Watch the location of the dot in the circular level display as the receiver is lowered through the water to make sure it remains in the center of the circle. If the dot has moved drastically, then reposition the receiver until it is as close to the center as possible. This is important for communication with the receiver.
9. Place the receiver in its moored location so the dot is as close to the center of the circle as possible. If the angle is too great, then reposition the receiver so the angle decreases. This is very important for modem communication.



### 2.2.2 Locate a deployed VR3-UWM

A deployed VR3-UWM can be located acoustically when the surface modem is within 350 meters of the VR3-UWM. This is performed by following the steps below.

1. Move to the general area the VR3-UWM is known to be in. The size of this general area depends on the acoustic conditions and the depth at which the receiver was deployed.
2. Deploy the surface modem, if not already deployed.
3. Select the *UWM Range Display* command (see the VR3HS Software manual) from either the speed buttons or from the Tools menu. The left side of the software window will change to a target range circle (see the VR3HS Software manual).
4. Select the VR3 ID number from the list of receivers. If the correct receiver number is not in the pull-down list, highlight an ID number in the box, enter the number on the computer keyboard, and press Enter.

5. Click the “Connect” button in the bottom left corner of the software window. The surface modem will then request the status of the receiver and will numerically report the slant range, surface distance, and receiver’s tilt angle on the right side of the window. The “Surface Distance” value will also be represented by the “Current Location” ring on the target range circle.
6. Move the boat until the “Surface Distance” decreases, making the “Current Location” ring shrink, and continue to move the boat until the ring is inside the “Target Area” circle.

## 3 VR3-UWM HARDWARE

### 3.1 HARDWARE FEATURES

The VR3-UWM receiver is housed in a high-pressure black plastic case. The completed unit is shown in the photo below. The VR3 transducer receives acoustic pings from transmitters in the area and stores this data to memory. The data is collected from the receiver's memory and sent to the computer on the surface with an acoustic underwater modem, which consists of a surface modem and a bottom modem. The bottom modem is permanently attached to the VR3-UWM and the surface modem is plugged in to a computer at the water's surface (see section 3.3.2).

A service port is available inside the VR3-UWM case (see section 3.2.1 for instructions on opening the VR3-UWM case). The service port is a DB9 serial port that allows a direct connection between the VR3-UWM and the computer running the VR3HS software.

#### **WARNING**

The VR3-UWM has a maximum depth rating of **200 meters (656 feet)**.



### 3.1.1 Underwater Modem

The VR3-UWM receiver uses the LinkQuest Underwater Acoustic Modem to communicate with the computer at the water's surface after the receiver is deployed. The surface modem (see Figure 1) is deployed on a ship (see section 3.3.2) and is physically connected to a computer running the VR3HS software. The bottom modem is attached directly to the VR3 receiver at the factory (see Figure 2).

The underwater modem operates in both fresh and salt water to a maximum range of 350 meters (984 feet) and a maximum depth of 200 meters (656 feet).



Figure 2 - Surface modem.



Figure 2 - Bottom modem transducer.

#### 3.1.1.1 Modem Communication

For communication to occur between the surface modem and the bottom modem, the surface modem must first “wake up” the bottom modem. The bottom modem cycles 120 seconds off and 2 seconds on to conserve power. The surface modem will transmit the “wake up” command for more than two minutes (120 seconds) to be sure the bottom modem will hear the command during one of its two-second-long ON periods. When the bottom modem has received the command to wake up, it will remain on for 600 seconds after each valid command to be sure communication has ended before beginning its on/off cycle. The bottom modem is capable of transmitting 880 bytes/transmission.

Each bottom modem has an individual address, with 65536 possible addresses. This means a VR3-UWM receiver won't reply to messages sent to a receiver with a different address. This ensures that you're communicating with the VR3 receiver you're intending to communicate with and not a neighbouring receiver. It also means that the correct address must be sent from the VR3HS software to communicate with the intended receiver. A receiver will not respond to the surface modem if the surface modem is not sending that receiver's assigned address. This needs to be kept in mind as a trouble shooting possibility if there is a communication problem with a receiver.

Communication between the surface modem and the bottom modem on the receiver will only happen if the surface modem is within the “hearing” area of the bottom modem. The modems (surface and bottom) have a 120-degree span in which they can detect communication from the other modem, to a maximum range of 350 meters (984 feet). This area is demonstrated two-dimensionally in Figure 3 (not drawn to scale). The surface modem marked A1 and the bottom modem can communicate because the two modems are within each other’s communication areas (marked with green lines). The modems don’t have to be directly in line with each other for communication, as the surface modem A2 illustrates. Modem B is outside the communication area and won’t be able to communicate with the bottom modem.

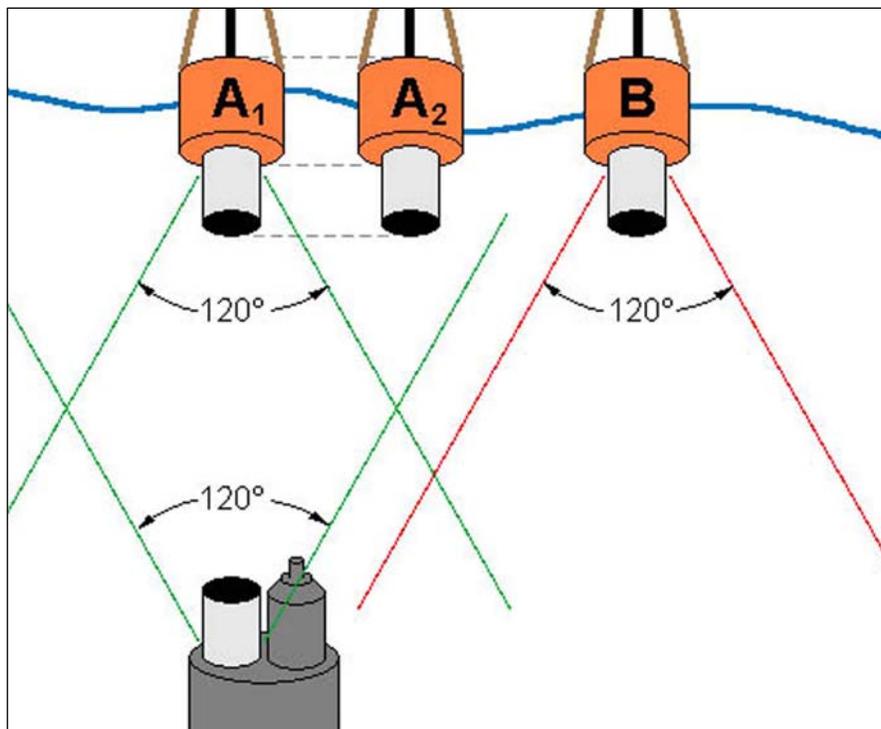


Figure 3 - Communication angle.

### 3.1.2 Resume Recording

A VR3-UWM receiver will record data from the time power is connected until power is disconnected. The only exception is when the receiver is communicating with the surface modem. Six hundred seconds after the last communication between the surface modem and the receiver, the data recording will resume unless the memory is full. This feature simplifies the process of collecting data while in the field.

If a study is completed when the data is loaded from the VR3-UWM, retrieve the VR3-UWM and remove the battery from the receiver (see section 3.2) to stop the receiver from recording.

### 3.1.3 Flash Memory

The VR3 receiver uses a non-volatile Flash Memory (available in either 4 MB or 8MB) to store valid detections from coded transmitters with the date/time at which the detections were recorded. The VR3 will not continue to record received data once the memory is full. The 8 MB memory is capable of storing more than one million valid detections while the 4 MB memory can store approximately 500,000 detections. If a valid detection is received every 90 seconds, it will require three years to fill the 8MB size VR3 memory (see Table 2).

Valid detection every...	Time to Fill Memory
15 seconds	197 days (0.5 years)
30 seconds	395 days (1.1 years)
45 seconds	592 days (1.6 years)
90 seconds	1184 days (3.2 years)

### 3.1.4 Battery Pack

The VR3-UWM uses an internally fitted battery pack. Battery packs are available in either the alkaline or lithium forms, and are similar in general appearance to each other. The lithium battery is shown in Figure 4. The alkaline battery pack allows the VR3-UWM to function for over one year and the lithium battery pack allows the V3-UWM for function for approximately 5 years. The procedure to install or replace the battery packs are very similar and are explained in section 3.2.

The battery pack covering may be a different colour than what is shown in this manual.

**NOTE:** The battery pack is **NOT rechargeable**. Properly dispose of the battery pack in the appropriate manner when it is depleted.



Figure 4 - General battery pack shape.

## 3.2 HARDWARE MAINTENANCE

The largest aspect of VR3-UWM hardware maintenance is installing the battery pack. To do this, open the case, remove the battery (if applicable), insert the battery, and close the case. These steps are explained in the following sections.

### 3.2.1 Opening VR3-UWM case

1. Place the VR3-UWM in a vertical position so the mounting ring is pointing up.
2. Place a 3/8" socket wrench on the top of the bolt shown in Figure 5. There are six such bolts around the circumference of the VR3-UWM.
3. Place a 7/16" wrench on the nut at the bottom of the bolt to hold the nut in place.
4. Use the socket to loosen the bolt three or four quarter turns (the space available to move the socket wrench).

**NOTE:** DO NOT remove the nuts on the mounting ring at the top of the VR3-UWM.

5. Move to the nut and bolt directly opposite the first nut and bolt and repeat Step 2 through Step 4.
6. Move to another nut and repeat Steps 2 through 5 until all six nuts are slightly loosened.
7. Repeat Steps 2 through 6 until all the nuts have been sufficiently loosened and then use your fingers to continue until the nuts are completely removed from the bolts.
8. Remove the bolts, nuts, and washers from the VR3-UWM case and store them in a safe location until they're needed to close the case.
9. Lift the top cap straight up so it lifts off the main cylinder. If the battery pack is installed, the battery wires are connecting the two pieces and must not be damaged.
10. Gently place the top cap upside down on a flat, stable surface so it is sitting on the tops of the mounting ring rods. Don't damage the battery wires that are still connecting the two sections together.

**WARNING:** The flat surface on the top cap is an O-ring surface and must not be damaged or the receiver may flood with water when submerged.

11. Disconnect the battery (see section 3.2.2).



Figure 5 - VR3-UWM halves bolted together.

## 3.2.2 Removing battery pack

This is performed after the VR3-UWM case has been opened (see section 3.2.1).

1. Identify the battery connector (shown in Figure 6A) on the round plate located on the inside of the top cap.
2. Squeeze the tabs on the sides of the battery connector and gently pull the connector apart to disconnect the battery pack. This also separates the two case halves.
3. Unscrew the 9/16" bolt from the center of the battery pack area (see Figure 6B).
4. Remove the bolt, washers (flat and split washers), and the PVC disc from the top of the battery pack. The bolt, which passes through the battery pack and screws into the bottom of the battery compartment (see section 3.2.3), is covered with a tube, either foam or rubber depending on the battery type. The tube should hold the washers on the bolt.
5. Lift the battery pack from the main cylinder section of the receiver.

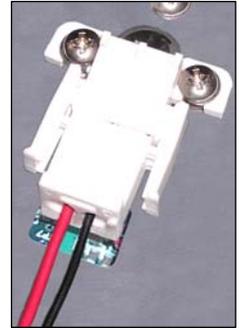


Figure 6A - Battery connector.

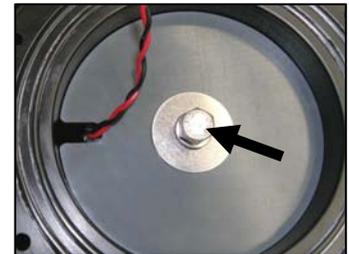
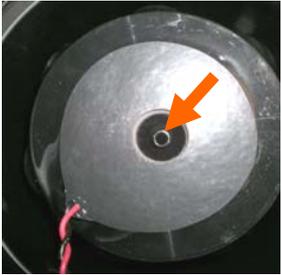


Figure 6B - Battery bolt.

## 3.2.3 Inserting battery pack

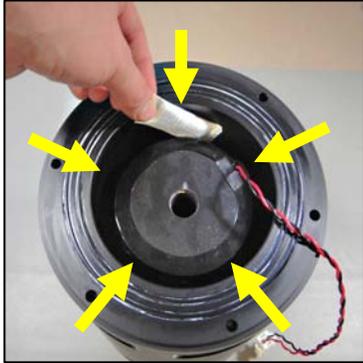
This is performed after the VR3-UWM case has been opened (see section 3.2.1) and the battery pack has been removed, if applicable (see section 3.2.2). The VR3-UWM is shipped without the battery pack installed so this procedure must be performed before the receiver is deployed.

### 3.2.3.1 Inserting Lithium battery pack

<p><b>STEP 1</b></p> <p>If a battery is already in the receiver, disconnect it as described in "Removing Battery" (section 3.2.2).</p>	<p><b>STEP 2</b></p> <p>Carefully place the battery in the main cylinder so the wire and connector are at the top.</p> 	<p><b>STEP 3</b></p> <p>Center the battery around the threaded hole in the bottom of the housing. Look down the hole in the middle of the battery pack to see where the threaded hole is in relation to the battery.</p> 
----------------------------------------------------------------------------------------------------------------------------------------	------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

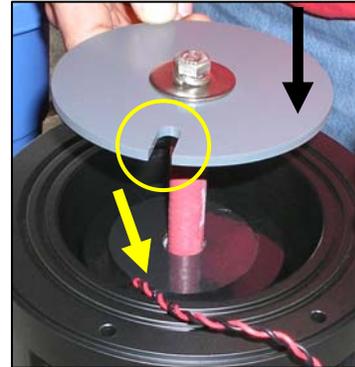
#### STEP 4

Place 5 desiccant packs around the battery at even spacing (see locations marked in photo).



#### STEP 5

Slide the bolt assembly (shown on left) into the hole in the middle of the battery. Make sure the notch in the PVC plate (circled in photo) lines up with the battery wire. Otherwise the battery wire will be damaged.



#### STEP 6

Thread the bolt into the threaded hole in the housing and finger-tighten the bolt. The battery position may need to be adjusted for the bolt and hole to line up.



#### STEP 7

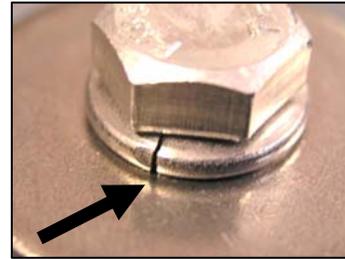
Use a socket wrench to tighten the bolt until the split washer is just flattened (see Step 8).



#### STEP 8

Visually check that the split washer is flattened.

Close the receiver case (see section 3.2.4).



Desiccant packs have been included in the bottom of the VR3-UWM to reduce the occurrence of condensation in the receiver. These packs should remain in the receiver case during storage and deployment.

We recommend that you replace the desiccant packs with each deployment and with each battery replacement cycle.

More information on the availability and usage of these packs is located on our website, [www.vemco.com](http://www.vemco.com).



### 3.2.3.2 Inserting Alkaline battery pack

1. Slide the alkaline battery pack into the main cylinder.
2. Insert the battery rod with the three large metal washers, the small split washer, and red rubber tubing on it (see Figure 7A) through the hole in the center of the battery pack, as shown in Figure 7B.
3. Screw the end of the 9/16" bolt into the hole in the bottom of the VR3-UWM case, identified with the white arrow in Figure 7C.
4. Use a wrench to tighten the bolt until the split washer on the end of the bolt is barely flat. **Don't use excess force or the case may be damaged.**
5. Insert the supplied foam strip between the battery pack and the inside of the case so the foam circles the circumference of the battery pack (see Figure 7D). This is to hold the battery and prevent it from moving horizontally in the case. **DO NOT remove the white backing** on the foam strip to expose the adhesive on the foam strip. The foam is thick enough to stay in place without being adhered to the battery case.
6. Place five (5) desiccant packs around the battery at even spacing (see box below).
7. Close the receiver case (see section 3.2.4).



Figure 7A - Washers on battery rod.



Figure 7B - Battery bolt hole in the bottom of the main cylinder.



Figure 7C – Inserting battery rod to secure battery pack in main cylinder.



Figure 7D - Foam around circumference of battery pack.

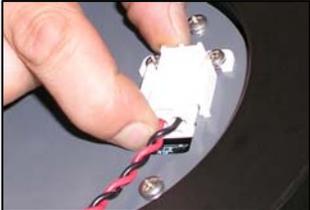
Desiccant packs have been included in the bottom of the VR3-UWM to reduce the occurrence of condensation in the receiver. These packs should remain in the receiver case during storage and deployment.

We recommend that you replace the desiccant packs with each deployment and with each battery replacement cycle.

More information on the availability and usage of these packs is located on our website, [www.vemco.com](http://www.vemco.com).



### 3.2.4 Closing VR3-UWM case

<p><b>STEP 1</b></p> <p>Coat the bolts with a <i>light</i> layer of grease, such as Never-Seez® with Molybdenum (lubrication only) or Loctite® 567 (lubricates and locks), to prevent “galling” from occurring. “Galling” essentially welds the nuts and bolts together and they will not come apart.</p>	<p><b>STEP 2</b></p> <p>Clean the O-ring and O-ring surfaces. Proper O-ring care is explained in section 5.1. The O-ring surfaces are found where the two halves of the receiver case meet.</p>	<p><b>STEP 3</b></p> <p>Curl the battery wires so they are below the top surface of the main cylinder case and away from the O-ring surfaces. If the wires are pinched, then water may leak into the receiver and destroy the receiver, or the battery wires may be damaged.</p> 
<p><b>STEP 4</b></p> <p>Lift the top cap and hold it above the main cylinder section of the receiver. It doesn't have to be lined up with the main cylinder section, just close enough to connect the battery.</p>	<p><b>STEP 5</b></p> <p>Connect the battery in the main cylinder section to the connector on the bottom of the top cap section. Listen for three beeps indicating that the receiver is powered up.</p> 	
<p><b>STEP 6</b></p> <p>Place the top cap on the main cylinder section without pinching the battery wires between the two halves of the case. It doesn't matter if the holes in the two halves are lined up at this point.</p> 	<p><b>STEP 7</b></p> <p>Verify that a ¼” split washer and ¼” flat washer, in that order, are still on each of the six bolts.</p> 	<p><b>STEP 8</b></p> <p>Slide the bolts into the holes around the circumference of the VR3-UWM case.</p> 
<p><b>STEP 9</b></p> <p>Visually check that the flat washers are against the surface of the receiver case. If the split washer is against the surface, then remove the bolt and switch the order of the washers on the bolt.</p> <div style="border: 1px solid black; background-color: #ffffcc; padding: 5px; margin-top: 10px;"> <p><b>NOTE:</b> The flat washer must always be the washer closest to the VR3-UWM case.</p> </div>	<p><b>STEP 10</b></p> <p>Rotate the top cap until the bolts drop into the holes in the main cylinder of the case.</p> 	<p><b>STEP 11</b></p> <p>Place a ¼” flat washer, then a ¼” split washer, and finally a ¼” nut, in that order, on the end of each bolt. NOTE: The flat washer should also be the washer closest to the VR3-UWM case.</p> 

### STEP 12

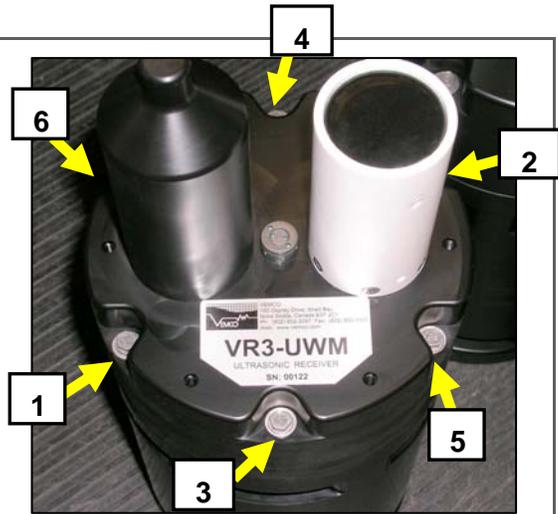
Tighten one of the nuts with your fingers until the nut won't tighten any farther. You might need to hold the top of the bolt while the nut is being tightened.



### STEP 13

Move to the nut directly opposite the first nut and tighten it with your fingers until it won't tighten any farther.

Move to another nut and repeat the criss-cross pattern until all six nuts are "finger tightened" on their respective bolts.



### STEP 14

Place a 3/8" socket wrench on the top of a bolt and a 7/16" wrench on the nut at the bottom.



### STEP 15

Use the socket wrench to tighten the bolt three or four turns within the space available. The wrench is used to hold the nut still.

### STEP 16

Move to the nut and bolt directly opposite the nut and tighten the bolt three or four turns within the space available.

Move to another nut and bolt and tighten the bolt three or four turns. Repeat the criss-cross pattern (see picture in Step 13) until all six nuts are tightened.

### STEP 17

Repeat this process of tightening the bolts three or four half turns at a time, using the criss-cross pattern, until the split washers are just flattening out.



### STEP 18

Visually inspect **all** split washers to be sure they're all at the correct compression (just barely flattened).



### 3.2.5 Setting Up Surface Modem

The orange surface modem is powered and connected to the computer running the VR3HS software through the supplied **VR3-UWM PC Interface unit** (see Figure 8). Three cables must be connected to the interface box for the surface modem to operate correctly: the LinkQuest surface modem, a power supply, and the computer serial port. The surface modem must be powered and physically connected to the computer before it is deployed (see section 3.3.2).

The surface modem cable is connected to the large connector on the box labelled “LinkQuest Surface Modem”. This connector is threaded on and is easiest to connect by initially threading the connector on the cable onto the connector on the box in a clockwise direction. After a few turns of the connector, push the cable connector towards the box. This relieves some of the strain on the threads, making the threading process easier for you and the connector.

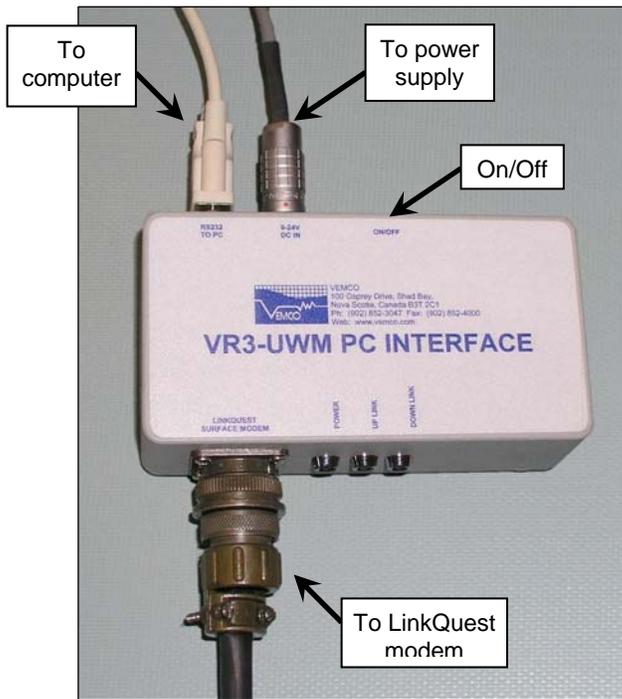


Figure 8 – VR3-UWM PC Interface in use.

The supplied power supply cable is connected to the connector on the box labelled “9-24V DC IN”. This cable has a cigarette lighter connector on one end and a metal connector on the other end. Line up the red dot on the metal connector with the red line on the interface box’s connector and push the two connectors together (see Figure 9). The connectors are designed so the orientation of the connector can not be reversed.



Figure 9 – Power connector in place.

The serial cable on the computer is connected to the DB9 connector on the interface box labelled “RS232 to PC”. Tighten the connector in place to prevent it from moving while the surface modem is being used.

When the surface modem is properly connected to the power supply and the computer through the VR3-UWM PC interface, turn the interface on by pushing the ON/OFF button up. The Power light (next to the surface modem cable) will light to indicate that the interface unit is powered. The “Up Link” and “Down Link” lights flash when the computer is in communication with the receiver through the underwater modem.

The surface modem can transmit signals at one of two power levels to accommodate where the communication is occurring, either in air or in water. It’s very important that the surface modem never transmits in air while set at high power. This can damage the modem. The **high power level** must only be used when the surface modem is in water and communicating with the bottom modem.

**WARNING**  
Only operate the surface modem in high power mode when it’s **in the water**.

The power level of the surface modem is selected within the VR3HS software (see the VR3HS Software manual). The low power level must be selected when the modem is operating in air, such as for the in-air test (see section 4.1). The high power level must only be selected when the modem is deployed in water.

### 3.3 DEPLOYING THE VR3-UWM SYSTEM

#### 3.3.1 Deploying the VR3-UWM receiver

The method used to deploy the VR3-UWM is designed by the user to incorporate the needs of each deployment location. The following condition(s) need to be followed for the VR3-UWM to operate correctly.

1. The VR3-UWM must be vertical when deployed, with the underwater modem transducer and receiver transducer pointing up. The VR3HS software will report the angle of the receiver from the vertical position but doesn't report if the modem transducer is pointing up or down.

The VR3-UWM has mooring holes in the case to allow the VR3-UWM to either be moored using ropes or cables, or be bolted to a plate. These holes are shown in the photos below (Figure 16 and Figure 17) and in the drawing on the next page (Figure 18). The suggested methods of mooring the VR3-UWM are shown in Figure 19.



Figure 7 - Ring on mounting assembly with holes for Mounting Option 1.



Figure 7 - Mounting holes in bottom of VR3-UWM.

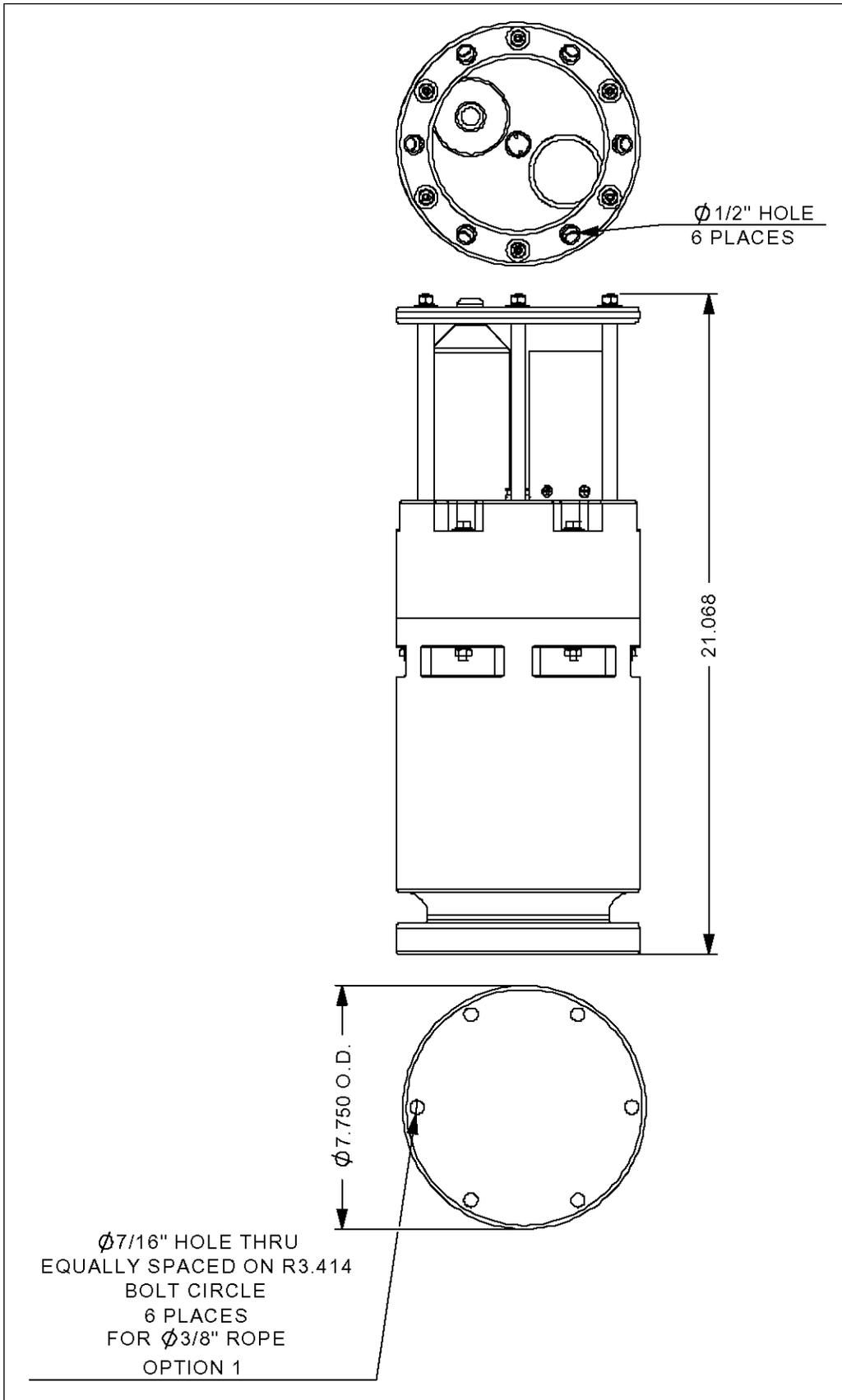


Figure 8 - Mooring hole locations and sizes on the VR3-UWM receiver.

## MOUNTING OPTIONS

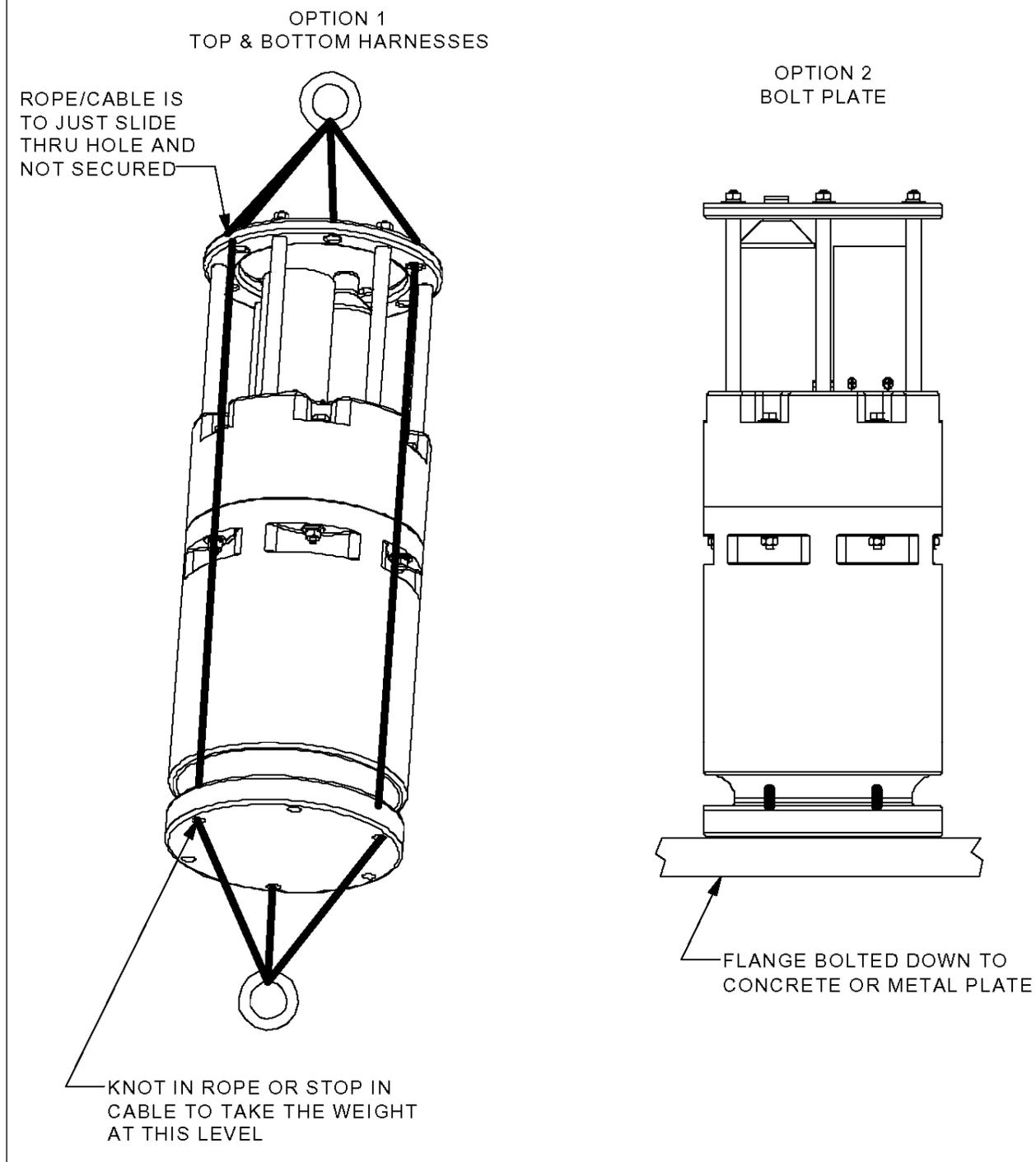


Figure 9 - Mounting options for mooring VR3-UWM receiver.

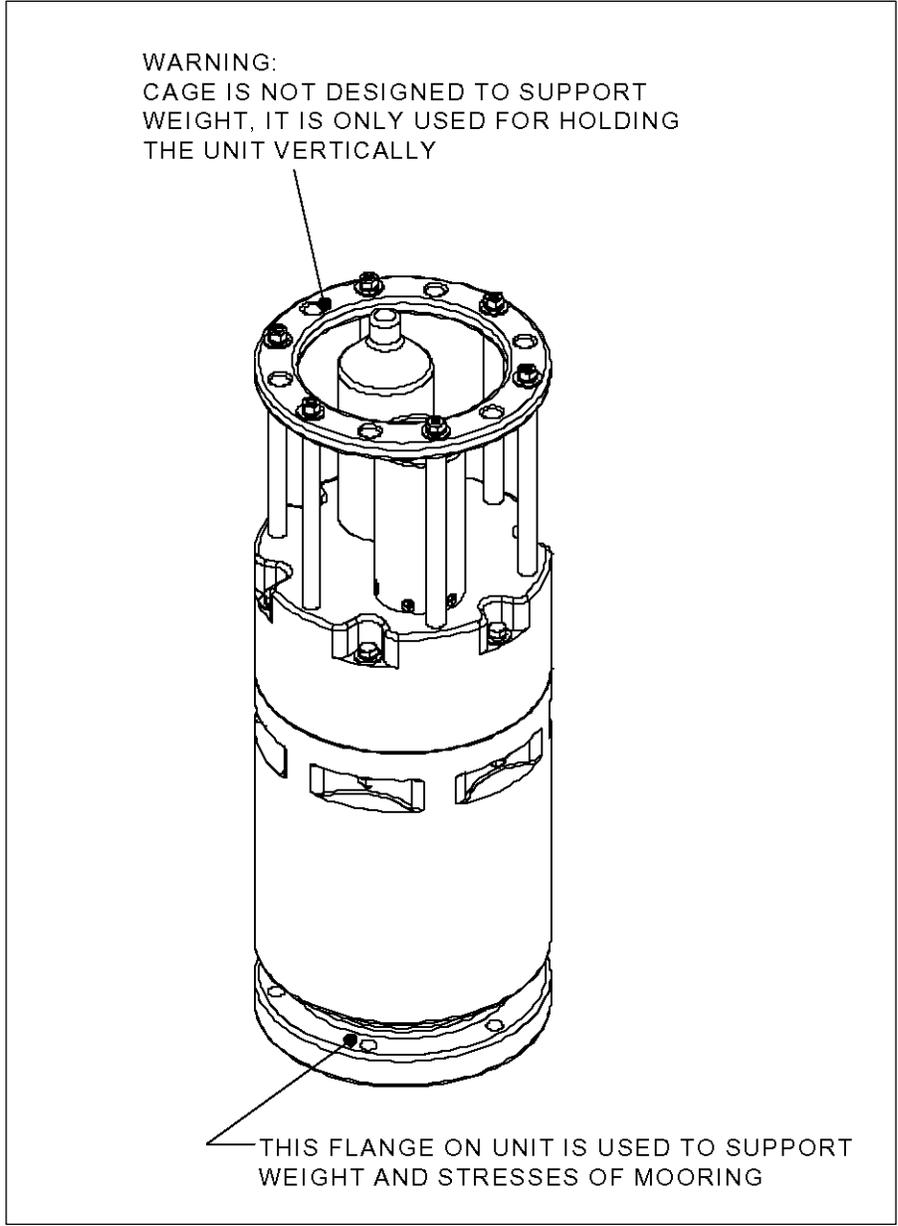


Figure 10 – Warnings about mooring the VR3-UWM receiver.

### 3.3.2 Deploying the Surface Modem

The LinkQuest surface modem must be deployed from a ship on the surface of the water. A mounting bracket (not provided) should be used to securely hold the surface modem. An example of a mounting bracket is shown in Figure 21. Rope, for example, can be attached to the mounting bracket at the four deployment holes to hold the modem at the desired depth.

Another method of deployment can be used as long as the following conditions are met:

1. Do not put strain (weight) on the black electrical cable or the cable could be damaged.
2. Do not damage the surface of the modem's housing or it could lead to extensive corrosion.
3. Hang the modem vertically so the white transducer is pointing down.

The two power adapters connected to the surface modem must be plugged in to a 120 Volt power source. The DB9 connector is plugged in to the serial port on the computer running the VR3HS software.

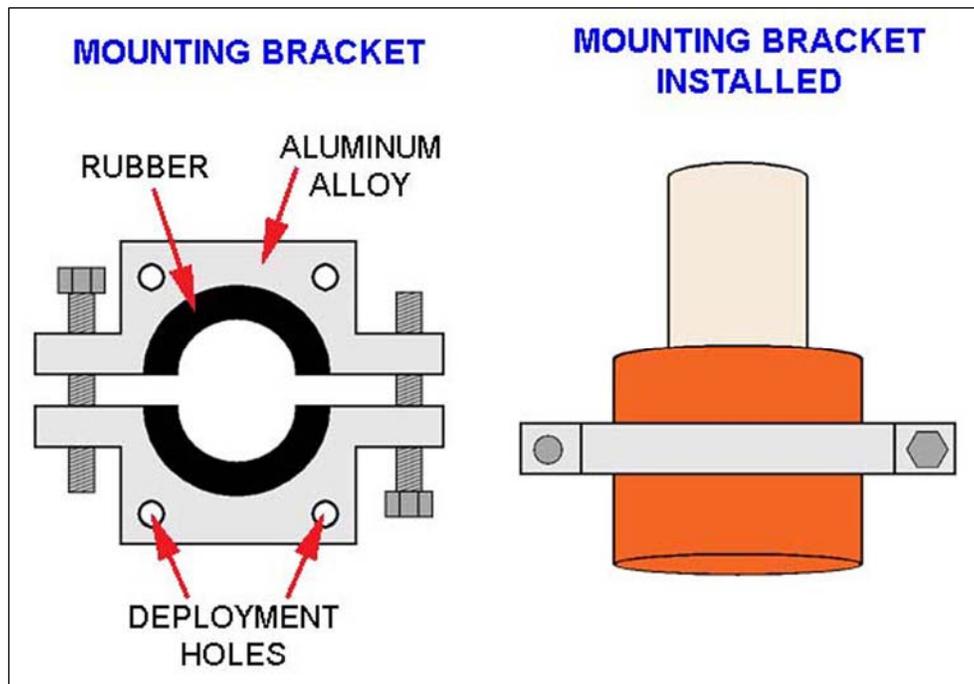


Figure 11 - Mounting bracket example.

## 4 TESTING

### 4.1 IN-AIR TESTING

Perform an in-air test before the VR3-UWM is deployed to become familiar with the equipment and to check that the surface modem and bottom modems are communicating with each other. Keep in mind that acoustic signals do not travel through air the same way they travel through water and this will affect the performance of the equipment.

Follow the steps listed below to perform the in-air test.

1. Open the VR3-UWM case (see section 3.2.1).
2. Place the top half of the VR3-UWM on its side on a flat, stable surface and secure it from rolling.
3. Place a piece of plastic foam, such as ordinary packaging foam, beneath the receiver to prevent vibrations from complicating the acoustic signals during the test.
4. Place the battery next to the top half of the receiver.
5. Power the VR3-UWM by connecting the battery (see section 3.2). The VR3-UWM receiver will beep three times and begin recording data.
6. Place an activated tag within 10 centimetres of the receiver's hydrophone (identified in Figure 22) and setup the surface modem (see step 6). The receiver will sound a beep for each received ping and a slightly longer beep when the ping string is stored in the receiver's memory. Be sure the tag remains next to the receiver for a long enough a period of time to allow the receiver to collect data from the transmitter. The length of time needed to collect data depends on the setup of the transmitter. For example, if the transmitter only pings every 2 minutes, then wait at least 10 minutes; if the transmitter pings every 30 seconds, then a shorter time period will gather the same amount of data.
7. Setup the surface modem (see section 3.2.5) and position it so it points at the bottom modem on the VR3-UWM receiver and is approximately 10 to 15 cm away. The two modem transducers (white cylinders) should be facing each other as shown in Figure 22.
8. Place a piece of plastic foam, such as ordinary packaging foam, beneath the surface modem to prevent vibrations from complicating the acoustic signals during the test.
9. Power the surface modem and physically connect it to the serial port on the computer (see section 3.2.5). Make note of the serial port number.

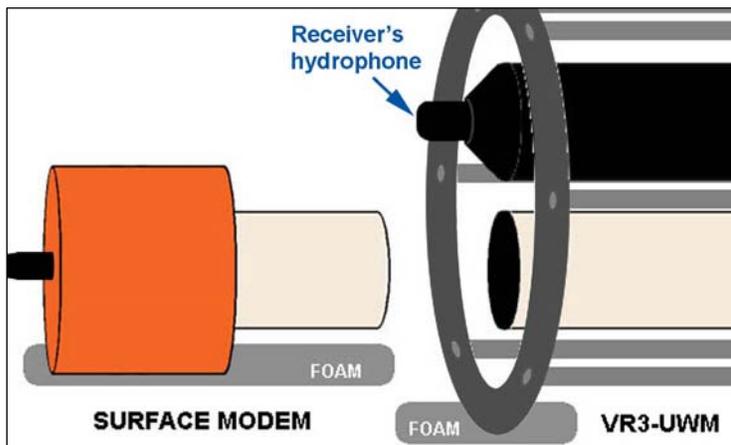


Figure 12 - Position of surface and bottom modem transducers for in-air test.

The VR3-UWM sounds a **beep** for each received ping and a slightly longer beep when the ping string is stored in the receiver's memory.

The beeps are only heard for **one day** after a study is initialized or data is uploaded and then will become silent.

10. Open the VR3HS software.
11. Select the com port number from the drop-down list in the bottom left corner of the software window (see the VR3HS Software manual).
12. Select “UWM” from the drop-down list to the right of the com port list.
13. Select the receiver ID number from the pull-down list. If the receiver has never been connected to this computer, the ID number will need to be entered in the box from the computer keyboard.
14. Click the “Connect” button. A window will appear asking if the modem is to be used in high power mode (see the VR3HS Software manual).
15. Click the “No” button to put the surface modem in low power mode. The surface modem will then attempt to wake up the bottom modem on the VR3-UWM (see section 3.1.1.1).
16. Upload the data from the receiver with the *Upload Logs* command (see the VR3HS Software manual). A window will open to show the progress of the upload.
17. Review the data file with *Display Logs* (see the VR3HS Software manual) or in a comma delimited compatible spread sheet program.

**WARNING**

Only operate the surface modem in high power mode when it's *in the water*.

## 5 APPENDICES

### 5.1 O-RING CARE

The O-rings located between the top cap and main cylinder sections of the VR3-UWM are vital to the watertight seal of the receiver. Each time the O-rings are disturbed, for any reason, they ***must be checked*** before the unit is sealed again.

The flat surface on the bottom of the top cap and the grooves in the flat top surface of the main cylinder are both O-ring surfaces (a surface that the O-rings come in contact with) and must be clean and smooth - free of debris and nicks. Dirt or damage to the surface may cause flooding of the VR3 receiver.

**WARNING**

Improper care of the O-rings and their mating surfaces can result in water leaking into the receiver casing.

The O-rings must be free from dirt or debris and covered with a ***light coat*** of O-ring grease for lubrication. The grease should make the surface slippery but not be seen. If too much grease is used, the O-rings may pop out of their grooves and not seal correctly. Each O-ring should be inspected for any damage, such as nicks or cracks. A damaged O-ring should be replaced ***immediately*** with an O-ring of the same size and type. Ensure that the O-rings are properly seated in their grooves while the top cap is lowered onto the main cylinder.

### 5.2 TROUBLE-SHOOTING

The following tips may help if problems are encountered. If the problem you're experiencing isn't included in this section, please contact VEMCO.

#### 5.2.1 Communication Problems

Problem	Possible Solution
Can't communicate with a deployed VR3-UWM receiver.	<ol style="list-style-type: none"> <li>1. Check that the correct receiver address is being used. Use the New button in the Configuration tab to check which receivers are within communication range of the surface modem.</li> <li>2. Make sure the surface modem is within communication range of the bottom modem.</li> <li>3. Check the serial port number in the software is correct (see the VR3HS Software manual).</li> </ol>
Can't communicate with a VR3-UWM receiver during in-air test.	<ol style="list-style-type: none"> <li>1. Check that the correct receiver address is being used. Use the New button in the Configuration tab to check which receivers are within communication range of the surface modem.</li> <li>2. Connect directly to the service port (see the VR3HS Software manual).</li> <li>3. Check the serial port number in the software is correct (see the VR3HS Software manual).</li> <li>4. Use VR3-UWM Communication Utility (see 5.2.2) to test equipment.</li> </ol>

## 5.2.2 VR3-UWM Communication Utility

This communication test requires the optional VR3-UWM Communication Test Package (including the VR3-UWM Communication Utility CD).

1. Place the VR3-UWM Communication Utility CD in the computer being used with the VR3-UWM and the testing software will installation will begin automatically.
2. Open the VR3-UWM Communication Utility software and select *File* → *Open Port* from the menu selections.
3. Select the COM port being used with the VR3-UWM from the pull-down list in the Port Settings (see Figure A-1).
4. Click the “Open” button at the bottom of the window.

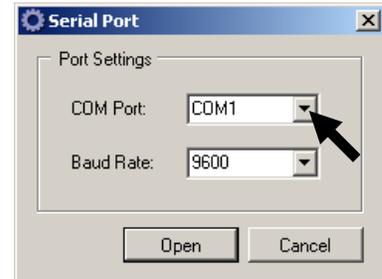


Figure A-1: Select COM port.

### Loopback Test

5. Select *Test* → *Loopback* from the menu selections.
6. Click the “Start” button in the bottom right corner of the Loopback Test window to start the test signal. This signal will be sent from the computer every second. When a loopback connector is not attached to the system, the response will be “Error. No Reply” (see sample in Figure A-2).
7. Connect the Serial Cable Loopback connector to the serial cable as shown in Figure A-3. If the response shown in the Loopback Test window changes to “Response Received” then communication to this point in the equipment is operating correctly.

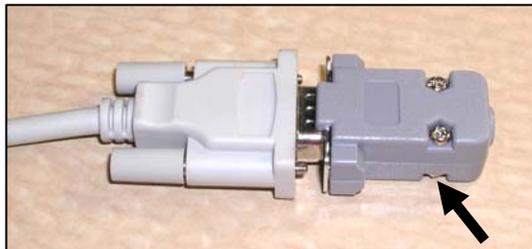


Figure A-3: Serial Cable Loopback connector

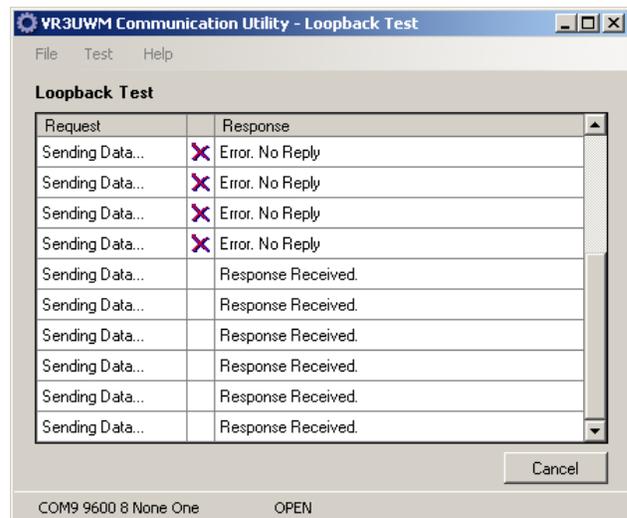


Figure A-2: Loopback test window.

8. Remove the Serial Cable Loopback connector from the serial cable and connect the serial cable to the RS232 connector on the VR3-UWM Interface box (see top left corner of Figure A-4).
9. Connect the Interface Loopback connector to the LinkQuest Surface Modem connector on the Interface box. NOTE: Push the Interface Loopback connector towards the box when the turning becomes difficult. Repeat until the connector is fully tightened.



Figure A-4: Interface Loopback connector.

10. If the response shown in the Loopback Test window changes to “Response Received” then communication to this point in the equipment is operating correctly.
11. Remove the Interface Loopback connector from the Interface box and connect the Surface Modem cable in its place.
12. Connect the Surface Modem Loopback connector to the end of the Surface Modem cable (where the Surface Modem normally connects) as shown in Figure A-5.
13. If the response shown in the Loopback Test window changes to “Response Received” then communication to this point in the equipment is operating correctly.
14. Remove the Surface Modem Loopback connector from the Surface Modem cable and connect the LinkQuest Surface Modem in its place.
15. Click the “Cancel” button in the bottom right corner of the window to stop the testing signal. Click the “Clear” button.

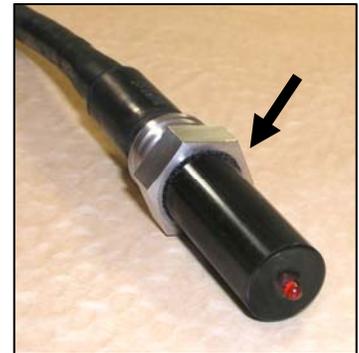


Figure A-5: Surface Modem Loopback connector

### Surface Modem Test

16. Select *Test* → *Surface Modem Test* from the menu selections. A warning window appears about removing all the loopback connectors and connecting the LinkQuest Surface Modem to the cable.
17. Click the “Start” button in the bottom right corner of the Surface Modem Test window to start the test signal. This signal will be sent from the computer every second.

The Response column shows “Response Received”, and the software version, when communication is functioning properly (see Figure A-6).

Click the “Cancel” button in the bottom right corner of the window to stop the testing signal.

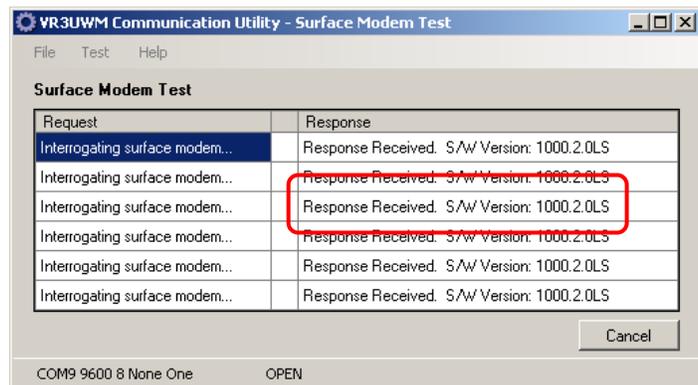


Figure A-6: Surface Modem test window

## 5.3 GLOSSARY

**Blanking Interval:** The Blanking Interval is the length of time (in milliseconds) after an acoustic signal has been received in which the VR3-UWM will ignore any subsequent signals. This is to eliminate the reception of echoes by the receiver.

**Coded tags:** Coded tags transmit a series of acoustic pings to form an ID (identity) number recognized by the receiver. The pings form a “ping train” that is usually followed by either a fix or random delay. The type and length of the delay is set at the time the tag is ordered and can’t be changed once the tag is built.

**Continuous tags:** Continuous tags transmit the acoustic pings continuously, without long delays between transmissions. Continuous tags are available with or without sensors.

**Coordinated Universal Time (UTC):** UTC is the international time standard. It is the current term for what was commonly referred to as Greenwich Mean Time (GMT). Zero (0) hours UTC is midnight in Greenwich, England, which lies on the zero longitudinal meridian.

**Pinger:** A VEMCO tag that contains no sensors. It can have either a coded or continuous transmission schedule.

**Tag:** A VEMCO tag is an acoustic transmitter that is attached to a marine creature and transmits an acoustic signal. The acoustic signal is received by a VEMCO receiver. VEMCO tags can transmit either a coded or continuous signal, with or without sensor data. After a tag is powered, it will continue to broadcast according to factory setup until powered down.

**Sensor transmitter:** A VEMCO tag that has at least one sensor. The type of sensor is usually included in the transmitter’s name. For example, a V16P has a pressure (depth) sensor and the V16T has a temperature sensor. A sensor transmitter can also have either a coded or continuous transmission schedule.

## 5.4 INDEX

- Battery pack, 9
  - Inserting, 11
  - Removing, 11
- Bottom modem, 22
- Deployment
  - Deploying VR3-UWM, 15
  - Mooring holes, 15
  - Surface modem, 19
- How Do I...
  - Deploy a VR3-UWM, 4
  - Locate a deployed VR3-UWM, 4
- In-air test, 14, 20, 22
- Memory, 6, 9
- O-ring, 10, 13, 22
  - Care, 22
- Power level, 14
- Quick Setup, 3
- Resume study, 8
- Serial port, 19
- Service port, 6
- Study, 1, 3
- Surface modem, 3, 22
  - Deploying, 19
  - Setting Up, 14
- System Review, 1
- Tag
  - Pinger, 2
  - Sensor Transmitter, 2
- Testing
  - In-air test, 3
- Trouble-shooting, 22
  - Communication, 22
- Underwater modem, 6, 7
  - Communication, 7
- Using this manual, 2
- UTC, 25
- VR3-UWM case, 6
  - Closing, 13
  - Opening, 10
- VR3-UWM Communication Utility, 23