ATTENTION – READ THIS FIRST!

All personnel involved with the installation, operation, or maintenance of the equipment described in this manual should read and understand the warnings and cautions provided below.

**CAUTION!**

This equipment contains devices that are extremely sensitive to static electricity. Therefore, extreme care should be taken when handling them. Normal handling precautions involve the use of anti-static protection materials and grounding straps for personnel.

**WARNING!**

High Voltage may be present in all parts of the system. Therefore, use caution when the electronics are removed from their containers for servicing.

**CAUTION!**

Operation with improper line voltage may cause serious damage to the equipment. Always ensure that the proper line voltage is used.
The Push Off Release Transponder contains both standard and proprietary hardware. At times, EdgeTech may change the standard components due to their availability or performance improvements. Although the component manufacturers—along with their models and styles—may change from unit to unit, replacement parts will generally be interchangeable.

EdgeTech will make every effort to see that replacement components are interchangeable and use the same software drivers (if applicable). At times, however, direct replacements may not exist. When this happens, EdgeTech will provide the necessary drivers with the replacement part, if applicable.

EdgeTech may also change certain hardware per customer requirements. Therefore, portions of this manual, such as parts lists and test features, are subject to change. These sections should be used for reference only. When changes are made that affect system operation, they will be explicitly noted. Also, some options and features may not be active in the customer's unit at time of delivery. Upgrades will be made available when these features are implemented.

**CONTACT EDGEtech CUSTOMER SERVICE WITH ANY QUESTIONS RELATING TO COMPATIBILITY.**
We, the employees at EdgeTech, would like to thank you for purchasing Push Off Release Transponder—Low Frequency, Small Diameter (PORT-LF SD). At EdgeTech, it is our policy to provide high-quality, cost-effective products and support services that meet or exceed your requirements. We also strive to deliver them on-time, and to continuously look for ways to improve them. We take pride in the products we manufacture, and want you to be entirely satisfied with your equipment.

Purpose of this Manual

The purpose of this manual is to provide the user with information on the setup and use of EdgeTech’s PORT-LF SD. Although this manual encompasses the latest operational features of the PORT-LF SD, some features may be periodically upgraded. Therefore, the information in this manual is subject to change and should be used for reference only.

Liability

EdgeTech has made every effort to document the PORT-LF SD in this manual accurately and completely. However, EdgeTech assumes no liability for errors or for any damages that result from the use of this manual or the equipment it documents. EdgeTech reserves the right to upgrade features of this equipment, and to make changes to this manual, without notice at any time.

Warnings, Cautions, and Notes

Where applicable, warnings, cautions, and notes are provided in this manual as follows:

**WARNING!**
*Identifies a potential hazard that could cause injury or death.*

**CAUTION!**
*Identifies a potential hazard that could damage equipment or data.*

**NOTE:** *Recommendations or general information that is particular to the material being presented.*
## Revision History

<table>
<thead>
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<th>DESCRIPTION</th>
<th>DATE</th>
<th>APPROVAL</th>
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<td>A</td>
<td>Release to Production</td>
<td>N/A</td>
<td>RM</td>
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<tr>
<td>B</td>
<td>Updates</td>
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<tr>
<td>C</td>
<td>Updated Images and Content</td>
<td>09/2015</td>
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<td>D</td>
<td>Updated Images and Information</td>
<td>09/21/2017</td>
<td>RM</td>
</tr>
</tbody>
</table>
WARRANTY STATEMENT

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for a period of one year after shipment. Warranty repair will be done by EdgeTech free of charge.

Shipping costs are to be borne by the customer. Malfunction due to improper use is not covered in the warranty, and EdgeTech disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose, and there is no warranty of merchantability. This warranty applies only if:

i. The items are used solely under the operating conditions and in the manner recommended in Seller's instruction manual, specifications, or other literature.

ii. The items have not been misused or abused in any manner, nor have repairs been attempted thereon without the approval of EdgeTech Customer Service.

iii. Written notice of the failure within the warranty period is forwarded to Seller and the directions received for properly identifying items returned under warranty are followed.

iv. The return notice authorizes Seller to examine and disassemble returned products to the extent Seller deems necessary to ascertain the cause for failure.

The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and Seller does not assume any other obligation or liability in connection with the sale or use of said products. Any product or service repaired under this warranty shall be warranted for the remaining portion of the original warranty period only.

Equipment not manufactured by EdgeTech is supported only to the extent of the original manufacturer's warranties.
Prior to returning any equipment to EdgeTech, a Returned Material Authorization (RMA) number must be obtained. The RMA will help us identify your equipment when it arrives at our receiving dock and track the equipment while it is at our facility. The material should be shipped to the address provided in the *EdgeTech Customer Service* section. Please refer to the RMA number on all documents and correspondences as well.

All returned materials must be shipped prepaid. Freight collect shipments will not be accepted. EdgeTech will pay freight charges on materials going back to the customer after they have been evaluated and/or repaired.

The following steps apply only to material being returned from outside the Continental United States. Follow them carefully to prevent delays and additional costs.

1. All shipments must be accompanied by three copies of your proforma invoice, showing the value of the material and the reason for its return. If the reason is for repair, it must be clearly stated in order to move through customs quickly and without duties being charged. Whenever possible, please send copies of original export shipping documents with the consignment.

2. If the value of the equipment is over $1000, the following Shipper's oath must be sent with the invoice. This oath can be typed on the invoice, or on a separate letterhead:

   "I, ______________________________, declare that the articles herein specified are the growth, produce, or manufacture of the United States; that they were exported from the United States from the port of _____________________, on or about _______________; that they are returned without having been advanced in value or improved in condition by any process of manufacture or any other means; and that no drawback, or allowance has been paid or admitted hereof."

   Signed ______________________________

3. If there is more than one item per consignment, a packing list must accompany the shipment. It is acceptable to combine the proforma invoice and packing list as long as the contents of each carton are clearly numbered and identified on the invoice.

4. Small items can be shipped prepaid directly to EdgeTech by FedEx, DHL, UPS, Airborne, etc.

5. If the equipment is the property of EdgeTech (formerly EG&G Marine Instruments Division), please insure for full value.

6. Fax one invoice, packing list, and a copy of the airway bill to EdgeTech upon shipment.
Customer service personnel at EdgeTech are always eager to hear from users of our products. Your feedback is welcome, and is a valuable source of information which we use to continually improve these products. Therefore we encourage you to contact EdgeTech Customer Service to offer any suggestions or to request technical support:

**NOTE:** Please have your system Serial Number available when contacting Customer Service.

---

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      West Wareham, MA 02576
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Facsimile: (508) 291-2491
24-Hour Emergency Technical Support Line: (508) 942-8043

For more information please go to [www.EdgeTech.com](http://www.EdgeTech.com).
COMPANY BACKGROUND

EdgeTech (formerly EG&G Marine Instruments) traces its history in underwater data acquisition and processing back to 1966. EdgeTech has designed, developed, and manufactured products, instruments, and systems—for the acquisition of underwater data, including marine, estuarine, and coastal applications—for over 50 years.

The company has responded to the needs of the scientific, Naval, and offshore communities by providing equipment—such as sub-bottom profilers, side scan sonar, acoustic releases, USBL positioning systems, and bathymetric systems—that have become standards in the industry.

EdgeTech has also consistently anticipated and responded to future needs through an active research and development program. Current efforts are focused on the application of cutting-edge CHIRP and acoustic technology.
TABLE OF CONTENTS

ATTENTION – READ THIS FIRST! ................................................................. iii
HARDWARE VARIATIONS AND COMPATIBILITY ........................................ iv
ABOUT THIS DOCUMENT ........................................................................... v
  Purpose of this Manual .............................................................................. v
  Liability ...................................................................................................... v
  Warnings, Cautions, and Notes ................................................................. v
WARRANTY STATEMENT ........................................................................... vi
RETURNED MATERIAL AUTHORIZATION .................................................. viii
CUSTOMER SERVICE ................................................................................ ix
COMPANY BACKGROUND ........................................................................... x
TABLE OF CONTENTS ................................................................................ xi
LIST OF FIGURES ....................................................................................... xiv
LIST OF TABLES ......................................................................................... xvi

☐ SECTION 1: OVERVIEW ............................................................................. 1-1

☐ SECTION 2: SPECIFICATIONS ................................................................. 2-1
  2.1 Mechanical Specifications ................................................................. 2-1
  2.2 Printed Circuit Board (PCB) ............................................................... 2-1
  2.3 Acoustic Specifications ...................................................................... 2-2
    2.3.1 Command Receiver ....................................................................... 2-2
    2.3.2 BACS Command Structure ......................................................... 2-2
    2.3.3 BACS Command Coding .............................................................. 2-2
    2.3.4 Standard Command Functions ..................................................... 2-3
    2.3.5 Transponder Specifications ......................................................... 2-3
  2.4 Power Supply Specifications ............................................................... 2-3
  2.5 Environmental Specifications ............................................................ 2-4
  2.6 Mechanical Drawings .......................................................................... 2-4

☐ SECTION 3: Installation ............................................................................ 3-1
  3.1 Acoustic ............................................................................................... 3-1
  3.2 Mechanical ......................................................................................... 3-1
APPENDIX B: EXPERT TIPS ......................................................................................................... B-2
Kynar Retention Rods: .................................................................................................................. B-2
Release Shaft: ............................................................................................................................... B-2
Top Pad Eye: ................................................................................................................................. B-2
Purging: ........................................................................................................................................ B-2
Pre-Deployment Check: .................................................................................................................. B-2
Deployment: .................................................................................................................................. B-2

APPENDIX C: POPUP OPTION .................................................................................................... C-3
C.1 Pop-Up Assembly ..................................................................................................................... C-3
Tools needed for assembly ............................................................................................................. C-3
C.2 Line Packing Considerations ................................................................................................. C-3
C.3 Line Packing Procedure .......................................................................................................... C-4
4. Attach the top end of the line to the stud inside the top floatation. ........................................... C-5
5. Once the bucket is loaded with line, follow the assembly instructions below to complete the Pop-up system. ................................................................. C-5
   C.3.1 To Assemble the Pop-Up ................................................................................................. C-6
C.4 Mechanical Drawings ............................................................................................................. C-9

APPENDIX D: LF-SD TANDEM KIT OPTION ........................................................................... D-1
Mechanical Drawing ....................................................................................................................... D-1

APPENDIX E: STRONGBACK OPTION ................................................................................... E-1
Mechanical Drawing ....................................................................................................................... E-1

APPENDIX F: STRONGBACK TANDEM OPTION ................................................................. F-1
Mechanical Drawing ....................................................................................................................... F-1
LIST OF FIGURES

Figure 2-1: PCB Connectors ....................................................................................................................... 2-1
Figure 2-2: PORT-LF SD Mechanical Drawing .......................................................................................... 2-5
Figure 4-1: Unscrew the Anti-Rotation Block to Remove it ....................................................................... 4-1
Figure 4-2: Removal of the Purge Port Plug .............................................................................................. 4-2
Figure 4-3: Removing the Transducer End Cap Kynar Retainer Rod .......................................................... 4-3
Figure 4-4: Gently pull the Transducer End cap free from the Housing .................................................... 4-3
Figure 4-5: The Transducer Sliding from the Housing ............................................................................... 4-4
Figure 4-6: The Battery Cable Plugged into its Header on the Circuit Board ............................................. 4-4
Figure 4-7: The Proper Alignment of the Motor Cable in the Battery Retention Plate Notch .................. 4-5
Figure 4-8: The Transducer End Entering the Housing .............................................................................. 4-6
Figure 4-9: The Proper Alignment of the Orientation Key ......................................................................... 4-6
Figure 4-10: Apply gentle pressure to the End Cap to Seat it into the Housing ......................................... 4-7
Figure 4-11: Inserting the Kynar Retaining Rod into the Slot ................................................................... 4-8
Figure 4-12: The Kynar Retaining Rod Fully Inserted into the Slot ............................................................ 4-8
Figure 4-13: Gently Push the Purge Port Plug in ...................................................................................... 4-9
Figure 4-14: Replace the Anti-Rotation Block with the Two Nylon Screws ............................................. 4-10
Figure 4-15: Remove the Anti-Rotation Block .......................................................................................... 4-12
Figure 4-16: The Cleaned and Greased Release Shaft ............................................................................. 4-13
Figure 4-17: Threading the Release Link onto the Shaft ......................................................................... 4-13
Figure 4-18: Replace the Anti-Rotation Block Using Two Nylon Screws ................................................. 4-14
Figure 6-1: The Completed Assembly of the PORT LF SD ......................................................................... 6-1
Figure 6-2: The Motor Connector unplugged from the Circuit Board Header ........................................... 6-2
Figure 6-3: Removing the Kynar Rod ........................................................................................................ 6-3
Figure 6-4: The Kynar Rod inserted .......................................................................................................... 6-3
Figure 6-5: The Removal of the Release Endcap ........................................................................................ 6-3
Figure 6-6: Gently Pull the Release End Cap Free from the Housing ........................................................ 6-4
Figure 6-7: The Release End Cap Freed from the Housing ....................................................................... 6-4
Figure 6-8: The Release End Must be Inserted into the Housing with a Bare Aluminum Ring ................. 6-5
Figure 6-9: The Release End Cap and Motor Assembly being Guided Back into the Housing ................. 6-6
Figure 6-10: The Release End Sliding into the Housing ............................................................................. 6-6
Figure 6-11: The Alignment of the Orientation Key ................................................................. 6-7
Figure 6-12: The Release End Cap Connected to the Housing ............................................... 6-7
Figure 6-13: Inserting the Kynar Rod ...................................................................................... 6-8
Figure 6-14: The Three Screwing Holding the Battery Retainer in Place .............................. 6-10
Figure 6-15: The Correct Wire Orientation for Battery Installation ........................................ 6-10
Figure 6-16: Remove the Old Battery Pack .......................................................................... 6-11
Figure 6-17: While Installing the New Battery, Ensure the Cable is at the Top ................. 6-11
Figure 6-18: Replace the Three Screws to Attach the Battery Retainer Plate ..................... 6-12
Figure 6-19: Disconnection the Motor Cable (JP2) from the Electronics Assembly .......... 6-13
Figure 6-20: The Transducer End O-rings .............................................................................. 6-14
Figure 6-21: The Release End O-rings .................................................................................. 6-14
Figure 6-22: Cross Section of Round and Back-up O-rings ................................................ 6-15
Figure 6-23: The PORT LF-SD Callout Assembly Drawing # 1 ............................................. 6-1
Figure 6-24: The PORT LF-SD Callout Assembly Drawing # 2 ............................................. 6-1
Figure 6-25: The PORT LF-SD Callout Assembly Drawing # 3 ............................................. 6-1
Figure 6-26: The Top Collar with Clamp ................................................................................ C-6
Appendix Figure A-1: PORT-LF SD Basic Parts (standard) ..................................................... A-1
Appendix Figure C-1: Attach the End of the Line to the Chain .............................................. C-4
Appendix Figure C-2: Line attached to inside and outside of bucket ..................................... C-4
Appendix Figure C-3: An Example of Flacked Line into the Canister ..................................... C-5
Appendix Figure C-4: Installing the Top Mating Collar ........................................................ C-6
Appendix Figure C-5: Inserting Release into the Top Cup from Above ................................. C-7
Appendix Figure C-6: Installing Anti-Slip Ring ...................................................................... C-7
Appendix Figure C-7: Bolting Release to Pop-Up Bottom Cup ............................................. C-8
Appendix Figure C-8: Flotation Pop-Up Assembly ............................................................... C-1
Appendix Figure C-9: PORT Pop-Up Canister 200M Assembly .......................................... C-2
Appendix Figure C-10: PORT Pop-Up Canister 200M Drawing ........................................... C-1
Appendix Figure D-1: 0018494 PORT LF-SD Optional Tandem Kit Diagram ........................ D-1
Appendix Figure D-2: 0017442 PORT LF-SD Optional Tandem Kit Callout Diagram ............ D-2
Appendix Figure E-1: 0017668 PORT LF-SD Optional Strongback Diagram ........................ E-1
Appendix Figure E-2: 0019087 PORT LF-SD Optional Strongback Callout Diagram ............ E-2
Appendix Figure F-1: 0019088 PORT LF-SD Optional Strongback Tandem Diagram ............ F-2
LIST OF TABLES

Table 2-1: Mechanical Specifications .......................................................... 2-1
Table 2-2: Command Receiver Specifications ........................................... 2-2
Table 2-3: BACS Command Coding ............................................................ 2-2
Table 2-4: Standard Command Functions .................................................. 2-3
Table 2-5: Transponder Specifications ....................................................... 2-3
Table 2-6: Power Supply Specifications ..................................................... 2-3
Table 2-7: Environmental Specifications—Temperature ........................... 2-4
Table 3-1: Status Reply Meanings .............................................................. 3-2
Table 6-1: General Inspection and Replacement Schedule ...................... 6-16
Table 6-2: Common Spares ...................................................................... 6-16
Appendix Table B-1: 0003121 PORT LF-SD Optional Tandem Parts ....... D-1
SECTION 1: OVERVIEW

This manual describes the EdgeTech low frequency, small diameter Push Off Acoustic Release/Transponder (PORT-LF SD). This model is a lightweight, robust, and easily deployable instrument. It can function both as an acoustic release and/or transponder at depths up to 3500 meters, and with release loads up to 250 Kg.

The PORT-LF SD has been designed for use as an instrument location and recovery system on oceanographic moorings and platforms. Additionally, the precision, high-output power transponder feature makes this instrument ideal for use in Long Baseline (LBL) Positioning and Navigation Systems.

The PORT uses a version of the EdgeTech’s field-proven, Binary Acoustic Command System (BACS) code structure. The BACS coding structure provides 12,000 possible secure command codes. Each release is factory-programmed with its own unique command set, including ENABLE, DISABLE, and RELEASE commands. Whenever the instrument receives a DISABLE or ENABLE command, it responds with a status reply message that indicates the orientation of the instrument (tilted or not tilted).

The transponder function can be turned on or off with the ENABLE and DISABLE commands. The transponder will self-disable after 512 pings. This prevents running the batteries down if it is left enabled by mistake. The ping counter is reset to zero each time it is enabled. When disabled the transponder will not reply when interrogated. This ensures that the unit will not interfere with nearby instruments and that no battery energy will be wasted replying to spurious noise sources during the deployment. The transponder ENABLE and DISABLE command has no effect on the RELEASE command.

The RELEASE command causes the mechanism on the instrument to rotate and to push off the threaded Release Link. While releasing, the PORT will ping once for every rotation of the release shaft. This provides confirmation that the shaft is turning and the Release Link is being pushed off. Once the threaded link is completely pushed out, the instrument is free. The RELEASE command has no effect on the ENABLE and DISABLE commands.
SECTION 2: SPECIFICATIONS

This section describes the specifications for the PORT-LF SD.

2.1 Mechanical Specifications

Mechanical specifications for the PORT-LF SD are as follows:

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Rating</td>
<td>3,500 m (11,480 ft)</td>
</tr>
<tr>
<td>Maximum Release Threshold</td>
<td>250 kg (550 lb)</td>
</tr>
<tr>
<td>Maximum Static Load</td>
<td>750 kg (1,650 lb)</td>
</tr>
<tr>
<td>Overall Length</td>
<td>71.8 cm (28.3 in)</td>
</tr>
<tr>
<td>Main Diameter</td>
<td>10.6 cm (4.2 in)</td>
</tr>
<tr>
<td>Weight in Water</td>
<td>2.5 kg (5.6 lb)</td>
</tr>
<tr>
<td>Weight in Air</td>
<td>7.2 kg (15.9 lb)</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Type 6061 Aluminum</td>
</tr>
<tr>
<td>Other Materials</td>
<td>Delrin, Nylon, Kynar, Ultem, Neoprene 316SS</td>
</tr>
<tr>
<td>Finish</td>
<td>Hard-anodized and Epoxy-painted</td>
</tr>
<tr>
<td>Release Type</td>
<td>Mechanical (motor-driven push off)</td>
</tr>
</tbody>
</table>

Table 2-1: Mechanical Specifications

2.2 Printed Circuit Board (PCB)

A photo of the PCB connectors on the PORT-LF SD’s board are shown in FIGURE 2-1:
2.3 Acoustic Specifications

The acoustic specifications for the PORT-LF unit are described in the following sub-sections.

2.3.1 Command Receiver

Specifications for the command receiver are as follows:

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>78 dB re 1 µPa</td>
</tr>
<tr>
<td>Receiver Type</td>
<td>Multi-stage band pass with hard-limited output (2,000 Hz / 300 Hz Bandwidths)</td>
</tr>
<tr>
<td>Pulse Width</td>
<td>22 ms</td>
</tr>
<tr>
<td>Period</td>
<td>250 ms</td>
</tr>
<tr>
<td>Total Command Time</td>
<td>9 seconds</td>
</tr>
<tr>
<td>Total Lock Out Time</td>
<td>14 s re beginning</td>
</tr>
<tr>
<td>Commands Per Tone Pair</td>
<td>2,000</td>
</tr>
</tbody>
</table>

*Table 2-2: Command Receiver Specifications*

2.3.2 BACS Command Structure

The BACS’ command structure consists of two 8-bit words separated by a 5-sec interval. Each word is comprised of 8 bits from a 16-bit command. The 16-bit command is a 15 bit, 11 block cyclic code with an overall parity bit appended to the end to form a 16-bit code with a minimum Hamming distance of 4 bits. Additionally, two transitions are required within each word, and no repetitions of words are allowed in a command.

2.3.3 BACS Command Coding

BACS command coding is described in the following table:

<table>
<thead>
<tr>
<th>PAIR NUMBER</th>
<th>“0”</th>
<th>“1”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9.5 kHz</td>
<td>9.9 kHz</td>
</tr>
<tr>
<td>2</td>
<td>9.5 kHz</td>
<td>10.3 kHz</td>
</tr>
<tr>
<td>3</td>
<td>9.5 kHz</td>
<td>10.7 kHz</td>
</tr>
<tr>
<td>4</td>
<td>9.9 kHz</td>
<td>10.3 kHz</td>
</tr>
<tr>
<td>5</td>
<td>9.9 kHz</td>
<td>10.7 kHz</td>
</tr>
<tr>
<td>6</td>
<td>10.3 kHz</td>
<td>10.7 kHz</td>
</tr>
</tbody>
</table>

*Table 2-3: BACS Command Coding*
### 2.3.4 Standard Command Functions

Functions for the three standard commands are given in the table below:

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENABLE</td>
<td>Enable Transponder</td>
</tr>
<tr>
<td>DISABLE</td>
<td>Disable Transponder</td>
</tr>
<tr>
<td>RELEASE</td>
<td>Activate mechanical release</td>
</tr>
</tbody>
</table>

*Table 2-4: Standard Command Functions*

### 2.3.5 Transponder Specifications

Specifications for the Transponder are given below:

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>80 dB re 1 µPa</td>
</tr>
<tr>
<td>RCV Detection Jitter</td>
<td>&lt; 0.1 ms</td>
</tr>
<tr>
<td>Interrogate Frequency</td>
<td>11 kHz standard (others are optional)</td>
</tr>
<tr>
<td>Post-Filter Bandwidth</td>
<td>300 Hz</td>
</tr>
<tr>
<td>Minimum Interrogate Pulse Width</td>
<td>5 ms</td>
</tr>
<tr>
<td>Reply Frequency</td>
<td>12 kHz standard (other frequencies available)</td>
</tr>
<tr>
<td>Reply Pulse Width</td>
<td>10 ms</td>
</tr>
<tr>
<td>Reply Source Level</td>
<td>192 dB re 1 µPa @ 1 m</td>
</tr>
<tr>
<td>Turnaround Time</td>
<td>12.5 ms</td>
</tr>
<tr>
<td>Lockout Time</td>
<td>1 second</td>
</tr>
</tbody>
</table>

*Table 2-5: Transponder Specifications*

### 2.4 Power Supply Specifications

The PORT-LF SD uses a pack of 24 welded “AA” alkaline batteries as a power supply *(FIGURE 2-2)*. Specifications for this battery pack are shown in the following table:

<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Supply</td>
<td>5V regulated</td>
</tr>
<tr>
<td>Quiescent Current Drain</td>
<td>250 µA</td>
</tr>
<tr>
<td>Design Life (@ 0° C)</td>
<td>1.25 years</td>
</tr>
<tr>
<td>Design Life (@ 0° C)</td>
<td>10,000 replies @ 10 ms</td>
</tr>
</tbody>
</table>

*Table 2-6: Power Supply Specifications*
2.5 Environmental Specifications

The environmental specifications for the PORT-LF SD unit are concerned with temperature as shown below:

<table>
<thead>
<tr>
<th>TEMPERATURE</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating</td>
<td>-10° C to +40° C (14° F to 104° F)</td>
</tr>
<tr>
<td>Storage (Batteries Removed)</td>
<td>--20° C to +60° C (-4° F to 140° C)</td>
</tr>
</tbody>
</table>

*Table 2-7: Environmental Specifications—Temperature*

2.6 Mechanical Drawings

Mechanical drawings for the PORT-LF SD is shown below
Figure 2-2: PORT-LF SD Mechanical Drawing
SECTION 3: INSTALLATION

This section contains the information relative to the basic set up of EdgeTech’s Push Off Release Transponder (PORT-LF SD) including important details concerning the orientation of the unit on a mooring structure.

NOTE: The Transponder will operate in any orientation. However, specifics of the intended deployment will mandate special installation concerns.

3.1 Acoustic

Efforts should be made to ensure that there is a clear acoustic path between the PORT-LF SD Transducer and the source (typically a dunking Transducer from a deck unit). Structural elements of a mooring system which have significantly different acoustic impedance than that of seawater will cause absorption or reflection of acoustic signals, which will degrade the operation of the unit. Floatation, including glass spheres, syntactic foam and plastic floats are particularly problematic. Floats placed physically close to the Transducer can create a blind area in the Transducers beam pattern.

3.2 Mechanical

The Release Load is held through the Top Pad Eye, Housing, and Release Link. There are isolation shoulder washers on the top pad eye to prevent electrical contact with the mooring. In some installations (such as a trawl resistant bottom mooring) the unit needs to be secured to the structure. It is important to verify that the Release Link is not obstructed in its motion, which could prevent it from disengaging.

The release mechanism is designed for in-line loads; side loading will severely degrade performance. Generally, the Release Link is treated as a disposable item. It is used to electrically isolate the release from the rest of the mooring. The Release Link is fabricated from “Utem”, a very high strength plastic. Arbitrary choice of an alternate Release Link could result in jamming, galvanic corrosion, or mooring failure due to insufficient strength.

3.2.1 Bio-Fouling Prevention

Anti-fouling paint can be used to prevent bio-fouling on the Housing and other external parts. However, note that the system is made of aluminum, so do not use paints that will react with it. Copper-based paints should not be used. Tin based paints may be used. Furthermore, using plenty of grease is an important
consideration for instruments deployed for long periods. Apply grease to the threaded release shaft. EdgeTech recommends the use of Novagard G624, be sure to use only silicone grease.

3.3 Status Reply

The PORT-LF SD is equipped with sensors that monitor the tilted or not tilted orientation of the system and release shaft rotation. This information allows the unit to send a coded status reply, based on the instruments orientation and to emit one ping each time the release shaft completes a rotation. The tilt status is useful for ascertaining whether the mooring or platform that has been deployed and/or has landed as planned. At the end of a deployment, the information is useful in determining whether forces such as strong currents or trawl activity have affected the mooring or platform. The status reply indicates one of two states:

- "upright (within 45° of upright)"
- "tilted (more than 45° from upright)"

After a(n) DISABLE or ENABLE command has been received, the unit transmits a series of pings encoded as follows:

<table>
<thead>
<tr>
<th>PATTERN</th>
<th>STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 pings at 2 second intervals</td>
<td>“upright”</td>
</tr>
<tr>
<td>7 pings at 2 second intervals</td>
<td>“tilted”</td>
</tr>
</tbody>
</table>

*Table 3-1: Status Reply Meanings*

The tilt sensor is a 45° mechanical switch that is mounted on the Release Circuit Board assembly. In the standard instrument configuration, with the release mechanism down, the unit is defined as “not tilted”. For applications requiring a narrower maximum allowable angle of tilt optional tilt switches are available. The switch can also be installed at different angles to change the standard orientation.
SECTION 4: OPERATING INSTRUCTIONS

This section of the manual covers instructions for normal operations, including opening and closing the Transducer End.

To start using the PORT, the Housing must be opened so that the battery can be plugged in. The instructions for this continue below in sub-section 4.1.

4.1 Turning the Unit On

Push Off Release Transponders (PORT) are carefully tested and shipped from the factory with a new battery pack installed. Unless otherwise requested, all battery packs are disconnected in transit, to prolonging the battery life.

To use the PORT LF-SD, the Housing MUST be opened so that the battery can be plugged into the JP3 header connector on the electronic board. Then, the unit must be closed and the Housing purged.

4.1.1 Removing Purge Port Plug

The Purge Port Plug keeps the unit sealed. If it is not removed first, the unit will not open.

1. Remove the anti-rotation block from the Release End of the instrument (Black Delrin block that keeps the Release Link from turning) by unscrewing the two nylon screws that hold it in place as shown in Figure 4-1.

Figure 4-1: Unscrew the Anti-Rotation Block to Remove it
2. Once the Anti-Rotation Block has been removed, the Purge Port Plug will be visible. Pull the urge Port Plug out of the end cap as shown in **FIGURE 4-2**.

![Purge Port Plug](image)

**FIGURE 4-2: Removal of the Purge Port Plug**

### 4.1.2 Removing the Transducer End

**CAUTION!**

> Separate the Transducer End from the Housing by gently pulling them apart. Be careful not to scratch the Housing when pulling the assembly from the tube. The main electronics and battery pack assembly is connected to the Transducer End Cap. Carefully slide the assembly out enough to plug the connector from the battery pack into the electronics board (connector JP3) if you are turning the system on.
1. Remove the Kynar retaining rod (white plastic rod) from the Transducer End of the Housing as shown in Figure 4-4. (Simply pull the rod out and away from the Housing).

![Figure 4-3: Removing the Transducer End Cap Kynar Retainer Rod](image)

2. Gently pull the Transducer End Cap free from the Housing as shown in Figure 4-5. You may need to work it side-to-side to get it started, but once the initial resistance is overcome, the Transducer should slide out easily, as shown in Figure 4-6.

![Figure 4-4: Gently pull the Transducer End cap free from the Housing](image)
4.1.3 Applying Power

The Electronics assembly and battery pack are mounted to an aluminum plate that is attached to the Transducer End Cap.

1. Plug the 3-pin connector from the battery pack into the 3-pin header (JP3) on the circuit board shown. (Take care to line up the pins correctly) as shown in FIGURE 4-7 and FIGURE 4-8.

The PORT will ping once after it has powered up and the Transponder will be enabled.
4.1.4 Closing the Transducer End

**CAUTION!**

Figure 4-8 shows the proper alignment of the Motor Cable in the battery plate notch. The motor cable must be placed between the notch as shown, otherwise it may be damaged and lead the Unit to fail.

Depending on how far the Transducer End had been pulled from the Housing, it is important to consider the wires and cables that are within the unit. Whenever operating the unit, be sure to check the orientation of cables to ensure they won’t be damaged.

*Figure 4-7: The Proper Alignment of the Motor Cable in the Battery Retention Plate Notch*
To close the Transducer End:

1. After connecting the battery pack connector, gently guide the Electronics assembly back into the Housing, taking care not to damage the sealing surface of the Housing or pinch any cables as shown in **Figure 4-9**.

![Figure 4-8: The Transducer End Entering the Housing](image)

a. Be sure to align the Orientation key to the Housing as shown in **Figure 4-10**.

![Figure 4-9: The Proper Alignment of the Orientation Key](image)
b. As the O-ring enters the Housing, firm but gentle pressure must be applied to seat the end cap fully against the Housing. **Figure 4-11** shows the alignment of the orientation key.

![Figure 4-10: Apply gentle pressure to the End Cap to Seat it into the Housing](image)

2. Make certain that the O-rings and O-ring surfaces are clean and lightly greased. EdgeTech recommends the use of Parker Super O-lube, be sure to use only silicone grease.

**CAUTION!**

DO NOT APPLY ANY SILICONE GREASE TO THE POTTED TRANSDUCER BECAUSE IT IMPEDES THE ACOUSTIC COUPLING BETWEEN TRANSDUCER AND WATER, REDUCING OR ELIMINATING
3. Insert the Kynar retaining rod back into the slot as shown in **FIGURE 4-12**. Continue inserting the rod until it comes out the other end of the slot as shown in **FIGURE 4-13**.

![Figure 4-11: Inserting the Kynar Retaining Rod into the Slot](image1)

![Figure 4-12: The Kynar Retaining Rod Fully Inserted into the Slot](image2)
4.1.5 Replacing the Purge Port Plug

**CAUTION!**

Before reinserting the Purge Port Plug, ensure it is clean and free of debris. Even small debris can cause the unit to flood.

1. Purge the instrument as per sub-section 4.1.6.
2. Replace the Purge Port Plug as shown in FIGURE 4-14.

*Figure 4-13: Gently Push the Purge Port Plug in*
3. Replace the anti-rotation block using the two nylon screws as shown in Figure 4-15.

![Figure 4-14: Replace the Anti-Rotation Block with the Two Nylon Screws](image)

4. At this point it is good practice to perform an air acoustic test of the system by running through the command set for the PORT-LF SD (See sub-section 4.3).
4.1.6 Leak Detection and Condensation Prevention

EdgeTech’s releases are provided with a 5/16-inch diameter purging port on the Release End Cap. The following procedure assumes the user has a vacuum pump, dry nitrogen gas cylinder, and compound pressure/vacuum gauge all arranged on a manifold setup. The recommended procedure for preparation of the instruments atmosphere is as follows:

1. Verifying that all other (other than the purge port) O-ring seals have been cleaned, lubricated and assembled.

2. Prepare the purge port plug for installation by cleaning and greasing it, the plug must be ready for immediate insertion.

3. Insert a purge port adaptor and draw a -3 PSIG vacuum, do not exceed -5 PSIG.

4. Close the manifold valve to the instrument and allow the instrument to sit for 15 minutes. Check the gauge afterwards and verify that the vacuum did not change. This step is done to detect gross O-ring problems (cut or missing).

5. Open the valve to the instruments purge port and:
   a. Backfill the Housing with dry nitrogen gas, do not exceed +5 PSIG.
   b. Draw a -3 PSIG vacuum on the instrument, do not exceed -5PSIG.
   c. In humid environments, you should repeat this process up to four times.
   d. After drawing the final vacuum in this process, remove the purge hose and quickly insert the purging plug before the -3 PSIG vacuum is lost.

6. Secure the purge plug with the anti-rotation block and nylon screws.

CAUTION!

When purging the instrument, be careful not to draw more than -5 PSIG vacuum. Exceeding this figure can damage the battery or electronic components, which in turn can result in instrument failure. If a purging set up is not available, then place a desiccant pack inside the Housing to help reduce moisture.
4.2 Arming the Instrument

The Release mechanism is easily armed. The shaft should be wiped clean and lubricated with silicone grease before installing the link.

NOTE:

The Release Link does not need to be tight.

Items required for arming:

- One (1) Release Link
- Silicone grease
- Phillips screw driver (#1 Phillips preferred)

To Arm the Instrument:

1. Remove the Anti-Rotation Block from the Release End of the instrument (Black Delrin block that keeps the Release Link from turning) by unscrewing the two nylon screws that hold it in place as shown in Figure 4-16.
2. Make certain that the Release Shaft is free of debris and is not damaged as shown in **FIGURE 4-17**.

![Figure 4-16: The Cleaned and Greased Release Shaft](image)

3. Grease the threads on the shaft and inside the link with silicone grease.

4. Thread the Release Link on to the Shaft until it bottoms out, then unscrew it ¼ turn as shown in **FIGURE 4-18**.

![Figure 4-17: Threading the Release Link onto the Shaft](image)
5. Replace the Anti-Rotation Block using two nylon screws as shown in Figure 4-20.
4.3 Acoustic Air Testing

This section describes the acoustic air testing to ensure proper function of the unit before deployment.

4.3.1 Setup

The specific acoustic impedance of air is quite different from that of seawater, which renders the Transducer a far less efficient receiver when out of water. For this reason, it is necessary to place the source (Deck Unit Transducer) within a meter or two of the PORT LF-SD Transducer, with no obstructions to the acoustic path. Depending on the environment, some experimentation may be necessary to find a suitable location.

4.3.2 Tests

For the following tests, it will be necessary to have the proper six digit commands unique to the unit being tested. If it appears that commands are not getting through, verify that the serial number of the unit being tested matches that on the sheet of command codes.

1. Using a deck unit, ascertain whether the PORT-LF SD is enabled or disabled by interrogating it if the unit has just been powered up it will be enabled. Unless otherwise specified, the PORT will be shipped from EdgeTech, with the interrogate frequency tuned to 11 kHz and the reply frequency set to 12 kHz.

2. Using the deck unit, send the ENABLE command. The instrument should reply with a series of pings based on the orientation (tilt) in the electronics assembly.

3. Next, send the RELEASE command.
   a. The shaft should rotate through seven rotations and send 1 ping for each complete rotation. After a successful release cycle the system will have transmitted 7 pings.
   b. If the shaft fails to turn 7 times or the cycle is somehow interrupted then after a one minute time out the PORT-MFE will send 9 fast pings.

4. Interrogate the instrument using the Deck Unit set at the appropriate interrogate frequency and tuned to the proper reply frequency.
   a. It is unlikely that the Deck Unit will display a valid range because of the proximity of the two Transducers, but you should be able to verify that the instrument transmits a reply pulse by listening to the speaker on the front panel of the Deck Unit.

5. Next, send the DISABLE command. The instrument should reply with the appropriate series of pings to indicate tilt status.
6. Now range on the instrument again with the deck unit. This time the unit should not transmit a reply pulse.

7. It is a good practice to finish up by sending the ENABLE command, so that during deployment the instrument will reply to range interrogations. If the PORT is being shipped or stored it should be disabled to conserve battery life.

The PORT should also be left disabled while deployed to conserve battery life. If the system is left enabled and it pings 512 times, it will disable itself to save battery life. Simply send the ENABLE command to use it again.

4.4 Post Deployment

After recovery, the Unit should be cleaned and rinsed with fresh water to avoid salt buildup and deterioration of mechanical parts.

A visual inspection of the Housing and release mechanism should be performed to detect any signs of damage, excessive wear, corrosion, etc.

If the PORT-MFE is not to be used again soon, the Unit should be turned off (battery unplugged - follow procedure described in sub-section 4.1).

If the Unit is to be stored for a long period of time, the batteries should be removed. See Maintenance procedures in SECTION 6: MAINTENANCE.
BACS codes are 16 bits long with 11 bits of information. Specifically each code is referred to as a 15, 11 block cyclic code with an overall even parity bit appended to the end. The information bits occupy the first 11 bit positions, the cyclic parity or redundant bits occupy the four positions after the information bits, and the overall parity bit occupies the last position. This particular code has good mathematical structure. The parity bits are easily calculated and a minimum Hamming distance of four bits exists between any two codes. The command timing is as follows:

1. 8 bits are sent with a period of roughly 250 ms and a pulse width of 22 ms
2. A word decode interval is 2.718 seconds
3. Following the first decode interval, a 40 ms detection window is open
4. If a detection occurs in the window, a second word decode interval occurs
5. During any of the sample gate intervals, if both "D0" and "D1" are present or if neither one is present then a command abort will occur and the command will not go through.

From the 11 information bits there are approximately 2000 unique commands for each tone pair employed. Commands composed of equal or repeated words are excluded, as are some containing very few transitions. Since there are six tone pairs available (refer to TABLE 2-3), over 12,000 unique commands exist. Certain ranges of these codes, which are rich in transitions, are designated as "guarded" commands; these are used for critical functions such as release.
SECTION 6: MAINTENANCE

The PORT requires minimal maintenance. Pre-deployment preparations and checks, and post-deployment cleaning will fulfill most of the maintenance requirements. The important tasks are battery replacement, 'O' ring care and maintenance, and general cleaning, inspection, and lubrication of operational elements.

CAUTION!

Whenever disassembling the PORT LF-SD, the Transducer End should ALWAYS be opened or removed first. When plugged in, the motor cable connects the Release End to the Transducer via the electronics board. Therefore, the Transducer End MUST be opened in order to unplug the motor connector before the Transducer End can be safely removed from the Housing.

6.1 To Open the PORT

Should the need arise for service or replacement of parts, the following instructions detail complete disassembly and reassembly of the Unit. These instructions will build upon the instructions in section 4.1, as they follow some of the same initial steps, but are more in depth.

Suggested tools include:

- Plyers
- Philips head Screw driver

Figure 6-1: The Completed Assembly of the PORT LF SD
6.1.1 PORT Disassembly

To Disassemble the PORT LF SD:

1. Refer to sub-section 4.1.1 to remove the Purge Plug Port.
2. Refer to sub-section the 4.1.2 to remove the Transducer End. (Do not go to step 4.1.3.)
3. Unplug the 5-pin Motor cable (JP1) from the electronics assembly. This 5-pin connector head and is slightly behind the battery, as shown in FIGURE 6-2.

*Figure 6-2: The Motor Connector unplugged from the Circuit Board Header*
4. To remove the Release End Cap, pull the Kynar rod from the Release End of the Housing, as shown in **FIGURE 6-4**, **FIGURE 6-5**, and **FIGURE 6-6**.

*Figure 6-4: The Kynar Rod inserted*  
*Figure 6-3: Removing the Kynar Rod*  
*Figure 6-5: The Removal of the Release Endcap*
5. Gently pull the Release End Cap free from the Housing as shown in **FIGURE 6-6**. You may need to work it side-to-side to get it started, but once the initial resistance is overcome, the Release should slide out easily, as shown in **FIGURE 6-7**.

![Figure 6-6: Gently Pull the Release End Cap Free from the Housing](image1)

![Figure 6-7: The Release End Cap Freed from the Housing](image2)

6. The unit is now completely disassembled. Any maintenance or part inspection can now be completed. Faulty, questionable, or worn parts should always be replaced.
6.1.2 PORT LF-SD Assembly

CAUTION!

The Release End should be put back into the Housing first to ensure no damage to cables and internal components occurs.

WARNING!

The Release End MUST be inserted into the section of Housing with the bare aluminum band to ground the grounding spring.

To Assemble the PORT LF SD:

1. Identify the bare aluminum ring inside one end of the Housing, normally this is located at the end of the housing opposite of the serial number. FIGURE 6-8 shows the bare aluminum opening of the housing, where the Release End MUST be inserted.

*Figure 6-8: The Release End Must be Inserted into the Housing with a Bare Aluminum Ring*
2. Guide the motor cable through the Housing before gently guide the Release End Cap and motor assembly back into the bare aluminum part of the Housing as shown in Figure 6-9.

![Figure 6-9: The Release End Cap and Motor Assembly being Guided Back into the Housing](image)

a. Take care not to damage the sealing surface of the Housing or pinch any cables as shown in Figure 6-10. Take care when guiding the Grounding Spring into the Housing.

![Figure 6-10: The Release End Sliding into the Housing](image)
b. Align the orientation key while inserting it as shown in FIGURE 6-11.

![Figure 6-11: The Alignment of the Orientation Key](image)

c. Apply gentle pressure to secure the Release End Cap to Housing as shown in FIGURE 6-12.

![Figure 6-12: The Release End Cap Connected to the Housing](image)
3. Insert the Kynar retaining rod back into the slot. Continue inserting rod until it comes out the other end of the slot as shown in **FIGURE 6-13**.

![Figure 6-13: Inserting the Kynar Rod](image)

4. To Close to the Transducer End, refer to sub-section **4.1.4**.

5. Purge the instrument as per sub-section **4.1.6**.

6. Replace the purge port plug and the anti-rotation block using the two nylon screws as shown in sub-section **4.1.5**.
6.2 Battery Replacement

The PORT uses a welded battery pack made up of high-quality “AA” alkaline batteries.

6.2.1 Battery Replacement Procedure

**WARNING!**

*IF THE UNDERWATER UNIT HAS BEEN DEPLOYED, THERE IS THE POSSIBILITY OF INTERNAL PRESSURIZATION, EXERCISE EXTREME CAUTION WHEN OPENING THE INSTRUMENT!*

**CAUTION!**

*Note the orientation of the battery and wires removing the battery. When installing a new battery, it is vital to correctly orient the wires to ensure the assembly can be plugged in.*

To Replace the Batteries:

1. Open the instrument, referring to sub-section 4.1.1.
2. Separate the Transducer End from the Housing by gently pulling them apart. Be careful not to scratch the Housing when removing the assembly, referring to sub-section 4.1.2.
3. Disconnect the 5-pin motor cable from the electronics assembly (JP2), referring to sub-section 6.1.1.
4. Remove the three screws that hold the battery retainer plate in place as shown in **FIGURE 6-14**.

![The Three Screws](image)

*Figure 6-14: The Three Screwing Holding the Battery Retainer in Place*

5. Note the orientation of the wires as shown in **FIGURE 6-15**.

![The Battery Connected Wire fits into the Groove](image)

*Figure 6-15: The Correct Wire Orientation for Battery Installation*
6. Remove the old battery pack, and properly dispose of it as shown in **FIGURE 6-16**.

7. Insert new battery pack and install the end plate as shown in **FIGURE 6-17** and **FIGURE 6-18**.
6.2.2 O-ring Considerations

The PORT’s End Cap assemblies use a standard O-ring and back-up O-ring to provide water right integrity to the Electronics Housing. Under normal usage, proper care, and lubrication, the O-rings should provide several years of usage. However, the O-rings are an inexpensive component, which is absolutely critical to the successful operation of the entire system. It is good practice to replace the O-rings periodically, depending on frequency of use. It is essential to inspect the O-rings and sealing surfaces before and after each deployment.

Prepare the sealing surfaces for assembly by cleaning with a lint-free towel or swab, moistened if needed with alcohol. Inspect for scratches or nicks which could impair the O-ring’s ability to provide a seal. Apply a light coat of O-ring lubricant (EdgeTech recommends the use of Parker Super O-lube, be sure to use only silicone grease) to the Housing bore and O-ring to facilitate insertion of the end cap. Make sure the lubricant is compatible with Nitrile rubber. Inspect the O-ring for damage such as tears, dimples, or other defects in the rubber. Replace any O-ring that is questionable or old. Lightly coat the O-ring with lubricant. Protect O-rings when stretching them over large diameters (i.e., cover diameter with plastic sleeve if needed).

**CAUTION!**

Applying too much lubricant to the O-ring can compromise the seal.
6.2.3 Additional O-rings

There are additional O-rings that provide the watertight integrity to the Housing. These are located on the purge port and release shaft. Check and replace these O-rings periodically as well.

6.2.4 Servicing O-ring Disassembly

If you are servicing O-rings or wish to inspect the Release End:

1. Remove the Purge Port Plug, referring to sub-section 4.1.1.
2. Remove the Transducer End, referring to sub-section 4.1.2. (Do not go to step 4.1.3)
3. When you open the Transducer End, slide the electronics assembly out just enough to disconnect the motor cable from (JP2), as shown in FIGURE 6-19.
4. Clean, Inspect, and lightly Grease the O-rings as shown in **Figure 6-20** and **Figure 6-21**. EdgeTech recommends the use of Parker Super O-lube, be sure to use only silicone grease.

*Figure 6-20: The Transducer End O-rings*

*Figure 6-21: The Release End O-rings*
6.3 General Cleaning and Inspection

Whenever the Unit has been recovered from a deployment, the Unit should be cleaned and rinsed with fresh water to avoid salt buildup and deterioration of mechanical parts. A visual check of the Housing and release mechanism should be performed to detect any signs of damage, excessive wear, corrosion, etc.

6.3.1 Inspection Particulars

- Check the condition of the threaded release shaft, particularly in the area in contact with the Release Link.
- Check for wear, corrosion or distortion of the Top Pad Eye (lifting eye).
- Check for corrosion of the Purge Plug.
- Check and replace if needed all O-rings.
  - Each End Cap has two O-rings: a rounded O-ring and a flat, back-up O-ring. The inner O-ring is the flat backup O-ring, the curved surface should be facing the outer round O-ring and toward the endcap. Both O-rings need to in the correct position and properly lubricated to ensure water tight integrity.
- Check and replace if needed the two Anodes.
- Check the Housing for signs of corrosion or damage to the hard coat.
  - If there is damage to the paint and or Hard Coat on the outside of the Release, use an epoxy based paint to seal the surface

![Figure 6-22: Cross Section of Round and Back-up O-rings](image)
6.3.2 General Inspection and Replacement Schedule

This chart is for customer convenience and gives general guidelines for inspection and suspected replacement times for key parts. Regular inspections and cleaning are vital and should be done in tandem.

<table>
<thead>
<tr>
<th>PART</th>
<th>SERVICE / INSPECTION</th>
<th>REPLACEMENT</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>O-rings</td>
<td>Before and After Each Deployment</td>
<td>As needed</td>
<td>Any questionable O-ring should be immediately replaced. EdgeTech recommends the use of Parker Super O-lube, silicone compound grease</td>
</tr>
<tr>
<td>Battery Pack</td>
<td>Before Each Deployment</td>
<td>As needed</td>
<td></td>
</tr>
<tr>
<td>Release Link</td>
<td>Before and After Each Deployment</td>
<td>Per release</td>
<td>Sacrificial part; can be recovered with assembly when using tandem kit.</td>
</tr>
<tr>
<td>Release Shaft</td>
<td>As needed</td>
<td>Check after 3-5 years</td>
<td>Contact EdgeTech CUSTOMER SERVICE for replacement</td>
</tr>
<tr>
<td>Anodes (2)</td>
<td>After Each Deployment</td>
<td>As needed</td>
<td></td>
</tr>
<tr>
<td>Anti-Rotation Block</td>
<td>Before and After Each Deployment</td>
<td>Should not be needed</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-1: General Inspection and Replacement Schedule

6.4 Common Spares

<table>
<thead>
<tr>
<th>QTY</th>
<th>DESCRIPTION</th>
<th>EDGETECH MTL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Battery Pack “AA” Alkaline Battery Pack</td>
<td>MTL 13</td>
</tr>
<tr>
<td>1</td>
<td>Release Link</td>
<td>MTL 8</td>
</tr>
<tr>
<td>2</td>
<td>ORING, Endcap to Housing</td>
<td>MTL 1</td>
</tr>
<tr>
<td>2</td>
<td>ORING, Back-Up, Endcap-to-Housing</td>
<td>MTL 2</td>
</tr>
<tr>
<td>2</td>
<td>ORING, Release Shaft</td>
<td>MTL 3</td>
</tr>
<tr>
<td>1</td>
<td>ORING, Release Shaft Insert</td>
<td>MTL 4</td>
</tr>
<tr>
<td>2</td>
<td>ORING, Purge Port</td>
<td>MTL 4</td>
</tr>
<tr>
<td>2</td>
<td>Kynar Retaining Rod</td>
<td>MTL 71</td>
</tr>
<tr>
<td>2</td>
<td>Nylon Screw 10-32” for Anti-Rotation Block</td>
<td>MTL 6</td>
</tr>
<tr>
<td>2</td>
<td>Isolation Washer</td>
<td>MTL 5</td>
</tr>
<tr>
<td>2</td>
<td>Anode</td>
<td>MTL 62</td>
</tr>
<tr>
<td>1</td>
<td>Adaptor, assembly, purge port</td>
<td>MTL 63</td>
</tr>
</tbody>
</table>

Table 6-2: Common Spares

6.5 Callout Assembly Drawings

Part Callout Assembly drawings for the PORT LF-5D are on the following pages:
Figure 6-23: The PORT LF-SD Callout Assembly Drawing # 1
Figure 6-24: The PORT LF-SD Callout Assembly Drawing # 2
Figure 6-25: The PORT LF-SD Callout Assembly Drawing # 3
Appendix Figure A-1: PORT-LF SD Basic Parts (standard)
Kynar Retention Rods:

EdgeTech recommends that prior to deployment the Kynar Retention Rods’ glands be protected from sediment accumulation. Field trials show that under certain environmental conditions these glands can become tightly packed with fine sediment. Buildup of this sediment can make Kynar Retention Rod removal difficult. To prevent this, EdgeTech recommends covering the glands by wrapping 2” electrical tape around the housing.

If a Kynar Retention Rod is difficult to remove, and sediment egress is suspected, soak the instrument in warm water to soften the sediment. When trying to remove the rod, pull tangent to the housing.

Release Shaft:

To prepare the release mechanism, apply a thin coating of Silicone grease to the release shaft threads. EdgeTech recommends NOVAGARD G624.

When threading the release link onto the shaft do not leave it bottomed out. Screw the link all the way on and then back it off ¼ to ½ of a turn to facilitate installation of the anti-rotation block.

Top Pad Eye:

Make certain that the isolation washers are in place on the top pad eye. Using a shackle without the isolation washers in place will lead to corrosion.

Purging:

Dry Nitrogen purging is recommended, but not mandatory. If you are going to purge the instrument follow the procedure in the manual, do not pull an excessive vacuum.

Ensure the purge port plug is in place before deployment.

Pre-Deployment Check:

Run thru the releases command set with a deck unit to verify that the release is fully functional.

Deployment:

Do not shock load the release. Kicking a relatively small anchor off the stern of a vessel can generate very large dynamic forces.
The PORT LF-SD and PORT MFE can be shipped as pop-up buoy system. This allows the unit to float to the surface upon detaching from a payload.

C.1 Pop-Up Assembly

PORT Pop-Up system is shipped assembled. If Pop-Up canister was purchased separately it will consist of:

- (1) Delrin Collar
- (1) Top (Flotation) Cup
- (1) Bottom (Line Holding) bucket
- (1) Sub Flotation Pop-Up Assembly Drawing [PN 0015784]
- (1) Package Containing all Required Assembly Hardware
  - (1) Clamp PORT Pop-Up Delrin
  - (1) Rubber Strip Neoprene 0.25” thick; 01” wide
  - (1) Clamp Hose 0.50 3-1/16 x 4”
  - (4) Tie Cable Clamp Head 102mm
  - (2) Galvanized Carbon Steel Shackle [1500lb]

Tools needed for assembly

- (1) Flat Head Screwdriver
- (1) 9/16” Socket Wrench
- (1) 7/16” Socket Wrench

C.2 Line Packing Considerations

Note: *Flaking* is the preferred method of line packing. *Never* wind the line around the center post, as this can cause line tangling.

The canister’s line capacity is a function of line diameter, line construction, and material. Stiff Lines have significant ‘memory.’ For example, 3-strand polypropylene does not pack as well as single- or double braid nylon. The decision of what diameter and type of line to be used needs to be carefully thought out, safe working loads and shock loading need to be considered.

When packing the canister with line, EdgeTech strongly recommended the line be randomly ‘flaked’ into the canister. Avoid coiling or laying the line in a pattern, as randomly packing and tamping it down as it builds up will yield the best results. The end of the line should be attached to the stud, which is inside of the flotation assembly. Floatation Assembly provides 15lbs. of buoyancy +5lbs. with optional trawl float.
C.3 Line Packing Procedure

1. Make sure that when selecting the line to be used it is of proper strength and material for the application. EdgeTech recommends a premium double braided nylon rope.

2. Attach the end of the line to the outside and inside of the bucket with Zip ties and attach the end of the line to the chain at the bottom of the bucket with a shackle as pictured below.

Appendix Figure C-1: Attach the End of the Line to the Chain

Appendix Figure C-2: Line attached to inside and outside of bucket
3. Flake the line into the bottom of the bucket, going around 2/3rds of the way around the center and then back, continue flaking back and forth advancing further around each time so the line lays evenly around the center post. **FIGURE C-3** illustrates how to load the line.
   a. Compress the line periodically as you load the bucket.

4. Attach the top end of the line to the stud inside the top floatation.

5. Once the bucket is loaded with line, follow the assembly instructions below to complete the Pop-up system.
C.3.1 To Assemble the Pop-Up

1. Install top collar on the PORT release by sliding it on the release end up to the transducer. Do not tighten the clamp: this will be done when the Pop-up assembly is completed.

![Figure 6-26: The Top Collar with Clamp](image)

*Figure 6-26: The Top Collar with Clamp*

![Appendix Figure C-4: Installing the Top Mating Collar](image)

*Appendix Figure C-4: Installing the Top Mating Collar*
2. The release is mated to the top cup by sliding the release down the open channel in the flotation so the top collar lies flush with the top of the cup.

3. Complete the top cup mating by installing the ¼” thick anti-slip neoprene strip around the release and secure with the included 316SS hose clamp. **DO NOT OVERTIGHTEN.**
   
   a. Over-torquing can squeeze the housing out of round compromising the O-ring seal. The anti-slip ring functions as a catch in the unlikely case the pop-up is over turned on ascent, it holds no load during standard operation.
4. Fill canister with desired line weight using proper **LINE PACKING PROCEDURE**. Affix one end to the stud protruding from the flotation; wind the other end out through the lip notch for future attachment to a secure fixture on bottom mooring. EdgeTech recommends utilizing the small holes lining the lip notch with light duty zip ties to secure line tightly to the outside of the cup.

**CAUTION:** Always use the proper **LINE PACKING PROCEDURE**. **Never** coil the line around the center post. A coiled line may become tangled or catch during pay-out, after the RELEASE command is sent.

5. Complete assembly by sliding the 3/8 galvanized bolt through the bottom post of the Pop-Up, through the last two links of the anchoring chain, and mating the ultem release link in the center.

6. Secure the connection by double nutting the bolt with a split lock washer between two nuts.

7. Tighten the clamp around the Release. When properly tightened, the collar should be rigidly affixed.
   a. The collar will fit in the same position regardless of the MFE (flush 3.5” transducer cap) or LF-SD (4.2” exposed transducer flange cap).

---

**PORT LF-SD ONLY**

When the Transducer Release Link is attached the Pop-Up Housing, there will be a small gap of about a ¾ inch between PORT LF Transducer and Pop-Up collar.
<table>
<thead>
<tr>
<th>QTY</th>
<th>PART</th>
<th>MTL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CUP BOTTOM PORT POP-UP</td>
<td>MTL 10</td>
</tr>
<tr>
<td>1</td>
<td>CUP TOP PORT POP-UP W/ FOAM 200M RATED</td>
<td>MTL 20</td>
</tr>
<tr>
<td>1</td>
<td>CLAMP PORT POP-UP DELRIN</td>
<td>MTL 30</td>
</tr>
<tr>
<td>.92 ft</td>
<td>RUBBER STRIP NEOPRENE 0.25 INCH THICK 01 INCH WIDE</td>
<td>MTL 40</td>
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<td>1</td>
<td>HARDWARE BOLT STD MACHINE HEX HD 3/8-16 X 5.0 INCH GALVANIZED STEEL</td>
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<td>MTL 80</td>
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<tr>
<td>1</td>
<td>HARDWARE CLAMP HOSE 0.50 3-1/16 X 4 INCH 316 SS</td>
<td>MTL 90</td>
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<tr>
<td>1</td>
<td>ASSY SUB CHAIN SPORT POP-UP 0.3125 INCH 1900# COLD GALV STEEL 0.75FT</td>
<td>ASM 110</td>
</tr>
<tr>
<td>.75 ft</td>
<td>HARDWARE CHAIN 0.3125 INCH 1900# COLD GALV STEEL</td>
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<td>2</td>
<td>HARDWARE SHACKLE STD ANCHOR 0.3125 INCH DIA 1500LB HIGH STRENGTH GALVANIZED CARBON STEEL W/ SAFETY PIN</td>
<td>MTL 120</td>
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<td>4</td>
<td>TIE CABLE CLAMP HEAD 102MM NYLON NATURAL ROHS</td>
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</tr>
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<td>ASSY SUB FLOATATION POP-UP</td>
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<td>FLOAT TRAWL POP-UP 08 INCH DIAMETER 400M RATED SAEPLAST ORANGE</td>
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<td>1</td>
<td>STOP ROPE 0.25 INCH BLACK</td>
<td>MTL 20</td>
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<tr>
<td>12 ft</td>
<td>THREAD WHIPPING 0.30 INCH DIA POLYESTER</td>
<td>MTL 30</td>
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<td>3.6 ft</td>
<td>ROPE 0.25 Inch BRAIDED SPECTRA</td>
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<tr>
<td>1</td>
<td>TIE CABLE 29.75 INCH 0.3 INCH WIDTH NYLON BLACK</td>
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<td>1</td>
<td>HARDWARE NUT STD HEX NYLOCK 1/4-20 316 SS</td>
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<tr>
<td>2</td>
<td>HARDWARE WASHER STD FLAT 0.25 INCH 316 SS</td>
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<td>1</td>
<td>DOC DRAWING ICD PORT POP-UP CANISTER 200M RATED</td>
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Appendix Table C-1: Pop-Up Parts - 0010838

C.4 Mechanical Drawings

Mechanical drawing for the Pop-Up are shown on the following pages:
Appendix Figure C-9: PORT Pop-Up Canister 200M Assembly
Appendix Figure C-10: PORT Pop-Up Canister 200M Drawing
APPENDIX D: LF-SD TANDEM KIT OPTION

The PORT series of acoustic releases come with an optional Tandem Kit. A Tandem Kit is used to join two releases, providing a single lift point and single release point. The primary purpose of the Tandem Kit is to add redundancy to the mooring, thereby increasing the odds of instrument recovery. However, a Tandem Kit does not double the working or release load ratings of individual releases, but it does add somewhat to the overall load rating.

When a Tandem is used with a mooring it can be recovered by releasing either PORT-LF SD release. In the event of a failure of the mooring to detach from the anchor, the RELEASE command can be sent to both PORT-LF SD’s freeing both the oblong ring and chain assembly. In normal use, when just one release is triggered the only thing that is lost is the oblong ring.

NOTE: When used to release heavy loads the last thread of the Ultem release link may pull out. Carefully inspect the release links after recovering the tandem set. Replace any damaged release links as required.

<table>
<thead>
<tr>
<th>QTY.</th>
<th>DESCRIPTION</th>
<th>EDGEtech MTL NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spreader, top, 316SS</td>
<td>MTL 1</td>
</tr>
<tr>
<td>2</td>
<td>Washer, Shoulder modified</td>
<td>MTL 2</td>
</tr>
<tr>
<td>1</td>
<td>Stud, Threaded 1/4-20”, 0.75”, 316SS</td>
<td>MTL 3</td>
</tr>
<tr>
<td>1</td>
<td>Washer, Shoulder, ¼ x 0.032” barrel nylon</td>
<td>MTL 4</td>
</tr>
<tr>
<td>2</td>
<td>Nut, Hex Nylok 5/16-18”, 316SS</td>
<td>MTL 5</td>
</tr>
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<td>1</td>
<td>Clamp Sport Delrin</td>
<td>MTL 6</td>
</tr>
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<td>Bolt, Hex 1/4-20”, 3.25”, 316SS</td>
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<td>Nut, Hex Nylock, 1/4-20”, 316SS</td>
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<td>Link Release Port Screw</td>
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<td>2</td>
<td>Shackle Anchor 0.3125”, Galvanized Carbon Steel</td>
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<td>Chain, 0.3125”, Galvanized Steel</td>
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<td>Link Oblong ½” Weldless Alloy Steel</td>
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<td>Anode (small)</td>
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<td>2</td>
<td>Bolt Shoulder, 5/16-18”, 0.375 x 1.50”, 316SS</td>
<td>MTL 15</td>
</tr>
</tbody>
</table>

Appendix Table B-1: 0003121 PORT LF-SD Optional Tandem Parts

Mechanical Drawing

A Mechanical Drawings of the Tandem Kit are shown below.
Appendix Figure D-1: 0018494 PORT LF-SD Optional Tandem Kit Diagram
Appendix Figure D-2: 0017442 PORT LF-SD Optional Tandem Kit Callout Diagram
APPENDIX E: STRONGBACK OPTION

The PORT Strong Back Release Transponder is ideal for heavy weight deployments in coastal environments. The strong back portion of the unit increases lift load rating to support heavy mooring deployments.

The Strong Back option for the PORT acoustic release increases the release rating of a PORT LF-SD to 2,500 pounds (1,136 kg) and the lifting load to 3,500 pounds (1,590 kg).

Mechanical Drawing

A Mechanical Drawing of the Strongback Option is shown below.
Appendix Figure E-1: 0017668 PORT LF-SD Optional Strongback Diagram
Appendix Figure E-2: 0019087 PORT LF-SD Optional Strongback Callout Diagram
APPENDIX F: STRONGBACK TANDEM OPTION

The Strongback Tandem Option combines the Strongback Option with the Tandem Option.

The PORT series of acoustic releases come with an optional Tandem Kit. A Tandem Kit is used to join two releases, providing a single lift point and single release point. The primary purpose of the Tandem Kit is to add redundancy to the mooring, thereby increasing the odds of instrument recovery. However, a Tandem Kit does not double the working or release load ratings of individual releases, but it does add somewhat to the overall load rating.

When a Tandem is used with a mooring it can be recovered by releasing either PORT-MFE release. In the event of a failure of the mooring to detach from the anchor, the RELEASE command can be sent to both PORT-MFEs freeing both the oblong ring and chain assembly. In normal use, when just one release is triggered the only thing that is lost is the oblong ring.

The PORT Strong Back Release Transponder is ideal for heavy weight deployments in coastal environments. The strong back portion of the unit increases lift load rating to support heavy mooring deployments. The Strong Back option for the PORT acoustic release Increases the release rating of a PORT MFE to 2,500 pounds (1,136 kg) and the lifting load to 3,500 pounds (1,590 kg).

Mechanical Drawing

A Mechanical Drawing of the Strongback Tandem Option is shown below.
Appendix Figure F-1: 0019088 PORT LF-SD Optional Strongback Tandem Diagram