

COASTAL ACOUSTIC TRANSPONDER

USER HARDWARE MANUAL

0009577_REV_C

September 2015



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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.

HARDWARE VARIATIONS AND COMPATIBILITY

The Coastal Acoustic Transponder (CAT) 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.

ABOUT THIS DOCUMENT

We, the employees at EdgeTech, would like to thank you for purchasing Costal Acoustic Transponder (CAT). 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 CAT. Although this manual encompasses the latest operational features of the CAT, 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 CAT 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.*

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.

RETURNED MATERIAL AUTHORIZATION

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

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.*

E-mail: service@edgetech.com

Mail: 4 Little Brook Road
West Wareham, MA 02576

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**24-Hour Emergency
Technical Support Line:** (508) 942-8043

For EdgeTech information please go to 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 45 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.

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 **SECTION 1: OVERVIEW**

This manual describes the EdgeTech, Coastal Acoustic Transponder (CAT) and the Extended Life Coastal Acoustic Transponder (ELCAT). The ELCAT is a modified version of the CAT, it has been lengthened and fitted with a second battery pack, doubling its deployment endurance. These models are compact, lightweight, robust, and easily deployed instruments. They function as a fully command able acoustic transponders with tilt indication. These units can be for use at depths up to 3500 meters.

The CAT and ELCAT have been designed for use as instrument location and positioning aids. They have applications as part of the recovery system on oceanographic moorings and platforms. The precision, high output power, command able transponder feature make these instruments ideal for use with positioning systems in difficult acoustic environments.

The CAT and ELCAT utilize EdgeTech's field proven Binary Acoustic Command System (BACS) code structure. The BACS coding structure provides 12,000 possible secure command codes. Each transponder is factory programmed with its own unique command set which includes transponder ENABLE, DISABLE. Whenever the instrument receives a command it responds with a status reply message which 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. 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 is wasted replying to interrogate signals meant for other systems.

SECTION 2: SPECIFICATIONS

2.1 Mechanical

Mechanical specifications for the CAT are as follows:

Depth Rating (working):	ft. (3,500 m.)
Overall Length:	in. (53 cm.) – CAT In. (61 cm.) – ELCAT
Transducer Diameter:	in. (10.8 cm.)
Tube Diameter:	in. (8.9 cm)
Est. Weight in Water:	lb. (2.04 kg.) – CAT lb. (2.57 kg.) – ELCAT
Weight in Air:	lb. (5.3 kg.) – CAT lb. (6.4 kg.) – ELCAT
Housing Material:	Type 6061 Aluminum
Other Materials:	Kynar, 316 SS, G10, Buna N, Zinc Anodes
Finish:	Hard anodized and Epoxy Painted
Transducer Type:	Oil filled, pre-stressed

2.2 Acoustic

The following sub-sections describe the acoustic specifications for the CAT unit.

2.2.1 Command Receiver

Command specifications for the unit are as follows:

Sensitivity:	78 dB 1 uPa
Receiver type:	Multi-stage band pass with hard-limited-output (2,000 Hz/300Hz Bandwidths)
Pulse Width:	22 ms
Period:	250 ms

Total Command Time:	9 seconds
Total Lockout Time:	7 seconds re beginning
Commands Per Tone Pair:	2,000 (6 pairs available)
Coding:	BACS 8000 series – Binary FSK

2.2.2 BACS Command Structure

Two 8-bit words separated by a 4-sec interval. Each word 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.

2.2.3 BACS Command Coding

Binary Tone Pairs:

PAIR NO	"0"	"1"
1	9.488 kHz	9.901 kHz
2	9.488	10.288
3	9.488	10.684
4	9.901	10.288
5	9.901	10.684
6	10.288	10.684

2.2.4 Standard Command Functions

ENABLE (Enable transponder)
DISABLE (Disable transponder)

2.2.5 Transponder

Transponder specifications for the CAT are listed below:

Sensitivity:	-78 dB re 1 uPa
Jitter:	< 0.1 ms RMS
Interrogate:	11.0 kHz (standard)
Post-Filter Bandwidth:	300 Hz

Min. Interrogate Pulse Width:	5 ms
Reply Frequency:	12.0 kHz Standard
Reply Pulse Width:	10 ms
Reply Source Level:	192 dB re 1 uPa @ 1 m
Turnaround Time:	12.5 ms
Lockout Time:	1 second

2.3 Power Supply

Batteries:	24 each "AA" alkaline welded pack (CAT) 48 each "AA" alkaline welded pack (ELCAT)
Main Supply:	5V regulated
Average Current Drain:	350 uA
Design Life (@ 2 degree C):	1 years (CAT) 2 years (ELCAT)
Design Life (@ 2 degree C):	15,000 replies @ 10 ms pulse width (CAT) 30,000 replies @ 10 ms pulse width (ELCAT)

2.4 Environmental

The environmental specifications for the unit are:

Temperature:	-10 deg. C to +40 deg. C (operating) -20 deg. C to +60 deg. C (storage, batt. removed)
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SECTION 3: INSTALLATION

This section contains the information relative to the basic set up of EdgeTech's Coastal Acoustic Transponders (CAT & ELCAT) including important details concerning the orientation of the unit on a mooring structure.

3.1 Installation Considerations

Consider the following when installing the CAT unit:

3.1.1 Orientation

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

3.1.2 Acoustic

Efforts should be made to ensure that there is a clear acoustic path between the transponders 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. A float placed physically close to the transducer can create a blind area in the transducers beam pattern. This is usually only an issue when deployments are in deep water and the surface vessel is directly above the floatation. If this issue is suspected moving away from the mooring will solve the issue.

3.1.3 Mechanical

The CAT can be easily mounted by clamping around the housing. Care should be taken when clamping so as to not distort the tube. Clamps should not be placed close to radial O-ring sealing areas (app. 1" in from the end of the tube). The clamps used to secure the CAT should provide electrical isolation from rest of the mooring or platform to prevent galvanic corrosion.

3.1.4 Bio-Fouling Prevention

Anti-fouling paint can be used to prevent bio-fouling on the housing and other external parts however please remember that 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. Applying a wrap of 2" electrical tape around

the tube, covering the closure rod cutouts is recommended. This will prevent sediment accumulation in the groove where the closure rod rides.

3.2 Status Reply

The CAT is equipped with a sensor that monitors the tilted or not tilted orientation of the system. This information allows the unit to send a coded status reply; based on the instruments orientation. The tilt status is useful for ascertaining whether the mooring or platform that has been deployed 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, either "upright (within 45 degrees of upright)" or "tilted (more than 45 degrees from upright)". After any command has been received, the unit transmits a series of pings encoded as follows:

<u>PATTERN</u>	<u>STATUS</u>
15 pings at 2 second intervals	"upright"
7 pings at 2 second intervals	"tilted"

The tilt sensor is a 45-degree mechanical switch that is mounted on the transponder circuit board assembly. In the standard instrument configuration, with the transducer end cap facing up, 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.

3.3 Operating Instructions

The following sub-sections cover normal operations for the unit, including turning on the instrument, opening and closing the housing, air acoustic tests, and post deployment considerations.

3.3.1 Turning on the Unit

Coastal Acoustic Transponders are carefully tested and shipped from the factory with a new battery pack installed (battery packs are disconnected unless otherwise requested). To use the instrument all that is required is opening the housing, plugging in the battery and then closing and purging the housing.

3.3.2 Opening the Housing

To open the housing:

1. Remove the purge plug retainer lower end cap of the instrument (a small G10 clip) by unscrewing the nylon screw that holds it in place.
2. Pull the purge port plug out of the end cap.
3. Remove the Kynar retaining rod (White plastic rod) from the transducer end of the housing. (Simply pull the rod out and away from the housing)
4. Gently pull the transducer end cap free from the housing. 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.
5. 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 if you are turning the system on.
6. If you are servicing O-rings or you simply wish to inspect the inside then slide the transducer and electronics assembly out enough to disconnect the 6 pin cable from (JP2) which goes to the lower end cap.
7. To remove the lower end cap, pull the Kynar rod from the lower end of the housing and then gently pull the end cap off.

3.3.3 Applying Power

To apply power to the unit:

1. The electronics assembly and battery pack, are mounted to an aluminum plate that is attached to the transducer end cap.
2. If the transducer cable (JP1) has been disconnected from the electronics assembly, plug it back into its header on the circuit board.
3. In the CAT the battery pack lead wire connectors directly to header JP3 on the circuit board, simply plug this connector in to power the CAT.
4. The ELCAT uses two battery packs that are coupled on a small circuit board mounted to the battery frame. The coupling PCB has a lead wire set that connect to JP3 on the main circuit board, simply plug this connector in to power the ELCAT.
5. The transponder will ping once after it has powered up and it will be enabled.

3.3.4 Closing the Housing

To close and seal the housing:

1. Make certain that the O-rings and O-ring surfaces are clean and lightly greased (use only silicone grease).

2. As the O-ring enters the housing bore, firm but gentle pressure must be applied to seat the end cap fully against the housing.
3. Gently guide the lower end cap back into the housing, taking care not to damage the sealing surface of the housing or pinch any cables. Be sure to align the orientation key while inserting it. While holding the end cap in place insert the Kynar retaining rod back into the slot. Continue inserting the rod until it comes out the other end of the slot.
4. After connecting the end cap ground cable, gently guide the electronics assembly back into the housing, taking care not to damage the sealing surface of the housing or pinch any cables. Be sure to align the orientation key to the housing. While holding the end cap in place insert the Kynar retaining rod back into the slot. Continue inserting the rod until it comes out the other end of the slot.
5. At this point it is good practice to perform an air acoustic test of the system by running through the command set for the CAT (See section 3.2).
6. Replace the purge port plug and the purge plug retainer using the nylon screw.
7. Purge the instrument as per section 3.3.5.

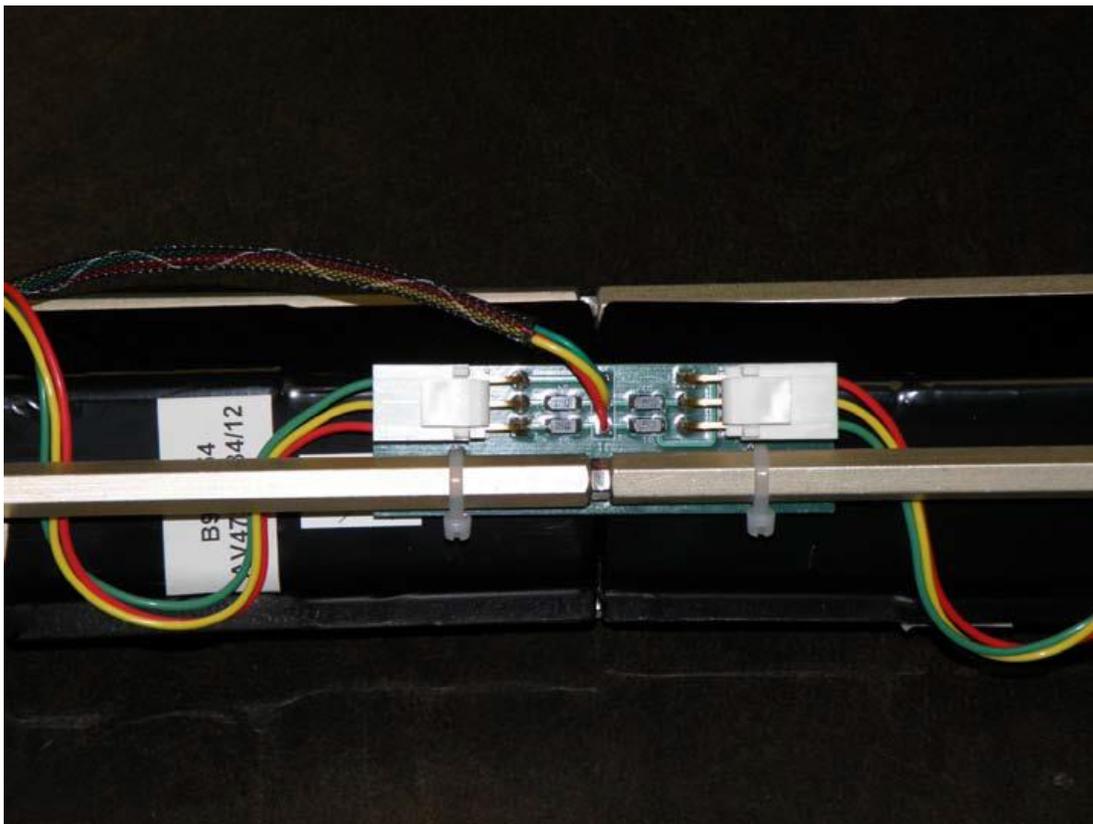


Figure 3-1: ELCAT Battery Coupling PCB

3.3.5 Leak Detection and Condensation Prevention

EdgeTech transponders are provided with a 5/16-inch diameter purging port on the bottom (release end) end cap. The recommended procedure for preparation of the instruments atmosphere is as follows. The procedure assumes that the operator has a vacuum pump, dry nitrogen cylinder, gauge all arranged on a manifold setup.

If you do not have the required equipment to purge the system then try to open the unit only in dry environments. Avoid opening the release in very humid environments. Desiccant packs can be placed inside the housing when purging is not available.

1. After 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; the plug must be ready for immediate insertion.
3. Insert a purge port vacuum adaptor and draw a -3 PSIG vacuum, do not exceed -3 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 performed to detect gross O-ring problems.
5. Open the valve to the instruments purge port and:
 - a. Backfill the housing with dry nitrogen gas, do not exceed +3 PSIG.
 - b. Draw a -3 PSIG vacuum on the instrument; do not exceed -3 PSIG.
 - c. In humid environments you should repeat this process up to four times.
 - d. After drawing the final vacuum in this process, quickly insert the purging plug before the -3 PSIG vacuum is lost.
 - e. Secure the purge plug with the retaining clip and nylon screw.

NOTE: When purging the instrument, be careful not to draw more than -3 PSIG vacuum, exceeding this figure can damage the batteries 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.

3.4 Acoustic Air Testing

The following sub-sections outline how to perform the acoustic air testing on the unit:

3.4.1 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 or speaker) within a meter or two of the CAT transducer, with no obstructions to the acoustic path. Depending on the environment, some experimentation may be necessary to find a suitable location.

3.4.2 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 CAT is enabled or disabled by interrogating it, if the unit has just been powered up it will be enabled. The standard CAT systems reply frequency is set to 12.0 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 range on the instrument and verify that the transponder is functional; you should be able to verify that the instrument transmits a reply pulse by listening to the alarm on the front panel of the deck unit.
4. Next send the DISABLE command. The instrument should reply with the appropriate series of pings to indicate tilt status. Now range on the instrument again with the deck unit. This time the unit should not transmit a reply pulse. If the CAT is being shipped or stored it should be disabled to conserve battery life. The CAT should also be left disabled while deployed to conserve battery life.

3.5 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 check of the housing should be performed to detect any signs of damage, excessive wear, corrosion, etc. If the CAT is not to be used again soon, the unit should be turned off (follow procedure described in Section [3.3.1](#)).

If the unit is to be stored for a long period of time, the batteries should be removed. See [/// SECTION 5: MAINTENANCE](#).

SECTION 4: SERIES 8000 COMMAND CODING

The Series 8000 Command Coding that is employed is 16 bits long with 11 bits of information. Specifically it 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:

- 8 bits are sent with a period of about 250 ms and a pulse width of 22 ms
- A word decode interval is 7 seconds
- Following the first decode interval, a 60 ms detection window is open
- If a detection occurs in the window, a second word decode interval occurs
- 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 the specification section), over 12,000 unique commands exist.

SECTION 5: MAINTENANCE

The CAT 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.

5.1 Battery Replacement

The CAT uses a double stack, "AA" cell, welded alkaline pack, while the ELCAT uses two, double stack, "AA" cell, welded alkaline packs.

5.1.1 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.

To replace the battery:

1. Open the instrument, refer to section [3.3.2](#).
2. Separate the transducer end from the housing by gently pulling them apart. Be careful not to scratch the housing throat when pulling the assembly from the tube.
3. Disconnect the end cap ground cable from the electronics assembly (JP2).
4. Remove the three screws that hold the (brown garolite) battery retainer plate in place.
5. Note the orientation of the battery(s) and wires, remove the old battery pack(s) and dispose of properly.
6. Insert a new battery pack(s) noting the wire orientation.
7. Re-install the battery retainer plate using the three screws.
8. Assemble the instrument, refer to section [3.3.4](#)

5.2 O-ring Considerations

The end cap assemblies of the CAT use a standard O-ring with a backup ring to provide watertight integrity to the electronics housing. The backup ring is flat on one side and concave on the other. The concave side is placed towards the O-ring and the O-ring should be towards the outside of the housing. Under normal usage, proper care and lubrication of the O-ring should provide several years of usage. However, like the batteries, the O-ring is 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-rings ability to provide a seal. Apply a light coat of O-ring lubricant (typically silicone based 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).

CAUTION!

Applying too much lubricant to the O-ring can compromise a seal.

5.2.1 Additional O-Rings

There are additional O-rings, which provide the watertight integrity to the housing. These are located on the purge port. Check and replace these O-rings periodically.

5.3 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.

5.3.1 Inspection Particulars

After each recovery:

- Check for wear, corrosion or distortion tube and end caps.
- Check for corrosion of the purge plug.

- Check and replace if needed all O-rings.
- Check and replace if needed the two zinc anodes.
- Check the housing for signs of corrosion or damage to the hard coat.

NOTE: For questions about replacement parts or other inquiries about the system, contact [EdgeTech Customer Service](#).