



CT•Xchange™ User Manual



Version 1.04
20 May 2016

Revision History

Revision	Date	Description	Author
Version 1.00	24 July 2015	First revision based on C•Xchange manual Ver. 2.52 and T•Xchange manual Ver. 1.21	Tony Nordstrom
Version 1.01	31 July 2015	Formatting edits	Jehan Zouak
Version 1.02	28 October 2015	Updated Specifications, section on Field Calibration	Dustin Olender
Version 1.03	13 April 2016	Formatting edits and minor updates	Jehan Zouak
Version 1.04	20 May 2016	Minor edits	Jehan Zouak

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General Description

CT•Xchange™ is the oceanographic industry's only field-swappable conductivity and temperature sensor. These sensors can be exchanged between different X•Series instruments and can be replaced easily and quickly in the field should the sensor be damaged.

CT•Xchange stores all pertinent manufacturing and calibration data internally. This allows the sensor to be swapped between any CT•Xchange-enabled instruments without manually updating the calibration coefficients. Calibration sheets can be printed on demand by any instrument connected to AML's SeaCast software. Re-calibrations require only the sensor, not the instrument, to be shipped to the service centre.

CT•Xchange is available in right angle mount only.

CT•Xchange sensors are engraved with a unique serial number and the conductivity and temperature range of the sensor, as shown in the image below.



CT•Xchange Engraving

Where Do I Start?

AML Oceanographic X•Series instruments ship with a USB stick containing the following:

- An instrument manual providing an overview on how to use and maintain the instrument;
- A SeaCast manual providing instructions on how to use the software to configure the instrument and review instrument data;
- Xchange™ sensor manuals (CT•Xchange, C•Xchange, SV•Xchange, P•Xchange, T•Xchange, and Tu•Xchange) providing overviews on how to install and maintain each of the Xchange™ sensors;

If you are configuring an instrument for field use or lab testing, begin with the SeaCast manual.

If you are performing instrument maintenance, begin with the instrument manual.

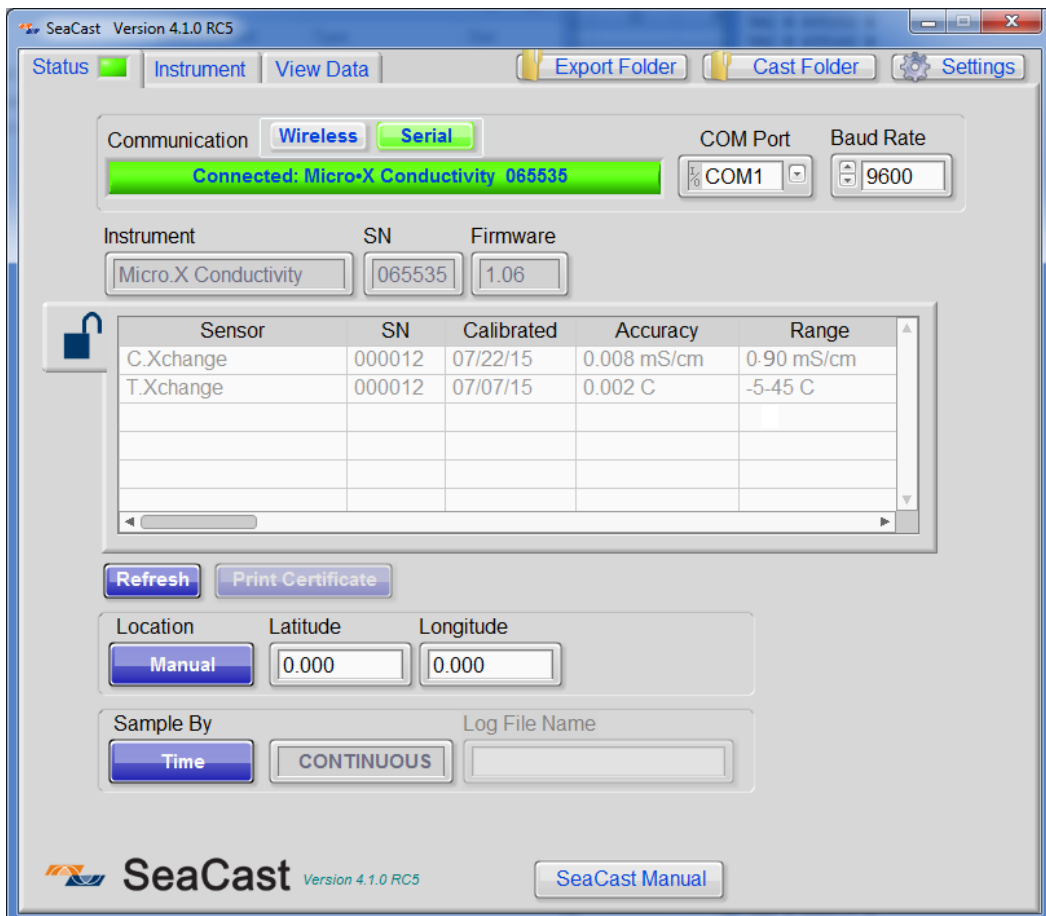
If you are planning to swap an Xchange™ sensor, read the Xchange™ manual corresponding to your sensor.

Shipping and Receiving

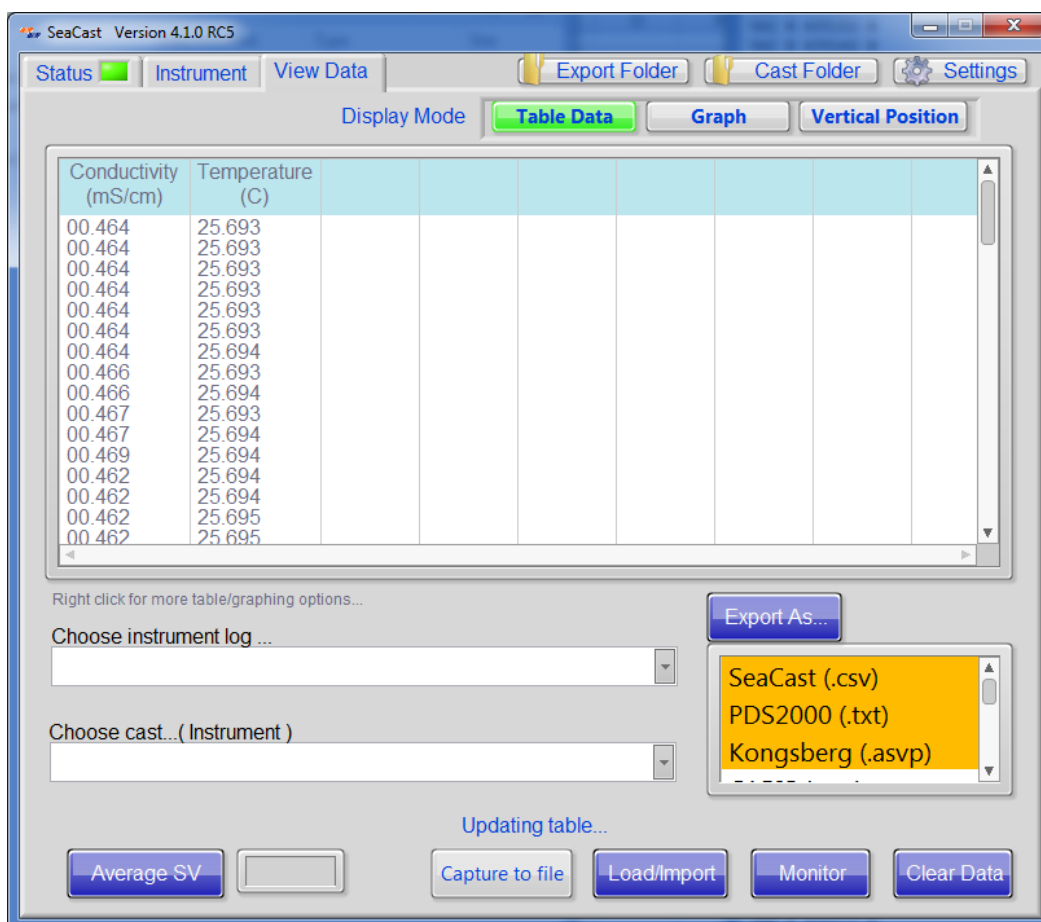
Receiving a Sensor

When receiving a new sensor, perform the following steps to ensure the sensor will be ready for deployment when required:

1. Inspect the shipping container, looking for signs of damage. Damage to the shipping container could indicate damage to the sensor inside.
2. Inspect for damage
 - Check the sensor for cracks, bends, or other signs of damage.
 - Check the connector for corrosion, dirt, and salt deposits.
3. Connect the sensor to an instrument, ensuring it is installed tightly onto its mount. The blue locking sleeve should be tight and sitting less than 1mm from the instrument end cap.
4. Connect the instrument to a computer using the data cable. Launch SeaCast and verify that the instrument tab is displaying accurate CT•Xchange sensor information. The sensor's serial number and last calibration dates should be displayed.
5. On the *View Data* page within SeaCast, select "Monitor," and allow the instrument to sample some data, as shown in the following figures. The sensor's conductivity reading should read very close to 0 mS/cm in air and a valid reading in water. The sensor's temperature reading should be ambient temperature in air and water temperature in water. This will confirm the sensor is working.



Step 4: Launch SeaCast and verify that the instrument tab is displaying accurate CT•Xchange sensor information.



Step 5: On the View Data page within SeaCast, select "Monitor," and allow the instrument to sample some data.

Returning a Sensor to the Factory

- If shipping for repair or recalibration, obtain an RMA number from the service centre.
- Pack the instrument in its original shipping box to prevent damage during shipping.

Request an RMA number using the contact options given in the Support section of this manual or on our website at <http://www.amloceanographic.com>.

Using the Sensor

Pressure Ratings

CT•Xchange is rated for operation to a maximum depth of 6000m. However, the instrument a CT•Xchange sensor is used on will likely be depth limited by both its pressure case and other installed sensors. **Deployments should never exceed the lowest of these pressure ratings.**

Installing the Sensor

CT•Xchange sensors attach to X•Series instruments equipped with a primary Xchange™ sensor mount.



Primary and secondary Xchange™ sensor mounts

1. Select a CT•Xchange with a calibration valid for the duration of the deployment.
2. Ensure that the primary Xchange™ sensor mount is clean and dry. Pay close attention to the electrical connector and its pins.
3. Check the sensor's O-ring for cleanliness (see "Inspecting and Replacing the O-Ring").
4. Align the sensor to the sensor mount.

5. Place the sensor into the mount.
6. Rotate the sensor until it drops down into the mount enough to allow the blue locking sleeve threads to engage the mount threads.
7. Screw down the blue locking sleeve until it stops. The bottom of the sleeve should be within 1 mm of the instrument end cap.

Removing the Sensor

1. If the sensor has been used in salt water, rinse it in fresh water while it remains installed on the instrument.
2. Dry the sensor before removal to protect the connector.
3. Unscrew the blue locking sleeve.
4. Lift the sensor out of the mount.
5. Ensure that the primary Xchange™ mount is dry and clean, using compressed air if necessary.
6. Immediately install the blanking plug (shown below) or a replacement sensor into the open Xchange™ mount.



CT•Xchange & SV•Xchange blanking plug

Pre-Deployment Procedures

- Upon Receipt
 1. Refer to “Receiving a Sensor” in this manual to verify the condition of the equipment.
 2. Verify the sensor calibration is valid for the duration of the deployment. If not, swap the sensor for one with valid calibrations or send it to a service centre for recalibration
- Before departure
 1. Ensure the sensor is properly mounted on the instrument. The blue locking sleeve should be fully threaded onto the sensor mount of the instrument, sitting less than 1mm from the instrument end cap.
 2. Test the instrument in water to ensure the sensor is functioning properly.

Post-Deployment Procedures

1. Rinse CT•Xchange thoroughly with distilled water. Tap water may be used if no distilled water is immediately available.
2. Ensure the sensor is clean, dry, and that the glass cross tubes have not been cracked before storage.

Compatibility with UV•Xchange™ Biofouling Control

UV•Xchange™ is a biofouling control device that irradiates sensing surfaces with UV-C light. UV-C radiation inhibits cell division, stopping biofouling before it can start.

Biofouling control is critical during long-term deployments with conductivity sensors. As fouling accumulates inside the glass measurement tubes, the volume of water being measured is reduced, causing the conductivity readings to bias low. UV•Xchange is highly effective at protecting CT•Xchange from long-term biological growth. It is required to preserve measurement integrity for long-term in-situ deployments.

For more detailed information related to biofouling control, refer to the UV•Xchange™ User Manual.

Copper Tape

A common strategy to prevent biofouling on a submerged surface is to coat the surface with copper tape. This method is often utilized on instrument bodies, cages, endcaps, and sensor housings. **Copper tape should not be applied to CT•Xchange.** The metallic tape will interfere with the external sensing field of the sensor. UV•Xchange alone is sufficient to maintain the measurement integrity of CT•Xchange.

Maintaining the Sensor

Periodic Maintenance

Periodic maintenance will prolong the life of the sensor. The following steps are recommended:

- Cleaning
 - If the sensor is dirty or oily, soak it in warm water with a small amount of grease-cutting soap (dish soap is acceptable).
 - Carefully clean the insides of the glass cross tubes.
 - Silver Platinum electrodes may be **gently** brushed with a clean Q-tip to remove extra residue.
 - Rinse thoroughly with distilled water to remove any residual soap or dirt.
- Before each use:
 - Inspect the O-ring under the blue locking sleeve of the sensor.
 - If O-ring is damaged, replace it with another. Type 2-116-N70D. See “Inspecting and Replacing the O-ring” later in this manual for more information.
 - If O-ring is dry or has been replaced due to damage, apply a small amount of silicone grease.
 - Ensure that the sensor is clean and undamaged.
 - Ensure that the sensor is properly installed on the instrument.
- After each deployment:
 - Clean and rinse the sensor using distilled or fresh water.
 - Dry the sensor completely; store it in a cool, dry place.
- Yearly
 - Send the sensor to a service centre for diagnostics and re-calibration.
 - Install connector and sensor blanking plugs in the instrument if not replacing sensors sent for calibration with others.
- Long term storage preparation
 - Ensure the instrument has been thoroughly cleaned and dried.
 - Remove all Xchange™ sensors from the instrument and dry the connectors.
 - Lubricate the underwater connectors (not Xchange™ mounts) with silicone spray.
 - Lubricate the retainer rings and O-rings with silicone grease.
 - Install connector and sensor blanking plugs in the instrument.

Field Calibration

Refer to “Appendix C – C•Xchange Field Calibration” in the SeaCast 4 User Manual.

Inspecting and Replacing the O-Ring

CT•Xchange has a primary O-ring seal which must be clean and lubricated. Any fibres or dirt on or around the O-ring and grooves may allow water into the connector, risking damage to the sensor and the sensor mount. To access the O-ring, perform the following steps:

- Remove the sensor from the instrument



- There is a black retaining ring above the blue locking sleeve on the sensor stem. Stretch the retaining ring open enough to allow it to slide up the sensor stem.



- Slide the blue locking sleeve up the stem to expose the O-ring.



- The O-ring should be slick with grease. If it is dry, apply silicone grease.
- Inspect the O-ring for dirt. Clean and reapply grease, if necessary.
- Inspect the O-ring for nicks and cracks. If any are found, the O-ring must be replaced. Use 2-116-N70D Buna Nitrile O-rings. Apply silicone grease to the new O-ring prior to use.

Caution: Do not use a sharp instrument to remove the O-ring. If the O-ring groove is scratched, the O-ring will not provide a waterproof seal. The O-ring can be removed easily with bare hands as shown below.



Pinch O-ring to
remove

Communications

CT•Xchange Commands

When using SeaCast, the full instrument command set is not usually necessary. However, text commands can be issued to the instrument and also to specific sensors on an instrument from SeaCast or any terminal emulation program, such as HyperTerminal.

There is additional command set functionality on CT•Xchange equipped instruments. To use these commands, direct communication with the CT•Xchange sensor must be established. There are two ways to accomplish direct communication with CT•Xchange:

1. On a Micro•X instrument with a primary sensor mount, CT•Xchange commands can be given directly to the instrument by typing commands into the terminal emulation program.
2. On all other X•Series instruments, the *TALK* command is used to direct communications to CT•Xchange. Use the following procedure to accomplish this:

Enter Talk Mode

- Establish communications with the instrument.
- Send the *DETECT* command to the instrument. The instrument will return a list of sensors detected on each slot of the instrument. The slot number for CT•Xchange will always be "1."
- Send the *TALK 1* command to the instrument, which will direct subsequent communications directly to the sensor board.

Exit Talk Mode

- Press the CTRL and C keys simultaneously.

Specific Commands of Interest

Command	Description
DIS OPTIONS	Displays the current settings for CT•Xchange.
DIS COND CAL	Displays the calibration information for CT•Xchange.
SET xxxxx FORMAT ab	Changes the numerical output format of the sensor. Where xxxxx=sensor type (SV, CONDUCTIVITY, TEMPERATURE, PRESSURE). a = number of digits ahead of the decimal place. b = number of digits after the decimal place I.e. SET SV FORMAT 42 changes the scan output format to 1475.25 SEE BELOW
SET COND FORMAT 23	Sets the C format to 2 digits ahead of the decimal place and 3 digits after the decimal place.
SET COND FORMAT 22	Sets the C format to 2 digits ahead of the decimal place and 2 digits after the decimal place.
SET TEMP FORMAT 23	Sets the T format to 2 digits ahead of the decimal place and 3 digits after the decimal place.
SET TEMP FORMAT 22	Sets the T format to 2 digits ahead of the decimal place and 2 digits after the decimal place.

*For the full set of commands, please refer to the Commands section of an Instrument manual.

Support

Troubleshooting

Instrument fails to detect the sensor:

- Is the sensor properly mounted on the instrument? Blue mounting collar should be firmly tightened and less than 1mm from the instrument endcap.
- Inspect the connectors on both the sensor and the instrument for corrosion or damaged contacts.
- Cycle power to the instrument.

Conductivity data is noisy (readings are jumping around more than expected):

- Ensure there are no bubbles trapped in the sensor.
 - To remove bubbles:
 - Flow water through the sensor in excess of 2 m/s to flush the bubbles out of the sensor. If there is sufficient room, move the sensor through the water vigorously by hand.
 - To prevent bubbles:
 - Pre-wet the sensor using one of the following methods:
 - Use water with a few small drops of dish soap and isopropyl alcohol in it. Soak the sensor for 5 minutes.
 - Use distilled water only and soak the sensor for 20 minutes.
- Inspect the connector on both the sensor and the instrument for corrosion or damaged contacts.
- Are there small scale thermal or salinity eddies or stratification of the water being tested? These can cause reading fluctuations, particularly in fast-response sensors such as CT•Xchange. In this case, rapid changes in readings are likely a reflection of true conditions.
- Is there a nearby source of electromagnetic interference? Examples are arcing brushes on electric motors, radio transmitters, switching power supplies, and faulty cathode ray tube monitors.
- Check the power supply to the sensor for noise. The power supply should have less than 30mV of noise.

Temperature data is noisy:

- Check the connector on both the sensor and the instrument for corrosion or damaged contacts
- Is the instrument subject to vibrations?
- Are there temperature eddies in the water being tested?
- Is there a nearby source of electromagnetic interference? Examples are arcing brushes on electric motors, radio transmitters, switching power supplies, and faulty cathode ray tube monitors.
- Check the power supply to the sensor for noise. The power supply should have less than 30mV of noise.

SeaCast fails to recognize the sensor:

- Download the latest version of SeaCast at <http://www.amloceanographic.com/seacast>.

Contact AML Oceanographic

Service

To request an RMA or technical support

Email: service@AMLOceanographic.com

Phone: 1-250-656-0771

Phone: 1-800-663-8721 (NA)

Fax: 1-250-655-3655

Sales

For all general sales inquiries

Email: sales@AMLOceanographic.com

Phone: 1-250-656-0771

Phone: 1-800-663-8721 (NA)

Fax: 1-250-655-3655

Website

<http://www.AMLOceanographic.com>

Customer Portal

My AML Oceanographic is AML's online data centre. This secure area within our website is designed to offer one easy location for interested individuals and organizations - distributors, customers, prospects, and other members of our community - to manage their interactions with AML. *My AML Oceanographic* will allow you to:

- View and manage your assets (instruments and sensors)
- Consult instrument diagnostic summaries
- View and download calibration and conformity certificates
- View and manage your technical support cases
- Consult and download sales estimates, sales orders, and invoice copies
- View account balances and generate account statements
- Assess inventory availability at AML

To access the Customer Portal, please navigate to the *Support* button - located on the top right of the AML Oceanographic home page - select *Customer Centre* from the options on the drop down menu and follow the instructions provided.

Mailing and Shipping Address

AML Oceanographic

2071 Malaview Ave.

Sidney, BC, Canada

V8L 5X6

Technical Specifications

Sensors

Channel	Range	Accuracy	Stability	Precision	Resolution	Response Time
Conductivity	0-90 mS/cm ¹	±0.01 mS/cm	±0.003 mS/cm/mth ³	±0.003 mS/cm	0.001 mS/cm	25 ms ⁴
Temperature	-5-45 °C ²	±0.005 °C	±0.005 °C/yr	±0.003 °C	0.001 °C	100 ms

¹ Will over-range to 100 mS/cm. Inquire for specifications

² Will over-range to 60 °C. Inquire for specifications.

³ When combined with UV•Xchange

⁴ At 1 m/s flow

Mechanical Materials

Housing				
Status	Type	Depth Rating	Diameter	Length
Standard	Ultem	6000 m	61 mm (2.4")	108 mm (4.25")

Sampling Capabilities

- Samples up to 25 times per second.

Ordering Codes

XCH-CT-RA090-n545	CT•Xchange™ Right Angle, Oceanographic (0-90 mS/cm, -5-45 °C) Range
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Warranty

AML warrants the instrument for a period of TWO YEARS from the date of delivery. AML will repair or replace, at its option and at no charge, components which prove to be defective. The warranty applies only to the original purchaser of the instruments and only to instruments and sensors manufactured by AML Oceanographic. The warranty of third party sensors will apply as per the specific vendor's warranty policy. The warranty does not apply if the instrument has been damaged, by accident or misuse, and is void if repairs or modifications are made by other than authorized personnel.

This warranty is the only warranty for new product given by AML. No warranties implied by law, including but not limited to the implied warranties of merchantability and fitness for a particular purpose shall apply. In no event will AML be liable for any direct, indirect, consequential or incidental damages resulting from any defects or failure of performance of any instrument supplied by AML.

DISCLAIMER

AML reserves the right to make any changes in design or specifications at any time without incurring any obligation to modify previously delivered instruments. Manuals are produced for information and reference purposes and are subject to change without notice.

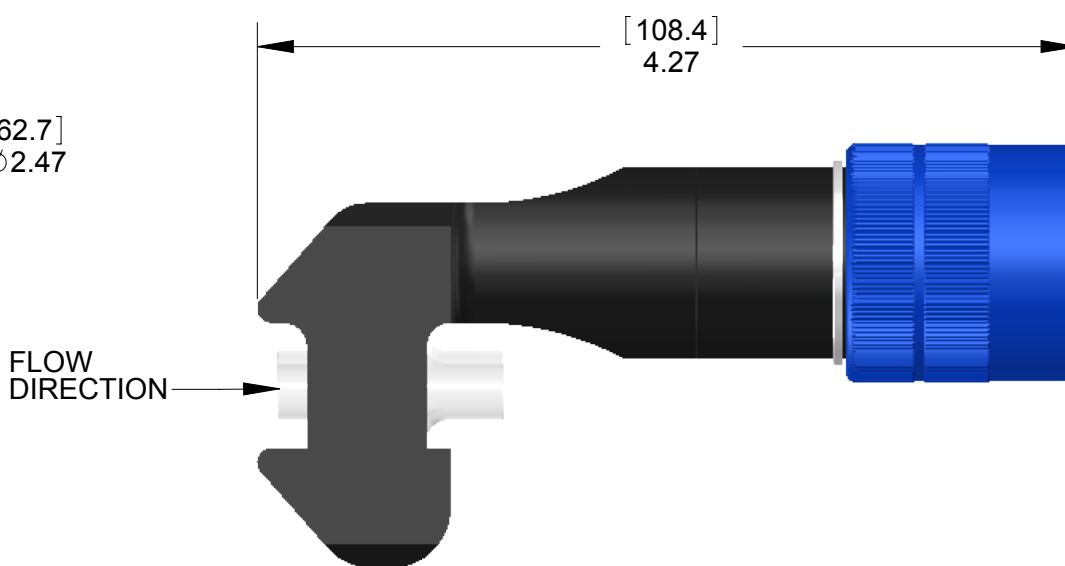
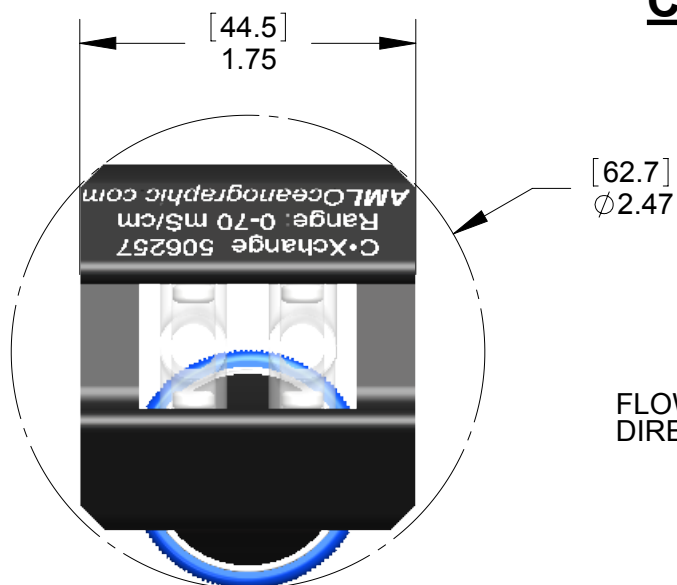
Technical Overview Drawings

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REVISION TABLE

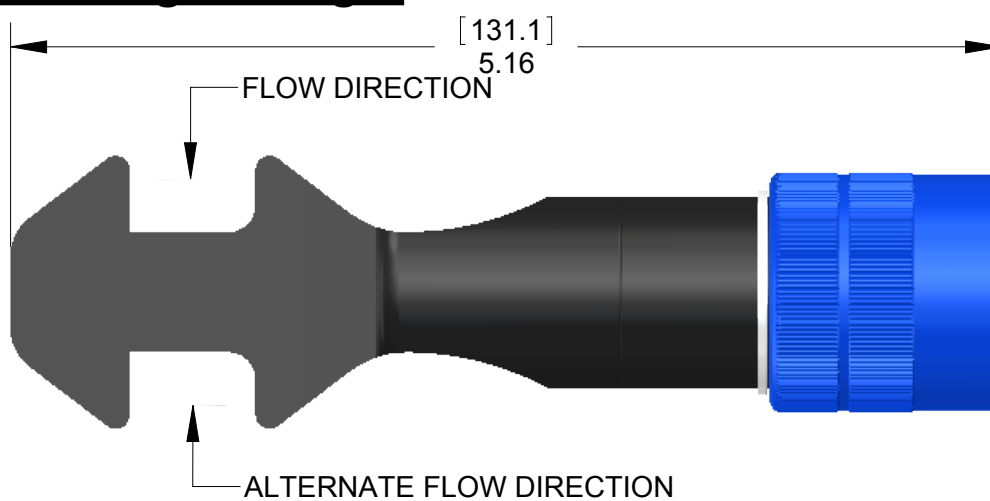
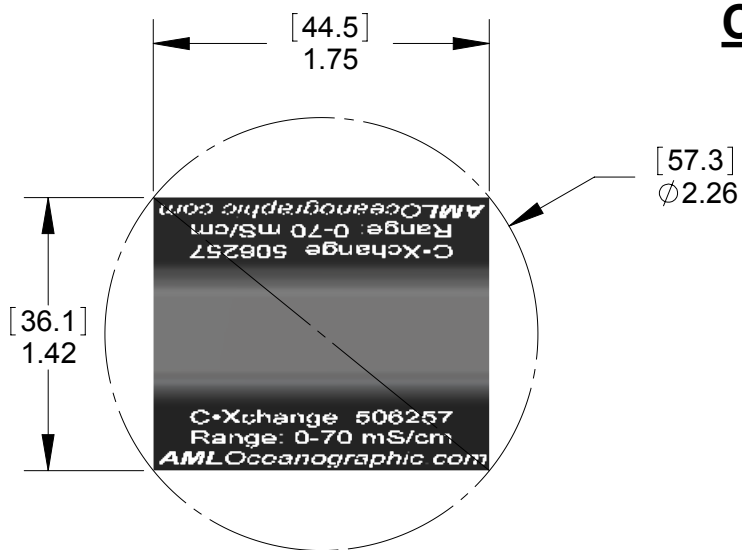
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C	UPDATED TUX & ADDED SENSOR WEIGHTS	LB	27NOV2015
D	UPDATED UVX	MS	11MAY2016

C Xchange Right Angle



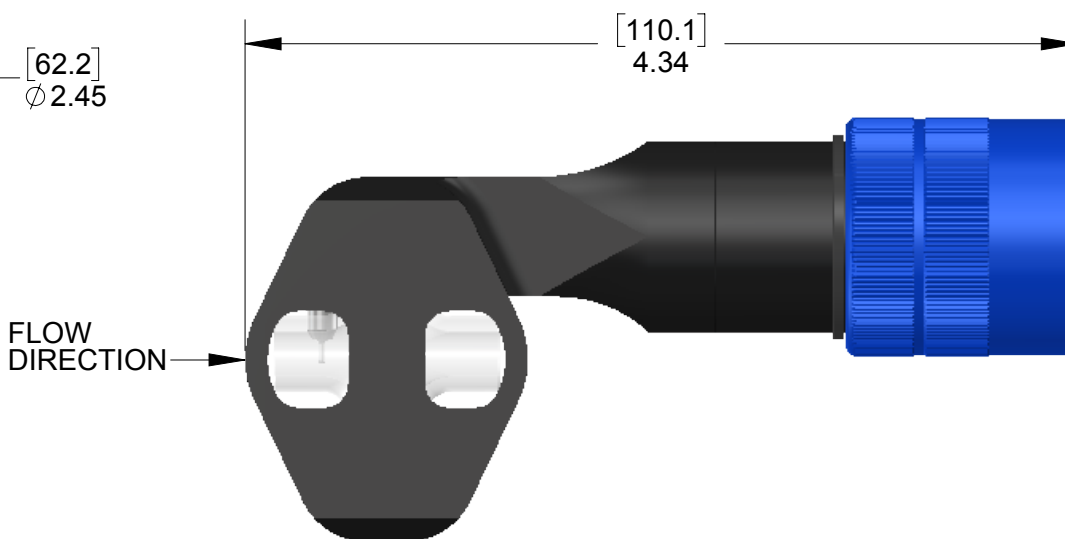
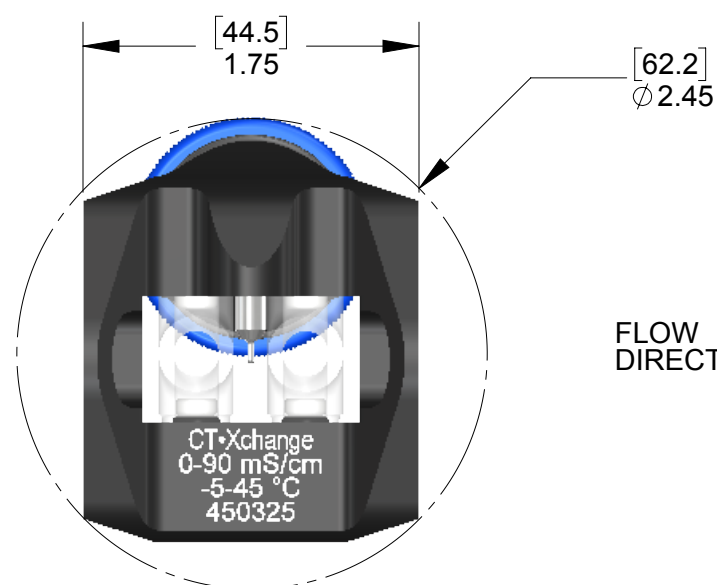
NOTE: WEIGHT = 120 g

C Xchange Straight



NOTE: WEIGHT = 132 g

CT Xchange



NOTE: WEIGHT = 110 g

NOTE: ALL WEIGHTS MEASURED IN AIR



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TOLERANCES:

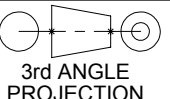
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 FRACTIONS: ± 1/32
 HOLE SIZES: ± 0.005(0.13)
 0.00: ± 0.015(0.38)
 0.000: ± 0.005(0.13)

UNLESS OTHERWISE SPECIFIED:

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 DIM'S ARE IN INCHES (MM)
 SURFACE FINISH: 63

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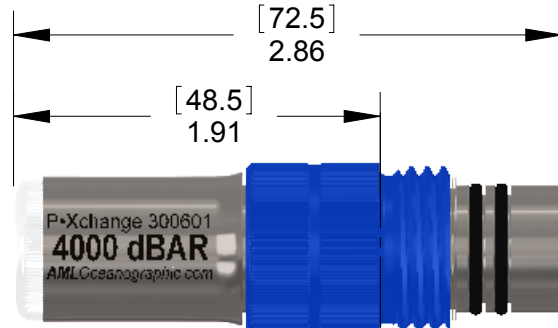
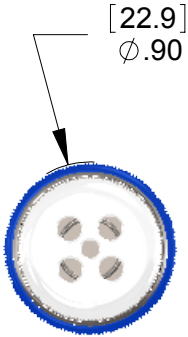
Xchange Sensor / Device Overview

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DATE 26FEB2010	MATERIAL: N/A		
 3rd ANGLE PROJECTION	SLD FILE NO.: N/A	SHEET NO. Sheet 1 of 3	

REVISION TABLE

REV	DESCRIPTION	BY	DATE
B	ADDED CTX	ABT	15AUG2015
C	UPDATED TUX & ADDED SENSOR WEIGHTS	LB	27NOV2015
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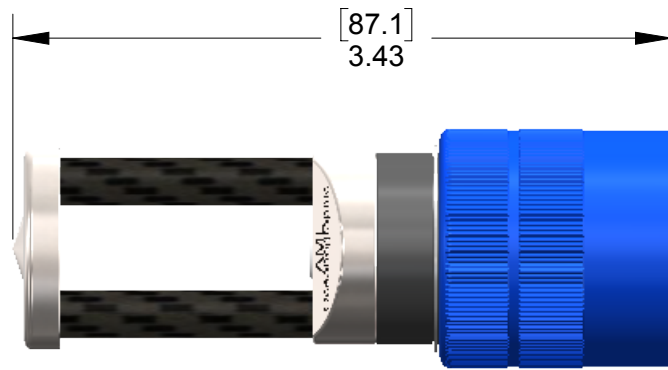
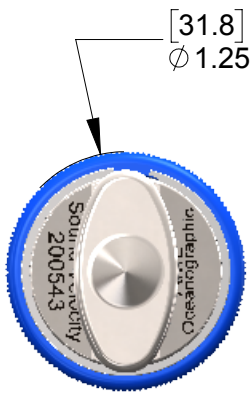
P Xchange



NOTE: WEIGHT = 57 g

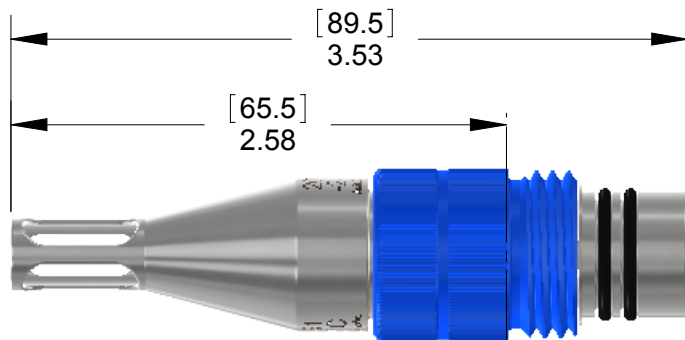
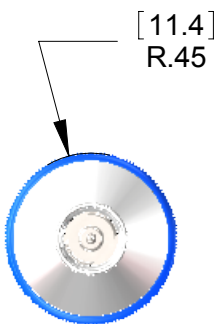
ENDCAP FACE LEVEL WHEN INSTALLED ON INSTRUMENT OR BULKHEAD.

SV Xchange



NOTE: WEIGHT = 62 g

T Xchange



NOTE: WEIGHT = 60 g

ENDCAP FACE LEVEL WHEN INSTALLED ON INSTRUMENT OR BULKHEAD.

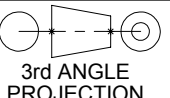
NOTE: ALL WEIGHTS MEASURED IN AIR



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TOLERANCES:
 ANGLES: ± 1°
 FRACTIONS: ± 1/32
 HOLE SIZES: ± 0.005(0.13)
 0.00: ± 0.015(0.38)
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 ORIGINAL SCALE: 1:1
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 SURFACE FINISH: 63

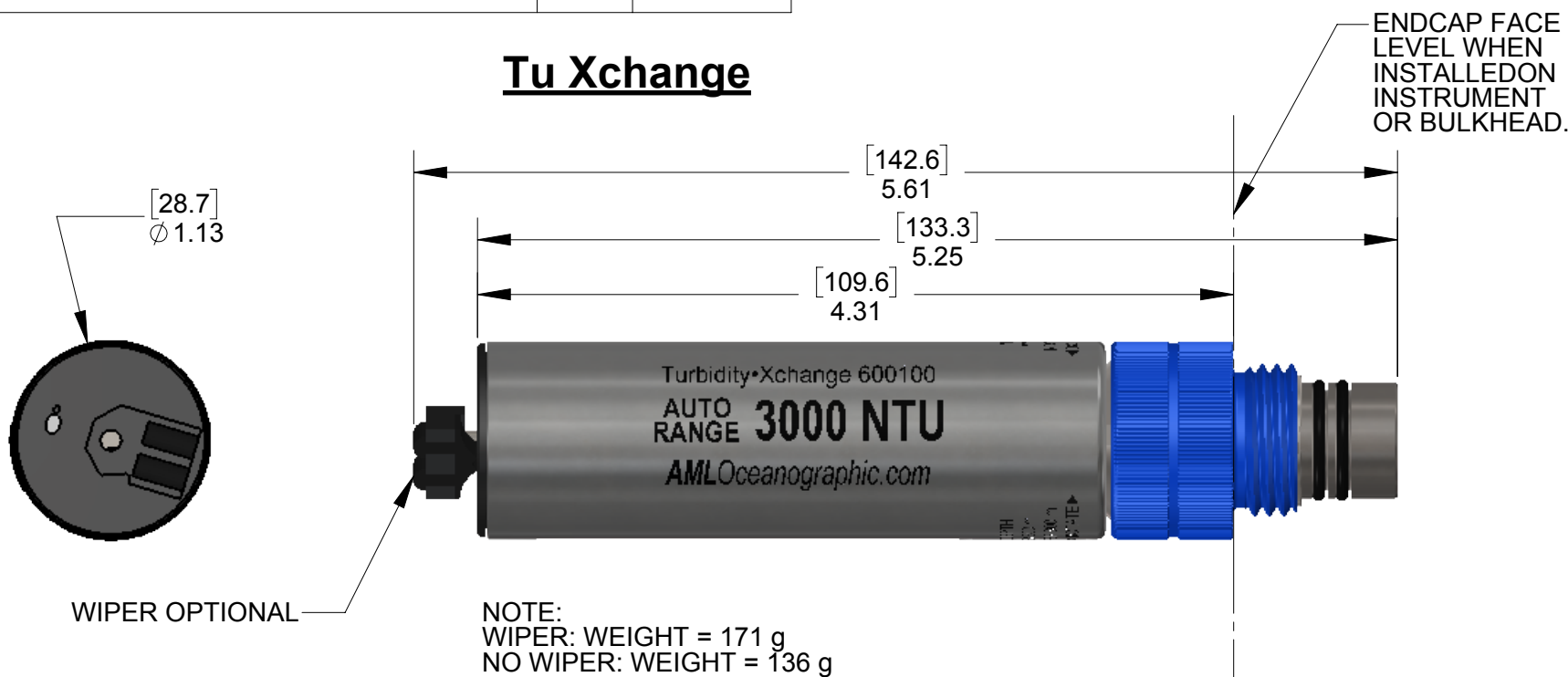
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DATE 26FEB2010	MATERIAL: N/A		
 SIZE B	SLD FILE NO.: N/A	SHEET NO. Sheet 2 of 3	

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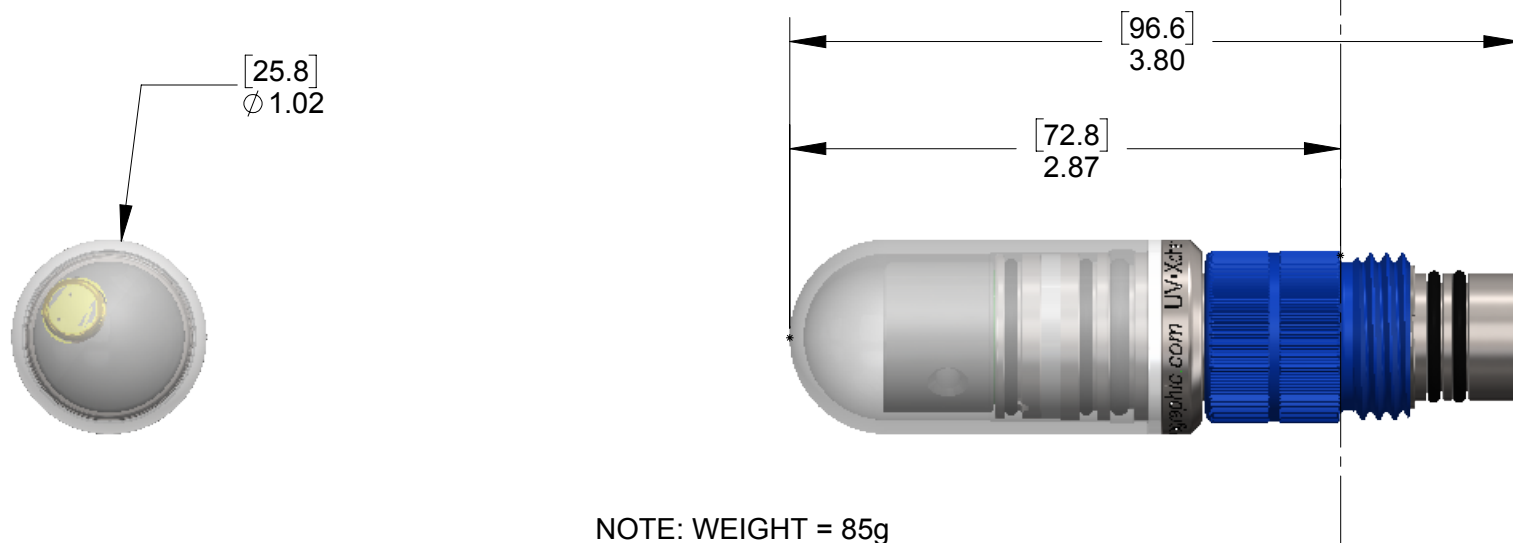
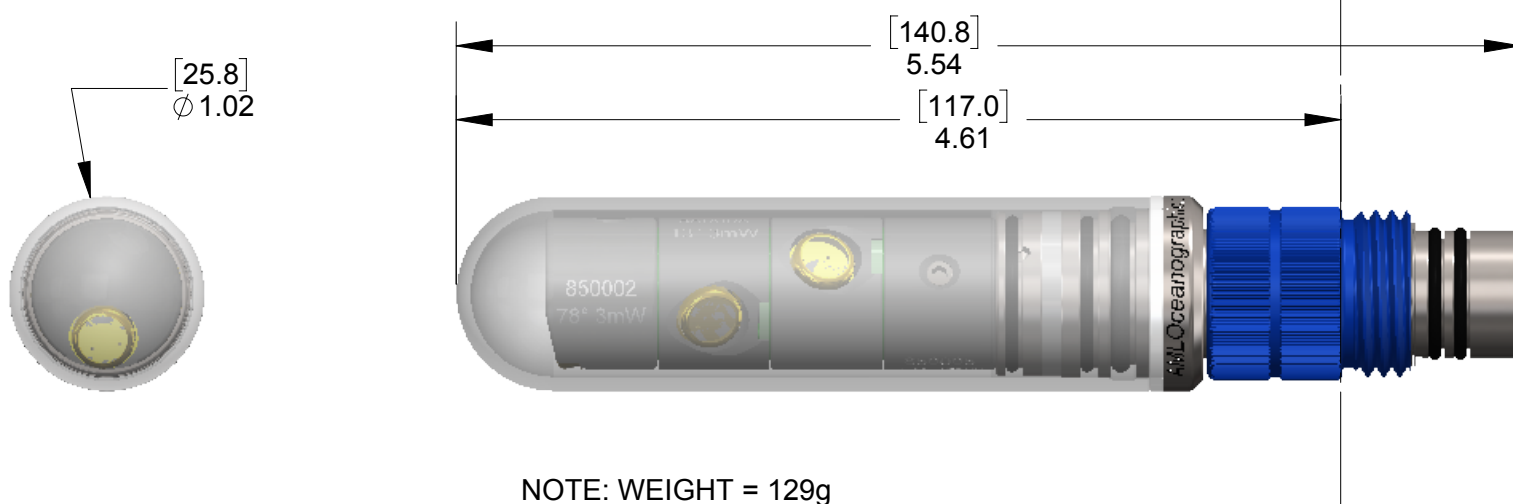
REVISION TABLE

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B	ADDED CTX	ABT	15AUG2015
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D	UPDATED UVX	MS	11MAY2016

Tu Xchange



UV Xchange



NOTE: ALL WEIGHTS MEASURED IN AIR



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TOLERANCES:

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UNLESS OTHERWISE SPECIFIED:

ORIGINAL SCALE: 1:1
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 SURFACE FINISH: 63

TITLE: Turbidity Xchange Sensor			
DRAWN I.L.	DRAWING NO.: SNS-GA-03351-D	REV N/A	AML NO. N/A
DATE 26FEB2010	MATERIAL: N/A		
3rd ANGLE PROJECTION	SIZE B	SLD FILE NO.: N/A	SHEET NO. Sheet 3 of 3