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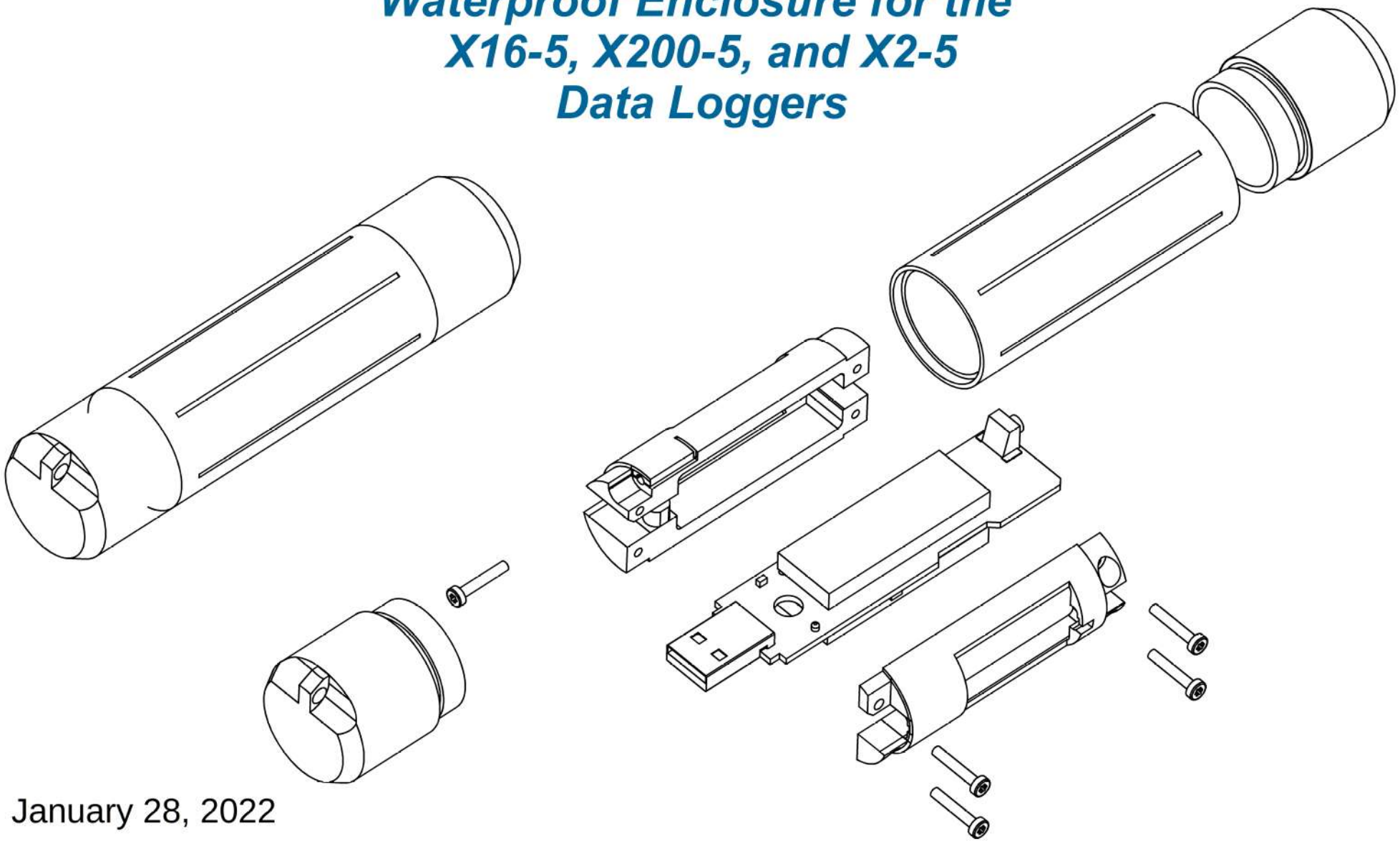
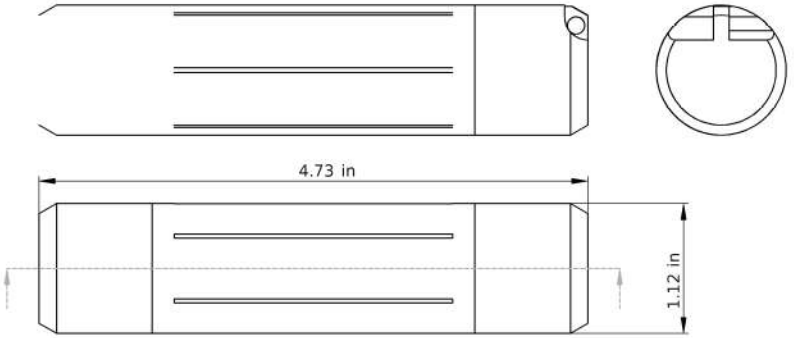
Instructions to Assemble A Waterproof Enclosure for the X16-5, X200-5, and X2-5 Data Loggers

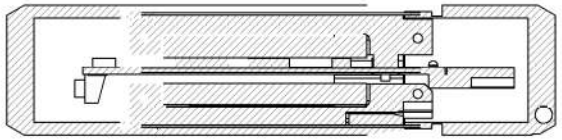


January 28, 2022

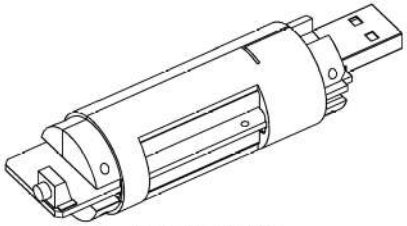
- The standard X16-5, X200-5, X2-5 data loggers are protected within a simple three-part plastic enclosure. The enclosure is not waterproof, dust proof, or rugged enough for certain applications. This document provides instructions for assembling a low-cost waterproof metal enclosure. The solution is based on a small cylindrical container commonly used for camping and hiking to protect matches, medication, and small personal items. This container is readily available at online retail stores, such as Amazon. The effectiveness of this solution depends heavily on the quality of the container but the issue is mitigated with new o-ring seals. The assembled enclosure should meet the protective requirements equivalent to IP65 or IP67, as defined by International Electrotechnical Commission (IEC).

Standard X16-5 Data Logger Enclosure

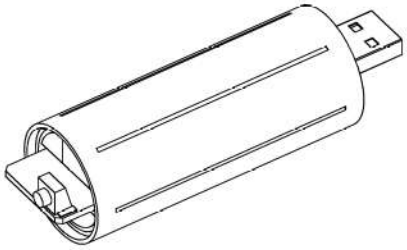




Plastic cradle holds logger within the cannister pipe. The two cannister end caps hold the cradle in place and prevents sliding within the pipe.



Cradle and logger



Cradle mounted inside pipe

Gulf Coast Data Concepts, LLC
Pipestone Data Logger
Jan 11, 2022

Parts List

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Identifier	Description	Quantity	Source
S1	Torx Plus Rounded Head Thread-Forming Screws for Plastic, 18-8 Stainless Steel, Number 2 Size, 1/2" Long	4	McMaster-Carr 96001A160
S2	Stainless Steel Pan Head Torx Screws, 2-56 Thread, 1/2" Long	1	McMaster-Carr 96710A373
O1	Oil-Resistant Soft Buna-N O-Rings, 1/16 Fractional Width, Dash Number 020	2	McMaster-Carr 2418T126
P1	Left side of 3D printed plastic cradle	1	.stl CAD model
P2	Right side of 3D printed plastic cradle	1	.stl CAD model
C1	Waterproof container, small 1.12 x 1.12 x 4.72 inches, aluminum	1	Amazon, eBay
L1	GCDC Data Logger: X16-5, X200-5, or X2-5	1	www.gcdataconcepts.com

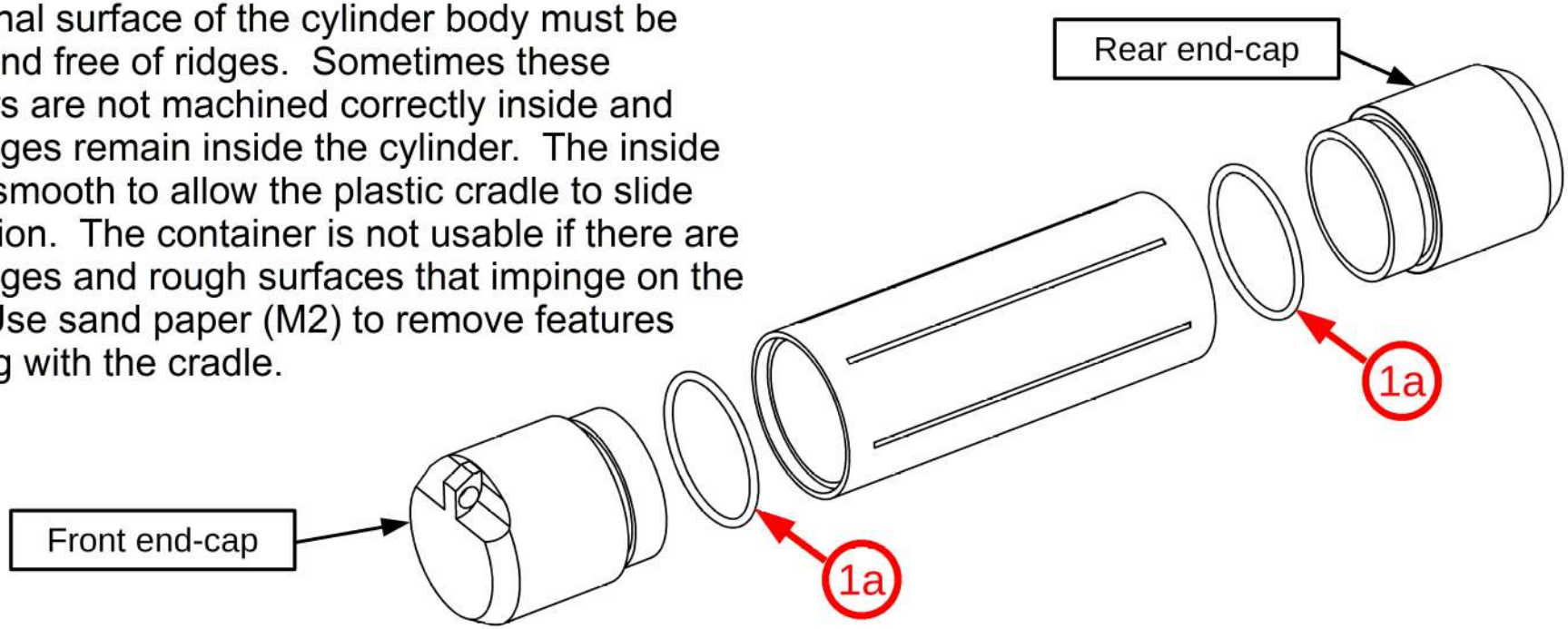
- Note: The particular waterproof container needed is available on Amazon and eBay. Prices range between $6 to $15 each and the containers are available in several colors. It's very important to select the container that matches this picture.

Identifier	Description	Quantity	Source
T1	IP7 Torx-Plus screwdriver	1	Amazon, Harbor-Freight
T2	Soldering iron for electronics	1	Amazon, McMaster-Carr
T3	Permanent marker or paint pen	1	Amazon, Home Depot, Lowe's
T4	Razor blade, exacto-knife or similar precision cutting instrument	1	Amazon, Home Depot, Lowe's
M1	½ wide polyimide plastic tape (Kapton) or equivalent	1	Amazon, McMaster-Carr
M2	200 grit sand paper	1	Amazon, Home Depot, Lowe's

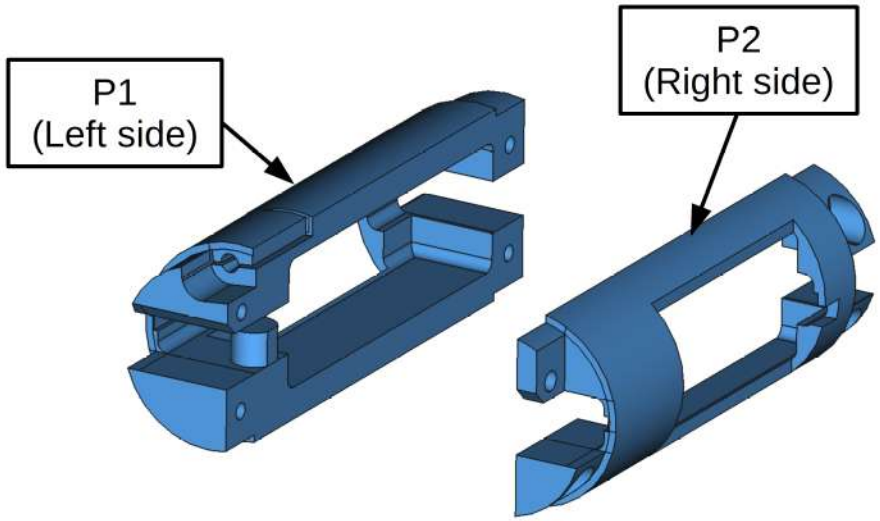
- Basic soldering skills are needed to modify the battery pack. The procedure is simple but patience and precision should be exercised.

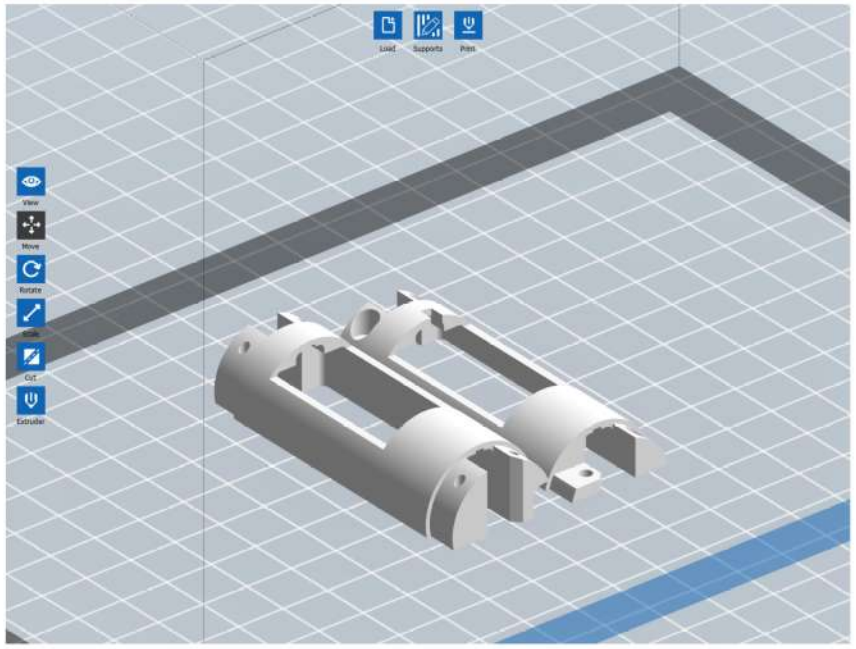
Instructions: Step 1 - Inspection of Container

- The “waterproof” container is not always fully waterproof as advertised by the manufacturer. The o-ring seals can leak when the container is submerged in water. Test the container as follows:
  - Open the container and ensure the inside is thoroughly dry.
  - Place a dry paper towel inside the container.
  - Closed the container firmly.
  - Submerge the container in a bucket of water for 5 minutes.
  - Remove the container from the water and thoroughly dry the external surface.
  - Open the container and inspect for water intrusion (droplets). Remove the paper towel and inspect for damp or wet areas of the paper towel. Any presence of water will indicate a failed o-ring seal.
  - Replace both o-ring seals (one on each end-cap) with the O1 replacement part (1a). Repeat the water test to ensure the container is properly sealed.
- The internal surface of the cylinder body must be smooth and free of ridges. Sometimes these containers are not machined correctly inside and raised edges remain inside the cylinder. The inside must be smooth to allow the plastic cradle to slide into position. The container is not usable if there are raised ridges and rough surfaces that impinge on the cradle. Use sand paper (M2) to remove features interfering with the cradle.



- The .stl models are designed to be printed with PLA+ type filament. Other filament materials, such as ABS or nylon, may shrink or distort in a manner that results in a cradle that will not fit within the container. The models should print well with photo-cured resin (MSLA) type printers. As with any 3D printing operation, your results may vary and require some adjustments to reach the desired outcome.
- Two part cradle:
  - P1: cradle_sideL.stl
  - P2: cradle_sideR.stl
- Contact GCDC at tech_support@gcdataconcepts.com for .stl files



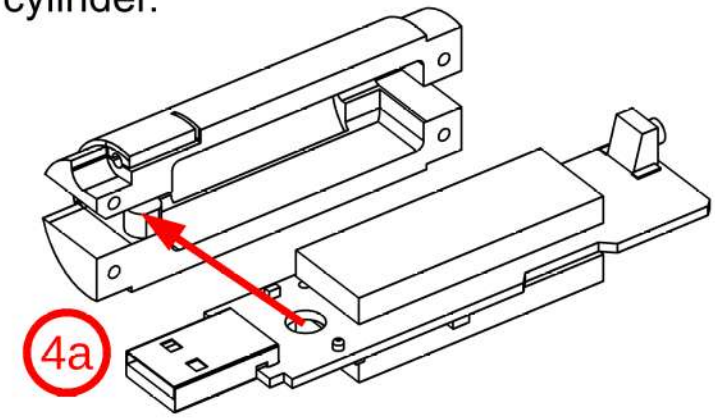


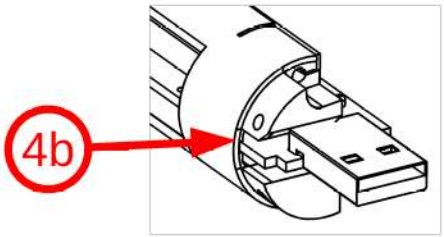
- Typically, the lithium-polymer battery pack is mounted on the top side of the printed circuit board. However, to fit within the container, the battery pack must be reconfigured to allow the circuit board to position along the center-line of the container. This requires separating the battery pack and mounting one battery on top and bottom of the circuit board.
  - Use a razor (T4) to gently cut the white plastic wrap holding the battery pack. Remove the wrap and separate the battery pack from the circuit board.
  - De-solder the battery pack from the circuit board. Be very careful not to short the positive and negative wires together. Use a piece of tape (M1) to insulate the wires if needed.
  - The battery pack is composed of two separate batteries connected in parallel. The batteries are held together with double-sided tape. Gently and slowly pull the batteries apart. The tape should release slowly. If needed, use a razor (T4) to cut the tape as the batteries are separated.
  - Solder the wires of one battery to the top-side of the circuit board and the second battery to the bottom side. Remember to solder the positive red wires to “BAT” and the negative black wires to “GND”.
  - Position the batteries 1/8 inch from the mounting hole on the circuit board. Correct positioning is important because the batteries must fit within the cradle. Secure the batteries in place on the circuit board using tape (M1). Do not tape over the microSD card.

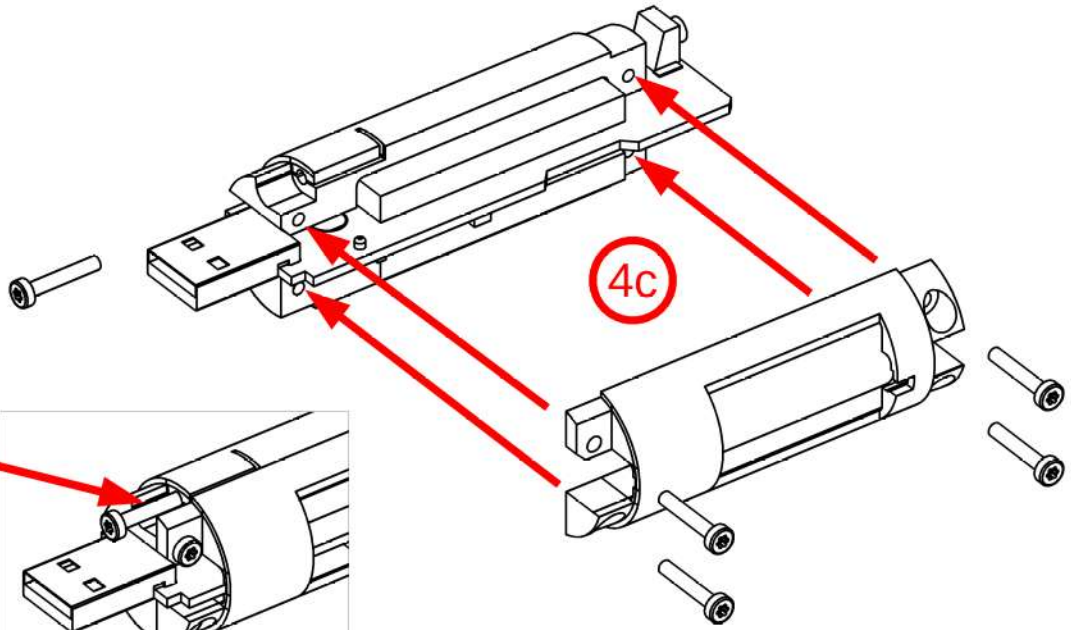
Before

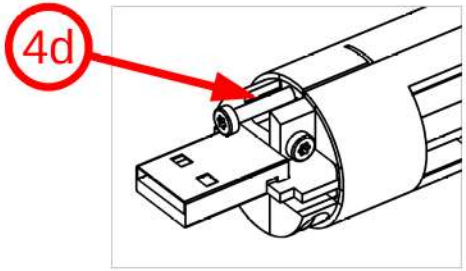
After

- The logger fits into P1 of the cradle. The logger mounting hole aligns with the post (4a) and the circuit board edges align with the cradle grooves (4b). To slip the logger into the cradle, open P1 wider to allow clearance for the circuit board to slip over the post. Once the circuit board is over the post, the board edges should align easily with the grooves. The logger will hold snug when properly aligned into P1.
- Mate P2 to P1 (4c). Using the torx driver (T1), turn one S1 screw into one of the four holes. Add a second S1 screw on the opposite corner. The two screws will align the sides and the remaining two screws will insert easier. Tighten all four screws snug.
- Start the S2 screw into the locking feature. Do not fully engage – turn about 25% of the threads (4d). This screw will be used to lock the cradle into position inside the container cylinder.









Instructions: Step 5 - Insert Cradle Into Container

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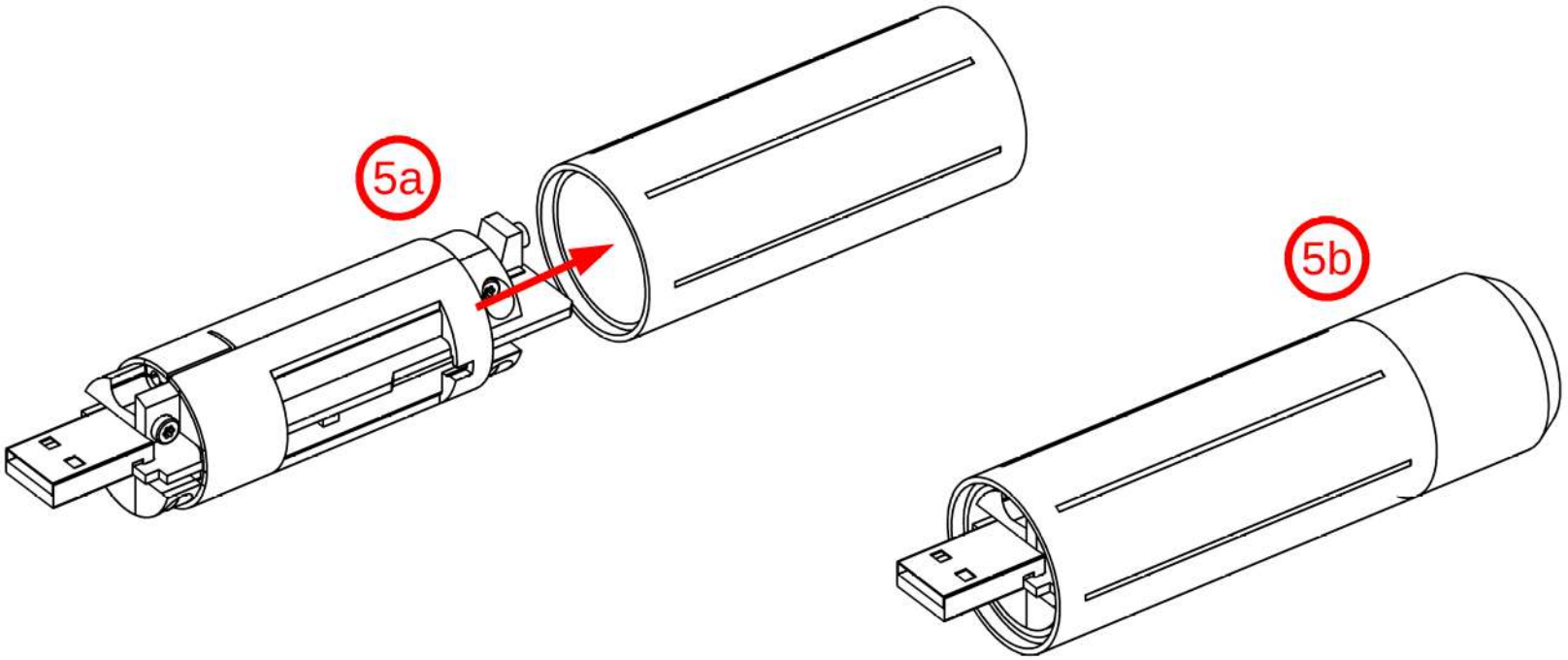
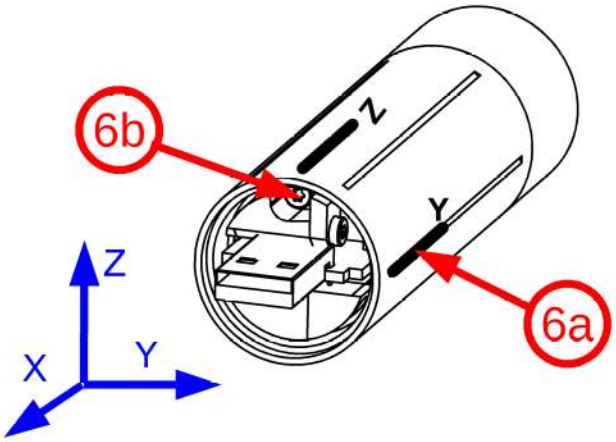
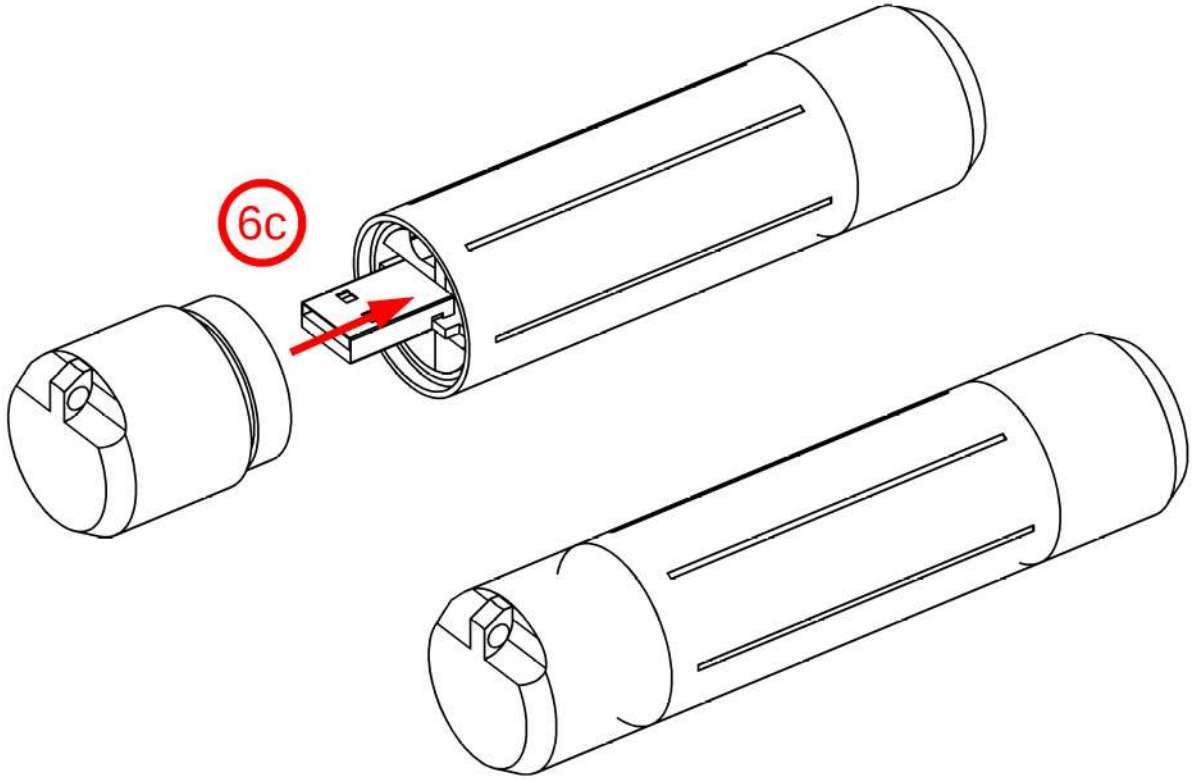
- Slide the cradle and logger assembly into the cylinder (5a). The cradle should fit snug or a little loose. If the cradle is too tight, remove it and use sand-paper to smooth the outside surface of the cradle.
- Position the cradle near the middle of the cylinder such that the logger extends equally from each end of the cylinder. This does not need to be precise. The end-cap will push the cradle into final position later in the next step.
- Screw the rear end-cap onto the cylinder (5b). Tighten the cap snug. The cap should fit flush with the cylinder and the o-ring will fully seat inside the cylinder.



Instructions: Step 6 - Close Container

- Rotate the cradle/logger to match a preferred orientation within the cylinder. For example, align the circuit board edges with the external groove features of the cylinder. The external groove can then be used to identify the Y-axis. Mark this groove (6a) with a permanent marker or paint pen (T3).
- Tighten the locking screw S2 until it is fully seated (6b). This will push the locking mechanism against the cylinder wall and secure the cradle within the container. The cradle/logger should not rotate or slide.
- Screw the front end-cap onto the cylinder and tighten (6c). The o-ring should fully seat and the cap will sit flush against the cylinder.
- Assembly is complete.





- Unscrew the rear end-cap to access to the on/off button. Press the button briefly and the logger will start recording. Although the indicator LEDs are located on the opposite end of the logger, you will still see the flashing LEDs through the gaps of the mounting cradle. Press and hold the button for 3 seconds to deactivate the logger.
- Unscrew the front end-cap to access the USB connector and indicator LEDs.
- If needed, the microSD card can be removed and accessed directly with a USB card reader.
  - Unscrew the front end-cap
  - Unscrew the locking screw (S2) using the torx driver (T1).
  - Hold the USB connector and pull the logger from the cylinder.
  - The microSD card is accessible from P2 side of the cradle. The card holder uses friction to keep the microSD card in place so pull the card directly out of the holder (no press-to-release type mechanism).