



RSTAR Affinity Tilt Logger Installation and User Manual

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REVISION HISTORY

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A	Initial release	23 January 2025, 2025	BV, SM, HW	JT, HW, MJ, SP

1 INTENDED AUDIENCE

The RSTAR Affinity Tilt Logger manual is designed to assist users in effectively installing, configuring, and using the Affinity Tilt Logger. It provides comprehensive guidance on the following key aspects:

1. Installation procedures.
2. Configuration and setup using the iOS/Android Field Utility App.
3. Data management using the browser-based RSTAR Affinity Data Platform software.
4. Maintenance and troubleshooting.

2 ICONS AND CONVENTIONS USED IN THIS GUIDE

This guide uses the following icons to call attention to important information.



WARNING: This icon appears when an operating procedure or practice, if not correctly followed, could result in personal injury or loss of life.



CAUTION: This icon appears when an operating procedure or practice, if not strictly observed, could result in damage to or destruction of equipment.



NOTE: This icon appears to highlight specific non-safety related information.

3 ABBREVIATIONS AND ACRONYMS

This section lists abbreviations and acronyms used in the document.

Abbreviation or acronym	Definition
MEMS	Micro-Electro-Mechanical Systems
LoRa®	Long-range
App	Application

4 SAFETY AND PRECAUTIONS



CAUTION: Normal safety precautions should be followed, and proper personal protective equipment (PPE) should be worn when working in the field, including safety glasses and nitrile gloves.

Always use respirators if drilling in concrete to limit silica dust inhalation.

5 INTRODUCTION

RST's RSTAR Affinity Tilt Logger is a high precision autonomous 3 axis inclinometer capable of detecting deflections as small as 0.0005°.



NOTE: In the context of RSTAR Affinity Tilt Logger, “tilt” and “inclination” are interchangeable.

Constructed with a robust and compact design featuring IP68 weatherproofing, the Affinity Tilt Logger is an ideal choice for a variety of challenging geotechnical environments.

The Logger uses a primary triaxial MEMS accelerometer sensor that captures accurate tilt and inclination data. Additionally, it is equipped with a secondary sensor for event detection, which intelligently adjusts the data sampling rate in response to significant, sudden external events such as earthquakes, landslides, and other severe structural failures.

RST provides two sensor options: high vibrations railways and standard. The high vibration sensor is used in environments where there are intense, short-duration vibrations. This includes scenarios such as installation next to railway tracks or near activities like sheet piling. The high vibration sensor is designed for compliance with high vibration and shock environments, while maintaining high tilt precision and temperature offset performance.

Providing both measurement and data logging capacity, the Affinity Tilt Logger integrates seamlessly with the RSTAR Affinity Data Platform, enabling real-time data insights, analysis, and alerting. Data from the Affinity Tilt Logger is wirelessly transmitted to the RSTAR Affinity Gateway via LoRa technology and stored in the cloud, allowing users to access their data from anywhere in the world. The Logger is equipped with a long-lasting battery and can operate for years autonomously. If necessary, the battery is field-replaceable without losing measurement continuity.

With options for internal and external antennas, as well as horizontal and vertical mounting, it provides flexibility to suit diverse monitoring requirements. At 40mm (1.6 in) height, it is also well suited for applications requiring a low-profile sensor.

The Affinity Tilt Logger is perfectly suited for applications requiring careful monitoring of structural stability or machinery alignment, providing crucial data that supports technical assessments and decision-making.

5.1 SYSTEM COMPONENTS

The RSTAR Affinity Tilt Logger consists of 5 key components:

- Tilt Logger Unit
The unit contains the triaxial MEMS sensors and the battery. It may also include the antenna if the internal antenna option is selected.
- Baseplate
The baseplate is a part of the tilt logger, acting as one of its enclosing walls. It helps to attach the logger to a designated mounting point.



NOTE: The logger unit is attached seamlessly to the baseplate, sealing the logger's electronics.



Figure 1: RSTAR Affinity Tilt Logger Unit with Internal Antenna and Baseplate

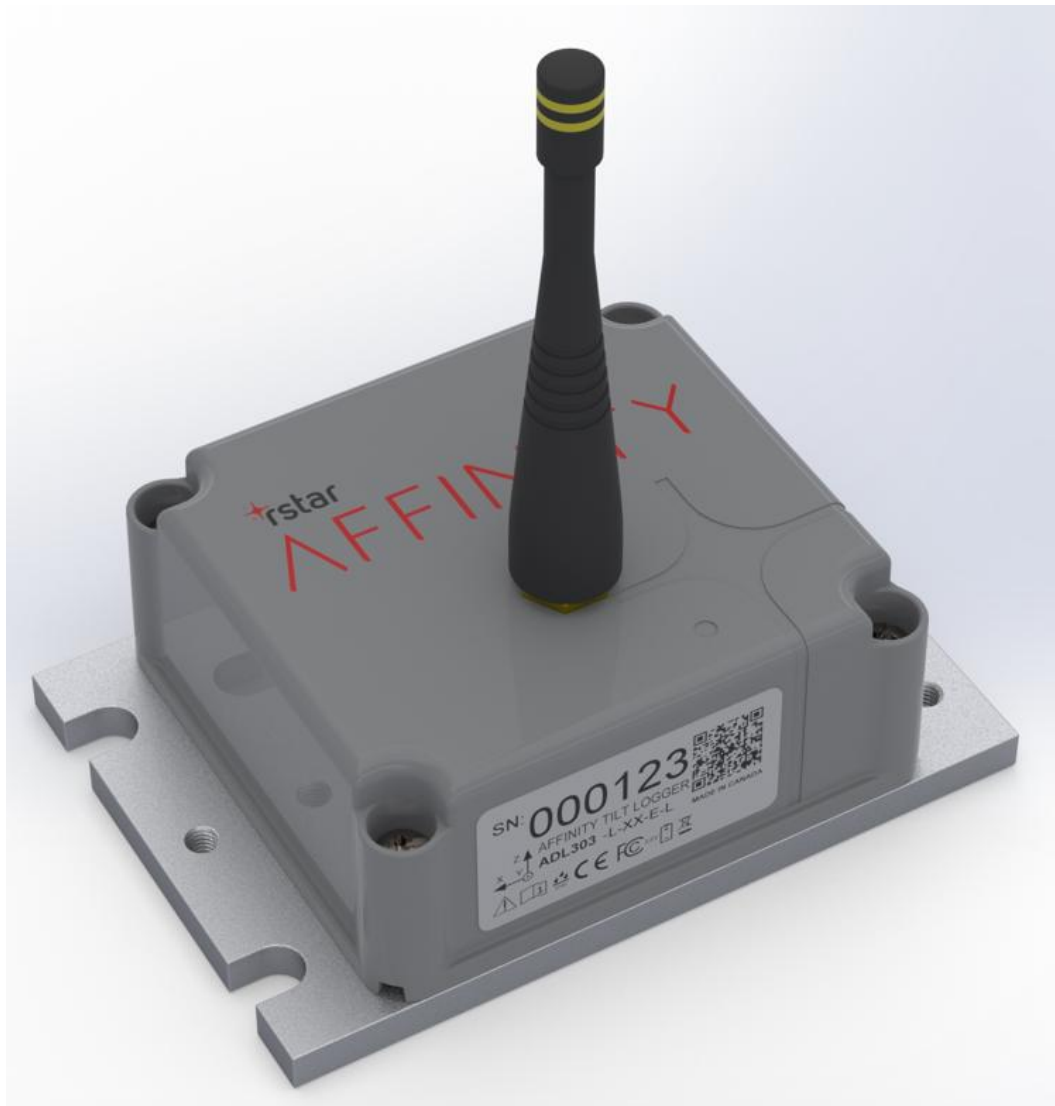


Figure 2: RSTAR Affinity Tilt Logger with External Antenna and Baseplate

- **Internal/External Antenna**
The internal antenna option uses a LoRa antenna that is located within the enclosure of the logger. This setup is generally suitable for environments where the distance and physical barriers between the logger and the gateway are minimal.

The external antenna option includes a female RP-SMA connector that allows for a LoRa antenna to be attached further away from the logger unit. This feature is particularly beneficial for increasing signal strength and is ideal for use in challenging environments where the logger is placed in locations that are difficult to reach or are outside the effective radio range of the internal antenna.

- **iOS/Android Smartphone Field Utility App**
The field utility app enables field technicians to manage and troubleshoot the Tilt Logger. It enables technicians to claim and configure the logger, diagnose issues, and download data directly to the RSTAR Affinity Data Visualization dashboard via an API. Additionally, the app supports firmware updates, battery initialization, and real-time clock synchronization, ensuring the logger operates efficiently and maintains accurate data records.
- **Browser-based RSTAR Affinity Data Platform Software**
The web-based Affinity software is a comprehensive platform that centralizes data from the tilt logger, enabling users to visualize, manage, and analyze their collected data. It supports detailed analyses, data export, and alarm setting based on data insights. Unlike the field utility app, which focuses on initial setup and basic data operations, the Affinity software offers advanced data management features.

5.2 FEATURES

- Wireless 2 in 1 sensor and data logger enables seamless data measurement and transmission
- LoRa technology for long range communication with low power consumption
- Robust, compact design with IP68 weatherproofing for longevity in rugged conditions
- Increased accessibility with user-friendly smartphone configuration app for iOS and Android
- Simplified instrument and data visualization with Web browser-based Affinity Data software
- High precision inclination measurement, calibrated for position, cross-axis, and temperature effects
- Seamless integration with RSTAR Affinity Data Platform
- Internal and external antenna options ensure reliable data transmission in varying environments
- Optimal Reliability with two distinct sensor options: one specifically designed for high-vibration environments such as railways and wind turbines, and another standard version tailored for typical applications
- Flexible data collection options - live wireless telemetry, and field App data synchronization to Data Platform

5.3 APPLICATIONS

- Structural health monitoring in bridges, tunnels, dams, and more
- Geotechnical slope movement monitoring in landslides, embankments and levees.
- Infrastructural and utility monitoring

6 TILT LOGGER CONFIGURATION

6.1 POWERING ON THE TILT LOGGER

Refer to Figure 3 and complete the following steps:

1. In a dry environment, loosen the 2 enclosure captive screws closest to the battery insulator pull tab by turning the screws counterclockwise 1 to 2 turns using a #2 Phillips driver. The screws are marked with blue arrows as shown in Figure 3.
2. Remove the battery insulator tab by pulling the tab away from the Tilt Logger. This will power up and activate the Tilt Logger.

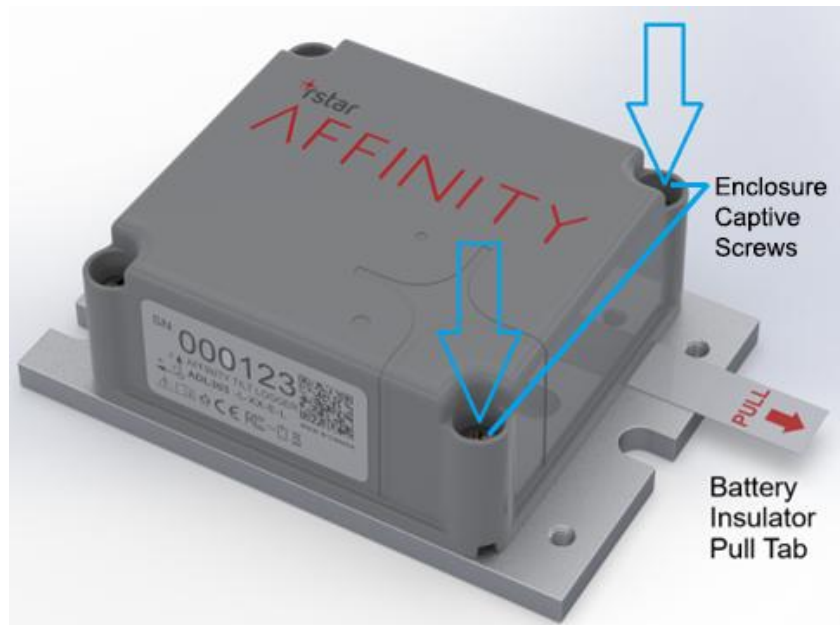


Figure 3: Removing the Battery Insulator Pull Tab

3. Re-tighten all 4 enclosure captive screws using a torque screwdriver. The table below shows the target tightening torque based on the material of the base plate.

Table 1: Enclosure Captive Screw Tightening Torque

Base Plate Material	Enclosure Fastener Tightening Torque	
	in-lb.	Nm
Stainless Steel	17	1.92
Anodized Aluminum	15	1.69



CAUTION: Failure to re-tighten the enclosure screws to the specified torque rating may result in water ingress and operational failure of the Tilt Logger unit.

6.2 DEVICE CONFIGURATION IN IOS/ANDROID FIELD UTILITY APP

6.2.1 Connecting to the Tilt Logger

1. Launch the Smartphone Field Utility app on iOS/Android.
2. Enter the correct credentials to log in to the app. The Select Site Menu will appear (see Figure 4). Select the appropriate work site.



NOTE: The Select Site Menu helps to organize instruments from different projects. If there are multiple work sites, choose the one where the Tilt Logger will be used.

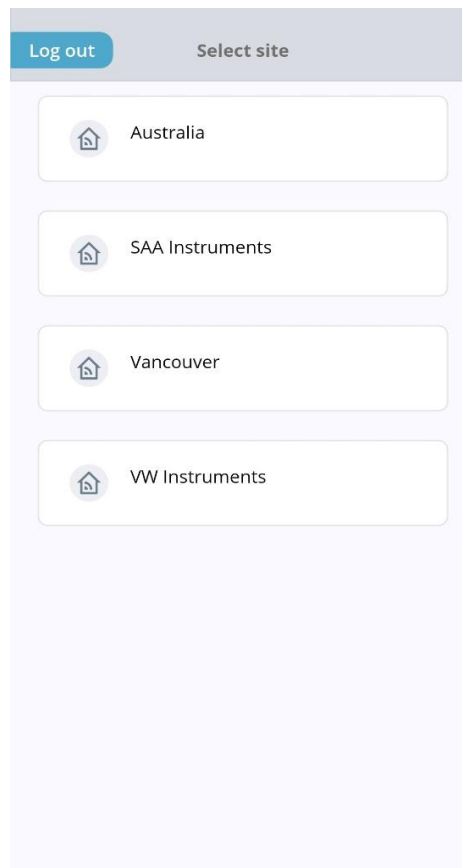


Figure 4: Select Site Menu

3. The Device Manager window is displayed (Figure 5). Select the logger using the specific serial number from the menu to connect via Bluetooth.

→ | **NOTE:** The serial number can be found printed on the lid label. This serial number will be prefixed by TL in the device cards.

→ | **NOTE:** If the specific Tilt Logger is not listed, click 'Re-scan' in the bottom right corner of the Detected Loggers window. Devices that are closer to the Smartphone will show a larger RSSI value.

In this example, the device being connected was TL000127.

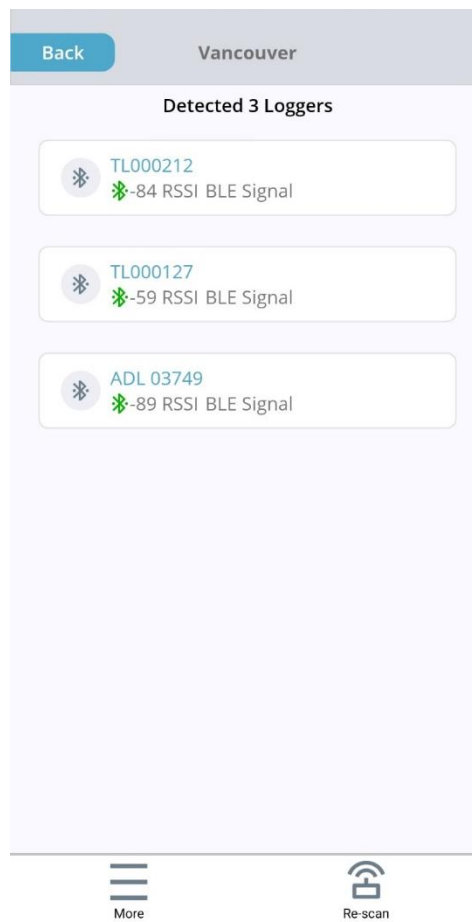


Figure 5: Device Manager Window

6.2.2 Claiming the Tilt Logger

To claim an unclaimed tilt logger within the Affinity system, follow these steps:



NOTE: “Claiming” a logger refers to the process of linking it to the selected work site.

1. If a Tilt Logger is currently Unclaimed, the Claim Logger Window will automatically appear, as shown in Figure 6.

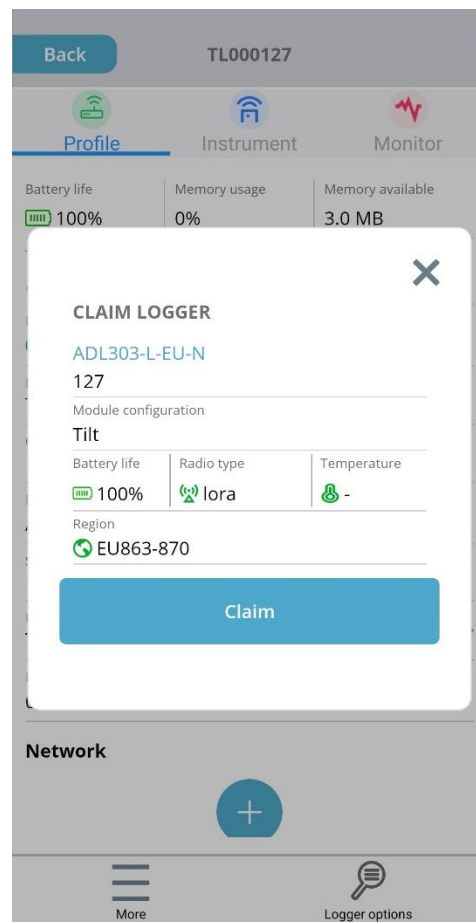



Figure 6: Claim Logger Window

2. Before proceeding with the claim, verify the logger information to ensure the correct tilt logger is being claimed.
3. Select the Claim button to complete the claiming process.

- **NOTE:** A logger can only be linked to one work site at a time. Attempting to claim a device for a site when it is already linked to another nearby site will result in an error message, and redirection to the Device Manager window.
- If a logger is incorrectly claimed to the wrong job site, it can be unclaimed and then correctly reclaimed. For instructions, see Appendix A.

6.2.3 Tilt Logger Configuration

1. Upon claiming the Tilt Logger, the Logger Setup Menu will appear as shown in Figure 7. In this menu, set the data reporting interval, device name, and device location.

- **NOTE:** RST recommends recording the position of the Tilt Logger when installed. Pressing the location button () will transmit and record the Smartphone's GNSS coordinates in the Affinity Dashboard.

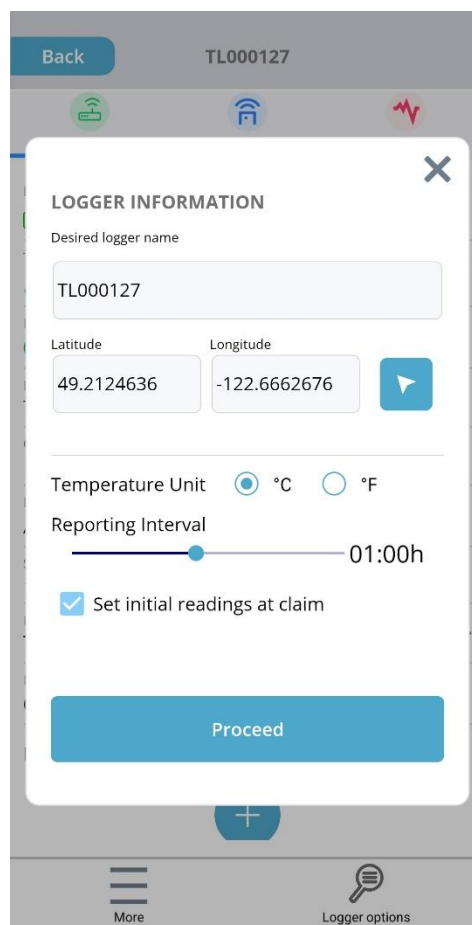


Figure 7: Logger Information Setup Menu

→ | **NOTE:** Setting a lower reporting interval will provide more frequent readings but will deplete the battery sooner. Energy consumption will be proportional to reading frequency. RST recommends reading at least 4 times per day to capture diurnal effects.

2. Select Proceed. The Main Dashboard as shown in Figure 8 appears.

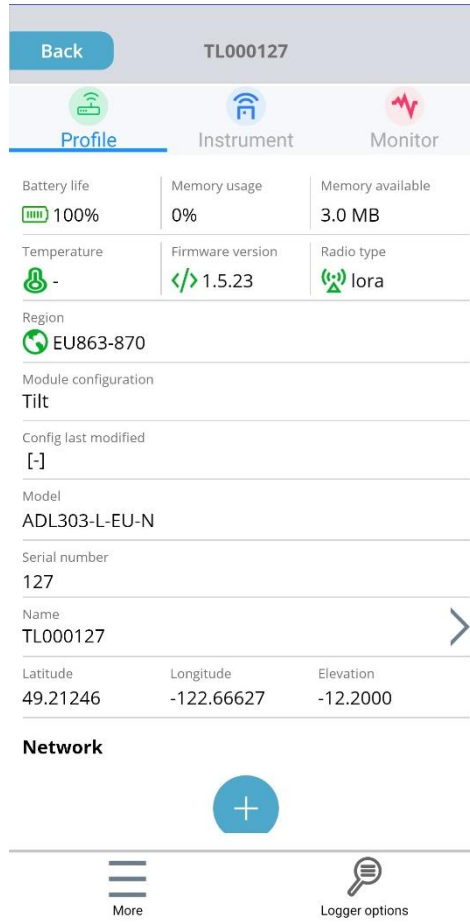


Figure 8: Main Dashboard

6.2.4 Pairing to Gateway

1. Select Pair Gateway from the Main Dashboard (see Figure 9). The Select Gateway menu appears (see Figure 10).
2. Select the desired Gateway to link the Tilt Logger to it.



CAUTION: When multiple Gateways are present, it is important to select the correct Gateway. This choice directly influences the display of telemetry data in the web-based Affinity Data Platform software.

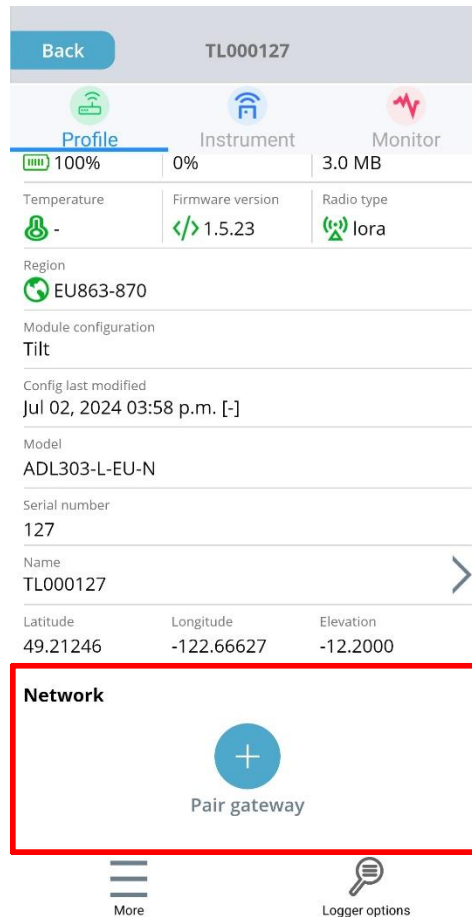


Figure 9: Pair Gateway Selection

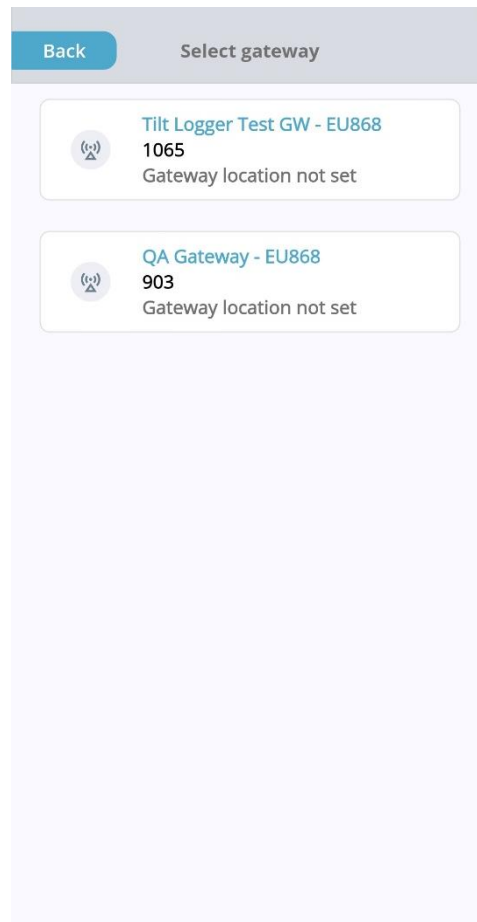


Figure 10: Select Gateway Menu

- After selecting a Gateway, the user will be returned to the Main Dashboard. Gateway information will populate, replacing the “Pair Gateway” option (see Figure 11).

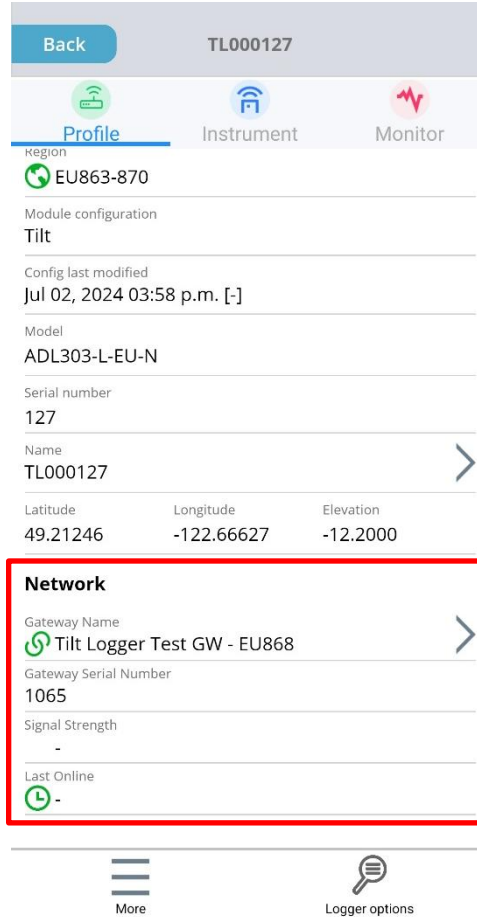


Figure 11: Main Dashboard Populated with Selected Gateway’s Details

- The Affinity Tilt Logger is now connected to the Gateway. The paired Tilt Logger will appear on the web-based Affinity software. However, telemetry data and connectivity information will be absent until after the first reporting interval has elapsed.

6.2.5 Sampling a Live Reading from the Tilt Logger

From main dashboard, navigate to the “Monitor” panel.

Tap the “Refresh” icon. The app will spend a few seconds loading in the latest information from the Tilt Logger.

7 TILT LOGGER UNIT INSTALLATION

Installation and orientation for the Affinity Tilt Logger will depend on the specific project requirements. Please refer to the corresponding section and follow the outlined instructions for an effective setup.



CAUTION: Please ensure that only the provided antenna is used for installation. Using a third-party antenna may damage the equipment and/or affect readings.

7.1 INSTALLATION PREREQUISITES

Ensure the logger is clean and operational.



NOTE: Ensure the Tilt Logger is powered up, configured, and claimed to the project site before proceeding with the physical installation.

1. Powering on: Section 6.1
2. Logger configuration: Section 6.2
3. Claiming logger to project site: Section 6.2.2

7.2 INSTALLATION PRECAUTIONS

- Ensure the mounting surface or structure is suitable for the tilt logger.
- Ensure that the concrete material can be suitably drilled and anchors installed without risk of cracking.
- If installing on a horizontal surface, choose a surface that is flat and stable.
- If installing on a vertical surface, verify that the structure can support the logger and that there is no risk of the logger detaching.
- Avoid direct sunlight to minimize its effect on temperature readings. Use a sunshade if required.
- Ensure a clear line of sight to the gateway to enhance battery performance.
- Install the tilt logger with the RSTAR logo or writing legible and right side up, as this orientation ensures the best calibration accuracy, particularly concerning temperature calibration.

7.3 TOOLS AND COMPONENTS

In addition to the RSTAR Affinity Tilt Logger, the following tools and components will be required depending on the mounting needs:

Installation on Concrete Structures:

- Hammer or rotary hammer drill
- Externally threaded wedge anchors (1/4" wedge anchors) or internally threaded drop-in anchors (1/4" drop-in anchors)
- Hammer
- Wrench or socket for tightening nuts (size 7/16" flat-to-flat)
- Concrete/masonry hammer/rotary drill bits (1/4" for wedge anchors, 3/8" for drop-in anchors)
- Thread locker (recommended)
- Torque wrench to anchor fasteners 75 in-lbs. (8.47 Nm)
- Torque screwdriver to tighten enclosure captive screws 15 in-lbs. to 17 in-lbs. (1.69 Nm to 1.92 Nm)
- Optional: angle bracket and fasteners
- Optional: torque screwdriver to tighten angle bracket screw to base plate 24 in-lbs. to 30 in-lbs. (2.71 Nm to 3.39 Nm)

Mounting on Poles:

- Angle bracket and fasteners
- 1/4" U-Bolt or band clamps (varying sizes)
- Nut Driver, wrench or socket (size 5/16" Flat-to-Flat) or slotted screwdriver
- Torque Screwdriver to tighten enclosure captive screws 15 in-lbs. to 17 in-lbs. (1.69 Nm to 1.92 Nm)
- Optional: thread locker
- Optional: torque screwdriver to tighten angle bracket screw to base plate 24 in-lbs. to 30 in-lbs. (2.71 Nm to 3.39 Nm)
- Optional: torque wrench to tighten gear clamps 30 in-lbs. to 34 in-lbs. (3.39 Nm to 3.84 Nm)

Attachment to Steel Surfaces:

- Steel encased cup magnets
- Angle bracket and fasteners (angle bracket mounted)
- Emery Cloth 80, 100 or 120 grit
- Torque screwdriver to tighten enclosure captive screws 15 in-lbs. to 17 in-lbs. (1.69 Nm to 1.92 Nm)
- Optional: thread locker
- Optional: torque screwdriver to tighten angle bracket screw to base plate 24 in-lbs. to 30 in-lbs. (2.71 Nm to 3.39 Nm)
- Optional: torque screwdriver to tighten magnets 20 in-lbs. to 22 in-lbs. (2.37 Nm to 2.49 Nm)

7.4 MOUNTING GUIDELINES

7.4.1 Mounting Orientation

1. The Affinity Tilt Logger can be mounted with respect to 3 types of primary orientations (horizontal, vertical and horizontal using an angle bracket).
2. Depending on the intended application, the unit can be directly mounted onto a concrete surface using concrete ¼" wedge anchors or ¼" drop-in anchors.



Figure 12: Direct Mounted Tilt Logger in Horizontal Orientation

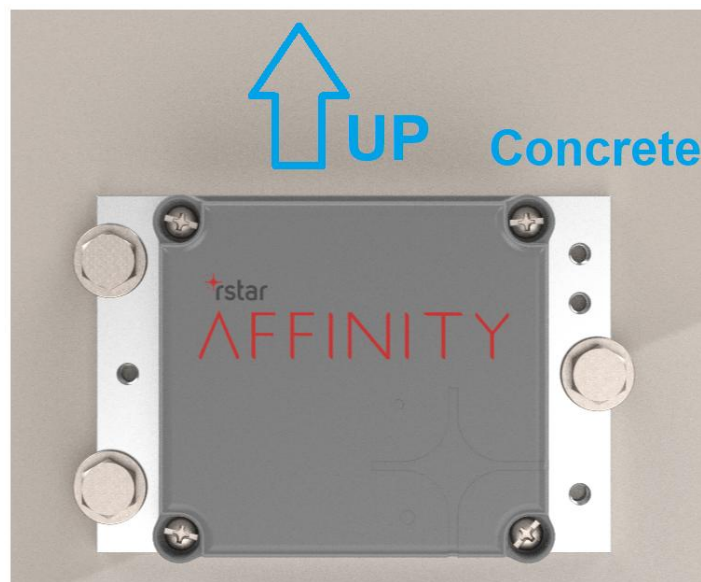


Figure 13: Direct Mounted Tilt Logger in Vertical Orientation

- The unit can also be assembled with an angle bracket to create a vertically oriented Tilt Logger.



Figure 14: Angle Bracket Mounted Tilt Logger in Horizontal Orientation

- To install a horizontally oriented Affinity Tilt Logger using a secondary bracket, an angle bracket and mounting fasteners will be required. Align the three screw holes on the base plate with the counter sink holes on the angle bracket and assemble using the fasteners provided. Use the thread locker as required and tighten the fasteners to the recommended torque settings as shown in the following table.

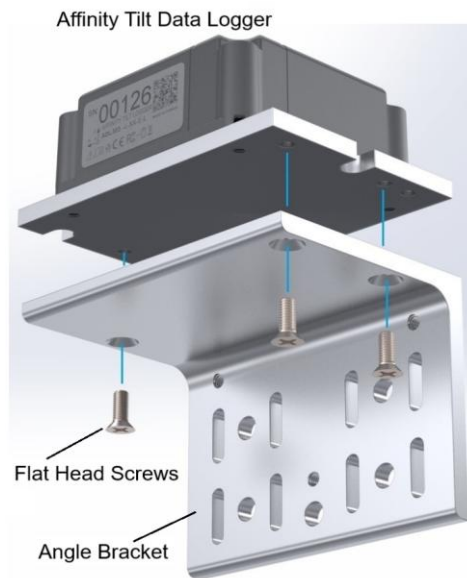


Figure 15: Assembling Angle Bracket onto Affinity Tilt Logger

Table 2: Angle Bracket Fastener Tightening Torque

Base Plate and Angle Bracket Material	Angle Bracket Fastener Tightening Torque	
	in-lb.	Nm
Stainless Steel	24-25	2.71-2.82
Anodized Aluminum	28-30	3.16-3.39

7.4.2 Mounting Onto a Concrete Structure

1. Determine the installation location, following all precautionary measures mentioned previously. Ensure there is sufficient clearance to open the lid.
2. Align one of the X or Y axes of the logger with the expected direction of movement. This alignment is crucial for accurate data collection.

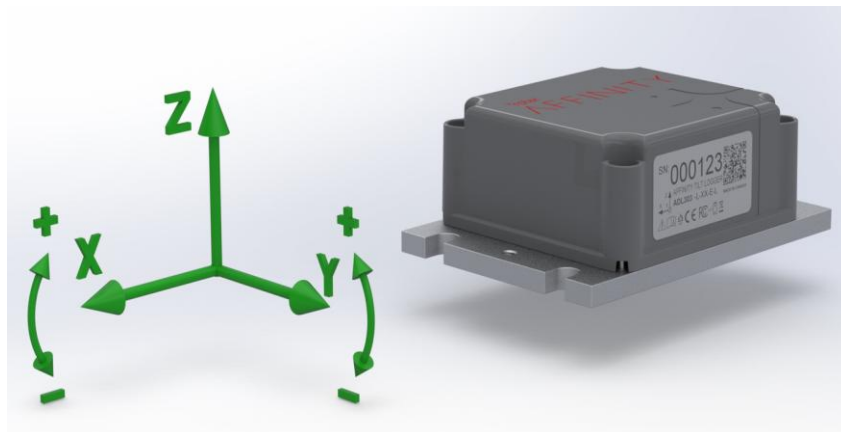


Figure 16: X and Y Axes for Affinity Tilt Logger

3. Use the provided Concrete Drilling Template (see figure below) for the following steps.



Figure 17: Concrete Drilling Template

- The table below outlines the mounting orientation and anchor type that corresponds to the hole sets shown on the drilling template.

Table 3: Mounting Orientation and Anchor Type Guide for Drilling Template

Drilling Template Hole Set	Mounting Orientation	Anchor Type
A	Direct Mounted Horizontal / Vertical	1/4" External Thread Wedge Anchor
B	Direct Mounted Horizontal / Vertical	1/4" Internal Thread Drop-In Anchor (3/8" OD)
C	Angle Bracket Mounted Vertical	1/4" External Thread Wedge Anchor
D	Angle Bracket Mounted Vertical	1/4" Internal Thread Drop-In Anchor (3/8" OD)

- Choose the appropriate hole set on the drilling template for the application. Ensure the letters corresponding to the chosen hole set are not upside down as this will lead to the Tilt Logger being mounted upside down.
- Refer to the next four sections for installation instructions of the Tilt Logger Orientations and Anchor Types to be used.

7.4.3 Direct Mounted or Vertical Orientation Using 1/4" Wedge Anchors

- If provided, 3 sets of 1/4" x 2-1/4" long wedge anchors, washers and nuts will be required to install each Affinity Tilt Logger.



Figure 18: 1/4" x 2-1/4" Long Wedge Anchors, 1/4" Flat Washers and 1/4" Hex Nuts

- Hole set A consisting of hole A1, and bushings A2 & A3 of the Drilling Template will be used for this installation. Note that hole A1, bushing A2 & bushing A3 corresponds to the three mounting slots on the Affinity Tilt Logger Base Plate shown below.

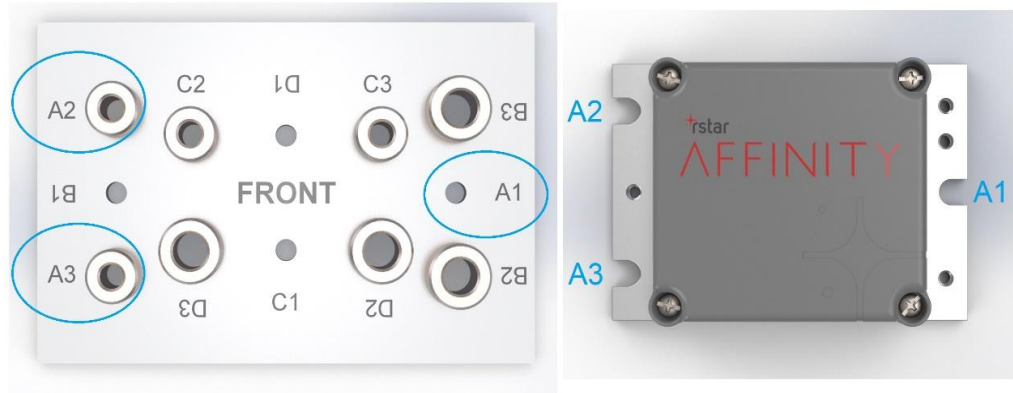


Figure 19: Drilling Template Hole Set A, Corresponding to Affinity Tilt Logger Base Plate Mounting Slots for $\frac{1}{4}$ " Wedge Anchors

- If the $\frac{1}{4}$ " x $2\text{-}\frac{1}{4}$ " long wedge anchors are provided, wrap masking tape or equivalent tape around $2\text{-}\frac{1}{4}$ " carbide-tipped steel concrete drill bits to set the required drill depths for holes A1, A2 & A3. The distance should be set as from the start of the drill shank (not the tip) to the start of the masking tape as shown below.

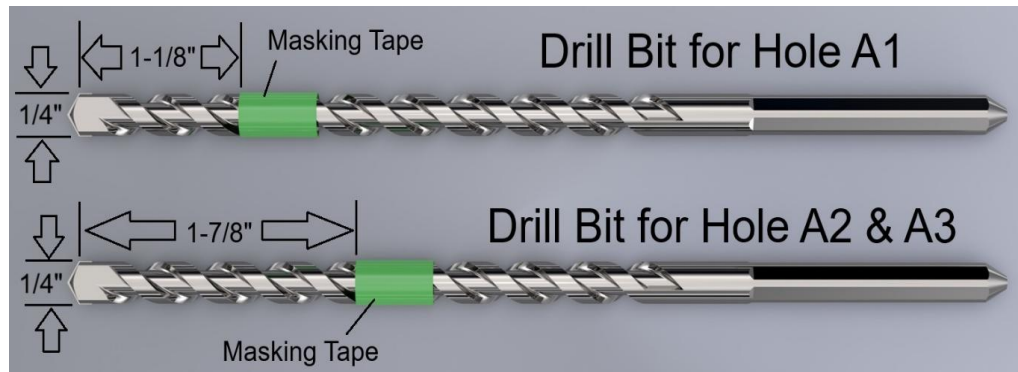


Figure 20: Masking Tape on $\frac{1}{4}$ " Concrete Drill Bits for Holes A1, A2 & A3 for $\frac{1}{4}$ " x $2\text{-}\frac{1}{4}$ " long Wedge Anchors



NOTE: The drill depth will depend on the length of the concrete wedge anchor to be used. If the $\frac{1}{4}$ " x $2\text{-}\frac{1}{4}$ " long wedge anchors are provided, the drill depth should be $1\text{-}\frac{1}{8}$ " deep.

4. Estimate the desired location of the first hole to drill. The first hole corresponds to mounting hole A1 for both the Drilling Template and Affinity Tilt Logger.
5. Use the first prepared drill bit for hole A1 to drill the first hole for the wedge anchor. Drill until the masking tape touches the concrete surface. Ensure that the hole axis is perpendicular to the concrete surface and is 1-1/8" deep.



WARNING: Do not use the Drilling Template as a guide to drill the First Hole. The Drilling Template may spin uncontrollably about the drill bit.

6. Install the first wedge anchor by gently hammering it into the drilled hole. When hammering, avoid damaging the concrete wedge anchor thread tip as this may prevent the nut from engaging the threads.
7. The wedge anchor should be perpendicular and protrude out about 1-1/8" above the concrete surface. There should be near complete threads on the wedge anchor protruding out of the concrete.

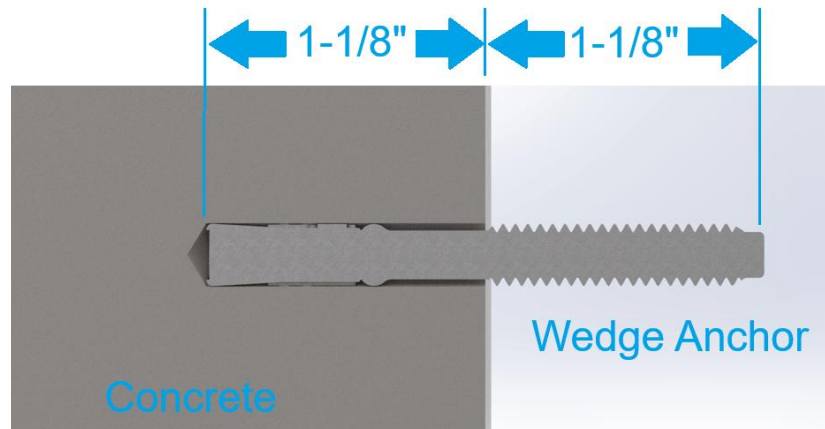


Figure 21: 1/4" x 2-1/4" long Wedge Anchor threads protruding out of concrete

8. Place the Drilling Template onto the concrete surface and align hole A1 with the installed wedge anchor. Use a level as needed to level the template, install the washer and nut and tighten to clamp the Drilling Template down.



Figure 22: Leveling and Fastening Drilling Template on Hole A1 with 1/4" Wedge Anchor, Nut and Washer

9. Use the second prepared drill bit for hole A2 & A3 to drill the second hole through bushing A2. Drill until the masking tape touches the top surface of bushing A2. This will ensure that the correct hole depth of 1-1/8" has been achieved. Be careful not to move the Drilling Template during drilling.



Figure 23: Drilling Second Hole Through Bushing A2 for Wedge Anchor

10. Remove the Drilling Template and install the second wedge anchor. Apply similar precautionary measures to avoid damaging the wedge anchor during hammering.

11. Re-install the Drilling Template onto the concrete surface and align hole A1 and bushing A2 with the 2 installed wedge anchors. Level as needed and tighten the washers and nuts to secure the Drilling Template in place.

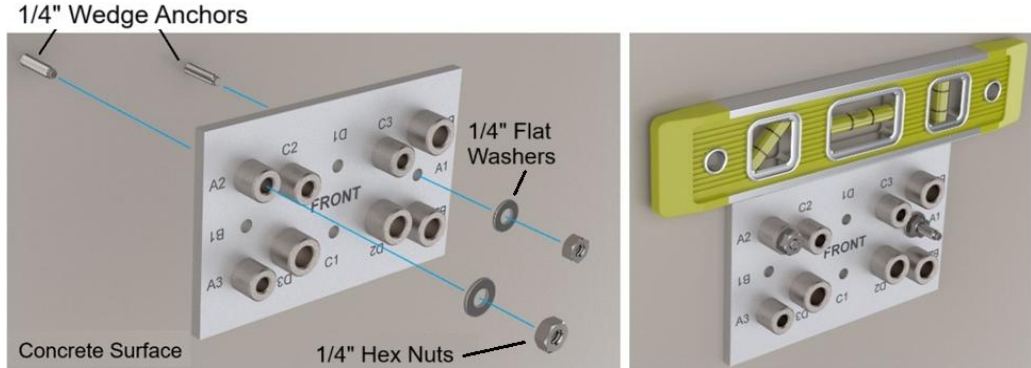


Figure 24: Fastening and Leveling Drilling Template on Hole A1 & Bushing A2 with Wedge Anchors

12. Use the second prepared drill bit for hole A2 & A3 to drill a third hole through bushing A3. Drill until the masking tape touches the top surface of bushing A3. This will ensure that the correct hole depth of 1-1/8" has been achieved. Please ensure that the Drilling Template does not move during drilling.



Figure 25: Drilling Third Hole Through Bushing A3 for Wedge Anchor

13. Remove the Drilling Template and install the third wedge anchor. Apply similar precautionary measures to avoid damaging the wedge anchor during hammering.
14. Install the Affinity Tilt Logger by feeding the Base Plate slots through the 3 installed $\frac{1}{4}$ " wedge anchors. Level and apply thread-locker as needed and tighten all nuts to 75 in-lbs. (8.47 Nm).

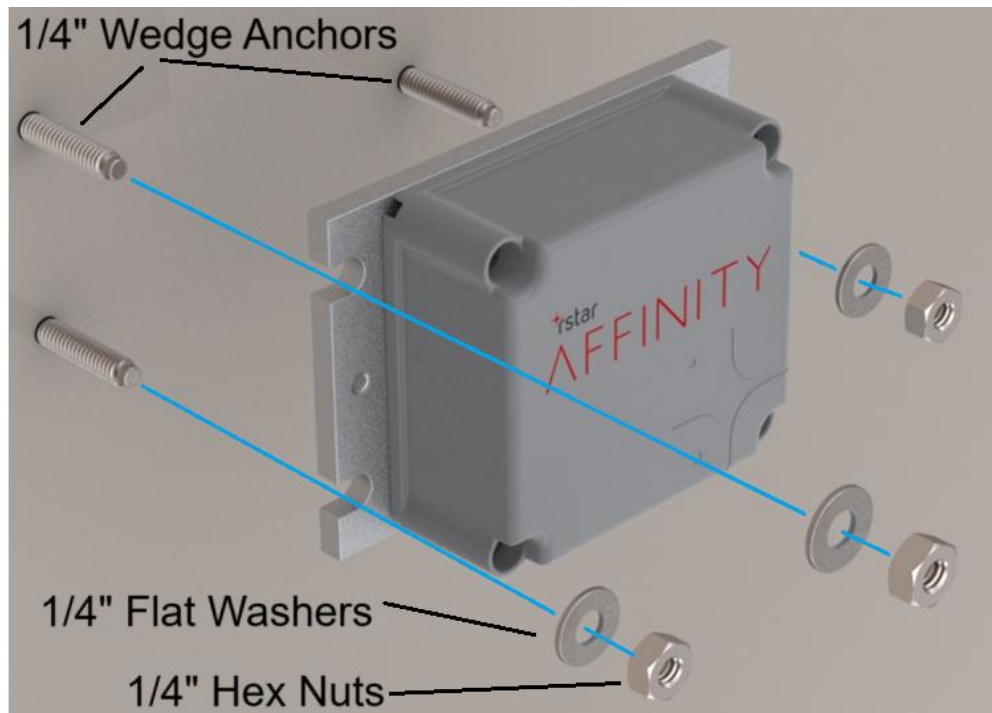


Figure 26: Installing the Affinity Tilt Logger with $\frac{1}{4}$ " Wedge Anchors, Washers and Nuts



NOTE: If spherical washer sets are required, install 3 sets of spherical washers and conical seats in between the base plate and concrete surface. The spherical washer sets are intended to be used on uneven surfaces.

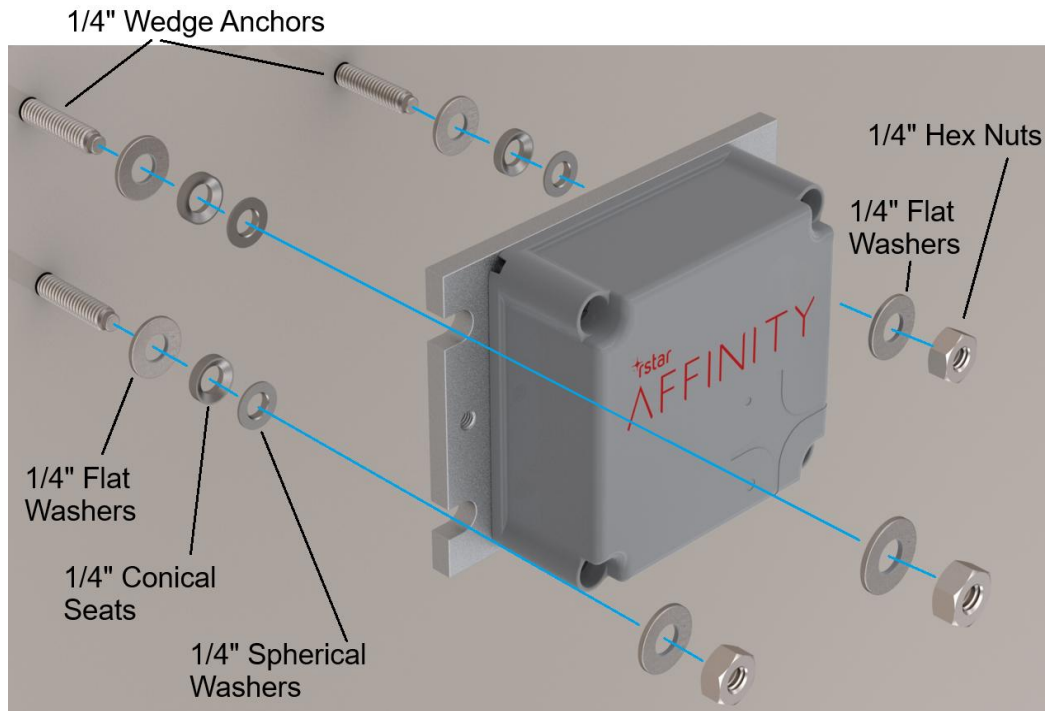


Figure 27: Installing the Affinity Tilt Logger with 1/4" Wedge Anchors and Spherical Washer set

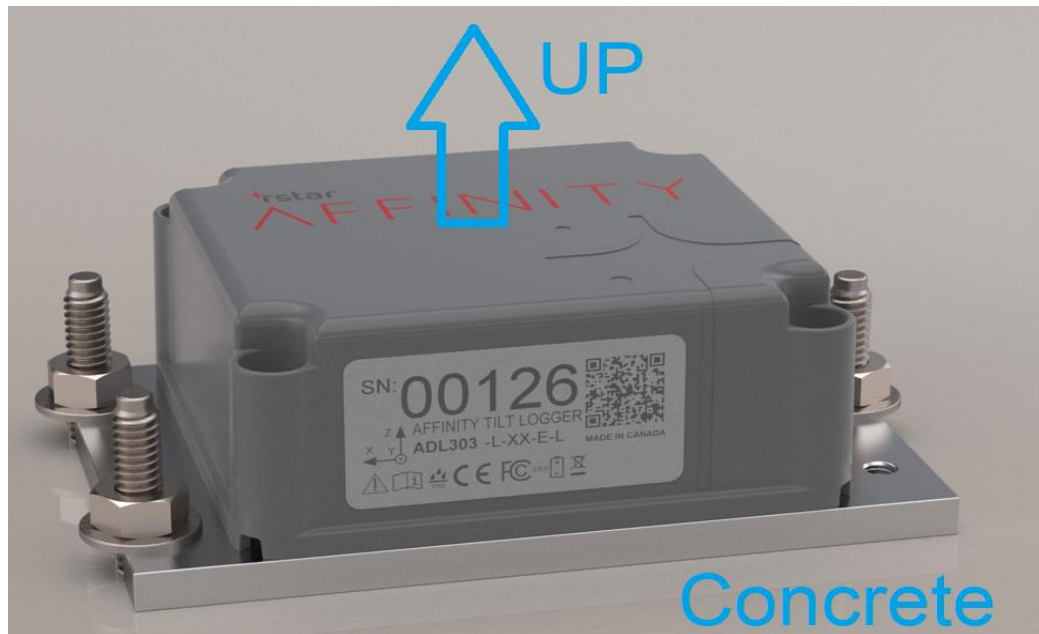


Figure 28: Direct Mounted Affinity Tilt Logger installed at Horizontal Orientation using 1/4" Wedge Anchors

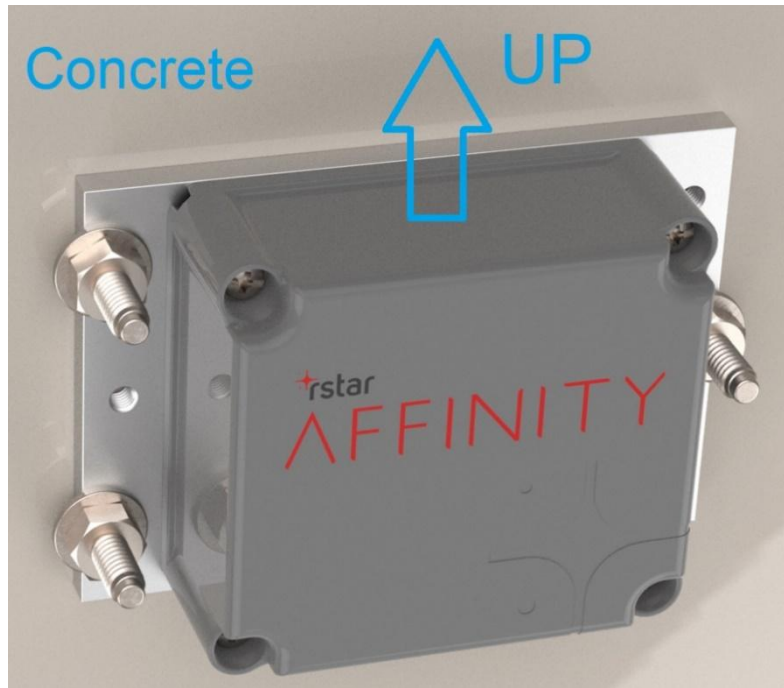


Figure 29: Direct Mounted Affinity Tilt Logger installed at Vertical Orientation using $\frac{1}{4}$ " Wedge Anchors

7.4.4 Direct Mounted Horizontal or Vertical Orientation Using $\frac{1}{4}$ " Drop-In Anchors

1. If provided, 3 sets of $\frac{1}{4}$ " x 1" long drop-in anchors, $\frac{1}{4}$ " x $\frac{5}{8}$ " long hex bolts and washers will be required to install each Affinity Tilt Logger.



Figure 30: $\frac{1}{4}$ " x 1" long Drop-In Anchors, $\frac{1}{4}$ " x $\frac{5}{8}$ " Long Hex Bolts and $\frac{1}{4}$ " Flat Washers

- Hole set B consisting of hole B1, and bushings B2 & B3 of the Drilling Template will be used for this installation. Note that hole B1, bushing B2 & bushing B3 corresponds to the three mounting slots on the Tilt Logger Base Plate as shown below.

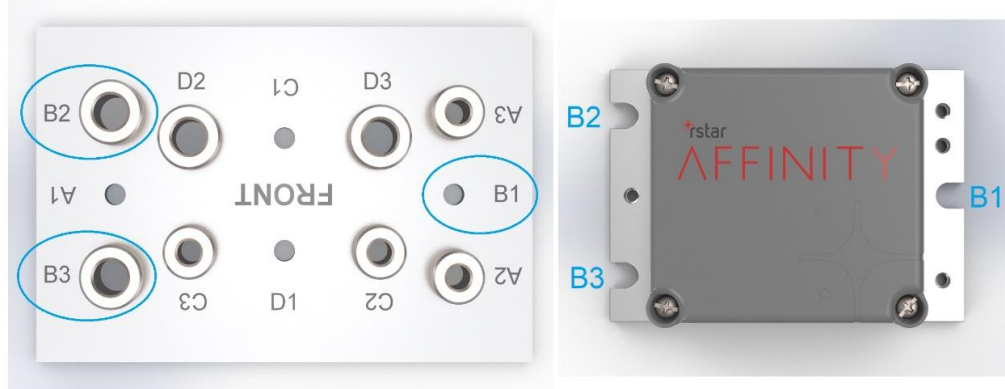


Figure 31: Drilling Template Hole Set B Corresponding to Affinity Tilt Logger Base Plate Mounting Slots for 1/4" Drop-In Anchors

- If the 1/4" x 1" long drop-in anchors are provided, wrap masking tape or equivalent tape around 2x 3/8" carbide-tipped steel concrete drill bits to set the required drill depths for holes B1, B2 & B3. The distance should be set as from the start of the drill shank (not the tip) to the start of the masking tape as shown below.

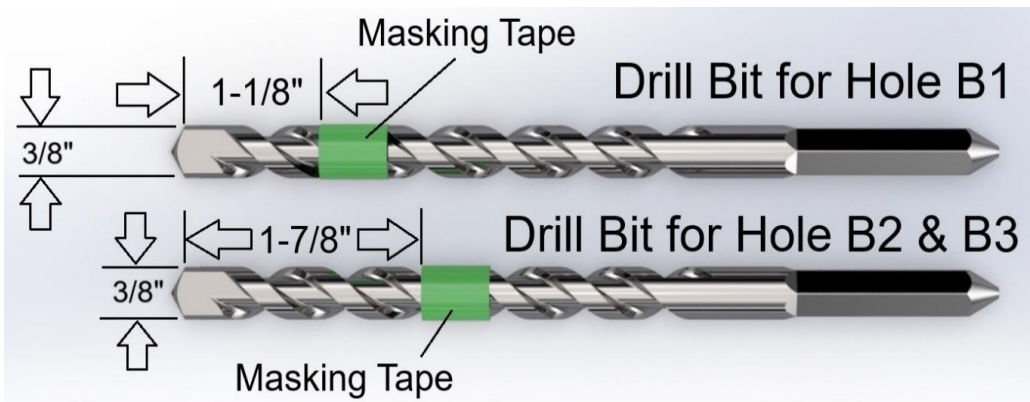


Figure 32: Masking Tape on 3/8" Concrete Drill Bits for Holes B1, B2 & B3 for 1/4" x 1" long Drop-In Anchors

→ **NOTE:** The drill depth will depend on the length of the concrete drop-in anchor to be used. If the 1/4" x 1" long drop-in anchors are provided, the drill depth should be 1" deep.

4. Estimate the desired location of the first hole to drill. The first hole corresponds to mounting hole B1 for both the Drilling Template and Affinity Tilt Logger.
5. Use the first prepared drill bit for hole B1 to drill the first hole for the drop-in anchor. Drill until the masking tape touches the concrete surface. Ensure that the hole axis is perpendicular to the concrete surface and is 1" deep.



WARNING: Do not use the Drilling Template as a guide to drill the first hole. The Drilling Template may spin uncontrollably about the drill bit.

6. Install the first drop-in anchor by placing it inside the drilled hole. Ensure that the drop-in anchor is flushed or slightly recessed about the concrete surface. Use a setting tool to hammer the drop-in anchor permanently in place.

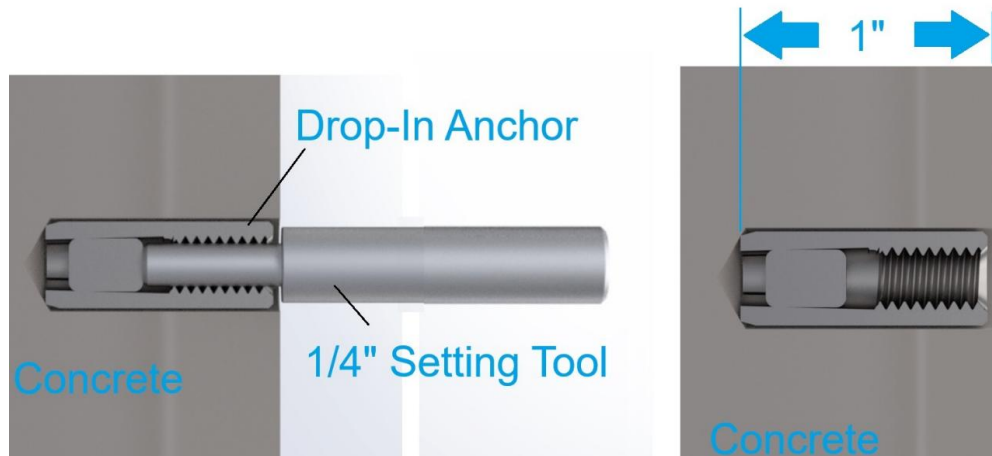


Figure 33: Setting Tool to set the $\frac{1}{4}$ " x 1" long Drop-In Anchor inside concrete

7. Place the Drilling Template back onto the concrete surface and align hole B1 with the installed drop-in anchor. Use the supplied $\frac{1}{4}$ " x $\frac{3}{4}$ " long hex bolt and washer, level as needed and tighten to clamp the drill template down.

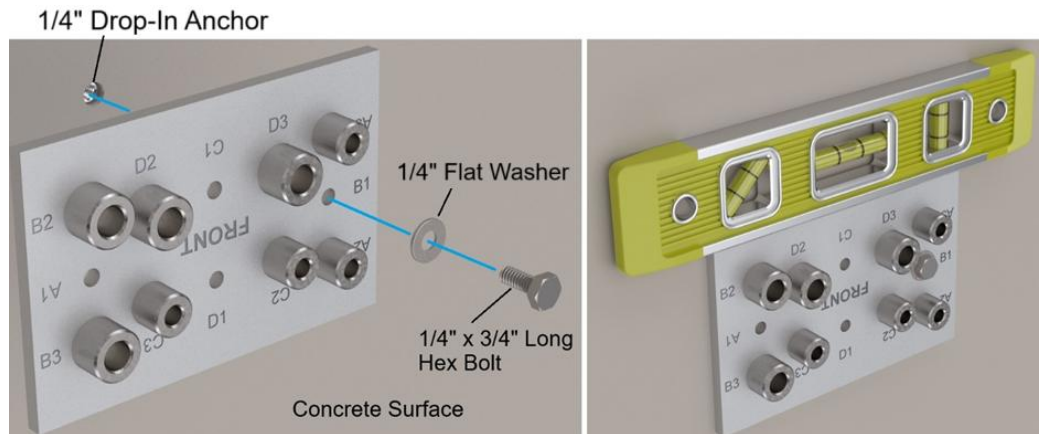


Figure 34: Leveling and Fastening Drilling Template on Hole B1 with 1/4" Drop-In Anchor, Hex Bolt and Washer

8. Use the second prepared drill bit for Hole B2 & B3 to drill the second hole through bushing B2. Drill until the masking tape touches the top surface of bushing B2. This will ensure that the correct hole depth of 1" has been achieved. Be careful not to move the Drilling Template during drilling.



Figure 35: Drilling Second Hole Through Bushing B2 for Drop-In Anchor

9. Remove the Drilling Template and install a second drop-in anchor inside the second drilled hole. Ensure that the drop-in anchor is flushed or slightly recessed about the concrete surface. Use a setting tool to hammer the drop-in anchor permanently in place.
10. Place the Drilling Template back on the concrete surface and align the first drop-in anchor with hole B1 and second drop-in anchor with bushing B2 of the Drilling Template. Use the supplied $\frac{1}{4}$ " x $\frac{3}{4}$ " long hex bolt and washer on hole B1 and the $\frac{1}{4}$ " x $1\text{-}\frac{1}{4}$ " long hex bolt and washer on bushing B2. Level as needed and tighten to clamp the drill template down.

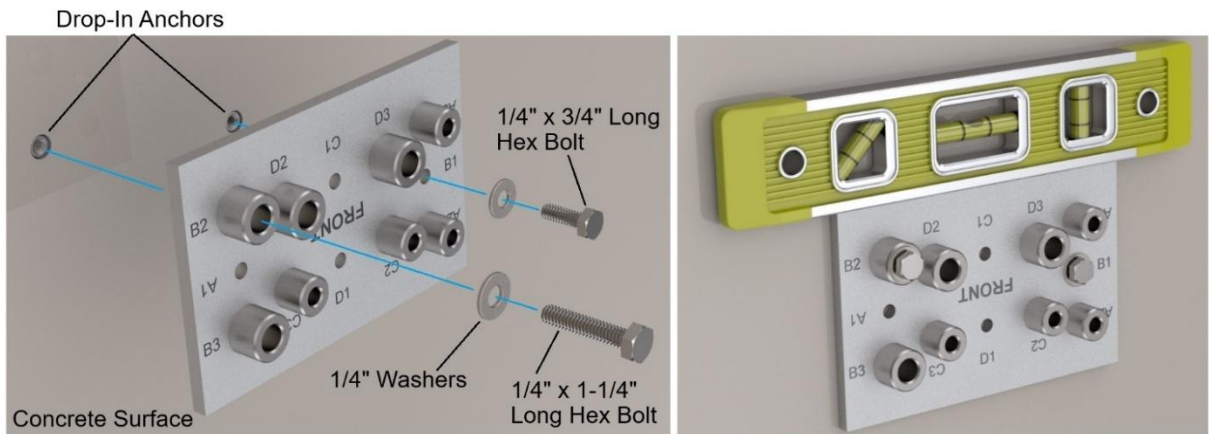


Figure 36: Leveling and Fastening Drilling Template on Hole B1 & Bushing B2 with $\frac{1}{4}$ " Drop-In Anchors, Hex Bolts and Washers

11. Use the second prepared drill bit for hole B2 & B3 to drill the third hole through bushing B3. Drill until the masking tape touches the top surface of bushing B3. This will ensure that the correct hole depth of 1" has been achieved. Be careful not to move the Drilling Template during drilling.



Figure 37: Drilling Third Hole Through Bushing B3 for Drop-In Anchor

- 12.** Remove the Drilling Template and install a third drop-in anchor inside the third drilled hole. Ensure that the drop-in anchor is flushed or slightly recessed about the concrete surface. Use a setting tool to hammer the drop-in anchor permanently in place.
- 13.** Install the Affinity Tilt Logger by aligning the 3 installed drop-in anchors with the open slots of the Base Plate. If supplied, install the $\frac{1}{4}$ " x $\frac{5}{8}$ " long hex bolts and washers. Level and apply thread locker as needed tighten the bolts to 75 in-lbs. (8.47 Nm).

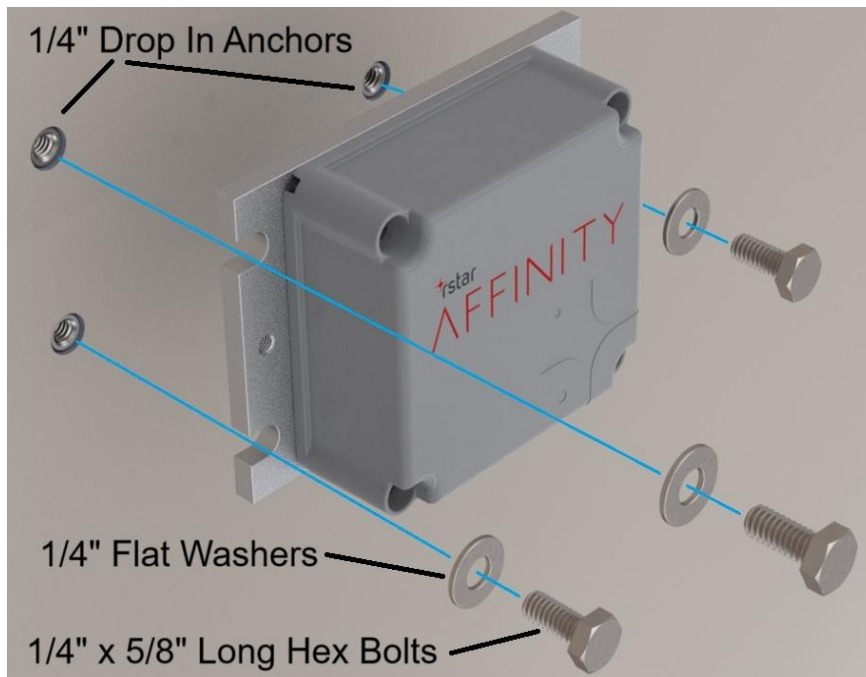


Figure 38: Installing the Affinity Tilt Logger with 1/4" Drop-In Anchors, Hex Bolts and Washers



Figure 39: Direct Mounted Affinity Tilt Logger Installed in Horizontal Orientation Using 1/4" Drop-In Anchors



Figure 40: Direct Mounted Affinity Tilt Logger Installed in Vertical Orientation Using ¼” Drop-In Anchors

7.4.5 Angle Bracket Mounted in Horizontal Orientation Using 1/4" Wedge Anchors

1. If provided, 3 sets of 1/4" x 2-1/4" long wedge anchors, washers and nuts will be required to install each Affinity Tilt Logger. Refer to the earlier section for instructions to assemble the Affinity Tilt Logger onto the Angle Bracket.



Figure 41: 1/4" x 2-1/4" Long Wedge Anchors, 1/4" Flat Washers and 1/4" Hex Nut

2. Hole set A consisting of hole C1, and bushings C2 & C3 of the Drilling Template will be used for this installation. Note that hole C1, bushing C2 & bushing C3 corresponds to the three mounting holes on the Affinity Tilt Logger Angle Bracket shown below.

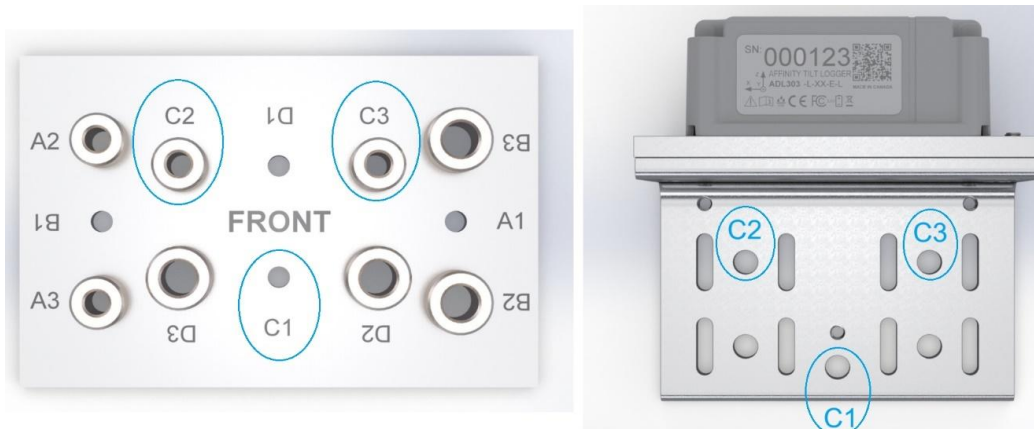


Figure 42: Drilling Template Hole Set C Corresponding to Tilt Logger Angle Bracket Mounting Holes for 1/4" Studded Wedge Anchor

- If the $\frac{1}{4}$ " x $2\text{-}\frac{1}{4}$ " long wedge anchors are provided, wrap masking tape or equivalent tape around $2 \times \frac{1}{4}$ " carbide-tipped steel concrete drill bits to set the required drill depths for holes C1, C2 & C3. The distance should be set as from the start of the drill shank (not the tip) to the start of the masking tape as shown below.

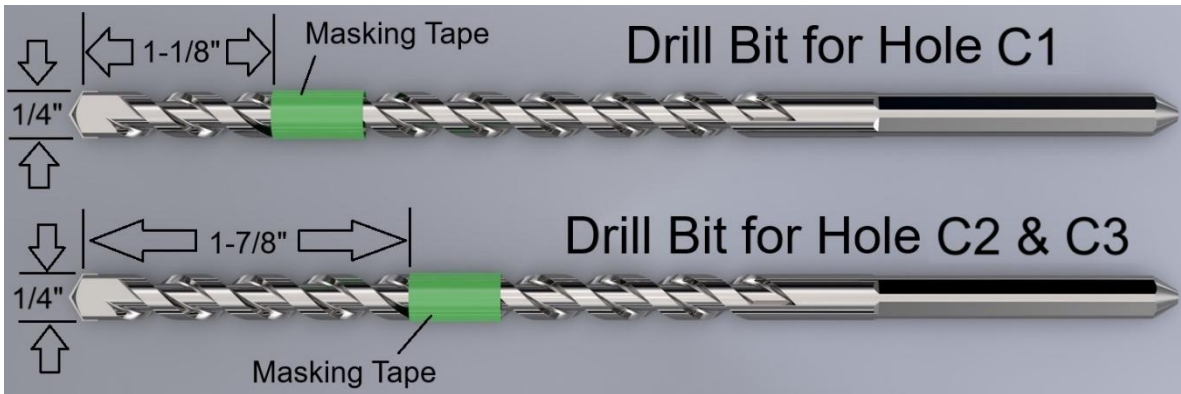


Figure 43: Masking Tape on $\frac{1}{4}$ " Concrete Drill Bits for Holes C1, C2 & C3 for $\frac{1}{4}$ " x $2\text{-}\frac{1}{4}$ " long Wedge Anchor



NOTE: The drill depth will depend on the length of the concrete wedge anchor to be used. If the $\frac{1}{4}$ " x $2\text{-}\frac{1}{4}$ " long wedge anchors are provided, the drill depth should be 1-1/8" deep.

- Estimate the desired location of the first hole to drill. The first hole corresponds to mounting hole C1 for both the Drilling Template and Affinity Tilt Logger.
- Use the first prepared drill bit for hole C1 to drill the first hole for the wedge anchor. Drill until the masking tape touches the concrete surface. Ensure that the hole axis is perpendicular to the concrete surface and is 1-1/8" deep.



WARNING: Do not use the Drilling Template as a guide to drill the first hole. The Drilling Template may spin uncontrollably about the drill bit.

- Install the first wedge anchor by gently hammering it into the drilled hole. When hammering, avoid damaging the concrete wedge anchor thread tip as this may prevent the nut from engaging the threads.
- The wedge anchor should be perpendicular and protrude out about 1-1/8" above the concrete surface. There should be near complete threads on the wedge anchor protruding out of the concrete.

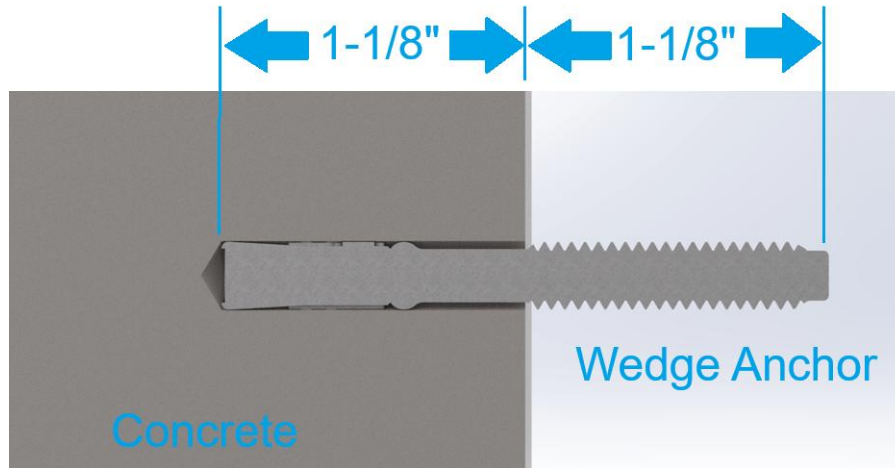


Figure 44: 1/4" x 2-1/4" Long Wedge Anchor Threads Protruding Out of Concrete

8. Place the Drilling Template onto the concrete surface and align Hole C1 with the installed wedge anchor. Use a level as needed to level the template, install the washer and nut and tighten to clamp the Drilling Template down.

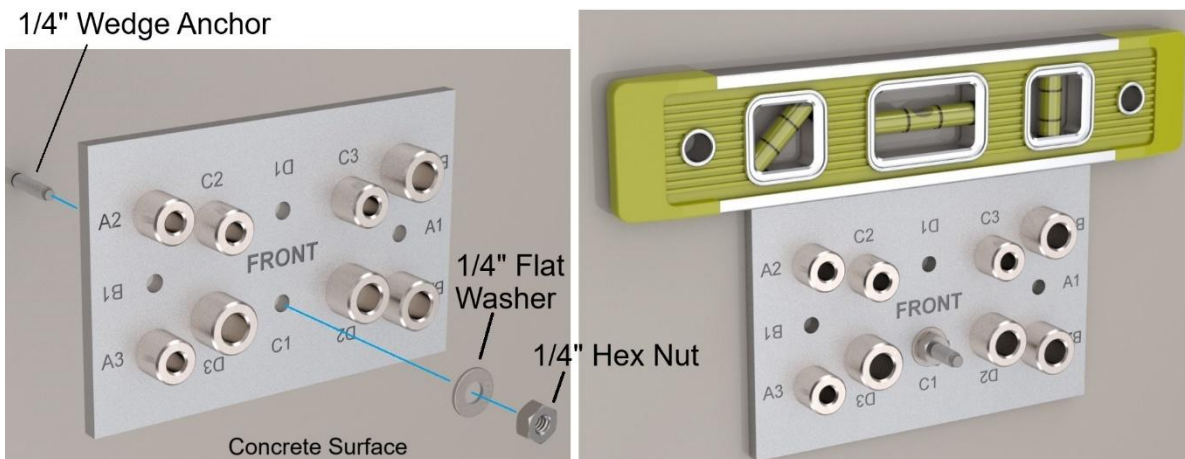


Figure 45: Leveling and Fastening Drilling Template on Hole A1 with 1/4" Wedge Anchor, Nut and Washer

9. Use the second prepared drill bit for hole C2 & C3 to drill the second hole through bushing C2. Drill until the masking tape touches the top surface of bushing C2. This will ensure that the correct hole depth of 1-1/8" has been achieved. Be careful not to move the Drilling Template during drilling.

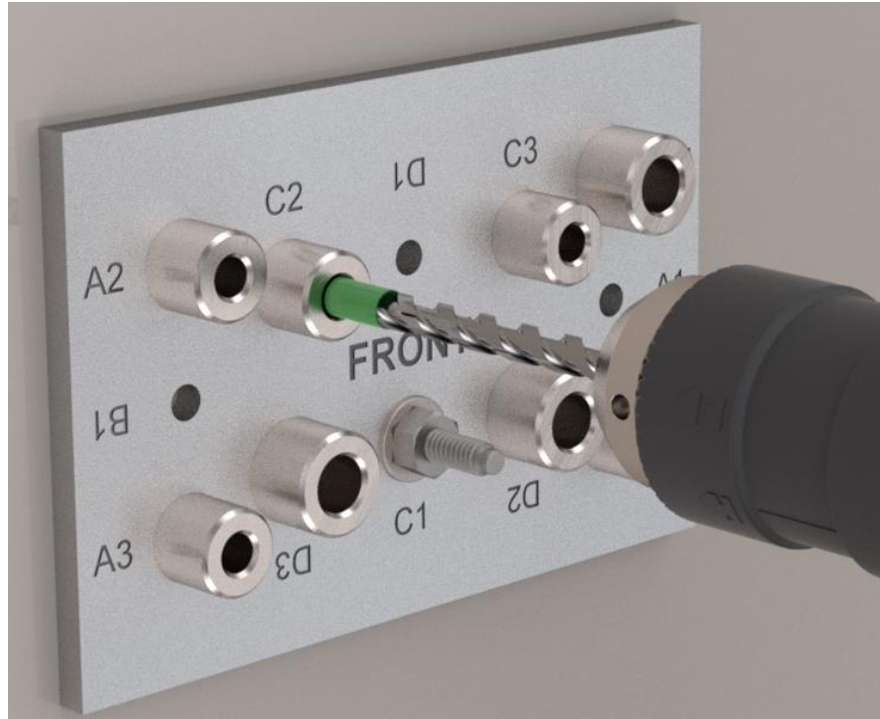


Figure 46: Drilling Second Hole Through Bushing C2 for Wedge Anchor

10. Remove the Drilling Template and install the second wedge anchor. Apply similar precautionary measures to avoid damaging the wedge anchor during hammering.
11. Re-install the Drilling Template onto the concrete surface and align hole C1 and bushing C2 with the 2 installed wedge anchors. Level as needed and tighten the washers and nuts to secure the Drilling Template in place.

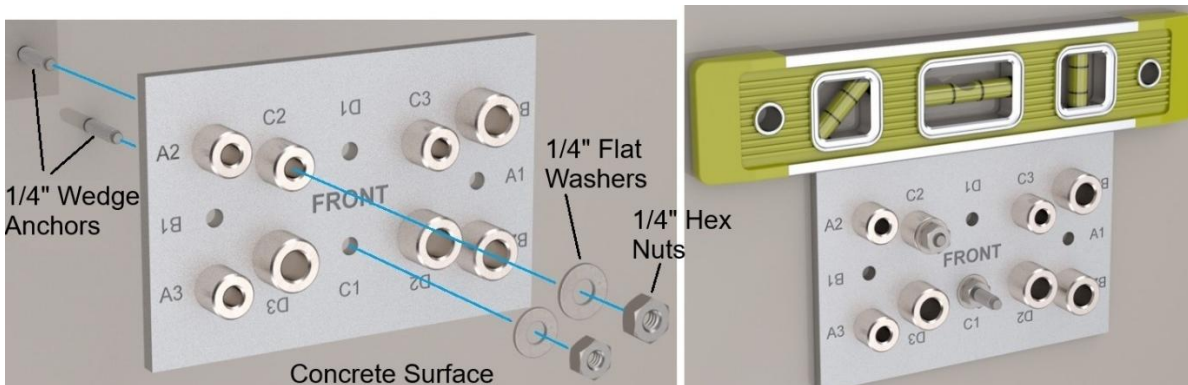


Figure 47: Fastening and Leveling Drilling Template on Hole C1 & Bushing C2 with Wedge Anchors

12. Use the second prepared drill bit for hole C2 & C3 to drill a third hole through bushing C3. Drill until the masking tape touches the top surface of bushing C3. This will ensure that the correct hole depth of 1-1/8" has been achieved. Be careful not to move the Drilling Template during drilling.



Figure 48: Drilling Third Hole Through Bushing C3 for Wedge Anchor

13. Remove the Drilling Template and install the third wedge anchor. Apply similar precautionary measures to avoid damaging the wedge anchor during hammering.
14. Install the Affinity Tilt Logger by feeding the Base Plate slots through the 3 installed 1/4" wedge anchors. Level and apply thread-locker as needed and tighten all nuts to 75 in-lbs. (8.47 Nm).

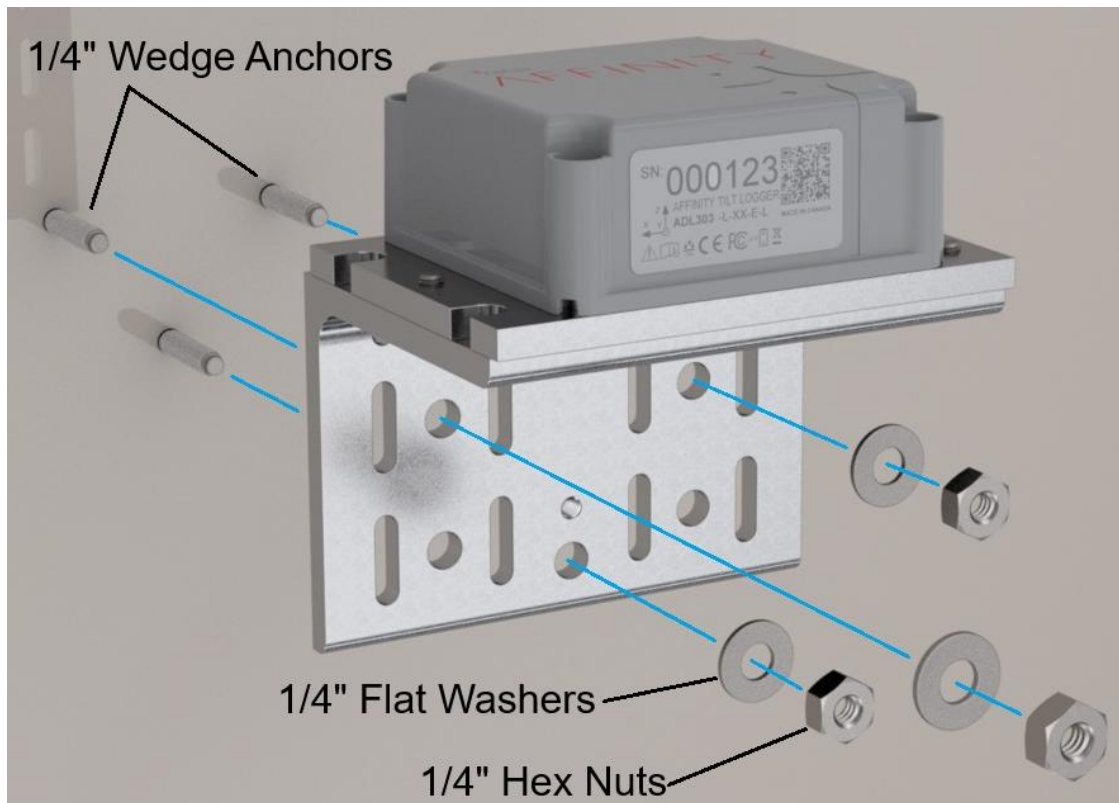


Figure 49: Installing the Affinity Tilt Logger with 1/4" Wedge Anchors, Washers & Nuts

→ **NOTE:** If spherical washer sets are required, install 3 sets of spherical washers and conical seats in between the base plate and concrete surface. The spherical washer sets are intended to be used on uneven surfaces.

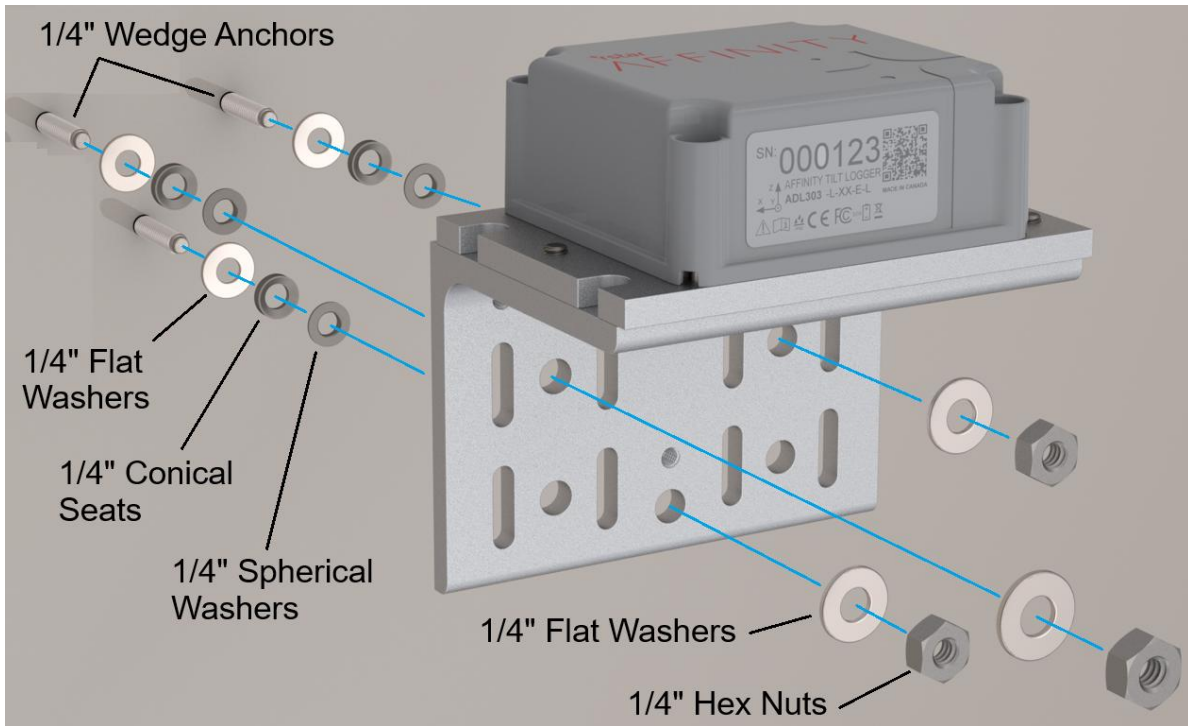


Figure 50: Installing the Affinity Tilt Logger with 1/4" Wedge Anchors and Spherical Washer Set



Figure 51: Angle Bracket Mounted Affinity Tilt Logger Installed in Horizontal Orientation Using 1/4" Wedge Anchors

7.4.6 Angle Bracket Mounted in Horizontal Orientation Using 1/4" Drop-In Anchors

1. If provided, 3 sets of 1/4" x 1" long drop-in anchors, hex bolts and washers will be required to install each Affinity Tilt Logger. Refer to the earlier section for instructions to assemble the Affinity Tilt Logger onto the Angle Bracket.



Figure 52: 1/4" x 1" Long Drop-In Anchors, 1/4" x 5/8" Long Hex Bolts and 1/4" Flat Washers

2. Hole set D consisting of hole D1, and bushings D2 & D3 of the Drilling Template will be used for this installation. Note that hole D1, bushing D2 & bushing D3 corresponds to the three mounting holes on the Affinity Tilt Logger Angle Bracket as shown in the figure below.

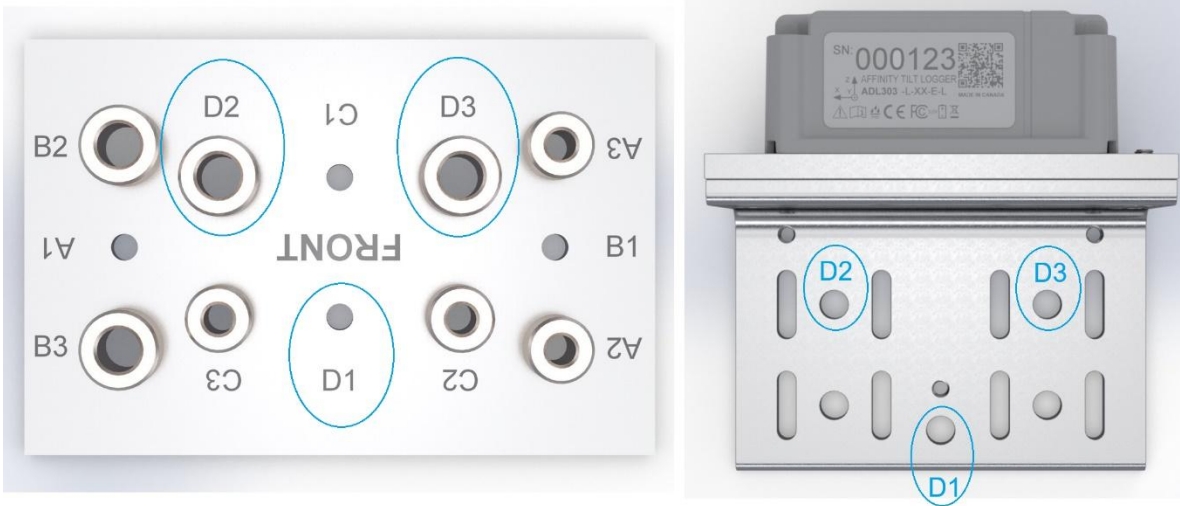


Figure 53: Drilling Template Hole Set D Corresponding to Affinity Tilt Logger Angle Bracket Mounting Holes for 1/4" Drop-In Anchor

3. If the 1/4" x 1" long drop-in anchors are provided, wrap masking tape or equivalent tape around 2x 3/8" carbide-tipped steel concrete drill bits to set the required drill depths for holes D1, D2 & D3. The distance should be set as from the start of the drill shank (not the tip) to the start of the masking tape as shown below.

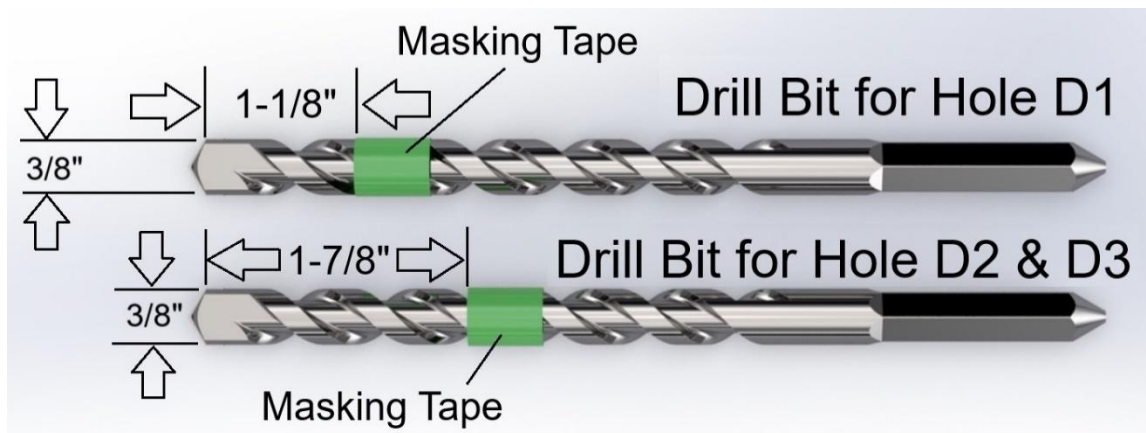


Figure 54: Masking Tape on 3/8" Concrete Drill Bits for Holes D1, D2 & D3 for 1/4" x 1" long Drop-In Anchors

4. Estimate the desired location of the first hole to drill. The first hole corresponds to mounting hole D1 for both the Drilling Template and Affinity Tilt Logger.
5. Use the first prepared drill bit for hole D1 to drill the first hole for the drop-in anchor. Drill until the masking tape touches the concrete surface. Ensure that the hole axis is perpendicular to the concrete surface and is 1" deep.



WARNING: Do not use the Drilling Template as a guide to drill the first hole. The Drilling Template may spin uncontrollably about the drill bit.

- Install the first drop-in anchor by placing it inside the drilled hole. Ensure that the drop-in anchor is flushed or slightly recessed about the concrete surface. Use a setting tool to hammer the drop-in anchor permanently in place.

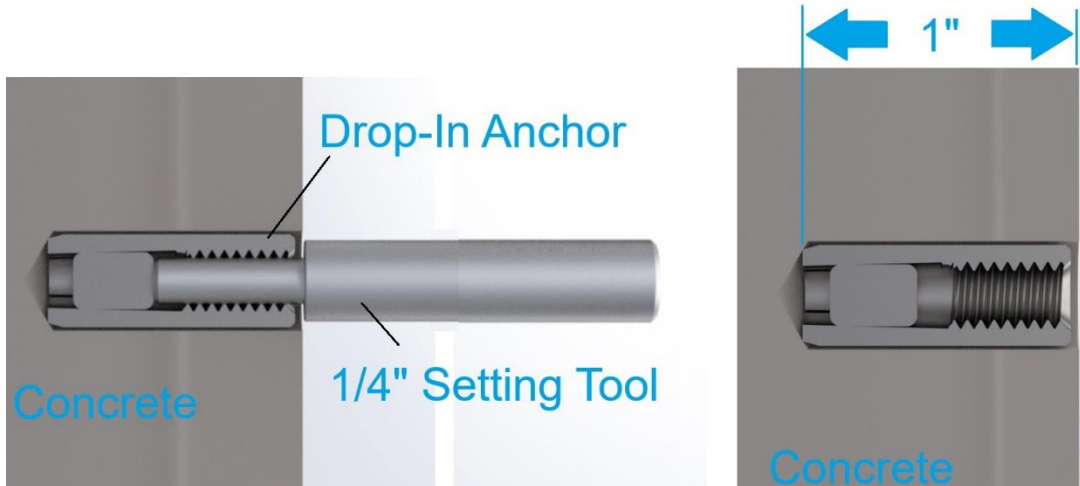


Figure 55: Setting Tool to set the 1/4" x 1" long Drop-In Anchor inside concrete

- Place the Drilling Template back onto the concrete surface and align hole D1 with the installed drop-in anchor. Use the supplied 1/4" x 3/4" long hex bolt and washer, level as needed and tighten to clamp the drill template down.

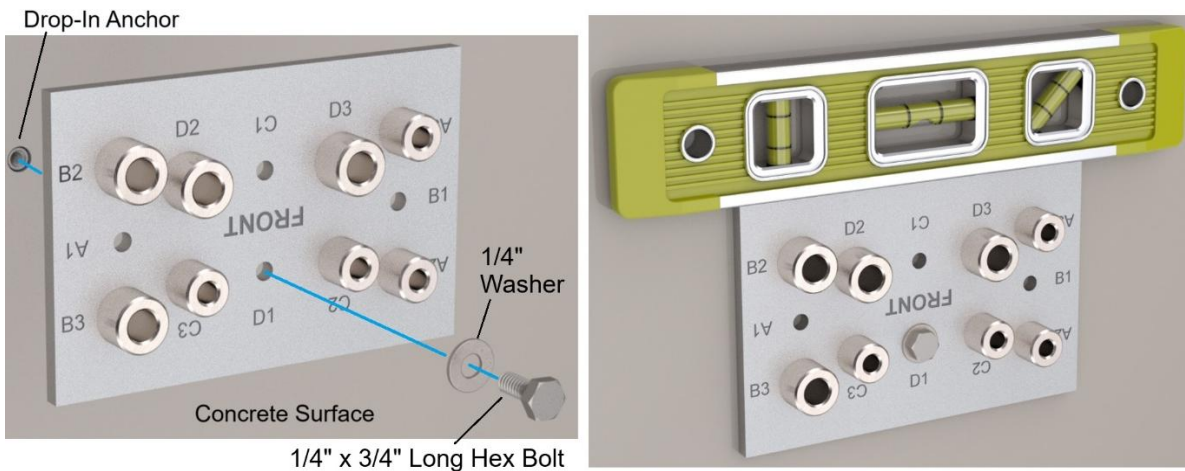


Figure 56: Leveling and Fastening Drilling Template on Hole D1 with 1/4" Drop-In Anchor, Hex Bolt and Washer

8. Use the second prepared drill bit for hole D2 & D3 to drill the second hole through bushing D2. Drill until the masking tape touches the top surface of bushing D2. This will ensure that the correct hole depth of 1" has been achieved. Be careful not to move the Drilling Template during drilling.

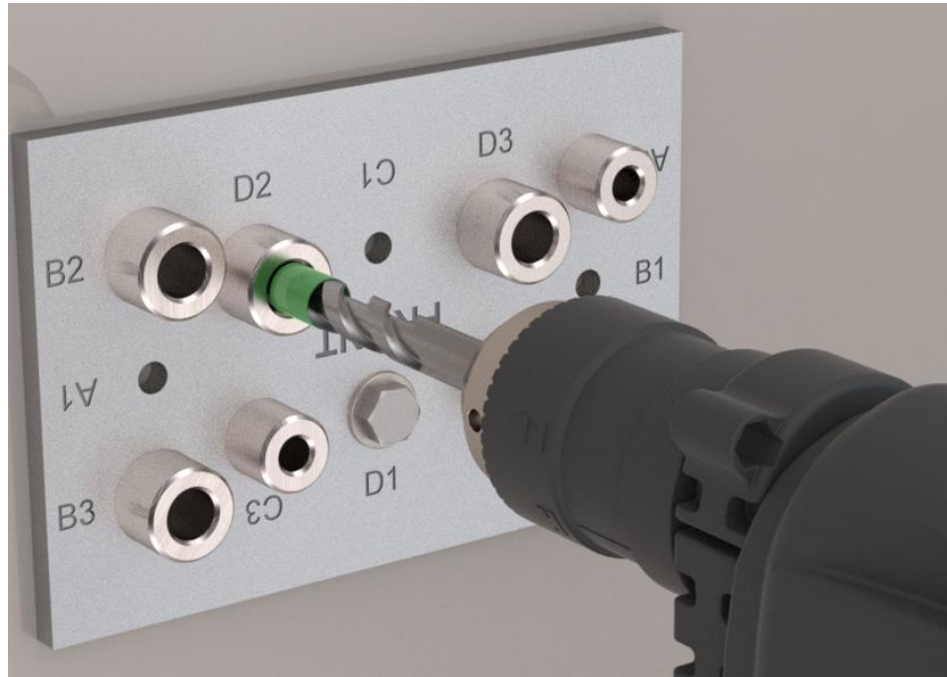


Figure 57: Drilling Second Hole Through Bushing D2 for Drop-In Anchor

9. Remove the Drilling Template and install a second drop-in anchor inside the second drilled hole. Ensure that the drop-in anchor is flushed or slightly recessed about the concrete surface. Use a setting tool to hammer the drop-in anchor permanently in place.
10. Place the Drilling Template back on the concrete surface and align the first drop-in anchor with hole D1 and second drop-in anchor with bushing D2 of the Drilling Template. Use the supplied $\frac{1}{4}$ " x $\frac{3}{4}$ " long hex bolt and washer on hole D1 and the $\frac{1}{4}$ " x $1\frac{1}{4}$ " long hex bolt and washer on bushing D2. Level as needed and tighten to clamp the drill template down.

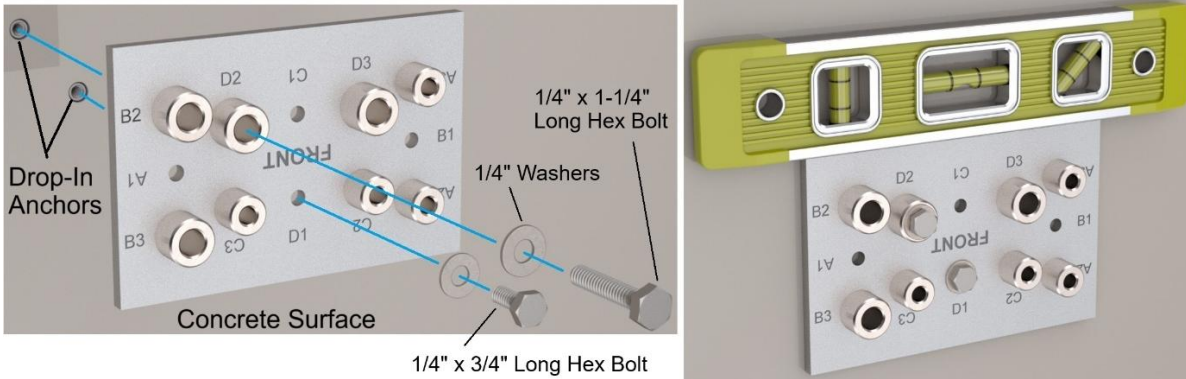


Figure 58: Leveling and Fastening Drilling Template on Hole D1 & Bushing D2 with 1/4" Drop-In Anchors, Hex Bolts and Washers

11. Use the second prepared drill bit for hole D2 & D3 to drill the third hole through bushing D3. Drill until the masking tape touches the top surface of bushing D3. This will ensure that the correct hole depth of 1" has been achieved. Be careful not to move the Drilling Template during drilling.



Figure 59: Drilling Third Hole Through Bushing D3 for Drop-In Anchor

12. Remove the Drilling Template and install a third drop-in anchor inside the third drilled hole. Ensure that the drop-in anchor is flushed or slightly recessed about the concrete surface. Use a setting tool to hammer the drop-in anchor permanently in place.

13. Install the Affinity Tilt Logger by aligning the 3 installed drop-in anchors with the open slots of the Base Plate. If supplied, install the 1/4" x 5/8" long hex bolts and washers. Level and apply thread locker as needed tighten the bolts to 75 in-lbs. (8.47 Nm).

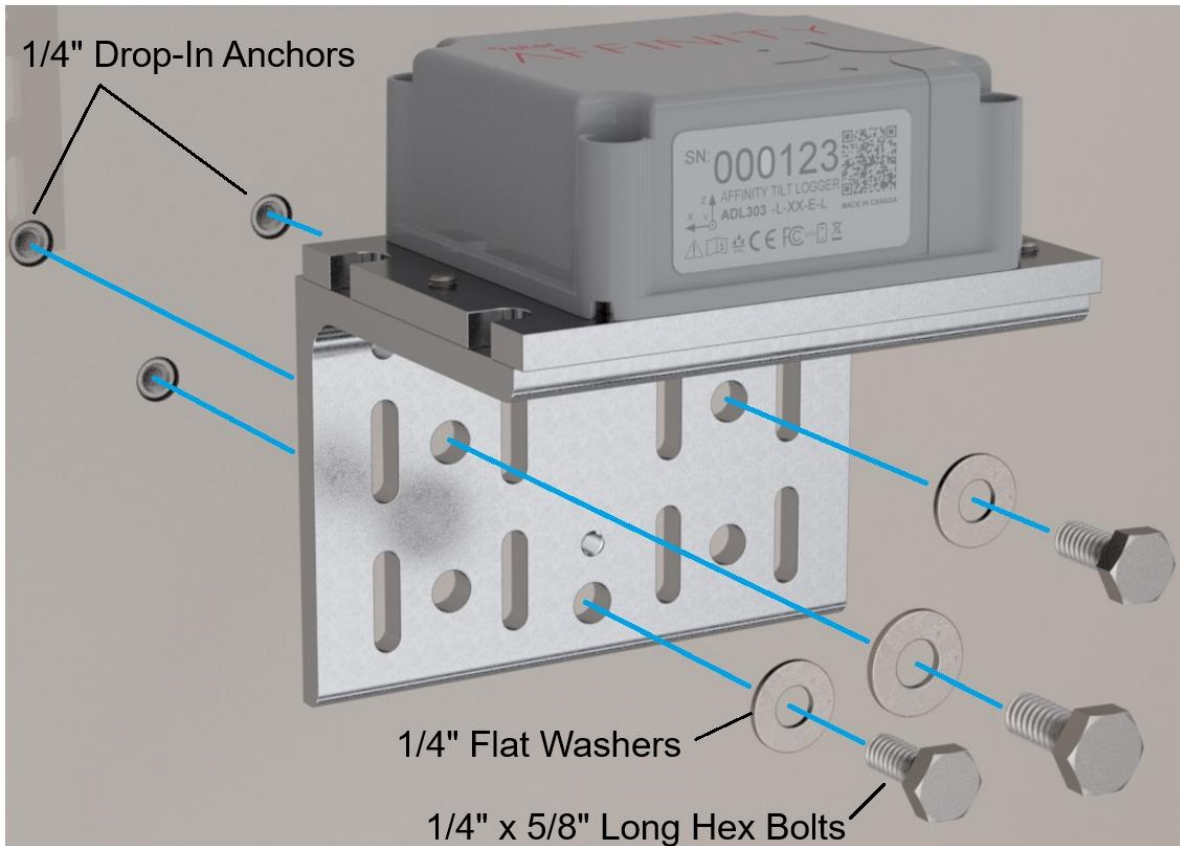


Figure 60: Installing the Affinity Tilt Logger with 1/4" Drop-In Anchors, Hex Bolts and Washers

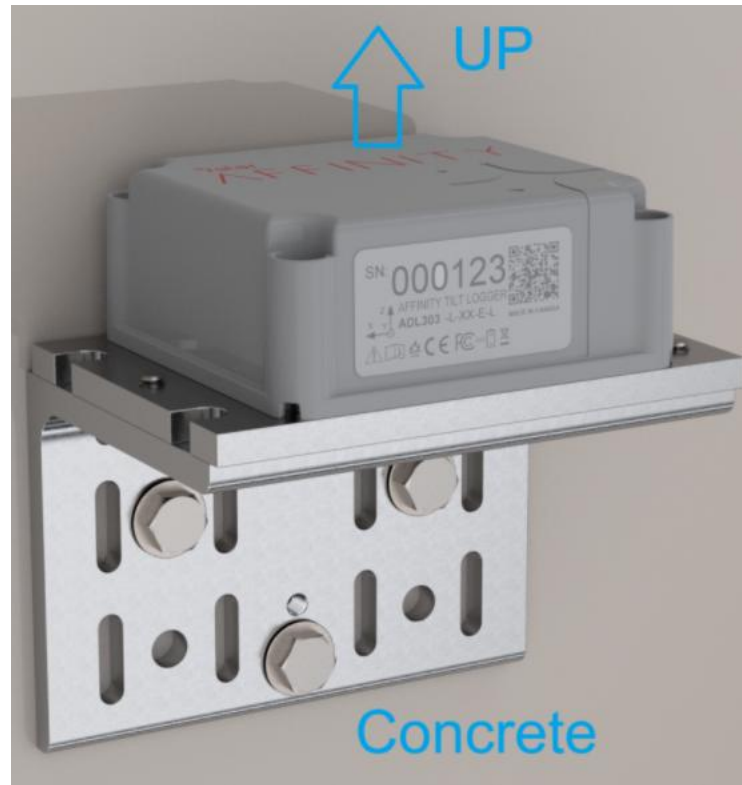


Figure 61: Angle Bracket Mounted Affinity Tilt Logger Installed in Horizontal Orientation Using 1/4" Drop-In Anchors

7.4.7 Mounting onto a 2" Diameter Pole Using U-Bolts

1. Assemble the Affinity Tilt Logger onto the Angle Bracket using the supplied mounting fasteners as mentioned in the earlier section.

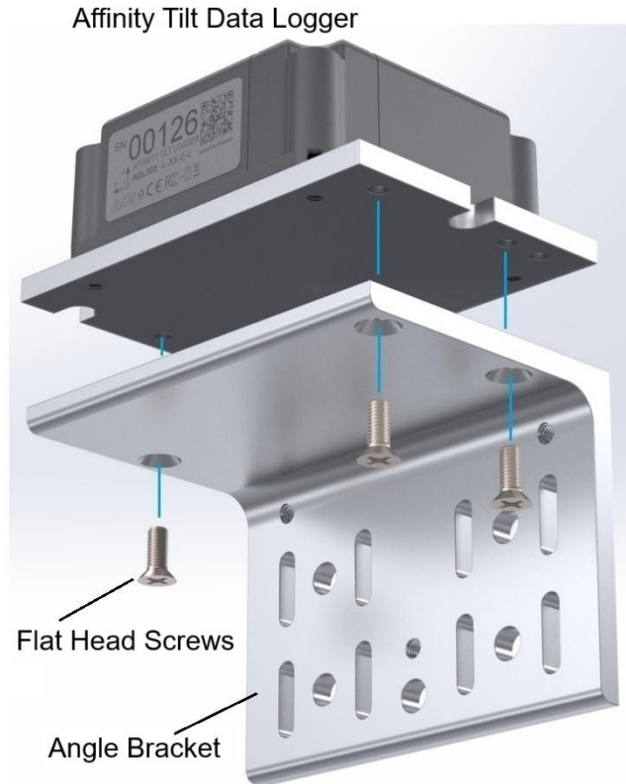


Figure 62: Assembling Angle Bracket onto Affinity Tilt Logger

2. To install the Affinity Tilt Logger onto a 2" diameter post, install a pair of the 2" U-bolts through the circular holes on the Angle Bracket. Level as needed and tighten the 1/4" Hex Nuts to 75 in-lbs. (8.47 Nm).

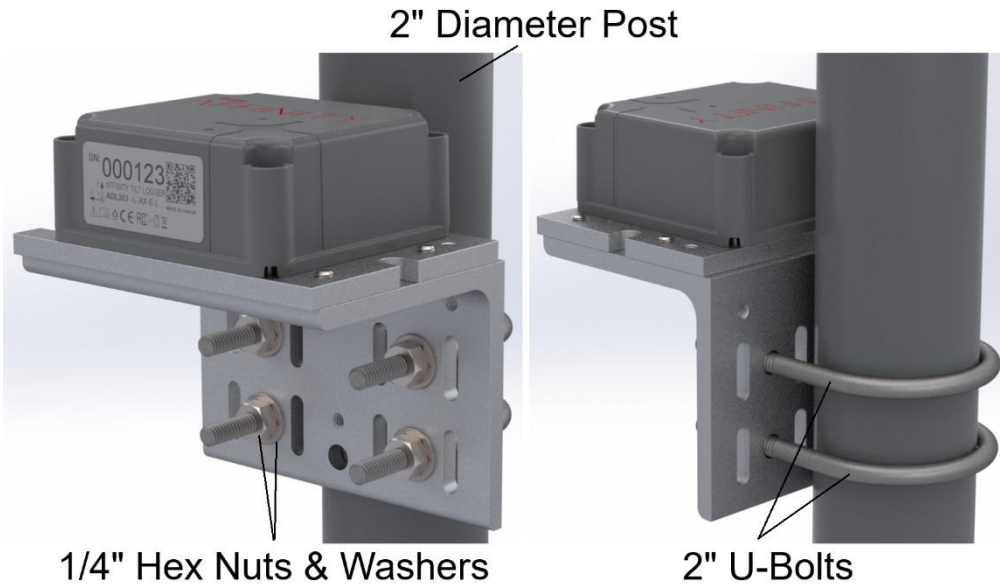


Figure 63: Installing Affinity Tilt Logger using 2" U-Bolts and 1/4" Hex Nuts and Washers

7.4.8 Mounting onto Varying Size Diameter Poles Using Gear Clamps

1. To mount the Affinity Tilt Logger onto a pole using gear clamps, use the appropriate gear clamp sizes as shown on the following table.

Table 4: Gear Clamps and Post Diameters

Gear Clamp	Post Diameter
HC5-20	1" to 1-1/2"
HC5-32	1-3/4" to 2-1/2"
HC5-64	3" to 4"
HC5-96	5-1/4" to 6"
HC5-128	7-1/2" to 8"
HC5-164	9" to 10"
HC5-200	11" to 12"
HC5-236	13-1/2" to 14"

2. To mount the Affinity Tilt Logger onto a 1" to 1-1/2" diameter post or a 1-3/4" to 2-1/2" diameter pole, install a pair of the required gear clamps through the inner slots of the Angle Bracket and level as needed. If the gear clamps are provided, tighten the clamps to 30 in-lbs. to 34 in-lbs. (3.39 Nm to 3.84 Nm). Other clamps within the 1" to 2-1/2" diameter range not listed on the gear clamp table may also be used.

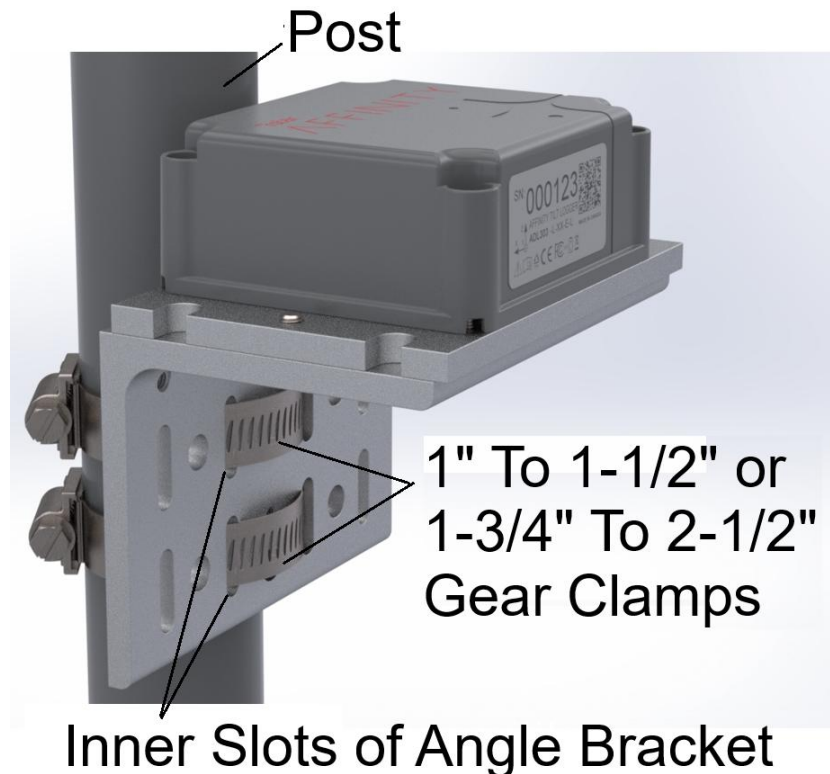


Figure 64: Installing the Affinity Tilt Logger with Gear Clamps through the Inner Slots of the Angle Bracket

3. To mount the Affinity Tilt Logger onto a larger than 2-1/2" diameter post size, install a pair of the required gear clamps onto the outer slots of the Angle Bracket and level as needed. If the gear clamps are provided, tighten the clamps to 30 in-lbs. to 34 in-lbs. (3.39 Nm to 3.84 Nm). Other clamps for larger than 2-1/2" diameter post size range not listed on the gear clamp table may also be used.

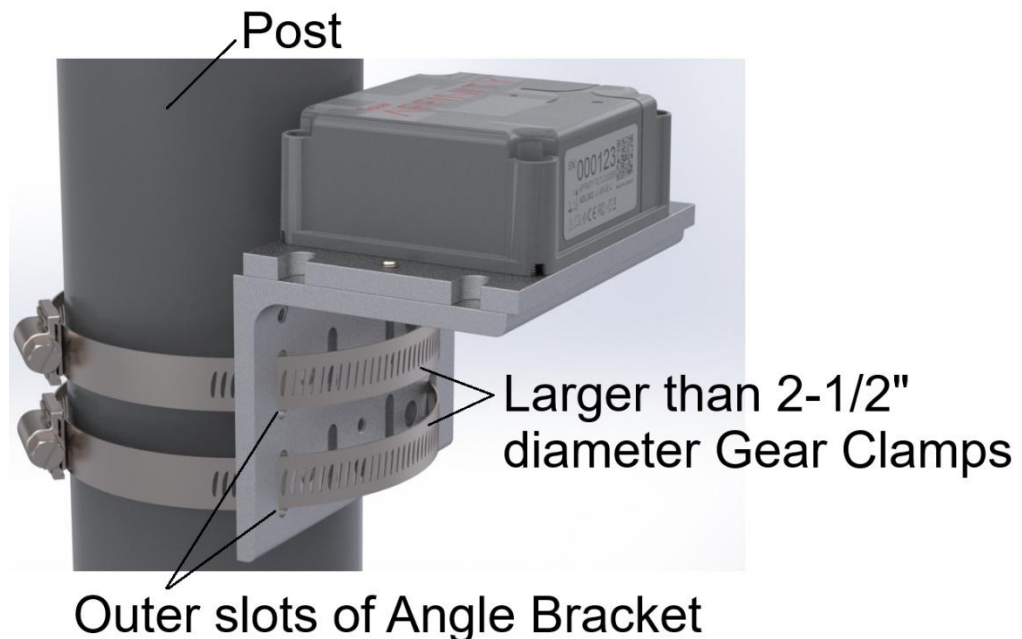


Figure 65: Installing the Affinity Tilt Logger with Gear Clamps through the Outer Slots of the Angle Bracket

7.4.9 Direct Mounted Horizontal or Vertical Orientation using Magnets



NOTE: This method attaches the Affinity Tilt Logger onto a flat steel surface without the need to drill or tap holes onto the steel surface.

1. Ensure that the steel surface where the Affinity Tilt Logger will be mounted to is clean, free of rust, uneven painted surface, or any debris that might interfere with the magnetic attachment. For glossy surfaces and surfaces with chipped paint, it is recommended to use an Emery Cloth (80, 100 or 120 Grit) to roughen the surface.



WARNING: Each magnets has a pull force of approximately 50 lbs (23 kg). It is recommended to use safety gloves and use precautionary measures when handling the magnets to prevent injuries.

2. For Direct Base Plate mounting, attach the supplied Steel Cup Encased Magnets onto the Affinity Tilt Logger's base plate with the supplied mounting screws. Use thread locker as needed and tighten the fasteners to the recommended torque setting as shown in the table below.

Table 5: Magnet Fastener Tightening Torque for Stainless Steel Base Plate

Base Plate Material	Magnet Fastener Tightening Torque	
	in-lb	N.m
Stainless Steel	21	2.37

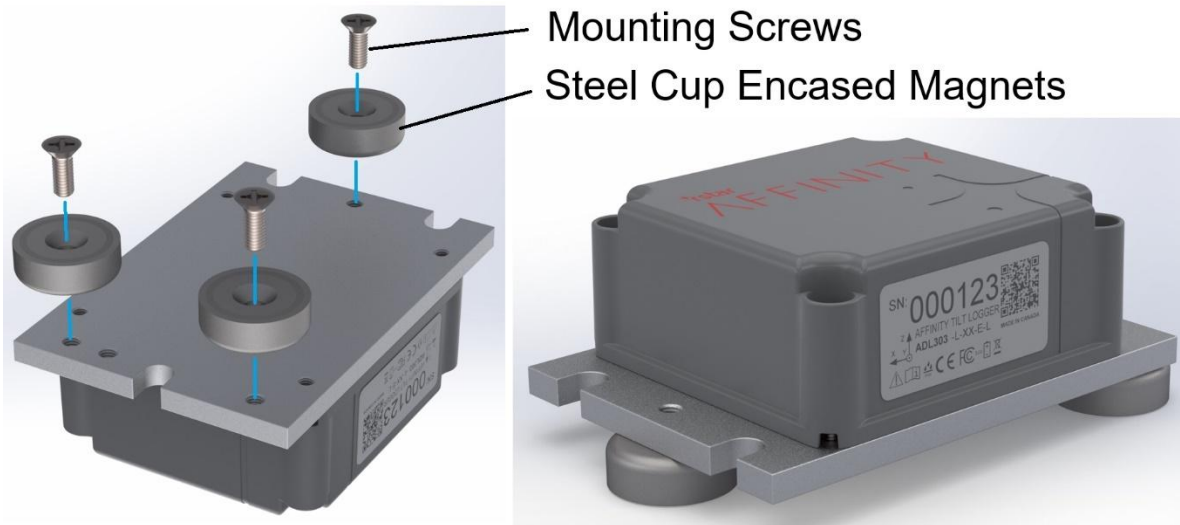


Figure 66: Installing Steel Cup Enclosed Magnets onto the Affinity Tilt Logger

3. While holding the plastic enclosure and part of the base plate of the Affinity Tilt Logger with two hands, tilt the instrument and gradually bring it towards the steel surface. Slowly allow the magnet to contact the steel surface, one magnet at a time until the Affinity Tilt Logger is securely attached to the steel surface.



WARNING: Each magnets has a pull force of approximately 50 lbs (23 kg). It is recommended to use safety gloves and use precautionary measures when handling the Logger to prevent injuries.

Tilting the Affinity Tilt Data
Logger towards steel surface

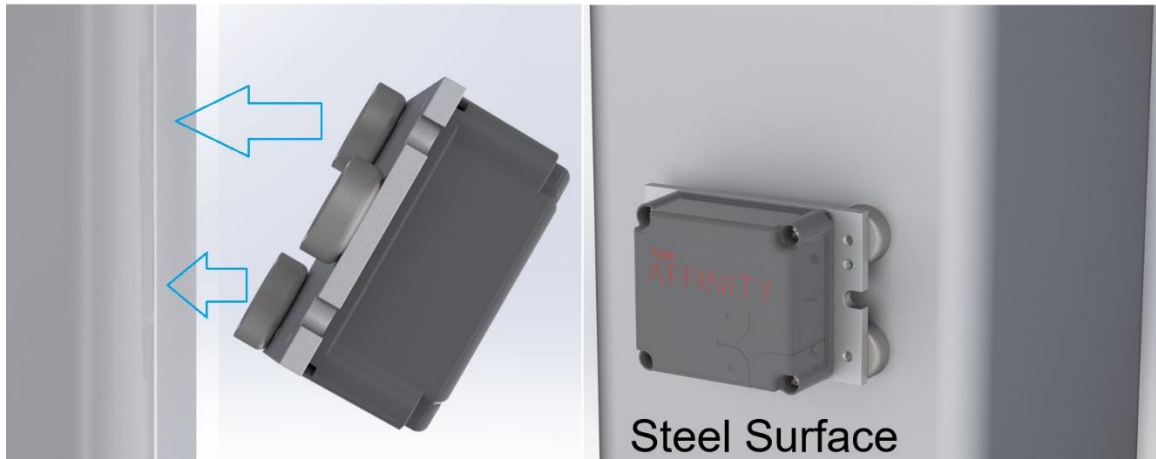


Figure 67: Installing Affinity Tilt Logger onto Steel Surface

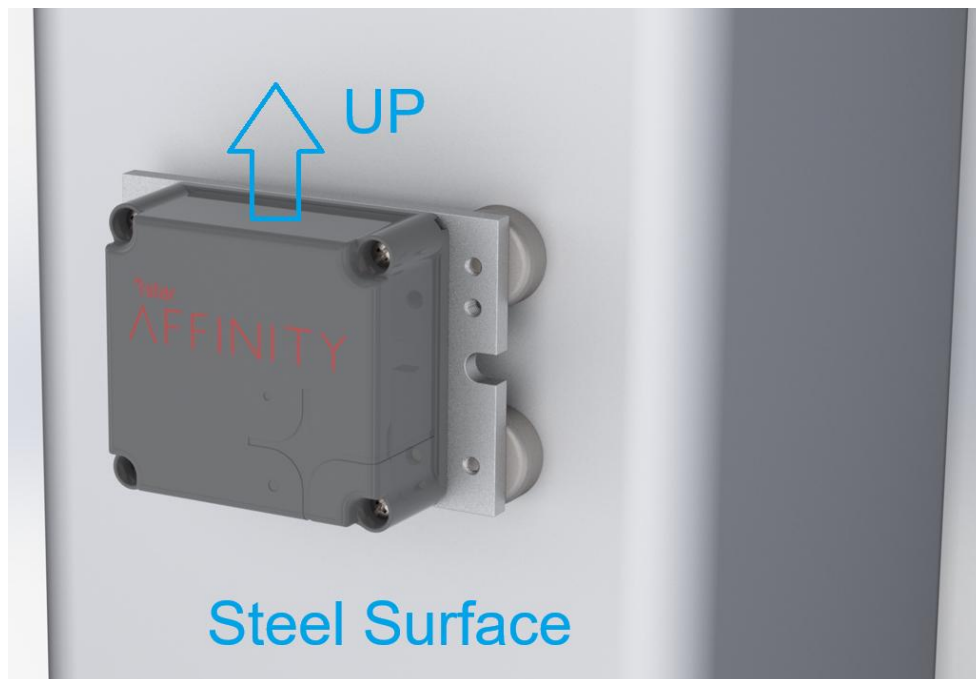


Figure 68: Direct Mounted Affinity Tilt Logger Installed in Vertical Orientation using Magnets

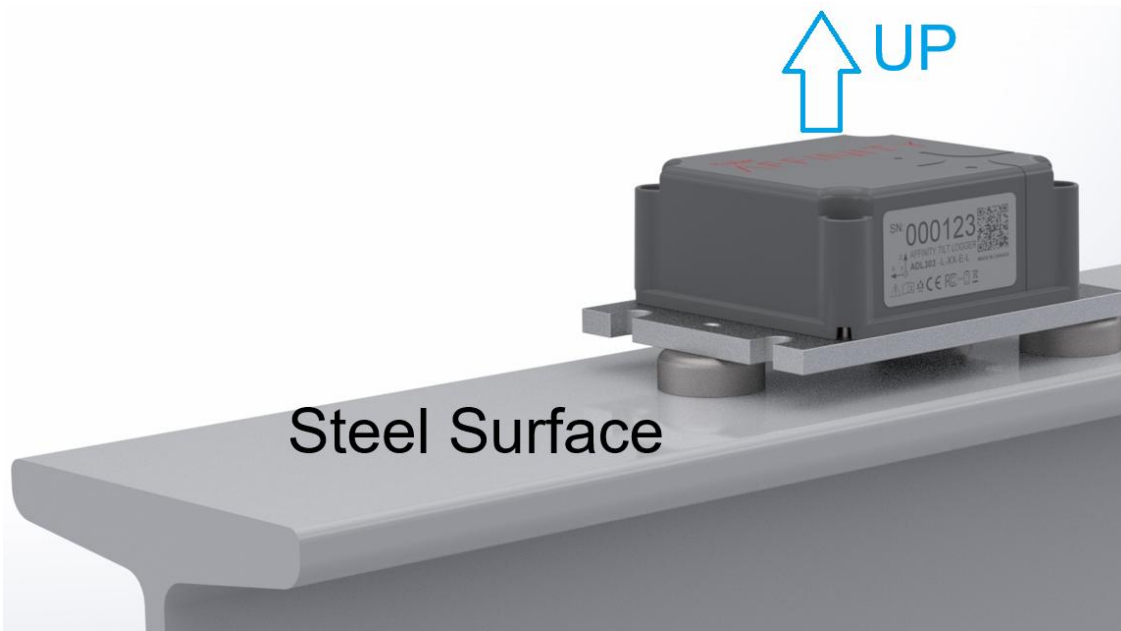


Figure 69: Direct Mounted Affinity Tilt Logger Installed in Horizontal Orientation using Magnets

7.4.10 Angle Bracket Mounted Horizontal Orientation using Magnets



NOTE: This method attaches the Affinity Tilt Logger onto a flat steel surface without the need for drilling or tapping holes onto the steel surface.

1. Ensure that the steel surface where the Affinity Tilt Logger will be mounted to is clean, free of rust, uneven painted surface, or any debris that might interfere with the magnetic attachment. For glossy surfaces and surfaces with chipped paint, it is recommended to use an Emery Cloth (80, 100 or 120 Grit) to roughen the surface.

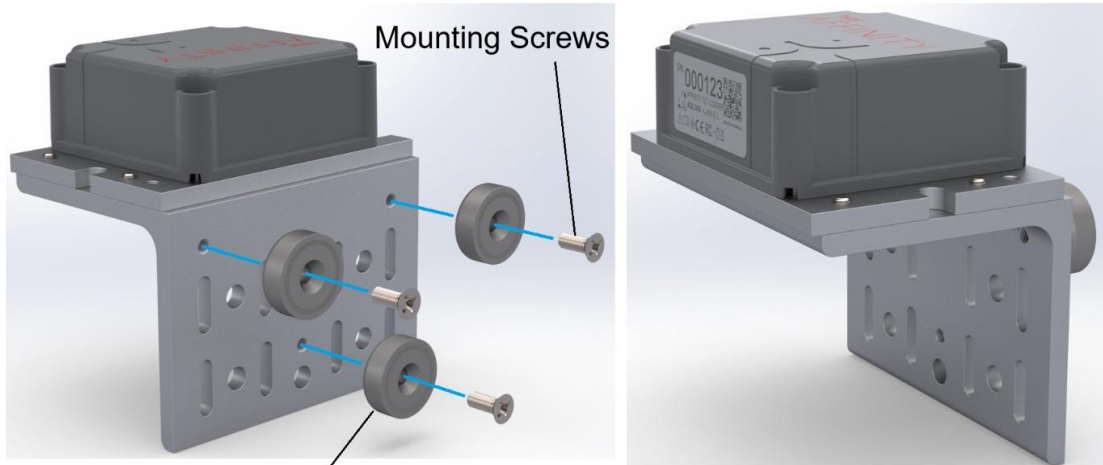


WARNING: Each magnets has a pull force of approximately 50 lbs (23 kg). It is recommended to use safety gloves and use precautionary measures when handling the Logger to prevent injuries.

2. For the Angle Bracket mounting, attach the supplied Steel Cup Encased Magnets onto the Affinity Tilt Logger's Angle Bracket with the supplied mounting screws. Use thread locker as needed and tighten the fasteners to the recommended torque setting as shown in the table below. Note that the Angle Bracket Magnet Mounting option is available in Aluminum made Angle Bracket and Base Plate only.

Table 6: Magnetic Fastener Tightening Torque for Aluminum Base Plates

Base Plate and Angle Bracket Material	Magnet Fastener Tightening Torque	
	in-lb	N.m
Anodized Aluminum	22	2.49



Steel Cup Encased Magnets

Figure 70: Installing Steel Cup Encased Magnets onto the Angle Bracket

3. While holding the top of the plastic enclosure and bottom part of the Angle Bracket of the Affinity Tilt Logger with two hands, tilt the instrument and gradually bring it towards the steel surface. Slowly allow the magnet to contact the steel surface, one magnet at a time until the Affinity Tilt Logger is securely attached to the steel surface.



WARNING: Each magnets has a pull force of approximately 50 lbs (23 kg). It is recommended to use safety gloves and use precautionary measures when handling the Logger to prevent injuries.

Tilting the Affinity Tilt Data
Logger towards steel surface

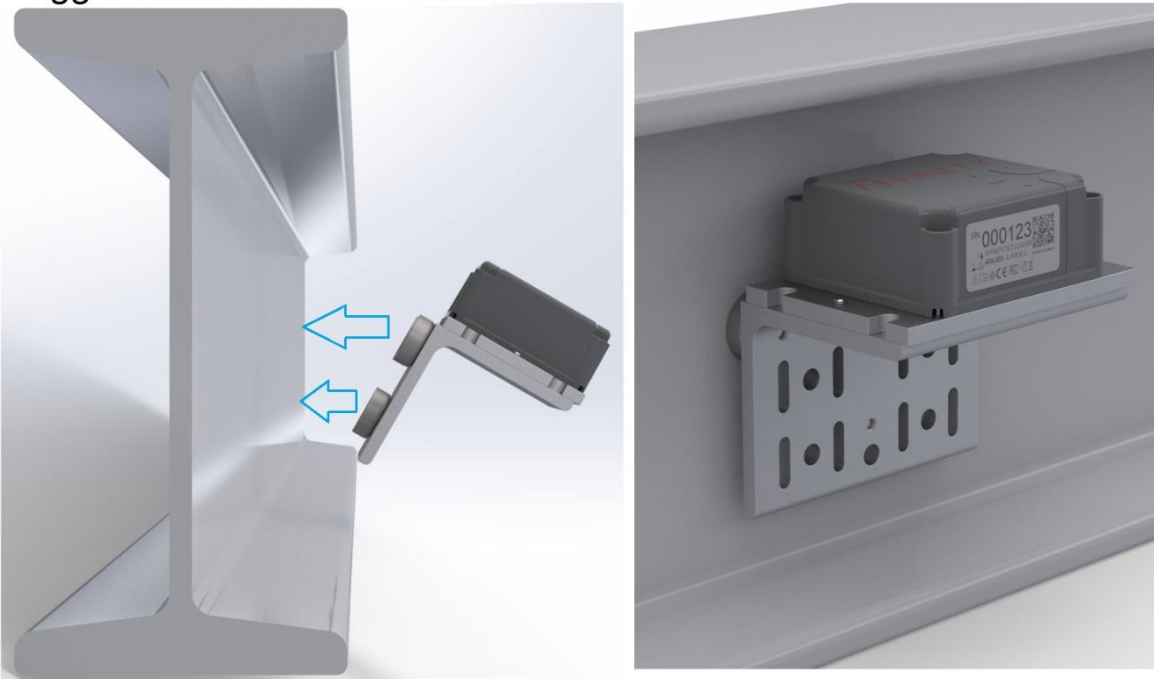


Figure 71: Installing Angle Bracket Mounted Affinity Tilt Logger onto Steel Surface

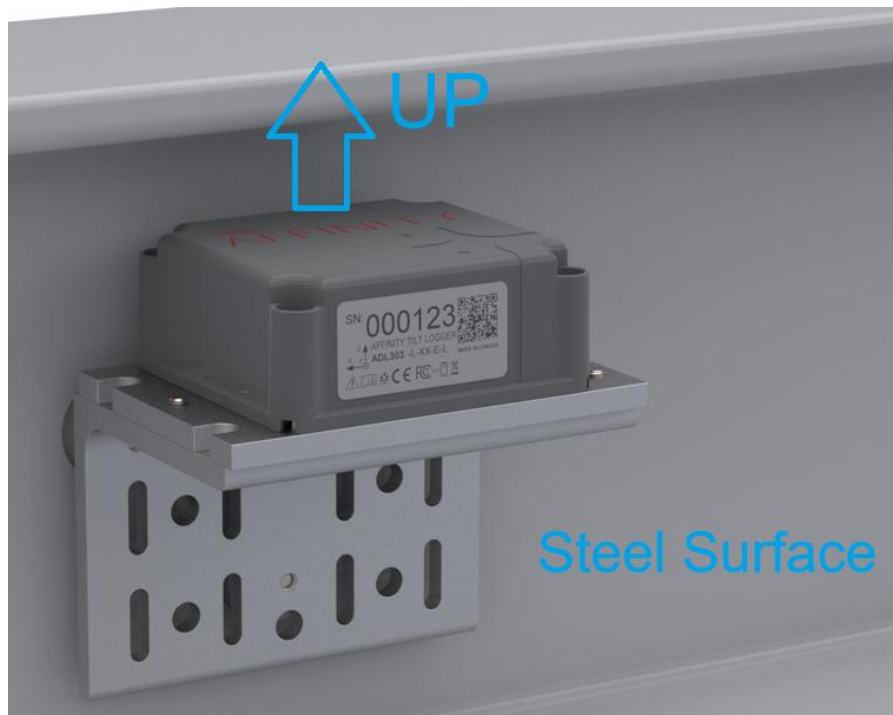


Figure 72: Angle Bracket Mounted Affinity Tilt Logger installed at Horizontal Orientation using Magnets

7.5 POST-INSTALLATION CHECKS

7.5.1 Signal verification via Field Utility App

If connected to a Gateway, the dashboard will contain some Gateway information.

1. Navigate to the Network Connection menu by selecting the Network arrow.

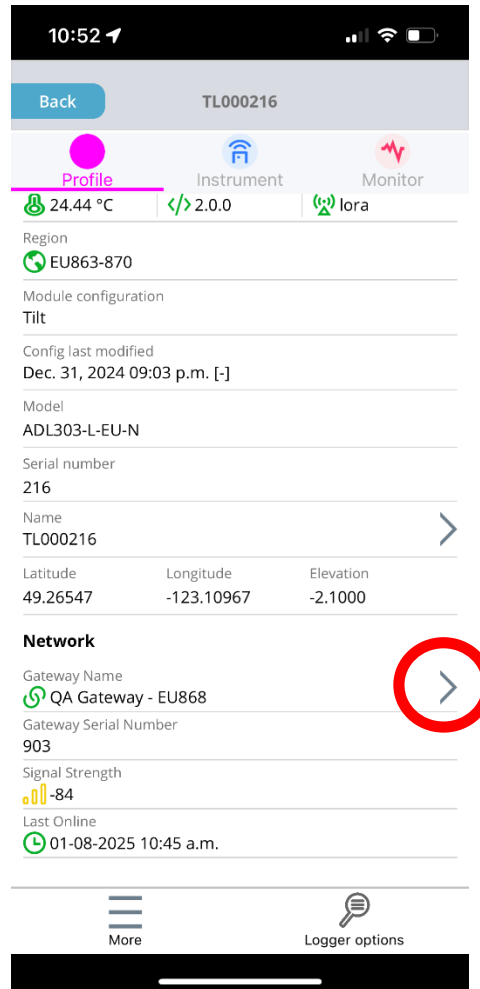


Figure 73: Navigating to the Network Connection Menu

2. Press the “Check Signal” button in the menu shown. This will show the signal strength between the Logger and Gateway as shown. A value will only be shown if the Logger has already communicated once with the Gateway. If communication has not yet occurred between the Gateway and the base station, the signal strength will not be shown.

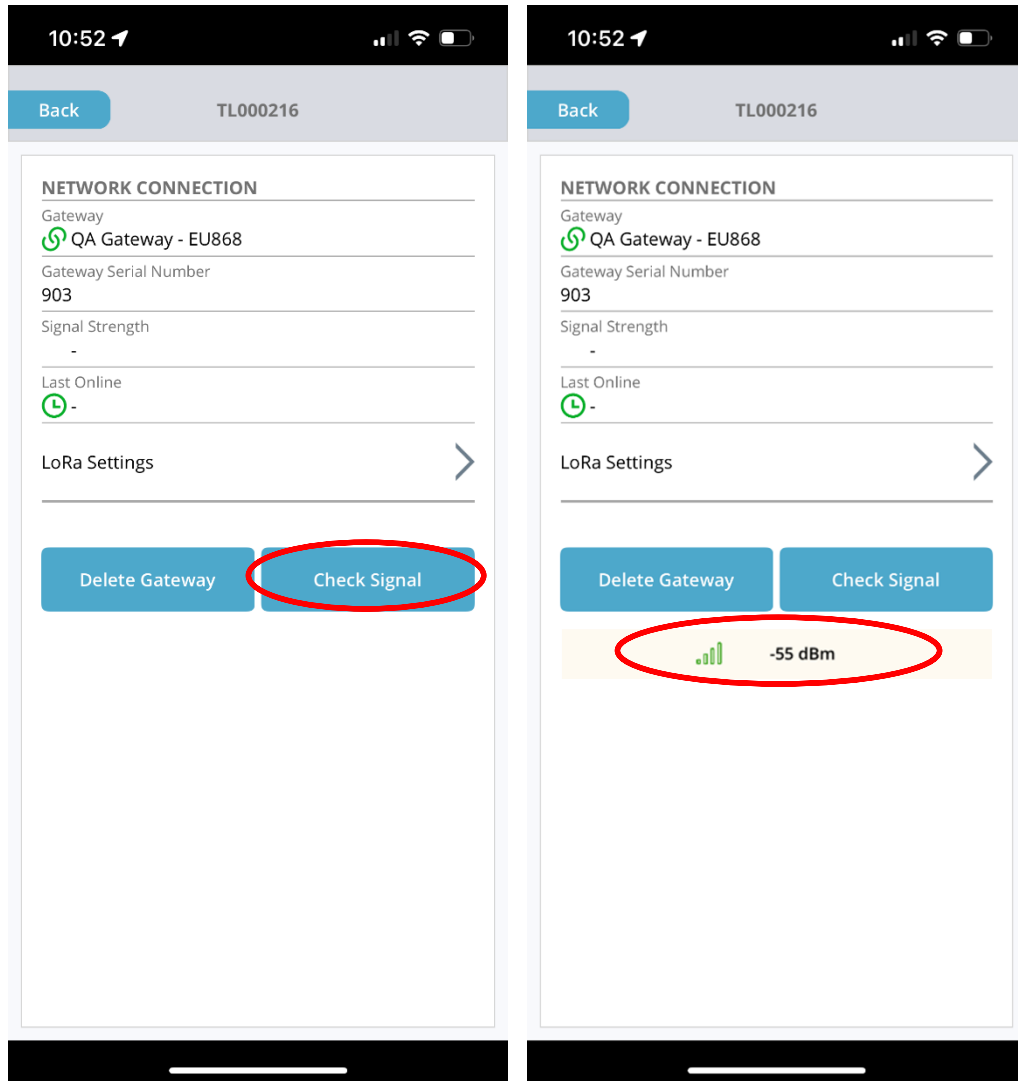


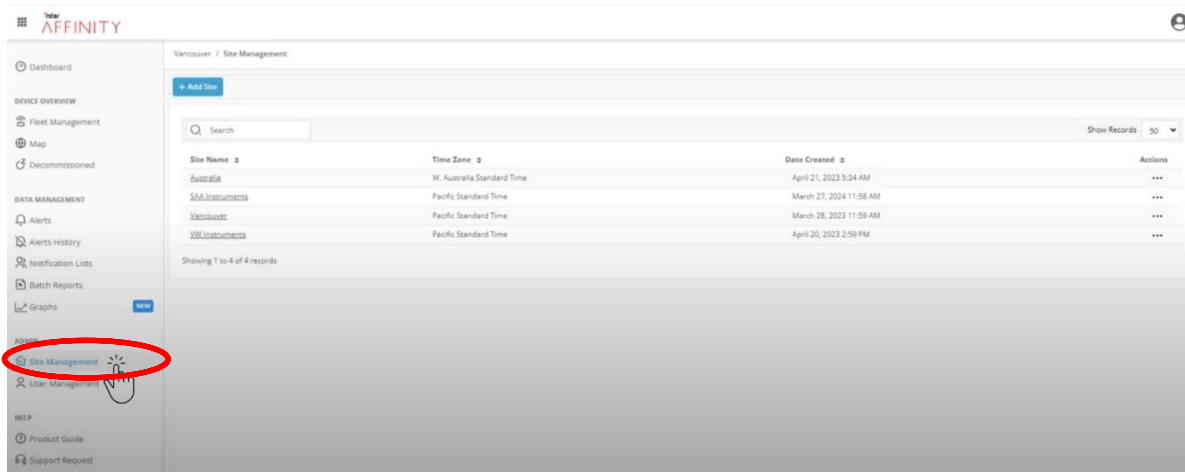
Figure 74: Check Signal Strength Between the Affinity Tilt Logger and Gateway

7.6 OTHER CONSIDERATIONS

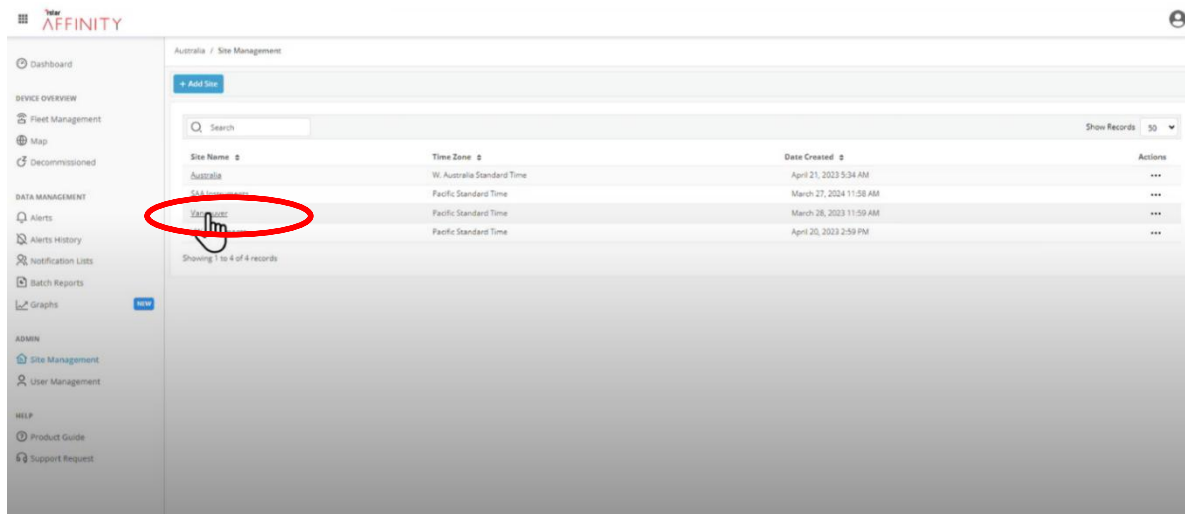
- Do not open the logger's plate in rain or any other adverse weather conditions. Ensure there is no water on the surface on the plate when opened.
- Keep dirt out of the seal to guarantee IP68 rating.

8 DATA MANAGEMENT USING THE RSTAR AFFINITY DATA PLATFORM (BROWSER-BASED)

1. Log in to the RSTAR Affinity Data Platform.
2. From the ADMIN menu, select the Site Management tab.

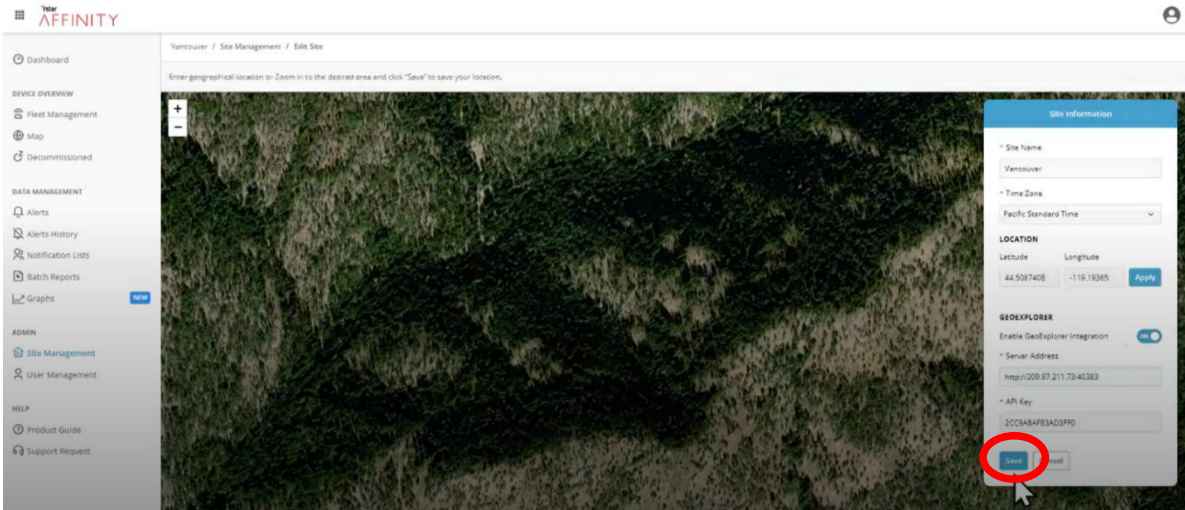


3. From the Site Management window, select the Site Name that corresponds to the paired Tilt Logger.

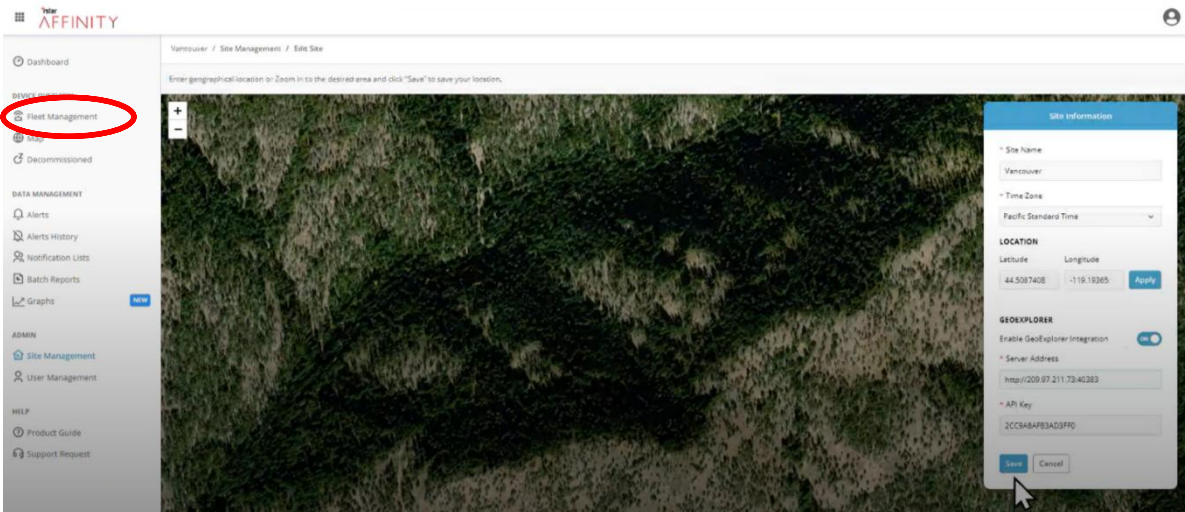


- The Edit Site window appears, providing an overview of the selected site, including Satellite view and Site Information.

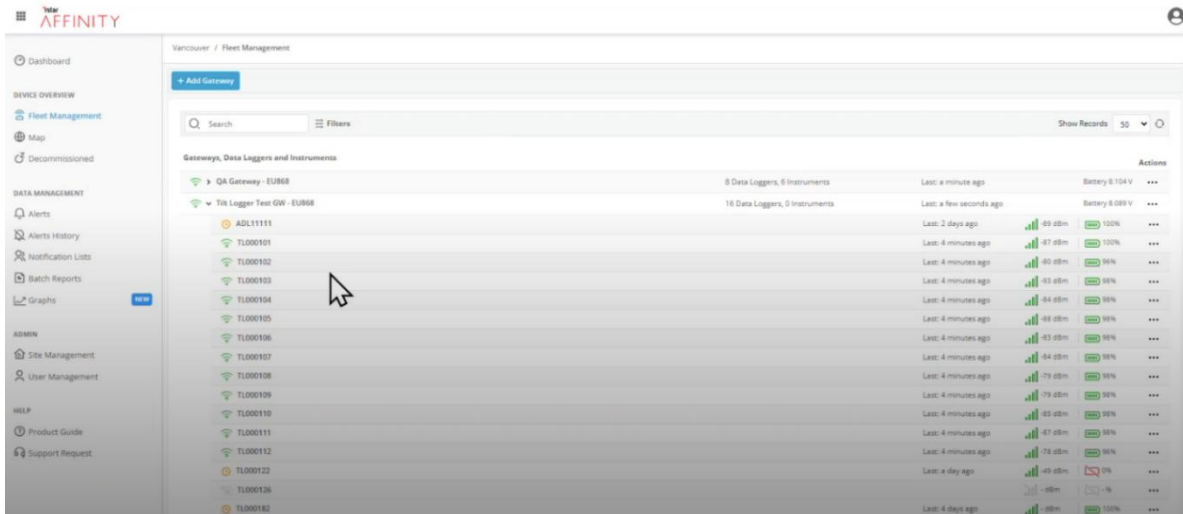
Click the Save button located in the Site Information box on the right-hand side of the screen.



- From the Device Overview Menu, select Fleet Management.



- The Fleet Management window appears, displaying Gateways, Data Loggers and Instruments.



- Locate the corresponding Gateway. Using the drop-down menu, display the paired Tilt Loggers for that Gateway.
- Prior to pairing a Tilt Logger to a Gateway using the Smartphone App, it will not appear in the drop-down menu for the Gateway.

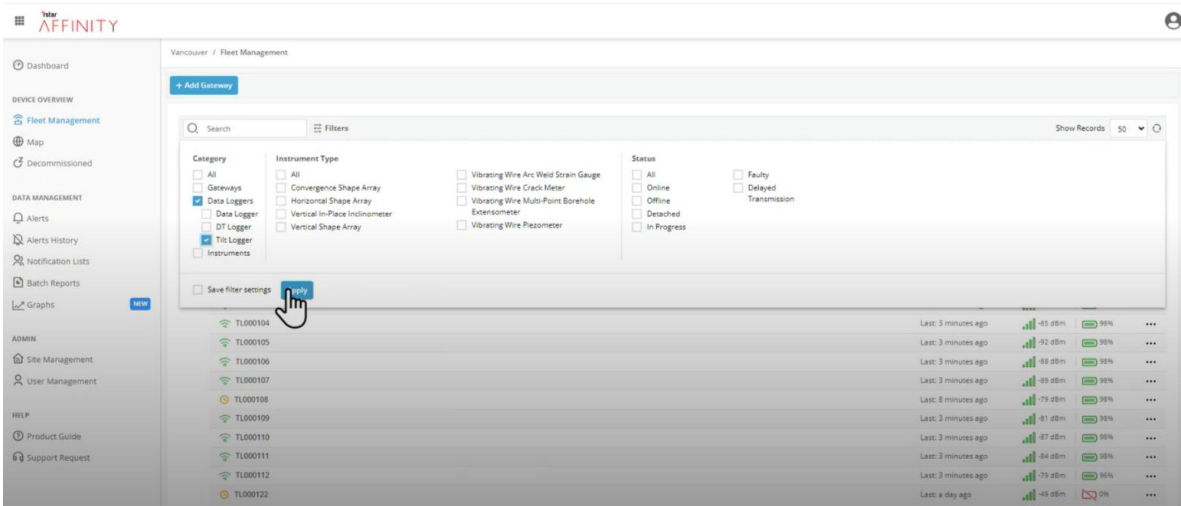


NOTE: To troubleshoot a failed pairing, unpair the Tilt Logger from the Gateway on the Smartphone app and then re-pair. Refresh the page in the Affinity Data Platform web-browser software.

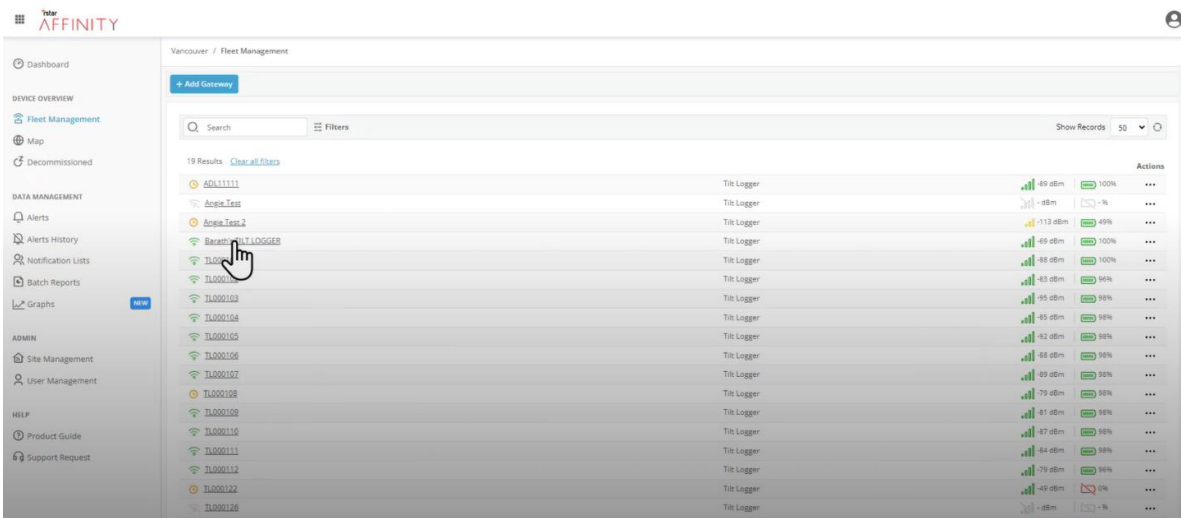
- After pairing, the Wi-Fi icon next to the Tilt Logger may appear greyed out. This is because the Tilt Logger must go through the reporting interval (as specified in the app) and log an initial reading.
- Once an initial reading is logged, the Wi-Fi icon turns green, and signal strength, last reading taken, and battery percentage get displayed.

8.1 DATA VISUALIZATION

1. From the Fleet Management window, select Filters.
2. Check the boxes for Data Loggers and Tilt Logger. Select Apply

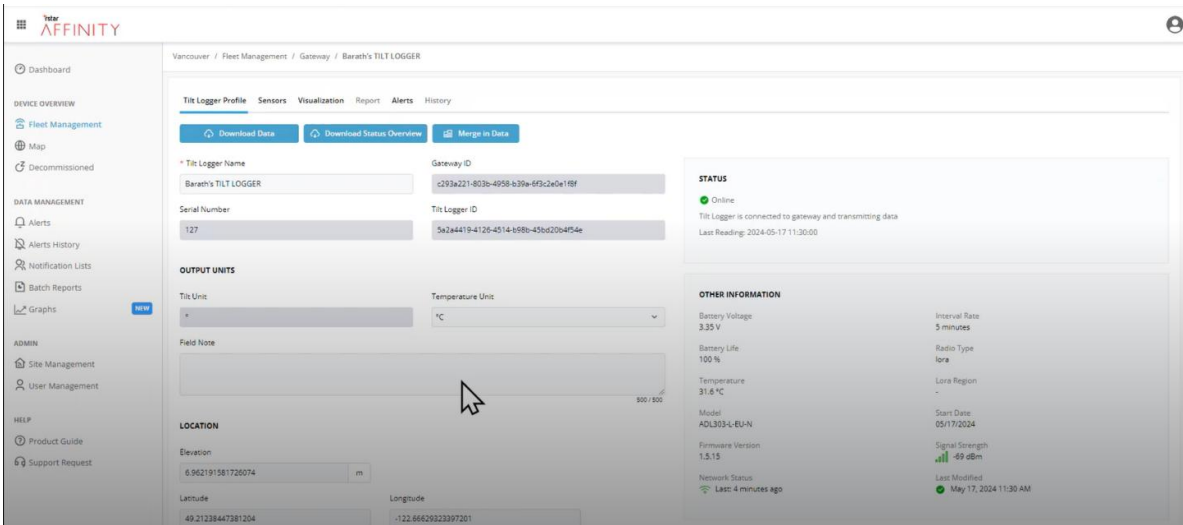


3. From the displayed results, select the specific Tilt Logger.



4. The Tilt Logger overview window appears. The following tabs are presented:

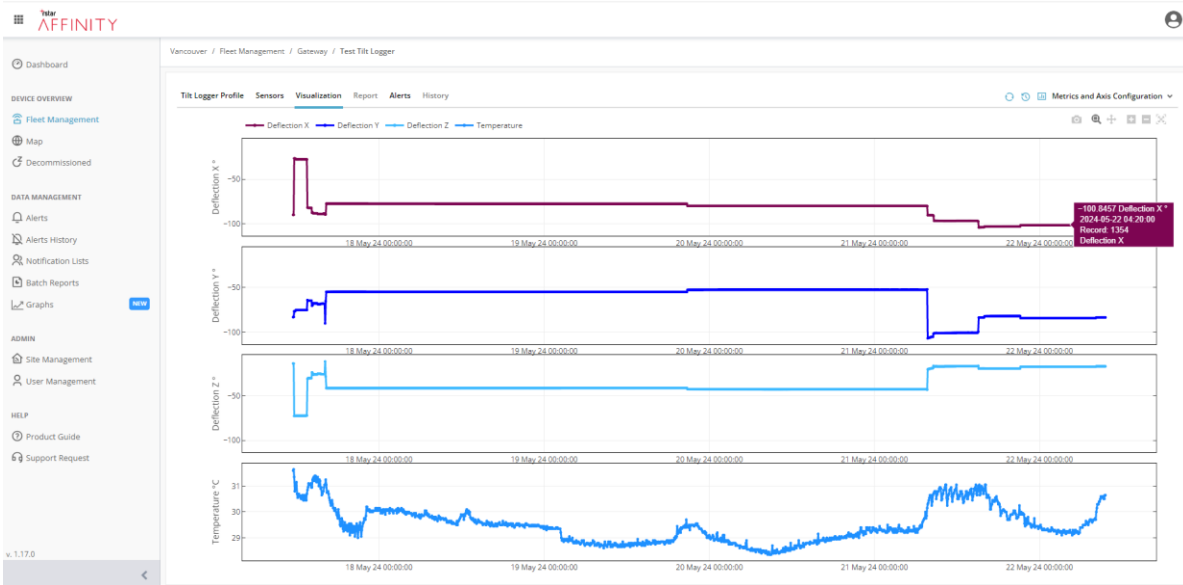
- Tilt Logger Profile
 - Tilt Logger Name, Tilt Logger ID, Serial Number and Gateway ID
 - Status and Last Reading
 - Output Units (Tilt Unit and Temperature Unit)
 - Location (Elevation, Latitude and Longitude)
 - Sampling Interval
 - Other Information
- Sensors
- Visualization
- Report
- Alerts
- History



5. The Sensors tab



6. The Visualization tab graphically represents the triaxial deflection and temperature data.



9 TILT AXES ORIENTATION AND CONVENTION

The Tilt Logger reports deflection and displacement directly in degrees of arc. The three tilt sensors measure the angle of the X, Y, and Z axes shown in Figure 75 above or below the horizontal plane. In the orientation shown in figure X, the X, Y, and Z axes would report 0° , 0° , and $+90^\circ$ respectively.

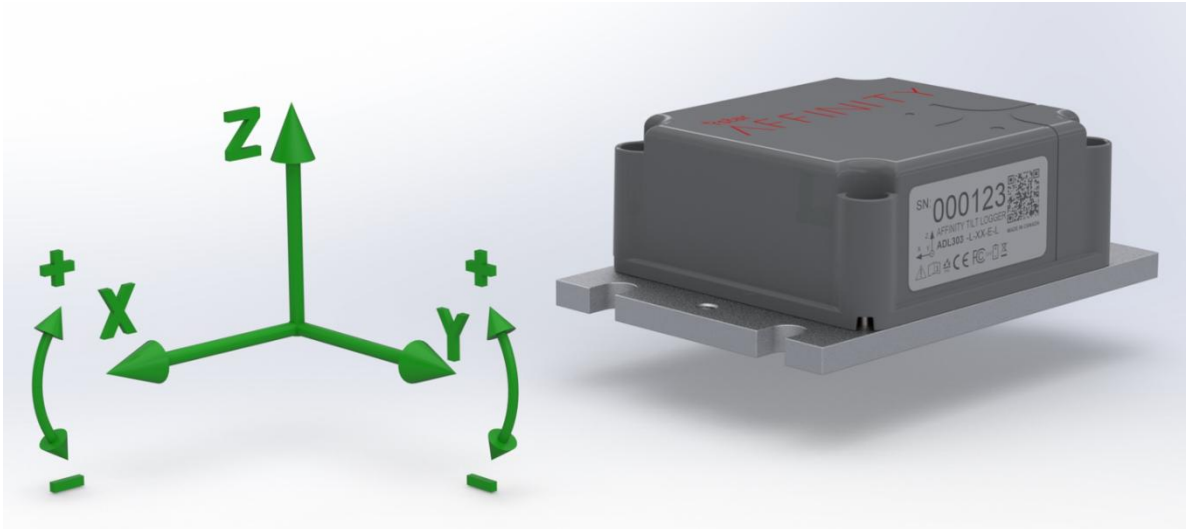


Figure 75: X, Y, and Z Axial Orientation for RSTAR Affinity Tilt Logger



NOTE: Deflection and displacement are determined using two of the three available axes. In Figure 75, axes X and Y are used for this purpose. The sensor's resolution, precision, and temperature sensitivity degrade beyond $\pm 60^\circ$ from the horizontal. When the sensor rotates out of the high-precision region, the unused sensor takes over.

Translations along the X, Y, or Z axes, as well as rotations in the horizontal plane, are not meaningfully detected by the accelerometers. In these cases, the angle between any axis and the horizontal plane remains unchanged.

10 MAINTENANCE

Maintenance of the RSTAR Affinity Tilt Logger is limited to replacing the battery for the ADL303 when depleted.



CAUTION: Ensure that water from the environment does not enter the enclosure while replacing the battery.

Follow the steps below to replace the ADL303 battery:

1. Wipe any excess dirt or debris away from the interface between the polycarbonate lid and the base plate
2. Loosen the 4 enclosure captive screws
3. Gently lift the side of the lid above the AFFINITY marking. The lid will be retained by rubber hinges underneath the label

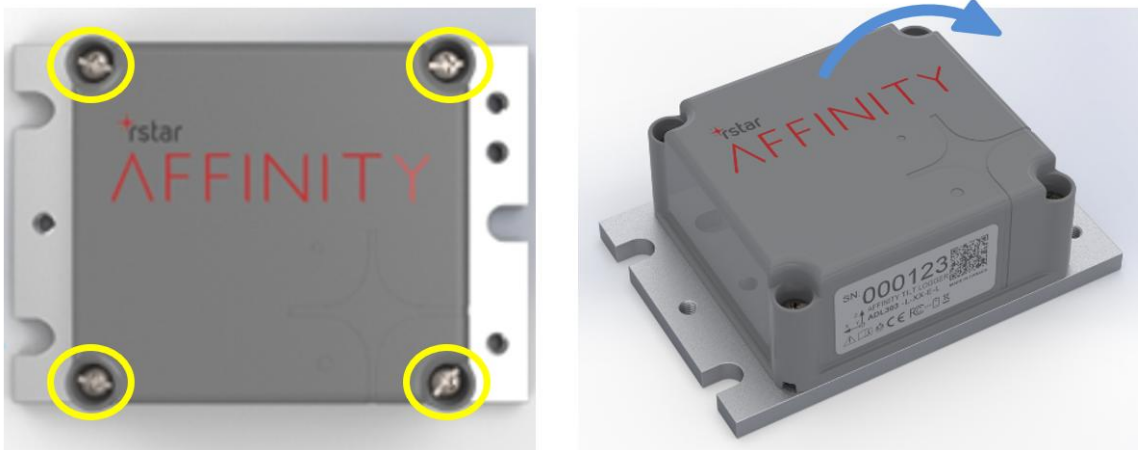


Figure 76: Remove Enclosure Captive Screws and Lift the Enclosure Lid to Replace Battery

4. Remove the depleted cell from the enclosure by using the pull loop
5. Transfer the pull loop to the new cell
6. Insert the new cell into the battery holder, ensuring that the positive button side of the terminal is correctly oriented
7. Check to make sure gasket is correctly seated in the lid groove, then place the lid back on the baseplate. Tighten the 4 enclosure captive screws as described in Section 6.1
8. Initialize the new battery in the field utility application



CAUTION: Only the SAFT LSH 14 is recommended for use in the ADL303. Using other cells may damage the device or result in reduced functionality. Be careful to ensure the baseplate sealing surface and the gasket are clean of any debris and the gasket is properly seated in the lid before closing the lid. Failure to do so will allow water to ingress into the enclosure.

11 PRODUCT SPECIFICATIONS

Item	Specification
General Specifications	
Primary Inclinometer Sensor	Triaxial MEMS Accelerometer
Secondary Event Detection Sensor	Low Power Triaxial MEMS Accelerometer
Dimensions	76 mm x 110 mm x 40 mm
Baseplate Dimensions	76 mm x 110 mm x 6 mm
Operating Temperature	-40 to +60 °C
Enclosure Ingress Protection	IP68
Enclosure Baseplate Material	Stainless Steel
Enclosure Radom Material	Glass Filled Polycarbonate
Mounting Options	Horizontal Surface Vertical Surface mount bracket Pole Mount Bracket Magnetic Mounting Feet
Vibration Resistance	8g (ADL303-L)
Drop Impact resistance	1m to Concrete
Data Logging Specifications	
Device Configuration	Field Utility Smartphone App via Bluetooth
Logging Interval	1 minute to 24 hours
Datalogging Modes	Standalone LoRaWAN connected
Maximum Records in Memory	200,000
Realtime Clock Accuracy	2.5ppm (<7s drift per month)* <i>*In standalone mode, synchronized to NTP when connected to Gateway.</i>
Radio Specifications	
LoRaWAN Regions Supported	EU868, AS923, US915, AU915
Range	15km
ISM Communications	Bi-Directional, Dashboard Configurable
ISM Antenna Options	Internal, External RP-SMA

Bluetooth Range	50m
Sensor Specifications	
Precision	0.0005° (8 ug) (ADL303-L)
Resolution	0.0001° (2ug) (ADL303-L)
Accuracy	0.002° (35 ug) (ADL303-L)
Range	+/- 30 from horizontal or vertical alignment.
Tilt Temperature Offset Uncertainty	0.0005°/°C (ADL303-L)
Tilt Temperature Sensitivity Uncertainty	0.01%/°C (ADL303-L)
Temperature Accuracy	0.5°C
Temperature Resolution	0.1°C

Battery Life

Battery life is dependent on many factors including:

- Sampling interval
- Update interval
- Radio link quality
- Ambient temperature

The following examples of lifetime estimates are for reliable radio links and temperatures above 0°C:

- 3.5 years at a 5-minute sampling/update interval
- 5 years at a 10-minute sampling/update interval
- 7.5 years at a 30-minute sampling/update interval
- 8.5 years at a 60-minute sampling/update interval

12 SERVICE, REPAIR AND CONTACT INFORMATION

This product does not contain any user-serviceable parts. Contact RST for product services or repairs.

- For sales information: sales@rstinstruments.com
- For technical support: support@rstinstruments.com
- Website: www.rstinstruments.com
- Toll free: 1-800-665-5599

RST Canada Office (Head Quarters)

Address: 11545 Kingston Street, Maple Ridge, BC, Canada V2X 0Z5

Telephone: 604-540-1100

Fax: 604-540-1005

Business hours: 7:30 a.m. to 5:00 p.m. (PST) Monday to Friday, except holidays

RST UK Office

Address: Unit 4 Charles Industrial Estate Stowupland Road, Stowmarket
Suffolk, UK, IP14 5AH

Telephone: +44 1449 706680

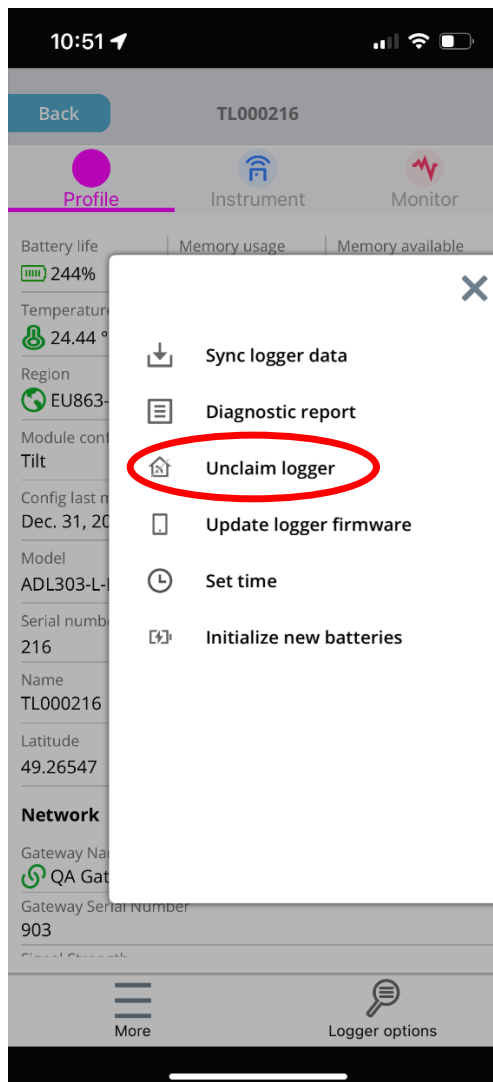
Business hours: 9:00 a.m. to 6:30 p.m. (GMT) Monday to Friday except holidays

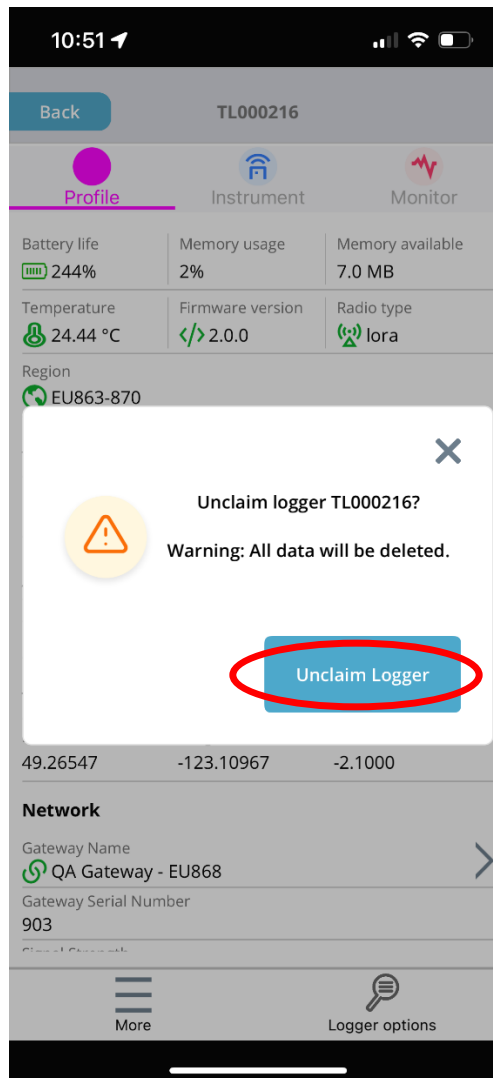
APPENDIX A: FIELD UTILITY APP ADDITIONAL FUNCTIONS

Unclaiming a Tilt Logger

From the main dashboard, navigate to the “Logger Options” menu.

Select “Unclaim logger” from the provided options. A popup will appear for the user to confirm their action. The user may press X on the top right corner of the pop-up to avoid unclaiming their logger.

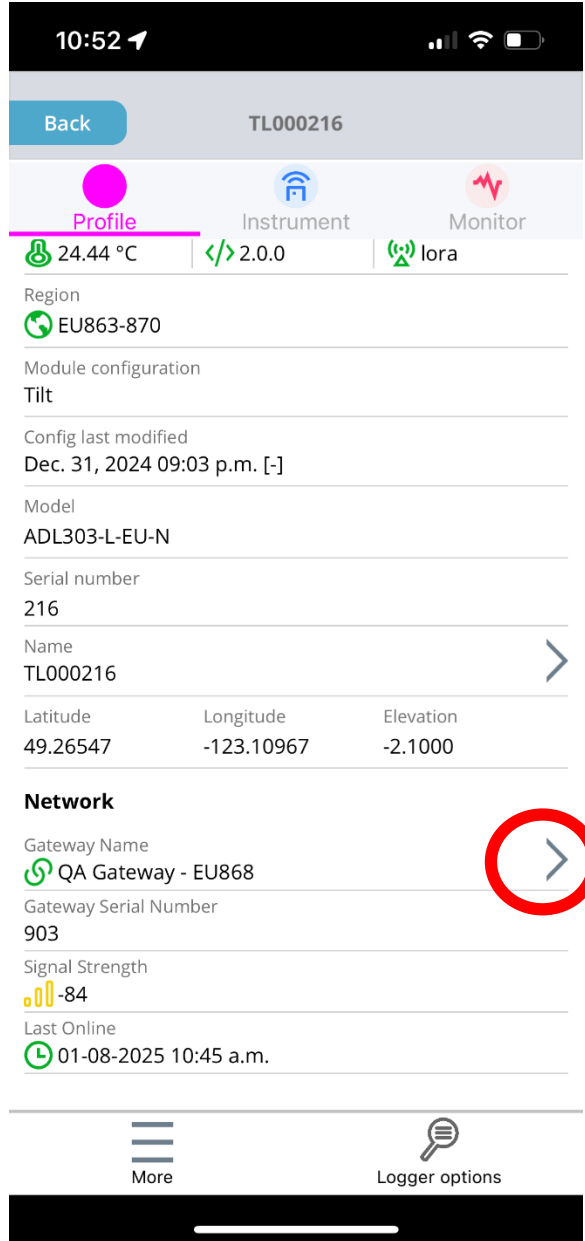




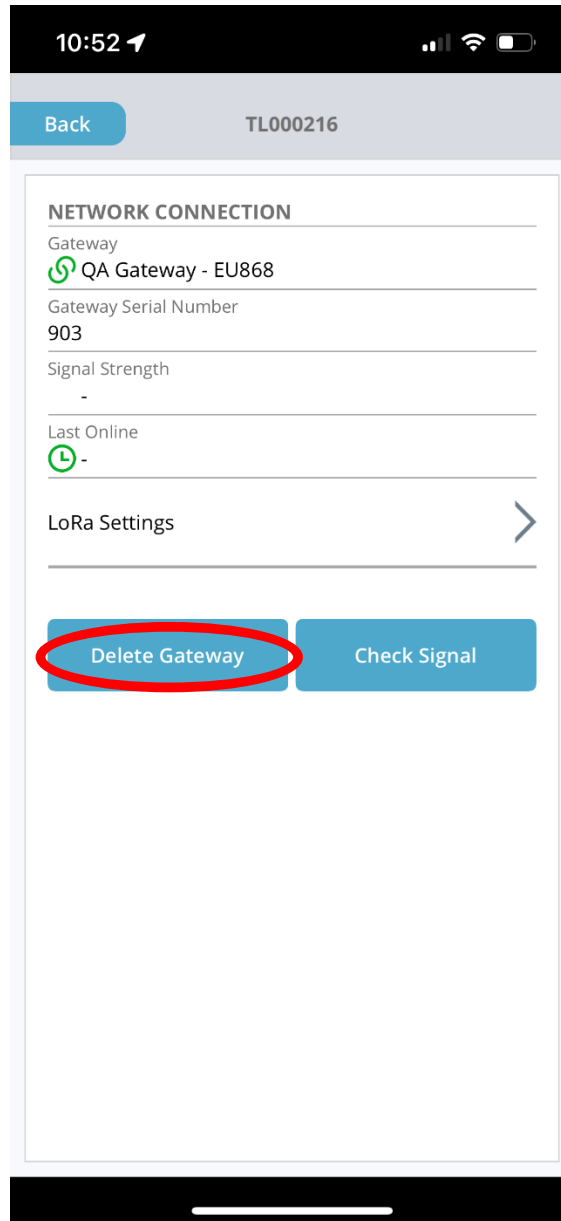
→ **NOTE:** Unclaiming a logger also deletes all previously collected data from the logger. Therefore, it is recommended that the user downloads all logger data prior to unclaiming.

Unpairing the Gateway from the Tilt Logger

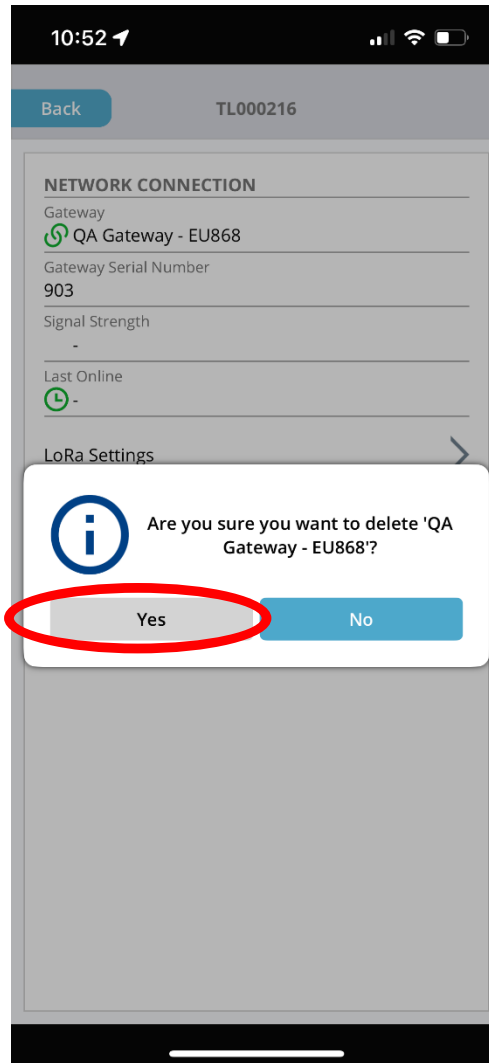
From the Main Dashboard, press the second arrow on the right-hand side corner to navigate to the Network Menu to view Gateway information.



In the Network menu shown, select “Delete Gateway”.



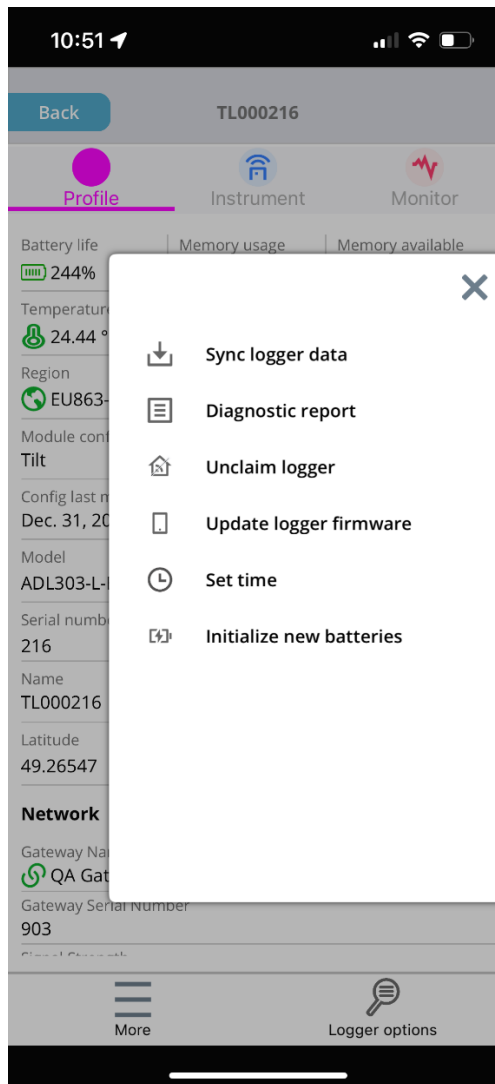
In the following pop-up select “Yes”.



The Tilt Logger is now unpaired from the Gateway. Upon unpairing, the Main Dashboard appears.

Logger Options

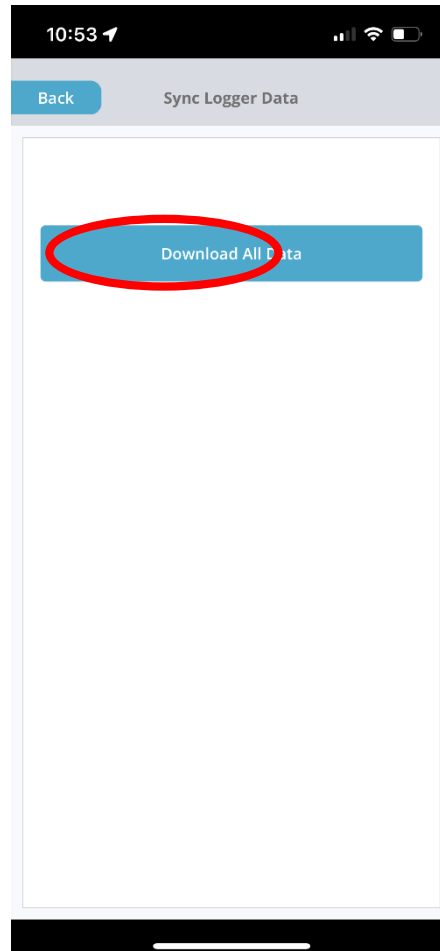
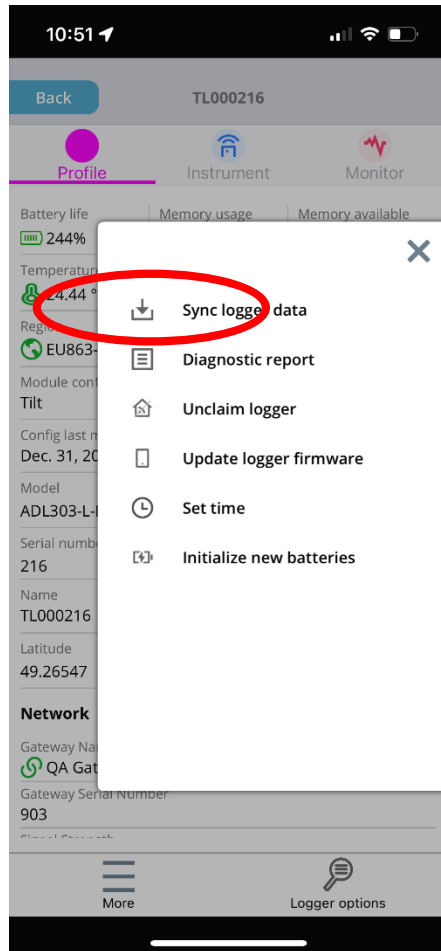
The Logger Options can be accessed by selecting “Logger Options” at the bottom of the main dashboard. The logger options menu allows for the user to download logger data, access diagnostic reports, update the logger’s firmware, update clock time, and initialize the device in the event new batteries are installed.



Downloading Data

From the Logger Options menu, select the “Sync logger data” option.

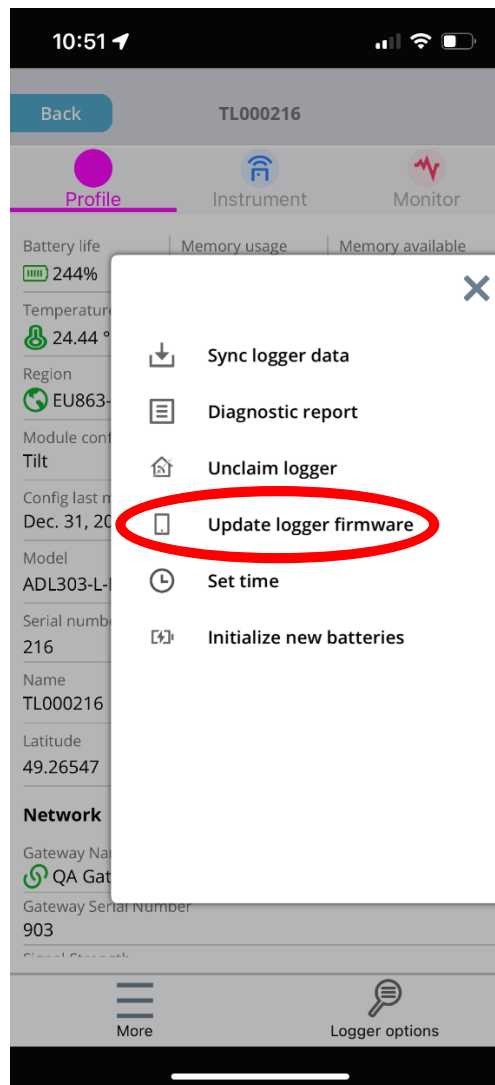
Select “Download All Data” in the window that appears.



Updating Logger Firmware

In the event of a new firmware release, the logger's firmware can be updated wirelessly.

From the Logger Options sidebar select the update Logger Firmware option. This initiates a data transfer between the old and new firmware. This process may take a few minutes to initiate.



Updating Logger's Time

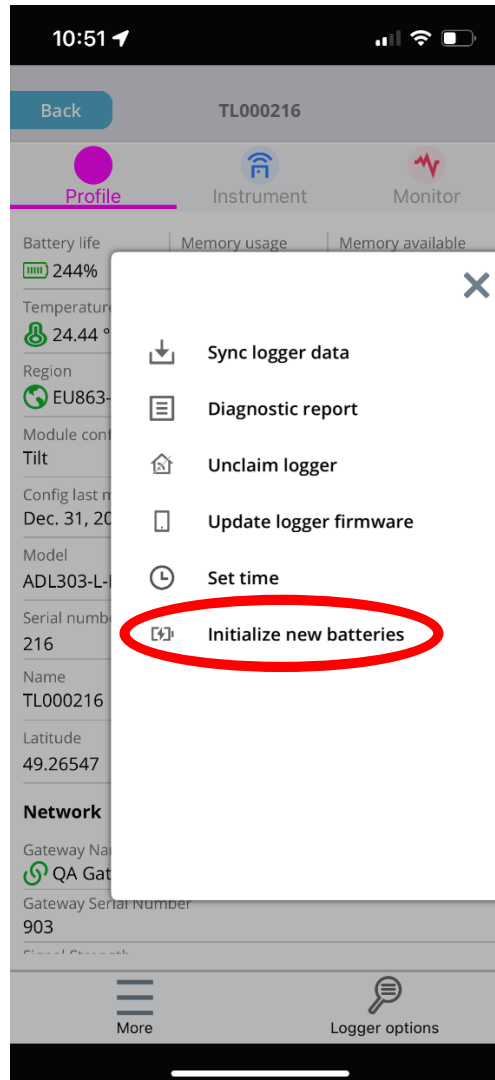
Select "Set Time" option on the logger. A popup will appear. Select "Yes" to update the Tilt Logger's time, to the time stored by the smart device.

Initialize New Batteries

When new batteries are installed, the internal coulomb counter needs to be reset to ensure accurate data on the battery's remaining life.

From the logger options menu, select "Initialize new batteries."

A warning will appear asking the user if they wish to initialize new batteries. Select "Yes".



Press the battery type on the menu in the appearing dialog box. This opens a panel where the user can scroll between compatible battery options and choose the appropriate battery type installed.

When the battery is appropriately chosen, press the "Select" icon. After a loading period, a message will appear confirming the successful initialization of the battery.

Modifying Profile

In the left sidebar, select the “My Profile” option.

The profile information page will appear, allowing the user to view their profile information including name, email address, organization, and job title.

A password field will also be present. To change the username or password, select upper arrows on the pages to select one or the other.

Manuals

Digital copies of the Affinity Tilt Logger manuals and datasheets information are always at your disposal through the app. To access them, select the “Manuals” option. The user will be routed to the RST Webpage describing the Affinity Tilt logger. Product information and pdf copies of the datasheet, and instruction manuals can easily be accessed.

Logging Out

Logging out will sign out the user from the app. Logging out will send them to the starting screen, where they will need to retype their client information and login before being able to access their Affinity Mobile application page.