US HARBORS

TIDES / WEATHER / LOCAL KNOWLEDGE™

COASTAL MONITORING PROGRAM

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Version 1.2 August 26, 2021

US Harbors Coastal Monitoring Pilot Program 2021-22

OVERVIEW:
In partnership with Divirod, a data and technology company that produces affordable tidal and water-monitoring sensors, US Harbors is launching a pilot program to monitor sea-level rise in Maine.

- The program will include 5 sites around the region, with a primary focus on communities in Penobscot Bay, ME.
- These locations will receive tidal data reporting and flooding alert services from Divirod for 6 months free of charge. After the trial period has completed the communities will have the choice to continue with the program at discounted rate. NOTE: Divirod does not charge for the sensors but works on an annual data subscription model based on number of sensors/data feeds, number of users, and types of data being distributed (API feeds are available for larger customers).
- The sensors communicate via satellite and require a power feed that can be either electric and/or solar and need minimal maintenance. Divirod will not be able to supply the solar solution for pilot locations, but it may be purchased if required.
- They stations can be installed either by local resources or the Divirod team, who will be in Maine in September (actual dates TBD).
- US Harbors will be conducting several zoom-based check-ins with the participant communities during the pilot to solicit feedback on the program.

Prosposed Locations:
- **Camden, ME**
- **Rockport, ME**
- **Rockland, ME**
- **Tenants Harbor, ME**
- **Belfast, ME**

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US Harbors and Divirod Make Affordable, Relatively Maintenance-Free, Tide Stations Available to Coastal Communities.

June 21, 2021

By Anastasia Fischer, *President*, US Harbors

The United States has over 95,000 miles of coastline. It includes a wide variety of ecosystems--from major metropolises to untouched wild areas—and encompasses radically different geographic, oceanographic, and weather conditions. Understanding local trends and predicting the hyper-local impacts of sea level rise across such an immense and variable shoreline is a significant challenge.

US Harbors provides tidal data, monthly tide charts, and coastal and marine weather forecasts on over 1,400 harbors in the U.S. It is designed to cover specific coastal conditions, and to help the millions of people who live and work on our coasts (and in the Great Lakes) plan their time on and near the water. We are receiving increasing numbers of calls and emails from users who are surprised by unpredicted tidal flooding in their neighborhoods, and from others asking how their small communities can better understand and plan for the hyper-local changes they are observing in sea level rise and the corresponding coastal erosion.

We are lucky that NOAA, the National Oceanic and Atmospheric Administration, has been measuring and predicting tides since the early 1800's. While early measurement techniques were rudimentary, today's highly engineered tide stations are sensitive enough to measure a wide variety of conditions beyond basic water levels. Impressively, NOAA has nearly 170 years of continuous data on water levels for the Presidio in San Francisco, CA. However, they currently maintain only 200 real-time observational tide (or water level) stations and rely on algorithms to derive tidal predictions for all other locations. While these algorithms are sophisticated and incorporate both historical water-level data and local hydrographies (the 3D mapping of the ocean floor and coastline used for nautical charts), they do not always reflect hyper-local conditions and shorelines as they evolve due to sea level rise and changing weather conditions.

After a year of research on helping small communities with their quest for accurate and dynamic local water level data, our team at US Harbors learned a few important things:

1. **Tide stations are complicated.** They require sensors, power sources, a communication system to transmit the data they collect, a data storage solution/backend to contain the data, and a way for humans to access that data.
2. **Tide stations are expensive.** For local communities with tight municipal budgets, building and maintaining even a simple tide station is out of the question. Tidal stations require significant investment both in infrastructure and in the technical expertise required to install AND maintain the system.

3. **NOAA is limited in budget and human resources.** Due to their large number of other obligations and responsibilities, it is unlikely that NOAA will be able to launch and maintain the number of hyper-local, real-time stations needed by the numerous communities thriving on our 95,000 miles of shoreline.

With rapidly changing coastal weather, rising sea levels, and increasing shoreline erosion, it is urgent that local communities have access to accurate water-level data for their specific location. To meet that need, US Harbors has joined forces with the data services company Divirod, to make highly affordable coastal monitoring and forecast services available to coastal communities around the country. Their proprietary space-edge technology is not intrusive, requires minimal maintenance, and has been extensively correlated with NOAA sources.

The stations are designed for simple installation and consist of a small box and antenna mounted on a pole or dock piling. For versatility, they can be powered by either standard electricity or solar power. Data is collected from the stations via satellites and aggregated by Divirod, who then shares that data with the community through a dashboard and alert system. The system allows the community to view, analyze, and monitor changes in sea level in their exact location, all with minimal investment and maintenance requirements.

> ***About the Technology***
> *Divirod's technology consists of two core components: An IoT device that acts as a passive radar data logger and cloud-based advanced analytics. The passive radar utilizes GNSS (GPS and other) satellite constellations as signal source to collect high-precision data about water and water content around the sensor location. This information is broadcast using LTE wireless network to the cloud, where the raw data is processed using proprietary algorithms in real-time. This processing provides hyperlocal information about water levels, tidal changes, snow/ice, soil moisture, and precipitation for each sensor location. Aggregating this inter-comparable information from a network of sensor locations, over extended periods of time, enables a wide range of actionable insights from improved situational awareness and disaster response to long-term water risk and resiliency planning for businesses and communities.*

Access to real-time, hyper-local water-level data can help everyone on the coast: individuals, businesses, municipalities, and state governments can use this data to understand local and regional water-level trends as they evolve. Most importantly, this type of hyper-local data can help all of us who live on the coast effectively plan for the impacts of storms and sea level rise, thereby making our coastal communities more resilient in the future.

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About US Harbors - https://usharbors.com
US Harbors provides hyperlocal tide information, coastal and marine weather, and coastal news on over 1,400 harbors in the U.S. Used by over 10 million people each year, the service is free and supports itself through advertising. The mission of the company is to promote the sustainability and resilience of coastal communities, both economically and environmentally.

About Divirod - https://divirod.com
Divirod provides data and services that enable short, medium, and long-term resiliency planning and action against water risk. Access is provided as Data-as-a-Service (DaaS) platform through web applications, APIs, reports, and alerts/notifications. All services are designed to provide convenient, timely, global, and affordable data access that ensures ease of use and value for the end-user. Additionally, Divirod enables long-term studies and optimizes modeling of changes in water levels by building up a data repository (data-lake) for big-data analytics.

Additional Resources
https://oceanservice.noaa.gov/education/tutorial_tides/tides10_oldmeasure.html
https://oceanservice.noaa.gov/education/tutorial_tides/tides11_newmeasure.html

EMAIL: anastasia@usharbors.com | PHONE: +1-207-318-9482 | INFO: www.usharbors.com/tidal-network

CALL TO ACTION:

"Why did my property flood this week and not last week? This month, and not last month?"

These questions are becoming more routine across the US and data is not available to address localized water-related risks. Did you know that existing flood detection and monitoring systems are insufficient and your property flood risk is likely just a modeled "guess" on a map? In response to accelerating risk and the lack of hyperlocal environmental water data, Divirod is establishing a flood detection and monitoring network. WE NEED YOUR HELP Our mission is to provide continuous localized and actionable environmental water data to address environmental water risk....stop guessing and start monitoring. Your data will be used to better understand short/long term water risks and resiliency planning/adaptation in the community you live in.

Coastal and Flood Monitoring

Divirod is inviting individuals, communities and businesses, located in areas of ongoing or increasing flood risk, to install a Divirod sensor on their property. We will measure and provide water-level data and flood alerts to each host site for **NO COST**. Contact us today at water.team@divirod.com to learn more about becoming part of the monitoring network and if your host site meets installation requirements.

There is not enough DATA

Our coastline and other inland landforms/waterways are continuously changing. As a result, environmental water datasets continuously change as well. Moreover, existing government-operated, environmental water-level monitoring stations are typically located great distances from your property. Stormwater/tidal models do not provide sufficient localized environmental water risk insight for your property...just one inch of water level can make a difference between being flooded or not. Divirod provides the ability to monitor and measure, rather than just model, localized environmental water risks for your property.

Potential Host Locations

Coastal and adjacent inland properties, adjacent to oceanfront/beach, bays/estuaries, canals, rivers, inlets, and lakes/reservoirs are ideal environmental water monitoring locations. Divirod sensors are very small and can be easily mounted on any existing infrastructure (pole, fence, rooftop, bridges, etc) that is elevated at least 8-10 ft above the area of interest.

Fort Lauderdale, FL

Tierra Verde, FL

Required install height:
antenna at minimum 10ft above water surface
Dimensions:
3 x 6 x 4 in (box) - 4 in diam (antenna)
Weight:
less than 1.5 pounds
Coverage:
1:12 ratio height to distance, circular
Power Consumption:
2-3 W, from 110V outlet plus internal battery
Shipment Includes:
DVS-200 (red eletronics box), DVS-200 mount, 4 inch antenna, antenna mount, (2) 1ft coax ccables, DC power supply (110V AC input)

The aggregated data gathered at all host locations will provide unique insights into forecasts and resiliency planning to help protect your community.

water.team@divirod.com

DIVIROD TIDAL MONITOR

Marinas are vital to the movement of people and commerce across cities, states, and countries. Additionally, marianas provide dock security and boat services. Tides and weather can impact marinas and waterways causing damage to boats, docks, and business, as well as prevent access to necessities like shelter, water, and fuel. Boat captains encounter navigational challenges attributable to weather conditions, tides, and waves. Docked boats also bear the challenge of anchoring, mooring, and docking with large tidal swings, king tides, and weather events. Divirod provides 24/7 hyperlocal tidal data for both marina operations staff and boat captains to combat these challenges.

What is Divirod Tidal Monitor?

Divirod Tidal Monitor is a monitoring, predictive, and early warning system installed at a marina to provide boat captains and marina operations with tidal level, range, and predictions, as well as wave height. This industry-leading service provides:

Safe Operations 24/7. Marinas are vital to commerce and everyday life. They are directly affected by tides and conditions can be different across a stretch of coastline. This system monitors tidal information locally day and night, and during weather events. The Divirod Tidal Monitor provides an automatic and continuous watchdog remote service accessible through your mobile device.

Non-intrusive instrumentation with maintenance. The sensing instrumentation is deployed in a marina to provide unique tidal information, wave height, or other water-derived anomalies. The instrumentation operates on its own and does not require any user intervention or maintenance.

Accurate, hyper-local information available at your fingertips. Getting the right information at the right time is vital to ensure boat safety and confident planning. Our system delivers intelligent warnings and alerts that enable decision-making before a crisis occurs. Machine learning algorithms complement the suite of information with forecasts and reports to aid in planning.

Results:

- Increased safety, confidence, and knowledge.
- Data insights for safe port and dock entry.
- Added real-time water levels to charts.
- Fully automatic, remote, and 24/7 multi-point monitoring.
- Damage avoided from real-time hyper-local information.

Technology Highlights:

A Whole New Way to Measure

Our technology establishes superior and reliable accuracy through the ultra stable signals of satellite constellations and offers consistent performance anywhere in the world.

Millimeter Precision Data and Insights

We deliver easy to understand information, reliable data, and direct access to information without the need to calibrate.

Real Time Monitoring and Alerts

We offer certainty, by delivering actionable real-time tidal data through intelligent dashboards.

Around the Clock Operation

We provide 24/7 availability, continuity of operations/service, and continuous access to near real-time, accurate tidal data.

sales.team@divirod.com

Sensor Location Guidelines

South Facing

- Reflected radar data captured from the GPS satellite constellation
    - Provides largest set of reflected radar data, with greater frequency
- North Facing = Smaller and less frequent set of reflected radar data due to fewer satellites (opposite is true if located in the southern hemisphere).

Unobstructed Field of View

- Provides the highest level of accuracy and precision, without additional reflected radar data processing.

Stationary Installation/Mounting Location

- Installation/Mounting location must be fixed during throughout the data capture period
- Minimum installation height of 10 feet (3 meters) above surface to be measured
- Increase height of installation provides increased capture/processing of reflected radar data
    - Results in a greater area for analysis and data reporting.
    - Area of interest to be measured should be less than 300 feet from installation location, in general.

Power Source

- Uninterrupted
- 110v Outlet/Hardwired (grid power)
- Solar Power

Communications

- 4G Cellular or WiFi coverage

Examples

Bad location: southern view for the sensor is towards a large bridge that would cause an interference.

Bad location: very small field of view with obstruction from boats, land, and docks.

Good location: clear southern and western field of view.

Good Location: clear, southern facing field of view.

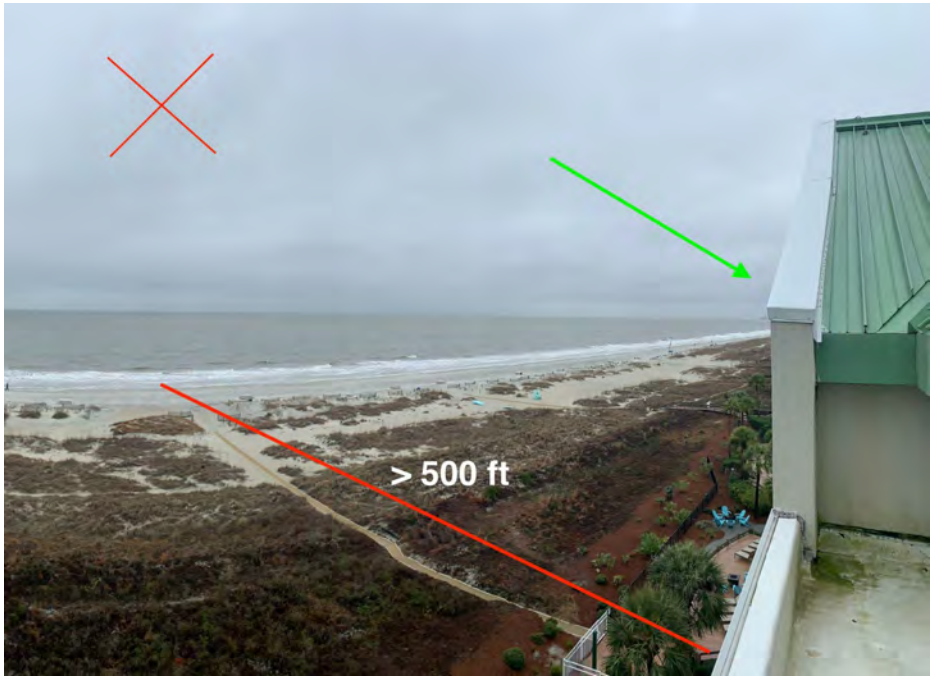
Bad location: northern facing, small field of view with boat obstructions.

Good location: clear field of view to the water with no obstructions.

Good location: clear field of view to the south with power source.

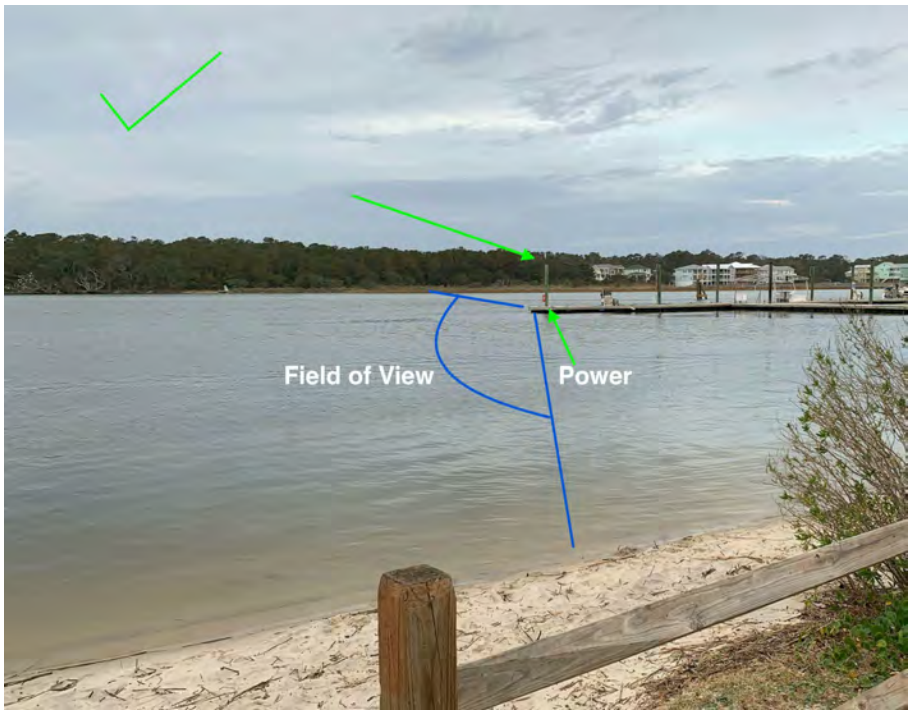
Bad location: obstructions in the field of view of the water.

Bad location: obstructions in the field of view towards the water.



Bad location: good field of view, but too far from the water.

divirod



Good location: clear field of view with a power source.

DiviSense™ DVS-200

Installation Guide

1. Handling Precautions

If these handling precautions are not followed, there is a big risk of damaging the unit

- Handle the unit with care as any impacts to the unit could cause internal damage.
- Don't push on the LED lights on the bottom of the unit as these will push in and cause internal damage.
- Don't overstretch the cable from the antenna to the electronics box as this could cause damage to the unit or the wire.
- Don't overstretch the cable to the transformer as this could cause damage to the unit or the wire.
- Be careful when tightening bolts and screws

2. Check Contents and Verify Location

Look over the Packing List to make sure you have all items for installation.

Verify the installation location and mounting previously agreed upon with a divirod representative or divirod partner.

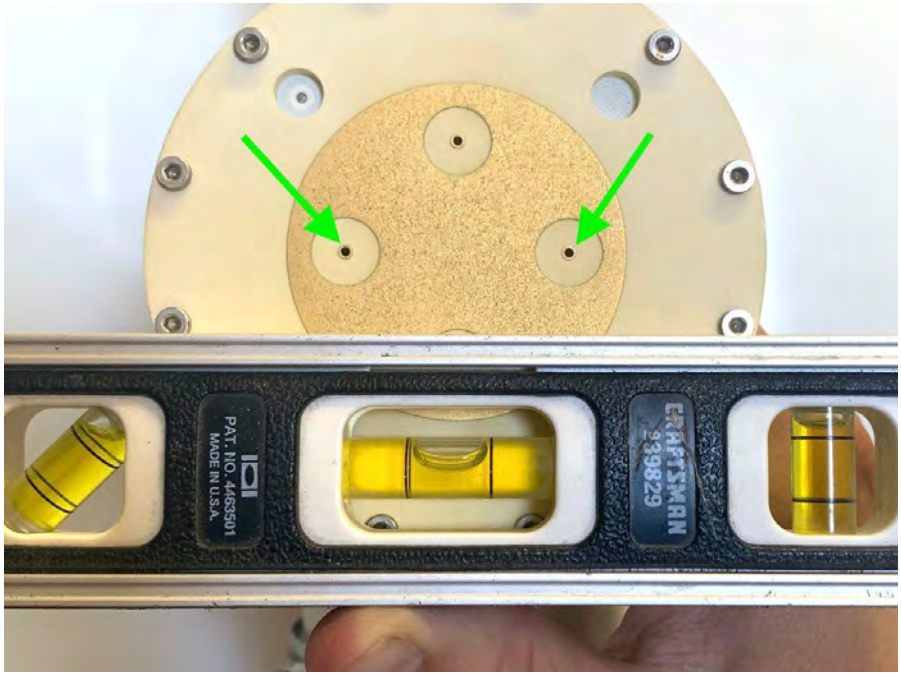
3. Mounting The Unit

Follow the instructions to mount the unit on a new or existing pole or instructure. With the adjustable bands, units can be installed on a variety of poles and objects of different shapes and sizes. If you have questions about a mounting location please contact divirod at support@divirod.com or your divirod representative.

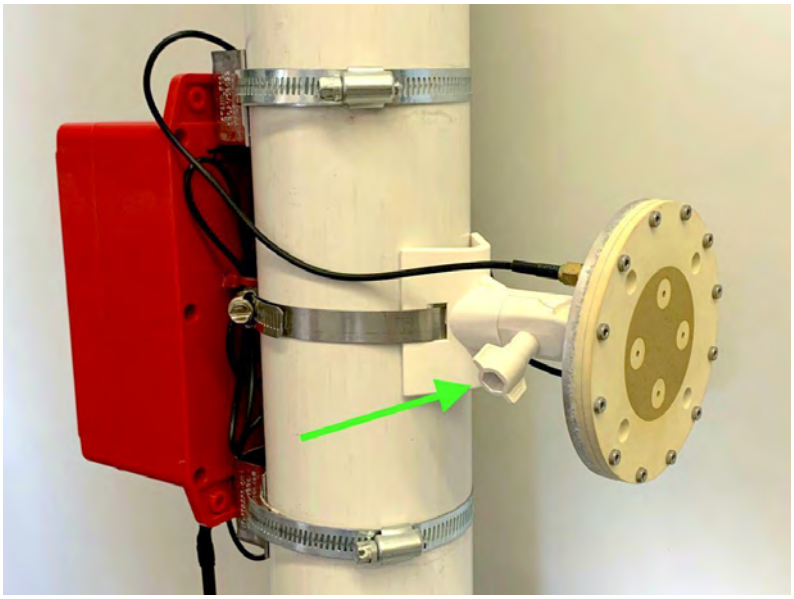
To attach the sensor unit to the mounting pole please follow the steps below:

- **Antenna**
  - Verify the antenna has been properly screwed onto the mount.
  - Loosen the hose clamp to open the band.
  - Wrap the hose clamp around the pole at the predetermined height.
    - Tighten the hose clamp around the pole so the mount won't move.

- Once the mount is secure, check for level on the antenna face.
- Use a level between the two holes as shown below



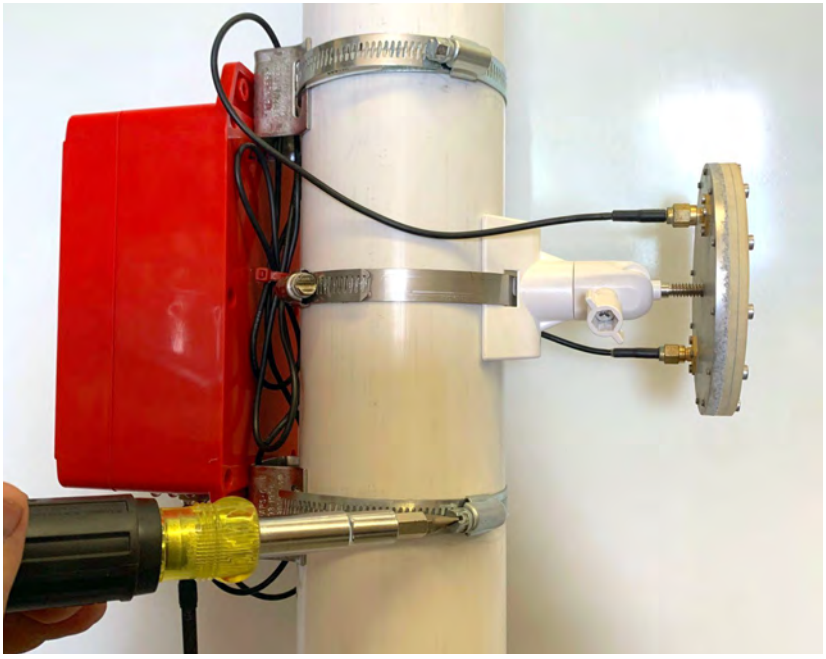
- Once this is level, tighten the mounting bolt handle until there is no movement of the antenna.



- After everything is tightened, verify the unit is level again.
- Measure from the center of the antenna to the ground or water level(if available).
- Record the heading of the sensor face (e.g. 0-360˚)
- Record these measurements in the divirod Installation Form

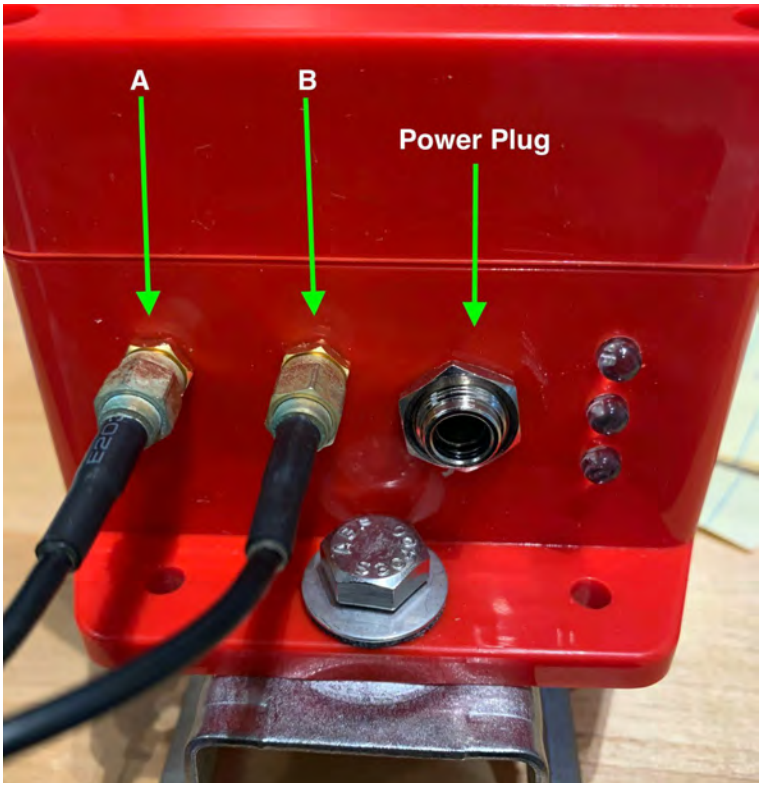
- **Red box**

- Verify the red box has been secured to the mounts using the (2) bolts.
- Loosen the hose clamps to open the band.
- Wrap the hose clamp around the pole with one band above and one below the antenna band. This way the red box and the antenna are facing opposite directions. If the mounting pole is too wide for the antenna cabling to reach the red box, the red box can be mounted to the side or above the antenna.

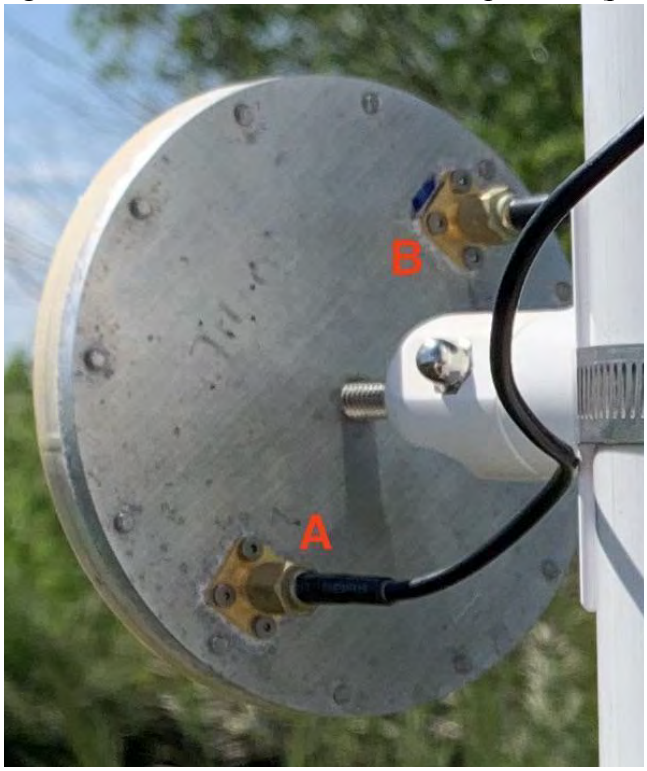


- Thigh the hose clamps until the red box is secure and can't move.

- **Cabling**
  - Hand tighten (1) coax cable on the port "A" of the red box(pictured below).



- Hand tighten the same cable to the antenna port “A”(pictured below).



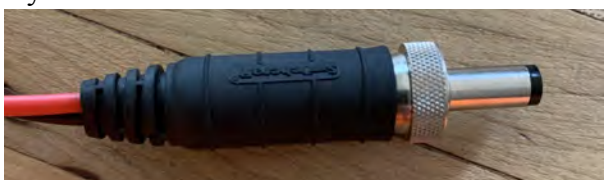
- Repeat the steps for the “B” ports with the other coax cable
- Secure the extra cable with zip ties on the pole

- **Mounted Unit**

4. Power

- **Transformer**
  - Using the provided transformer, connect the red and black connector on the transformer with the red and black connector on the wire harness with the barrel plug. Plug in the other end of the transformer with the 2-prong outlet plug into a 120V outlet.

- **12V DC Power**
  - Use the provided barrel connector and wire to connect to the 12V DC power system you will be using with a waterproof connection. The positive wire is marked by the red connector.



5. Powering The Unit

Once the unit is mounted, attach the power supply from the power source by plugging in the jack and securing the nut. Make sure the barrel plug is pushed in as far as it will go before tightening the nut. Then hand tighten the nut. DO NOT OVERTIGHTEN the nut as the internal components may be damaged.

Once power is provided to the DVS-200 the red LED light will come on. Then the blue and red LED lights will come on as the unit is now acquiring the position. This process could take up to 2 minutes to complete. Once the signal is acquired, the green and blue LED lights will alternate, which displays that the unit is in measurement mode and is collecting data.

Confirm that the unit is secure, all wires secured to the pole, the field of view is correct, and the unit is still collecting data (alternating green and blue LED blinking pattern). Once

these items have been confirmed and the Installation Form has been filled out and submitted, the installation is complete.