

uAvioni 

VEKTOR

User and Installation Guide



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1 Revision History

| Revision | Date | Comments |
|----------|----------|---------------------------|
| A | 1/10/17 | Initial release |
| B | 5/29/18 | Squitter Map Instructions |
| C | 4/4/2019 | Input power requirements |

2 Warnings / Disclaimers

All device operational procedures must be understood prior to operation.

Received traffic information is to be used as an aid to situational awareness and is merely supplemental and advisory in nature.

uAvionix is not liable for damages arising from the use or misuse of this product.

This equipment is classified by the United States Department of Commerce's Bureau of Industry and Security (BIS) as Export Control Classification Number (ECCN) 7A994.

These items are controlled by the U.S. Government and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. government or as otherwise authorized by U.S. law and regulations.

3 Limited Warranty

uAvionix products are warranted to be free from defects in material and workmanship for two years from the installation in the vehicle. For the duration of the warranty period, uAvionix, at its sole option, will repair or replace any product which fails under normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost.

This warranty does not apply to cosmetic damage, consumable parts, damage caused by accident, abuse, misuse, water, fire or flood, lightning, damage caused by unauthorized servicing, or product that has been modified or altered without the express written consent of uAvionix.

IN NO EVENT, SHALL UAVIONIX BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE, MISUSE OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

Warranty Service

Warranty repair service shall be provided directly by uAvionix.

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5 Introduction

The uAvionix Vektor is an ICAO Annex 10/RTCA DO-260B compliant Mode-S ES transponder designed specifically for installation and use on vehicles operating inside an airfield and the aircraft movement area.

Installation is simple with included magnetic mounting hardware for temporary or non-penetrating positions, or as a hard-mounted unit to the vehicles roof structure. With a simple wiring harness that allows for permanent connections to the vehicle 12VDC electrical system or via a cigarette lighter adaptor for ease of portability, the unit can be installed and configured in minutes on any commercial, industrial or military vehicle.

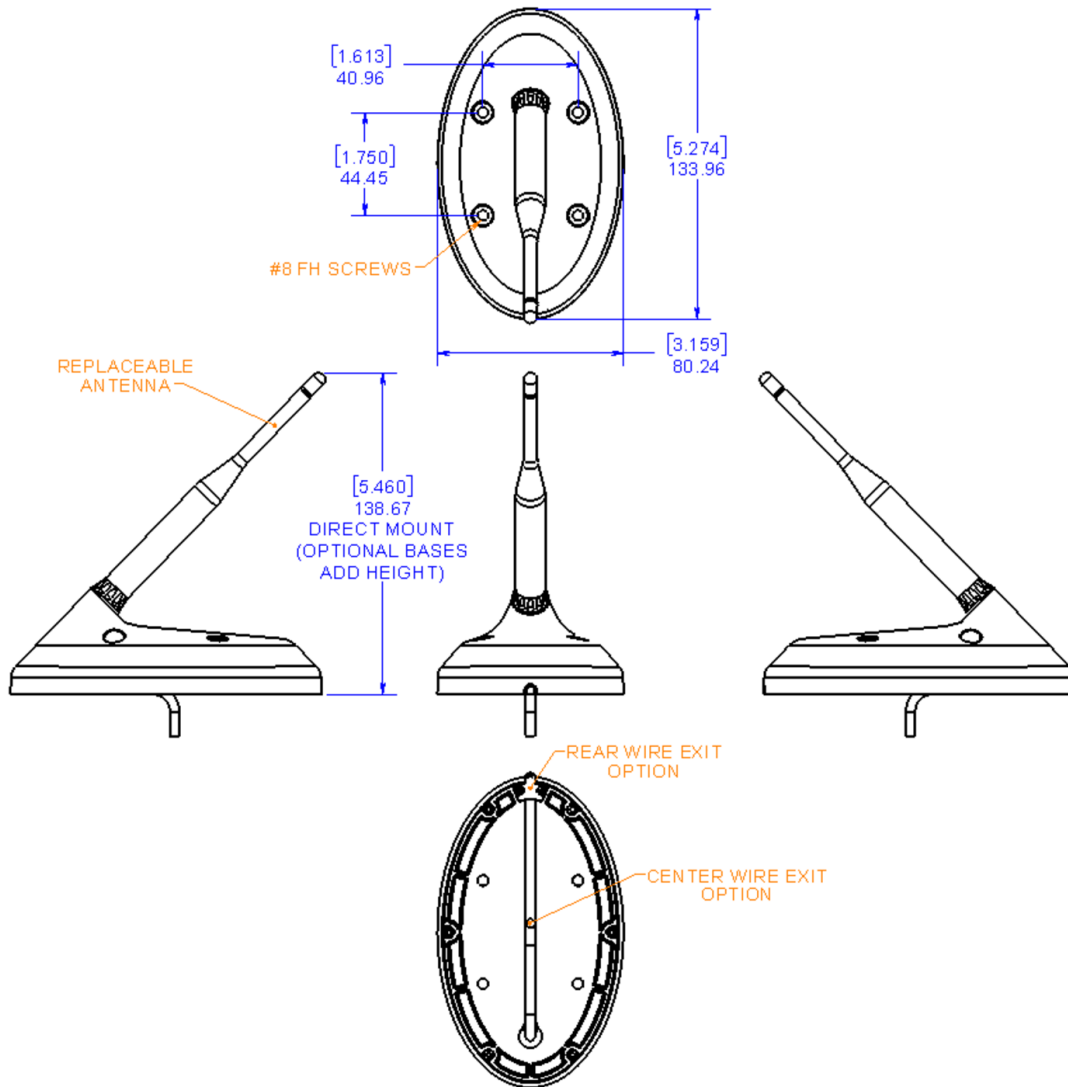
The Vektor provides improved visibility by controllers of the position of vehicles at airfields equipped with multilateration, ADS-B and primary radar systems by more accurately providing the position of the vehicle and the identification/call sign on the controller's surface display. Safety and security are further improved when interfaced with the uAvionix pingStation dual-band ADS-B receiver and situational awareness surface displays.

6 Features

- SBAS-enabled GPS receiver and Mode S Extended Squitter ADS-B for highly accurate, reliable positioning
- Integrated 1090MHz and 978MHz/UAT receiver
- Low power consumption for connection to accessory power outlet
- IP67 enclosure for weather protection
- Magnetic or fixed/penetration mounting
- Field configurable via secure WiFi

6.1 Mechanical Specification

Vektor consists of an electronics unit and an antenna assembly. Vektor can be permanently mounted or temporarily magnetically mounted.



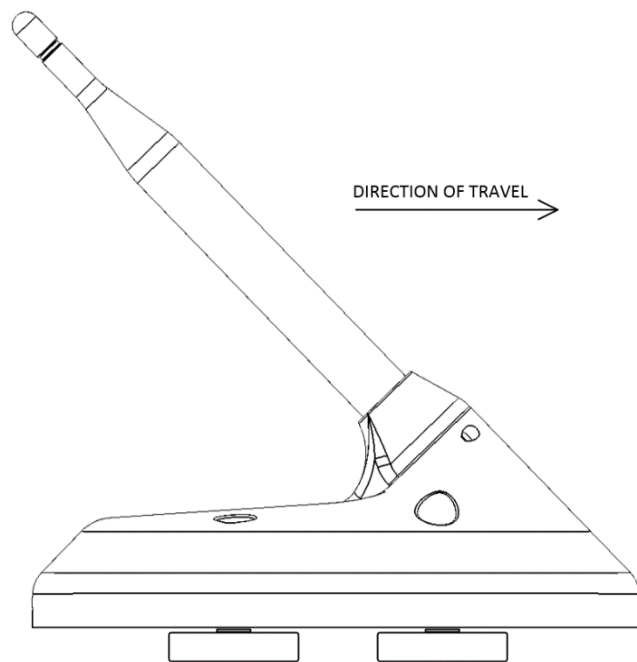
7 Installation

7.1 Magnetic Mounting

The Vektor comes with strong rare earth magnetic mounts designed specifically to hold the unit in place at speeds up to 165 kmh (100 mph). This ensures that the transponder may remain installed during normal airfield operations or when the vehicle is operating on public motorways.

To mount the transponder, ensure that roof of the vehicle is made of metal, magnetic mounts will not attach with sufficient force to fiber glass or aluminum roofs. In addition, before placing the unit on the roof, ensure that the area is clean of dust, debris or rust. To ensure proper contact with the roof, the area of the roof should present a flat, uniform surface. Areas with ridges and irregular contours should be avoided.

To minimize unnecessary wind loading of the unit, align the unit to the front of the vehicle or the primary direction of travel. In addition, to ensure GPS accuracy and minimize time to position lock, the unit should have a clear line of sight to the sky. To mitigate reflections or blocking of 1090 MHz transmissions, the unit should be a minimum of 12 cm from other roof mounted equipment such as warning lights, and 50 cm from other radio frequency emitting antennas.



The power cable from unit will protrude from the bottom of the unit and the magnetic mounts provide sufficient clearance for the cable. The area where the cable makes entry into the unit has been weatherproofed to ensure compliance with IP67 moisture and dust penetration standards.

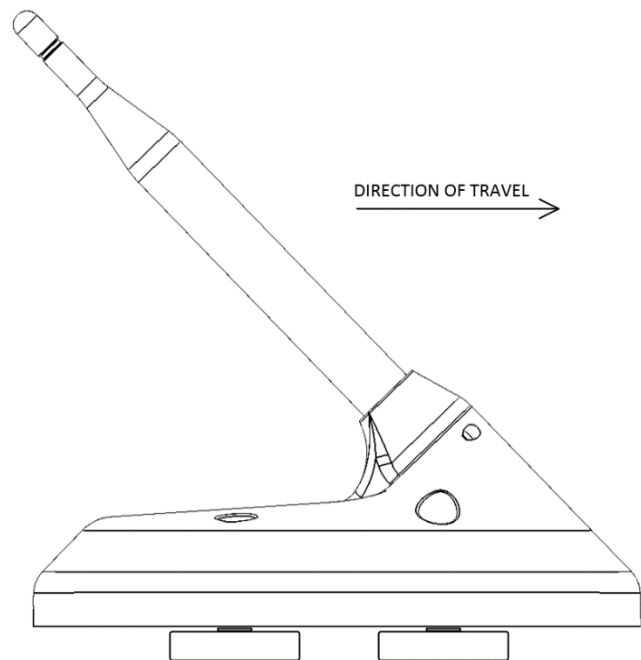
uAvionix recommends the use of a cable guard to protect the cable as it enters the passenger compartment through the weather stripping of the door or window. Contact your specific vehicle manufacturer/dealer for recommendations designed for your make and model.

The cable is then attached to the power supply, per the guidelines in section “Connection to Vehicle Electrical System”.

7.2 Fixed / Penetration Mounting

The Vektor has been designed to allow for permanent installation on the surface of a vehicle and for all wiring to be introduced through the interior of the passenger compartment.

Identify the best suited location for the unit. To minimize unnecessary wind loading of the unit, align the unit to the front of the vehicle or the primary direction of travel. In addition, to ensure GPS accuracy and minimize time to position lock, the unit should have a clear line of sight to the sky. To mitigate reflections or blocking of 1090 MHz transmissions, the unit should be a minimum of 12 cm from other roof mounted equipment such as warning lights, and 50 cm from other radio frequency emitting antennas.

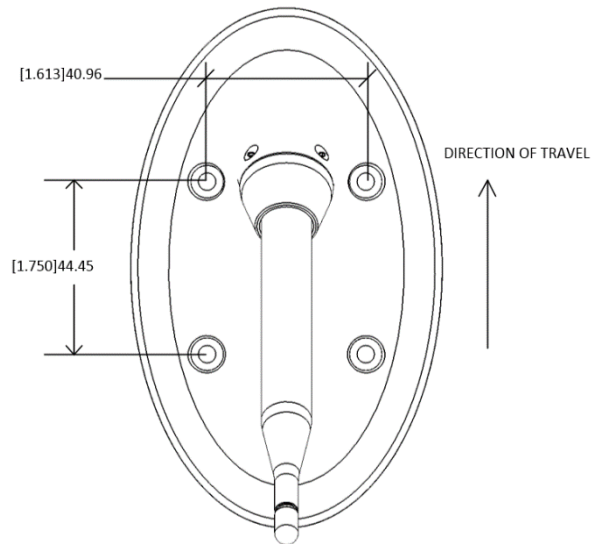


Remove the vehicles passenger compartment roof liner and expose the underside of the roof. Use care when disconnecting electronics such as overhead lights and securing clips.

Verify the area is clear of vehicle structural elements or electronics in the area immediately below the desired Vektor installation point.

Use masking tape to cover an area 100 mm by 200 mm on the exterior of the roof at the desired installation location.

Using the hole pattern in the drawing below and four #8 flat-head screws of the appropriate length to fasten Vektor to the vehicle, mark the location of the four bolt penetrations and that of the cable opening. Ensure proper alignment of the unit to the direction of travel.



Use appropriate power tools to create penetrations through the vehicle roof for the four mounting bolts and cable entry.

Remove protective tape from the roof of the car, exposing the openings. Remove all traces of glue and dust from the roof and allow to dry before continuing to next step.

Place a bead of silicone sealant around the base of the unit, ensuring that a complete ring of silicone is made on the bottom of the unit.

Pass the units wiring harness through the center opening and position the unit to align the four mounting bolts to the four bolt openings on the roof.

Lower the unit to the roof evenly ensuring that an even seal is made between the Vektor unit and the roof of the car with silicone between them.

Tighten the enclosed bolts and washers from the underside of the vehicle roof to a force of 15 Nm.

Apply a thin bead of silicone around the entire base of unit and the roof and smooth with a slightly damp finger to remove excess.

To allow for proper curing of silicone based sealants. Installation should be performed when weather conditions will remain free of rain, fog or

condensation for a period of 24 hours. Failure to provide for proper curing of the silicone, may result in an improper seal of the area and leaks may occur in the passenger compartment.

Place electrical cable in most appropriate and convenient manner from the roof penetration to the electrical source and secure with plastic or metal tie wraps to minimize rattles during operation.

The cable is then attached to the power supply, per the guidelines in section “Connection to Vehicle Electrical System”.

7.3 Connection to the Vehicle Electrical System



ABSOLUTE MAXIMUM DC VOLTAGE GREATER THAN 36 Vdc WILL CAUSE PERMANENT DAMAGE TO THE EQUIPMENT

Vektor shall be connected to the vehicle electrical installation via the supplied wiring harness. Wiring harness is comprised a single 3 meter, solid copper, 2 lead, 16 gauge cables with each Vektor. Use a 1 Amp circuit breaker for power supply protection to the Vektor.

| Wire Color | Function |
|------------|----------------|
| Red | Vehicle Power |
| Black | Vehicle Ground |

The external sheath of the supplied cable is tough, shear-resistant and resistant to mineral oils and abrasion. During the installation, it is necessary to ensure the bend radius of the cable is no greater than a minimum bend radius of 22mm.

For units equipped with a cigarette lighter adaptor terminated wiring harness, the electrical installation is simply to plug the adaptor into the cigarette lighter.

Please note that some vehicles only provide power to the cigarette lighter adaptor when the vehicles master electrical system is switched to “ON” by the ignition key. Other vehicles provide power to the cigarette lighter regardless of the position of the ignition key. It is important to know what type of system your vehicles is equipped with to understand when the transponder will be powered and broadcasting.

8 Configuration

Configuration of the Vektor is simple with the uAvionix Echo App for iOS or Android.

8.1 Install

Install the uAvionix Echo App from either the Apple App store or Google Play.



8.2 Connect

Vektor contains an integrated Wi-Fi radio for configuration and connectivity to display applications. At power up the Wi-Fi connection is active for 120 seconds. After 120 seconds access via Wi-Fi is disabled.

Join your mobile device to the wireless network named **Ping-XXXX** using the procedure for your device. If required, the WPA passphrase is uavionix. The process for iOS is shown below.

Go to Settings > Wi-Fi, and verify Wi-Fi is turned on.

Tap the SSID Ping-XXXX, where XXXX is a random string i.e. Ping-1E75.

If required, enter uavionix as the WPA password for the secure Wi-Fi network, then tap Join

Once your device is connected proceed.
Note: A message indicating no internet connection available is normal when connected to Vektor.



8.3 Program

Launch the **uAvionix Echo** application and complete the fields as required for your device/vehicle.

Selected Device Type: Choose Vektor.

Control: This setting controls device transmit functions. The selections available will depend on the device type selected.

TX enabled: Transmit ADS-B message enabled, receive is also enabled.

RX Only: ADS-B out disabled.

Standby: Transmit and Receive Disabled.

ICAO: Enter the ICAO Number of the Vehicle in Hexadecimal format.

Call Sign: Enter the tail number of the vehicle. (A-Z 0-9)

Emitter: This should be set to the vehicle type, either SURFACE VEHICLE or SURFACE EMERGENCY VEHICLE.

Vehicle Length: Select the length value in meters that matches the vehicle.

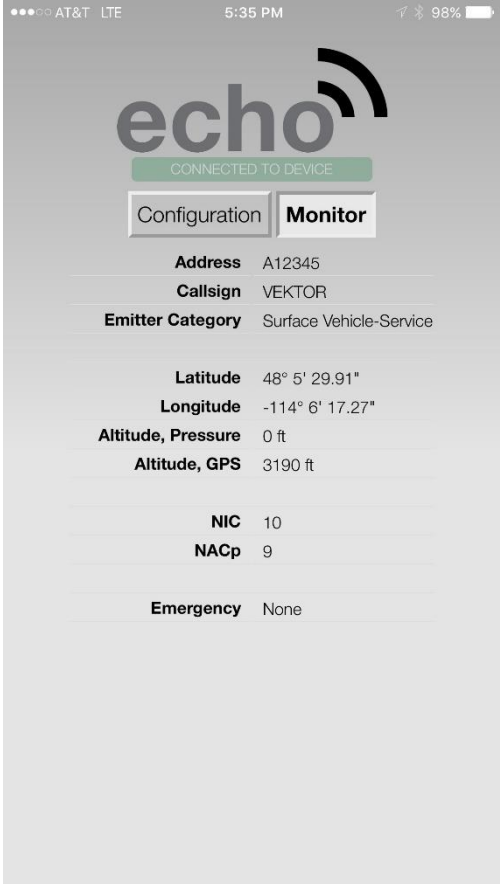
Vehicle Width: Select the width value in meters that matches the vehicle.

GPS Antenna Offsets (optional): Choose the lateral and longitudinal offset in meters from the front of the vehicle.

After completing all data fields click the **Update** button.

The screenshot shows the 'echo' application interface. At the top, there's a status bar with 'AT&T', '6:39 PM', and '97%' battery. Below the app name, a yellow banner says 'PLEASE CONNECT TO ECHO-XXXX WI-FI NETWORK IN SETTINGS'. There are two tabs: 'Configuration' (active) and 'Monitor'. Under 'Selected Device Type', a dropdown menu shows 'Vektor'. The 'Transceiver Configuration' section includes: 'Control' dropdown set to '1090ES TX enabled'; 'ICAO Number (hex)' text field with 'A12345'; 'Call Sign' text field with 'VEKTOR'; 'Emitter Category' dropdown set to 'Surface Vehicle - Emerg'; 'Vehicle Length (meters)' dropdown set to 'L ≤ 15'; 'Vehicle Width (meters)' dropdown set to 'W ≤ 23'; 'GPS Antenna Offset, Lateral from roll axis (meters)' dropdown set to '0'; and 'GPS Antenna Offset, Longitudinal aft from aircraft nose (meters)' dropdown set to '0'. An 'Update' button is at the bottom.

The **Monitor** tab allows the installer to check the operation of the internal GPS system. Note that the Altitude, Pressure reading will always be zero.

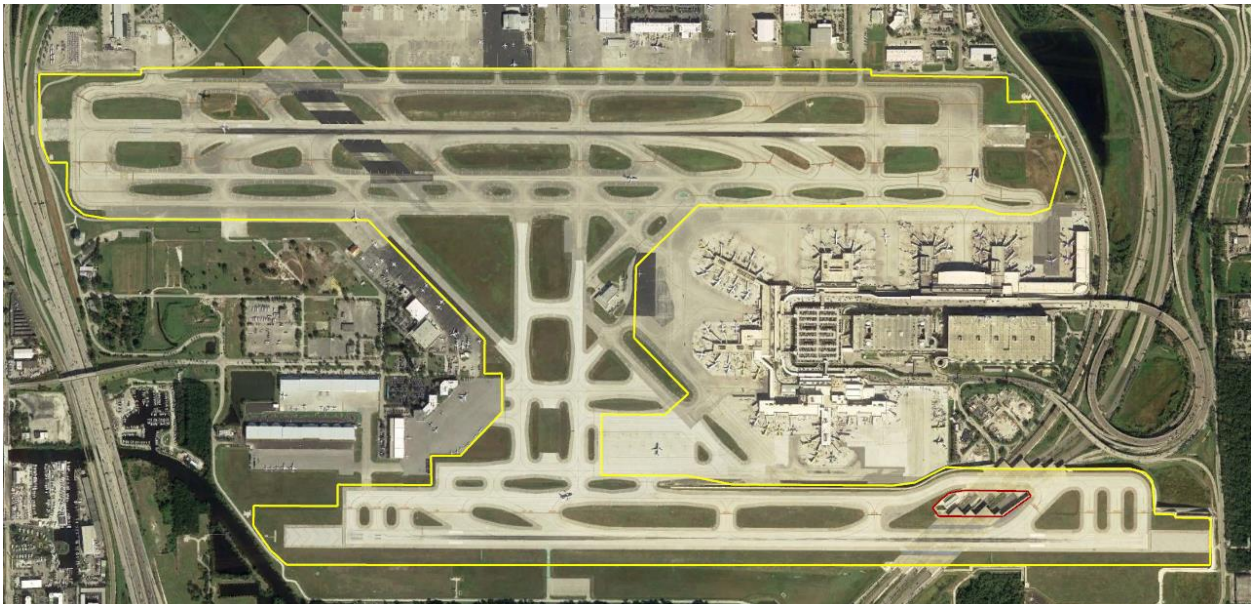


9 Squitter Maps

Vektor can intelligently transmit when traveling in sensitive areas and automatically stop transmitting in low-risk areas using a squitter map. A squitter map is a KML file containing both transmit inclusion and exclusion zones. Vektor will transmit when the device is located in an inclusion zone and cease operation when it is outside the inclusion zone or when it is located inside an exclusion zone.

A valid squitter map must contain a single closed geofence or polygon labeled as Inclusion Zone. Additional closed shapes can be placed inside the inclusion zone and labeled as an Exclusion Zone. Subsequent zones should be named Exclusion Zone 01, Exclusion Zone 02, etc.

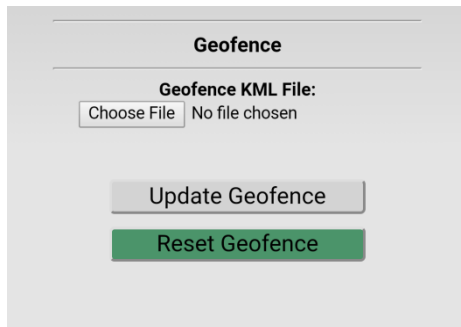
A screenshot of an example is shown below.



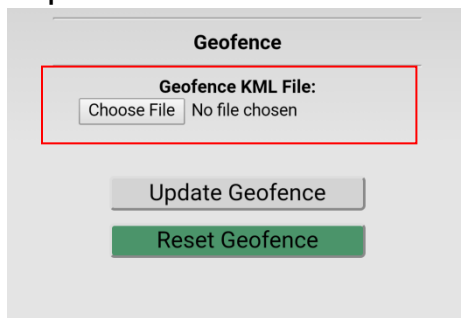
The yellow polygon above is an example inclusion zone and the red polygon represents an exclusion zone.

9.1 Uploading a Squitter Map

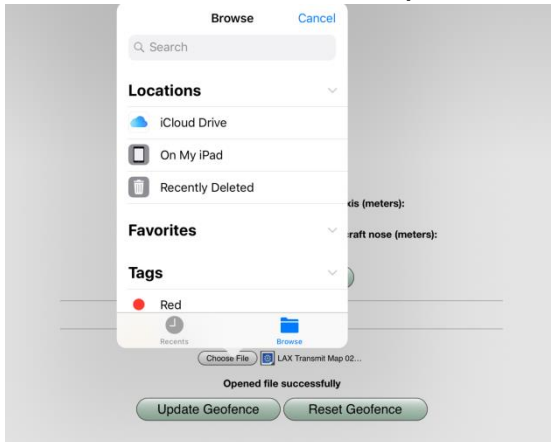
1. Copy the desired KML file to your mobile device. Since the mobile device will be connected to Vektor during this process, the KML file cannot be stored in the cloud and must be stored on the mobile device.
2. Power on Vektor.
3. Connect to the Vektor Wi-Fi as shown in section 8.2 *Connect*.
4. Open the Echo mobile application.
5. Scroll down to the Geofence section of the application.



6. Tap Choose File.



7. Browse to the desired squitter map and select it.



8. Tap Update Geofence.

9. A confirmation message should appear.



After upload a full system test should be performed to verify Vektor is functioning correctly with the squitter map.

9.2 Clearing a Squitter Map

1. Power on Vektor.
2. Connect to the Vektor Wi-Fi as shown in section 8.2 *Connect*.
3. Open the Echo mobile application.
4. Scroll down to the Geofence section of the application.
5. Tap Reset Geofence
6. A confirmation message should appear.



10 Normal Operation

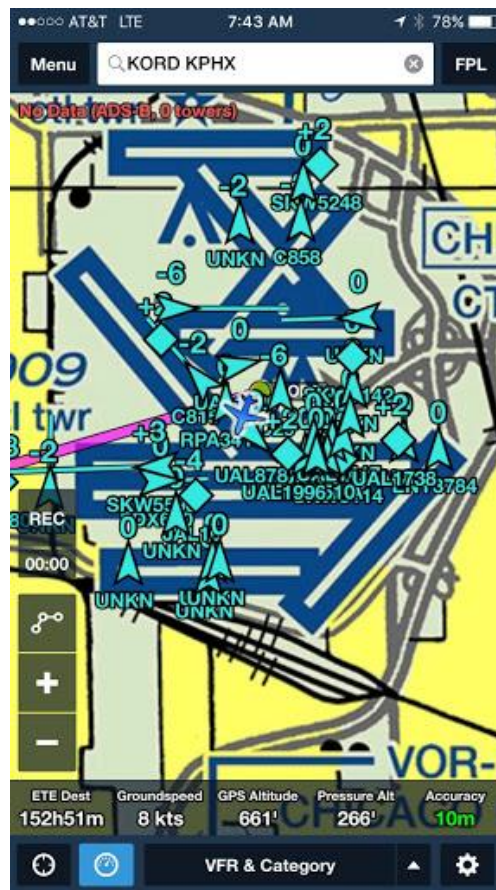
Vektor is compatible with IOS, Android and PC based GDL 90 compatible Electronic Flight Bag (EFB) applications.

Vektor must be connected to the device as described in section 8.2.

Configure the EFB application as necessary to access the device. In most applications, Vektor will be automatically detected.

ADS-B traffic and flight information should begin streaming to the application when in range.

ForeFlight displaying ADS-B traffic from Vektor is shown below.



11 Technical Parameters

11.1 Extended Squitter Messages

Vektor operates in two transmitting modes: Stationary and Moving.

Vehicle Stationary (the vehicle is stationary – position was changed by no more than 10m for a period of 30s).

| Schedule (ms) in a 10 sec Period | Cumulative Seconds | DF18 Extended Squitter Message |
|-------------------------------------|-----------------------|--------------------------------|
| 700 | 0.7s | AIRCRAFT EMERGENCY STATUS |
| 200 | 0.9s | AIRCRAFT IDENTIFICATION |
| 300 | 1.2s | AIRCRAFT EMERGENCY STATUS |
| 300 | 1.5s | SURFACE POSITION |
| 300 | 1.8s | AIRCRAFT OPERATION STATUS |
| 700 | 2.5s | AIRCRAFT EMERGENCY STATUS |
| 900 | 3.4s | AIRCRAFT EMERGENCY STATUS |
| 900 | 4.3s | AIRCRAFT EMERGENCY STATUS |
| 700 | 5.0s | AIRCRAFT EMERGENCY STATUS |
| 900 | 5.9s | AIRCRAFT EMERGENCY STATUS |
| 300 | 6.2s | AIRCRAFT EMERGENCY STATUS |
| 300 | 6.5s | SURFACE POSITION |
| 300 | 6.8s | AIRCRAFT OPERATION STATUS |
| 700 | 7.5s | AIRCRAFT EMERGENCY STATUS |
| 900 | 8.4s | AIRCRAFT EMERGENCY STATUS |
| 900 | 9.3s | AIRCRAFT EMERGENCY STATUS |
| 700 | 10.0s | AIRCRAFT EMERGENCY STATUS |

Vehicle Moving

| Schedule (ms) in a 5 sec Period | Cumulative Seconds | DF18 Extended Squitter Message |
|------------------------------------|-----------------------|--------------------------------|
| 400 | 0.4s | SURFACE POSITION |
| 100 | 0.5s | AIRCRAFT EMERGENCY STATUS |
| 300 | 0.8s | SURFACE POSITION |
| 200 | 1.0s | AIRCRAFT IDENTIFICATION |
| 300 | 1.3s | SURFACE POSITION |
| 200 | 1.5s | AIRCRAFT EMERGENCY STATUS |
| 400 | 1.9s | SURFACE POSITION |
| 100 | 2.0s | AIRCRAFT OPERATION STATUS |
| 200 | 2.2s | SURFACE POSITION |
| 300 | 2.5s | AIRCRAFT EMERGENCY STATUS |
| 400 | 2.9s | SURFACE POSITION |
| 100 | 3.0s | AIRCRAFT EMERGENCY STATUS |
| 500 | 3.5s | SURFACE POSITION |
| 300 | 3.8s | SURFACE POSITION |
| 200 | 4.0s | AIRCRAFT EMERGENCY STATUS |
| 400 | 4.4s | SURFACE POSITION |
| 100 | 4.5s | AIRCRAFT OPERATION STATUS |
| 200 | 4.7s | SURFACE POSITION |
| 300 | 5.0s | AIRCRAFT EMERGENCY STATUS |

11.2 Technical Parameters

| Parameter | Value |
|------------------------------------|--|
| Carrier Frequency | 1090MHz \pm 1MHz |
| Output Power | 20W |
| Pulse and Spectral characteristics | DO-260B Annex 10, Vol.4 |
| Output Message rate | Annex 10, Vol.4 |
| Output Message Format | DO-260B DF18 <ul style="list-style-type: none"> - Extended squitter surface position - Extended squitter identification and category |
| GPS | SBAS-enabled GPS receiver -167dBm Sensitivity |
| Interface | WiFi 802.11bgn Access Point |
| DC Voltage | 11 to 32V |
| Power Consumption | 1.5W |
| Operating Temperature | -45°C to +70°C |
| Relative Humidity | up to 100% |
| Dimensions | 134 x 140 x 80mm |
| Weight | 150g |
| Serviceability | Firmware upgradable over the WiFi interface. |

Use a 1 Amp circuit breaker for power supply protection to the Vektor.

Power to be provided by the vehicle battery.



The CE Declaration of Conformity was issued for this product.
The product is marked with the CE marking.

12 Warranty Conditions



Warning!

Use the equipment only in closed areas and routes of the airport (the equipment is not intended for operation on public roads)!



Warning!

The user is not allowed to make any modifications to the equipment!



Caution!

Use the equipment only in an intended manner described in this Operational and Technical Manual.



Caution!

It is necessary to carry out the maintenance of the equipment on a regular basis.

The daily technical maintenance consists in visual inspection of the equipment and checking its mounting on a vehicle. In the winter season, it is necessary to remove thicker snow and ice layers from the Vektor transmitter surface.

In longer time periods, minimally once a year, it is necessary to check the condition, placing and connection of the power cable.



Caution!

The manufacturer shall not be responsible for any damages caused by an incorrect installation on the vehicle and /or an unqualified installation in the vehicle electrical installation.

The manufacturer's shall not be responsible for any damages caused by equipment use in discrepancy with this Manual. Any other use or installation of the equipment must be consulted with the manufacturer.

The manufacturer shall not be responsible for any damages caused by the equipment falling from the vehicle, on the vehicle or in its environment.

13 Environmental Qualification Forms

| | | |
|--|--|---|
| Nomenclature | Vektor | |
| Part No | UAV-10007831-001 | |
| Manufacturer | uAvionix Inc | |
| Address | 300 Pine Needle Lane Bigfork, MT 59911 | |
| Conditions | DO-160G Section | Description of Conducted Tests |
| Temperature and Altitude | 4.0 | Equipment tested to Category B2 |
| Low temperature ground survival | 4.5.1 | -55°C |
| Low Temperature Short-Time Operating | 4.5.1 | -45°C |
| Low Temperature Operating | 4.5.2 | -45°C |
| High Temperature Operating | 4.5.4 | +70°C |
| High Temperature Short-Time Operating | 4.5.3 | +70°C |
| High Temperature Ground Survival | 4.5.3 | +85°C |
| Loss of Cooling | 4.5.5 | Cooling air not required (+70°C operating without cooling) |
| Altitude | 4.6.1 | 35,000feet |
| Decompression | 4.6.2 | Equipment identified as Category B2 – no test |
| Overpressure | 4.6.3 | Equipment identified as Category B2 – no test |
| Temperature Variation | 5.0 | Equipment tested to Category B2 |
| Humidity | 6.0 | Equipment tested to Category B2 |
| Operation Shocks | 7.2 | Equipment tested to Category B |
| Crash Safety | 7.3 | Equipment tested to Category B type 5 |
| Vibration | 8.0 | Aircraft zone 2: type 3, 4, 5 to Category S level M, type 1 (Helicopters) to Category U level G |
| Explosion | 9.0 | Equipment identified as Category X – no test |
| Waterproofness | 10.0 | Equipment identified as Category X – no test |
| Fluids Susceptibility | 11.0 | Equipment identified as Category X – no test |
| Sand and Dust | 12.0 | Equipment identified as Category X – no test |
| Fungus | 13.0 | Equipment identified as Category X – no test |
| Salt Spray | 14.0 | Equipment identified as Category X – no test |
| Magnetic Field | 15.0 | Equipment identified as Category Z |
| Power Input | 16.0 | Equipment identified as Category ZX |
| Voltage Spike | 17.0 | Equipment identified as Category B |
| AF Conducted Susceptibility | 18.0 | Equipment identified as Category B |
| Induced Signal Susceptibility | 19.0 | Equipment identified as Category AC |
| RF Susceptibility | 20.0 | Equipment identified as Category TT |
| RF Emissions | 21.0 | Equipment identified as Category B |
| Lightning Induced Transient Susceptibility | 22.0 | Equipment identified as Category XXXX – no test |
| Lightning Direct Effects | 23.0 | Equipment identified as Category X – no test |
| Icing | 24.0 | Equipment identified as Category X – no test |
| Electrostatic Discharge | 25.0 | Equipment identified as Category X – no test |
| Fire, Flammability | 26.0 | Equipment identified as Category C |