



skySensor™ TSO

User and Installation Guide



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Patent uavionix.com/patents

1 Revision History

Revision	Date	Comments
A	7/17/2023	Initial release

2 Warnings / Disclaimers

All device operational procedures must be learned on the ground.

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 of skySensor on the aircraft. For the duration of the warranty period, uAvionix, at its sole option, will repair or replace any product which fails in 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.

Restrictions: This warranty does not apply to cosmetic damage, consumable parts, damage caused by accident, abuse, misuse, fire or flood, theft, damage caused by unauthorized servicing, or product that has been modified or altered.

Disclaimer of Warranty: 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. Proof of purchase for the product from uAvionix or authorized reseller is required to obtain and better expedite warranty service.

Please email or call uAvionix support with a description of the problem you are experiencing. Also, please provide the model, serial number, shipping address and a daytime contact number.

You will be promptly contacted with further troubleshooting steps or return instructions. It is recommended to use a shipping method with tracking and insurance.

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5 TSO and System Information

5.1 Certification

This installation manual provides mechanical and electrical information necessary to install skySensor. It is not equivalent to an approved airframe-specific maintenance manual, installation design drawing, or installation data package. The content of this manual assumes use by competent and qualified personnel using standard maintenance procedures in accordance with Title 14 of the Code of Federal Regulation and other related accepted procedures. The conditions and tests required for approval of this article are minimum performance standards. Those installing this article either on or within a specific type or class of aircraft must determine that the aircraft installation conditions are within the standards which include any accepted integrated functions not specified by the standards. TSO articles, articles approved with 14 CFR Part 21.8(d), and any accepted integrated function(s) not specified in the standard must have separate approval for installation in or on an aircraft. The article may be installed only according to 14 CFR Part 43 or the applicable airworthiness requirements. This is an incomplete system intended to provide the functions identified in, and when installed according to this installation manual.

5.2 TSO Authorizations

skySensor complies with the following TSOs when properly installed and interfaced with equipment as detailed in this guide.

Function	TSO/RTCA/SAE	Class/Type
Position Light	TSO-C30c SAE/AS8037	Type II (forward, green)
Anti-collision Light	TSO-C96b SAE/AS8017D	Class II

5.3 TSO Functions

Function	DO-178C DAL	DO-254 DAL
Position Light	D	D
Anti-collision Light	D	D

5.4 Non-TSO Functions

Function	DO-178C DAL	DO-254 DAL
Wi-Fi Connected ADS-B Receiver	E	E

5.5 TSO Deviations and Incomplete

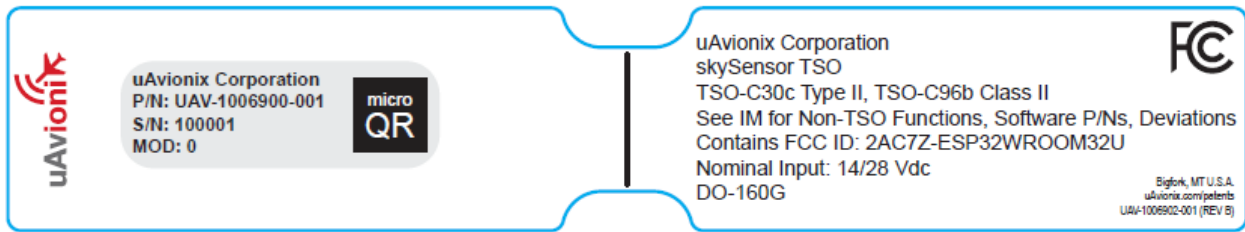
TSO	Deviation
C30c	uAvionix was granted a deviation from TSO-C30c Paragraph a.(2), TSO-C30c Paragraph c.(1).(viii), and SAE/AS8037 Section 4 to use RTCA/DO-160G in place of RTCA/DO-160B.

5.6 FCC ID

Model	FCC ID
Contains	2AC7Z-ESP32WROOM32U

5.7 Device Marking

5.7.1 skySensor Hardware



5.7.2 skySensor Software

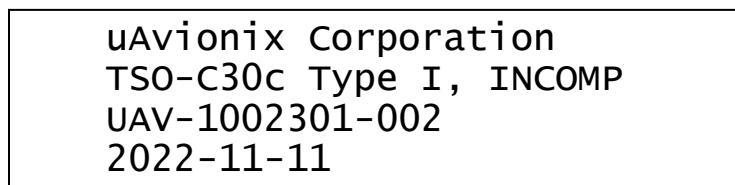
The software contained in the skySensor is identified by electronic marking. Reference Section 10.4 for information on determining the software part numbers.

5.7.3 skyBeacon-skySensor Installation Kit



5.7.4 skyBeacon / skySensor Wingtip Adapters

Wingtip adapters were previously TSO authorized, and certain part numbers may be used to adapt skySensor installations. For reference, an example skySensor wingtip adapter marking is shown below.



5.8 Environmental Qualification Form

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	25,000 feet
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 A
Humidity	6.0	Equipment tested to Category C
Operation Shocks and Crash Safety	7.0	Equipment tested to Category B
Vibration	8.0	Type 5 (Single Engine), Category S, Aircraft Zone 5, Vibration Test Curve M
Explosion	9.0	Equipment identified as Category X – no test
Waterproofness	10.0	Equipment tested to Category S
Fluids Susceptibility	11.0	Equipment tested to Category F
Sand and Dust	12.0	Equipment tested to Category D
Fungus	13.0	Equipment identified as Category X – no test
Salt Spray	14.0	Equipment tested to Category S
Magnetic Field	15.0	Equipment tested to Category Z
Power Input	16.0	Equipment tested to Category BX
Voltage Spike	17.0	Equipment tested to Category B
AF Conducted Susceptibility	18.0	Equipment tested to Category B
Induced Signal Susceptibility	19.0	Equipment tested to Category AC
RF Susceptibility	20.0	Equipment tested to Category TT
RF Emissions	21.0	Equipment tested to Category H
Lightning Induced Transient Susceptibility	22.0	Equipment tested to Category A2G2L2
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 tested to Category A
Fire, Flammability	26.0	Equipment tested to Category C

5.9 Continued Airworthiness

Maintenance of skySensor is "on condition" only.

The aircraft must be returned to service in a means acceptable to the appropriate aviation authority.

The forward position light is designed with 3 green LEDs. The anti-collision light is designed with 4 white LEDs. If any LED fails, the unit must be repaired or replaced.

Note: Use dark glasses or cover the device to ensure eye safety during LED inspection.

5.10 System Limitations

Installation

This article meets the **minimum** performance and quality control standards required by a technical standard order (TSO). Installation of this article requires a separate approval.

Anti-collision Lighting

skySensor must be evaluated as a system with other installed anti-collision lighting to ensure appropriate coverage. skySensor output intensities and coverage can be found in Section 6.2.2.

Current 14 CFR 23.2530 (Amdt. 64) requires that anti-collision lights, "if required by part 91 of this chapter, must have the intensities, flash rate, colors, field of coverage, and other characteristics to provide sufficient time for another aircraft to avoid a collision." Prior to this update, historical rules require that;

Aircraft originally certificated after March 31, 1957 and before August 11, 1971:

The system must produce a minimum of 100 effective candelas, with decreasing intensities to 30 degrees above and below the horizontal plane. Ref CAR 3-1 / 14 CFR 23.1401.

Aircraft originally certificated after August 10, 1971 and before September 1, 1977:

The system must produce a minimum of 400 effective candelas, with decreasing intensities to 30 degrees above and below the horizontal plane. Ref 14 CFR 23.1401 Amdt. 11.

Aircraft originally certificated after August 31, 1977:

The system must produce a minimum of 400 effective candelas, with decreasing intensities to 75 degrees above and below the horizontal plane. Ref 14 CFR 23.1401 Amdt. 20.

ADS-B Receiver Functionality

skySensor's Non-TSO Function ADS-B receiver is designed for situational awareness only. It is not intended to, nor capable of, interfacing with systems such as TSO-C195b "Avionics Supporting ADS-B Aircraft Surveillance Applications (ASA)" equipment.

6 System Specifications

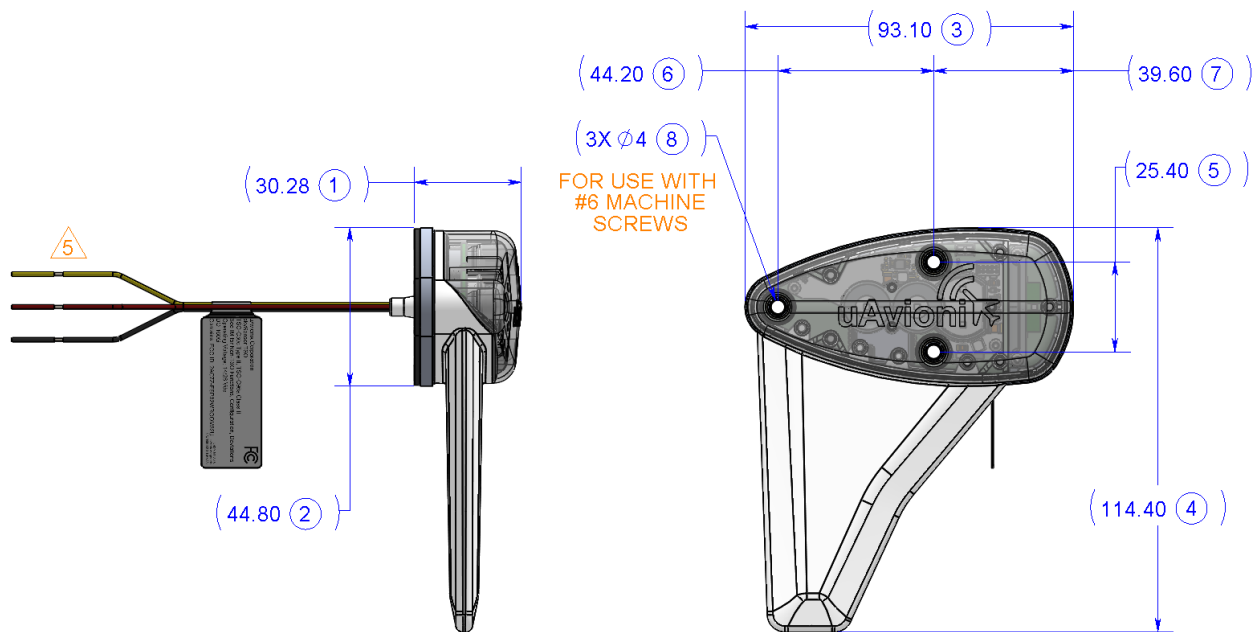
6.1 System Functionality

skySensor is a wing-tip mounted unit that contains an LED position light, LED anti-collision light, and Wi-Fi enabled ADS-B IN and GNSS receiver.

6.2 skySensor Specifications

6.2.1 Physical Specifications

Characteristics	Specifications
Width	3.665 in (93.10 mm)
Height	4.504 in (114.4 mm)
Depth	1.192 in (30.28 mm)
Weight	3.5 oz (100 grams)
Operating Temperature Range	-45°C to +70°C
Maximum Pressure Altitude	25,000 ft
Input Voltage Range	9.7 to 30.3 VDC
14V Current	0.64A maximum
28V Current	0.32A maximum



6.2.2 Position Light Specifications

Characteristics	Specifications
Type	Type II (forward, green)
Color	Aviation Green
Minimum intensity, horizontal plane from nose	0 to 10 deg, 40 candelas 10 to 20 deg, 30 candelas 20 to 110 deg, 5 candelas

6.2.3 Anti-collision Light Specifications

Characteristics	Specifications
Class II (400 candela) horizontal coverage [1]	± 2 degrees from 90 degrees (perpendicular to fuselage)
Class III (100 candela) horizontal coverage [1]	± 30 degrees from 90 degrees (perpendicular to fuselage)

[1] Horizontal coverage specified where 0 degrees is the nose of the aircraft, and 180 degrees is the tail

skySensor anti-collision flashes are automatically synchronized with an installed skyBeacon by using GNSS timing, without the need for a hard-wired synchronization bus. Prior to both units obtaining a GNSS lock, the anti-collision flashes will be unsynchronized.

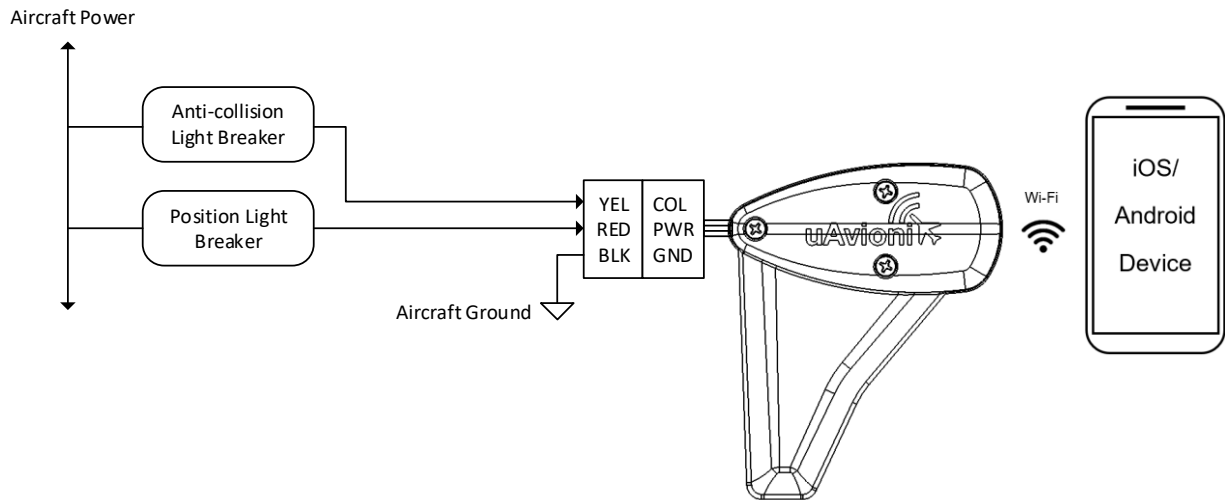
6.2.4 GNSS Specifications (Non-TSO Function)

Characteristics	Specifications
Number of Channels	72
Constellations	GPS, GLONASS, SBAS, QZSS
Frequency	1575.42 MHz L1, C/A code
Sensitivity	
Tracking	-166 dBm
Reacquisition	-160 dBm
Cold Start	-148 dBm
Hot Start	-160 dBm
Horizontal position accuracy	2 m RMS with SBAS
Velocity accuracy	0.05 m/s
Heading accuracy	0.3 degrees
TTF (Time to First Fix)	
Cold start	29 s
Hot start	1 s
Position update interval	1 second (1 Hz)

6.2.5 ADS-B Receiver Specifications (Non-TSO Function)

Characteristics	Specifications
Wi-Fi	
Standard	802.11b/g/n
Security	WPA2 PSK
Frequency	2.4 GHz
Message protocol	UCP (GDL90 compatible)
Network protocol and port	UDP port 4000
978MHz UAT ADS-B Receiver	
Frequency	978 MHz
Modulation	Continuous phase FSK
Data Rate	1.041667 Mbps
1090MHz ADS-B Receiver	
Frequency	1090 MHz
Modulation	Pulse Position Modulation

6.2.6 System Interfaces

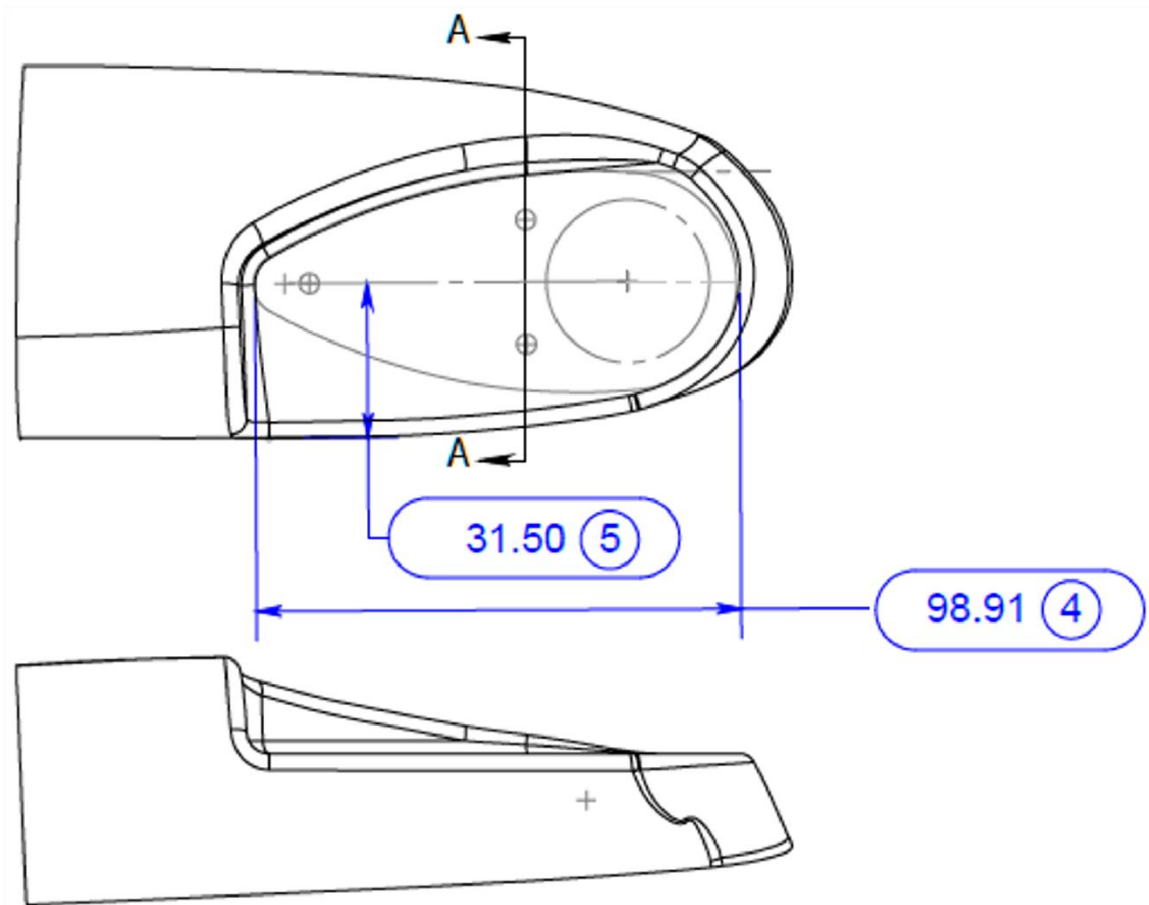


6.3 skyBeacon / skySensor Wingtip Adapters

Wingtip adapters are available to allow or enhance fitment to selected aircraft. Part numbers ending in -001 (e.g. UAV-1002301-001) adapt skyBeacon on the port wingtip, and those ending in -002 (e.g. UAV-1002301-002) adapt skySensor on the starboard wingtip.

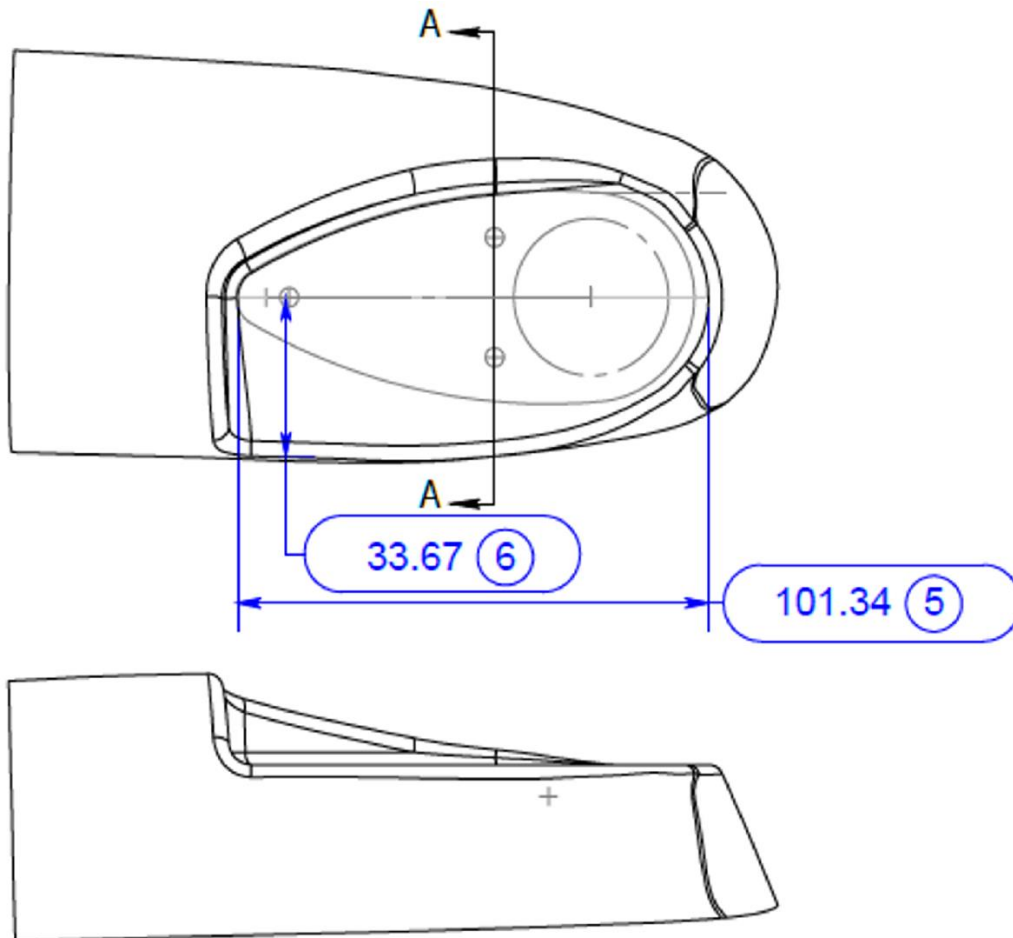
6.3.1 UAV-1002301-() C150/C152

Characteristics	Specifications
Width	6.2 in (157 mm)
Height	2.9 in (74 mm)
Depth	1.8 in (45 mm)
Weight	0.6 oz (19 grams)
Intended Aircraft Application	Cessna 150L, 150M, 152, 185E, 180H, 182N



6.3.2 UAV-1002302-() C172/C182

Characteristics	Specifications
Width	6.5 in (164 mm)
Height	3.2 in (81 mm)
Depth	2.1 in (53mm)
Weight	0.9 oz (25 grams)
Intended Aircraft Application	172L, 172M, 172N, 172Q, 172R, 172RG, 182Q, 182R, 182S, 182T, T182T, R182, 180J, 180K, A185K, U206G, TU206F, TU206G, 177B, 177RG



7 Installation

7.1 Unpacking and Inspecting

Carefully unpack the device and make a visual inspection of the unit for evidence of any damage incurred during shipment. If the unit is damaged, notify the shipping company to file a claim for the damage. To justify your claim, save the original shipping container and all packing materials.

7.2 Authorized Part Numbers

skySensor

Item	P/N
skySensor TSO Hardware	UAV-1006900-()
skySensor ADS-B Software	UAV-1006928-()
skySensor Wi-Fi Software	UAV-1007057-()

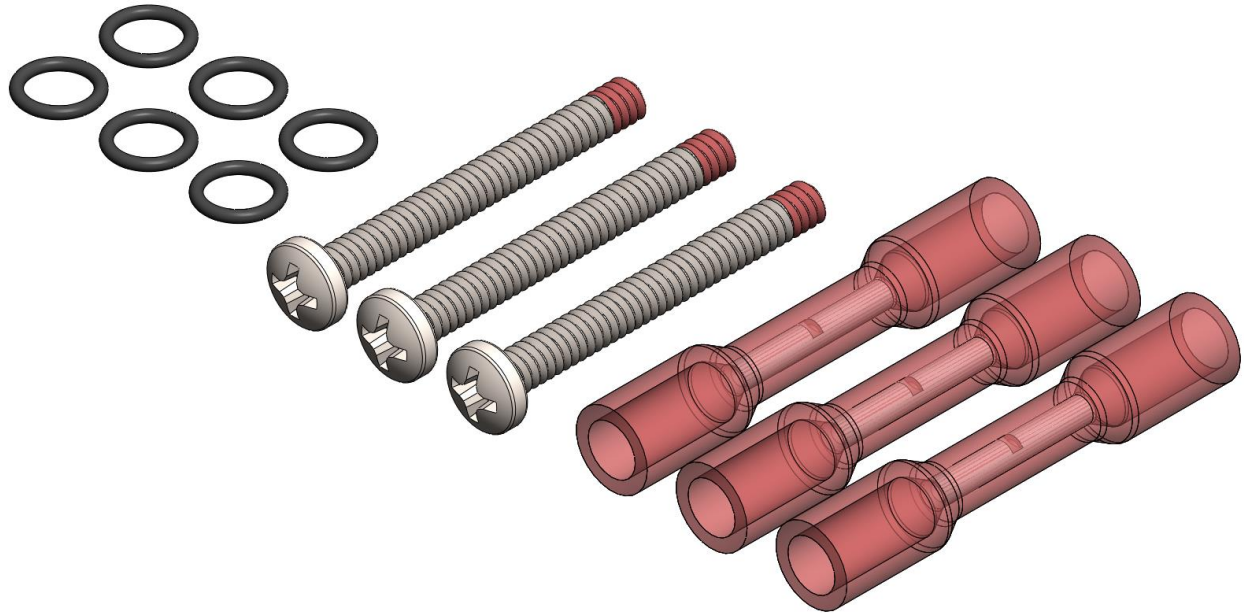
skySensor Installation Kits and Adapters

Item	P/N
skyBeacon-skySensor Installation Kit	UAV-1007046-()
Wingtip Adapters (as required)	UAV-1002301-002 and UAV-1002302-002

7.2.1 skyBeacon-skySensor Installation Kit UAV-1007046-001

The skyBeacon-skySensor Installation Kit consists of the following parts:

#	Item	P/N
1	6-32 x 1-1/4" Screw (3)	UAV-1001459-001
2	5mm x 1mm O-Ring (6)	UAV-1002038-001
3	Wire Splice (3)	UAV-1001487-001



7.3 Installation Materials and Tools

In addition to the available installation kit(s), skySensor may require standard aviation parts for installation. Parts may include:

- Wire
- Circuit breakers
- Environmental splices
- Ring terminals for grounding

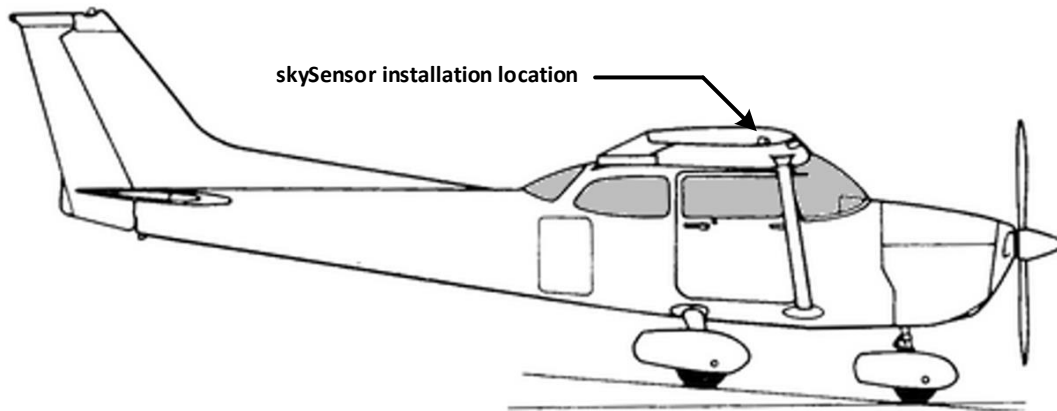
Minimally, skySensor installation requires access to the following tools:

- Phillips screwdriver
- Appropriate crimping tool(s)

7.4 Mounting

skySensor is a wingtip, forward, right position light. The assembly should be mounted as far outboard on the aircraft as practical, parallel to the

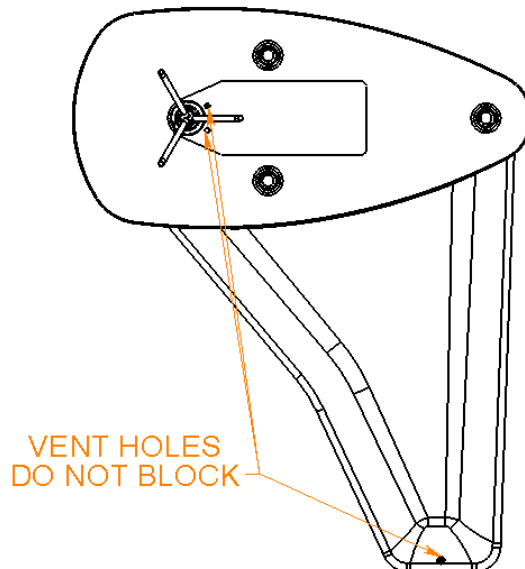
vertical and horizontal centerlines of the aircraft. Ensure that when mounted, the fin and top of the assembly are free from obstructions. skySensor **must** be mounted with the fin pointing down to ensure proper performance.



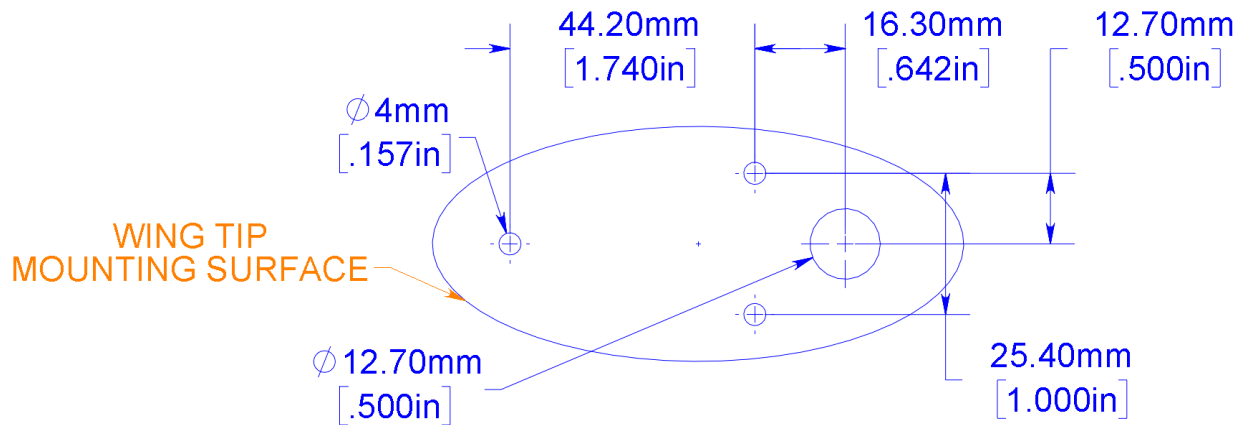
Aircraft starboard (right-hand) side



To ensure performance of the integrated altitude sensor, the wire bundle exiting the skySensor enclosure, and vent holes shown below, must not be further sealed. These areas function as the static pressure sensing ports.



Determine if skySensor can be directly installed to the wingtip mounting surface or requires an available Wingtip Adapter. Reference the mounting surface dimensions below.



General Mounting Instructions

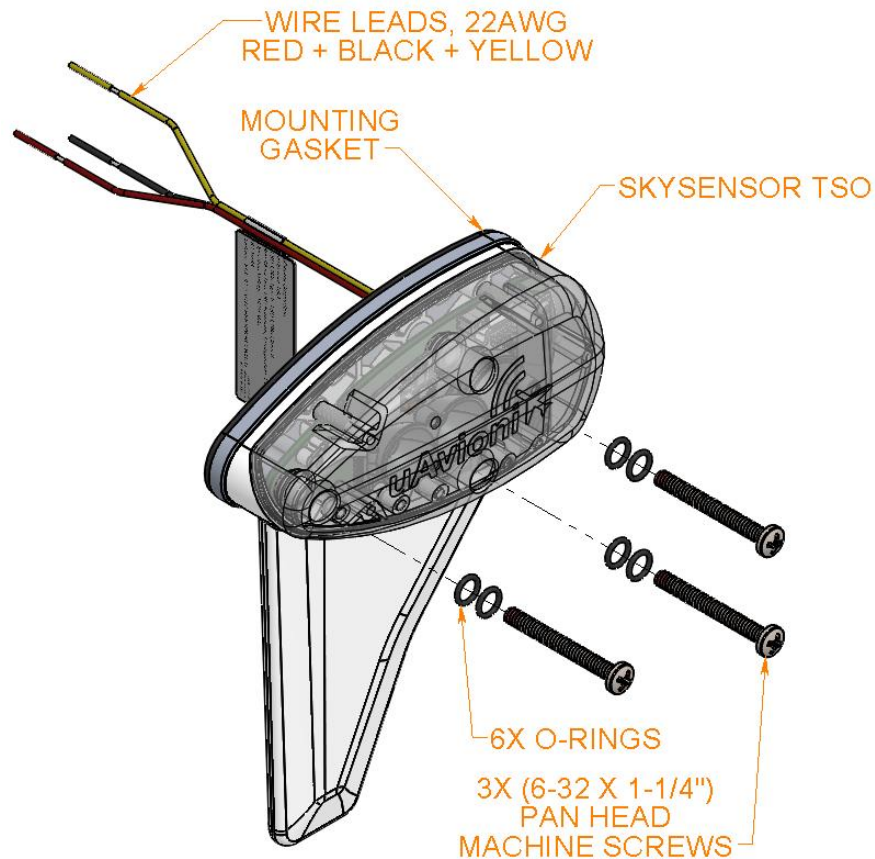
1. Remove the existing starboard (green) position light.
2. Detach the power wire(s).
3. Install wiring according to Section 7.5.
4. If skySensor fits without adaptation, mount skySensor using the three supplied 6-32 screws. See Section 7.4.1.
5. If skySensor requires adaptation to achieve proper fit and finish, see Section 7.4.2.
6. Changes to the existing position and anti-collision light circuit breaker rating are not required.

Note: Installation of the skySensor must be in accordance with AC 43.13-2B, Chapter 1.

7.4.1 Mounting Without Wingtip Adapter

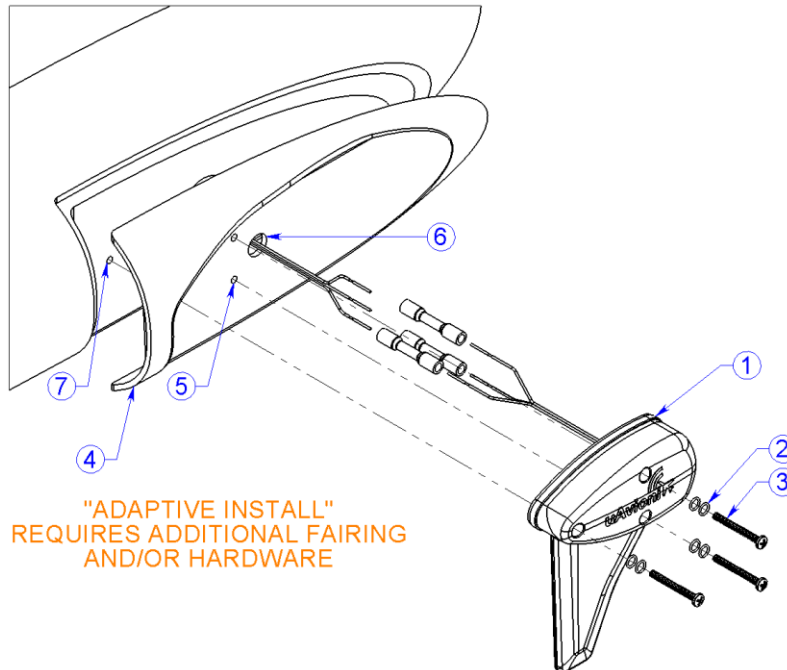
skySensor is mounted with three 6-32-inch screws to the existing holes and nut plates in the end of the wing. Two O-rings per screw must be used between the screw and skySensor assembly.

Note: the O-ring nearest the head of the screw must be replaced if the screw is tightened and subsequently removed.



7.4.2 Mounting With Wingtip Adapter

The following procedure is generalized for all wingtip adapter models. Wingtip adapters allow or refine the fit of the installation.



skySensor is mounted with three 6-32-inch screws to the existing holes and nut plates in the end of the wing, with the wingtip adapter sitting between the wing and skySensor.

- 1) Locate mounting holes (Item 5) and wire pass through holes (Item 6) to match the wingtip.
- 2) Drill clearance holes for #6 screws through the wingtip adapter (Item 4) for the mounting holes and a 0.5-1" hole for the wire pass through.
- 3) Wire the skySensor according to Section 7.2.
- 4) Position skySensor and skySensor wingtip adapter onto the wingtip and confirm alignment with existing mounting holes (Item 7).
- 5) Install 2 O-ring seals (Item 2) into each screw hole in the lens.

Note: the O-ring nearest the head of the screw must be replaced if the screw is tightened and subsequently removed.

- 6) Use appropriate length mounting screws (Item 3) to attach skySensor to the wingtip adapter. Tighten screws to 8-10 in-lbs or until screw is properly seated.

7.5 Wiring

skySensor requires connections to power and ground.

Color	Type	Function
Red	Power	Position Light Power (14/28V only)
Yellow	Power	Anti-collision Light Power (14/28V only)
Black	Power	Aircraft Ground

skySensor is designed to use existing position and/or anti-collision light wiring. If new wiring is required, refer to AC 43.13-1B Chapter 11 for guidance. The wiring should present an impedance of less than 0.5ohm. The following table provides guidance for typical aircraft hook-up wire.

Gauge	ohm/km	Maximum Length for 0.5ohm
20 AWG	35	14.2m
22 AWG	64	7.8m

Wiring Instructions

1. Connect the skySensor red wire to the switched position light power wire using environmental splices or equivalent.
2. If replacing a position light with integrated anti-collision strobe, connect the skySensor yellow wire to the switched anti-collision power wire using environmental splices or equivalent.



WARNING: The yellow wire must be connected directly to 14/28V aircraft power. It must NOT be connected to a high voltage anti-collision power supply.

3. Connect the skySensor black wire to the battery or airframe ground. Pay close attention to the condition of ground connections, as effective grounding is critical to ensure device performance.

7.6 EMC Checkout

An EMC check should be performed after skySensor installation is complete. The EMC check verifies that the newly installed equipment is not producing interference to other avionics and that the existing avionics are not producing interference impacting skySensor. The testing assumes that a skySensor operational check has been completed and that the installed avionics are tested and in working condition.

1. Power on all avionics except the skySensor (and skyBeacon if installed on the same power bus).
2. Verify all existing avionics are functioning properly. Some systems may require startup messages to be acknowledged/cleared to verify proper function.
3. After confirming all existing avionics are functioning properly, power off all existing equipment.
4. Power on skySensor and perform the following tests as they apply to the existing aircraft equipment.
5. Observe load shedding procedures as appropriate for the aircraft during testing to ensure adequate power to complete the testing while maintaining enough reserve to support pre-flight and engine start.

VHF COM RADIOS

Verify skySensor operates without interference from the VHF COM operation.

1. Power on the VHF COM radio.
2. Transmit on a low, medium, and high frequency. Unused frequencies are recommended for this test. Example frequencies: 118.0, 126.0, and 135.0 Mhz.
3. During each transmission verify skySensor continues to operate properly.

Verify each radio operates without interference from the skySensor.

1. Connect a client device to skySensor Wi-Fi (see Section 11.2).
2. Monitor a local VHF COM frequency and verify there are no unintended squelch breaks or other tones that would interfere with communications.

3. Monitor a remote (distant) VHF COM frequency and verify there are no unintended squelch breaks or other tones that would interfere with communications.
4. Monitor an unused VHF COM frequency and verify there are no unintended squelch breaks or other tones that would interfere with communications.

VHF NAV RADIOS

Verify VHF NAV operates without interference from skySensor.

1. Power on the VHF NAV radio.
2. Connect a client device to skySensor Wi-Fi (see Section 11.2).
3. Monitor a local, remote, and unused frequency.
4. Verify there are no misleading navigation indications during the monitoring of each frequency.
5. Verify audible station ID and that the station is clear of audio interference that would prevent identification.

ADDITIONAL AVIONICS

Additional avionics should be tested according to the manufacturer EMC/EMI test procedures. This testing assumes the existing equipment is functional and operating correctly at time of testing. The following summarizes a typical EMC test.

1. Operate skySensor.
2. Connect a client device to skySensor Wi-Fi (see Section 11.2).
3. Operate the existing installed avionics according to manufacturer instructions. If capable, utilize the device transmit and receive functions through a range of values.
4. Verify no errors, warnings, or unexpected operation is observed on skySensor during operation of the installed avionics.
5. Verify no errors, warnings, or unexpected operation is observed on the installed avionics during operation of skySensor.

8 Maintenance

The skySensor is not a user serviceable product. All service must be performed either by uAvionix or an authorized uAvionix repair center.

9 Care and Cautions

The skySensor should be regularly cleaned with warm soapy water and a soft cloth micro-fiber rag. Use of chemical cleaners and degreasers should be avoided. If the skySensor is exposed to cleaning chemicals, you should promptly wash off all residue.

DO NOT wax, buff, paint or attempt to polish any part of the skySensor assembly. Doing so may damage the housing. Avoid any contact with abrasive materials including scrubbing pads.

Never hit, tap on or flex the fin portion of a properly mounted skySensor assembly. Doing so will cause undue stress in the assembly and could void your warranty.

The wingtip adapter may be painted.

10 System Configuration

No system configuration is required for typical installations. For advanced Wi-Fi configuration or to read software part electronic marking, reference the following information.

10.1 Connect to skySensor Wi-Fi

When powered, skySensor serves as a Wi-Fi access point. The SSID of the skySensor is in the form SkySensor_XXXX, for example SkySensor_7782.

The skySensor Wi-Fi connection is secure. The WPA2 passphrase is written on an inclusion in your package, and should be entered exactly as printed. WPA2 passphrases are case sensitive.

Power skySensor and connect using this information from the desired client device. This may be an iOS, Android, or Windows device, for example.

10.2 Open configuration web page


Using a web browser such as Chrome, open the configuration web page at the following address:

<http://192.168.4.1>

10.3 Update Wi-Fi configuration (optional)

If desired, the Wi-Fi channel and power level can be updated via the settings page at the following address:

<http://192.168.4.1/settings>



Device Settings

Settings loaded.

WiFi

Channel: Auto

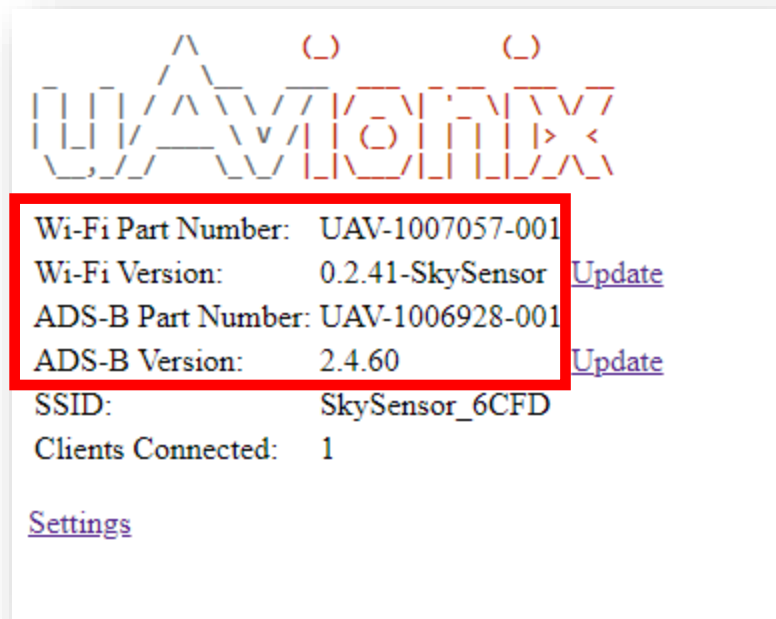
Pwr Level: ▼

[Main Page](#)

Click 'Save' after making any changes on this page.

10.4 Determine software part electronic marking

The current skySensor software versions are displayed on the configuration webpage:



Annually, or as required, confirm the displayed “Wi-Fi Part Number,” “Wi-Fi Version,” “ADS-B Part Number,” and “ADS-B Version” are current per Service Bulletins listed at:

<https://uavionix.com/support/skysensor/>

If software is not current, apply Service Bulletins as appropriate to update the software.


11 Normal Operation

11.1 Aircraft Lighting

To ensure skySensor is enabled, aircraft power to the position light **must** remain on.

- For the position light to be illuminated, aircraft power (usually switched) to the position light must be provided
- For the anti-collision light to strobe, aircraft power (usually switched) to the anti-collision light AND to the position light must be provided

11.2 Wi-Fi ADS-B Receiver

 Refer to AC 91.21-1D, AC 120-76, and AC 91-78 for information on the use of Portable Electronic Devices (PEDs) aboard aircraft. The aircraft operator must confirm compatibility of any PEDs and skySensor prior to operation. Discontinue use and shut off the PED and skySensor should interference be discovered.

To ensure skySensor is enabled, aircraft power to the position light **must** remain on.

- For the Wi-Fi ADS-B receiver to function, aircraft power to the position light must be provided

A red LED annunciator can be seen by looking down on the skySensor. Blinking indicates receipt of ADS-B data.

When powered, skySensor serves as a Wi-Fi access point. The SSID of the skySensor is in the form SkySensor_XXXX, for example SkySensor_7782.

The skySensor Wi-Fi connection is secure. The WPA2 passphrase is written on an inclusion in your package, and should be entered exactly as printed. WPA2 passphrases are case sensitive.

Power skySensor and connect to its Wi-Fi, using the provided information, from the desired client device running Electronic Flight Bag (EFB) software. This is typically an iOS or Android device.

Once connected, follow the instructions for your EFB application. ADS-B traffic, weather, and GNSS position data will be made available to the application.

12 Support

For additional questions or support please visit:

<https://www.uavionix.com/support/>