

OPS9243 Traffic Monitor

Feature Set

- 1-100m (3-328') detection range
- Default speed reporting up to 138mph (222kph)
- Speed accurate to within ± 1 mph (1.6kph)
- Direction reporting (Inbound/Outbound)
- Traffic count and speed bracket information
- Vehicle classification and Lane detection (future)
- Narrow $20^\circ \times 24^\circ$ beam width (-3 dB)
- RS-232 interface supporting 15m (50 ft.) cable lengths
- USB interface for Data Storage option
- Simple API control
- FCC/IC certification
- Wide operating input voltage, 5-24V
- <2.0W Active power
- Wide temperature operating range, -40°C to $+85^\circ\text{C}$
- Small form factor

The OPS9243 is a complete traffic monitor solution gathering and reporting all traffic statistics seen in the systems field of view (FOV). The OPS9243 utilizes embedded machine learning models to accurately count car traffic and report their speeds. Special real time alerts can be set to alert for excessive speeding or counts. Future updates will provide vehicle classification and lane detection.

The OPS9243 comes in two variations, a low power, small form factor solution that reports summary traffic statistics over an RS-232 interface and a larger version capable of storing traffic data for a data dump over USB at a later time. It provides a long detection range of up to 100m and a narrow $20^\circ \times 24^\circ$ FOV. Typical usage covers 2 lanes of traffic in either one direction or one lane in both directions.

Description

Operating Principle

The OPS9243 is a complete traffic monitor using 24GHz radar sensor technology. It has embedded machine learning models to accurately count traffic and provide speed information.

The OPS9243 actively pulses out signals which bounce off the vehicles and provides speed information. It utilizes Doppler constant wave modulation to report the speed of vehicles. This data is processed through machine learning models to separate out and count vehicles while also providing correction for vehicles speeds due to cosine error. Future updates will provide the ability to assign which lane a vehicle is traveling in and the type of vehicle (truck/bus, car, motorcycle).

The OPS9243 provides summary statistics at set intervals or can store the data in internal flash memory for later processing on a PC. Different interface options are available (RS-232 or USB) depending on the type of operation. The data can be consumed locally by a traffic controller for making traffic decisions (street light control) or send the data to the cloud for wider traffic monitoring and decisions.

Block Diagram

The block diagram of the OPS9243 is shown in Figure 1. The key components are the RF, processor, and wired or wireless interface.

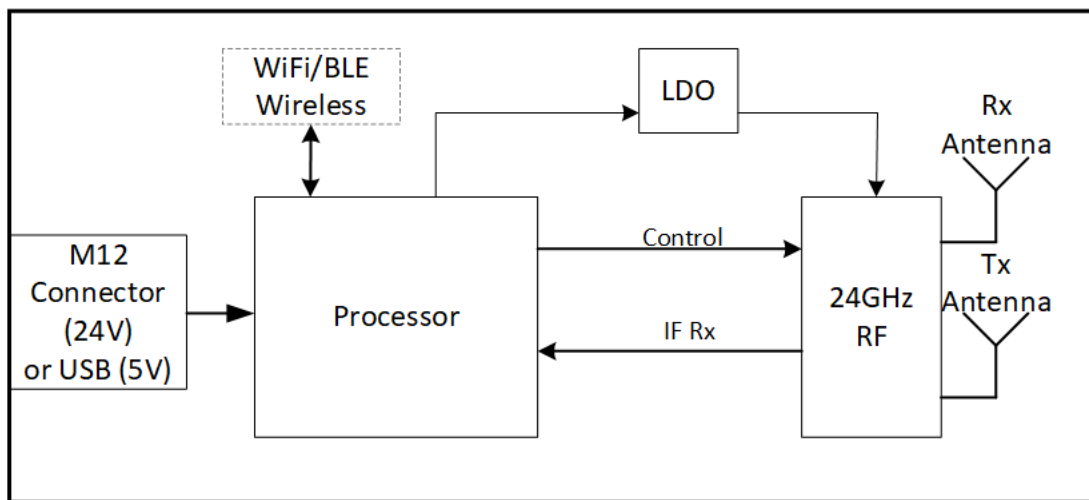


Figure 1. OPS9243 Block Diagram

Interface

The OPS9243 utilizes either an RS-232 interface with $\pm 5V$ signal swings over a male, 4-pin M12 connector or USB interface. RS-232 can support long cable lengths up to 15m (50 ft.). The pinout is defined as in Figure 2. The data provided over the RS-232 is defined in the AN-10 API Interface specification or the API Engineering Specification (ES-002-A, contact OmniPreSense for the document). Data storage products utilize USB Type B interface to dump the data to a PC and charge the battery.

Summary data statistics can be scheduled for delivery at set intervals or queried in real time. The same API interface available on other OmniPreSense radar sensors is available for setting configuration information, power levels, etc. The OPS9243 has additional API controls to report summary traffic information. Refer to the AN-10 API Interface application note for more detailed description.

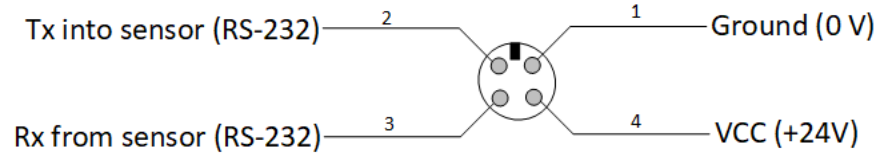


Figure 2. M12 RS-232 Connector Pinout

An LED mounted on the bottom of the RS-232 sensors provides additional information as to the status of the OPS9243 operation. The default operation provides a blue LED when an object speed is detected and moving away from the sensor and a red LED when the speed of the object is towards the sensor. The LED can be turned off in the API with the OL/OI command.

Power

RS-232 enabled system power is supplied to the OPS9243 over a 4-pin M12 connector located at the bottom of the system. The supply voltage is 24V when using the M12 connector. The system typically draws 2W during fully active operation. The pinout for the M12 connector is shown in Figure 2. Data storage systems have a 50,000mAHr battery which provides at least 24 hours of operation.

Antenna Pattern

The OPS9243 antenna designs provides a narrow beam width of 20° (-3 dB point) in the azimuth and 24° (-3 dB point) in altitude. Horizontal is the left/right direction when the M12/USB connector is positioned on the bottom of the sensor. Minimal signal is transmitted behind the module due to its construction which helps eliminate false detections. The narrow antenna pattern coverage is shown in Figure 3.

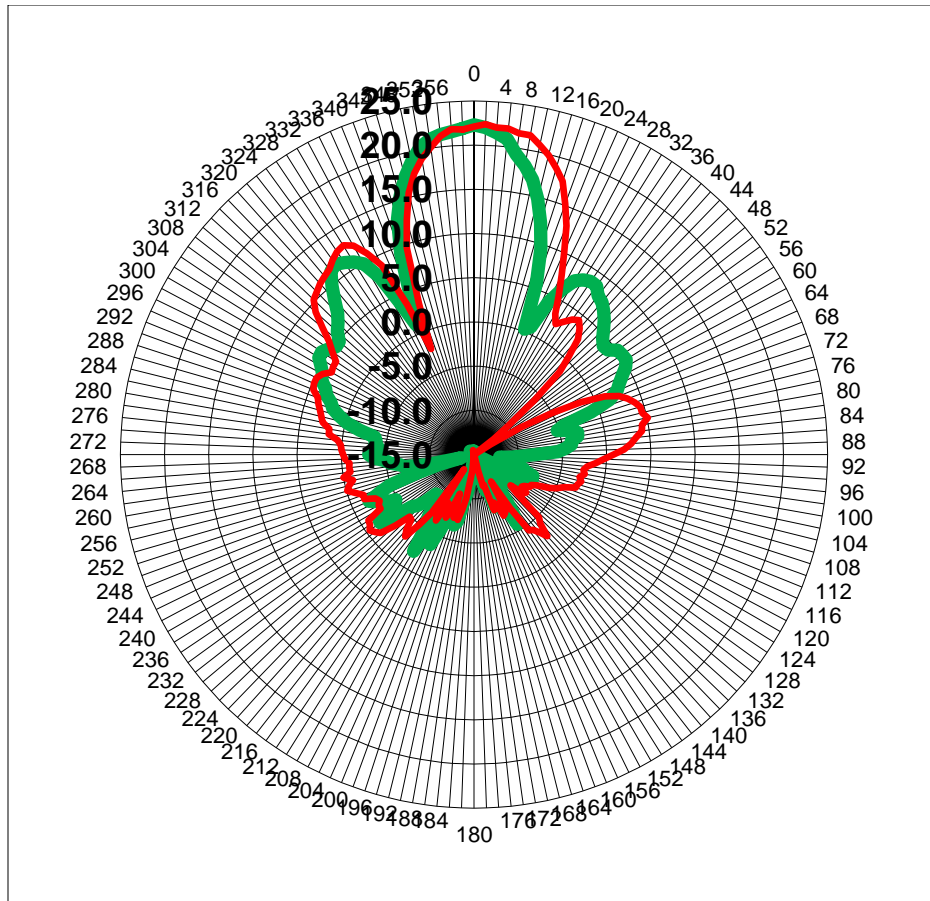


Figure 3. OPS9243Antenna Pattern

Detection Range

The detection range of the OPS9243 is dependent on the object to be detected or its RCS (radar cross section). Generally, the OPS9243 detects cars between 50-100m and larger vehicles such as busses and trucks at 75-100m. Motorcycles can be detected at distances of 25-50m.

In its default mode, the OPS9243 can detect vehicles with speeds up to 138mph (222kph). This is configurable via the API.

Enclosure

The OPS9243 comes in an all-weather IP67 enclosure. Two difference size are used, one 5 x 5 x 2.4 in. (130 x 130 x 61 mm) for most of the sensors and another 5.91 x 9.84 x 3.94 in. (150 x 250 x 100 mm) for the data storage option. The smaller enclosure weighs 12.1 oz. (343g).

Mounting Guidelines

Properly mounting the sensor is important to optimize the return signal and overall performance. The best operation is achieved when the sensor faces the objects to be detected and tries to capture as much of their motion as possible. As an example, for vehicle traffic monitoring, the sensor field of view should be focused on the center of the lane or lanes of traffic.

When mounting the sensor, take care to angle the sensor either horizontal (azimuth) or vertical (elevation or altitude) such that it focuses the sensor field of view where the objects are expected to be. See [AN-19 Traffic Monitor Mounting Guidelines](#) for guidance on best mounting practices. On the OmniPreSense website is a convenient [Field of View Calculator](#) to calculate the focus point of the sensor field of view based on the height, down angle, and angle looking into the road.

The sensor should be mounted with the M12/USB connector on the bottom. Depending on the height of installation, the sensor may need to be angled downward towards the desired focus point. Internally the OPS9243 sensor board is angled 10° downward as show in Figure 4. Some older models shipped may have a 15° internal down angle. Discuss with OmniPreSense for the appropriate angle to have installed in the OPS9243.

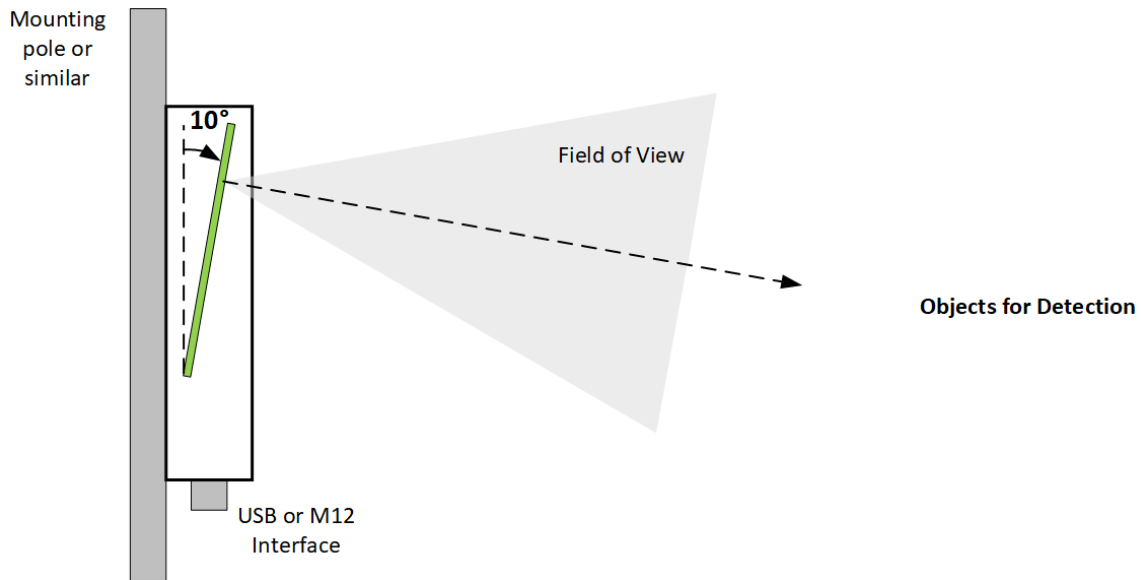


Figure 4. OPS9243 Internal Downward Angle (side cutaway view)

Electrical Specifications

Target Absolute Maximum Ratings

$T_A = -40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$ with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Notes
Supply Voltage	V_{dd}	23	24	25	V	RS-232 interface
		4.75	5	5.25	V	USB interface
Power Dissipation	P_{max}			2.2	W	
Operating Temperature	T_a	-40		85	$^{\circ}\text{C}$	
Storage Temperature	T_{stg}	-40		105	$^{\circ}\text{C}$	

Target Operating

$T_A = -40\text{ }^{\circ}\text{C}$ to $85\text{ }^{\circ}\text{C}$ with all voltages with respect to ground.

Parameter	Symbol	Min	Typ	Max	Units	Notes
Transmit Frequency	F_{tx}	24		24.25	GHz	
Transmit Power	P_{tx}	6	11	15	dBm	$24\text{GHz} \leq F_{tx} \leq 24.25\text{GHz}$
Transmit Power Adjustment	P_{txadj}	3	9		dB	Adjustable via API
Idle Transmit Power	P_{txadj}			-30	dBm	Not transmitting
Antenna Gain	G_{ant}		11		dBi	
Receive Antenna Azimuth	RA_{azi}		20		$^{\circ}$	-3 dB beamwidth
Receive Antenna Altitude	RA_{alt}		24		$^{\circ}$	-3 dB beamwidth
Active Current	I_{cc}		84	92	mA	24V input, Actively transmitting
			300	338	mA	5V input, Actively transmitting
Idle Current	I_{idl}		35	38	mA	24V input, No transmissions
			140	158	mA	5V input, No transmissions
Hibernate Current	I_{hib}	< 1			mA	
Reset Time	T_{RST}	200			ns	
Startup Time	T_{SRT}			2	μs	Processor startup time after release of T_{RST}

Mechanical Specifications

The mechanical outline drawing for the OPS9243 is shown in Figure 5. All units are in mm [mils].

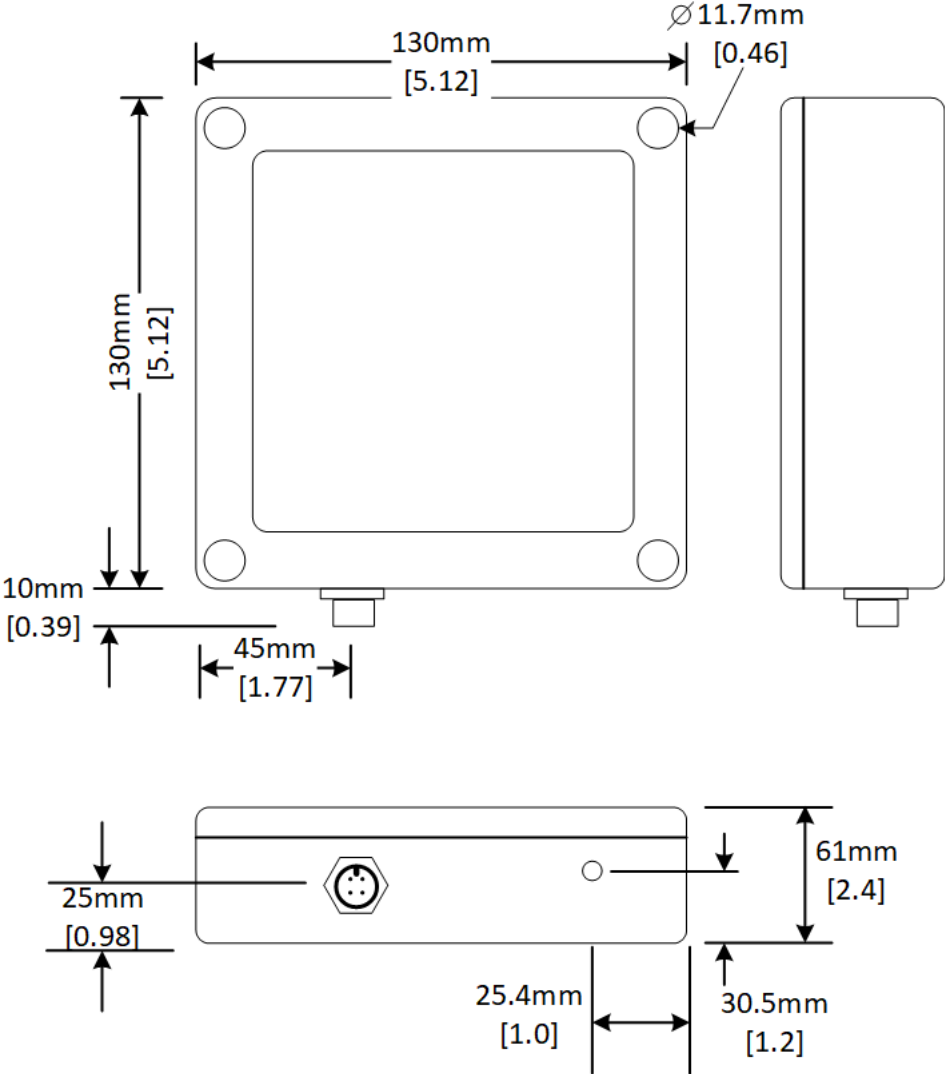


Figure 5. RS-232 Interface Mechanical Specifications

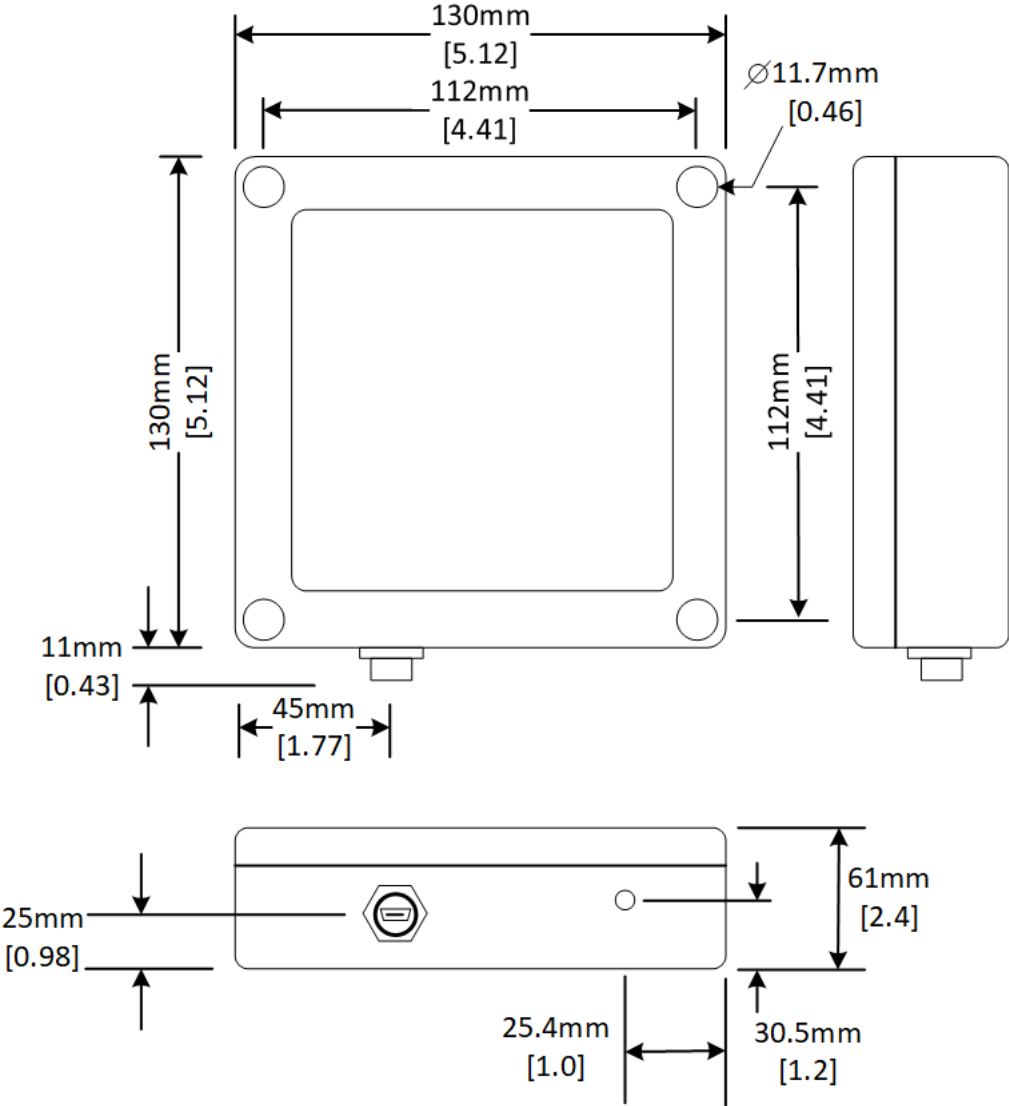


Figure 6. USB Interface Mechanical Specifications

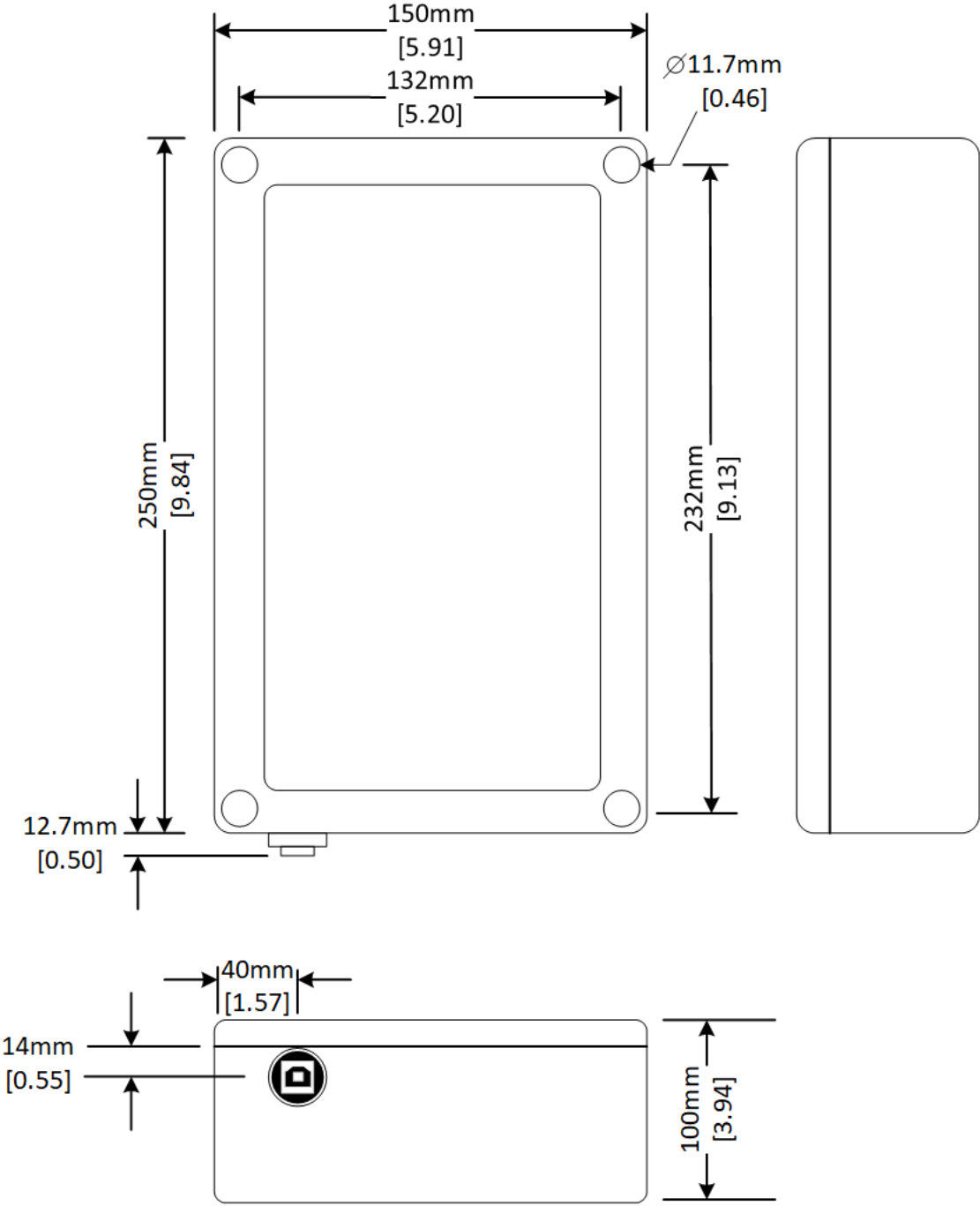


Figure 7. USB Interface Mechanical Specifications (Data Storage option)

FCC Notice and Liability Disclaimer

FCC 15B Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC 15C Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

FCC RF Exposure Statement

This transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users must be provided with transmitter operation conditions for satisfying RF exposure compliance.

IC Statement (English and French)

This device complies with ISED Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'ISED Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radio électrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Non-modification Statement

OmniPresense Corporation has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

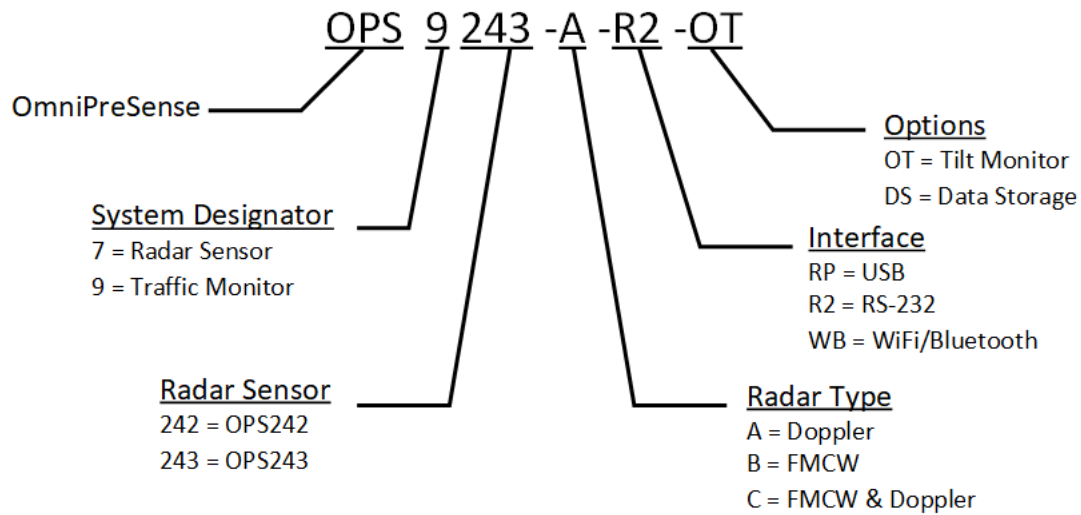
The OPS8243-A and OPS9243-A utilize the following certified module:

“Contains FCC ID: 2ALLL243A”

“Contains IC: 24107-243A”

Ordering Information

The OPS9243 comes in various versions. The part number can be decoded using the below key.



Ordering Part Information

Part Number	Radar Type	Interface	Features/Notes
OPS9243-A-R2	Doppler	RS-232	
OPS9243-A-R2-OT	Doppler	RS-232	Tilt Monitor
OPS9243-A-RP-DS	Doppler	USB	Data Storage

Revision History

Version	Date	Notes
A	November 30, 2020	Initial release.
B	March 28, 2021	Minor corrections to text.
C	May 15, 2021	Added Data Storage option and associated description, features.
D	June 14, 2021	Updated internal angle to 10°
E	June 17, 2021	Updated part number scheme and Ordering Part Numbers