

# OS1

## Mid-Range High-Resolution Imaging Lidar

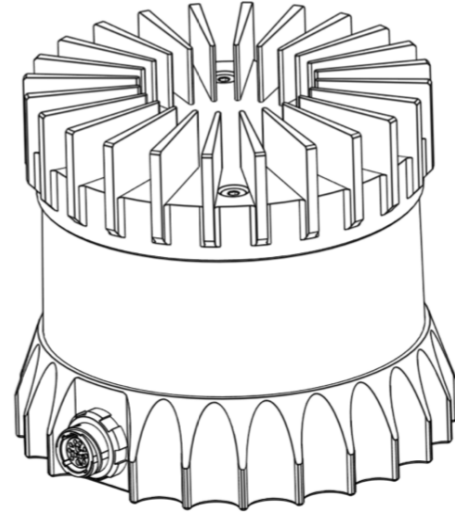
Revision: 8/20/2020

### SUMMARY

The OS1 offers an industry-leading combination of price, performance, reliability, size, weight, and power. It is designed for indoor/outdoor all-weather environments and long lifetime. As the smallest high performance lidar on the market, the OS1 can be directly integrated into vehicle facias, robots, and drones.

### HIGHLIGHTS

- Fixed resolution per frame
- Camera-grade ambient and intensity data
- Multi-sensor crosstalk immunity
- Fixed intrinsic calibration
- Open source drivers



### OPTICAL PERFORMANCE

Range (80% Lambertian Reflectivity)	105 m @ >90% detection probability, 100 klx sunlight 120 m @ >50% detection probability, 100 klx sunlight
Range (10% Lambertian Reflectivity)	40 m @ >90% detection probability, 100 klx sunlight 60 m @ >50% detection probability, 100 klx sunlight
Minimum Range	0.25 m for point cloud data 0 m - 0.25 m blockage detection (flag to indicate object within 0.25 m)
Range Accuracy	±5 cm for lambertian targets, ±10 cm for retroreflectors
Precision (10% Lambertian Reflectivity; 1 sigma / standard deviation)	0.25 - 2 m: ± 3 cm 2 - 20 m: ± 1.5 cm 20 - 60 m ± 3 cm >60 m: ± 10 cm
Range Resolution	0.3 cm
Vertical Resolution	32, 64, or 128 channels
Horizontal Resolution	512, 1024, or 2048 (configurable)
Field of View	Vertical: 45° (+22.5° to -22.5°) Horizontal: 360°
Angular Sampling Accuracy	Vertical: ±0.01° / Horizontal: ±0.01°
False Positive Rate	1/10,000
Rotation Rate	10 or 20 Hz (configurable)
# of Returns	1 (strongest)

## LASER

Laser Product Class	Class 1 eye-safe per IEC/EN 60825-1: 2014
Laser Wavelength	865 nm
Beam Diameter Exiting Sensor	9.5 mm
Beam Divergence	0.18° (FWHM)

## LIDAR OUTPUT

Connection	UDP over gigabit Ethernet
Points Per Second	655,360 (32 channel) 1,310,720 (64 channel) 2,621,440 (128 channel)
Data Per Point	Range, intensity, reflectivity, ambient, channel, azimuth angle, timestamp
Timestamp Resolution	< 1 $\mu$ s
Data Latency	< 10 ms

## IMU OUTPUT

Connection	UDP over gigabit Ethernet
Samples Per Second	100
Data Per Sample	3 axis gyro, 3 axis accelerometer
Timestamp Resolution	< 1 $\mu$ s
Data Latency	< 10 ms
Additional Details	InvenSense ICM-20948; datasheet for more details: <a href="https://www.invensense.com/products/motion-tracking/9-axis/icm-20948/">https://www.invensense.com/products/motion-tracking/9-axis/icm-20948/</a>

## CONTROL INTERFACE


Connection	TCP and HTTP APIs
Time Synchronization	Input sources: <ul style="list-style-type: none"><li>• IEEE1588 Precision Time Protocol (PTP)</li><li>• gPTP</li><li>• NMEA \$GPRMC UART message support</li><li>• External PPS</li><li>• Internal 10 ppm drift clock</li></ul> Output sources: <ul style="list-style-type: none"><li>• Configurable 1 - 60 Hz output pulse</li></ul>
Lidar Operating Modes	Hardware-triggered angle firing (guaranteed fixed resolution per rotation): <ul style="list-style-type: none"><li>• x 512 @ 10 Hz or 20 Hz</li><li>• x 1024 @ 10 Hz or 20 Hz</li><li>• x 2048 @ 10 Hz</li></ul>
Additional Programmability	Multi-sensor phase lock Azimuth masking Cross-talk reduction Queryable intrinsic calibration information: <ul style="list-style-type: none"><li>• Beam angles</li><li>• IMU pose correction matrix</li></ul>

## MECHANICAL/ELECTRICAL

Power Consumption	14 - 20 W (22 W peak at startup)
Operating Voltage	22 - 26 V, 24 V nominal
Connector	Proprietary pluggable connector (Power + data + DIO)

Dimensions	Diameter: 85 mm (3.34 in) Height: <ul style="list-style-type: none"> <li>• Without cap: 58.35 mm (2.3 in)</li> <li>• With thermal cap: 73.5 mm (2.9 in)</li> </ul>
Weight	Without cap: 378 g (13.3 oz) With radial cap: 455 g (16.0 oz)
Mounting	Bottom: 4x M3 screws, 2x locating 2 mm pin holes Top: 4x M3 screws, 4x locating 2 mm pin holes, 1x M6 screw

## OPERATIONAL

Operating Temperature	OS1: -20 °C to +50 °C (with mount) OS1 Cold Start: -40 °C to +50 °C (with mount)
Storage Temperature	-40 °C to +105 °C
Ingress Protection	IP68 (1m submersion for 1 hour, with I/O cable attached) IP69K (with I/O cable attached)
Shock	IEC 60068-2-27 (Amplitude: 100 g, Shape: 11 ms half-sine, 3 shocks x 6 directions) IEC 60068-2-29 (Amplitude: 40 g, Shape: 6 ms half-sine, 1,500 shocks x 6 directions)
Vibration	IEC 60068-2-64 (Amplitude: 3 G-rms, Shape: 10 - 1000 Hz, Mounting: sprung masses, 3 axes w/ 8 hr duration each)
Compliance	<p><b>Laser Safety:</b></p> <ul style="list-style-type: none"> <li>• IEC/EN 60825-1:2014 Class 1 eye safe</li> <li>• US 21CFR1040: Complies with FDA performance standards for laser products except for deviations pursuant to Laser Notice No. 56, dated May 8th, 2019 (pending Q3 2020)</li> </ul> <p><b>Product Safety:</b> IEC/EN 62368-1:2014 (pending Q3 2020)</p> <p><b>EMC:</b></p> <ul style="list-style-type: none"> <li>• FCC 47Cfr Part 15B, Class A</li> <li>• EN 55032: 2012/AC: 2013, Class A</li> <li>• IEC/EN 61000-4-3,4,5,6</li> <li>• IEC/EN 61000-6-2:2005 Class A</li> <li>• IEC/EN 61000-6-4: 2007</li> </ul> <p></p>

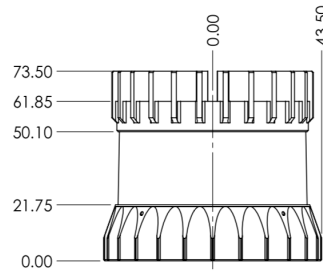
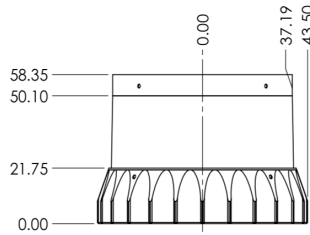
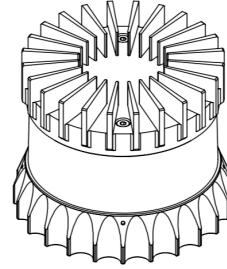
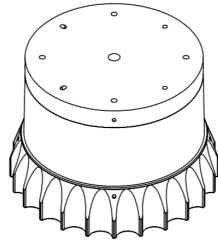
## ACCESSORIES

Included Interface Box	Polycarb/FR4, 100 g, 75 mm x 50 mm x 25 mm (LxWxH), 2 m CAT6 cable, 24 V power adapter, 5 m sensor cable
Optional Mount	Aluminum, 530 g, 110 mm x 110 mm x 20.5 mm (LxWxH), 4 x M8 thru holes

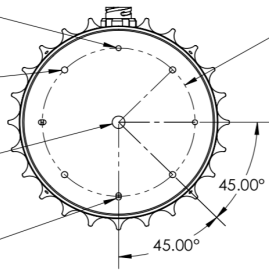
## SOFTWARE

Sample Drivers	ROS, C++
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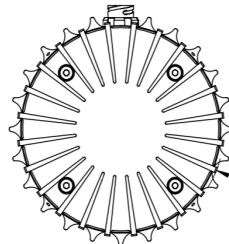
# EXTERIOR DIMENSIONS



- 2X  $\varnothing 2.02 \nabla 3.50$   
DOWEL HOLE
- 4X  $\varnothing 2.50 \nabla 5.00$   
M3X0.5 - 6H  $\nabla 4.00$   
MOUNT HOLES
- $\varnothing 5.00 \nabla 7.00$   
M6X1.0 - 6H  $\nabla 6.00$   
MOUNT HOLES
- 2X 2.02 X 3.00  $\nabla 3.50$   
DOWEL SLOT

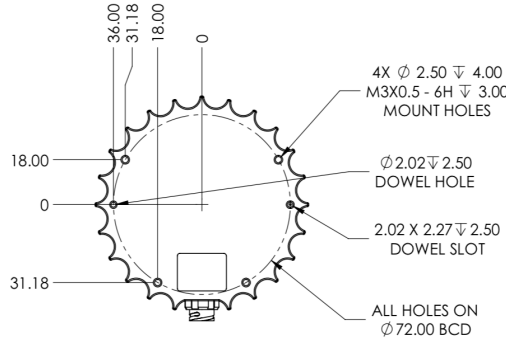


ALL HOLES ON  
 $\varnothing 60.00$  BCD



R40.41

(Sensor Bottom)



\*Specifications are subject to change without notice.