

OS1

Mid-Range High-Resolution Imaging Lidar

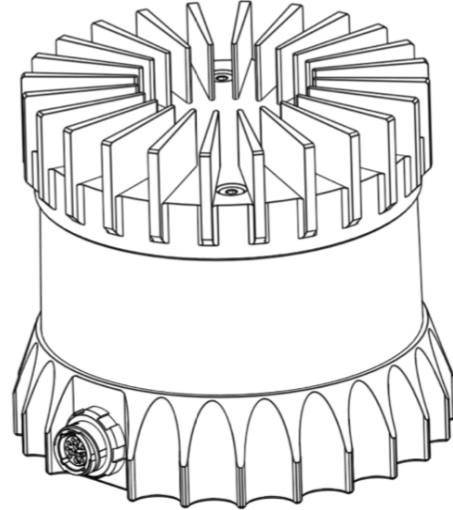
Revision: 2/10/2021

FIRMWARE VERSION: v2.0

HARDWARE VERSION: 840-102145-D (Rev D)

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, drones, and fixed infrastructure.



HIGHLIGHTS

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

OPTICAL PERFORMANCE

| | |
|---|---|
| Range (80% Lambertian reflectivity, 2048 @ 10 Hz mode) | 100 m @ >90% detection probability, 100 klx sunlight 120 m @ >50% detection probability, 100 klx sunlight |
| Range (10% Lambertian reflectivity, 2048 @ 10 Hz mode) | 45 m @ >90% detection probability, 100 klx sunlight 55 m @ >50% detection probability, 100 klx sunlight |
| Minimum Range | 0.3 m for point cloud data 0 m - 0.3 m blockage detection flag to indicate object within 0.3 m (v2.0 beta feature) |
| Range Accuracy | ±3 cm for lambertian targets, ±10 cm for retroreflectors |
| Precision (10% Lambertian reflectivity, 2048 @ 10 Hz mode, 1 standard deviation) | 0.3 - 1 m: ± 0.7 cm 1 - 20 m: ± 1 cm 20 - 50 m ± 2 cm >50 m: ± 5 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: $\pm 0.01^\circ$ / Horizontal: $\pm 0.01^\circ$ |
| 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 Rate | 66 Mbps (32 channel) 129 Mbps (64 channel) 254 Mbps (128 channel) |
| Data Per Point | Range, signal, reflectivity, near-infrared, channel, azimuth angle, timestamp |
| Timestamp Resolution | < 1 μ 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 μ s |
| Data Latency | < 10 ms |
| Additional Details | InvenSense ICM-20948; datasheet for more details: https://www.invensense.com/products/motion-tracking/9-axis/icm-20948/ |

CONTROL INTERFACE

| | |
|-----------------------|---|
| Connection | TCP and HTTP APIs |
| Time Synchronization | Input sources: <ul style="list-style-type: none"> • IEEE1588 Precision Time Protocol (PTP); Accuracy: <1 ms error • gPTP; Accuracy: <1 ms error • NMEA \$GPRMC UART message support • External PPS; Accuracy: <1 ms error • Internal 10 ppm drift clock; Accuracy: <20 ppm error Output sources: <ul style="list-style-type: none"> • Configurable 1 - 60 Hz output pulse |
| Lidar Operating Modes | Hardware-triggered angle firing (guaranteed fixed resolution per rotation): <ul style="list-style-type: none"> • x 512 @ 10 Hz or 20 Hz • x 1024 @ 10 Hz or 20 Hz • x 2048 @ 10 Hz |


| | |
|----------------------------|--|
| Additional Programmability | Multi-sensor Phase Lock Azimuth Masking Low-power Standby Mode Queryable intrinsic calibration information: <ul style="list-style-type: none"> • Beam angles • IMU pose correction matrix |
|----------------------------|--|

MECHANICAL/ELECTRICAL

| | |
|-------------------|---|
| Power Consumption | 14 - 20 W (22 W peak at startup, 28 W peak if operating below -40 °C) |
| 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"> • Without cap: 58.35 mm (2.3 in) • With thermal cap: 73.5 mm (2.9 in) |
| Weight | Without cap: 377 g (13.3 oz) With radial cap: 447 g (15.8 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 | -40 °C to +60 °C (with mount) Between +53 °C and +60 °C, sensor automatically reduces range (max 20% range reduction) |
| Storage Temperature | -40 °C to +75 °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) |
| 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>For US Laser Safety: • IEC/EN 60825-1:2014 Class 1 eye safe • FDA US 21CFR1040 Notice 50 Class 1</p> <p>Product Safety: • UL 62368-1 • CSA 22.2 No. 62368-1-19</p> <p>EMC: FCC 47CFR Part 15, Subpart B, Class A</p> <p>For EU Laser Safety: IEC/EN 60825-1:2014 Class 1 eye safe</p> <p>Product Safety: EN/IEC 62368-1</p> <p>EMC: • EN 55032:2012/AC 2013; CISPR 32:2015 • EN 55024:2010; CISPR 24:2010 • EN 61000-3-2:2014 • EN 61000-3-3:2013</p> <p></p> |
|------------|---|

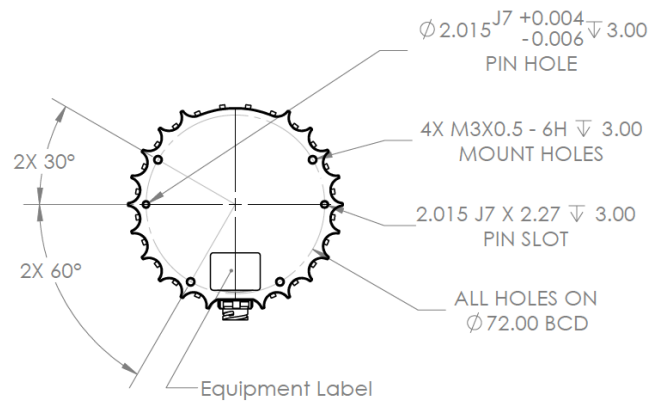
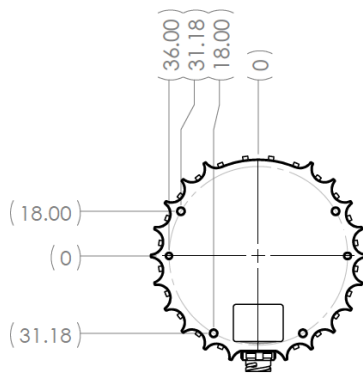
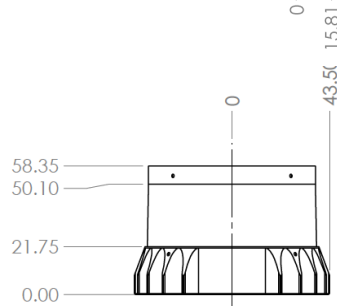
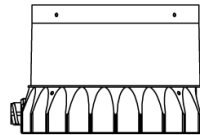
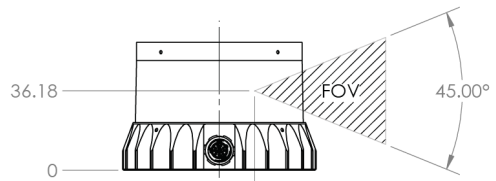
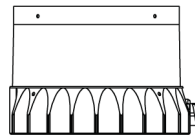
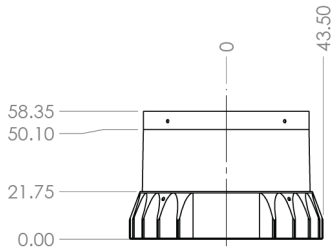
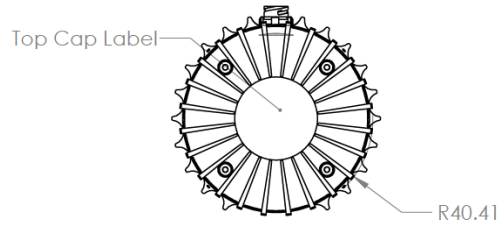
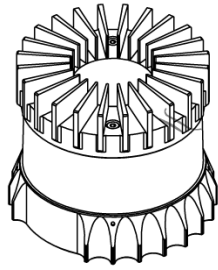
ACCESSORIES

| | |
|------------------------|--|
| 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++ |
|----------------|----------|

EXTERIOR DIMENSIONS



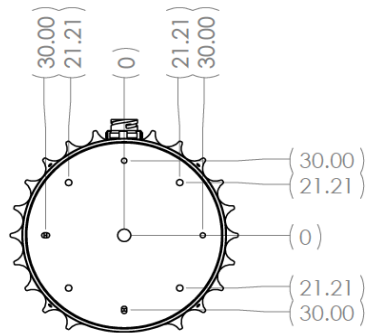
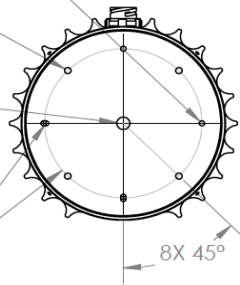
2X \varnothing 2.015 J7 $\begin{matrix} +0.004 \\ -0.006 \end{matrix}$ ∇ 3.50
PIN HOLE

4X M3X0.5 - 6H ∇ 4.00
MOUNT HOLES

M6X1.0 - 6H ∇ 6.00
MOUNT HOLES

2X 2.015 J7 X 3.00 ∇ 3.50
PIN SLOT

ALL HOLES ON
 \varnothing 60.00 BCD



*Specifications are subject to change without notice.

WWW.OUSTER.COM

REV: 2/10/2021 • © 2021 Ouster, Inc. • All rights reserved