

# OS2

## Long-Range High-Resolution Imaging Lidar

**FIRMWARE VERSION: v2.5.x**

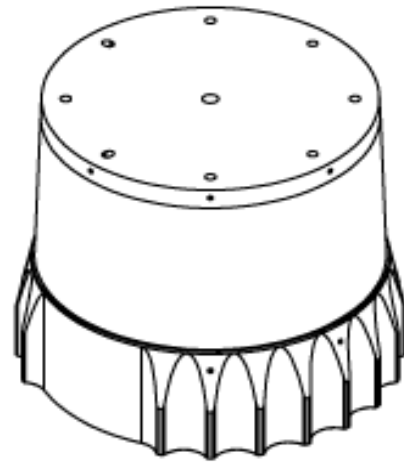
**HARDWARE VERSION: REV7**

### SUMMARY

The long-range OS2 features 200 m of range on a dark 10% target and a maximum range of over 400 m. The OS2's high resolution combined with range delivers superior object detection capabilities for autonomous vehicles and long-range industrial applications. Rated IP68/69K for all weather conditions.

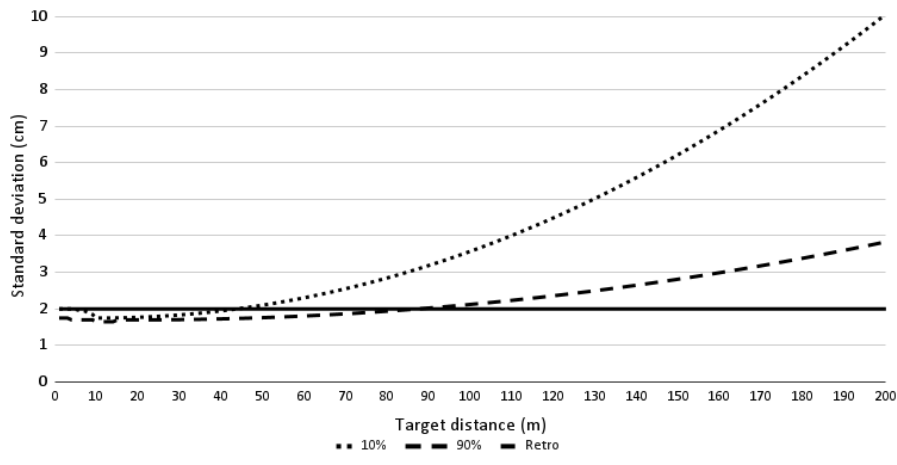
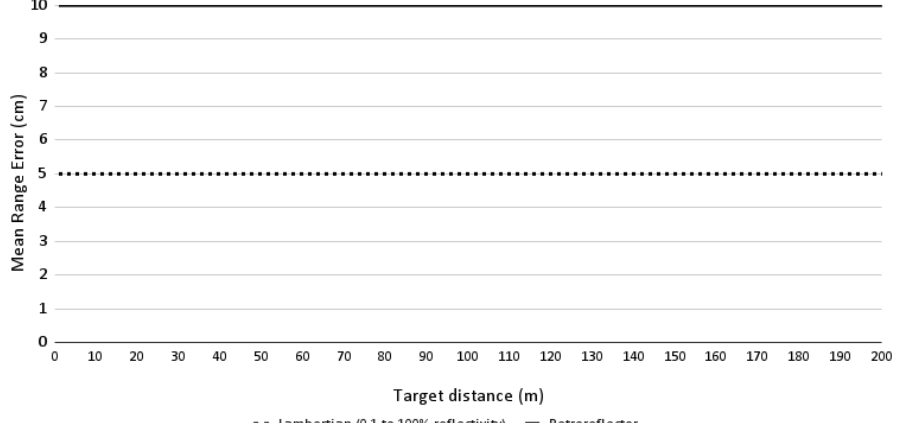
### HIGHLIGHTS

- 100% increase in range with the new L3 Chip
- Dual Return mode
- Fixed resolution per frame
- Camera-grade near-infrared and signal data
- Multi-sensor crosstalk suppression
- Open source ROS and C++ drivers
- Ouster SDK for software development



### OPTICAL PERFORMANCE

Range (80% Lambertian reflectivity, 1024 @ 10 Hz mode)	350 m @ >90% detection probability, 100 klx sunlight
Range (10% Lambertian reflectivity, 1024 @ 10 Hz mode)	200 m @ >90% detection probability, 100 klx sunlight
Minimum Range	0.8 m
Vertical Resolution	32, 64, or 128 channels
Horizontal Resolution	512, 1024, or 2048 (configurable)
Rotation Rate	10 or 20 Hz (configurable)
Field of View	Vertical: 22.5° (+11.25° to -11.25°) Horizontal: 360°
Angular Sampling Accuracy	Vertical: ±0.01° / Horizontal: ±0.01°
False Positive Rate	1/10,000
Range Resolution	0.1 cm <b>Note:</b> For <i>Low Data Rate Profile</i> the Range Resolution = 0.8cm
# of Returns	2 (strongest, second strongest)

<p>Precision (Lambertian and Retro reflective, 1024 @ 10 Hz mode, 1 standard deviation)</p>	<p>Min: <math>\pm 2.0\text{cm}</math>, Max: <math>\pm 10</math></p>  <table border="1"> <caption>Standard deviation (cm) vs Target distance (m)</caption> <thead> <tr> <th>Target distance (m)</th> <th>10% (cm)</th> <th>90% (cm)</th> <th>Retro (cm)</th> </tr> </thead> <tbody> <tr><td>0</td><td>2.0</td><td>1.8</td><td>2.0</td></tr> <tr><td>50</td><td>2.5</td><td>1.8</td><td>2.0</td></tr> <tr><td>100</td><td>4.0</td><td>2.2</td><td>2.0</td></tr> <tr><td>150</td><td>6.5</td><td>2.8</td><td>2.0</td></tr> <tr><td>200</td><td>10.0</td><td>3.8</td><td>2.0</td></tr> </tbody> </table>	Target distance (m)	10% (cm)	90% (cm)	Retro (cm)	0	2.0	1.8	2.0	50	2.5	1.8	2.0	100	4.0	2.2	2.0	150	6.5	2.8	2.0	200	10.0	3.8	2.0
Target distance (m)	10% (cm)	90% (cm)	Retro (cm)																						
0	2.0	1.8	2.0																						
50	2.5	1.8	2.0																						
100	4.0	2.2	2.0																						
150	6.5	2.8	2.0																						
200	10.0	3.8	2.0																						
<p>Range Accuracy <b>Note:</b> "Accuracy is calculated based on the error between the mean of 100 measurements on static target at a given range and the true range"</p>	 <table border="1"> <caption>Mean Range Error (cm) vs Target distance (m)</caption> <thead> <tr> <th>Target distance (m)</th> <th>Lambertian (0.1 to 100% reflectivity) (cm)</th> <th>Retroreflector (cm)</th> </tr> </thead> <tbody> <tr><td>0</td><td>5.0</td><td>2.0</td></tr> <tr><td>100</td><td>5.0</td><td>2.0</td></tr> <tr><td>200</td><td>5.0</td><td>2.0</td></tr> </tbody> </table>	Target distance (m)	Lambertian (0.1 to 100% reflectivity) (cm)	Retroreflector (cm)	0	5.0	2.0	100	5.0	2.0	200	5.0	2.0												
Target distance (m)	Lambertian (0.1 to 100% reflectivity) (cm)	Retroreflector (cm)																							
0	5.0	2.0																							
100	5.0	2.0																							
200	5.0	2.0																							

### LASER

Laser Product Class	Class 1 eye-safe per IEC/EN 60825-1: 2014
Laser Wavelength	865 nm
Beam Diameter Exiting Sensor	19 mm
Beam Divergence	0.09° (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 (Megabits Per Second) (Legacy Mode) 2048x10	66 Mbps (32 channel) 129 Mbps (64 channel) 254 Mbps (128 channel)
Data Rate (Megabits per second) (Dual Return Profile) Not applicable for 1024x20 & 2048x10 Modes	up to 43.6 Mbps (32 channel) up to 85.6 Mbps (64 channel) up to 169.4 Mbps (128 channel)

Data Rate (Megabits per second) (Low Data Rate Profile)	up to 11.83 Mbps (32 channel) up to 22.32 Mbps (64 channel) up to 43.29 Mbps (128 channel)
Data Rate (Megabits per second) (Single Return Profile)	up to 32.81 Mbps (32 channel) up to 64.26 Mbps (64 channel) up to 127.18 Mbps (128 channel)
Data Per Point	Range, signal, reflectivity, near-infrared, channel, azimuth angle, timestamp
Timestamp Resolution	< 1 $\mu$ s
Data Latency	< 10 ms

### IMU OUTPUT

Connection	UDP over 1000Base-T
Samples Per Second	100
Data Per Sample	3 axis gyro, 3 axis accelerometer
Timestamp Resolution	< 1 $\mu$ s
Data Latency	< 10 ms
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); Accuracy: &lt;1 ms error</li> <li>• gPTP; Accuracy: &lt;1 ms error</li> <li>• NMEA \$GPRMC UART message support</li> <li>• External PPS; Accuracy: &lt;1 ms error</li> <li>• Internal 10 ppm drift clock; Accuracy: &lt;20 ppm error</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 Low-power Standby Mode 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	18 - 24 W (28 W peak at startup, 30 W peak if operating below 10 °C)
Connector	Proprietary pluggable connector (Power + data + DIO)

Operating Voltage	9V - 34 V, 12 V or 24 V nominal
Dimensions	Diameter: 119.6 mm (4.71 in) Height: 98.9 mm (3.89 in)
Weight	1100 g (38.8 oz)
Mounting	Bottom: 4x M3 screws, 2x locating 2 mm pin holes, 4x M4 screws, 2x locating 3 mm pin holes, 4x M6 screws Top: 4x M4 screws, 4x locating 3mm pin holes, 1x M6 Screw

#### OPERATIONAL

Operating Temperature	-20 °C to +60 °C Between +52 °C to +60 °C, sensor automatically reduces range (max 20% range reduction)
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: 25 g, Shape: 10 ms half-sine, 400 shocks x 6 directions)
Vibration	IEC 60068-2-64 (Amplitude: 2 G-rms, Shape: 10 - 1000 Hz, Mounting: sprung masses, 3 axes w/ 8 hr duration each)
Compliance	<p><b>For US</b> Laser Safety:  <ul style="list-style-type: none"> <li>• IEC/EN 60825-1:2014 Class 1 eye safe</li> <li>• FDA US 21CFR1040 Notice 56 Class 1</li> </ul> Product Safety:  <ul style="list-style-type: none"> <li>• UL 62368-1</li> <li>• CSA 22.2 No. 62368-1-19</li> </ul> EMC: FCC 47CFR Part 15, Subpart B, Class A</p> <p><b>For EU</b> Laser Safety: IEC/EN 60825-1:2014 Class 1 eye safe  Product Safety: EN/IEC 62368-1  EMC:  <ul style="list-style-type: none"> <li>• EN 55032:2012/AC 2013; CISPR 32:2015</li> <li>• EN 55024:2010; CISPR 24:2010</li> <li>• EN 61000-3-2:2014</li> <li>• EN 61000-3-3:2013</li> </ul> </p> <p><b>Note:</b> Ouster UK (Ltd): 125 Princes Street, Edinburgh EH2 4AD, Scotland, United Kingdom Contact: Neil Calder, Phone Number: +44(0).131.563.9078</p> <div style="text-align: center;">  </div>

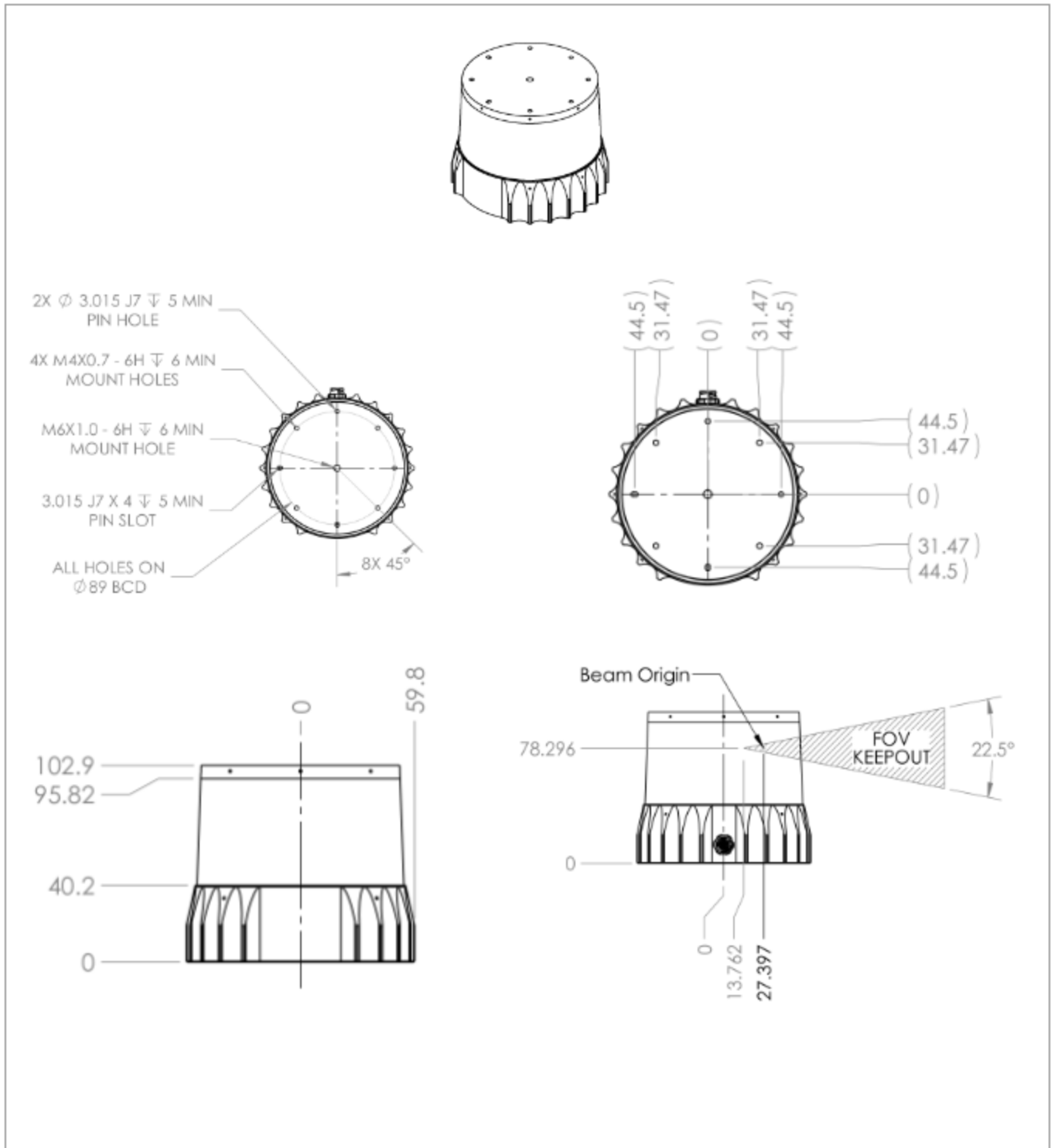
### ACCESSORIES

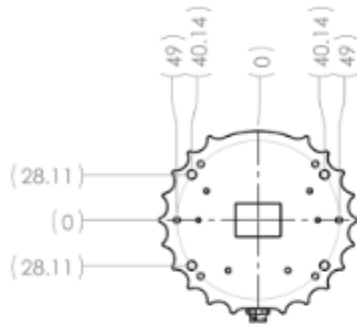
Included Interface Box	Polycarb/FR4, 100 g, 75 mm x 50 mm x 25 mm (LxWxH), 2 m CAT6 cable, 24 V power adapter, 5 m sensor cable
------------------------	--

### SOFTWARE

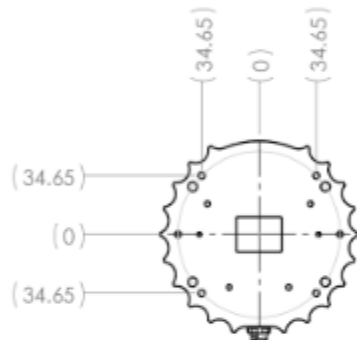
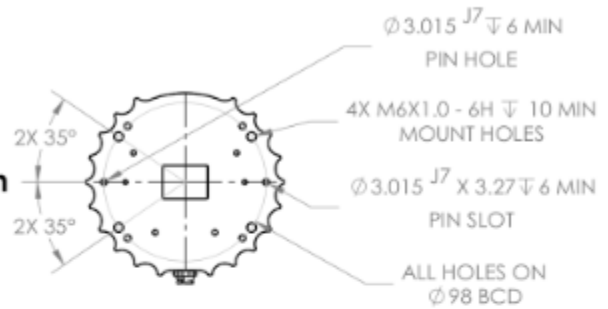
Sample Drivers	Ouster SDK, ROS, C++
----------------	----------------------

### EXTERIOR DIMENSIONS

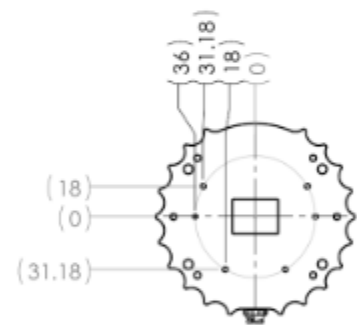
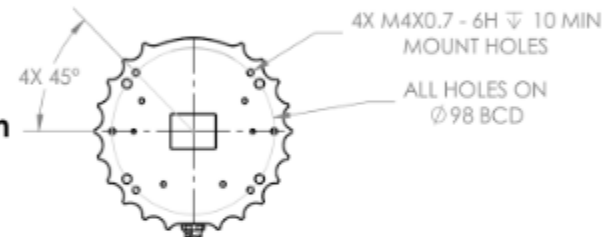




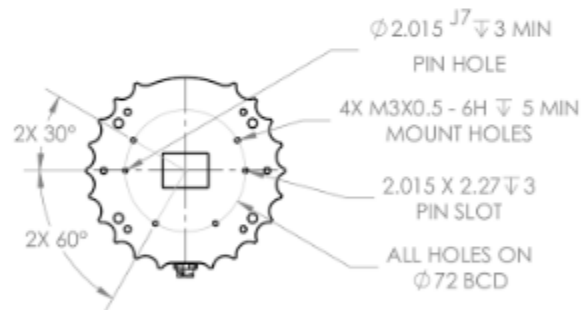
**M6 Thread Pattern**



**M4 Thread Pattern**



**M3 Thread Pattern**



\*Specifications are subject to change without notice.