**OS1**

Mid-Range High-Resolution Imaging Lidar

*Revision: 6/8/2021*

**FIRMWARE VERSION:** v2.1.x

**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 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

<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>100 m @ &gt;90% detection probability, 100 klx sunlight</td>
</tr>
<tr>
<td>(80% Lambertian reflectivity, 1024 @ 10 Hz mode)</td>
<td>120 m @ &gt;50% detection probability, 100 klx sunlight</td>
</tr>
<tr>
<td>Range</td>
<td>45 m @ &gt;90% detection probability, 100 klx sunlight</td>
</tr>
<tr>
<td>(10% Lambertian reflectivity, 1024 @ 10 Hz mode)</td>
<td>55 m @ &gt;50% detection probability, 100 klx sunlight</td>
</tr>
<tr>
<td>Minimum Range</td>
<td>0.3 m for point cloud data</td>
</tr>
<tr>
<td>Range Accuracy</td>
<td>±3 cm for lambertian targets, ±10 cm for retroreflectors</td>
</tr>
<tr>
<td>Precision</td>
<td>0.3 - 1 m: ± 0.7 cm</td>
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<tr>
<td>(10% Lambertian reflectivity, 2048 @ 10 Hz mode, 1 standard deviation)</td>
<td>1 - 20 m: ± 1 cm</td>
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<tr>
<td></td>
<td>20 - 50 m: ± 2 cm</td>
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<tr>
<td></td>
<td>&gt;50 m: ± 5 cm</td>
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<tr>
<td>Range Resolution</td>
<td>0.3 cm</td>
</tr>
<tr>
<td>Vertical Resolution</td>
<td>32, 64, or 128 channels</td>
</tr>
<tr>
<td>Horizontal Resolution</td>
<td>512, 1024, or 2048 (configurable)</td>
</tr>
<tr>
<td>Field of View</td>
<td>Vertical: 45° (+22.5° to -22.5°)</td>
</tr>
<tr>
<td></td>
<td>Horizontal: 360°</td>
</tr>
<tr>
<td>Angular Sampling Accuracy</td>
<td>Vertical: ±0.01° / Horizontal: ±0.01°</td>
</tr>
<tr>
<td>False Positive Rate</td>
<td>1/10,000</td>
</tr>
<tr>
<td>---------------------</td>
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</tr>
<tr>
<td>Rotation Rate</td>
<td>10 or 20 Hz (configurable)</td>
</tr>
<tr>
<td># of Returns</td>
<td>1 (strongest)</td>
</tr>
</tbody>
</table>

**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 µs
- 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 µs
- Data Latency: < 10 ms

**CONTROL INTERFACE**
- Connection: TCP and HTTP APIs
- Time Synchronization: Input sources:
  - 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:
  - Configurable 1 - 60 Hz output pulse
- Lidar Operating Modes: Hardware-triggered angle firing (guaranteed fixed resolution per rotation):
  - 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:  
• Beam angles  
• IMU pose correction matrix |
<table>
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<tbody>
<tr>
<td><strong>MECHANICAL/ELECTRICAL</strong></td>
<td><strong>Power Consumption</strong></td>
</tr>
<tr>
<td><strong>Operating Voltage</strong></td>
<td>22 - 26 V, 24 V nominal</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>Proprietary pluggable connector (Power + data + DIO)</td>
</tr>
</tbody>
</table>
| **Dimensions** | Diameter: 85 mm (3.34 in)  
Height:  
• 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

For US
Laser Safety:
• IEC/EN 60825-1:2014 Class 1 eye safe
• FDA US 21CFR1040 Notice 50 Class 1

Product Safety:
• UL 62368-1
• CSA 22.2 No. 62368-1-19

EMC: FCC 47CFR Part 15, Subpart B, Class A

For EU
Laser Safety: IEC/EN 60825-1:2014 Class 1 eye safe

Product Safety: EN/IEC 62368-1

EMC:
• EN 55024:2010; CISPR 24:2010
• EN 61000-3-2:2014
• EN 61000-3-3:2013

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
Specifications are subject to change without notice.