The RIEGL miniVUX-1DL is a sister device to the miniature UAV laser scanner RIEGL miniVUX–1UAV. The added indicator “DL” means "downward looking" and refers to its special design tailored to meet the needs of corridor mapping tasks (downward looking, optimized field of view, small size).

Thus, the RIEGL miniVUX-1DL is perfectly suited for tasks such as powerline and pipeline surveillance, or for infrastructure inspection as in highway or railway monitoring.

The specific wedge prism scanner construction produces a FOV (Field of View) of ± 23°, and the circular scan pattern provides a very high point density and good point distribution.

The RIEGL miniVUX-1DL makes use of RIEGL’s unique Waveform-LiDAR technology, allowing echo digitization and online waveform processing. Multi-target resolution is the basis for penetrating even dense foliage.

An easy to remove SD card for data storage and/or the option for streaming the scan data via LAN TCP/IP interface – in combination with the modest power consumption of the scanner – allows straightforward integration into various types of UAVs.

In addition to the stand-alone version of the miniVUX-1DL, RIEGL also offers fully-integrated system solutions.

Typical applications include:
- **Pipeline and Power Line Monitoring**
- **Highway and Railtrack Inspection**
- **Further Applications in Corridor Mapping**
Scan Pattern Example RIEGL miniVUX®-1DL

The rotating wedge prism generates a circular scan pattern with 23° off-nadir scan angle. The figures below show the point distribution on ground for the following parameters:

- Ground speed of aircraft: 35 kts (18 m/s)
- Height above ground: 80 m (260 ft)
- Scan rate: 75 revolutions per second
- Laser pulse repetition rate: 100 000 shots per second

Red dots = circular arc behind the scan origin
Blue dots = circular arc in front of the scan origin
For reasons of better clarity every hundred-fiftieth measurement point is plotted.

Detailed views (2 m x 2 m) of point distribution from left to right: nadir, x=20 m off-nadir and x=40 m off-nadir
Besides of the stand-alone miniVUX-1DL LiDAR engine, RIEGL offers also system solutions, combining the miniVUX-1DL with IMU/GNSS systems of different performance and of different form factors as well as optional RGB camera systems. With regards to the IMU/GNSS system, three options are available, depending on customer’s requirements and the integration environment:

**RIEGL miniVUX-SYS with APX-15 UAV**
- IMU/GNSS unit integrated with LiDAR engine RIEGL miniVUX-1DL
- total weight approx. 2.8 kg
- interfaces for up to 2 cameras
- suited for integration into fixed-wing UAVs

**RIEGL miniVUX-SYS with APX-20 UAV**
- higher-grade IMU/GNSS unit integrated with LiDAR engine RIEGL miniVUX-1DL
- total weight approx. 3.3 kg
- interfaces for up to 2 cameras
- suited for integration into all types of UAVs

Please contact sales@riegl.com to get more detailed information.

1) See technical details in the corresponding Applanix datasheet

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Data Sheet
**Technical Data RIEGL miniVUX®-1DL**

### Laser Product Classification

**Class 1 Laser Product according to IEC 60825-1:2014**

The following clause applies for instruments delivered into the United States: Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed.3., as described in Laser Notice No. 56, dated May 8, 2019.

### Range Measurement Performance

**Measuring Principle**
time of flight measurement, echo signal digitization, online waveform processing

<table>
<thead>
<tr>
<th>Laser Pulse Repetition Rate PRR</th>
<th>100 kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Measuring Range</td>
<td>1)</td>
</tr>
<tr>
<td>natural targets ( p \geq 20 % )</td>
<td>140 m</td>
</tr>
<tr>
<td>natural targets ( p \geq 60 % )</td>
<td>240 m</td>
</tr>
<tr>
<td>natural targets ( p \geq 80 % )</td>
<td>260 m</td>
</tr>
<tr>
<td>Typ. Operating Flight Altitude AGL</td>
<td>1) 2)</td>
</tr>
<tr>
<td>natural targets ( p \geq 20 % )</td>
<td>100 m (330 ft)</td>
</tr>
<tr>
<td>natural targets ( p \geq 60 % )</td>
<td>160 m (525 ft)</td>
</tr>
<tr>
<td>Max. Number of Targets per Pulse</td>
<td>5</td>
</tr>
</tbody>
</table>

1) Rounded values. 2) Typical values for average conditions.

### Minimum Range

- **Accuracy** 3)
- **Precision** 7)

### Echo Signal Intensity

- for each echo signal, high-resolution 16 bit intensity information is provided near infrared
- 1.6 x 0.5 mrad
- 160 mm x 50 mm @ 100 m

### Laser Beam Divergence

- 8) Measured at 50% peak intensity, 1.6 mrad corresponds to an increase of 160 mm of beam diameter per 100 m distance.

### Laser Beam Footprint

- rotating wedge prism
- \( \pm 23° - 46° \) (circular scan pattern)
- 10 - 75 revolutions/second equivalent to 20 - 150 scans/sec
- 0.036° \( \leq \Delta \theta \leq 0.27° \)
- 0.001° [3.6 arcsec]

### Scanner Performance

- **Scanning Mechanism** rotating wedge prism
- **Field of View** ± 23° = 46° (circular scan pattern)
- **Angular Step Width** \( \Delta \theta \) (selectable) between consecutive laser shots
- **Angle Measurement Resolution** 0.001° [3.6 arcsec]

### Interfaces

- **Configuration, Scan Data Output & Communication with External Devices**
- 2 x LAN 10/100/1000 Mbit/sec
- WLAN IEEE 802.11 a/b/g/n
- Serial RS-232 interface for data string with GNSS-time information, TTL input for 1PPS synchronization pulse.
- Power Output 10 V DC, max. 4.5 W

### General IO & Control

- 2 x TTL input/output, 1 x Remote on/off
- 2 x GNSS RS-232 Tx & PPS, Power (USB 2.0), Trigger, Exposure
- for SDHC/SDXC memory card 32 GByte (can be upgraded to 64 GByte)

### Memory Card Slot

- for SDHC/SDXC memory card 32 GByte (can be upgraded to 64 GByte)

### General Technical Data

- **Power Supply Input Voltage / Power Consumption**
- 11 - 34 V DC / typ. 43 W @ 75 revolutions/sec
- **Main Dimensions (L x W x H)**
- without Cooling Fan / with Cooling Fan
- 232 x 99 x 123 mm / 232 x 111 x 123 mm
- **Weight**
- miniVUX-1DL / Cooling Fan / Protective Cap
- approx. 2.4 kg / approx. 0.04 kg / approx. 0.05 kg
- max. 80 % non condensing @ 31°C
- IP64, dust-proof and splash-proof
- 0°C up to +40°C (operation) 1) / -20°C up to +50°C (storage)

### Temperature Range

- 11) Continuous operation of ambient temperature of \( \geq 30°C \) (\( \geq 86°F \)) requires a minimum amount of air flow at approx. 3 m/s. For applications where a 3 m/s air flow along the cooling fins cannot be guaranteed, the cooling fan has to be used.
- 12) Valid for the initial start-up. After a warm-up phase, operation down to -10°C is also possible.

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**RIEGL Laser Measurement Systems GmbH**

Riedenburgstraße 48
3580 Horn, Austria
Phone: +43 2982 4211
office@riegl.co.at | www.riegl.com

**RIEGL USA Inc.** | info@rieglusa.com | www.rieglusa.com
RIEGL Japan Ltd. | info@riegl-japan.co.jp | www.riegl-japan.co.jp
RIEGL China Ltd. | info@riegl.cn | www.riegl.cn
RIEGL Australia Pty Ltd. | info@riegl.com.au | www.riegl.com

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This data sheet is compiled with care. However, errors cannot be fully excluded and alterations might be necessary.

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1) Rounded values. 2) Typical values for average conditions. Maximum range is specified for flat targets with size in excess of the laser beam diameter, perpendicular angle of incidence, and for atmospheric visibility of 23 km. In bright sunlight, the max. range is shorter than under overcast sky.

2) For terrain assumed, scan angle \( \pm 23° \) FOV, additional rot angle \( \pm 5° \)

3) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achievable range is reduced.

7) One sigma @ 50 m range under RIEGL test conditions.

8) Measured at 50% peak intensity, 1.6 mrad corresponds to an increase of 160 mm of beam diameter per 100 m distance.

5) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.

6) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.

9) internally available (not available with standard interface box) 10) 1x externally available with standard interface box