The **RIEGL VUX-1LR** is a very lightweight and compact laser scanner, meeting the challenges of airborne laser scanning by helicopter, gyrocopter, and other small aircraft both in measurement performance as in system integration. With regard to the specific constraints and flight characteristics, the **RIEGL VUX-1LR** is designed to be mounted in any orientation and even under limited weight and space conditions. Modest in power consumption, the instrument requires only a single power supply. The entire data set of an acquisition campaign is stored onto an internal 240 GByte SSD and/or provided as real-time line scan data via the integrated LAN-TCP/IP interface.

The **RIEGL VUX-1LR** provides highspeed data acquisition using a narrow infrared laser beam and a fast line scanning mechanism. High-accuracy laser ranging is based on **RIEGL**’s unique echo digitization and online waveform processing, which enables achieving superior measurement results even under adverse atmospheric conditions, and the evaluation of multiple target echoes. The scanning mechanism is based on an extremely fast rotating mirror, which provides fully linear, unidirectional and parallel scan lines, resulting in excellent regular point pattern.

**Typical applications include**

- **Corridor Mapping:** Power Line, Railway Track and Pipeline Inspection
- **Topography in Open-Cast Mining**
- **Terrain and Canyon Mapping**
- **Surveying of Urban Environments**
- **Archeology and Cultural Heritage Documentation**
- **Agriculture & Forestry**
- **Resources Management**
- **Rapid Response in Small Scale Surveying (Collision Investigation, Risk Prevention)**
Technical Data RIEGL VUX®-1LR

Laser Product Classification

Class 1 Laser Product according to IEC60825-1:2007

The following clause applies for instruments delivered into the United States:

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Range Measurement Performance

Measuring Principle

time of flight measurement, echo signal digitization, online waveform processing, multiple-time-around-processing

Laser Pulse Repetition Rate PRR \(^1\)

<table>
<thead>
<tr>
<th>PRR</th>
<th>50 kHz</th>
<th>100 kHz</th>
<th>200 kHz</th>
<th>400 kHz</th>
<th>600 kHz</th>
<th>820 kHz reduced power (^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Measuring Range (^3) (^4)</td>
<td>820 m</td>
<td>600 m</td>
<td>430 m</td>
<td>300 m</td>
<td>250 m</td>
<td>215 m</td>
</tr>
<tr>
<td>natural targets (p \geq 20%)</td>
<td>1350 m</td>
<td>1000 m</td>
<td>720 m</td>
<td>520 m</td>
<td>430 m</td>
<td>370 m</td>
</tr>
<tr>
<td>natural targets (p \geq 60%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>110 m</td>
</tr>
<tr>
<td>Max. Operating Flight Altitude AGL (^1) (^5)</td>
<td>530 m</td>
<td>380 m</td>
<td>270 m</td>
<td>190 m</td>
<td>160 m</td>
<td>140 m</td>
</tr>
<tr>
<td>(1740 ft)</td>
<td>(1250 ft)</td>
<td>(880 ft)</td>
<td>(620 ft)</td>
<td>(520 ft)</td>
<td>(460 ft)</td>
<td>(230 ft)</td>
</tr>
</tbody>
</table>

Minimum Range

Accuracy \(^6\) \(^7\)

- 5 m
- 15 mm
- 10 mm
- up to 820 kHz
- up to 750 000 meas./sec. (@ 820 kHz PRR & 330° FOV)
- for each echo signal, high-resolution 16 bit intensity information is provided near infrared
- 0.5 mrad \(^10\)
- 50 mm @ 100 m, 250 mm @ 500 m, 500 mm @ 1000 m

Scanner Performance

Scanning Mechanism

- rotating mirror
- up to 330° (full range measurement performance)
- 10 - 200 revolutions per second, equivalent to 10 - 200 scans/sec
- 0.004° ≤ \(\Delta \theta\) ≤ 1.5°
- 0.001°
- for real-time synchronized time stamping of scan data
- scanner rotation synchronization

Data Interfaces

Configuration

- LAN 10/100/1000 Mbit/sec
- Serial RS232 interface for data string with GNSS-time information
- TTL input for 1PPS synchronization pulse

Scan Data Output

- 240 GByte SSD
- TTL input/output
- SMA connector

GNSS Interface

- Internal Memory
- External Carriage
- External GNSS Antenna

General Technical Data

Power Supply Input Voltage / Consumption \(^1\)

- 11 - 32 V DC / typ. 65 W
- 227 x 180 x 125 mm / 227 x 209 x 129 mm
- approx. 3.5 kg / approx. 3.75 kg
- max. 80 % non-condensing @ 31°C
- IP64, dust and splash-proof
- 16 500 ft (5 000 m) above MSL / 18 000 ft (5 500 m) above MSL
- 0°C up to +40°C (operation) / -20°C up to +50°C (storage)

Optional Components (integrated)

- Embedded GNSS-Inertial System

- high performance multi-channel, multi-band GNSS receiver, solid-state MEMS IMU

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\(^{1}\) Rounded values.
\(^{2}\) Laser power optimized (reduced) for measurements of short ranges with high pulse repetition rate.
\(^{3}\) 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.
\(^{4}\) Ambiguity to be resolved by post-processing with RIIIA ALI software.
\(^{5}\) Reflectivity \(p \geq 20\%\), flat terrain assumed, scan angle ±45° FOV
\(^{6}\) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
\(^{7}\) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.
\(^{8}\) One sigma @ 150 m range under RIEGL test conditions.
\(^{9}\) User selectable.
\(^{10}\) Measured at the 1/e2 points. 0.50 mrad corresponds to an increase of 50 mm of beam diameter per 100 m distance.

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Technical Data RIEGL VUX®-1LR
Maximum Measurement Range & Point Density RIEGL VUX®-1LR

The following conditions are assumed for the Operating Flight Altitude AGL:

- ambiguity resolved by multiple-time-around (MTA) processing & flight planning
- target size ≥ laser footprint
- average ambient brightness
- operating flight altitude given at a FOV of ±45°
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- ambiguity resolved by multiple-time-around (MTA) processing & flight planning
- target size ≥ laser footprint
- average ambient brightness
- operating flight altitude given at a FOV of +/-45°
Maximum Measurement Range & Point Density RIEGL VUX®-1LR

PRR = 820 kHz reduced power

Dimensional Drawings RIEGL VUX®-1LR

RIEGL VUX®-1LR with Cooling Fan Device
Multiple-Time-Around Data Acquisition and Processing

In time-of-flight laser ranging a maximum unambiguous measurement range exists, which is defined by the laser pulse repetition rate and the speed of light. In case the echo signal of an emitted laser pulse arrives later than the emission of the subsequently emitted laser pulse, the range result becomes ambiguous — an effect known as “Multiple-Time-Around” (MTA).

The RIEGL VUX-1LR allows ranging beyond the maximum unambiguous measurement range using a sophisticated modulation scheme applied to the train of emitted laser pulses. The dedicated post-processing software RiMTA provides algorithms for multiple-time-around processing, which automatically assign definite range results to the correct MTA zones without any further user interaction required.