

NEW

RIEGL miniVUX[®]-1LR

- **max. measuring range up to 500 m**
- **operating flight altitude AGL up to 250 m / 820 ft**
- **very compact & lightweight (1.55 kg / 3.4 lbs)**
- **360° field-of-view**
- **robust aluminum housing, ready to be mounted on multi-rotor, rotary-wing, and fixed-wing UAVs**
- **makes use of RIEGL's unique echo signal digitization and online waveform processing**
- **multiple target capability – up to 5 target echoes per laser shot**
- **scan speed up to 100 scans/sec**
- **measurement rate up to 100,000 measurements/sec**
- **mechanical and electrical interface for IMU mounting**
- **exceptionally well suited to measure snowy and icy terrains**
- **user-friendly, application- and installation-oriented solutions for integration**

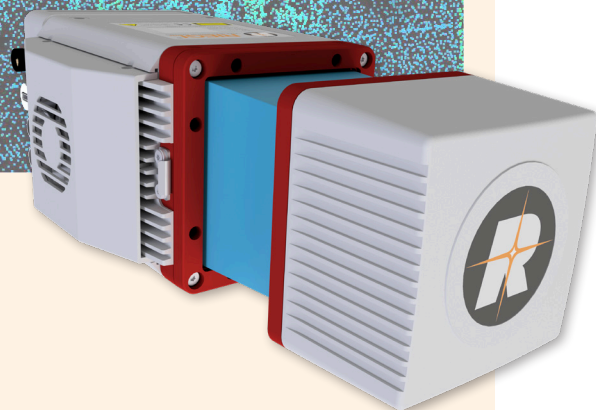
With the *RIEGL* miniVUX-1LR *RIEGL* offers a further version of the proven miniVUX-Series of LiDAR sensors. The extremely lightweight and compact design is particularly suited for straightforward integration with UAS/UAV/RPAS.

With its small and sophisticated design and the stable aluminum housing, the *RIEGL* miniVUX-1LR offers various integration possibilities with platforms even when space or payload capabilities are restricted. Scan data can be stored on the easy-to-remove SD card and/or streamed via LAN-TCP/IP interface.

Its measurement range of up to 500 m / 1640 ft combined with the 360° field of view makes the sensor especially suited for safe and efficient drone-based surveying of open pit mines, waste dumps, inaccessible canyons, and so on.

RIEGL's well proven Waveform-LiDAR technology provides excellent digital LiDAR signal processing, multiple targets per laser shot enabling the penetration of even dense foliage, optimum distribution of measurements, calibrated amplitudes and reflectance estimates and thus highly accurate, extremely informative measurement data.

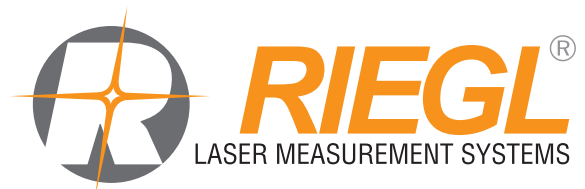
With the miniVUX-1LR, *RIEGL* continues on the proven path of offering the LiDAR sensor itself as a stand-alone version for customized system assemblies, but also as a key element of fully-integrated system solutions ready for straightforward integration with diverse platforms.



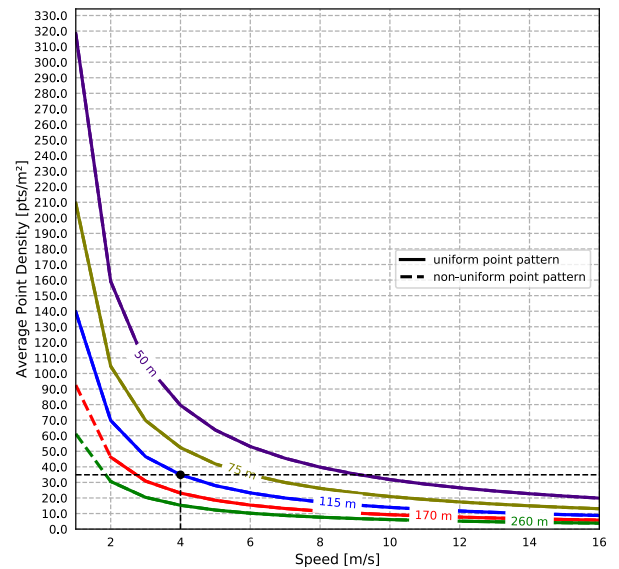
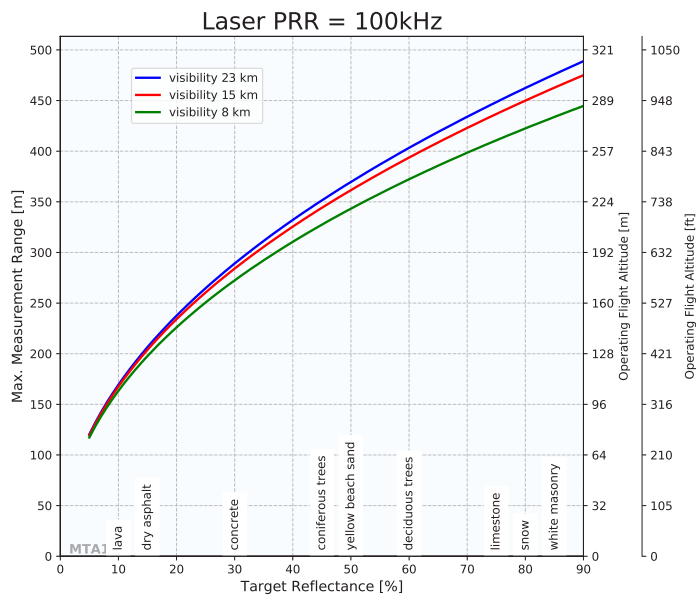
Typical applications include

- **Open-Pit Mining**
- **Dump Site Monitoring**
- **Measurements of Inaccessible Canyons**
- **Landslide Mapping and Monitoring**
- **Glacier and Snowfield Mapping and Monitoring**

visit our website
www.riegl.com



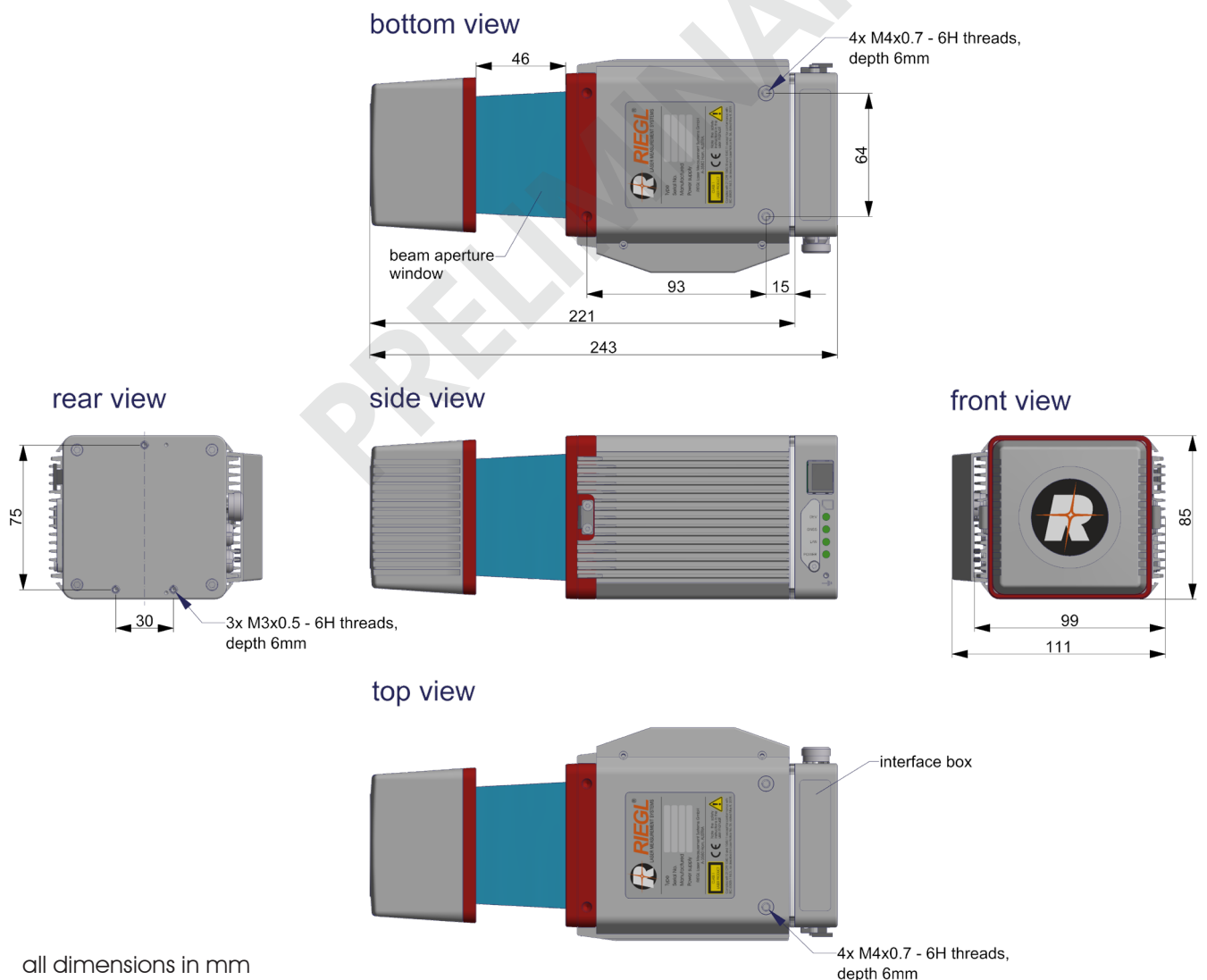
Maximum Measurement Range vs. Target Reflectance *RIEGL* miniVUX®-1LR



Operating Flight Altitude AGL given for the following conditions:
FOV of +/-45°, target size \geq laser footprint, overcast sky, ambient brightness 10klx

Example: miniVUX-1LR at 100,000 pulses/second, speed = 4 m/s,
range to target = 115 m, resulting point density ~ 35 pts/m²

Dimensional Drawings *RIEGL* miniVUX®-1LR



Besides of the stand-alone miniVUX-1LR LiDAR engine, *RIEGL* offers also system solutions, combining the miniVUX-1LR with IMU/GNSS systems of different performance and of different form factors as well as optional RGB camera systems. Additionally, a special add-on to the miniVUX-SYS allows for straightforward integration with any multi-rotor UAV, e.g. a DJI Matrice M600 or M300.

RIEGL miniVUX-1LR with APX-15 UAV¹⁾



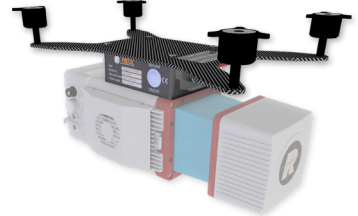
- IMU/GNSS unit integrated with LiDAR engine
- total weight approx. 2 kg
- interfaces for up to 2 cameras
- suited for integration into fixed-wing UAVs

RIEGL miniVUX-1LR with APX-20 UAV¹⁾



- higher-grade IMU/GNSS unit partly integrated with LiDAR engine
- total weight approx. 2.5 kg
- interfaces for up to 2 cameras
- suited for integration into all types of UAVs

RIEGL Integration Kit 300 / 600



- add-on to the miniVUX-SYS coming with shock-absorbing mounting-kit, power supply module and cabling
- total weight of integration kit 300 / 600 approx. 0.35 kg / approx. 0.7 kg
- suited for integration into multi-rotor UAVs

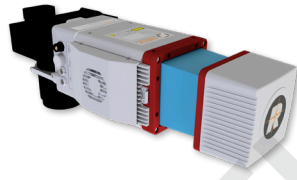
¹⁾ See technical details in the corresponding Applanix datasheet

Camera Options with *RIEGL* miniVUX®-1LR

RIEGL miniVUX-1LR LiDAR Sensor equipped with APX-15 UAV¹⁾



with two Sony Alpha 6000 cameras
(oblique mount)



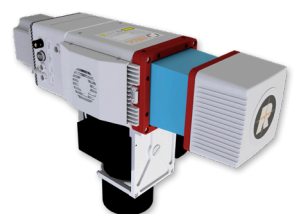
with nadir-looking camera
e.g. Alpha 6000 camera or
Sony A7R III or Sony A7R IV

integration of other 3rd party
cameras possible²⁾

RIEGL miniVUX-1LR LiDAR Sensor equipped with APX-20 UAV¹⁾



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with nadir-looking camera
e.g. Sony Alpha 6000 camera or
Sony A7R III or Sony A7R IV

integration of other 3rd party
cameras possible²⁾

¹⁾ See technical details in the corresponding Applanix data sheet.

²⁾ Multispectral camera, hyperspectral camera, thermal imaging sensor – more information on request.

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

Technical Data *RIEGL* miniVUX®-1LR

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.

CLASS 1
LASER PRODUCT

Range Measurement Performance

Measuring Principle

time of flight measurement, echo signal digitization,
online waveform processing

Laser Pulse Repetition Rate PRR ¹⁾	100 kHz		
Max. Measuring Range ²⁾ natural targets ρ ≥ 20 % natural targets ρ ≥ 60 % natural targets ρ ≥ 80 %	@ 90 klx ³⁾ 210 m 350 m 400 m	@ 10 klx ⁴⁾ 240 m 400 m 460 m	@ 0.1 klx ⁵⁾ 260 m 440 m 500 m
Typ. Operating Flight Altitude AGL ^{1) 6)} natural targets ρ ≥ 20 % natural targets ρ ≥ 60 %	150 m (490 ft) 250 m (820 ft)		
Max. Number of Targets per Pulse ⁷⁾	5		

1) Rounded values.

2) 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.

3) clear sky

4) overcast sky

5) twilight

6) Flat terrain assumed, scan angle ±45° FOV

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

Minimum Range

Accuracy ^{8) 10)}

Precision ^{9) 10)}

Laser Pulse Repetition Rate ¹⁾

Max. Effective Measurement Rate ¹⁾

Echo Signal Intensity

Laser Wavelength

Laser Beam Divergence ¹¹⁾

Laser Beam Footprint

5 m

15 mm

10 mm

100 kHz

100 000 meas./sec. (@ 100 kHz PRR & 360° FOV)

for each echo signal, high-resolution 16 bit intensity information is provided
near infrared

2.5 x 0.5 mrad

9 mm x 15 mm @ exit, 250 mm x 50 mm @ 100 m

- 8) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
9) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.

- 10) One sigma @ 50 m range under *RIEGL* test conditions.
11) Measured at 50% peak intensity, 2.5 mrad corresponds to an increase of 250 mm of beam diameter per 100 m distance.

Scanner Performance

Scanning Mechanism

Field of View (selectable)

Scan Speed (selectable)

Angular Step Width $\Delta \phi$ (selectable)
between consecutive laser shots

Angle Measurement Resolution

rotating mirror

up to 360°

10 - 100 revolutions per second, equivalent to 10 - 100 scans/sec

$0.036^\circ \leq \Delta \phi \leq 0.36^\circ$

0.001°

Interfaces

Configuration, Scan Data Output &
Communication with External Devices

GNSS Interface ¹²⁾

General IO & Control ¹³⁾

Camera Interface

Memory Card Slot

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.

2 x TTL input/output, 1 x Remote on/off

2 x GNSS RS-232 Tx & PPS, Power, Trigger, Exposure

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

12) Internally available (not available with standard interface box)

13) 1x externally available with standard interface box

General Technical Data

Power Supply Input Voltage / Consumption

Main Dimensions (L x W x H) / Weight

with Cooling Fan

without Cooling Fan

Humidity

Protection Class

Temperature Range ¹⁴⁾

11 - 34 V DC / typ. 18 W @ 100 scans/sec

243 x 111 x 85 mm / approx. 1.6 kg

243 x 99 x 85 mm / approx. 1.55 kg

max. 80 % non condensing @ 31°C

IP64, dust and splash-proof

-10°C up to +40°C (operation) / -20°C up to +50°C (storage)

- 14) Continuous operation at ambient temperature of $\geq 30^\circ\text{C}$ ($\geq 86^\circ\text{F}$) 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.



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