

NEW

RIEGL miniVUX[®]-1UAV

- **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 wave-
form 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 in snowy and icy terrains
- **user-friendly, application- and**
installation-oriented solutions for
integration



The new *RIEGL* miniVUX-1UAV is an extremely lightweight airborne laser scanner, designed specifically for integration with the newly emerging survey platforms within UAS/UAV/RPAS.

The small and sophisticated design of the stable aluminum housing enables integration with platforms that offer restricted space or payload capabilities. The 360° field of view allows complete acquisition of the environment.

An easy to remove SD storage 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, enables simple integration possibilities with most UAS/UAV/RPAS systems.

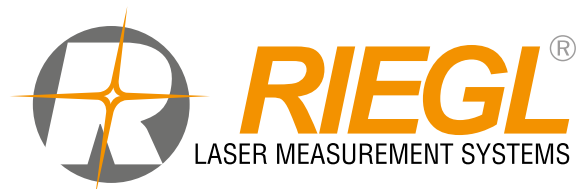
The *RIEGL* miniVUX-1UAV makes use of *RIEGL*'s unique Waveform-LiDAR technology, allowing echo digitization and online waveform processing. Multi-target resolution is the basis for penetrating even dense foliage. Additionally the wavelength is optimized for the measurement of snowy and icy terrain.

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

Typical applications include

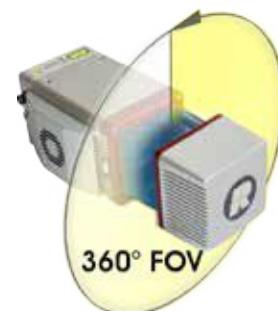
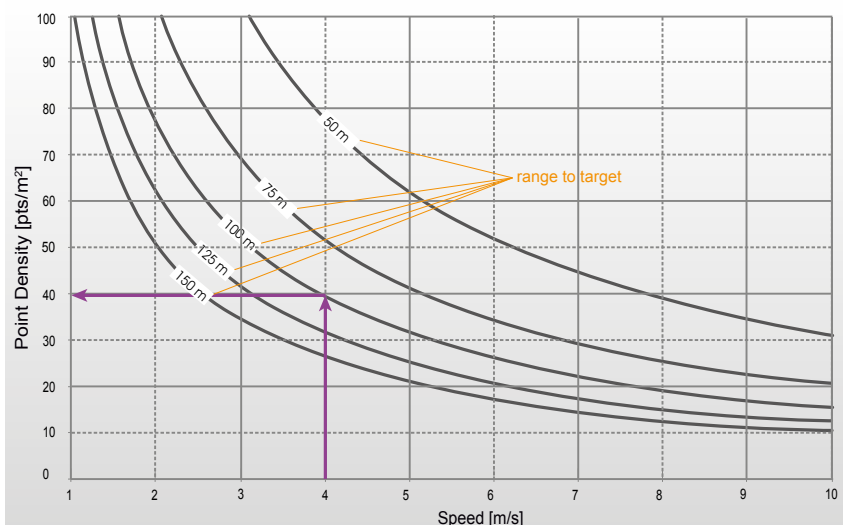
- **Agriculture & Forestry**
- **Glacier and Snowfield Mapping**
- **Archeology and Cultural Heritage Documentation**
- **Construction-Site Monitoring**
- **Landslide Monitoring**

visit our website
www.riegl.com

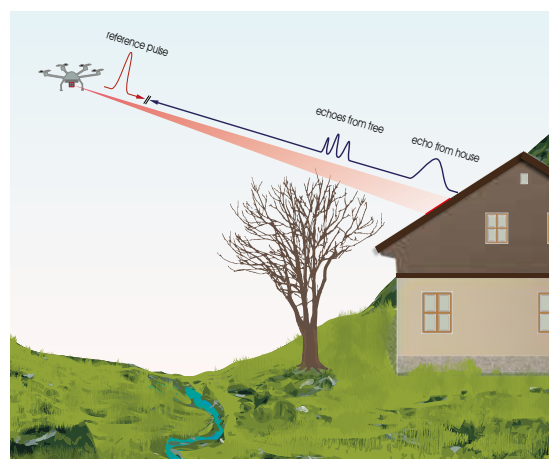
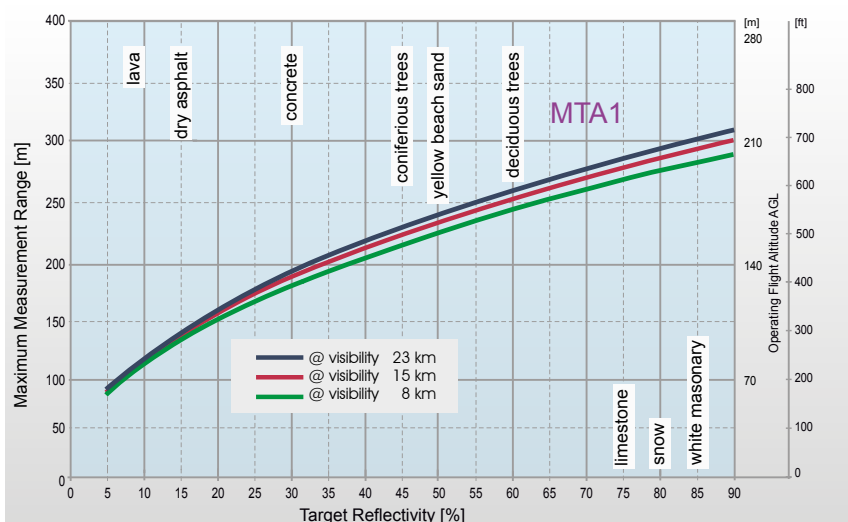


Maximum Measurement Range vs. Target Reflectivity *RIEGL* miniVUX®-1 UAV

PRR = 100 kHz



Example: miniVUX-1 UAV at 100,000 pulses/second
range to target = 100 m, speed = 4 m/s
Resulting Point Density ~ 40 pts/m²



MTA1: no ambiguity / one transmitted pulse „in the air“

The following conditions are assumed for the Operating Flight Altitude AGL

- target size ≥ laser footprint
- average ambient brightness
- operating flight altitude given at a FOV of +/-45°

RIEGL miniVUX-SYS System Integration Options

Besides of the stand-alone miniVUX-1 UAV sensor for integration by the customer, *RIEGL* offers also integrated system solutions, combining the miniVUX-1 UAV with an IMU/GNSS system and an optional RGB camera system for pointcloud colorization. With regards to the IMU/GNSS system, two options are available, depending on customer's requirements and the integration environment:

RIEGL miniVUX-SYS with APX-15 UAV¹⁾



very compact IMU/GNSS unit fully integrated with the LiDAR engine in an attached interface box

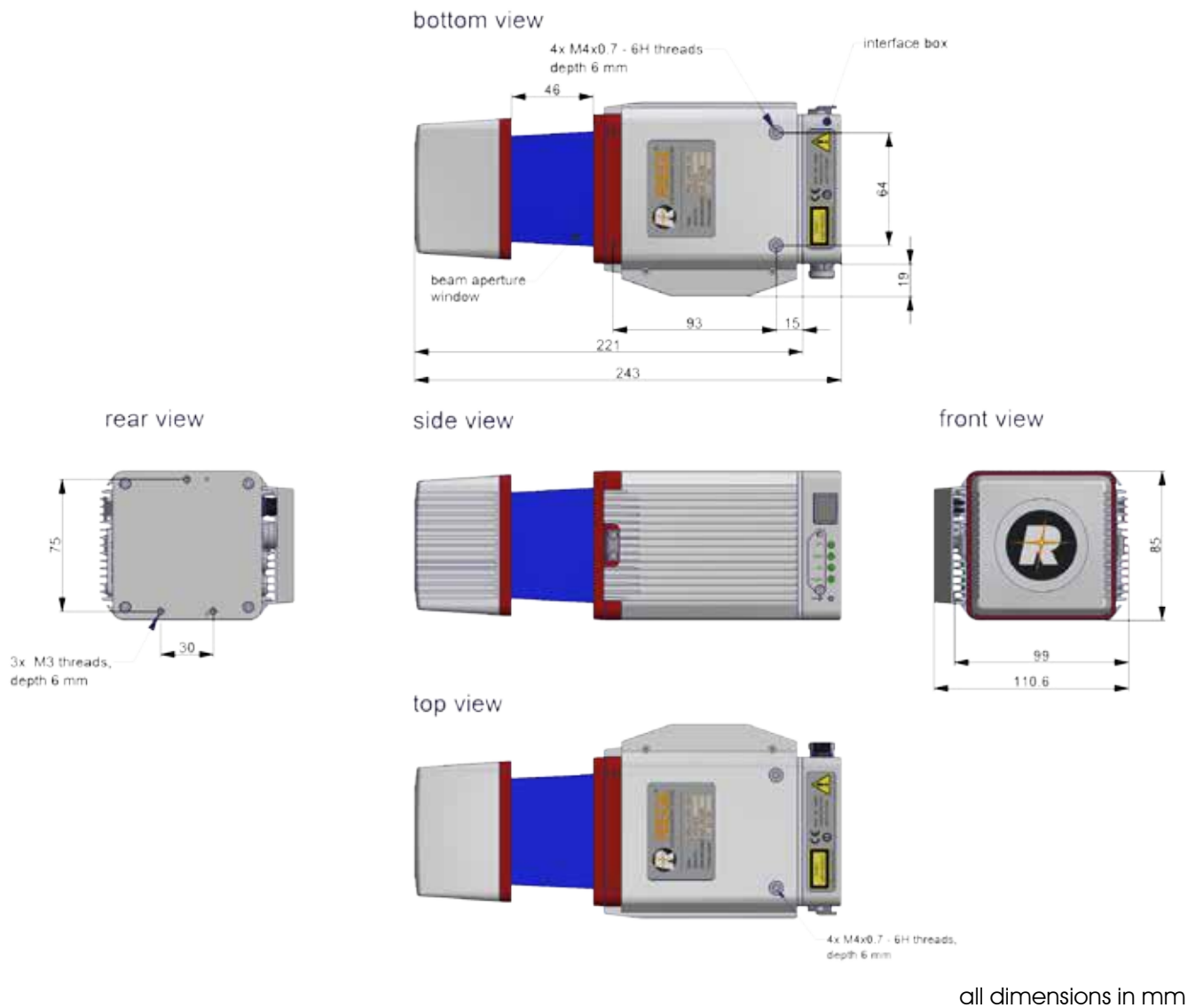
RIEGL miniVUX-SYS with AP20¹⁾ and control unit



external IMU-sensor, firmly attached and tightly coupled with the LiDAR engine and a separate control unit for interfacing

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

¹⁾ See technical details at the corresponding Applanix datasheet



RIEGL miniVUX®-1 UAV Additional Equipment



Cooling Fan

The *RIEGL* miniVUX-1 UAV is equipped with a cooling fan; a lightweight structure with an axial fan providing forced air convection. It takes care that the sensor can be operated even under conditions where sufficient natural air flow cannot be guaranteed. Power supply is provided via integrated contact pins.

The cooling fan is easy to demount by the customer when it might be necessary due to restricted space conditions. In that case, please note, that continuous operation of the sensor requires forced air convection. Thus, the scanner will turn off, if the environmental conditions/temperatures exceed the temperature range given for the sensor.



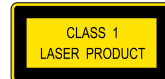
Protective Cap

To shield the glass window of the *RIEGL* miniVUX-1 UAV from mechanical damage and soiling, a protective cap is provided to cover the upper part of the instrument during transport and storage.

Technical Data *RIEGL* miniVUX®-1 UAV

Laser Product Classification

Class 1 Laser Product
according to IEC60825-1:2014



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 $\rho \geq 20\%$	150 m
natural targets $\rho \geq 60\%$	250 m
Max. Operating Flight Altitude AGL ^{1) 3)}	100 m (330 ft)
Max. Number of Targets per Pulse	5

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.
3) Reflectivity $\rho \geq 20\%$, flat terrain assumed, scan angle $\pm 45^\circ$ FOV, additional roll angle $\pm 5^\circ$

Minimum Range

Accuracy ^{4) 6)}

Precision ^{5) 6)}

Laser Pulse Repetition Rate ¹⁾

Max. Effective Measurement Rate ¹⁾

Echo Signal Intensity

Laser Wavelength

Laser Beam Divergence ⁷⁾

Laser Beam Footprint

3 m

15 mm

10 mm

100 kHz

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

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

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

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

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

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

Scanner Performance

Scanning Mechanism

Field of View (selectable)

Scan Speed (selectable)

Angular Step Width $\Delta \vartheta$ (selectable)

between consecutive laser shots

Angle Measurement Resolution

rotating mirror

up to 360°

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

$0.05^\circ \leq \Delta \vartheta \leq 0.5^\circ$

0.001°

Interfaces

Configuration, Scan Data Output &
Communication with External Devices
GNSS Interface

2 x LAN 10/100/1000 Mbit/sec

WLAN IEEE 802.11 a/b/g/n

Serial RS232 interface for data string with GNSS-time information,

TTL input for 1PPS synchronization pulse.

Power Output 10 V DC, max 4.5 W ⁸⁾

2 x TTL input/output ⁹⁾, 1 x Remote on/off

2 x USB 2.0, Trigger, Exposure ⁹⁾

for SDHC/SDXC memory card 32 GByte (can be upgraded to 128 GByte)

SPI (Serial Peripheral Interface) ⁸⁾

8) internally available (not available with standard interface box)

9) 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 ¹⁰⁾

11 - 34 V DC / typ. 16 W @ 100 scans/sec

242 x 110 x 85 mm / approx. 1.6 kg

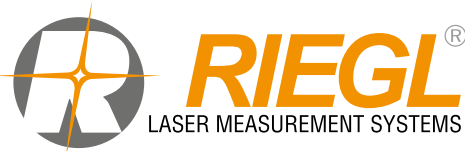
242 x 99 x 85 mm / approx. 1.55 kg

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)

10) 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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