# RIEGL miniVUX®-2UAV

- *100 kHz / 200 kHz Laser PRR selectable*
- *measurement rate up to 200,000 measurements/sec*
- *scan speed up to 100 scans/sec*
- *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*
- *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 *RIEGL* miniVUX-2UAV is an extremely lightweight airborne laser scanner, designed specifically for integration with UAS/UAV/RPAS. The sister type of the proven *RIEGL* miniVUX-1UAV sensor offers 100 kHz and 200 kHz laser PRR. With 200 kHz PRR, the sensor provides up to 200,000 measurements per second and thus a dense point pattern on the ground for UAV-based applications that require the acquisition of small objects.**

The small and sophisticated design of the stable aluminum housing offers various integration possiblities 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 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, enable straight-forward integration with most UAS/UAV/RPAS types.

The *RIEGL* miniVUX-2UAV 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. As a further special feature, the wavelength is optimized for the measurement of snowy and icy terrain.

In addition to the stand-alone version of the miniVUX-2UAV, *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***



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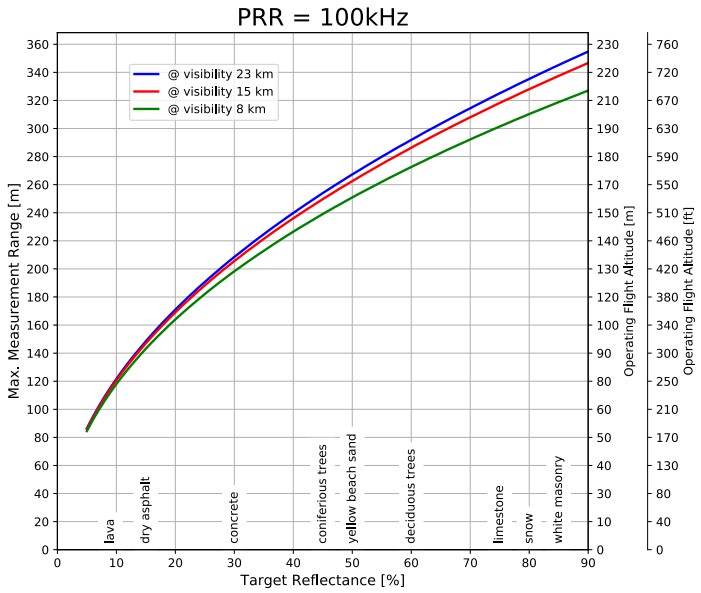
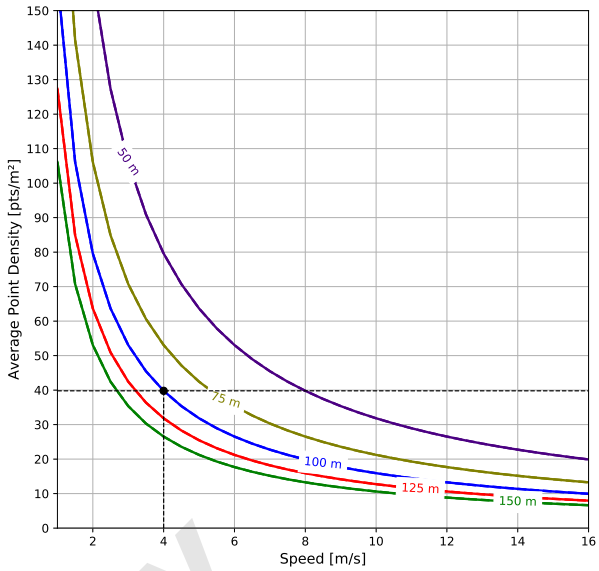
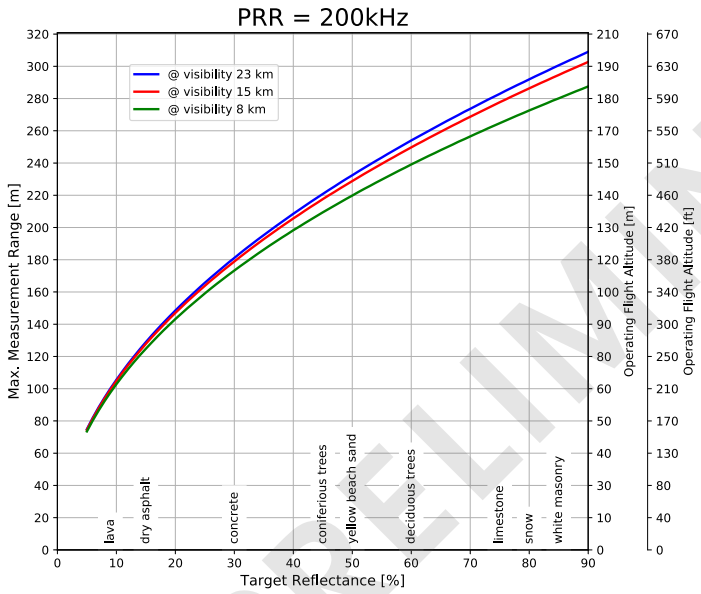
RIEGL®
LASER MEASUREMENT SYSTEMS

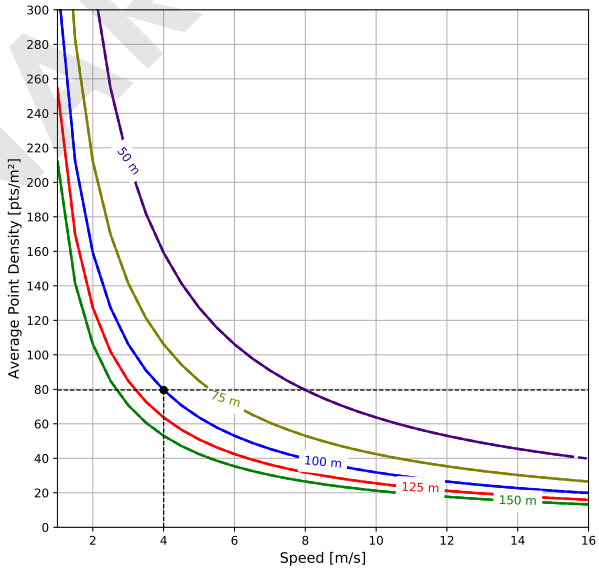
## Maximum Measurement Range vs. Target Reflectance *RIEGL* miniVUX®-2UAV




**Example:** miniVUX-2UAV at 100,000 pulses/second, range to target = 100 m, speed = 4 m/s — Resulting Point Density ~ 40 pts/m²



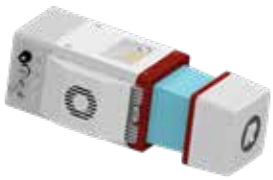

**Example:** miniVUX-2UAV at 200,000 pulses/second, range to target = 100 m, speed = 4 m/s — Resulting Point Density ~ 80 pts/m²



## *RIEGL* miniVUX-SYS System Integration Options

Besides of the stand-alone miniVUX-2UAV LiDAR engine, *RIEGL* offers also system solutions, combining the miniVUX-2UAV 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 straight forward integration with your multi-rotor UAV, e.g. a DJI Matrice M600.

### *RIEGL* miniVUX-2UAV with APX-15 UAV[1)]



- 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-2UAV with APX-20 UAV[1)]

- 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

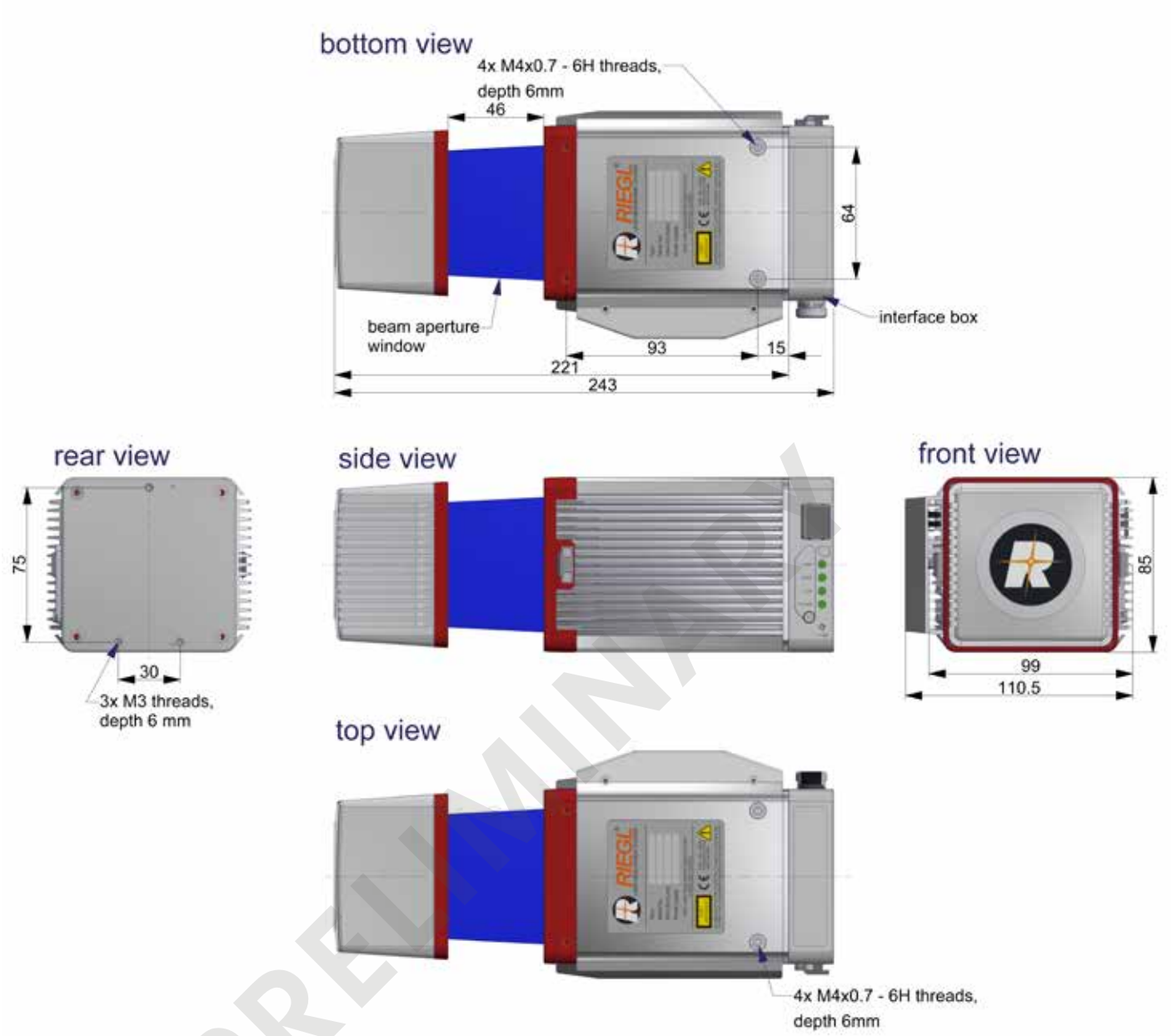
### *RIEGL* Integration Kit 600

- add-on to the miniVUX-SYS coming with shock-absorbing mounting-kit, power supply module and cabling
- total weight approx. 0.7 kg (without sensor and camera)
- suited for integration into mulit-rotor UAVs

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

1) See technical details in the corresponding Applanix datasheet

# Dimensional Drawings *RIEGL* miniVUX®-2UAV Stand-Alone



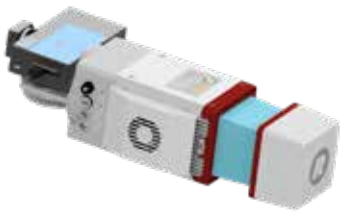



all dimensions in mm

# *RIEGL* miniVUX®-2UAV Camera Options

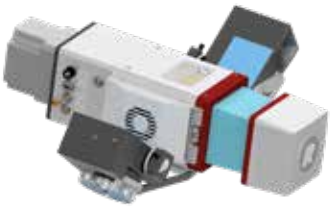
**_RIEGL_ miniVUX-2UAV LiDAR Sensor equipped with APX-15 UAV[1)]**

*with two Sony Alpha 6000 cameras (oblique mount)*



*with Nadir-looking camera e.g. Sony Alpha 6000 camera or Sony Alpha 7R III*

**_RIEGL_ miniVUX-2UAV LiDAR Sensor equipped with APX-20 UAV[1)]**



*with two Sony Alpha 6000 cameras (oblique mount)*

*with Nadir-looking camera e.g. Sony Alpha 6000 camera or Sony Alpha 7R III*

1) See technical details in the corresponding Applanix datasheet

# Technical Data *RIEGL* miniVUX®-2UAV

| | |
|---|---|
| Laser Product Classification | Class 1 Laser Product according to IEC 60825-1:2014<br>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 |

| Laser Pulse Repetition Rate PRR [1] | 100 kHz | 200 kHz |
|---|---|---|
| Max. Measuring Range [2] | | |
| natural targets ρ ≥ 20 % | 170 m | 150 m |
| natural targets ρ ≥ 60 % | 290 m | 250 m |
| natural targets ρ ≥ 80 % | 330 m | 280 m |
| Typ. Operating Flight Altitude AGL [1] [3] | | |
| natural targets ρ ≥ 20 % | 100 m (330 ft) | 85 m (280 ft) |
| natural targets ρ ≥ 60 % | 160 m (525 ft) | 140 m (460 ft) |
| Max. Number of Targets per Pulse [4] | 5 | 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) Flat terrain assumed, scan angle ±45° FOV
4) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achieveable range is reduced.

| | |
|---|---|
| Minimum Range | 3 m |
| Accuracy [5] [7] | 15 mm |
| Precision [6] [7] | 10 mm |
| Laser Pulse Repetition Rate [1] | 100 kHz / 200 kHz (selectable) |
| Max. Effective Measurement Rate [1] | up to 200 000 meas./sec. (@ 200 kHz PRR & 360° FOV) |
| Echo Signal Intensity | for each echo signal, high-resolution 16 bit intensity information is provided |
| Laser Wavelength | near infrared |
| Laser Beam Divergence [8] | 1.6 x 0.5 mrad |
| Laser Beam Footprint | 160 mm x 50 mm @ 100 m |

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.
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.

## Scanner Performance

| | |
|---|---|
| Scanning Mechanism | rotating mirror |
| Field of View (selectable) | up to 360° |
| Scan Speed (selectable) | 10 - 100 revolutions per second, equivalent to 10 - 100 scans/sec |
| Angular Step Width Δ φ (selectable) between consecutive laser shots | 0.018° ≤ Δ φ ≤ 0.36° |
| Angle Measurement Resolution | 0.001° |

## Interfaces

| | |
|---|---|
| Configuration, Scan Data Output & Communication with External Devices | 2 x LAN 10/100/1000 Mbit/sec<br>WLAN IEEE 802.11 a/b/g/n |
| GNSS Interface | 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 [9] |
| General IO & Control | 2 x TTL input/output [10], 1 x Remote on/off |
| Camera Interface | 2 x GNSS RS-232 Tx & PPS, Power, Trigger, Exposure [10] |
| Memory Card Slot | for SDHC/SDXC memory card 32 GByte (can be upgraded to 64 GByte) |

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

## General Technical Data

| | |
|---|---|
| Power Supply Input Voltage / Consumption | 11 - 34 V DC / typ. 18 W @ 100 scans/sec |
| Main Dimensions (L x W x H) / Weight | |
| with Cooling Fan | 243 x 111 x 85 mm / approx. 1.6 kg |
| without Cooling Fan | 243 x 99 x 85 mm / approx. 1.55 kg |
| Humidity | max. 80 % non condensing @ 31°C |
| Protection Class | IP64, dust and splash-proof |
| Temperature Range [11] | -10°C up to +40°C (operation) / -20°C up to +50°C (storage) |

11) Continuous operation at ambient temperature of ≥ 30°C (≥ 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.



RIEGL LASER MEASUREMENT SYSTEMS

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