Miniaturized LiDAR Sensor for Unmanned Laser Scanning

NEW

RIEGL miniVUX®-1UAV

- *extremely compact, lightweight (1.55 kg), and robust*
- *360° field-of-view*
- *stable aluminium housing, ready to be mounted to fixed-wing, rotary-wing, and multi-rotor UAVs*
- *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 for measuring snowy and icy terrain*

World Premiere at
INTERGEO 2016

The new *RIEGL* miniVUX-1UAV is an extremely lightweight miniaturized airborne laser scanner, ideally suited for the implementation of emerging survey solutions by UAS/UAV/RPAS.

The small size and sophisticated design of the stable aluminium housing allows mounting under limited weight and space conditions. The 360° field of view allows data acquisition of the entire surroundings.

Modest in power consumption, the instrument requires only a single power supply. The entire data set of an acquisition campaign is stored onto an easily removable SD storage card and/or provided as line scan data stream via the integrated LAN-TCP/IP interface.

The *RIEGL* miniVUX-1UAV makes use of *RIEGL's* waveform processing LiDAR technology offering echo digitization and online waveform processing. Its multiple-target capability enables achieving superior measurement results even under adverse atmospheric conditions. The wavelength of the laser is well suited for measuring of snowy and icy terrain.

Typical applications include

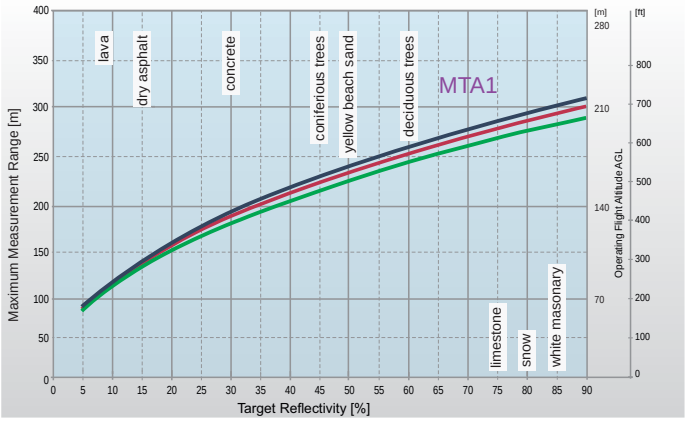
- *Agriculture & Forestry*
- *Archeology and Cultural Heritage Documentation*
- *Construction-Site Monitoring*
- *Glacier and Snowfield Mapping*
- *Landslide Monitoring*

visit our website
www.riegl.com

RIEGL®
LASER MEASUREMENT SYSTEMS

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

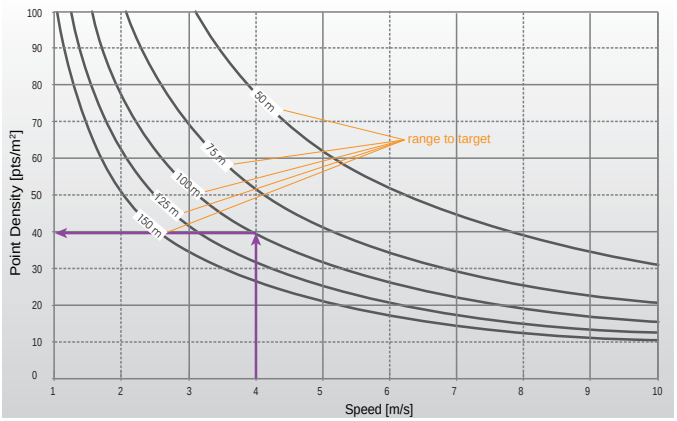
PRR = 100 kHz



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

@ visibility 23 km
@ visibility 15 km
@ visibility 8 km

PRR = 100 kHz



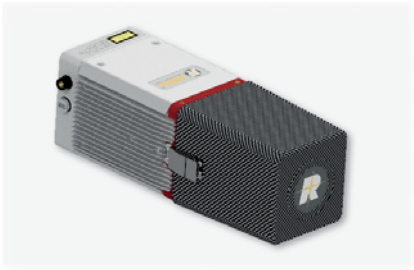
Example: miniVUX-1 at 100,000 pulses/second
range to target = 100 m, speed = 4 m/s
Resulting Point Density ~ 40 pts/m²

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®-1UAV Additional Equipment and Integration

Cooling Fan Device



***RIEGL* miniVUX-1UAV with Protective Cap**

***RIEGL* VUX-1UAV with external IMU-Sensor**
(*RIEGL* VUX-SYS)

Additional Equipment for *RIEGL* miniVUX-1UAV

Cooling Fan Device

Lightweight structure with an axial fan providing forced air convection for applications where sufficient natural air flow cannot be guaranteed. Power supply is provided via integrated contact pins. The cooling fan device is easy to mount by the customer and is included in the scanner's scope of delivery.

The cooling fan device is to be mounted whenever the environmental conditions/ temperatures require (see "temperature range" on page 4 of this datasheet).

Protective Cap

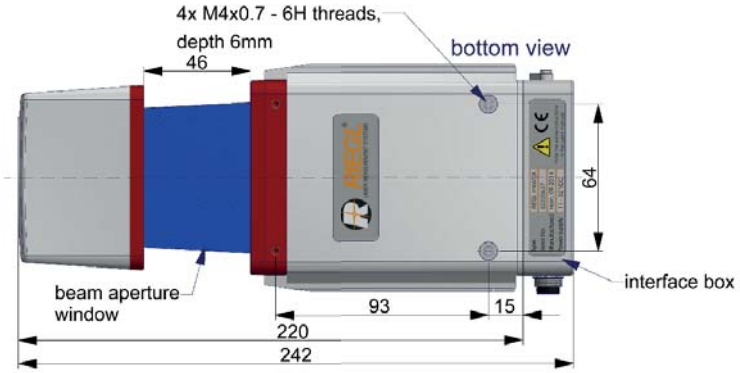
To shield the glass window of the *RIEGL* miniVUX-1UAV from mechanical damage and soiling, a protective cap is provided to cover the upper part of the instrument during transport and storage.

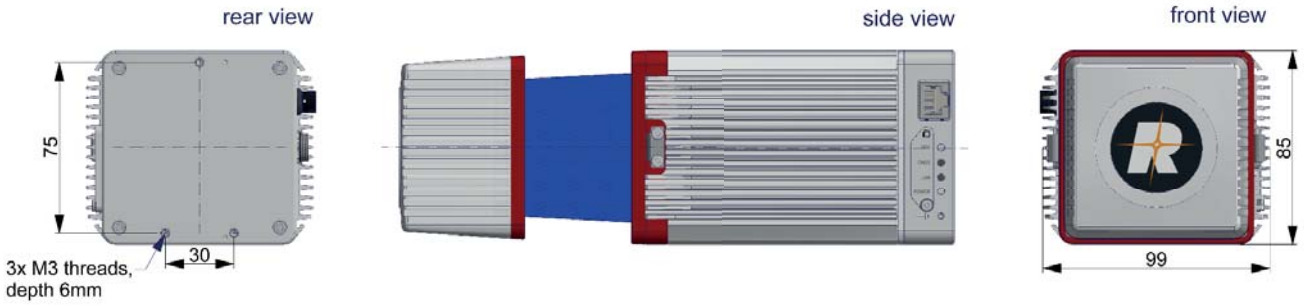
Options for *RIEGL* miniVUX-1UAV Integration

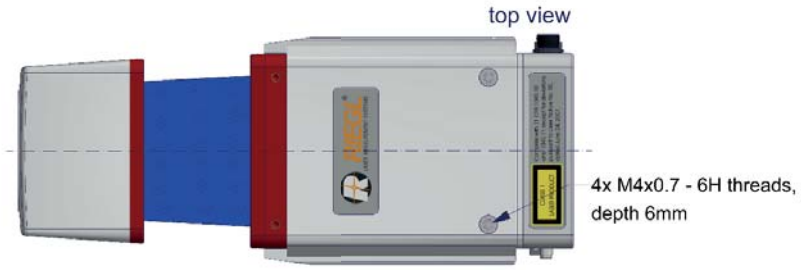
RIEGL offers user-friendly, application- and installation-oriented solutions for integration of the miniVUX-1UAV LiDAR sensor:

- ***RIEGL* VUX-SYS**
  Complete airborne laser scanning system for flexible use in UAS/UAV/RPAS, helicopter, gyrocopter and ultra-light aircraft installations, comprising the *RIEGL* miniVUX-1UAV, an IMU/GNSS system and a dedicated control unit.
- ***RIEGL* RiCOPTER**
  Ready to fly remotely piloted airborne laser scanning system with *RIEGL* VUX-SYS integrated

Details to be found on the relevant datasheets and infosheets.







all dimensions in mm

Technical Data *RIEGL* miniVUX®-1UAV

Laser Product Classification	Class 1 Laser Product according to IEC60825-1:2014 (Ed. 03) 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

Laser Pulse Repetition Rate PRR [1]	100 kHz
Max. Measuring Range [2]	
natural targets ρ ≥ 20 %	150 m
natural targets ρ ≥ 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 ρ ≥ 20%, flat terrain assumed, scan angle ±45° FOV, additional roll angle ± 5°

Minimum Range	3 m
Accuracy [4] [6]	15 mm
Precision [5] [6]	10 mm
Laser Pulse Repetition Rate [1]	100 kHz
Max. Effective Measurement Rate [1]	up to 100 000 meas./sec. (@ 100 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 [7]	1.6 x 0.5 mrad
Laser Beam Footprint	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 @ 150 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	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 ϑ (selectable) between consecutive laser shots	0.05° ≤ Δ ϑ ≤ 0.5°
Angle Measurement Resolution	0.001°

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
GNSS Interface	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 [9]
General IO & Control	2 x TTL input/output [8], 1 x Remote on/off
Camera Interface	2 x USB 2.0, Trigger, Exposure [8]
Memory Card Holder	for SDHC/SDXC memory card up to 128 GByte
Serial Interface to External Devices	SPI (Serial Peripheral Interface) [9]

8) 1 x externally available with standard interface box
9) internally available (not available with standard interface box)

General Technical Data

Power Supply Input Voltage / Consumption	11 - 32 V DC / typ. 16 W @ 100 scans/sec
Main Dimensions (L x W x H)	
without / with Cooling Fan Device	242 x 99 x 85 mm / 242 x 110 x 85 mm
Weight	
without / with Cooling Fan Device	approx. 1.55 kg / approx. 1.6 kg
Humidity	max. 80 % non condensing @ 31°C
Protection Class	IP64, dust and splash-proof
Temperature Range [10]	-10°C up to +40°C (operation) / -20°C up to +50°C (storage)

10) Continuous operation requires forced air convection. For applications where sufficient natural air flow alongside the cooling fins cannot be guaranteed an additional Cooling Fan Device (cooling fan with corresponding air deflector) has to be used.

RIEGL® LASER MEASUREMENT SYSTEMS

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