

NEW

RIEGL miniVUX-SYS[®]

- **complete miniaturized & lightweight UAV-based LiDAR system integrating a RIEGL miniVUX-1UAV or a RIEGL miniVUX-1DL LiDAR sensor**
- **different IMU/GNSS options available**
- **various mounting options for highly flexible installation**
- **prepared for remote control via low-bandwidth data link**
- **prepared for interfacing with optional RGB camera(s) and thermal imaging sensor(s)**
- **Integration Kit 600 available for straightforward system integration with selected multi-rotor UAV types**

The **RIEGL miniVUX-SYS** is a complete laser scanning system of low weight and compact size for flexible use in UAV-based applications on a variety of UAV/UAS/RPAS.

The system comprises a **RIEGL miniVUX-1UAV** or a **RIEGL miniVUX-1DL** LiDAR engine, an IMU/GNSS system (different versions available), and an optional RGB camera system.

The measurement performance of **RIEGL's** UAV LiDAR sensor in combination with the Inertial Measurement Unit and the associated GNSS receiver results in survey-grade measurement accuracy.

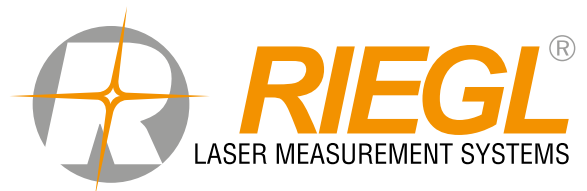
The miniVUX-SYS is delivered with the necessary software tools for processing and geo-referencing of the acquired scan data, and processing of the IMU/GNSS data.

Typical applications include

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



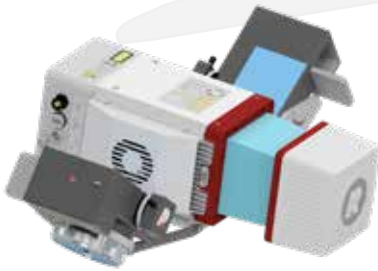
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RIEGL miniVUX®-SYS with APX-15 UAV (e.g. for fixed-wing UAVs)

For this miniVUX-SYS solution, the APX-15 UAV¹⁾ IMU/GNSS unit is integrated in a small interface box which is attached to the rear part of the LiDAR sensor. Due to its compact and lightweight design and the total weight of approx. 2 - 2.8 kg (depending on scanner type, without camera(s)), the RIEGL miniVUX-SYS with APX-15 UAV is very well suited for an integration with UAV platforms offering limited/restricted weight and space conditions. Optionally, a single or a dual RGB camera system is available.

RIEGL miniVUX-1UAV LiDAR Sensor equipped with APX-15 UAV



with two Sony Alpha 6000 cameras
(oblique mount)



with Nadir-looking camera
e.g. Sony Alpha 6000 camera

RIEGL miniVUX-1DL LiDAR Sensor equipped with APX-15 UAV



with Nadir-looking camera
e.g. Sony Alpha 6000 camera

RIEGL miniVUX®-SYS with APX-20 UAV (e.g. for fixed-wing, single-rotor or multi-rotor UAVs)

For this miniVUX-SYS solution, the new, higher-grade APX-20 UAV¹⁾ IMU/GNSS system is used. The LiDAR sensor is equipped with a specifically designed interface box accommodating the GNSS board stack as well as the camera trigger electronics. The IMU sensor is tightly coupled with the LiDAR sensor. With its weight of approx. 2.5 - 3.3 kg (depending on scanner type, without cameras) the RIEGL miniVUX-SYS with APX-20 UAV is universally applicable for an integration with more or less all types of UAVs that are capable of carrying this payload weight. Optionally, a single or a dual RGB camera system is available.

RIEGL miniVUX-1UAV LiDAR Sensor equipped with APX-20 UAV



with two Sony Alpha 6000 cameras
(oblique mount)



with Nadir-looking camera
e.g. Sony Alpha 6000 camera

RIEGL miniVUX-1DL LiDAR Sensor equipped with APX-20 UAV

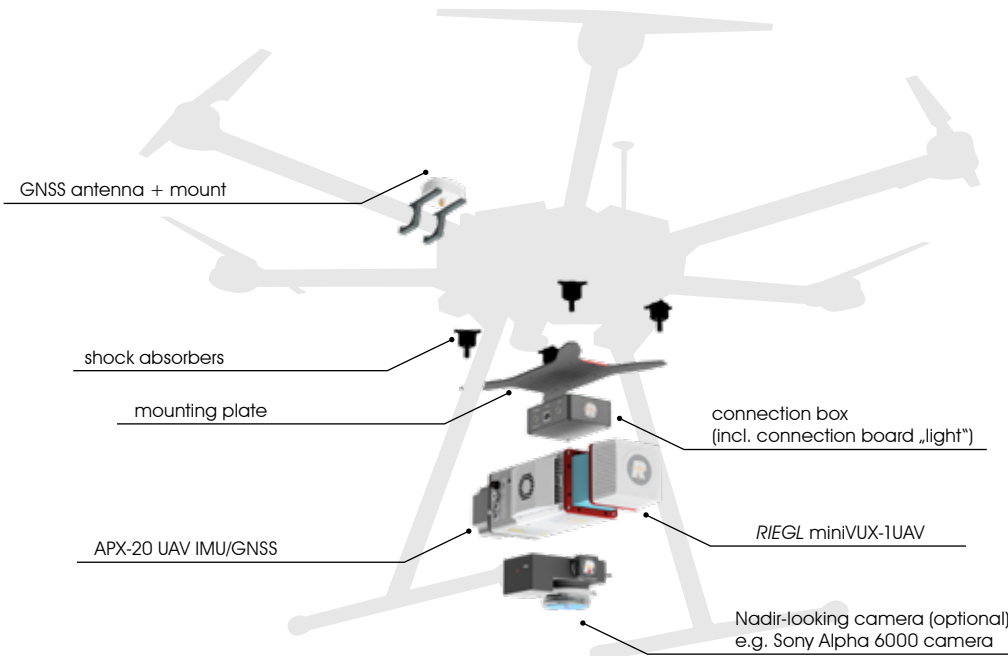


with Nadir-looking camera
e.g. Sony Alpha 6000 camera

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

RIEGL Integration Kit 600 (e.g. for multi-rotor UAVs)

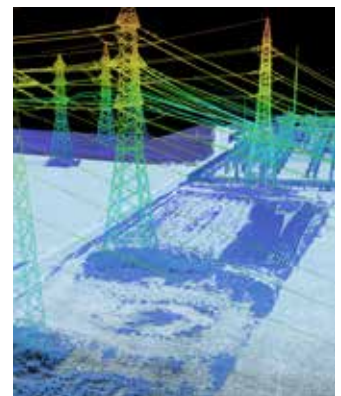
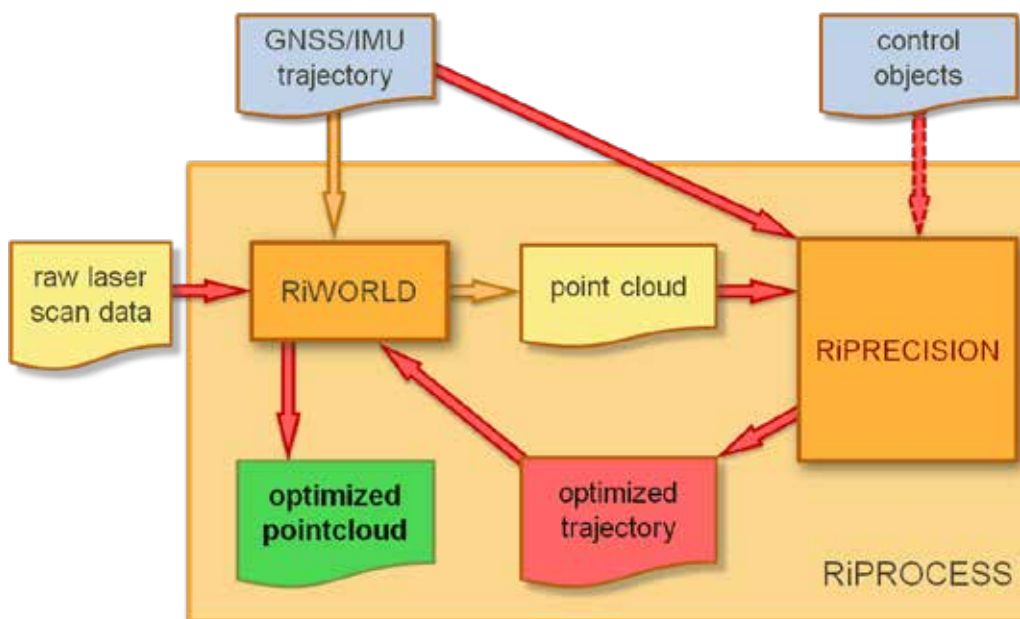
The RIEGL Integration Kit 600 is an add-on to the miniVUX-SYS for its integration with your multi-rotor UAV, e.g. a DJI Matrice M600. The package comes with an appropriate, shock absorbing mounting-kit, power supply module, and necessary cabling for quick and straight forward integration.



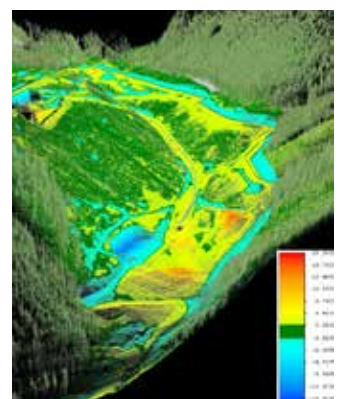
DJI Matrice M600 equipped with RIEGL miniVUX-SYS using RIEGL Integration Kit 600

RIEGL miniVUX®-SYS – Processing Workflow and Scan Data Examples

Using RIEGL's software suites (RiPROCESS, RiWORLD) and dedicated processing workflows with specialized alignment tools like RiPRECISION conducting the whole procedure of scan data alignment fully automatically, processing time can be reduced to a minimum. RiPROCESS can interface the optimized, georeferenced point cloud in further post-processing tools via LAS or other data exchanges in various user-defined coordinate systems.



power line surveying



cut- and fill volume comparison of disposal site

Technical Data *RIEGL* miniVUX®-SYS

Scanner Performance

RIEGL UAV LiDAR Sensors
(for details refer to the corresponding data sheet)

Typ. Operating Flight Altitude AGL ¹⁾²⁾
 Maximum Range ³⁾
 Minimum Range
 Accuracy / Precision
 Laser Pulse Repetition Rate
 Max. Effective Measurement Rate
 Field of View (selectable) ⁴⁾
 Max. Scan Speed
 Max. Number of Targets per Pulse ⁵⁾

RIEGL miniVUX-1UAV

80 m (260 ft)
 250 m
 3 m
 15 mm / 10 mm
 up to 100 kHz
 up to 100,000 meas./sec.
 up to 360°
 100 scans/sec
 5

RIEGL miniVUX-1DL

80 m (260 ft)
 200 m
 3 m
 15 mm / 10 mm
 up to 100 kHz
 up to 100,000 meas./sec.
 up to 46° field of view, + -23° off nadir
 150 scans/sec
 5

1) Rounded values

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

3) Maximum range is specified for natural targets $\rho \geq 60\%$.

4) Note limitations when integrated in kinematic systems.

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

IMU & GNSS ⁶⁾

IMU Accuracy

Roll, Pitch

Heading

IMU Sampling Rate

Position Accuracy (typ.)

horizontal

vertical

Applanix APX-15 UAV ⁷⁾

0.025°

0.08°

200 Hz

< 0.05 m

< 0.1 m

Applanix APX-20 UAV ⁷⁾

0.015°

0.035°

200 Hz

< 0.05 m

< 0.1 m

6) In addition to the APX-15 UAV and the APX-20 UAV IMU/GNSS system, also a AP20 IMU/GNSS system with external control unit is optionally available. Corresponding details provided on request.

7) See technical details in the corresponding Applanix datasheet.

Interfaces

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

General IO & Control

Camera Interface

Memory Card Holder

Serial Interface to External Devices

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 ⁸⁾

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

SPI (Serial Peripheral Interface) ⁹⁾

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

9) 1 x externally available with standard interface box

General Technical Data

Power Supply Input Voltage / Consumption

RIEGL UAV LiDAR Sensors

Main Dimensions (L x W x H) / Weight
 with Cooling Fan
 without Cooling Fan

RIEGL miniVUX-SYS

Main Dimensions (L x W x H) / Weight
 miniVUX-1UAV with APX-15 UAV
 miniVUX-1UAV with APX-20 UAV
 miniVUX-1DL with APX-15 UAV
 miniVUX-1DL with APX-20 UAV

Integration Kit 600

Weight

Camera(s)

Humidity

Protection Class

Temperature Range ¹⁰⁾

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

RIEGL miniVUX-1UAV

243 x 111 x 85 mm / approx. 1.6 kg
 243 x 99 x 85 mm / approx. 1.55 kg

RIEGL miniVUX-1DL

232 x 111 x 123 mm / approx. 2.4 kg
 232 x 99 x 123 mm / approx. 2.35 kg

264 x 110 x 85 mm / approx. 2.0 kg

352 x 110 x 85 mm / approx. 2.5 kg

264 x 110 x 85 mm / approx. 2.8 kg

352 x 110 x 85 mm / approx. 3.3 kg

approx. 0.7 kg

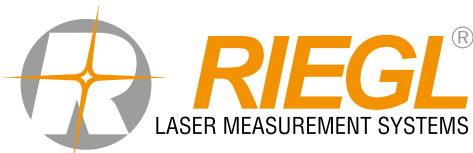
depending on selected camera type

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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