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**, **RIEGL miniVUX-2UAV**, 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 sensors 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

**Features**
- Complete miniaturized & lightweight UAV-based LiDAR system with
  - RIEGL miniVUX-1UAV,
  - RIEGL miniVUX-2UAV, or
  - RIEGL miniVUX-1DL LiDAR sensor integrated
- 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
- Integration Kit 600 available for straightforward system integration with selected multi-rotor UAV types

visit our website
www.riegl.com
**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 equipped with APX-15 UAV**

RIEGL miniVUX-2UAV equipped with APX-15 UAV

RIEGL miniVUX-1DL equipped with APX-15 UAV

with two Sony Alpha 6000 cameras (oblique mount)

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

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

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**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 camera(s)), 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 equipped with APX-20 UAV**

RIEGL miniVUX-2UAV equipped with APX-20 UAV

RIEGL miniVUX-1DL equipped with APX-20 UAV

with two Sony Alpha 6000 cameras (oblique mount)

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

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

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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 straightforward integration.

**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.
Technical Data RIEGL miniVUX®-SYS

### Scanner Performance

**RIEGL UAV LiDAR Sensors**

- Laser Pulse Repetition Rate (PRR)
- Max. Effective Measurement Rate
- Typ. Operating Flight Attitude AGL
- Accuracy / Precision
- Field of View
- Max. Scan Speed
- Max. Number of Targets per Pulse

<table>
<thead>
<tr>
<th>RIEGL miniVUX-2UAV</th>
<th>RIEGL miniVUX-1UAV</th>
<th>RIEGL miniVUX-1DL</th>
</tr>
</thead>
<tbody>
<tr>
<td>up to 200 kHz</td>
<td>100 kHz</td>
<td>100 kHz</td>
</tr>
<tr>
<td>up to 200,000 meas./sec.</td>
<td>100,000 meas./sec.</td>
<td>100,000 meas./sec.</td>
</tr>
<tr>
<td>140 m (460 ft)</td>
<td>160 m (525 ft)</td>
<td>160 m (525 ft)</td>
</tr>
<tr>
<td>15 mm / 10 mm</td>
<td>15 mm / 10 mm</td>
<td>15 mm / 10 mm</td>
</tr>
<tr>
<td>up to 360°</td>
<td>up to 360°</td>
<td>up to 46°, +23° off nadir</td>
</tr>
<tr>
<td>100 scans/sec</td>
<td>100 scans/sec</td>
<td>150 scans/sec</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

1) Rounded values
2) 200 kHz Laser PRR, reflectance $\geq 60\%$, flat terrain assumed, scan angle $\leq 45°$ FOV
3) 100 kHz Laser PRR, reflectance $\geq 60\%$, flat terrain assumed, scan angle $\leq 45°$ FOV
4) 100 kHz Laser PRR, reflectance $\geq 60\%$, flat terrain assumed, scan angle $\leq 45°$ FOV

### IMU & GNSS

- **IMU Accuracy**
  - Roll, Pitch
  - Heading
- **IMU Sampling Rate**
  - 200 Hz
- **Position Accuracy (typ.)**
  - horizontal: $< 0.05$ m
  - vertical: $< 0.1$ m

<table>
<thead>
<tr>
<th>RIEGL miniVUX-2UAV</th>
<th>RIEGL miniVUX-1UAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applanix APX-20 UAV</td>
<td>Applanix APX-15 UAV</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IMU Accuracy</th>
<th>IMU Sampling Rate</th>
<th>Position Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.015°</td>
<td>200 Hz</td>
<td>$&lt; 0.05$ m</td>
</tr>
<tr>
<td>0.035°</td>
<td>200 Hz</td>
<td>$&lt; 0.05$ m</td>
</tr>
<tr>
<td>0.08°</td>
<td></td>
<td>$&lt; 0.1$ m</td>
</tr>
</tbody>
</table>

### Interfaces

- Configuration, Scan Data Output & Communication with External Devices
- GNSS Interface
- General IO & Control
- Camera Interface
- Memory Card Slot
- Serial Interface to External Devices

<table>
<thead>
<tr>
<th>Interfaces</th>
<th>Configuration, Scan Data Output &amp; Communication with External Devices</th>
<th>GNSS Interface</th>
<th>General IO &amp; Control</th>
<th>Camera Interface</th>
<th>Memory Card Slot</th>
<th>Serial Interface to External Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 x LAN 10/100/1000 Mbit/sec</td>
<td></td>
<td></td>
<td></td>
<td>2 x GNSS RS-232 Tx &amp; PPS, Power (USB 2.0), Trigger, Exposure</td>
<td></td>
<td>SPI (Serial Peripheral Interface)</td>
</tr>
</tbody>
</table>

### General Technical Data

**RIEGL UAV LiDAR Sensors**

- **Power Supply Input Voltage**
- **Consumption**
- **Main Dimensions (L x W x H) / Weight**
- **Temperature Range**
- **Humidity**
- **Protection Class**

<table>
<thead>
<tr>
<th>RIEGL miniVUX-2UAV</th>
<th>RIEGL miniVUX-1UAV</th>
<th>RIEGL miniVUX-1DL</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 - 34 V DC</td>
<td>11 - 34 V DC</td>
<td>11 - 34 V DC</td>
</tr>
<tr>
<td>typ. 18 W @ 100 scans/sec</td>
<td>typ. 43 W @ 75 revolutions/sec</td>
<td></td>
</tr>
<tr>
<td>243 x 111 x 85 mm / approx. 1.6 kg</td>
<td>232 x 111 x 123 mm / approx. 2.44 kg</td>
<td>232 x 111 x 123 mm / approx. 2.4 kg</td>
</tr>
<tr>
<td>243 x 99 x 85 mm / approx. 1.55 kg</td>
<td>232 x 99 x 85 mm / approx. 1.57 kg</td>
<td></td>
</tr>
<tr>
<td>-10°C up to +40°C (operation)</td>
<td>-10°C up to +40°C (operation)</td>
<td>-20°C up to +50°C (storage)</td>
</tr>
<tr>
<td>-20°C up to +50°C (storage)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>max. 80% non condensing @ 31°C</td>
<td>IP64, dust and splash-proof</td>
<td></td>
</tr>
<tr>
<td>Protection Class</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integration Kit 600</th>
<th>Weight</th>
<th>Camera(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>optional, technical data depending on selected camera type</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>