The RIEGL VUX-SYS is a completely integrated laser scanning system of low weight and compact size for flexible use in kinematic applications (e.g. UAS/UAV/RPAS, helicopter, gyrocopter and ultra-light aircraft installations).

The system comprises a RIEGL VUX-1 Series LiDAR Sensor, an IMU/GNSS system and - if applicable - a dedicated control unit. The excellent measurement performance of the VUX-1 in combination with the precise inertial measurement unit and the associated GPS/GLONASS receiver results in survey-grade measurement accuracy over its full range of applications.

The VUX-SYS is specifically designed to be easily installed or exchanged by the user, alternatively either in the RIEGL VP-1 HeliCopterPod, the RICOPTER unmanned aerial system, or in any kinematic measuring system, whatsoever.

The VUX-SYS provides interfaces for controlling up to four digital cameras. When installed in the VP-1 HeliCopterPod or the RICOPTER UAV the VUX-SYS is complemented by up to two cameras.

The small size, low weight, and small number of interconnecting cables required account for a very short set-up time of the system. The VUX-SYS is delivered with the necessary software tools for processing scan data as well as IMU/GNSS data. Based on the software bundle RiPROCESS and its associated software tools, scan data is geo-referenced, calibrated and exported fully automatically. RIEGL offers an optional system calibration service.

Typical applications include:
- Corridor Mapping: Power Line, Railway Track, and Pipeline Inspection
- Terrain and Canyon Mapping
- Surveying of Urban Environments
- Topography in Open-Cast Mining
- Agriculture & Forestry
- Archeology and Cultural Heritage Documentation
- Construction-Site Monitoring
### RIEGL VUX®-SYS - Integration Options

#### RIEGL VUX-1 with APX-20 UAV
- **Interface for 4 optional cameras available**
  - **Main Dimensions**
    - VUX-1 with IMU: 314 x 180 x 125 mm
    - VUX-1 with IMU and Cooling Fan Device: 314 x 209 x 128 mm
  - **Weight**
    - VUX-1 with IMU: approx. 4.2 kg
    - Cooling Fan Device: approx. 0.25 kg
    - Camera(s): depending on selected camera type

#### RIEGL VUX-1 with AP20
- **With separate control unit accommodating the GNSS board stack as well as the camera trigger electronics for up to 4 optional cameras**
  - **Main Dimensions**
    - VUX-1 with IMU: 295 x 180 x 125 mm
    - VUX-1 with IMU and Cooling Fan Device: 295 x 209 x 128 mm
    - Control Unit: 210 x 124 x 79 mm
  - **Weight**
    - VUX-1 with IMU: approx. 4.2 kg
    - Cooling Fan Device: approx. 0.25 kg
    - Control Unit: approx. 0.9 kg
    - Camera(s): depending on selected camera type

#### RIEGL VUX-1 with AP60
- **With separate control unit accommodating the GNSS board stack as well as the camera trigger electronics for up to 4 optional cameras**
  - **Main Dimensions**
    - VUX-1 with IMU: 337 x 180 x 125 mm
    - VUX-1 with IMU and Cooling Fan Device: 337 x 209 x 128 mm
    - Control Unit: 210 x 124 x 79 mm
  - **Weight**
    - VUX-1 with IMU: approx. 6.8 kg
    - Cooling Fan Device: approx. 0.25 kg
    - Control Unit: approx. 0.9 kg
    - Camera(s): depending on selected camera type

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*all dimensions in mm*
**RIEGL VUX®-SYS System Installation**

**RIEGL VUX®-SYS installed in RICOPTER (Unmanned)**

The VUX-SYS fits the dedicated mounting bay of the RICOPTER directly without any adaptations. The system is supplemented by two digital cameras, covering a field of view of approximately 160 degrees, where as the VUX-SYS covers a FOV of 230°. The low weight of the VUX-SYS enables the RICOPTER to operate up to half an hour at a gross weight of 25 kg.

**RIEGL VUX®-SYS installed in VP-1 (Airborne)**

The VUX-SYS fits the small and lightweight RIEGL VP-1 HeliCopterPod, to be mounted on standard hard points and typical camera mounts of manned helicopters. Quick release adapter brackets and a minimum of external cabling (i.e. power supply, LAN, GPS antenna) allow quick system installation and removal.

**RIEGL VUX®-SYS installed in VMQ (Mobile)**

Fully integrated into the measuring head of the system, the VUX-SYS is the core part of the RIEGL VMQ Single Scanner Mobile Mapping System. Together with the universal VMQ roof mount the system can be easily mounted on a great variety of vehicles. One single external VMQ main cable minimizes the efforts of the set-up time. The swivel plate allows the operator to achieve different point cloud patterns according to the project requirements.

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**RIEGL VUX-SYS for RICOPTER**

**System Components:**
- RIEGL VUX-1UAV or RIEGL VUX-1LR LiDAR sensor
- IMU/GNSS unit (Applanix AP20 or AP60)
- GNSS antenna
- control unit 1)
- camera(s) optional (2x e.g. SONY Alpha 6000 or SONY Alpha 7R III)
- connecting cables

**RIEGL VUX-SYS for VP-1**

**System Components:**
- RIEGL VUX-1UAV or RIEGL VUX-1LR LiDAR sensor
- IMU/GNSS unit (Applanix AP20 or APX-20 UAV)
- GNSS antenna
- control unit 1)
- camera(s) optional (1x Nikon D810, or 1x Phase One iXU, or 4x Sony Alpha 6000)
- connecting cables

**RIEGL VUX-SYS for VMQ**

**System Components:**
- RIEGL VUX-1HA LiDAR sensor (preferred) or RIEGL VUX-1UAV sensor (possible)
- IMU/GNSS unit (Applanix AP20 or AP60)
- GNSS antenna
- control unit 1)
- up to 4 digital camera(s) (e.g., FLIR Ladybug® 5+, Nikon D810, 5 MPix industrial camera)
- connecting cables

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1) for use with AP20 and AP60
### Scanner Performance
(for details refer to the corresponding RIEGL data sheets)

<table>
<thead>
<tr>
<th>RIEGL VUX-1 Series Sensor</th>
<th>VUX-1LR</th>
<th>VUX-1UAV</th>
<th>VUX-1HA a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Range</td>
<td>1,350 m 2)</td>
<td>920 m 2)</td>
<td>420 m 3)</td>
</tr>
<tr>
<td>Minimum Range</td>
<td>5 m</td>
<td>3 m</td>
<td>1.2 m</td>
</tr>
<tr>
<td>Accuracy / Precision</td>
<td>15 mm / 10 mm up to 820 kHz</td>
<td>10 mm / 5 mm up to 550 kHz</td>
<td>5 mm / 3 mm up to 1000 kHz</td>
</tr>
<tr>
<td>Laser Pulse Repetition Rate</td>
<td>up to 750,000 meas./sec. up to 330°</td>
<td>up to 500,000 meas./sec. up to 330°</td>
<td>up to 1,000,000 meas./sec. up to 360°</td>
</tr>
<tr>
<td>Max. Scan Speed</td>
<td>200 scans/sec</td>
<td>200 scans/sec</td>
<td>250 scans/sec</td>
</tr>
</tbody>
</table>

1) Not recommended to be seen as a first choice for ALS and UAV applications because of its lower range capability.
2) Maximum range is specified for natural targets \( \Delta \geq 60\% \).
3) Maximum range is specified for natural targets \( \Delta \geq 80\% \).
4) Note limitations when integrated in kinematic systems.

### Data Interfaces
- **Configuration**
  - LAN 10/100/1000 Mbit/sec or TTL PWM
- **Scan Data Output**
  - LAN 10/100/1000 Mbit/sec or USB 2.0
- **Internal Data Storage**
  - Solid State Disc SSD, 1TByte
- **Memory Card Slot**
  - for CFAST® memory card 120 GByte (can be upgraded to 256 GByte)
- **GNSS Interface**
  - Serial RS-232 interface for data string with GNSS-time information, TTL Input for 1PPS synchronization pulse
- **Camera**
  - 4x trigger and event marker

### IMU & GNSS
- **Applanix AP20** a) 7)
  - Roll, Pitch 8) 0.015°
  - Heading 8) 0.035°
  - IMU Sampling Rate 200 Hz
  - Position Accuracy (typ.) horizontal < 0.05 m, vertical < 0.1 m
- **Applanix APX-20 UAV** a) 7)
  - Roll, Pitch 8) 0.015°
  - Heading 8) 0.035°
  - IMU Sampling Rate 200 Hz
  - Position Accuracy (typ.) horizontal < 0.05 m, vertical < 0.1 m
- **Applanix AP60** a) 7)
  - Roll, Pitch 8) 0.005°
  - Heading 8) 0.005°
  - IMU Sampling Rate 200 Hz
  - Position Accuracy (typ.) horizontal < 0.05 m, vertical < 0.1 m

7) See technical details at the according Applanix datasheet
8) values are given for airborne applications
9) roll, pitch for mobile applications: 0.005°
10) heading for mobile applications: 0.05°
11) heading for mobile applications: 0.015°

### General Technical Data
- **Power Supply**
  - Input Voltage 11 - 34 V DC
  - typ. 95 W
- **Humidity**
  - max. 80 % non condensing @ 31°C
- **Temperature Range**
  - -10°C up to +40°C (operation) / -20°C up to +50°C (storage)

### RIEGL VUX-SYS UAV Platform Integration

**RiCOPTER with VUX-SYS components:**
- RIEGL VUX-1UAV
- APX-20 UAV
- Sony Alpha 7R III
- Flir Tau 2 thermal camera

VUX-SYS set-up (example)