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
**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, whereas 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.

---

**RIEGL VUX-SYS for RiCOPTER System Components:**
- RIEGL VUX-1UAV LiDAR sensor or RIEGL VUX-1LR LiDAR sensor
- IMU/GNSS unit (Applanix AP20 or APX-20 UAV)
- 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 LiDAR sensor or RIEGL VUX-1LR LiDAR sensor
- IMU/GNSS unit (Applanix AP20, APX-20 UAV or AP60)
- GNSS antenna
- control unit ¹
- digital camera(s) (1x Nikon D810, or 1x Phase One iXU, or 1x Phase One XM-50 /-100, or up to 4x Sony Alpha 6000, or up to 3 x Sony A7R III)
- connecting cables

**RIEGL VUX-SYS for VMQ System Components:**
- RIEGL VUX-1HA LiDAR sensor (preferred) or RIEGL VUX-1UAV LiDAR 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

¹) for use with AP20 and AP60
### RIEGL VUX®-SYS Technical Data

#### Scanner Performance
**RIEGL VUX-1 Series Sensor**

<table>
<thead>
<tr>
<th>Feature</th>
<th>VUX-1LR</th>
<th>VUX-1UAV</th>
<th>VUX-1HA</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</td>
<td>10 mm / 5 mm</td>
<td>5 mm / 3 mm</td>
</tr>
<tr>
<td>Laser Pulse Repetition Rate</td>
<td>up to 800 kHz</td>
<td>up to 550 kHz</td>
<td>up to 1,000 kHz</td>
</tr>
<tr>
<td>Max. Effective Measurement Rate</td>
<td>up to 750,000 meas./sec.</td>
<td>up to 500,000 meas./sec.</td>
<td>up to 1,000,000 meas./sec.</td>
</tr>
<tr>
<td>Field of View (selectable) (^4)</td>
<td>up to 330°</td>
<td>up to 330°</td>
<td>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 D ≥ 60%.

\(^{3}\) Maximum range is specified for natural targets D ≥ 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

\(^{5}\) applies to IMU APX-20 UAV only

\(^{6}\) CFast is a registered trademark of CompactFlash Association

#### IMU & GNSS
- **Applanix APX-20 UAV**
  - Roll, Pitch: 0.015°, 0.035°
  - Heading: 200 Hz
  - Position Accuracy (typ.):
    - horizontal: < 0.05 m
    - vertical: < 0.1 m
- **Applanix AP20**
  - Roll, Pitch: 0.015°, 0.035°
  - Heading: 200 Hz
  - Position Accuracy (typ.):
    - horizontal: < 0.05 m
    - vertical: < 0.1 m
- **Applanix AP60**
  - Roll, Pitch: 0.002°, 0.005°
  - Heading: 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: 0.005°

\(^{11}\) heading for mobile applications: 0.015°

#### General Technical Data
- **Power Supply Input Voltage**: 11 - 34 V DC
- **Power Consumption**: 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 or Sony A7R IV**
- **Flir Tau 2 thermal camera**
- **other 3rd party cameras integrated**

---

1) Multispectral camera, hyperspectral camera – more information on request.