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 296 x 180 x 125 mm
VUX-1 with IMU and Cooling Fan Device 296 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

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 for RICOPTER
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 (2x e.g. SONY Alpha 6000 or SONY Alpha 7R III)
- connecting cables

¹) for use with AP20 and AP60

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 for VP-1
System Components:
- RIEGL VUX-1UAV or RIEGL VUX-1LR LiDAR sensor
- IMU/GNSS unit (Applanix AP20, APX-20 UAV or AP60)
- GNSS antenna
- control unit ¹)
- camera(s) optional (e.g., Nikon D810, or 1x Phase One iXU, 5 MPix industrial camera)
- connecting cables

¹) for use with AP20 and AP60

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 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

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

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</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Range</td>
<td>1,350 m</td>
<td>920 m</td>
<td>420 m</td>
</tr>
<tr>
<td>Minimum Range</td>
<td>5 m</td>
<td>3 m</td>
<td>1.2 m</td>
</tr>
<tr>
<td>Laser Pulse Repetition Rate</td>
<td>up to 820 kHz</td>
<td>up to 550 kHz</td>
<td>up to 1000 kHz</td>
</tr>
<tr>
<td>Field of View (selectable)</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 $p \geq 60\%$
3) Maximum range is specified for natural targets $p \geq 80\%$
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 (6) | for CFast® memory card 120 GByte (can be upgraded to 256 GByte) |
| GNSS Interface | Serial RS232 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

<table>
<thead>
<tr>
<th>IMU Accuracy</th>
<th>Applanix AP20</th>
<th>Applanix APX-20 UAV</th>
<th>Applanix AP60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roll, Pitch</td>
<td>0.015°</td>
<td>0.015°</td>
<td>0.002°</td>
</tr>
<tr>
<td>Heading</td>
<td>0.035°</td>
<td>0.035°</td>
<td>0.005°</td>
</tr>
<tr>
<td>IMU Sampling Rate</td>
<td>200 Hz</td>
<td>200 Hz</td>
<td>200 Hz</td>
</tr>
<tr>
<td>Position Accuracy (typ.)</td>
<td>&lt; 0.05 m</td>
<td>&lt; 0.05 m</td>
<td>&lt; 0.05 m</td>
</tr>
<tr>
<td>horizontal</td>
<td>&lt; 0.1 m</td>
<td>&lt; 0.1 m</td>
<td>&lt; 0.1 m</td>
</tr>
<tr>
<td>vertical</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

General Technical Data

<table>
<thead>
<tr>
<th>Power Supply Input Voltage</th>
<th>11 - 34 V DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>typ. Power Consumption</td>
<td>95 W</td>
</tr>
<tr>
<td>Humidity</td>
<td>max. 80 % non condensing @ 31°C</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>-10°C up to +40°C (operation) / -20°C up to +50°C (storage)</td>
</tr>
</tbody>
</table>

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)