Complete Sensor System for *RIEGL* RiCOPTER and *RIEGL* VP-1

RIEGL VUX-SYS®

- ***complete miniaturized ALS System***
- ***RIEGL VUX-1 lightweight airborne laser scanner integrated***
- ***inertial measurement unit and GPS/ GLONASS receiver integrated***
- ***compact control unit with various interfacing options***
- ***various mounting options for highly flexible aircraft installation***
- ***prepared for remote control via low-bandwidth data link***
- ***operates up to 4 digital cameras***

The *RIEGL* VUX-SYS is a complete on-board airborne laser scanning system of low weight and compact size for flexible use in UAS/UAV/RPAS, helicopter, gyrocopter and ultra-light aircraft installations.

The system comprises the *RIEGL* VUX-1 airborne laser scanner, an IMU/GNSS system and 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 helicopter pod, the *RIEGL* RiCOPTER unmanned aerial system, or in any mobile measuring system, whatsoever.

The VUX-SYS is complemented within the VP-1 by one single high resolution digital camera, and in the RiCOPTER by two lightweight consumer-grade digital cameras. It is prepared to handle up to 4 independent cameras in other installations.

The small size, low weight, and small number of interconnecting cables required accounts 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.

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***
- ***Precision Agriculture***
- ***Archaeology and Cultural Heritage Documentation***
- ***Construction-Site Monitoring***

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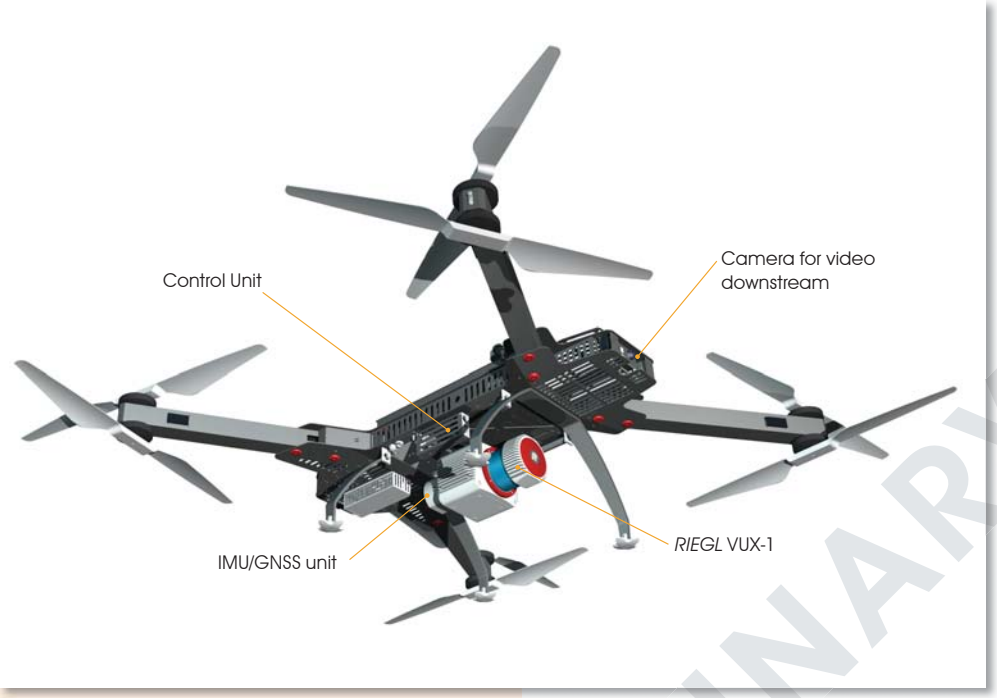
www.riegl.com

RIEGL®
LASER MEASUREMENT SYSTEMS

RIEGL VUX®-SYS for RiCOPTER

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. The low weight of the VUX-SYS enables the RiCOPTER to operate for about half an hour at a gross weight of 25kg.

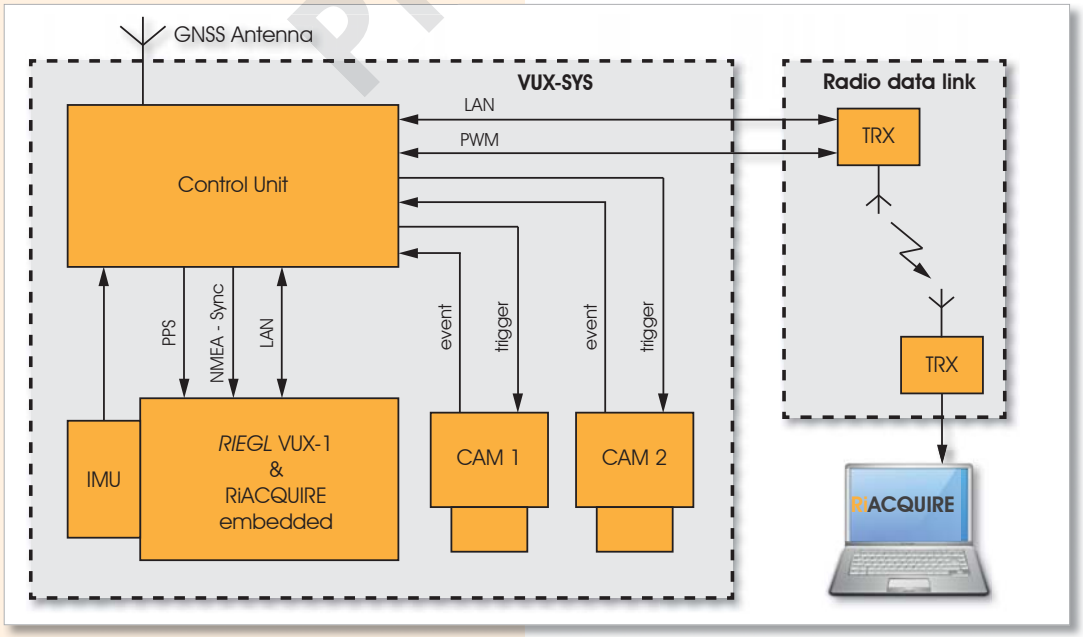


RIEGL VUX-SYS for RiCOPTER System Components:

- *RIEGL* VUX-1 UAS LiDAR sensor
- IMU/GNSS unit (Applanix AP20)
- GNSS antenna
- Control Unit
- 2 cameras (SONY alpha 6000)
- connecting cables

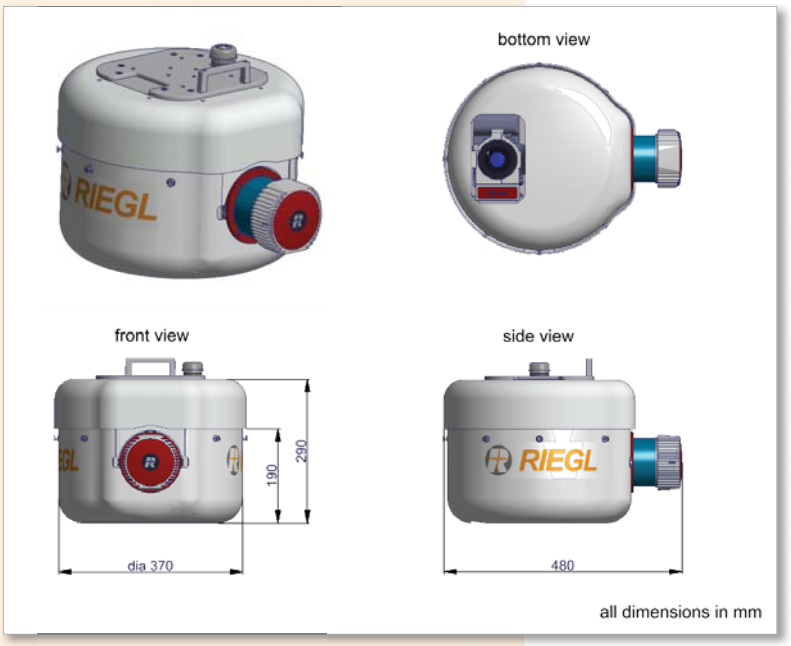
RIEGL VUX®-SYS - Block Diagram Remote Control Setup

Accounting for the integration in unmanned remotely piloted systems, a dedicated TTL interface for receiving and emitting **P**ulse-**W**idth **M**odulated (PWM) signals enables full control as well as system status feedback. Based on a predefined set of commands and associated pulse widths the system can be controlled easily via a standard remote-control radio channel of low bandwidth.
It is possible to adjust the data rate of scan data for streaming monitoring data even in real-time via suitable radio channels of sufficient bandwidth.



RIEGL VUX®-SYS for VP-1

The VUX-SYS fits the small and lightweight *RIEGL* VP-1 pod, 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* VP-1**
System Components:

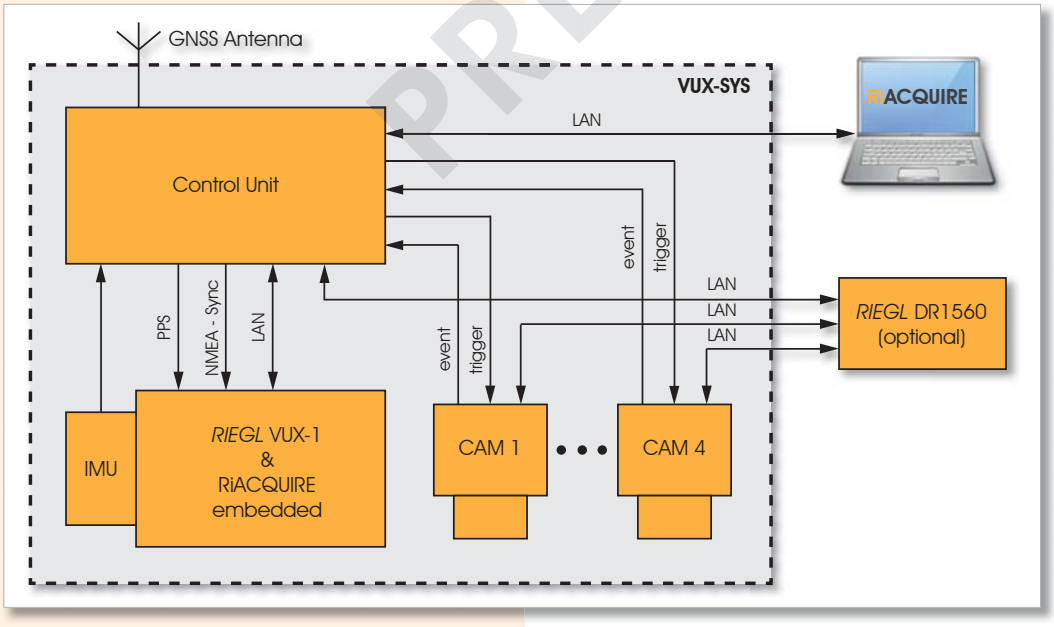
- *RIEGL* VUX-1 UAS LiDAR sensor
- IMU/GNSS unit (Applanix AP20)
- GNSS antenna
- Control unit
- digital camera (Nikon D810 or Phase One iXU150)
- connecting cables

***RIEGL* VP-1**
Technical Data:

- quick installation & removal using the existing mounts (e.g. AirFILM Camera System); mounting and operation at enduser's responsibility
- total weight approx. 19 kg
- area exposed to wind 0.114 m²

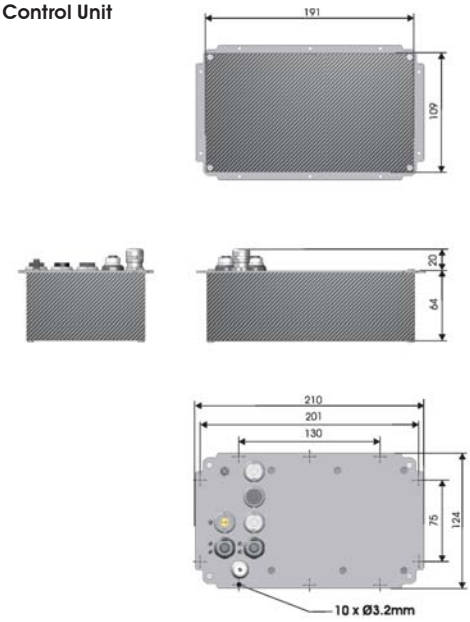
RIEGL VUX®-SYS - Block Diagram Conventional Control Setup

The VUX-SYS contains a LAN interface for direct control from an operator's working station running RiACQUIRE. RiACQUIRE is fully compatible with the VUX-SYS and enables full control over the laser scanner, the IMU/GNSS system, and optionally up to 4 digital cameras.
Scan data and image data can be directly stored on the particular sensor's internal storage, or can be directly stored on an optional data recorder DR1560 or on a Laptop.
The control unit contains trigger and event marker interfaces for each camera. Precise time stamps of the camera's release-events are stored in the raw scan data stream enabling combination of point cloud data and imagery in subsequent data processing.

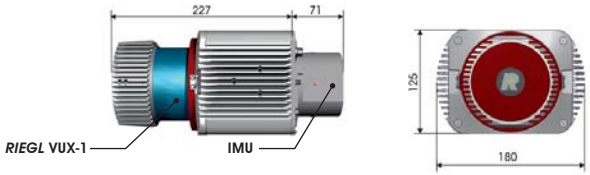


RIEGL VUX®-SYS Mechanical Drawings

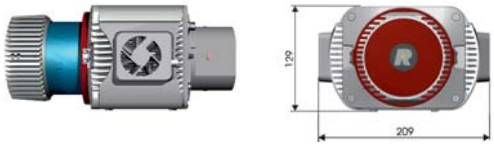
Control Unit



***RIEGL* VUX-1 with IMU**



***RIEGL* VUX-1 with IMU and Cooling Fan Device**



Camera:

(symbolic image)

GNSS antenna:

(symbolic image)

all dimensions in mm

Technical Data *RIEGL* VUX®-SYS

Scanner Performance (for details refer to the VUX-1 data sheet)

Maximum Range (natural targets ρ ≥ 20%)	550 m
Minimum Range	3 m
Accuracy	10 mm
Precision	5 mm
Laser Pulse Repetition Rate	up to 550 kHz
Max. Effective Measurement Rate	up to 500 000 meas./sec. (@ 550 kHz PRR & 330° FOV)
Scanning Mechanism	rotating mirror
Field of View (selectable)	up to 330° (Note limitations when integrated in RiCOPTER / VP-1)
Scan Speed (selectable)	10 - 200 revolutions/sec, equivalent to 10 - 200 scans/sec
Angle Measurement Resolution	0.001°

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
GNSS Interface	Serial RS232 interface for data string with GNSS-time information, TTL input for 1PPS synchronization pulse
Camera	4x trigger and event marker

IMU & GNSS (Applanix AP20)

IMU Accuracy	
Roll, Pitch	0.015°
Heading	0.035°
IMU Sampling Rate	200 Hz
Position Accuracy (typ.)	0.05 m - 0.3 m

General Technical Data

Power Supply Input Voltage / Consumption	11 - 32 V DC / typ. 72 W (3 A @ 24 V DC)
Main Dimensions	
VUX-1 with IMU, without Cooling Fan Device	298 x 180 x 125 mm
VUX-1 with IMU and Cooling Fan Device	298 x 209 x 129 mm
Control Unit	210 x 124 x 84 mm
Weight (Cabling included)	
VUX-1 without / with Cooling Fan Device	approx. 3.6 kg / approx. 3.85 kg
Control Unit	approx. 0.9 kg
IMU/GNSS (Applanix AP20)	approx. 0.7 kg
Camera(s)	depending on selected camera type
Humidity	max. 80 % non condensing @ 31°C
Temperature Range	0°C up to +40°C (operation) / -20°C up to +50°C (storage)

RIEGL® LASER MEASUREMENT SYSTEMS

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