

Basic Configuration Package

Scanner Basic Configuration RIEGL VUX-1UAV

Part-No. HW-VUX1-01-001-00

The RIEGL VUX-1UAV is a very lightweight and compact laser scanner, meeting the challenges of emerging survey solutions by UAS/UAV/RPAS, gyrocopter and ultra-light aircraft, both in measurement performance as in system integration.

With regard to the specific constraints and flight characteristics of UAS, the RIEGL VUX-1UAV is designed to be mounted in any orientation and even under limited weight and space conditions.

Detailed technical specifications, interfaces and laser classification according to the preliminary datasheet RIEGL VUX-1UAV.

Main Features

- *) compact (227x180x125 mm, without cooling fan device), lightweight (3.6 kg), and rugged
- *) easily mountable to professional UAS / UAV / RPAS
- *) scan data storage on internal 240 GByte SSD Memory
- *) survey-grade accuracy / precision, typ. 10 mm / 5 mm
- *) scan speed up to 200 scans / second
- *) measurement rate up to 500,000 meas./sec (@ 550 kHz PRR & 330° FOV)
- *) operating flight altitude up to more than 1,000 ft
- *) field of view up to 330° for practically unrestricted data acquisition
- *) regular point pattern, perfectly parallel scan lines
- *) cutting edge RIEGL technology

providing:

- echo signal digitization
- online waveform processing
- multiple-time-around processing
- *) multiple target capability - practically unlimited number of target echoes

Mechanical and Electrical Interfaces

- *) mechanical and electrical interface for IMU mounting
- *) electrical interfaces for GPS data string and Sync Pulse (1PPS)
- *) LAN-TCP/IP interface

Cables

- Multi Purpose Power and Signal Cable for VUX, 3m, new version
(Part-No. HW-VUX-03-005-00)
- USB Debug Cable for VUX, 1.5m
(Part-No. HW-VUX-03-000-00)
- USB extension Cable for USB 2.0 mass storage media, for VUX, 1.5m
(Part-No. HW-VUX-03-001-00)

Cooling fan device

(Part-No. HW-VUX-06-001-00)

Lightweight structure with two axial fans providing forced air convection for applications where sufficient natural air flow cannot be guaranteed.

Dimensions / weight of VUX-1 with cooling fan device: 227 x 208 x 129 mm / 3.85 kg

Connection Board for VUX

(Part-No. HW-VUX-06-000-00)

Embedded RiACQUIRE UAS Software, embedded in VUX-1 or VQ-XXX Scanner

(Part-No. SW-VQXX-02-000-00)

RiACQUIRE-Embedded is designed to run on *RIEGL* devices used in UAV-systems.

Features:

- running directly on *RIEGL* VUX-1
- scan data are stored on the internal SSD drive and written to a RiPROCESS project structure
- prepares monitoring trajectory and scanner data for data transfer
- Get control via pulse control interface (TTL) & UDP interface
 - *) listens to and executes commands from ground-based RiACQUIRE
- controls image acquisition for GigE interfaces
- enables internal memory manager for INS-GNSS data

Single User License RiMTA

(Part-No. SW-GP-02-030-00)

for detecting the correct MTA zone for each measurement automatically for instruments with multiple-time-around- capability (MTA).

- automatic resolution of range ambiguity in time-of-flight ranging
- unlimited number of MTA zones
- processes data acquired with instruments with multiple-time-around- capability (MTA)
- smoothly integrated in the *RIEGL* data processing workflow

RiVSTARTUP

(Part-No. SW-GP-07-005-00)

Tool for first start up operation of *RIEGL* V-Line Laser Scanners.

RiVLib - Scandata Interface Library

(Part-No. SW-GP-07-006-00)

Library enabling smooth integration of *RIEGL*'s V-Line Laser Scanners into user applications. The library allows 2D real-time data interfacing and includes tools to create and to query 2D databases containing measurement data and meta information. The library is available in shared library format for Linux (x86) and Windows operating systems. 1 license included.

Software Maintenance for 12 months

(Part-No. SW-VQXX-12-000-00)

- Free software updates
- E-mail and telephone support

User`s Manual (in English language)

"Technical Documentation & Operating Instructions"

including, between other things, instructions for: Safety, Installation, Operation, etc.

Scanner Basic Configuration RIEGL VUX-1LR

Part-No. HW-VUX1-01-001-01

The *RIEGL VUX-1LR* (Long Range) is a very lightweight and compact laser scanner, meeting the challenges of emerging survey solutions, both in measurement performance as in system integration.

Typical applications:

- *) corridor mapping
- *) power line, rail track and pipeline inspection
- *) surveying of urban environments
- *) archeology and cultural heritage domumentation

Detailed technical specifications, interfaces and laser classification according to the preliminary datasheet *RIEGL VUX-1LR*.

Main Features

- *) compact (227x180x125 mm, without cooling fan device), lightweight (3.6 kg), and rugged
- *) ideally suited for airborne surveying from helicopters
- *) fully-integrated system solution *RIEGL VP-1 Helipod* available for user-friendly mounting to helicopters
- *) scan data storage on internal 240 GByte SSD Memory
- *) survey-grade accuracy / precision, typ. 15 mm / 10 mm
- *) scan speed up to 200 scans / second
- *) Max. Effective Measurement Rate: up to 750.000,-- meas./sec.
- *) Max. Operating Flight Altitude AGL: 1.740ft. (530m)
- *) field of view up to 330° for practically unrestricted data acquisition
- *) regular point pattern, perfectly parallel scan lines
- *) cutting edge *RIEGL* technology

providing:

- echo signal digitization
- online waveform processing
- multiple-time-around processing
- *) multiple target capability - practically unlimited number of target echoes

Mechanical and Electrical Interfaces

- *) mechanical and electrical interface for IMU mounting
- *) electrical interfaces for GPS data string and Sync Pulse (1PPS)
- *) LAN-TCP/IP interface

Cables

- Multi Purpose Power and Signal Cable for VUX, 3m, new version
(Part-No. HW-VUX-03-005-00)
- USB Debug Cable for VUX, 1.5m
(Part-No. HW-VUX-03-000-00)
- USB extension Cable for USB 2.0 mass storage media, for VUX, 1.5m
(Part-No. HW-VUX-03-001-00)

Cooling fan device

(Part-No. HW-VUX-06-001-00)

Lightweight structure with two axial fans providing forced air convection for applications where sufficient natural air flow cannot be guaranteed.

Dimensions / weight of VUX-1 with cooling fan device: 227 x 208 x 129 mm / 3.85 kg

Connection Board for VUX

(Part-No. HW-VUX-06-000-00)

Embedded RiACQUIRE UAS Software, embedded in VUX-1 or VQ-XXX Scanner

(Part-No. SW-VQXX-02-000-00)

RiACQUIRE-Embedded is designed to run on *RIEGL* devices used in remotely controlled systems.

Features:

- running directly on *RIEGL* VUX-1
- scan data are stored on the internal SSD drive and written to a RiPROCESS project structure
- prepares monitoring trajectory and scanner data for data transfer
- Get control via pulse control interface (TTL) & UDP interface
 - *) listens to and executes commands from ground-based RiACQUIRE
- controls image acquisition for GigE interfaces
- enables internal memory manager for INS-GNSS data

Single User License RiMTA

(Part-No. SW-GP-02-030-00)

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Software Maintenance for 12 months

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including, between other things, instructions for: Safety, Installation, Operation, etc.

RIEGL VP-1 Universal Pod for Helicopter Installation

Part-No. HW-VP1-01-000-00

internal mounting structure with shock absorbing elements for carrying:

- VUX-1 scanner,
- IMU/GNSS (Applanix AP20)
- VUX-SYS Control Unit
- Camera Nikon D810

coming with GFK protective covers

Set of cable (lengths to be specified)

- Power supply cable
- GPS antenna cable
- TCP/IP cable for scan data transfer to the Panasonic Toughbook
- USB cable for configuration of the NIKON camera and cam data transfer to the Toughbook

RIEGL Software Packages / Modules

Single Scanner License RiACQUIRE

Part-No. SW-GP-02-020-00

Data Acquisition Software for *RIEGL* Airborne & Mobile Scanner Systems

- Controlling *RIEGL* airborne and mobile laser scanners semi-automatically or manually
- Supported *RIEGL* Laser Scanners: LMS-Q1560, LMS-Q780, LMS-Q680(i), LMS-Q560, LMS-Q240(i), LMS-Q120(i)(ii), LMS-Z420i, LMS-Z620, and *RIEGL* V-Line Laser Scanners
- Generic support of digital cameras
- Supported INS/GNSS Systems: IGI AEROcontrol, Applanix POS AV/LV/MV, OxTS RT Family, GGS AeroDIDOS, IXSEA AIRINS/LANDINS, NovAtel SPAN
- Highly simplified system status feedback for fast recognition by the operator
- Easy access for the operator to configure system parameters
- Quality assurance with a detailed history of events, system parameters and operator's interactions stored for analysis later on
- Monitoring data via UDP, TCP, and RS232 Interface
- For operating systems Windows 7, Windows VISTA, Windows XP, and Linux

Single User License RiPROCESS

Part-No. SW-GP-02-023-00

- Project-oriented managing software for processing of *RIEGL* airborne and mobile laser scanner data from raw data to point-cloud-based data in WGS84 or projection (e.g. UTM) utilizing RiANALYZE and RiWORLD in remote control mode
- Fast access to data for visual inspection in a large variety of visualization formats, ranging from color-coded raster data to digitized echo data for every laser measurement (depending on used laser scanner)
- System calibration and scan data adjustment based on matching data acquired on flat objects
- Statistical analysis of matching quality of scan data; comparison of laser data to surveyed reference objects
- Interface to further post-processing tools via LAS, Terrasolid, and ASCII data exchange
- Operation in a multiple-workstation environment enhancing data post-processing throughput by parallel computing
- For operating systems Windows 7 Professional, Windows VISTA Professional, and Windows XP Professional

Single User License RiWORLD

Part-No. SW-GP-02-025-00

Geo Referencing Software for RIEGL Scan Data

- Transformation of laser data into the coordinate system of the position and orientation data set, usually WGS84
- Makes use of geometrical system description and calibration information
- Support of different formats of position and orientation data by software tool POF-Import
- Compatible with different definitions of the navigation frames, e.g., east-north-up (ENU) or north-east-down (NED)
- Provides information for subsequent transformation into a local, levelled, north-east-aligned coordinate system for accurate visualization based on single-precision numbers
- Processes a large number of files for unattended operation in batch mode
- Provides different data output formats including LAS format
- Smoothly integrated into RiPROCESS
- For operating systems Windows 7 Professional, Windows VISTA Professional, and Windows XP Professional

Accessories

Lens Adapter & Protection Tube for NIKON Lens AF 50 f/1.8D NIKKOR for use with VZ-xx Camera Mount

Part-No. HW-CAM-10-023-00

High Precision Camera Mount for RIEGL VP-1, for Nikon D800/D810

Part-No. HW-VP1-05-002-00

VP-1 Transport Case

Part-No. HW-VP1-05-000-00

Splash-proof, foam-lined to fit shape of VP-1,
with wheels and telescope handle,

Dimensions: 750 x 635 x 410 mm

Adapter Plate for IMU mounting for VUX-SYS

Part-No. HW-VUX-06-002-00

adapter plate for mounting the IMU sensor to the VUX-1 laser scanner engine

Sub-Systems

VUX-SYS-CU

Part-No. HW-VUX-02-000-00

consisting of:

- compact IMU/GNSS unit (Applanix AP20) including GNSS antenna and IMU Sensor (IMU-42) which is directly attached to the VUX-1 scanner engine
- VUX-SYS Control Unit with following interfaces.

- 1. VUX-1:** for power supply, ethernet data lines, synchronisation lines and several IO lines to VUX-1 scanner
- 2. CAM 1/3 & CAM 1/4:** to be used for up to 4 external cameras (power and trigger)
- 3. GNSS:** connector for GNSS antenna
- 4. CONTROL:** provides several inputs and outputs of the VUX-1 scanner and IMU/GNSS unit
- 5. POWER:** power input 11-32 V DC for complete system
- 6. LAN1 / LAN2:** provides access to IMU/GNSS unit and VUX-1
- 7. IMU:** connection to the IMU sensor

Associated Software:

- *) PosPac MMS V7.X, node locked, GNSS-Inertial w/SmartBase Tool Set
- *) PosPac MMS Maintenance, GNSS Inertial Tool Set

Digital Camera NIKON D810

Part-No. HW-CAM-09-015-00

- 36.3 million effective megapixels rendering 7360 x 4912 pixel images
- Rugged, but lightweight magnesium alloy body (146x123x81.5, approx. 980g)
- CMOS sensor, 35.9 x 24.0 mm, total pixels: 37.09 million, Nikon FX format
- Sensitivity: ISO 64–12800 in steps of 1/3, 1/2 or 1EV. Can also be set to approx. 0.3, 0.5, 0.7 or 1 EV (ISO 32 equivalent) below ISO 64 or to approx. 0.3, 0.5, 0.7, 1 or 2 EV (ISO 51200 equivalent) above ISO 12800;
auto ISO sensitivity control available
- Exposure metering: TTL exposure metering using 91K-pixel RGB sensor
- Exposure modes: Programmed auto with flexible program (P); shutter-priority auto (S); aperturepriority auto (A); manual (M)
- Interfaces: SuperSpeed USB (USB 3.0 Micro-B connector), Type C HDMI connector,
Audio Input/Output: Stereo mini-pin jack (3.5-mm diameter)
- Built-in flash
- Electronically-controlled vertical-travel focal-plane mechanical shutter, electronic front-curtain shutter available in mirror
up release mode, speeds ranging from 1/8,000 to 30 s in steps of 1/3, 1/2 or 1 EV, bulb, X250
- 8-cm (3.2-in.), approx. 1229k-dot (VGA) TFT LCD with 170° viewing angle, approx. 100% frame coverage, and automatic monitor brightness control using ambient brightness sensor
- CompactFlash (CF) (Type I, UDMA compliant), SD, SDHC (UHS-I compliant), SDXC (UHS-I compliant)

NIKON Lens AF D 50/1.8 NIKKOR

Part-No. HW-CAM-10-007-00

Panasonic Toughbook CF-C2

Part-No. HW-GP-06-434-00

NIKON Camera Control Pro 2

Part-No. SW-CAM-07-000-00

for parametrizing of the NIKON camera settings

Services

Digital Camera Calibration Service for up to three camera lenses

Part-No. ST-GP-11-002-00

Provides complete set of camera calibration parameters for use in RiSCAN PRO including internal calibration, lens distortion parameters and mounting calibration parameters. Parameters are delivered within a RiSCAN PRO project. Calibration statistics included (available for camera-lens combinations as recommended by RIEGL LMS).

VUX-SYS System Calibration Service

Part-No. HW-VUXSYS-11-000-00

RIEGL Software Training

Part-No. ST-GP-11-009-00

RIEGL Software Training for RiACQUIRE, RiPROCESS, RiANALYZE (GPU), RiMTA and RiWORLD

Duration: 4 working days, in Horn, Austria or at the customer's site
max. number of participants from side of the end customer: 4 persons

Notes:

- *) Travelling and accommodation expenses of the RIEGL engineer(s) are not included and to be invoiced separately.
- *) Training is limited to putting the complete system into first operation and exemplary data processing, but does not cover managing and processing of real airborne surveying projects.
- *) Participants require a laptop for the training
- *) Additional training days are to be charged at additional costs of EUR 1.600,--/day plus accommodation costs.