

# RIEGL VUX<sup>®</sup>-1HA

- **very high measurement rate up to 1,000,000 meas./sec**
- **very high scan speed up to 250 scans / second**
- **5 mm survey-grade accuracy**
- **field of view 360° for 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**
- **compact (227x180x125 mm), lightweight (3.5 kg), and rugged**
- **userfriendly mounting**
- **mechanical and electrical interface for IMU mounting**
- **electrical interfaces for GPS data string and sync pulse (1PPS)**
- **LAN-TCP/IP interface**
- **internal data storage on Solid State Disc SSD, 1 TByte**

**RIEGL's VUX-1HA High Accuracy kinematic LiDAR sensor is a very high speed, non-contact profile measuring system using a narrow laser beam and a fast line scanning mechanism, enabling full 360 degree beam deflection without any gaps.**

High performance pulsed laser ranging, based on RIEGL's well-proven echo signal digitization technology with subsequent online waveform processing results in superior measurement capabilities even under adverse atmospheric conditions and in excellent multiple target echo discrimination.

The RIEGL VUX-1HA is a compact and lightweight laser scanner, mountable in any orientation and even under limited space conditions on land based vehicles, tunnel measuring devices, watercraft, etc.

The instrument needs only one power supply and provides line scan data via the integrated LAN-TCP/IP interface. The binary data stream can easily be decoded by user-designed software making use of the available software library RiVLib.

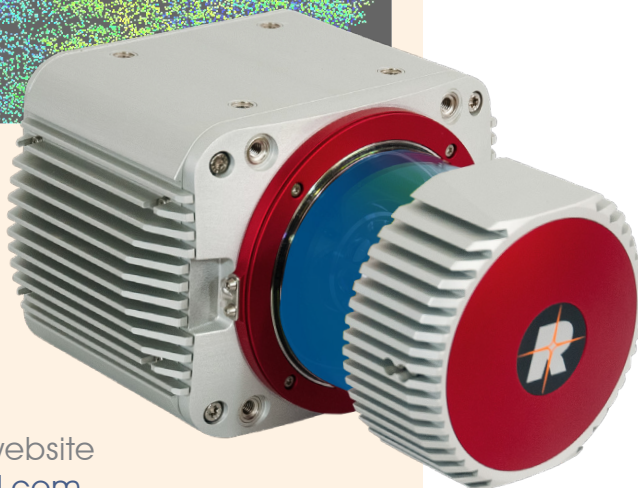
## Typical MLS applications include

### ROAD:

- **Transportation Infrastructure Mapping**
- **Road Surface Measurement**
- **HD Mapping for Autonomous Vehicles**
- **City Modeling**
- **GIS Mapping and Asset Management**
- **As-Built Surveying**

### RAIL:

- **Rapid and Safe Data Capture with Minimal Disruption to Network Schedules**
- **Track and Infrastructure Monitoring**
- **Clash Detection Simulation and Clearance Analysis**



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## Laser Product Classification

## Class 1 Laser Product

according to IEC 60825-1:2014

The following clause applies for instruments delivered into the United States:  
Complies with 21 CFR 1040.10 and 1040.11 except for conformance with  
IEC 60825-1 Ed.3., as described in Laser Notice No. 56, dated May 8, 2019.

CLASS 1  
LASER PRODUCT

## Range Measurement Performance

### Measuring Principle

time of flight measurement, echo signal digitization,  
online waveform processing, multiple-time-around-capability

Laser Pulse Repetition Rate PRR <sup>1)</sup>	300 kHz	500 kHz	750 kHz	1000 kHz
Max. Measuring Range <sup>2) 3)</sup>				
natural targets $p \geq 10 \%$	150 m	120 m	100 m	85 m
natural targets $p \geq 80 \%$	420 m	330 m	270 m	235 m
Max. Number of Targets per Pulse <sup>4)</sup>	practically unlimited (details on request)			

1) Rounded values.  
2) Typical values for average conditions. Maximum range is specified for flat targets with size in excess of the laser beam diameter, perpendicular angle of incidence, and for atmospheric visibility of 23 km. In bright sunlight, the max. range is shorter than under overcast sky.  
3) Ambiguity to be resolved by post-processing with RIMTA software.  
4) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achievable range is reduced.

### Minimum Range

Accuracy <sup>5) 7)</sup>

Precision <sup>6) 7)</sup>

Laser Pulse Repetition Rate <sup>1) 8)</sup>

Max. Effective Measurement Rate <sup>1)</sup>

Echo Signal Intensity

Laser Wavelength

Laser Beam Divergence

Laser Beam Footprint (Gaussian Beam Definition)

1.2 m

5 mm

3 mm

up to 1000 kHz

up to 1 000 000 meas./sec. (@ 1000 kHz PRR & 360° FOV)

for each echo signal, high-resolution 16 bit intensity information is provided

near infrared

0.5 mrad <sup>9)</sup>

4.5 mm @ exit, 5 mm @ 5 m, 6.6 mm @ 10 m,  
13 mm @ 25 m, 25 mm @ 50 m, 50 mm @ 100 m

- 5) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.  
6) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.

- 7) One sigma @ 30 m range under *RIEGL* test conditions.  
8) User selectable.  
9) Measured at the 1/e<sup>2</sup> points. 0.50 mrad corresponds to an increase of 50 mm of beam diameter per 100 m distance.

## Scanner Performance

Scanning Mechanism

Field of View (selectable)

Scan Speed (selectable)

Angular Step Width  $\Delta \theta$  (selectable)

between consecutive laser shots

Angle Measurement Resolution

Internal Sync Timer

Scan Sync (optional)

rotating mirror

360° „full circle“

10 - 250 revolutions per second, equivalent to 10 - 250 scans/sec

$0.0036^\circ \leq \Delta \theta \leq 0.3^\circ$

0.001°

for real-time synchronized time stamping of scan data

scanner rotation synchronization

## Data Interfaces

Configuration

Scan Data Output

GNSS Interface

LAN 10/100/1000 Mbit/sec

LAN 10/100/1000 Mbit/sec or USB 2.0

Serial RS-232 interface for data string with GNSS-time information,

TTL input for 1PPS synchronization pulse

1 TByte SSD

TTL input/output

SMA connector

Internal Data Storage

External Camera

External GNSS Antenna

## General Technical Data

Power Supply Input Voltage / Consumption <sup>10)</sup>

Main Dimensions <sup>10)</sup>

VUX-1HA without / with Cooling Fan

Weight <sup>10)</sup>

VUX-1HA without / with Cooling Fan

Humidity

Protection Class

Temperature Range <sup>11)</sup>

11 - 34 V DC / typ. 65 W

227 x 180 x 125 mm / 227 x 209 x 129 mm

approx. 3.5 kg / approx. 3.75 kg

max. 80 % non condensing @ 31°C

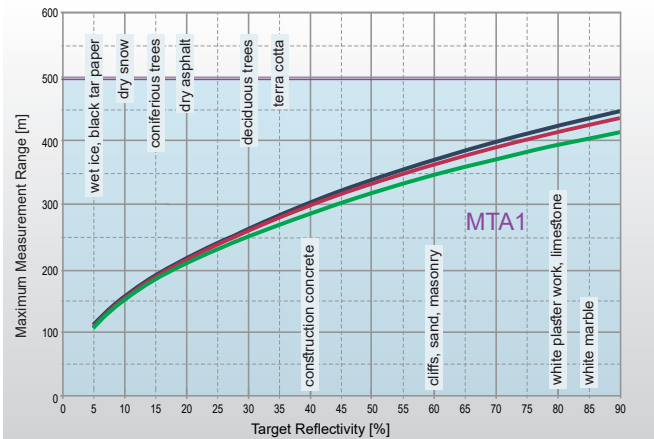
IP64, dust and splash-proof

-10°C up to +40°C (operation) / -20°C up to +50°C (storage)

10) without external IMU/GNSS, cooling fan not in operation.

11) The instrument requires air convection with a minimum flow rate of 5 m/s for continuous operation at +15 °C and above. If the necessary flow rate cannot be provided by the moving platform, the cooling fan (included in the scope of delivery) has to be used.

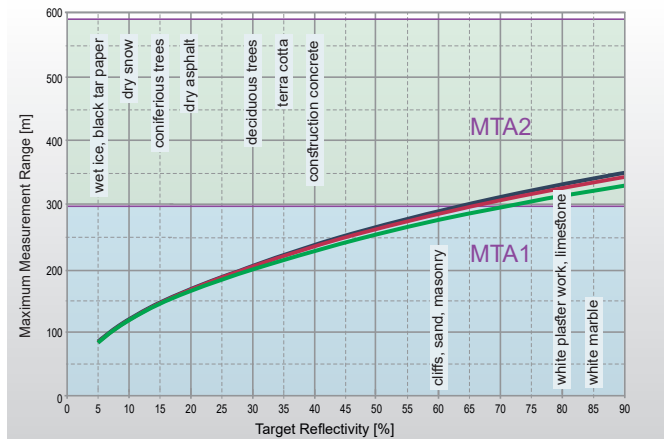
PRR = 300 kHz



MTA1: no ambiguity / one transmitted pulse „in the air“

— @ visibility 23 km  
— @ visibility 15 km  
— @ visibility 8 km

PRR = 500 kHz

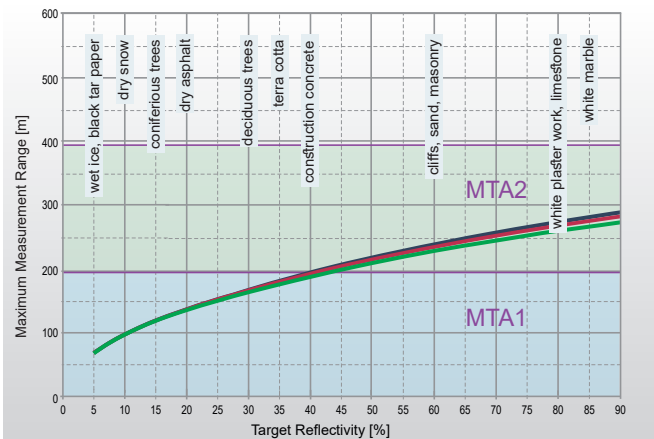


MTA1: no ambiguity / one transmitted pulse „in the air“

MTA2: two transmitted pulses „in the air“

— @ visibility 23 km  
— @ visibility 15 km  
— @ visibility 8 km

PRR = 750 kHz

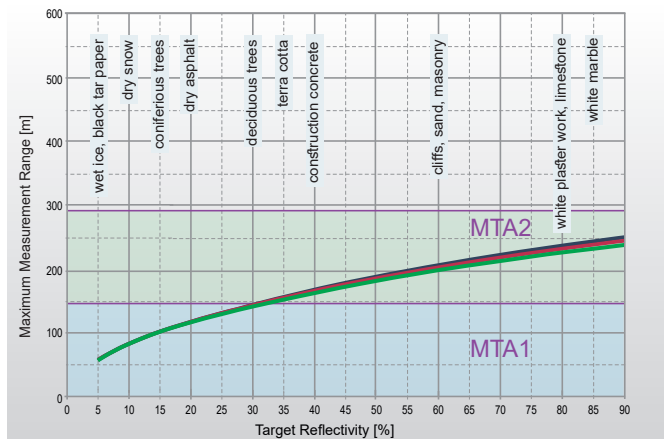


MTA1: no ambiguity / one transmitted pulse „in the air“

MTA2: two transmitted pulses „in the air“

— @ visibility 23 km  
— @ visibility 15 km  
— @ visibility 8 km

PRR = 1000 kHz



MTA1: no ambiguity / one transmitted pulse „in the air“

MTA2: two transmitted pulses „in the air“

— @ visibility 23 km  
— @ visibility 15 km  
— @ visibility 8 km

## *RIEGL VUX®-1HA* Additional Equipment and Integration



Cooling Fan



*RIEGL VUX-1HA* with Protective Cap



*RIEGL VUX-1HA* with external IMU-Sensor (*RIEGL VUX-SYS*)

### Additional Equipment for *RIEGL VUX-1HA*

#### Cooling Fan

Lightweight structure with two axial fans providing forced air convection for applications where sufficient natural air flow cannot be guaranteed. Power supply is provided via a connector on the rear side of the *RIEGL VUX-1HA*. The cooling fan can be mounted either on the top side or on the bottom side of the *RIEGL VUX-1HA* and is included in the scanner's scope of delivery.

The cooling fan has to be mounted whenever the environmental conditions/temperatures require the use (see "temperature range" on page 2 of this data sheet).

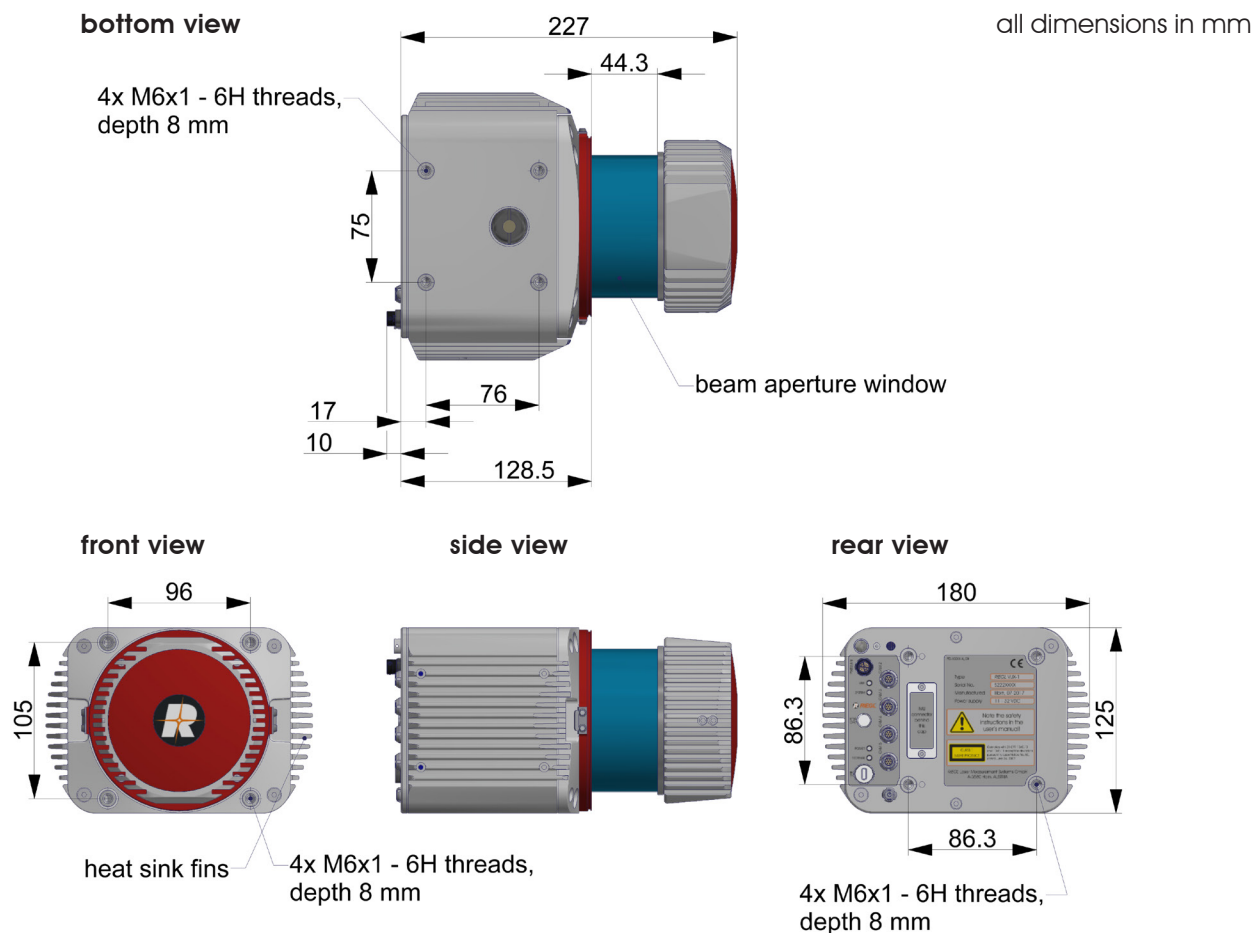
#### Protective Cap

To shield the glass tube of the *RIEGL VUX-1HA* from mechanical damage and soiling, a protective cap is provided to cover the upper part of the instrument during transport and storage.

### Options for *RIEGL VUX-1HA* Integration

*RIEGL* is developing user-friendly, application- and installation-specific solutions for integration of the *VUX-1HA* LiDAR sensor into whatsoever type of moving platform.





## RIEGL VUX®-1HA with Cooling Fan Device

