

RIEGL VUX-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**
- **scan data storage on internal 240 GByte SSD memory**

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.

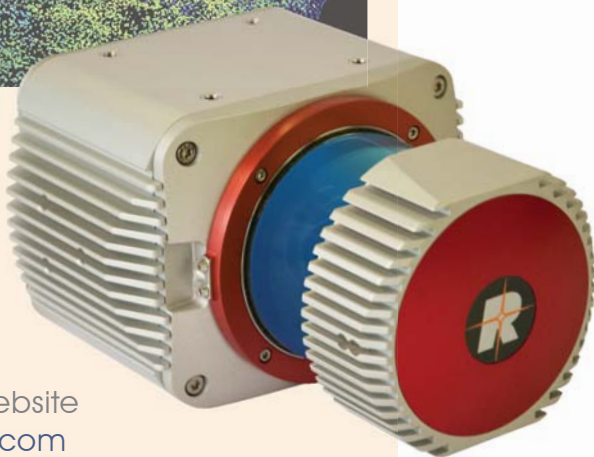
High performance pulsed laser ranging, based on *RIEGL's* well-proven echo signal digitization technology with subsequent online waveform processing results in superior measurement capabilities even under adverse atmospheric conditions and in excellent multiple target echo discrimination.

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.

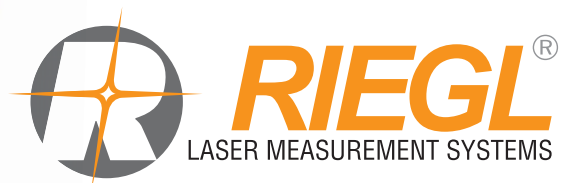
The instrument needs only one power supply and provides line scan data via the integrated LAN-TCP/IP interface. The binary data stream can easily be decoded by user-designed software making use of the available software library RiVLib.

Typical applications include

- **Indoor and Outdoor Mobile Laser Mapping**
- **Tunnel Profile Measurements**
- **Railway Applications like Clearance Analysis, etc**



visit our website
www.riegl.com



Technical Data RIEGL VUX®-1HA

Laser Product Classification

Class 1 Laser Product according to IEC60825-1:2007

The following clause applies for instruments delivered into the United States: Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.



Range Measurement Performance

Measuring Principle

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

Laser Pulse Repetition Rate PRR ¹⁾	300 kHz	500 kHz	750 kHz		1000 kHz	
			full power	reduced power ²⁾	full power	reduced power ²⁾
Max. Measuring Range ³⁾⁴⁾						
natural targets $\rho \geq 10\%$	150 m	120 m	100 m	85 m	50 m	40 m
natural targets $\rho \geq 80\%$	420 m	330 m	270 m	235 m	135 m	120 m
Max. Number of Targets per Pulse	practically unlimited (details on request)					

1) Rounded values.
 2) Laser power optimized (reduced) for measurements of short ranges with high pulse repetition rate.
 3) 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.
 4) Ambiguity to be resolved by post-processing with RIMTA MLS software.

Minimum Range

Accuracy ⁵⁾⁷⁾

Precision ⁶⁾⁷⁾

Laser Pulse Repetition Rate ¹⁾⁸⁾

Max. Effective Measurement Rate ¹⁾

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 ⁹⁾

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/e² 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

Internal Memory

External Camera

External GNSS Antenna

LAN 10/100/1000 Mbit/sec

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

Serial RS232 interface for data string with GNSS-time information,

TTL input for 1PPS synchronization pulse

240 GByte SSD

TTL input/output

SMA connector

General Technical Data

Power Supply Input Voltage / Consumption ¹⁰⁾

Main Dimensions ¹⁰⁾

VUX-1HA without / with Cooling Fan Device

Weight ¹⁰⁾

VUX-1HA without / with Cooling Fan Device

Humidity

Protection Class

Temperature Range ¹¹⁾

11 - 32 V DC / typ. 65 W

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

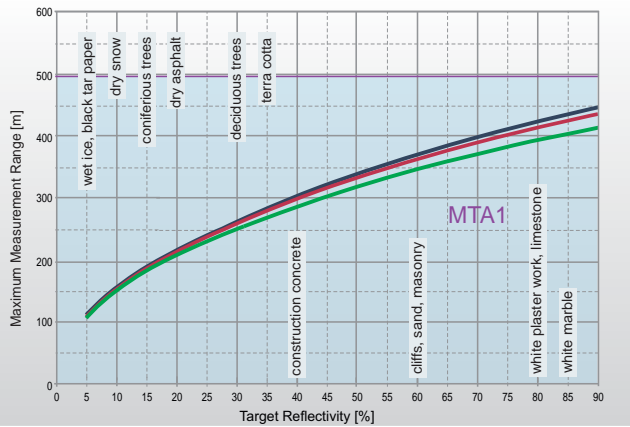
approx. 3.5 kg / approx. 3.75 kg
max. 80 % non condensing @ 31°C

IP64, dust and splash-proof

0°C up to +40°C (operation) / -20°C up to +50°C (storage)

10) without external IMU/GNSS, cooling fan device 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 device (included in the scope of delivery) has to be used.

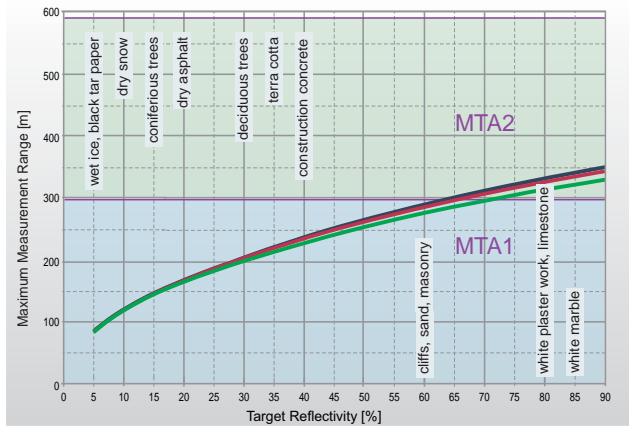
PRR = 300 kHz



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



PRR = 500 kHz

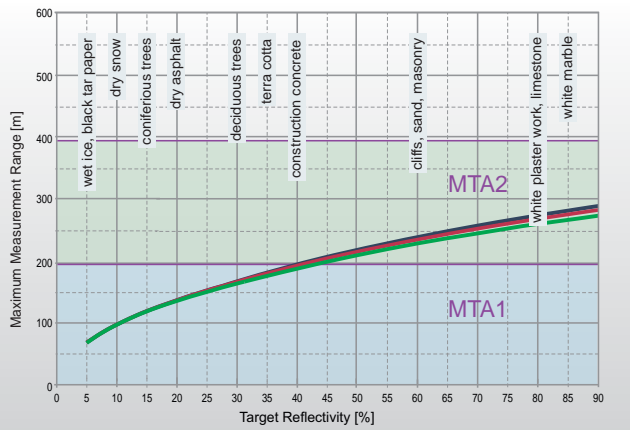


MTA1: no ambiguity / one transmitted pulse „in the air“

MTA2: two transmitted pulses „in the air“



PRR = 750 kHz

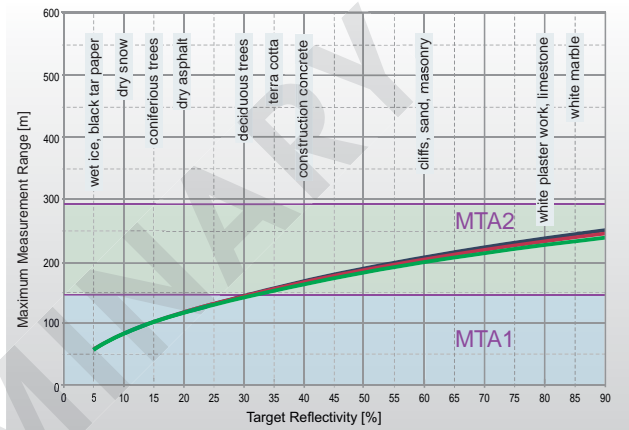


MTA1: no ambiguity / one transmitted pulse „in the air“

MTA2: two transmitted pulses „in the air“



PRR = 1000 kHz

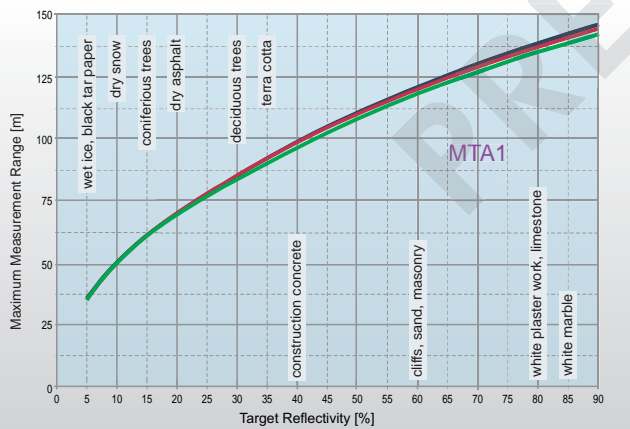


MTA1: no ambiguity / one transmitted pulse „in the air“

MTA2: two transmitted pulses „in the air“



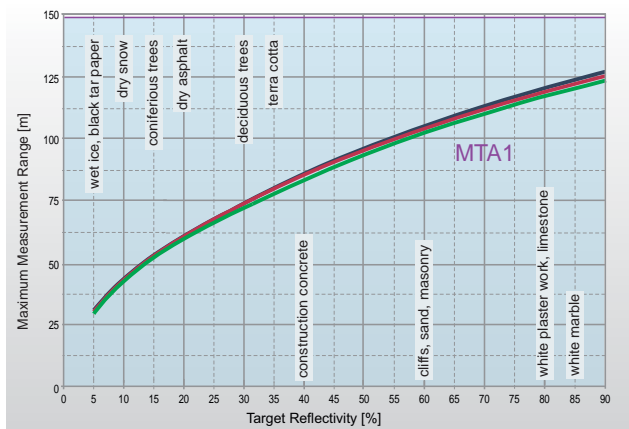
PRR = 750 kHz reduced



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



PRR = 1000 kHz reduced



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

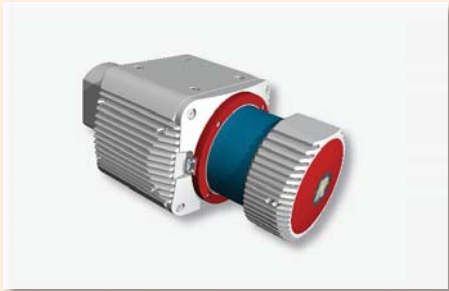




Cooling Fan Device



RIEGL VUX-1HA with Protective Cap



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

Additional Equipment for RIEGL VUX-1HA

Cooling Fan Device

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 device 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 device is to be mounted whenever the environmental conditions/temperatures require (see "temperature range" on page 2 of this datasheet).

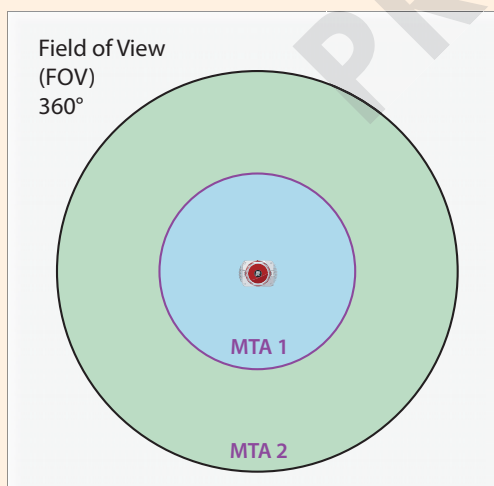
Protective Cap

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

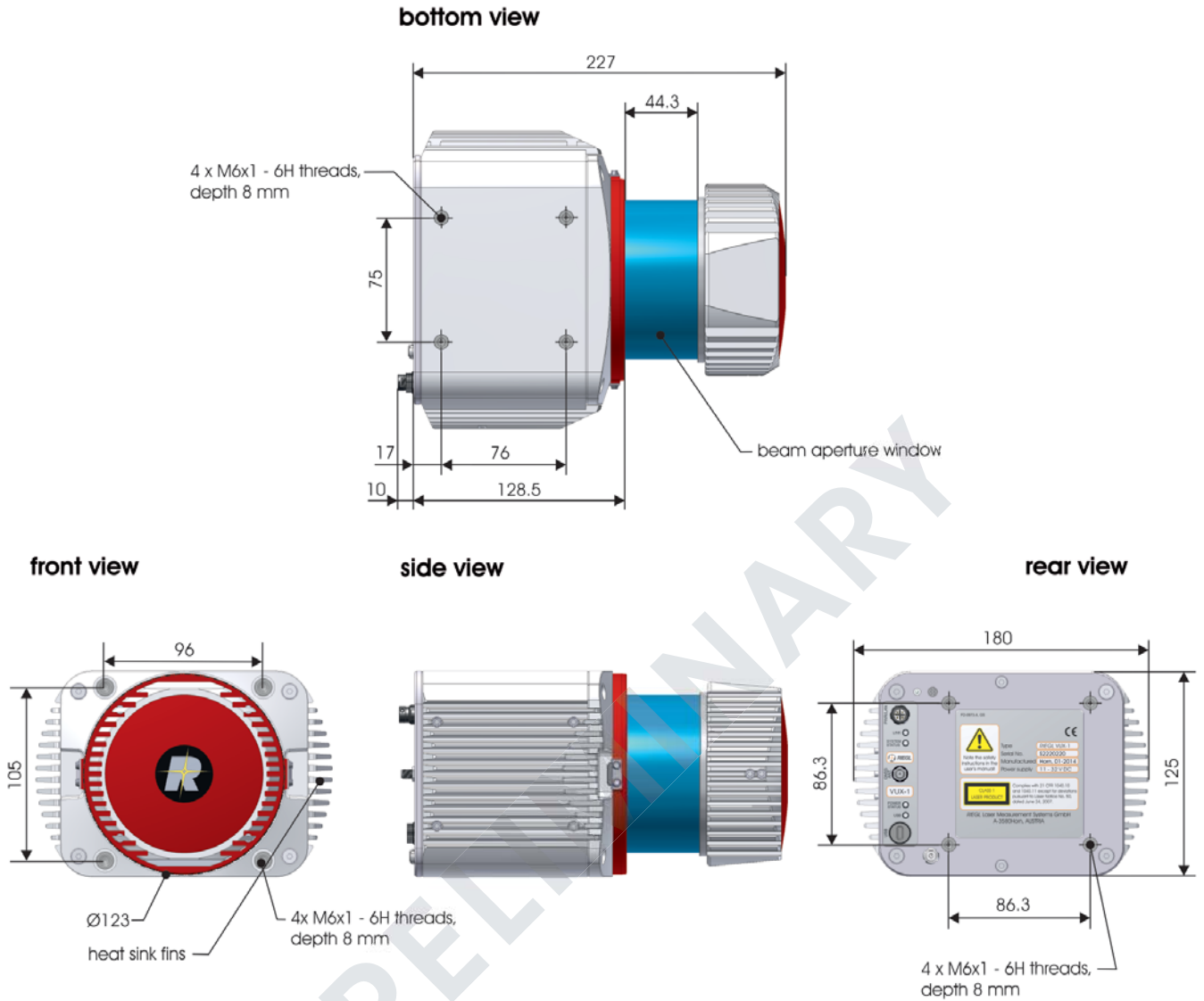
RIEGL is developing user-friendly, application- and installation-specific solutions for integration of the VUX-1HA LiDAR sensor into whatsoever type of moving platform.

Multiple-Time-Around Data Acquisition and Processing

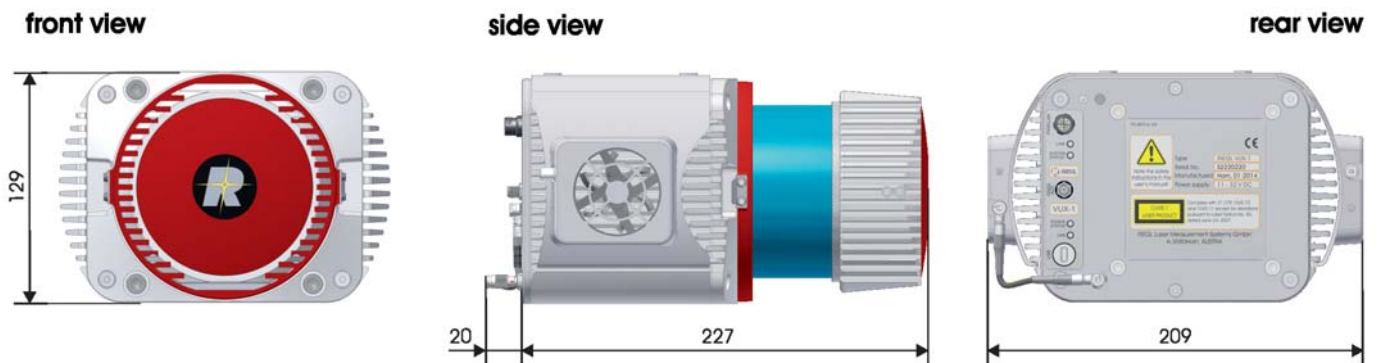


In time-of-flight laser ranging a maximum unambiguous measurement range exists, which is defined by the laser pulse repetition rate and the speed of light. In case the echo signal of an emitted laser pulse arrives later than the emission of the subsequently emitted laser pulse, the range result becomes ambiguous - an effect known as „Multiple-Time-Around“ (MTA).

The RIEGL VUX-1HA allows ranging beyond the maximum unambiguous measurement range using a sophisticated modulation scheme applied to the train of emitted laser pulses. The dedicated post-processing software RIMTA provides algorithms for multiple-time-around processing, which automatically assign definite range results to the correct MTA zones without any further user interaction required.

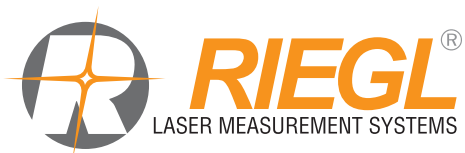


Dimensional Drawings *RIEGL VUX®-1HA* with Cooling Fan Device



all dimensions in mm

PRELIMINARY



RIEGL Laser Measurement Systems GmbH
Riedenburgstraße 48
3580 Horn, Austria
Phone: +43 2982 4211 | Fax: +43 2982 4210
office@riegl.co.at
www.riegl.com

RIEGL USA Inc.
Orlando, Florida | info@rieglusa.com | www.rieglusa.com
RIEGL Japan Ltd.
Tokyo, Japan | info@riegl-japan.co.jp | www.riegl-japan.co.jp
RIEGL China Ltd.
Beijing, China | info@riegl.cn | www.riegl.cn

www.riegl.com