

RIEGL miniVUX[®]-HA

SURVEY-GRADE PERFORMANCE

- **5 mm accuracy**
- **4 mm precision**
- **100 kHz / 200 kHz / 300 kHz
Laser PRR selectable**
- **measurement rate up to
300,000 measurements/sec**
- **scan speed up to 150 scans/sec**
- **minimum range 1 m**
- **very compact & lightweight
(1.85 kg / 4.1 lbs)**
- **up to 360° field-of-view**
- **robust aluminum housing**
- **makes use of RIEGL's unique echo
signal digitization and online
waveform processing**
- **multiple target capability –
up to 5 target echoes per laser shot**
- **mechanical and electrical interface
for IMU mounting**
- **user-friendly, application- and
installation-oriented solutions for
integration**



visit our website
www.riegl.com

With the *RIEGL* miniVUX-HA a miniVUX-Series LiDAR sensor especially suited for applications in mobile laser scanning is provided.

The extremely lightweight and compact sensor comes in a robust aluminum housing and offers itself as the core part of small, user-friendly, and economically priced kinematic laser scanning systems.

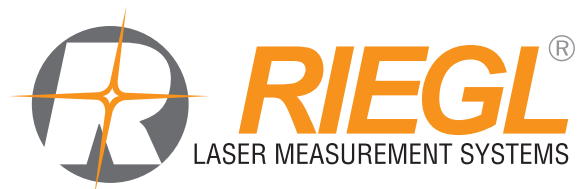
RIEGL's state-of-the-art Waveform-LiDAR technologies provide pure digital LiDAR signal processing, multiple targets per laser shot enabling the penetration of dense foliage, calibrated amplitudes and reflectance estimates and thus highly accurate, extremely informative measurement data. Scan data can be stored on the easy-to-remove SD card and/or streamed via LAN-TCP/IP interface.

The *RIEGL* miniVUX-HA provides up to 300,000 meas./sec, 150 lines/sec scan speed, 360° field of view, 5 mm accuracy and 4 mm precision – these features allow the kinematic acquisition of laser scan data in a wide range of applications.

The sensor is offered as the core part of the *RIEGL* VMY Mobile Mapping Systems, which are fully integrated with IMU/GNSS and optional cameras.

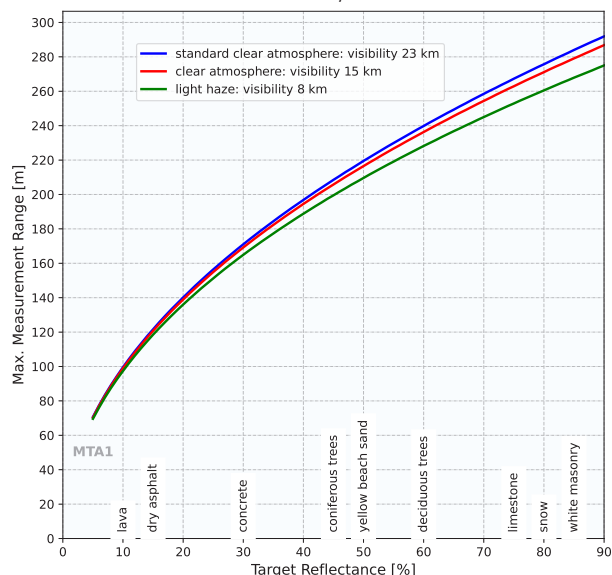
Typical applications include

- **Transportation Infrastructure Mapping**
- **City Modeling**
- **As-Built Surveying**
- **GIS Mapping and Asset Management**
- **HD Mapping for Autonomous Vehicles**
- **Rapid Capture of Construction Sites
and Bulk Material**
- **Open-Pit Mine Surveying**



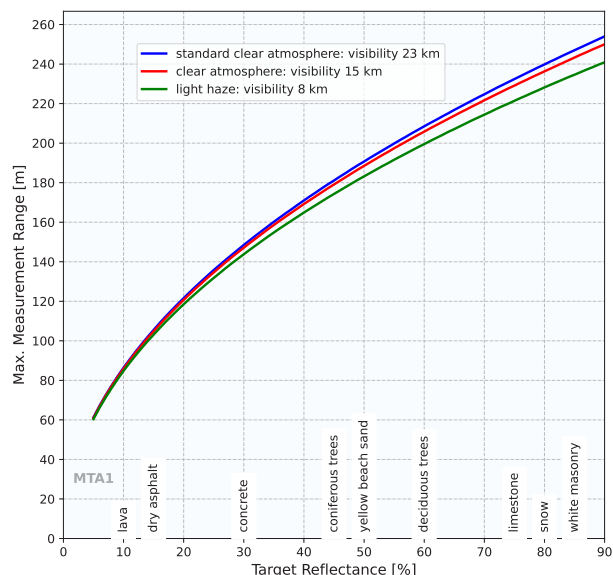
Maximum Measurement Range vs. Target Reflectance *RIEGL miniVUX®-HA*

Laser PRR = 100 kHz / 300 kHz 120° FOV



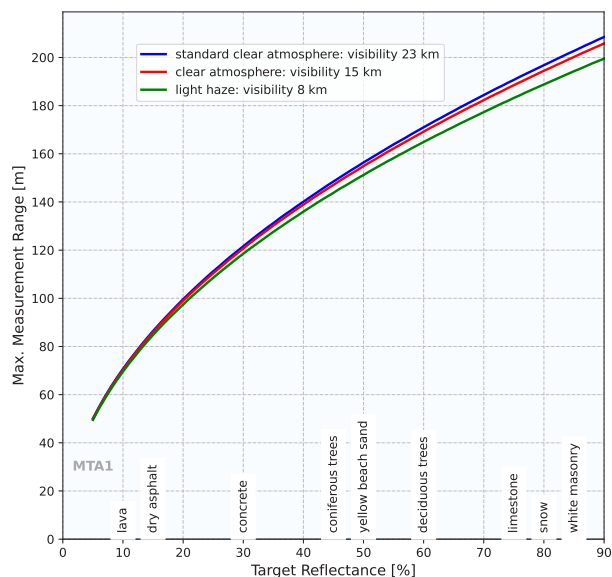
MTA 1: no ambiguity / one transmitted pulse „in the air“

Laser PRR = 200 kHz



MTA 1: no ambiguity / one transmitted pulse „in the air“

Laser PRR = 300 kHz



MTA 1: no ambiguity / one transmitted pulse „in the air“

RIEGL miniVUX®-HA - Integration Examples

The *RIEGL miniVUX-HA* LiDAR sensor is the core part of *RIEGL*'s compact and economically priced VMY Mobile Mapping Systems. The VMY-1 (based on a single *miniVUX-HA* sensor) and the VMY-2 (with two *miniVUX-HA* sensors integrated) are well suited for a variety of mobile mapping applications.

To further increase efficiency, the optional integration of up to four cameras allows simultaneous acquisition of imagery to complement the captured LiDAR data.

The innovative design of both systems enables folding and thus a convenient transport and space-saving storage.

Please find more detailed information on the according datasheets:

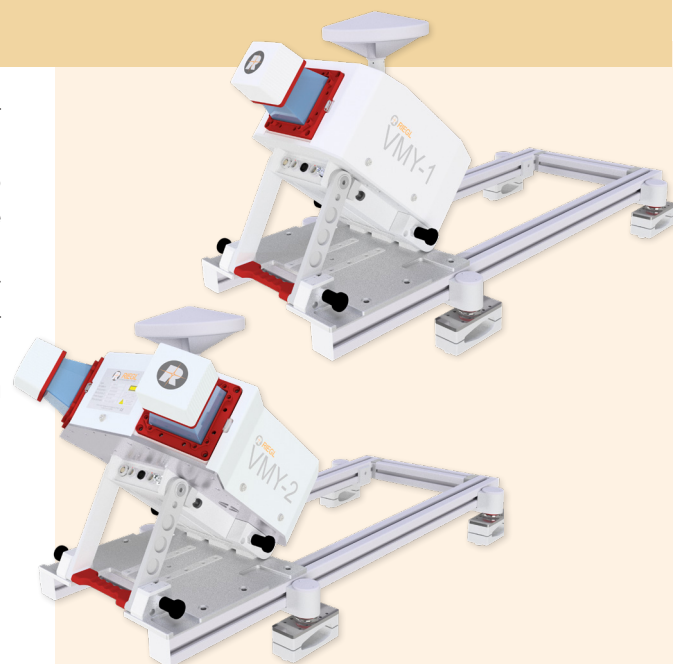
RIEGL VMY-1

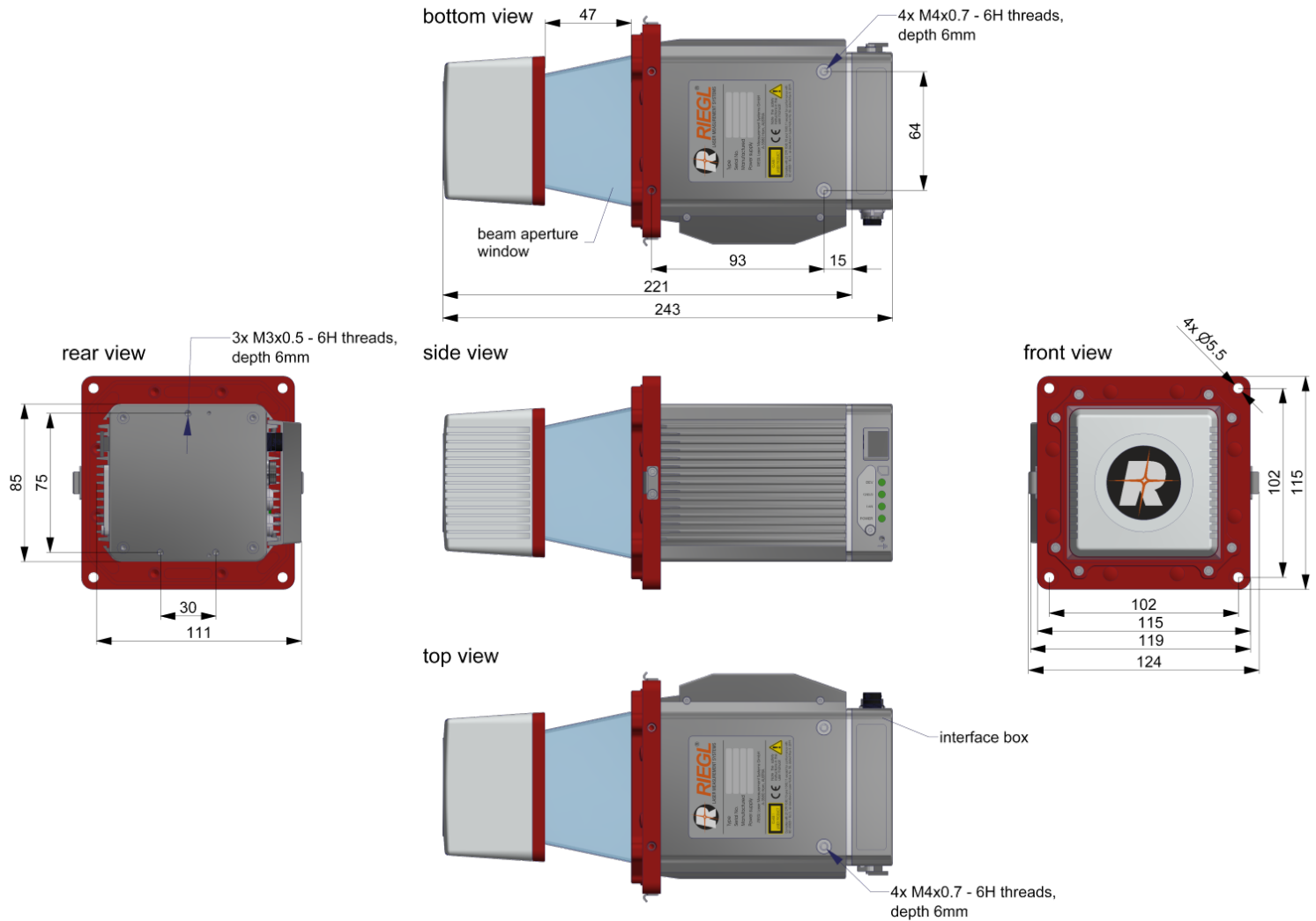
Single Scanner
Mobile Mapping
System



RIEGL VMY-2

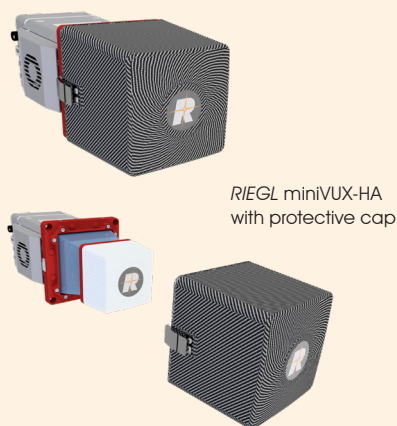
Dual Scanner
Mobile Mapping
System





all dimensions in mm

RIEGL miniVUX®-HA - Additional Equipment and Integration



Additional Equipment for *RIEGL* miniVUX-HA

Protective Cap

To shield the glass prism of the *RIEGL* miniVUX-HA from mechanical damage and soiling, a protective cap is provided to cover the upper part of the instrument during transport and storage. It is secured by two spring-loaded latch fasteners and has to be removed before scan data acquisition is started.

Options for *RIEGL* miniVUX-HA Integration

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

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

Laser Pulse Repetition Rate PRR ¹⁾	100 kHz	200 kHz	300 kHz	300 kHz / 120° FOV ⁴⁾
Max. Measuring Range ²⁾				
natural targets $\rho \geq 20\%$	140 m	120 m	100 m	140 m
natural targets $\rho \geq 60\%$	240 m	210 m	170 m	240 m
natural targets $\rho \geq 80\%$	270 m	240 m	200 m	270 m
Max. Number of Targets per Pulse ³⁾	5	5	5	5

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) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achievable range is reduced.
4) Measurement program for UAV applications with maximum range performance @ 300 kHz with limited scanner FOV of 120°.

Minimum Range

Accuracy ^{4) 6)}

Precision ^{5) 6) 7)}

Laser Pulse Repetition Rate ¹⁾

Max. Effective Measurement Rate ¹⁾

Echo Signal Intensity

Laser Wavelength

Laser Beam Divergence ⁸⁾

Laser Beam Footprint

1 m

5 mm

4 mm

100 kHz / 200 kHz / 300 kHz (selectable)

up to 300 000 meas./sec. (@ 300 kHz PRR & 360° FOV)

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

1.6 x 0.5 mrad

12 mm x 15 mm @ exit, 160 mm x 50 mm @ 100 m

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

- 6) One sigma @ 16 m range under RIEGL test conditions.
7) Degraded precision on targets with very low reflectivity below 1.5 m range.
8) Measured at 50% peak intensity, 1.6 mrad corresponds to an increase of 160 mm of beam diameter per 100 m distance.

Scanner Performance

Scanning Mechanism

Field of View (selectable)

Scan Speed (selectable)

Angular Step Width $\Delta \varphi$ (selectable) between consecutive laser shots

Angle Measurement Resolution

rotating mirror

up to 360° @ 100/200/300 kHz

10 - 150 scans/sec ⁹⁾ @ 100 kHz

20 - 150 scans/sec ⁹⁾ @ 200 kHz

30 - 150 scans/sec ⁹⁾ @ 300 kHz

$0.036^\circ \leq \Delta \varphi \leq 0.54^\circ$

0.001°

⁹⁾ equivalent to revolutions per second

Interfaces

Configuration, Scan Data Output & Communication with External Devices GNSS Interface ¹⁰⁾

General IO & Control ¹¹⁾

Camera Interface

Memory Card Slot

2 x LAN 10/100/1000 Mbit/sec

WLAN IEEE 802.11 a/b/g/n

Serial RS-232 interface for data string with GNSS-time information,
TTL input for 1PPS synchronization pulse.

2 x TTL input/output, 1 x Remote on/off

2 x GNSS RS-232 Tx & PPS, Power, Trigger, Exposure

for SDHC/SDXC memory card 32 GByte (can be upgraded to 64 GByte)

10) internally available (not available with standard interface box)

11) 1x externally available with standard interface box

General Technical Data

Power Supply Input Voltage / Consumption

Main Dimensions (L x W x H) / Weight with Cooling Fan

Humidity

Protection Class

Temperature Range ¹²⁾

11 - 34 V DC / typ. 24 W @ 150 scans/sec

243 x 115 x 115 mm / approx. 1.85 kg

max. 80 % non condensing @ 31°C

IP64, dust-tight and splash-proof

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

- 12) Continuous operation at ambient temperature of $\geq 30^\circ\text{C}$ ($\geq 86^\circ\text{F}$) requires a minimum amount of air flow at approx. 3 m/s. For applications where a 3 m/s air flow along the cooling fins cannot be guaranteed, the cooling fan has to be used.



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