RIEGL
VMQ®-1HA

420m | 1 MHz | | | optional |

The *RIEGL* **VMQ-1HA** is a compact, economically priced High-Speed Single Scanner Mapping System, well suited for a variety of mobile mapping applications.

The system consists of a measuring head, a compact control unit for system operation, and a special roof mount for convenient mounting.
The optional integration of up to four cameras allows simultaneous acquisition of imagery to complement the captured LiDAR data.

The central part of the system is the fully integrated *RIEGL* VUX-1HA LiDAR sensor providing 1 million measurements and up to 250 scan lines per second for an outstanding performance in mobile applications.

High Speed
Single Scanner Mobile Mapping System

Typical Applications

- Transportation Infrastructure Mapping • Road Surface Measurement • City Modeling • Rapid Capture of Construction Sites and Bulk Material • Open-Pit Mine Surveying • GIS Mapping and Asset Management • As-Built Surveying

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RIEGL®

RIEGL LMS GmbH, Austria | *RIEGL USA Inc.* | *RIEGL Japan Ltd.* | *RIEGL China Ltd.*

Key Features

- **RIEGL High-Performance LiDAR Sensor for Mobile Mapping**

  Core component of the *RIEGL* VMQ-1HA is the **kinematic LiDAR Sensor VUX-1HA**. Especially developed for mobile applications, the high-accuracy, high-speed laser scanner offers a maximum effective measurement rate of up to 1 MHz, 5 mm accuracy, 250 scan lines/sec, and a 360 degree "full circle" field of view.

  Fully integrated into the measuring head of the VMQ-1HA, the sensor enables acquisition of dense point cloud patterns even with single passes at common traffic speeds. At 80 km/h acquisition speed the typical average point density is about 9 cm line spacing and 6 mm point spacing on the road surface.

- **Camera Interface**

  A wide range of cameras can be used with the system including 5-megapixel and 9-megapixel cameras with GigE vision interface for seamless integration into the entire acquisition and processing workflow. Further cameras such as high resolution DSLR cameras up to 36-megapixel or the POINT GREY Ladybug5® spherical imaging system can also be integrated to the seamless *RIEGL* workflow.
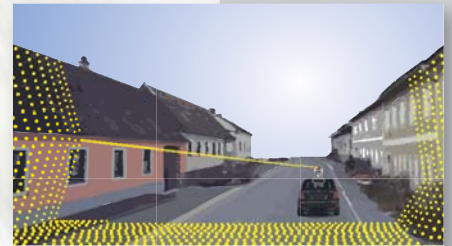
- **Multiple Swivel Positions**

  By means of the swivel plate the measuring head can be set to seven different predefined mounting angles (-45° to +45° in 15° increments). This flexible system configuration allows the generation of different point cloud patterns meeting diverse project requirements. The possibility of scan data acquisition with different horizontal orientation of the measuring head improves the scan pattern especially for multi-pass applications.

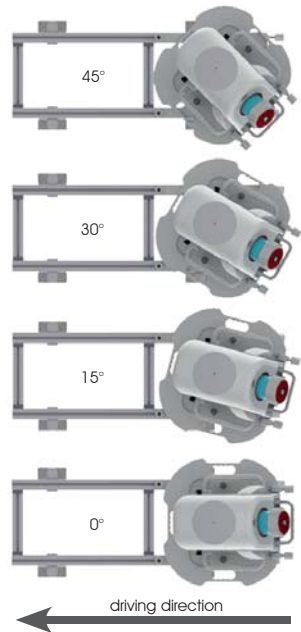- **Seamless *RIEGL* Workflow**

  Seamless *RIEGL* workflow for MLS data acquisition, processing and adjustment is provided by *RIEGL's* proven software suite.

RIEGL VUX-1HA
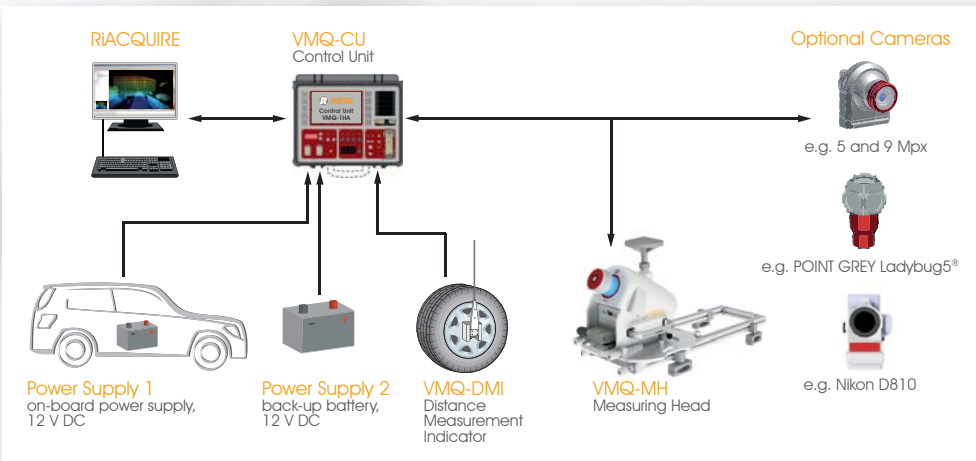high-accuray kinematic LiDAR sensor
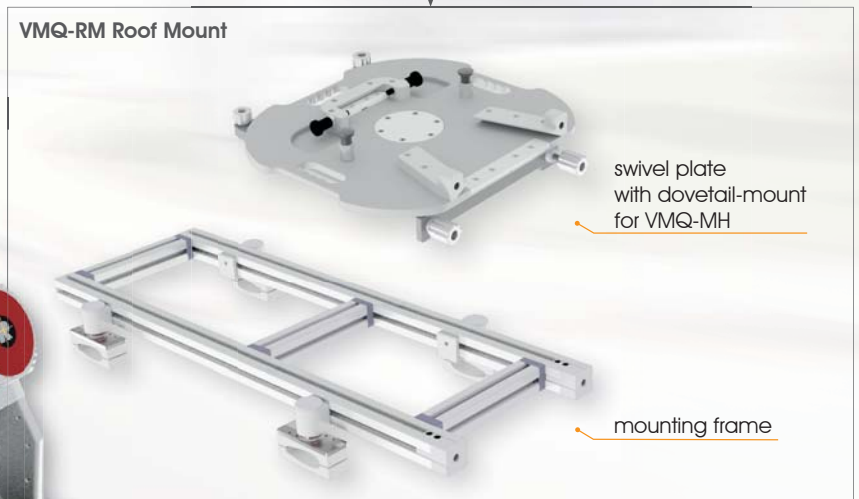

360° vertical field of view
in a single pass

45°

30°

15°

0°

driving direction

multiple swivel positions

RIEGL VMQ-1HA System Block Diagram

RiACQUIRE

VMQ-CU
Control Unit

Optional Cameras

e.g. 5 and 9 Mpx

e.g. POINT GREY Ladybug5®

e.g. Nikon D810

Power Supply 1
on-board power supply,
12 V DC

Power Supply 2
back-up battery,
12 V DC

VMQ-DMI
Distance
Measurement
Indicator

VMQ-MH
Measuring Head

**RIEGL VMQ-1HA
System Components:**

- *RIEGL* VMQ-MH
  Measuring Head

- *RIEGL* VMQ-CU
  Control Unit

- VMQ-DMI
  Distance Measurement Indicator

- up to 4 cameras (optional)

- sustainable power supply with back-up battery

- connecting cables

RIEGL VMQ-1HA Setup and Components

optional components

optional camera,
e.g. POINT GREY Ladybug5®

mounting plate for
Ladybug camera

optional GPS azimuth
measurement subsystem

VMQ-MH Measuring Head

protective cover
with GNSS antenna

VUX-1HA laser scanner
with IMU/GNSS unit

VMQ
mounting platform

VMQ-RM Roof Mount

swivel plate
with dovetail-mount
for VMQ-MH

mounting frame

Physical Data	Main Dimensions (L x W x H)	Weight (approx.)
VMQ-MH Measuring Head	496 x 387 x 507 mm	18 kg
VMQ-RM Roof Mount		
Mounting Frame	1149 x 440 x 110 mm	9 kg
Swivel Plate	568 x 514 x 70 mm	13 kg
VMQ-CU Control Unit	560 x 455 x 265 mm	26 kg
VMQ-MC Main Cable	standard length 5 m	8 kg

RIEGL VMQ-1HA Technical Data

420m max. measurement range

1 MHz pulse repetition rate (peak)

online waveform processing

optional digital camera

multiple target capability

eye safe operation at Laser Class 1

VMQ-1HA Scanner Performance

Eye Safety Class	Laser Class 1 (Class 1 Laser Product according to IEC60825-1:2007)					
Effective Measurement Rate [1] [3]	300 kHz	500 kHz	750 kHz full power	750 kHz reduced power[2]	1000 kHz full power	1000 kHz reduced power[2]
Max. Range, Target Reflectivity ρ ≥ 80% [4]	420 m	330 m	270 m	135 m	235 m	120 m
Max. Range, Target Reflectivity ρ ≥ 10% [4]	150 m	120 m	100 m	50 m	85 m	40 m
Max. Number of Targets per Pulse	practically unlimited (details on request)					
Minimum Range	1.2 m					
Accuracy [5] [7] / Precision [6] [7]	5 mm / 3 mm					
Field of View	360° "full circle"					
Scan Speed (selectable)	up to 250 scans/sec					

1) Rounded values, selectable by measurement program.
2) Laser power optimized (reduced) for measurements of short ranges with high pulse repetition rate.
3) In order to reduce MTA ambiguities in mobile mapping applications it is recommended to use measurement programs with reduced laser power for short range applications and programs with reduced pulse repetition rate for long range applications.
4) 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.
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.

IMU/GNSS Performance [8]	IMU (Option A)	IMU (Option B)
Position Accuracy (absolute)	typ. 20 - 50 mm	typ. 20 - 50 mm
Roll & Pitch Accuracy	0.015°	0.005°
Heading Accuracy	0.05° / 0.025° [9]	0.015°

8) One sigma values, no GNSS outage, with DMI option, post-processed using base station data.
9) Improved heading accuracy with dual antenna option @ 2 m baseline.

Electrical Data

Power Supply Input Voltage	11 - 15 V DC
Power Consumption	typ. 200 W (max. 260 W)

Interfaces

Interfaces Measuring Head (VMQ-MH)	Interfaces Control Unit (VMQ-CU)
4 x trigger pulse, exposure pulse, NMEA data (e.g. for optional cameras or additional devices) 1 x PPS out pulse for synchronization of additional device 2 x LAN, 1000 Mbit/sec for data transfer to control unit of external devices (e.g. image data acquisition) 1 x secondary antenna connector for GPS azimuth measurement subsystem	1 x DMI input (for distance measuring indicator; odometer) 1 x synchronization output NMEA + PPS (for synchronization of additional device) 1 x NAV RS232 (COM port for IMU/GNSS for RTK, SBAS) 1 x LAN, 1000 Mbit/sec (e.g. connect additional computer) 2 x USB 3.0 (e.g. image data transfer from Point Grey Ladybug5®) 1 x touch screen incl. USB (for system operation) 1 x DVI (additional video output of main system PC)
VMQ-MC Main Cable (single cable connection between VMQ-MH and VMQ-CU)	

Further Information

RIEGL VUX-1HA Data Sheet

RiACQUIRE Data Sheet

RiPROCESS Data Sheet

RiWORLD Data Sheet

RiPRECISION MLS Brochure

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