

RIEGL VMQ-1HA



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 compact measuring head with a quick release system for convenient mounting. A swivel plate enables multiple mounting angles in order to optimize the field of view of the system. 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-1HA²²** LiDAR sensor providing 1.8 mio. measurements and up to 250 scan lines per second for an outstanding performance in mobile applications.

Use the latest advancements in **RIEGL** LiDAR Technology for your mobile applications:
1.8 MHz effective measurement rate
250 scan lines/sec



High Speed Single Scanner Mobile Mapping System

Typical Applications

- Transportation Infrastructure Mapping
- Road Surface Measurement
- HD Mapping for Autonomous Vehicles
- 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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Key Features

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

Core component of the *RIEGL* VMQ-1HA is the **kinematic LiDAR Sensor VUX-1HA²²**. Especially developed for mobile applications, the high-accuracy, high-speed laser scanner offers a maximum effective measurement rate of up to 1.8 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 4 mm point spacing on the road surface.

• **Multiple Swivel Positions**

By means of the swivel plate the measuring head can be set to seven different pre-defined 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.

• **System Operation**

The VMQ-1HA is powered via the VM Power Supply Box. It provides power for the VMQ-MH Measuring Head, the DMI, and either for the VM-IU Interface Unit, or a data acquisition laptop. The VM Power Supply Box enables failsafe operation by redundant power input from the vehicles on-board power supply and a backup battery.

The VM-IU is a compact data acquisition unit for convenient system operation. It provides extended disk space to store scan data as well as camera data from the *RIEGL* cameras (GigE-vision cameras) and various spherical cameras up to 72 MP.

Optionally the system can also be operated with a user laptop instead of the VM-IU, if no *RIEGL* cameras are used.

• **Seamless *RIEGL* Workflow**

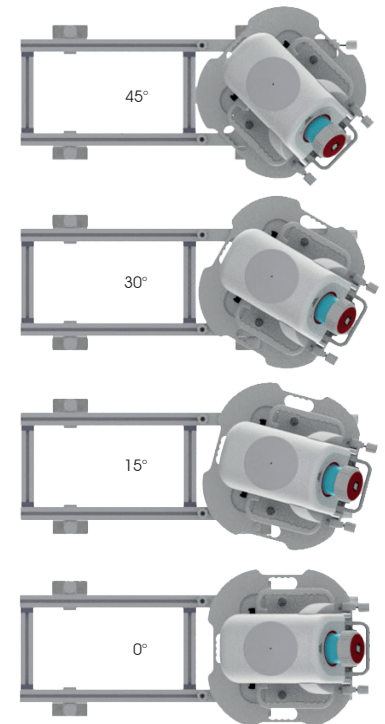
A handy touch-screen and the *RIEGL* data acquisition software facilitate the operator's task in the field by providing real-time visualization of acquired scan data and imagery. The *RIEGL* software packages also offer comprehensive features in data processing. This covers enhanced scan data adjustment to merge overlapping mobile scan data. Furthermore it enables the scan data to be fitted to specific control objects which results in a consistent point cloud of enhanced precision and increased geo-referenced accuracy. Finally, the precise geo-referenced scan data and high resolution (panorama) images can be exported to well-known file formats, or interfaced directly with third-party software.



RIEGL VUX-1HA²²
high-accuracy kinematic LiDAR sensor



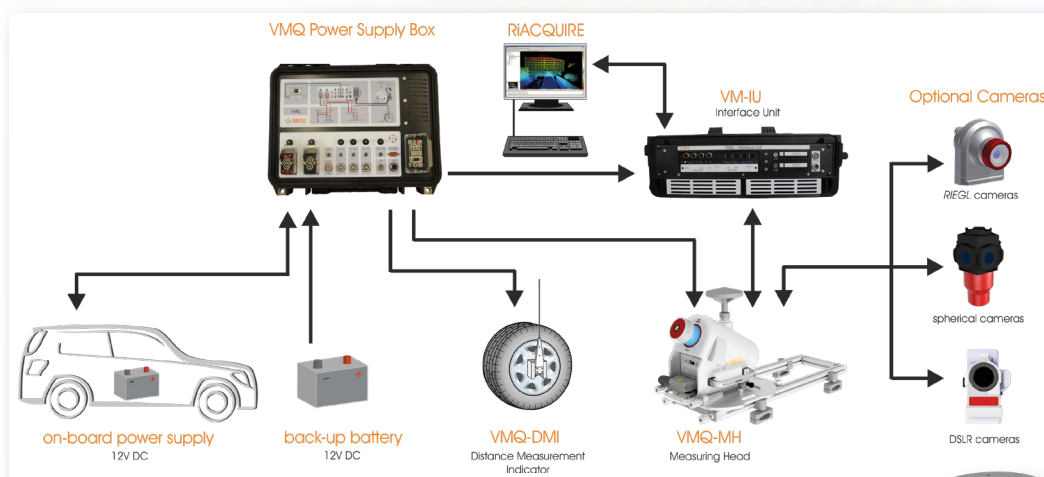
360° vertical field of view
in a single pass



driving direction

multiple swivel positions

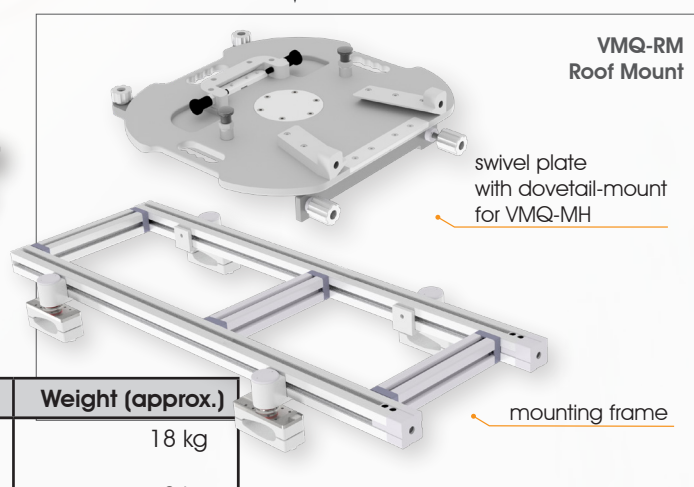
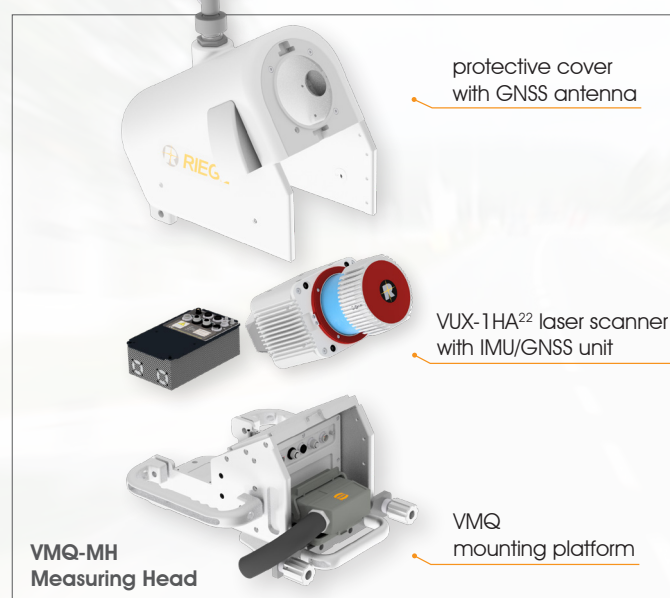
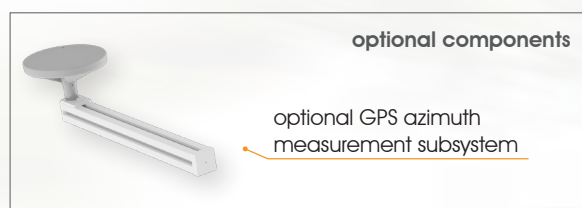
RIEGL VMQ-1HA System Block Diagram



RIEGL VMQ-1HA System Components:

- RIEGL VMQ-MH Measuring Head
- RIEGL VM-IU Interface Unit
- RIEGL VM Power Supply Box
- VM-DMI Distance Measurement Indicator
- up to 4 cameras (optional)
- sustainable power supply with back-up battery
- connecting cables

RIEGL VMQ-1HA Setup and Components



Physical Data

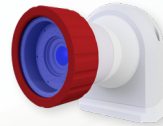
	Main Dimensions (L x W x H)	Weight (approx.)
VMQ-MH Measuring Head	496 x 387 x 507 mm	18 kg
VMQ-RM Roof Mount		
Mounting Frame	1149 x 440 x 110 mm	9 kg
Swivel Plate	568 x 514 x 70 mm	13 kg
VM Power Supply Box	415 x 330 x 175 mm	7.8 kg
VM-IU Interface Unit	550 x 353 x 230 mm	14.8 kg
VMQ-MC Main Cable	standard length 5 m	8 kg

RIEGL VMQ-1HA Camera Options

A wide range of cameras can be used with the system including 5 MP/12 MP/24 MP *RIEGL* cameras with GigE vision interface for seamless integration into the entire acquisition and processing workflow. Cameras such as high resolution DSLR cameras up to 45 MP or various spherical cameras up to 72 MP can also be integrated to the seamless *RIEGL* workflow.

RIEGL cameras

The cameras are available with different resolutions and lens types. For further details please refer to the table below.



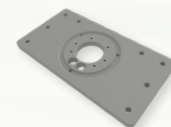
DSLR cameras



with *RIEGL* camera mount

extended
mounting plate
for up to 4 cameras

Spherical cameras



mounting kit
for spherical
cameras

RIEGL VMQ-1HA system
with 2x *RIEGL* cameras, 1x DSLR camera and 1x spherical camera

RIEGL Camera Options	max. number of cameras	max. frames per second ¹⁾	resolution [px (H) x px (V)]	pixel size [μm]	lens focal length [mm]	Field of View (FOV) ²⁾
5 MP RAW ^{3) 5)}	2	20	2464 x 2056	3.45	5	80.7° x 70.7°
12 MP RAW ^{3) 5)}	2	8	4112 x 3008	3.45	8 / 16	83.1° x 65.9° / 47.8° x 35.9°
12 MP JPEG ^{4) 5)}	2	17 ⁴⁾	4112 x 3008	3.45	8	83° x 66°
24 MP RAW ^{3) 5)}	2	4.5	5328 x 4608	2.74	8	79.5° x 71.5°
24 MP JPEG ^{3) 5)}	2	9 ⁴⁾	5328 x 4608	2.74	8	79.5° x 71.5°

¹⁾ Maximum frame rate of a single camera operated in 8-bit mode. The use of multiple cameras may reduce maximum frame rates.

²⁾ Nominal values (actual values may be slightly different due to manufacturing tolerances).

³⁾ A user defined "region of interest" can be defined during data acquisition, resulting in a reduction of the FOV and the resolution.

This may help to reduce image file sizes on the one hand and to further increase frame rates on the other hand.

⁴⁾ @ 90% image compression.

⁵⁾ The *RIEGL* cameras require the usage of the VM-IU Interface Unit.

Specifications *RIEGL* Cameras

RIEGL offers high-sensitive ball-joint directional cameras (5 MP, 12 MP, and 24 MP) with leading edge CMOS technology for high resolution images, high frame rates, and minimized lens distortion. The camera's CMOS global shutter sensor provides a high dynamic range, hardly any smearing effects caused by sunlight, great details in shadows and highlights, and low temporal dark noise for more signal gain up to 40 dB.

The VMY-2 system allows the integration of up to two *RIEGL* cameras to the appropriate mounting plate. While horizontal mounting allows standard picture acquisition, nadir mounting enables acquisition of the road surface.

Pavement Mount

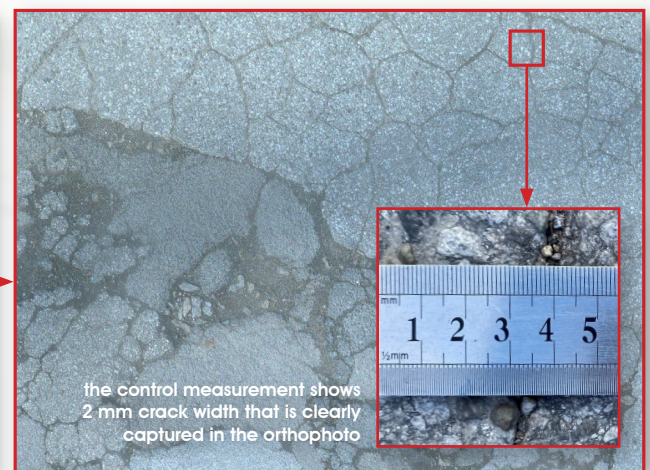
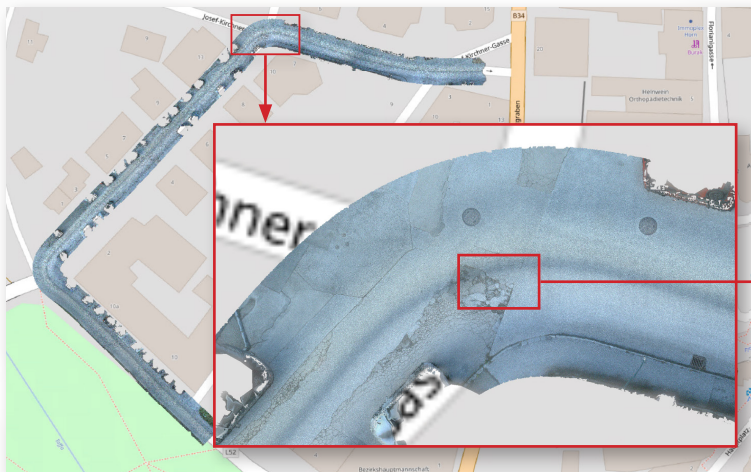
Mounted in nadir orientation the cameras allow focusing on the road surface, so that a lane width can be reliably covered in any case.

Used in nadir mounting the *RIEGL* cameras offer

- detailed capturing of the road surface
- reliable data for pavement analysis and crack indexing
- little distortion of projected image on road surface
- generation of true-orthophotos with up to millimeter resolution



NADIR orientation of the *RIEGL* cameras with pavement mount



application example of pavement data acquisition with subsequent generation of true-orthophotos (RiPROCESS)

**RIEGL VMQ-1HA Technical Data**max.
measurement rangepulse repetition
rate (peak)online waveform
processingoptional
digital cameramultiple
target capabilityeye safe operation
at Laser Class 1**VMQ-1HA Scanner Performance**

Laser Class	Laser Class 1 (Class 1 Laser Product according to IEC 60825-1:2014)					
Effective Measurement Rate ^{1) 2)}	300 kHz	500 kHz	1000 kHz	1250 kHz	1500 kHz	1800 kHz
Max. Range, Target Reflectivity $\rho \geq 80\%$ ^{3) 4)}	475 m	370 m	235 m	235 m	235 m	235 m
Max. Range, Target Reflectivity $\rho \geq 10\%$ ^{3) 4)}	170 m	130 m	85 m	85 m	85 m	85 m
Max. Number of Targets per Pulse ⁵⁾	15	15	9	7	5	4
Minimum Range	1 m @ PRR $\geq$ 1 MHz, 1.2 m @ PRR < 1 MHz					
Accuracy ^{6) 7)} / Precision ^{7) 8)}	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) Setting of intermediate PRR values possible.

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 RIUNITE software.

5) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achievable range is reduced.

6) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.

7) One sigma @ 30 m range under RIEGL test conditions.

8) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.

IMU/GNSS Performance

	AP+30	AP+50	AP+60
Position Accuracy Horizontal	typ. 0.02 m	typ. 0.02 m	typ. 0.02 m
Position Accuracy Vertical	typ. 0.03 m	typ. 0.03 m	typ. 0.03 m
Roll & Pitch Accuracy ⁹⁾	0.010°	0.005°	0.0025°
Heading Accuracy ⁹⁾	0.025° ¹⁰⁾	0.015° ¹⁰⁾	0.015°

9) Absolute accuracy specifications (RMS). Typical performance. Actual results are dependent upon satellite configuration, atmospheric conditions, and other environmental effects. Post processed using base station data. No GNSS outages, with DMI option.

10) Improved heading accuracy with dual antenna option @ 2 m baseline.

General Technical Data

Power Supply Input Voltage	11 - 15 V DC
Power Consumption	typ. 160 W (max. 220 W) ¹¹⁾
Temperature Range	-10°C up to +40°C (operation) / -20°C up to +50°C (storage)
Humidity	max 80% non condensing @ +31°C

11) with 2 x 12 MP RIEGL camera

Interfaces

Interfaces Measuring Head (VMQ-MH)	VM Power Supply Box	Interface Unit (VM-IU)
4x trigger pulse, exposure pulse, NMEA data (e.g. for optional cameras or additional devices) 1x PPS out pulse for synchronization of additional device 2x LAN, 1000 Mbit/sec for data transfer to control unit of external devices (e.g. image data acquisition) 1x secondary antenna connector for GPS azimuth measurement subsystem	1x DMI input (for distance measuring indicator; odometer) 1x NAV RS-232 (COM port for IMU/GNSS for RTK, SBAS) 3x power supply socket (2x 24V DC / 1x 12V DC)	4x LAN 1Gbit/sec M12 sockets, 3 ports pre-configured 4x LAN 1Gbit/sec RJ45 sockets, 2 ports pre-configured 4x USB 3.0 (e.g. image data transfer from a spherical camera) 1x display port 1x WLAN (integrated antenna) 1x Bluetooth (integrated antenna) 2x slots for removable hard disk 1x power supply input (+24V DC) 1x power supply output (+24V DC) for display (touchscreen)