

# RIEGL VMX-450<sup>®</sup>

- *2 RIEGL VQ-450 scanners smoothly integrated with IMU/GNSS unit*
- *very high measurement rate up to 1.1 million meas./sec*
- *scanning rate up to 400 lines/sec*
- *eye safe operation (laser class 1)*
- *high penetration of obstructions (e.g. fences, vegetation) by means of echo digitization and online waveform processing*
- *precisely time-stamped images of up to 6 high-resolution cameras*
- *fully-calibrated system*
- *user-friendly mounting and installation, short setup time*
- *compact and lightweight design*
- *aerodynamically-shaped protective cover*

The **RIEGL VMX-450 Mobile Laser Scanning System** offers extremely high measurement rates providing dense, accurate, and feature-rich data even at high driving speeds.

The roof-carrier mounted measuring head integrates two **RIEGL VQ-450** laser scanners as well as inertial measurement and GNSS equipment, housed under an aerodynamically-shaped protective cover. A well-designed camera platform ensures user-friendly mounting and setup of up to six digital cameras.

Fast 3D data collection, featuring high accuracy and high resolution, provides a basis for a variety of applications like mapping of roadways and rail corridors (e.g. route inventory, noise protection, clearance gauge), waterways, ports, and harbors (e.g. river banks, jetties, cliffs) as well as extended urban and vacant areas.

#### Typical applications include

- *Mapping of Transportation Infrastructure*
- *City Modeling*
- *Fast Mapping of Construction Sites*
- *Surveying of Mining / Bulk Materials*
- *Network Planning*

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**RIEGL**<sup>®</sup>  
LASER MEASUREMENT SYSTEMS

## System Description RIEGL VMX®-450



The RIEGL VMX-450 comprises fully-integrated and calibrated laser scanners, IMU/GNSS equipment, optional camera sub-system, and corresponding RIEGL software packages. Modular design and genuine mounting mechanism ensure quick setup on different vehicles (or vessels, railcars) and reduce post-processing efforts to a minimum in a seamless workflow from data acquisition to highly accurate survey-grade 3D point cloud in common global and local coordinate systems. The integrated IMU/GNSS allows the system to be operated practically worldwide<sup>1)</sup>. System calibration is maintained even when the system is removed, shipped or stored.

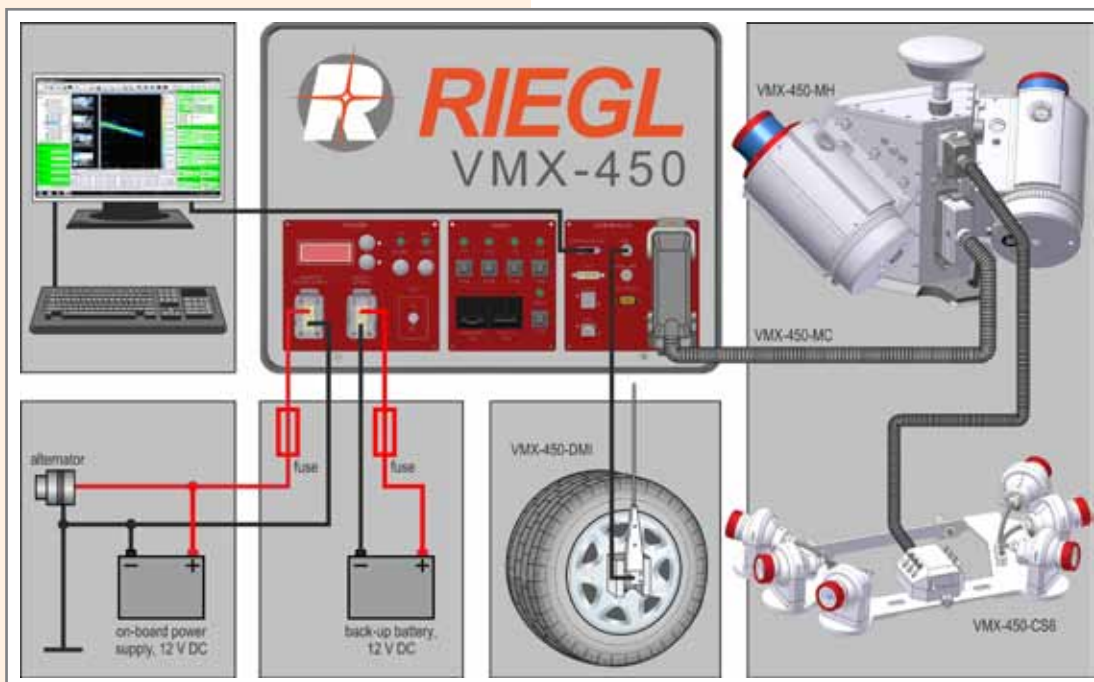
Each of the two RIEGL VQ-450 laser scanners provides low-noise, gapless 360° profiles at a measurement rate of 550,000 meas./sec and a scan rate of up to 200 profiles/sec. RIEGL's unrivaled echo signal digitization technology with online waveform processing results in excellent multiple target detection capability and provides calibrated amplitude and reflectance readings as valuable attributes to each point of the final point cloud.

The VMX-450-CS6 camera sub-system complements the scan data by precisely time-stamped images. Intrinsic calibration of the cameras is provided ex factory as well as seamless integration into the entire acquisition and processing workflow.

Data acquisition and operator control is accomplished through the compact control unit box VMX-450-CU, optimized for easy transportation and powered directly from the vehicle's onboard power supply. A handy touch-screen, feedback of device states and online monitoring data facilitate the operator's tasks in the field.

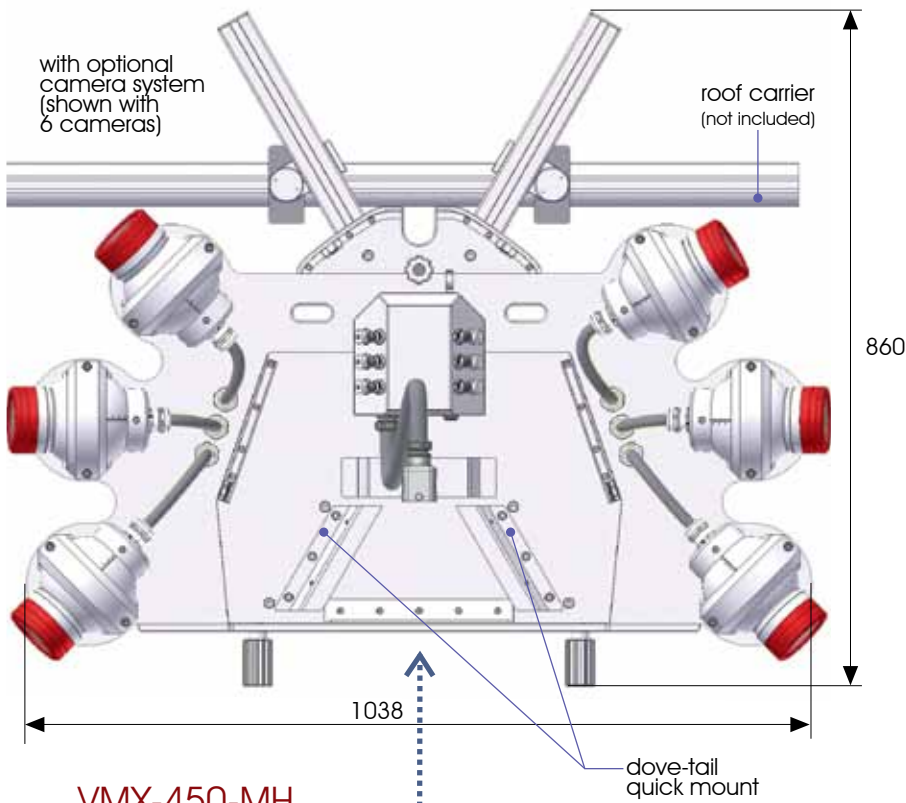
The included RIEGL software packages offer comprehensive and comfortable features in data processing, covering enhanced scan data adjustment tools, incorporating control points, synchronous measurements in scan data and images, colorizing point clouds, and even combination with other data sets of e.g. RIEGL airborne laser scanners. Finally, export your precise geo-referenced results in global and local coordinates or make use of direct interfaces to third-party software.

1) The installed IMU is listed neither in the European Export Control List (i.e. Annex 1 of Council Regulation 428/2009) nor in the Canadian Export Control List. Detailed information on certain cases will be provided on request.

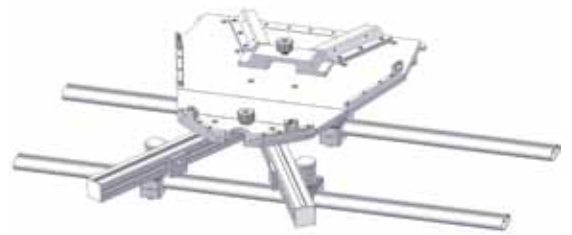


RIEGL VMX-450 system components with optional camera system VMX-450-CS6

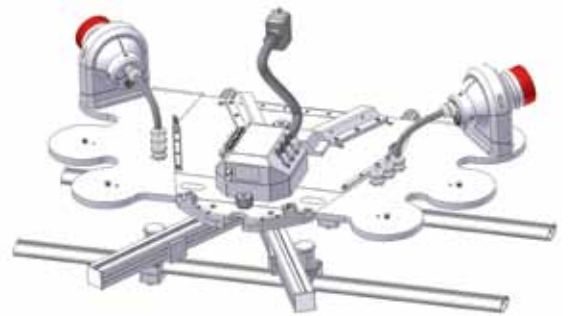
**VMX-450-RM** Roof Mount



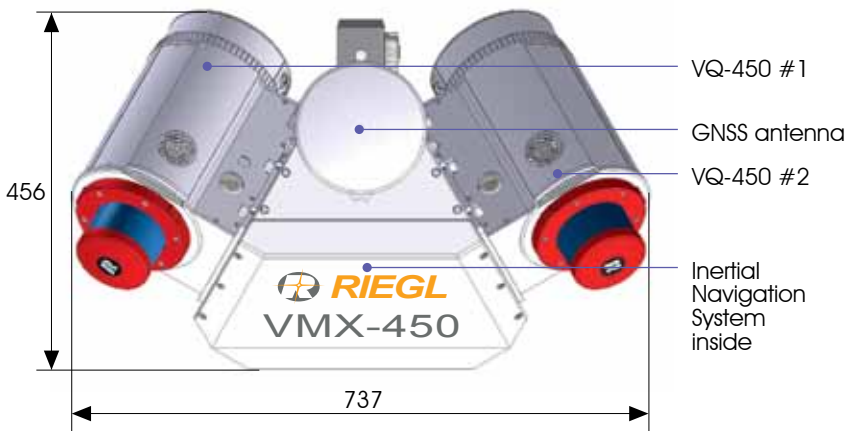
without camera system



with optional camera system (shown with 2 cameras)



**VMX-450-MH**  
Measuring Head



with optional camera system (typical configuration with 4 cameras) and protective cover

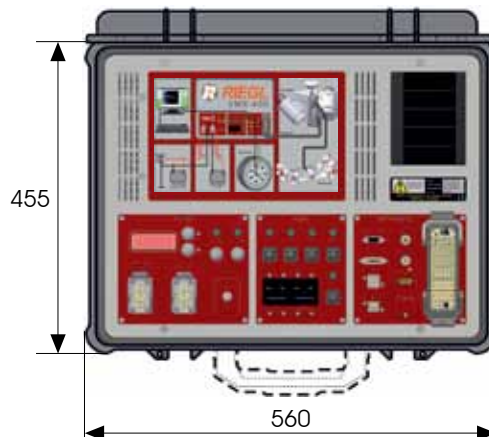


**VMX-450-MC** Main Cable

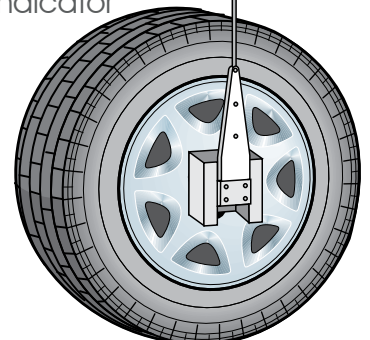


all dimensions in mm

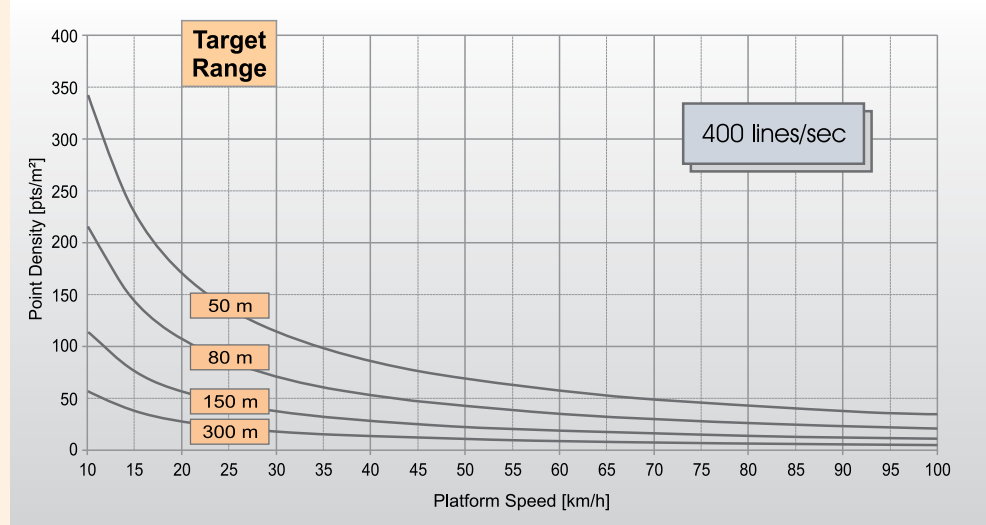
**VMX-450-CU** Control Unit



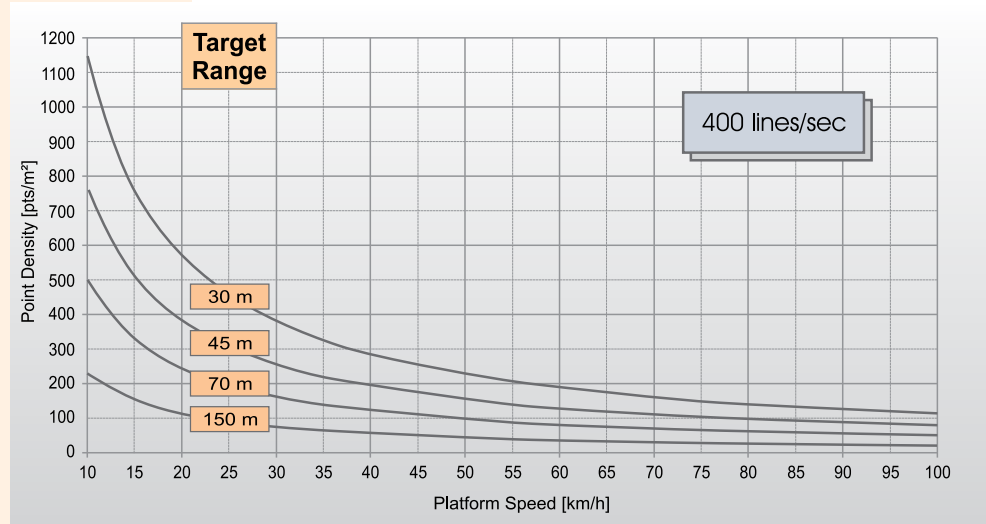
**VMX-450-DMI**  
Distance Measurement Indicator



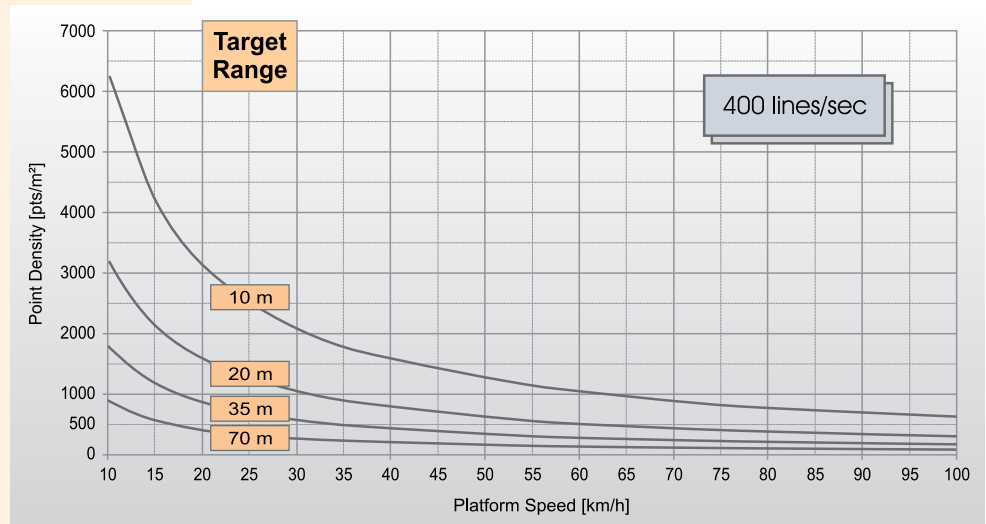
PRR = 300 kHz: for long range applications



PRR = 600 kHz: for medium range applications



PRR = 1.1 MHz: for high-resolution mobile laser scanning in urban areas



## RIACQUIRE

- Project-oriented acquisition software for RIEGL mobile scan data
- Management of integration settings and calibration parameters
- Control and parameterization of scanners and cameras
- Online visualization of monitoring data and image preview
- Status feedback on all system components
- Quality assurance assistance by event history and project report

## RIPROCESS

- Project-oriented processing software for RIEGL mobile scan data
- Fast access to point cloud data in different visualization formats
- Advanced scan data adjustment (relative and absolute)
- Tools for processing scan and image data
- **NEW** software plugin **RIPRECISION** (optional) for fully automated scan data adjustment
- Synchronous measurements in point cloud and images
- Combination with RIEGL airborne laser data
- Data export into global/local coordinates and interfaces to third-party software
- Operation in a multiple-workstation environment and parallel task processing

## RIWORLD

- Transformation of scan data into geo-referenced point cloud data
- Consideration of geometrical system description and calibration parameters (e.g. lever arms)
- Support of different formats of position and orientation data
- Smoothly integrated into RIPROCESS task management
- Interfacing to third party software packages



## RIEGL VMX-450-CS6 Camera System (optional)

The standard configuration of the optional camera system comprises 4 cameras with 5-megapixel resolution. Images are precisely time-stamped and the intrinsic camera calibration is offered as a RIEGL factory service. The unique and flexible spherical mounting mechanism allows flexible orientation according to project requirements. The exterior orientation can be easily determined by tools within RIPROCESS. Additionally, a wide range of cameras can be added to the system like DSLR cameras, thermal or hemispherical imagers. Up to 6 cameras are supported in total.

### 5 MPx Camera Specifications:

2/3" color CCD, global electronic shutter (progressive scan)

Pixel Array: 2452 x 2056 (H x V), 3.45 x 3.45  $\mu\text{m}^2$

Interface: Gigabit Ethernet

Trigger: distance-based / constant time-interval  
(each camera individually)

Exposure : 38  $\mu\text{s}$  to 60 s, auto / manual

Gain: 0 to 32 dB, auto / manual

Field of View: 80° x 65° (H x V), 5 mm lens

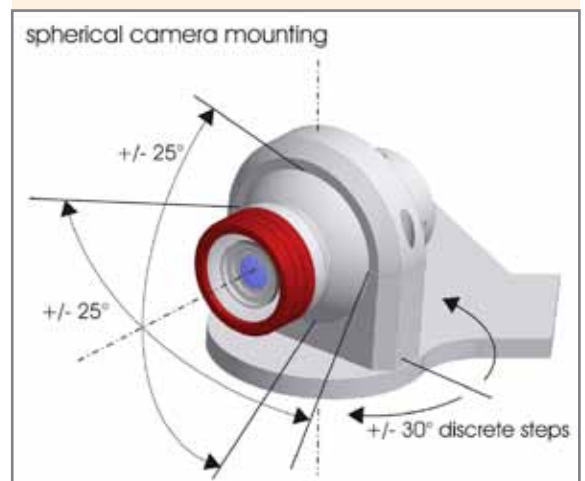
Max. frame rates: 3<sup>2)</sup> @ 6 cameras

5<sup>2)</sup> @ 4 cameras

8<sup>3)</sup> @ 2 cameras

Other lens types on request.

- 1) In a typical configuration with four 5 MPx cameras. Maximum frame rate of a single camera is 9 fps.
- 2) Limited by transfer rate to HDDs.
- 3) Limited by max. trigger rate of CCD sensor.



3D point cloud  
(true color coded)

# Technical Data Mobile Laser Scanning System *RIEGL* VMX®-450

## 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.



## 2 x VQ-450 Measurement Performance

| Effective Measurement Rate <sup>1)</sup> | 300 kHz                                    | 400 kHz | 600 kHz | 760 kHz | 1.1 MHz |
|--|--|---------|---------|---------|---------|
| Max. Measurement Range <sup>2)</sup>     |  |         |         |         |         |
| natural targets $\rho \geq 10\%$         | 300 m                                      | 260 m   | 200 m   | 180 m   | 140 m   |
| natural targets $\rho \geq 80\%$         | 800 m                                      | 700 m   | 450 m   | 330 m   | 220 m   |
| Max. Number of Targets per Pulse         | practically unlimited (details on request) |         |         |         |         |

Minimum Range

1.5 m

Accuracy <sup>3) 5)</sup>

8 mm

Precision <sup>4) 5)</sup>

5 mm

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

1100 000 meas./sec (2 x 550 000 meas./sec)

Line Scan Speed (selectable)

up to 400 lines/sec (2 x 200 lines/sec)

1) Rounded values, selectable by measurement program.  
2) The following conditions are assumed: target larger than the footprint of the laser beam, perpendicular angle of incidence, visibility 23 km, average ambient brightness.

3) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.  
4) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.  
5) One sigma @ 50 m range under *RIEGL* test conditions.

## IMU/GNSS Performance <sup>6)</sup>

Position (absolute)

typ. 20 - 50 mm

Position (relative) <sup>7)</sup>

typ. 10 mm

Roll & Pitch

0.005°

Heading

0.015°

6) One sigma values, no GNSS outages, with DMI option, post-processed using base station data.

7) With a control point spacing < 100 m.

## Physical Data

VMX-450-MH Measuring Head

including GNSS antenna and protection caps

Main Dimensions (L x W x H)

737 x 456 x 485 mm

Weight (approx.)

43 kg

VMX-450 Protective Cover

620 x 747 x 364 mm

3 kg

VMX-450-CU Control Unit

560 x 455 x 265 mm

26 kg

VMX-450-RM Roof Mount

778 x 515 x approx. 120 mm

13 kg

including mounting brackets

VMX-450-MC Main Cable

3 m (standard length)

5 kg

VMX-450-CS6 Camera System

607 x 1038 x 208 mm <sup>8)</sup>

19 kg <sup>8)</sup>

8) Typical configuration with 4 cameras.

## Electrical Data / Interfaces

Power Supply Input Voltage

11 - 15 V DC

Power Consumption

typ. 440 W (max. 680 W) <sup>8)</sup>

Interfaces

LAN, 10/100/1000 Mbit/sec

USB 2.0

DVI

SYNC OUT (synchronization output NMEA+PPS)

NAV RS232 (COM of IMU/GNSS system for RTK, SBAS)

interfaces for additional sensor devices (scanner, cameras, etc.)

removable hard disks for project data transfer

## Environmental Data

Temperature Range

VMX-450-MH Measuring Head

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

VMX-450-CU Control Unit

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

VMX-450-CS6 Camera System

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

Humidity

max. 80% non condensing @ +31°C

Protection Class

VMX-450-MH Measuring Head

IP64, dust and splash-proof

VMX-450-CU Control Unit

IP64 (closed lid), IP20 (open lid)

VMX-450-CS6 Camera System

IP65, dust and water jet-proof



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