

RIEGL VMX[®]-RAIL



5.4 MHz pulse repetition rate,
and 750 lines per second resulting
in up to 13,000 pts/m²
in approximately 3m range
at 80 km/h platform speed



The RIEGL VMX-RAIL is a fully integrated Mobile Laser Scanning System for track mapping and clearance surveying. The triple scanner system design allows for utmost efficient capturing of dense, accurate, and feature-rich data.

Take advantage of the VMX-RAIL for

- accurate surveying in challenging environments
- reliable capturing of railway infrastructure, topology, and vegetation
- platform speed up to 130 km/h for operation during regular rail schedules
- reduction of scan shadows by triple scanner system design
- flexible camera options to complement scan data with high resolution imaging
- data export to Third-Party Rail-Processing Software Packages



Triple Scanner Mobile Mapping System Specifically Designed for Rail Application

Typical Applications

- Rapid and Safe Data Capture with Minimal Disruption to Network Schedules
- Rail Infrastructure Asset Management
- As-Built Surveying
- Track and Infrastructure Monitoring
- Clash Detection Simulation and Clearance Analysis
- Railway Planning and Engineering

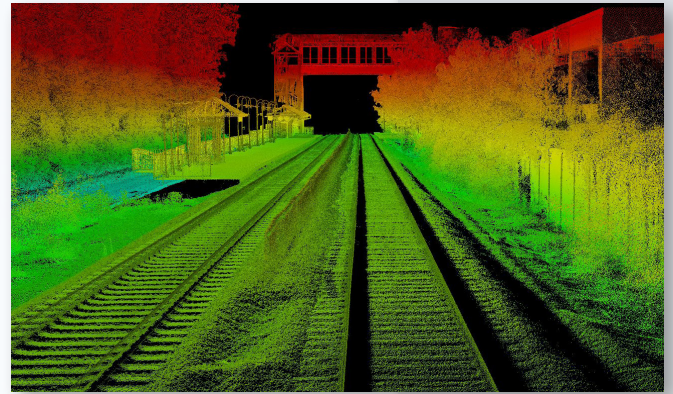


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VMX-RAIL Key Features

- rugged measuring-head for reliable long-term operation in harsh environments
- equipped with 3 VUX-1HA²² High Accuracy Laser Scanners
- optimized scanner orientation to increase the field of view and to minimize scan shadows
- unique crossed point cloud pattern along 360 deg of the clearance profile for improved feature extraction and small object detection
- 5.4 MHz pulse repetition rate and 750 lines per second resulting in up to 13,000 pts/m² in approximately 3m range at 80 km/h platform speed

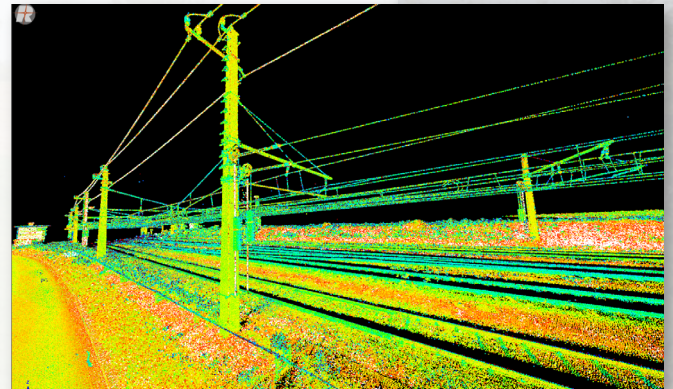


RIEGL VMX-RAIL scan data

State-of-the-Art Track Mapping & Clearance Surveying

RIEGL VMX-RAIL Mobile Laser Scanning System

- enables the capture of the complete rail corridor, including catenary systems, rail heads, and the complete periphery, even signs orthogonal to running direction
- high-end system performance supports rapid data acquisition of dense point clouds
- fully integrated and calibrated measuring head
- optionally integrated camera system and open interfaces to various external sensors



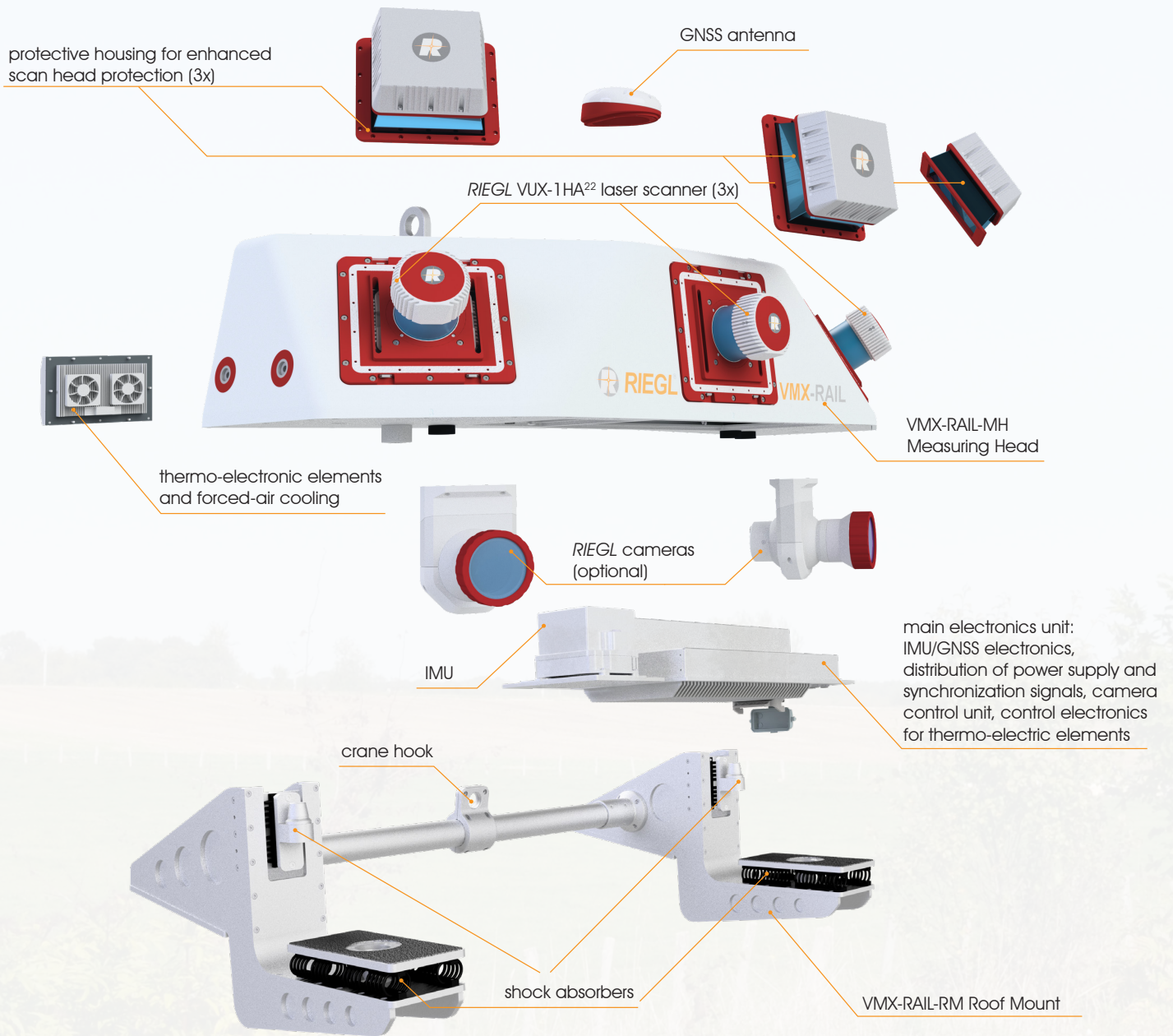
RIEGL VMX-RAIL scan data

product	Functionality			
	extraction of rail axis	extraction of profiles	clearance	track planning
TopoDOT®	✓	✓	✓	with Bentley OpenRail
CARD/i	✓	✓	✓	✓
Orbit 3DM	✓	✓	✓	with Bentley OpenRail

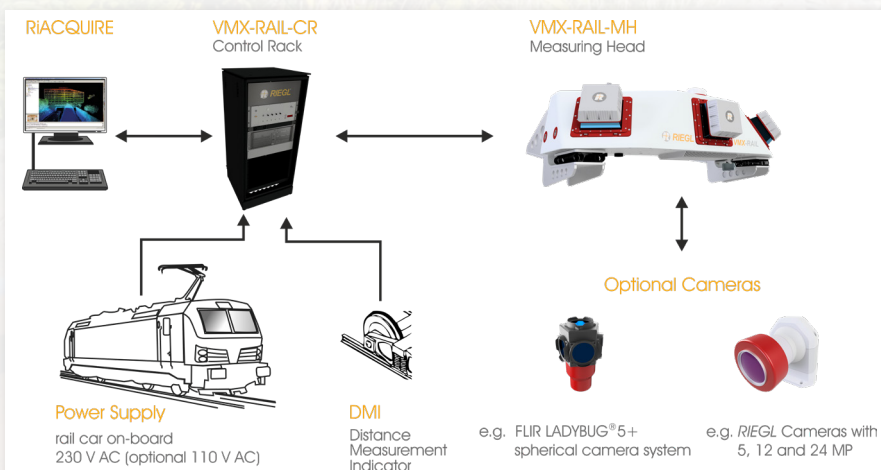


rail specific post processing with various third party software packages possible (shown example data: TopoDOT)

RIEGL VMX-RAIL Components and Setup

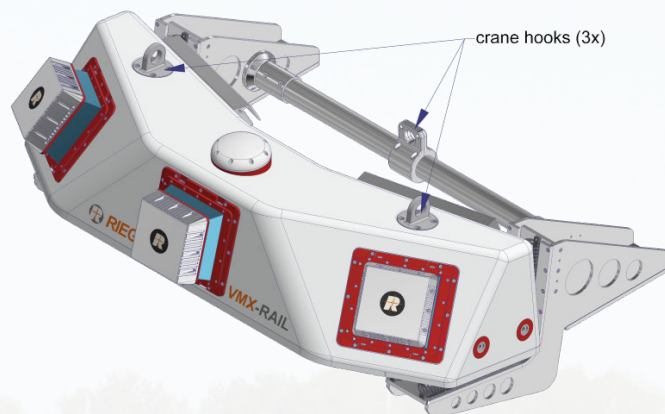
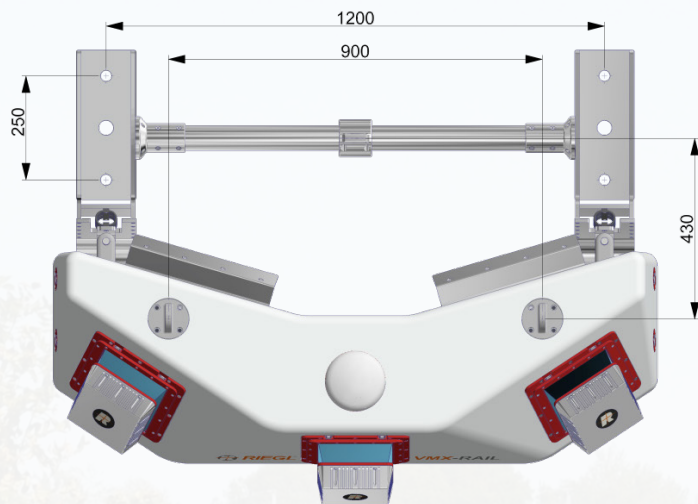
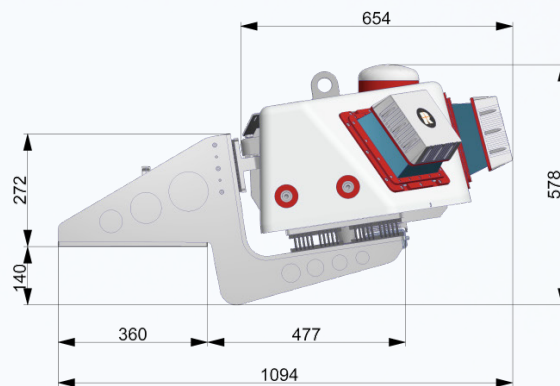
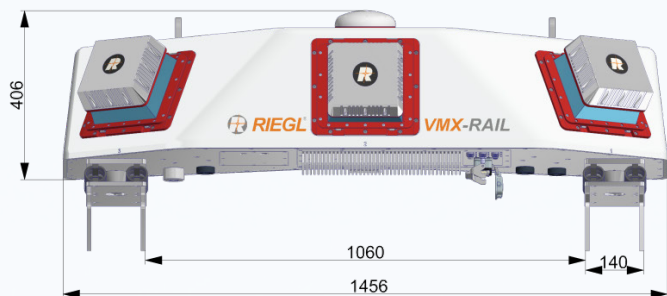


RIEGL VMX-RAIL System Block Diagram



RIEGL VMX-RAIL System Components

- **VMX-RAIL-MH:** temperature stabilized measuring head equipped with 3 RIEGL VUX-1HA²² scanners
- **VMX-RAIL-CR:** The control rack is the central unit for system operation and data recording. An uninterruptible power supply (UPS) ensures failsafe system operation.
- **VMX-RAIL-RM:** shock proof mounting element
- **VMX-RAIL-DMI:** optical DMI or integration of compatible on-board rotary wheel encoder
- **Options:** prepared for integration of up to 6 cameras



all dimensions in mm

Weight and Dimensions	Weight	Dimensions (L x W x H)
VMX-RAIL-MH Measuring Head	95 kg	654 x 1456 x 406 mm
VMX-RAIL-RM Roof Mount	30 kg	837 x 1340 x 412 mm
VMX-RAIL-CR Control Rack	76 kg	min. 500 mm stack space requirement in a 19" rack
VMX-RAIL-MC Main Cable	approx. 2 kg per meter	tailored cable length

RIEGL VMX-RAIL-CR

- 19 inch rack based control unit for fixed installation in a rail car
- The VMX-RAIL Main Cable is connected with a Harting® connector to the rear of the VMX-RAIL Control Rack.



all dimensions in mm
* 1 rack unit $\hat{=}$ 44,5 mm

RIEGL VMX-RAIL Technical Data



max. measurement range



pulse repetition rate (peak)



online waveform processing



optional digital camera



multiple target capability



eye safe operation at Laser Class 1

VMX-RAIL Scanner Performance

Laser Class	Laser Class 1 (Class 1 Laser Product according to IEC 60825-1:2014)			
Effective Measurement Rate ¹⁾	900 kHz	1.5 MHz	3.75 MHz	5.4 MHz
Max. Range, Target Reflectivity $\rho \geq 80\%$ ^{2) 3)}	475 m	370 m	235 m	235 m
Max. Range, Target Reflectivity $\rho \geq 10\%$ ^{2) 3)}	170 m	130 m	85 m	85 m
Max. Number of Targets per Pulse	15	15	7	4
Minimum Range	1 m @ PRR \geq 1MHz, 1.2 m @ PRR < 1MHz			
Accuracy ^{4) 6)} / Precision ^{5) 6)}	5 mm / 3 mm			
Field of View	360° "full circle"			
Scan Speed (selectable)	up to 750 scans/sec			

1) Rounded values, selectable by measurement program.

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) Ambiguity to be resolved by post-processing with RIUNITE software.

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 @ 30 m range under RIEGL test conditions.

IMU/GNSS Performance ⁷⁾

Position Accuracy (absolute)	typ. 20 - 50 mm
Roll & Pitch Accuracy	0.005°
Heading Accuracy	0.015°

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

General Technical Data

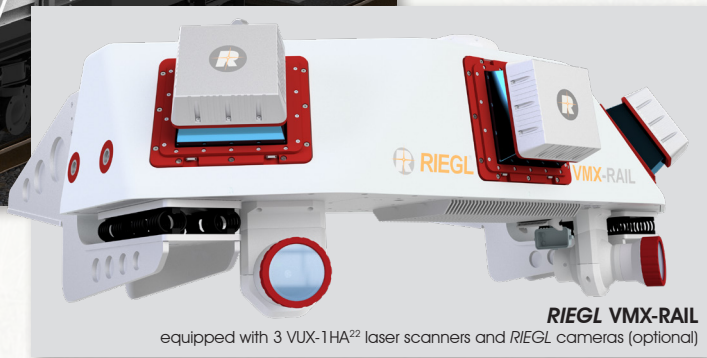
VMX-RAIL-CR Power Supply Input Voltage	230 V AC (optionally 110 V AC)
Uninterruptible Power Supply (UPS)	failsafe operation by bridging power supply gaps for approx. 15 minutes in scanning mode and 35 minutes in standby mode
VMX-RAIL-MH Input Voltage	24 V DC (powered via VMX-RAIL-CR)
VMX-RAIL-CR typ. Power Consumption system operation without cameras additional power consumption per camera	typ. 750 W / max. 1020 W typ. 6 W / max. 30 W
Mounting Interface	4 x M24 threads
- VMX-RAIL-MH - VMX-RAIL-RM - shock absorbers between RM and MH - crane hooks	aluminium sand cast, powder-coated, with internal thermal insulation aluminium anodized wire rope springs stainless steel
Protection Class VMX-RAIL-MH	IP65
Temperature Range	-10°C up to +40°C (operation) / -20°C up to +50°C (storage)
Interface VMX-RAIL-CR to VMX-RAIL-MH	single main cable for power & data interface with robust Harting® connectors
Humidity Monitoring	3x desiccant cartridges with humidity indicator, valve for nitrogen purge
Humidity Controlling	active dehumidification unit

Data Interfaces

<p>VMX-RAIL-MH</p> <p>6 x multi-purpose ports supporting complementary camera systems and additional devices, each with</p> <ul style="list-style-type: none"> - trigger pulse - precise time stamping of exposure pulse - NMEA data - PPS - LAN 1 GigE - power 24 V DC, max. 30 W
<p>VMX-RAIL-CR</p> <p>1 x DMI input (for distance measuring indicator; odometer) 1 x NAV RS-232 (COM port for IMU/GNSS for RTK, SBAS) 1 x NAV RS-232 (COM output for synchronization of external device) 1 x AUX power supply output (+28V DC, max 30W) 1 x rack-based industrial PC with standard interfaces: -) LAN, 1000 Mbit/sec (e.g. to connect additional computer) -) USB 3.0 (e.g. image data transfer from FLIR Ladybug® 5) -) display port -) HDMI</p> <p>3 x removable double SSD drive carrier with a total of 4.5TB swappable disc space</p>
<p>VMX-RAIL-MC (single cable connection between VMX-RAIL-MH and VMX-RAIL-CR) with 10 GigE Link</p>



customized integration example



RIEGL VMX-RAIL
equipped with 3 VUX-1HA²² laser scanners and RIEGL cameras (optional)

RIEGL Cameras (optional) ¹⁾

	max. numbers of cameras	max. frames ²⁾ per second	resolution [px (H) x px (V)]	pixel size [μm]	lens focal length [mm]	Field of View ⁴⁾ (FOV)
5 MP CMOS ³⁾	6	20	2464 x 2056	3.45	5	80.7° x 70.7°
12 MP CMOS ³⁾	6	8	4112 x 3008	3.45	8 / 16	83.1° x 65.9° / 47.8° x 35.9°
24 MP CMOS ³⁾	6	4.5	5328 x 4608	2.74	8.5	79.5° x 71.5°

1) The combination of different cameras is possible.
 2) Maximum frame rate of a single camera operated with 8-bit color depth. Use of multiple cameras have effects on maximum frame rate.
 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) Nominal values (actual values may be slightly different due to manufacturing tolerances).