

RIEGL VZ[®]-4000

- *very long range up to 4000 m*
- *eye safe operation at Laser Class 1*
- *wide field of view, 60° x 360°*
- *high speed data acquisition up to 222,000 meas. / second*
- *high accuracy, high precision ranging based on echo digitization and online waveform processing*
- *multiple target capability - unlimited number of targets*
- *optional waveform data output*
- *built-in calibrated digital camera*
- *on-board inclination sensors*
- *integrated L1 GPS receiver with antenna*
- *integrated compass*
- *built-in SSD data storage media*
- *compact and rugged design*



This 3D VZ-Line Laser Scanner offers superior and unrivaled long range measurement performance of up to 4000 m reflectorlessly while still maintaining completely eye safe operation (Laser Class 1).

RIEGL's unique V-Line technology is based on echo digitization and online waveform processing and is the key to enable such extreme long range measurements. The VZ-4000 operates even in poor visibility and demanding multi target situations caused by dust, haze, rain, snow, etc. which are frequently found in difficult environments such as mine sites.

Modes of Operation:

- stand-alone operation with integrated graphical user interface via 7" touchscreen
- remote control VNC Viewer with any standard tablet PC or mobile device via WiFi
- remote operation with RiSCAN PRO on a notebook via LAN or WiFi connection
- customized operation by third party tools / applications based on RIEGL's well documented interfaces and scanner libraries, e.g. RiVLib

Typical applications include

- *Topography & Mining*
- *Long Range Monitoring*
- *Civil Engineering*
- *Archaeology*

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www.riegl.com





Extreme Long Range Performance

The High-Speed, High-Resolution 3D Laser Scanner *RIEGL* VZ-4000 offers an extremely long range of up to 4000 m and a wide field of view of 60° vertical and 360° horizontal. It uses an invisible laser beam for eye safe operation in Laser Class 1.

Highest accuracy and reliability of range measurement is based on *RIEGL*'s unique V-Line technology of echo digitization and online waveform processing which enables such extreme long range measurements even with poor visibility and demanding multi target situations caused by dust, haze, rain, snow, etc.

Built-in Camera

A built-in calibrated 5-Megapixel camera capturing images deflected by the laser mirror allows coverage of the whole field of view with an appropriate number of high resolution images automatically stitched together to create a high resolution panorama image. This panorama image in combination with precise 3D measurements produced by the VZ-4000 enables the creation of photorealistic virtual models for geological and geotechnical investigations of pitwalls and geological features.

Waveform Data Output (optional)

The digitized echo signals, also known as waveform data, acquired by the *RIEGL* VZ-4000 are the basis for waveform analysis. This data is provided via the optionally available waveform data output and accessible with the associated *RIEGL* software library RiWAVELib for investigations and research on multi target situations based on the digital waveform data samples of the target echoes.

Designed for Demanding Fieldwork

3D profiling of the narrow infrared laser beam is realized with a light-weight vertically oscillating/rotating mirror which is mounted on a stable 360 degree horizontally rotateable mechanism.

This compact and rugged design with a dust- and splash-proof housing is the basis for long-term and reliable operation even under adverse environmental conditions.

Compatible Software Packages

The *RIEGL* VZ-4000 is compatible with the well-proven *RIEGL* software package RiSCAN PRO for terrestrial laser scanning, *RIEGL*'s interface library RiVLib, as well as the workflow-optimizing software packages RiMONITOR and RiMINING.

The optional software plugin RiMTA-3D provides for automatic assignment of the correct MTA zone in multiple time around processing.

Stand-alone Registration

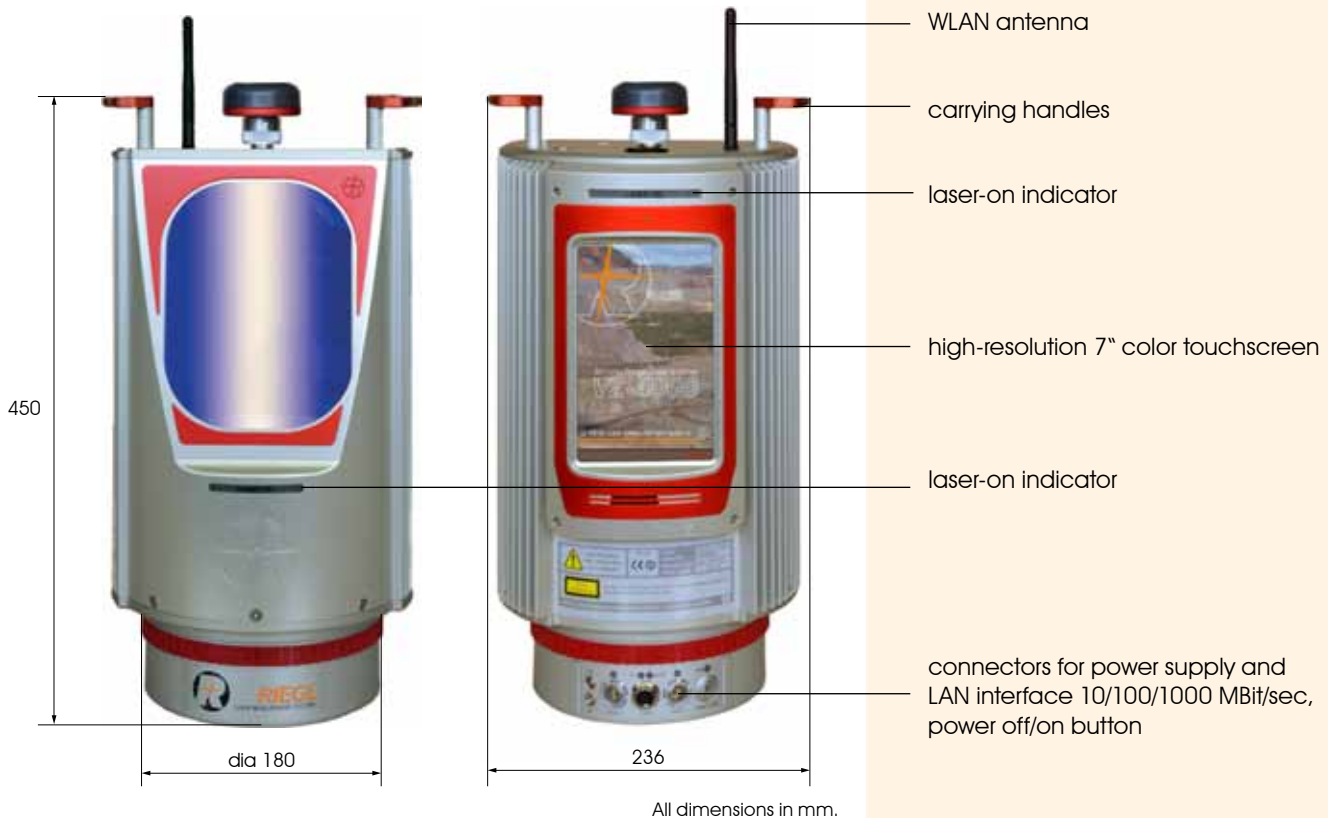
- integrated GPS receiver (L1) or external high-end GNSS receiver connected
- integrated compass, accuracy typ. 1° (one sigma value, available for vertical scanner setup position)
- on-board inclination sensors (tilt range $\pm 10^\circ$, accuracy typ. $\pm 0.008^\circ$)

Registration via Control Points

- fast fine scanning of reflectors for precise determination of scanner position using control points

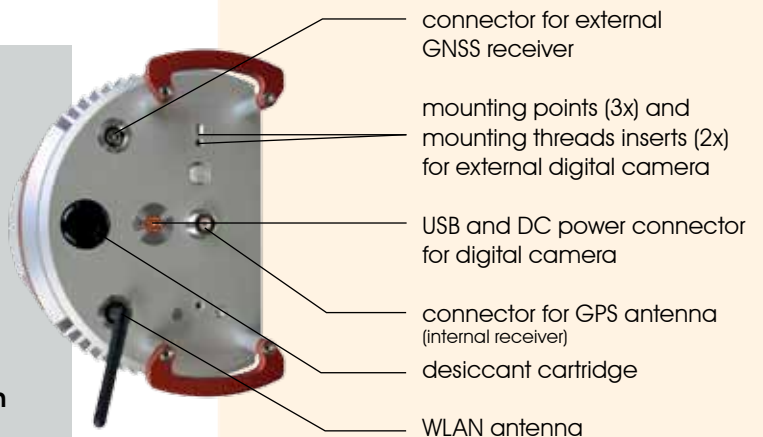
Totalstation-like-Registration

- setup above well known point (integrated laser plummet)
- precise fine scanning of well known remote target (reflector)
- on-board inclination sensors
- Backsighting



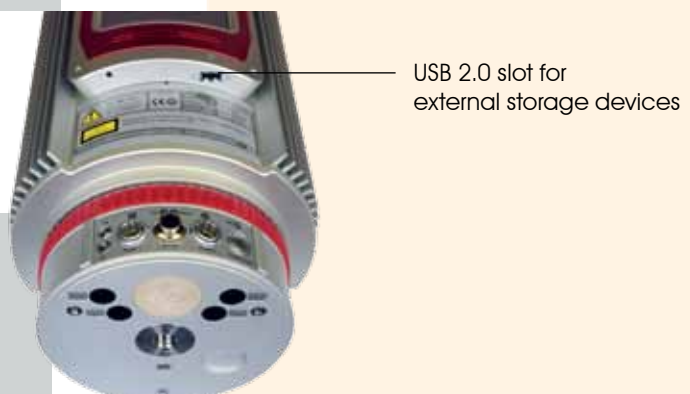
Communication and Interfaces

- LAN port 10/100/1000 MBit/sec within base
- integrated WLAN interface with high-gain antenna
- USB 2.0 for connecting an external digital camera
- connector for GPS antenna
- two external power supply ports
- connector for external GPS synchronization pulse (1PPS)
- connector for external GNSS receiver



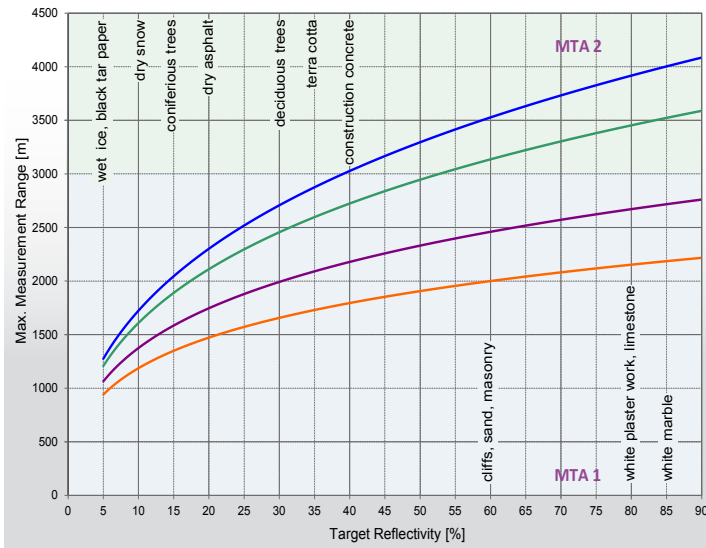
Scan Data Storage

- internal 80 GByte SSD (Solid State Disc) (2 GByte reserved for the operating system)
- external storage devices (USB flash drives or external hard drives) via USB 2.0 interface

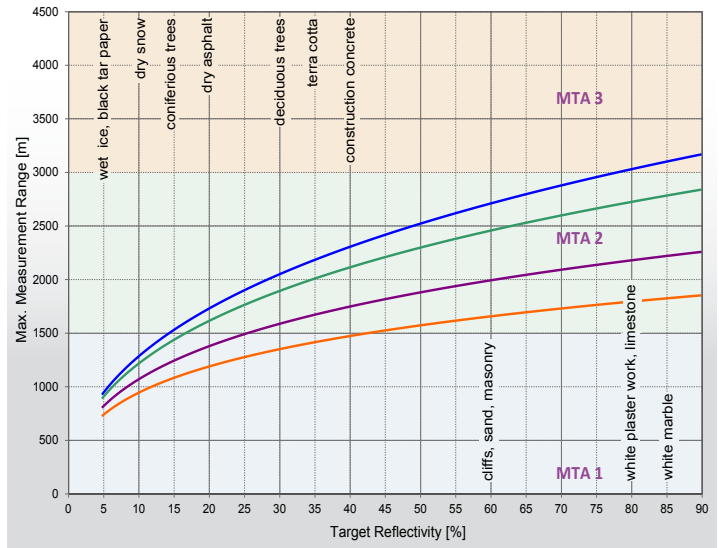


- standard clear atmosphere: visibility 23 km
- clear atmosphere: visibility 15 km
- light haze: visibility 8 km
- medium haze: visibility 5 km

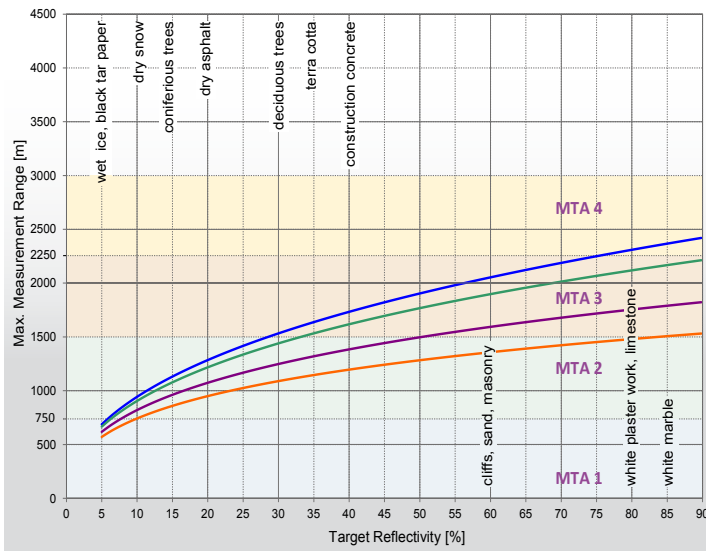
50 kHz PRR



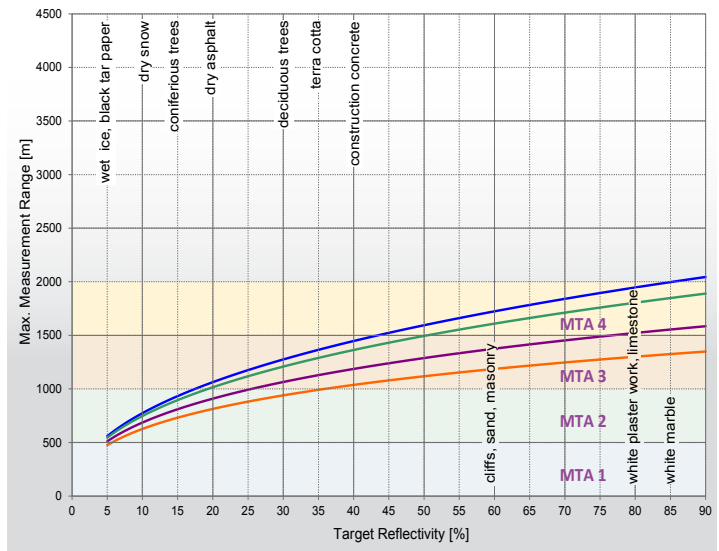
100 kHz PRR



200 kHz PRR



300 kHz PRR



The following conditions are assumed:

- flat target larger than footprint of the laser beam
- perpendicular angle of incidence
- average brightness
- ambiguity resolved by post processing with RiMTA-3D

MTA zones:

- MTA 1: no ambiguity / 1 pulse „in the air“
- MTA 2: 2 pulses „in the air“
- MTA 3: 3 pulses „in the air“
- MTA 4: 4 pulses „in the air“

User-Friendly and Efficient Operation and Acquisition Workflow

Operation is easy with the integrated graphical user interface via 7" touchscreen, or by remote control of the scanner via VNC Viewer with any tablet PC or mobile device via WiFi connection.

Highly efficient scan data acquisition and global registration is supported by on-board inclination sensors, integrated L1 GPS receiver, an interface for a high-end external GNSS receiver on top of the scanner, a digital compass and built-in SSD data storage media. With a visual project overview of acquired scan data, it is possible to ensure complete data coverage or check the progress of a project.



Power Supply

Add-on Rechargeable Battery

- optional add-on rechargeable battery pack (high power, high capacity NiMH cells)
- compact thin cylinder design, short-circuit-proof and protected connection pins
- rechargeable during standard scan operation via external power supply
- integrated micro-controller based charging electronics
- easily attachable to base of the laser scanner by central locking screw

Power Supply

- intelligent power supply management, up to three independent external power sources can be connected simultaneously for uninterrupted operation
- reliable under- and over voltage protection
- wide external voltage supply range 11-32 V DC
- power consumption typ. 75 W (max. 90W)
- LED indicators for power status



Technical Data *RIEGL* VZ[®]-4000

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.

CLASS 1
LASER PRODUCT

Range Measurement Performance ¹⁾

Measuring Principle

time of flight measurement, echo signal digitization,
online full waveform analysis, full waveform export capability (optional)
single pulse ranging

Mode of operation

Pulse repetition rate PRR (peak) ²⁾	50 kHz	100 kHz	200 kHz	300 kHz
Effective Measurement Rate ²⁾	37 000 meas./sec	74 000 meas./sec	147 000 meas./sec	222 000 meas./sec
Max. Measurement Range ³⁾				
natural targets $\rho \geq 90\%$	4 000 m ⁴⁾	3 100 m ⁴⁾	2 400 m ⁴⁾	2 000 m ⁴⁾
natural targets $\rho \geq 20\%$	2 300 m	1 700 m ⁴⁾	1 200 m ⁴⁾	1 000 m ⁴⁾
Max. Number of Targets per Pulse	practically unlimited ⁵⁾			

Accuracy ^{6) 8)}

15 mm

Precision ^{7) 8)}

10 mm

Minimum Range

5 m

Laser Wavelength

near infrared

Laser Beam Divergence

0.15 mrad

Laser Beam Footprint (Gaussian Beam Definition)

18 mm @ exit, 75 mm @ 500 m, 150 mm @ 1000 m, 300 mm @ 2000 m

1) With online waveform processing.

2) Rounded values, selectable by measurement program.

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 RIMTA-VZ

5) Details on request.

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

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

8) One sigma @ 150 m range under *RIEGL* test conditions.

9) 0.15 mrad correspond to 15 mm increase of beam width per 100 m of range.

Scanner Performance

Scanning Mechanism

Vertical (Line) Scan

lightweight mirror

rotating / oscillating

total 60° (+30° / -30°)

100°/sec to 14 400°/sec (÷ 20 rotations/sec), full FOV

0.002° ≤ Δθ ≤ 0.280° ¹¹⁾

between consecutive laser shots

better 0.0005° (1.8 arcsec)

integrated, for vertical scanner setup position, details see page 2

integrated, LI, with antenna

integrated, for vertical scanner setup position, details see page 2

integrated

integrated, for real-time synchronized time stamping of scan data

scanner rotation synchronization

providing digitized echo signal information for specific target echoes

Horizontal (Frame) Scan

rotating head

max. 360°

0°/sec to 60°/sec ¹⁰⁾

0.002° ≤ Δφ ≤ 3° ¹¹⁾

between consecutive scan lines

better 0.0005° (1.8 arcsec)

Angle Measurement Resolution

Inclination Sensors

GPS Receiver

Compass

Laser Plummet

Internal Sync Timer

Scan Sync (optional)

Waveform Data Output (optional)

10) Frame scan can be disabled, providing 2D scanner operation.

11) Selectable.

Communication

Interfaces

LAN port 10/100/1000 Mbit/sec in the base
integrated WLAN interface with high-gain antenna
connector for GPS antenna

2 connectors for external power supply

connector for external GNSS-timing signals

connector for external high-end GNSS receiver

internal 80 GByte SSD, external storage devices

(USB flash drives or external hard drives) via USB 2.0 interface

Scan Data Storage

General Technical Data

Power Supply Input Voltage

11 - 32 V DC

Power Consumption

typ. 75 W (max. 90 W)

Main Dimensions / Weight

236 x 226.5 x 450 mm (length x width x height), approx. 14.5 kg

Humidity

max. 80 % non condensing @ +31°C

Protection Class

IP64, dust- and splash-proof

Temperature Range

0°C up to +40°C (operation) / -10°C up to +50°C (storage)

Integrated Digital Camera

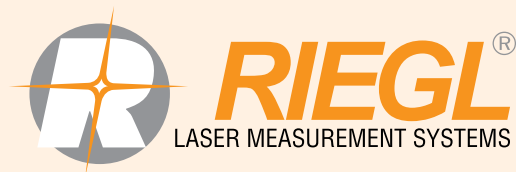
field of view 7.2°x5.5° (v x h)

resolution 2560 x 1920 pixels (5 Mpixel)

Display

7" WVGA (800 x 480) color

capacitive touchscreen, full operation control for stand alone usage



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