

Technical Data *RIEGL* VZ®-2000i

Laser Product Classification

Class 1 Laser Product according to IEC 60825-1:2014
The following clause applies for instruments delivered into the United States:
Complies with 21 CFR 1040.10 and 1040.11 except for conformance with
IEC 60825-1 Ed.3., as described in Laser Notice No. 56, dated May 8, 2019.



Range Measurement Performance ¹⁾

Measuring Principle / Mode of Operation

time of flight measurement, echo signal digitization, online waveform processing, multiple-time-around processing, full waveform export capability (optional) / single pulse ranging

Laser Pulse Repetition Rate PRR (peak) ²⁾	50 kHz	100 kHz	300 kHz	600 kHz	1.2 MHz
Effective Measurement Rate (meas./sec) ²⁾	21,000	42,000	125,000	250,000	500,000
Max. Measurement Range ³⁾					
natural targets $\rho \geq 90\%$	2,500 m	1,850 m	1,100 m	800 m	600 m
natural targets $\rho \geq 20\%$	1,300 m	950 m	540 m	380 m	290 m
Minimum Range	2.0 m	1.5 m	1.5 m	1.0 m ⁴⁾	1.0 m ⁴⁾
Max. Number of Targets per Pulse ⁵⁾	15	15	15	8	4

Accuracy ^{6) 8)}

Precision ^{7) 8)}

Laser Wavelength

Laser Beam Divergence

5 mm

3 mm

near infrared

0.27 mrad ⁹⁾

¹⁾ With online waveform processing.

²⁾ Rounded values.

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⁾ Minimum range specified for vertical zenith angles from 30 deg to 120 deg, resp. 90° vertical field of view.

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

⁸⁾ One sigma @ 100 m range under *RIEGL* test conditions.

⁹⁾ Measured at the 1/e² points. 0.27 mrad corresponds to an increase of 27 mm of beam diameter per 100 m distance.

Scanner Performance

Scan Angle Range

Scanning Mechanism

Scan Speed

Angular Step Width ¹⁰⁾ $\Delta \vartheta$ (vertical), $\Delta \varphi$ (horizontal)

Vertical (Line) Scan

total 100° (+60° / -40°)

rotating multi-facet mirror

3 lines/sec to 240 lines/sec

$0.0007^\circ \leq \Delta \vartheta \leq 0.6^\circ$

between consecutive laser shots

better 0.0007° (2.5 arcsec)

Horizontal (Frame) Scan

max. 360°

rotating head

0°/sec to 150°/sec ¹¹⁾

$0.0015^\circ \leq \Delta \varphi \leq 0.62^\circ$

between consecutive scan lines

better 0.0005° (1.8 arcsec)

Angle Measurement Resolution

Orientation Sensors

GNSS Receiver

Laser Plummet

Internal Sync Timer

Scan Sync (optional)

Waveform Data Output (optional)

Cloud Storage

Automatic On-board registration

integrated 3-axis accelerometer, 3-axis gyroscope,
3-axis magnetometer (compass), barometer
integrated L1, concurrent reception of GPS, GLONASS, Beidou
Real Time Kinematics RTK
integrated
integrated, for real-time synchronized time stamping of scan data
scanner rotation synchronization for operating several scanners
providing digitized echo signal information for specific target echoes
Amazon S3, FTP-Server, Microsoft Azure
automatic scan data registration as background process

¹⁰⁾ Selectable.

¹¹⁾ Frame scan can be disabled, providing 2D scanner operation.

General Technical Data

Power Supply Input Voltage

Power Consumption

External Power Supply

Main Dimensions

Weight

Humidity

Protection Class

Temperature Range

Storage

Operation

Low Temperature Operation ¹²⁾

11 - 34 V DC

typ. 70 W (max. 87 W)

up to two independent external power sources can be connected
for uninterrupted operation, in addition to the *RIEGL* add-on NiMH battery

206 mm x 346 mm (width x height)

approx. 9.8 kg (with antennas)

max. 80 % non condensing @ +31°C

IP64, dust- and splash-proof

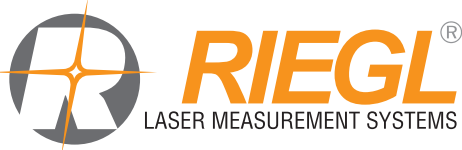
-10°C up to +50°C

0°C up to +40°C: standard operation

-20°C: continuous scanning operation if instrument is powered on
while internal temperature is at or above 0°C and still air

-40°C: scanning operation for about 20 minutes if instrument is powered on
while internal temperature is at or above 15°C and still air

¹²⁾ Insulating the scanner with appropriate material will enable operation at even lower temperatures.



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Data Sheet, *RIEGL* VZ-2000i, 2019-11-22

Long Range, Very High Speed 3D Laser Scanner

RIEGL VZ®-2000i

- **high laser pulse repetition rate of up to 1.2 MHz**
- **high speed data acquisition with up to 500,000 measurements/sec**
- **eye safe operation at Laser Class 1**
- **wide field of view 100°x360°**
- **range up to 2500 m, accuracy 5 mm**
- **high accuracy, high precision ranging based on echo digitization, online waveform processing, and multiple-time-around processing**
- **new, innovative processing architecture for data acquisition and simultaneous geo-referencing, in real-time**
- **automatic on-board registration**
- **NEW simultaneous image and scan data acquisition**
- **cloud connectivity via Wi-Fi and 3G/4G LTE**
- **fully compatible with the RIEGL VMZ Hybrid Mobile Laser Mapping System**
- **multiple target capability**
- **optional waveform data output**
- **orientation sensor for pose estimation**
- **remote control**
- **integrated GNSS receiver**

Based on a future-oriented, innovative new processing architecture, internet connectivity, and *RIEGL*'s latest waveform processing LiDAR technology, the *RIEGL* VZ-2000i Long Range 3D Laser Scanning System combines proven user friendliness in the field with fast and highly accurate data acquisition.

Its new processing architecture enables execution of different background tasks (such as point cloud registration, geo-referencing, orientation via integrated Inertial Measurement Unit, etc.) on-board in parallel to the simultaneous acquisition of scan data and image data. A full documentation of the scanner's software components – directly accessible on the *RIEGL* VZ-2000i – provides a sound basis for creation of your own python apps to enhance the scanner functionality. The system provides highest flexibility by supporting numerous peripherals and accessories such as the integrated GNSS unit for high accurate RTK solution, a SIM Card slot for 3G/4G LTE, WLAN, LAN, USB, and different other ports of external units.

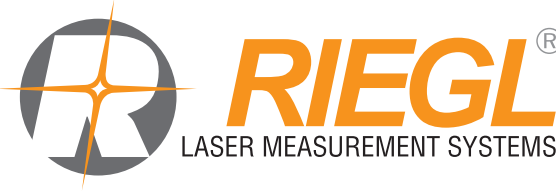
RIEGL's unique Waveform-LiDAR technology – based on echo digitization, online waveform processing, and multiple-time-around processing – is the key to enabling such high speed, long range, high accuracy measurements even in poor visibility and demanding multi-target situations caused by dust, haze, rain, vegetation, etc.

Typical applications include

- **Topography and Mining**
- **Natural Hazard Surveying**
- **Construction Site Monitoring**
- **Archeology & Cultural Heritage Documentation**
- **City Modeling**
- **Tunnel Surveying**
- **Civil Engineering**
- **Research**



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www.riegl.com



Terrestrial Laser Scanning

Data Sheet

Camera Option

A high-precision mount enables the **integration of an optional DSLR camera**. The camera can be easily integrated into the mount by means of two screws. Precise position and orientation of the camera is enabled by three supporting points. Power supply and a USB interface are provided via the scanner directly. The combination of scanner, software, and camera results in photorealistic 3D data, exact identification of details, positions, and distance measurements, as well as a re-creation of any virtual point of view. A new feature enables the acquisition of images simultaneously during scanning and thus, reduces the time for handling a scan position drastically.

GNSS Receiver Options

- >> Integrated L1 GNSS receiver, RTK capability by using of:
 - GNSS correction service via internet
 - recommended base station via LoRa radio (up to 10 km), network, or NTRIP/TCP
- >> external GNSS Receiver with Bluetooth

Lightweight Carbon Tripod

RIEGL offers a lightweight carbon tripod to support a quick and smooth workflow for data acquisition.

Power Supply via Rechargeable Batteries

The RIEGL VZ-2000i can be connected to the following optionally available rechargeable batteries:

- >> **NEW** RIEGL Add-On Rechargeable Li-Ion Battery RBLI 2900 (3 X 99 Wh)
- >> RIEGL Add-On Rechargeable NiMH Battery RBNE 2210 (205 Wh)
- >> NiMH Battery (235 Wh)

Use of other battery types to be discussed with RIEGL support.

Waveform Data Output Option

The digitized echo signals, also known as full waveform data, acquired by the RIEGL VZ-2000i 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 advanced research and analysis of digital waveform data samples acquired in multiple-target situations.

RIEGL Software Packages

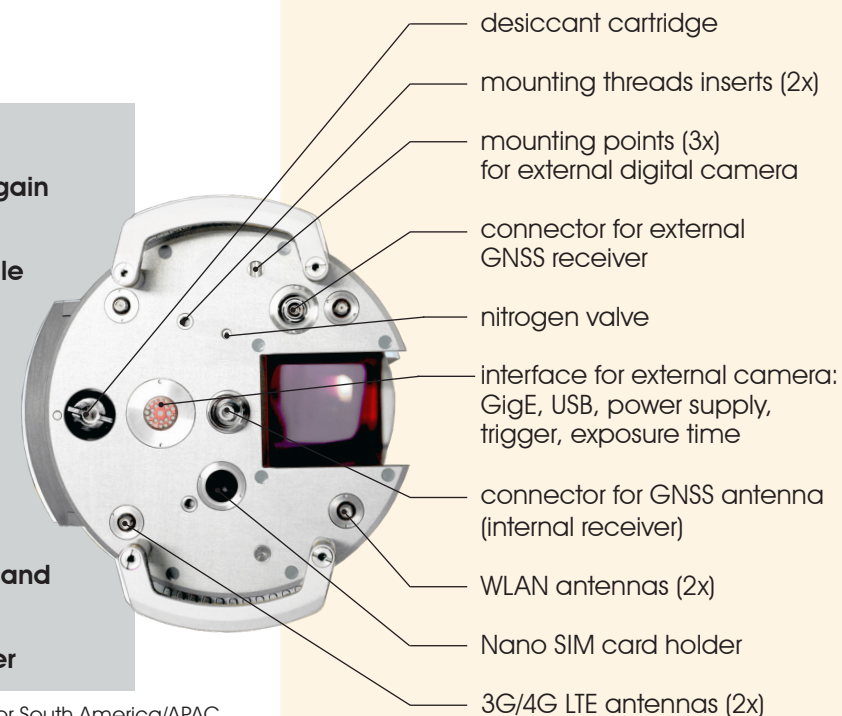
- >> **RISCAN PRO** standard processing software for efficient data acquisition and registration in terrestrial laser scanning
- >> **RISOLVE** for automatic registration, colorization, and 2D-map generation
- >> **RIMINING** optimized workflow for open-pit mining breakline detection and volume calculation fully supported various mining exchange formats for full compatibility with mine planning software



Communication and Interfaces

- LAN port 10/100/1000 MBit/sec
- integrated WLAN interface with high-gain MIMO antennas
- integrated multi-mode cellular module available for different regions¹⁾ with MIMO 3G/4G LTE antennas
- GigE and USB for connecting an external digital camera
- connector for GNSS antenna
- two external power supply ports
- connector for external GNSS receiver and synchronization (1PPS)
- Bluetooth connection to GNSS receiver

¹⁾ available for North America, Europe/APAC, Japan, or South America/APAC



Scan Data Storage

- internal 1 TB SSD (Solid State Disc) 900 GB useable
- external storage devices (SDXC cards up to 512 Gbytes or USB flash drives)

