The RIEGL VZ-400 V-Line® 3D Terrestrial Laser Scanner provides high speed, non-contact data acquisition using a narrow infrared laser beam and a fast scanning mechanism. High-accuracy laser ranging is based upon RIEGL’s unique echo digitization and online waveform processing, which enables superior measurement performance even during adverse environmental conditions and provides multiple return capability.

The RIEGL VZ-400 is a very compact and lightweight surveying instrument, mountable in any orientation and even able to perform in limited space conditions.

Modes of Operation:
- stand-alone data acquisition without the need of a computer
- basic configuration and control via built-in user interface
- remote operation via RiSCAN PRO on a notebook, connected either via LAN interface or integrated WLAN
- well-documented command interface for smooth integration into mobile laser scanning systems
- interfacing to post processing software

User Interfaces:
- integrated Human-Machine Interface (HMI) for stand-alone operation without a computer
- high-resolution 3.5" TFT color display, 320 x 240 pixel, scratch resistant glass with anti-reflection coating and multi-lingual menu
- water and dirt resistant key pad with large buttons for instrument control
- speaker for audible status and operation communications

Typical applications include
- As-Built Surveying
- Architecture & Facade Measurement
- Archaeology & Cultural Heritage Documentation
- City Modelling
- Tunnel Surveying
- Civil Engineering
- Forestry
- Research

• high speed data acquisition
• wide field-of-view, configurable
• high-accuracy, high-precision ranging based on echo digitization and online waveform processing
• multiple target capability
• superior measurement capability in adverse atmospheric conditions
• high-precision mount for optional digital camera
• integrated inclination sensors and laser plummet
• Integrated GPS receiver with antenna
• interface for external GNSS receiver
• various interfaces (LAN, WLAN, USB 2.0)
• internal data storage
High Accuracy Performance

The 3D Terrestrial Laser Scanner RIEGL VZ-400 provides scan data acquisition with 5 mm accuracy / 3 mm repeatability, a measurement range up to 600 m, and an efficient measurement rate up to 122,000 measurements/sec. The fully portable, rugged and robust instrument offers a wide field of view of 100° vertical and 360° horizontal, and uses an invisible laser beam for eye safe operation in Laser Class 1.

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 2.0 interface are provided via the scanner directly.

The combination of scanner, software, and camera results in photorealistic 3D data, exact identification of details, position and distance measurements, as well as recreation of any virtual point of view.

Waveform Data Output Option

The digitized echo signals, also known as waveform data, acquired by the RIEGL VZ-400 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.

Compatible Software Packages

The RIEGL VZ-400 is compatible with the RIEGL software package RiSCAN PRO for terrestrial laser scanning, RIEGL’s interface library RiVLib, as well as the workflow-optimizing software packages, e.g. RiMINING. Combined with the one-touch workflow of the scanner, RIEGL’s ultimate 3D scene capture solution, RiSOLVE, enables fully automatic registration and colorization of scan data.

Supported Registration Methods

Direct Geo-Referencing

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

GNSS Traversing

- GNSS position (RTK or autonomous)
- on-board inclination sensors
- automatic acquisition of well known remote target (reflector)

Free Stationing

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

Backsighting

- setup on well known point
- on-board inclination sensors
- precise fine scanning of well known remote target (reflector)
Operating Elements and Connectors

**Communication and Interfaces**
- LAN port 10/100/1000 MBit/sec within rotating head
- LAN port 10/100 MBit/sec within base
- Integrated WLAN interface with rod antenna
- USB 2.0 for external storage devices (USB flash drives, external HDD)
- USB 2.0 for connecting the optional digital camera
- Connector for GPS antenna
- Two ports for external power supply
- Connector for external GPS synchronization pulse (1PPS)
- Connector for external GNSS receiver

**Scan Data Storage**
- Internal 32 GB bytes flash memory (2 GB bytes reserved for the operating system)
- External storage devices (USB flash drives or external hard drives) via USB 2.0 interface

**Max. Measurement Range**

The following conditions are assumed:
Flat target larger than footprint of laser beam, perpendicular angle of incidence, average brightness
Technical Data RIEGL VZ®-400

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.

Range Performance 1)

<table>
<thead>
<tr>
<th>Laser Pulse Repetition Rate PRR (peak) 2)</th>
<th>Long Range Mode</th>
<th>High Speed Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 kHz</td>
<td>300 kHz</td>
<td></td>
</tr>
<tr>
<td>Effective Measurement Rate (meas./sec) 2)</td>
<td>42 000</td>
<td>122 000</td>
</tr>
</tbody>
</table>
| Max. Measurement Range 3)
| natural targets p ≥ 90 %                  | 600 m           | 350 m           |
| natural targets p ≥ 20 %                  | 280 m           | 160 m           |
| Max. Number of Targets per Pulse           | practically unlimited 4) |
| Accuracy 5) 7)                            | 5 mm            |
| Precision 4) 7)                            | 3 mm            |

Minimum Range

| Laser Wavelength | 1.5 m |
| Laser Beam Divergence 8) | 0.35 mrad |

Scanning Mechanism

Scan Angle Range

| Vertical (Line) Scan | max. 100° (+60° / -40°) |
| Horizontal (Frame) Scan | max. 360° |

Angular Step Width Δ θ (vertical), Δ ϕ (horizontal)

| 0.0024° ≤ Δ θ ≤ 0.288° 9) |
| 0.0024° ≤ Δ ϕ ≤ 0.5° |

Angle Measurement Resolution

better 0.0005° (1.8 arcsec)

Inclination Sensors

GPS Receiver, Compass, Internal Sync Timer

Scan Sync (optional)

<table>
<thead>
<tr>
<th>Vertical (Line) Scan</th>
<th>Horizontal (Frame) Scan</th>
</tr>
</thead>
<tbody>
<tr>
<td>between consecutive laser shots</td>
<td>between consecutive scan lines</td>
</tr>
<tr>
<td>better 0.0005° (1.8 arcsec)</td>
<td>better 0.0005° (1.8 arcsec)</td>
</tr>
</tbody>
</table>

Scanner Performance

Compass (optional), for vertical scanner setup position, details see page 2

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

Internal Sync Timer, scan data scanner rotation synchronization

Technical Data

Power Supply Input Voltage

| 11 - 32 V DC |
| typ. 65 W (max. 80 W) |

Power Consumption

up to three independent external power sources can be connected for uninterrupted operation

External Power Supply

Main Dimensions

Ø 180 x 308 mm (diameter x length) approx. 9.6 kg

Weight

max. 80 % non condensing @ +31°C

Humidity

IP64, dust- and splash-proof

Protection Class

Temperature Range

Storage

Operation

-10°C up to +50°C

Low Temperature Operation 11)

-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

-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

-10°C up to +50°C

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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) Details on request.
5) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
6) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.
7) One sigma @ 100 m range under RIEGL test conditions.
8) Measured at the 1/e² points. 0.35 mrad corresponds to an increase of 35 mm of beam diameter per 100 m distance.
9) Selectable. 10) Frame scan can be disabled, providing 2D scanner operation.
11) Insulating the scanner with appropriate material will enable operation at even lower temperatures.

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