

# RIEGL VZ<sup>®</sup>-400

- **very high speed data acquisition**
- **wide field-of-view, controllable while scanning**
- **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 mounting pads for optional digital camera**
- **integrated inclination sensors and laser plummet**
- **integrated GPS receiver with antenna**
- **various interfaces (LAN, WLAN, USB 2.0)**
- **internal data storage capability**

The V-Line<sup>®</sup> 3D Terrestrial Laser Scanner **RIEGL VZ-400** 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 allows achieving superior measurement capability even under adverse atmospheric conditions and the evaluation of multiple target echoes.

The line scanning mechanism is based upon a fast rotating multi-facet polygonal mirror, which provides fully linear, unidirectional and parallel scan lines. The **RIEGL VZ-400** is a very compact and lightweight surveying instrument, mountable in any orientation and even under limited space conditions.

#### Modes of Operation:

- stand-alone data acquisition without the need of a notebook, basic configuration and commanding via the 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

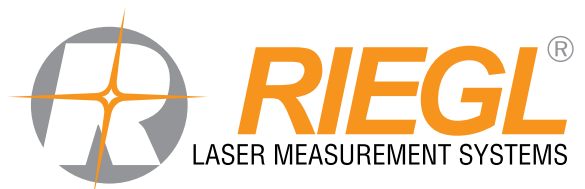
#### User Interfaces:

- integrated Human-Machine Interface (HMI) for stand-alone operation without computer
- high-resolution 3,5" TFT color display, 320 x 240 pixel, scratch resistant cover glass with anti-reflection coating and multi-lingual menu
- water and dirt resistant key pad with large buttons for instrument control
- loudspeaker for audible signaling of messages by voice

#### Typical applications include

- **As-Built Surveying**
- **Architecture & Facade Measurement**
- **Archaeology & Cultural Heritage Documentation**
- **City Modelling**
- **Tunnel Surveying**
- **Civil Engineering**

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[www.riegl.com](http://www.riegl.com)





### Scanner Hardware **RIEGL VZ-400**

allows high-speed, high resolution and accurate 3D measurements

- Range up to 600 m @ Laser Class 1
- Repeatability 3 mm
- Measurement rate up to 122 000 measurements/sec
- Field of View up to 100° x 360°
- LAN/WLAN data interface, easily allowing wireless data transmission
- Operated by any standard PC or Notebook or cable less
- Fully portable, rugged & robust

### Software **RiSCAN PRO**

RIEGL software package for scanner operation and data processing

- Data archiving using a well-documented tree structure in XML file format
- Object VIEW / INSPECTOR for intelligent data viewing and feature extraction
- Straightforward Global Registration
- Interfacing to Post Processing Software



### Digital Camera (optional)

provides high resolution calibrated color images

- NIKON D800, D600, D700
  - D800: 36.3 Megapixel, Nikon FX format
  - D600: 24.3 Megapixel, Nikon FX format
  - D700: 12.1 Megapixel, Nikon FX format
  - USB interface

Mounting device with digital camera can be easily fixed by means of two knurled head screws. Precise position and orientation is provided by three supporting points. Power supply and USB 2.0 interface is provided by the scanner directly.

### The combination of the key components **Scanner**, **Software** and **Camera** results in

- Automatic generation of high resolution textured meshes
- Photorealistic 3D reconstruction
- Exact identification of details
- Online position and distance measurements
- Online setting of any virtual point of view

## Global Scan Position Registration



### Stand-alone Registration

- integrated GPS receiver (L1)
- integrated biaxial inclination sensors (tilt range  $\pm 10^\circ$ , accuracy typ.  $\pm 0.008^\circ$ )
- integrated compass, accuracy typ.  $1^\circ$   
(one sigma value, available for vertical scanner setup position)
- RiSCAN PRO Processing and Multistation Adjustment Module (MSA)

### Registration via control points

- precise and fast fine scanning of retro-reflectors
- RiSCAN PRO Processing

### Totalstation-like-Registration

- setup above well known point (integrated laser plummet)
- integrated inclination sensors
- precise fine scanning of well known remote target (reflector)
- RiSCAN PRO Processing Backsighting function



WLAN antenna

Carrying handles

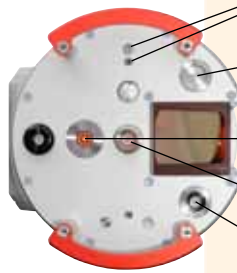
High-resolution color TFT display

Key pad for instrument control

Connectors for power supply and LAN interface 10/100 MBit/sec, power off/on button

## 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



Mounting points (3x) and mounting threads inserts (2x) for digital camera

Connector for external GNSS receiver (optional)

USB and DC power connector for digital camera

Connector for GPS antenna (internal receiver)

Connector for WLAN antenna

## Scan Data Storage

- internal 32 GByte flash memory (1 GByte reserved for the operating system)
- external storage devices (USB flash drives or external hard drives) via USB 2.0 interface



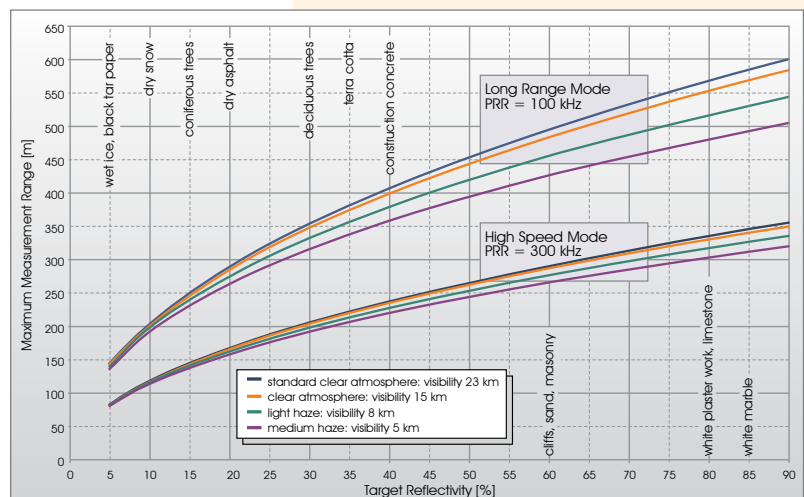
USB 2.0 slot for external memory devices

LAN 10/100/1000 MBit/sec, for rapid download of scan data

## 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<sup>®</sup>-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 <sup>1)</sup>

	Long Range Mode	High Speed Mode
Pulse repetition rate PRR (peak) <sup>2)</sup>	100 kHz	300 kHz
Effective Measurement Rate <sup>2)</sup>	42 000 meas./sec	122 000 meas./sec
Max. Measurement Range <sup>3)</sup>		
natural targets $\rho \geq 90\%$	600 m	350 m
natural targets $\rho \geq 20\%$	280 m	160 m
Max. Number of Targets per Pulse	practically unlimited <sup>4)</sup>	
Accuracy <sup>5) 7)</sup>	5 mm	
Precision <sup>6) 7)</sup>	3 mm	

## Minimum Range

1.5 m

## Laser Wavelength

near infrared

## Laser Beam Divergence <sup>8)</sup>

0.35 mrad

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/e<sup>2</sup> points. 0.35 mrad corresponds to an increase of 35 mm of beam diameter per 100 m distance.

## Scanner Performance

### Scan Angle Range

*Vertical (Line) Scan*  
total 100° (+60° / -40°)

### Scanning Mechanism

rotating multi-facet mirror

### Scan Speed

3 lines/sec to 120 lines/sec

### Angular Step Width $\Delta \vartheta$ (vertical), $\Delta \phi$ (horizontal)

0.0024° ≤  $\Delta \vartheta$  ≤ 0.288° <sup>9)</sup>  
between consecutive laser shots

### *Horizontal (Frame) Scan*

max. 360°

rotating head

0°/sec to 60°/sec <sup>10)</sup>

0.0024° ≤  $\Delta \phi$  ≤ 0.5° <sup>9)</sup>

between consecutive scan lines

### Angle Measurement Resolution

better 0.0005° (1.8 arcsec)

better 0.0005° (1.8 arcsec)

### Inclination Sensors

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

### GPS Receiver

integrated, L1, with antenna

### Compass

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

### Internal Sync Timer

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

### Scan Sync (optional)

scanner rotation synchronization

9) Selectable.

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

## General Technical Data

### Power Supply Input Voltage

11 - 32 V DC

### Power Consumption

typ. 65 W (max. 80 W)

### External Power Supply

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

### Main Dimensions

Ø 180 x 308 mm (diameter x length)

### Weight

approx. 9.6 kg

### Humidity

max. 80 % non condensing @ +31°C

### Protection Class

IP64, dust- and splash-proof

### Temperature Range

-10°C up to +50°C

#### Storage

0°C up to +40°C: standard operation

#### Operation

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

#### Low Temperature Operation

-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



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