

3D Terrestrial Laser Scanner with Online Waveform Processing

# 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*



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**RIEGL**  
LASER MEASUREMENT SYSTEMS

Terrestrial Laser Scanning

digitization and online waveform processing, which allows achieving superior measurement capability even under adverse atmospheric conditions and the evaluation of multiple target echoes.

## System Configuration



### 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 125 000 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 D700, NIKON D300(s), NIKON D200*

*- D700: 12.1 Megapixel, Nikon FX format*

*- D300(s): 12.3 Megapixel*

*- D200: 10.2 Megapixel*

*- 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.

### 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.  $\pm 0.008^\circ$ )*

*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*

# Operating Elements and Connectors



WLAN antenna

Carrying handles

High-resolution color TFT display

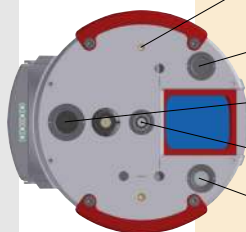
Key pad for instrument control

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

## Communication and Interfaces

LAN interface 10/100/1000 MBit/sec within rotating head  
 LAN interface 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 connectors for external power supply  
 connector for external GPS synchronization pulse (1PPS)

TOP VIEW



Mounting points for digital camera (2x)

Connector for GPS antenna (optional)

USB connector for digital camera

Connector for GPS antenna

Connector for WLAN antenna

USB 2.0 slot for external memory devices

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

## 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



# Power Supply

## Add-on rechargeable battery

optional add-on rechargeable battery pack (high power, high capacity NIMH cells)  
 compact disc design, short-circuit-proof and protected connection pins  
 rechargeable during standard scan operation via external power supply  
 integrated micro-controller based charging electronics  
 easily pluggable to base of the laser scanner by central locking screw  
 DC voltage source (11-32 V DC) sufficient for recharging



## External 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. 65 W  
 LED indicators for power status

# Technical Data 3D Scanner Hardware *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.



## Physical Data

temperature range 0°C to +40°C (operation), -10°C to +50°C (storage)  
 protection class IP64 (dust and splash-proof)  
 weight 9.8 kg

## Range Performance<sup>1)</sup>

	Long Range Mode	High Speed Mode
Laser PRR (Peak) <sup>2)</sup>	100 kHz	300 kHz
Effective Measurement Rate <sup>2)</sup>	42 000 meas./sec	125 000 meas./sec
Max. Measurement Range <sup>3)</sup> for natural targets 90% for natural targets 20%	600 m 280 m	350 m 160 m
Max. Number of Targets per Pulse	practically unlimited <sup>4)</sup>	practically unlimited <sup>4)</sup>
Accuracy <sup>5) 7)</sup>	5 mm	5 mm
Precision <sup>6) 7)</sup>	3 mm	3 mm

## Minimum Range

1.5 m

## Laser Wavelength

near infrared

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

0.3 mrad

1) with online waveform analysis

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 an 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) 0.3 mrad correspond to 30 mm increase of beamwidth per 100 m of range.

## Scan Performance

Scan Angle Range

Scanning Mechanism

Scan Speed

Angular Stepwidth (vertical), (horizontal)

Angle Measurement Resolution

Inclination Sensors

Internal Sync Timer

Scan Sync (optional)

Vertical (Line) Scan

total 100° (+60° / -40°)

rotating multi-facet mirror

3 lines/sec to 120 lines/sec

0.0024° 0.288°<sup>9)</sup>

between consecutive laser shots

better 0.0005° (1.8 arcsec)

Horizontal (Frame) Scan

max. 360°

rotating head

0°/sec to 60°/sec<sup>10)</sup>

0.0024° 0.5°<sup>9)</sup>

between consecutive scan lines

better 0.0005° (1.8 arcsec)

integrated, for vertical scanner setup position

integrated real-time synchronized time stamping of scan data

scanner rotation synchronization

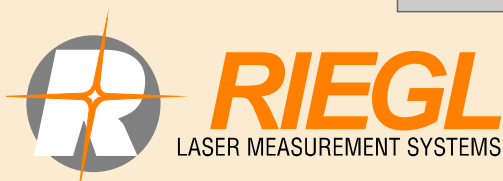
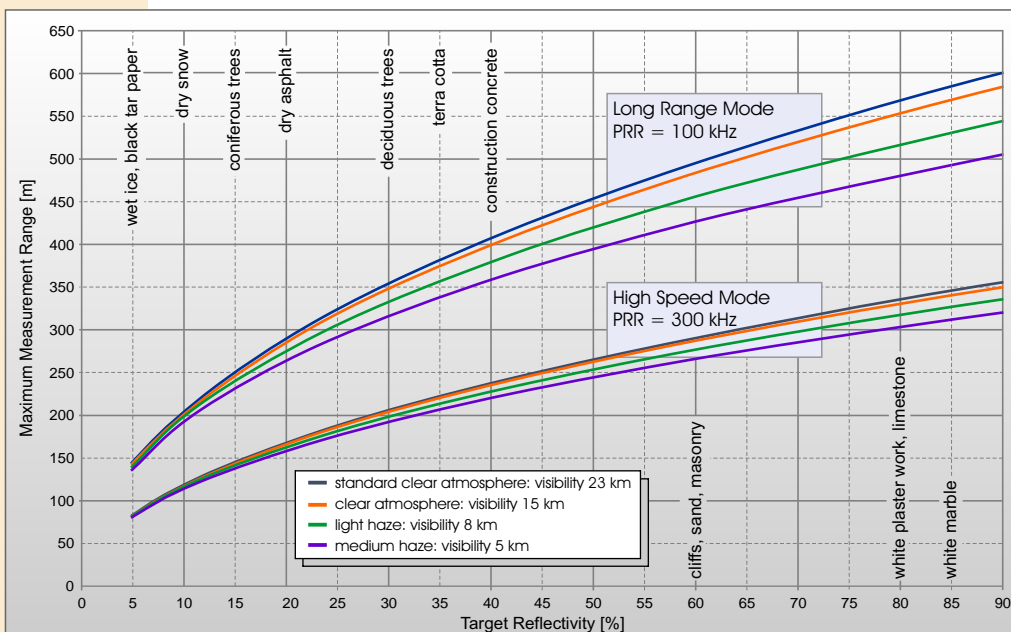
9) selectable

10) frame scan can be disabled, providing 2D operation

## Max. Measurement Range

The following conditions are assumed:

Flat target larger than footprint of laser beam, perpendicular angle of incidence, average brightness



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