ONLINE WAVEFORM PROCESSING
3D TERRESTRIAL LASER SCANNER SYSTEM

RIEGL VZ-400

The new *RIEGL* VZ-400 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 analysis, 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*

- *very high speed data acquisition*
- *wide field-of-view, controllable while scanning*
- *high-accuracy, high-precision ranging based on echo digitization and online waveform analysis*
- *multiple target capability*
- *superior measurement capability in adverse atmospheric conditions*
- *high-precision mounting pads for digital camera*
- *integrated inclination sensors and laser plummet*
- *integrated GPS receiver*
- *various interfaces (LAN, WLAN, USB 2.0)*
- *internal data storage capability*

visit our webpage
www.riegl.com

RIEGL
LASER MEASUREMENT SYSTEMS

System Configuration

Scanner Hardware RIEGL VZ-400

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

- *Range up to 500 m @ Laser Class 1*
- *Repeatability 5 mm*
- *Measurement rate up to 125.000 measurements/s*
- *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

- *Canon EOS 450D:*
  - 12.2 Megapixel (4.272 x 2.848 pixel)
  - 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 <u>Scanner</u>, <u>Software</u> and <u>Camera</u> 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), up to 2.5 m accuracy*
- *integrated biaxial inclination sensors (tilt range ±10°, accuracy typ. ±0.008°)*
- *integrated compass (magnetic field sensor)*
- *RiSCAN PRO Processing and Multistation Adjustment Module (MSA)*

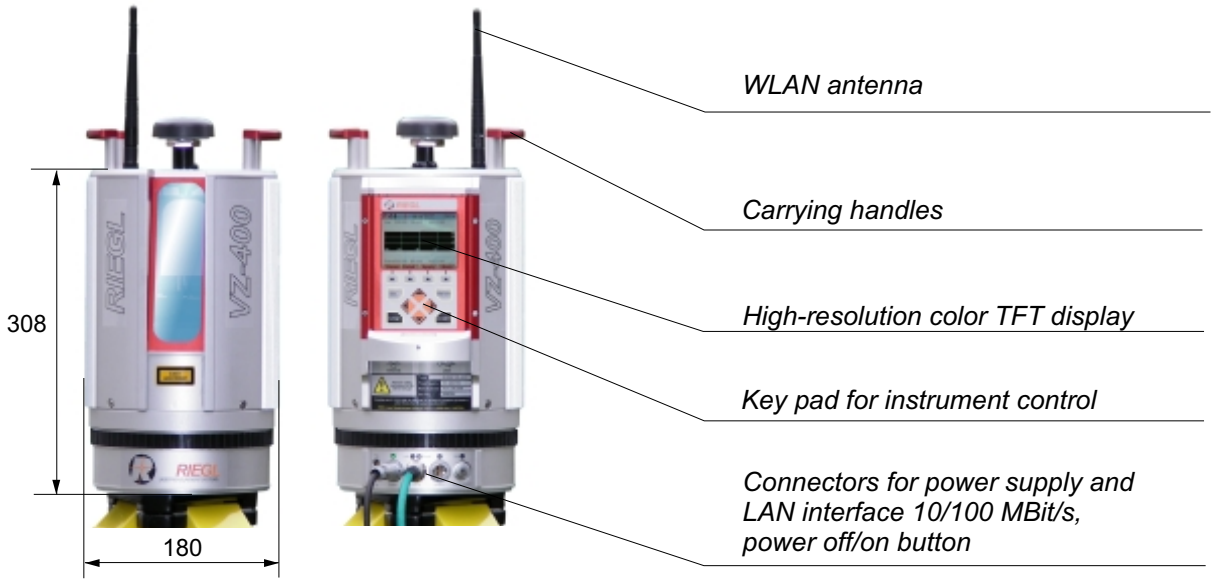
Registration via control points

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

Totalstation-like-Registration

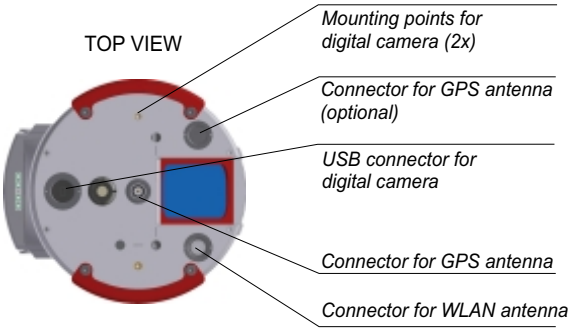
- *setup above well known point (integrated laser plummet)*
- *integrated inclination sensors*
- *precise fine scanning of well known remote target (reflector)*
- *RiSCAN PRO Processing Backsighting function*

Operating Elements and Connectors



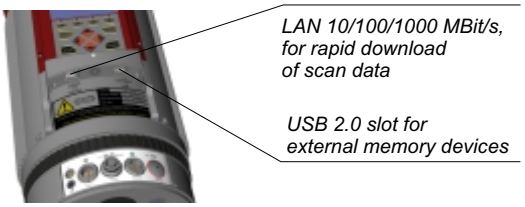
Communication and Interfaces

- *LAN interface 10/100/1000 MBit/s within head*
- *LAN interface 10/100 MBit/s 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 digital camera*
- *connector for GPS antenna*
- *two connectors for external power supply*
- *connector for external GPS synchronization pulse (1PPS)*



Scan Data Storage

- *internal 8 GByte flash memory*
- *external storage devices (USB flash drives or external hard drives) via USB 2.0 interface*



Power Supply

Add-on rechargeable battery

- *optional rechargeable add-on battery pack (high power, high capacity lithium manganese cells)*
- *compact slim 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 sufficient for recharging (11-32 V DC)*

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*
- *LED indicators for power status*

Technical Data 3D Scanner Hardware *RIEGL* VZ-400

Rangefinder performance [1]

Laser Product Classification

CLASS 1 LASER PRODUCT

according to IEC60825-1:1993+A1:1997+A2:2001
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 July 26, 2001.

	Long Range Mode	*High Speed Mode*
Laser PRR (Peak) [2]	100 kHz	300 kHZ
Effective Measurement rate [2]	42 000 meas./s	125 000 meas./s
Max. Measurement range [3]		
for natural targets $\rho \geq 80\%$	500 m	300 m
for natural targets $\rho \geq 10\%$	160 m	100 m
Accuracy [4] [6]	5 mm	5 mm
Precision [5] [6]	5 mm	5 mm

Minimum range	1 m
Laser wavelength	near infrared
Beam divergence [7]	0.3 mrad
Number of targets per pulse	unlimited

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 in excess of 23 km. In bright sunlight, the operational range is considerably shorter than under an overcast sky.
4) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
5) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.
6) One sigma @ 100 m range under *RIEGL* test conditions.
7) 0.3 mrad correspond to 30 mm increase of beamwidth per 100 m of range.

Scanner performance

Vertical (line) scan	
Scanning range	total 100° (+60° / -40°)
Scanning mechanism	rotating multi-facet mirror
Scanning rate	3 lines/s to 120 lines/s
Angular stepwidth D J [8] between consecutive laser shots	0.0024° £ D J £ 0.288°
Angle measurement resolution	better 0.0005° (1.8 arcsec)
Horizontal (frame) scan	
Scanning range	max. 360°
Scanning mechanism	rotating head
Scanning rate [9]	0°/s to 60°/s
Angular stepwidth D j [8] between consecutive scan lines	0.0024° £ D j £ 0.5°
Angle measurement resolution	better 0.0005° (1.8 arcsec)
Inclination Sensors	integrated, for vertical scanner setup position
Internal Sync Timer	integrated GPS-synchronized time stamping of scan data

8) Selectable
9) frame scan can be disabled, providing 2D operation

General technical data

Interfaces	LAN, 10/100/1000 MBit/sec within head LAN, 10/100 MBit/sec, integrated WLAN USB 2.0
Data storage	internal 8 GByte flash memory
Power supply input voltage	11 - 32 V DC
Power consumption	typ. 60 W
Main dimensions / Weight	308 mm x 180 mm (length x diameter) / 9.8 kg
Temperature range	0°C to +40°C (operation), -10°C to +50°C (storage)
Protection class	IP64, dust and splash proof

RIEGL
LASER MEASUREMENT SYSTEMS
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