

# RIEGL VZ-400i

- *new, innovative processing architecture for data acquisition and simultaneous geo-referencing, filtering and analysis in real-time*
- *cloud connectivity via Wi-Fi and 4G LTE*
- *high laser pulse repetition rate of up to 1.2 MHz*
- *eye safe operation at Laser Class 1*
- *wide field of view, 100°x360°*
- *high speed data acquisition up to 500,000 measurements/sec*
- *range up to 800 m, accuracy 5 mm*
- *high accuracy, high precision ranging based on echo digitization, online waveform processing, and multiple-time-around processing*
- *multiple target capability for an unlimited number of target echoes*
- *optional full waveform data output*
- *user friendly touch-screen interface*
- *MEMS IMU for pose estimation*

The **RIEGL VZ-400i** is a 3D Laser Scanning System which combines an innovative new processing architecture, internet connectivity, and a suite of MEMS sensors with **RIEGL's** latest Laser Scanning Engine technology.

This real-time data flow is enabled through dual processing platforms: a dedicated processing system for data acquisition, waveform processing and system operations, and a second processing platform which enables real-time data registration, georeferencing, filtering and analysis to be executed simultaneously. The VZ-400i harnesses this power by streaming it in real-time via the integrated 3G/4G/LTE modem, WiFi, Bluetooth, and Ethernet communications hardware.

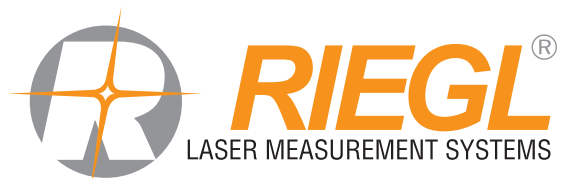
With its integrated gyroscope, accelerometer, compass and barometer, the VZ-400i's 1200kHz pulse repetition rate can be fully utilized in nearly any environment and orientation. The system enables an incredible range of flexibility by providing support for numerous external peripherals and accessories via its integrated USB Ports and stable mounting points.



#### Typical applications include

- *As-Built Surveying*
- *Architecture & Facade Measurement*
- *Archeology & Cultural Heritage Documentation*
- *City Modelling*
- *Tunnel Surveying*
- *Civil Engineering*
- *Forestry*
- *Research*
- *Monitoring*

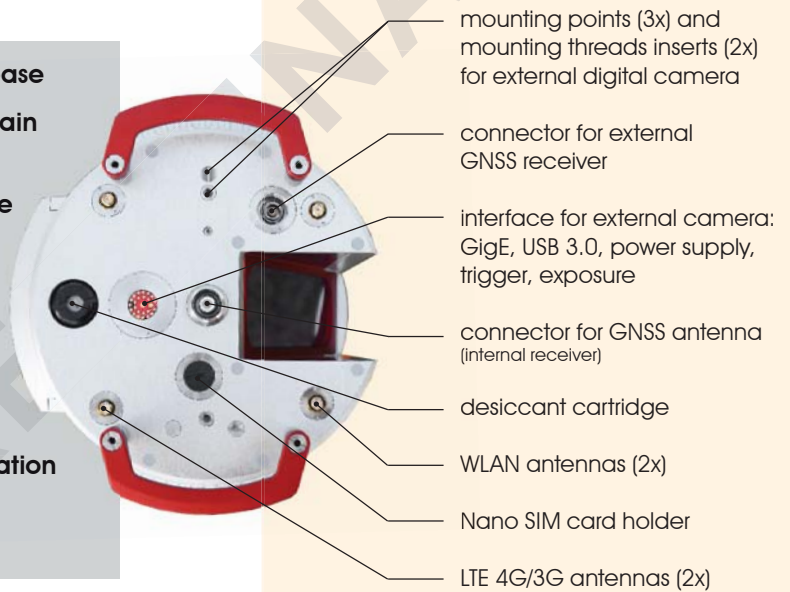
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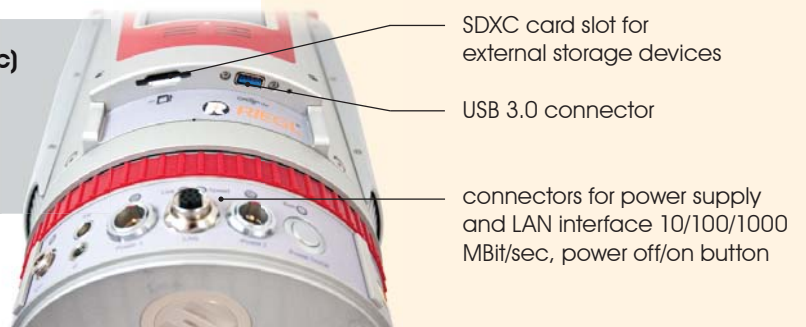
### Communication and Interfaces

- LAN port 10/100/1000 MBit/sec within base
- integrated WLAN interface with high-gain MIMO antennas
- integrated multi-mode cellular module with MIMO LTE 4G/3G antennas
- GigE and USB 3.0 for connecting an external digital camera
- connector for GNSS antenna
- two external power supply ports
- connector for external GPS synchronization pulse (1PPS)
- connector for external GNSS receiver



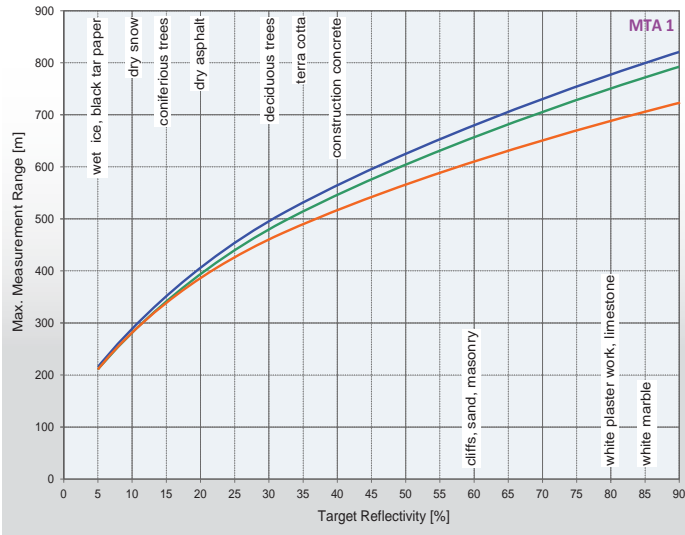
### Scan Data Storage

- internal 256 GBytes SSD (Solid State Disc)
- external storage devices (SDXC cards up to 512 GBytes or USB 3.0 flash drives)

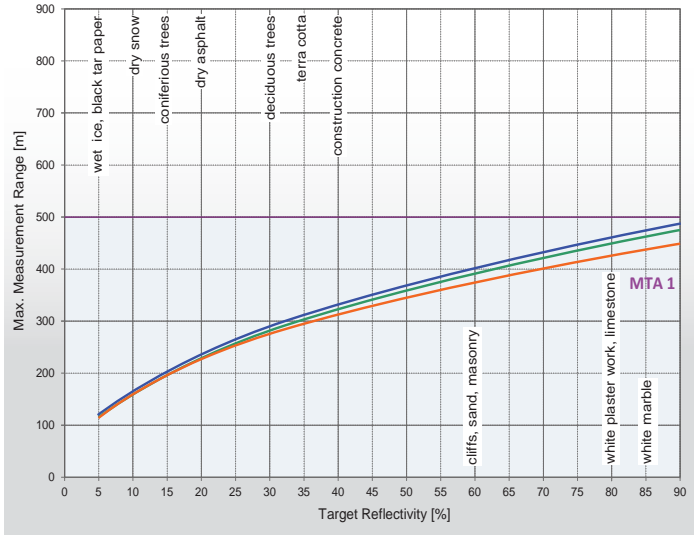


■ standard clear atmosphere: visibility 23 km  
■ clear atmosphere: visibility 15 km  
■ light haze: visibility 8 km

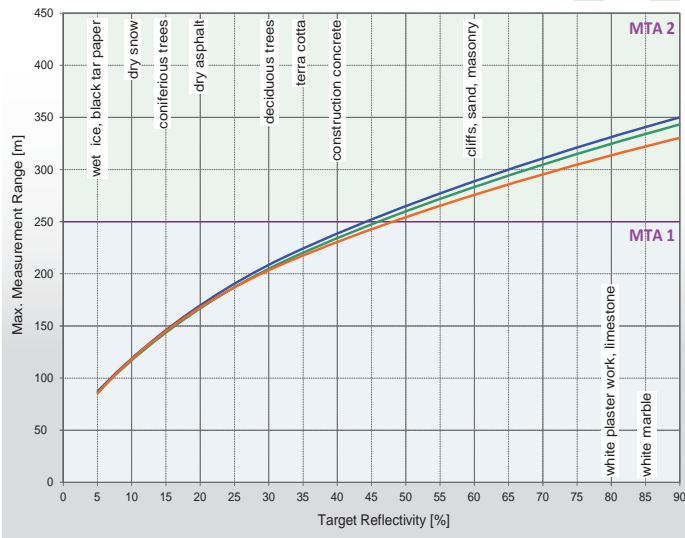
### 100 kHz PRR



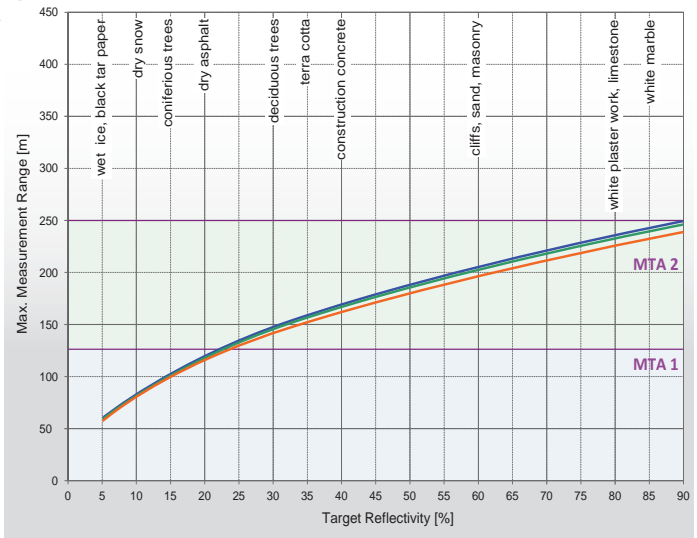
### 300 kHz PRR



### 600 kHz PRR



### 1200 kHz PRR



**The following conditions are assumed:**

- flat target larger than footprint of the laser beam
- perpendicular angle of incidence
- average brightness
- ambiguity resolved by post processing with RIMTA TLS

**MTA zones:**

- MTA 1: no ambiguity / 1 pulse „in the air“*
- MTA 2: 2 pulses „in the air“*

# Technical Data RIEGL VZ<sup>®</sup>-400i

## 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>

Laser Pulse Repetition Rate PRR (peak) <sup>2)</sup>	100 kHz	300 kHz	600 kHz	1200 kHz
Effective Measurement Rate (meas./sec) <sup>2)</sup>	42,000	125,000	250,000	500,000
Max. Measurement Range <sup>3)</sup>				
natural targets $\rho \geq 90\%$	800 m	480 m <sup>4)</sup>	350 m <sup>4)</sup>	250 m <sup>4)</sup>
natural targets $\rho \geq 20\%$	400 m	230 m <sup>4)</sup>	160 m <sup>4)</sup>	120 m <sup>4)</sup>
Max. Number of Targets per Pulse	15	15	8	4

Accuracy <sup>6) 8)</sup>

5 mm

Precision <sup>7) 8)</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) Ambiguity to be resolved by post-processing with RIMTA TLS

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°)

*Horizontal (Frame) Scan*

max. 360°

Scanning Mechanism

rotating multi-facet mirror

rotating head

Scan Speed

3 lines/sec to 240 lines/sec

0°/sec to 150°/sec <sup>10)</sup>

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

0.0007°  $\leq \Delta \theta \leq 0.6^\circ$  <sup>9)</sup>

between consecutive laser shots

0.0015°  $\leq \Delta \phi \leq 0.62^\circ$  <sup>9)</sup>

between consecutive scan lines

Angle Measurement Resolution

better 0.0007° (2.5 arcsec)

better 0.0005° (1.8 arcsec)

Orientation Sensors (MEMS)

integrated 3-axis accelerometer, 3-axis gyroscope,

3-axis magnetometer (compass), barometer

integrated L1, concurrent reception of GPS, GLONASS, Beidou

integrated

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

scanner rotation synchronization

providing digitized echo signal information for specific target echoes

GNSS Receiver

Laser Plummet

Internal Sync Timer

Scan Sync (optional)

Waveform Data Output (optional)

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. 60 W (max. 80 W)

External Power Supply

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

Main Dimensions

206 x 308 mm (width x height)

Weight

approx. 9.7 kg (with antennas)

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

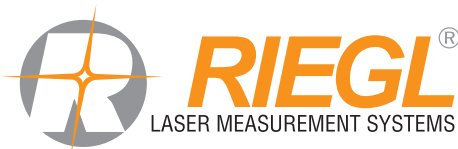
Operation

-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 <sup>11)</sup>

-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

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



**RIEGL Laser Measurement Systems GmbH**  
Riedenburgstraße 48  
3580 Horn, Austria  
Phone: +43 2982 4211 | Fax: +43 2982 4210  
office@riegl.co.at  
www.riegl.com

**RIEGL USA Inc.**  
Orlando, Florida | info@rieglusa.com | www.rieglusa.com  
**RIEGL Japan Ltd.**  
Tokyo, Japan | info@riegl-japan.co.jp | www.riegl-japan.co.jp  
**RIEGL China Ltd.**  
Beijing, China | info@riegl.cn | www.riegl.cn

www.riegl.com