COMPONENTE 1: ÉSCANER 3D CON ACCESORIOS

RIEGL VZ-400i

RIEGL VZ-400i®

- *high laser pulse repetition rate of up to 1.2 MHz*
- *high speed data acquisition with up to 500,000 measurements/sec*
- *eye safe operation at Laser Class 1*
- *wide field of view 100°x360°*
- *range up to 800 m*
- *high accuracy, high precision ranging based on echo digitization, online waveform processing, and multiple-time-around processing*
- *innovative processing architecture for data acquisition and simultaneous geo-referencing in real-time*
- *automatic on-board registration*
- *simultaneous image and scan data acquisition*
- *user-developed apps via python software*
- *cloud connectivity via Wi-Fi and 3G/4G LTE*
- *integrated IMU for pose estimation and kinematic data acquistion*
- *multiple target capability*
- *optional waveform data output*
- *integrated GNSS receiver*

The *RIEGL* VZ-400i is a cutting-edge 3D Laser Scanning System which combines a future-oriented, innovative processing architecture and internet connectivity with *RIEGL*'s latest waveform processing LiDAR technology.

This real-time data flow is enabled through dual processing platforms: a dedicated processing system for simultaneous acquisition of scan data and image data, waveform processing and system operations, and a second processing platform which enables automatic on-board registration, geo-referencing, and analysis to be executed in parallel. The VZ-400i provides an integrated 3G/4G LTE modem, Wi-Fi, and Ethernet communications hardware.
With its integrated orientation sensor (MEMS IMU, compass, and barometer), the VZ-400i's up to 1200 kHz pulse repetition rate can be fully utilized in many environments and orientations. The system provides a high range of flexibility by supporting 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*
- *Building Information Modeling (BIM)*
- *Forensics & Crash Scene Investigation*
- *City Modeling*
- *Tunnel Surveying*
- *Civil Engineering*
- *Forestry*
- *Research*
- *Monitoring*

visit our website
www.riegl.com

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LASER MEASUREMENT SYSTEMS

Camera Option

A DSLR camera or the *RIEGL* VZ-i-20M heavy duty camera can be integrated using a high-precision camera mount. Power supply and USB interface are provided via the scanner directly. Acquisition of images simultaneously during scanning reduces the time for handling a scan position drastically.

GNSS Receiver Options

>> RTK capability by using of:

- *RIEGL* VZ-i GNSS RTK Receiver, recommended base station via LoRa radio (up to 10 km), network, or NTRIP/TCP
- GNSS correction service via internet

>> external GNSS Receiver via data-cable or Bluetooth



recommended base station
EMLID REACH RS2



Lightweight Carbon Tripod

RIEGL offers a lightweight carbon tripod to support a quick and smooth workflow for data acquisition.

Power Supply via Rechargeable Batteries

The *RIEGL* VZ-400i can be connected to the following optionally available rechargeable batteries:

>> *RIEGL* Add-On Rechargeable Li-Ion Battery RBLI 2900 (3 X 99 Wh)

>> NiMH Battery (235 Wh)

Use of other battery types to be discussed with *RIEGL* support.



RIEGL Add-On Rechargeable Li-Ion Battery RBLI 2900



NiMH Battery

Waveform Data Output Option

The digitized echo signals, also known as full waveform data, acquired by the *RIEGL* VZ-400i 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 advanced research and analysis of digital waveform data samples acquired in multiple-target situations.

RIEGL Software Packages

>> **RiSCAN PRO** standard processing software
for efficient data acquisition and registration in terrestrial laser scanning

>> **RiSOLVE**
for automatic registration, colorization, and 2D-map generation

>> **RiMINING**
optimized workflow for open-pit mining

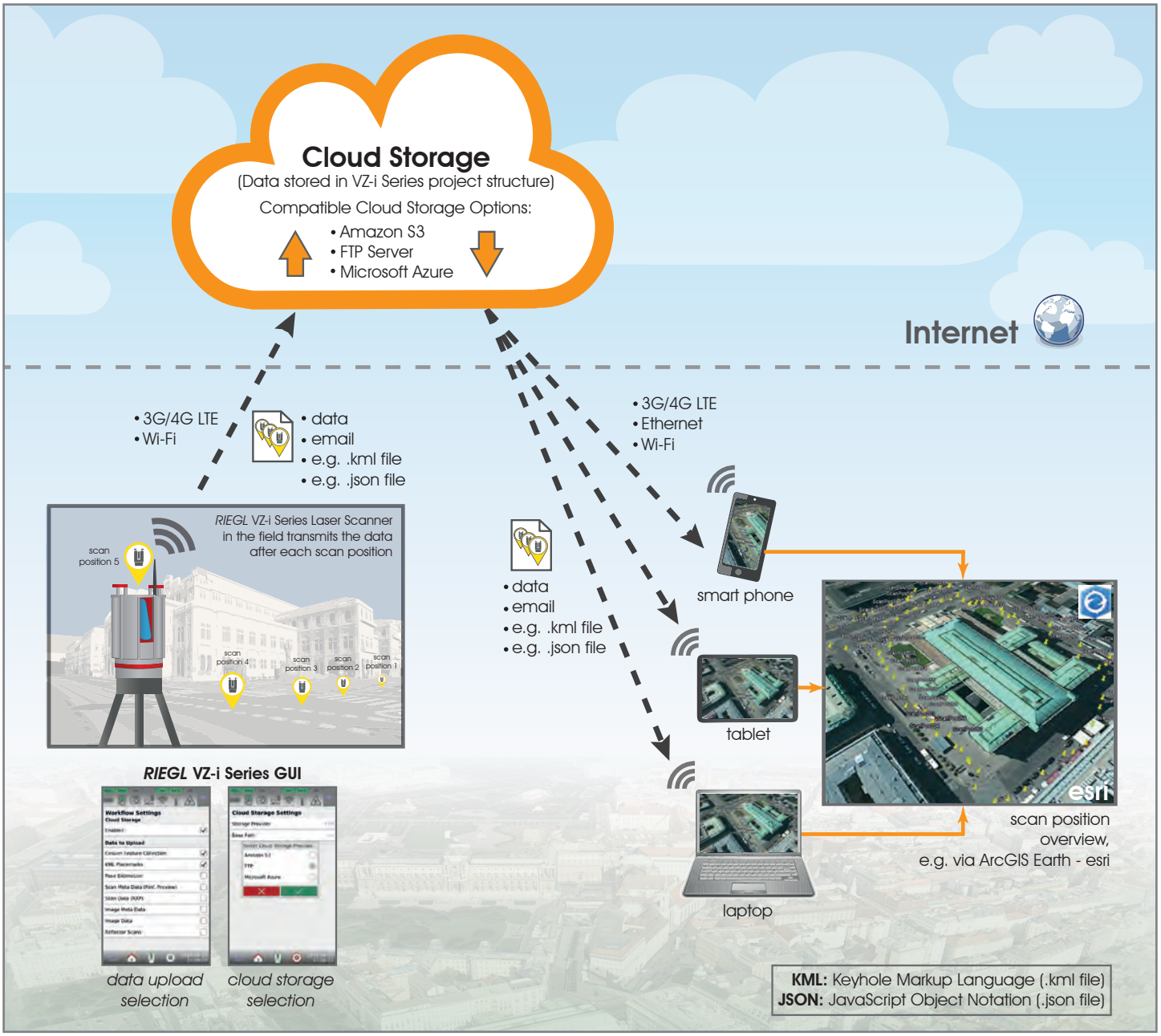


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The *RIEGL* VZ-i Series provides cloud connectivity via either the 3G/4G LTE, Wi-Fi network, or LAN.

The content uploaded to, stored in, and downloaded from the cloud, as well as the appropriate cloud storage provider or FTP server are user definable. The defined data then is transferred to the cloud after finishing each scan.

Supported cloud storage currently includes Amazon S3 and Microsoft Azure.



Transferable data includes:

- >> the scanner's position in WGS84 geographic coordinates as *.kml and *.json
- >> scan data preview as *.png image
- >> thumb-nails of the images as *.jpg
- >> scan data as *.rxp
- >> image data as *.jpg
- >> error messages

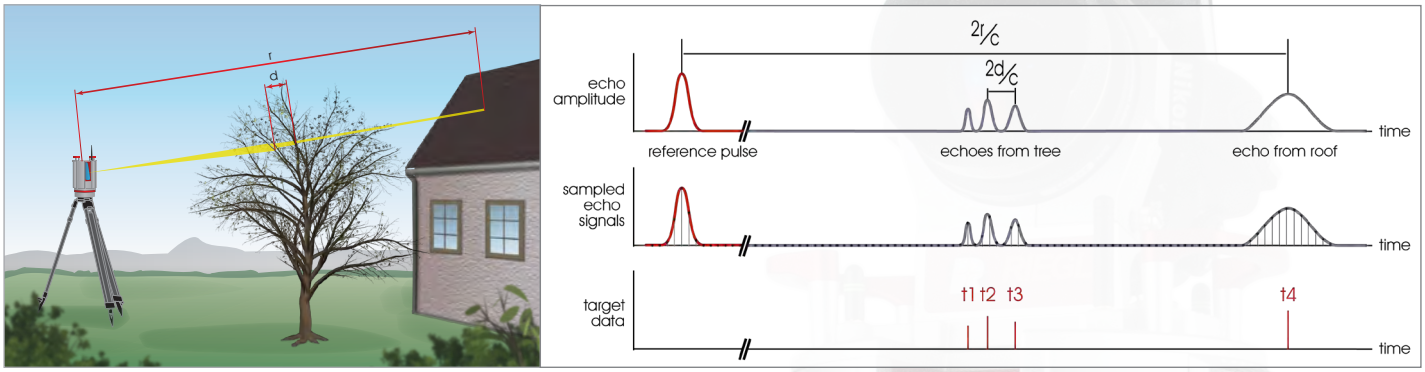
Please note: Adequate data transmission bandwidth is required.

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RIEGL's sophisticated LiDAR technology is the basis for highly informative scan data. Every laser pulse received provides several attributes in addition to the range measurement information. By using different features and filters provided with the scanner's software, this information can be used to significantly improve the informative content of point clouds.

Multi Target Capability - the Basis for High Penetration Capability

Utilizing the pulsed time-of-flight method for laser range measurements, the VZ-400i enables determination of the range to all targets a single laser pulse is interacting with. Depending on the measurement program used, the maximum number of targets, which can be detected, is varying (4-15).



Pulse Shape Deviation Output

Even if the distance between two targets is too short to discriminate between the two echoes, valuable information about the pulse shape of the return pulse is given. That allows to discriminate whether the return echo originates from a single target or from two nearby targets. A simple thresholding with respect to the pulse shape information can remove most of the „invalid" points and keep only the reliable „real" targets.



original data



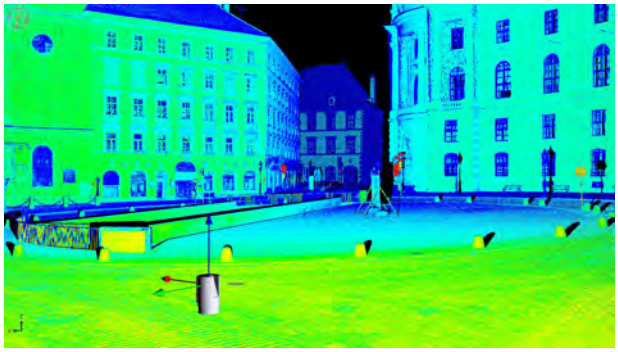
automatic selection of „invalid" points using the pulse shape deviation attribute information



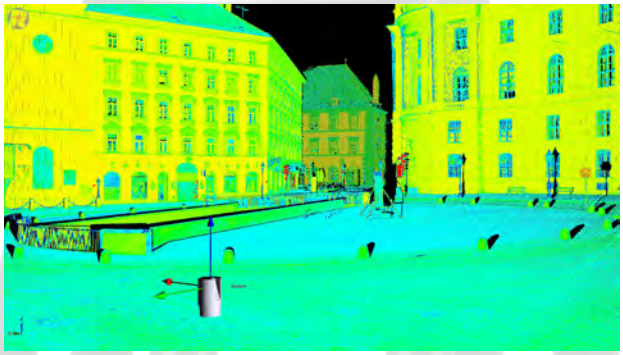
data after elimination of the „invalid" points

Calibrated Reflectance Output

This feature allows displaying the scan data colored by range-independent reflectance of the scanned object for better data classification.



point cloud colored by the range-depending amplitude



point cloud colored by the range-independent reflectance

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Rain, Haze, and Dust Penetration

Using deviation and reflectance filters, range measurements caused by rain drops, dust or haze can be identified, selected, and deleted, resulting in a clear and clean point cloud of the relevant scene.



point cloud before filter application



automatically cleaned-up point cloud

Operation & Remote Control

>> Easy operation of the *RIEGL* VZ-400i with the integrated Graphical User Interface (GUI) via touchscreen.

>> Remote control via *RIEGL* VZ-i Series App on your device. The GUI of the laser scanner will be displayed on the screen of your smart device. Connect locally or from anywhere in the world.

The App is available for iOS (iPhone, iPad, iPad Touch), Android and Windows PC (32 and 64 Bit).

Download now!



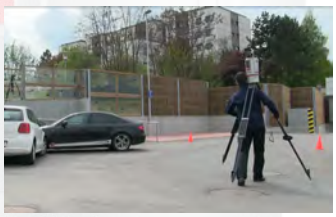
RIEGL VZ-i Series App

Scanner Motion Detection

Several pre-defined data acquisition workflows (e.g. Default, Forensics, OneTouch) are available. These **pre-defined workflows** allow the operation of the scanner by pushing just one icon on the screen per scan position. Once the tripod is re-arranged, a new scan position will automatically be generated. Modifications or creations of individual workflows to meet user specific requirements are also possible.



select the appropriate scanning parameters and start the first scan



move the scanner to the next scan position



to start the next scan, just press the START-button

User Applications

User developed applications (written in python software language) for further improvement of processing of surveying missions can be uploaded into the scanner.

RIEGL Kinematic App for Mobile Data Acquisition

The integrated IMU in connection with the *RIEGL* VZ-i GNSS RTK receiver allows the acquisition of kinematic scan data and trajectory data, resulting in a highly accurate 3D point cloud.

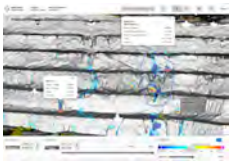
RIEGL Kinematic App Infosheet



RIEGL Monitoring Apps

- configuration of complex monitoring scenarios
- on-board data processing
- visualization of results via web viewer

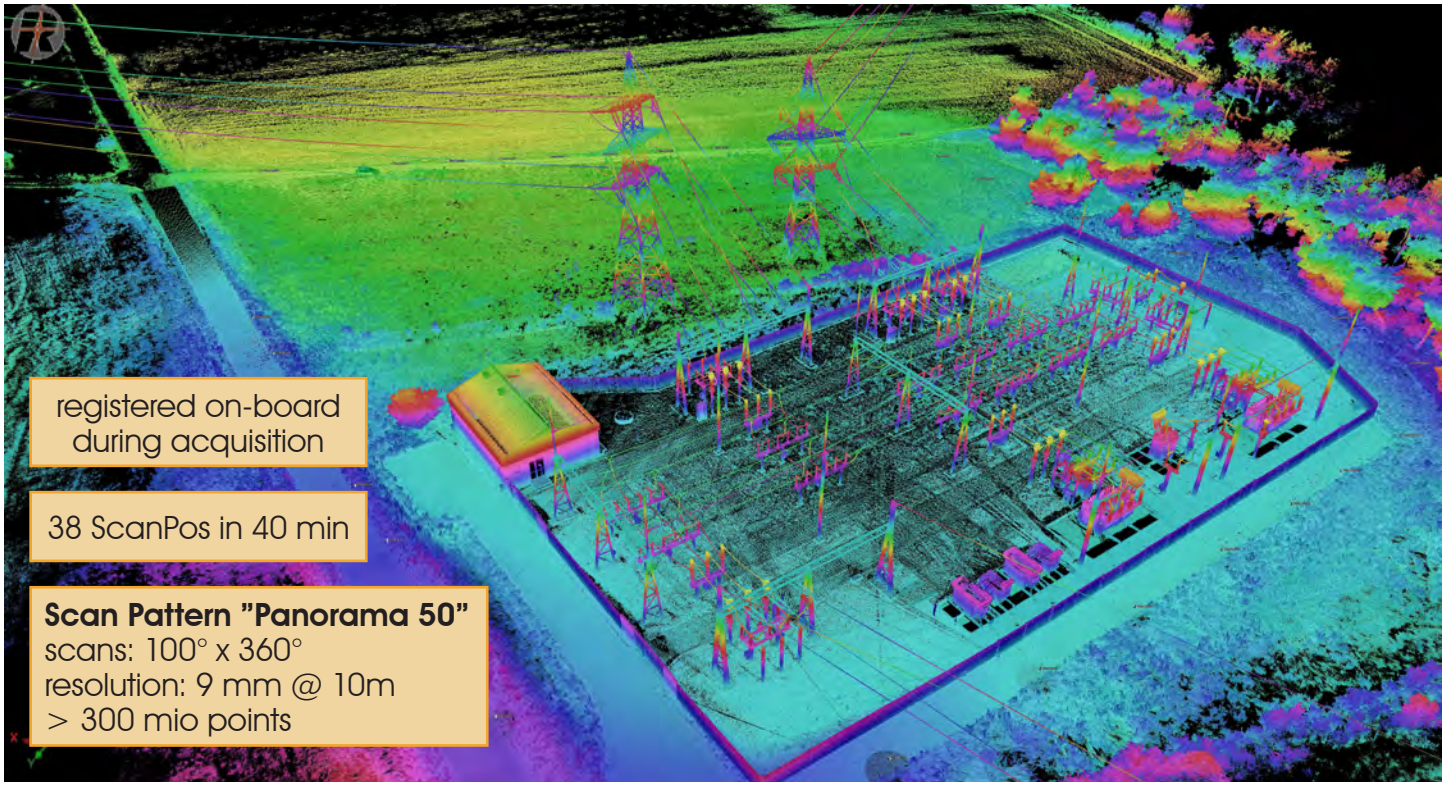
RIEGL Monitoring App Infosheet



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Automatic On-board Registration

Matching point clouds of different scan positions (registration) has always been one of the most time-consuming tasks during the post processing of 3D scanning projects.



Scan data of a power plant, height scaled with grayscale overlay based on reflection

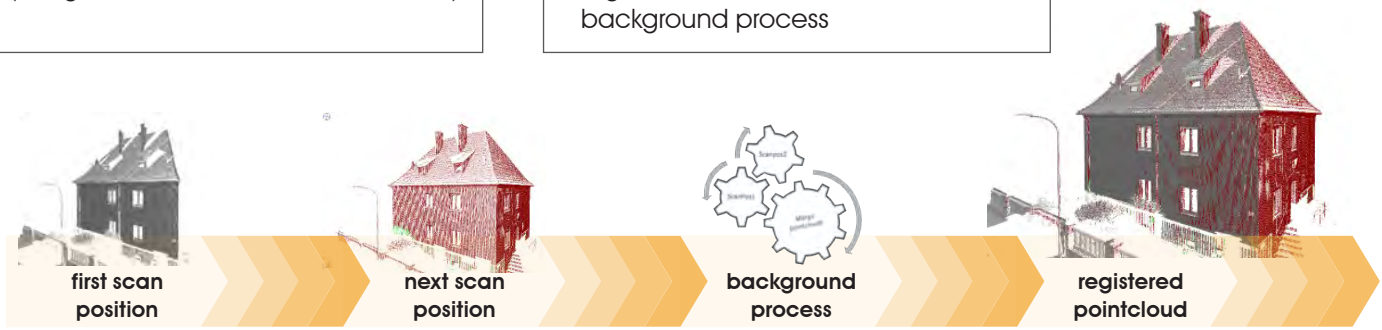
With two processors on-board, the *RIEGL* VZ-400i is able to perform different processes in real-time such as automatic on-board registration in parallel to the scan data acquisition.

Processor 1

- scan data acquisition
- simultanous acquisition of photographs during scanning
- pose estimation (using GNSS/IMU/environment sensors)

Processor 2

- conversion of scan data into *RIEGL* data base
- on-board multiple time around resolution
- registration of scan data as a background process



RIEGL RiSCAN PRO / RiSOLVE Software

RiSCAN PRO / RiSOLVE allows a fully automatic registration and colorization of scan data. This stream-lined process enables an efficient and fast workflow to acquire, register and colorize 3D scan data. With additional tools for filtering, scene animation and measurements, a rapid turnaround of critical information is realized.

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Field Experience

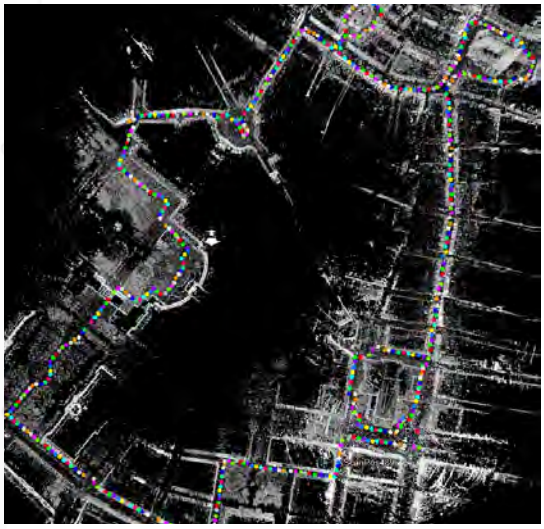
The VZ-400i's high performance scanning technology provides high pulse repetition rates and high line scan speeds as well as user-friendliness, enabling a significant reduction of the scanning time in the field.

1 operator → **8 hours** → **500+ scans**

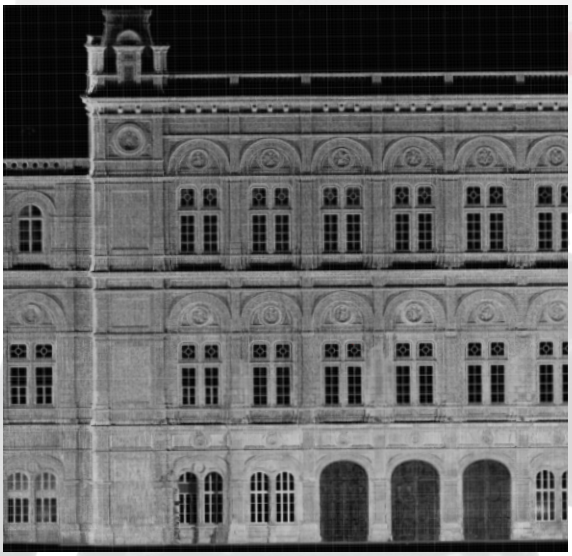
More than 500 scans (50 mdeg) of approx. 5 km of downtown streets with adjoining buildings have been taken by just one operator within 8 hours of full acquisiton time in the field. The mission was executed during night, the data of the whole scene was acquired by taking individual scan positions with approx. 10 m distance in between.



RIEGL VZ-400i night scan



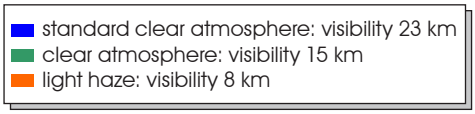
overview of scan positions (colored dots)



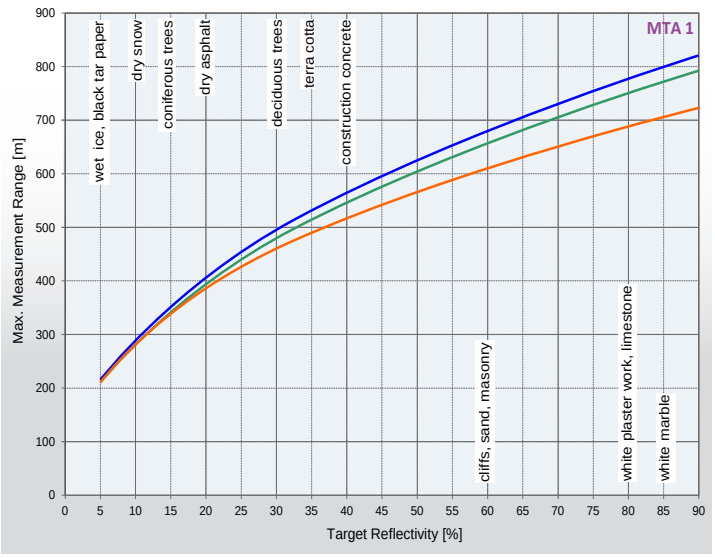


scan data detail, reflectance-scaled

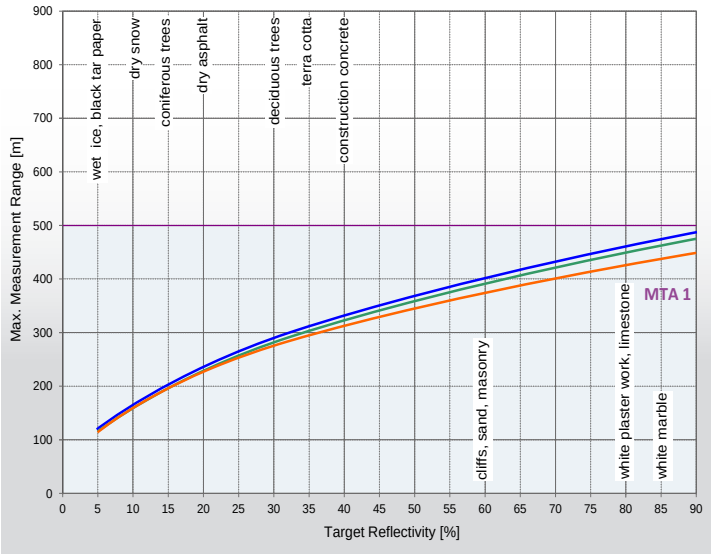
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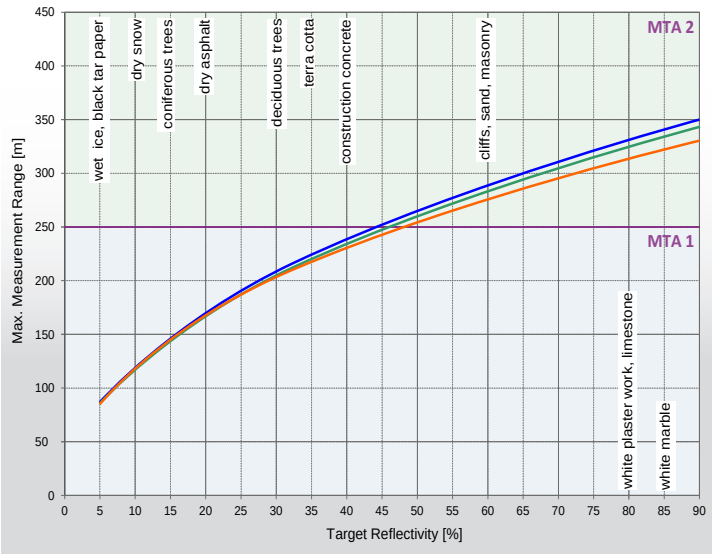
100 kHz Laser Pulse Repetition Rate



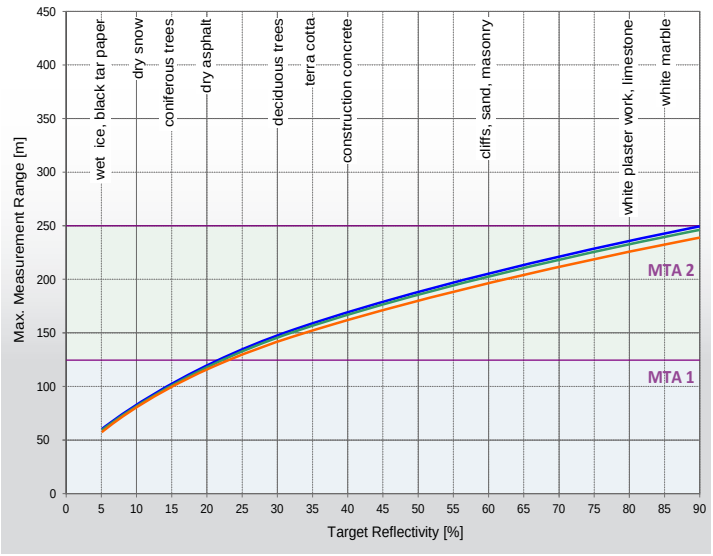
300 kHz Laser Pulse Repetition Rate



600 kHz Laser Pulse Repetition Rate



1200 kHz Laser Pulse Repetition Rate



The following conditions are assumed:

- flat target larger than the footprint of the laser beam
- perpendicular angle of incidence
- average brightness
- ambiguity resolved by post processing within RiSCAN PRO

MTA** (Multiple Time Around) **zones:

MTA 1: no ambiguity / 1 pulse „in the air"
MTA 2: 2 pulses „in the air"

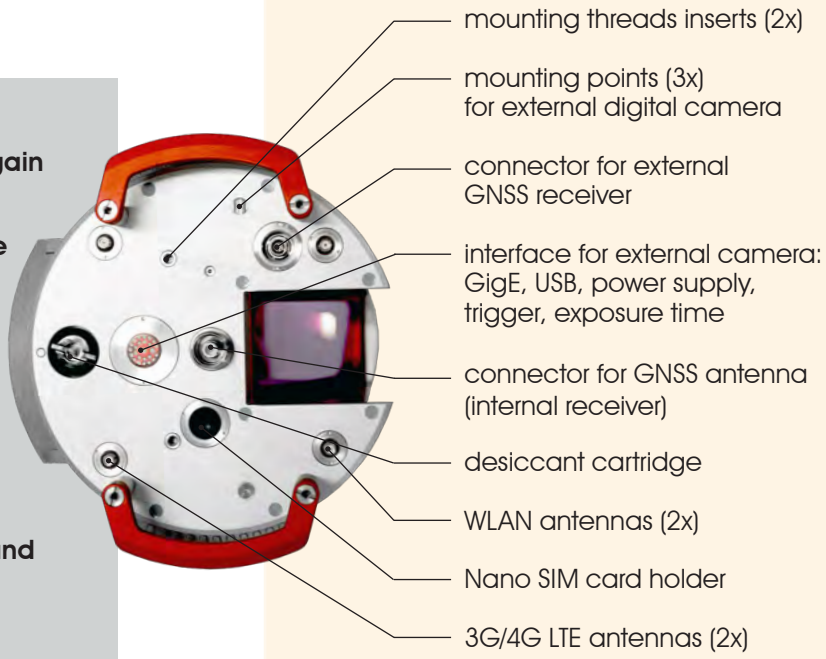
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All dimensions in mm.

Communication and Interfaces

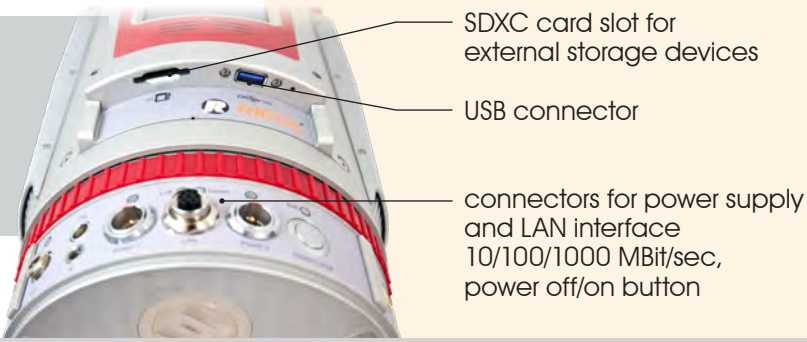
- **LAN port 10/100/1000 MBit/sec**
- **integrated WLAN interface[1] with high-gain MIMO antennas**
- **integrated multi-mode cellular module available for different regions[2] with MIMO 3G/4G LTE antennas**
- **GigE and USB for connecting an external digital camera**
- **connector for GNSS antenna**
- **two external power supply ports**
- **connector for external GNSS receiver and synchronization (1PPS)**
- **Bluetooth connection to GNSS receiver**



1) could be deactivated at the factory due to country-specific regulations
2) available for North America, Europe/APAC, Japan, or South America/APAC

Scan Data Storage

- **internal 1 TB SSD (Solid State Disc)**
  900 GB useable
- **external storage devices**
  (SDXC cards up to 512 GBytes or USB flash drives)



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Technical Data *RIEGL* VZ®-400i

Laser Product Classification	Class 1 Laser Product according to IEC 60825-1:2014 The following clause applies for instruments delivered into the United States: Complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed.3., as described in Laser Notice No. 56, dated May 8, 2019.



Range Measurement Performance [1]

Measuring Principle / Mode of Operation: time of flight measurement, echo signal digitization, online waveform processing, multiple-time-around processing, full waveform export capability (optional) / single pulse ranging

Laser Pulse Repetition Rate PRR (peak) [2] [3]	100 kHz	300 kHz	600 kHz	1200 kHz
Effective Measurement Rate (meas./sec) [2]	42,000	125,000	250,000	500,000
Max. Measurement Range [4]				
natural targets ρ ≥ 90 %	800 m	480 m	350 m	250 m
natural targets ρ ≥ 20 %	400 m	230 m	160 m	120 m
Minimum Range	1.5 m	1.2 m	0.5 m [5]	0.5 m [5]
Max. Number of Targets per Pulse [6]	15	15	8	4

Ranging Accuracy [7] [9]	5 mm
Ranging Precision [8] [9]	3 mm
3D Position Accuracy [10]	3 mm @ 50 m, 5 mm @ 100 m
Laser Wavelength	near infrared
Laser Beam Divergence	0.25 mrad @ 1/e [11], 0.35 mrad @ 1/e² [12]

1) With online waveform processing.
2) Rounded values.
3) In order to minimize multiple-time-around issues it is crucial to carefully select the laser pulse repetition rate according to the application in question.
4) 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.
5) Minimum range specified for vertical zenith angles from 30 deg to 120 deg, resp. 90° vertical field of view.
6) If more than one target is hit, the total laser transmitter power is split and, accordingly, the achieveable range is reduced.
7) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
8) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.
9) 1 sigma @ 100 m range under *RIEGL* test conditions.
10) 1-sigma value, based on target modelling, under *RIEGL* test conditions.
11) Measured at the 1/e points. 0.25 mrad corresponds to an increase of 25 mm of beam diameter per 100 m distance.
12) Measured at the 1/e² points. 0.35 mrad corresponds to an increase of 35 mm of beam diameter per 100 m distance.

Scanner Performance

	Vertical (Line) Scan	*Horizontal (Frame) Scan*
Scan Angle Range	total 100° (+60° / -40°)	max. 360°
Scanning Mechanism	rotating multi-facet mirror	rotating head
Scan Speed	3 lines/sec to 240 lines/sec	0°/sec to 150°/sec [13]
Angular Step Width [14] Δ ϑ (vertical), Δ φ (horizontal)	0.0007° ≤ Δ ϑ ≤ 0.6° between consecutive laser shots	0.0015° ≤ Δ φ ≤ 0.62° between consecutive scan lines
Angular Accuracy [15]	0.0028° (10 arcsec)	0.0028° (10 arcsec)
Angle Measurement Resolution	better 0.0007° (2.5 arcsec)	better 0.0005° (1.8 arcsec)

Orientation Sensors	integrated 3-axis accelerometer, 3-axis gyroscope, 3-axis magnetometer (compass), barometer
GNSS Receiver	integrated L1, concurrent reception of GPS, GLONASS, Beidou
Laser Plummet	integrated
Internal Sync Timer	integrated, for real-time synchronized time stamping of scan data
Scan Sync (optional)	scanner rotation synchronization for operating several scanners
Waveform Data Output (optional)	providing digitized echo signal information for specific target echoes
Cloud Storage	Amazon S3, FTP-Server, Microsoft Azure
Automatic On-board Registration	automatic scan data registration as background process

13) Frame scan can be disabled, providing 2D scanner operation.
14) Selectable.
15) 1-sigma value, based on target modelling, under *RIEGL* test conditions.

General Technical Data

Power Supply Input Voltage / Consumption	11 - 34 V DC / typ. 65 W (max. 83 W)
External Power Supply	up to two independent external power sources can be connected simultaneously for uninterrupted operation, in addition to the *RIEGL* Add-On Li-Ion battery RBLI 2900
Main Dimensions (width x height)	206 mm x 346 mm
Weight	approx. 9.7 kg (with antennas)
Humidity	max. 80 % non condensing @ +31 °C
Protection Class	IP64, dust-tight and splash-proof
Temperature Range	
Storage	-10 °C up to +50 °C
Operation	0 °C up to +40 °C: standard operation
Low Temperature Operation [16]	-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

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

RIEGL® LASER MEASUREMENT SYSTEMS

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RIEGL USA Inc., *Headquarters North America*

RIEGL Japan Ltd.
RIEGL China Ltd.
RIEGL Australia Pty Ltd.
RIEGL Canada Inc.

RIEGL Asia Pacific Ltd.
RIEGL South America SpA
RIEGL Deutschland Vertriebsgesellschaft mbH
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Contact us

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LASER MEASUREMENT SYSTEMS



RIEGL VZ-400i

QUICK START GUIDE

QUICK START GUIDE
RIEGL VZ-400i





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1. INTRODUCING *RIEGL* VZ-400i

The *RIEGL* VZ-400i is – first of all – a state-of-the-art laser scanner based on time-of-flight ranging with short infrared laser pulses. It provides highly accurate point clouds at an incredible measurement speed also over long ranges if need be. For each emitted laser pulse, there can be up to several so-called echo returns giving rise to a point of a point cloud. Each of these carries additional information like an estimate of the target's reflectivity, an amplitude giving the strength of the optical echo signal detected by the instrument and much more.[1]



1.1. Much more than just a laser scanner

However, your *RIEGL* VZ-400i is much more than just a laser scanner. It incorporates additional sensors and supports the use of sensors like calibrated cameras, it has a vast internal storage, an impressive computational power, an intuitive user interface and a very broad range of additional communication interfaces – both wired and wireless – to connect the *RIEGL* VZ-400i with the outside world.

As the *RIEGL* VZ-400i is much more than just a laser scanner it is justified to see it as a laser scanner system for terrestrial laser scanning, or – just another wording – a terrestrial LiDAR system. By the way, by just adding a higher-grade integrated IMU GNSS system, it also is a kinematic LiDAR system providing data in mobile laser scanning.

In the following Quick Start Guide we want to outline the considerations and preparations for carrying out standard surveying tasks, and also give a few hints on how to tackle more tricky tasks. Please note, that the present Quick Start Guide does not intend to replace the comprehensive user manual: in the Quick Start Guide we merely try to define the strategic decisions for optimally setting up your scan project with your *RIEGL* VZ-400i. This comprises environmental factors as well as technical configuration. The good news is: you do not have to be an expert on all these topics. The *RIEGL* VZ-400i will guide you through scan data acquisition, make sure all additional measurements are carried out correctly and additional data are acquired and stored internally in order to be well prepared for the essential step of registering the data.

We also invite you to initially explore the graphical user interface of the *RIEGL* VZ-400i. This user interface provides all the features to operate and configure your LiDAR system in the field. You do not need any tablet or laptop computer to achieve this task. So, most of the time you just need the *RIEGL* VZ-400i, a power supply, and a tripod in the field. After you finished data acquisition you will usually transfer the data onto a computer for further processing.

[1]The key characteristics of *RIEGL*'s waveform processing LiDAR technique briefly mentioned here are presented in more detail in the comprehensive operation guide: *RIEGL* VZ-400i User Manual. See section: General Description […]: Distance Measurement.

2. SAFETY
RIEGL VZ-400i



2.1. General Warnings & Instruction

General:

- Always follow basic safety precautions when operating this instrument to reduce risk of personal injury and to prevent damage to the instrument and any products connected to it. To avoid potential hazards, use this product only as specified.
- Observe all warnings and instructions marked on the product.
- Refer all servicing to qualified service personnel.
- Do not operate with suspected defects or obvious mechanical damage. If you suspect there is damage to this product, have it inspected by qualified personnel.
- In addition to the following safety instructions, specific Warnings, Hints and Notes appear throughout this document where they apply and may be not included in the summary below.
- For personal safety and in order to avoid permanent damage of the instrument, we kindly request you to carefully work through this document and also the Safety Warnings and Cautions concerning accessories before operating the instrument.

Personal Safety:

- The instrument must never be connected to 110, 230 or 400 VAC. Opening the instrument is dangerous due to the high voltages, and must therefore be avoided at all costs.
- To prevent injuries or accidents, keep the instrument out of the reach of children. The rubber fittings or parts thereof, as well as other small parts of the equipment, could be swallowed causing severe injuries.
- Never push objects of any kind (e.g. needles) into connectors or sockets.
- Be sure to use only the accessories supplied, or accessories recommended by *RIEGL LMS*, otherwise fire, electric shock, damage or even personal injury may result.
- To prevent electric shock and damage, do not plug in, connect or handle with wet hands.
- If glass is broken, handle with care.
- Be careful to keep your fingers and hands clear of the moving parts of the instrument, especially when using the scanner with the optional mount for manual tilt.
- To prevent personal injury and damage of the instrument please note: Due to the weight of some *RIEGL* scanners only persons in good physical condition may lift and carry the instrument for mounting and transportation.

2.1. General Warnings & Instruction



Risks of Packaging Materials:

- Warning: in order to avoid the danger of suffocation, keep plastic foils, bags and bubble wraps away from babies and children. Do not use them in or near children's bed, push chairs or playpens. Packaging materials are not a toy, so please tie them up before disposing of them.

Environment and Maintenance:

- Keep product surfaces clean and dry, always unplug the instrument before cleaning.
- Please note the hints provided for maintenance and care of the product.
- The instrument contains sensitive optical, electrical and mechanical components and thus requires appropriate handling. Protect the instrument against high humidity, direct sunlight as well as high and extremely low temperature. Please note the details given about the instrument in this document.
- Note the special temperature ranges for operation and storage of the instrument given in the appropriate chapter of this document. Storage and operation outside the specified temperature ranges may cause wrong measurement results or even damage the instrument.
- If the device is brought from a cold environment into a warmer installation site, bedewing can occur. Wait until the instrument is temperature-balanced and completely dry before you operate it.
- Do not place any liquids on or next to the instrument.
- Do not use the instrument where there may be a concentration of flammable or explosive gases, as it may cause a fire or explosion.
- Do not expose the instrument or its components (including electrical cables and accessories) to radioactive radiation. This can completely degrade or even destroy the highly sensitive electronics and electro-optical components. Furthermore, it is practically impossible to decontaminate the



equipment after exposure to radioactive radiation.

Mounting:

- The instrument must never be connected to 110, 230 or 400 VAC. Opening the instrument is dangerous due to the high voltages, and must therefore be avoided at all costs.
- To prevent damage, do not drop the instrument or subject it to severe shock or vibration. Ensure that the instrument is securely placed or properly mounted to avoid potential hazards.
- Install the instrument in a way that no one can step on or trip over the cables. If necessary, provide a suitable cable duct.
- Do not modify, bend forcibly, pull strongly, scratch etc. or otherwise alter the cables. Additionally, do not place heavy objects on the cables, or place them close to a heat source as it may result in a fire or electric shock.
- Do not use force when mounting the instrument. Never use rough tools such as a hammer or chisel, even if the fitting is not good.
- Allow adequate ventilation around the instrument, so that heat can properly dissipate.
- The moving part (scanner head) of the instrument must not be turned manually, otherwise the internal gears will be damaged.
- When mounting the instrument outside of or within the cabin of vehicles like cars, aircrafts, etc., all applicable safety regulations for mounting (e.g. emergency landing conditions for aircrafts) have to be obeyed by the system integrator. These regulations serve to avoid personal injury by an accidentally unfixed, loosened instrument, broken mounting parts etc. under normal operating conditions as well as for situations with exceptional mechanical stress (crashes).

Measurement:

- Measurement of very hot targets: *RIEGL* laser measurement instruments not expressly specified for high temperature (HT-) applications MUST NOT

2.1. General Warnings & Instruction



be used for measuring extended targets with a surface temperature higher than +600°C. Failure to comply with this instruction may result in damage or even in destruction of the highly sensitive components.

A glass reflector prism must be at least 200 meters away from the laser scanner (even for an overview scan).

Please note the instrument-specific information in the Technical Data part of the manual.

Verification of Measurement Quality:

- We strongly recommend that you check the quality of the acquired data on a regular basis. Especially before starting an extensive data acquisition campaign. This check can be carried out by, for example, registering a scan position by means of scanning a number (e.g. 8) of flat retro-reflecting targets at different distances and at angles covering a range of more than 180 deg horizontally, which have also been surveyed by a highly accurate total station. The check is passed if the residual error is less than the instrument's specified accuracy.

Transportation:

- Transportation of the scanner has to be carried out as follows:
  a. by persons or in car: inside the original heavy-duty carrying case
  b. by truck or by airplane: inside the original heavy-duty carrying case, which itself is then shock-absorbing packed into a transportation cardboard box, exactly as the instrument was originally shipped to the customer.

Laser Safety:

- Please note the relevant instructions concerning laser safety in the chapter LASER SAFETY of the Technical Data part of the manual.
- Laser radiation inside the instrument may exceed the permissible emission limits of the specified laser class,

thus never open the housing. Do not operate instruments which are evidently damaged.

- Furthermore, we recommend that the instrument is not directly aimed at people's eyes, especially if they are using binoculars. Aligning the laser instrument with infrared cameras or night vision devices may result in damage of these devices.
- Do not look into the transmitter aperture.

Electromagnetic Compatibility:

- For electromagnetic compatibility, please note the information about the instrument in the chapter ELECTROMAGNETIC COMPATIBILITY of the Technical Data part of the manual.

Batteries:

- To prevent leakage, fire or damage, please read the appropriate instructions.
- Do not heat or throw the batteries into a fire.
- Do not install them with inverted polarity.
- Do not store them in humid places as they may corrode.
- Do not use if there is leaking, swelling, a rise in temperature, or any other abnormal condition.
- If there is a leak and the liquid gets into your eyes, do not rub them. Rinse with clean water, then seek medical attention immediately. If the liquid gets in contact with your skin or clothes, rinse with clean water.
- Do not let metal objects touch the battery contacts. This may cause a short circuit.



Disposal:

When your *RIEGL* instrument finally reaches the end of its life-cycle, please take care for proper disposal according to Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE).

RIEGL is prepared to take back waste *RIEGL* instruments and their accessories free of charge in the production plant at Horn for proper treatment in compliance with the objectives of the WEEE.

3. UNBOXING *RIEGL* VZ-400i

When unboxing the 3D Laser Scanner *RIEGL* VZ-400i ordered with the Scanner Basic Configuration Package you will find:



Scanner Carrying Case for
RIEGL VZ-i Series
(not included into the Scanner Basic Configuration Package)
HW-VZXX-05-008-00

For details, please look up its key components in the User Manual – General Description. If you want to order additional equipment, please contact:
sales@riegl.com

3.1. *RIEGL* VZ-400i at delivery

1. 3D Laser Scanner *RIEGL* VZ-400i
   Part-No. HW-VZ400-01-000-01
2. Add-On Rechargeable Battery RBLI 2900 (optional)
   Part-No. HW-VZXX-04-005-00
3. *RIEGL* VZ-i GNSS RTK antenna
   Part-No. HW-VZI-06-000-00
4. WLAN Antenna for VZ-i Series
   Part-No. HW-VZI-06-001-00
5. GSM Antenna VZ-i Series 4G (short)
   Part-No. HW-VZI-06-002-00
6. GSM Antenna VZ-i Series 4G (long)
   Part-No. HW-VZ400i-06-002-00
7. GPS Antenna for VZ-XXX
   Part-No. HW-VZ400-06-000-00
8. Retroreflectors – 100 pcs, white, diameter 50 mm
   Part-No. HW-GP-06-002-00
9. USB Debug Cable for VUX and VZ-i Series, 1.5 m
   Part-No. HW-VUX-03-000-00
10. AC Power Supply Unit for VZ-i Series
    Part-No. HW-VZXX-04-000-00
11. LAN cable M12-M12, 3 m
    Part-No. HW-GP-03-000-00
    LAN cable M12-RJ45, 0.3 m
    Part-No. HW-GP-03-002-00
12. Rechargeable NiMH Battery for External Power Supply (optional)
    Part-No. HW-GP-04-000-0
13. Set of Protection Caps for VZ-i Series instruments
    Part-No. HW-VZXX-06-065-00
14. a) User Manual (in English language)
    b) Quick Start Guide (in English language)
    Part-No. ST-VZ400I-06-000-00
15. RiSCAN PRO Viewer, Acquisition & Processing Software
    Part-No. SW-GP-07-000-00
16. License RiSCAN PRO Plugin RiMTA TLS Module
    Part-No. SW-GP-02-040-00
17. Cover plate to protect interface for external camera
    We recommend using the cover plate when no external camera is used.
    Part-No. HW-VZXX-06-064-00

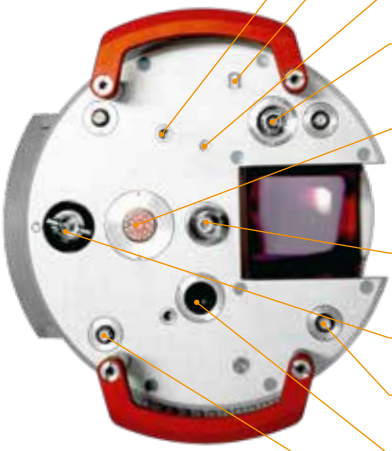




4. INTERFACES *RIEGL* VZ-400i



4.1. Additional Sensors and Storage Devices



mounting threads inserts (2x)

mounting points (3x)
for external digital camera

nitrogen valve

connector for external
GNSS receiver

interface for external camera:
GigE, USB, power supply, trigger,
exposure time

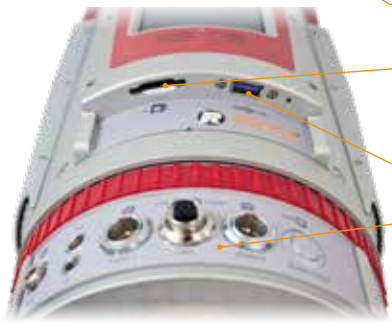
connector for GNSS antenna
(internal receiver)

desiccant cartridge

WLAN antennas (2x)

Nano SIM card holder

3G/4G LTE antennas (2x)



SDXC card slot for
external storage devices

USB 3.0 connector

connectors for power supply
and LAN interface
10/100/1000 MBit/sec,
power on/off button



Please protect unused interfaces from dirt and water by using the protective caps supplied.

5. SCANNING MISSION *RIEGL VZ-400i*



Carrying out a laser-scanning project successfully takes at least these steps:

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5.2.2. Automatic Registration - Example 22
5.2.3. Automatic Registration 24
5.2.4. Image Acquisition 26
5.2.5. Scanning Parameters 28

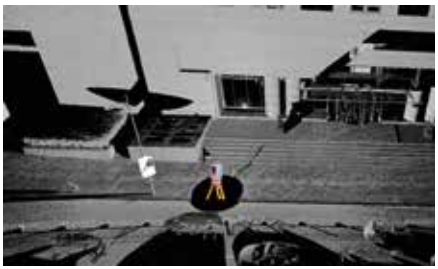
5.3. Setup & Data Acquisition [in the field] 30

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5.4.1. Transfer Data from Scanner to Computuer 38
5.4.2. Register Scan Data in Coordinate System 42
5.4.3. Post-Processing Software 44

5.1. Project Planning

In the planning phase, you will take into account the specification of the *RIEGL* VZ-400i, the requirements on the final data product stated by your client, and of course the specifics of the object or the site you have to deliver data on. You will find a project planning checklist in the following chapter. Already at this early planning stage you should consider how you intend to register all the scan data in the requested coordinate system. Whether the entire scanning site provides continuous good visibility of GNSS satellites or if you have to take data also in GNSS-denied areas with no immediate information on your scan positions will impact your acquisition strategy. In the first case, you can rely on an automatic registration process in almost all projects, whereas in the second case you should additionally scan some marked (e.g. retro-reflective) targets (with or without coordinates known in the target coordinate system). In whatever way you intend to register the data, make sure that the data is acquired with sufficient redundancy or, in other words, with overlap. Only overlapping data can be registered. This you have to ensure by proper planning and careful execution of data acquisition. Another reason for acquiring data with overlap is to reduce so-called scan shadows. Every opaque object casts a shadow of the measuring laser light into the scene. The resulting data gaps may be filled in by scan data acquired from a different position. Thus, there is a trade-off between the number of scan positions and the amount of tolerable scan shadows. It is your task in the project planning phase to find a satisfying compromise between acquisition time (number of scan positions) and residual scan shadows. Additionally, you should follow some rules of thumb to estimate a reasonable and practicable overlap for automatic registration of scan data (see chapter 5.2. Scan Preparations – 5.2.2. Automatic Registration.).



Every opaque object casts a scan shadow



Acquire data with overlap to reduce scan shadows

5.1. Project Planning



Location

- ☐ Address (kml-file*)
- ☐ Accessibility
- ☐ Contact person (mobile number,...)
- ☐ Dimension of the project (per m^2)
- ☐ Permission for scanning & photographing
- ☐ Possibility to charge batteries
- ☐ Internet access (WLAN, password)

Requirements

- ☐ Project description and requirements of your client
- ☐ Angular resolution
- ☐ Points per square meter
- ☐ True-color point cloud
- ☐ Exact geo-referencing
- ☐ Survey control points with total station and GNSS
- ☐ Fine scans of control points
- ☐ Required coordinate system for this project

*KML is a file format used to display geographic data in an Earth browser such as Google Earth. https://developers.google.com/kml/ (2017-07-12)

5.1.1. Checklist

When envisaging a new scan project, you may find it useful to consider the items of the following scan-mission checklist or establish your own checklist based on your experience and specific field of activity.

Calculation

- ☐ Number of scans
  (based on the given information about the location and data acquisition requirements)
- ☐ Total project time,
  e.g. 1 minute scanning time per scan position, 1 minute for photographs per scan position with some extra time
- ☐ Required rechargeable batteries,
  e.g. *RIEGL* Add-On RBNE 2210 lasts for about 4 hours
- ☐ Raw data
  (app. 50 GB in 1 hour)

Equipment

- ☐ Laser scanner
- ☐ Tripod
- ☐ Antennas
- ☐ Rechargeable batteries
- ☐ Charging units
- ☐ Cables
- ☐ Base station & tripod
- ☐ Reflectors
- ☐ Calibrated photo camera
- ☐ Storage media (USB, SD card, hard drive)
- ☐ Sim card
- ☐ Laptop for QA/QC already during acquisition

Tools for documentation:

- ☐ Paper
- ☐ Tablet
- ☐ Laptop
- ☐ Photo camera
- ☐ Video camera

5.2. Scan Preparations



OneTouch Workflow (default)

The OneTouch workflow (default) enables data acquisition in a project with as little user interaction as possible. Beside some initial pushing of buttons to define where to store the data and to verify the project name or to change it to your needs, the only "touch" is to start data acquisition as soon as the instrument is physically setup at a new scan position.

Each new project is automatically georeferenced by means of GNSS measurements. Pose estimation on each scan position is performed automatically. The scan pattern is fixed to a panoramic scan with 0.04 deg resolution ("Panorama 40") and 1200 kHz pulse repetition frequency to optimize scan time. Reflector search and scan are switched off. Image aquisition during scan is enabled.

After acquisition at a scan position is done, the *RIEGL* VZ-400i increments to the next scan position as soon as the instrument is physically moved.

We recommend this workflow for the fastest and safest data acquisition and data registering process, together with the *RIEGL*'s post-processing software RiSOLVE. It also allows individual customization of the workflow and scan parameters. This workflow is not only suited for the first commissioning of the *RIEGL* VZ-400i, it also can be used for the vast majority of projects.

OneTouch (registration) Workflow

The OneTouch (registration) workflow is equal to the OneTouch workflow. Moreover the on-board Automatic Registration is enabled.

5.2.1. Workflows

The RIEGL VZ-400i is shipped with the predefined workflows: OneTouch, OneTouch (registration), Forensic and Expert. These workflows cannot be altered, they can serve as a basis for customized workflows containing modified parameters. Such a number of personal workflows for recurring scanning situations or environments can be created and will enhance your project efficiency.

Forensic Workflow

The Forensic workflow is tailored for the specific needs to acquire scan data of crime scenes and accidents rapidly and with only a minimum of user interaction outdoors. This workflow is identical to the OneTouch workflow, the only difference is that the image acquisition has to be triggered manually by the operator (interactive mode).

Expert Workflow

The Expert workflow is intended for experienced users. It provides quite a high level of user interaction for defining the location of the project coordinate system and for defining the scan parameters. It does not search the scan data for retroreflective targets automatically, nor does it do a subsequent reflector scan. In case a camera is attached to the *RIEGL* VZ-400i and ready to use, images are taken automatically.

For detailed information, refer to (Operation Manual).

5.2. Scan Preparations



Standard Workflow

The *RIEGL* standard workflow consists of: "Automatic Registration" with subsequent „Multistation Adjustment".
This allows the user to generate the desired detailed report with all necessary statistical evaluations.

For a successful automatic registration please:

- always thread the scans „on a string of pearls". It is recommended (but not absolutely necessary) that control points are present during the first and last scan.

- start with relatively short distances between the scan positions (approximately the distance to the scanned object, e.g. 10 meters in the city area, smaller distances in very narrow corridors).
With increasing experience you can increase the distance a little, but:

- especially with bad GNSS reception, but also to the „last reserve": change the scanner within 20 seconds! The time at a scan position can be „arbitrarily" long.

- pay attention to overlapping scans (additional scans at house corners and passages)

- All 5-10 scan positions are recommended to use control points, *RIEGL* reflectors should only be mounted on flat surfaces and should be "fine scanned" from the front.

- RTK GNSS is recommended but not mandatory

- If the scanner has to be restarted (e.g. after changing the battery), please start again as exactly as possible at the last scan position.

- If you have scanned into a dead end, return to a central already known scan position and continue scanning from there. (then the possibly necessary „manual pushing" is much easier)

5.2.2. Automatic Registration - Example

Based on field experiences we developed a standard workflow for scan projects, which guarantees a high accurate automatic registration and a fast high resolution workflow.

• When scanning buildings: scan once around (closed loop), then if possible from outside (with GNSS information) through the building and then scan outside again.

• In order to achieve a reliable and high accuracy of the entire project: scan outside exclusively from a survey tripod, inside buildings also from lighter carbon tripods. (Attention: slow moving or sinking of the scanner cannot be detected!)

Thus, you can achieve about 40 scans per hour with the so-called "Panorama40" scan pattern, 7mm resolution @ 10m with simultaneous photos; the registration rate is almost 100% if upper rules are observed - independent of the GNSS reception. (Only the scans after the „dead ends" with insufficient GNSS information have to be positioned manually)

There are certainly other successful strategies, but the above one has been tested countless times.

5.2. Scan Preparations



Select your assumed project scenario

- **Automatic Selection:** The project scenario will be derived automatically from the first scan of your project.
- **Outdoor Non-Urban:** Especially suited for projects in open areas.
- **Outdoor Urban:** Especially suited for projects in urban environments.
- **Indoor Large:** Especially suited for projects in, e.g., large halls or cathedrals.
- **Indoor Small:** Especially suited for projects with scans taken in very confined spaces, e.g., small caves or narrow alleyways.
- **Mining Medium:** Especially suited for projects in large areas where each scan captures objects up to a range of 1000 m, like in large open pit mining sites.
- **Mining Large:** Especially suited for projects in very large areas where each scan captures objects up to a range of 2000 m, like in very large open pit mining sites.

Acquiring a single project covering various scenarios

In case a single project covers data acquisition in varying scenarios, e.g., indoors and outdoors, we recommend to set the scenario to the most prominent one. In case the automatic on-board registration fails, you have more and more flexible options to register your project within RiSCAN PRO and RiSOLVE afterwards.

Acquire data with sufficient overlap

Choose the distance between sequential scan positions in a way ensuring good overlap and similarity of the scan data acquired. Similarity of successive scans means that most data of the objects in the scene are similar but taken from a slightly different perspective. Similarity is governed by two parameters: the distance between successive scan positions and the distance of each scan position to the major objects you intend to take data of. As a rule of thumb, these two distances should be about equal.

5.2.3. Automatic Registration

Your RIEGL VZ-400i is able to register the scan positions directly on the scanner via the automatic on-board registration tool in near-real-time as a background process.

For example: in large open areas, the distance between scan positions may be as large as 30 m, whereas in confined areas like alley ways it has to be as low as 3 m.

Make use of GNSS, if available

GNSS information is not strictly required for the automatic registration process, but it supports the process as an "initial guess" of the scanners position. Additionally, GNSS derived position data allows you to continue your acquisition path (succession of scan positions) near to any previous scan position.

Registration in GNSS denied areas

Automatic registration is also possible in areas with no GNSS signals available, e.g. indoor, caves, tunnels (GNSS denied areas). However, extra care should be executed in choosing your acquisition path. Pay special attention to the hints above (acquire data with sufficient overlap). In case data have to be acquired indoors including more than one room, make sure to take a scan directly in each doorway acquiring a scan which gathers data in both rooms. Automatic registration in GNSS denied areas is especially supported by the results from the integrated IMU (IMU = internal measurement unit) providing the relative position and orientation of the new scan position with respect to the previous scan position. The accuracy of the IMU result depends critically on the time it takes you to move from one scan position to the next. It is thus recommended to move quickly (less than 25 seconds) and smoothly thus avoiding any abrupt movements or excessive rotations with the scanner.

5.2. Scan Preparations



Image Acquisition

Your VZ-i Scanner in combination with an external Nikon camera D610, D810, or D850 is able to capture images during scan. To enable this feature go to workflow manager >> image acquisition and set the mode to "During Scan – Auto or On"

It defines an enormous time saving workflow.
The HDR Image Acquisition is not recommended for this function.



5.2.4. Image Acquisition

The external camera system for your scanner allows different methods to achieve high quality images of your scan project. According to light conditions, scan speed and camera model you are able to decide between image acquisition during or after the scan process.

The exposure time is limited by the scan speed and the resolution. It will be clamped automatically in case of wrong selection.

Exposure time limits:

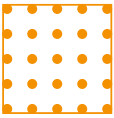
1200KHZ / SCAN RESOLUTION [MDEG]	Min. Exposure Time Nikon D850	Min. Exposure Time Nikon D810	Min. Exposure Time Nikon D610
10	1/15	1/13	1/13
20	1/60	1/50	1/40
30	1/125	1/100	1/100
40	1/250	1/125	1/160
50	1/400	1/320	1/250
60	1/400	1/400	1/320
80	1/640	1/500	1/400
100	1/800	1/640	1/500



5.2. Scan Preparations

Use Predefined Scan Pattern

The full field of view scan patterns are called by default "Panorama XX" where XX indicates the angular resolution (e.g. Panorama 50 means full field of view with an angular resolution of 50 mdeg).

PREDEFINED SCAN PATTERN	Panorama 20	Panorama 40	Panorama 50	Panorama 60	Panorama 80
Scan pattern (right): The beam divergence of 0,35 mrad is approx. equal to 20 mdeg.					
Scan resolution	**20 mdeg**	**40 mdeg**	**50 mdeg**	**60 mdeg**	**80 mdeg**
Scan time*	180 sec	45 sec	30 sec	25 sec	19 sec
Measurements**	90 Mio	22.5 Mio	14.4 Mio	10 Mio	5.6 Mio
Resolution @20m	7 mm	14 mm	17.5 mm	21 mm	28 mm
Resolution @50m	17 mm	34 mm	44 mm	52 mm	70 mm
Scan Positions 8h***	140	400	505	555	626
Scan resolution	High res		**Standard**		Low res

*) for Panorama (full field of view = 100 deg x 360 deg) scan @ 1200 kHz measurement program
**) for Panorama scan, approximately, in vegetation more multiple targets, with open sky less targets
***) approximately, no photographs, 20 - 25 seconds for moving the tripod to the next scan position

5.2.5. Scanning Parameters

You have to set the scanning parameters of the RIEGL VZ-400i according to your projects requirements in order to get a comprehensive dataset while at the same time minimizing acquisition time.

Measurement Speed

Measurement speed is more or less the same as the pulse repetition rate of the laser (PRR). This is the number of laser pulses emitted per second, ranging from 100 thousand per second (100 kHz) to 1.2 million per second (1200 kHz).

The lower the measurement speed, the further your instrument can measure. More precisely, when you lower the speed by a factor of 4, you can measure the same target from up to twice the distance.

LASER PULSE REPETITION RATE PRR (peak) [1) 2)]	100 kHz	300 kHz	600 kHz	1200 kHz
Effective Measurement Rate (meas./sec) [1)]	42,000	125,000	250,000	500,000
Max. Measurement Range [3)]				
natural targets ρ ≥ 90 %	800 m	480 m	350 m	250 m
natural targets ρ ≥ 20 %	400 m	230 m	160 m	120 m
Minimum Range	1.5 m	1.2 m	0.5 m [4)]	0.5 m [4)]
Max. Number of Targets per Pulse	15	15	8	4

www.riegl.com; datasheet *RIEGL* VZ-400i (PDF)

Please note: This manual is current at the time of its printing. Text and technical data contained herein is subject to change without notice. For updated product information you must refer to the latest datasheet in RIEGL's website.

1) Rounded values.
2) In order to minimize multiple-time-around issues it is crucial to carefully select the laser pulse repetition rate according to the application in question.
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) Minimum range specified for vertical zenith angles from 30° to 120°, resp. 90° vertical field of view.

5.3. Setup & Data Acquisition [in the field]



These steps lead you through the basic steps of data acquisition using the predefined "OneTouch" workflow.

1. Plug in **SIM card** and mount GSM Antenna, if needed.
2. Mount the **WLAN Antenna**, if needed.
3. Mount the Add-On **power supply**, if needed.
4. Mount integrated **GNSS receiver** with or without **camera** on the scanner. Make sure the camera is mounted stable. For exact mounting refer to RiSCAN PRO User Manual – chapter Mounting.



5. Set up the **tripod** in the field, make sure it is stable. Mount the **scanner** as high as possible to cover most of the scanned objects.



6. Connect the scanner with an **external power supply** via an original *RIEGL* power supply cable only. **Please note:** The DC power supply (e.g. mains supply or battery) must be selected in such a way that it matches the input supply settings, selected for operating the scanner, please see chapter "System Settings" in the Operation Guide. The power supply cable is to be connected to a suitable DC power supply with a **voltage within the range specified** in the user manual: Technical Data, chapter "Physical and Electrical Data".



7. Use the integrated **internal** memory or use an **external storage** (e.g. USB, SD-Card, PC)



Once on site you will set up the instrument typically on a tripod, power up your instrument and enter some initial information via the instruments user interface like the projects name and the storage location. To make sure the acquired data meets your high expectations, we will guide you step by step from setup to data acquisition.

8 Turn the scanner on.

9 Check the **status bar**:



Scanner temperature inside the housing

GNSS reception: position (3D) accuracy [m]

Power supply [V]: Add-On RBNE 2210, 11-34 V DC, NORCELL SK1218D, LiPo 4s, LiPo 6s, LiPo 8s, TRACER BP2607, TRACER BP2624 RBLI2900

Storage device, free memory [%], 1–2 % reserved for operating system

External camera on top

LAN e.g. 1 GBit/sec

WLAN AP = Access Point OR signal strength in [%], if set to Client mode

Mobile network

Laser emission

Meaning of the status color

Green: ready for use
Yellow: warning
Red: danger
Gray: not in use or no connection

5.3. Setup & Data Acquisition [in the field]



10



Press the **"Go!"** icon on the home screen.

11

Start Workflow:

- Choose **storage media**
- Select/define **project**
- Select **workflow**
  (e.g. "OneTouch" or "OneTouch (registration)"



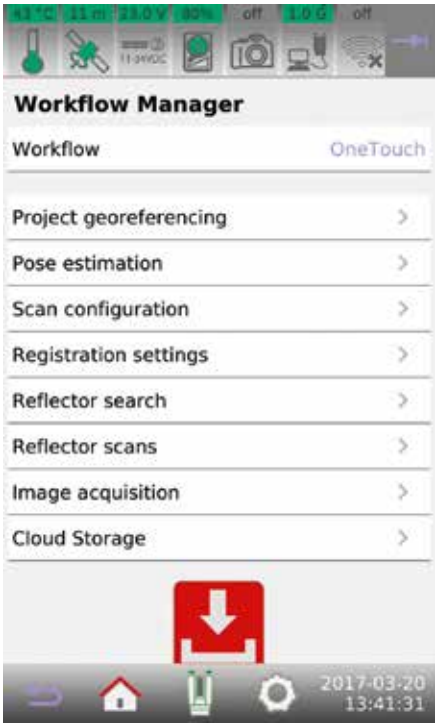


HINT: Workflow Manager

The workflow "OneTouch" is set by default. The used scan pattern is "Panorama 40", that means data acquisition with a scan resolution of 40 mdeg and the max. field of view of 360° x 100° delivers around 22.5 million points per scan position in about 45 seconds.

You can adjust the following settings:

- Project georeferencing
- Pose estimation
- **Scan configuration**
  (e.g. measurement program, scan pattern)
- **Registration settings**
- Reflector search
- Reflector scans
- Image acquisition
- Cloud storage



5.3. Setup & Data Acquisition [in the field]



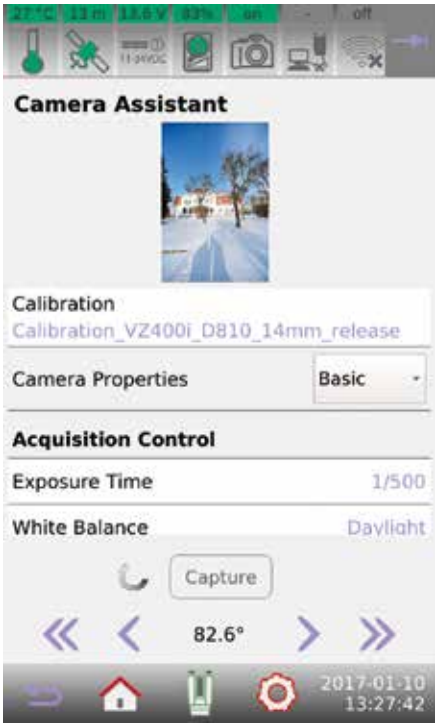
HINT: Automatic Registration

To register the scan positions in your scan project automatically during the scan data acquisition, enable the "Automatic Registration" in the Registration Settings of the Workflow Manager. Or use the workflow "OneTouch (registration)". **Please note:** If you enable the Automatic Registration during data acquisition, the next scan positions will be registered automatically. The previous scan position can be registered in RiSOLVE / RiSCAN PRO afterwards.

For detailed description and hints about data acquisition with automatic registration, please see chapter: 5.2. Scan Preparations – Automatic Registration.

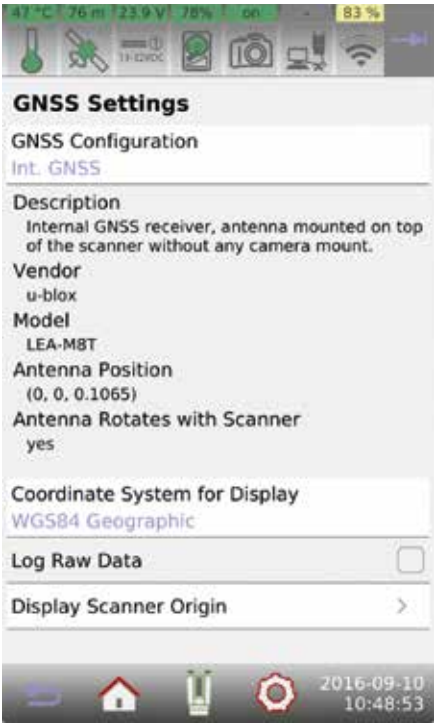
12

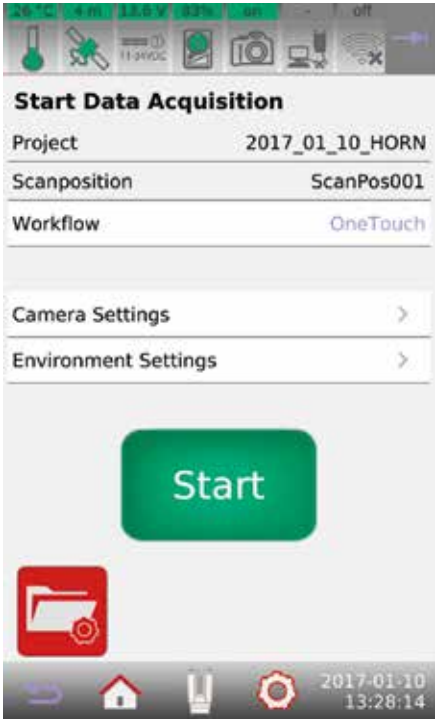
Press the **"Camera"** icon on the home screen. Use an appropriate exposure time, white balance and ISO number.



13 Press **„GNSS“** on the home screen. Define which GNSS receiver is used and the coordinate system. You can use also coordinate systems imported from the GeoSysManger database.

14 Push **“Start”** to start data acquisition progress.



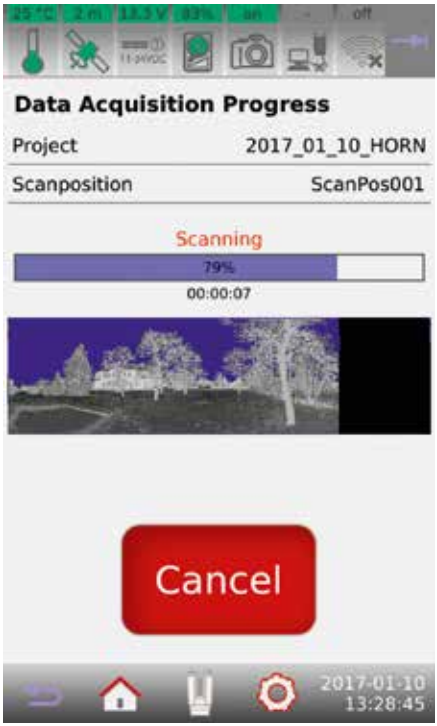


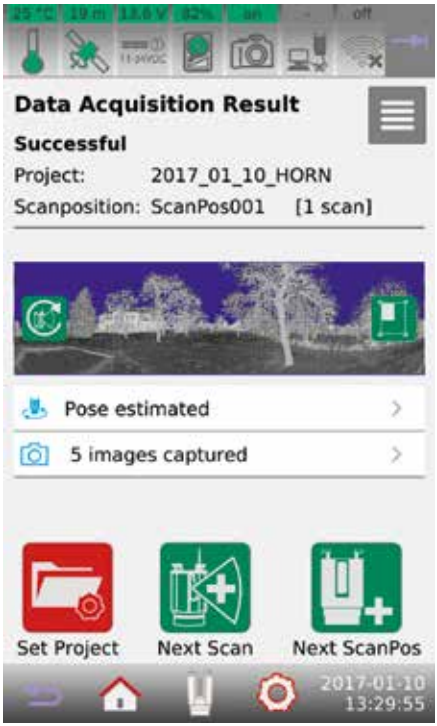
5.3. Setup & Data Acquisition [in the field]



15 The pose estimation, the scan acquisition, the image acquisition and the IMU Trajectory Estimation will be performed automatically. **Note: To obtain accurate point clouds, ensure that the scanner is not moved during this process.**

16 Check the **results**, if they satisfy your expectations or requirements. To reacquire the acquisition, push the button.





17 Make a **detail scan**, if desired. By pushing the icon , will lead you to the acquired scan, where you can make a rectangular selection. Push the icon to acquire that area in detail.



18 **Move the scanner to the next scan position.** The next scan position is automatically incremented, as soon as the scanner is moved to the next scan position, due to the tilt sensor of the scanner.

Please note: It is important to acquire data with overlap for an optimum registration process and to avoid scan shadows (refer to chapter 5.1. Project Planning and 5.2. Scan Preparations – 5.2.1. Workflows). It is also possible to continue on any previous scan position.

19 Repeat previous steps until you are finished.

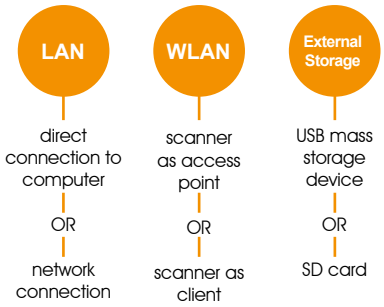
20 Shut down instrument by pressing the On/Off button for about 2 seconds.



5.4. Post-Processing [in the office]

LAN, WLAN or External Storage?

There are several options to transfer the scan data from the scanner to your computer: LAN, WLAN and external storage. There is also an option for cloud storage which uses either: 3G/4G LTE, LAN or WLAN (please refer to: Operation Guide)



Transmission Speed

One important parameter for your decision should be the transmission speed:

LAN local area network	up to 100 Mbyte/sec (1 Gbit/sec)
External Storage SD card, USB hard drive, USB flash drive	up to 50 Mbyte/sec
WLAN wireless LAN	up to 2.5 Mbyte/sec

Local Area Network (LAN)

1. Connect the scanner directly with your computer or to an existing company network via **LAN cable** included with delivery:



2. Press the **"Settings"** icon on the home screen of the scanner and go to **"Network Settings"** and **"LAN Settings".**



3. Depending on the connection, choose a mode provided from the scanner (static IP, DHCP Client, DHCP Server). See table on the right side:

5.4.1. Transfer Data from Scanner to Computer

When data acquisition is finished, the crucial part of post-processing has begun. Some standard tasks will be to copy the data from the scanner to your computer, import and post-process them in one of RIEGL's post-processing software.

LOCAL AREA NETWORK (LAN) – Modes

Direct Connection

VZ-i scanner with STATIC IP Address



static IP address **192.168.0.**129 by default

static IP address e.g. **192.168.0.**200

Configure both devices with a static IP address and check if the first three entries and the submask are the same. Access via computer's File Explorer: Enter scanner's **static IP address** e.g. **\\192.168.0.129**.

WARNING: Don't use the scanner's IP address **192.168.0.128.** because of IP address conflict!

VZ-i scanner as DHCP Server



DHCP server **192.168.0.129** by default

DHCP client

Access via computer's File Explorer: Enter scanner's **IP address** e.g. **\\192.168.0.129** or **serial number \\H222xxxx**

Network Connection

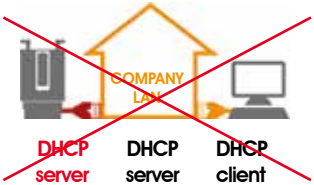
VZ-i scanner as DHCP Client



DHCP client **DHCP server** **DHCP client**

Access via computer's File Explorer: Enter scanner's **IP address (see LAN Settings on the scanner)** or **serial number \\H222xxxx**.

VZ-i Scanner as DHCP Server



DHCP server **DHCP server** **DHCP client**

WARNING: Don't connect the scanner into an existing company network, if it's configured as a **DHCP server**. This can cause serious problems within the LAN network and its connected devices, because only one DHCP server per network is allowed.



5.4. Post-Processing [in the office]

Wireless Area Network (WLAN)

For a WLAN connection the scanner offers two modes: scanner as Access Point or as Client.

If the scanner's mode is set to **"Access Point"**. The scanner establishes an access point and prodive a WLAN network other devices are able to connect to. The **name of the network** is the SSID setup in the WLAN Settings of the scanner, by default it is the serial number of the scanner, e.g. **H222xxxx**.

You can also connect the scanner as a **"Client"** to an existing WLAN network. Click on the name of the currently displayed WLAN network (SSID) to display all available networks in the vicinity and select the one you want to connect to. When prompted, enter the key to access the network.



WIRELESS AREA NETWORK (WLAN) – Modes

VZ-i scanner as Access Point



access point client

Connect the computer to the WLAN of the scanner (e.g. "H222xxxx") and access via computer's File Explorer: Enter scanner's **IP address,** e.g. **10.0.2.1** or scanner's **serial number** **H222xxxx.**

VZ-i scanner as Client



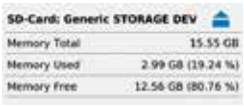
client server client

Access via computer's File Explorer: Enter scanner's **IP address, e.g.** **10.0.2.1** orscanner's **serial number** **H222xxxx**.

5.4.1. Transfer Data from Scanner to Computer

External Storage

1. Plug in your USB flash drive, external hard drive or SD card.
2. Choose "File Manager" on the app screen (second home screen)
3. Select your project folder in the "Source …" area
4. Press copy
5. Paste the folder in the "Destination …" area
6. Eject the external storage properly by tapping on the "storage device" icon in the status bar and pressing the eject button:



2



As soon as you have copied the data, you can import them in the post-processing software of your choice. For instructions, please see (User Manual: RiSCAN PRO, Quick User Guide: RiSOLVE & User Manual: RiMINING).



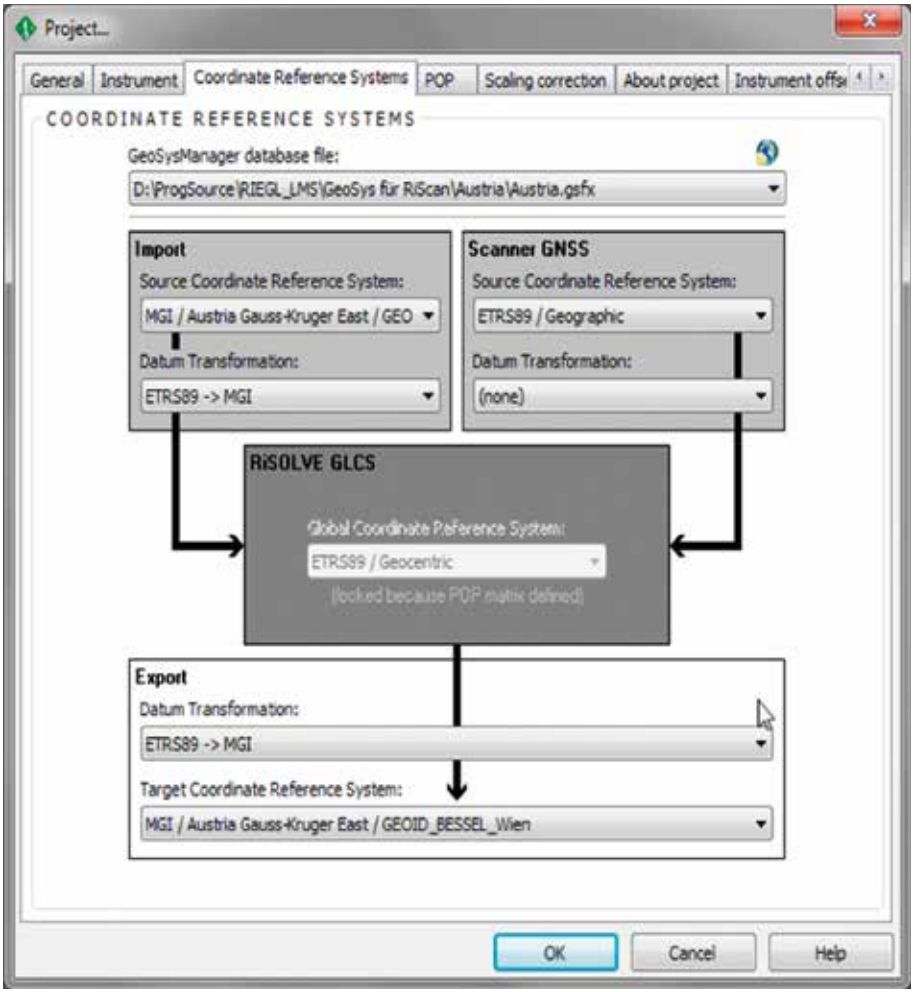
RIEGL's GeoSysManager

In *RIEGL* post-processing software this registration takes place in the so-called project coordinate system (PRCS). This is a Cartesian coordinate system with its axes pointing to east, north and zenith at its center. Please note that this is intentionally a Cartesian coordinate system without any scaling which one might consider to apply according to a map projection. Map projections are taken care of at least when exporting the scan data into any known coordinate reference system (CRS) or even into a CRS defined by you.
Map projections are handled by *RIEGL*'s GeoSysManager, which is an integral part of *RIEGL*'s post-processing software.

For more details, please consult the according documentation for the GeoSysManager.

5.4.2. Register Scan Data in Coordinate System

After importing the data in a project of your post-processing software the first and most essential task is to precisely register all your scan data into a single coordinate system.



GeoSysManager

5.4. Post-Processing [in the office]



RiSCAN PRO

RiSCAN PRO is a fully integrated solution for producing accurate and refined TLS point cloud data from your data acquired in the field. It offers advanced features for point cloud optimization, such as batch registration, 3D bundle adjustment, intelligent filtering tools, data merging, high-performance 3D and 4D visualization capabilities, and also features for meshing point clouds and for calculating volumes.

RiSCAN PRO, in contrast to RiSOLVE and RiMINING, also allows you to control your *RIEGL* VZ-400i during data acquisition while downloading and processing the acquired data immediately. This gives you the ability to apply quality assurance /quality control (QA/QC) directly already during acquisition. However, you have to be connected to your scanner via a high-band width connection, preferably via a wired Ethernet connection or via a fast WLAN connection.

One-Touch Processing Wizard

In order to follow the line of a simple One-Touch acquisition workflow also in the post processing software, it is possible to perform a complete processing chain from a first filtering, registration up to a combined point cloud including a RiPANO project automatically with the implemented One-Touch Processing Wizard in RiSCAN PRO.



RiSCAN PRO: One-Touch Processing Wizard

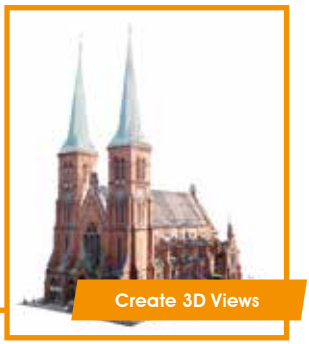
Each task can be selected or excluded from the chain, some can be edited before. This allows acquisition, processing and exporting large scan projects within a short time.

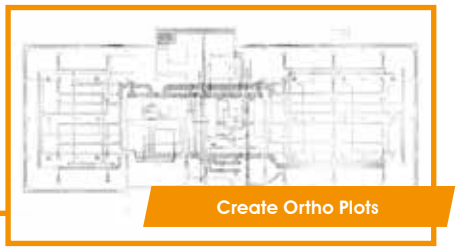
5.4.3. Post-Processing Software

RIEGL offers the following software products for post-processing your data acquired with your RIEGL VZ-400i: RiSCAN PRO, RiSOLVE and RiMINING. We want to give you a very brief overview on the features of these products.



1. **Task 1: Convert Scan**
   Convert raw RXP scan data into RDB 2
2. **Task 2: Filter Scans**
   Keep one echo per laser shot. Delete points with a Reflectance below -25.00 dB and above 5.00 dB. Delete points with a Pulse Shape Deviation above 15.
3. **Task 3: Register Scan Position**
   Register Scan Positions with Automatic Registration 2
4. **Task 4: Fine Adjust Project**
   Adjust Scan Positions with Multi Station Adjustment 2
5. **Task 5: Calibrate Camera Mounting**
   Calibrate Camera Mounting by using data from first 3 Scan Positions
6. **Task 6: Colorize Scan from Photos**
7. **Task 7: Generate Octree based Point Cloud**
   Generate combined point cloud (0.050m)
8. **Task 8: Create 3D Views**
   Create 3D view with combined point cloud
9. **Task 9: Create Ortho Plots**
   Create orthoplots as GeoTIFF images from the top
10. **Task 10: Export as RiPANO**
    Export a standalone RiPANO Web Viewer project
11. **Task 11: Export as LAS version 1.4**
12. **Task 12: Create Video Renderings**
    Create an .mpeg video along scan positions











RiSOLVE: Forensics



RiSOLVE: Crash Scene Investigation

RiSOLVE

RiSOLVE has, compared to RiSCAN PRO, a reduced feature set. However, it emphasizes an easy-to-use user interface, a fully automatic registration process, colorization of scan data, and preparing printouts of data (2D PDF generation). With additional tools for filtering, scene animation and measurements, RiSOLVE enables rapid turnaround of time critical information.

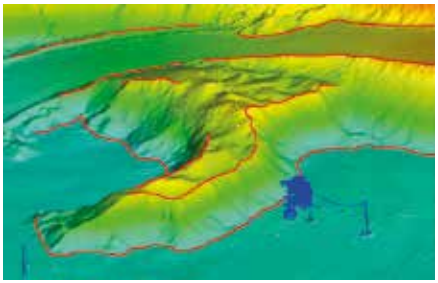


RiSOLVE: 2D PDF generation

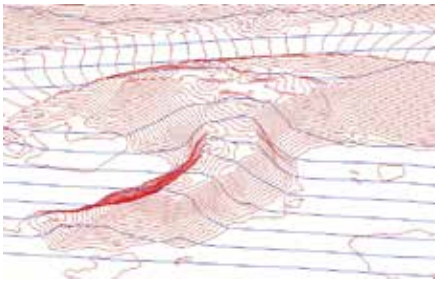


Intelligent filtering tools

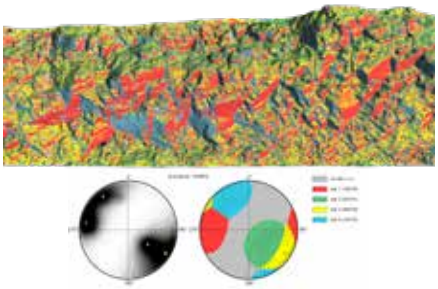
5.4.3. Post-Processing Software



Data Filtering and Classification, Breakline-Extraction, Surface Modelling



Feature Extraction



Classification Results from LIS GeoTec Tool

RiMINING

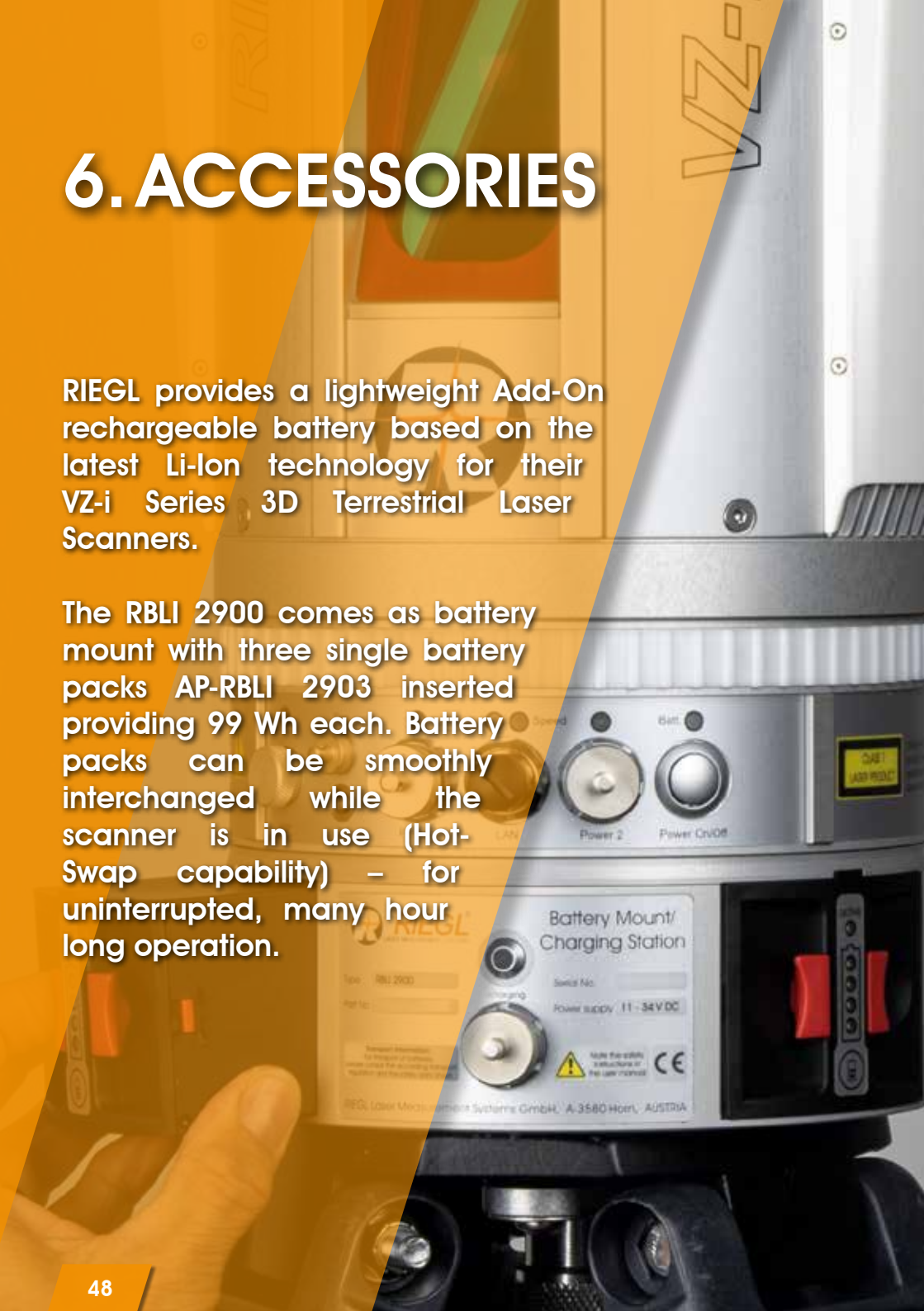
RiMINING is designed to optimize and simplify scan data processing in open-pit mining. The focus of the software design is on workflow simplification and automation. Automatic registration is accomplished utilizing state-of-the-art alignment algorithms in combination with the built-in sensors of the *RIEGL* VZ-400i. Advanced filtering algorithms enable automatic classification of ground points and allow thus elimination of vegetation, objects and outliers. Typical mining post-processing tasks like break line detection and volume calculation are fully supported. Extracted information can be utilized by mine planning software by exporting derived data in various mining exchange formats.

For more information, please see:
www.riegl.com

6. ACCESSORIES

RIEGL provides a lightweight Add-On rechargeable battery based on the latest Li-Ion technology for their VZ-i Series 3D Terrestrial Laser Scanners.

The RBLI 2900 comes as battery mount with three single battery packs AP-RBLI 2903 inserted providing 99 Wh each. Battery packs can be smoothly interchanged while the scanner is in use (Hot-Swap capability) – for uninterrupted, many hour long operation.



6.1. *RIEGL* Add On Battery

RIEGL Add-On Rechargeable Li-Ion Battery RBLI 2900 for RIEGL VZ-i Series 3D Terrestrial Laser Scanners

Capacity

With just one battery pack inserted, the RBLI 2900 provides enough power to run the scanner reliably for more than one and a half hour, with 3 up to 5 hours.

	1 battery pack	3 battery packs
VZ-400i (typ. scan @ 1200 kHz "Panorama 40")	typ. 1 h 40 min	typ. 5 h
VZ-2000i (typ. scan @ 50 kHz "long range")	typ. 1 h 35 min	typ. 4 h 45 min

Note: *The times given above are rough guidelines, as they depend on several factors such as ambient temperature, use of additionial equipment, to give examples.*

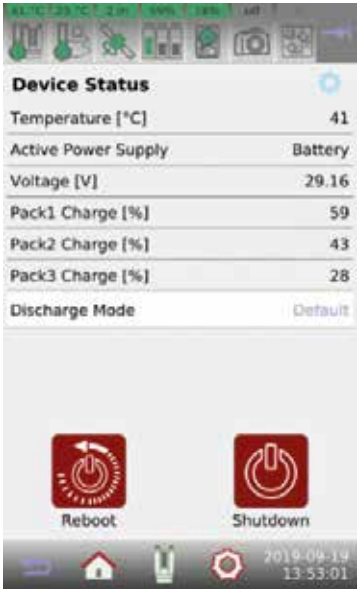
Charging

You can see the charging status of each single battery pack in the status bar of the graphical user interface. The order of the icons refers to the order when you look at the battery mount from the front view. By pressing the icon you can see now the device status and the charging info for each battery pack. The charging status can also be displayed on the battery pack itself by pressing the battery symbol – the leds indicates 25 % steps:



Display charging status on the battery pack

Note: *You can also use only one battery pack and remove the other two packs from the station e.g. for weight reasons. Empty battery dummies are available to protect the connection.*



Note: Please fully charge the AP-RBLI 2903 immediately after receipt!
Due to transport conditions and self-discharge, the battery may not be fully charged on receipt of delivery. E.g., for transport by air flight the battery may only be charged to 24%.

6.1. *RIEGL* Add On Battery



Storage – Keep the lifetime as long as possible during longer storage

As you may know, proper charging level during storage enables longer operational life for your battery. So, we would like to shortly remind owners of the new RBLI 2900 about the correct storage of the Battery Packs AP-RBLI 2903.
In order to keep the lifetime as long as possible, the level of charge of the Battery-Pack Li-Ion AP-RBLI 2903 should always be **over 40 % during longer storage periods (>14 days)**.

Due to the cell technology of Li-Ion cells, which have a self-discharge rate of between 5 % and 10 %, the battery's operational life can be impaired when storing an empty AP-RBLI 2903 (charging level <5 %) for a longer period.

To avoid self-discharge during storage of the AP-RBLI 2903:

- **remove** the AP-RBLI 2903 **packs from the Battery Mount/Charging Station** RBLI 2900 during a longer storage period
- and **fully charge them every 3 months**

When charging the AP-RBLI 2903 after deep discharging, the blue LED indicates charging with blinking 2 times every 2 sec.

The environmental temperature during storage must be between -10°C and +30°C. **The optimal (storage) temperature is below +25°C**, because low temperatures keep the self-discharge rate low.

Discharge Battery

For safe storage reasons there are different possible modes to discharge the battery:

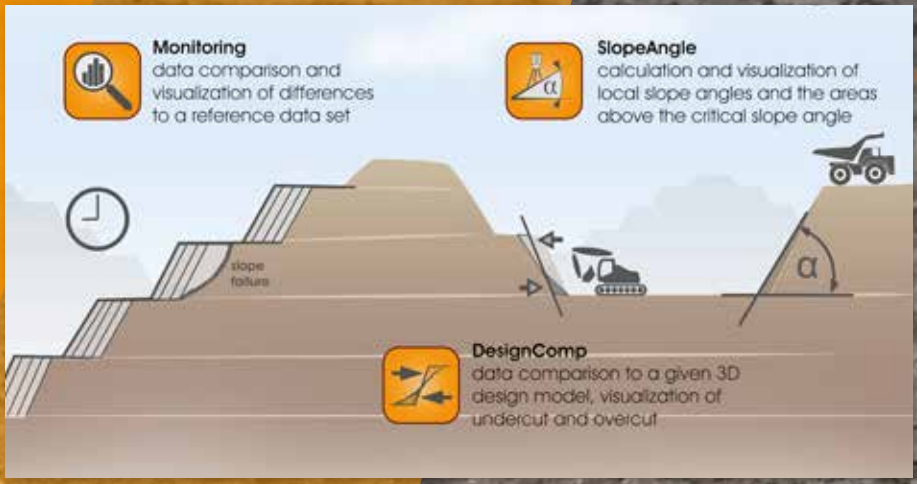
- Default means discharge to 0 %
- Air Flight means discharge to <25 %
- Storage means discharge to <40 %



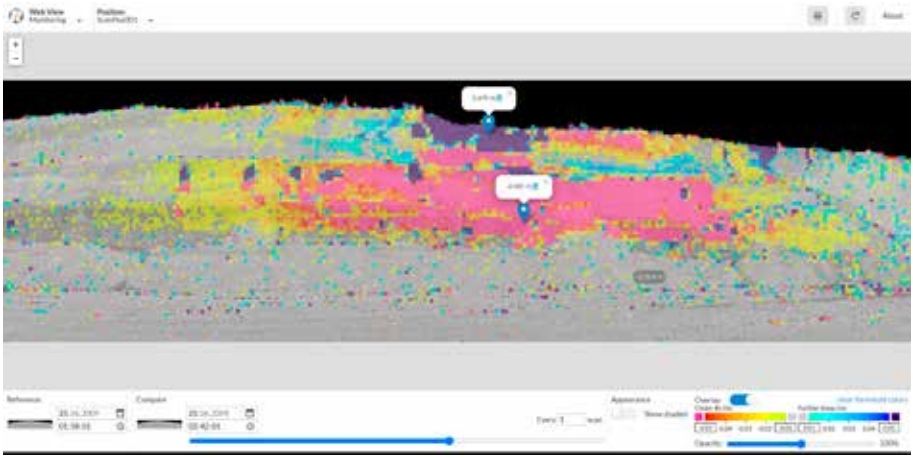
7. MINING APPS

The Mining Apps are provided as a bundle of three different Apps for your *RIEGL* VZ-i Scanner with mining related functionality but also suitable for other monitoring areas:

- Monitoring App
- Design Compare App
- Slope Angle App



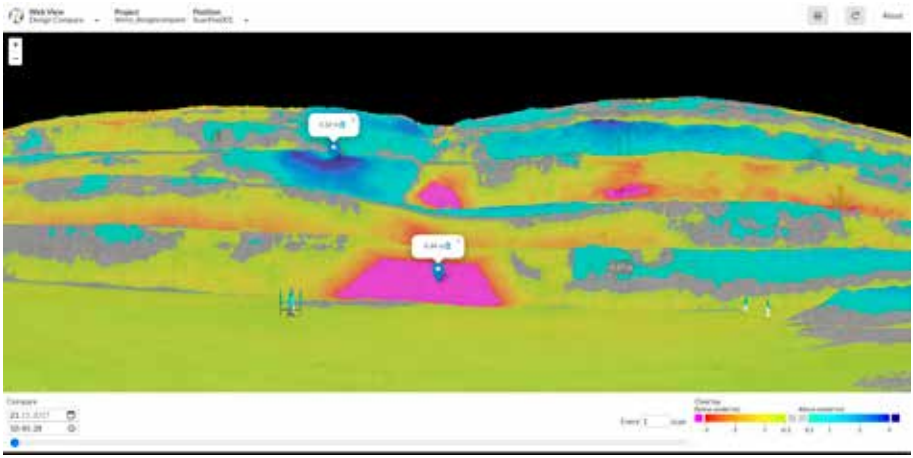
7.1. Monitoring App



Example slope failure area: By sliding through the timeline of acquired scans movement trends can be detected with enough lead time to evacuate the endangered areas before the slope failure take place.

Using this app, change detection can be calculated to a given reference scan. This allows to detect movements of e.g., highwalls long before it is visible to the human eye. The interpretation of the movements through a time series of scans allows the prediction of a possible slope failure. It ensures to have enough time to evacuate people and to remove machinery from the endangered areas.

7.2. Design Compare App



Screenshot of the web browser interface: Threshold values and colour tables can be set by the user absolutely flexible

Using this app, overcut and undercut are calculated based on a given design model. While undercut is a waste of money, overcut can involves major safety risks. With the use of this app, the operation of heavy equipment such as digging machines can be optimized to streamline the mining process.

7.3. Slope Angle App



Screenshot of the web browser interface: Critical slope-angles of more than 70° are highlighted in pink in this example. Markers can be set interactively to monitor these points over a time-series of scans.

Using this app, slope angles are calculated automatically from scan data. Critical slope angles can be highlighted and sent to the user, e.g., the operator of loaders. The real-time information helps them to keep the slope angles of stockpiles and dump areas within the defined limits. They receive the information on a web browser on every device, which is connected to the mine network. No software installation or processing of the data is necessary. Everything is processed automatically within the app on the scanner.

8. APPENDIX: FAQ *RIEGL* VZ-400i



8.1. Frequently Asked Questions

KEYWORD	QUESTION	ANSWER
Power	**What is the most frequent problem in the field?**	Mainly the scanner runs out of power. Please calculate the requested number of rechargeable batteries before scanning. Please use either an original *RIEGL* power supply only, or a power supply with appropriate specifications and performance data.
Booting the scanner	**Why is the scanner not starting?**	Check the power supply. Check battery status. Check if the temperature is out of range.
High temperature	**What can I do if the temperature is too high? (red temperature icon)**	Use a sunshield against the direct sunlight. This will cool down the temperature inside the housing.
Low temperature	**What can I do if the temperature is too low? (red temperature icon)**	Keep the scanner inside of a warm car. Power the scanner up inside the car and put it only for the scan outside.
Operator in the point cloud	**How can I avoid standing in the field of view?**	Check the rotation of the scanner and the starting point of the scan. For the panorama scans the scanner starts at the zero position which is the position of the socket for the LAN cable.
User Manual	**Where can I find the digital user manual?**	The user manuals are stored as PDF in the internal folder "intern\manuals" of your scanner.
Files on the Scanner	**How can I access to the files on the scanner?**	**Computer:** see chapter "Transfer Data from Scanner to computer". **Mobile device:** connect scanner and mobile device via WLAN and use e.g. a File Explorer App on your mobile device by adding a new Linux connection and search for a connection that is called like the serial number of the scanner.

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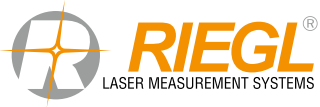
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***RIEGL LASER MEASUREMENT SYSTEMS* GmbH**
3580 Horn, Riedenburgstrasse 48, AUSTRIA
Tel.: +43-2982-4211, Fax.: +43-2982-4210
E-mail: office@riegl.co.at
www.riegl.com

Rev. 2022-01-24 (BA02.xx_4.5.0_1.7.0)

Revision History:
Rev. 2021-02-23 (BA02.xx_03.05.00 – 01.05.02)
Rev. 2020-09-11 (BA 02.xx_03.01.00-01.04.02)
Rev. 2019-10-03 (BA 01.xx_2.0.2_01.16.01)
Rev. 2018-12-10 (BA 01.xx_01.12.02_01.14.00)
Rev. 2018-01-15 (BA 01.xx_1.7.3_01.09.04)
Rev. 2017-09-12 (BA 01.xx_1.6.1_01.09.01)
Rev. 2017-07-12 (BA 01.xx_1.6.1_01.08.03)
Rev. 2017-04-19 (BA 01.xx_1.6.0_01.08.00)
Rev. 2016-01-17 (BA 01.xx_1.0.5_01.06.02)



***RIEGL* Laser Measurement Systems GmbH**
Horn, Austria
Phone: +43 2982 4211 | www.riegl.com

***RIEGL* USA Inc.**
Winter Garden, Florida, USA
Phone: +1 407 248 9927 | www.rieglusa.com

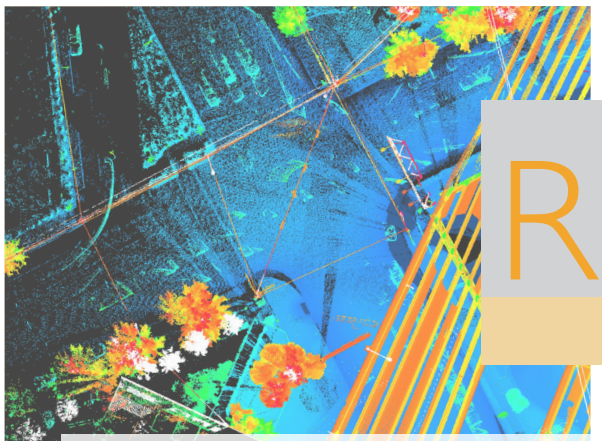
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COMPONENTE 2:
SOFTWARE OFICINA

RiSCAN PRO



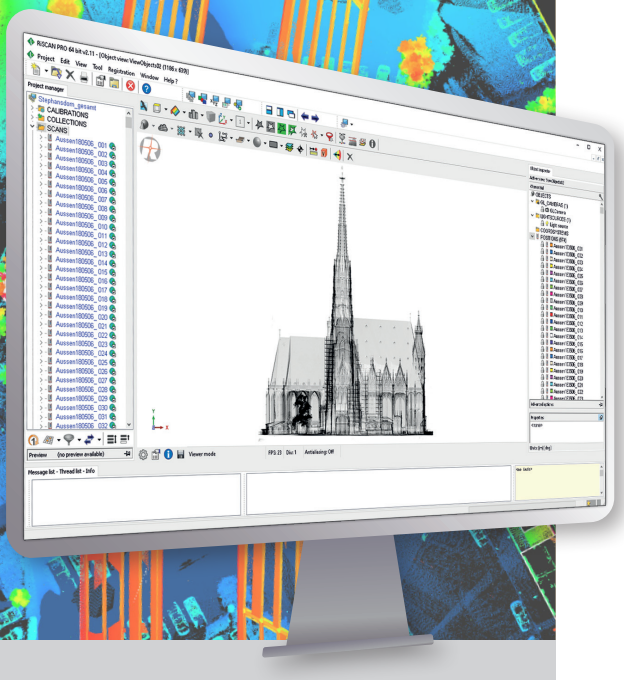
Operating & Processing Software

RiSCAN PRO

for *RIEGL* 3D Laser Scanners

Key Features:

- *2D and 3D visualization*
- *geodetic tools*
- *automatic filtering*
- *automatic registration*
- *multi station adjustment*
- *colorization of pointclouds*
- *import/export in different formats*
- *RiPANO export*
- *create animations*
- *create plots*
- *simple meshing*
- *volume calculation*



visit our website www.riegl.com

RiSCAN PRO is *RIEGL*'s software solution for Terrestrial Laser Scanning (TLS) projects. With advanced features for point cloud optimization, such as automatic registration, multi station adjustment, flexible filtering tools, data merging, and high-performance 3D visualization capabilities, RiSCAN PRO provides a fully integrated solution for producing accurate and refined TLS point cloud data.

With tools designed to optimize the acquisition workflow in the field, RiSCAN PRO provides the ability to perform real-time QA/QC of data coverage and scan registration in the field. Data is streamed in real-time from the scanner to the software, where all processing features required to produce a perfect point cloud are provided.

RiSCAN PRO integrates sensor fusion and the transformation capabilities necessary to turn the data from multiple sensors into a seamless, colorized point cloud with a number of valuable attributes. These data can then be exported in a number of widely supported point cloud formats for further analysis and information extraction in software solutions tailored to each application.

Typical applications include

- *Architecture & Facade Measurements*
- *As-built Surveying*
- *Agriculture & Forestry*
- *Topography Applications*
- *Archeology & Cultural Heritage*
- *City Modeling*

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LASER MEASUREMENT SYSTEMS

Automatic Registration

Automatic merging of point clouds from different scan positions. Especially tailored for VZ-i Series Scanners, it enables fast registration of hundreds of scan positions with no user interaction necessary.

Multi Station Adjustment

MSA= Optimization of all scan positions, so that

- scan data from neighboring scan positions match
- GNSS measurements match scan positions
- measurements from tilt sensors match scan position's orientation
- scan data match externally surveyed control points statistically correct optimization with correct measurement accuracies

Flexible Filtering

Due to the fact that scan data is based on the *RIEGL* data base RDB 2, filtering can be done by many point attributes like reflectance, deviation, number of echos or by isolated points, range etc..

Coordinate Systems

Coordinate reference systems can be downloaded from the online EPSG database. User coordinate systems can be defined by supplying parameters or by importing point lists.

Enhanced Graphics

The state of the art 3D point cloud visualization based on the *RIEGL* RDB 2 point cloud file format allows to visualize each and every scanned data point in 3D whereas point colors are derived in real time from any of the additionally acquired point attributes such as amplitude, reflectance, deviation, or true color.

64-Bit Architecture

RiSCAN PRO is a truly 64-Bit software that allows to utilize all available system RAM with the benefit of large scale parallel data processing and data visualization of billions of points simultaneously in one single 3D view.

ACQUIRE

VZ-Line scanner control
fully customizable parameters

- field of view
- scan resolution
- pulse rate
- image overlap

configuration of external cameras

scan and image data acquisition in real-time

real-time data transfer

real-time 2D preview

real-time data conversion

automatic target selection

target acquisition

reflector model estimation

- circular disk
- cylinder
- corner cube prism

VIEW

large dataset support

LoD (Level of Detail) support

2D, 3D, and panorama views

X-ray view

view by attribute:

- amplitude
- reflectance
- deviation
- range
- true color
- echo

additional view types

- height
- distance to surface

animations

- 3D animations
- time lapse (4D)
- slice-trough animation

high resolution ortho plots
e.g. geotiff export

The design of RiSCAN PRO´s project structure enables smooth data transfer to numerous third party post-processing packages. The XML-based project file structure is published and well-documented, thus enabling open access to all project information in an easy way. *RIEGL*´s RDB2 pointcloud libary allows to access all scan data in a convenient way.
For detailed information see RiSCAN PRO´s online help manual.

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Main Features

PROCESS

data adjustment
- automatic registration
- MSA bundle adjustment
- image adjustment
- camera mounting
- camera model
- point cloud colorization

project georeferencing
- GeoSysManager 2
- EPSG online DB
- custom CRS
- engineering CRS

filtering
- single source points NEW
- dynamic objects NEW (people, cars, ...)
- mirror objects NEW (caused by glas facades or similar objects)
- by attributes (reflectance, deviation,...)
- isolated points
- octree
- terrain
- above/below plane

homogenization of scan data
- octree based point cloud
- x-ray prepared point cloud

ANALYZE

meshing
- smooth
- decimate
- texture

volume calculation
- mesh to point cloud
- mesh to mesh
- mesh to surface
- mesh to plane
- point cloud to plane
- cut & fill

surface comparison
- voxel comparison
- mesh to mesh
- mesh to surface

polyline creation

breakline tool

contour lines

sections

sphere fitting

plane fitting

EXCHANGE

export formats:
- .3pf
- .asc Crystalix
- .csv ASCII
- .dm Datamine
- .dtm SURPAC
- .dxf Autocad
- .e57 (w/ Reg & Imgs)
- .las 1.1-1.4 LAS
- .laz 1.2 LAZ
- .obj
- .pdf, .tif, .jpg 2D Plot
- .pod PointTools
- .pol Polyworks
- .pts, .ptx
- .rqx RiALITY
- .stl Stereolithography
- .wrl

import formats:
- .3pf
- .csv ASCII
- .dp DotProduct
- .dxf Autocad
- .las 1.1-1.4 LAS
- .laz 1.2 LAZ
- .mpc Mantis
- .obj
- .ply
- .pol Polyworks
- .pts, .ptx
- .rdbx, .rdb RIEGL Database
- .rxp VZ-Scanners
- .sdw *RIEGL* ALS
- .stl Stereolithography
- .tif, jpg, bmp, images
- .vtp Polydata

Export as a *RIEGL* RiPANO Project

RiPANO is a software for fast and easy visualization of terrestrial laser scan projects. It allows CAD users to easily extract ortho views and plots for further use in CAD software. The software runs plugin-free in a browser or stand-alone on a Windows computer or a MacOS computer.

Note:
To export RiPANO projects with RiSCAN PRO a separate RiPANO export license for RiSCAN PRO is required.







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One Touch Processing Wizard

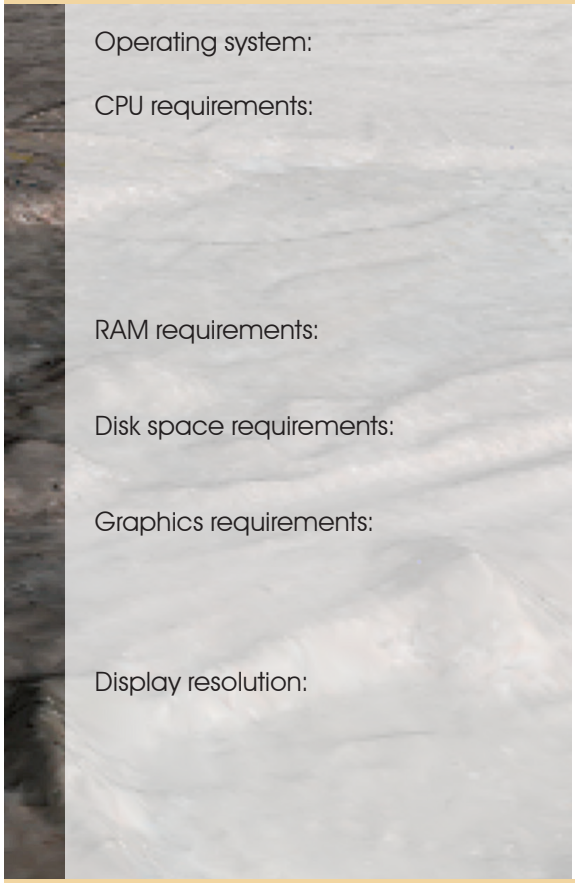


Task 1: convert scans
Task 2: filter scans
Task 3: register scan positions
Task 4: fine adjust project
Task 5: calibrate camera mounting
Task 6: colorize scans from photos
Task 7: mark single source points
Task 8: mark dynamic objects
Task 9: generate octree based point clouds
Task 10: create 3D views
Task 11: create ortho plots
Task 12: export as RiPANO
Task 13: export as LAS
Task 14: create video renderings

The One Touch Processing Wizard allows you to automate key processing steps. The result is a registered, adjusted, colored and homogenized point cloud.

It is especially helpful for beginners but also for standard users of the VZ-i series laser scanners – if they follow the recommended standard workflow but also for power users who have to process large projects over and over again.

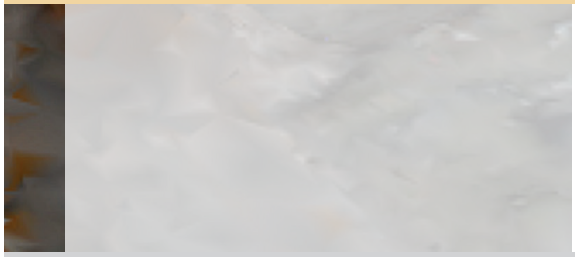
System Requirements



Operating system:	Windows 10, 11
CPU requirements:	Only **Intel Core i Processors** are supported. Select a model with a high **Core Base Frequency** and a high **Max Turbo Frequency**. A high number of **Performance Cores** is preferable. Processors with the **KS** suffix in the Processor Number usually meet the above requirements e.g.: Intel Core i9 processor 14900KS
RAM requirements:	Minimum*: 16 GB Recommended: 64 GB
Disk space requirements:	Minimum*: 500 GB Solid State Drive Recommended: 2 TB Solid State Drive
Graphics requirements:	Minimum*: NVIDIA GeForce 20 series or Quadro with 8 GB GPU memory Recommended: Latest NVIDIA GeForce with 12 GB GPU memory
Display resolution:	Minimum*: 1920 x 1080 pixels Note: 3840 x 2160 pixels Ultra-High Definition (UHD) displays supported

*Minimum requirements apply for projects up to ~100 Scan Positions

Download Information



To download RiSCAN PRO, please navigate to http://www.riegl.com/ and click on „DOWNLOADS".
(Download after email registration only.)

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RIEGL USA Inc., *Headquarters North America*

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COMPONENTE 3:
COMPUTADOR PORTATIL CON ACCESORIOS

SNAP VENTA DE COMPUTADORES co

DESDE: 2019
CENTRO COMERCIAL UNILAGO
LOCAL 1-109 AL LADO DE LA ENTRADA (2) !!
3112157546/3013670122

Categoría	Especificación Técnica del Equipo Ensamblado
Chasis	Chasis portátil 17.3" Full-Size con bahía **ODD interna (DVD/CD/Blu-ray RW)** compatible. Construcción reforzada para Workstation / Gaming.
Procesador	**Intel® Core™ i9-14900HX** (24 núcleos / 32 hilos, 8P+16E) — Base: **2.2 GHz**, Turbo Boost máx: **5.8 GHz**, Caché: **36 MB**.
Tarjeta Gráfica (GPU)	NVIDIA® **GeForce RTX™ 4080 / 4090 Laptop GPU** (según configuración del cliente). 12 GB / 16 GB GDDR6.
Pantalla	**17.3"** UHD / QHD+ (dependiendo selección), panel IPS, antirreflejo, 120 Hz / 240 Hz según configuración.
Memoria RAM	**64 GB DDR5 5600 MHz** (2×32 GB) – Ampliable hasta **128 GB**.
Almacenamiento	1× **M.2 NVMe PCIe 4.0** SSD **4 TB** (se puede configurar con 2 unidades M.2).
Ranuras de Almacenamiento	• 2× Ranuras M.2 NVMe PCIe Gen4 / Gen5. • 1× Bahía interna **ODD (DVD/CD/Blu-ray RW)** incluida.
Unidad Óptica	**Unidad interna** Super Multi **DVD-RW / CD-RW / Blu-ray RW** SATA Slim.
Sistema Operativo	Windows 11 Pro (licencia opcional).
Teclado	Retroiluminado RGB de tamaño completo con teclado numérico.
Audio	2× Altavoces estéreo de alta potencia + 2× Woofer bajos. Certificado Hi-Res Audio.
Cámara Web	Full HD 1080p con obturador físico y reducción de ruido 3D.
Puertos USB	3× USB-A 3.2 Gen1 / Gen2 2× USB-C Thunderbolt 4 (DP Alt Mode, carga USB-PD).
Puertos de Video	1× HDMI 2.1 (8K@60 / 4K@120) 1× Mini DisplayPort Soporte multi-pantalla.
Red / Conectividad	LAN 2.5 GbE Wi-Fi 6E / Wi-Fi 7 (según disponibilidad) Bluetooth 5.3+.
Lector de Tarjetas	Lector SD UHS-II.
Seguridad	TPM 2.0, lector de huella, seguridad BIOS, ranura Kensington.
Batería	4 celdas, 99 Wh (máximo permitido para avión).
Cargador / Adaptador	Adaptador de Alta Potencia 280W / 330W (según GPU seleccionada).
Dimensiones	Aproximado: **410 × 290 × 35 mm** (el chasis con ODD es más grueso que modelos ultradelgados).
Peso	Entre **3.2 – 3.6 kg** dependiendo de la configuración.
Garantía	12 meses directa con SNAP Computadores y Tecnología (partes y servicio).

COMPONENTE 4:
AERONAVE NO TRIPULADA UAV - OPERACIÓN CLASE B

MAVIC 3 ENTERPRISE

ENTERPRISE

https://enterprise.dji.com
Síguenos en @DJIEnterprise

ENTERPRISE

SERIE **DJI MAVIC 3** ENTERPRISE

Tu dron comercial para el día a día



El Mavic 3 Enterprise redefine los estándares de la industria para los drones comerciales pequeños. Con un obturador mecánico, una cámara con zoom 56× y un módulo RTK para lograr una precisión centimétrica, el Mavic 3E lleva la eficiencia de las misiones a nuevas cotas. Hay una versión térmica disponible para misiones de extinción de incendios, búsqueda y rescate, inspecciones y operaciones nocturnas.

Dos modelos, innumerables aplicaciones

DJI MAVIC 3E

Gran angular: CMOS 4/3, 20 MP, obturador mecánico
Zoom: distancia focal equivalente de 162 mm, 12 MP, zoom híbrido 56×

DJI MAVIC 3T

Gran angular: distancia focal equivalente de 24 mm, 48 MP
Zoom: distancia focal equivalente de 162 mm, 12 MP, zoom híbrido 56×
Térmica[1]: DFOV: 61°, distancia focal equivalente de 40 mm, resolución de 640×512

Rendimiento de cámara incomparable

- Cámara HD gran angular
- Foto inteligente con poca iluminación
- Térmica
- Zoom en pantalla dividida simultáneo

Compacto y portátil

- Aeroestructura ligera de 915g/920g[2]
- Cuerpo compacto que cabe en la palma de tu mano
- Perfecto tanto para pilotos principiantes como expertos

Vida de la batería ultralarga

- 45 min de tiempo de vuelo máx.[3]
- Centro de carga de 100 W para carga rápida de las baterías
- Carga directa del dron a 88 W

Seguridad de vuelo de nivel superior

- Objetivos gran angular permiten detección de obstáculos omnidireccional sin puntos ciegos[4]
- RPO avanzado
- APAS 5.0: redireccionamiento automático esquivando obstáculos[5]

Numerosos accesorios

- DJI RC Pro Enterprise[6]
- Módulo RTK[7]
- Altavoz[7]
- Estación móvil D-RTK 2[7]

Paquete completo de software

- DJI Pilot 2
- DJI FlightHub 2
- DJI Terra
- DTAT 3.0

1. NO expongas los objetivos de la cámara térmica a fuentes intensas de energía, como el sol, lava o rayos láser. De lo contrario, el sensor de la cámara podría quemarse y sufrir daños permanentes.
2. DJI Mavic 3E (con hélices): 915 gramos; DJI Mavic 3T (con hélices): 920 gramos.
3. Medido a una velocidad uniforme de 32.4 km/h, al nivel del mar y en un entorno sin viento, hasta que la batería se descargó por completo hasta el 0 %.
4. La capacidad de detección omnidireccional está limitada por condiciones ambientales, como el clima y las interferencias electromagnéticas. Vuela con precaución cuando operes en condiciones complejas (p. ej., con vientos de más de 12 m/s).
5. Solo admitido en modo de vuelo manual. Se recomienda tener precaución al volar en entornos peligrosos.
6. Actualmente solo disponible con la compra de la Serie DJI Mavic 3 Enterprise.
7. Los accesorios se venden por separado.

Specs

Aircraft

Weight (with propellers, without accessories) [1]	DJI Mavic 3E: 915 g DJI Mavic 3T: 920 g
Max Takeoff Weight	DJI Mavic 3E: 1,050 g DJI Mavic 3T: 1,050 g
Dimensions	Folded (without propellers): 221×96.3×90.3 mm (L×W×H) Unfolded (without propellers): 347.5×283×107.7 mm (L×W×H)
Diagonal Distance	380.1 mm
Max Ascent Speed	6 m/s (Normal Mode) 8 m/s (Sport Mode)
Max Descent Speed	6 m/s (Normal Mode) 6 m/s (Sport Mode)
Max Flight Speed (at sea level, no wind)	15 m/s (Normal Mode) Forward: 21 m/s, Side: 20 m/s, Backward: 19 m/s (Sport Mode) [2]
Max Wind Speed Resistance	12 m/s [3]
Max Take-off Altitude Above Sea Level	6000 m (without payload)
Max Flight Time (no wind)	45 mins [4]
Max Hover Time (no wind)	38 mins
Max Flight Distance	32 km
Max Tilt Angle	30° (Normal Mode) 35° (Sport Mode)
Max Angular Velocity	200°/s

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Propeller Model	9453F Propellers for Enterprise
Beacon	Built into the aircraft

Wide Camera

Sensor	DJI Mavic 3E: 4/3 CMOS, Effective pixels: 20 MP DJI Mavic 3T: 1/2-inch CMOS, Effective pixels: 48 MP
Lens	DJI Mavic 3E: FOV: 84° Format Equivalent: 24 mm Aperture: f/2.8-f/11 Focus: 1 m to ∞ DJI Mavic 3T: FOV: 84° Format Equivalent: 24 mm Aperture: f/2.8 Focus: 1 m to ∞
ISO Range	DJI Mavic 3E: 100-6400 DJI Mavic 3T: 100-25600
Shutter Speed	DJI Mavic 3E: Electronic Shutter: 8-1/8000 s Mechanical Shutter: 8-1/2000 s DJI Mavic 3T: Electronic Shutter: 8-1/8000 s
Max Image Size	DJI Mavic 3E: 5280×3956 DJI Mavic 3T: 8000×6000
Still Photography Modes	DJI Mavic 3E: Single: 20 MP Timed: 20 MP JPEG: 0.7/1/2/3/5/7/10/15/20/30/60 s JPEG+RAW: 3/5/7/10/15/20/30/60 s Smart Low-light Shooting: 20 MP Panorama: 20 MP (raw image) DJI Mavic 3T: Single: 12 MP/48 MP Timed: 12 MP/48 MP JPEG: 2/3/5/7/10/15/20/30/60 s* Panorama: 12 MP (raw image); 100 MP (stitched image) Smart Low-light Shooting: 12 MP

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	DJI Mavic 3T: 4K: 85 Mbps FHD: 30 Mbps
Supported File Formats	exFAT
Photo Format	DJI Mavic 3E: JPEG/DNG (RAW) DJI Mavic 3T: JPEG
Video Format	MP4 (MPEG-4 AVC/H.264)

Tele Camera

Sensor	1/2-inch CMOS, Effective pixels: 12 MP
Lens	FOV: 15° Format Equivalent: 162 mm Aperture: f/4.4 Focus: 3 m to ∞
ISO Range	DJI Mavic 3E: 100-6400 DJI Mavic 3T: 100-25600
Shutter Speed	Electronic Shutter: 8-1/8000 s
Max Image Size	4000×3000
Photo Format	JPEG
Video Format	MP4 (MPEG-4 AVC/H.264)
Still Photography Modes	DJI Mavic 3E: Single: 12 MP Timed: 12 MP JPEG: 0.7/1/2/3/5/7/10/15/20/30/60 s Smart Low-light Shooting: 12 MP DJI Mavic 3T: Single: 12 MP Timed: 12 MP JPEG: 2/3/5/7/10/15/20/30/60 s Smart Low-light Shooting: 12 MP
Video Resolution	H.264 4K: 3840×2160@30fps FHD: 1920×1080@30fps
Bitrate	DJI Mavic 3E: 4K: 130 Mbps

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Thermal Imager	Uncooled VOx Microbolometer
Pixel Pitch	12 μm
Frame Rate	30 Hz
Lens	DFOV: 61° Format Equivalent: 40 mm Aperture: f/1.0 Focus: 5 m to ∞
Sensitivity	≤50 mk@F1.1
Temperature Measurement Method	Spot Meter, Area Measurement
Temperature Measurement Range	-20° to 150° C (-4° to 302° F, High Gain Mode) 0° to 500° C (32° to 932° F, Low Gain Mode)
Palette	White Hot/Black Hot/Tint/Iron Red/Hot Iron/Arctic/Medical/Fulgurite/Rainbow 1/Rainbow 2
Photo Format	JPEG (8-bit) R-JPEG (16-bit)
Video Resolution	640×512@30fps
Bitrate	6 Mbps
Video Format	MP4 (MPEG-4 AVC/H.264)
Still Photography Modes	DJI Mavic 3T: Single: 640×512 Timed: 640×512 JPEG: 2/3/5/7/10/15/20/30/60 s
Digital Zoom	28x
Infrared Wavelength	8-14 μm
Infrared Temperature Measurement Accuracy	±2° C or ±2% (using the larger value)

Gimbal

Stabilization	3-axis (tilt, roll, pan)
Mechanical Range	DJI Mavic 3E: Tilt: -135° to 100° Roll: -45° to 45°

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Max Control Speed (tilt)	100°/s
Angular Vibration Range	±0.007°

Sensing

Type	Omnidirectional binocular vision system, supplemented with an infrared sensor at the bottom of the aircraft.
Forward	Measurement Range: 0.5-20 m Detection Range: 0.5-200 m Effective Sensing Speed: Flight Speed ≤15 m/s FOV: Horizontal 90°, Vertical 103°
Backward	Measurement Range: 0.5-16 m Effective Sensing Speed: Flight Speed ≤12 m/s FOV: Horizontal 90°, Vertical 103°
Lateral	Measurement Range: 0.5-25 m Effective Sensing Speed: Flight Speed ≤15 m/s FOV: Horizontal 90°, Vertical 85°
Upward	Measurement Range: 0.2-10 m Effective Sensing Speed: Flight Speed ≤6 m/s FOV: Front and Back 100°, Left and Right 90°
Downward	Measurement Range: 0.3-18 m Effective Sensing Speed: Flight Speed ≤6 m/s FOV: Front and Back 130°, Left and Right 160°
Operating Environment	Forward, Backward, Lateral, and Upward: Surface with a clear pattern and adequate lighting (lux >15) Downward: Diffuse reflective surface with diffuse reflectivity>20% (e.g. walls, trees, people) and adequate ligh >15)

Video Transmission

Video Transmission System	DJI O3 Enterprise Transmission
Live View Quality	Remote Controller: 1080p/30fps
Operating Frequency [6]	2.400-2.4835 GHz 5.725-5.850 GHz
Max Transmission Distance (unobstructed, free of interference) [7]	DJI Mavic 3E: FCC: 15 km CE: 8 km SRRC: 8 km MIC: 8 km

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Max Download Speed[9]	15 MB/s (with DJI RC Pro Enterprise)
Latency (depending on environmental conditions and mobile device)	Approx. 200 ms
Antenna	4 Antennas, 2T4R
Transmission Power (EIRP)	2.4 GHz: <33 dBm (FCC), <20 dBm (CE/SRRC/MIC) 5.8 GHz: <33 dBm (FCC), < 30 dBm (SRRC), <14 dBm (CE)

DJI RC Pro Enterprise

Video Transmission System	DJI O3 Enterprise Transmission
Max Transmission Distance (unobstructed, free of interference) [7]	FCC: 15 km CE/SRRC/MIC: 8 km
Video Transmission Operating Frequency [6]	2.400-2.4835 GHz 5.725-5.850 GHz
Antenna	4 Antennas, 2T4R
Video Transmission Transmitter Power (EIRP)	2.4 GHz: <33 dBm (FCC), <20 dBm (CE/SRRC/MIC) 5.8 GHz: <33 dBm (FCC), <14 dBm (CE), < 23 dBm (SRRC)
Wi-Fi Protocol	802.11 a/b/g/n/ac/ax Support 2×2 MIMO Wi-Fi
Wi-Fi Operating Frequency [6]	2.400-2.4835 GHz 5.150-5.250 GHz 5.725-5.850 GHz
Wi-Fi Transmitter Power (EIRP)	2.4 GHz: <26 dBm (FCC), <20 dBm (CE/SRRC/MIC) 5.1 GHz: <26 dBm (FCC), <23 dBm (CE/SRRC/MIC) 5.8 GHz: <26 dBm (FCC/SRRC), <14 dBm (CE)
Bluetooth Protocol	Bluetooth 5.1
Bluetooth Operating Frequency	2.400-2.4835 GHz
Bluetooth Transmitter Power (EIRP)	< 10 dBm
Screen Resolution	1920×1080
Screen Size	5.5 inches

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Rated Power	12 W
Storage Capacity	Internal Storage (ROM): 64 GB Supports a microSD card for expanded capacity.
Charging Time	Approx. 1 hour 30 minutes (with the included DJI USB-C Power Adapter (100W) only charging the remote conti USB charger at 15 V) Approx. 2 hours (with a USB charger at 12 V) Approx. 2 hours 50 minutes (with the included DJI USB-C Power Adapter (100W) charging the aircraft and rem controller simultaneously)
Operating Time	Approx. 3 hours
Video Output Port	Mini-HDMI port
Operating Temperature Range	-10° to 40° C (14° to 104° F)
Storage Temperature	-30° to 60° C (-22° to 140° F) (within one month) -30° to 45° C (-22° to 113° F) (one to three months) -30° to 35° C (-22° to 95° F) (three to six months) -30° to 25° C (-22° to 77° F) (more than six months)
Charging Temperature	5° to 40° C (41° to 104° F)
Supported DJI Aircraft[10]	DJI Mavic 3E DJI Mavic 3T
GNSS	GPS+Galileo+GLONASS
Dimensions	Antennas folded and controller sticks unmounted: 183.27×137.41×47.6 mm (L×W×H) Antennas unfolded and controller sticks mounted: 183.27×203.35×59.84 mm (L×W×H)
Weight	Approx. 680 g
Model	RM510B

Storage

Supported Memory Cards	Aircraft: U3/Class10/V30 or above is required. A list of recommended microSD cards can be found below.
Recommended microSD Cards	Remote Controller: SanDisk Extreme PRO 64GB V30 A2 microSDXC SanDisk High Endurance 64GB V30 microSDXC SanDisk Extreme 128GB V30 A2 microSDXC SanDisk Extreme 256GB V30 A2 microSDXC SanDisk Extreme 512GB V30 A2 microSDXC

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Kingston Canvas React Plus 128GB V90 A1 microSDXC

Aircraft:
SanDisk Extreme 32GB V30 A1 microSDHC
SanDisk Extreme PRO 32GB V30 A1 microSDHC
SanDisk Extreme 512GB V30 A2 microSDXC
Lexar 1066x 64GB V30 A2 microSDXC
Kingston Canvas Go! Plus 64GB V30 A2 microSDXC
Kingston Canvas React Plus 64GB V90 A1 microSDXC
Kingston Canvas Go! Plus 128GB V30 A2 microSDXC
Kingston Canvas React Plus 128GB V90 A1 microSDXC
Kingston Canvas React Plus 256GB V90 A2 microSDXC
Samsung PRO Plus 256GB V30 A2 microSDXC

Battery

Capacity	5000 mAh
Standard Voltage	15.4 V
Max Charging Voltage	17.6 V
Type	LiPo 4S
Chemical System	LiCoO2
Energy	77 Wh
Weight	335.5 g
Charging Temperature	5° to 40° C (41° to 104° F)

Charger

Input	100-240 V (AC Power), 50-60 Hz, 2.5 A
Output Power	100 W
Output	Max. 100 W (total) When both ports are used, the maximum output power of each interface is 82 W, and the charger will dynami allocate the output power of the two ports according to the load power.

Charging Hub

Input	USB-C: 5-20 V, 5.0 A

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RTK Module

Dimensions	50.2×40.2×66.2 mm (L×W×H)
Weight	24±2 g
Interface	USB-C
Power	Approx. 1.2 W
RTK Positioning Accuracy	RTK Fix: Horizontal: 1 cm + 1 ppm; Vertical: 1.5 cm + 1 ppm

Speaker

Dimensions	114.1×82.0×54.7 mm (L×W×H)
Weight	85±2 g
Interface	USB-C
Rated Power	3 W
Max Volume [11]	110 dB @ 1 m
Effective Broadcast Distance [11]	100 m @ 70 dB
Bit Rate	16 Kbps/32 Kbps
Operating Temperature Range	-10° to 40° C (14° to 104° F)

Other

Notes	[1] The standard weight of the aircraft (including the battery, propellers, and a microSD card). The actual prod weight may vary due to differences in batch materials and external factors. [2] Maximum speed in Sport mode is 19m/s when operating in EU regions. [3] Max wind speed resistance during takeoff and landing. [4] Measured with Mavic 3 Enterprise Series flying at a constant speed of 32.4 kph in a windless environment a level until the battery reached 0%. Data is for reference only. Please pay attention to RTH reminders in the DJI app during flight. [5] DO NOT expose the infrared camera lenses to strong sources of energy such as the sun, lava, or laser bean Otherwise, the camera sensor may be burned, leading to permanent damage. [6] In some countries and regions, the 5.8 and 5.1GHz frequencies are prohibited, or the 5.1GHz frequency is allowed for indoor use. Check local laws and regulations for more information. [7] Measured in an unobstructed environment free of interference. The above data shows the farthest comm range for one-way, non-return flights (with no payload) under each standard. During your flight, please pay at

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COMPONENTE 5:

LICENCIA A PERPETUIDAD DE SOFTWARE PARA PROCESAMIENTO DE IMÁGENES RECOLECTADAS POR SISTEMAS DRONES QUE PERMITA POSPROCESO FOTOGRAMÉTRICO

PIX4D MAPPER PERPETUO +
PIX4D CLOUD

PIX4Dmatic 1.66 FEATURE LIST

	Features		Advantages
INPUTS	Aerial and terrestrial images in .jpg .jpeg .tiff formats		Process any RGB images that support basic EXIF/XMP tags
	LiDAR and RGB images from PIX4Dcatch		Process both LiDAR and RGB images outputs from PIX4Dcatch for a full terrestrial workflow
	Multi-camera support in the same project		Create a project using images from different cameras and process them together
	Import image geolocations and orientations as .csv or .txt		Text file import (.csv/.txt) for image geolocation and orientation
	Ground Control Points (GCPs)		Import and mark ground control points to improve the absolute accuracy of the project
	Known reference coordinate system support		Select EPSG or ESRI codes from known coordinate systems libraries. Select a default coordinate reference system for easy setup
	Geoid support		Support of most commonly used geoid models. You can select a geoid height even if there are geoids available
	Arbitrary coordinate reference system support		Georeferencing of the project with GCPs in local or site specific coordinate systems
	Site localization		Import a .wkt created with PIX4Dcatch, or a .prj file and set your custom coordinate system
	Region of interest (ROI)		Define a region of interest to delimit an area in order to reduce the extent of outputs generated for a project, speed up the processing, or create sharper outputs
	Scale constraint		Define a scale constraint with a distance and an accuracy, which enables scaling a project based on that input at the Calibration step
	Orientation constraint		Define an orientation constraint with a direction and an assigned axis, which enables orienting a project without orientation information at the Calibration step
	Open Photogrammetry Format (OPF) 1.0		Import a project created with the Open Photogrammetry Format (OPF) 1.0 specifications
	Edit Camera Internals and Externals		Fine-tune camera settings for enhanced control over calibration and data accuracy
	Geometries (.dxf, .shp, zipped .shp)		Import geometry files in .dxf, .shp, zipped .shp or .GeoJSON to view in your project
PROCESSING	Multicore CPU + GPU support		Increase the processing speed by leveraging the power of CPU cores and threads, as well as GPUs
	Backup mechanism		An automatic backup mechanism ensures that you do not lose your work when something unexpected stops PIX4Dmatic
	Save copy		Save copy allows you to easily create a copy of your project, so that you can continue your work while being sure you have a copy of a previous state
	Calibration		Define the *Template*, *Pipeline*, *Image Scale*, *Keypoints* and *Internals confidence* parameters for the optimization of internal camera parameters (e.g. focal length, principal point of autocollimation and lens distortions) and external camera parameters (position, orientation) during calibration
	Reoptimize		Reoptimize internal and external camera parameters based on GCPs, MTPs, VTPs, or mITPs to improve the reconstruction
	Auto-mark		Auto-mark will find more marks in images for tie points or geometry vertices, as long as you marked at least 2 images
	AutoGCP		Automatic detection of control targets of known shape for faster marking experience
	Intersection Tie Points (ITPs)		Generate intersection tie points as part of the calibration for improved calibration e.g. for indoor scenes
	Merge & Register projects		Merge & register two projects
	Depth point cloud		Create a depth point cloud based on LiDAR inputs from PIX4Dcatch
	Point cloud densification		Define the point cloud Density, Number of Matches, Image Scale, Noise filter, and Sky filter parameters to create a dense point cloud based on the sparse point cloud created during calibration
	Depth & dense fusion		Create a single point cloud based on the depth point cloud and the dense point cloud
	Mesh		Define the mesh Input, Template, Texture size, Deghosting, Decimation, Sky mask, Smoothing parameters to create a 3D Textured Mesh
	Digital Surface Model		Define the Resolution cm/px, enable Surface smoothing with its Median filter radius (px) and enable Interpolation for the digital surface model creation
	Orthomosaic		Create an orthomosaic based on the digital surface model and the images and set Deghosting or Oblique parameters
	Quality report		Assess the quality of the reconstruction between processing steps with the detailed quality report
	Processing templates		Select the Nadir, Oblique, PIX4Dcatch or Custom processing template

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RAYCLOUD	Project visualization		Visually assess the accuracy of the camera geotags, the quality of optimized camera positions, automatic tie points, dense point cloud, mesh, digital surface model and orthomosaic. In Perspective or Orthographic views
	GCPs		Annotate GCPs with the highest accuracy, using both original images and 3D information at the same time
	Checkpoints		Annotate Checkpoints with the highest accuracy, using both original images and 3D information at the same time to verify the absolute accuracy of the project
	Manual Tie Points (MTPs)		Create and mark manual tie points to improve the calibration of your project
	Intersection Tie Points (ITPs)		Create and mark manual ITPs or edit and delete automatic ITPs to improve the calibration of your project
	Vertex Tie Points (VTPs)		A geometry vertex can be converted to a vertex tie point (VTP), so that image marks of geometries are taken into account in Reoptimization or Calibration
	Undo/Redo your changes		Undo/Redo actions
	History		All actions of a given session are available in the history panel. Revert to the project at any stage, while keeping the other steps that were done as items in the history
	Status center		The status center displays tracking notifications and progress reports of different processing steps
	Distance measurement		Measure a distance in the 2D or 3D views, refine in the images for higher accuracy. Option to take projection distortions into account
	Marker		Create a marker to measure or highlight a specific point in your project
	Polyline		Create a polyline to vectorize linear objects
	Polygon		Create a polygon to vectorize a surface with the option to add a planarity constraint, add polygon holes, edit polygons or connect polygons into a polygonal mesh surface
	Vector layers and Layers templates		Enhance workflow with customizable vector layers and pre-defined layer templates for efficient data management
	ASPRS Classes		Classify point clouds from your projects. You can edit classes membership, export per class, delete, or show/hide each class
	Section view		Create vertical or horizontal sections, or sections along a polyline, in order to vectorize a scene in a plane or to verify the quality of the results
	Base maps		Get context about your scene by displaying map or satellite data in the background of your scene in the 2D viewer
	Point Cloud editing		Edit and optimize your point clouds for higher-quality meshes, DSMs, and orthomosaics. Disabled points are always stored in the "Disabled points" panel
	Clipping box		Isolate and focus on specific regions within your point cloud for more targeted analysis
	Videos & views		Create views of your project to easily access the same view point again, to document your scene in a custom report or to create a video animation of your project
	Invert selection		Allows to invert the selected point clouds
	Color by elevation		Use a histogram and a selection of spectrums to interactively display your point clouds by elevation value
	Color by relative confidence		A color by relative confidence tool for advanced users to assess their data accuracy
	Minimum number of matches slider		Display the Automatic Tie Points (ATPs), dense point cloud, or fused point cloud based on the number of matches each point has to assess the quality
	Snapping window		Facilitates the picking of points when creating a geometry in the 3D view by giving a sense of depth
	Object selection tool		A smart object selection tool for point cloud classification
	Image masks		Create masks in images to improve the point cloud or mesh

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EXPORT	**Export GCPs**		Export GCPs for enhanced workflow flexibility
	Export MTPs, mITPS, ITPs (.txt, .csv)		Export tie point marks
	Point cloud (.laz, .las 1.4, .las 1.2, .XYZ)		Export generated point clouds in .laz, .las (1.2 and 1.4 for better compatibility) and .xyz file formats
	Mesh (.obj, Cesium 3D tiles, .slpk)		Export a generated digital surface model in a single cloud optimized .geotiff or in tiles. Optionally with .tfw and .prj files. Select the compression rate of the file. LZW compression available
	Point cloud from Mesh (.laz)		Export a point cloud from your mesh for better modeling in Revit
	Digital Surface Model (.tiff, .tfw, .prj)		Export generated digital surface model in a single .tiff or in tiles. Optionally with .tfw and .prj files. Select the compression rate of the file. LZW compression available
	Orthomosaic (.tiff, .tfw, .prj, .jpg, .jgw)		Export a generated orthomosaic in a single or tiled cloud optimized .geotiff with optional .tfw and .prj files, or as .jpg with a .jgw file for geolocation. Select the compression rate of the file. LZW or JPEG compression available
	Quality report (.pdf)		Export the quality report to assess the accuracy and quality of projects
	Custom report (.pdf)		Export custom reports with your logo containing an Overview plan, Views, and an Inventory describing your project
	Geometries (.dxf, zipped .shp, .shp or .GeoJSON)		Export created geometries (Markers, Polylines, Polygons) and layers to .dxf, zipped .shp, .shp or .GeoJSON
	Direct export to PIX4Dsurvey		Seamless export of processed PIX4Dmatic projects (.p4m) into PIX4Dsurvey
	Share to PIX4Dcloud		Upload results from PIX4Dmatic to PIX4Dcloud for sharing and collaboration
	Open Photogrammetry Format (OPF) 1.0		Export a project in the Open Photogrammetry Format (OPF) 1.0 specifications
	Video (.webm)		Export a video of your project to share on social media or with stakeholders
LANGUAGE	Language option		English, Japanese, Spanish, French, Simplified Chinese, Traditional Chinese, Korean, German, Portuguese, Turkish
LICENSING OPTIONS	Organizational license support		If you are in a Pix4D organization, you can access those organizational licenses and see how many are available
	SSO support		SSO-enrolled companies can use their defined SSO provider to log in
	Offline license		Fully offline licensing available
	Proxy configuration		The usage of proxys is supported for system or manual proxy configurations

HARDWARE SPECS

CPU: Quad-core or hexa-core Intel i5

GPU: Any NVIDIA GPU that supports OpenGL 4.1 or higher

Disk Space: 150 GB Free Space (2000-5000 images at 20MP). 350 GB Free Space (5000-10000 images at 20MP)

OS: Windows 10, 11 (64 bit) or macOS Sonoma (14.x) + Ventura (13.x)

RAM: 32GB (2000-5000 images at 20MP). 64GB (5000-10000 images at 20MP)

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PIX4Dcloud

Lista de características

	Características		Ventajas
ENTRADAS	Imágenes aéreas (nadir y oblicuas) y terrestres	☁	Procesar imágenes tomadas desde cualquier ángulo, desde cualquier plataforma aérea o terrestre, tripulada o no tripulada
	Cualquier cámara (compacta, SLR, multiespectral, GoPro) en .jpg o .tiff	☁	Utiliza las imágenes adquiridas con cualquier cámara, desde las de pequeño tamaño hasta las de gran tamaño, desde las cámaras de consumo hasta las altamente especializadas
	Compatibilidad de múltiples cámaras para el mismo proyecto	☁	Crear un proyecto con imágenes de diferentes cámaras y procesarlas conjuntamente
CARACTERÍSTICAS	Selección de plantillas	☁	Optimiza el procesamiento y la generación de resultados utilizando diferentes plantillas de procesamiento en función de los resultados requeridos
	Selección del sistema de coordenadas de salida	☁	Procesar los proyectos en el sistema de coordenadas a tu elección para garantizar flujos de trabajo óptimos
	Vista de mapa en el panel de control	☁	Mostrar la ubicación geográfica de los conjuntos de datos
	Mediciones de distancia y área	☁	Mide las distancias y las áreas para una planificación precisa. Guarda las anotaciones para establecer las medidas como permanentes
	Mediciones de volumen	☁	Mide los volúmenes basándote en el Modelo de Superficie Digital (MDS) para realizar estudios precisos del lugar
	Perfil de elevación	☁	Generar perfiles de elevación basados en el MDS. Se muestra la información de elevación de cada punto
	Anotaciones	☁	Agregar diferentes tipos de anotaciones (marcadores, inspecciones, líneas, áreas, círculos o polígonos) ayuda a transmitir información más valiosa y procesable. Las anotaciones pueden importarse y exportarse en diferentes formatos de archivo, como: .csv, .GeoJSON, Shapefiles, .dxf.
	Inspector virtual	☁	Inspeccionar virtualmente cualquier área de interés en el modelo 3D y en todas las imágenes originales utilizadas para la reconstrucción. Ampliar imágenes específicas, fijar y comentar las imágenes con información detallada o acciones a realizar. También puedes guardar las inspecciones como anotaciones
	Procesamiento multiespectral y visualización de NDVI	☁	Genera mapas NDVI automáticamente para analizar mejor tu conjunto de datos multiespectrales
	Compartir	☁	Mejora la colaboración y los informes compartiendo anotaciones, mediciones, perfiles de elevación, volúmenes y proyectos con el equipo y las partes interesadas
	Pix4D Autotags	☁	Detección automática de GCPs y puntos de enlace con Pix4D Autotags. Disponible exclusivamente para proyectos subidos desde PIX4Dcatch
	Importación de resultados existentes	☁	Importa el ortomosaico y el MDS en .geotiff, la nube de puntos en .las y .laz, y la malla 3D en formatos de archivo .obj.
RESULTADOS	Resultados en 2D	☁	Ortomosaicos Nadir en formato GeoTiff
		☁	Vectores 2D en formato .geojson, .csv y .shp
	Resultados en 2,5D	☁	MDS o MDE en formato GeoTiff
	Resultados de salida en 3D	☁	Nube de puntos 3D en formato de salida .laz
		☁	Malla texturizada 3D en formato .fbx y .obj
		☁	Gaussian Splatting 3D en formato de salida .ply. Disponible exclusivamente para proyectos subidos desde PIX4Dcatch.
		☁	Informe de calidad en formato .pdf
INTEGRACIONES DE TERCEROS	Trimble Connect	☁	Exporta los archivos que desee a la plataforma Trimble Connect
SOPORTE	Correo electrónico personal	☁	Los titulares de la licencia pueden ponerse en contacto con el servicio de asistencia por correo electrónico
	Comunidad	☁	Todos pueden escribir en la Comunidad
MULTI-IDIOMA	Idiomas disponibles	☁	Inglés, español, italiano, japonés, coreano, francés, portugués (Brasil), tailandés, alemán