Airborne Laser Scanner with Online Waveform Processing

RIEGL VQ®-480

The V-Line® Airborne Laser Scanner *RIEGL* VQ-480 provides high speed, non-contact data acquisition using a narrow infrared laser beam and a fast line scanning mechanism. High-accuracy laser ranging is based on *RIEGL*´s unique echo digitization and online waveform processing, which allows achieving superior measurement results even under adverse atmospheric conditions, and the evaluation of multiple target echoes.

The scanning mechanism is based on a fast rotating multi-facet polygonal mirror, which provides fully linear, unidirectional and parallel scan lines.

The *RIEGL* VQ-480 is a very compact and lightweight scanner, mountable in any orientation and even under limited space conditions on helicopters or UAVs. The instrument needs only one power supply and provides line scan data via the integrated LAN-TCP/IP interface. The binary data stream can easily be decoded by user-designed software making use of the available software library RiVLib.

- ***high-accuracy ranging based on echo digitization and online waveform processing***
- ***high laser repetition rate - fast data acquisition***
- ***multiple target capability - unlimited number of targets***
- ***perfectly linear scan lines***
- ***compact, rugged and lightweight design***
- ***electrical interfaces for GPS data string and Sync Pulse (1PPS)***
- ***mechanical interface for IMU mounting***
- ***integrated LAN-TCP/IP interface***

Typical applications include

- ***Corridor Mapping***
- ***Power Line Inspection***
- ***Cultural Heritage Mapping***

visit our website www.riegl.com

RIEGL®
LASER MEASUREMENT SYSTEMS

Technical Data *RIEGL* VQ®-480

Laser Product Classification

Class 1 Laser Product according to IEC60825-1:2007
The following clause applies for instruments delivered into the United States:
Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.

Range Measurement Performance

Measuring Principle: time-of-flight measurement, echo signal digitization, online waveform processing

Laser Pulse Repetition Rate PRR [1]	50 kHz	100 kHz	150 kHz	200 kHz	300 kHz
Effective Measurement Rate (meas./sec) [1] [2]	25 000	50 000	75 000	100 000	150 000
Max. Unambiguous Measuring Range [3]					
natural targets ρ ≥ 20%	950 m	750 m	650 m	550 m	450 m
natural targets ρ ≥ 60%	1500 m	1200 m	900 m [4]	700 m [4]	450 m [4]
Max. Operating Flight Altitude AGL [2]	750 m (2450 ft)	600 m (2000 ft)	550 m (1800 ft)	450 m (1500 ft)	350 m (1150 ft)
Max. Number of Targets per Pulse	practically unlimited (details on request)				

Minimum Range	10 m
Accuracy [5] [7]	25 mm
Precision [6] [7]	25 mm
Laser Pulse Repetition Rate PRR [1] [8]	up to 300 kHz
Max. Effective Measurement Rate [1]	up to 150 000 meas./sec (@ 300 kHz PRR & 60° FOV)
Echo Signal Intensity	for each echo signal, high-resolution 16 bit intensity information is provided
Laser Wavelength	near infrared
Beam Divergence	0.3 mrad
Laser Beam Footprint (Gaussian Beam Definition)	31 mm @ 100 m, 75 mm @ 250 m, 150 mm @ 500 m

1) Rounded values.
2) Reflectivity ρ ≥ 20%, ±30° FOV, additional roll angle ±5°.
3) The following conditions are assumed: target larger than the footprint of the laser beam, perpendicular angle of incidence, visibility 23 km, average ambient brightness.
4) Limited by maximum unambiguous range.
5) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.
6) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.
7) One sigma @ 150 m range under *RIEGL* test conditions.
8) User selectable.

Scanner Performance

Scanning Mechanism	rotating multi-facet mirror
Field of View (selectable)	60° (+30° / -30°)
Scan Speed (selectable)	10 - 100 scans/sec
Angular Step Width $\Delta\vartheta$ (selectable) between consecutive laser shots	$0.006° \leq \Delta\vartheta \leq 0.24°$
Angle Measurement Resolution	0.001°
Internal Sync Timer	for real-time synchronized time stamping of scan data
Scan Sync (optional)	scanner rotation synchronization

Data Interfaces

Configuration	LAN 10/100/1000 Mbit/sec
Scan Data Output	LAN 10/100/1000 Mbit/sec
GPS-System	Serial RS232 Interface for data string with GPS-time information, TTL input for 1 PPS synchronization pulse

Mechanical Interfaces

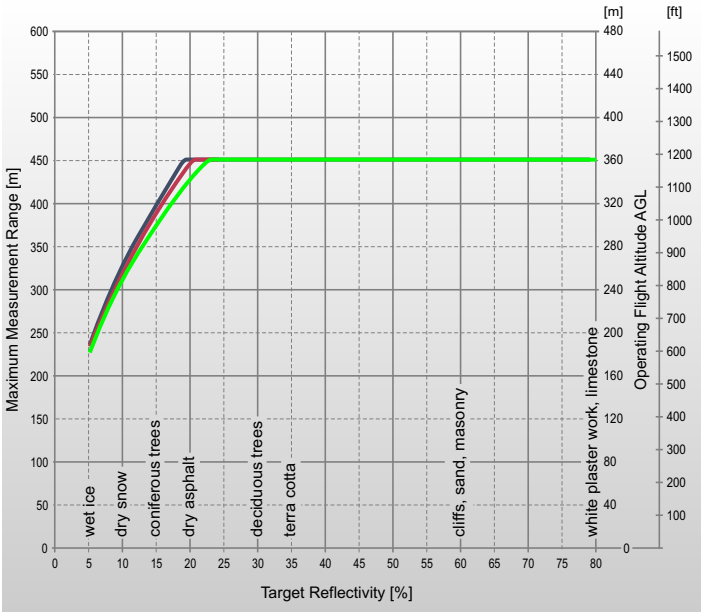
Mounting of Laser Scanner	mounting base block (with 8 x M8 thread inserts and 6 x mounting slots)
Mounting of IMU Sensor	3 x M6 thread inserts in the bottom and the top plate (rigidly coupled with the internal mechanical structure)

General Technical Data

Power Supply Input Voltage	18 - 32 V DC
Power Consumption	typ. 65 W
Main Dimensions / Weight	360.5 x 219 mm (length x width), approx. 13 kg
Humidity	max. 80% non condensing @ +31°C
Protection Class	IP64, dust and splash-proof
Max. Flight Altitude (operating)	16 500 ft (5 000 m) above MSL
Max. Flight Altitude (not operating)	18 000 ft (5 500 m) above MSL
Temperature Range	-10 °C to +40 °C (operation) / -20 °C to +50 °C (storage)

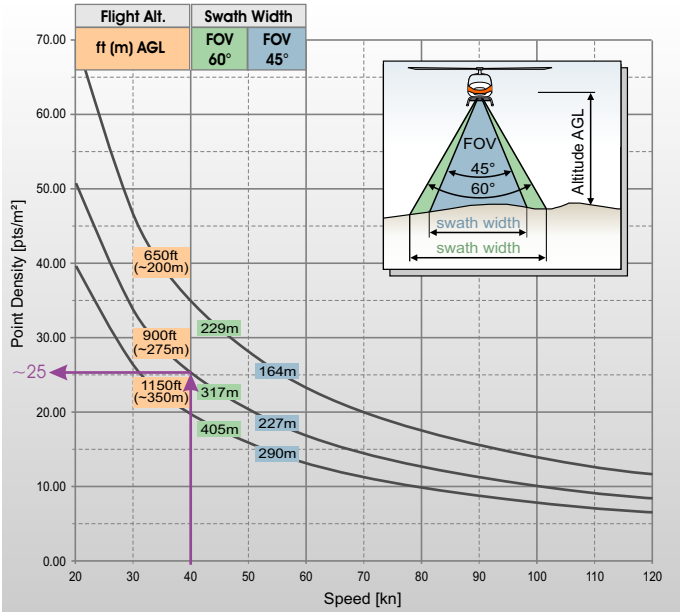
Maximum Measurement Range & Point Density for *RIEGL* VQ®-480

PRR = 300 kHz



@ visibility 23 km
@ visibility 15 km
@ visibility 8 km

PRR = 300 kHz

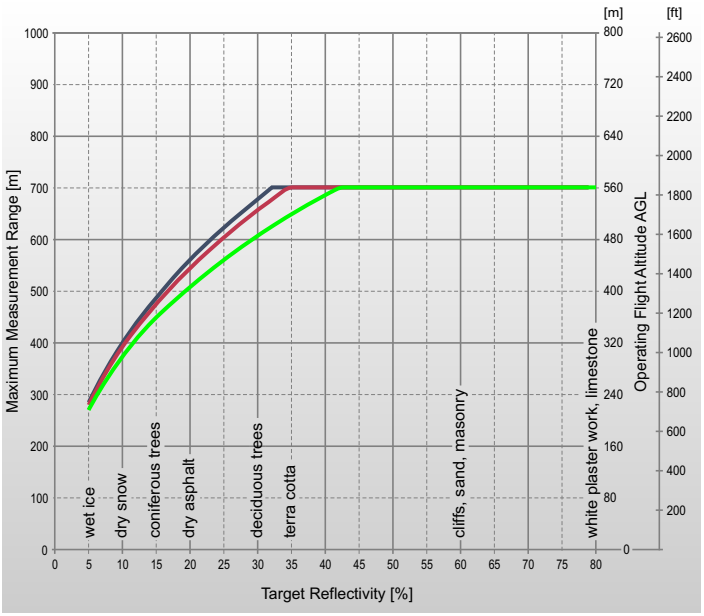


Example: VQ-480 at 300,000 pulses/second
Altitude = 900ft AGL, Speed = 40 kn
Resulting Point Density ~ 25 pts/m²

For the Operating Flight Altitude AGL, the following conditions are assumed

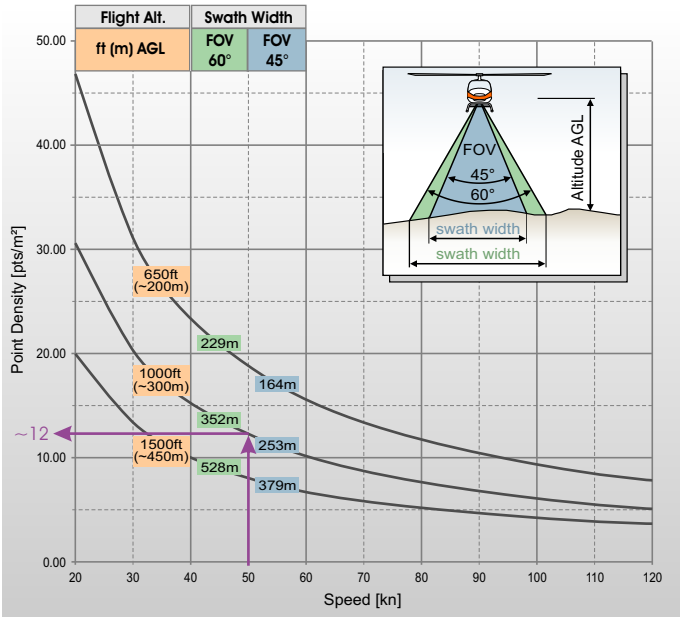
- target size ≥ laser footprint
- average ambient brightness
- scan angle 60°
- roll angle +/-6°

PRR = 200 kHz



@ visibility 23 km
@ visibility 15 km
@ visibility 8 km

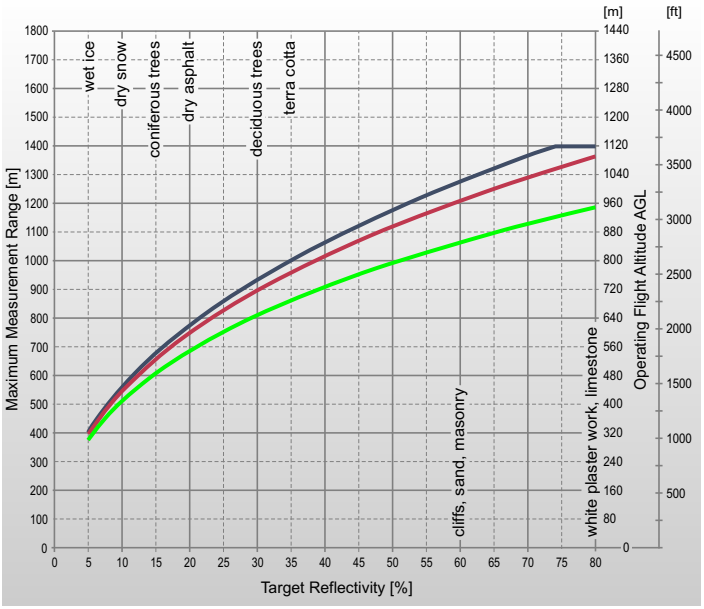
PRR = 200 kHz



Example: VQ-480 at 200,000 pulses/second
Altitude = 1000ft AGL, Speed = 50 kn
Resulting Point Density ~ 12 pts/m²

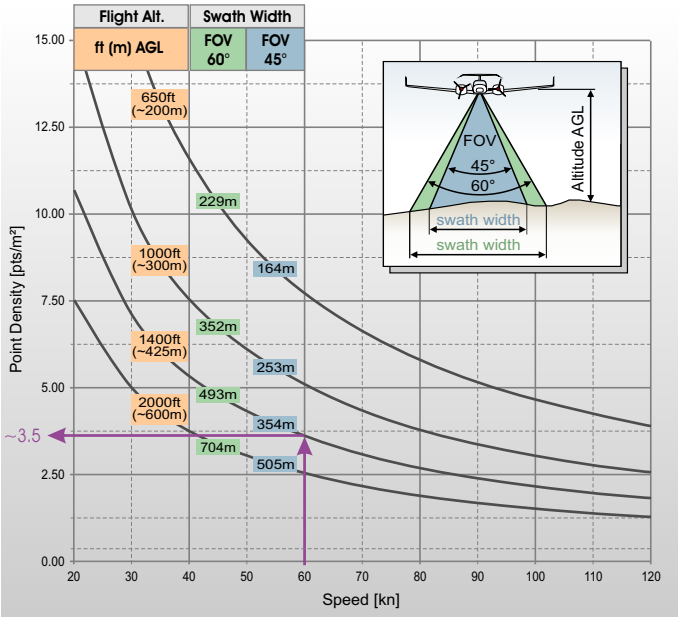
Maximum Measurement Range & Point Density for *RIEGL* VQ®-480

PRR = 100 kHz



— @ visibility 23 km
— @ visibility 15 km
— @ visibility 8 km

PRR = 100 kHz

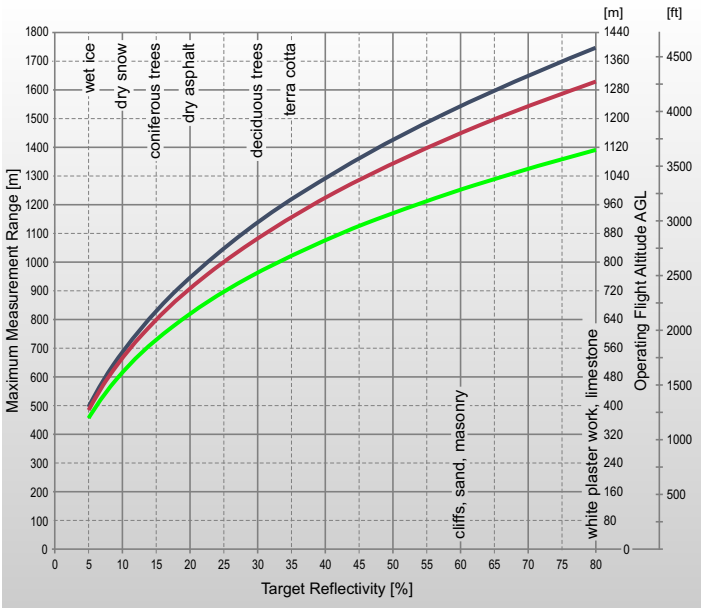


Example: VQ-480 at 100,000 pulses/second
Altitude = 1400ft AGL, Speed = 60 kn
Resulting Point Density ~ 3.5 pts/m²

For the Operating Flight Altitude AGL, the following conditions are assumed

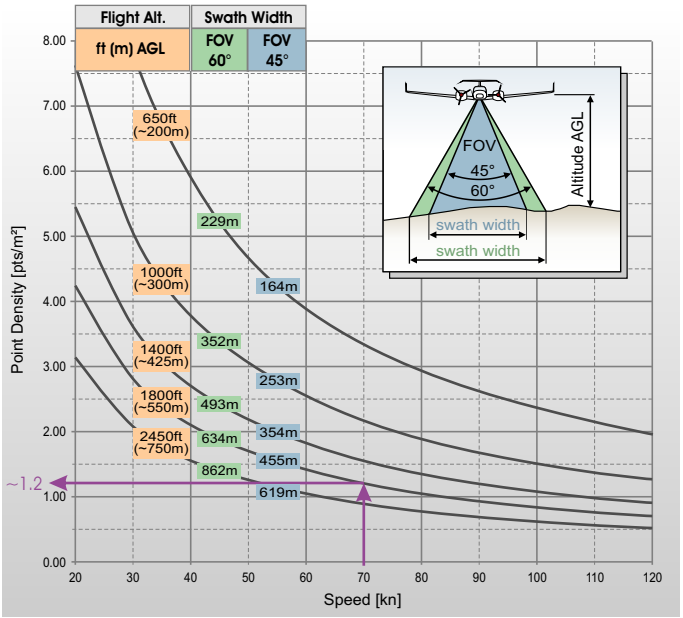
- target size ≥ laser footprint
- average ambient brightness
- scan angle 60°
- roll angle +/-6°

PRR = 50 kHz



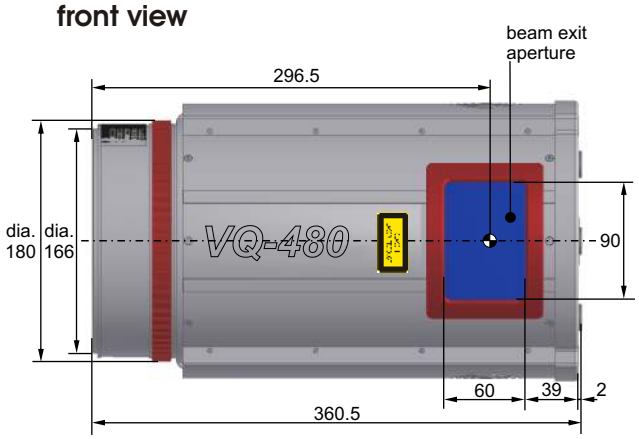
— @ visibility 23 km
— @ visibility 15 km
— @ visibility 8 km

PRR = 50 kHz

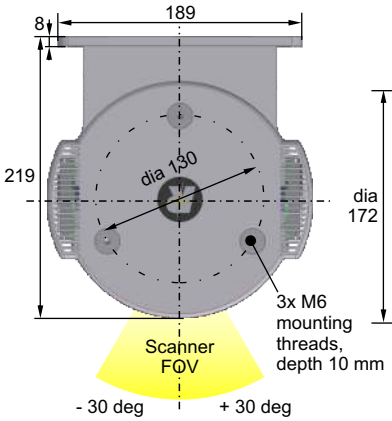


Example: VQ-480 at 50,000 pulses/second
Altitude = 1800ft AGL, Speed = 70 kn
Resulting Point Density ~ 1.2 pts/m²

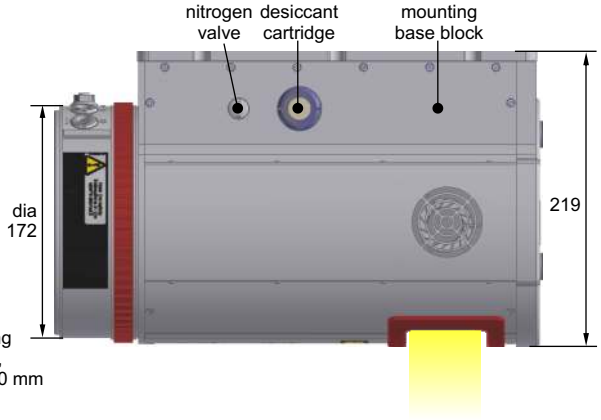
front view



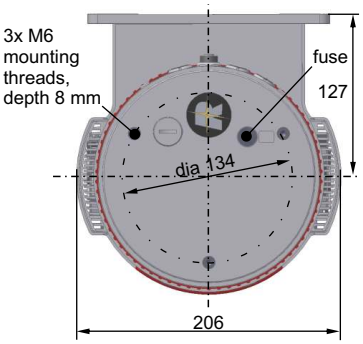
top view



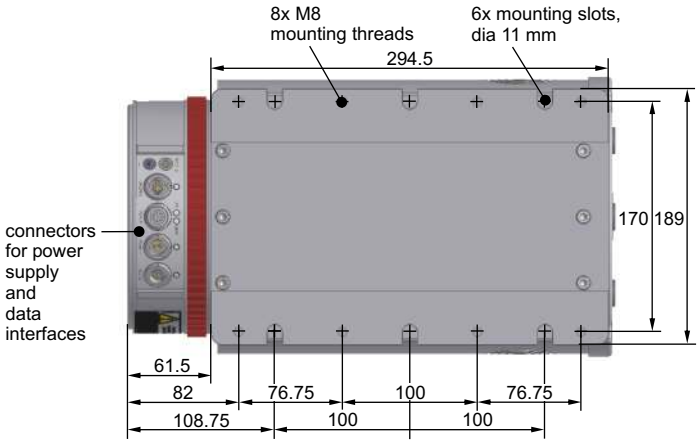
side view



bottom view



rear view



all dimensions in mm

RIEGL®
LASER MEASUREMENT SYSTEMS

RIEGL Laser Measurement Systems GmbH, 3580 Horn, Austria
Tel.: +43-2982-4211, Fax: +43-2982-4210, E-mail: office@riegl.co.at
RIEGL USA Inc., Orlando, Florida 32819, USA
Tel.: +1-407-248-9927, Fax: +1-407-248-2636, E-mail: info@rieglusa.com
RIEGL Japan Ltd., Tokyo 1640013, Japan
Tel.: +81-3-3382-7340, Fax: +81-3-3382-5843, E-mail: info@riegl-japan.co.jp

www.riegl.com