

# RIEGL VUX<sup>®</sup>-240

- **laser pulse repetition rate up to 1.8 MHz**
- **measurement rate up to 1,500,000 meas./sec**
- **scan speed up to 400 lines/second**
- **operating flight altitude up to 1,400m / 4,600 ft**
- **Field of View up to 75°**
- **perfectly linear and parallel scan lines**
- **cutting edge RIEGL technology providing:**
  - **echo signal digitization**
  - **multiple target capability**
  - **online waveform processing**
  - **multiple-time-around processing**
- **compact & lightweight**
- **easily mountable to unmanned platforms (UAVs) and to helicopters, gyrocopters, and other small manned aircrafts**
- **mechanical and electrical interface for INS/GNSS integration (optional)**
- **interfaces for up to 4 optional cameras**
- **scan data storage on internal 1 TByte SSD Memory**

The *RIEGL VUX-240* is a lightweight airborne laser scanner, especially designed for use on UAS/UAV/RPAS and small manned aeroplanes or helicopters.

With its wide field of view of 75 degrees and an extremely fast data acquisition rate of up to 1.8 MHz, the instrument is perfectly suited for high point density corridor mapping applications.

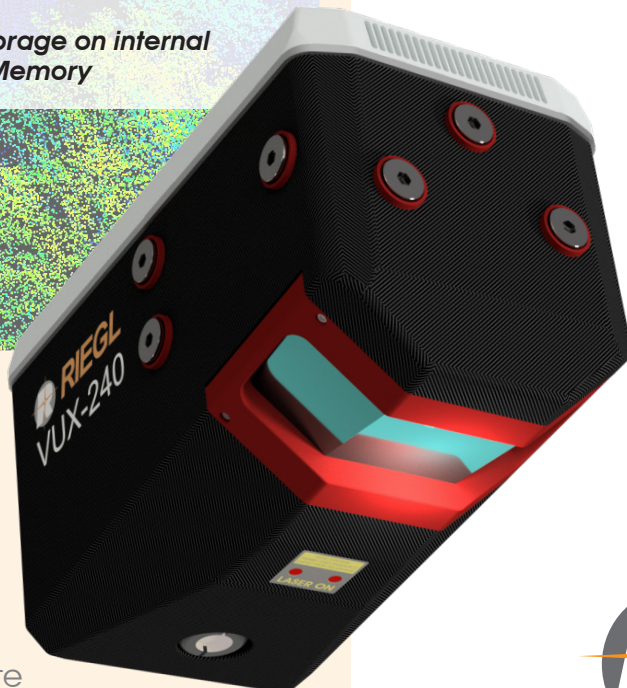
The VUX-240 makes use of *RIEGL's* unique Waveform-LiDAR technology, allowing echo digitization and online waveform processing. Multi-target resolution is the basis for penetrating even dense foliage.

A continuously rotating polygon mirror wheel enables scan speeds of up to 400 lines per second, for efficiently covering large areas when operated from fast UAVs or aircrafts.

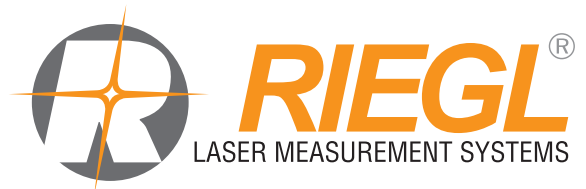
The scanner provides an internal data storage capacity of 1 TByte and is equipped with interfaces for an external IMU/GNSS system as well as to control up to four external cameras.

## Typical applications include

- **Corridor Mapping: Power Line, Railway Track and Pipeline Inspection**
- **Topography in Open-Cast Mining**
- **Surveying of Urban Environments**
- **Archeology and Cultural Heritage Documentation**
- **Agriculture & Forestry**



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[www.riegl.com](http://www.riegl.com)



# Technical Data RIEGL VUX®-240

## Laser Product Classification

Class 3R Laser Product according to IEC60825-1:2014  
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.

INVISIBLE LASER RADIATION  
AVOID DIRECT EYE EXPOSURE  
CLASS 3R LASER PRODUCT

NOHD (Nominal Ocular Hazard Distance)

0.3 m

ENOHD (Extended Nominal Ocular Hazard Distance)

2.5 m

MAX. AVERAGE OUTPUT <15 mW  
PULSE DURATION APPROX. 3 ns  
WAVELENGTH 1550 nm  
STANDARD IEC60825-1:2014

## Range Measurement Performance

### Measuring Principle

time of flight measurement, echo signal digitization, multiple target capability, online waveform processing, multiple-time-around-processing

Laser Pulse Repetition Rate PRR <sup>1)</sup>	150 kHz	300 kHz	600 kHz	1200 kHz	1800 kHz
Max. Measuring Range <sup>2) 3)</sup>					
natural targets $\rho \geq 20\%$	1200 m	850 m	650 m	450 m	350 m
natural targets $\rho \geq 60\%$	1900 m	1400 m	1050 m	750 m	650 m
natural targets $\rho \geq 80\%$	2150 m	1600 m	1200 m	850 m	700 m
Max. Operating Flight Altitude AGL <sup>2) 4)</sup>					
@ $\rho \geq 20\%$	900 m (2950 ft)	600 m (1950 ft)	500 m (1650 ft)	350 m (1150 ft)	250 m (800 ft)
@ $\rho \geq 60\%$	1400 m (4600 ft)	1050 m (3450 ft)	900 m (2950 ft)	550 m (1800 ft)	500 m (1650 ft)
Max. Number of Targets per Pulse <sup>5)</sup>	15	15	15	8	5

1) Rounded average PRR.  
2) Typical values for average conditions and average ambient brightness. In bright sunlight, the max. range is shorter than under an overcast sky.  
3) The 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. Range ambiguities have to be resolved by multiple-time-around processing.  
4) Effective FOV 75°, additional roll angle  $\pm 5^\circ$ .  
5) If the laser beam hits, in part, more than one target, the laser's pulse power is split accordingly. Thus the achievable range is reduced.

Minimum Range

5 m

Accuracy <sup>7) 9)</sup>

20 mm

Precision <sup>8) 9)</sup>

15 mm

Laser Pulse Repetition Rate <sup>1) 10)</sup>

up to 1800 kHz

Max. Effective Measurement Rate <sup>1)</sup>

up to 1,500,000 meas./sec. (@ 1800 kHz PRR & 75° FOV)

Echo Signal Intensity

for each echo signal, high-resolution 16 bit intensity information is provided

Laser Wavelength

near infrared

Laser Beam Divergence

0.35 mrad <sup>11)</sup>

Laser Beam Footprint (Gaussian Beam Definition)

35 mm @ 100 m, 175 mm @ 500 m, 350 mm @ 1000 m

7) Accuracy is the degree of conformity of a measured quantity to its actual (true) value.

9) One sigma @ 150 m range under RIEGL test conditions.

8) Precision, also called reproducibility or repeatability, is the degree to which further measurements show the same result.

10) User selectable.

11) Measured at the 1/e<sup>2</sup> points. 0.35 mrad corresponds to an increase of 35 mm of beam diameter per 100 m distance.

## Scanner Performance

Scanning Mechanism

rotating polygon mirror

Scan Pattern

parallel scan lines

Field of View (selectable)

$\pm 37.5^\circ = 75^\circ$

Scan Speed (selectable)

40 - 400 lines/sec

Angular Step Width  $\Delta \theta$  (selectable)

$0.002^\circ \leq \Delta \theta \leq 0.24^\circ$  <sup>12) 13)</sup>

between consecutive laser shots

Angle Measurement Resolution

0.001°

Scan Sync (optional)

scanner rotation synchronization

## Data Interfaces

Configuration

LAN 10/100/1000 Mbit/sec

Scan Data Output

LAN 10/100/1000 Mbit/sec

GNSS Interface

Serial RS-232 interface for data string with GNSS-time information,

TTL input for 1PPS synchronization pulse

External Camera

4x power, RS-232, 1pps, trigger, exposure, TTL input/output

External IMU & GNSS

combined connector with power supply and

signal interface to external IMU & GNSS

## General Technical Data

Power Supply Input Voltage / Consumption <sup>14)</sup>

11 - 34 V DC / typ. 60 W

Main Dimensions (L x W x H)

292 mm x 164 mm x 185 mm (without IMU/GNSS)

380 mm x 164 mm x 185 mm (with IMU/GNSS)

Weight

$\leq 4.1$  kg (without IMU/GNSS),  $\leq 4.9$  kg (with IMU/GNSS)

Humidity

max. 80 % non condensing @ 31°C

Protection Class

IP64, dust and splash-proof

Max. Flight Altitude (operating & not operating)

18 500 ft (5 600 m) above MSL (Mean Sea Level)

Temperature Range

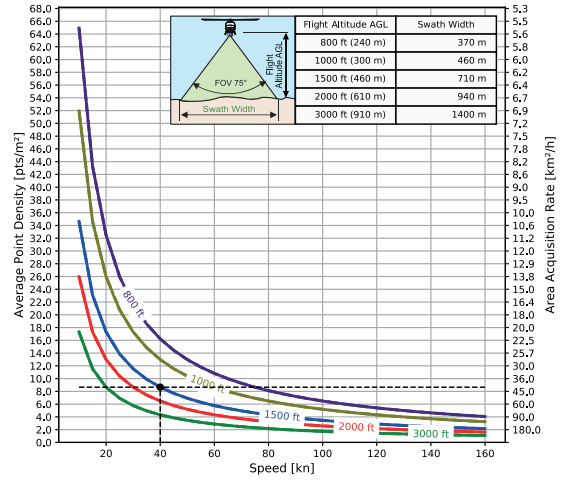
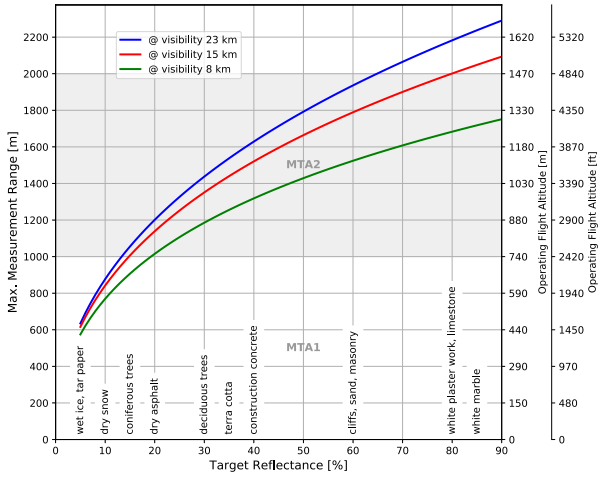
-10°C up to +40°C (operation) / -20°C up to +50°C (storage)

<sup>12)</sup> The angular step width depends on the selected laser PRR.  
<sup>13)</sup> The maximum angular step width is limited by the maximum scan rate.

<sup>14)</sup> without external IMU/GNSS

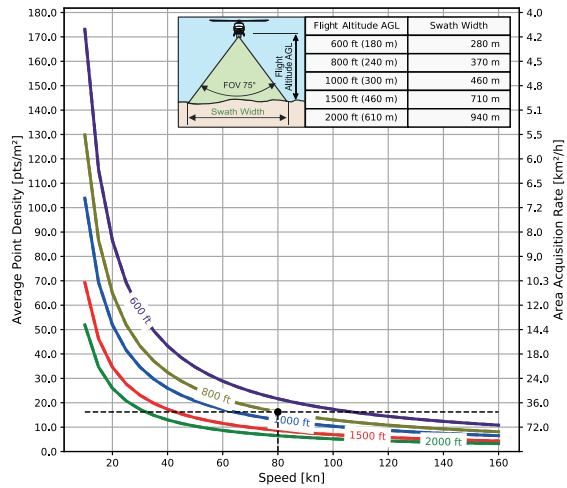
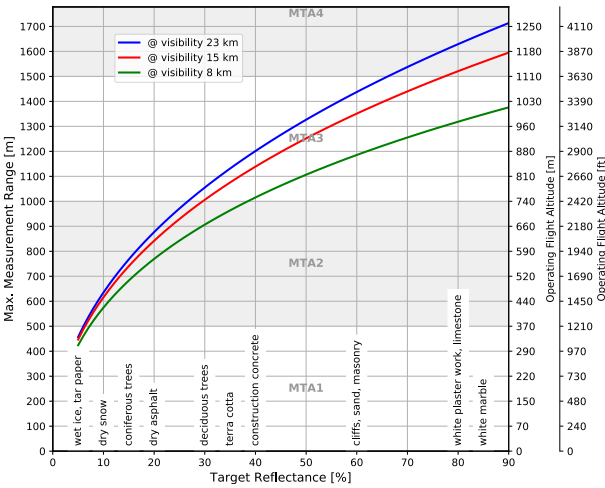
to be continued at page 6

## PRR = 150 kHz



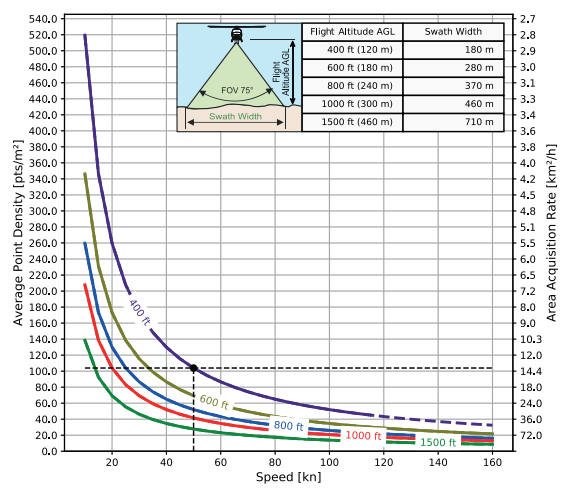
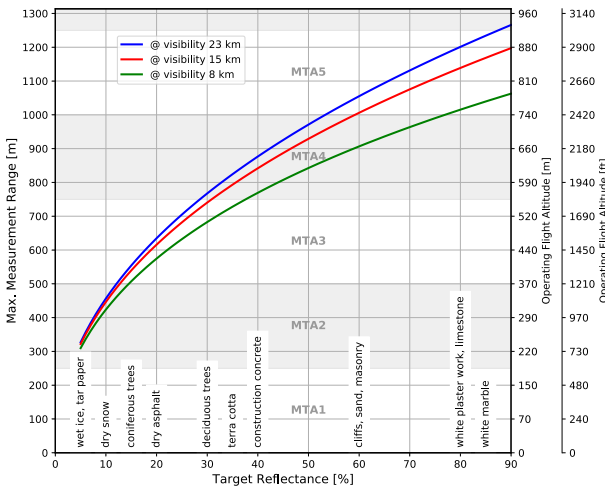
Example: VUX-240 at 150,000 pulses/sec, laser power level 100%  
Altitude = 1,500 ft AGL, Speed 40 kn, resulting point density ~ 9 pts/m<sup>2</sup>

## PRR = 300 kHz



Example: VUX-240 at 300,000 pulses/sec, laser power level 100%  
Altitude = 800 ft AGL, Speed 80 kn, resulting point density ~ 16 pts/m<sup>2</sup>

## PRR = 600 kHz

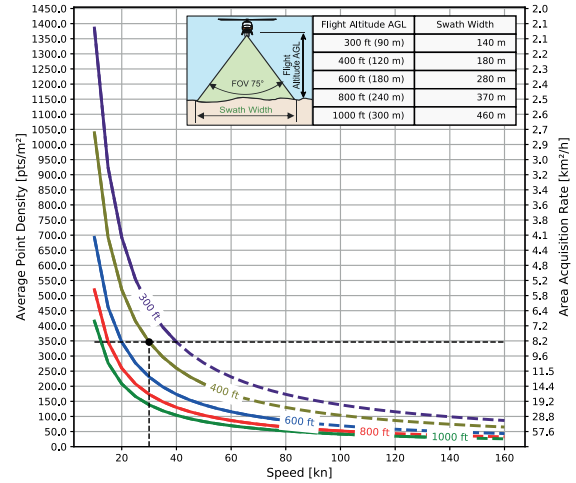
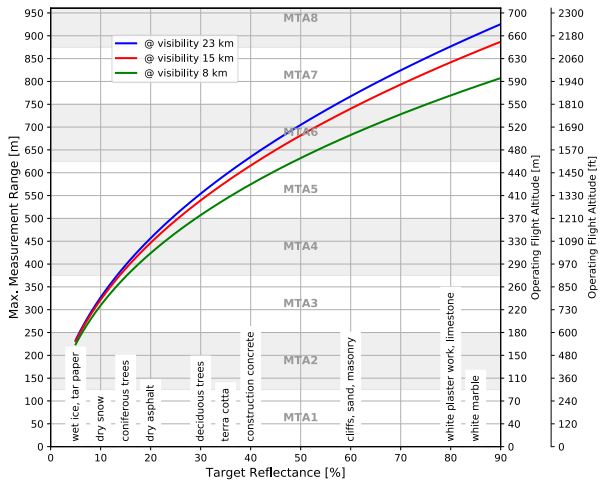


Example: VUX-240 at 600,000 pulses/sec, laser power level 100%  
Altitude = 400 ft AGL, Speed 50 kn, resulting point density ~ 104 pts/m<sup>2</sup>



# Maximum Measurement Range & Point Density RIEGL VUX<sup>®</sup>-240

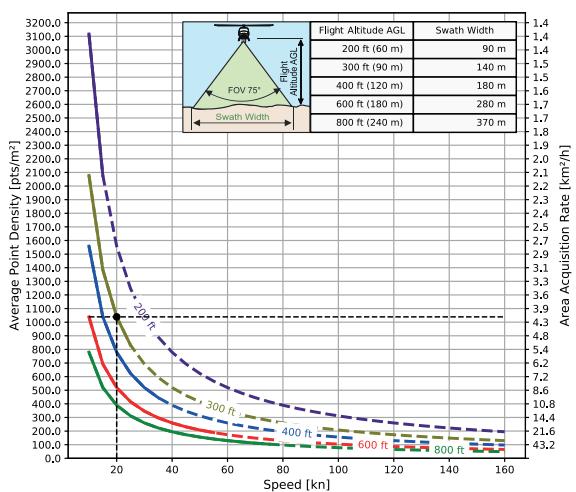
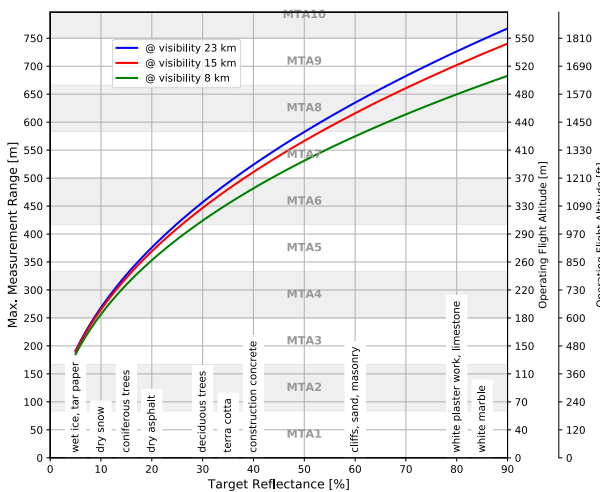
PRR = 1200 kHz



Operating Flight Altitude AGL given for the following conditions:  
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,  
average ambient brightness, target size ≥ laser footprint, roll angle ±5

Example: VUX-240 at 1,200,000 pulses/sec, laser power level 100%  
Altitude = 400 ft AGL, Speed 30 kn, resulting point density ~ 346 pts/m<sup>2</sup>

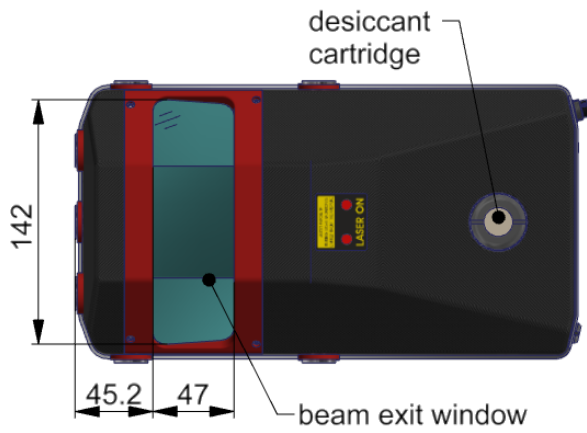
PRR = 1800 kHz



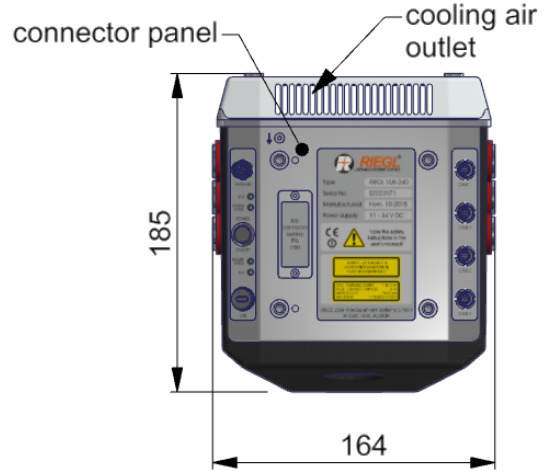
Operating Flight Altitude AGL given for the following conditions:  
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,  
average ambient brightness, target size ≥ laser footprint, roll angle ±5

Example: VUX-240 at 1,800,000 pulses/sec, laser power level 100%  
Altitude = 300 ft AGL, Speed 20 kn, resulting point density ~ 1039 pts/m<sup>2</sup>

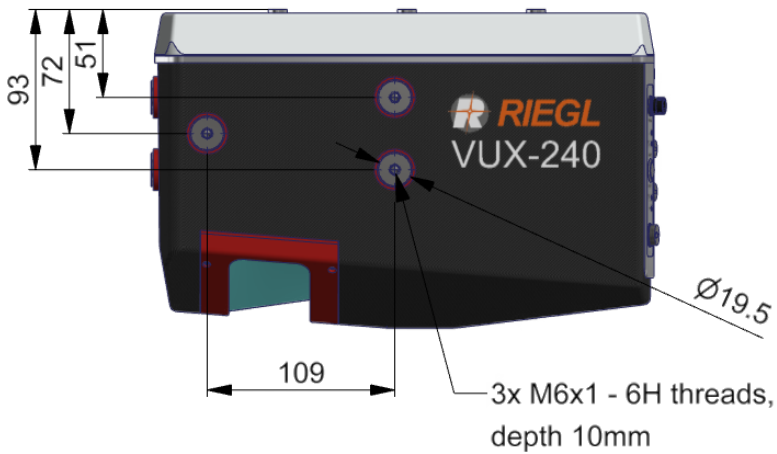
bottom view



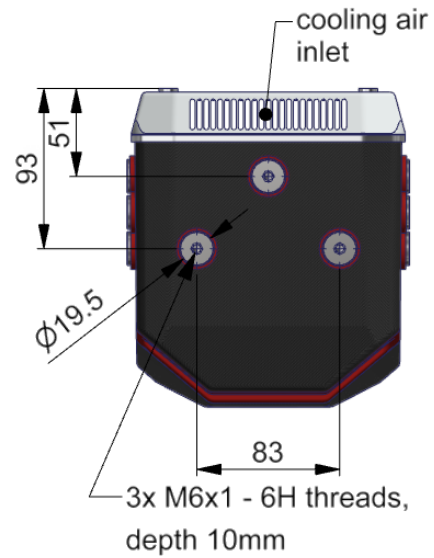
rear view



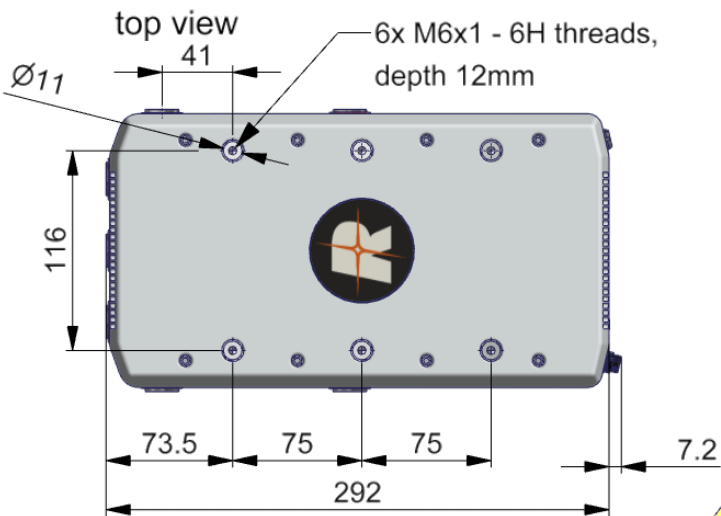
side view



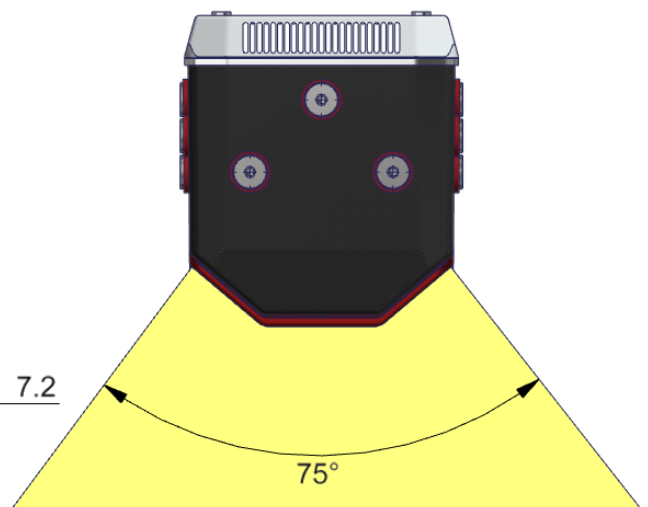
front view



top view



front view with FOV



all dimensions in mm

## Technical Data RIEGL VUX<sup>®</sup>-240 (continued)

### Data Storage

Internal Data Storage  
Memory Card Slot<sup>1)</sup>

Solid State Disc SSD, 1 TByte  
for CFAST<sup>® 2)</sup> memory card 120 GByte (can be upgraded to 256 GByte)

1) applies to IMU APX-20 UAV only

2) CFAST is a registered trademark of CompactFlash Association

### External IMU & GNSS (optional)

IMU Accuracy<sup>4)</sup>

Roll, Pitch  
Heading

IMU Sampling Rate

Position Accuracy (typ.)

Applanix APX-20 UAV<sup>3)</sup>

0.015°

0.035°

200 Hz

0.02 – 0.05 m

Applanix AP-20<sup>3)</sup>

0.015°

0.05°/0.025°<sup>5)</sup>

200 Hz

0.02 – 0.05 m

Applanix AP-50 Air<sup>3)</sup>

0.005°

0.010°

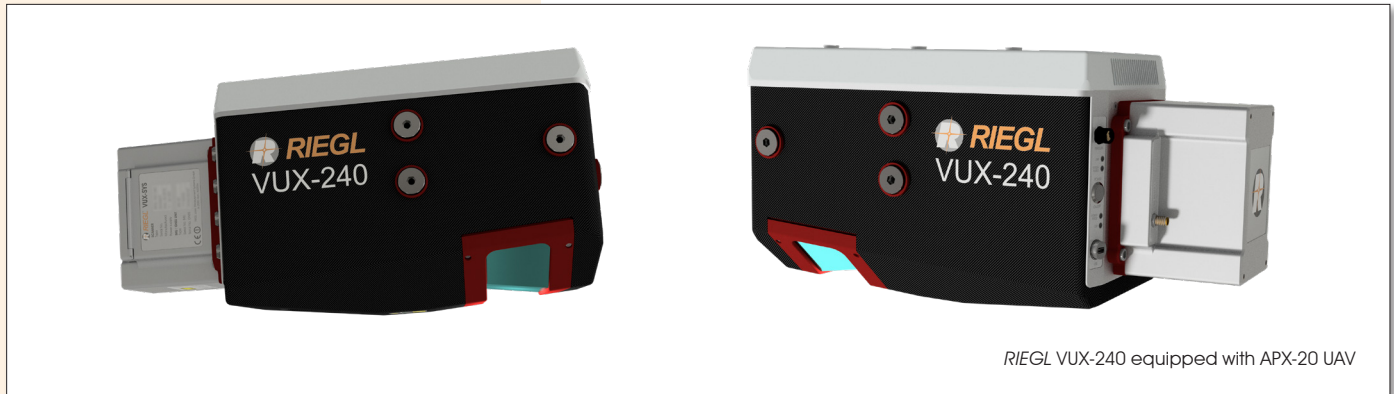
200 Hz

0.02 – 0.05 m

3) See technical details at the according Applanix datasheet.

4) Accuracy specifications for post-processed data.

5) Improved heading accuracy with dual antenna option (GAMS) @ 2m baseline.



RIEGL VUX-240 equipped with APX-20 UAV

## RIEGL VUX<sup>®</sup>-240 UAV Platform Integration (optional)



manned helicopter with RIEGL VUX-240 LiDAR Sensor,  
AP-50 Air and nadir RGB camera fully integrated



RICOPTER with RIEGL VUX-240 LiDAR Sensor,  
APX-20 UAV and nadir RGB camera fully integrated



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