

# RIEGL VUX<sup>®</sup>-240<sup>24</sup>

- **laser pulse repetition rate up to 2.4 MHz**
- **measurement rate up to 2,000,000 meas./sec**
- **scan speed up to 600 lines/second**
- **operating flight altitude up to 1,430m / 4,700 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 crewed aircraft**
- **mechanical and electrical interface for IMU/GNSS integration (optional)**
- **RIEGL RiLOC IMU/GNSS system solutions available**
- **interfaces for up to 4 optional cameras**
- **scan data storage on internal 2 TByte SSD Memory**
- **removeable CFAST<sup>®</sup> memory card**

The **RIEGL VUX-240<sup>24</sup>** is the new version of the proven **RIEGL VUX-240**, offering higher pulse repetition rates and faster scanning speed for further increased field performance and workflow efficiency. The sophisticated design enables integration with UAS/UAV/RPAS and adequate crewed aero planes or helicopters.

With its wide field of view of 75 degrees and an extremely fast data acquisition rate of up to 2.4 MHz, the instrument is perfectly suited for high point density applications.

A continuously rotating polygon mirror wheel enables scan speeds of up to 600 lines per second, for efficiently covering large areas when operated from fast UAVs or aircraft.

The VUX-240<sup>24</sup> 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.

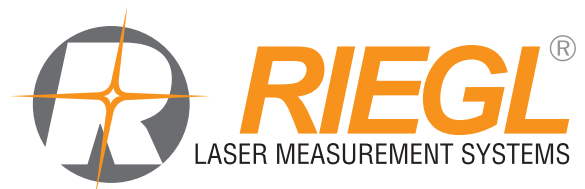
The scanner provides an internal data storage capacity of 2 TByte and is equipped with interfaces for an external IMU/GNSS system as well as to control up to four external cameras.

## 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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# Technical Data *RIEGL VUX*<sup>®</sup>-240<sup>24</sup> (continued)

## 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) <sup>1) 2)</sup>

ENOHD (Extended Nominal Ocular Hazard Distance) <sup>1) 3)</sup>

0 m

0 m

- 1) NOHD and ENOHD stated for operating the device from an aircraft flying at a speed higher than 1 kn.

- 2) For a stationary operated device NOHD is 0.3 m.  
3) For a stationary operated device ENOHD is 3.5 m.

MAX. AVERAGE OUTPUT <50 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>4)</sup>       | 300 kHz             | 600 kHz             | 1200 kHz           | 1800 kHz           | 2400 kHz           |
|-----------------------------------------------------|---------------------|---------------------|--------------------|--------------------|--------------------|
| Max. Measuring Range <sup>5) 6)</sup>               |                     |                     |                    |                    |                    |
| natural targets $p \geq 20\%$                       | 1200 m              | 880 m               | 640 m              | 530 m              | 460 m              |
| natural targets $p \geq 60\%$                       | 1940 m              | 1440 m              | 1060 m             | 880 m              | 770 m              |
| natural targets $p \geq 80\%$                       | 2180 m              | 1630 m              | 1200 m             | 1000 m             | 880 m              |
| Max. Operating Flight Altitude AGL <sup>5) 7)</sup> |                     |                     |                    |                    |                    |
| @ $p \geq 20\%$                                     | 890 m<br>(2900 ft)  | 650 m<br>(2150 ft)  | 470 m<br>(1550 ft) | 390 m<br>(1250 ft) | 340 m<br>(1100 ft) |
| @ $p \geq 60\%$                                     | 1430 m<br>(4700 ft) | 1060 m<br>(3500 ft) | 780 m<br>(2550 ft) | 650 m<br>(2150 ft) | 570 m<br>(1850 ft) |
| Max. Number of Targets per Pulse <sup>8)</sup>      | 30                  | 24                  | 11                 | 7                  | 5                  |

4) Rounded average PRR.  
5) Typical values for average conditions and average ambient brightness. In bright sunlight, the max. range is shorter than under an overcast sky.  
6) 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.  
7) Effective FOV 75°, additional roll angle  $\pm 5^\circ$ .  
8) 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

Accuracy <sup>9) 11)</sup>

Precision <sup>10) 11)</sup>

Laser Pulse Repetition Rate <sup>4) 12)</sup>

Max. Effective Measurement Rate <sup>4)</sup>

Echo Signal Intensity

Laser Wavelength

Laser Beam Divergence

Laser Beam Footprint (Gaussian Beam Definition)

5 m

20 mm

15 mm

up to 2400 kHz

up to 2,000,000 meas./sec. (@ 2400 kHz PRR & 75° FOV)

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

near infrared

0.35 mrad <sup>13)</sup>

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

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

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

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

12) User selectable, setting of intermediate PRR values possible.

13) 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

Scan Pattern

Field of View (selectable)

Scan Speed (selectable)

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

between consecutive laser shots

Angle Measurement Resolution

Scan Sync (optional)

rotating polygon mirror

parallel scan lines

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

40 - 600 lines/sec

$0.002^\circ \leq \Delta \theta \leq 0.18^\circ$  <sup>14) 15)</sup>

0.001°

scanner rotation synchronization

## Data Interfaces

Configuration

Scan Data Output

GNSS Interface

General IO & Control <sup>16)</sup>

Camera Interfaces at connector panel

Camera Interfaces via multi purpose connector <sup>16)</sup>

IMU Interface (optional) <sup>17)</sup>

LAN 10/100/1000 Mbit/sec

LAN 10/100/1000 Mbit/sec

Serial RS-232 interface, TTL input for 1pps synchronization pulse, accepts different data formats for GNSS-time information

1x TTL input, 1x TTL output, 1x Remote on/off

4x power (each max. 2.0 A), trigger, exposure, and GNSS RS-232 Tx & PPS

1x trigger and exposure

IMU data, power

## General Technical Data

Power Supply Input Voltage / Consumption <sup>18)</sup>

Main Dimensions (L x W x H)

Weight

Humidity

Protection Class

Max. Flight Altitude (operating & not operating)

Temperature Range

18 - 34 V DC / typ. 77 W

292 mm x 162 mm x 185 mm (without IMU)

approx. 4.3 kg

max. 80 % non condensing @ 31°C

IP64, dust and splash-proof

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

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

14) The angular step width depends on the selected laser PRR.  
15) The maximum angular step width is limited by the maximum scan rate.

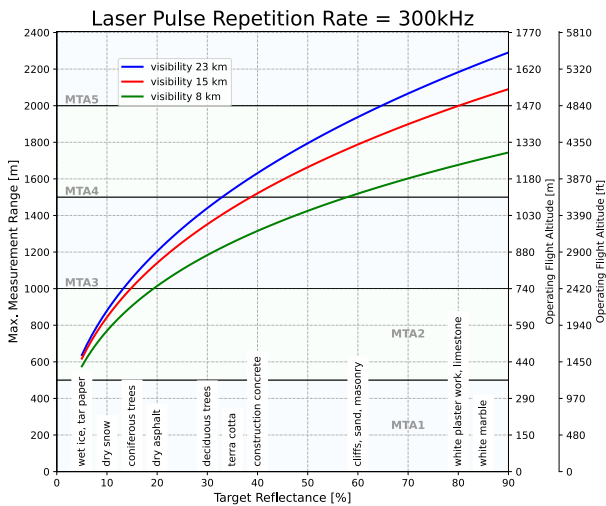
16) externally available via connection board (including 1x power camera)

17) applies only with IMU/GNSS system

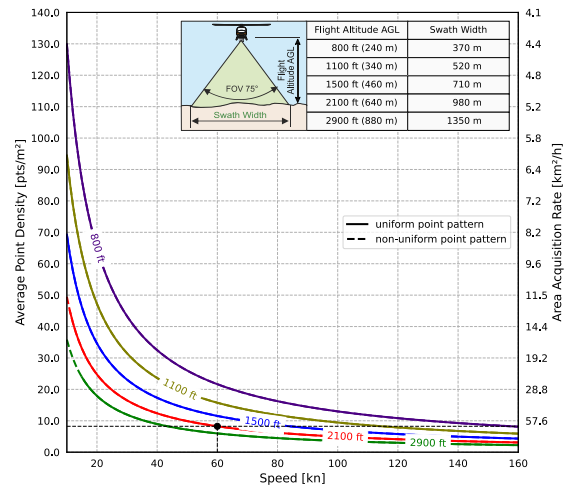
18) Separate input power connector for external cameras, without external IMU/GNSS.

to be continued at page 6

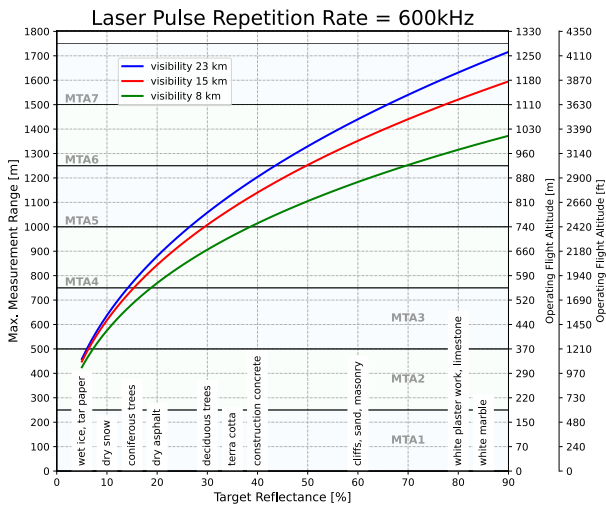
# Maximum Measurement Range & Point Density *RIEGL VUX®-240*<sup>24</sup>



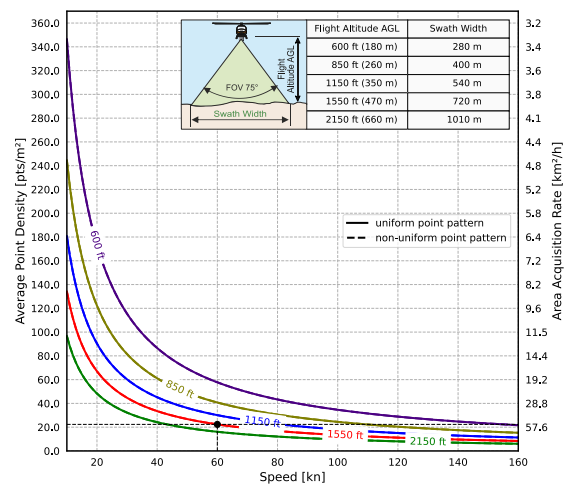
Operating Flight Altitude AGL given for the following conditions:  
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,  
average ambient brightness, target size  $\geq$  laser footprint, roll angle  $\pm 5^\circ$



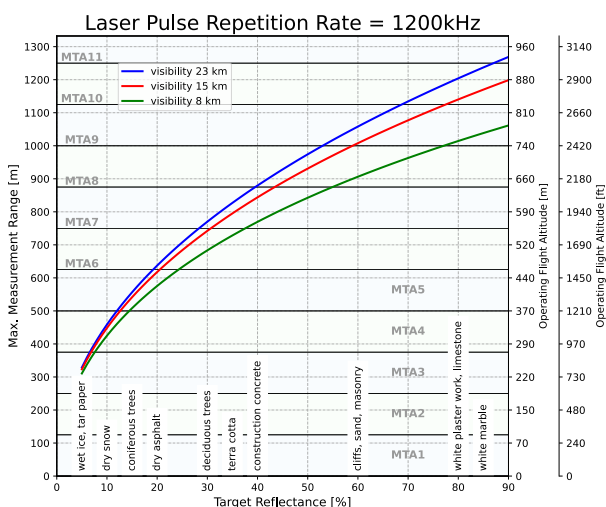
Example: VUX-240<sup>24</sup> at 300,000 pulses/sec, laser power level 100%  
Altitude = 2,100 ft AGL, Speed 60 kn, resulting point density  $\sim 8.3$  pts/m<sup>2</sup>



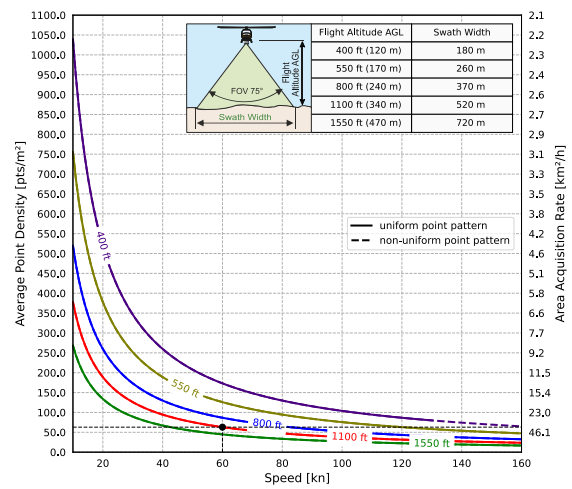
Operating Flight Altitude AGL given for the following conditions:  
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,  
average ambient brightness, target size  $\geq$  laser footprint, roll angle  $\pm 5^\circ$



Example: VUX-240<sup>24</sup> at 600,000 pulses/sec, laser power level 100%  
Altitude = 1,550 ft AGL, Speed 60 kn, resulting point density  $\sim 22.3$  pts/m<sup>2</sup>

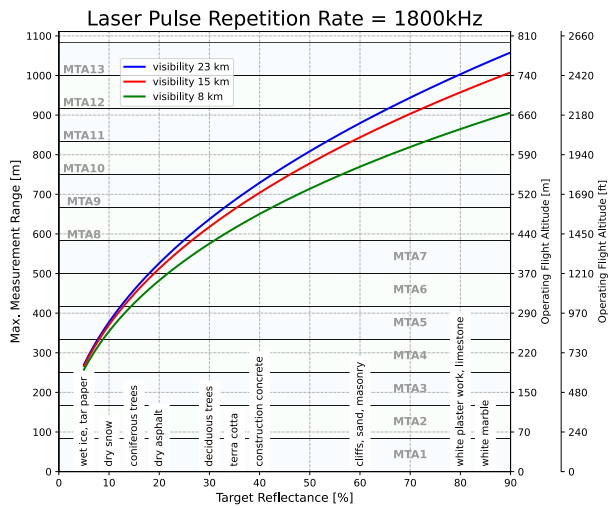


Operating Flight Altitude AGL given for the following conditions:  
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,  
average ambient brightness, target size  $\geq$  laser footprint, roll angle  $\pm 5^\circ$

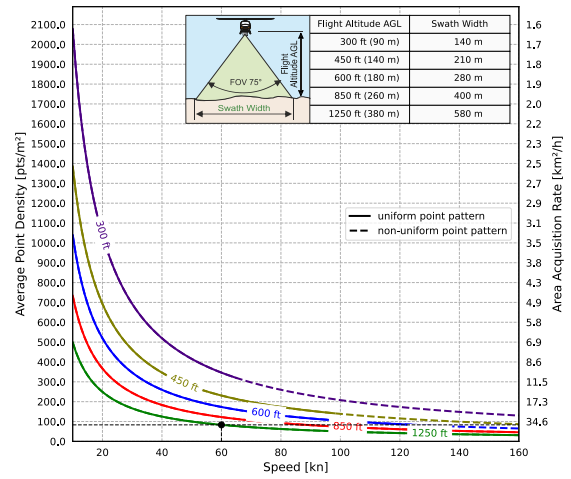


Example: VUX-240<sup>24</sup> at 1,200,000 pulses/sec, laser power level 100%  
Altitude = 1,100 ft AGL, Speed 60 kn, resulting point density  $\sim 63$  pts/m<sup>2</sup>

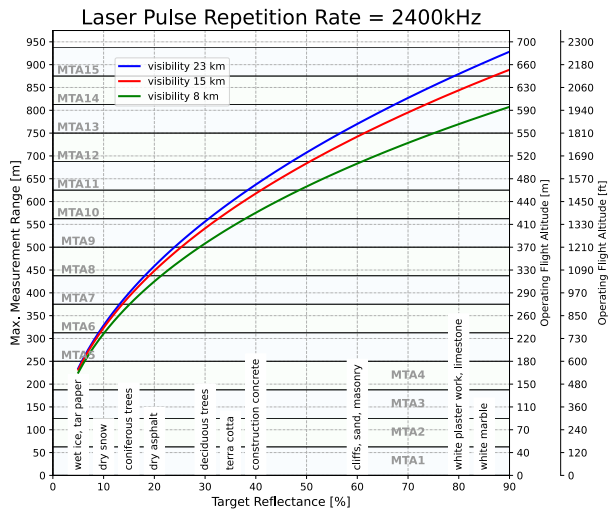
# Maximum Measurement Range & Point Density *RIEGL VUX<sup>®</sup>-240<sup>24</sup>*



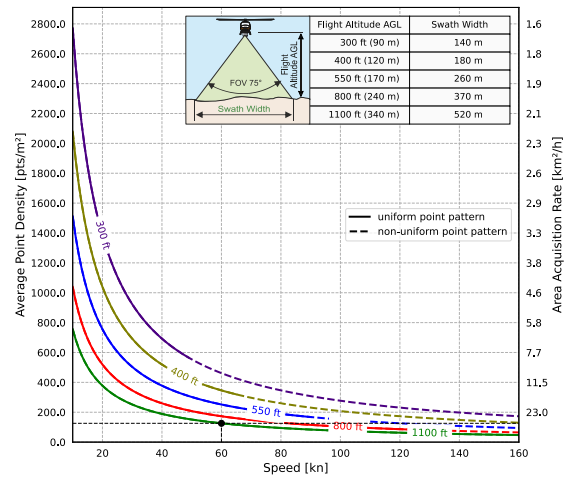
Operating Flight Altitude AGL given for the following conditions:  
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,  
average ambient brightness, target size  $\geq$  laser footprint, roll angle  $\pm 5^\circ$



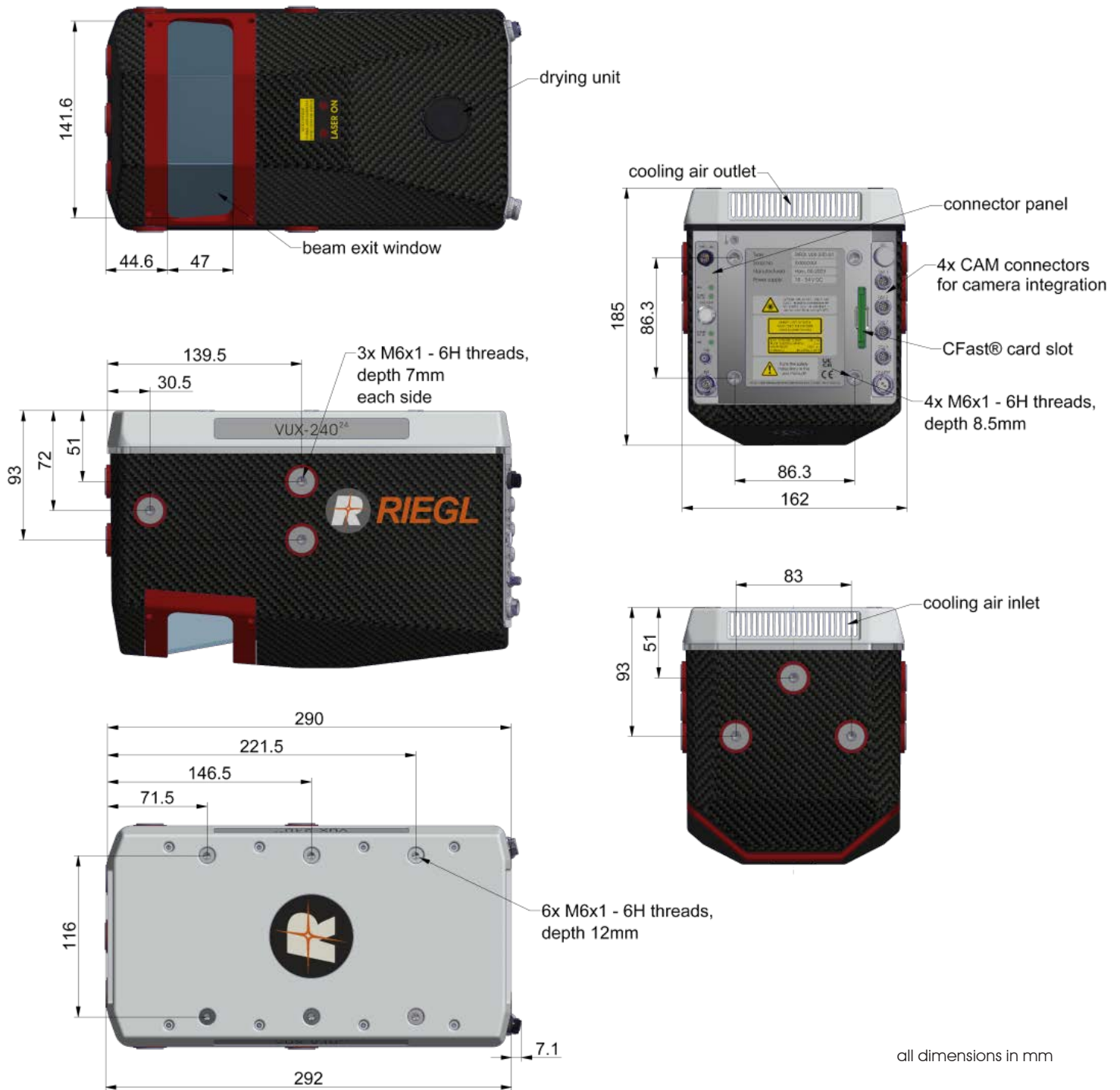
Example: VUX-240<sup>24</sup> at 1,800,000 pulses/sec, laser power level 100%  
Altitude = 1,250 ft AGL, Speed 60 kn, resulting point density  $\sim 83.1$  pts/m<sup>2</sup>



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



Example: VUX-240<sup>24</sup> at 2,400,000 pulses/sec, laser power level 100%  
Altitude = 1,100 ft AGL, Speed 60 kn, resulting point density  $\sim 125.93$  pts/m<sup>2</sup>



# Technical Data RIEGL VUX<sup>®</sup>-240<sup>24</sup> (continued)

## Data Storage

Internal Data Storage  
Memory Card Slot

Solid State Disc SSD, 2 TByte  
for CFAST<sup>®</sup> 1) industrial memory card 1 TByte

1) 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.)

System Total Weight (approx.) <sup>6)</sup>

| RILOC-F <sup>2)</sup> /<br>RILOC-F <sub>inside</sub> <sup>2)</sup> | Applanix AP+30 <sup>3)</sup> | Applanix AP+50 <sup>3)</sup> | Applanix AP+60 <sup>3)</sup> |
|--------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|
| 0.005°                                                             | 0.010°                       | 0.005°                       | 0.0025° <sup>5)</sup>        |
| 0.005°                                                             | 0.025°                       | 0.010°                       | 0.005°                       |
| up to 700 Hz                                                       | 200 Hz                       | 200 Hz                       | 200 Hz                       |
| 0.02 - 0.03 m                                                      | 0.02 - 0.05 m                | 0.02 - 0.05 m                | 0.02 - 0.05 m                |
| 4.6 kg / 4.5 kg                                                    | 4.9 kg                       | 4.9 kg                       | 6.8 kg                       |

2) See technical details at the RILOC-F/RILOC-F<sub>inside</sub> infosheet

3) See technical details at the according Applanix datasheet

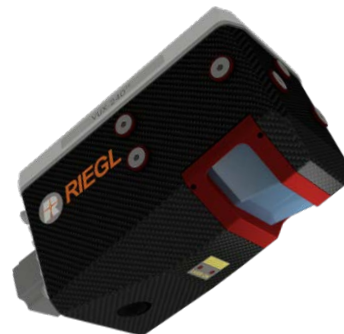
4) Accuracy specifications for post-processed data

5) May require local gravity model to achieve full accuracy

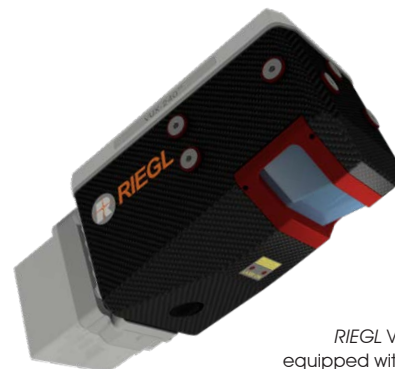
6) Single scanner with AP+board and with external IMU sensor



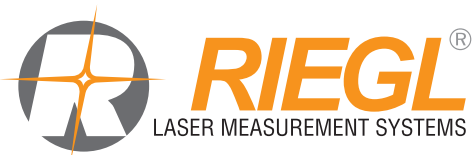
RIEGL VUX-240<sup>24</sup>  
equipped with RILOC-F<sub>inside</sub>



RIEGL VUX-240<sup>24</sup>  
equipped with AP+30 / AP+50



RIEGL VUX-240<sup>24</sup>  
equipped with AP+60



RIEGL Laser Measurement Systems GmbH, Headquarters  
RIEGL USA Inc., Headquarters North America

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