

RIEGL VUX[®]-180²⁴

- scan speed up to 800 lines/second
- laser pulse repetition rate up to 2.4 MHz
- measurement rate up to 2,000,000 meas./sec
- operating flight altitude up to 980 m / 3,250 ft
- Field of View up to 75°
- compact & lightweight (2.7 kg / 5.9 lbs)
- cutting edge RIEGL technology providing:
 - echo signal digitization
 - multiple target capability
 - online waveform processing
 - multiple-time-around processing
- easily mountable to unmanned platforms (UAVs) and small manned aircraft
- mechanical and electrical interface for IMU/GNSS integration
- interfaces for up to 5 external cameras
- scan data storage on internal SSD Memory
- removeable CFAST[®] memory card

The *RIEGL VUX-180²⁴* is a lightweight and versatile airborne laser scanner offering a wide field of view of 75 degrees and an extremely high pulse repetition rate of up to 2.4 MHz. These features – in combination with an increased scan speed of up to 800 lines/second – make the *RIEGL VUX-180²⁴* perfectly suited for high speed surveying missions and applications where an optimal line and point distribution is required.

The *RIEGL VUX-180²⁴* 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.

For smooth and straight forward data storage, the scanner provides an internal data storage capacity of 2 TByte and a removeable CFast[®] card. Interfaces for the integration of an appropriate external IMU/GNSS system and up to five optional external cameras are available.

The sophisticated design of the *RIEGL VUX-180²⁴* – already proven in the *RIEGL VUX-120*, *VUX-160*, and *VUX-240* series – enables smooth integration with fast-flying UAS/UAV/RPAS, small manned aeroplanes and helicopters. It is offered both, as stand-alone UAV LiDAR sensor and also in various fully-integrated UAV-based laser scanning system configurations with appropriate IMU/GNSS system and optional cameras. This allows the scanner to perfectly meet all the specific requirements of the customers' applications.

Typical applications include

- **High-Speed Corridor Mapping and High-Density Applications:** e.g. mapping and monitoring of critical infrastructure like power lines, railway tracks, pipelines, runways
- **Topography in Open-Cast Mining**
- **Surveying of Urban Environments**
- **Agriculture & Forestry**



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www.riegl.com



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.



NOHD (Nominal Ocular Hazard Distance) ^{1) 2)}
ENOHD (Extended Nominal Ocular Hazard Distance) ^{1) 3)}

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.

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 ⁴⁾	300 kHz	600 kHz	1200 kHz	1800 kHz	2400 kHz
Max. Measuring Range ^{5) 6)}					
natural targets $\rho \geq 20\%$	810 m	590 m	420 m	350 m	300 m
natural targets $\rho \geq 60\%$	1340 m	980 m	710 m	590 m	510 m
natural targets $\rho \geq 80\%$	1520 m	1120 m	810 m	670 m	590 m
Max. Operating Flight Altitude AGL ^{5) 7)}					
@ $\rho \geq 20\%$	600 m (1950 ft)	430 m (1400 ft)	310 m (1000 ft)	260 m (850 ft)	220 m (750 ft)
@ $\rho \geq 60\%$	980 m (3250 ft)	720 m (2350 ft)	520 m (1700 ft)	430 m (1400 ft)	380 m (1250 ft)
Max. Number of Targets per Pulse ⁸⁾	32	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) Considering max. effective FOV 75°, additional roll angle $< \pm 5$ deg.
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

5 m

Accuracy ^{9) 11)}

10 mm

Precision ^{10) 11)}

5 mm

Laser Pulse Repetition Rate ^{4) 12)}

up to 2400 kHz

Max. Effective Measurement Rate ⁴⁾

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

Echo Signal Intensity

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

Laser Wavelength

near infrared

Laser Beam Divergence

0.4 mrad ¹³⁾

Laser Beam Footprint (Gaussian Beam Definition)

40 mm @ 100 m, 200 mm @ 500 m, 400 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/e² points. 0.4 mrad corresponds to an increase of 40 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)

50 - 800 lines/sec

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

$0.002^\circ \leq \Delta \vartheta \leq 0.24^\circ$ ^{14) 15)}

between consecutive laser shots

Angle Measurement Resolution

0.001°

Scan Sync (optional)

scanner rotation synchronization

Data Interfaces

Configuration, Scan Data Output &

Communication with External Devices

GNSS Interface

LAN 10/100/1000 MBit/sec

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

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

5x power (max. 2.0 A), trigger, exposure, and GNSS RS-232 Tx & PPS

1x trigger and exposure

General IO & Control ¹⁶⁾

Camera Interfaces at connector panel

Camera Interfaces via multi purpose connector ¹⁷⁾

IMU Interface (optional) ¹⁸⁾

IMU data, power

14) The angular step width depends on the selected laser PRR.

15) The maximum angular step width is limited by the max. scan rate.

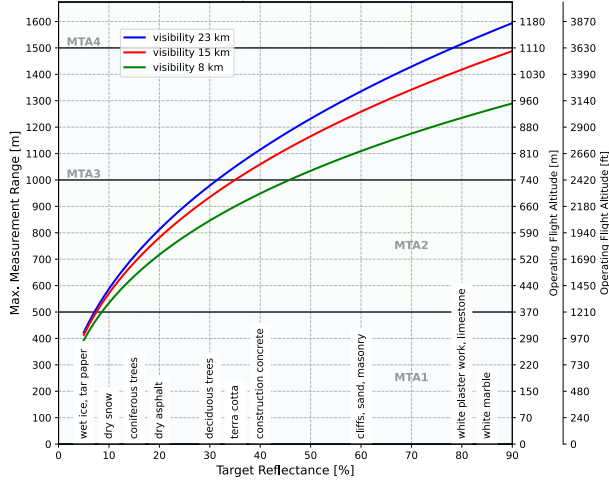
16) externally available via multi-purpose connector

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

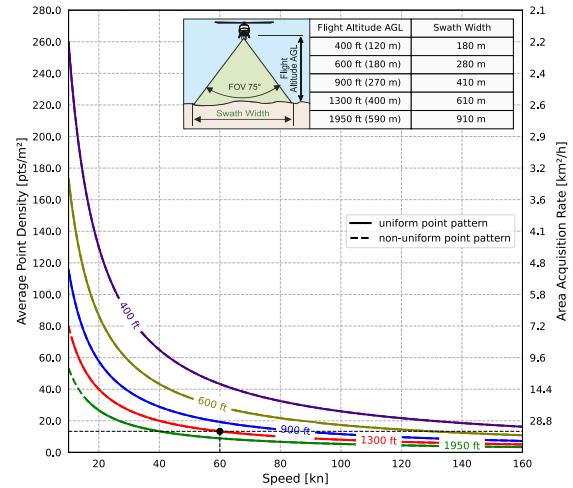
18) applies only with IMU/GNSS system

Maximum Measurement Range & Point Density *RIEGL VUX®-180*²⁴

Laser Pulse Repetition Rate = 300kHz

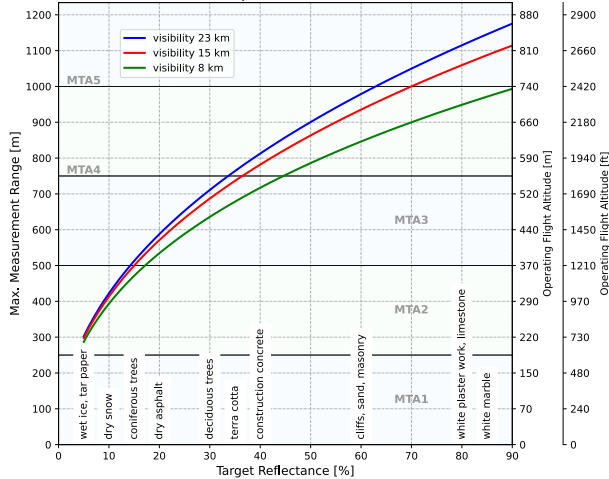


Operating Flight Altitude AGL given for the following conditions:
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,
average ambient brightness, target size \geq laser footprint, roll angle $\leq \pm 5$ deg

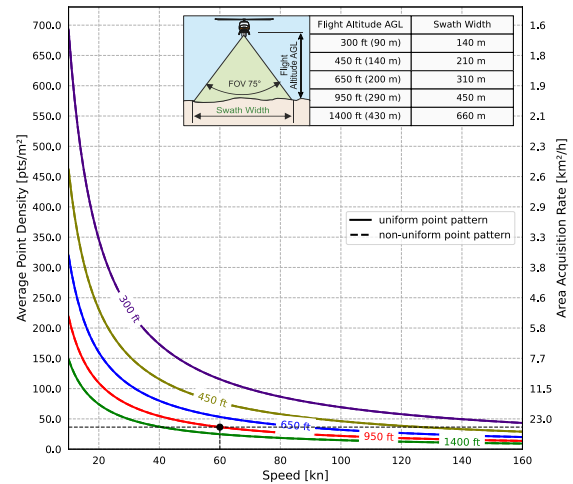


Example: VUX-180²⁴ at 300,000 pulses/sec, laser power level 100%
altitude 1,300 ft AGL, speed 60 kn, resulting point density ~ 13.3 pts/m²

Laser Pulse Repetition Rate = 600kHz

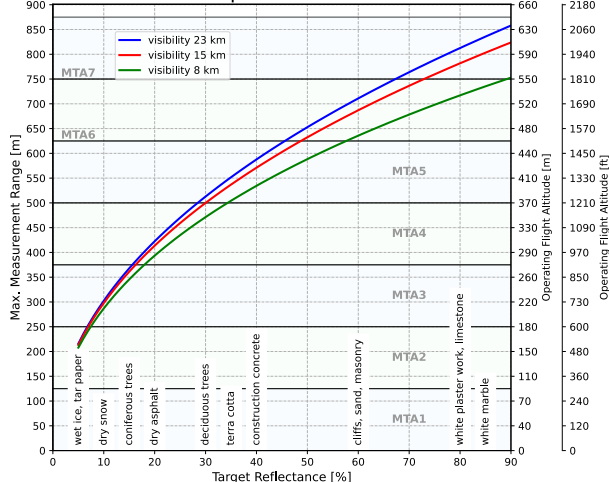


Operating Flight Altitude AGL given for the following conditions:
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,
average ambient brightness, target size \geq laser footprint, roll angle $\leq \pm 5$ deg

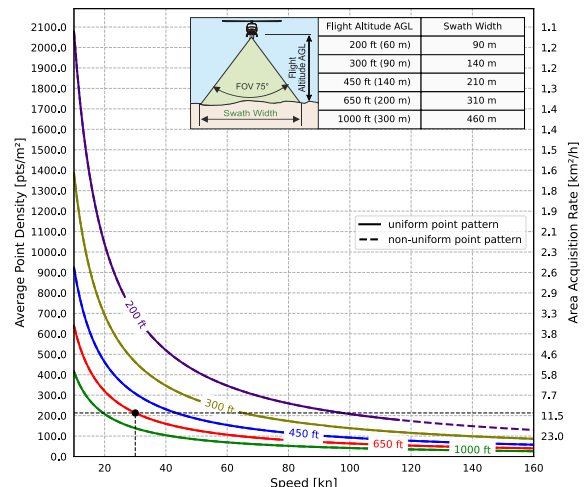


Example: VUX-180²⁴ at 600,000 pulses/sec, laser power level 100%
altitude 950 ft AGL, speed 60 kn, resulting point density ~ 36.5 pts/m²

Laser Pulse Repetition Rate = 1200kHz



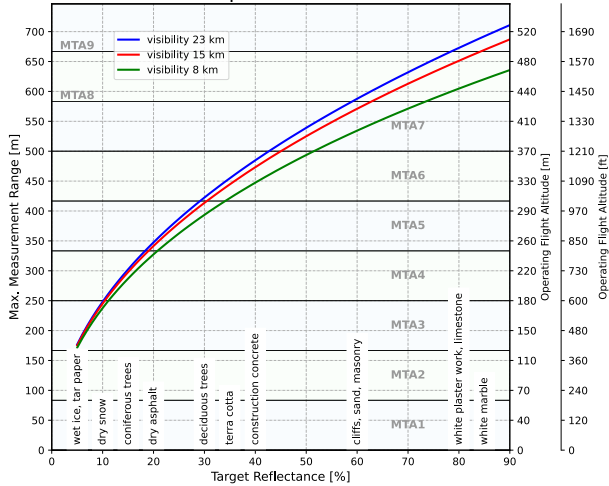
Operating Flight Altitude AGL given for the following conditions:
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,
average ambient brightness, target size \geq laser footprint, roll angle $\leq \pm 5$ deg



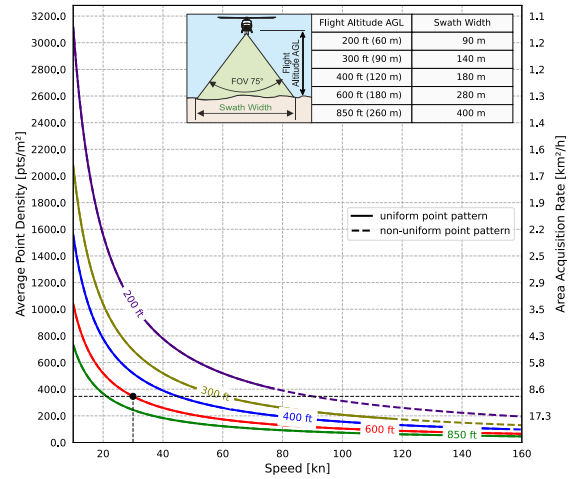
Example: VUX-180²⁴ at 1,200,000 pulses/sec, laser power level 100%
altitude 650 ft AGL, speed 30 kn, resulting point density ~ 213.1 pts/m²

Maximum Measurement Range & Point Density *RIEGL VUX®-180*²⁴

Laser Pulse Repetition Rate = 1800kHz

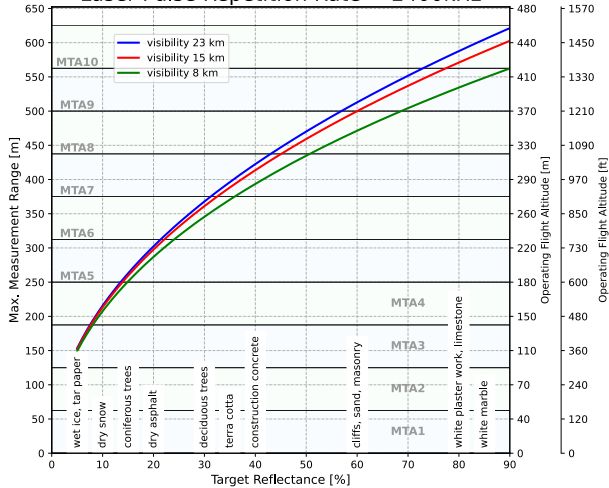


Operating Flight Altitude AGL given for the following conditions:
FOV 75°, ambiguity resolved by multiple-time-around (MTA) processing,
average ambient brightness, target size \geq laser footprint, roll angle $< \pm 5$ deg

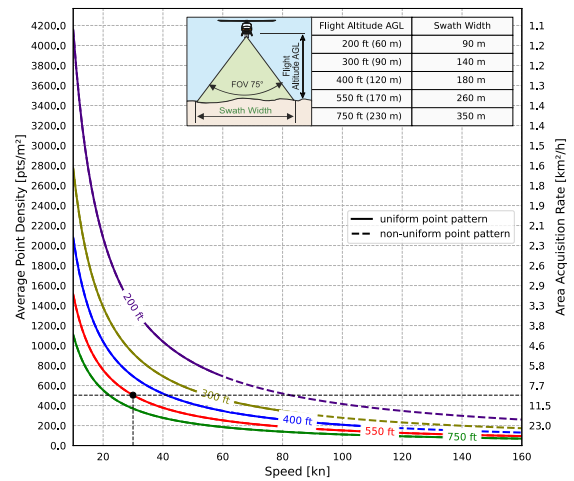


Example: VUX-180²⁴ at 1,800,000 pulses/sec, laser power level 100%
altitude 600 ft AGL, speed 30 kn, resulting point density ~ 346.3 pts/m²

Laser Pulse Repetition Rate = 2400kHz



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 $< \pm 5$ deg



Example: VUX-180²⁴ at 2,400,000 pulses/sec, laser power level 100%
altitude 550 ft AGL, speed 30 kn, resulting point density ~ 503.7 pts/m²

General Technical Data

Power Supply Input Voltage / Consumption ¹⁾

Main Dimensions (L x W x H)

Weight

Humidity

Protection Class

Max. Flight Altitude (operating & not operating)

Temperature Range

18 - 34 V DC / typ. 65 W

283 mm x 117 mm x 134 mm

2.7 kg (with connection box)

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)

Data Storage

Internal Data Storage

Memory Card Slot

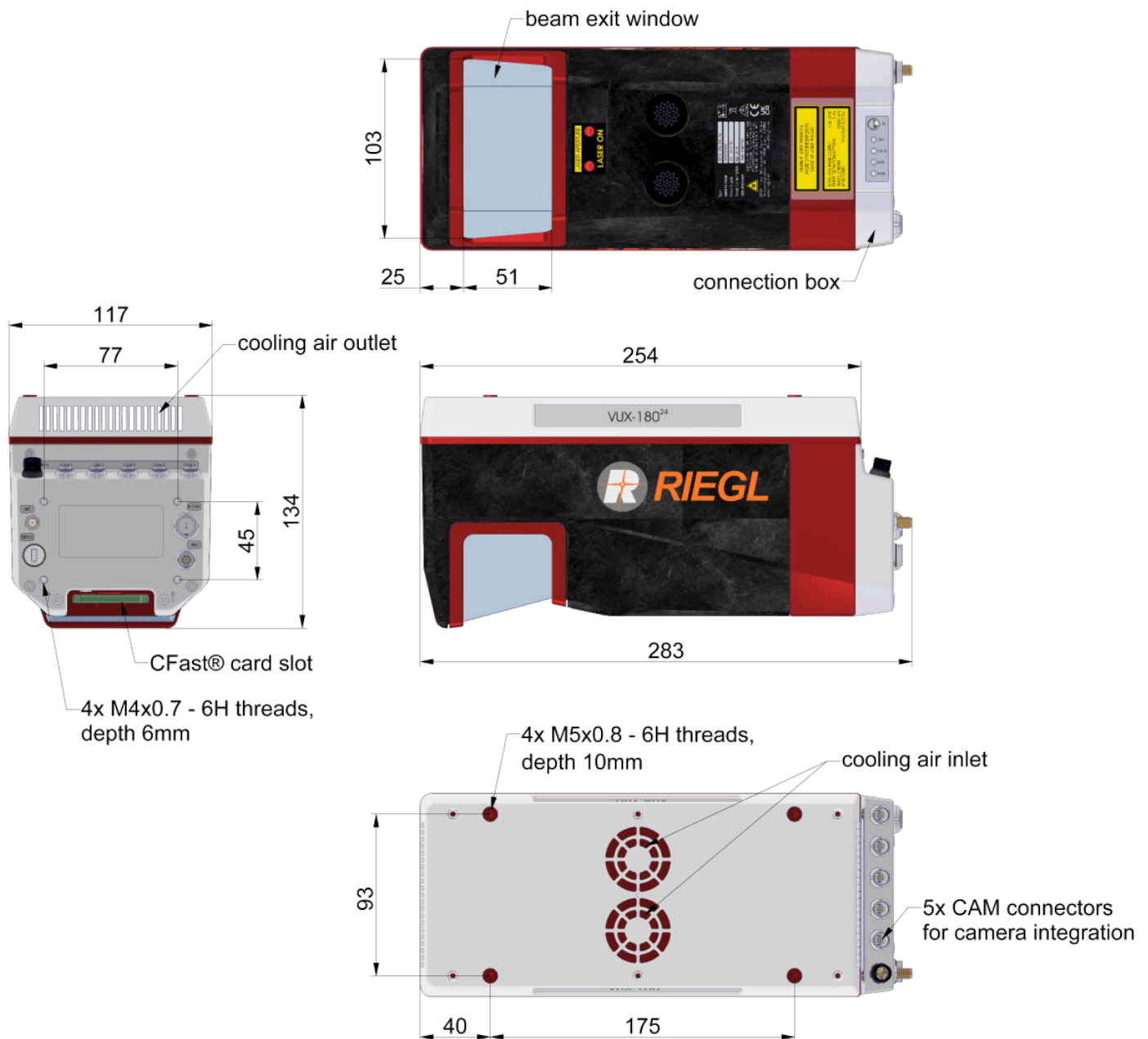
Solid State Disc SSD, 2 TByte

for CFAST® ²⁾ industrial memory card 1 TByte

1) Separate input power connector for external cameras.

2) CFAST® is a registered trademark of CompactFlash Association.

Dimensional Drawings VUX®-180²⁴



all dimensions in mm

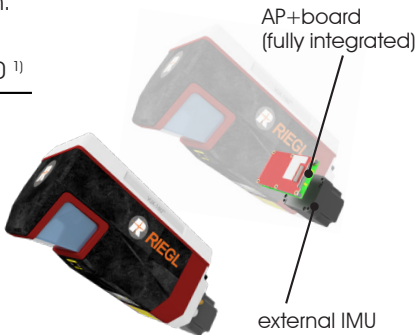
RIEGL VUX®-180²⁴ System Integration

The RIEGL VUX-180²⁴ can be optionally complemented with an appropriate IMU/GNSS system.

External IMU & GNSS (optional)

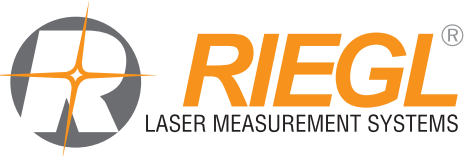
IMU Accuracy ²⁾
Roll, Pitch
Heading
IMU Sampling Rate
Position Accuracy (typ.)
System Total Weight (approx.) ³⁾

Applanix AP+30 ¹⁾	Applanix AP+50 ¹⁾
0.010°	0.005°
0.025°	0.010°
200 Hz	200 Hz
0.02 - 0.05 m	0.02 - 0.05 m
3.2 kg	3.2 kg



1) See technical details at the according Applanix datasheet
2) Accuracy specifications for post-processed data

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



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

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RIEGL China Ltd.
RIEGL Australia Pty Ltd.
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