

EYESAFE 1534-NM LASER RANGEFINDER

TURNKEY EYESAFE LRF



Voxtel's turnkey eyesafe laser rangefinder (LRF) is a new class of high-performance, non-ITAR restricted 1534-nm rangefinder designed for long range and high accuracy range measurements in an extremely compact, lightweight, and low-power system. The LRF includes a small-form-factor eyesafe diode-pumped solid-state (DPSS) laser, Voxtel's highly sensitive ROX™ InGaAs avalanche photodiode (APD) receiver, and custom amplification and pulse-processing circuits, which achieve industry's highest sensitivity. The combination of the state-of-the-art APD receiver, and the low-divergence diffraction-limited DPSS laser pulses achieve extremely long standoff range with sub-150-mm range precision using a small-sized package. The LRF can deliver optimized performance over a wide temperature range, and under a variety of conditions including: direct sunlight, cover, night operation, and low visibility—including fog, rain and snow.

Each LRF is calibrated at the factory to provide optimal performance over a -45 °C to 65 °C temperature range. To provide ideal operation in variable conditions, a serial command set is used with a USB interface. This allows fast and easy control and dynamic configuration of the LRF. The controller can be flexibly configured for: • time-variable-threshold (TVT) operation, to reduce false alarms due to nearfield scattering, • time-over-threshold (TOT), to reduce amplitude-dependent time-walk errors • auto-calibration, to enable a user-defined false-alarm rate (FAR) in changing background optical radiation levels • multi-pulse processing, to enhance range and resolution • passive operation, to measure the pulse-repetition frequency (PRF) of external lasers.

The LRF is powered using a lithium-ion polymer (LiPo) battery. More than 200 thousand range events are possible before battery recharging is necessary. The battery is charged using the micro-USB connector.

EAR 99: NOT ITAR CONTROLLED

FEATURES

- **Eyesafe:** Class 1, 1534-nm laser
- **Long Range:** 3 km (100 μJ)/5 km (300 μJ)
- **Fine Range Precision:** Better than 150-mm single-shot or 50-mm multi-pulse
- **Easy to operate:** Factory calibrated and automated to optimize range performance from -45 °C to 65 °C
- **Low Noise-Equivalent Input (NEI):** As little as 35 photons
- **Excellent beam quality:** $M^2 < 1.15 \times DL$, where DL is the diffraction limit
- **Programmable Operating Modes:**
 - Time-variable Threshold (TVT): Reduces false alarms due to nearfield scattering
 - Programmable Threshold: User-set or auto-calibrated to background flux
 - Enhanced Performance: Multi-pulse processing for extended range and increased precision
 - Range Walk Correction: Time-over-threshold (TOT) calibration reduces range errors due to pulse amplitude variation.
 - Passive PRF Decoding: Allows the frequency of other sensed lasers to be determined

ORDERING INFORMATION

- **FUKF-KGAC:** 100-μJ laser, 3-km range
- **FUMF-KGAC:** 300-μJ laser, 5-km range

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SPECIFICATIONS

Model	FUKF- KGAC	FUMF- KGAC
Voxtel laser model number	LAK0-EX0C	LAK0-FX0C
Voxtel APD photoreceiver model number	RUC1-K1AC	RUC1-K1AC
Laser Pulse energy	100 μ J	300 μ J
Measurement range ¹	3 km	5 km
Maximum measurement rate	10 Hz	10 Hz
Minimum range distance ²	10 meters	
Range precision (single-shot/multi-shot) ^{3,4}	150 mm / 50 mm	
Maximum number of targets	4	
Minimum target separation ²	5 meters	
Transmitter		
Eye safety / classification	Class 1 / 1M (EN 60825-1: 2007)	
Laser type	DPSS	
Operating wavelength	1534 nm	
Spectral line width (FWHM)	< 0.02 nm	
Wavelength shift with temperature	+0.014 nm/+°C	
Beam quality (M^2)	1.15 x DL	
Beam divergence, full angle ($1/e^2$)	< 0.95 mrad	< 0.70 mrad
Pulse duration (ns)	4 ns	7 ns
Receiver		
Receiver aperture area	20 mm x 18 mm	
Detector type	InGaAs APD	
APD responsivity ($M = 1$) ⁵	1.1 A/W	
APD gain (M)	1 – 20	
Excess noise [$F(M)$] ⁶	$k_{eff} < 0.18$	
Noise equivalent input (NEI)	35 photons	40 photons
Boresight Aiming Laser		
Operating wavelength	650 nm	
Power	5 mW	
Eye safety	Class IIIa	
Range (day/night)	30 meters/ 250 meters	
Electrical—Micro-USB Data Interface		
Pin 1	+5VDC CMOS	
Pin 2	Data - (3.3 V CMOS)	
Pin 3	Data + (3.3 V CMOS)	
Pin 4	Floating as a USB device (not connected; slaved to host)	
Pin 5	Signal Ground	
Power		
Power source	Rechargeable LiPO Battery	
During standby and ranging	80 mW	
Max power during battery recharge	1.7 W	2 W
Mechanical		
Weight	206.2 g	212.5 g
Operating Conditions		
Operating temperature	-45 °C to +65 °C	
Operating humidity	90%	
Storage temperature	-55 °C to +85 °C	
Water resistance (rating)	IP64	
Lifetime (MTTF)	>50 million shots	

¹ 2.3 x 2.3-m² target; single-shot, 30% reflectivity

² Less than 10X NEI

³ When calibrated with TOT

⁴ Pulse returns 10X the NEI and greater

⁵ 1534-nm spectral response

⁶ Parameterization of McIntyre equation: $F(M) = k_{eff} M + (1 - k_{eff})(2 - 1/M)$

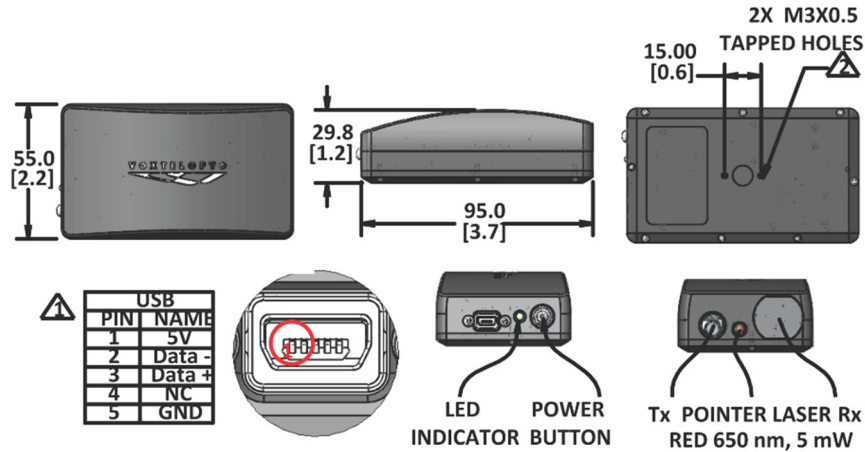


CAUTION

Class 1 Invisible Laser
Radiation Present

Avoid long-term viewing of laser.

DIMENSIONS



SOFTWARE

The LRF can be easily programmed using the simple serial communications command set over USB interface. User-programmable features include:

Sample of Available Software Controlled Operating Configurations
Automatic threshold setting for user-input FAR level
Time-variable threshold (TVT) to reduce nearfield false alarms
Multipulse processing for extended range and improved resolution
Passive pulse-detection mode for external laser pulse repetition frequency measurements
Time-over-threshold (TOT) range-walk correction

The latest device drivers and firmware can be downloaded at voxtel-inc.com.

To configure and operate the LRF, serial commands can be sent from a host processor. The available commands can be found in the Voxel document *LRF Software ICD: Modules, Kits, and Components*.

To configure and operate the LRF using a terminal emulator of a graphical user interface, see the *Quick Start* section of the Voxel document *LRF User Manual: Modules, Kits, and Components*.

LITHIUM-ION POLYMER (LIPO) BATTERY

The LRF incorporates a 3.7VDC, 750 mAh LiPo battery. The LiPo battery recharging function is controlled by the microprocessor in the LRF. The LRF incorporates an automatic power-down function, which turns the unit off if the LiPo battery voltage level drops below 2.9V. This feature protects the battery and electronics from damage. A bi-color LED mounted next to the micro-USB socket indicates the charging status and voltage level of the battery.

Battery charging and operation states are automatically controlled by the LRF, depending on: user-selected mode, LiPo battery power level, and availability of recharging power through the micro-USB socket.

Battery Charging and Status

LED	LiPo Battery Status	LRF State	Pin 1
Off	NA	Off	0V
Flashing Red	Low Battery (< 2.9V)	Auto Off	0V
Flashing Green	Charging (< 3.3V)	On	5V
Steady Green	> 3.3V	On	0V
Steady Green	Fully Charged (> 3.3V)	On	5V
2-Hz Green	Charging	Off	5V
Double-pulse Green	Full Charge	Off	5V