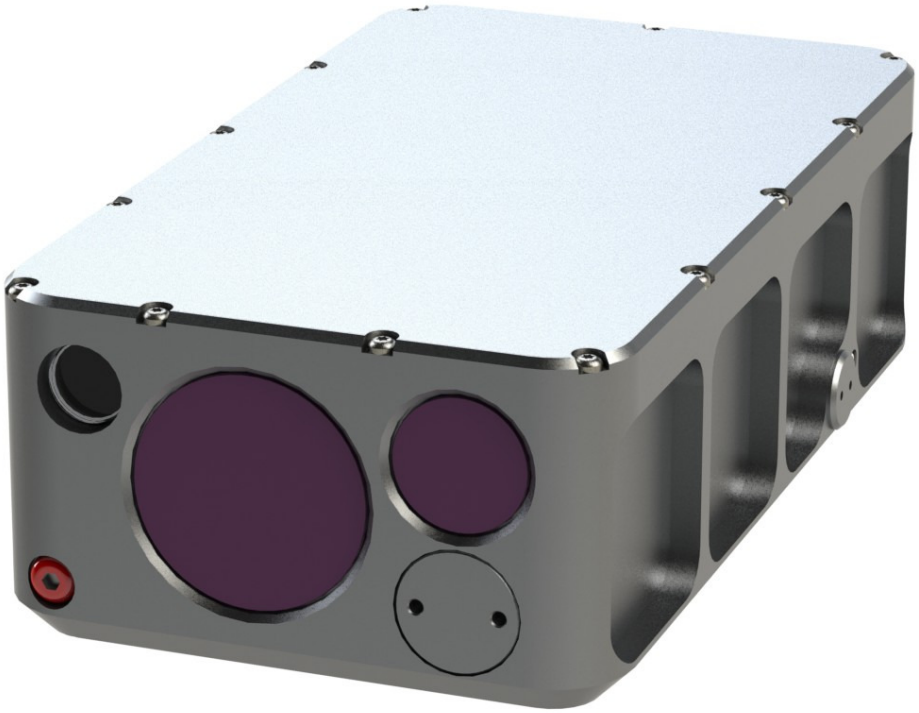
RangePRO Model P-102 Laser Rangefinder Module



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$$P_R = \frac{P_L \times \chi^2 \times \delta \times D_L^2 \times A_I \times \cos\beta}{4 \times R^2 \times A_L}$$

1 DESCRIPTION

The RangePRO Model P-102 is a compact OEM laser rangefinder module providing an advanced digital rangefinding capability for military, paramilitary and commercial applications. All assemblies are integrated onto a precision bore-sighted platform.

It integrates with host systems such as weapon, sensing, or surveillance and tracking stations, and thermal imaging cameras. It requires power and control command input, and provides range-to-target and self-diagnostic data output.

The P-102 ranges at low to medium repetition rates over distances to 30km depending on target size, target reflectivity, atmospheric conditions and customer supplied external optics (typically up to 9km for a vehicle type target).

The diode pumped laser module is a state-of-the-art integrated design, utilising diffusion bonding techniques, resulting in high laser performance from a compact module. The laser transmitter is a collimated eye-safe laser system, providing ranging rates from single shot up to 6Hz.

The receiver module design ensures a compact, highly effective receiver system which incorporates an APD detector for maximum sensitivity.

For system integration convenience, the P-102 is equipped with a bore-sighting video camera using an ultra-high dynamic range sensor which supports correct viewing of targets against all types of backgrounds, while still being identifiable. The signal is output to the operator via the unit's interface connector using video overlay to show a dedicated graticule identifying the LRF aim point as well as target distance and other system and target metrics.

An integrated electrical protection/filter module ensures stand-alone MIL-STD compliance for power as well as signals.

The unit enclosure is fully environmentally sealed and purged and utilises select materials and specialised surface treatments to prevent corrosion.

Advanced digital signal processing techniques are employed to provide accurate, reliable ranging. Signals from the detector are digitally sampled. The samples are examined to determine all potential real target returns. If a valid target is detected within the user-set range gate it's range data is output, if more than one target is detected within the range gate the nearest or farthest may be selected for data output.

All signal and range computation is done "on the fly". Using this philosophy, the only task remaining after the sampling has expired is to transfer the range data through the serial port. Effectively the speed of the signal processing is limited only by the data output rate.

The system employs an adaptive range threshold to compensate for changing noise levels. The worst case for noise is when the system electronics are being operated at the high end of their temperature specification and when ranging is being performed in strong sunlight. The best case is the reverse situation. The adaptive range threshold feature results in more reliable ranging (fewer false alarms) when noise is elevated and higher sensitivity (further ranging) when noise is reduced, thus maximising the system capability under varying conditions. The threshold is calculated on a "shot-by-shot" basis.

RangePRO laser rangefinder software is easily upgradeable, upgrades can be installed in the field via a PC.

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2 SYSTEM SPECIFICATIONS

Notation - use of brackets in tables: [*notes & qualifications*] (*units*).

2.1 System Performance

PARAMETER		SPECIFICATION
Control		
Control Functions		all control functions and range data via comms port
Ranging		
Laser Type		Nd:YAG/OPO
Wavelength (nm)		1,570 ± 5
Output Energy [per pulse] (mJ)		nominally 7 [up to max. allowable for Class 1M]
Beam Divergence [full angle; typical] (mrad)		1
Receiver Aperture (mm)		31
Detector [main]		APD with time variant gain
Range Read-out Limits (m) [factory selectable]	**minimum**	50
	maximum	30,000
Ranging Performance [1] [Std. Clear [2]; max.] (m)	**man [0.45x1.8m]**	5,500
	vehicle [2.3x2.3m]	9,000
	building [large]	20,000
Extinction Ratio [std test: 500m lambertian target, 85% reflectivity, P_d > 90%] (dB)		>43
Range Resolution (m)		1
Range Accuracy [typical] (m)		± 1
Target Dis-crimination (m)	**Lateral [1m^2 targets @ 5,000m]**	≤ 10
	Axial [between 500 & 5,000m]	≤ 20
Ranging Rate (Hz)	**typical**	1
	max.	6 [3]

[1] Target albedo 0.3 @ 1,570nm.
[2] Standard Clear atmosphere; Extinction Coefficient 0.038 km^{-1} @ 1,570nm (Beta Spec), sea level visibility = 23.5km.
[3] Duty cycles may be required at elevated temperatures, TBD.

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PARAMETER	SPECIFICATION
Boresight Camera	
Video Format	NTSC [4] CVBS [standard definition]
Field of View (°)	6.4 (H) x 4.8 (V)
Instantaneous Field of View (µrad)	176
Aim Point Accuracy (µrad)	340
Usable Scene Illumination Level for Target Recognition	[TBD; operation under low light may be monochrome]
Safety & Protection	
Laser Classification [5]	Class 1M
Visible Emission Filter	blocking
Visible Emission [@ ≥ 5m]	nil
Audible Emission [@ ≥ 5m]	nil
Support	
MTBF [ground mobile] (shots)	> 20×10^6
Operational Life (years)	10

2.2 Communications

PARAMETER	SPECIFICATION
Port(s)	one serial port [shared with power input]
Type	RS-422
Data Rate	19,200 [6]

2.3 Physical Characteristics

PARAMETER		SPECIFICATION
Mass [approx.] (g)		975
Dimensions (mm)	**Length**	162
	Width	92.5
	Height	53
Mounting		3-point mount [M4 heli-coil inserts]; 4mm guide pins [7, 8]
Thermal Interface [9]		[see outline dwg]

[4] PAL video format can be supported at request.
[5] Australian/New Zealand Standard AS/NZS IEC 60825.1:2011 *Safety of Laser Products - Equipment classification and requirements.*
[6] Other data rates can be supported at request.
[7] Some kinematic isolation is recommended to be provided by the installer.
[8] Mounting holes and mechanical interface surfaces are electrically conductive.
[9] For continuous operation, heat transfer must be provided between the dedicated heat transfer interface pad of the unit to the mounting surface, by the installer.

2.4 Electrical Requirements

PARAMETER			SPECIFICATION
Supply Voltage [10] [external] (Vdc)			10 to 33
Current Drain [@ 12 Vdc] (A)	**standby mode**		< 0.1
	firing	**at 1Hz**	< 0.5
		at 5Hz	< 2
	low power mode		< 0.03

2.5 Environmental

PARAMETER			SPECIFICATION
Temperature (°C)	**Operate [11]**	**min. [12]**	-32
		max. [13]	+55
	Survive	**min. [12]**	-40
		max. [13]	+70
Vibration and Shock [14]			MIL-STD-810G
EMI/EMC [14]			MIL-STD-461E
Altitude [operational] (ft)			25,000

2.6 Connector/Pin Details

PARAMETER		SPECIFICATION
Power & Comms Connection: micro-D Connector, Panel, Plug, 9 Way [15]		
Pins	**1**	RS-422 Rx+ (LRF input)
	2	RS-422 Rx- (LRF input)
	3	CVBS (Video) GND
	4	RS-422 Tx+ (LRF output)
	5	RS-422 Tx- (LRF output)
	6	CVBS (Video) Signal
	7	V in (+) (DC power)
	8	V in (-) (GND / 0V)
	9	[not used] [16]

[10] Electrical protection/filter compliant with MIL-STD-704F and -1275D. Refer to manufacturer for details.
[11] Duty cycles may be required at elevated temperatures, TBD.
[12] Without wind chill effect.
[13] Without solar radiation effect.
[14] Refer to manufacturer for details.
[15] Other connector options available at request.
[16] Optional signal provided on customer request. Refer to manufacturer for details.

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3 OUTLINE DRAWING

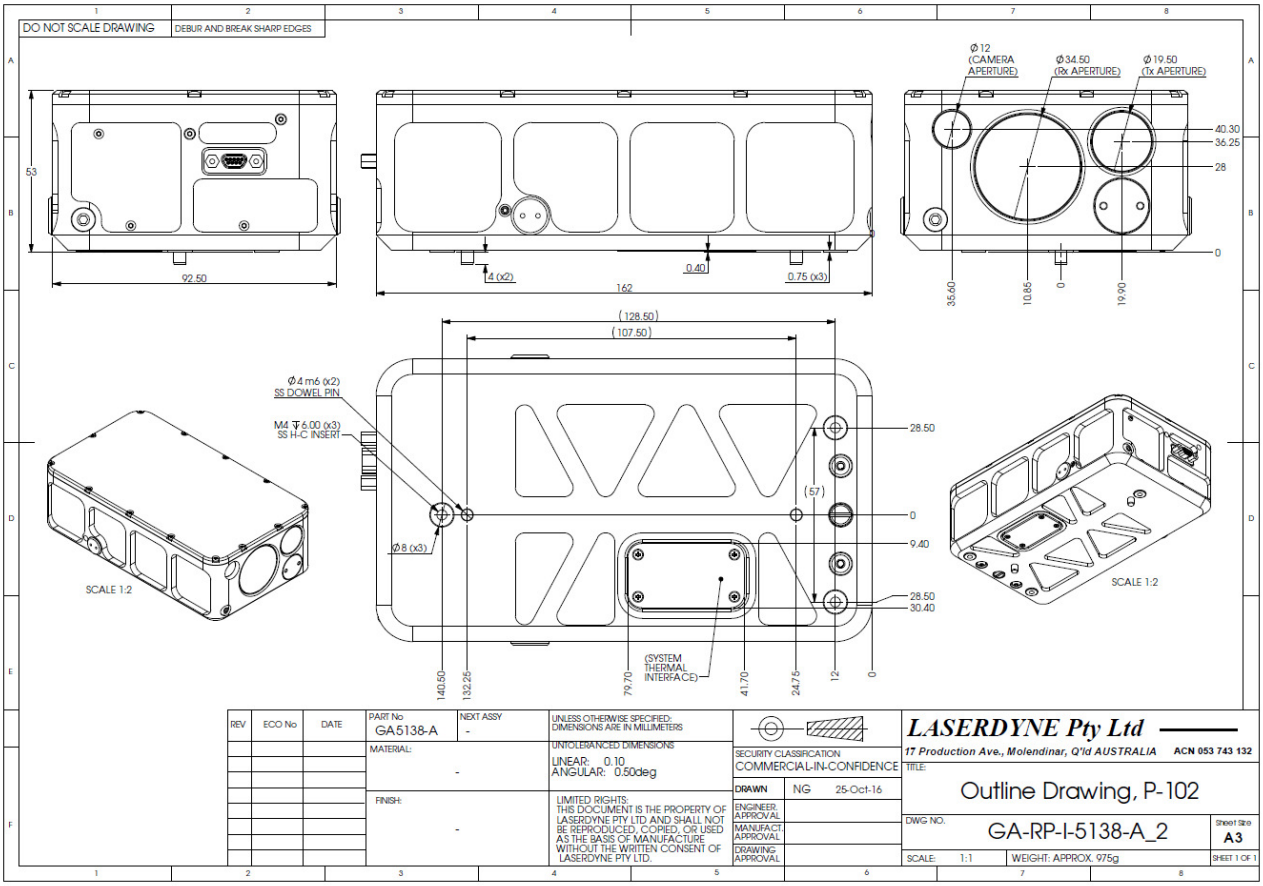

Figure 3-1: Outline Drawing

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