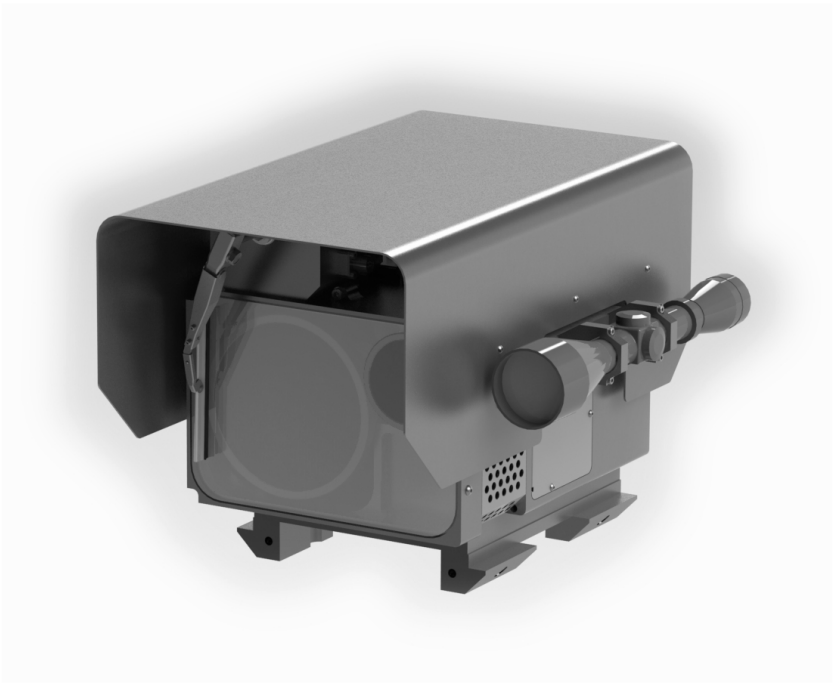
RangePRO Model L-NAV30K Laser Rangefinder Module



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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 L-NAV30K laser rangefinder system provides an advanced digital rangefinding capability for military, and specifically for naval, applications.

It is designed to operate as an integral part of a larger system such as weapons fire control, thermal sensing or surveillance and tracking stations. It requires power and control command input, and provides range-to-target and self-diagnostic data output.

The RangePRO L-NAV30k maritime laser rangefinder is a long-range system designed specifically for fixed installation and maritime applications. It can range out to 25km from a large target in standard clear conditions.

The housings are machined from solid aluminium alloy which are then surface treated and epoxy painted to protect against the marine environment and corrosion. The circuit cards are protected with a Mil spec conformal coating, and the system is fully sealed and backfilled with dry air. Attention has been paid to all materials in the construction to maximize reliability and stability.

The system is fitted with an alignment telescope and a red (635nm) pointer laser beam to facility alignment and pointing.

The main feature of the system is the transmitter, a collimated diode pumped laser system with an output at the eye-safe wavelength of 1570nm. The maximum pulse rate is 30Hz which allows rapid ranging from a moving target for tracking applications. The laser exhibits very high reliability and a long life of more than 100 million shots which gives a high Mean Time To Failure (MTTF). The laser output satisfies the requirements of Class 1M of the standard IEC825.

The receiver has a large aperture for high sensitivity to the return signal and the detector is an InGaAs photodiode.

The system employs advanced digital signal processing technology to provide accurate, reliable ranging with true multiple-target detection capability. All the return signals from the time of firing are digitised and all multiple returns are detected and stored. These signals are interrogated for determination of real target returns, which are then further processed to determine ranges.

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.

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The system employs an adaptive range threshold to compensate for changing noise levels. 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.

The signal processing algorithm has been optimised for accurate targeting in poor atmospheric conditions such as smoke, haze, and moisture. Range gating is easily performed through software.

Control of the rangefinder and data transfer is performed via an RS-422 interface.

Diagnostic testing software (Built In Test) checks such parameters and operational status of the power supplies, PLD boot, microprocessor boot, internal temperature, and humidity.

A visible laser incorporated into the system, and a co-mounted sighting telescope, simplify boresighting and alignment checking.

The system operates from low voltage dc (28V) input.

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

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2 SYSTEM SPECIFICATIONS

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

2.1 System Performance

PARAMETER		SPECIFICATION
Control		
Control Functions		all control functions and range data via Serial port: laser controls are fire, repetition rate
Ranging		
Laser Type		Diode Pumped Nd:YAG/OPO
Wavelength (nm)		1,570
Output Energy (mJ)		nominally 8 [up to max. allowable for Class 1M]
Beam Diameter [at exit] (mm)		40
Beam Divergence [full angle; typical] (µrad)		800 [2mrad option]
Receiver Aperture (mm)		115
Detector		InGaAs with time variant gain
Range Read-out Limits (m)	**minimum**	200
	maximum	30,000
Ranging Performance [Standard Clear Atmosphere [1]] (m)	**vehicle/small craft [2.3x2.3m] [2]**	12,000
	building/large craft [20x20m] [3]	25,000
Range Accuracy (m)		± 2.5 [1m rms]
Target Discrimination (m)	**Lateral [1m² targets at 5,000m]**	≤ 20
	Axial [between 100 & 5,000m]	≤ 100
Ranging Rate (Hz)	**max.**	30 [for 1min, 1min off]
	typical	15 [continuous for 10min, 3min off]

[1] Extinction coefficient = 0.0448km^{-1} (Modtran) @ 1,570nm; sea level visibility = 23.5km.
[2] Target albedo = 0.10 @ 1,570nm.
[3] Target albedo = 0.85 @ 1,570nm.

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

PARAMETER		SPECIFICATION
Safety & Protection		
Laser Safety Classification [4]	**laser pointer**	Class 1
	rangefinder transmitter	Class 1M
Visible Emission Filter		blocking
Visible Emission [@ ≥ 10m]		nil
Audible Emission [@ ≥ 10m]		nil
Support		
MTBF	**hours**	19,000 in standby (25degC)
(MIL-HDBK-217FN1)	**laser shots**	> $5x10^6$; laser diode pump lifetime > 10^9 (25degC)
Operational Life (years)		10
Reliability % (100hrs)		99.3
Sighting Scope		
Brand/Model [5]		Leupold VX-II
Magnification [6]		4X to 12X [zoom]
Objective Diameter (mm) [6]		50
Alignment to Boresight (microrads)		<200
Laser Pointer		
Wavelength (nm)		635 (red)
Power Output (mW)		< 0.5
Beam Divergence (mrads)		1.5 (typical)
Alignment to Boresight (microrads)		< 200
Activation		via RS-422 Comms

[4] Australian/New Zealand Standard AS/NZS 2211.1:1997 *Laser Safety Part 1: Equipment classification, requirements and user's guide.*
[5] Or customer selection.

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2.2 Communications

PARAMETER	SPECIFICATION
Port(s)	One Serial port [shared with power input]
Type	RS-422 bidirectional
Data Format	8 bit; no parity
Data Rate (Baud)	19,200 [others on request]
Data Sent	Range [diagnostics optional]

2.3 Physical Characteristics

PARAMETER		SPECIFICATION
Mass [approx.] (kg) [6]		< 18 (inc sunshield, telescope, and wiper assembly)
Dimensions [approx.] (mm) [7]	**Length**	420
	Width	316.85
	Height	284.92

2.4 Electrical Requirements

PARAMETER		SPECIFICATION
External Supply	**DC Voltage (Vdc) via connector on rear of Rangefinder system**	20 to 32 [28 nominal]
Current Drain [@ 28Vdc] (A)	**typical**	2.5 at max rep rate
	Peak max	6.0 with heater and wiper

[6] Including optional telescope and wiper
[7] Including connectors, mounting feet, optional telescope, sunshield

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2.5 Environmental

PARAMETER			SPECIFICATION
Temperature (°C)	**Operate** [8]	**min.** [9]	-32
		max. [10]	+55
	Survive	**min.** [9]	-40
		max. [10]	+71
Vibration and Shock			MIL-STD-810F, Cat 20, (Ground Mobile-Wheeled Vehicles) 5-500Hz 1hr each axis MIL-STD-810F, Cat 21, (Marine Vehicles) 1-100Hz 2hrs each orthogonal axis; Resonance Search; and Endurance at 33Hz
Sealing [11]			immersion proof
EMI/EMC [11, 12]			MIL-STD-461D

2.6 Connector/Pin Details

PARAMETER		SPECIFICATION
Connector A (J1): dc Power Input: Connector, MilSpec, Plug, Jam Nut, 10Way, 38999/24KC98PB		
Purpose		dc power input
Pins	**A**	N/C
	B	N/C
	C	N/C
	D	Protective Ground
	E	Shield
	F	Power On/Off + (28VDC+ 150W)
	G	Power On/Off - (28VDC- 150W)
	H	Shield
	J	Presence Loop In
	K	Presence Loop Out

[8] Degraded performance for operational temperature range < -25°C and > + 50°C.
[9] Without wind-chill.
[10] Without solar radiation.
[11] With compliant line connectors attached.
[12] Refer to manufacturer for details.

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PARAMETER		SPECIFICATION
Connector B (J2): Comms Port Connection: Connector, MilSpec, Plug, Jam Nut, 13Way, 38999/24KB35PN		
Purpose		data transfer and control signals
Pins	**1**	LRF RS-422 Rx+
	2	LRF RS-422 Rx-
	3	Shield
	4	LRF RS-422 Tx+
	5	LRF RS-422 Tx-
	6	Shield
	7	LRF RS-422 Ground
	8	Synchr. +
	9	Synchr. -
	10	Shield
	11	Presence Loop In
	12	Presence Loop Out
	13	Shield
Connector C: Utility Connection: Connector, MilSpec, Socket, Jam Nut, 6Way, 38999/24KA35SN		
Purpose		utility signals
Pins	**1**	do not connect [factory use only]
	2	do not connect [factory use only]
	3	do not connect [factory use only]
	4	do not connect [factory use only]
	5	do not connect [factory use only]
	6	do not connect [factory use only]
Connector D: Earth Point Connection: M4 tapped hole		
Connector E: Wiper Interface Connection: Connector, MilSpec, Panel, Plug, Bayonet, 4Way, MS3112E8-4S		
Purpose		controls for wiper
Pins	**A**	HOME
	B	RUN
	C	NO CONNECT
	D	+28Vdc IN

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3 SET-UP

3.1 Mounts

The RangePRO rangefinder is designed to mount in a customer-supplied V-block type mount. The mating part of the L-NAV30K is shown in the following figure.

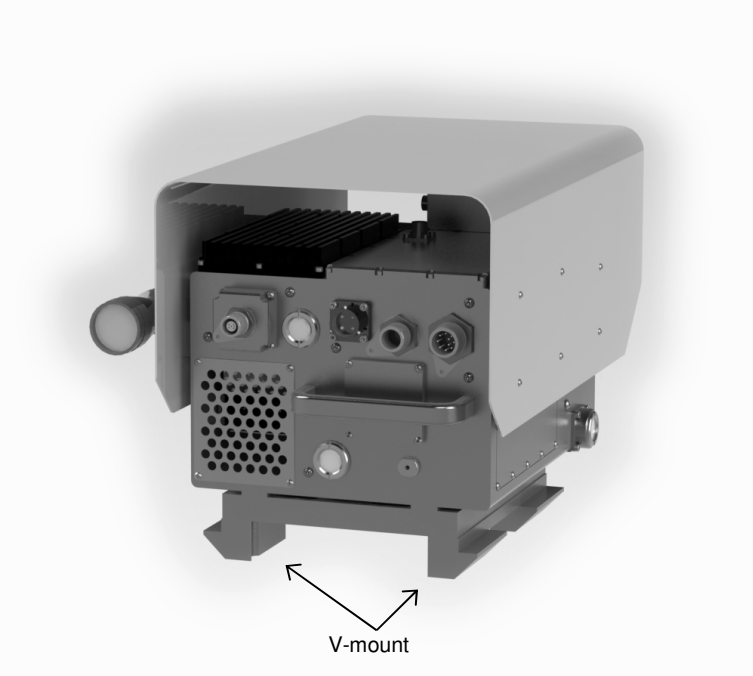

Figure 3-1: Mounts

3.2 Connections

CAUTION: do not connect or disconnect when external power is applied;
user-supplied connections must be correctly wired (see Connector/Pin Details).

The RangePRO has five connection points:
- located on the rear of the unit;
  - Connector A (J1), the dc Power Input connector,
  - Connector B (J2), the Comms Port connector,
  - Connector C, the Utility Connector.
  - Connector D, the Earth Point;
- located on the top of the unit (under the sun-shield);
  - Connector E, the Wiper Interface Connector.

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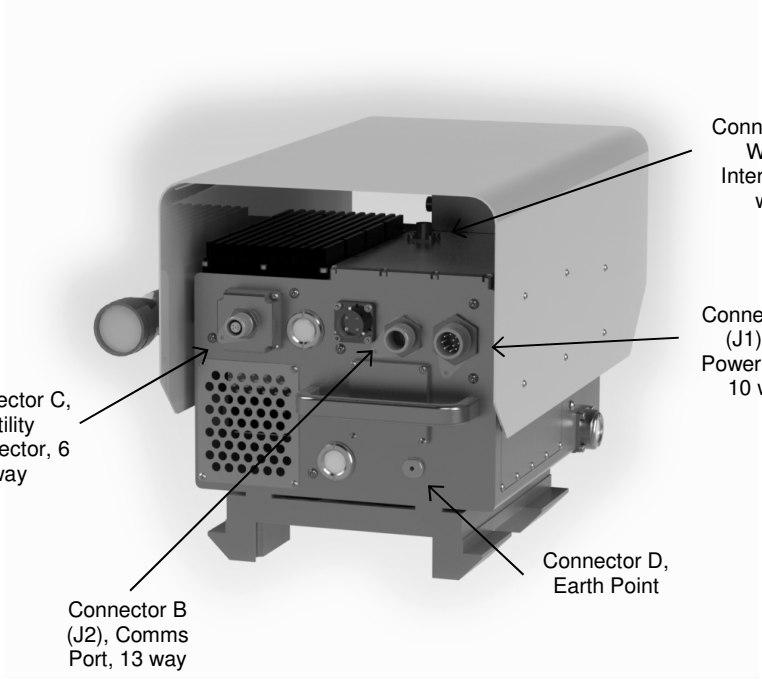

Figure 3-2: Connections

4 OUTLINE DRAWINGS

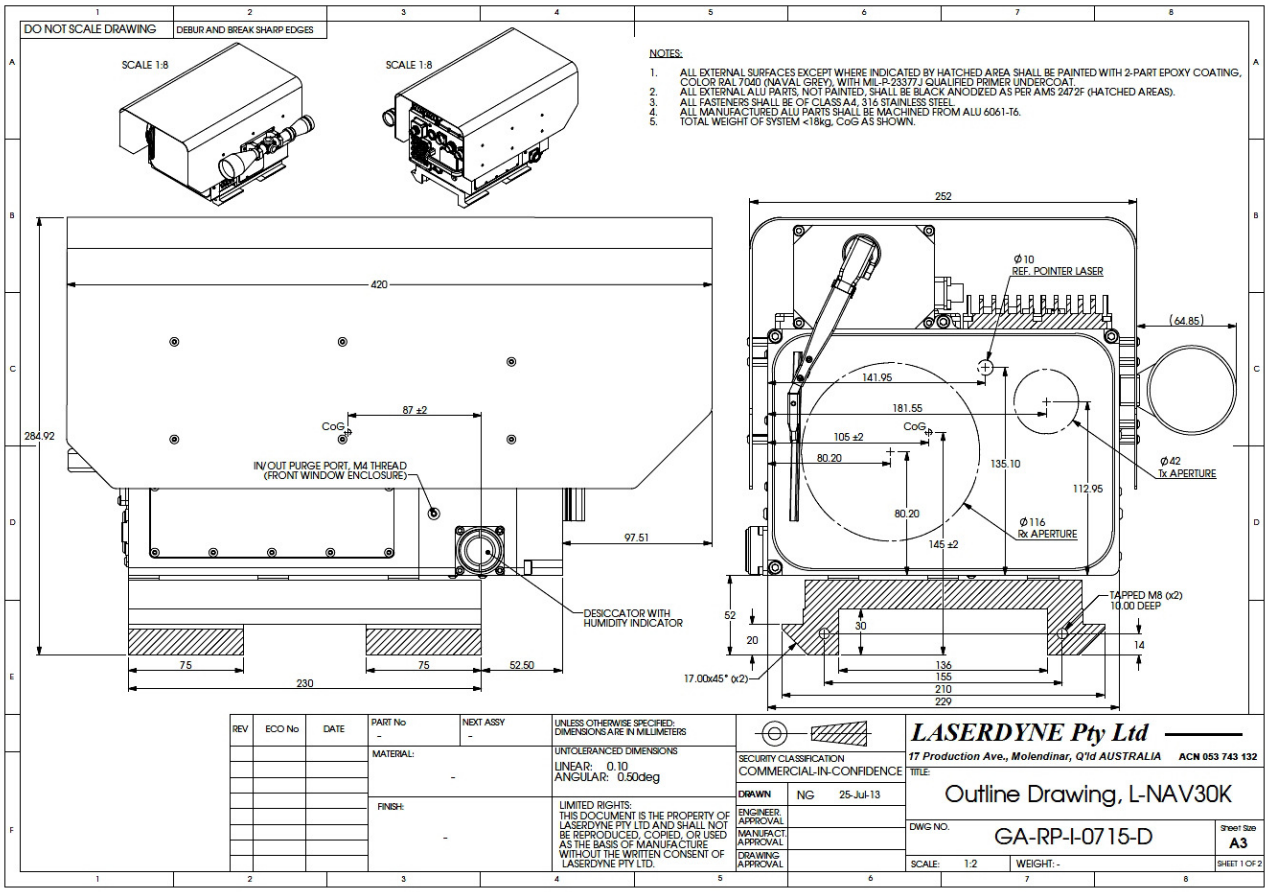

Figure 4-1: Outline Drawing Left & Front Views

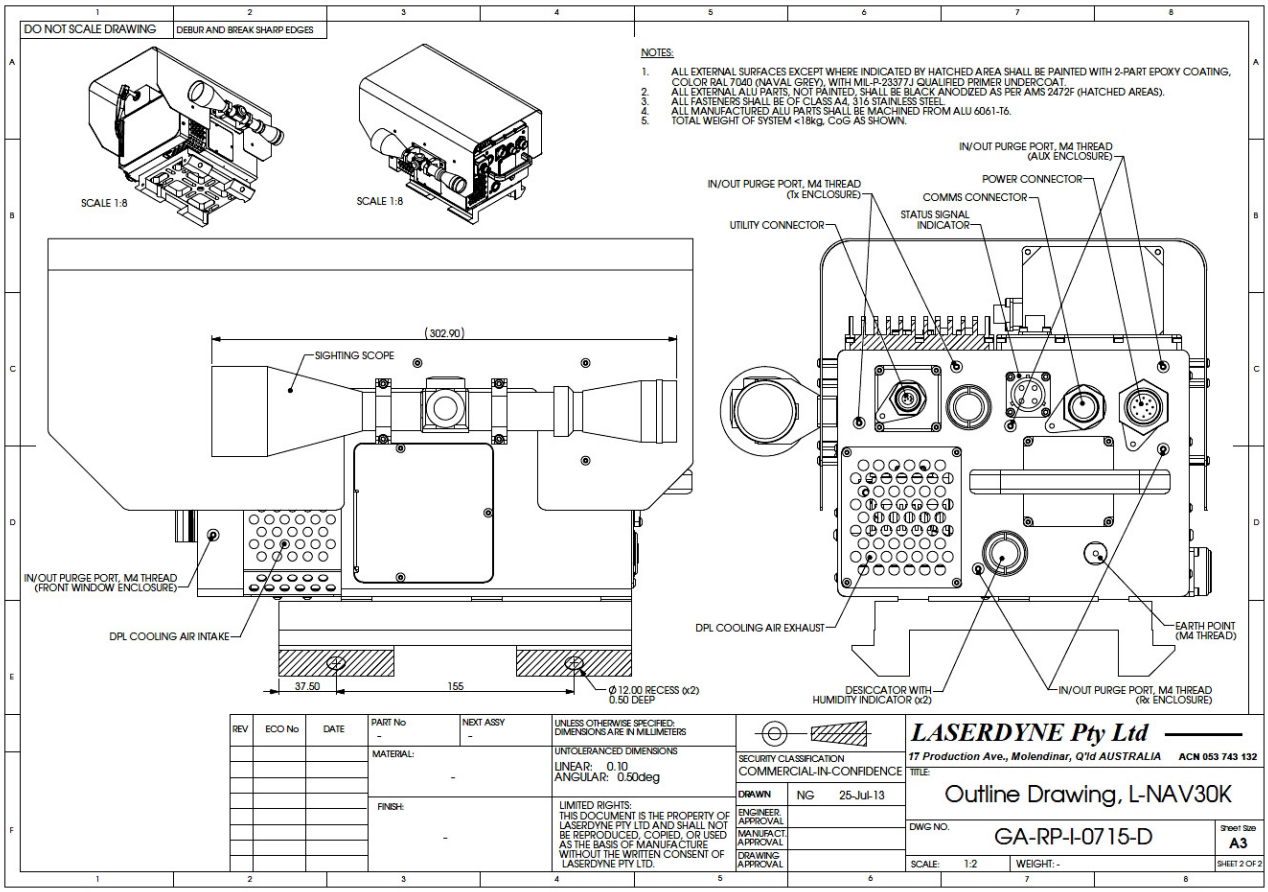

Figure 4-2: Outline Drawing Right, Rear & 3D Views

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