

RangePRO Model L-GM20 Laser Rangefinder Module



TABLE OF CONTENTS

Chapter	Page
1 DESCRIPTION	1-1
2 SPECIFICATIONS	2-1
2.1 System Performance	2-1
2.2 Communications	2-3
2.3 Physical Characteristics	2-3
2.4 Electrical Requirements	2-3
2.5 Environmental	2-4
2.6 Connector/Pin Details	2-4
3 SET-UP	3-1
3.1 Mounts	3-1
3.2 Connections	3-1
4 OUTLINE DRAWINGS	4-1
LIST OF FIGURES	
Figure 3-1: Mounts & Connections	3-1
Figure 4-1: Outline Drawing Left & Front Views	4-1
Figure 4-2: Outline Drawing Right & Rear Views	4-2

$$P_R = \frac{L^2 \times \delta \times D^2 \times A_1 \times \cos\beta}{4 \times R^2 \times A_L}$$

RangePRO Model L-GM20 Laser Rangefinder Module

1 DESCRIPTION

The RangePRO Model L-GM20 laser rangefinder system provides an advanced digital ranging capability for military 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-GM20 laser rangefinder is a long range system designed for ground mobile or fixed installation applications, and for integration into other systems. 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 to protect against 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. A reference camera can be fitted as an option, replacing the laser pointer module.


The optional reference camera is a small colour video camera and lens assembly with an overlaid and adjustable reticule and is designed specifically for pointing alignment of laser rangefinders.

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 typical pulse rate is 10Hz but it can be operated to 20Hz with a lower duty cycle, 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 output beam energy is limited to less than 8mJ which satisfies the stringent safety Class 1M of the standard IEC825 and has a Nominal Ocular Hazard Distance (NOHD) of less than zero. An NOHD less than zero means that the eye will not suffer permanent damage even if the laser pulse strikes the eye at zero range.

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.


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

Product Specification

RangePRO Model L-GM20 Laser Rangefinder Module

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 or optional reference camera, 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.

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

RangePRO Model L-GM20 Laser Rangefinder Module

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
Receiver Aperture (mm)		110
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]	25,000
Range Accuracy [typical] (m)		± 2.5 [1m rms]
Target Discrimination (m)	Lateral [1m² targets at 5,000m]	≤ 20
	Axial [between 100 & 5,000m]	≤ 50
Ranging Rate (Hz)	max.	20 [for 1min, 1min off] ⁵
	typical	10 [continuous for 10mins; 3 min off]

¹ Extinction coefficient = 0.0448km⁻¹ (Modtran) @ 1,570nm; sea level visibility = 23.5km.

² Target albedo = 0.30 @ 1,570nm.

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

RangePRO Model L-GM20 Laser Rangefinder Module

PARAMETER		SPECIFICATION
Safety & Protection		
Laser Safety Classification ³	laser pointer	Class 1
	rangefinder transmitter	Class 1M
Nominal Hazard Distances for:	eye [NOHD]	< 0
[rangefinder transmitter] (m) ^{3,4}	skin [NSHD]	< 0
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 ⁵		3X to 9X [zoom]
Objective Diameter (mm) ⁵		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
[Option to Laser Pointer] Reference Camera		
Aperture (mm)		16
Video Out		Composite Video, NTSC
FOV (°)		6.6 x 4.9
Focus		Infinity
MTF		0.2 @ 70 lp/mm
Reticule		Crosshairs
Positioning Resolution (µrad)	by pixel	150
	by line-pairs	300

³ Australian/New Zealand Standard AS/NZS IEC 60825.1:2011 Safety of Laser Products - Equipment classification and requirements.

⁴ When set < 8mJ for Class 1 operation. For unaided viewing.

⁵ Or customer selection.

RangePRO Model L-GM20 Laser Rangefinder Module

2.2 Communications

PARAMETER	SPECIFICATION
Port(s)	One Serial port
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)	9.8
Dimensions [approx.] (mm) ⁶	Length
	Width
	Height

2.4 Electrical Requirements

PARAMETER	SPECIFICATION
External Supply DC Voltage (Vdc) via connector on rear of Rangefinder system	12 to 32 [28 nominal]
Current Drain [@ 28Vdc] (A)	typical
	peak max

⁶ Including connectors, mounting feet, optional telescope

$$P_R = \frac{P_L \times \chi^2 \times \delta \times D_L^2 \times A_1 \times \cos\beta}{4 \times R^2 \times A_L}$$

RangePRO Model L-GM20 Laser Rangefinder Module

2.5 Environmental

PARAMETER			SPECIFICATION
Temperature (°C)	Operate ⁷	min. ⁸	-30
		max. ⁹	+55
	Survive	min. ⁸	-40
		max. ⁹	+71
Vibration and Shock			MIL-STD-810F, Cat 20, (Ground Mobile-Wheeled Vehicles) 5-500Hz 1hr each axis
Sealing ¹⁰			immersion proof
EMI/EMC ^{10, 11}			MIL-STD-461D

2.6 Connector/Pin Details

PARAMETER		SPECIFICATION
Connector A (J1): dc Power Input: Connector, MilSpec, Panel Plug, Bayonet, 10 Way, MIL-DTL-38999(Series III) D38999/24WC98PB		
Purpose		dc power input
Pins	A	N/C
	B	N/C
	C	N/C
	D	Protective Ground
	E	Shield
	F	Power Input [+28Vdc, 3A max.]
	G	Power Return [0Vdc, 3A max.]
	H	Shield
	J	Presence Loop In
	K	Presence Loop Out

⁷ Degraded performance for operational temperature range < -25°C and > + 50°C.

⁸ Without wind-chill.

⁹ Without solar radiation.

¹⁰ With compliant line connectors attached.

¹¹ Refer to manufacturer for details.

$$P_R = \frac{P_L \times \chi^2 \times \delta \times D_L^2 \times A_1 \times \cos\beta}{4 \times R^2 \times A_L}$$

RangePRO Model L-GM20 Laser Rangefinder Module

PARAMETER		SPECIFICATION
Connector B (J2): Comms Port Connection: Connector, MilSpec, Panel, Plug, Bayonet, 13Way, Mil-DTL-38999(Series III) D38999/24WB35PN		
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: Earth Stud		
Purpose		Earthing Stud
Pins	M4 Thread	Connection resistance <50mΩ or as per other installation requirements
Connector D (J3): Auxiliary and Laser Blanking Connection: Connector, MilSpec, Panel, Plug, Bayonet, 6 Way, MIL-DTL-38999(Series III) D38999/24WA35PN		
Purpose		laser blanking signal
Pins	1	+5V laser emission pulse
	2	RTN
	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]
[Optional] Connector E (J4): Camera Video Out Connection: Lemo ERA.2E.275.CTL		
Purpose		Video output from alignment camera
Pins	Center	CVBS (NTSC)
	Shield	Video GND

$$P_R = \frac{P_L \times \lambda^2 \times \delta \times D_L^2 \times A_1 \times \cos\beta}{4 \times R^2 \times A_L}$$

RangePRO Model L-GM20 Laser Rangefinder Module

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-GM20 is shown in the following figure.

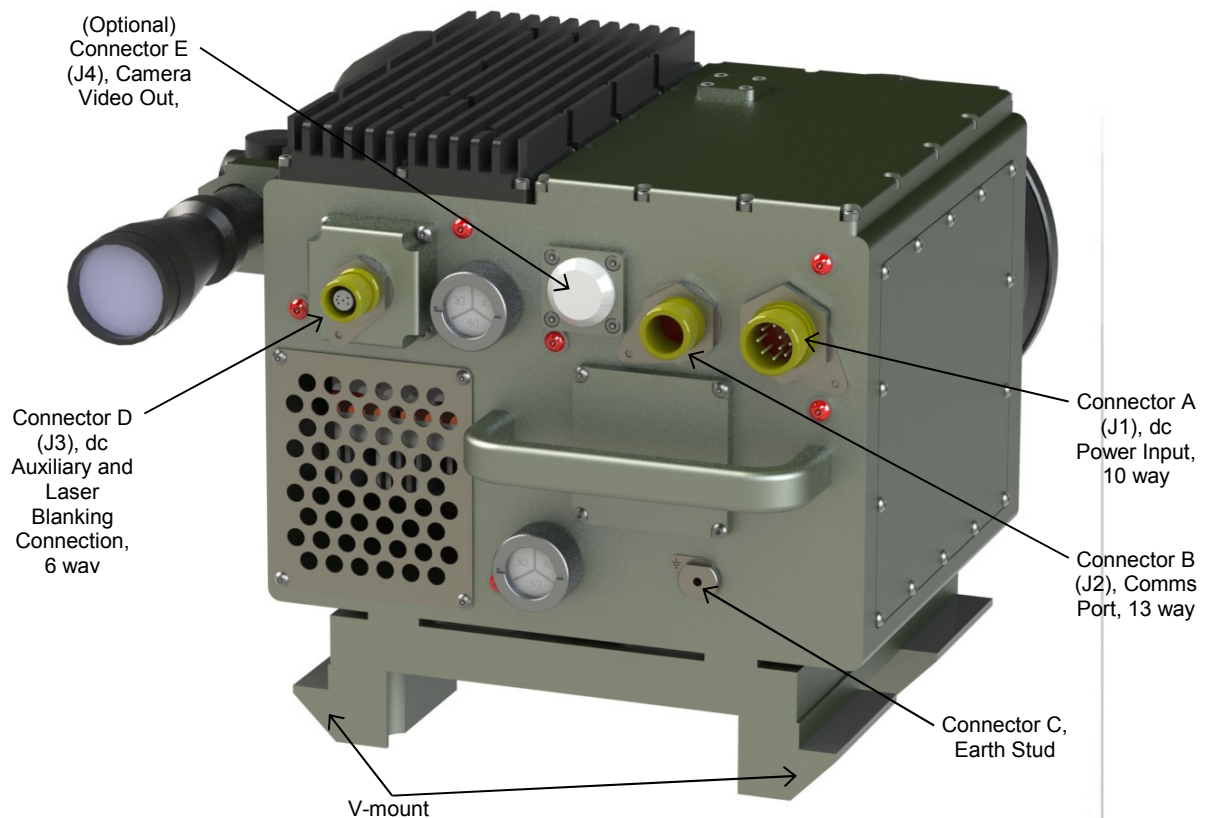


Figure 3-1: Mounts & Connections

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 (including one optional) 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, a Ground Stud;
- Connector D (J3), the Auxiliary and Laser Blanking connector; and
- (Optional) Connector E (J4), the Camera Video Out connector.

Product Specification

RangePRO Model L-GM20 Laser Rangefinder Module

4 OUTLINE DRAWINGS

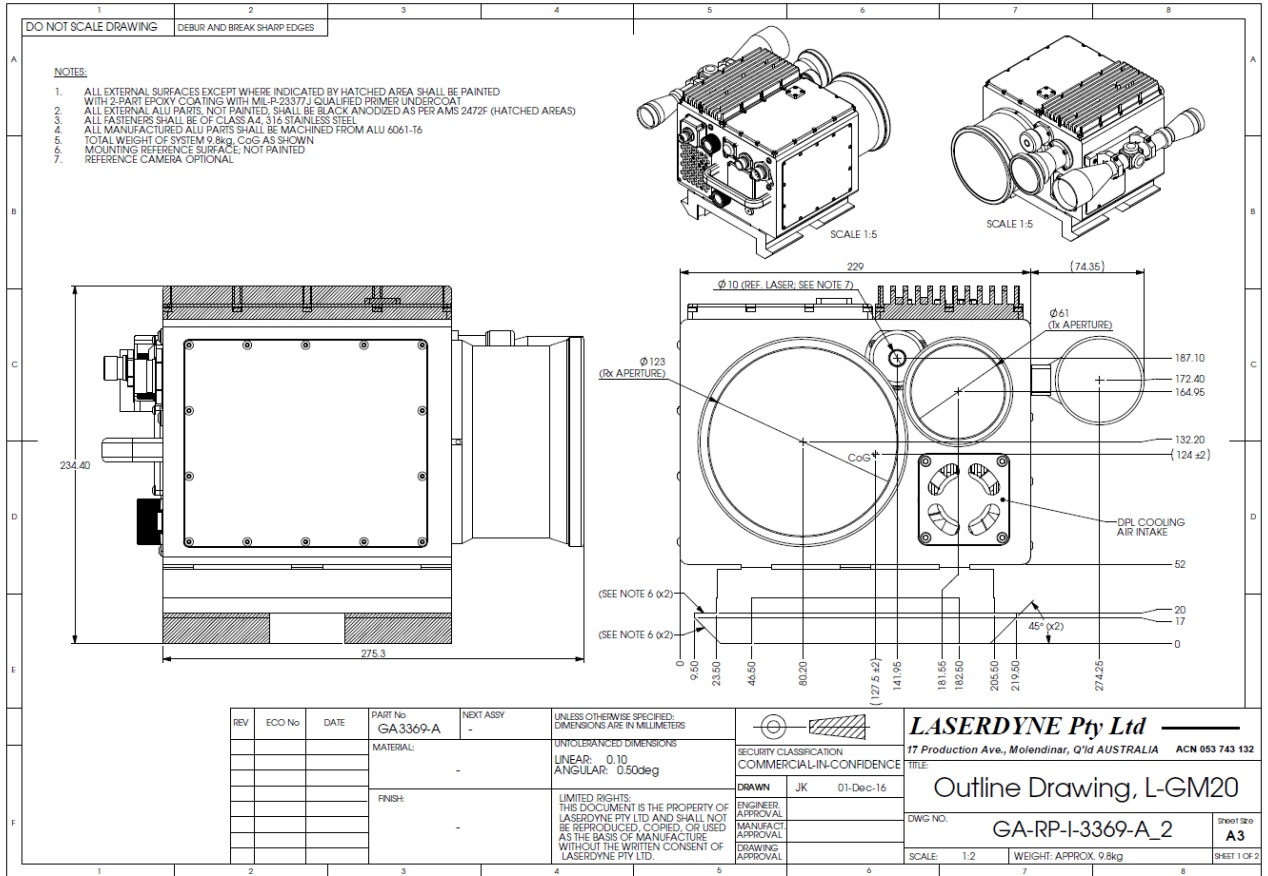


Figure 4-1: Outline Drawing Left & Front Views

$$P_R = \frac{P_L \times X^2 \times \delta \times D_L^2 \times A_1 \times \cos\beta}{4 \times R^2 \times A_L}$$

RangePRO Model L-GM20 Laser Rangefinder Module

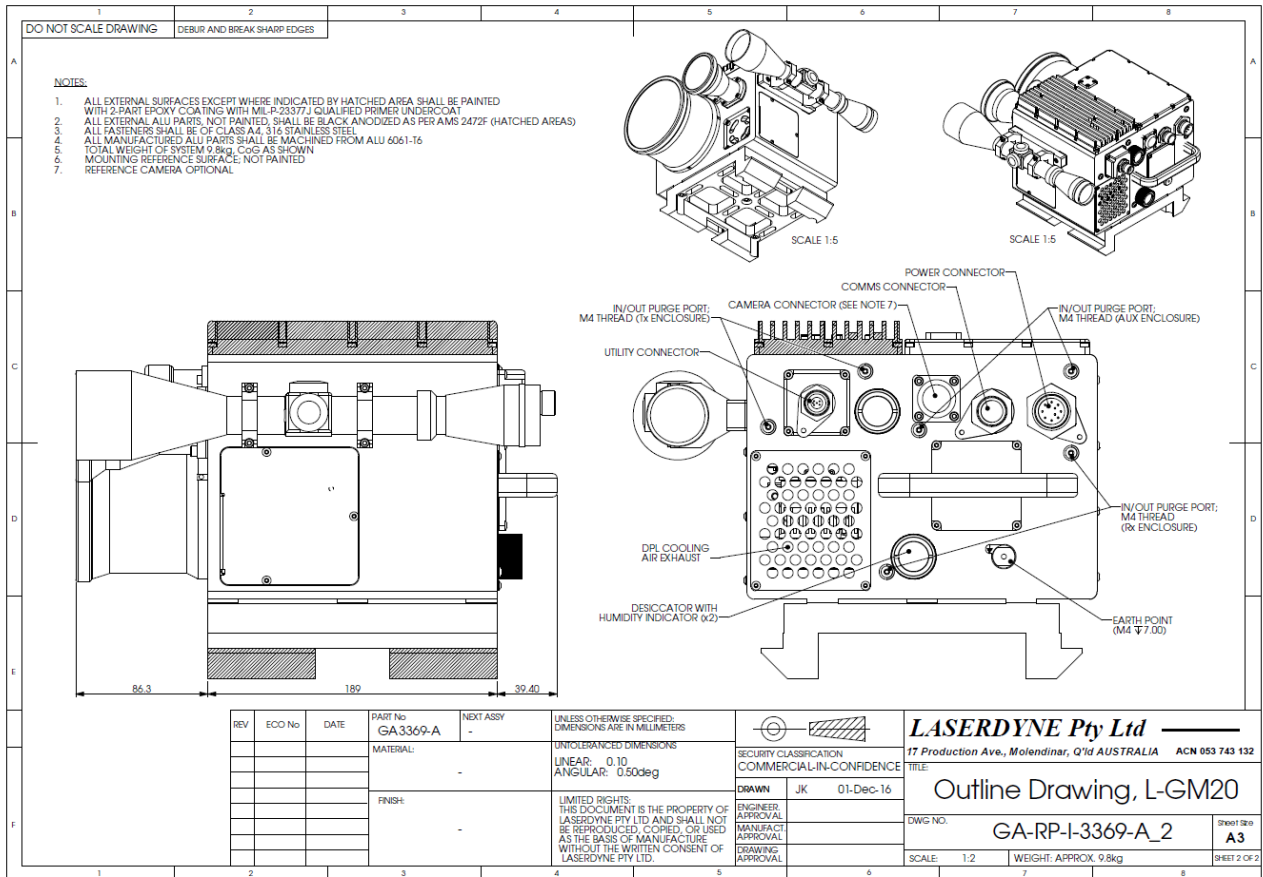


Figure 4-2: Outline Drawing Right & Rear Views



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