

RangePRO Model L-GM20 Laser Rangefinder Module

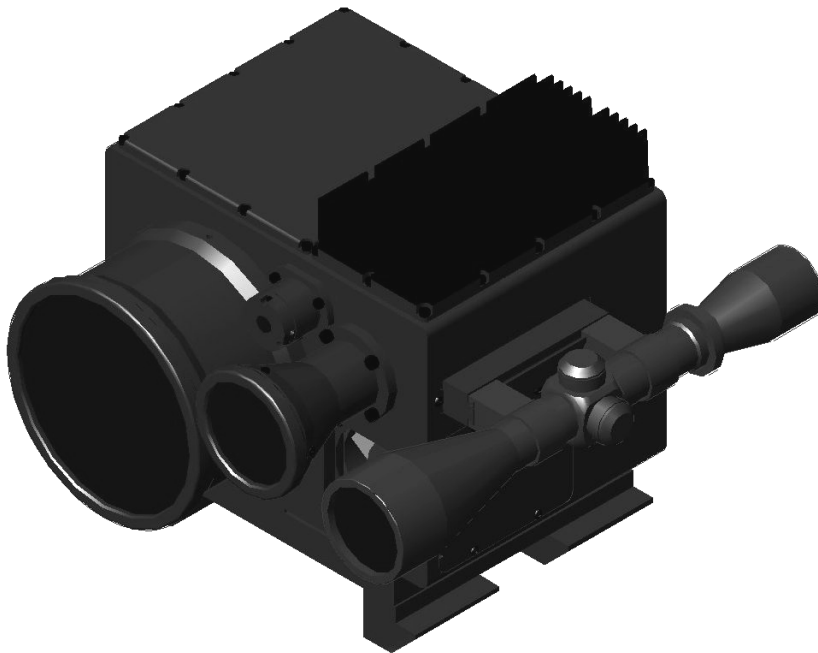


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$$P_R = \frac{P_L \times \tau^2 \times \delta \times D_L^2 \times A_t \times \cos\beta}{4 \times R^2 \times A_L}$$



RangePRO Model L-GM20 Laser Rangefinder Module

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.

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 can be limited to 8mJ which satisfies the most stringent safety class (Class 1) of the standard IEC825 and has a Nominal Ocular Hazard Distance (NOHD) of less than zero. Higher energy output can be used with a NOHD still less than zero but it is not classified as Class1. 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.

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



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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.

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


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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) | for Class 1 | < 8 |
| | for NOHD < 0m, not Class 1 | up to 15 |
| Beam Diameter [at exit] (mm) | | 40 |
| Beam Divergence [full angle; typical] (mrad) | | 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 [1m ² targets at 5,000m] | ≤ 20 |
| | Axial [between 100 & 5,000m] | ≤ 100 |
| Ranging Rate (Hz) | max. | 20 [for 1min, 1min off] ⁵ |
| | typical | 10 [continuous for 10mins] |

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

² Target albedo = 0.30 @ 1,570nm.

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| PARAMETER | | SPECIFICATION |
|--|-------------------------|---|
| Safety & Protection | | |
| Laser Safety Classification ³ | laser pointer | Class 1 |
| | rangefinder transmitter | Class 1 when set <8mJ at low rep rate; Class 3B when set >8mJ |
| Nominal Hazard Distances for: [rangefinder transmitter] (m) ^{3,4} | eye [NOHD] | < 0 |
| | skin [NSHD] | < 0 |
| Visible Emission Filter | | blocking |
| Visible Emission [@ ³ 10m] | | nil |
| Audible Emission [@ ³ 10m] | | nil |
| Support | | |
| MTBF (MIL-HDBK-217FN1) | hours | 19,000 in standby (25degC) |
| | 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-1 |
| Magnification ⁵ | | 4X to 12X [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 |

³ Australian/New Zealand Standard AS/NZS 2211.1:1997 *Laser Safety Part 1: Equipment classification, requirements and user's guide.*

⁴ When set < 8mJ for Class 1 operation.

⁵ Or customer selection.

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



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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) | 8.1 | |
| Dimensions [approx.] (mm) ⁶ | Length | 307.3 |
| | Width | 311.9 |
| | Height | 245.9 |

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 | 2.5 at max rep rate |
| | peak max | 4.0 with heater |

⁶ Including connectors, mounting feet, optional telescope

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



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2.5 Environmental

| PARAMETER | | | SPECIFICATION |
|------------------------|---------|------|--|
| Temperature (°C) | Operate | min. | -25 |
| | | max. | +45 |
| | Survive | min. | -32 |
| | | max. | +71 |
| Vibration and Shock | | | MIL-STD-810F, Cat 20, (Ground Mobile-Wheeled Vehicles) 5-500Hz 1hr each axis |
| Sealing ⁷ | | | immersion proof |
| EMI/EMC ^{7,8} | | | MIL-STD-461D |

2.6 Connector/Pin Details

| PARAMETER | | | SPECIFICATION |
|--|---|------------------------------|----------------|
| Connector A (J1): dc Power Input: Connector, MilSpec, Panel Plug, Bayonet, 10Way, 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 On/Off + (28VDC+ 150W) | |
| | G | Power On/Off - (28VDC- 150W) | |
| | H | Shield | |
| | J | Presence Loop In | |
| | K | Presence Loop Out | |

⁷ With compliant line connectors attached.

⁸ Refer to manufacturer for details.

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



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| 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: Ground Stud | | |

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



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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-GM20 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 three connection points located on the rear of the unit:

- Connector A (J1), the dc Power Input connector;
- Connector B (J2), the Comms Port connector; and
- Connector C, a Ground Stud.

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



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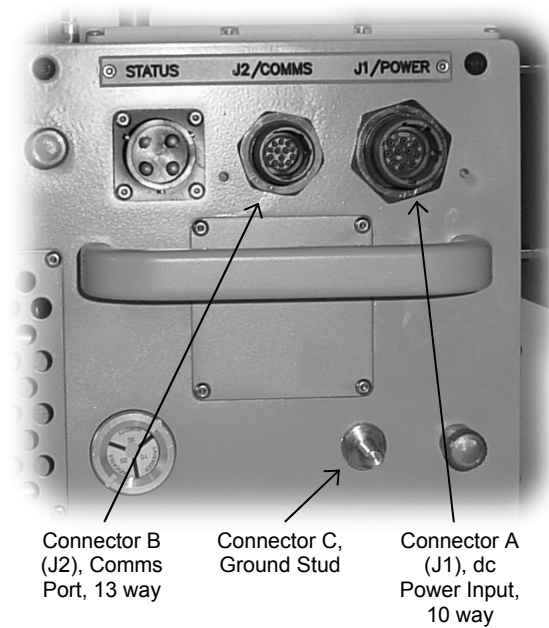


Figure 3-2: Connections

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



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4 OUTLINE DRAWINGS

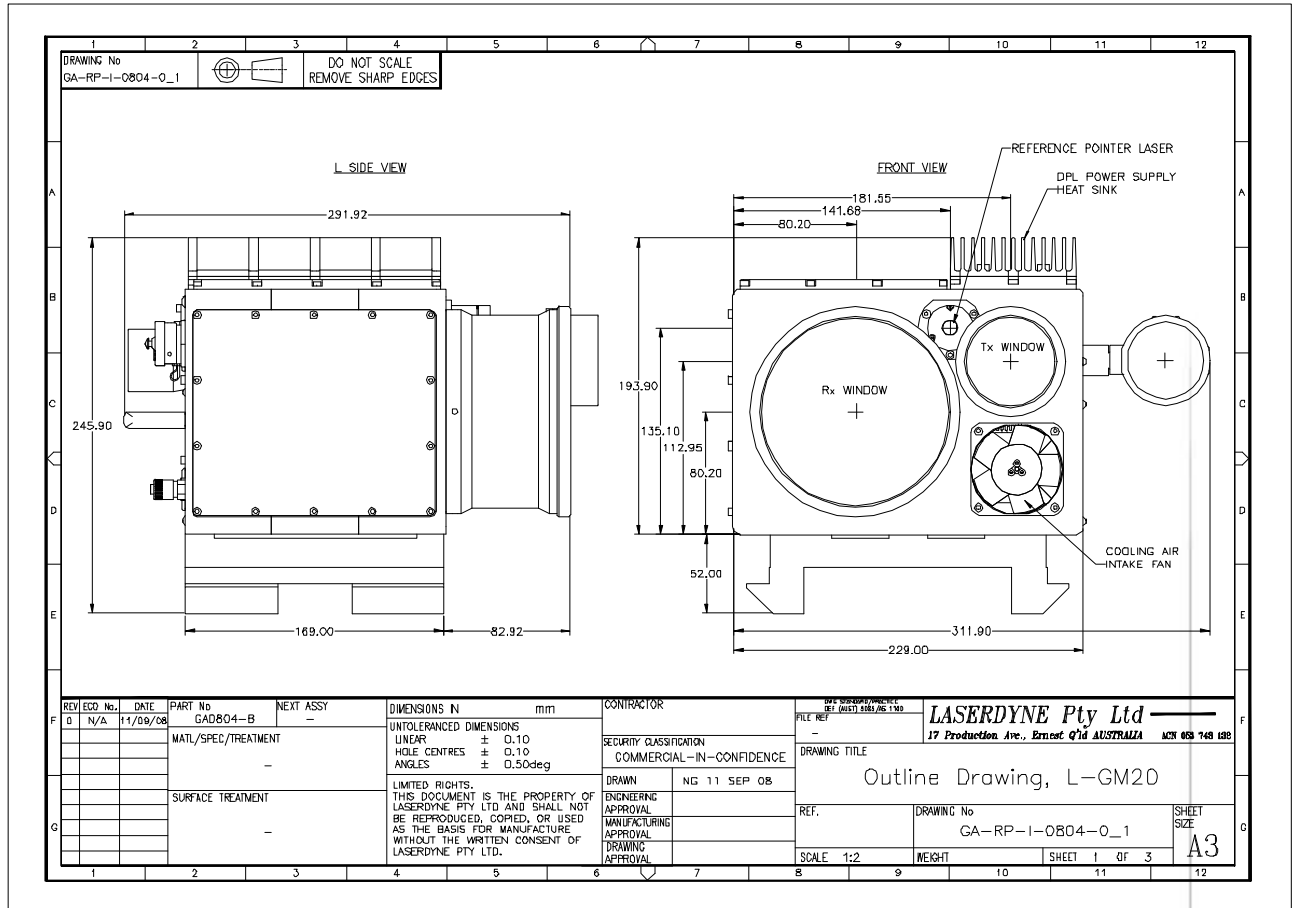


Figure 4-1: Outline Drawing Left & Front Views

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

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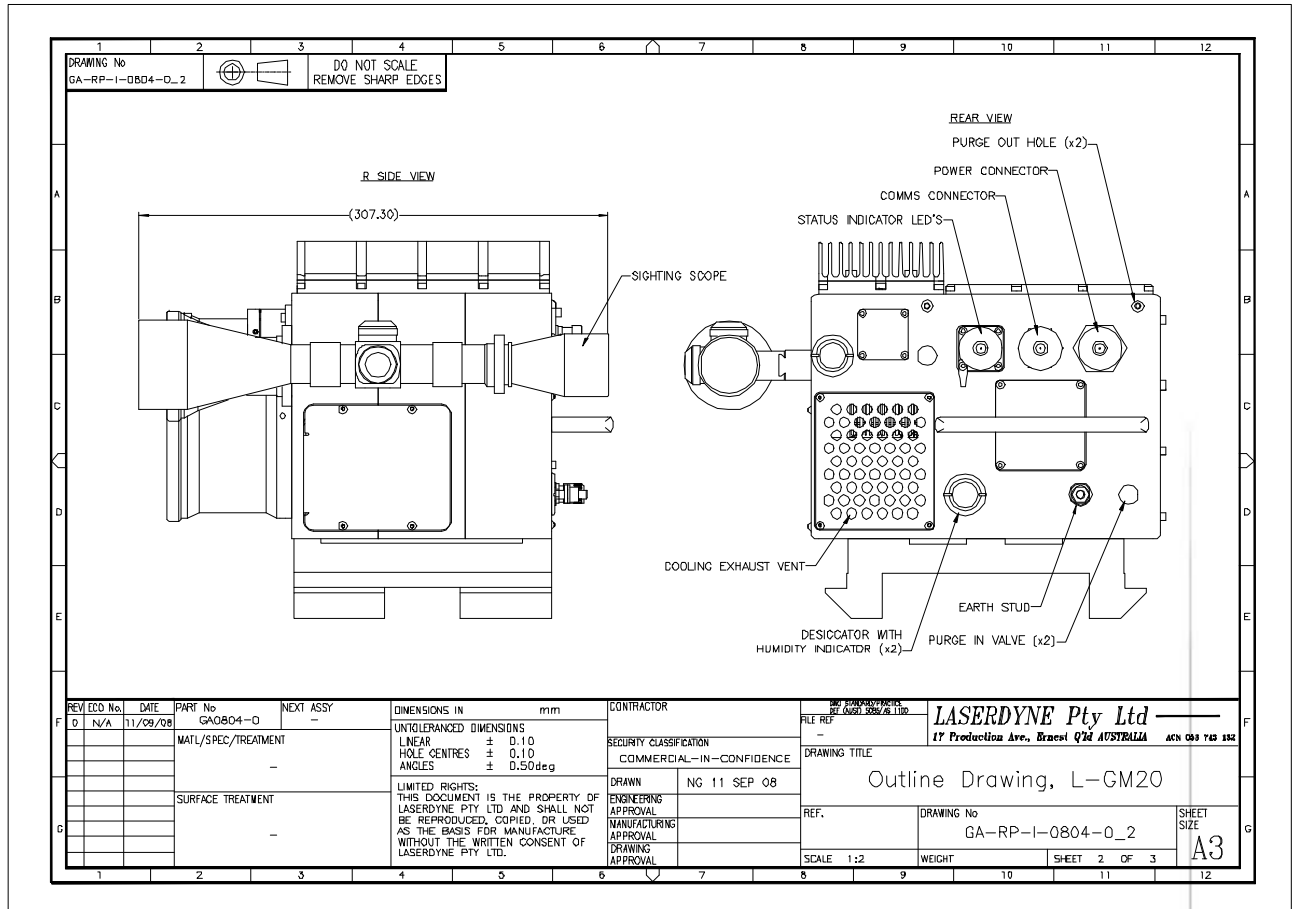
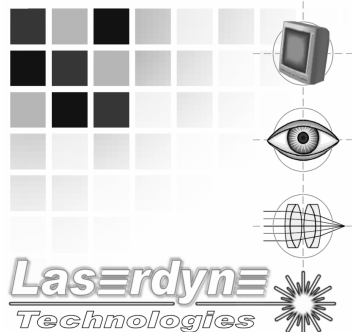


Figure 4-2: Outline Drawing Right & Rear Views



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