ERDI LASER®
ERDI TECH LTD

1535nm Eye-safe Laser Ranging Module

Model: LRF0305C

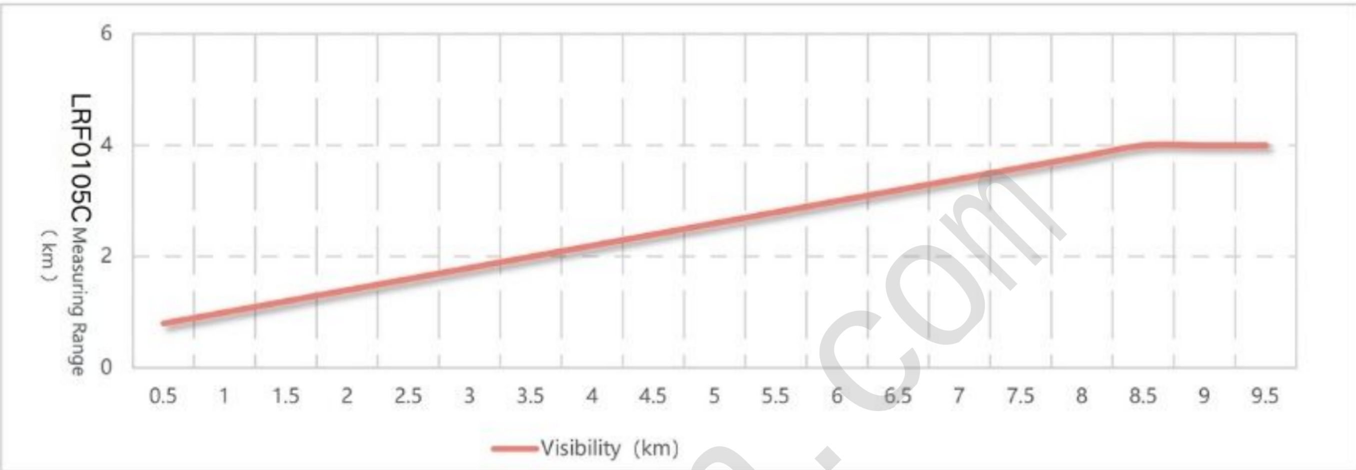
1. PRODUCT DESCRIPTION

The LRF0305C is a mini 1535nm eye-safe laser rangefinder module measuring 10–4000m with ±1m accuracy, 1–10Hz TOF operation and multi-target detection (up to 3 targets). Powered from a 3–5V supply with <1.5W operating power in a 27×25×15.5mm, 14g housing and controlled via UART (TTL 3.3V), it is ideal for UAV navigation, robotics, EO/IR payloads and industrial sensing applications.

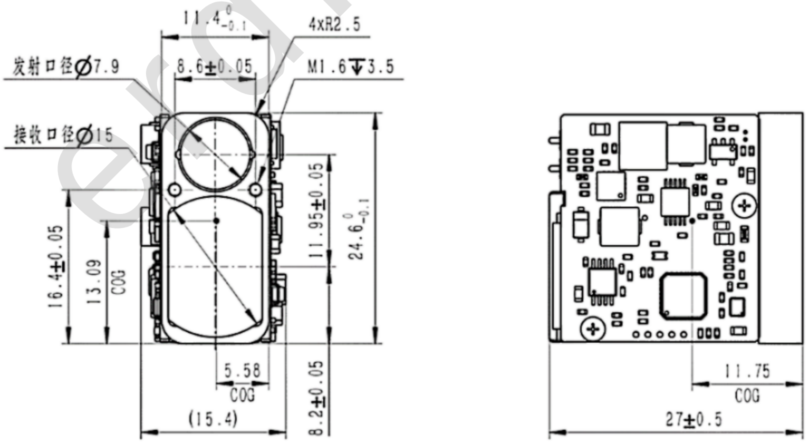
2. TECHNICAL SPECIFICATIONS

PROJECT		PERFORMANCE INDICATORS
Model		LRF0305C
Performance Indicators	Laser Wavelength	1535±5nm
	Eye- safety	Class I (IEC 60825-1)
	Divergence Angle	≤0.6 mrad
	Laser Energy	≥100 μJ
	Field of View (FOV)	~7. 4mrad
	Maximum Measuring Range (Visibility > 8km)	≥ 4000m @60% Reflectivity, Building Target
		≥3000m @30% Reflectivity, 2.3×2.3m Target
		≥1500m @30% Reflectivity, 0.5×1.7m Target
		≥800m @30% Reflectivity, 0.2×0.3m Target
	Minimum Range	≤10 m
	Ranging Frequency	1Hz ~10Hz
	Multi-Target Detection	Up to 3 targets
	Ranging Accuracy	±1 m
	Accuracy Rate	≥98%
	False Alarm Rate	≤1%
Electrical Specifications	Interface Type	UART(TTL 3.3V)
	Power Supply Voltage	DC 3~5V
	Standby Power Consumption (Full Temperature Range)	≤10mW (Power on pulled low)
		≤0.8W (Power on pulled high)
	Operating Power Consumption (Full Temperature Range)	5V.≤0.9W@1Hz
		5V,<1. 5W@10Hz
	Peak Power Consumption	<3W@5V

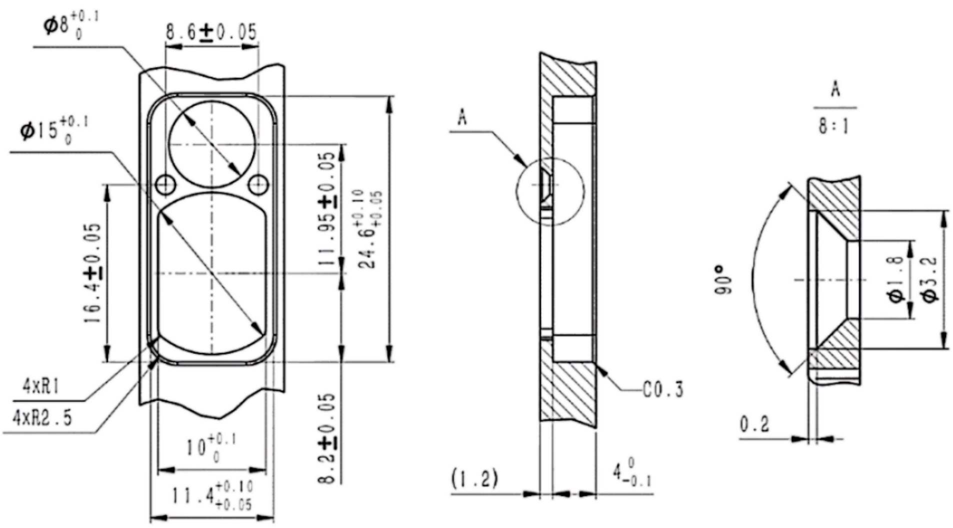
	Start-up Time	≤350ms (After startup, response time ≤20ms)
Physical Characteristics	Weight	≤ 14±1g
	Dimensions	≤ 27×25×15.5mm(L×W×H)
	Shock	1200g, 1ms
	Vibration	5~50~5 Hz, 1 octave/min, 2.5g
Environmental Adaptability	Operating Temperature	-40 ~ +70℃
	Storage Temperature	-45 ~ +70℃
	Reliability	MTBF>1500h



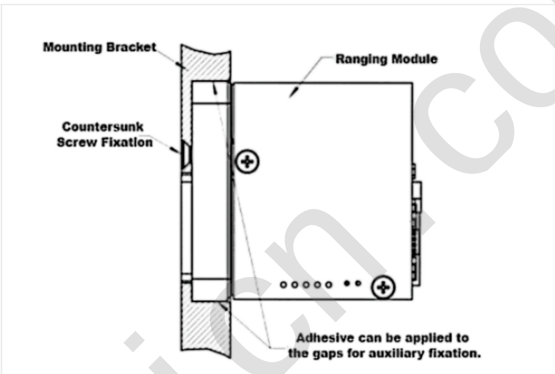
3. MECHANICAL DIMENSIONS



Recommended mounting bracket dimensions are as follows:



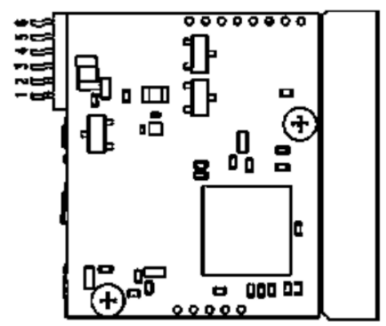
Installation Diagram:



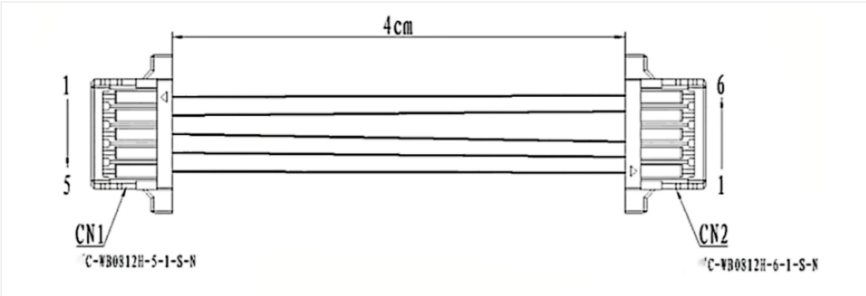
4. PIN INTERFACE

Interface Type: UART (TTL 3.3V)
Connector Model: FWF08002-S06B13W5M (Tesga Connector)

Pin	Definition	Description
1	POWER_ON	Module Power Switch, TTL 3.3V Level; Module On (>2.7V), Module Off (<0.3V)
2	UART_RX	Serial Port Receiver, TTL 3.3V Level
3	UART_TX	Serial Port Transmitter, TTL 3.3V Level
4	NC	
5	Power Positive	Power Supply, 3~5V
6	GND	Serial Port Ground



Cable Definition:



Matching Cable Pinout:

CN1(C-WBO812H-5-1-S-N)	CN2(C-WBO812H-6-1-S-N)	Cable Specifications	Color
1	6	AWG32	Black
2	5	AWG32	Red
3	3	AWG32	Yellow
4	2	AWG32	Green
5	1	AWG32	White

5. COMMUNICATION PROTOCOL

5.1 Protocol Format

Baud rate: **115200 bps** (factory default) / **57600 bps / 38400 bps / 9600 bps**

Data format: **1 start bit, 8 data bits, 1 stop bit, no parity.**

5.1.1 Data Packet Format

Field	Length	Value Range	Description
Frame Header	2	0×EE 0×16	Fixed byte
Data Length	1	2~7	Number of subsequent valid bytes
Device ID	1	0×03	Fixed byte
Command Code	1	0x00~0xFF	Command type code
Parameters	0~5	0x00~0xFF	Parameter value (depends on the command)
Checksum	1	0x00~OxFF	Checksum: lower 8 bits of the sum of Device ID + Command Code + Parameters

5.2 **Ranging Command**

After the ranging module is powered on, the **POWER_ON** signal is low by default. The host must pull **POWER_ON** high and then wait for approximately **0.3 s** (to allow the driver capacitors to fully charge) before issuing any of the commands described below; otherwise, the ranging module may not respond.

During subsequent standby operation, if **POWER_ON** has not been pulled low again, this 0.3 s waiting time is not required.

5.2.1 Device Self-test

Send: EE 16 02 03 01 04 (send self-test command, returns the current operating status information)

Return: EE 16 06 03 01 Status3 Status2 Status1 Status0 Check

For bit-wise parsing, the hexadecimal value needs to be converted to binary.

Status3: reserved
Status2: echo intensity, 0x00~0xFF
Status1: bit0 -- FPGA system status: 0 abnormal, 1 normal
bit1 -- laser emission status; 1 emitting 0 not emitting
bit2 -- main pulse detection status; 1 main pulse present 0 no main pulse
bit3 -- echo detection status; 1 echo present 0 no echo
bit4 -- bias switch status; 1 bias on 0 bias off
bit5 -- bias output status; 1 bias normal 0 bias abnormal
bit6 -- temperature status; 1 temperature normal 0 temperature abnormal
bit7 -- emission shutdown status; 1 valid 0 invalid
Status0:
bit0 -- 5V6 power status; 1 normal 0 abnormal

5.2.2 Single ranging & continuous ranging

① Single ranging
Send: EE 16 02 03 02 05
Return: EE 16 06 03 02 Status Result2 Result1 Result0 Check

② Continuous ranging
Send: EE 16 02 03 04 07
Return: EE 16 06 03 04 Status Result2 Result1 Result0 Check

For bit parsing, hexadecimal needs to be converted to binary.
When measuring first/last target:

Status:
0x00 means this ranging result is a single target;
0x01 means this ranging result has a front target;
0x02 means this ranging result has a back target;
0x03 reserved;
0x04 means this ranging result is over-range;
0x05 reserved;

Multi-target ranging:
Status bit3~0:
0x0 indicates that this ranging result is a single target;
0x1 indicates that this ranging result has a front target;
0x2 indicates that this ranging result has a back target;

0x3 indicates that this ranging result has both a front target and a back target;
0x4 indicates that this ranging result is over-range;
0x5 reserved;

Status bit7~4:
0x0~0xF indicate the index number of the current distance result; value range [0, N-1], number of targets $1 \le N \le 3$;

Result2: high 8 bits of the distance value,
Result1: low 8 bits of the distance value,
Result0: decimal part of the distance value.
Distance value = Result2 × 256 + Result1 + Result0 × 0.1, unit: m.

5.2.3 Stop ranging
Send: EE 16 02 03 05 08
Return: EE 16 02 03 05 08

5.2.4 Ranging error
Return: EE 16 0603 06 Status3 Status2 Status1 Status0 Check (when a ranging error occurs, the module actively returns this command)

For bit parsing, hexadecimal needs to be converted to binary.
Status3: reserved, Status2: reserved, Status1: reserved

Status0:
bit0 -- FPGA system status; 1 normal 0 abnormal
bit1 -- laser emission status; 1 emitting 0 not emitting
bit2 -- main pulse detection status; 1 main pulse present 0 no main pulse
bit3 -- echo detection status; 1 echo present 0 no echo
bit4 -- bias switch status; 1 bias on 0 bias off
bit5 -- bias output status; 1 bias normal 0 bias abnormal
bit6 -- temperature status; 1 temperature normal 0 temperature abnormal
bit7 -- emission shutdown status; 1 valid 0 invalid

5.3 Configuration command

5.3.1 Set baud rate
Send: EE 16 06 03 A0 BD24 BD16 BD8 BD0 Check
Return: EE 16 06 03 A0 BD24 BD16 BD8 BD0 Check
For bit parsing, hexadecimal needs to be converted to binary. The baud rate is of type U32, with the high byte first BD24–BD0.

5.3.2 Set ranging frequency
Send: EE 16 04 03 A1 Freq 00 Check

Return: EE 16 02 03 A1 A4
For bit parsing, hexadecimal needs to be converted to binary. Freq: 0x01~0x0A.

5.3.3 Set gating distance

① Set minimum gating distance
Send: EE 16 04 03 A2 Dis-H Dis-L Check
Return: EE 16 04 03 A2 Dis-H Dis-L Check

② Set maximum gating distance
Send: EE 16 04 03 A4 Dis-H Dis-L Check
Return: EE 16 04 03 A4 Dis-H Dis-L Check

③ Query minimum gate distance
Send: EE 16 02 03 A3 A6
Return: EE 16 04 03 A3 Dis-H Dis-L Check

④Query maximum gate distance
Send: EE 16 02 03 A5 A8
Return: EE 16 04 03 A5 Dis-H Dis-L Check

For bit parsing, hexadecimal needs to be converted to binary.
Dis-H: high 8 bits of distance, Dis-L: low 8 bits of distance.
Dis = Dis-H × 256 + Dis-L (10~20000 minimum gate distance range, unit: m).

5.4 Other shortcut commands

5.4.1 Set first target mode
Send: EE 16 03 03 03 01 07
Return: EE 16 02 03 03 06

5.4.2 Set last target mode
Send: EE 16 03 03 03 02 08
Return: EE 16 02 03 03 06

5.4.3 Set multi-target mode
Send: EE 16 03 03 03 03 09

5.4 Other shortcut commands

5.4.3 Set multi-target mode
Return: EE 16 02 03 03 06

5.4.4 Query FPGA version
Send: EE 16 02 03 A6 A9
Return: EE 16 06 03 A6 Version1 Version2 Version3 Version4 Check

5.4.5 Query MCU version
Send: EE 16 02 03 A7 AA
Return: EE 16 06 03 A7 Version1 Version2 Version3 Version4 Check

5.4.6 Query hardware version
Send: EE 16 02 03 A8 AB
Return: EE 16 06 03 A8 Version1 Version2 Version3 Version4 Check

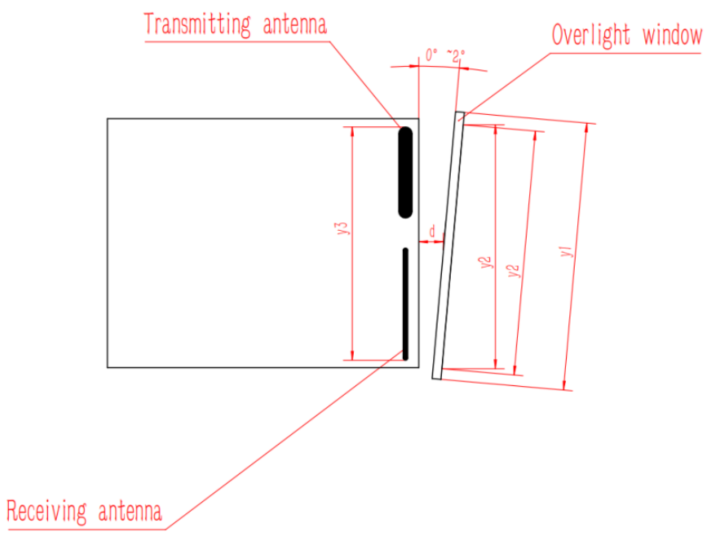
5.4.7 Query device SN
Send: EE 16 02 03 A9 AC
Return: EE 16 06 03 A9 SN1 SN2 SN3 SN4 Check

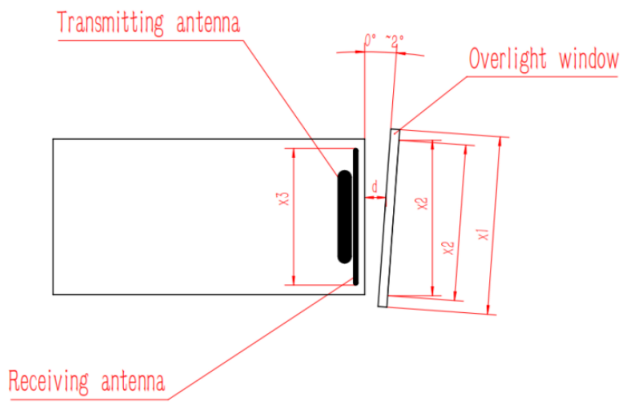
6. OPTICAL COATING RECOMMENDATION

For 1535 nm laser rangefinders, it is recommended that the optical window be coated with an **anti-reflective (AR) coating** optimized for 1525 nm–1545 nm, with transmittance ≥ 99%.
Depending on the actual application environment, additional protective coatings such as **hydrophobic** or **hard coatings** can be applied to the external surface. Other performance criteria should comply with **MIL-STD-810G**, with overall transmittance ≥ 97%.

Optical Window Geometry and Installation Recommendations

- The **effective aperture** of the optical window should be determined according to the specific product design.
- The **outer diameter** of the window should ensure:
  - (Effective aperture – outer diameter) ≥ 2 mm
  - (Antenna outer diameter – projection of effective aperture) ≥ 1.5 mm
    (See schematic illustration below.)
- Since the optical window introduces some laser absorption, its **thickness** should be controlled within **2 – 4 mm**, depending on overall dimensions.
- Due to the high transmittance of the window, the **emission optical axis** should be aligned with the **window normal** within **2°–4°**.
  (See the schematic diagram showing the relative positions of the window and optical barrels.)
- The **air gap** between the optical window and the rangefinder should be minimized. Figure 3 illustrates two recommended configurations for optical window placement.





The effective aperture of the optical window y_2 - the outer diameter of the optical window y_1>2mm
The outer diameter of the rangefinder antennay_3-the projection size of the effective aperture of the optical window y_2, >1.5mm
The air gap d between the optical window and the rangefinder should be as small as possible

The effective aperture of the optical window x_2 - the outer diameter of the optical window x_1>2mm
The outer diameter of the rangefinder antenna x_3-the projection size of the effective aperture of the optical window x_2, >1.5mm
The air gap d between the optical window and the rangefinder should be as small as possible

Schematic diagrams of two ways of the external dimensions and placement of the optical window

7. DAILY MAINTENANCE AND TROUBLESHOOTING

7.1 Measured distance result does not match the actual distance

- If tests are carried out in conditions such as heavy smog or water-mist weather with high humidity, it is easy to measure back water droplets or particles in the air. It is recommended to choose a good test environment.
- Under extreme low-temperature conditions, within 20 m there is a risk that the ranging accuracy exceeds the tolerance.

7.2 Ranging performance is reduced, target at theoretical range cannot be measured

- Very low target reflectivity will affect the returned laser energy and thus affect the ranging performance. When the ranging target is a low-reflectivity object such as a lake surface, wet road surface in rainy weather, or glass, the actual performance of the product cannot reach the theoretical range.
- The ranging module does not irradiate the target point vertically but forms a certain angle. In an oblique-measurement state, the returned laser energy will attenuate, resulting in reduced ranging performance.
- Under extreme low-temperature conditions, the ranging performance may decrease slightly.

7.3 Using our complete communication cable to communicate with the PC, no command response

Check whether the communication cable is broken (the 6-pin communication cable is thin and easy to break).

7.4 Using self-prepared cable for communication, no command response

Check whether the external wiring sequence of the module is correct, whether the communication cable is short-circuited, open-circuited or has poor contact, and check whether the serial-port TX and RX wire order is reversed.