LR2000E2

USER MANUAL



v1.2 | 2025.10 | ERDI TECH LTD

905 ± 5 nm
WAVELENGTH

IEC Class 1
LASER SAFETY CLASS
IEC classification

4–2000 m
MEASUREMENT RANGE

±1 m
RANGING ACCURACY
At ≤ 400 m; see notes

25.7 × 13.3 × 24.6 mm
DIMENSIONS
Rectangular

UART-TTL
COMMUNICATION
Customizable

Accuracy: ±1 m for d ≤ 400 m; ±0.004d for 400 m < d ≤ 2000 m. Distance d is expressed in meters.
Dimensions and tolerances: 25.7 ± 0.1 mm × 13.3 ± 0.1 mm × 24.6 mm (+0/−0.05 mm). See Section 6.

1. Product Overview

The **LR2000E2 series ranging module** is a high-precision, compact ranging module with a center operating wavelength of **905 nm**. It provides a ranging capability of **4 m to 2000 m**. The ranging update rate is **2–10 Hz** and can be customized according to customer requirements.

It uses a **UART-TTL communication interface** and is supplied with test software and an interface protocol document, supporting custom application development. The module features **small size, low weight, high accuracy, and a high update rate**.

It can be used for auxiliary ranging in handheld devices such as **night vision devices, thermal imagers, telescopes, and laser illuminators**. It is also suitable for other ranging applications, including **site monitoring, aviation, communications, railways, road monitoring, power line inspection, smart water conservancy, and outdoor sports**.

2. Technical Specifications

NO.	PARAMETER	SPECIFICATION
1	Laser Wavelength	905 ± 5 nm
2	Laser Beam Divergence	< 6 mrad
3	Optical Material	PMMA
4	Receiver Aperture	9.2 mm × 14.5 mm
5	Measurement Range	4–2000 m
6	Ranging Accuracy	±1 m (d ≤ 400 m) ±0.004d (400 m < d ≤ 2000 m)
7	Measurement Rate	2–10 Hz (adaptive)
8	Valid Measurement Rate	≥ 98% (d ≤ 400 m) ≥ 80% (400 m < d ≤ 2000 m)
9	False Alarm Rate	≤ 1%
10	Communication Interface	UART-TTL, customizable
11	Baud Rate	115200 bps
12	Supply Voltage	3.3–5 V
13	Startup Time	≤ 200 ms

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NO.	PARAMETER	SPECIFICATION
14	Startup Inrush Current	< 400 mA
15	Operating Power Consumption	≈ 1.2 W
16	Operating Temperature	−20 °C to +60 °C
17	Storage Temperature	−40 °C to +60 °C
18	Protection Rating	—
19	Laser Safety Class	IEC Class 1
20	Dimensions	25.7 ± 0.1 mm × 13.3 ± 0.1 mm × 24.6 mm (+0/−0.05 mm) (Rectangular)
21	Weight	≈ 10 g
22	Shock	—
23	Vibration	5–50–5 Hz, 1 octave/min, 2.5 g
24	Reliability	MTBF ≥ 1500 h

3. Functional Description

The device supports single-shot measurement and continuous (multiple) measurements.

3.1 External Circuit Enable

Enables the module for normal operation.

3.2 External Circuit Disable

Disables the external circuit to reduce power consumption.

3.3 Single-Shot Measurement

Triggers a single distance measurement. For low-reflectivity targets, the module will automatically repeat the measurement until stable distance data is obtained, and then reports the result via the serial port in the standard data format.

3.4 Continuous Measurement

In continuous measurement mode, the laser module performs continuous ranging with a typical update rate of 2 Hz, and a maximum update rate of up to 10 Hz.

4. Hardware Installation Guide

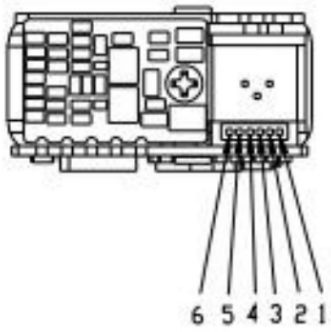
4.1 Packing List

Laser Rangefinder Module × 1
Power Cable × 1

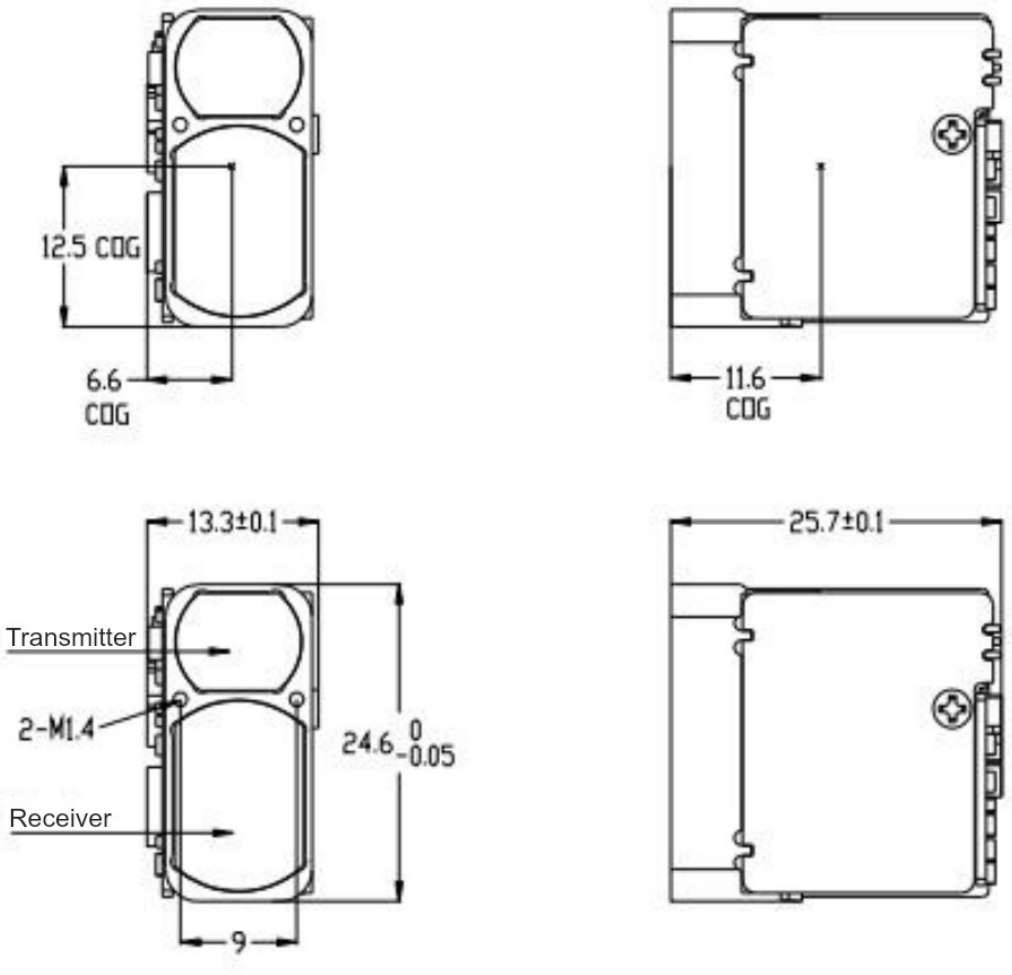
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5. Electrical Interface Definition

Pin	Signal	Description
1	GND	Power supply negative
2	VCC	Power supply positive
3	I/O (Reserved)	Reserved for expansion
4	TXD	Transmit data: module → host
5	RXD	Receive data: host → module
6	SW-SHOT	Function enable (active high) Note: Compatible with active-low control requirements



6. Mechanical Dimensions



Mechanical Dimensional Drawing and Electrical Interface Diagram

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7. Optical Window Selection and Coating Recommendations

7.1 Material Recommendations

H-K9L optical glass or fused silica is recommended for the optical window.

H-K9L and fused silica are among the most commonly used colorless optical materials. They are suitable for the 300–2100 nm wavelength range and offer good cost-effectiveness and excellent physical properties.

7.2 Manufacturing Recommendations

- The wedge angle tolerance of the window should be as small as possible. Recommended wedge angle tolerance: ≤ 3′ (tolerance grade ≤ Grade 7).
- The optical surfaces should be as smooth as possible.

7.3 Coating Recommendations

For a 905 nm laser rangefinder, an antireflection (AR) coating for the 855–955 nm wavelength range is recommended, with transmittance ≥ 99.5%.

Depending on the operating environment, additional protective coatings, such as a hydrophobic coating or a hard coating, may be applied to the outer surface. For other requirements, refer to GJB 2485-95; transmittance: ≥ 98%.

7.4 Optical Window Geometry and Installation Recommendations

The clear aperture of the window depends on the specific product. The outer dimensions shall meet the following requirements:

- Optical-window outer dimension − clear-aperture dimension ≥ 2 mm
- Projected clear-aperture dimension − optical-assembly outer dimension ≥ 1.5 mm

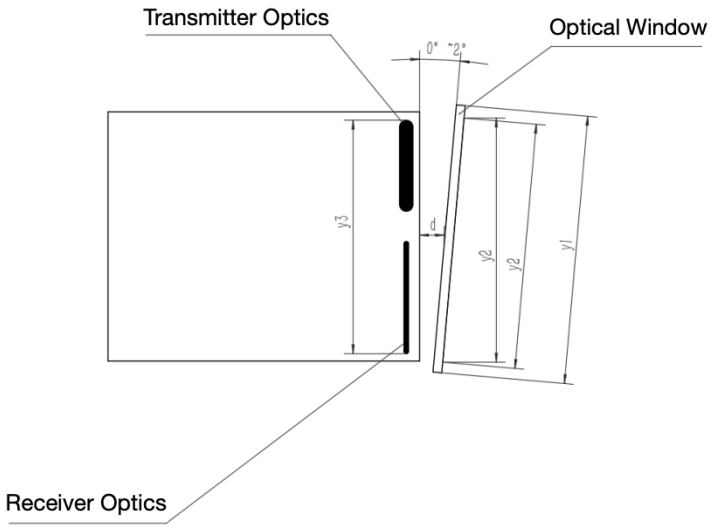
A schematic is shown below.

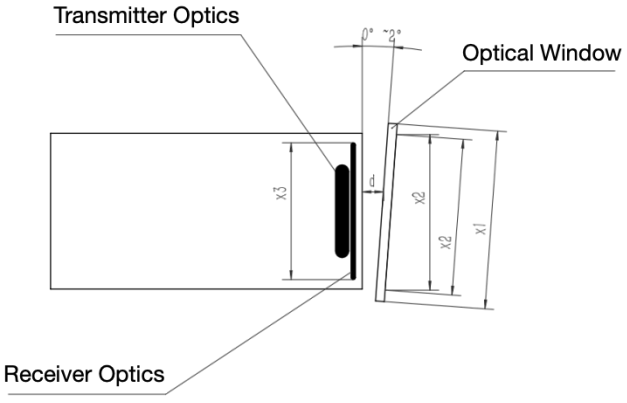
Since the window absorbs a small portion of the laser energy, a window thickness of 2–4 mm is recommended, depending on the available mechanical space.

Due to the high transmittance of the window, it is recommended that the transmitter optical axis be parallel to the surface normal of the window. The relative positions of the window and the two lens barrels are shown in the figure below.

In addition, the air gap between the window and the rangefinder should be less than 0.5 mm. The figure below shows two window installation arrangements.

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Optical-window outer dimension y_1 − clear-aperture dimension y_2 > 2 mm Projected clear-aperture dimension y_2 − optical-assembly outer dimension y_3 > 1.5 mm The air gap d between the optical window and the rangefinder should be as small as possible	Optical-window outer dimension x_1 − clear-aperture dimension x_2 > 2 mm Projected clear-aperture dimension x_2 − optical-assembly outer dimension x_3 > 1.5 mm The air gap d between the optical window and the rangefinder should be as small as possible

8. Host Communication Protocol

Protocol Format

- Communication method: Serial communication
- Baud rate: 115200 bps (default)
- Data bits: 8 bits
- Frame length: 8 bytes

Data Protocol									
		Frame Header (H)	Frame Header (L)	Function Code	D1	D2	D3	D4	Checksum
	Send	55	AA						SUM(Function Code + DATA1 + ... + DATA4)
	Response	55	AA						SUM(Frame Header (H) + Frame Header (L) + ... + DATA4)

Data Protocol									
		Frame Header (H)	Frame Header (L)	Function Code	D1	D2	D3	D4	Checksum
Measurement Commands									
Single-Shot Ranging	Send	55	AA	88	FF	FF	FF	FF	SUM[3:7]
		55 AA 88 FF FF FF FF 84							
	Response	55	AA	88	STA	FF	DIS_H	DIS_L	SUM[1:7]
		STA = 1: Measurement successful; any other STA value: Measurement failed DIS_H: High byte of the measured distance; DIS_L: Low byte of the measured distance **Returned values use hexadecimal notation. Reported value = measured value × 10.**							
Continuous Ranging	Send	55	AA	89	FF	FF	FF	FF	SUM[3:7]
		55 AA 89 FF FF FF FF 85							
	Response	55	AA	89	STA	FF	DIS_H	DIS_L	SUM[1:7]
		STA = 1: Measurement successful; any other STA value: Measurement failed DIS_H: High byte of the measured distance; DIS_L: Low byte of the measured distance **Returned values use hexadecimal notation. Reported value = measured value × 10.**							
Stop Ranging	Send	55	AA	8E	FF	FF	FF	FF	SUM[3:7]
		55 AA 8E FF FF FF FF 8A							
	Response	55	AA	8E	STA	FF	FF	FF	SUM[1:7]
		STA = 0: Failed to stop continuous ranging; STA = 1: Continuous ranging stopped successfully							
Angle Measurement	Send	55	AA	8A	FF	FF	FF	FF	SUM[3:7]
		55 AA 8A FF FF FF FF 86							
	Response	55	AA	8A	STA	FF	ANG_H	ANG_L	SUM[1:7]
		STA = 0: Measurement failed; STA = 1: Measurement successful ANG_H: High byte of the measured angle; ANG_L: Low byte of the measured angle **Returned values use hexadecimal notation. Reported value = measured value × 10.** **Available only on modules equipped with an angle sensor**							
Power-On Self-Test									
Self-Test Information	Response	55	AA	80	STA	00	00	ErrCode	SUM[1:7]
		STA = 0: Power-on initialization failed; ErrCode contains the error code STA = 1: Power-on initialization successful							

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Data Protocol									
		Frame Header (H)	Frame Header (L)	Function Code	D1	D2	D3	D4	Checksum
System Settings									
Baud Rate	Send	55	AA	TYPE	FF	FF	FF	FF	SUM[3:7]
		TYPE = 01: Set baud rate to 9600 bps TYPE = 02: Set baud rate to 14400 bps TYPE = 03: Set baud rate to 19200 bps TYPE = 04: Set baud rate to 38400 bps TYPE = 05: Set baud rate to 56000 bps TYPE = 06: Set baud rate to 57600 bps TYPE = 07: Set baud rate to 115200 bps TYPE = 08: Set baud rate to 128000 bps TYPE = 09: Set baud rate to 230400 bps **A baud rate change takes effect only after the module is restarted.**						
	Response	55	AA	TYPE	STA	FF	FF	FF	SUM[1:7]
		STA = 0: Setting failed; STA = 1: Setting successful							
LD Constant-On Mode	Send	55	AA	86	FF	FF	FF	STA	SUM[3:7]
		STA = 0: Disable LD constant-on mode; STA = 1: Enable LD constant-on mode 55 AA 86 FF FF FF 01 84 Enable 55 AA 86 FF FF FF 00 83 Disable							
	Response	55							
		STA = 0: LD is already on; STA = 1: LD is already off; STA = FF: Operation failed **Note: Do not leave LD constant-on mode enabled for extended periods.**							

Notes:

1. Command and response frames use different checksum ranges. Use the range specified for each frame.
2. The checksum is the least significant 8 bits of the sum of the specified bytes.
3. All transmitted and received frame bytes are represented in hexadecimal notation.

9. Safety Warnings and Precautions

- To avoid eye injury, do not look directly into the laser emission aperture. The module is classified as **Class 1**.
- Operating ambient temperature range: −20 °C to +60 °C. Avoid exposure to high temperatures, high humidity, rain, snow, or dust.
- Do not attempt to disassemble the module yourself. Doing so may void the warranty or damage the device.
- This product is intended mainly for integration into civilian equipment such as UAVs, outdoor observation devices, and surveying and mapping systems.
- The spot/beam adjustment mode is for developers only. To avoid eye injury, do not direct the laser beam toward anyone's eyes in this mode.
- Factors affecting ranging capability, ranging response time, and ranging accuracy include:

  Target reflectivity: In general, the higher the target reflectivity, the better the ranging capability and the faster the ranging response. The LR2000E2 measurement range is 4–2000 m, as specified in Section 2. The achievable range depends on the target and measurement conditions. (Targets that produce little diffuse reflection, such as water surfaces, may be impossible to measure.)
  Target shape: When the reflective surface area is too small or the surface is uneven, ranging capability and response speed will decrease accordingly.

Measurement angle: When the laser beam is perpendicular to the target's reflective surface, ranging performance is better and response is faster. Otherwise, ranging performance and response speed decrease. Under extreme incidence angles, the ranging capability and response time specified in this manual cannot be guaranteed.

Measurement environment: Factors affecting ranging capability and response speed also include sunlight intensity, the concentration of water vapor and suspended particles in the air, and the measurement direction relative to direct sunlight. (Rain, fog, snow, haze, and smog reduce the measurement range.)

The ranging performance of this series of rangefinder modules is specified under the following conditions:

- The target has **medium reflectivity**, such as a building wall;
- The target's reflective surface is **perpendicular** to the laser emission direction;
- The weather is **clear**, and the measurement is performed **without direct sunlight**.

Recommendation: When measuring distant targets, mount the module on a tripod to reduce vibration during measurement and achieve better ranging performance.

Suitable Targets for Measurement

This product can measure **high-reflectivity targets** (e.g., highway traffic signs), **medium-reflectivity targets** (e.g., building walls), and **low-reflectivity targets** (e.g., trees, golf flagpoles, animals, etc.). When target reflectivity falls below a certain level, the measurement range decreases accordingly.


Highway Traffic Sign


Building Wall


Trees


Animals

The ranging performance of this module is specified under the following conditions:

The target has **medium reflectivity**, such as a building wall;

The target's reflective surface is **perpendicular** to the laser emission direction;

The weather is **clear**, and the measurement is performed **without direct sunlight**.

Note:

When measuring distant targets, it is recommended to mount the module on a tripod to reduce vibration during measurement and achieve better ranging performance.

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