LR1000E4

USER MANUAL

v1.2 | 2025.10 | ERDI TECH LTD

905 ± 5 nm
WAVELENGTH

IEC Class 1
LASER SAFETY CLASS
IEC classification

4–1000 m
MEASUREMENT RANGE

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

25.7 × 14.2 × 26.2 mm
DIMENSIONS
Rectangular

UART-TTL
COMMUNICATION
Customizable

Accuracy: ±1 m at d ≤ 400 m; ±(1 m + d × 0.1%) at d > 400 m. See the Technical Specifications table for target conditions.
Drawing dimensions: 25.7 ± 0.1 mm × 14.2 mm (+0/−0.05 mm) × 26.2 mm (+0/−0.05 mm). See Section 6.

1. Product Overview

The compact, high-precision **LR1000E4 laser rangefinder module** operates at a center wavelength of **905 nm**. It provides a range of **4–1000 m** and a nighttime range of up to 1200 m at 10 km visibility. Its adaptive measurement rate is **3–10 Hz** and can be customized to meet application requirements.

The module uses a **UART-TTL communication interface** and is supplied with dedicated test software and protocol documentation for custom application development. Its key features are **compact size, low weight, high accuracy, and a high measurement rate**.

It is suitable for handheld systems such as **night-vision devices, thermal imagers, telescopes, and laser illuminators** used for auxiliary ranging. Other applications include **border-security monitoring, aviation, communications, railway systems, law enforcement, smart water management, and outdoor sports**.

2. Technical Specifications

No.	Parameter	Specification
1	Laser Wavelength	905 ± 5 nm
2	Laser Beam Divergence	< 9 mrad
3	Optical Material	Resin Aspheric Lens
4	Receiver Aperture	9.2 mm × 14.5 mm
5	Measurement Range	4–1000 m
6	Ranging Accuracy	±1 m (≤ 400 m)[1] ±(1 m + d × 0.1%) (> 400 m)[2]
7	Measurement Rate	3–10 Hz (adaptive)
8	Valid Measurement Rate	≥ 98%
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
14	Inrush Current	< 350 mA
15	Sleep Power Consumption	< 1 mW
16	Standby Power Consumption	< 0.3 W
17	Short-Range Power Consumption	< 0.6 W
18	Operating Power Consumption	≤ 1 W
19	Operating Temperature	−20 °C to +55 °C (customizable down to −40 °C)
20	Storage Temperature	−40 °C to +60 °C
21	Ingress Protection Rating	IP67 (lens cavity only)
22	Laser Safety Class	IEC Class 1

No.	Parameter	Specification
23	Dimensions	25.7 × 14.2 × 26.2 mm (rectangular; tolerances in Section 6)
24	Weight	≤ 10 g
25	Shock Resistance	—
26	Vibration Resistance	5–50–5 Hz, 1 octave/min, 2.5 g
27	Reliability	MTBF ≥ 1500 h
Notes: 1) Target size: 2.3 m × 2.3 m; reflectivity: 90%; 2) Target size: 2.3 m × 4.6 m; reflectivity: 90%; 3) The accuracy values in the table apply to measurements made using a whiteboard target.		

3. Functional Description

The module supports **single-shot and continuous measurement** modes.

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 measurement of the distance to the target. For low-reflectivity targets, the system automatically performs repeated measurements until stable distance readings are obtained. The measurement result is then transmitted via the serial interface in the standard data format.

3.4 Continuous Measurement
In continuous-measurement mode, the module repeatedly measures the distance to the target. The standard measurement rate is adaptive from **3 to 10 Hz**. The module also supports 2 Hz and 5 Hz settings; operation at up to 30 Hz requires a customized version. Measurement-rate settings are configured through the serial interface.

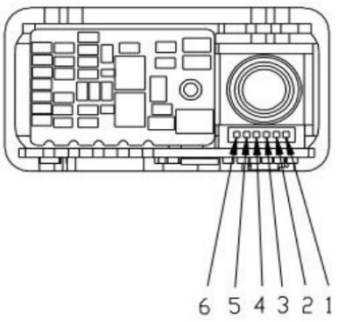
4. Hardware Installation Guide

4.1 Packing List

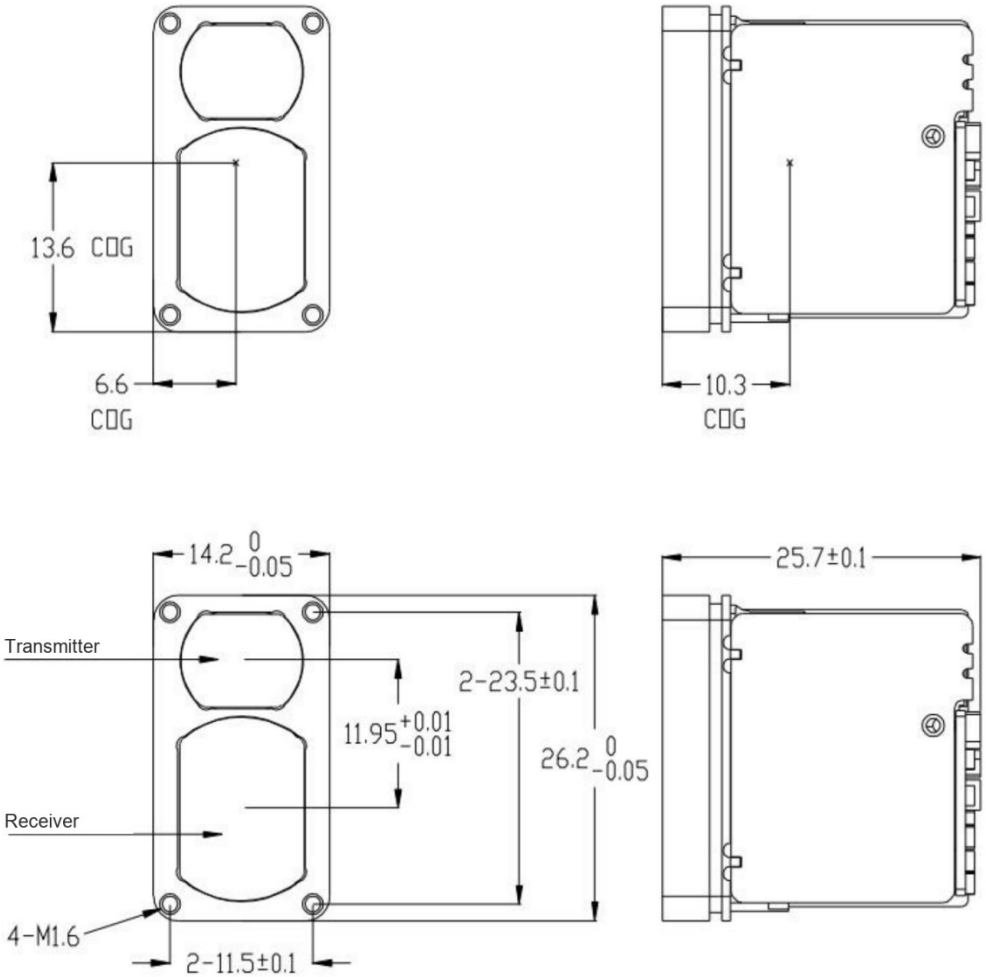
Laser Rangefinder Module × 1
Power Cable × 1

5. Electrical Interface Definition

Pin	Signal	Description
1	GND	Power ground
2	VCC	Power input
3	I/O (Reserved)	Reserved for expansion
4	TXD	Transmit data: module → host
5	RXD	Receive data: host → module
6	SW-SHOT	Function-enable input (configured active high or active low)



6. Mechanical Dimensions



Mechanical Drawing and Center-of-Gravity Locations

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 300–2,100 nm wavelength range and offer good cost efficiency 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 anti-reflection (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 coating requirements, refer to GJB 2485-95; the specified transmittance is ≥ 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:

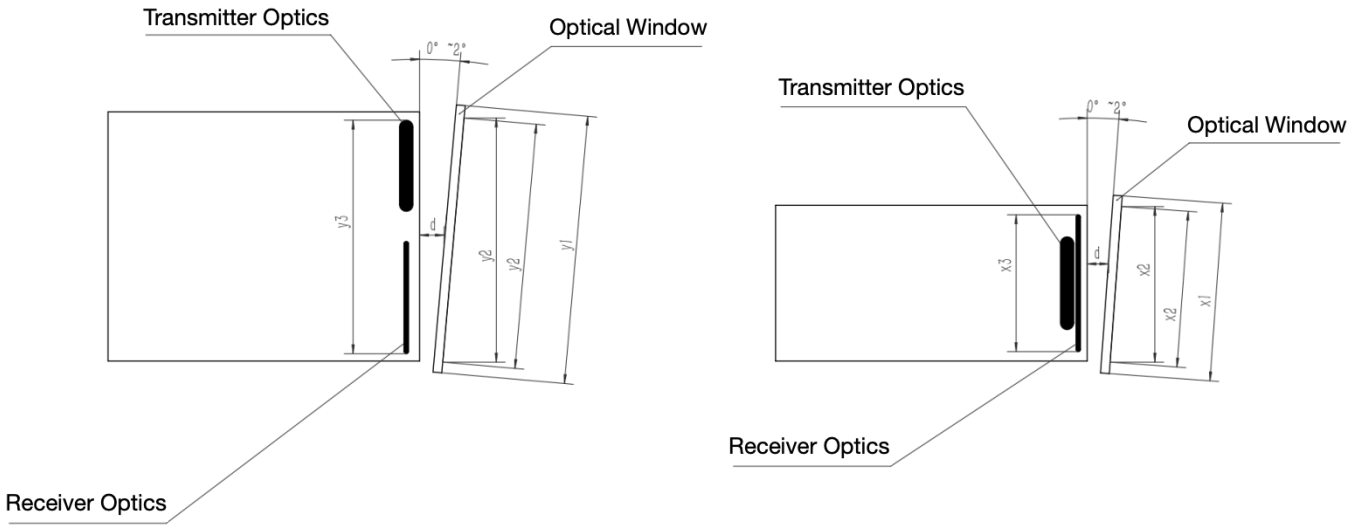
- Optical-window outer dimension − clear-aperture dimension > 2 mm
- Projected clear-aperture dimension − optical-assembly outer dimension > 1.5 mm

The following schematics illustrate these requirements.

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.

The transmitter optical axis should be parallel to the surface normal of the optical window. The figure below shows the relative positions of the window and the two lens barrels.

Keep the air gap between the optical window and the rangefinder below 0.5 mm. The figure below shows two recommended window-installation arrangements.



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 interface: UART-TTL serial
- 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 **The returned value is expressed in hexadecimal notation. Raw output = 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 **The returned value is expressed in hexadecimal notation. Raw output = 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 **The returned value is expressed in hexadecimal notation. Raw output = measured value × 10.** **Available only for 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 identifies the corresponding error STA = 1: Power-on initialization successful							

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 IEC **Class 1**.
- Operating ambient temperature range: **−20 °C to +55 °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, and must not be used for military applications.
- The 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 LR1000E4 measurement range is 4–1000 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 flagsticks, 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.