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LDR100 Laser Ranging Target Indicator

Model:LDR100

PRODUCT DESCRIPTION

The LDR100 Laser Ranging Target Indicator is a high-precision optoelectronic device designed to measure distance information accurately by emitting a laser beam towards a specific target and calculating the laser's flight time. This innovative Laser Ranging Target Indicator facilitates communication through a reliable RS422 communication interface, boasting exceptional performance and user-friendly operation. Its versatile application across various platforms, including handheld, airborne, and vehicle-mounted systems, is attributed to its compact size, lightweight nature, and low power consumption. Notably, the Laser Ranging Target Indicator operates at a wavelength of 1064nm, and direct exposure to human eyes is strictly prohibited for safety reasons

TECHNICAL SPECIFICATIONS

Wavelength	1064nm
Output Energy	Full temperature range: 100mJ～120mJ, Average output energy ≥110mJ
Adjacent pulse energy fluctuation range	≤8%
Beam Divergence Angle	≤0.15mrad (Accepted by the sleeve hole method, the ratio of hole to no-hole is not less than 86.5%)
Beam Pointing Stability	≤0.03mrad (1σ)
Irradiation Frequency	Precisely coded from 45ms to 56ms (checksum 20Hz)
Pulse Period Accuracy	≤±2.5μs
Pulse Width	15ns±5ns
Irradiation Time	Not less than 90s, interval 60s, or not less than 60s, interval 30s, continuous irradiation for 4 cycles at room temperature and low temperature, and 2 cycles at high temperature
Ranging Range	Minimum value not greater than 300m, maximum value not less than 35km (23km visibility, medium atmospheric turbulence, for a 2.3m×2.3m target with a target reflection coefficient greater than 0.2)
Irradiation Distance	Not less than 16km for a 2.3m×2.3m target
Preparation time for powering on at room temperature	< 30 seconds
Preparation time for low-temperature power-on	< 3 minutes
Service Life	≥2 million times
Ranging Count Range	200m～40km
Ranging Accuracy	±2m
Accuracy Rate	≥98%
Ranging Frequency	1Hz, 5Hz, 10Hz, 20Hz
Installation Reference Plane Non-Parallelism with Laser Emission Optics Axis	≤0.5mrad
Installation Reference Plane Flatness	0.01mm（Design guarantee）
Dimensions	239mm╳116mm╳81mm

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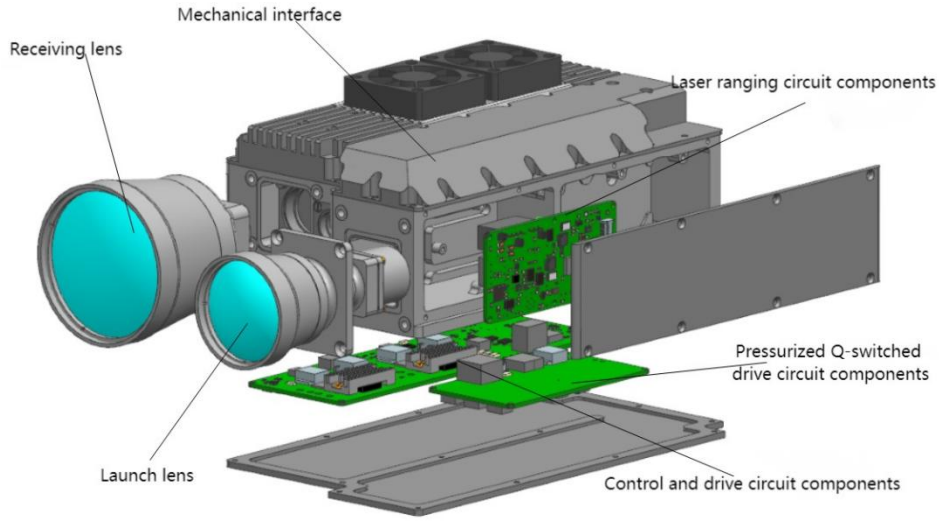
Weight	2500g

1、Overview

The LDR100 medium-sized laser rangefinder (hereinafter referred to as the laser rangefinder) is a precision optoelectronic product that emits laser light to specific targets and calculates distance information based on laser flight time. It is characterized by outstanding performance and user-friendly operation. This laser rangefinder is classified as eye-safe and utilizes serial communication for data transfer.

1.1 Main Components of the Laser Rangefinder

The laser rangefinder is a precision optoelectronic integrated product, consisting primarily of components as shown in Figure 1:



1.2. Functions and Performance

The laser rangefinder features the following main functions:

- Laser ranging with real-time distance reporting
- Protection against reverse polarity, overcurrent, and overvoltage
- Synchronous signal output for laser emission
- Real-time reporting of current operating temperature for upper-level computation and analysis
- Laser emission count reporting
- Power on/off control
- Single-shot and continuous ranging capabilities

Key performance indicators of the laser rangefinder include:

- Wavelength: 1.064μm
- Output Energy: Full temperature range: 100mJ～120mJ, Average output energy ≥110mJ, Single pulse energy ＞100mJ (first 2 seconds excluded)
- Adjacent pulse energy fluctuation range: ≤8%
- Beam Divergence Angle: ≤0.15mrad (Method of acceptance: aperture ratio, the ratio of with hole to without hole should not be less than 86.5%)
- Beam Pointing Instability: ≤0.03mrad (1σ)
- Illumination Frequency: Accurate encoding from 45ms to 56ms (Checksum: 20Hz)
- Pulse Period Accuracy: ≤±2.5μs
- Pulse Width: 15ns±5ns
- Illumination Duration: Not less than 90s, interval of 60s, or not less than 60s, interval of 30s, continuous illumination for 4 cycles at normal and low temperatures, and 2 cycles at high temperature
- Ranging Range: Minimum not greater than 300m, maximum not less than 35km (23km visibility, medium atmospheric

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turbulence, for a 2.3m×2.3m target with a target reflectivity greater than 0.2)

- Illumination Distance: Not less than 16km for a 2.3m×2.3m target
- Normal Power-on Preparation Time: Not more than 30 seconds; Low-temperature Power-on Preparation Time: Not more than 3 minutes
- Service Life: ≥2 million times
- Ranging Count Range: 200m～40km
- Ranging Accuracy: ±2m
- Correct Measurement Rate: ≥98%
- Ranging Frequency: 1Hz, 5Hz, 10Hz, 20Hz
- Non-parallelism between Installation Reference Surface and Laser Emission Optical Axis: ≤0.5mrad
- Installation Reference Surface Flatness: 0.01mm (Design Assurance)
- Insulation Resistance: Under standard atmospheric pressure, the insulation resistance value of the specified measurement point should comply with the requirements in Table 1.

Table 1: Specified Insulation Resistance Values for Designated Measurement Points

Index	Environmental Condition	Insulation Resistance	Megohmmeter Output Voltage
1	Standard Atmospheric Conditions	≥20MΩ	100V

- External markings (including product number) should be securely affixed, clear, complete, and easily identifiable.

1.3. Ranging Principle

Upon activation, the laser target indicator emits laser pulses at a frequency of 1Hz. These pulses are transmitted through the emitting antenna to the designated target. Most of the emitted light is either absorbed by or diffusely reflected off the target surface, while a minute portion of the light is reflected back to the receiving antenna and converges onto the detector module. The detector module samples the reflected signal and, through algorithms, derives the distance information of the target.

Calculation Example:
Round-trip Measurement Time = 10μs
One-way Propagation Time = 10μs/2 = 5μs
Ranging Distance = Speed of Light × Propagation Time = 300,000 km/s × 5μs = 1,500m

1.4. Ranging Capability under Different Visibility Conditions

The atmospheric visibility significantly impacts the ranging performance of the laser target indicator. For the ranging capability of this product under different visibility conditions, please refer to Figure 2.

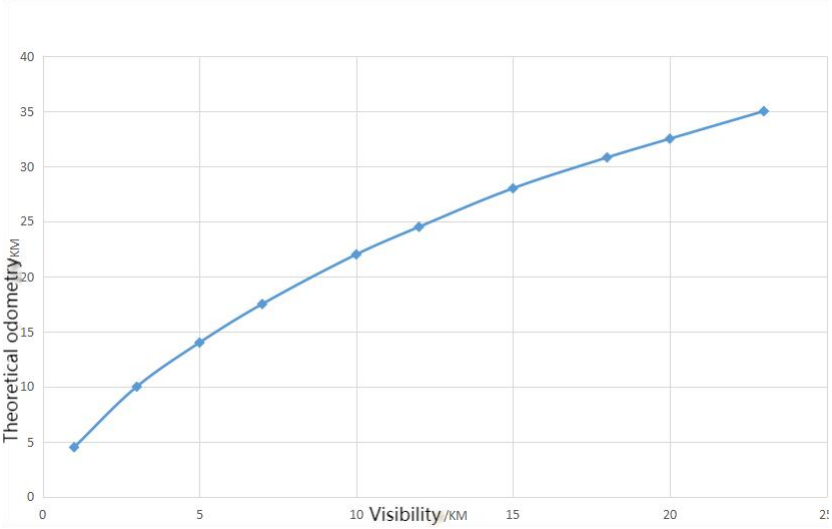

Figure 2: Relationship Curve Between Laser Target Indicator Ranging Capability and Atmospheric Visibility

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1.5. Eye Safety This laser ranging device operates with a 1064nm laser source. During use, it is essential to avoid direct exposure of the laser beam to the human eye to prevent potential harm.

2. Interfaces and Accessories

2.1. Mechanical and Optical Interfaces

The mechanical interface of the laser ranging device consists of three through-holes. The device is securely fastened to the mounting platform using three M5 screws. The dimensional specifications of the mechanical and optical interfaces are illustrated in Figure 3.

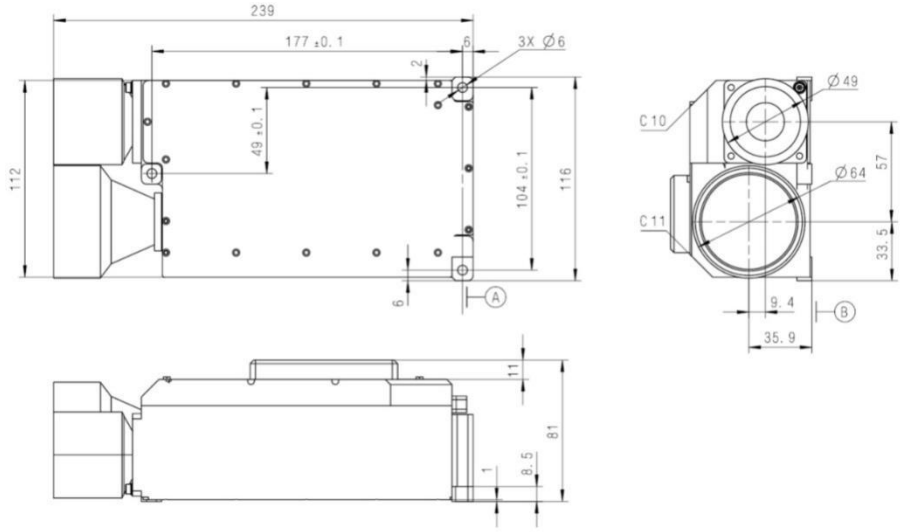

Figure 3: Mechanical and Optical Interface Diagram

2.2. Electrical Interface

The electrical interface is detailed in Table 1.

Table 1: Electrical Interface for Laser Rangefinder

Index	Name	Description	Remarks
1-5	+28V		
12-16	+28V_GND		
6	T+	Laser Transmit	RS422 communication
7	T-		
8	R-	Laser Receive	
9	R+		
10	GND	Communication GND	
17	SYNC_IN+	Laser Receive Sync	Sync Signal Input
18	SYNC_IN-		
19	SYNC_OUT-	Laser Output Sync	Sync Signal Output
20	SYNC_OUT+		
11	Control Signal_+12V	Power Control	Signal Current ≤20mA
21	Control Signal_+12V		

2.2.1. Software

2.2.1.1. Communication Protocol Definition Data exchange between the laser rangefinder and the upper computer is carried out using a 422 bus, with the following characteristics:

a) Baud Rate: 38.40kbps;

b) Byte Construction: Low byte comes first, high byte comes later; Low bit comes first, high bit comes later;

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c) Byte Composition Format: 1 start bit, 8 data bits, 1 stop bit;

d) Communication Cycle: 20ms.

2.2.1.2. System Software Instructions Sent to the Laser Rangefinder Work instructions sent from the system software to the laser rangefinder are listed in Table 2.

Table 2: Work Instructions

Command	Meaning
55 02 AA	Single-shot ranging
55 03 AA	Ranging at 1Hz
55 04 AA	Ranging at 5Hz
55 0A AA	Ranging at 10Hz
55 0B AA	Ranging at 20Hz
55 00 AA	Stop ranging
55 0C 0D AA	Query command

2.2.1.3. Data Sent from Laser Rangefinder to System Software

Table 3: Query Response Data Information

Number	Name	Description	Remarks
0	Frame header	0xAA	
1	Flag bit	0x0A	
2	A current		
3	A current		
4	flag bit	0x0B	
5	B-channel current		
6	B-channel current		
7	Flag bit	0x0C	
8	C circuit current		
9	C circuit current		
10	Pulse width		
11	Pulse width		
12	Spare		
13	Spare		
14	Spare		
15	Status word		0x0A A-Channel Enable 0x0B B-Channel Enable 0x0C C-Channel Enable 0x0D ABC-Channel Enable
16	Temperature		
17	End of frame	0x55	

Table 4: Distance echo data information

Number	Name	Description	Remarks
0	Frame header	0xAA	

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1	Distance value high byte		
2	Distance value low byte		
3	Status word		
4	Laser self-test status		
5	Spare		
6	Spare		
7	End of frame	0x55	

2.3. Accessories

In addition to the laser target indicator, this product includes the following accessories:

- Product packaging box (for batch production)
- User maintenance manual
- Product qualification certificate
- Product history record
- Fine mesh gloves
- J30J-21TJL connector

3.Maintenance and Service

3.1. Cleaning, Maintenance, and Storage Cleaning of the laser target indicator involves cleaning the lens and the outer casing. Lens Cleaning:

- Dust particles should be blown away using an air blower.
- Fingerprints should be wiped gently using a small amount of alcohol-ether mixture on degreased cotton, followed by air drying in a cool place.
- Do not use fabric to clean the lens. Outer Casing Cleaning:
- Structural components can be lightly wiped with alcohol and air-dried.
- Electronic products, plugs, and cables should be kept away from moisture and dirt as much as possible.

Maintenance of the Laser Target Indicator: The laser target indicator does not require maintenance under normal working conditions. However, if stored in a dust-free environment for over a year, the following maintenance steps are recommended:

- Check the appearance of the laser target indicator for abnormalities.
- Inspect all screws for tightness.

Storage of the Laser Target Indicator:

- Ensure thorough drying before packaging the product.
- Avoid outdoor storage in the field. Suitable storage conditions include temperatures of 0°C to 35°C, relative humidity not exceeding 80%, absence of corrosive substances, no strong mechanical vibrations or impacts, and no strong magnetic fields.

3.2. Testing Operators should strictly follow power supply and communication definitions, correctly connect the instrument, and send the appropriate commands.

3.3. After-Sales Service The laser target indicator is a precision product. In case of malfunctions, the entire unit should be returned to the factory for analysis, diagnosis, and repair. Self-repair is not permitted.

INSTALLATION AND ADJUSTMENT

The mechanical interface of the laser ranging target indicator includes 3 screw mounting via holes. The laser ranging target indicator is fixed on the installation platform through 3 M6 screws, and then the communication plug is connected to the laser ranging target indicator connection. socket, and connect the power supply correctly according to the interface definition.

SUGGESTIONS FOR USING LIGHT WINDOWS

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1. Material selection

1.1 Light window materials

The light window material is Chengdu Guangming Optical Glass H-K9L. H-K9L is the most common colorless optical glass, suitable for the laser range of 300nm to 2100nm, with high cost performance and superior physical properties.

1.2 Processing requirements

a) The wedge angle tolerance of the light window is as small as possible. We recommend that the wedge angle tolerance be ≤3′ (tolerance level ≤7);

b) The optical surface of the light window is as smooth as possible. We recommend that the arithmetic mean deviation (Ra) of the profile is 0.012.

2. Usage suggestions

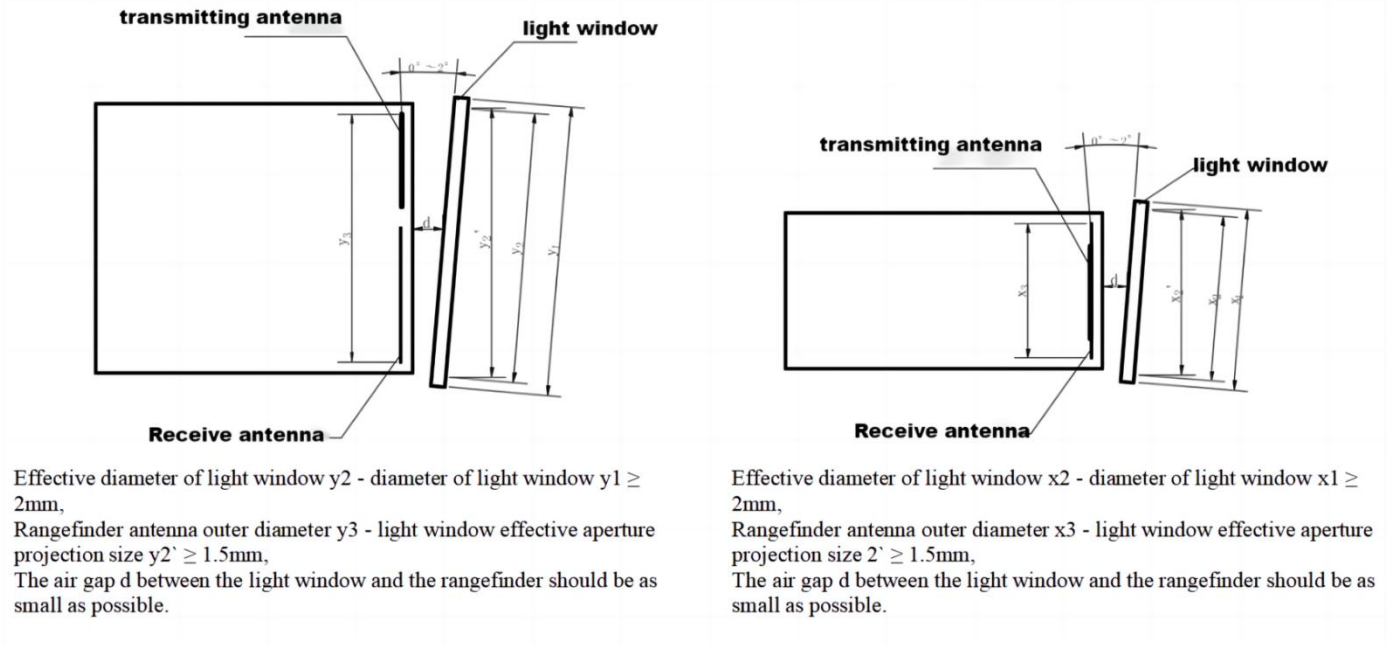
2.1 Recommendations for light window coating

It is recommended that the light window of the 1064nm laser detector be coated with 1040nm ~ 1090nm anti-reflection coating, with a transmittance of ≥99%. According to the specific use environment of the product, you can choose other protective films such as hydrophobic film or hard film on the surface of the light window. The other indicators refer to GJB2485-95, and the transmittance is ≥97%. In addition, the damage threshold of the film layer should be ≥50MW/cm^2.

2.2 Window appearance and usage suggestions

The effective diameter of the light window depends on different products. Its overall dimensions should ensure that the effective diameter of the light window - the diameter of the light window is ≥ 2mm, and the outer diameter of the photometer antenna - the projection size of the effective diameter of the light window is ≥ 1.5mm. The schematic diagram is shown in the figure below. Since the light window has a certain absorption of laser light, it is recommended that the thickness of the light window itself be controlled within 2 to 4 mm according to the overall dimensions.

Due to the high transmittance of the light window, it is recommended that the axis deviation between the emission optical axis and the normal line of the light window be controlled within 2° to 4°. The position of the light window and the two lens barrels is shown in the figure below. At the same time, the air gap between the light window and the photometer should be as small as possible.



(a) Method 1 (b) Method 2

Figure 4 Schematic diagram of light window dimensions and placement

OPERATE

In order to enable you to fully understand the various functions of this system and correctly master the installation, use and maintenance methods, please read this chapter carefully before installing and using this system.

1. Boot operation

1.1 Before starting up

Before starting up, correctly connect the product and cross-linking equipment according to the cross-linking diagram shown in Figure 5.

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Figure 5 Cross-linking diagram of products and equipment

1.2 Power on
Start-up operation: Connect the power supply.

2. Shutdown operation
2.1 Before shutting down
Before shutting down, make sure that the product's work process and tasks are in the end state, and the program exits (at least 50ms after the product sends back data).
2.2 Shut down
Shutdown steps: Disconnect power.

INSPECTION AND MAINTENANCE

1. General inspection
Visual and power-on inspections should be performed after the product is used for the first time and after the resource module is replaced. For products in normal use, only perform power-on inspection before use.
1.1 Visual inspection
The steps for visual inspection are as follows:
- Check whether the appearance of the product is normal;
- Check whether the cable connection is correct and the connection should be firm.

1.2 Power-on inspection
The power-on inspection steps are as follows:
- Complete the boot operation according to steps 6.1;
- Complete the self-check operation according to 6.3.2;
- After the inspection is completed, follow the steps in 6.2 to complete the shutdown operation.

2. Regular maintenance
The laser photometer does not require maintenance under normal working conditions. Maintenance is required when stored in a dust-free environment for more than one year. The content includes:
2.1 General inspection
The product is generally inspected when it is not powered. The steps are as follows:
- All marks and numbers on products and test cable plugs (sockets) should be correct and clear;
- Various screws on the panel should be tightened;

It should be ensured that the optical glass of the product does not have light spots, pitting, water spots, mold, fingerprints, dust particles and other attachments and cracks that hinder normal observation.
2.2 Power-on inspection
Conduct a comprehensive inspection and maintenance of the laser detector when it is powered on, including:
- Turn on the power of the products in sequence;
- Follow steps 6.1 to complete the boot operation;
- Complete the self-test operation according to 6.3.2;
- Complete the shutdown operation according to the steps in 6.2.

FAILURE PHENOMENON ANALYSIS AND TROUBLESHOOTING METHODS

The laser ranging camera is a precision product. When a fault occurs, the entire machine needs to be returned to the factory for fault analysis, location and repair. Self-repair is not allowed.

Common fault phenomena and troubleshooting methods are shown in Table 7.

Table 7 Common fault phenomena and troubleshooting methods

Fault phenomenon	Possible Causes	Inspection Method	Troubleshooting
The product cannot be powered on normally	● Power supply and connection cable failure ● Circuit failure	Check power supply and connection cables	● Replace the power supply or connecting cable ● If there is a circuit failure,

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			please contact the manufacturer for assistance.
Unable to send communication command	● Connection line failure ● The power supply is abnormal ● Laser photometer communication failure	● Check whether the connection cable is normal ● Check whether the power supply is normal	● Replace the connecting cable and power supply ● For communication problems, please contact the manufacturer for assistance.

PACKAGING, TRANSPORTATION AND STORAGE REQUIREMENTS

1. Packaging

When unsealed products need to be restocked, they should be packed in the original packaging. When the product needs to be returned to the factory, the original packaging should be used as much as possible. When using other forms of packaging, it should not cause product performance degradation or damage.

2. Transportation

Repackaged products can be transported by cars, trains, planes, ships, etc. During transportation, the packages should be fixed on the transportation vehicle to avoid impacts, rough handling, and rain and snow. Road transportation and railway transportation environment refer to GJB 150.16A-2009.

3. Storage

Repackaged products must not be stored in the open air. It should be stored in a warehouse between 0°C and +30°C, with a relative humidity of no more than 70%, no erosion by corrosive substances, no strong mechanical vibration and impact, and no strong magnetic field.

OPERATION AND MAINTENANCE MANUAL

Safety Instructions

For safe usage of this product, carefully read this user manual before operating the product:

- This laser photometer is a precision optical device. Improper operation may lead to dangerous laser hazards. Do not open, adjust, attempt to repair, or modify any part of the laser photometer's components or performance.
- Electrostatic Protection: The electronic components of the laser photometer are sensitive to electrostatic discharge. Do not touch any electronic parts without proper protective measures.
- Operate the laser photometer power supply only within the specified voltage and power range.
- Do not touch optical lenses with fingers or hard objects (to prevent oil contamination or lens scratching).
- Avoid measuring highly reflective targets at close range (to prevent damage to core detector components).
- Do not store in non-specified conditions (highly polluted environment, beyond storage temperature range, etc.).
- Avoid subjecting the laser photometer to strong mechanical impacts (vibration, impact, dropping, etc.).
- Do not expose the laser photometer to rapid temperature changes (>3°C/min) to prevent lens breakage.