ERDI LASER®
ERDI TECH LTD

20mJ Laser Target Designator Module

Model: LDR20K1

1. PRODUCT DESCRIPTION



The LDR20K1 laser rangefinder/designator can measure the distance to a target and provide laser target designation for laser-guided projectiles. It is primarily used in airborne applications requiring high reliability. The device features a compact size, low weight, long ranging and designation distance, high accuracy, and strong environmental adaptability.

2. CONTROL FUNCTIONS

The laser rangefinder/designator can perform the following control functions through a serial interface:

- Respond to a laser ranging command and stop ranging at any time upon receiving a stop command;
- Output one set of range data and status information for each pulse during ranging;
- Support range gating during ranging;
- Automatically stop ranging after 5 minutes (at 1 Hz) or 1 minute (at 5 Hz) if no stop command is received after continuous ranging is initiated;
- Allow configuration of designation mode and code;
- Respond to a laser designation command, perform designation according to the preset mode and code, and stop designation at any time upon receiving a stop command;
- Automatically stop designation after completing one cycle if no stop command is received;
- Output one set of range data and status information for each pulse during laser designation;
- Perform power-on self-test and periodic self-test, and output status information;
- Respond to a self-test command and output status information;
- Report the cumulative number of emitted laser pulses.

3. TECHNICAL SPECIFICATIONS

1. Operating modes: ranging, designation.
2. Pump source: diode array.
3. Operating wavelength: 1.064 μm (1064 nm).
4. Pulse energy: ≥ 20 mJ.
5. Pulse energy fluctuation: within one designation cycle, single-pulse energy deviation shall not exceed ±10% of the mean pulse energy (statistics taken after 2 s of emission).
6. Beam divergence: ≤ 0.6 mrad.
7. Pulse width: 10 ± 5 ns.

8. Laser optical-axis stability: ≤ 0.05 mrad.

9. Ranging performance:

Ranging frequency: 1 Hz / 5 Hz, and single-shot.

a) Continuous ranging at 1 Hz: duration ≥ 5 minutes, then rest 1 minute.

b) Continuous ranging at 5 Hz: duration ≥ 1 minute, then rest 1 minute.

c) Minimum measurement range: ≤ 300 m.

d) Maximum measurement range: ≥ 3,000 m.

e) Ranging accuracy: ±1 m.

f) Acquisition rate: ≥ 98%.

g) Ranging logic: first and last target.

10. Designation performance:

a) Laser code accuracy: 2.5 μs.

b) Fundamental designation frequency: 20 Hz.

c) Designation cycles:

- Short-cycle designation: single designation duration ≥ 20 s, interval ≤ 30 s, continuous for 8 cycles.
- Long-cycle designation: single designation duration ≥ 47 s, repeat start with interval ≤ 30 s, continuous for 2 cycles.

After completion of one designation cycle, the interval before restarting continuous designation shall be ≥ 30 minutes.

11. Laser coding:

a) Complies with weapon system requirements and supports user-defined code expansion.

b) Supports external synchronization signal input to control emission timing for coding.

c) Coding method: precise frequency code (eight groups of pre-stored periodic codes).

12. Dimensions and mass:

a) External envelope: ≤ 92 mm × 67 mm × 53 mm.

b) Mass: ≤ 290 g.

13. Power input requirements:

a) Average operating power consumption ≤ 55 W; peak power ≤ 100 W.

b) Operating voltage range: 20 V – 28 V.

14. Electrical "three-proof" treatment: circuit boards shall receive conformal coating after design and debugging to provide three-proof protection.

4. ENVIRONMENTAL ADAPTABILITY REQUIREMENTS

4.1 Temperature Requirements

- High-temperature conditions
  Operating temperature: ≤ +55 °C
  Storage temperature: ≤ +70 °C
- Low-temperature conditions

Operating temperature: ≥ –40 °C
Storage temperature: ≥ –45 °C

4.2 Vibration Requirements

- The unit shall withstand flight vibration and the shocks occurring during takeoff and landing. All equipment shall also withstand environmental conditions equivalent to vehicle transportation.
- Vibration type: swept-frequency sinusoidal vibration.
- From 15 Hz to 33 Hz: constant displacement vibration with an amplitude of 0.91 mm.
- From 33 Hz to 700 Hz: constant acceleration vibration with an acceleration of 2 g.
- Duration: 1 hour per axis in three orthogonal directions.
- Test condition:
  The product shall be mounted on the vibration test bench in normal operating configuration and powered on.
  Post-test requirement:
  The product shall operate normally after the vibration test.

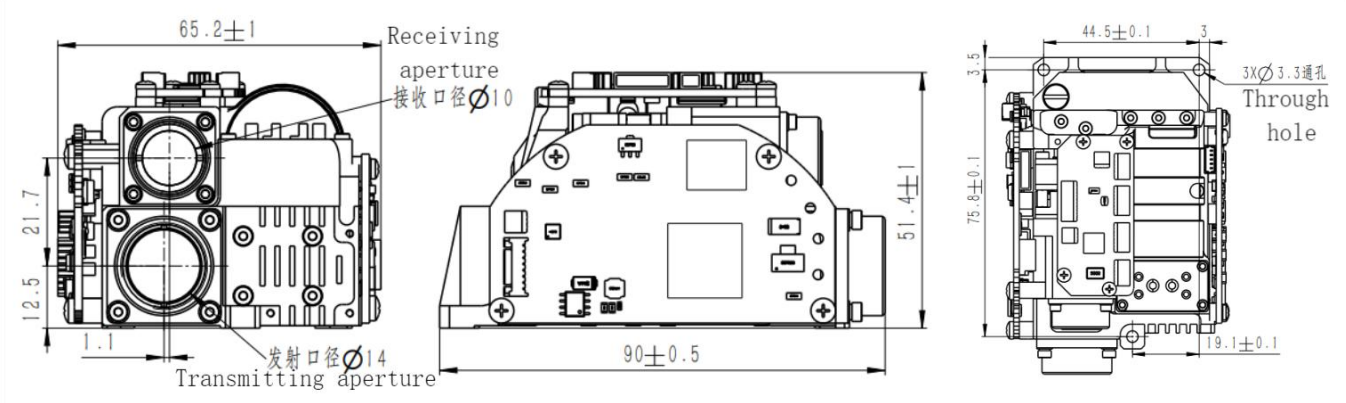
4.3 Shock Requirements

- Vertical axis: ≥ 10 g
- Lateral axis: ≥ 10 g
- Longitudinal axis: ≥ 10 g
- Shock waveform: post-peak sawtooth wave, duration 11 ms.
- Each of the X, Y, and Z axes shall be tested in both directions, for a total of 18 shocks.
- Test condition:
  The product shall be mounted on the shock test bench in normal operating configuration and powered on.
  Post-test requirement:
  The product shall operate normally after the shock test.

5. INTERFACES

5.1 Mechanical Interface

(The mechanical interface defines the physical mounting and alignment requirements of the laser rangefinder/designator. Details such as mounting holes, reference surfaces, and alignment axes should be specified according to the system integration design.)



5.2 Electrical Interface

Communication interface: RS422.

Connector model and interface definition can be found in Table 1.

Connector: MOLEX 53048-0810

Mating plug: MOLEX 51021-0800

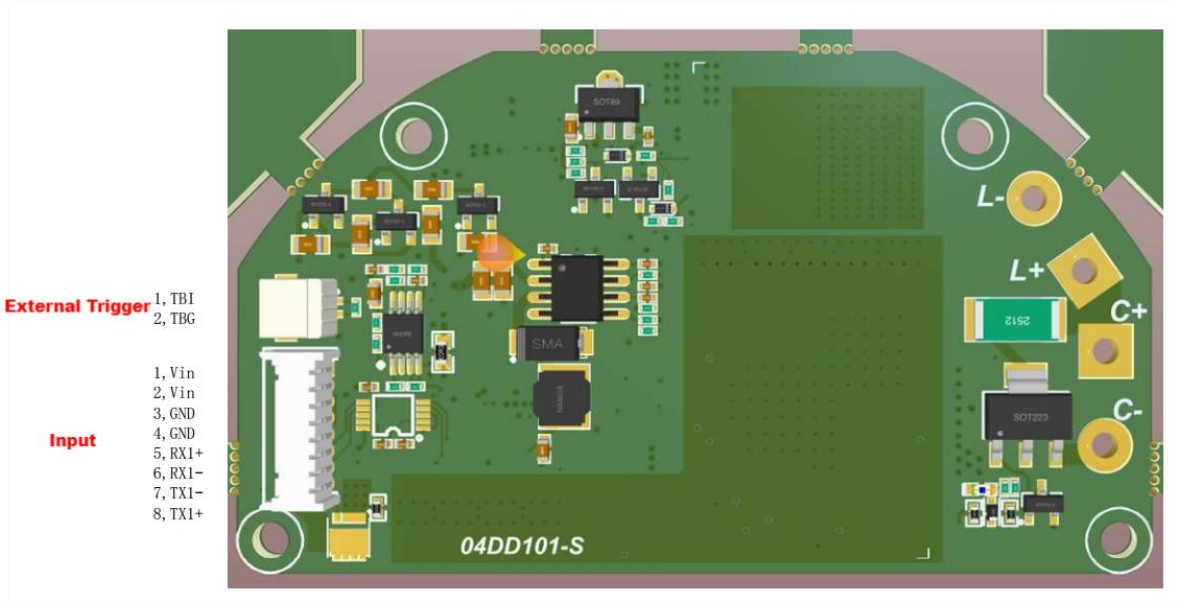
Table 1 — Electrical Interface Definition (TTL)

Pin No.	Signal Name	Description
1	Vin	Power supply +24 V
2	Vin	Power supply +24 V
3	GND	Power return (–)
4	GND	Power return (–)
5	RX1+	Host → Laser rangefinder/designator module (RS-422 RX+)
6	RX1–	Host → Laser rangefinder/designator module (RS-422 RX–)
7	TX1–	Laser rangefinder/designator module → Host (RS-422 TX–)
8	TX1+	Laser rangefinder/designator module → Host (RS-422 TX+)

External trigger interface:

Pin No.	Signal Name	Description
1	TBI	External trigger + (triggered on rising edge)
2	TBG	External trigger –

Figure 2 — Electrical Interface Diagram



6. COMMUNICATION PROTOCOL

6.1 Communication Standard

Asynchronous serial communication standard: RS-422
Baud rate: 115200 bps
Transmission format: 8 data bits, 1 start bit, 1 stop bit, no parity bit
For each byte, the least significant bit (LSB) is transmitted first.
For multi-byte data, the low byte is transmitted first.

6.2 Output Information

Output information refers to the commands sent from the host system to the laser rangefinder/designator module, consisting of:
Header: 0x55
Command byte 1
Command byte 2
Command byte 3
Checksum (tail): obtained by performing a bitwise XOR operation on bytes 1 through 4.

The definitions of Command Byte 1 are as follows:

Table 2 — Definition of Command Byte 1

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0x00 Standby 0x01 Start self-test 0x02 Single ranging 0x03 Continuous ranging (1 Hz) 0x04 Continuous ranging (5 Hz) 0x05 Designation 0x06 Long-cycle designation 0x07 Short-cycle designation 0x08 Stop ranging/designation 0x09 Set gate value 0x0A Report cumulative laser pulse count 0x19–0x20 Modify laser code parameters 9–16 0x29–0x30 Read laser code parameters 9–16							

The definitions of Command Byte 2 are as follows:

Table 3 — Definition of Command Byte 2

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
When in laser designation mode: Laser code 1–16 When in ranging mode: 1 – first target, 2 – last target When in gate value setting mode: lower byte of range gate value When modifying laser code parameters 9–16: lower byte of the laser code, period × 100 (e.g., 5000 represents 50 ms, valid range 40 ms–63 ms)							

The definitions of Command Byte 3 are as follows:

Table 4 — Definition of Command Byte 3

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
When in designation mode: laser designation time setting (1–25) When in gate value setting mode: higher byte of range gate value When modifying laser code parameters 9–16: higher byte of the laser code, period × 100 (e.g., 5000 represents 50 ms, valid range 40 ms–63 ms)							

6.3 Input Information

Input information refers to the status data received by the host system from the laser rangefinder/designator module, including:

- **Header:** 0x55
- **Status byte**
- **Target distance / cumulative laser pulse count** (2 bytes): low byte first, high byte second.
  For laser code parameters 9–16, the value represents the period × 100 (e.g., 5000 = 50 ms, valid range 40–63 ms); low byte first, high byte second.
- **Current temperature** of the laser rangefinder/designator module
- **Checksum (tail)**: obtained by performing a bitwise XOR operation on bytes 1–5.

The definitions of the status byte are as follows:

Table 5 — Status Byte Definition

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0: No laser emission 1: Laser emission present	0: Valid ranging 1: Invalid ranging	Laser flag alternates between 1 and 0	1: Over-temperature warning 0: Temperature normal		0: No external trigger 1: External trigger present	00: Standby 01: Ranging 02: Designation	

Target Distance Information Definition:

The distance value is represented by **2 bytes (16 bits)** as an integer, which can be directly converted to a decimal value.

In **standby mode**, status information is returned every **10 seconds** as part of the periodic self-test.
In **ranging** and **designation** modes, status is returned according to the laser emission frequency.

Cumulative Laser Pulse Count Definition:
Since a 16-bit binary number represents values in the range **0–65535**, and the laser rangefinder/designator has a service life of **1,000,000 pulses**, the pulse count is defined as a multiple of **20**, resulting in a range of **0–1,310,700**.

Current Temperature of the Laser Rangefinder/Designator Module:
Bits **d7–d0** represent the temperature in **two's complement** format, with a valid range of **–128 to +127**, in units of **°C**.

7. EQUIPMENT OPERATION INSTRUCTIONS

7.1 **Communication Connection**
Asynchronous serial communication standard: RS-422
Baud rate: 115200 bps

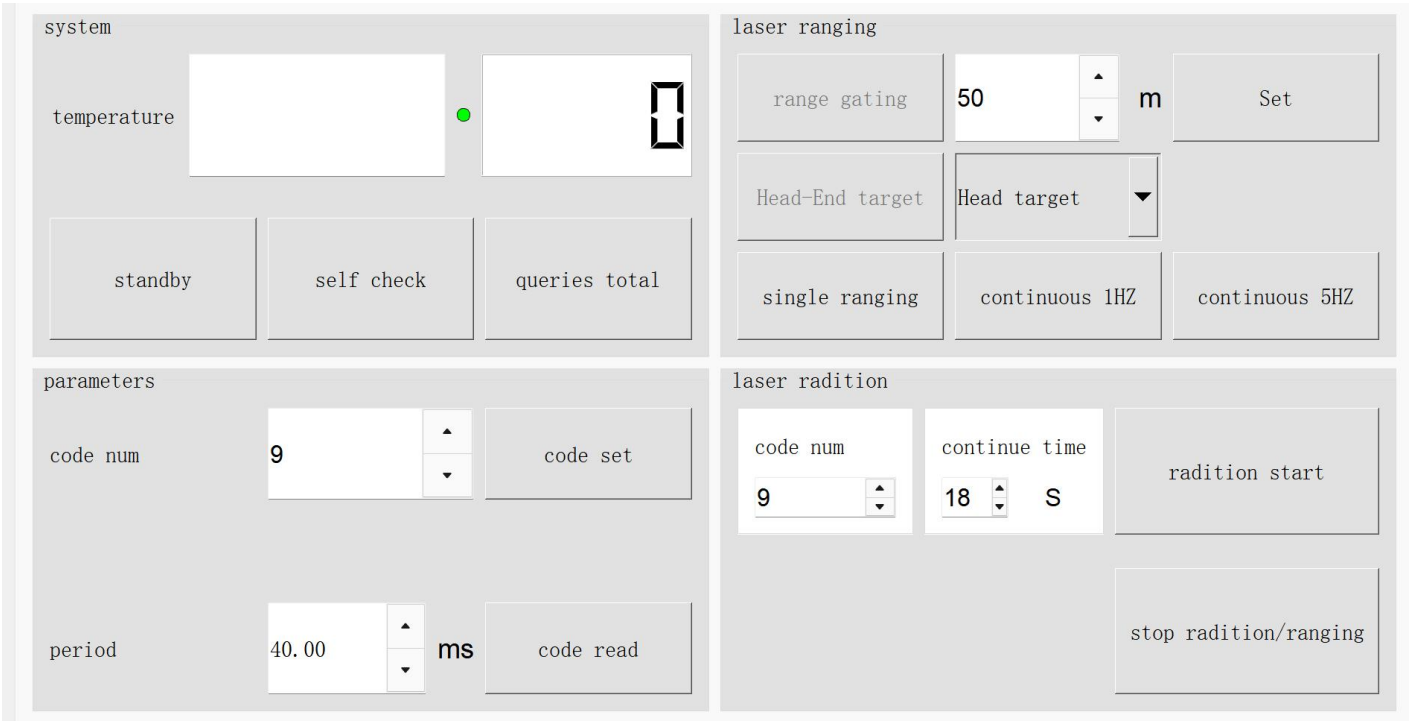


Check the communication cable and click **"Detect"** until an available serial port is found. Select the **115200 baud rate** and connect to the serial port.

7.2 Receiving Information

The output information is displayed in the software's data reception window.
Click **"Clear"** to erase historical data and receive new data.
After each command is executed, corresponding feedback data will be received.

7.3 Command Transmission and System Status Indication



7.3.1 Status Bar — Operation Status and Fault Indication

In the status bar, a **gray icon** indicates the **initial or idle state**,

a **green (or active) icon** indicates **normal operation**,

and a **red icon** indicates a **fault condition**.

7.3.1.1

Each time data is received from the lower module, it includes **temperature information** temperature . The temperature value is displayed in the **status section**.

When a **red fault indicator** appears, the current operation must be stopped immediately and the fault investigated to prevent potential equipment damage.

7.3.1.2

When executing a **query command**, the corresponding query result will be displayed in the respective display field of the status bar.

7.3.2 Command Bar — Sending Commands

Overview:

The command bar includes options such as **laser pulse count query** and **code query**, with the results displayed in the corresponding areas of the status bar.

Buttons for **laser emission** and **designation commands** (or to **stop ranging/designation**) are also provided.
Command feedback information will be displayed in the **reception window**.

7.3.2.1 Pulse Count Query

During operation, the device records the number of laser pulses emitted in both ranging and designation modes.
When a **pulse count query command** is sent, the device returns information containing the laser pulse count, which is displayed in the **status bar**.

7.3.2.2 Self-Test

Click **"Self-Test"** to send a self-test command.
Upon receiving the command, the device enters the self-test mode, simulating operating conditions to verify internal system status.
The device returns its status, and any detected faults are displayed in the **status bar**.

7.3.2.3 Single Ranging

The **single ranging command** instructs the device to emit one laser pulse and return the measurement result, including **main/echo information** (see Section 7.5 for explanation) and the calculated range data.

7.3.2.4 Continuous 1 Hz Ranging

Upon receiving this command, the device continuously emits laser pulses at **1 Hz** and returns the corresponding ranging results.
The returned data format is the same as for single ranging.

7.3.2.5 Continuous 5 Hz Ranging

Upon receiving this command, the device continuously emits laser pulses at **5 Hz** and returns the corresponding ranging results.
The returned data format is the same as for single ranging.

7.3.2.6 Short Designation

This command sets the device to **designation mode**, emitting coded laser pulses with a **20 s active duration** and a **30 s interval**, for up to **8 consecutive cycles**.
Each designation cycle returns **main/echo information** and **distance data** for that cycle.

7.3.2.7 Long Designation

This command sets the device to **designation mode**, emitting coded laser pulses with a **47 s active duration** and a **30 s interval**, for up to **2 consecutive cycles**.
Each designation cycle returns **main/echo information** and **distance data**.

7.3.2.8 Designation

This command sets the device to **designation mode** with a **single cycle duration less than 60 s**.
After completing one designation cycle, the device automatically stops.
Each cycle returns **main/echo information** and **distance data**.

7.3.2.9 Stop Ranging/Designation

When this command is received, the device immediately stops the current operation.
Each working process must be terminated with a **stop command**.

7.3.2.10 Code Setting

This command allows modification of the parameters for the selected **laser code number**.
After modification, subsequent operations using this code will apply the updated code parameters (e.g., 50 ms).

7.3.2.11 Code Reading

After selecting a **code number**, click **"Code Query"** to read back the user-set coding information.
The returned information will be displayed in the **code parameter cycle field**.

7.3.2.12 Range Gate and Target Selection Setting

This function allows configuration of the **range gate** and **target type**.

The **range gate** defines the minimum displayed distance (see Section 7.4). Targets below this distance will display a range of zero.

The **target selection** allows switching between **first target** and **last target** display modes.

7.3.2.13 Standby

This command sets the device to **standby mode**, switching internal circuits to a low-power state until the next operational command is received.

Note:

The **parameter panel** allows selection of the current code number. If this code number has been configured, its **code cycle parameter** will be displayed automatically.

The **duration setting** defines how long the selected code will remain active.
When a **designation command** is sent, the device will operate according to the selected code's period (e.g., 50 ms) and the configured duration (e.g., 30 s).

7.4 Range Display



7.4.1 Distance 1

"Distance 1" displays the **target distance** calculated during ranging or designation operation.

When the device has **not yet performed ranging or designation**, or when the **"Clear"** button is clicked, the display remains in the initial state as shown above.

During **normal ranging or designation**, Distance 1 shows the **measured distance value**.

When the measurement is **out of range** or **invalid**, Distance 1 displays **0xFFFF**.

7.4.2 Main and Echo Wave Indication

The **main wave** represents the **laser pulse emission signal** generated by the device.

The **echo wave** represents the **received laser pulse signal**.

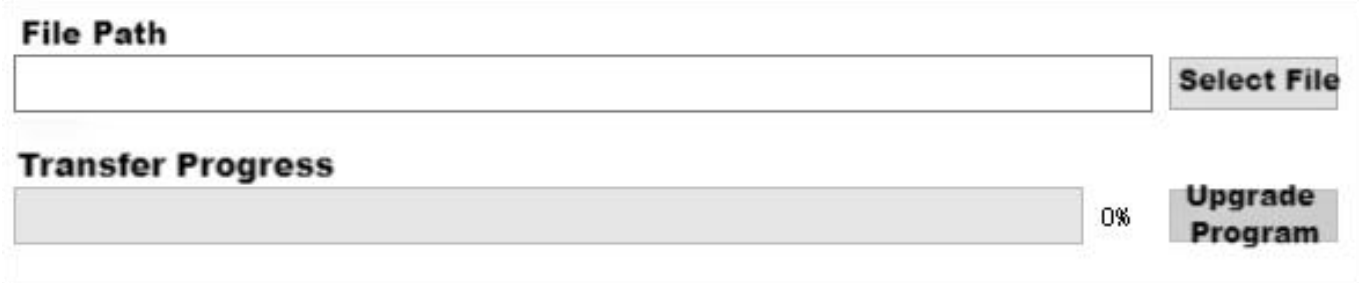
A **main wave value of 1** indicates that the device has successfully emitted a laser pulse.

An **echo wave value of 1** indicates that the device has successfully received the reflected pulse.

A **display value of 0** for either the main or echo wave means that the transmission or reception for that cycle was **incomplete**, and the **device status should be checked**.

7.5 Program Upgrade

When a **firmware or software upgrade** is required, switch the program to the **upgrade page** as shown below (the specific interface or procedure follows in the next section).



At this time, the **Upgrade Program** button is grayed out and unavailable. Click **Select Burn File** (usually a *.bin* file). When the receiving interface displays the symbol **'C'**, it indicates that the system is in the **waiting-for-upgrade** state. The **Upgrade**

Program button then becomes active. Click **Upgrade Program** to start the update. Wait until the progress bar reaches **100%**, indicating that the program update is complete. The system will **automatically restart** after the update.

8. ACCOMPANYING DOCUMENTS AND ACCESSORIES

- One laser illuminator
- One operation manual
- One connector plug
- One inspection report
- One certificate of conformity

9. TRANSPORTATION AND STORAGE

During transportation or storage, avoid exposure to **dust, moisture, acidic or alkaline vapors**, and **other corrosive chemicals**.

10. PRECAUTIONS FOR USE

- This product emits **Class IIIB laser radiation**. Do **not** aim the laser directly at the **eyes or skin**, or focus it through optical lenses.
- The laser housing is **airtight and dustproof**. Do not attempt to open it — breaking the seal may cause **damage to the core laser components**.
- The product contains **high voltage**; **unauthorized personnel** must not disassemble it.
- To prevent damage to the **laser detector**, do not perform ranging on **targets within 50 meters**, and do not cover the optical window with hands or other objects.
- During **optical axis alignment** or **indoor laser emission**, ensure the **receiving window is fully covered** to avoid damaging the photodetector.
- **Disconnect power** before plugging or unplugging cables.
- Ensure the **power supply parameters** meet the specified requirements in this manual.
- Keep the **transmitting and receiving windows** clean and free of contamination.