ERDI LASER®

LDR60K1 Laser Rangefinder Target Designator

⋚ PRODUCT DESCRIPTION

The LDR60K1 Laser Range Finder and Indication System is a cutting-edge device designed specifically for those seeking high-precision target ranging and laser-coded indications. It is capable of achieving precise measurements over ultra-long distances, reaching up to and beyond 8000m, and its effective coverage for target indication also extends to 5000m and more. A notable feature of this product is its extreme lightweight design, with the overall weight controlled within 700g, making it both compact and portable while maintaining excellent performance and stability.

Furthermore, this system specially offers customization of the laser divergence angle, with an adjustment range of 0.35 to 1mrad, allowing for flexible adaptation to the needs of different operational scenarios. The LDR60K1 strictly adheres to internationally accepted standards, ensuring wide applicability and high reliability worldwide. With its outstanding durability, precise measurement capabilities, and compact, portable design, the LDR60K1 Laser Range Finder and Indication System is undoubtedly the ideal choice for professionals pursuing efficient and accurate operations.

The laser range finder and target indicator has the following functions:

- It possesses laser ranging functionality, outputting distance data and status information for each pulse during ranging.
- It responds to laser ranging commands and can stop ranging at any time upon receiving a stop command.
- It performs cumulative counting of laser pulses.
- It monitors temperature and reports the current temperature value to the system.
- It allows for setting the target indication time, encoding, and outputting the selected settings.
- It responds to laser target indication commands, indicating targets according to the set mode and encoding.
- It outputs distance values and status information for each pulse during laser target indication.

- It can perform laser target indication (laser-coded illumination status) at a frequency set by external commands, with a reserved software interface supporting 8 fixed encodings.
- Power-on self-test: Automatically conducts self-tests on relevant items upon power-on, reports the self-test results after completion, and transitions to standby mode.
- Periodic self-test: Conducts periodic tests during the operation of the laser range finder and target indicator without affecting its normal function. If a fault is detected, it reports the self-test results.
- Initiated self-test: Upon receiving a self-test initiation signal from the system, the laser range finder and target indicator tests its functions and reports the results.


⋚ TECHNICAL SPECIFICATIONS

Range Finding/Target Indication Parameters	
Laser ranging and target designation operating mode	Ready to work instantly
Maximum ranging distance	≥8000m (visibility 20km, target reflectivity 0.2, target size 2.3m x 2.3m)
Minimum ranging distance	300m
Ranging accuracy	±2m
Ranging logic	3 goals
Laser target designation distance	≥5000m
Ranging frequency	1 ~ 20Hz

Target designation frequency	1～20Hz
Accuracy rate (or Measurement success rate)	98%
Continuous ranging time	5min(1Hz)/1min (5Hz)/20S（20hz）
Continuous laser target designation time	**Short-cycle Laser Target Designation:** ➢ Duration of a single illumination is not less than 17 seconds, with an interval of not more than 30 seconds, and continuous illumination for 8 cycles. **Long-cycle Laser Target Designation:** ➢ The duration of a single laser target designation is not less than 47 seconds. When initiating laser target designation again, the interval is not more than 30 seconds, and it is capable of continuous laser target designation for 2 cycles. ➢ After a single long-duration or short-duration target designation, the interval for restarting is not more than 30 minutes.
Encoding	Complies with MIL-STD-810F requirements; possesses user-defined coding expansion capabilities.
Laser encoding pattern	Equipped with external synchronization signal reception capability. Precise frequency codes (eight sets of pre-stored periodic code encodings); Customizable code patterns, etc.
Encoding accuracy	≤2.5μs
Laser Parameters	
Laser Type	LD Pumped Nd:YAG Crystal
Cooling Method	Passive cooling, no temperature control
Wavelength	1064nm±3nm
Single Pulse Energy	≥60mJ
Energy Fluctuation	＜10% (Energy Standard Deviation / Average Energy Value × 100%) - Less than 10% (Energy Standard Deviation / Average Energy Value × 100%)
Repetition Rate	0～20Hz adjustable - Adjustable from 0 to 20 Hz
Pulse Width	≥15ns±5ns
Beam Divergence Angle	≤0.35mrad [Customizable 0.3mrad～1mrad]
Laser Beam Axis Instability	≤0.05mrad
Laser Start-up Time	10s
Laser Safety Class	Class 4
Environmental adaptability	
Operating Temperature	-40℃~55℃
Storage Temperature	-55℃~70℃
Vibration and Shock Standards	Meets the vibration and shock requirements for airborne equipment as specified in MIL-STD-810F
Electrical Parameters	
Power Supply Voltage	20～28VDC(typical 24 V)
Total Power Consumption	Standby Power Consumption: ≤ 10 W Average Power Consumption: ≤ 50 W Peak Power Consumption: ≤ 120 W
Communication Interface	RS422 (Standard)
Baud Rate	115200bit/s
Mechanical Parameters	
Weight	≤650g
Overall Dimensions	≤117×97×53mm
Non-parallelism between Mounting Base and Optical Axis	0.5mrad

℞ STRUCTURAL DRAWING (mm)

The overall dimensions are ≤117×97×53mm (L×W×H). The mechanical interface is as shown in Figure 1：
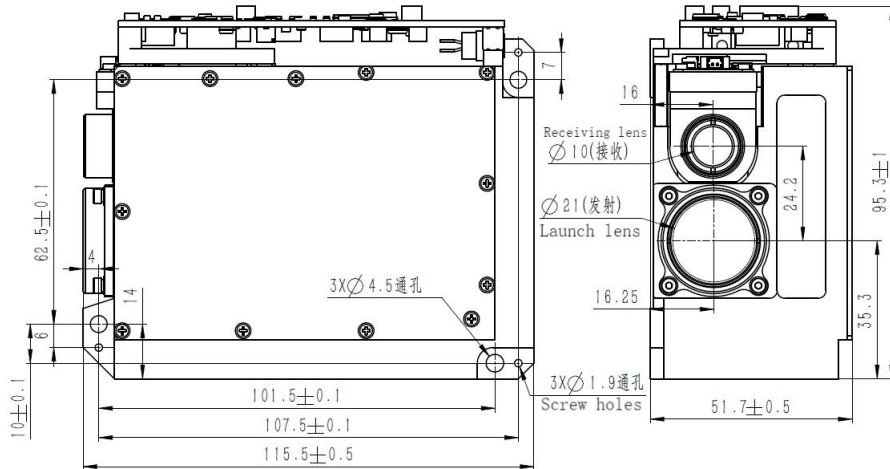
⋉ ELECTRICAL INTERFACE

Baud rate: 115200 bits per second.

The socket model for the laser rangefinder target designator is J30J-15ZKP; the corresponding plug model for the photoelectric system end is J30J-15TJL(WL150A4). The specific signal definitions for the laser rangefinder target designator are shown in Table 1:

Pin	Signal Definition	Input/Output	Description	Remarks
1	+24V	Input	The power supply characteristics meet the relevant requirements of MIL-STD-810F.	Power supply
2	+24V			
3	+24V			
4	+24V_GND			
5	+24V_GND			
6	+24V_GND			
7	Power-on control +	Input\Output	See the requirements for the power-on control section for details.	I/O control
8	Power-on control -			
9	RS422_RX+	Input\Output	The signal level and drive capability meet the RS422 interface standard. Characteristic impedance: 120Ω.	The transmit/receive pin definitions correspond to the laser rangefinder target designator itself.
10	RS422_RX-			
11	RS422_TX+			
12	RS422_TX-			
13	RS422_GND			
14	External synchronization control signal +	Input	The signal level and drive capability comply with the RS422 interface standard.	External synchronization signal for controlling laser encoding.
15	External synchronization control signal -			

⋉ COMMUNICATION PROTOCOL

1.Scope

This document outlines the software communication protocol between the Computer Board (hereinafter referred to as JSB) and the Laser Rangefinder Target Designator (hereinafter referred to as LD).

Communication Protocol between JSB and LD

2.Interface Description

The communication between JSB and LD employs a four-wire RS422 interface, encompassing transmission in two directions: from JSB to LD (control commands) and from LD to JSB (return status).

3.Communication Standard and Baud Rate

For both control commands and return codes, the communication standard and baud rate are stipulated as follows:

- Asynchronous serial communication standard: RS-422;
- Baud rate: 115200bps;
- Transmission format: 1 start bit;
- Data bits: 8;
- Stop bits: 1;
- Parity bit: none.

For each byte of information, the least significant bit (LSB) is transmitted first. In the case of multi-byte information, the lower byte is transmitted first.

4.Message Format

The communication message format is as follows:

Table 3: Message Format Description

Message Header (1 byte)
Subsystem ID Number (1 byte)
Message Body
Message Tail (1 byte, i.e., checksum)

The "Message Header" is 0xdd, serving as a synchronization code indicating the start of a frame of information.

The "Subsystem ID" is 0x03, identifying the Laser Rangefinder Target Designator.

The "Message Body" represents specific control commands and return status information content (see "Data Protocol" for details).

The "Message Tail" is the checksum, calculated by summing all bytes of the message body and taking the modulo 256 of the result.

5.Time Sequence Control

After power-on and initialization, the LD (Laser Device) reports readiness information at a 10-second interval.

The JSB (Control System) sends various operational commands to the LD in real-time as needed. Upon receiving any command from the JSB, the LD must respond with a corresponding status frame within 20 milliseconds; otherwise, the response is considered invalid. For ranging commands and target designator commands, the LD continuously replies with status updates according to the pulse cycle until laser emission stops. For commands to read the laser pulse count, the corresponding return byte represents the pulse count; for ranging and target designator commands, the corresponding return byte represents the target distance.

During continuous ranging or target designation by the LD, it must respond to stop commands from the JSB at any time, providing feedback on the stop status. When the ranging or target designator period of the laser expires, it actively sends a stop status frame. It does not respond to other commands, and for ranging commands received during continuous ranging or target designator commands received during target designation, it does not respond to them belatedly after the current continuous ranging or target designation ends.

Target designator commands have higher priority than ranging commands. During ranging, the LD can still respond to target designator commands.

The self-check results returned by the LD should represent the latest power-on self-check, periodic self-check, or startup self-check results.

6.Exception Handling Requirements

- When the LD and JSB receive any scrambled data sequences, they should not enter an unknown state or cause a system lock-up. They should be able to respond normally when valid data sequences arrive.
- Both parties must strictly perform checksum verification, and any information that fails the verification should be discarded.
- Certain protective conditions should be designed to ensure that no communication data sequence can lead to unrecoverable failures.

7.Data Protocol

Output Information

Output information refers to the commands sent by the JSB to the LD, as described in Table 4.

Table 4: Description of Output Information

Pin	Labels	Content
0	Message Header	0xdd
1	ID Identifier	0x03
2	Command Word 1	See Table 5
3	Command Word 2	See Table 6
4	Command Word 3	See Table 7
5	Checksum	Checksum: Modulo 256 of the sum of bytes 0 ～ 4

Table 5 Command word 1 definition

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0x00: No self-test							
0x01: Self-test							
0x10: Single ranging							
0x02: Ranging at 1HZ							
0x03: Ranging at 5HZ							
0x04: Single shot (Short-time target designator mode: each cycle has a target designator time of 17s, with a 30s interval, capable of continuous target designator for 8 cycles)							
0x05: Continuous shot (Long-time target designator mode: each cycle has a target designator time of 47s, with a 30s interval, capable of continuous target designator for 2 cycles)							
0x06: Short shot (One cycle, with adjustable target designator time < 60s)							
0x07: Stop ranging/target designator							
0x08: Range gating (Lower limit for ranging distance, ranging will not display if below the set value)							
0x09: Query laser cumulative count							
0x0C: Ranging first target (Reserved)							
0x0D: Ranging last target (Reserved)							

0x0E: MRAK mode

0x11 ~ 0x20: Code setting (Corresponding to codes 1 ~ 16)

0x21 ~ 0x30: Code querying (Corresponding to codes 1 ~ 16)

Table 6 Command word 2 definition

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
For the laser target designator:0x01 to 0x10 correspond to codes 1 to 16.							
For range gating:The low byte of the distance value.							
For code setting:The low byte of the code cycle.							

Table 7 Command word 3 definition

BIT15	BIT14	BIT13	BIT12	BIT11	BIT10	BIT9	BIT8
For the laser target designator:The laser target designator time setting is from 0 to 60 seconds.							
For range gating:The high byte of the distance value.							
For code setting:The high byte of the code cycle.							

8.Input Information

Input information refers to the status information received by JSB from LD, as shown in Table 8.

Table 8: Description of Input Information

Pin	Labels	Content
0	Message Header	0xdd
1	ID Identifier	0x03
2	Status Word 1	See Table 9
3	Status Word 2	See Table 10
4	Target Distance / Accumulated Count / Code Cycle	The distance value can be directly converted into a decimal number. Since a 16-bit binary number represents a range of 0 ~ 65535, and the service life of the laser rangefinder target designator is 1 million times, it is agreed that the number of laser emissions is a multiple of 20, ranging from 0 ~1310700.
5		
6	Current temperature of the laser rangefinder/target designator.	Represented in two's complement, with a range of -128~ +127 degrees Celsius.
7	Checksum.	The sum of bytes 0~ 6 is taken modulo 256.

The relevant definitions of status word 1 and status word 2 information are shown in Table 9 and Table 10:

Table 9 Status word 1 information definition

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0: No laser 1: With laser	0: Distance measurement is valid 1: Distance measurement is invalid	1/0: Pulse emission flag (0 and 1 alternate when a new pulse is generated)	1: Over temperature alarm 0: Normal temperature	1: UART device failure 0: UART device normal	1: Charge and discharge fault 0: Charge and discharge normal	Temperature control preparation status 0: Not ready 1: Ready	

Table 10 Status word 2 information definition

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0x0～0xf corresponds to codes 1～16				0000: Standby 1001: Single ranging 0001: Ranging at 1HZ 0010: Ranging at 5HZ 0011: Single shot 0100: Continuous shot 0101: Short shot 0110: Range gating 0111: Stop ranging/target designator 1000: Self-check 1010: MARK ranging 1011: Code query			

ꓤ PRECAUTIONS FOR USE

- The laser emitted by this product is classified as Class 3B. Do not expose it directly to human eyes or skin, or focus it through lenses.
- The laser housing of the product is designed to be airtight and dustproof. Do not attempt to open the housing yourself, as damaging the product's seal may result in damage to the core laser components.
- This product contains high voltage. Non-professionals should not attempt to disassemble the product.
- To prevent damage to the laser detector, do not range targets at close distances (within 50 meters), and do not cover the optical window with your hand or other objects.
- When adjusting the system's optical axis or emitting the laser indoors, ensure that the receiving window is fully covered to prevent damage to the photoelectric detector.