ERDI LASER®
ERDI TECH LTD

120 mJ Laser Target Designator/Rangefinder Module

Model: LR120K1

1. PRODUCT DESCRIPTION

The LR120K1 is a long-range 1064 nm laser rangefinder and target designator that delivers ≥120 mJ pulse energy, ≤0.15 mrad divergence, ≥30 km ranging, ±1m accuracy and 20 Hz coded laser designator. Powered from 18–32 V DC with ≤120 W average power, RS422 and CAN 2.0B interfaces, and a compact ≤75 × 90 × 220 mm, ≤2 kg housing tested to GJB150 vibration and shock standards, it is ideal for artillery fire support, laser-guided munitions and vehicle or shipborne EO/IR platforms.

2. TECHNICAL SPECIFICATIONS

Functional Characteristics
Provides laser ranging capability
Supports long-cycle laser designator, short-cycle laser designator, and emergency laser designator modes.
Includes built-in fixed frequency codes and supports online coding
Supports receiver detector lockout via command control; the receiver is locked by default at power-on.
Provides product temperature reporting.
Supports both internal trigger and external trigger operating modes.
Supports querying the laser emission count (cumulative count).
Provides energy adjustment capability for product maintenance.

Performance Parameters	
Operating wavelength	1064 nm ± 3 nm
Energy (minimum)	≥ 120 mJ
Energy levels	50 mJ, 80 mJ, 120 mJ
Energy ranges per level	● 50–70 mJ ● 80–100 mJ ● ≥ 120 mJ
Energy stability	≤ ±10% per cycle (calculated after 2 s of laser designator)
Effective range (large target) Laser ranging:	a) ≥ 30 km (conditions: visibility ≥ 45 km, target reflectivity 0.2, relative humidity ≤ 80%) b) ≥ 20 km (conditions: visibility ≥ 30 km, target reflectivity 0.2, relative humidity ≤ 80%) c) Minimum ranging distance: ≤ 300 m
Ranging accuracy	± 1 m
Repetition rate	Laser ranging: 1 Hz, 5 Hz laser designator: 20 Hz

Valid measurement rate	≥ 98%
Pulse width	15 ns ± 5 ns
Beam divergence	≤ 0.15 mrad
Optical axis parallelism	Parallelism between mounting datum plane and optical axis ≤ 0.3 mrad
Operating modes	a) Laser ranging: continuous operation ≥ 10 min, rest 5 min b) Short-duration laser designator: Single laser designator duration ≥ 16 s, interval ≤ 9 s, 10 consecutive cycles; interval between major cycles ≤ 15 min c) Long-durationlaser designator: Single laser designator duration ≥ 60 s, interval ≤ 60 s, 5 consecutive cycles constitute one major cycle; interval between major cycles ≤ 30 min d) Emergency illumination (switching from ranging to laser designator): Single laser designator duration ≥ 16 s, interval ≤ 9 s, laser designator can be initiated at any time
Laser designator coding	a) 16 coding patterns b) Coding accuracy: ± 1 μs c) Coding range: 45,000 μs – 60,000 μs
Weight Requirements	
Total unit weight	≤ 2 kg
Weight consistency	≤ 50 g
Structural Requirements	
Overall dimensions	≤ 75 mm (W) × 90 mm (H) × 220 mm (L)
3D digital model requirements	The external model shall be complete and comprehensive, including details such as screws, cable routing, and mating connectors.
Load cable routing shall be included in the model design to avoid interference with the system.	
Electrical Interface	
DC input	18 V–32 V, typical supply 28 V
Average power consumption	≤ 120 W @ 28 V
Peak power consumption	≤ 200 W @ 28 V
Power-on inrush current	≤ 5 A @ 28 V
Digital ground, power ground, and mechanical housing shall be electrically isolated.	
Environmental Adaptability Requirements	
Operating Temperature	–40 °C to +60 °C
–40 °C to +60 °C	–45 °C to +65 °C High-temperature storage: 2 h Low-temperature storage: 2 h
Vibration	
Equipment vibration testing shall be conducted in accordance with MIL-STD-810G, Laboratory Environmental Test Methods for Military Equipment.	
Vibration conditions	8.2 Hz – 86.4 Hz: 0.1 g²/Hz 156.4 Hz – 172.8 Hz: 0.025 g²/Hz 234.6 Hz – 259.2 Hz: 0.006 g²/Hz Other frequency points within 15 Hz – 2000 Hz: acceleration spectral

	density of 0.004 g²/Hz Vibration shall be applied along the X, Y, and Z axes, 15 minutes per axis.
Shock	
Vertical axis	≥ 20 g
Lateral and longitudinal axes	≥ 15 g
Pulse duration	11 ms
3 axes, 2 directions per axis, 18 shocks in total	
Shock testing shall be conducted in accordance with MIL-STD-810G, Laboratory Environmental Test Methods for Military Equipment.	

3. COMMUNICATION INTERFACE

A standard isolated RS-422 communication interface is provided.
Interface chip model: SMUM2682MP.

A standard isolated CAN 2.0B bus communication interface is provided, with a transmission rate greater than 1 Mbps.
CAN transceiver chip model: SMUM3053MP or ADM3053.
No bus termination resistor is included.
Firmware upgrade can be implemented via the CAN interface (CAN protocol to be defined).

Firmware upgrade can also be implemented via the serial interface.

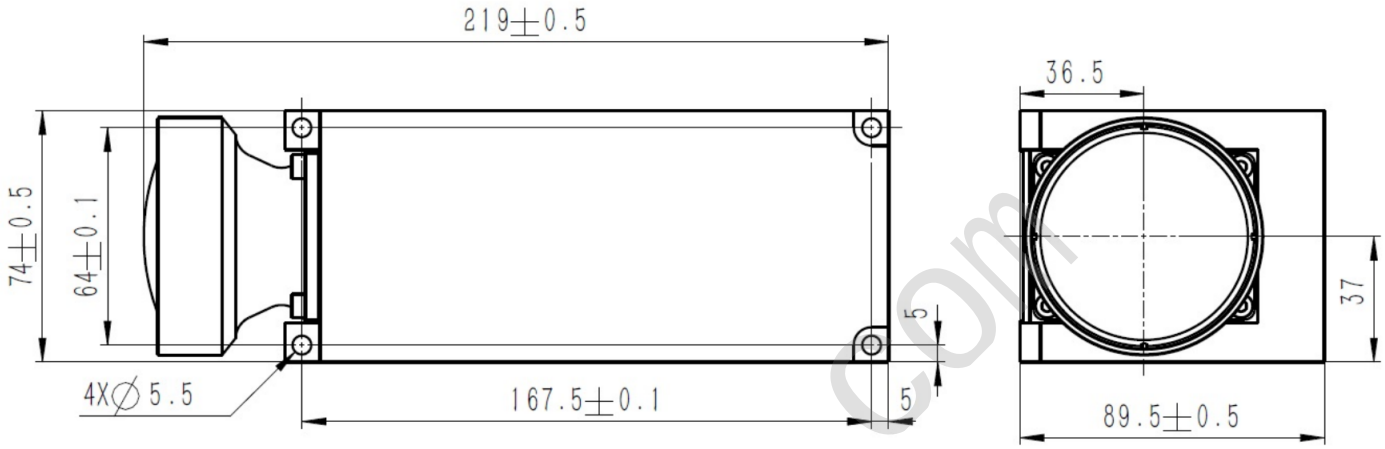
Laser target designator connector: Receptacle J106-4H14ZKSP-02
Electro-optical platform mating plug: Plug J106-4H14TJSL-01
Connector manufacturer: Guihang

Table 1 — Connector Pin Assignment Description

Pin	Definition	Description
A1	+28 V Input Power	
A2	+28 V Input Ground	
4	Designator Serial TX+ (from designator to EO platform +)	
11	Designator Serial RX− (from EO platform to designator −)	
9	Designator Serial TX− (from designator to EO platform −)	
2	Designator Serial RX+ (from EO platform to designator +)	
8	Designator Serial Ground	
14	External Sync RS-422 RX+	
12	External Sync RS-422 RX−	RS-422 level input
13	External Sync RS-422 GND	
5	CAN H	Isolated CAN 2.0B, 1 Mbps, no termination

6	CAN L	resistor installed
7	CAN GND	
B1	Laser Designation Sync Signal Output TX+	
B2	Laser Designation Sync Signal Output TX−	RS-422 level output, active low, pulse width 10 μs
3	Laser Designation Sync Signal Output GND	

4. MECHANICAL DIMENSIONS



5. COMMUNICATION PROTOCOL

5.1. Communication Interface Standard

- **Asynchronous serial communication standard:** RS-422
- **Baud rate:** 115200 bps
- **Transmission format:**

- 8 data bits
- 1 start bit
- 1 stop bit
- 1 even parity bit

For each byte, the **least significant bit (LSB)** is transmitted first.

5.2 Message Format

The communication message format of the **Laser Target Designator** is as follows:

Message Header (1 byte)
Subsystem ID

Message Body
Message Trailer (1 byte, checksum)

The **Message Body** described in the table above is detailed in **Section 3, "Data Protocol."**
The **Message Header**, **Subsystem ID**, and **Message Trailer** are defined in **Tables C-1, C-2, and C-3**, respectively.

Table C-1 — Message Header Description

Byte Name	Data Type	Byte Length	Value/Value Range	Notes
Start-of-Message Code	Unsigned Byte	1	0xCC	Constants

Table C-2 Subsystem ID Number Description

Byte Name	Data Type	Byte Length	Value/Value Range	Notes
Subsystem ID number	Unsigned Byte	1	0x05	Constants

Table C-3 Information Trailer (Checksum) Description

Byte Name	Data Type	Byte Length	Value/Value Range	Notes
Checksum	Unsigned Byte	1	0-255	Checksum is calculated as the sum of all bytes in the message body modulo 256.

The first byte of the **Message Header** is **0xCC**, which serves as the synchronization code indicating the start of a message frame.
The **Subsystem ID** is an identification code assigned by the system to the laser target designator for unit recognition; the Subsystem ID of the laser target designator is **0x05**.
The **Message Trailer** is the checksum, calculated as the sum of all bytes in the message body modulo **256**.

5.3 Data Protocol

5.3.1 Output Information

Output information refers to the **commands sent from the system to the laser target designator**.
The command message packet has a **fixed length of 7 bytes**, with a **4-byte message body**.
The detailed definition is shown in **Table C-4**.

Table C-4 — Output Command Message Body Data Format

Command Description	Byte 1	Byte 2	Byte 3	Byte 4
Power-On Handshake	0x00	N/A	N/A	N/A
Start Self-Test	0x01	N/A	N/A	N/A
Continuous Ranging	0x02	0x00 = 1 Hz Ranging 0x01 = 5 Hz Ranging 0x02 = 20 Hz Ranging	N/A	N/A
Laser Designation	0x03	Laser Designation Duration (1–85 s)	1–1024 correspond to the lower 8 bits of	1–1024 correspond to the upper 8 bits of the 1024

			1024 laser coding values	laser coding values
Laser Stop	0x05	N/A	N/A	N/A
Read Temperature Data	0x06	N/A	N/A	N/A
Energy Adjustment	0x07	0x00 = Increase Energy 0x01 = Decrease Energy	N/A	N/A
Read Product Identification Code	0x10	N/A	N/A	N/A
Receiver Disable	0x0C	N/A	N/A	N/A
Receiver Enable	0x0D	N/A	N/A	N/A
Single-Shot Ranging	0x0B	N/A	N/A	N/A
External Trigger	0x0E	Laser Designation Duration （1~90s）	N/A	N/A

Remark 1: The laser target designator can respond to the illumination command while in ranging mode.
Remark 2: During illumination, the laser target designator responds only to the **Laser Stop** command and the **Power-On Handshake** command.
Remark 3: "N/A" fields default to **0x00**.

5.3.2 Input Information

Input information refers to the **status data received by the system from the laser target designator**.
The status message packet has a **fixed length of 9 bytes**, with a **6-byte message body**.
The detailed definition is shown in **Table C-5**.

Table C-5 — Status Message Body

Status Description	Byte 1	Byte 2	Byte 3	Byte 4~5	Byte 6
Handshake Response	0x00	Power-on self-test result: 0x00 = Normal 0x01 = Fault	When a power-on self-test fault occurs: Fault code (Remark 1)	Laser Pulse Count (Remark 2)	N/A
Start Self-Test Response	0x01	Start self-test result: 0x00 = Self-test in progress 0x01 = Self-test completed	When "self-test completed": Fault code (Remark 1)	N/A	N/A
Continuous Ranging in Progress	0x02	Periodic self-test result: 0x00 = Normal 0x01 = Fault	When a periodic self-test fault occurs: Fault code (Remark 1)	Distance Value Count (Remark 3)	0x00 = 1 Hz Ranging 0x01 = 5 Hz Ranging 0x02 = 20 Hz Ranging

Laser Designation in Progress	0x03	Periodic self-test result: 0x00 = Normal 0x01 = Fault	When a periodic self-test fault occurs: Fault code (Remark 1)	Distance Value Count (Remark 3)	N/A
Laser Stop	0x05	N/A	N/A	N/A	N/A
Temperature Report	0x06	N/A	N/A	Temperature Value	N/A
Energy Adjustment Response	0x07	0x00 = Increase Energy 0x01 = Decrease Energy	Adjustment value (1–10)	N/A	N/A
Thermal Control Status	0x08	0x00 = Ready 0x01 = Not Ready	When a periodic self-test fault occurs: Fault code (Remark 1)	N/A	N/A
Product Identification	0x10	Identification Code 1 (Remark 4)	Identification Code 2 (Remark 4)	Bytes 4–6 (Remark 4)	
Receiver Disable	0x0C	N/A	N/A	N/A	N/A
Receiver Enable	0x0D	N/A	N/A	N/A	N/A
Single-Shot Ranging in Progress	0x0B	Periodic self-test result: 0x00 = Normal 0x01 = Fault	When a periodic self-test fault occurs: Fault code (Remark 1)	Distance Value Count (Remark 3)	N/A
External Trigger	0x0E	Laser Designation Duration (1–90 s)	N/A	N/A	N/A

Remark 1: Fault codes are evaluated bit by bit: **0 = Pass**, **1 = Fail**. **Bit0–Bit7** represent each SRU. See **Table C-6** for details.

Remark 2: Actual laser pulse count = **Laser Pulse Count × 100** (Scale = 100). Transmission order is **low byte first, then high byte**.

Remark 3: Bit4 and **Bit5** represent the low and high bits of the distance value count, respectively (range: **0–65535**; if ranging is invalid, the value is set to **0**).

Remark 4: The product identification code consists of **2 bytes**.

The **upper 4 bits** of Byte 2 indicate the product ID of the laser target designator (constant **0x05**).

The **lower 4 bits** of Byte 2 indicate the **ones digit** of the software version.

The **upper 4 bits** of Byte 3 indicate the **first decimal digit** of the software version, and the **lower 4 bits** indicate the **second decimal digit**.

Bytes 4–6 represent the software version date: **year (last two digits)**, **month**, and **day**, respectively.

Remark 5: "N/A" fields default to **0x00**.

Remark 6: The shutter is **OFF by default**.

Table C-6 — SRU Fault Code Table

Fault Bit (bit)	SRU Name
0	(Reserved)
1	Overcurrent/Undercurrent Fault
2	No Laser Emission
3	Temperature Read Failure
4	Shutter Fault
5	(Reserved)
6	(Reserved)
7	Laser Coding Board Communication Fault

5.4 Control Flow

5.4.1 Message Acknowledgement

After power is applied, the laser target designator performs a **power-on self-test**.
The system actively sends a **"Power-On Handshake"** command to the laser target designator. After receiving the command, the laser target designator shall reply with a **"Handshake Response"** within the acknowledgement timeout, indicating that the handshake is successful and communication with the system has been established.

After communication is established, the system sends control commands to the laser target designator. Upon receiving a command, the laser target designator starts executing it and reports status information to the system. The main control flow is as follows:

- When the system sends a **"Start Self-Test"** command, the laser target designator replies **"Start Self-Test in Progress."** During the self-test, it does not respond to other commands. After completion, the laser target designator proactively reports **"Start Self-Test Completed"** along with detailed self-test results. If the self-test can be completed within the **passive acknowledgement timeout**, it may directly reply **"Self-Test Completed."**
- When the system sends a **"Single-Shot Ranging"** command, the laser target designator performs a single measurement and reports the ranging status and distance value.
- When the system sends a **"Continuous Ranging"** command, the laser target designator starts ranging and reports the ranging status and distance value. The first ranging status frame shall be returned within

the acknowledgement timeout; otherwise, it is considered a communication fault or a laser target designator fault.

- When the system sends an **"Illumination"** command, the laser target designator starts illumination and reports the illumination status and distance value. The first illumination status frame shall be returned within the acknowledgement timeout; otherwise, it is considered a communication fault or a laser target designator fault.
- When the system sends an **"External-Trigger Illumination"** command, the laser target designator enters and replies **"External-Trigger Illumination Mode."** It performs coded illumination according to the external trigger signal and reports illumination status and distance value. After the configured external-trigger illumination duration expires, it reports **"Stop Status"** and automatically returns to **Internal-Trigger Illumination Mode**.
- The laser target designator defaults to **Internal-Trigger Illumination Mode**. If it enters **External-Trigger Illumination Mode** by command, then each time a **Laser Stop** command is received, it shall reply with stop status and automatically return to **Internal-Trigger Illumination Mode**.
- When the system sends a **"Read Product Identification"** command, the laser target designator shall return the **Product Identification Code** within the acknowledgement timeout; otherwise, it is considered a communication fault or a laser target designator fault.
- When the laser target designator is not emitting laser (i.e., not ranging or illuminating), it periodically reports **"Thermal Control Status"** to the system at a period of **1000 ms**.

Passive acknowledgement timeout: 600 ms
Active acknowledgement timeout (only when replying "Start Self-Test Completed"): 1000 ms

Illumination commands have higher priority than ranging commands. The laser target designator shall be able to respond to an illumination command during ranging. During illumination, it responds only to the stop command, or stops automatically when the illumination time expires.

In **boresight/alignment mode**, the laser will not respond to commands outside of alignment mode.

The laser target designator shall provide a **reset function**. Upon receiving the **"Power-On Handshake"** command, it shall return to the default state regardless of its current state.

5.4.2 Error Handling

- If any byte in a received frame has a **parity error** or **framing error**, the entire message shall still be received completely, but the received message is invalid.
- If the **checksum** is incorrect, the received message is invalid and the system shall wait for the next frame.