



## LDR20K1 Laser Target Designator Technical Specification Document

Model:LDR20K1

### PRODUCT DESCRIPTION

The LDR20K1 Laser Target Designator is capable of measuring the distance to a target and providing laser target designation for the firing of the target. It is primarily used in airborne applications that require high reliability. It features compact size, lightweight, long-range target designation, high precision, and strong environmental adaptability.

The laser target designator can achieve the following control functions through a serial interface:

- 1) Respond to laser ranging commands and can stop ranging at any time upon receiving a stop command;
- 2) Output distance data and status information for each pulse during ranging;
- 3) Ranging has a distance gating function;
- 4) If no stop command is received after initiating continuous ranging, it will automatically stop ranging after 5 minutes (1Hz) or 1 minute (5Hz);
- 5) Can set irradiation mode and coding;
- 6) Respond to laser target designation commands, designate targets according to the set mode and coding, and can stop target designation at any time upon receiving a stop command;
- 7) If no stop command is received after initiating target designation, it will automatically stop after one cycle of target designation;
- 8) Output distance value and status information for each

pulse during laser target designation;

- 9) Perform power-on self-test and periodic self-test, and output status information;
- 10) Respond to start self-test commands and output status information;
- 11) Can report the cumulative number of laser pulse counts.



### TECHNICAL SPECIFICATIONS

#### Parameter Specifications

- 1) Operating Modes: Ranging, Target Designation;
- 2) Pump Source: Diode Array;
- 3) Operating Wavelength: 1.064 $\mu$ m;
- 4) Pulse Energy:  $\geq 20$ mJ;
- 5) Pulse Energy Fluctuation: Within a target designation cycle, the energy fluctuation of a single pulse does not exceed 10% of the average energy (measured after 2 seconds of light emission);
- 6) Beam Divergence:  $\leq 0.6$ mrad;
- 7) Pulse Width: 10 $\pm$ 5ns;
- 8) Laser Axis Stability:  $\leq 0.05$ mrad;
- 9) Ranging Performance:
- 10) Ranging Frequency: 1Hz/5Hz, single shot;
  - a) Continuous ranging time at 1Hz is not less than 5 minutes, with a 1-minute rest;
  - b) Continuous ranging time at 5Hz is not less than 1 minute, with a 1-minute rest;
  - c) Minimum measurement distance: not greater than 300m;
  - d) Maximum measurement distance: not less than 3000m;
  - e) Ranging accuracy:  $\pm 1$ m;
  - f) Probability of correct measurement: not less than 98%;



g) Ranging logic: first and last targets;

11) Target Designation Performance:

a) Laser coding accuracy: 2.5 $\mu$ s.

b) Laser target designation frequency base: 20Hz.

c) Laser target designation cycle:

- Short cycle target designation:

A single target designation lasts not less than 20 seconds, with an interval not exceeding 30 seconds, and continuous target designation for 8 cycles.

- Long cycle target designation:

A single target designation lasts not less than 47 seconds, with a restart interval not exceeding 30 seconds, and continuous target designation for 2 cycles.

After the end of a target designation cycle, the interval before restarting continuous target designation is not less than 30 minutes.

12) Laser Coding:

a) Complies with MIL-STD-810G system requirements and has user self-coding expansion capability;

b) Capable of receiving external synchronization signals to control laser emission for coding;

c) Coding method: Precise frequency code (eight pre-stored periodic code encodings);

13) Dimensions and Weight:

a) Outer dimensions envelope:  $\leq 92\text{mm} \times 67\text{mm} \times 53\text{mm}$ ;

b) Weight:  $\leq 290\text{g}$ .

14) Input Power Requirements:

a) Average power consumption during operation is not greater than 55W, and the peak is not greater than 100W.

b) Operating voltage range is 20V to 28V.

15) Electrical Protection:

After the circuit board is designed and adjusted, it is coated with a three-proof varnish for "three-proof" treatment.

## **Environmental Adaptability Requirements**

Temperature Requirements

1) High-temperature requirements:

Operating temperature:  $\leq +55^{\circ}\text{C}$ ;

Storage temperature range:  $\leq +70^{\circ}\text{C}$ .

2) Low-temperature requirements:

Operating temperature:  $\geq -40^{\circ}\text{C}$ ;

Storage temperature range:  $\geq -45^{\circ}\text{C}$ .

Vibration Requirements

Capable of withstanding flight vibration and the impact of takeoff and landing, and all equipment can withstand the environmental conditions of automotive transportation.

Vibration is a swept spectrum, with 15Hz to 33Hz being equal displacement sine vibration with a displacement of 0.91mm; 33Hz to 700Hz being equal acceleration sine vibration with an acceleration of 2g.

Vibration in three directions for 1 hour each.

Test specimen status: The product is placed on the test bench in the normal operating state during impact, and the product is powered on;

After impact testing, the product should work normally.

Shock Requirements

Vertical axis direction  $\geq 10\text{g}$ ,

Transverse axis direction  $\geq 10\text{g}$ ,

Longitudinal axis direction  $\geq 10\text{g}$ ;

Ring sawtooth wave, duration 11ms, X, Y, Z axes, two directions per axis, one time each, totaling 18 times.

Test specimen status: The product is placed on the test bench in the normal operating state during impact, and the product is powered on;

After shock testing, the product should work normally.

 **STRUCTURAL DRAWING (mm)**

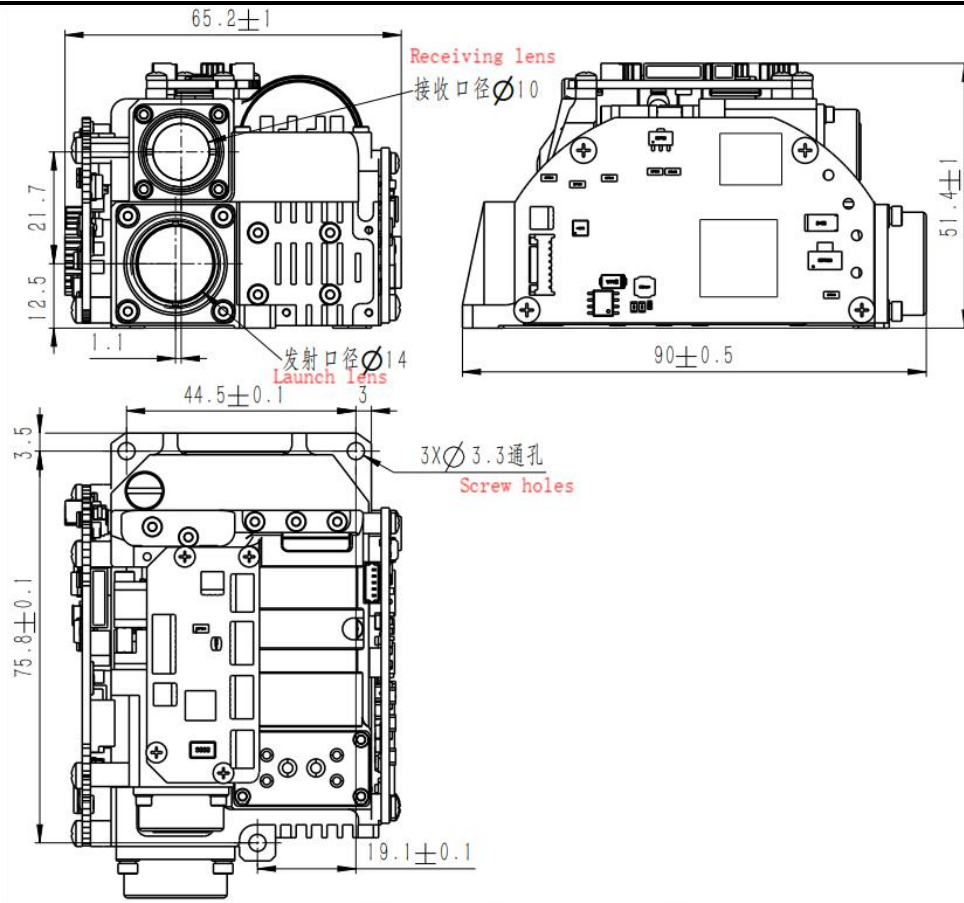


Figure 1 Mechanical Interface

## ELECTRICAL INTERFACE

Communication Interface: One TTL level serial port.

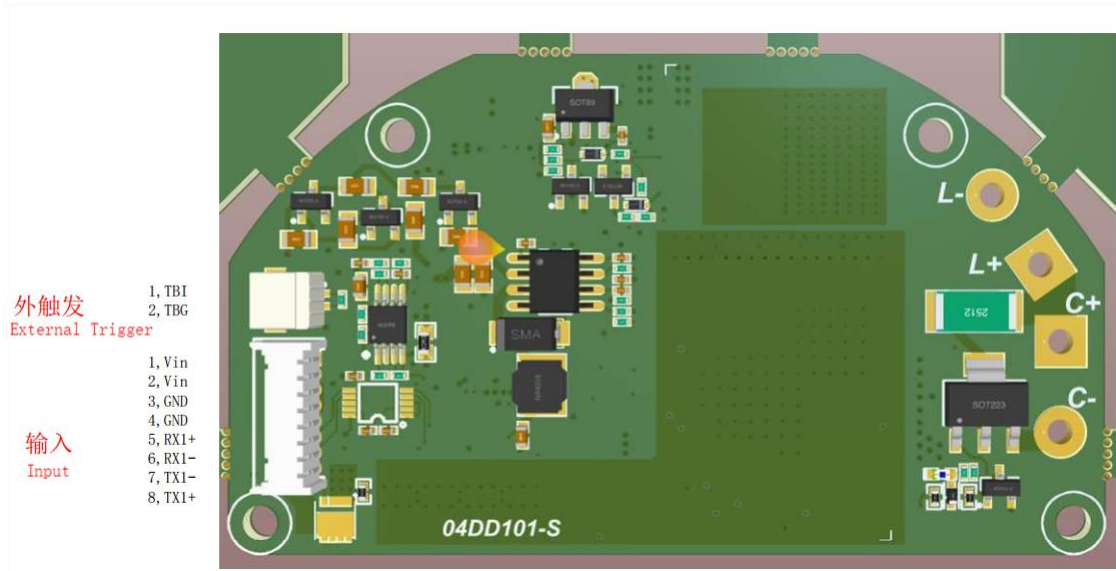
Connector model and interface definition see Table 1.

Table 1 Electrical Interface Definition (Using TTL)

Socket MOLEX 53048-0810		
Corresponding Plug MOLEX 51021-0800		
Pin	Signal Name	Description
1	Vin	Power Supply + (24V)
2	Vin	Power Supply + (24V)
3	GND	Power Supply -
4	GND	Power Supply -
5	RX1+	Upper Computer -> Laser Measurement Component + (422-RX+)
6	RX1-	Upper Computer -> Laser Measurement Component - (422-RX-)
7	TX1-	Laser Measurement Component -> Upper Computer - (422-TX-)
8	TX1+	Laser Measurement Component -> Upper Computer + (422-TX+)
External Trigger		
1	TBI	External Trigger + (Pulse Rising Edge Trigger)
2	TBG	External Trigger -



Figure 2 Schematic Diagram of Electrical Interface



## COMMUNICATION PROTOCOL

### 1. Communication Standards

Asynchronous Serial Communication Standard: TTL

Baud Rate: 115200bps

Transmission Format: 8 data bits, 1 start bit, 1 stop bit, no parity bit.

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

### 2. Output Information

Output information refers to the commands sent by the host computer system to the laser ranging and target designator module, including:

- 1) Information Header (0x55);
- 2) Command Word 1;
- 3) Command Word 2;
- 4) Command Word 3;
- 5) "Information Trailer" is the checksum, which is the result of the XOR operation of bytes 1 - 4.

The relevant definitions of Command Word 1 are shown as follows:

Table 2 Definitions of Command Word 1

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0x00: Standby							
0x01: Start Self-Test							
0x02: Single Ranging							
0x03: Continuous Ranging (1Hz)							
0x04: Continuous Ranging (5Hz)							
0x05: Short Illumination (Duration 25s, Interval 15s, target designator 8 cycles)							
0x08: Stop Ranging / target designator							
0x09: Strobe Value Setting							
0x0A: Report the Cumulative Number of Laser Pulses							
0x19 - 0x20: Modification of Laser Coding Parameters 9 - 16							
0x29 - 0x30: Reading of Laser Coding Parameters 9 - 16							

The relevant definitions of Command Word 2 are shown as follows:

Table 3 Definitions of Command Word 2

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
When using the laser target designator: Laser Coding 1 - 16.							
When performing laser ranging: 1 - First Target, 2 - Last Target.							
When setting the strobe value: Low byte of the distance strobe value.							



When modifying the parameters of Laser Coding 9 - 16: Low byte of the laser coding, cycle  $\times$  100 (5000 represents 50ms, with a range of **46ms - 56ms**).

The relevant definitions of Command Word 3 are shown as follows:

Table 4 Definitions of Command Word 3

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
When using the target designator: Set the time of the laser target designator (1 - 25).							
When setting the strobe value: High byte of the distance strobe value.							
When modifying the parameters of Laser Coding 9 - 16: High byte of the laser coding, cycle $\times$ 100 (5000 represents 50ms, with a range of <b>46ms - 56ms</b> ).							

### 3. Input Information

Input information refers to the status information received by the Upper Computer system from the laser target designator module, including:

- 1) Information Header (0x55);
- 2) Status Word;
- 3) Target Distance/Cumulative Number of Laser Pulses (2 bytes); with the low byte first and the high byte second; Parameters of Laser Coding 9 - 16, cycle  $\times$  100 (5000 represents 50ms, with a range of 46ms - 56ms); with the low byte first and the high byte second;
- 4) Current Temperature of the Laser Target Designator Module
- 5) "Information Trailer" is the checksum, which is the result of the XOR operation of bytes 1 - 5.

The relevant definitions of the Status Word information are shown in Table 5:

Table 5 Definitions of Status Word Information

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0: No laser 1: There is a laser	0: Ranging is valid. 1: Ranging is invalid.	Laser Mark 1/0 Alternating	1: Over-temperature Warning 0: Temperature Normal		0: None 1: External Trigger	00: Standby 01: Ranging 02: Indicating	

Definition of Target Distance Information: The distance value is represented by 2 bytes (16 bits) as an integer, and it can be directly converted into decimal.

In standby mode, the self-test returns the status every 10 seconds. In ranging and target designator modes, the status is returned according to the laser frequency.

Definition of Cumulative Number of Laser Pulses: Since the range represented by a 16-bit binary number is from 0 to 65535, and the service life of the laser ranging target designator is 1 million times, it is agreed that the number of laser emissions is a multiple of 20, with a range from 0 to 1310700.

Current Temperature of the Laser Ranging Target Designator Module: d7 - d0: Represented by two's complement, with a value range from -128 to +127, and the unit is (°C).

Note:

1. The status feedback frame automatically returns one frame every 10 seconds, that is, the status frame is fed back every 10 seconds in the states of power-on, standby, stopping ranging, and stopping target designator.
2. After 1Hz ranging for 5 minutes and 5Hz ranging for 1 minute (both are 300 times of ranging), the device automatically stops ranging.
3. After the coding change setting, the parameters are saved in the flash and will not be lost when the power is turned on again.
4. BIT05 in Table 5 is 1/O alternating, indicating that the feedback data has been updated.
5. Each time the target designator is started, a cycle of continuous target designator is carried out, and it will automatically stop after completion. Therefore, the coding only involves the interval time of laser pulses, and the starting of the target designator is accompanied by the irradiation time parameter (1 - 25s).

**6. When sending the short target designator command, the target designator cycle is selected from the coding of 1 - 16, and the target designator cycle is the cycle set by coding 9 - 16.**