LDR40K2 Laser Target Designator
Technical Specification Document

Model:LDR40K2

PRODUCT DESCRIPTION

The LDR40K2 laser target designator measures the distance to the target and can provide target laser designation for laser-guided applications in airborne fields with high reliability requirements. It features small size, light weight, long-range target designation, high precision, and strong environmental adaptability.

Main Functions

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

1) Capable of laser ranging and real-time reporting of distance values;
2) Protection against reverse polarity connection and overvoltage circuit protection;
3) Laser target designation at an internally set frequency of 20Hz;
4) Laser target designation at a frequency set by external commands;
5) Laser target designation triggered by an external synchronization signal (laser target designation in external synchronization mode), with precise encoding;
6) Capable of real-time reporting of the current working temperature for the host computer to judge and calculate;
7) Laser reception lockout function;
8) Over-temperature warning function: When the laser rangefinder and target designator's working temperature is too high to continue emitting laser, it should send an over-temperature warning status message to the host computer and protect the safety of the laser rangefinder and target designator;
9) Reporting the number of laser emissions;
10) Reserved software interface with energy adjustment function (when energy decreases, it can be adjusted through the software interface to ensure energy ≥ 45mJ);
11) Reporting information includes pulse count number during ranging and laser target designation;
12) Self-check and output of fault codes.

Power-on self-check includes:
- RS422 serial communication status;
- High-temperature warning.

Startup and periodic self-checks include:
- RS422 serial communication status;
- High-temperature warning;
- Laser emission or no emission.

Note: Since the laser rangefinder/target designator can only detect charging/discharging and laser emission/no emission faults when emitting laser, the power-on self-check does not require detection of these two faults. The startup self-check and periodic self-check report the detection results from the last target designation or ranging.

Temperature warning output, expected target designator or ranging performance (standby status, temperature range -40~60°C, operating status, -40~80°C).

TECHNICAL SPECIFICATIONS

Parameter Specifications

1) Operating Modes: Ranging, Target Designation
2) Pump Source: Diode Array;
3) Operating Wavelength: 1.064μm;
4) Pulse Energy: ≥45mJ;
5) Pulse Energy Fluctuation: Within a target designation cycle, the fluctuation of single pulse energy does not exceed 10% of the average energy (statistic taken after 2 seconds of emission);
6) Beam Divergence: ≤0.5mrad;
7) Pulse Width: 15±5ns;

8) Laser Axis Stability: ≤0.05mrad;
9) Optical Axis Alignment Error Relative to Mounting Datum: Azimuth ≤0.5mrad, Elevation ≤0.25mrad;
10) Ranging Performance:
a) Ranging Frequency: 1Hz/5Hz, single shot;
b) Continuous ranging time at 1Hz is not more than 5 minutes, with a 1-minute rest;
c) Continuous ranging time at 5Hz is not more than 1 minute, with a 1-minute rest;
d) Minimum measurement distance: no more than 300m;
e) Maximum measurement distance: no less than 5000m;
f) Ranging Accuracy: ±2m;
g) Probability of Ranging: no less than 98%;
11) Target Designation Performance:
a) Laser Encoding Precision: 2.5μs.
b) Base Frequency for Laser Target Designation: 20Hz.
c) Continuous Target Designation Time

- Short Cycle Target Designation:

A single target designation lasts no more than 20 seconds, with an interval no less than 30 seconds, and continues for 10 cycles.

- Long Cycle Target Designation:

A single target designation lasts no more than 47 seconds, with a target designation restart interval no less than 30 seconds, capable of continuous designation for 2 cycles.
After the completion of a target designation cycle, a 30-minute interval is required before restarting continuous target designation.
12) Laser Encoding:
a) Complies with MIL-STD-810G requirements and has user self-encoding expansion capabilities;
b) Capable of receiving external synchronization signals to control laser emission for encoding;
c) Encoding Method: Precise frequency code (eight pre-stored cycle code encodings);
13) Dimensions and Weight:
a) Outer dimensions envelope: ≤106mm×98mm×48mm;
b) Weight: ≤450g.
14) Power Supply:
a) The electrical and electronic components of the laser rangefinder and target designator should be compatible with the system power characteristics.
b) Average power is no greater than 80W, and peak power is no greater than 100W.
c) Input power is +26V±4VDC (voltage fluctuation range +22V to +30V). Reverse polarity protection is required for the input power.
15) Electrical Protection:
After the circuit board is designed and debugged, it should be coated with conformal coating for "three protections" treatment.

Environmental Adaptability Requirements
Temperature Requirements
1) High Temperature Requirements
Working temperature: +55℃, maintained for 2 hours;
Storage temperature range ≤+70℃.
2) Low Temperature Requirements
Working temperature: -40℃, maintained for 2 hours;
Storage temperature range ≥-45℃.
Vibration Requirements
Capable of withstanding flight vibrations 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 is equal acceleration sine vibration, with an acceleration of 2g.
Each direction vibrates for 1 hour.
Test Sample Condition: The product is placed on the test bench in normal use condition and powered on.
After the shock test, the product should work normally.

Shock Requirements

- Vertical axis direction ≥ 10g,
- Transverse axis direction ≥ 10g,
- Longitudinal axis direction ≥ 10g;
- Ring sawtooth wave, duration 11ms, X, Y, Z axes, each axis in two directions, one time each, totaling 18 times.
- Test Sample Condition: The product is placed on the test bench in normal use condition and powered on.

- After the shock test, the product should work normally.

STRUCTURAL DRAWING (mm)

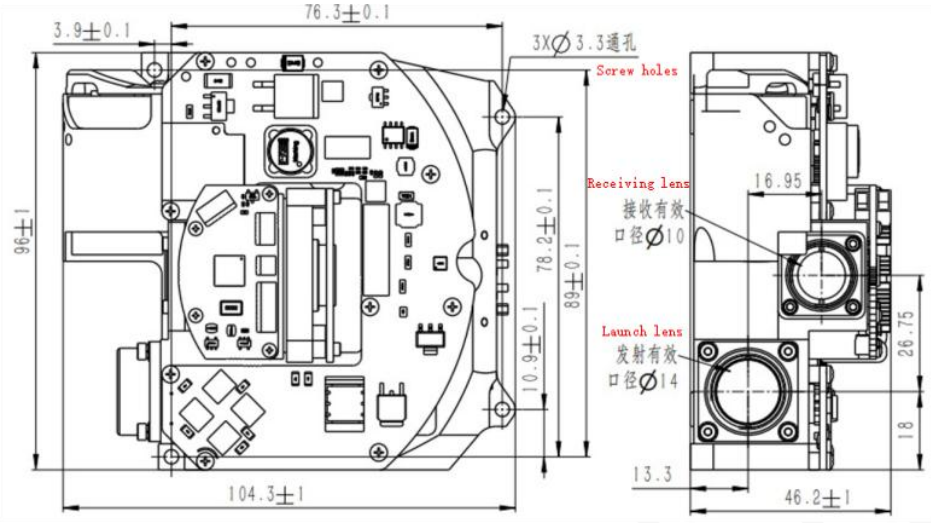

Figure 1 Mechanical Interface

ELECTRICAL INTERFACE

The model of the laser rangefinder and target designator socket is J30J-15ZKL, and its corresponding plug is J30J-15TJP; the corresponding plug must be provided upon delivery. The electrical interface definition is shown in Table 1:

Table 1: Electrical Interface Definition

Pin	Signal Name	Remarks
P-1	VIN+	26V±4V
P-2	VIN+	26V±4V
P-3	NC	External Sync Positive
P-4	VDD	Software Program Input
P-5	GND	Software Program Input
P-6	ARM_SWCLK	Software Program Input
P-7	ARM_SWDAT	Software Program Input
P-8	NC	External Sync Negative
P-9	GND	26V Ground
P-10	GND	26V Ground
P-11	RS422_TX+	Transmitter + for Rangefinder and Target Designator
P-12	RS422_TX-	Transmitter - for Rangefinder and Target Designator
P-13	RS422_RX-	Receiver - for Rangefinder and Target Designator
P-14	RS422_RX+	Receiver + for Rangefinder and Target Designator
P-15	GND	Signal Ground

Note:

- The laser rangefinder/target designator has reverse polarity protection for the power supply.
- The contractor provides the plug.

COMMUNICATION PROTOCOL

1.Communication Standard

Asynchronous Serial Communication Standard: RS422 Serial Port

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. For multi-byte information, the lower byte is transmitted first.

2.Output Information

Output information refers to commands sent by the host computer system to the Laser Rangefinder Target Designator module, including:

- Information header (0x55);
- Command word 1;
- Command word 2;
- Command word 3;
- "Information tail" is the checksum, which is the result of the XOR operation of bytes 1-4.

The relevant definitions of command word 1 are as follows:

Table 2 Command word 1 definition

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
0x00: Standby 0x01: Initiate self-test 0x02: Single distance measurement 0x03: Continuous distance measurement (1Hz) 0x04: Continuous distance measurement (5Hz) 0x05: Short target designation (duration 18s, interval 10s, 8 cycles of target designation) 0x06: Long target designation (duration 60s, interval 60s, 4 cycles of target designation) 0x08: Stop distance measurement/ target designation 0x09: Set gating value 0x0A: Report cumulative laser pulse count 0x19 ~ 0x20: Change laser encoding parameters 9 ~ 16 0x29 ~ 0x30: Read laser encoding parameters 9 ~ 16							

The relevant definitions of command word 2 are as follows:

Table 3 Command word 2 definition

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
When Laser target designation is active: Laser codes range from 1 ~ 16. When laser ranging is active: 1 - First target, 2 - Last target. When setting the gating value: Low byte of distance gating value. When modifying parameters for laser codes 9 to 16: Low byte of laser code, period × 100 (5000 represents 50ms, range of 46ms ~ 56ms).							

The relevant definitions of command word 3 are as follows:

Table 4 Command word 3 definition

BIT07	BIT06	BIT05	BIT04	BIT03	BIT02	BIT01	BIT00
When setting Laser Target Designation: Set Laser Target Designation time (1 ~ 25). When setting the gating value: High byte of distance gating value. When modifying parameters for laser codes 9 ~ 16: High byte of laser code, period × 100 (5000 represents 50ms, range of							

46ms ~ 56ms).

3.Input Information

Input information refers to the status information received by the Upper Computer from the Laser Target Designation module, including:

- Information header (0x55);
- Status word;
- Target distance/accumulated laser pulse count (2 bytes); low byte first, high byte second;
- For laser codes 9 to 16 parameters, period × 100 (5000 represents 50ms, range of 46ms to 56ms); low byte first, high byte second;
- Current temperature of the Laser Target Designation module;
- "Information tail" is the checksum, which is the XOR result of bytes 1 to 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: Laser present	0: Ranging effective 1: Ranging ineffective	Laser marker alternating between 1 / 0	1: Over-temperature alarm 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 BIT) as an integer, which can be directly converted to a decimal number.

In standby mode, a self-check status is returned every 10S cycle. In ranging and Target Designator modes, the status is returned based on the laser frequency.

Definition of cumulative laser pulse count: Since a 16-bit binary number represents a range of 0 ~ 65535, and the service life of the laser rangefinder is 1 million times, it is agreed that the laser emission count is a multiple of 20, with a range of 0 ~ 1310700.

Current temperature of the Laser Rangefinder Target Designator module: d7-d0: represented in two's complement, with a range of -128 ~ +127, in units of ℃ (degrees Celsius).

Notes:

- A status feedback frame is automatically returned every 10 seconds, meaning that a status frame is fed back every 10s during power-on, standby, stop ranging, and stop Target Designator states.
- The device automatically stops ranging after 5 minutes of ranging at 1Hz and 1 minute of ranging at 5Hz (both are 300 rangings).
- After changing the encoding settings, the parameters are saved in the flash memory and will not be lost when the power is turned off and back on.
- BIT05 in Table 5 indicates 1/O alternating, which means that the feedback data has been updated.
- Each activation of Target Designator involves a continuous Target Designator cycle, which stops automatically upon completion. Therefore, the encoding only involves the laser pulse interval, and the Target Designator time parameter (1 ~ 60s) is included when initiating Target Designator .
- When sending short/long Target Designator commands, the Target Designator cycle is selected from encodings 1 ~ 16, with the Target Designator period set by encodings 9 ~ 16.