0105C Laser Rangefinder Module Manual

Model:LRF0105C

⟁ PRODUCT DESCRIPTION

In order to enable operators to use the various functions of the LRF0105C small laser rangefinder product safely and correctly, this instruction manual provides instructions on use and maintenance. Applies to operators and service personnel of this product.

The LRF0105C small laser rangefinder (hereinafter referred to as the laser rangefinder) is a precision optoelectronic product that emits laser light at the measured target and calculates distance information based on the laser flight time. This laser rangefinder communicates through the RS422/TTL communication interface, which has the characteristics of outstanding performance and simple operation. The laser of this rangefinder is prohibited from direct exposure to human eyes.

⟁ PRODUCT COMPOSITION, SUPPORTING EQUIPMENT, WORKING PRINCIPLE AND RELATIONSHIP WITH CROSS-LINKING EQUIPMENT

The main components of the LRF0105C small laser rangefinder product are as follows:
a) Circuit components;
b) Receive and transmit components.
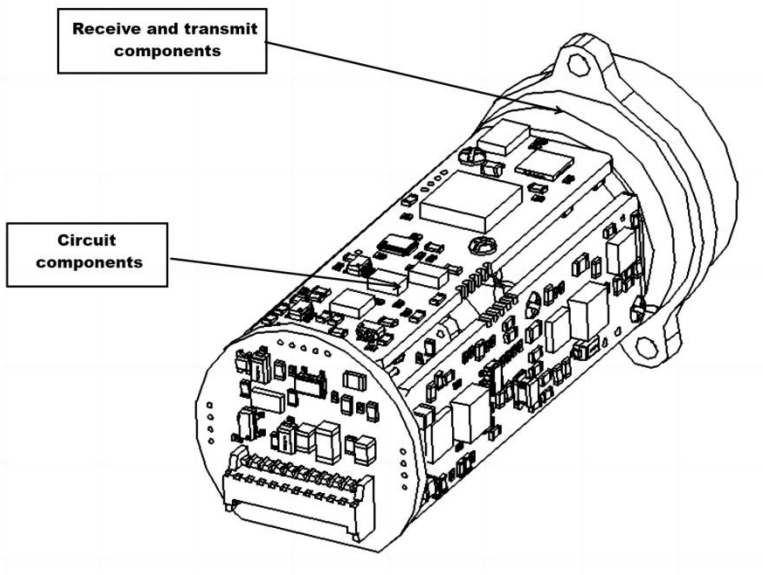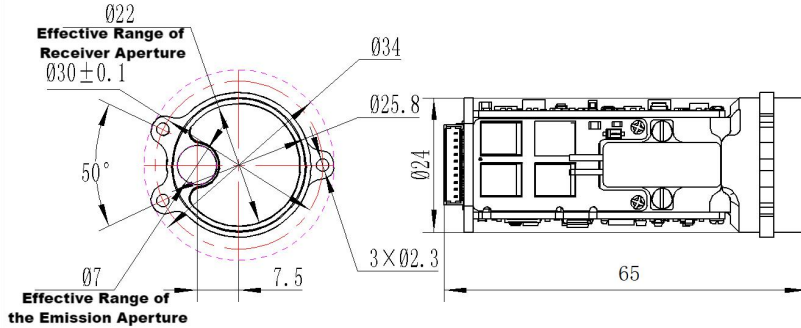The overall dimensions are φ34mm×65mm, and the weight is ≤45g. Its appearance diagram is shown in Figure 1.

Figure 1 Schematic diagram of product appearance

1. Cross-linking relationship

1.1 Mechanical and optical interface

The overall dimensions of the mechanical and optical interface are shown in Figure 2.

1.2 Electrical interface

a) Power supply voltage: 4.5V~8.5V (typ. 5V);

The host computer uses a 1.25mm pitch 10PIN connector to achieve cross-link testing with the rangefinder. The pin definition of the rangefinder communication port is shown in Table 2.

Table 2: Control Command Information Received by the Rangefinder
Electrical Pin Definitions for the Product

Pin No.	Label Electrical	Electrical Characteristics Definition	Definition Remarks
P-1	VIN+	Input Power Supply Positive	Power Supply
P-2	COM	Input Power Supply Negative	
P-3	POWER_CTL	Low Power Control Port	Floating or High-Level Effective (3V to 12V)
P-4	RS422_TXD+	Signal Output Port	From Rangefinder to Host Computer
P-5	RS422_TXD-		
P-6	RS422_RXD-	Signal Input Port	From Host Computer to Rangefinder
P-7	RS422_RXD+		
P-8	GND	Communication Ground	Communication Ground
P-9	TTL_RXD	Signal Input Port	3.3V TTL
P-10	TTL_TXD	Signal Output Port	
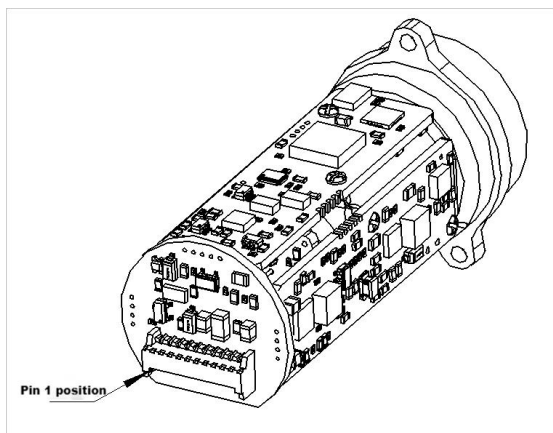
Connector Connection Pin 1 Location

1.3 Software

1.3.1、Data:

Data transmission from the rangefinder to the host computer includes the following:

- **Control commands:** including single-shot ranging, continuous ranging, query commands, and more.
- **Feedback data:** including distance information, ambient temperature, rangefinder status, and more.

Data exchange is carried out using RS422/TTL communication with the following characteristics:

- Baud rate: 38400 (factory default)/9600/57600/115200;
- Byte structure: Little-endian, with low-order bits first and high-order bits last;
- Byte composition: 1 start bit, 8 data bits, no parity, 1 stop bit.

1.3.2、Information:

The format of control command information is as shown in Table 3.

Table 3: Control Command Information Received by the Rangefinder

Byte	Instructions	Byte Data (Command Byte, Data, Checksum)	Remark
1	Header	0x55	
2～5		Single Shot Ranging: 0xF2 0x00 0x00 0xF2	The return data are shown in Table 2
		1Hz Ranging: 0xF3 0x01 0x00 0xF2	
		5Hz Ranging: 0xF3 0x02 0x00 0xF1	
		10Hz Ranging: 0xF3 0x03 0x00 0xF0	
		Stop Ranging: 0xF3 0x00 0x00 0xF3	
		Baud rate setting: 0xF6 ___ ___ 0xXX	__ __ is the set baud rate/100 (hexadecimal representation), 0xXX is the XOR of 2 to 4 bytes
		Self-test instructions: 0xF0 0x00 0x00 0xF0	The return data is shown in Table 4
		Query command: 0xF8 0x00 0x00 0xF8	
		Strobe value setting: 0xF4 ___ ___ 0xXX	__ __ is the set strobe value (expressed in hexadecimal), 0xXX is the XOR of 2 to 4 bytes
6	Frame end	0xAA	

The rangefinder's feedback data is divided into regular data and query data.

Regular data: It includes target count, measured distance, rangefinder status, and more. Refer to Table 4 and Table 5 for details.

Query data: It includes ambient temperature, rangefinder status, and more. Refer to Table 6 for details.

Table 4 Conventional data returned by the distance measuring machine

Byte	Instructions	Byte value (hex)
1	Frame Header	0xAA
2	Number of Targets	
3	High Byte of First Target Distance Information	
4	Low Byte of First Target Distance Information	
5	Decimal Byte of First Target Distance Information	Two decimal places
6	High Byte of Last Target Distance Information	
7	Low Byte of Last Target Distance Information	
8	Decimal Byte of Last Target Distance Information	Two decimal places
9	Ranging Status Byte	The status word is shown in Table 3
10	High Byte of Emission Count	Hexadecimal notation

11		
12	Low Byte of Emission Count	
13		
14	Checksum	The second to 13th bytes are OR
15	Frame End	0x55

Note: Only when the rangefinder calculates the distance from the blind area to the maximum count, the correct measurement results are displayed, and in other cases, 0xFF is displayed, that is, invalid state。

Table 5 Status word meaning

No.	Byte 9	Meaning
1	0xF2	Single Shot Ranging
2	0xF3	1Hz Ranging
3	0xF4	5Hz Ranging
4	0xF6	10Hz Ranging
5	0xF5	Stop Ranging

Table 6 Query data returned by the distance measuring machine

Byte	Instructions	Byte value (hex)
1	Frame Header	0xCC
2	Reserved	Reserved
3	Environmental Temperature Byte	8-bit signed number, unit: ℃
4	Self-Check Information Byte	0x00: Represents querying the default value. 0xFF: Indicates laser emission abnormality. 0x03: Indicates normal laser emission.
5	High-Intensity Operating Status Byte	0x01: Normal operating mode flag. 0x00: High-intensity operating mode flag.
6	High Byte of Distance Selection Value	Hexadecimal Representation
7	Low Byte of Distance Selection Value	
8	High Byte of Baud Rate	Hexadecimal Representation, Baud Rate is Feedback Data × 100
9	Low Byte of Baud Rate	
10	High Eight Bits of Emission Count	Hexadecimal Representation
11		
12	Low Eight Bits of Emission Count	
13		
14	Checksum	XOR of Bytes 2 to 13
15	Frame End	0x55

⊒ PRODUCT DESCRIPTION

1 Function

The main functions of DYC-20B small laser range finder are:

a) Laser ranging function;

b) Power on and temperature collection function;

c) With distance gating function;

d) Equipped with first/last target ranging function;

e) Equipped with laser self-check and self-check query functions;

f)Equipped with serial port update program function.

2 Performance

The main performance indicators are as follows:

a) Working wavelength: 1535nm±5nm;

b) Ranging capability: ≥1200m (visibility ≥5Km, target reflection coefficient 0.3, relative humidity ≤60%, for 1.7m×0.5m standard target plate or equivalent target);

c) Ranging blind zone: ≤30m;

d) Distance measurement accuracy: ≤±1m;

e) Ranging frequency: single, 1Hz, 5Hz, 10Hz;

f) Accuracy rate: ≥98%;

g) False alarm rate: ≤1%;

h) Divergence angle: ≤1mrad;

i) Distance resolution: ≤48m.

3. Applicable environmental conditions

a) Working temperature: -40℃～+60℃;

b) Storage temperature: -55℃～+70℃;

c)Vibration: Place the sample machine in the storage box, and conduct a vibration test in three mutually perpendicular axes (one of which is parallel to the optical axis of the objective lens) according to Figure C.3 and Table C.7 in GJB 150.16A-2009. , vibrate for 40 minutes in each direction. After the vibration is completed, all functions of the laser rangefinder are normal and can still work normally.

4. Security

In order to ensure the safety of test subjects and test personnel, the following safety measures were taken during the design process of the LRF0105C small laser range finder:

a) Conduct safety design and analysis in accordance with GJB 900A-2012 "General Requirements for Equipment Safety Work";

b) Use non-flammable materials, and the mechanical and electrical interface connections are stable and reliable;

c) The components that control key systems and key functions have error-proof designs;

d) Take reasonable design measures to avoid water vapor accumulation and cause short circuit;

e) Use eye-safe laser as the working band;

f) Work below the human body safety voltage.

⊒ LIGHT WINDOW SELECTION AND COATING RECOMMENDATIONS

1.Material suggestions

It is recommended to use optical glass H-K9L as the light window material. H-K9L is the most common colorless optical glass, suitable for the laser range of 300nm to 2100nm, with high cost performance and superior physical properties.

2. Processing suggestions

The wedge angle tolerance of the light window should be as small as possible, and the wedge angle tolerance is recommended to be ≤3′ (tolerance level ≤7);

The optical surface of the light window should be as smooth as possible, and the recommended arithmetic mean deviation (Ra)

of the profile is 0.012.

3. Coating suggestions

It is recommended that the light window of the 1535nm laser rangefinder be coated with 1525nm ~ 1545nm anti-reflection coating, with a transmittance of ≥99%.

According to the specific use environment of the product, other protective films such as hydrophobic film or hard film can be selected on the surface of the light window. The other indicators refer to GJB2485-95, and the transmittance is ≥97%.

4. Light window appearance and usage suggestions

The effective diameter of the light window depends on different products. Its overall dimensions should ensure that the effective diameter of the light window - the diameter of the light window is ≥ 2mm, and the outer diameter of the rangefinder antenna - the projection size of the effective diameter of the light window is ≥ 1.5mm. The schematic diagram is shown in the figure below. Since the light window has a certain absorption of laser light, it is recommended that the thickness of the light window itself be controlled within 2 to 4 mm according to the overall dimensions.

Due to the high transmittance of the light window, it is recommended that the axis deviation between the emission optical axis and the normal line of the light window be controlled within 0° to 2°. The position diagram of the light window and the two lens barrels is shown in the figure below. At the same time, the air gap between the light window and the rangefinder should be as small as possible. Figure 4 is a schematic diagram of the two ways of placing the light window.
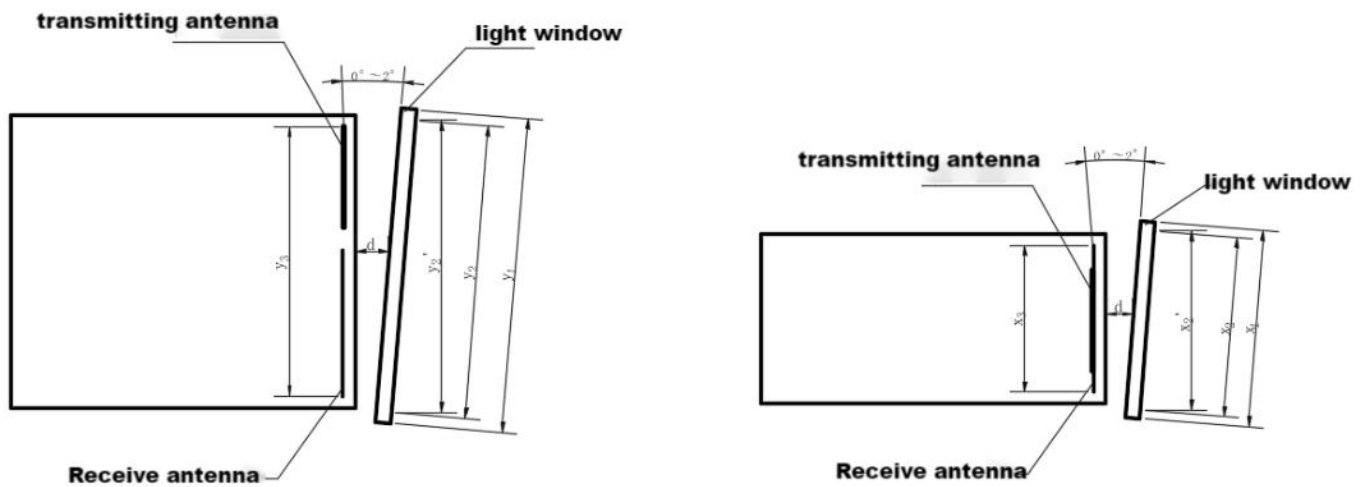
Effective diameter of light window y2 - diameter of light window y1 ≥ 2mm,
Rangefinder antenna outer diameter y3 - light window effective aperture projection size y2` ≥ 1.5mm,
The air gap d between the light window and the rangefinder should be as small as possible.

Effective diameter of light window x2 - diameter of light window x1 ≥ 2mm,
Rangefinder antenna outer diameter x3 - light window effective aperture projection size 2` ≥ 1.5mm,
The air gap d between the light window and the rangefinder should be as small as possible.

Figure 4 Schematic diagram of the appearance, size and placement of light windows in two ways
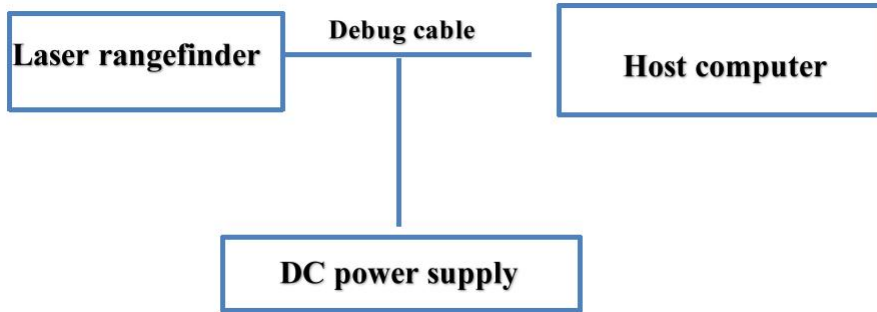
⊇ OPERATE

In order to enable you to fully understand the various functions of this system,

Correctly master the installation, use and maintenance methods. Please read this chapter carefully before installing and using this system.

1. Power-on operation

1.1 Before starting up
Connect the laser rangefinder, debugging cable, DC power supply and host computer as shown in Figure

```
┌─────────────────────┐   Debug cable   ┌─────────────────────┐
│  Laser rangefinder  │─────────────────│    Host computer    │
└─────────────────────┘                 └─────────────────────┘
              │
         ┌──────────────────────┐
         │   DC power supply     │
         └──────────────────────┘
```

1.2 Power on

Start-up operation: Connect the power supply.

2. Shutdown operation

2.1 Before shutting down

Before shutting down, make sure that the working processes and tasks of each product are in the finished state and the program exits.

2.2 Shut down

Shutdown steps: Disconnect power.

3.Operation

3.1 Ranging mode

How to operate distance measurement mode:

a) Send the "single ranging" command to the laser range finder, and the laser range finder performs a single range measurement and reports the ranging status and distance value;

b) Send the "1Hz ranging" command to the laser range finder. The laser range finder performs ranging once every second and reports the ranging status and distance value.

c) Send the "stop ranging" command to stop ranging.

d) Send the "5Hz ranging" command to the laser range finder. The laser range finder performs ranging five times per second and reports the ranging status and distance value.

e) Send the "stop ranging" command to stop ranging.

f) Send the "10Hz ranging" command to the laser range finder. The laser range finder performs ranging ten times per second and reports the ranging status and distance value.

g) Send the "stop ranging" command to stop ranging.

3.2 Distance gating settings

Distance gating means setting a gating distance (in hexadecimal notation) within the range of the ranging capability. Target distance information lower than the gating value will not be sent back, and the distance measurement value higher than the gating within the range range is valid. ranging;

If you need to set it, the operation method is as follows:

a) Send the "Gating Value Setting" command to the laser rangefinder;

b) Send the "ranging" command to the laser range finder, the laser range finder measures the distance and determines whether the return distance value is greater than the distance gate value and then reports the distance measurement result;

c) Send the "stop ranging" command to stop ranging;

If you do not need to use the distance gating function, you need to manually restore the initial settings (the gating value is set to 0).

3.3 Self-test mode

Self-check operation method:

a) Send a "self-check query" command to the laser rangefinder;

The laser rangefinder starts self-test and sends back the current ambient temperature, working status and other information.

⊋ INSPECTION AND MAINTENANCE

1. General inspection

Visual and power-on inspections should be performed after the product is used for the first time and after the resource module is replaced. For products in normal use, only perform power-on inspection before use.

1.1 Visual inspection

The steps for visual inspection are as follows:

a) Check whether the appearance of the product is normal;

b) Check whether the cable connection is correct and the connection should be firm.

1.2 Power-on inspection

The power-on inspection steps are as follows:

a) Complete the boot operation according to steps 5.1;

b) Start the self-test test module;

c) After the inspection, follow the steps in 5.2 to complete the shutdown operation.

2. Regular maintenance

The laser rangefinder does not require maintenance under normal working conditions. Maintenance is required when stored in a dust-free environment for more than one year. The content includes:

2.1 General inspection

The product is generally inspected when it is not powered. The steps are as follows:

a) All marks and numbers on products and test cable plugs (sockets) should be correct and clear;

b) Various screws on the panel should be tightened;

c) It should be ensured that the optical glass of the product does not have light spots, pitting, water spots, mold, fingerprints, dust particles and other attachments and cracks that hinder normal observation.

2.2 Power-on inspection

Perform comprehensive inspection and maintenance on the laser rangefinder when it is powered on, including:

a) Turn on the power of the products in sequence;

b) Complete the boot operation according to steps 5.1;

c) Start the product self-test module and complete the product self-test;

d) Follow the steps in 5.2 to complete the shutdown operation.

℞ FAILURE PHENOMENON ANALYSIS AND TROUBLESHOOTING METHODS

The laser rangefinder is a precision product. When a fault occurs, the entire machine needs to be returned to the factory for fault analysis, location and repair. Self-repair is not allowed.

Common fault phenomena and troubleshooting methods are shown in Table 7.

Table 7 Common fault phenomena and troubleshooting methods

Fault phenomenon	Possible Causes	Inspection Method	Troubleshooting
The product cannot be powered on normally	a) a) Power supply and connection cable failure b) Circuit failure	Check power supply and connection cables	a) Replace the power supply or connecting cable b) If there is a circuit failure, please contact the manufacturer for assistance.
Unable to return communication message	a) Connection line failure b) The power supply is abnormal c) Communication failure of laser range finder	a) Check whether the connection cable is normal b) Check whether the power supply is normal	a) Replace the connecting cable and power supply b) For communication problems, please contact the manufacturer for assistance.

℞ PACKAGING, TRANSPORTATION AND STORAGE REQUIREMENTS

1 Packaging

When unsealed products need to be restocked, they should be packed in the original packaging. When the product needs to be returned to the factory, the original packaging should be used as much as possible. When using other forms of packaging, it should not cause product performance degradation or damage.

2. Transportation

Repackaged products can be transported by cars, trains, planes, ships, etc. During transportation, the packages should be fixed on the

transportation vehicle to avoid impacts, rough handling, and rain and snow. Road transportation and railway transportation environment refer to GJB 150.16A-2009.

3. Storage

Repackaged products must not be stored in the open air. It should be stored in a warehouse with a storage temperature of 0°C to +30°C, a relative humidity of no more than 80%, no erosion by corrosive substances, no strong mechanical vibration and impact, and no strong magnetic field.

⅀ SAFETY INSTRUCTIONS

In order to use this product safely, you should read these instructions carefully before operating this product.

a) This laser rangefinder is a precision optical mechanical product. Failure to operate according to regulations may cause dangerous laser damage. Do not open or adjust any part of the laser rangefinder, and do not attempt to repair or adjust the performance of the laser rangefinder by yourself;

b) Pay attention to electrostatic protection: The electronic components of the laser rangefinder are electrostatic discharge sensitive equipment. Do not touch any electronic equipment without protective measures;

c) The laser rangefinder is only allowed to be powered on and operated within the specified voltage and power range;

d) It is forbidden to touch the optical lenses with fingers or hard objects (to prevent grease from contaminating or scratching the lenses);

e) It is prohibited to measure high reflectivity targets at too close range (to prevent damage to the core components of the detector, etc.);

f) It is prohibited to store under non-stipulated conditions (high pollution environment, exceeding storage temperature range, etc.);

g) The laser rangefinder is prohibited from being subjected to strong mechanical impact (vibration, impact, falling, etc.).