4km 1535nm High-End Laser Range Finder Module

Key Properties

- Max Range: ≥ 5000m for Building targets (4x6m)
  ≥ 4000m for NATO targets (2.3x2.3m)
  ≥ 2100m for Human targets (0.5x1.7m)
  ≥ 1100m for UAV targets (0.2x0.3m)
- Min Range: 15m
- Accuracy: ±1m
- Frequency: 1~10Hz
- Wavelength: 1535nm
- Laser Safety: Class 1
- Communication Interface: TTL(UART)

Function

- Single Measurement
- Continuous Measurement
- First/Last/Multiple Target Mode
- Baudrate Setting
- Frequency Setting
- Gating Distance Setting

Introduction

The LRF4K10LH utilizes a 1535nm laser with excellent atmospheric penetration, and the laser divergence angle is reduced to less than 0.6mrad through precision optics. This allows the ranging module to measure targets of size 2.3x2.3 (NATO targets) at a distance of up to 4000m, with a maximum measurement distance of ≥5000m, compliant with laser safety class 1 standards.

The LRF4K10LH is a single-pulse ranging module independently developed by IADIY. Its communication interface adopts TTL (3.3V) and utilizes UART protocol. It can also be customized to RS422 according to specific requirements. Additionally, we provide testing software, command sets, and communication protocols for user convenience in secondary development.

Note: Please avoid targets within 5 meters, especially highly reflective ones like glass or smooth metal surfaces, to prevent potential permanent damage to the detection components.

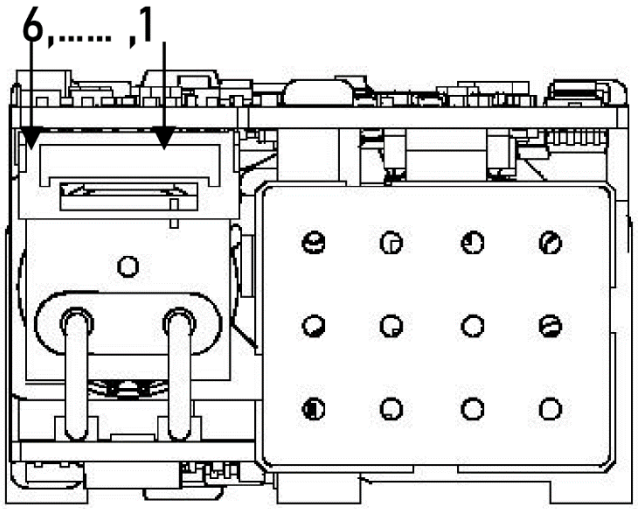
1. Specifications

Technical specifications	
Model Name	LRF4K10LH
Max Range	≥ 5000m for Building targets (4x6m) ≥ 4000m for NATO targets (2.3x2.3m) ≥ 2100m for Human targets (0.5x1.7m) ≥ 1100m for UAV targets (0.2x0.3m) (Conditions: Reflectivity≥30%, Visibility≥8km)
Min Range	15 m
Accuracy	±1 m
Frequency	1~10 Hz
Range Resolution	≥20 m
Detection Probability	≥98 %
False Alarm Rate	≤1 %
Multi-target detection	Up to 3 targets
Optical Design	
Wavelength	1535±5 nm
Laser Safety	Class 1
Beam Divergence	≤0.6 mrad
Emission Aperture	Φ8 mm
Receiving Aperture	Φ16 mm
Communication	
Communication Interface	3.3V TTL (UART)
Baud rate	9600~115200 bps
Interface Connector	A1257WR-S-6P
Power Consumption	
Input Voltage	DC 4.5 ~ 16V
Standby Power Consumption	≤1 mW
Average Power Consumption	≤2.5 W @10 Hz
Peak Power Consumption	≤7 W @12 V
Mechanical	
Dimension	48 × 30.5 × 21 mm
Weight	≤32±1 g
Optical axis stability	≤0.05 mrad
Non-perpendicular optical axis to base	≤0.5 mrad

Environmental	
Operating Temperature	-40 ~ +70 °C
Storage Temperature	-55 ~ +75 °C
Protection Class	IP67
Shock Resistance	1200g/1ms (GJB150.16A-2009)
Vibration Resistance	5~50~5 Hz, 1 Octave range/min, 2.5g
Reliability	MTBF ≥ 1500 h
Electrical isolation	Power, communication and structural isolation
ESD Class	Contact discharge 6kV, Air discharge 8kV (Lens position)
Electromagnetic Compatibility (EMC)	CE/FCC
Environmental Compliance	RoHS2.0

2. Pin Assignment

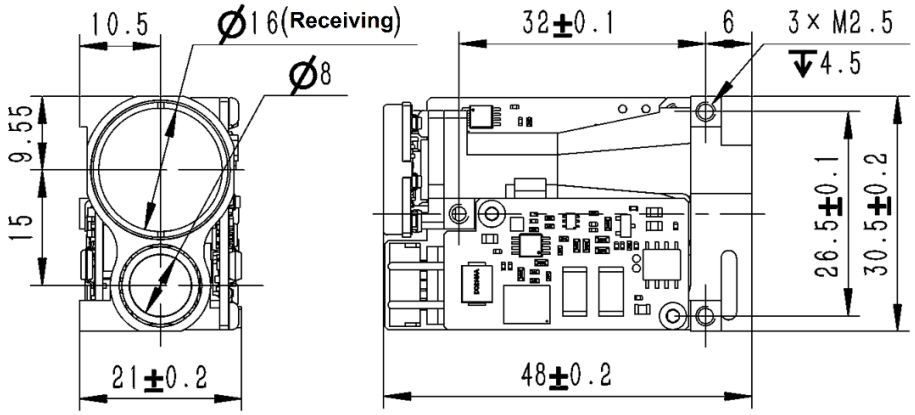
The electrical interface connector model used by LRF4K10LH is A1257WR-S-6P, and the specific wiring definitions are shown in the table below.



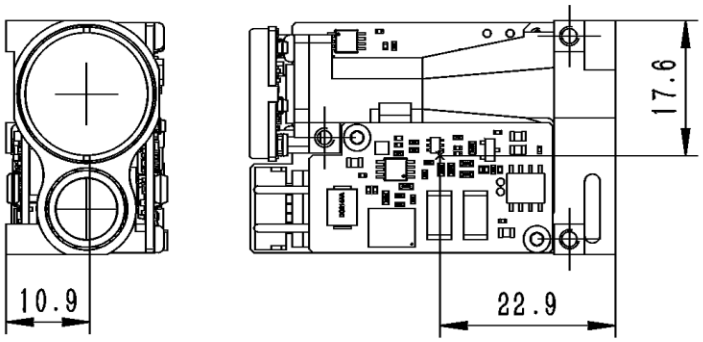
Pin Assignment for TTL_3.3V			
Pin N	**Definition**	**Description**	**Cable**
1	Power +	Power supply, 4.5 ~ 16V	Red
2	Power -	Power supply, ground	Black
3	POWER_ON	Module power switch, TTL_ 3.3V level; Module ON (> 2.7V), Module OFF (< 0.3V);	White
4	UART_TX	Serial port sender, TTL_ 3.3V level	Yellow
5	UART_RX	Serial port receiver, TTL_ 3.3V level	Green
6	GND	Serial port ground	Black

3. Dimensions

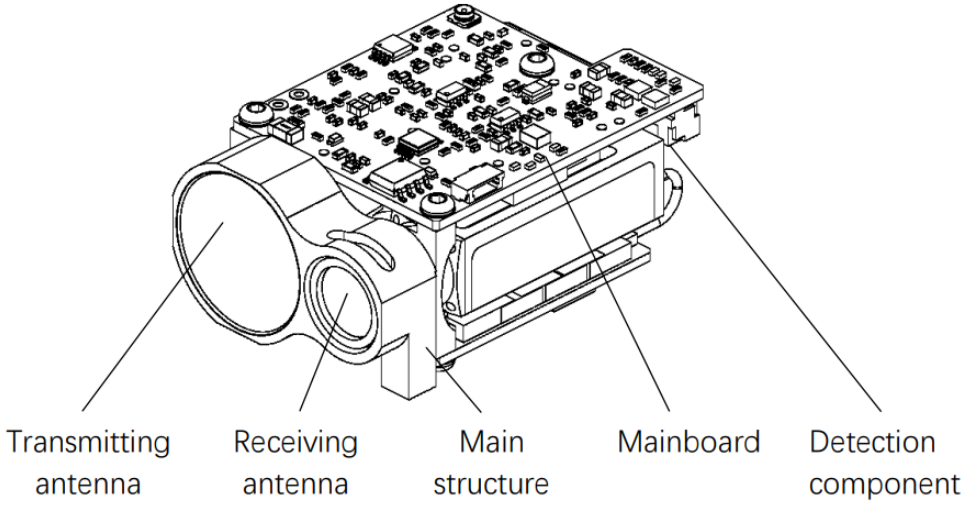
The overall dimensions and user installation interface of the ranging module are depicted in the figure below.



The centroid position of the ranging module is also illustrated in the same figure.



Product Configuration Diagram



4. Communication

After powering on the ranging module, it defaults to standby mode. To initiate command operations as outlined in section 4.5, it is necessary to enable the module power switch (where power_on is pulled up) for approximately 0.5 seconds, allowing the driving capacitor to complete charging.

4.1 UART configuration parameters:

At a default baud rate of 115200 bps, the protocol is set to 8N1, and byte data is in hexadecimal.

Baud rate: 115200bps(default) / 57600bps / 9600bps

Data bits: 8

Parity bits: None

Stop bits: 1

4.2 Data Frame Format

Description	Number of bytes	Value	Remark
Frame header	2	0xEE 0x16	Fixed value
Data length	1	2~9	Total number of bytes encompassing the device code, command code, and command parameters
Device code	1	0x03	Fixed value
Command code	1	0~255	Indicates the current control command's function
Command parameters	0~4	0~255	Indicates the function parameters of the current command
Checksum	1	0~255	Checksum is the sum of byte data in device code, command code, and command parameters, considering only the lower 8 bits

4.3 Control command (system to rangefinder module)

Command code	Description	Command parameter bytes
0x01	Equipment self-check	0
0x02	Single ranging	0
0x03	Set first / last / multiple targets	1
0x04	Continuous ranging	0
0x05	Stop ranging	0
0xA0	Set baud rate	4
0xA1	Set continuous ranging frequency	2
0xA2	Set minimum gating distance	2
0xA3	Query minimum gating distance	0
0xA4	Set maximum gating distance	2
0xA5	Query maximum gating distance	0
0x91	Query light output times after power on	0

4.4 Response data (rangefinder module to system)

Command code	Explain	Command parameter bytes
0x01	Equipment self-check	4
0x02	Single ranging	4
0x03	Set first / last / multiple targets	0
0x04	Continuous ranging	4
0x05	Stop ranging	0
0x06	Ranging abnormality (Returned only when the system is in a state of ranging abnormality, following the response command of single ranging or continuous ranging)	4
0xA0	Set baud rate	4
0xA1	Set continuous ranging frequency	2
0xA2	Set minimum gating distance	2
0xA3	Query minimum gating distance	2
0xA4	Maximum gating distance	2
0xA5	Query maximum gating distance	2
0x91	Query light output times after power on	3

4.5 Command description

4.5.1 Equipment self-check

Control command						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0x01	0x04

Response data										
Byte	0	1	2	3	4	5	6	7	8	9
Describe	0xEE	0x16	0x06	0x03	0x01	Status0	Status1	Status2	Status3	CHK

*Status0: reserved

*Status1: echo intensity (0x00~0xFF)

*Status2:	bit0 -- FPGA system status	1 normal	0 abnormal
	bit1 -- laser light output state	1 light emission	0 laser no emit light
	bit2 -- main wave detection status	1 with main wave	0 without main wave
	bit3 -- echo detection status	1 with echo	0 without echo
	bit4 -- bias switch status	1 bias on	0 bias off
	bit5 -- bias output state	1 bias normal	0 bias abnormal
	bit6 -- temperature state	1 laser PWM normal	0 laser PWM abnormal
	bit7 – laser PWM state	1 valid	0 invalid
*Status3:	bit0 – 5V6 power status	1 normal	0 abnormal
	Bit1 – 15V power status	1 normal	0 abnormal

4.5.2 Single ranging

Control command						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0x02	0x05

Response data										
Byte	0	1	2	3	4	5	6	7	8	9
Describe	0xEE	0x16	0x06	0x03	0x02	Status	Val_H	Val_L	Val_D	CHK

*Status (when ranging the first / last target):

0x00 indicates that the ranging result is a single target;

0x01 indicates that there is a front target in the ranging result;

0x02 indicates that there is a rear target in the ranging result;

0x03 reserved;

0x04 indicates that the ranging result is out of range;

0x05 reserved;

* Status (when multi-target ranging):

bit3~0：

0x_0 indicates that the ranging result is a single target;

0x_1 indicates that there is a front target in the ranging result;

0x_2 indicates that there is a rear target in the ranging result;

0x_3 indicates that the ranging result has front target and rear target;

0x_4 indicates that the ranging result is out of range;

0x_5 reserved;

Bit7~4：

0x0_ ~ 0xf_ indicates the current distance result number; Value range [0, N-1], number of targets 1 ≤ N ≤ 16;

*Range value:

Val_H as Ranging value integer high 8 bits

Val_L as Ranging value integer lower 8 bits

Val_D as Ranging value decimal places

Range value = Val_H × 256 + Val_L + Val_D × 0.1 (unit m)

4.5.3 Set first / last / multiple targets

Control command							
Byte	0	1	2	3	4	5	6
Describe	0xEE	0x16	0x03	0x03	0x03	Target	CHK

*Target: 0x01 Set the first target ranging;

0x02 Set last target ranging;

0x03 Set multi-target ranging;

Response data						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0x03	0x06

4.5.4 Continuous ranging

Control command						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0x04	0x07

Response data										
Byte	0	1	2	3	4	5	6	7	8	9
Describe	0xEE	0x16	0x06	0x03	0x04	Status	Val_H	Val_L	Val_D	CHK

*Status (when ranging the first / last target):

0x00 indicates that the ranging result is a single target;

0x01 indicates that there is a front target in the ranging result;

0x02 indicates that there is a rear target in the ranging result;

0x03 reserved;

0x04 indicates that the ranging result is out of range;

0x05 reserved;

* Status (when multi-target ranging):

bit3~0：

0x_0 indicates that the ranging result is a single target;

0x_1 indicates that there is a front target in the ranging result;

0x_2 indicates that there is a rear target in the ranging result;

0x_3 indicates that the ranging result has front target and rear target;

0x_4 indicates that the ranging result is out of range;

0x_5 reserved;

Bit7~4：

0x0_ ~ 0xf_ indicates the current distance result number; Value range [0, N-1], number of targets $1 \le N \le 16$;

*Range value:

Val_H as Ranging value integer high 8 bits

Val_L as Ranging value integer lower 8 bits

Val_D as Ranging value decimal places

Range value = Val_H × 256 + Val_L + Val_D × 0.1 (unit m)

4.5.5 Stop ranging

Control command						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0x05	0x08

Response data						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0x05	0x08

4.5.6 Ranging anomaly

Response data										
Byte	0	1	2	3	4	5	6	7	8	9
Describe	0xEE	0x16	0x06	0x03	0x06	reserve	reserve	reserve	Status	CHK

Status1: bit0 -- FPGA system status; 1 normal 0 exception

Bit1 -- laser light output state; 1 light output 0 no light

Bit2 -- main wave detection status; 1 main wave 0 no main wave

Bit3 -- echo detection status; 1 echo 0 no echo

Bit4 -- bias switch status; 1 bias on 0 bias off

Bit5 -- bias output state; 1 The bias voltage is normal 0 bias abnormal

Bit6 -- temperature state; 1 The temperature is normal 0 abnormal temperature

Bit7 -- light output off state; 1 valid 0 is invalid

This instruction is returned only when bit0~7 in status is abnormal.

4.5.7 Set baud rate of laser ranging module

Control command										
Byte	0	1	2	3	4	5	6	7	8	9
Describe	0xEE	0x16	0x06	0x03	0xA0	Bau_H24	Bau_H16	Bau_L8	Bau_L0	CHK

* Bau_H24: Baud High24 * Bau_H16: Baud High16

* Bau_L8: Baud Low8 * Bau_L0: Baud Low0

Response data										
Byte	0	1	2	3	4	5	6	7	8	9
Describe	0xEE	0x16	0x06	0x03	0xA0	Bau_H24	Bau_H16	Bau_L8	Bau_L0	CHK

* Bau_H24: Baud High24 * Bau_H16: Baud High16

* Bau_L8: Baud Low8 * Bau_L0: Baud Low0

4.5.8 Set continuous ranging frequency

Control command								
Byte	0	1	2	3	4	5	6	7
Describe	0xEE	0x16	0x04	0x03	0xA1	Freq	reserve	CHK
*Freq: 0x01~0x0A (1~10Hz) * reserve: Fixed as 0x00								

Response data						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0xA1	0xA4

4.5.9 Set minimum gating distance

Control command								
Byte	0	1	2	3	4	5	6	7
Describe	0xEE	0x16	0x04	0x03	0xA2	DIS_H	DIS_L	CHK
DIS_H: Distance high 8 bits DIS_L: Distance lower 8 bits DIS: 10~20000 Minimum gating distance range, in M								

Response data								
Byte	0	1	2	3	4	5	6	7
Describe	0xEE	0x16	0x04	0x03	0xA2	DIS_H	DIS_L	CHK
DIS_H: Distance high 8 bits DIS_L: Distance lower 8 bits DIS: 10~20000 Minimum gating distance range, in M								

4.5.10 Query minimum gating distance

Control command						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0xA3	0xA6

Response data								
Byte	0	1	2	3	4	5	6	7
Describe	0xEE	0x16	0x04	0x03	0xA3	DIS_H	DIS_L	CHK
DIS_H: Distance high 8 bits DIS_L: Distance lower 8 bits DIS: 10~20000 Minimum gating distance range, Unit m								

4.5.11 Set maximum gating distances

Control command								
Byte	0	1	2	3	4	5	6	7
Describe	0xEE	0x16	0x04	0x03	0xA4	DIS_H	DIS_L	CHK
DIS_H: Distance high 8 bits DIS_L: Distance lower 8 bits DIS: 10~20000 Minimum gating distance range, in M								

Response data								
Byte	0	1	2	3	4	5	6	7
Describe	0xEE	0x16	0x04	0x03	0xA4	DIS_H	DIS_L	CHK
DIS_H: Distance high 8 bits DIS_L: Distance lower 8 bits DIS: 10~20000 Minimum gating distance range, in M								

4.5.12 Query maximum gating distance

Control command						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0xA5	0xA8

Response data								
Byte	0	1	2	3	4	5	6	7
Describe	0xEE	0x16	0x04	0x03	0xA5	DIS_H	DIS_L	CHK
DIS_H: Distance high 8 bits DIS_L: Distance lower 8 bits DIS: 10~20000 Minimum gating distance range, in M								

4.5.13 Query light out times after power ON

Control command						
Byte	0	1	2	3	4	5
Describe	0xEE	0x16	0x02	0x03	0x91	0x94

Response data									
Byte	0	1	2	3	4	5	6	7	8
Describe	0xEE	0x16	0x05	0x03	0x91	DATA1	DATA2	DATA3	CHK
DATA 1: total light output times, bit23 ~ bit16 DATA 2: total light output times, bit15 ~ bit8 DATA 3: total light output times, bit7 ~ bit0									

4.6 Command example

4.6.1 Equipment self-check

SEND: EE 16 02 03 01 04

RECV: EE 16 06 03 01 FF 00 F7 FF F9

4.6.2 Single ranging

SEND: EE 16 02 03 02 05

RECV: EE 16 06 03 02 04 00 00 00 09

4.6.3 Continuous ranging

SEND: EE 16 02 03 04 07

RECV: EE 16 06 03 04 04 00 00 00 0B

RECV: EE 16 06 03 04 04 00 00 00 0B

RECV: ……

4.6.4 Stop ranging

SEND: EE 16 02 03 05 08

RECV: EE 16 02 03 05 08

4.6.5 Set first target

SEND: EE 16 03 03 03 01 07

RECV: EE 16 02 03 03 06

4.6.6 Set end goal

SEND: EE 16 03 03 03 02 08

RECV: EE 16 02 03 03 06

4.6.7 Set multiple targets

SEND: EE 16 03 03 03 03 09

RECV: EE 16 02 03 03 06

4.6.8 Set continuous ranging frequency 1Hz

SEND: EE 16 04 03 A1 01 00 A5

RECV: EE 16 02 03 A1 A4

4.6.9 Set continuous ranging frequency 5Hz

SEND: EE 16 04 03 A1 05 00 A9

RECV: EE 16 02 03 A1 A4

5. Package List

	NAME	Qty.
1	LRF4K10LH Laser rangefinder module	1
2	Serial port cable	1
4	Product manual (electronic version)	1
5	Product test report	1

6. Precautions For Use

6.1 Safety mark

	**【Danger】** Be cautious of laser radiation. This product falls under safety class 1. Ensure proper safety precautions and avoid direct exposure to the laser.
	**【Warning】** Any nonstandard operation may result in product damage and potential personal injury.
	**【Electrostatic protection】** Static electricity can cause irreversible damage to the internal components of the product. Exercise caution and implement proper electrostatic protection measures during use.
	**【Environmental humidity】** During transportation, storage, and use, avoid exposing this product to humid environments. Working in high humidity conditions, which may lead to condensation and frost, can impact ranging performance and may damage the module.

6.2 Precautions for use

6.2.1 Avoid ranging targets within 5m, especially close-range highly reflective targets (glass, smooth metal surfaces, etc.). Prevent multiple ranging modules from operating toward each other at close range, and avoid high-energy laser light sources shooting directly at the receiving antenna of the ranging module. Keep the receiving lens blocked during product assembly and commissioning to prevent potential permanent damage to detection components.

6.2.2 Do not disassemble any parts of the product. Any modifications made to the electronic, mechanical, and optical components will void the warranty. Before using the product, carefully read the manual. Usage beyond specified working conditions (working voltage/temperature range, impact vibration level, etc.) may cause permanent damage, voiding the warranty. If damage occurs, contact the after-sales department for assistance.

6.2.3 Ranging objects with low surface reflectivity in strong light environments may reduce ranging performance. Ranging through materials like glass, optical filters, plexiglass, or other translucent substances may result in significant ranging errors. Rapid temperature changes and adverse weather conditions such as rain, snow, fog, haze, and dust can affect performance.

6.2.4 During transportation and storage, please keep the product stored in the provided packaging. When using the product, ensure it is kept away from water and other liquids to prevent dust or other contaminants. Keep the optical glass surface (transmitting and receiving windows) clean. If there is dust or stubborn deposits that are difficult to remove, please contact the after-sales department.