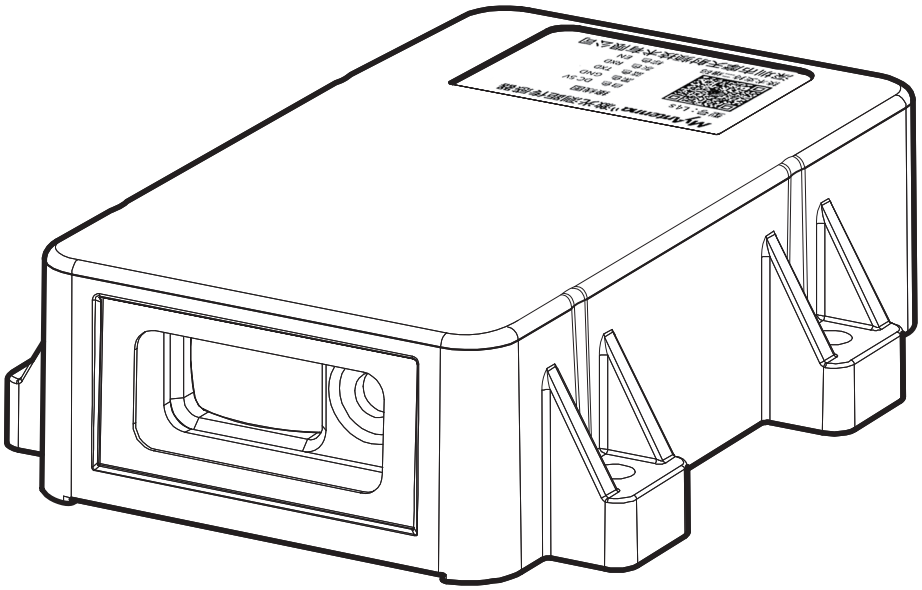
L4 Series

Laser Distance Sensor

User's Manual



Introduction

- Thank you for purchasing our products. Be sure you have read this manual and understood its contents before proceeding.
- This manual is only for client reference.
-

Change History

Date	Version	Change Description
01/06/2017	1.0	First draft
06/11/2019	1.1	Addition of the <Quick Start> chapter
28/11/2023	1.2	Updating manual layouts

Safety Policy

WARNING

- This product is intended to detect objects and does not have the control function to ensure safety such as accident prevention.
- Please read all safety instructions carefully before using this instrument.
- Do not use the product as a sensing device to protect the human body.
- Do not directly view or point the laser at an eye. This can create a hazard. Low-power visible lasers do not normally present a hazard but may present some potential for hazard if viewed directly for extended periods.
- Do not use this device in flammable or explosive environments.
- Do not use this device near strong electromagnetic interference.
- Do not disassemble or modify the device or the sensor module.

Cautions on Handling Laser Light

Laser Classification (Class 2)

The L4, L4s, L4s-Filled produce visible Class 2 laser beams. (Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007)

Laser Hazardous Class

Classification according to IEC 60825-1-2014.

Class	Model	Description of hazardous evaluation
Class 1	—	Safe under reasonably foreseeable conditions of operation
Class 1M	—	Safe under reasonably foreseeable conditions of operation, except for diverging or large area beams when collecting optics used. Hazardous when collecting optics used.
Class 2	L4 L4s L4s-Filled	Visible beam, low power. Blink response of eye affords protection.
Class 2M	—	Visible beam, low power. Blink response of eye affords protection. Hazardous when collecting optics used.
Class 3R	—	Direct intrabeam viewing is hazardous, but risk is lower than for 3B.
Class 3B	—	Direct intrabeam viewing is always hazardous.
Class 4	—	High power. Capable of producing hazardous diffuse reflections. Capable of producing skin burns and fire hazardous.

Warning Label

To ensure stable performance, please observe these precautions:

- Purchase Notes for Glue-Filled Series: Once damaged, the glue-filled sensors cannot be repaired. Please strictly follow the instructions for power supply and wiring, and avoid any incorrect connections.
- Due to the exposed components of L4, please follow proper procedures to prevent damage from electrostatic discharge/transient voltage and current/power short circuits/squeezing or impact.
- Please don't touch the circuit board directly, especially sensitive optical components. Please make sure to wear anti-static gloves or wristbands.
- Make sure the wiring is strong. It is best to solder the cables and do not use pins to avoid unstable contact, which may lead to frequent power on and off. Instantaneous power off and on again may damage the control chip and optical components.
- Transparent liquids and oils need to be measured by adding a reflective float to the liquid surface.
- Black substances, such as crude oil, coal and other black gelatin and solid materials, require the laser to be vertically directed to a smooth surface, and the indoor environment can be stably measured up to 12 meters.
- Strongly reflective surfaces, such as mirror painted surfaces, smooth surfaces of stainless steel, aluminum plates, etc., need to be equipped with auxiliary materials for diffuse reflection. Use white paper for short distances and add 3M diffuse reflection material for long distances. First, connect the computer to check the amount of light returned. You can measure the distance normally between 60# and 3000#. If it is less than 60#, adjust the reflection angle (the strongest when it is vertical) or paste white paper to enhance the reflection signal.
- If it is greater than 3000#, adjust the reflection angle (inclined at a certain angle) or change to a frosted surface to weaken the signal strength.
- Avoid spraying insulating paint or other chemicals on the laser source and lens of L4. Otherwise, the coating on the laser source or lens will be damaged by chemicals and the laser cannot be emitted or received.
- To avoid mutual interference, the minimum distance between laser beams should be at least 15 cm (not less than 10cm) when using multiple modules.
- If glue filling is required, please consult a technician before proceeding. Otherwise, the light propagation path will be blocked and measurement will be impossible.
- Please read this manual thoroughly and follow the steps, otherwise repeated communication will affect your efficiency.

Electromagnetic Compatibility (EMC)

"Electromagnetic Compatibility" refers to the ability to operate stably in the presence of electromagnetic radiation and static charge environments without causing electromagnetic interference to other devices. Although the L4 series already meets strict regulations and standards in this regard, it cannot completely rule out the possibility of potential interference to other devices.

Trash Disposal

This product should not be discarded as household waste. Please dispose of this product in accordance with the regulations implemented in the country/region of use.

Order Information			
Model	**Cable Connector Type**	**Ordering Code**	**Description**
L4-40	Bottom 5 Pins 2.54mm Pitch	M03-0100360000	PCBA, 0.03-40m, Working temperature: -10 — 50°C
L4-80	Bottom 5 Pins 2.54mm Pitch	M03-0100370000	PCBA, 0.03-80m, Working temperature: -10 — 50°C
L4s-40	M8 Straight (Detachable 2m Cable)	M03-0401400000	IP56, Waterproof and dustproof housing, 0.03-40m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0401500000	
L4s-80	M8 Straight (Detachable 2m Cable)	M03-0401600000	IP56, Waterproof and dustproof housing,0.03-80m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0401700000	
L4s-40 Filled	M8 Straight (Detachable 2m Cable)	M03-0401800000	IP67, Shockproof, waterproof and dustproof housing, 0.03-40m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0401900000	
L4s-80 Filled	M8 Straight (Detachable 2m Cable)	M03-0402000000	IP67, Shockproof, waterproof and dustproof housing, 0.03-80m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0402100000	

Table of Contents

1.0 Product Overview and Features

Product Overview

The L4 series are single-point laser distance sensors based on the principle of phase-shift laser ranging, a type of time-of-flight measurement method commonly used for medium to short-range distances. It offers millimeter-level accuracy, making it one of the most precise methods for measuring distances in medium and short-range applications. When a continuously modulated beam of light is directed at the target object, the light beam reflects back, and the distance is calculated by analyzing the phase changes in the received light.

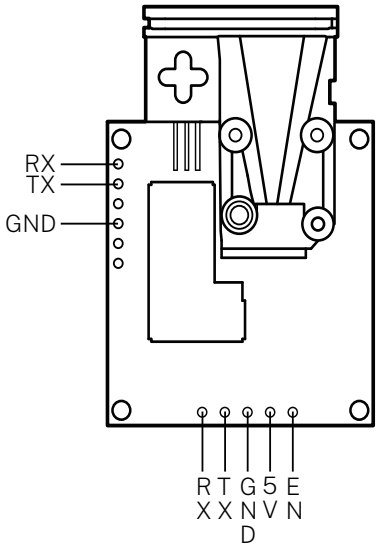
The L4 series laser rangefinder products have a 1-millimeter resolution and find applications in a wide range of fields. They are suitable for a wide temperature range and offer high accuracy. These sensors are well-suited for monitoring and controlling small targets at medium to short distances.

Product Features

- **Long Range:** The L4 series offer a maximum range of up to 80 meters, making it suitable for various long-distance ranging needs.
- **Accurate Measurement:** It exhibits excellent temperature drift characteristics, automatically compensating for errors caused by temperature changes.
- **High Data Rate:** The system supports data acquisition rates of 10Hz and 20Hz, providing high-speed data collection.
- **High Precision:** It boasts high precision with an error margin of only ±1mm.
- **High Signal-to-Noise Ratio:** The system has a high signal-to-noise ratio, which means that measurement results are hardly affected by factors such as the target's color, surface roughness, and material.
- **Compact Design:** The system is compactly designed, making it convenient for use and integration into various applications.
- **Easy to Assemble:** Supports two types of pin interface configurations, either a 6-pin 2.54mm single-row pin/hole or a 5-pin 2.54mm single-row pin/hole, facilitating easy integration into a mainboard.

2.0 Wiring Diagram and Dimensions

2.1 Electrical Wiring Diagram



Bottom 5 pins 2.54mm pitch single row pin/hole interface	
Power interface	+5VDC,GND
232 interface	Where RX is receiving and TX is transmitting

Left 6 pins 2.54mm pitch single row pin/hole interface
Where RX is for receiving and TX is for transmitting

⚠ **Note:** The EN pin is usually not connected. If you need EN to control the power supply of the entire module circuit, you can remove the resistor in the red circle in the figure below. The EN pin has a high level to turn on the power and a low level to turn off the power. If you need to power the device with a battery, you should replace the reverse protection diode in the blue box with a 0-ohm resistor. The power supply voltage can be 3.5V to 4.2V.

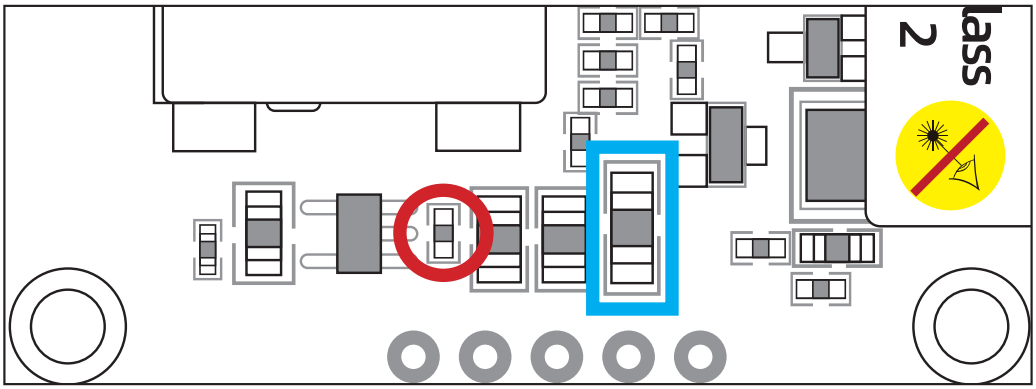


Figure 1. L4 module partial (bottom) diagram

2.2 L4/L4s/L4s-Filled to TTL/232 to USB Connecting

◎ L4 to USB Wiring Instructions

1. As shown in Figure 2, the 5V and GND of the sensor are connected to the 5V and GND of the 232 to USB converter respectively.
2. The RX of the sensor is connected to the 232TX of the 232 to USB converter, and the TX of the sensor is connected to the 232RX of the 232 to USB converter.

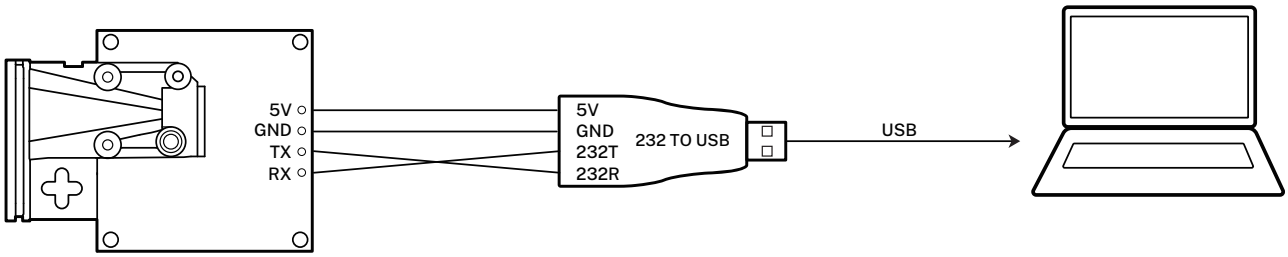


Figure 2. L4 to USB wiring diagram
(For details on the function of the EN pin, please refer to the description in 2.1 electrical wiring diagram)

◎ L4s/L4s-Filled to USB Wiring Instructions

1. As shown in Figure 3, the white wire is connected to the 5V DC power supply of the 232 to USB converter and the black wire is connected to the GND of the converter.
2. The blue wire is connected to the 232RX of the 232 to USB converter, and the gray wire is connected to the 232TX of the 232 to USB converter.
3. The brown wire is no need to connect.

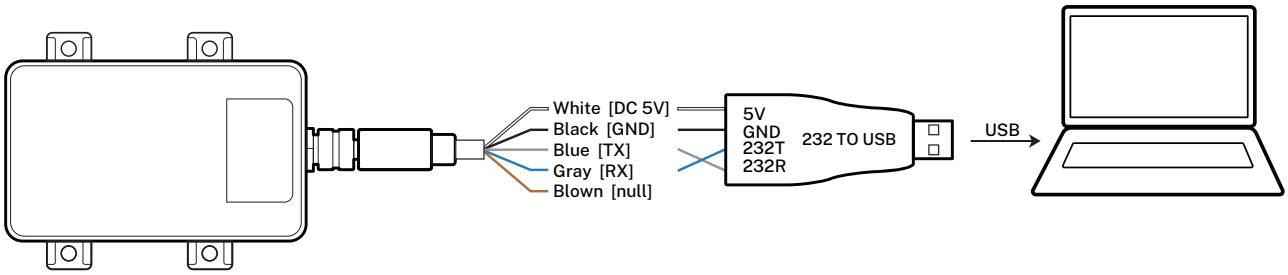


Figure 3. L4s/L4s-Filled to USB wiring diagram (brown wire is not connected)

◎ The USB to 232 converters of our company feature magnetic upper covers. Upon opening, there is a small screwdriver inside for conveniently and securely fastening after wiring.

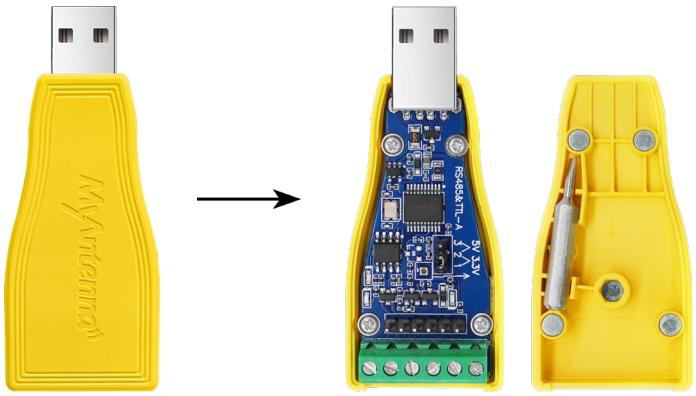
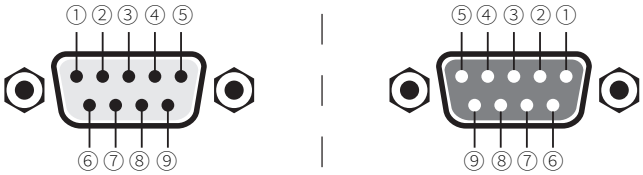


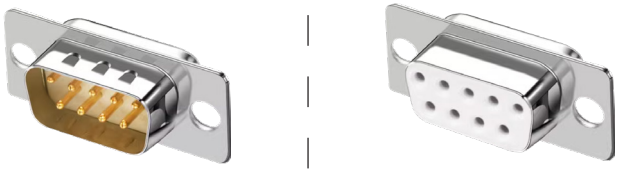
Figure 4. the USB to 232 converter

2.3 L4/L4s/L4s-Filled to DB9 Connecting to

DB9 Male Connector (9 Pins) | DB9 Female Connector (9 Holes)



Pins start from the left | Holes start from the right



DB9 Pins Description			Connection to Pins of the L4/L4S
1	DCD	Data Detection	
2	RXD	Data Reception	TX
3	TXD	Send Data	RX
4	DTR	Receive Ready	
5	GND	Signal Ground	GND
6	DSR	Send Ready	
7	RTS	Request to Send	
8	CTS	Clear to Send	
9	RI	Ring Indicator	

◎ L4 to DB9 Wiring Instructions

1. As shown in Figure 5, externally supply DC5V to the L4 module. Ensure that the DB9 adapter cable shares a common ground with the module.
2. Connect the RX of the sensor to the TXD (pin 3) of the DB9 adapter cable. Connect the TX of the sensor to the RXD (pin 2) of the DB9 adapter cable.

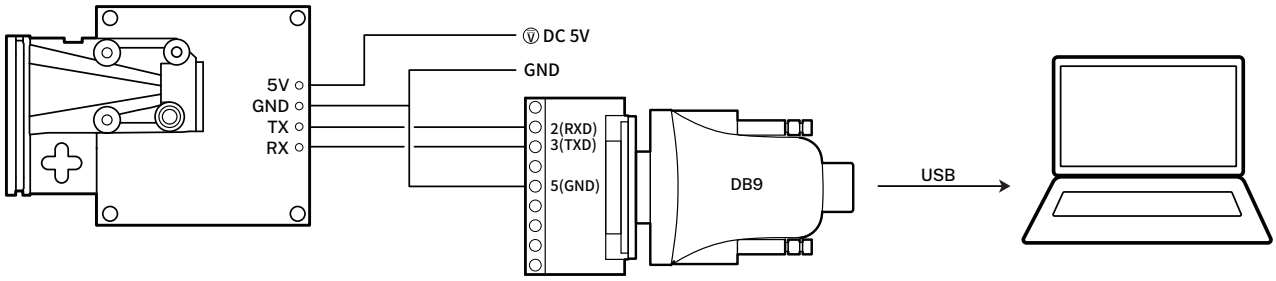


Figure 5. L4 to DB9 wiring diagram

◎ L4s/L4s-Filled to DB9 Wiring Instructions

1. Follow the instructions in Figure 6 to supply DC5V externally to the L4 module. Ensure that the DB9 adapter cable shares a common ground with the module.
2. Connect the blue wire to pin 2 (RXD) of the DB9 adapter cable, and the gray wire to pin 3 (TXD) of the DB9 adapter cable.
3. Leave the brown wire unconnected.

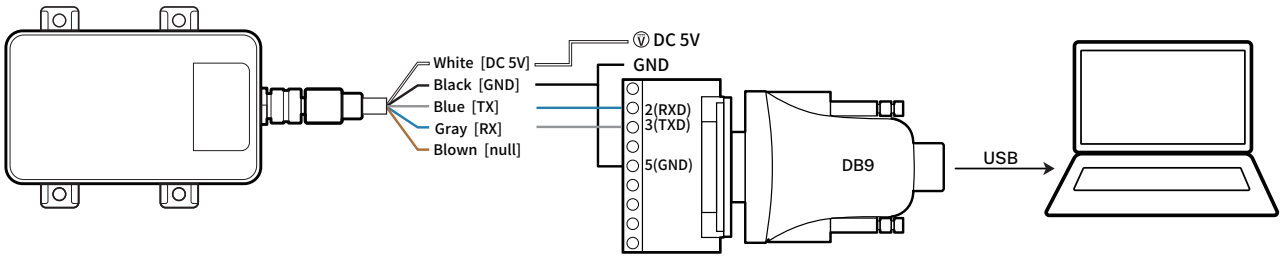


Figure 6. L4s/L4s-Filled to DB9 wiring diagram (brown wire is not connected)

◎ The Aviation Cable Connecting Instrument

As shown in Figure 7, the interface is type B. Pay attention to the limit direction. Align the cable port ⑤ with the corresponding product interface port ⑤ , then insert and tighten.

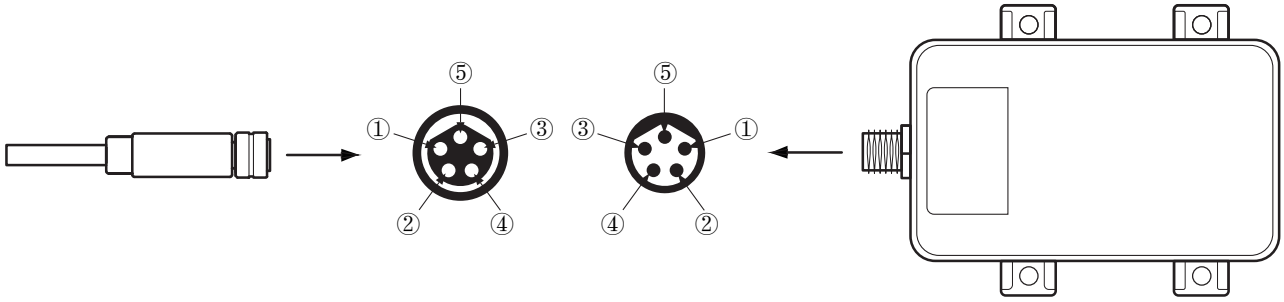


Figure 7. The aviation cable and product connector diagram

Number	1	2	3	4	5
Interface	NC	DC 5V	TX	GND	RX
Corresponding cable color	Brown	White	Blue	Black	Gray

2.4 L4/L4s/L4s-Filled Dimensions

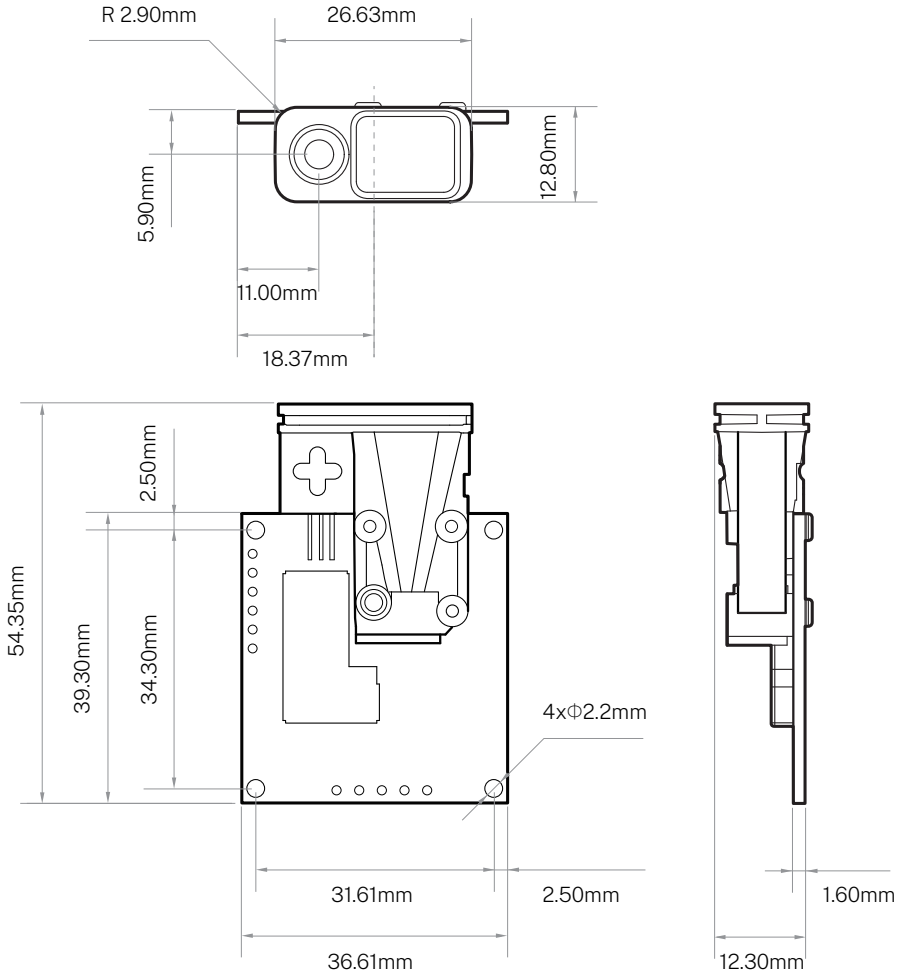


Figure 8. L4 dimensions

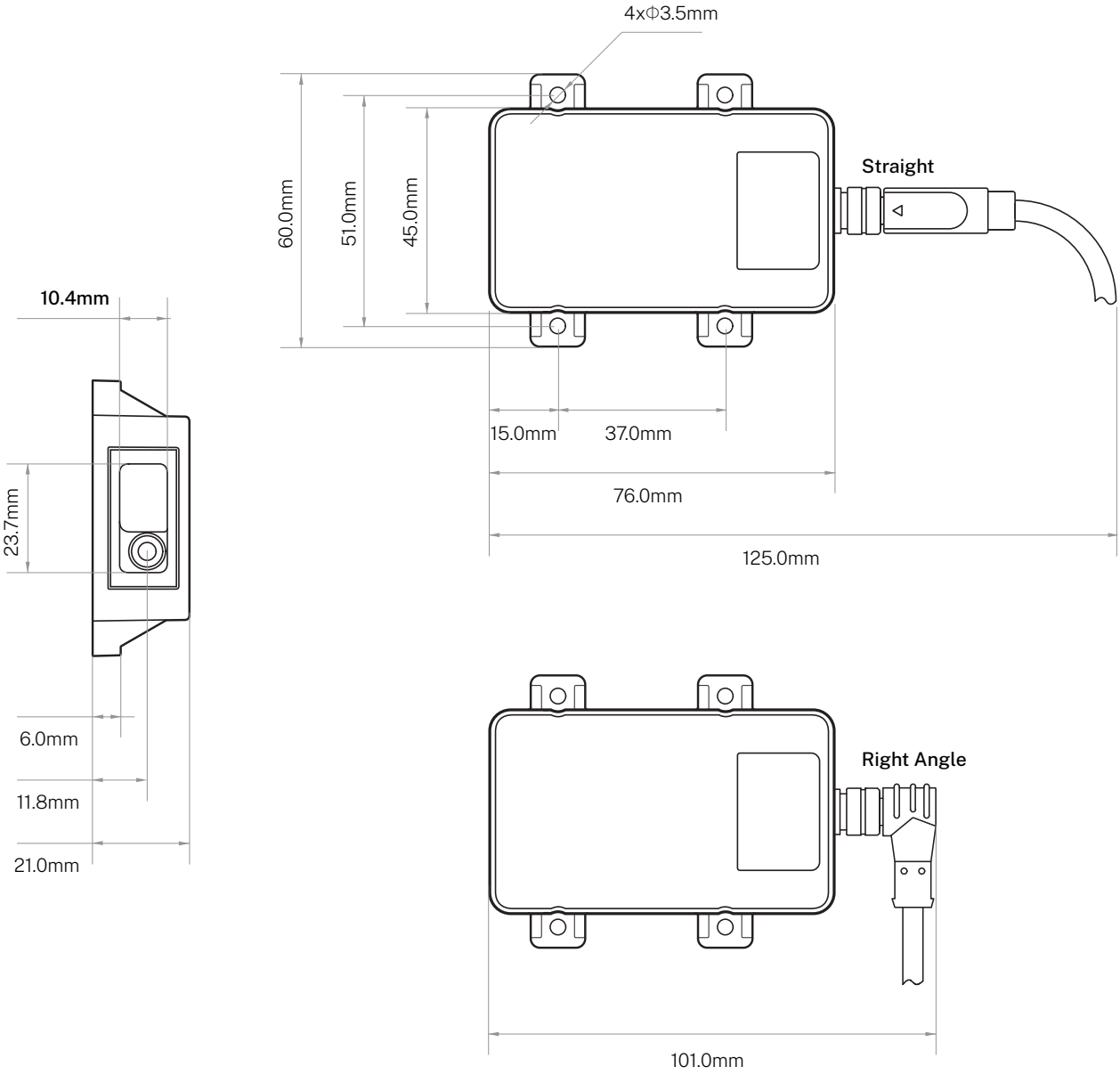
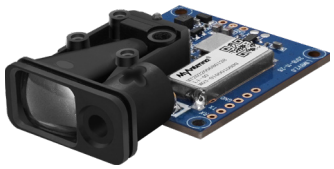


Figure 9. L4s&L4s-Filled dimensions

(Default straight interface, if right angle interfaces are required, please indicate it when ordering.)

3.0 Parameters

Product model	L4	L4s	L4s-Filled
Product image			
Power supply	DC 5V		
Power consumption	20Hz, 0.6W, standby <0.2W		
System startup time	600ms		
Optical device parameters	Wavelength : 650nm Optical power : <1mW (Class 2 laser) Spot type : point laser Spot size : ≤ 6mm at 10m (See 7.0 Measurement Distance and Spots Sizes for details) Working life : Approximately 20,000 hours (50,000-60000 hours for customized wide temperature version)		
Communication interface	RS232		
Baud rate	9600/19200/38400/115200 Baud, default 38400		
Serial port format	Baud rate : 38400 Data bits : 8 Stop bits : 1 Verification : none Flow Control : none		
Communication protocol	Modbus RTU ASCII Custom Hex		
Sampling rate	10Hz, 20Hz, default 20Hz		
Measurement range	0.03M-40M/0.03M-80M (Available for selection)		
Zero reference point	Default housing frontend (Adjustable)		
Resolution	0.1mm		
Absolute accuracy	±(1mm+ D*5‰), D is the actual measurement distance		
Repeatability	±1mm		

Working temperature	-10 — +50°C (Customizable -20 — +65°C , please contact us for details)		
Storage temperature	-20 — +60°C (Customizable -40 — +85°C , please contact us for details)		
Operating humidity	< RH85%		
Waterproof rating	—	IP56	IP67
Cable	—	2m Aviation cable	2m Aviation cable
Net weight	15.8 g	55.6 g	84.3 g
Gross weight	17.1 g	206 g	233 g
Size	54.35*36.61*14.3mm	100*60*21mm (Right angle interface) 125*60*21mm (Straight interface)	

- With strong reflectors, longer distances can be measured. The measurement range can be set through the downstream command, and the maximum setting is 40/80 meters.
- In harsh environments, such as outdoor sunlight, the performance will be affected. It can be used with a target reflector to improve performance.
- In fast mode, the recovered light signal is weak, the error will become larger, and there are certain requirements for the measurement target and distance, and not suitable for outdoor daytime applications.

4.0 Serial Port Identification

After connecting according to the instructions, plug the serial 232 to USB adapter into the computer, open the computer device manager, and check whether the driver has been successfully installed on the port. If not, you need to find the supplier of the adapter to obtain it. Driver or download it from their official website and make sure the installation is successful, as shown below:

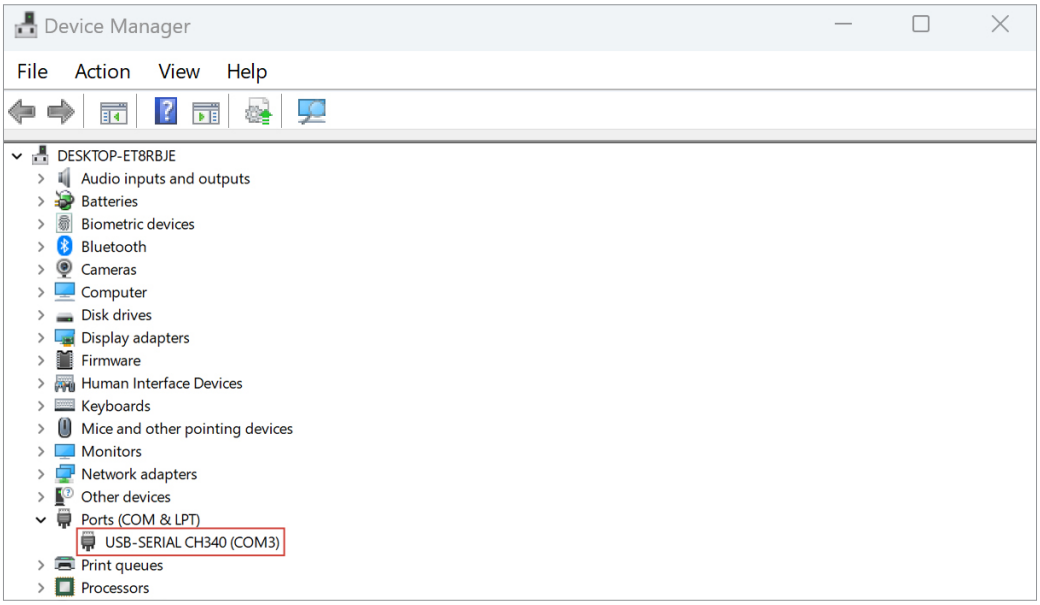


Figure 10. Serial port driver location diagram

5.0 Power-on Test Steps

◎ After the serial port recognition is successful, aim the sensor at a target distance of more than 3cm. Do not aim at black objects or glass. Proceed as follows:

1. Power on the sensor and check whether the laser light is on. The sensor lights up the red laser by default when it is powered on. If the laser light is successfully lit, open the SSCOM serial port assistant software provided by our company, select the corresponseing COM number, and select the baud rate as the factory default value L4 is 38400, and other parameters do not need to be configured.
2. Click to open the serial port, enter the single measurement command iSM (lowercase i, uppercase SM) in the command window, click Send, and see if the measurement value is returned, as follows:

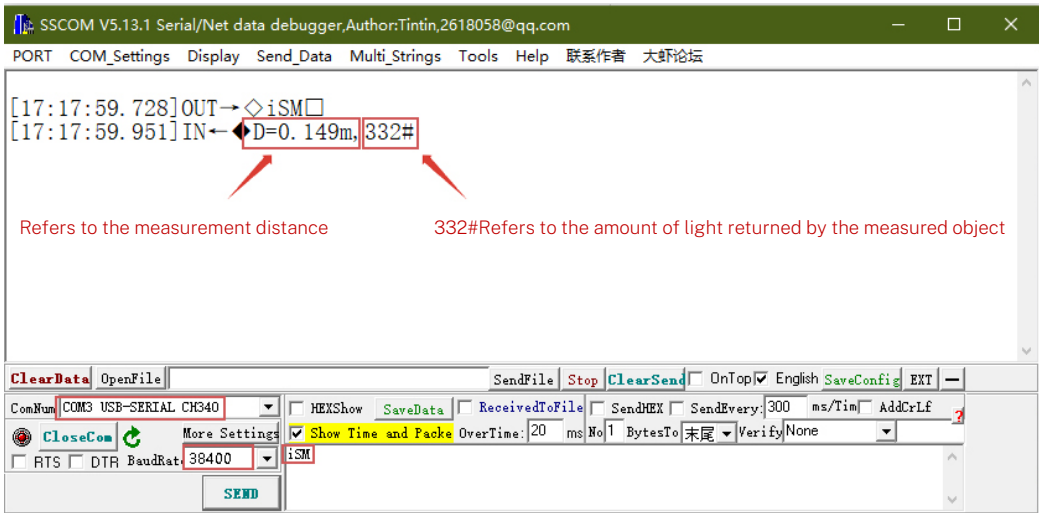


Figure 11. Serial port assistant software window diagram

◎ **If the distance value is successfully measured, the sensor verification is successful.**

◎ **If the sensor laser does not light up or it does but the test does not return any value, please do the following checks:**

1. Check whether the signal line rx. tx is firmly connected or connected incorrectly? (L4 requires tx and rx cross wiring.)
2. Measure the power supply voltage. Does it meet the 5V requirement?
3. Is the COM number selected correctly?
4. Is the baud rate selected as 38400?
5. Check whether the command is entered correctly, with i in lowercase and SM in uppercase. (Commands are case-sensitive)
6. If the 5V power is not taken through USB, the power supply and serial port ground supply are required, otherwise it will malfunction.
7. If you still cannot connect through the serial port assistant after following the above steps, it may also be caused by this reason. It is recommended to purchase our converter.

If the error code returned is "E=255", please scroll down to the error code section to check the cause of the error or contact our technical personnel.

◎ After the detection sensor can measure successfully, it can be connected to your device or host computer. If you do not need to develop software, you can directly use the SSCOM serial port assistant to measure the distance and save the measurement data. Please refer to the ASCII command below. If you need to develop host computer software, please refer to the following MODBUS RTU protocol.

6.0 Communication Protocol

This product supports the following three protocols (ASCII, Modbus RTU, and HEX). In the absence of command execution by the product, you can send the corresponding protocol command, and the product will automatically execute the protocol you intend to apply.

Baud rate: 9600/19200/38400/115200, Default L4 is 38400.

Format: 8n1

6.1 ASCII Text Communications Protocol Format

Instruction	Function
iGET:X	Get parameters
iSET:X,Y	Setting parameters
iSM	Single measurement
iACM	Continuous measurement
iFACM	Fast and continuous measurements
iHALT	Stop measurement
iLD:X	Laser on/off

<CR><LF> : Represents carriage return and line feed "\r\n".

6.1.1 Distance Offset (iGET:1/iSET:1,X)

Get distance offset

【Host】iGET:1

【L4】OFFSET=X<CR><LF> OK<CR><LF>

Set distance offset

【Host】iSET:1,X

【L4】OK<CR><LF>

In which X is the distance offset value, the unit is millimeters, the range is -10000 — 10000, the default is 0.

For example

Set distance offset -10 mm — — iSET:1,-10.

6.1.2 Measuring Range (iGET:2/iSET:2,X)

Get range

【Host】iGET:2

【L4】RANGE=X<CR><LF> OK<CR><LF>

Set range

【Host】iSET:2,X

【L4】OK<CR><LF>

In which X is the measuring range value, the unit is millimeters, the range is 500 — 80000, the default is 40000 (40 meters).

For example

Set range 60 meters - iSET: 2,60000.

6.1.3 Baud Rate (iGET:3/iSET:3,X)

Set baud rate

【Host】iSET:3,X

【L4】OK<CR><LF>

In which X is the baud rate, supporting 9600/19200/38400/57600/115200,
The default L4 is 38400.

For example

Set the baud rate to 9600 - iSET:3,9600.

6.1.4 Protocol Format Type (iGET:4/iSET:4,X)

Get protocol type

【Host】iGET:4

【L4】PROTOCOL=X<CR><LF> OK<CR><LF>

Set protocol type

【Host】iSET:4,X

【L4】OK<CR><LF>

In which X is the protocol format type value. 0=MODBUS RTU protocol; 1=ASCII protocol; 2=HEX protocol; the default is 1=ASCII protocol.

Note: This parameter will affect the power-on status of the L4 module: the completion of information output during power-on initialization and the protocol type format that will be run when the power-on automatic measurement mode is valid.

For example

Set MODBUS RTU protocol - iSET:4,0.

6.1.5 Output Fistance Number Format (iGET:5/ iSET:5,X)

Get the output distance number format

【Host】iGET:5

【L4】DATATYPE=X<CR><LF> OK<CR><LF>

Set the output distance number format

【Host】iSET:5,X

【L4】OK<CR><LF>

In which X is the output distance digital format definition. Meter unit, 0=three decimal places; 1=four decimal places, the default is 0=three decimal places.

For example

Set the output distance number format to four decimal places - iSET:5,1.

6.1.6 Slave Device Address (iGET:6/iSET:6,X)

Get Slave device address

【Host】iGET:6

【L4】ADDRESS=X<CR><LF> OK<CR><LF>

Set Slave device address

【Host】iSET:6,X

【L4】OK<CR><LF>

Among them, X is the slave device address (involved in MODBUS-RTU protocol). Range 1—247. Factory default is 1.

For example

Set the slave device address to 4 - iSET:6,4.

6.1.7 Measurement Output Rate (iGET:7/iSET:7,X)

Get Measurement Output Rate

【Host】iGET:7

【L4】FREQUENCY=X<CR><LF> OK<CR><LF>

Set Measurement Output Rate

【Host】iSET:7,X

【L4】OK<CR><LF>

In which X is the measured output rate. Support 10/20. The factory default is 20, which means about 20HZ output rate.

Note: This parameter is valid in fast continuous measurement mode.

For example

Set the measurement output rate to 20 - iSET:7,20.

6.1.8 Power On Automatic Measurement Identification (iGET:8/iSET:8,X)

Get Power on automatic measurement identification

【Host】iGET:8

【L4】AUTMEAS=X<CR><LF> OK<CR><LF>

Set Get Power on automatic measurement identification

【Host】iSET:8,X

【L4】OK<CR><LF>

Among them, X is the automatic measurement mark after power-on. Range 0 — 2. 0=Automatic measurement on power-on is invalid; 1=Automatic continuous measurement on power-on; 2=Automatic and rapid continuous measurement on power-on; the factory default is 0.

Note: The power-on automatic measurement function requires the protocol format type to be set first (iSET:4,X).

For example

Set automatic continuous measurement on power-up - iSET:8,1.

6.1.9 Single Measurement (iSM)

【Host】Request iSM

【L4】Normal Response D=Xm,N#<CR><LF>

Error response E=Y <CR><LF>

Among them,

X is the distance information (such as 1 meter-1.000);

N is the amount of light return (such as 500);

Y is the fault code (such as 258), see appendix description;

Once the single measurement is completed, the laser is turned off.

For example

D=1.314m, 520#<CR><LF> means the distance is 1.314 meters and the amount of light returned is 520

E=258<CR><LF> means out of range.

6.1.10 Continuous Measurement (iACM)

【Host】Request iACM

【L4】Normal Response D=Xm,N#<CR><LF>

Error response E=Y <CR><LF>

The analysis description is the same as single measurement (iSM)

Note: The Host only needs to send the command once, and after the L4 module responses, it will continuously measure and output information.

Applicable scenarios

Applications where distance changes relatively quickly.

6.1.11 Fast Continuous Measurement (iFACM)

【Host】Request iFACM

【L4】Normal Response D=Xm<CR><LF>

Error response E=Y <CR><LF>

Among them,

X is the distance information (such as 1 meter-1.000);

Y is the fault code (such as 258), see appendix description.

For example

D=1.314m<CR><LF> Indicates that the distance is 1.314 meters and the amount of light returned is 520.

E=258<CR><LF> Indicates out of range.

Note: The Host only needs to send the command once, and after the L4 module responses, it will quickly and continuously measure and output information.

Applicable scenarios

Distance changes more slowly and requires more precise measurements for applications.

6.1.12 Stop Measurement (iHALT)

【Host】Request iHALT

【L4】Response STOP<CR><LF> OK<CR><LF>

In continuous measurement or fast continuous measurement mode, send this command to stop measurement and the laser will turn off.

6.1.13 Laser On/Off (iLD:X)

Laser on

【Host】Request iLD:1

【L4】Response LASER OPEN<CR><LF> OK<CR><LF>

Laser off

【Host】Request iLD:0

【L4】Response LASER CLOSE<CR><LF> OK<CR><LF>

6.1.14 Check Whether Version Information Is Printed After Power-on

Send:iGET:9

Response:PON-MSGOUT=0, Indicates that version information will not be printed after powering on.

PON-MSGOUT=1, Indicates that version information will be printed after power-on.

6.1.15 Set Up Whether To Print The Version Number After Power-on

iSET:9,0 Set up not to print version information after power on.

iSET:9,1 Set up to print version information on power-on

Response: ok.

6.1.16 Check Whether The Laser Light Is Turned On After Power-on

Send: iGET:10

Response: PON-LD=0, Indicates that the laser light does not light up when the power is turned on.

PON-LD=1, Indicates that the laser light is on when the power is turned on.

6.1.17 Set Up Whether To Turn On The Laser Light After Power-on

iSET:10,0 Set the laser light not to light up when the power is turned on.

iSET:10,1 Set the laser light to light up when power is turned on.

Response:ok.

6.2 MODBUS RTU Communication Protocol

Request format frame				
1Byte	1Byte	2Bytes	2Bytes	2Bytes
Address code	Function code	Initial address	Register number (N)	CRC

Response format frame				
Normal				
1Byte	1Byte	1Bytes	2*N Bytes	2Bytes
Address code	Function code	Number of bytes	Register value	CRC
Abnormal				
1Byte	1Byte	1Bytes	2Bytes	
Address code	Error code	Abnormal code	CRC	
Abnormal code definition: 0x01: Function code error 0x02: Wrong starting address 0x03: Wrong number of registers 0x04: Register value error 0x05: CRC error 0x06: Device busy Example error code: 0x83 = function code + 0x80				

CRC code calculation method: The calculation range of CRC is from the beginning of the address code to the end of the byte before the CRC. The low 8-bit byte of CRC16 is in the front and the high 8-bit byte are in the back.

See Appendix

Measuring distance: register address and data format.

Register address	Register description	Data format of return value
0x00 0x0F	Measure distance	Measure distance 4Bytes (high bit in front, low bit in back)

For Example:

a) Read Measurement Distance

Description	Address code	Function code	Initial address	Number of registers	CRC	
Send	0x01	0x03	0x00 0x0F	0x00 0x02	0xF4 0x08	
Normal response (The measured distance is 57.505m)						
Description	**Address code**	**Function code**	**Number of bytes**	**Register 1 value**	**Register 2 value**	**CRC**
Normal response	0x01	0x03	0x04	0x00 0x0	0xE0 0xA1	0x72 0x4B

Note (The distance in this instruction is 4 bytes, 0x00 0x00 0xE0 0xA1, the distance is 0x0000E0A1, converted to decimal is 57505mm)						
Normal response	0x01	0x03	0x04	0x80 0x00	0x01 0x05	0x12 0x60
Note (The distance in this command is 4 bytes, 0x80 0x00 0x01 0x05, the highest bit is 1, indicating a measurement failure, the fault code is 0105H=261, indicating that the measurement range is exceeded)						
If the starting address is wrong, the response is as follows						
Description	Address Code	Error Code	Exception Code	CRC		
Error response	0x01	0x83	0x02	0xC0 0xF1		
Note(Exception code is 0X02, indicating that the starting address is wrong)						

b) Check Whether Version Information Is Printed After Power-on

Send	**01 03 00 27 00 02 F4 00**
The first byte 01 is the device address, and the last two bytes F4 00 are the CRC code. After the device address is changed to another one, the CRC needs to be changed accordingly.	
Response	**01 03 02 00 01 B8 44**
of which the 4th/5th two-byte 00 01 is to print the version information after power on, and 00 00 is to not print the version information after power on.	

c) Set Up Whether Version Information Is Printed After Power-on

Send	**01 10 00 27 00 01 02 XX YY NN MM**
The first byte 01 is the device address, XXYY=00 00, configured not to print the version number upon power-on, XXYY=00 01, configured to print the version number upon power-on; NN MM is the CRC code.	
Response	**01 10 00 27 00 01 B1 C2**

d) Set Whether To Turn On The Laser Light After Power-on

Send	**01 10 00 29 00 01 02 XX YY NN MM**
The first byte 01 is the device address, XXYY=00 00, configured to turn off the laser light on power, XXYY=00 01, configured to turn on the laser light on power; NN MM is the CRC code.	
Response	**01 10 00 29 00 01 D0 01**

6.3 CUSTOM HEX Communication Protocol

Request format frame				
Frame header		**Data**		**Verification**
1Byte	1Byte	1Byte	1Bytes	1Bytes
Frame header 1	Frame header 2	Function code	Parameters (alternate)	BCC
A5	5A	02-Single measurement 03-Continous measurement 04-Fast continuous measurement 05-Stop measurement	00	XOR verification: frame header + data
Response format frame				
Frame header		**Data**		**Verification**
1Byte	1Byte	1Byte	4Bytes	1Bytes
Frame header 1	Frame header 2	Function code	Distance value or fault code	BCC
B4	69	Normal: function code Error: 0x80 | Function code	High byte first	XOR check: frame header + data

Note: CUSTOM HEX communication protocol does not support parameter acquisition or setting operations.

6.3.1 Single Measurement

Function code 02

【Host】Request	A5 5A 02 00 FD
【L4】Normal response	B4 69 02 00 00 01 90 4E
【L4】Error response	B4 69 82 00 00 01 02 5C
In the normal response, 00 00 01 90 is the measured distance value, 0x00000190 (hexadecimal) = 400 (decimal), which is 400mm.	
In the error response, the high bit of function code 82 is 1, indicating a fault, and the fault code is 0x00000102 (hexadecimal) = 258 (decimal), which indicates that the measurement range is exceeded. (see the appendix for Error code description)	

6.3.2 Continuous Measurement

Function code: 03

【Host】request	A5 5A 03 00 FC
【L4】Normal response	B4 69 03 00 00 01 90 4F
【L4】Error response	B4 69 83 00 00 01 02 5D
Analysis is the same as “single measurement”.	

6.3.3 Fast And Continuous Measurement

Function code: 04

【Host】Request	A5 5A 04 00 FB
【L4】Normal response	B4 69 04 00 00 01 90 48
【L4】Error response	B4 69 84 00 00 01 02 5A
Analysis is the same as “single measurement”.	

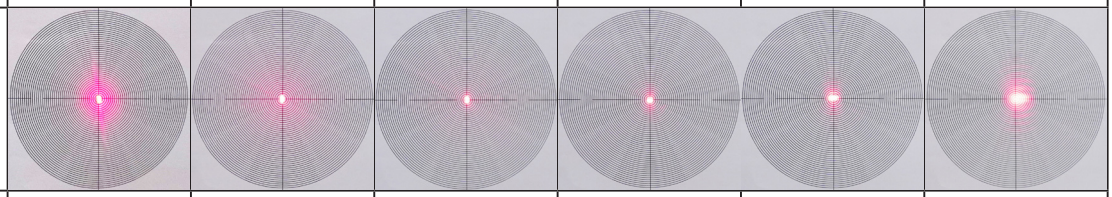
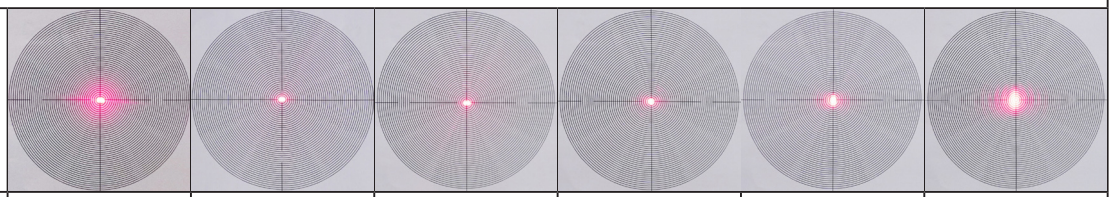
Note: Since this protocol cannot perform parameter operations, the measurement rate can be set through the ASCII text protocol.

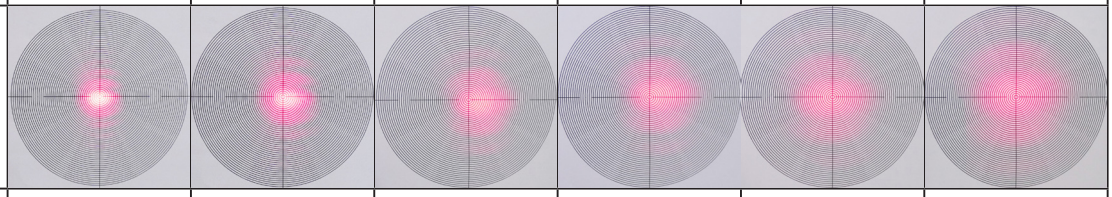
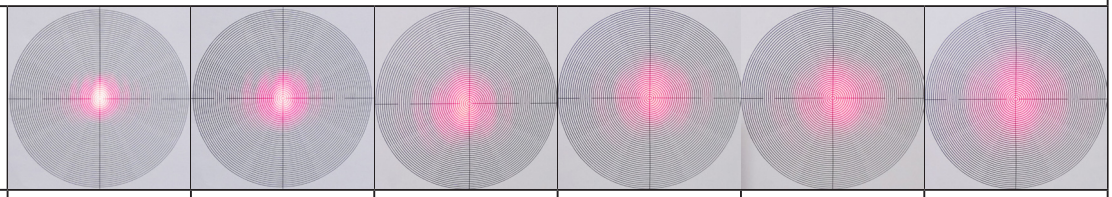
6.3.4 Stop Measurement

Function code: 05

【Host】Request	A5 5A 05 00 FA
【L4】Response	B4 69 05 00 00 00 00 D8
Measurement stops and the laser turns off.	

7.0 Measurement Distance and Spots Sizes

Range	0.05M	0.5M	1M	5M	10M	20M
Module flat test						
Spot size	3*4mm	3*4mm	3*4mm	3.5*4mm	6*3.5mm	10*6mm
Module side test						
Spot size	4*3mm	4*3mm	4*3mm	4*3.5mm	3.5*6mm	6*10mm

Range	30M	40M	50M	60M	70M	80M
Module flat test						
Spot size	9*12mm	14*10mm	22*12mm	24*14mm	22*16mm	24*18mm
Module side test						
Spot size	12*9mm	10*14mm	12*22mm	14*24mm	16*22mm	18*24mm

8.0 Appendix

8.1 CRC Calibration

/* CRC High-order byte value table */

```
const u8 auchCRCHi[] = {
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1,
0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1,
0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1,
0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41,
0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1,
0x81, 0x40,
0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40
} ;
```

/* CRC Low-order byte value table*/

```
const u8 auchCRCLo[] = {
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7, 0x05, 0xC5, 0xC4, 0x04, 0xCC, 0x0C,
0x0D, 0xCD,
0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09, 0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9, 0x1B, 0xDB,
0xDA, 0x1A,
0x1E, 0xDE, 0xDF, 0x1F, 0xDD, 0x1D, 0x1C, 0xDC, 0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2, 0x12, 0x13,
0xD3,
0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32, 0x36, 0xF6, 0xF7, 0x37, 0xF5, 0x35,
0x34, 0xF4,
```

```
0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A, 0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8,
0xE9, 0x29,
0xEB, 0x2B, 0x2A, 0xEA, 0xEE, 0x2E, 0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7,
0xE6, 0x26,
0x22, 0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2, 0x62, 0x66, 0xA6,
0xA7, 0x67,
0xA5, 0x65, 0x64, 0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F, 0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9,
0xA8, 0x68,
0x78, 0xB8, 0xB9, 0x79, 0xBB, 0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74,
0x75, 0xB5,
0x77, 0xB7, 0xB6, 0x76, 0x72, 0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0, 0x50, 0x90, 0x91, 0x51, 0x93, 0x53,
0x52, 0x92,
0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94, 0x54, 0x9C, 0x5C, 0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A,
0x9B, 0x5B,
0x99, 0x59, 0x58, 0x98, 0x88, 0x48, 0x49, 0x89, 0x4B, 0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D,
0x4C, 0x8C,
0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43, 0x83, 0x41, 0x81, 0x80, 0x40
} ;

u16 CRC16(u8 *Start_Byte,u16 Num_Bytes)
{
        u8  uchCRCHi = 0xFF;          // CRC high byte initialization
        u8  uchCRCLo = 0xFF;          // CRC low byte initialization
        u16 uIndex;                   // Pointer to CRC lookup table
while (Num_Bytes--)
        {
                uIndex = uchCRCLo ^ *Start_Byte++;     // Calculate CRC
                uchCRCLo = uchCRCHi ^ auchCRCHi[uIndex];
                uchCRCHi = auchCRCLo[uIndex];
        }
        return(uchCRCHi <<8 | uchCRCLo);
}

BCC XOR Calibration
u8 BCC(u8* dat,u16 len)
{
   u8 i;
   u8 bcc = 0;
   for(i=0;i<len;i++)
   {
      bcc ^= dat[i];
   }
   return bcc;
}
```

8.2 Error Code

Decimal	Hexadecimal	Description
0	0	No Error
140	8C	CUSTOM HEX Protocol function code error
141	8D	CUSTOM HEX Protocol check error
142	8E	CUSTOM HEX Protocol parameter error
252	FC	The temperature is too high (Above 60℃)
253	FD	The temperature is too low (Below -20℃)
255	FF	Weak reflection or calculation failure
256	100	Strong reflection
258	102	Beyong setting distance range
285	11D	Photosensitive device abnormality (Need a return to factory repair)
286	11E	Laser tube abnormality (Need a return to factory repair)
290	122	Hardware abnormality (Need a return to factory repair)

MODBUS_RTU Exception code	
0	No errors
0x01	Function code error
0x02	Wrong starting address
0x03	Wrong number of registers
0x04	Register value error
0x05	CRC Error
0x06	The device is busy.

9.0 Maintenance and After-sales Service

9.1 Maintenance

1. The instrument should be stored in a dry place and protected from dust.
2. Make sure the instrument power supply is reliably connected before starting up. Please do not switch the power on and off continuously to avoid damaging components or accelerating the aging of electronic components and reducing their lifespan.
3. Never immerse the laser rangefinder in water.
4. Keep the instrument lens clean and wipe away dust with cotton cloth soaked in alcohol.
5. Never use corrosive or oily substances to clean the instrument lens.
6. Check the instrument regularly, especially after the instrument is used abnormally, or before and after the instrument performs important measurements.

9.2 After-sales Service

1. **"7-day return service":** Suppose the product has non-human quality problems within 7 days from the date of sale, the manufacturer's inspection report is attached, and the packaging accessories are intact, customers can choose to return, exchange, or repair the product.
2. **"15-day exchange service":** Free exchange and repair services are supported with non-human quality problems within 15 days from the date of purchase of the instrument and the manufacturer's test report is attached. When exchanging, please ensure that the packaging accessories are intact.
3. **"30-day free maintenance": I**f the product has non-human quality problems within 30 days from the date of sale, the customer can choose to repair it. If the product still cannot be used normally after two consecutive repairs, the customer can choose to replace it with a new product of the same model.
4. **"One-year warranty service":** If quality problems occur with the product within one year from the date of purchase, the customer can send the machine to our designated maintenance center or our headquarters for inspection and repair. If parts need to be replaced during maintenance, the corresponding parts cost will be charged appropriately by our company. If there is no need to update parts, customers can enjoy free maintenance services.

9.3 After-sales Instructions

1. Factory warranty: All instruments are guaranteed by the factory or the service centers authorized by the factory. The company does not assume any responsibility for any issues not caused by our factory or designated service centers.
2. The included freebies are not covered by the warranty: Giveaways/freebies come with the purchase are not covered by replacement or warranty.
3. If customers return or replace an item, it should be returned in the same condition in which it was received, and it should include all items that were in the original package. Returns or replacements will not be accepted if the packaging is damaged, or missing any parts, or is damaged during return shipping because it wasn't packaged correctly, or the machine is used, scratched, or worn.

Warranty Policy

1. Warranty Period

Under normal use, a year warranty will be offered from the purchase date for malfunctions not caused by human factors.

2. Below circumstances are not applied for warranty and will be repaired for a fee.

- Damage caused by improper use, maintenance and storage by the buyer.
- Dismantled and repaired by oneself or at a repair center other than our factory.
- No warranty card or purchase invoice.
- The machine number on the warranty card is inconsistent with the repair product or has been altered;
- Product damage caused by force majeure.
- Parts that need to be replaced due to normal wear and tear.
- Loss or damage caused by abnormal factors such as temperature/humidity in the environment in which the instrument is used.
- Damage caused by improper operation.

3. When the instrument needs maintenance, please send it to the local dealer with the original purchase invoice/receipt.

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