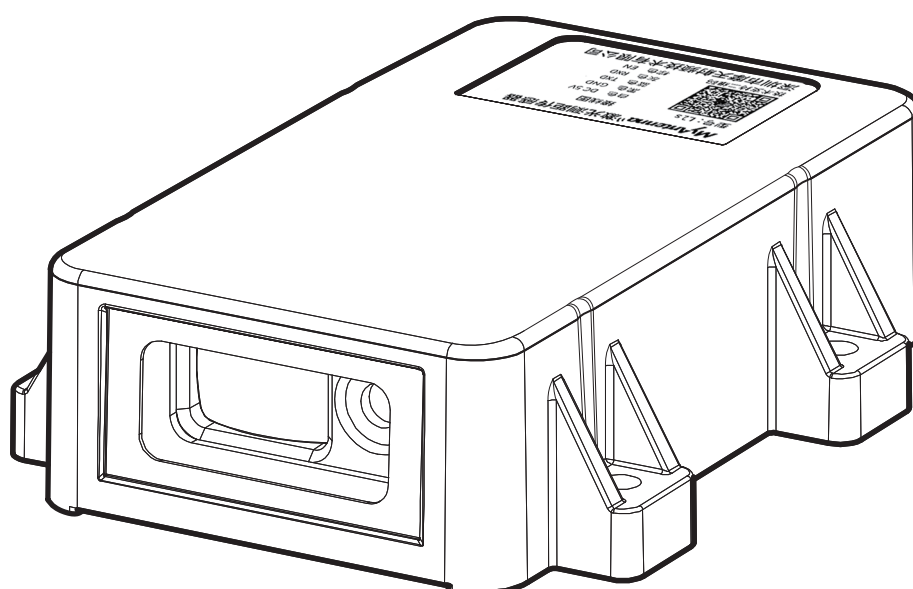


L2 Series

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.
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Change History

Date	Version	Change Description
01/06/2017	1.0	First draft
06/11/2019	1.1	Addition of the <Quick Start> chapter
08/08/2021	1.2	Adding <If laser turned on upon power-up> feature Adding <Power-Up Version Information Printing> feature Correcting Errors
25/04/2023	1.3	Adding signal strength register, error code register to Modbus RTU Updating Modbus RTU commands
17/11/2023	1.4	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 L2, L2s, L2s-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	L2 L2s L2s-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 L2, 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.
- To ensure secure connections, preferably soldering cables, avoiding using pins, and prevent unstable connect that may cause frequent power on and power off. Instant power interruptions and restarts will impact control chips and optical components and cause damage.
- For transparent liquids and oils, it is necessary to add a reflective buoy to the liquid surface for measurement;
- The black substances, such as crude oil, coal and other black coagulated and solid materials, require a smooth surface with laser vertical orthophoto, and the indoor environment can be stably measured up to 12 meters.
- Strongly reflective surfaces, such as mirrors, painted surfaces, shiny metals like stainless steel/aluminum, or other smooth surfaces, are less than ideal for direct measurement. Direct measurement on such surfaces can easily lead to abnormal measurement data or errors, requiring the addition of diffuse reflection auxiliary materials. Use white paper for short-distance measurements and add 3 meters of diffuse reflection material for long-distance measurements.
First, connect the device to a computer to check the amount of return light. Distance readings can be normally obtained between 60# and 3000#. If it is less than 60#, adjust the reflection angle (the strongest when 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 changed to a matte surface to weaken the signal strength.
- Avoid spraying the L2 laser source and lens with insulating paint or other chemicals, 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.
- When networking multiple modules, avoid using 120-ohm terminal resistors within 100 meters, as this will weaken the signal and affect communication.
- If need glue filling, please consult our technical engineer before operating, otherwise the light propagation path will be blocked and measurement will be impossible.
- Please read this manual thoroughly and follow the steps to operate, 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 L2 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
L2-40	Bottom 4 Pins 3.5mm Pitch	M03-0100320000	PCBA, 0.03-40m, Working temperature: -10 — 50°C
L2-80	Bottom 4 Pins 3.5mm Pitch	M03-0100340000	PCBA, 0.03-80m, Working temperature: -10 — 50°C
L2s-40	M8 Straight (Detachable 2m Cable)	M03-0400980000	IP56, Waterproof and dustproof housing, 0.03-40m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0400990000	
L2s-80	M8 Straight (Detachable 2m Cable)	M03-0401060000	IP56, Waterproof and dustproof housing, 0.03-80m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0401070000	
L2s-40 Filled	M8 Straight (Detachable 2m Cable)	M03-0401000000	IP67, Shockproof, waterproof and dustproof housing, 0.03-40m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0401010000	
L2s-80 Filled	M8 Straight (Detachable 2m Cable)	M03-0401080000	IP67, Shockproof, waterproof and dustproof housing, 0.03-80m, Working temperature: -10 — 50°C
	M8 Right Angle (Detachable 2m Cable)	M03-0401090000	

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1.0 Product Overview

The L2 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 L2 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. Which are well-suited for monitoring and controlling small targets at medium to short distances.

Product Features

- **Long Range:** The L2 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 $\pm 1\text{mm}$.
- **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 4-pin 3.5mm single-row pin/hole, facilitating easy integration into a mainboard.

2.0 Wiring Diagram and Dimensions

2.1 L2 Wiring Diagram

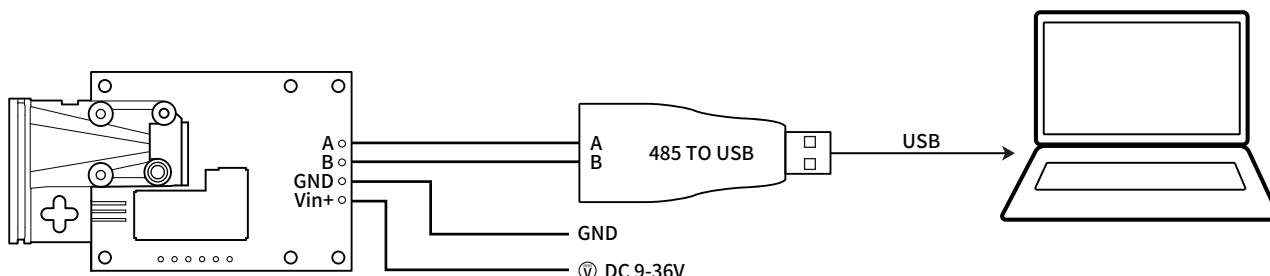


Figure 1. L2 wiring diagram

© L2 Wiring Instructions

1. As shown in Figure 1, connect the laser sensor's A to the 485 to USB converter's A (some manufacturer label it as T/R+), and the laser sensor's B to the 485 to USB converter's B (or T/R-);
2. Connecting the laser sensor's Vin+ to DC 9-36V's positive pole and the laser sensor's GND to DC 9-36V's negative pole;
3. Do not connect the sensor's GND to the converter's GND to avoid potential differences, which can lead to data errors or even damage to the interface chip.

2.2 L2s/L2s-Filled Wiring Diagram

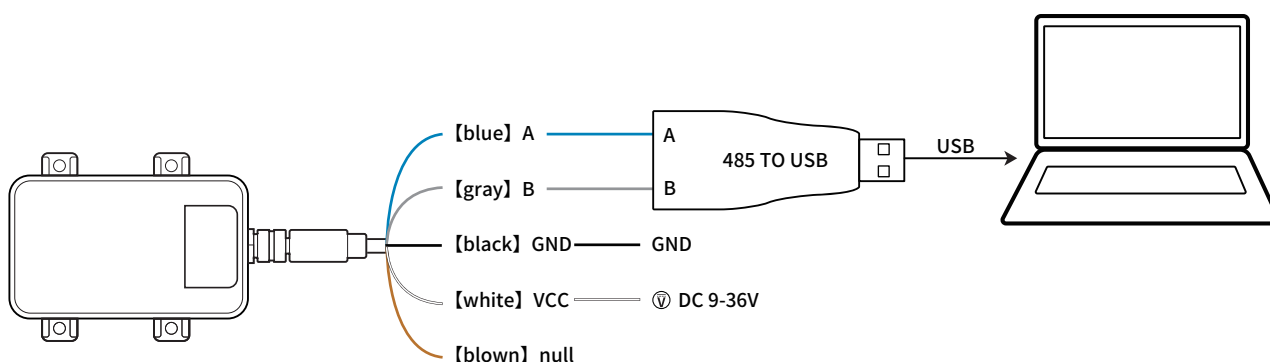


Figure 2. L2s/L2s-Filled wiring diagram (brown wire is not connected)

© L2s Wiring Instructions

1. As Shown in Figure 2, connect the blue wire to the 485 to USB converter's A (some manufacturer label it as T/R+), and grey wire to the 485 to USB converter's B (some manufacturer label it as T/R-);
2. Connecting the white wire to DC 9-36V power converter's positive pole and black wire to power supply's negative pole(GDN);
3. The brown wire is no need to be connected;
4. Do not connect the laser sensor's GND to the converter's GND to avoid potential differences, which can lead to data errors or even damage to the interface chip.

- © The USB to 485/TTL converters of our company feature magnetic upper covers. Upon opening, there is a small screwdriver inside for conveniently and securely fastening after wiring.

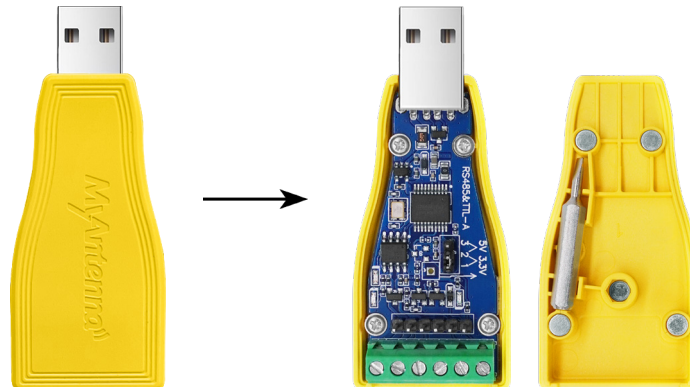


Figure3. The USB to 485/TTL converter

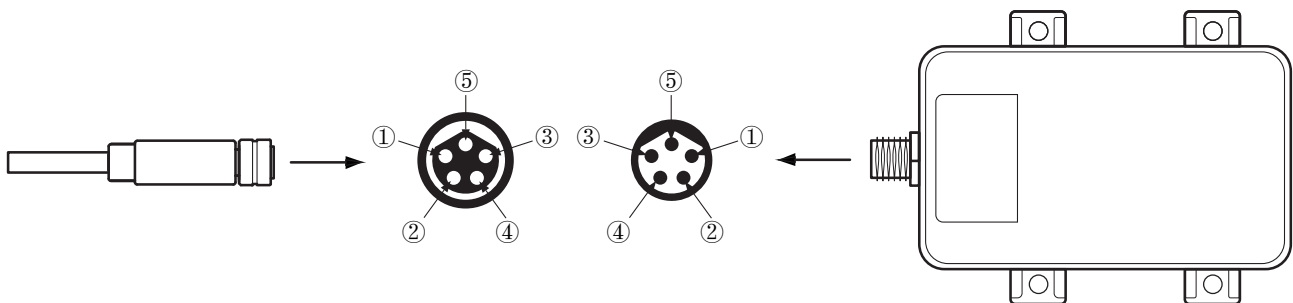
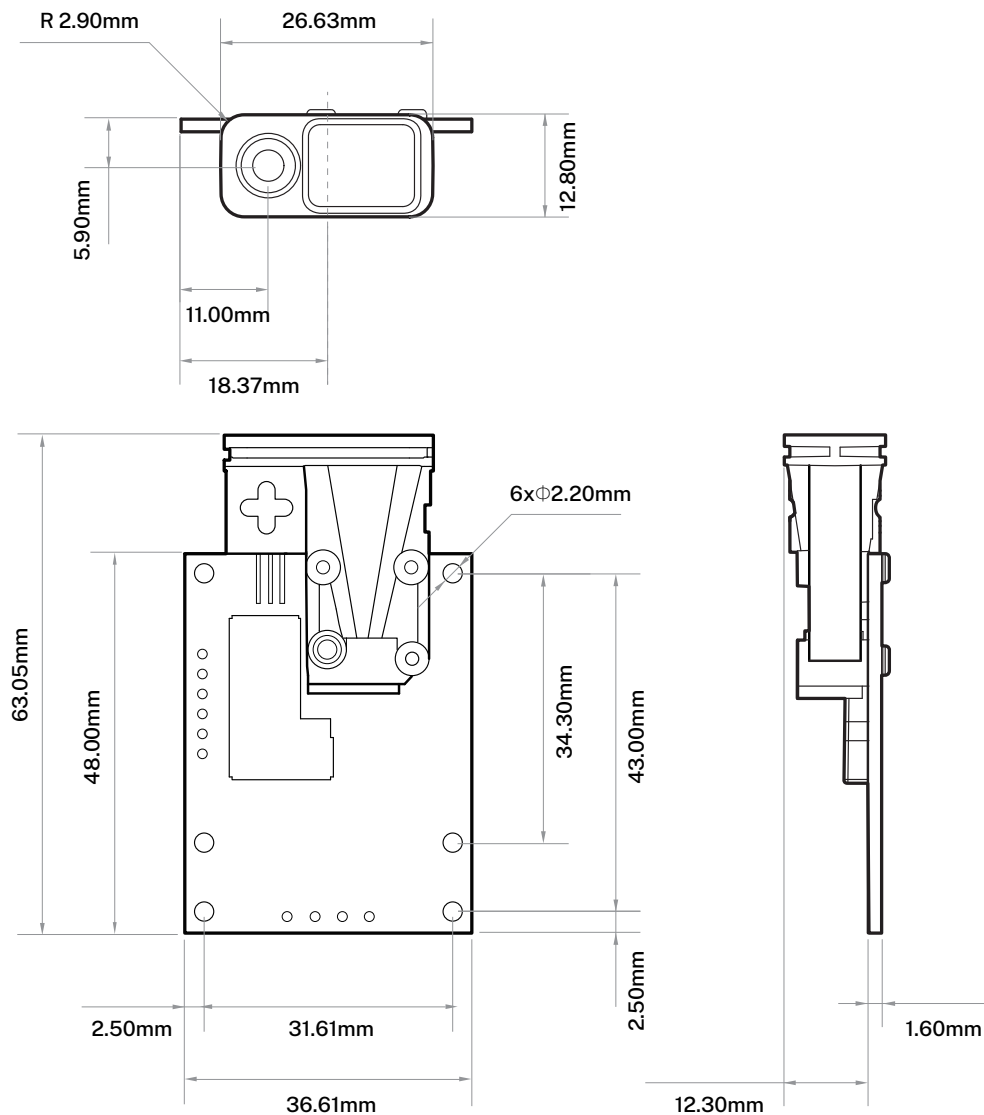


Figure 4. The aviation cable and product connector diagram

Number	1	2	3	4	5
Interface	NC	DC 9-36V	A	GND	B
Corresponding cable color	Brown	White	Blue	Black	Gray

The Aviation Cable Connecting Instrument

As shown in Figure 4, 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.



3.0 Parameters

Product model	L2	L2s	L2s-filled
Product image			
Power supply	DC 9-36V		
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 10mm (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	RS485		
Baud rate	9600/19200/38400/115200 Baud, default 115200		
Serial port format	Baud rate : 115200 Data bits : 8 Stop bits : 1 Verification : none Flow Control : none		
Communication protocol	Modbus RTU ASCII		
Sampling rate	10Hz, 20Hz, default 20Hz		
Measurement range	0.03M-40M/0.03M-80M (Available for choose)		
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	17.5 g	57.4 g	87.0 g
Gross weight	18.8 g	208.8 g	236.3 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 range value 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 wiring diagram, open the computer's Device Manager and check if a COM port number is displayed under Ports. If it is not displayed, it indicates that the converter does not have the driver installed. You will need to contact the converter's supplier to obtain the driver or download it from their official website.

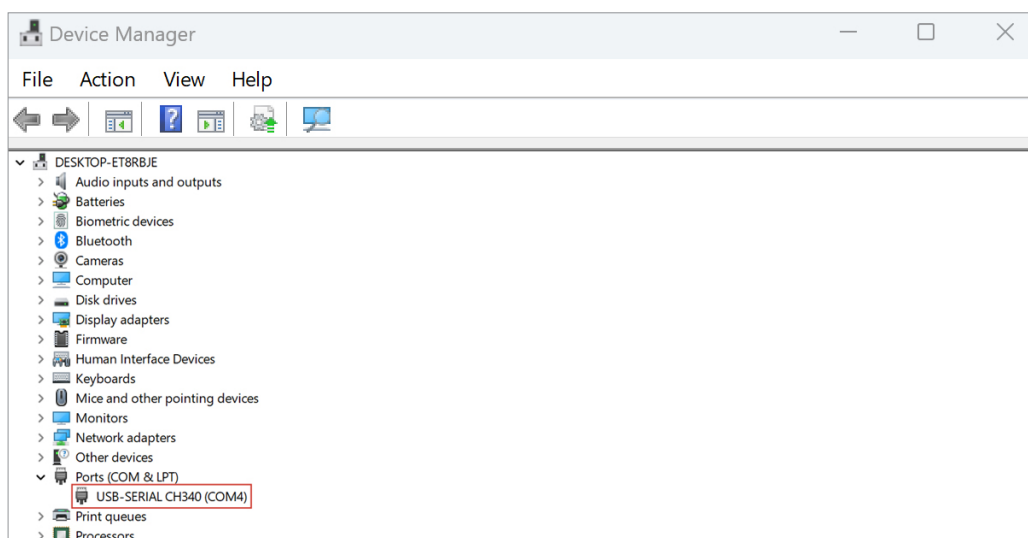


Figure 7. Serial port identification

5.0 Power-on Test Steps

© After successful serial port recognition, align the laser sensor with a target object at a distance of more than 3cm (below 3cm is considered a blind spot), and follow the steps below:

1. Power on the laser sensor and check if the laser light illuminates. If the laser light successfully illuminates, open the SSCOM Serial Port Assistant software provided by our company, and select the corresponding COM port with a default baud rate of 115200. We do not configure any other parameters.
2. Click 'Open 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:

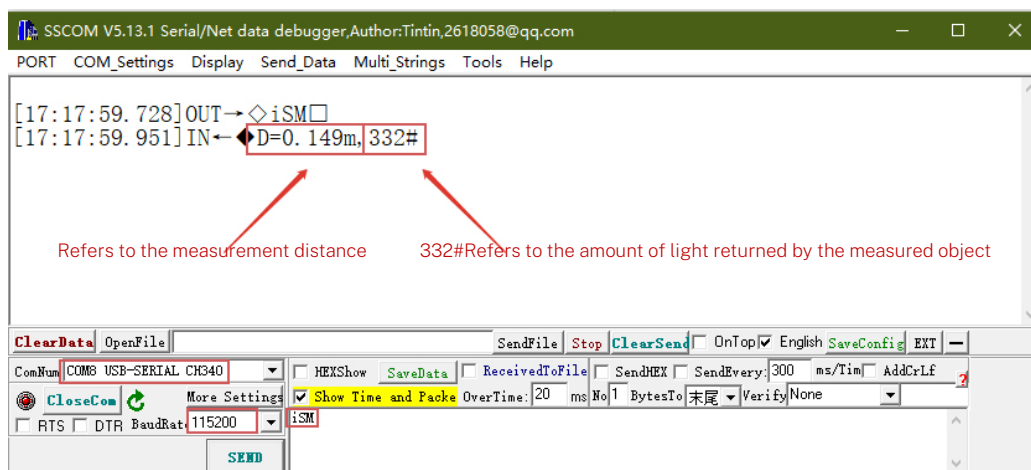


Figure 8. SSCOM settings

- ⊙ If distance values can be measured, it indicates that the laser sensor is functioning properly.
- ⊙ If the sensor laser is not light on or light on but the test does not return any values, please do the following checks:
 1. Are wires A and B firmly connected? Are they reversely connected?
 2. Is power supply voltage 9-36V?
 3. Is the COM port number correct?
 4. Is the Baud rate 115200?
 5. Is the command correct? 'i' in lowercase, 'SM' in uppercase.
 6. If you still cannot connect through the serial port assistant after following the above steps, you may consider replacing the converter or purchasing one from our company.

If you receive an error code like 'E=255,' please refer to the troubleshooting section of this manual to identify the cause of the error or contact our technical support team.

When the sensor has been verified to measure correctly, you can proceed to interface it with your control equipment.

6.0 Communication Protocol

This product supports two protocols (ASCII and Modbus RTU). 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 115200.

Serial Port Settings:

Baud rate	115200
Data bits	8
Stop bits	1
Verification	NONE
Flow Control	NONE

6.1 ASCII Text Communication Protocol

Command	Function
iGET:X	Query parameter, X is the parameter type
iSET:X,Y	Set parameter, X is parameter type, Y is parameter value
iSM	Single measurement
iCM	Manual Measurement
iACM	Auto continuous measurement
iFACM	Quick auto continuous measurement
iHALT	Stop Measurement
iLD:X	Laser On/Off

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

Table 1. ASCII command

Important Notice:

When entering commands, please use the English input method, and start the command with a lowercase 'i'.

6.1.1 Single Measurement

Features:

The shortest measurement time for a single measurement is 220ms. The measurement time increases as the reflection signal weakens, typically ranging from 300ms to 1000ms or more. After a single measurement is completed, the laser automatically turns off.

Applicable Scenarios:

Static measurements with minimal or negligible changes in distance, without specific requirements on measurement duration.

【Host】 iSM

【L2】 Normal Response D=Xm, N#<CR><LF>
Error Response E=Y <CR><LF>

X represents distance information (e.g., 40.000),
N represents the echo level (e.g., 500),
Y represents the error code (e.g., 258), as explained in the appendix.
<CR><LF> represents a carriage return and line feed (\r\n), which is included in every response command for readability purposes.

For example:

D=1.234m,500#<CR><LF>, indicating the distance is 1.234M, the echo level is 500
E=258<CR><LF>, indicating out of range.

6.1.2 Manual Measurement

Features:

The measurement frequency can be setting by yourself, operating in a question-and-answer mode.

Applicable Scenarios:

The distance varies, and the rate of change can be either fast or slow. It requires autonomous control of measurements, with a response sent after each measurement.

【Host】 iCM

【L2】 Normal Response D=Xm,N#
Error Response E=Y

Parsing instructions are the same as for the single measurement. (iSM)

Note:

The Host sends one command, and L2 responds once. After completing one measurement, the laser remains on.

6.1.3 Auto Continuous Measurement

Features:

The measurement frequency is fixed at approximately 8Hz, with distance data continuously reported upon sending a single command.

Applicable Scenarios:

Distance changes relatively slowly and require precise measurements.

【Host】 iACM

【L2】 Normal Response D=Xm,N#
Error Response E=Y

Parsing instructions are the same as for the single measurement. (iSM)

Note:

The Host only needs to send one command, and the L2 module upon responding, continuously measures and outputs information.

6.1.4 Fast Auto Continuous Measurement

Features:

Configurable measurement frequency at 10 or 20Hz, with continuous distance data reporting upon sending a single command.

Applicable Scenarios:

Applications with rapidly changing distances.

【Host】 iFACM

【L2】 Normal Response D=Xm

Error Response E=Y

X represents distance information(e.g.,1M-1.000);

Y represents the error code (e.g.,258), as explained in the appendix.

For example:

D=1.234m indicating the distance is 1.314M, with no echo level in the data;

E=258 indicating out of range.

Note:

The Host only needs to send one command, after the L2 module upon responding, performs fast continuous measurements and outputs information.

6.1.5 Stop Measurement

【Host】 iHALT

【L2】 STOP OK

In continuous measurement or fast continuous measurement mode, sending this command stops the measurement and turns off the laser.

6.1.6 Laser On/Off

Turn on the laser:

【Host】 iLD:1

【L2】 LASER OPEN OK

Turn off the laser:

【Host】 iLD:0

【L2】 LASER CLOSE OK

6.1.7 Offset

Set offset:

【Host】 iSET:1,X

【L2】 OK

X represents the distance offset value in millimeters(mm), with a range of -3000 to 3000, and a default value of 0.

For example:

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

Set offset:

【Host】 iGET:1

【L2】 OFFSET=X OK

6.1.8 Measurement Range

Set range:

【Host】 iSET:2,X

【L2】 OK

X is the measurement value, unit is millimeters(mm), range:50—80000, default 80000mm(80M) .

For example:

Set range to 60 meters — — iSET:2,60000

Query Range:

【Host】 iGET:2

【L2】 RANGE=X OK

6.1.9 Baud Rate

Set baud rate:

【Host】 iSET:3,X

【L2】 OK

X is the Baud rate, support 9600/19200/38400/115200, default 115200.

For example:

Set Baud rate to 9600 — — iSET:3,9600

Note:

After adjusting the baud rate, it must be powered off first and then powered on again for the changes to take effect.

Query baud rate:

【Host】 iGET:3

【L2】 BAUDRATE=X OK

6.1.10 Slave Device Address

Set slave device address:

【Host】 iSET:6,X

【L2】 OK

X is the slave device address (Involvement with the MODBUS-RTU Protocol), range 1 — 247. Default is 1.

For example:

Set slave device address to 4 — iSET:6,4

Query slave device address:

【Host】 iGET:6

【L2】 ADDRESS=X OK

6.1.11 Sampling Rate

Set sampling rate:

【Host】 iSET:7,X

【L2】 OK

X is the measurement sampling rate, with support for 10/20Hz. Default is 20Hz, indicating 20 distance data samples per second.

Note:

This parameter is effective in Quick Continuous Measurement mode.

For example:

Set sampling rate to 10Hz — iSET:7,10

Query sampling rate:

【Host】 iGET:7

【L2】 FREQUENCY=X OK

6.1.12 Power-On Automatic Measurement

Note:

When configured for automatic measurement upon power-up, the sensor will automatically report distance data after power is applied.

Important:

To enable automatic measurement functionality, it is crucial to configure the protocol type to match the actual application's protocol. The sensor automatically adapts to the normal communication protocol with external devices, and no configuration is required when not using the automatic measurement upon power-up feature.

Set protocol type:

【Host】 iSET:4,X

【L2】 OK

X is the protocol format type value. 0 = MODBUS RTU Protocol; 1 = ASCII Protocol. Default is 0 = MODBUS RTU Protocol.

For example:

Set MODBUS RTU protocol — iSET:4,0

Set Power-Up automatic measurement flag:

【Host】 iSET:8,X

【L2】 OK

X is the power-up automatic measurement flag. You can configure it as 0, 1, or 2. 0 = Power-Up Automatic Measurement Disabled; 1 = Power-Up Automatic Continuous Measurement; 2 = Power-Up Automatic Fast Continuous Measurement; Default is 0.

For example:

Set power-up automatic measurement — iSET:8,2.

Query protocol type:

【Host】 iGET:4

【L2】 PROTOCOL=X OK

Query Power-up automatic measurement flag:

【Host】 iGET:8

【L2】 AUTMEAS=X OK

6.1.13 Print Version Information on Power-Up

Note:

Upon power-up, the sensor will print a version information message. It can be configured not to print if it affects the application.

Set print version information on power-up:

【Host】 iSET:9,X

【L2】 OK

X=0 indicates that the laser light is off upon power-up;

X=1 indicates that the laser light is on upon power-up.

Query laser activation on power-up:

【Host】 iSET:9,X

【L2】 OK

X=0 indicates that version information will not be printed on power-up; X=1 indicates that version information will be printed on power-up.

6.1.14 Laser Activation on Power-up

Note:

The laser light is turned on by default upon power-up for easy target alignment. It can be configured not to turn on upon power-up if it affects the application.

Set laser activation on power-up:

【Host】 iSET:10,X

【L2】 OK

X=0 indicates that the laser light is off upon power-up;

X=1 indicates that the laser light is on upon power-up.

Query laser activation on power-up:

【Host】 iGET:10

【L2】 PON-LD=X

X=0 indicates that the laser light is off upon power-up;

X=1 indicates that the laser light is on upon power-up.

6.1.15 Decimal Places

Note:

The default setting is 3 decimal places, accurate to millimeters. Using 4 decimal places provides accuracy to micrometers, but the data may be less stable. It is typically not recommended to use 4 decimal places.

Set decimal places:

【Host】 iSET:5,X

【L2】 OK

X=0 is 3 decimal; X=1 is 4 decimal.

Query decimal places:

【Host】 iGET:5

【L2】 DATATYPE=X

X=0 is 3 decimal; X=1 is 4 decimal, default X=0.

6.2 Modbus RTU Communication Protocol

Request Frame Format (Hexadecimal)				
Address code	Function code	Register start address	Number of registers(N)	CRC
1Byte	1Byte	2Byte	2Byte	2Byte
Response Format Frame (Hexadecimal)				
Normal Response				
Address code	Function code	Number of bytes	Register value	CRC
1Byte	1Byte	1Byte	2*N Byte	2Byte
Abnormal Response				
Address code	Error code	Exception code	CRC	
1Byte	1Byte	1Byte	2Byte	
<p>Modbus RTU Protocol Exception Error Codes and Fault Code Definitions</p> <p>0x01: Function code error</p> <p>0x02: Register start address error</p> <p>0x03: Register quantity error</p> <p>0x04: Register value error</p> <p>0x05: CRCError</p> <p>0x06: Device busy</p> <p>Sample Error Codes:</p> <p>When a read command encounters an error, 0x83 = function code 03 + 0x80</p> <p>When a write command encounters an error , 0x90 = function code 10 + 0x80</p> <p>CRC Calculation Method: The CRC calculation encompasses the bytes from the address code to the byte immediately preceding the CRC field. For CRC16, the lower 8 bits are placed in front of the higher 8 bits. See the details in the appendix.</p>				

Table 2. Modbus RTU protocol format

Register Starting Address in Hexadecimal	Register Starting Address (Corresponding Siemens PLC Address,Decimal, Hexadecimal converted to Decimal + 1)	Register Length	Data Type	Register Description
0x000F	40016	2	Uint32	Single Measurement
0x0010	40017	2	Uint32	Manual Rapid Measurement - Response Mode
0x0013	40020	2	Uint32	Automatic Continuous Measurement - Continuous Mode
0x0034	40053	2	Uint32	Fast Automatic Continuous Measurement - Continuous Mode
0x0031	40050	1	Uint16	Stop measurement
0x000B	40012	2	Uint32	Measurement range
0x0019	40026	1	Uint16	Baud rate
0x0007	40008	1	Uint16	Laser on/off
0x000D	40014	1	Uint16	Distance offset
0x0017	40024	1	Uint16	Slave address
0x001B	40028	1	Uint16	Sampling rate
0x0027	40040	1	Uint16	Whether to print version Information after power-on
0x0029	40042	1	Uint16	Whether to turn on the laser light after power-on

Table 3. Register functions



Notices:

The first byte 01 of all the following instructions is the slave device address, and the last two bytes are the CRC; if the slave address is modified, the CRC should be modified accordingly.

When using PLC, the address of the registers should be converted from hexadecimal to decimal and then add 1, as shown in the table above.

6.2.1 Single Measurement

Features:

The shortest time for a single measurement is 220ms, the weaker the reflected signal the longer the time, usually need 300-1000ms range. The laser is automatically turned off at the end of a single measurement.

Applicable scenarios:

Stationary measurements, basically no change or very small change in distance, applications that do not require the length of the measurement.

【Host】 Host Requests					
When reading 2 registers					
Descriptions:	Address code	Function code	Register start address	No. of registers	CRC
Send:	0x01	0x03	0x00 0x0F	0x00 0x02	0xF4 0x08

【L2】 Normal Response						
Descriptions:	Address code	Function code	Byte count	Register 1 Values	Register 2 values	CRC
Normal Response:	0x01	0x03	0x04	0x00 0x00	0x03 0xAC	0x7B 0x7F

Note:

The distance in this instruction is 4 bytes, 0x00 0x00 0x03 0xAC, and the distance is 0x000003AC, which is converted to decimal as 940mm.

Measurement failure response:

0x01 0x03 0x04 0x00 0x00 0x00 0x00 0xFA 0x33

4 bytes of distance 0x00000000, indicates measurement failure, please re-measure or check the device.

Abnormal response for example:				
Descriptions:	Address code	Error code	Exception codes	CRC
Abnormal response:	0x01	0x83	0x02	0xC0 0xF1

Error code 83, indicating an abnormal function of function code 03;

Exception code 02, indicating a start address error

6.2.2 Manual Ordinary Measurement

Features:

The measurement frequency can be set by yourself. The fastest is 10Hz. One command, one response.

Applicable scenarios:

Suitable for applications where distance changes relatively slowly and requires more accurate measurement; or applications where autonomous control of measurements is required, sending once and responding once. After completing a measurement, the laser is still on.

【Host】 01 03 00 10 00 02 C5 CE

【L2】 Same description as single measurement

6.2.3 Automatic Continuous Measurement

Features:

The measurement frequency is fixed, about 8Hz, send a command, continuously report the distance data.

Applicable scenarios:

The distance changes slowly, and requires more accurate measurement applications.

【Host】 01 03 00 13 00 02 35 CE

【L2】 Same description as single measurement

Note:

Automatic and continuous distance measurement. After the host sends the command only once, the slave L2 will continuously measure the distance and report the data, which will occupy the RS485 bus.

6.2.4 Fast Automatic Continuous Measurement

Features:

Measuring frequency can be configured, 10 or 20Hz, send a command, continuously report the distance data.

Applicable scenarios:

Applications where the change of distance is relatively fast.

【Host】 01 03 00 34 00 02 85 C5

【L2】 Same description as single measurement

The measurement rate is based on the sample rate parameter (10/20Hz), and the sample rate is configured first. Default 20Hz.

Note:

Automatic and continuous distance measurement. After the host sends the command only once, the slave L2 will continuously measure the distance and report the data, which will occupy the RS485 bus.

6.2.5 Stop Measurement

【Host】 01 10 00 31 00 01 02 00 01 63 B1

【L2】 01 10 00 31 00 01 50 06

6.2.6 Laser On/Off

【Host】 01 10 00 07 00 01 02 XX YY NN MM

【L2】 01 10 00 07 00 01 B0 08

XXYY-is the mark of the laser switch to be set, 0000-laser off, 0001-laser on.

NNMM-Calibration for CRC.

6.2.7 Offset

Set offset:

【Host】 01 10 00 0D 00 01 02 XX YY NN MM

【L2】 01 10 00 0D 00 01 90 0A

XXYY-for the distance offset value to be set, 2 bytes, the range is the range-3000 to 3000mm, such as 10mm, hex XXYY = 00 0A.

NNMM-Calibration for CRC.

Query offset:

【Host】 01 03 00 0D 00 02 55 C8

【L2】 01 03 02 XX YY NN MM.

XXYY- the queried distance offset value, 2 bytes. For example, 10mm, hex XXYY=00 0A

NNMM-Calibration for CRC

6.2.8 Measurement Range

Set measurement range:

【Host】 01 10 00 0B 00 02 04 XX YY ZZ WW NN MM

【L2】 01 10 00 0B 00 02 30 0A

XXYYZZWW-the range value to be set, e.g. 40000mm,

hex XXYYZZWW = 00 00 9C 40.

NNMM-Calibration for CRC.

Query measurement range:

【Host】 01 03 00 0B 00 02 B5 C9

【L2】 01 03 04 XX YY ZZ WW NN MM

XXYYZZWW-is the queried range value, e.g. 40000mm,

hex XXYYZZWW = 00 00 9C 40.

NNMM-Calibration for CRC.

6.2.9 Baud Rate

Set baud rate:

【Host】 01 10 00 19 00 02 04 XX YY ZZ WW NN MM

【L2】 01 10 00 19 00 02 90 0F

XXYYZZWW-the baud rate to be communicated, supports 9600/19200/38400/115200, 4 bytes.

NNMM-Calibration for CRC.

Note:

After adjusting the baud rate, it must be powered off first and then powered on again for the changes to take effect.

Query baud rate:

【Host】 01 03 00 19 00 02 15 CC

【L2】 01 03 04 XX YY ZZ WW NN MM

XXYYZZWW-is the queried baud rate, 4 bytes, e.g. 115200, hex 00 01 C2 00.

NNMM-Calibration for CRC.

6.2.10 Slave Device Address

Set slave device address:

【Host】 01 10 00 17 00 01 02 XX YY NN MM

【L2】 01 10 00 17 00 01 B1 CD

XXYY-is the slave device address value to be set, 2 bytes.

Range 0001 — 00F7.

NNMM-Calibration for CRC.

Query slave device address:

【Host】 01 03 00 17 00 02 74 0F

【L2】 01 03 02 XX YY NN MM

XXYY-is the queried slave device address value, 2 bytes.

Range 0001 — 00F7.

NNMM-Calibration for CRC.

6.2.11 Sampling Rate

Set sampling rate:

【Host】 01 10 00 1B 00 01 02 XX YY NN MM

【L2】 01 10 00 1B 00 01 71 CE

XXYY-is the sampling rate to be set, 2 bytes. 000A-10Hz, 0014-20Hz.

NNMM-Calibration for CRC.

Query sampling rate:

【Host】 01 03 00 1B 00 02 B4 0C

【L2】 01 03 02 XX YY NN MM

XXYY-is the queried sample rate, 2 bytes. 000A-10Hz, 0014-20Hz.

NNMM-Calibration for CRC.

6.2.12 Print Version Information on Power-Up

Note:

The sensor will print a version information after power up, if it affects the application, it can be configured not to print.

Set printed version information on power-up:

【Host】 01 10 00 27 00 01 02 XX YY NN MM

【L2】 01 10 00 27 00 01 B1 C2

XXYY-An identifier for whether or not version information is printed on power-up; 0000 power-up does not print version information; 0001 power-up prints version information.

NNMM-Calibration for CRC.

Query printed version information on power-up:

【Host】 01 03 00 27 00 02 F4 00

【L2】 01 03 02 XX YY NN MM

XXYY-An identifier for whether or not version information is printed on power-up; 0000 power-up does not print version information; 0001 power-up prints version information.

NNMM-Calibration for CRC.

6.2.13 Laser On/Off

Note:

The laser light is turned on by default after powering up, which is easy to align with the target, if it affects the application it can be matched to power up without light.

Set laser On/Off:

【Host】 01 10 00 29 00 01 02 XX YY NN MM

【L2】 01 10 00 29 00 01 D0 01

XXYY-identifies whether or not the laser is turned on at power-up, 0000 turns the laser off at power-up, 0001 turns the laser on at power-up.

NNMM-Calibration for CRC.

Query laser On/Off:

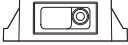
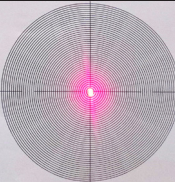
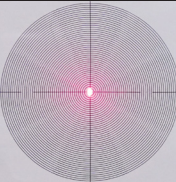
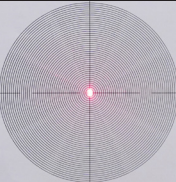
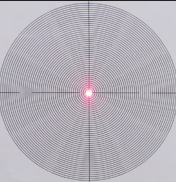
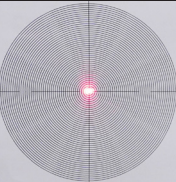
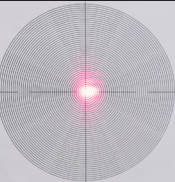
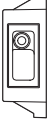
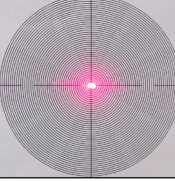
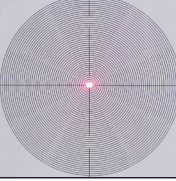
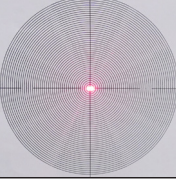
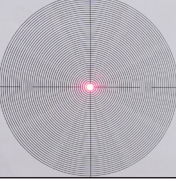
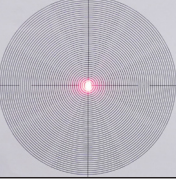
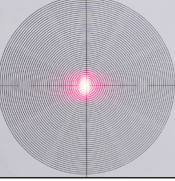
【Host】 01 03 00 29 00 02 15 C3

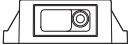
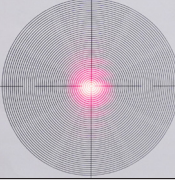
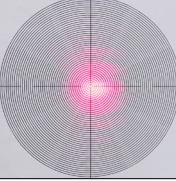
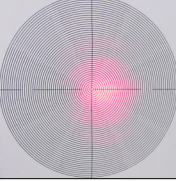
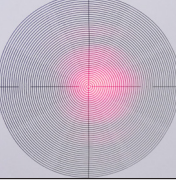
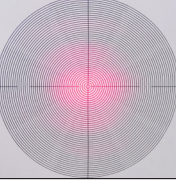
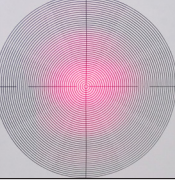

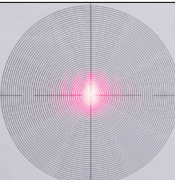
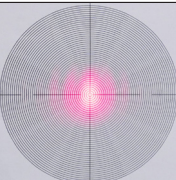
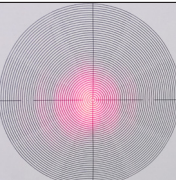
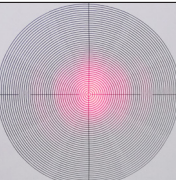
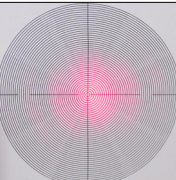
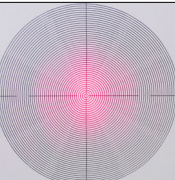
【L2】 01 03 02 XX YY NN MM

XXYY- identifies whether or not the laser is turned on at power-up, 0000 turns the laser off at power-up, 0001 turns the laser on at power-up.

NNMM-Calibration for CRC.

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 Higher Byte Value Table */
```

```

nst 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, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
};

```

```
/* CRC Low-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);
}

```

8.2 Error Code

8.2.1 ASCII Protocol Error Code

Error code	Description
252	High temperature (over 60 °C)
253	Low temperature (below -20 °C)
255	Weak reflection or computational failure
256	Highly reflective
258	Out of measurement range
285	Abnormal photosensitive device
286	Laser tube abnormality
290	Hardware abnormality

Table 5: ASCII error codes

8.2.2 Modbus Protocol Exception Code

exception code	Description
0X00	No error
0x01	Function code error
0x02	Start address error
0x03	Register number error
0x04	Register value error
0x05	CRC error
0x06	Equipment busy
0x07	High temperature (module over 60 °C)
0x08	Low temperature (module below -20 °C)
0x09	Signal too weak/long signal calculation time
0x0A	The signal is too strong
0x0B	Out of measurement range
0x0C	Abnormal photosensitive device
0x0D	Laser tube abnormality
0x0E	Other exceptions

Table 6: Modbus protocol exception codes

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"**: If 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.

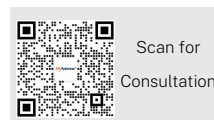
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