USER MANUAL

WT53R-TTL

Laser Ranging Sensor

Tutorial Link

Google Drive

Link to instructions DEMO:
WITMOTION Youtube Channel

If you have technical problems or cannot find the information that you need in the provided documents, please contact our support team. Our engineering team is committed to providing the required support necessary to ensure that you are successful with the operation of our AHRS sensors.

Contact

Technical Support Contact Info

Application

- Robot
- UAV
- Intelligent Device

Contents

Tutorial Link 2
Contact 2
Application 2
Contents 3
1 Overview 4
2 Parameter 4
3 Pin 5
4 Hardware Connection 6
4.1 Serial Connection 6
4.2 PC Connection 8
4.3 Alarm Connection 9
5 Software Connection 10
5.1 Device 10
5.2 Data View 11
5.3 ID 13
5.4 Reset 15
5.5 Baud Rate 16
5.6 Return Rate 18
5.7 Calibration Module 19
5.8 Measurement Mode 20
5.9 Alarm Threshold 22
6 Communication Protocol 23
6.1 Serial Mode 23
6.2 Modbus Protocol 24
6.3 Modbus Register 26

1 Overview

- With voltage stabilization circuit, the working voltage is 5V~36V.
- Black metal shell design, waterproof, high working stability.
- High precision laser ranging sensor and optical filter. Effectively filter out optical interference.
- Set the alarm distance, if the measurement distance is less than the set value, the voltage output of the alarm pin changes.

2 Parameter

Parameter	Specification
➢ Voltage	5V-36V
➢ Current	<38mA
➢ Size	23.2mm x69mm 0.913" x 2.717"
➢ Fixed Hole	Spacing 16mm, hole radius 1mm Spacing 0.630", hole radius 0.039"
➢ Acquisition Rate	20Hz
➢ Measuring Distance	40mm-4000mm (4000mm without optical cover) 1.575"-157.480" (157.480"without optical cover)
➢ Interface	TTL
➢ Baud Rate	Supports 2400-921600, default 115200
➢ Ranging Error	±20mm ±0.787"

3 Pin

Name	Function
Red	5~36V power output
Green	RX line（TTL）
Yellow	TX line（TTL）
Black	GND
White	Alarm line (Requires external pull-up, low level when alarming)

4 Hardware Connection

4.1 Serial Connection

Step 1. Connect the sensor with offered Type-C wire.

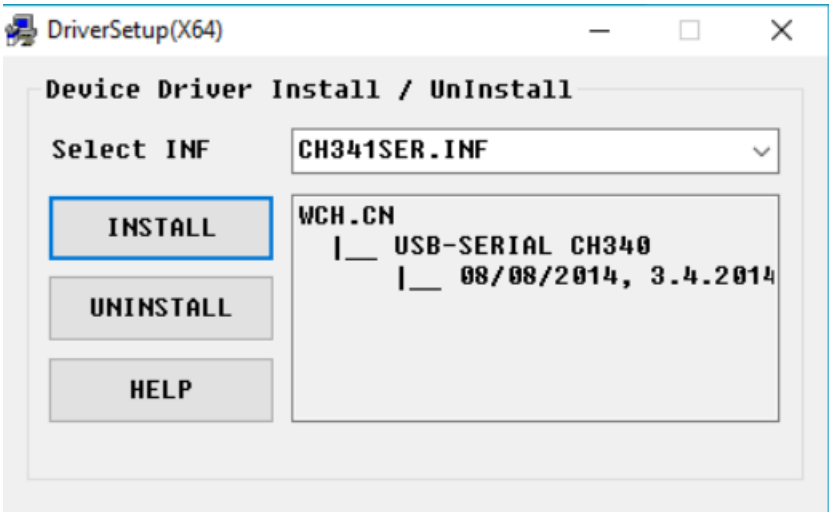
(Warm Reminder:If you wanna use a longer cable,it should be a standard Type-C data cable)

Step 2. Unzip the software and install the driver CH340

- Software and driver download

*How to Install and update the CH340 driver

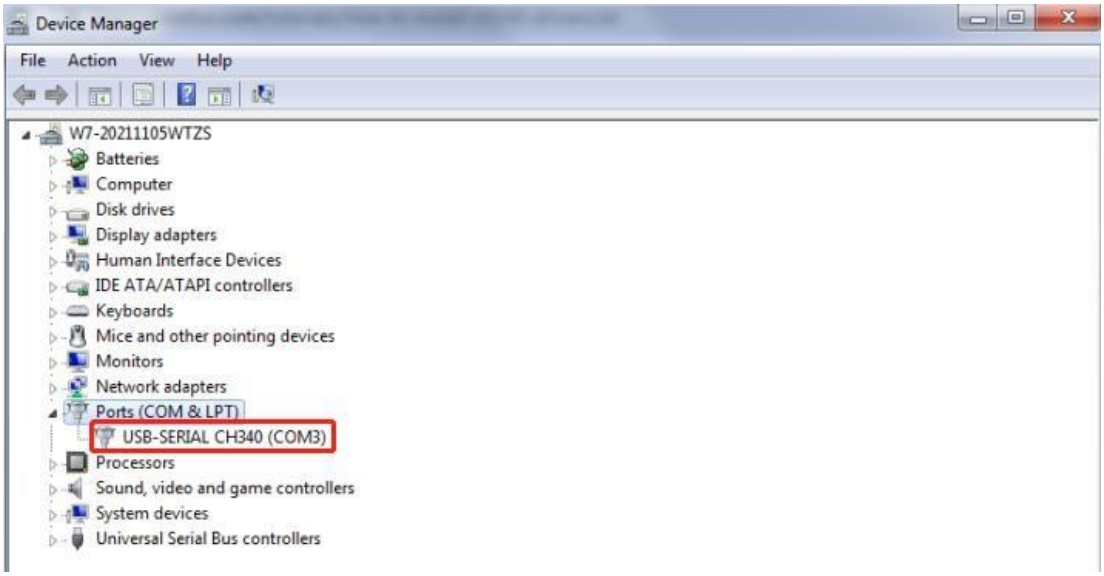
Click the "Uninstall" button first. Then click on the "Install" button.



*How to verify your driver is working

1）To check that the CH340 enumerates to a COM port, you can open the device manager. You can click the **Start** or ⊞ (Windows) button and type "*device manager* to quickly search for the application.

2）After opening the device manager, you will need to open the **Ports (COM & LPT)** tree. The CH340 should show up as **USB-SERIAL CH340 (COM##)**. Depending on your computer, the COM port may show up as a different number.



4.2 PC Connection

To connect with a computer, a serial port module with USB to TTL level is required. The following two USB-to-serial modules are recommended:

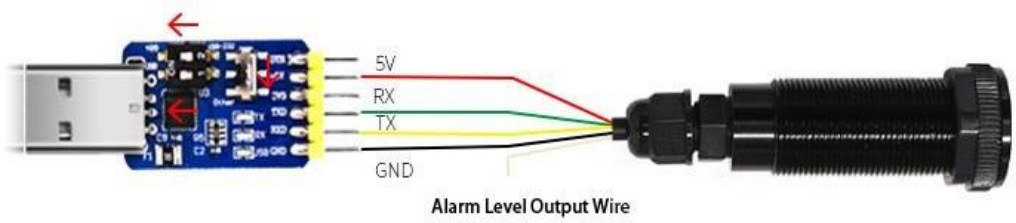
1. USB-TTL serial module (Figure 1): Connect the module to the USB-TTL, then plug it into the computer.

Connect USB-TTL: VCC TX RX GND Connect to +5V/3V3 RX TX GND of USB. Note that TX and RX need to be crossed, TX is connected to RX, and RX is connected to TX.

2. Six-in-one module (Picture 2): DIP switch 1 of the module is set to ON, DIP switch 2 is set to 2, and switch S1 is set to other (screen printing).

Connection method: VCC TX RX GND Connect to +5V RX TX GND. Note that TX and RX need to be crossed, TX is connected to RX, and RX is connected to TX.

PC-serial module connection diagram:



4.3 Alarm Connection

The sensor has its own hardware alarm function, and the alarm distance can be set by the host computer. When the sensor measurement distance is less than the alarm threshold, the alarm line will trigger the alarm level.

Alarm line wiring description: When the measurement distance is less than the set threshold, the alarm line will generate a low-level signal. The non-alarm state is a floating state. The circuit recommends using a 100K resistor for pull-up. When an alarm occurs, the alarm line is pulled down to a low level.

5 Software Connection

(Old version software instruction)

Note:

1. The object to be measured and the sensor should be as parallel as possible. If there is a deviation, the deviation angle cannot be greater than the laser emission angle.

2. To detect fast-moving objects, the sampling frequency should be adjusted (WT53R-TTL sets the timing preset time and measurement time interval).

3. The laser light source is a beam-type laser that is invisible to the naked eye (the laser can be seen with a mobile phone camera). Obstacles in the emission angle of the light source will affect the ranging effect.

4. The module is affected by natural light. In general, the stronger the natural light, the greater the impact. That is, the ranging distance becomes shorter, the accuracy becomes worse, and the fluctuation becomes larger. Under strong light (such as sunlight), it is generally recommended to be used in close-range detection scenarios.

5.1 Device

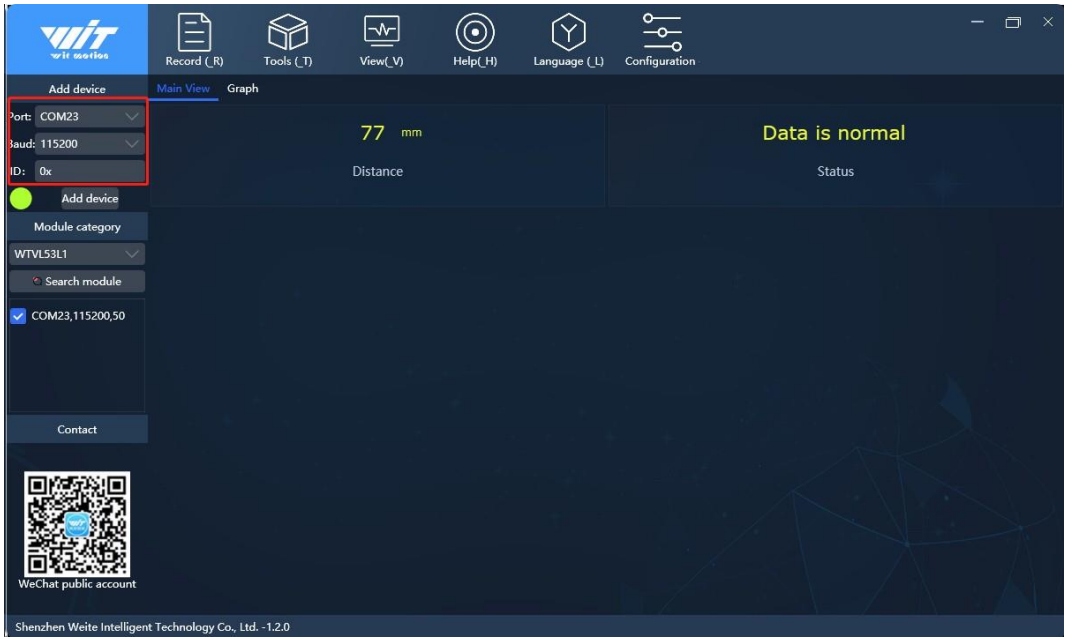
- Software and driver download

First, connect the module to the computer through the serial port module. After installing the driver corresponding to the serial port module, the corresponding serial port number can be queried in the device manager, as follows:

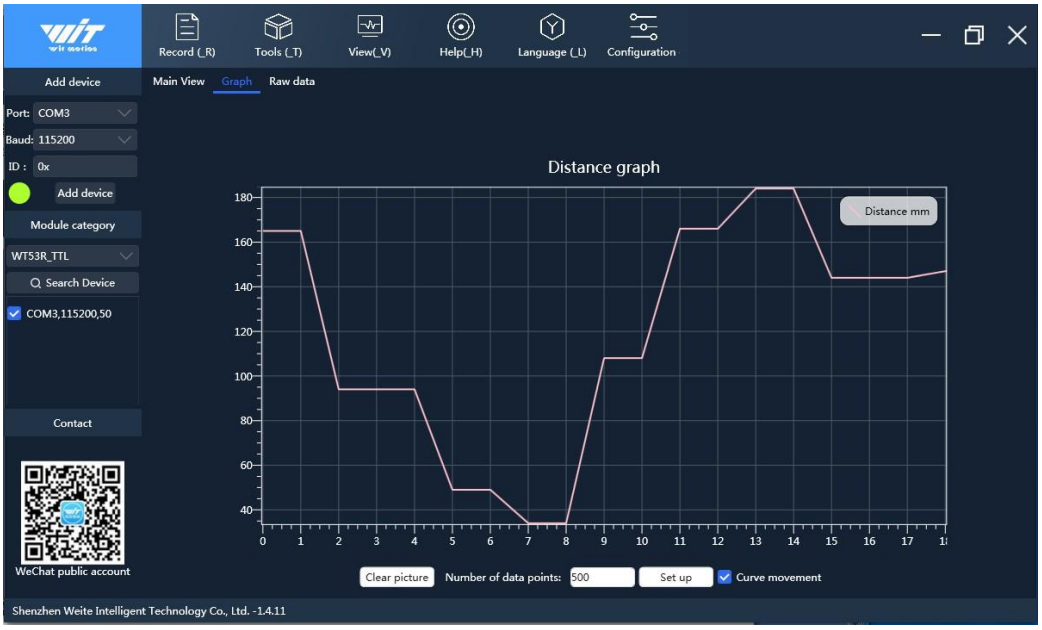
5.2 Data View

After the hardware is connected, open the host computer, select the corresponding serial port, and click the serial port. The host computer automatically searches for the sensor device, and the search window can be manually closed after the device is found. Check the corresponding device on the left side of the host computer to see the sensor data. The operation process is as follows:

Open the host computer and select the corresponding serial port number (default baud rate: 115200):



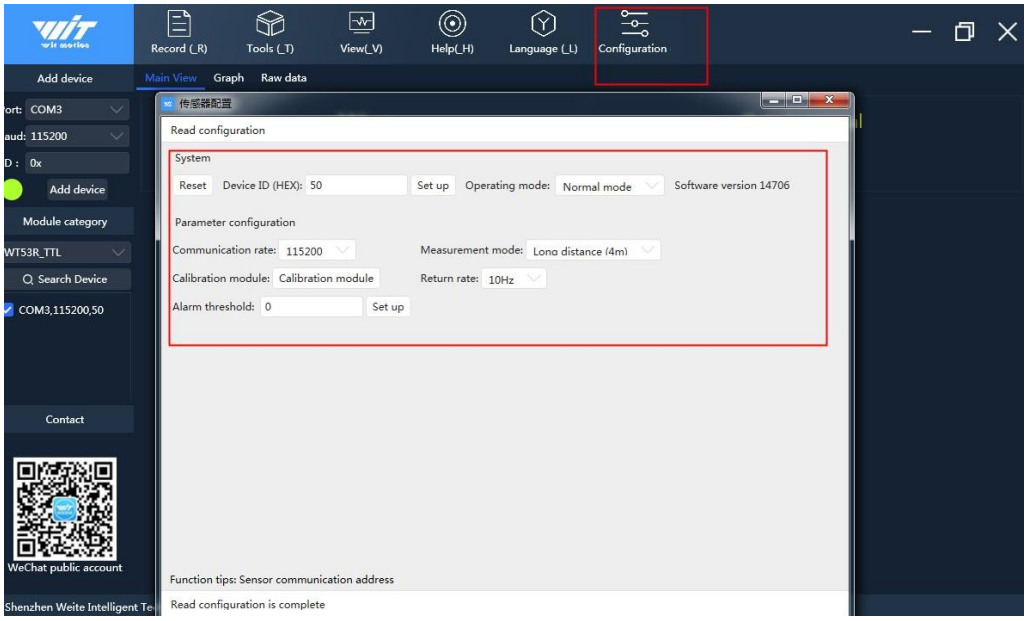
Click "Search Device" below, after the search is complete, check the corresponding sensor to view the data, as follows:



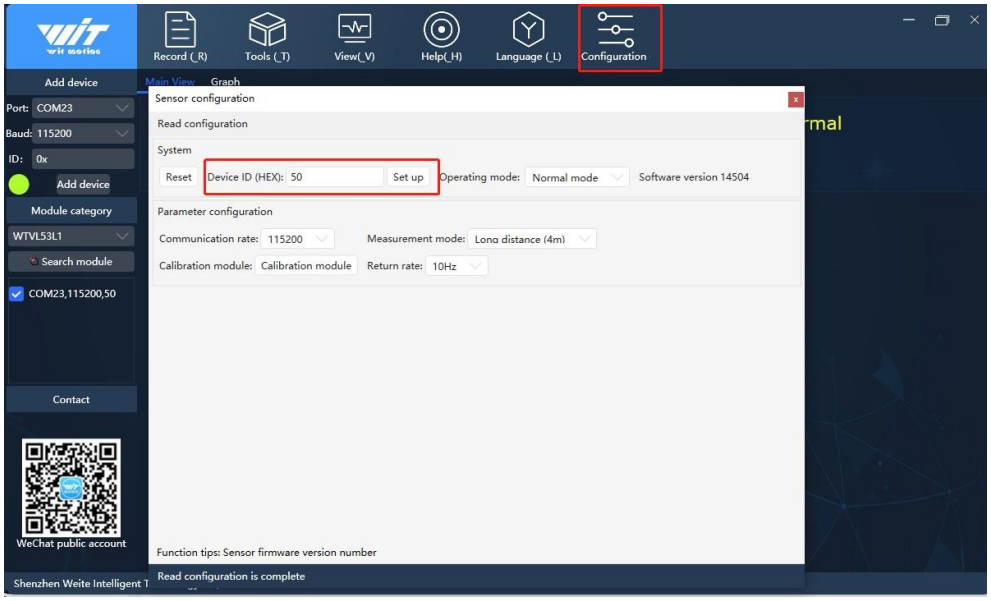
5.3 ID

When there are multiple Modbus connections, different Modbus IDs need to be set to read data normally. After setting the ID, the data can be read normally only when the host computer is used to search for the device again. The device ID is saved after power off. The specific process is as follows:

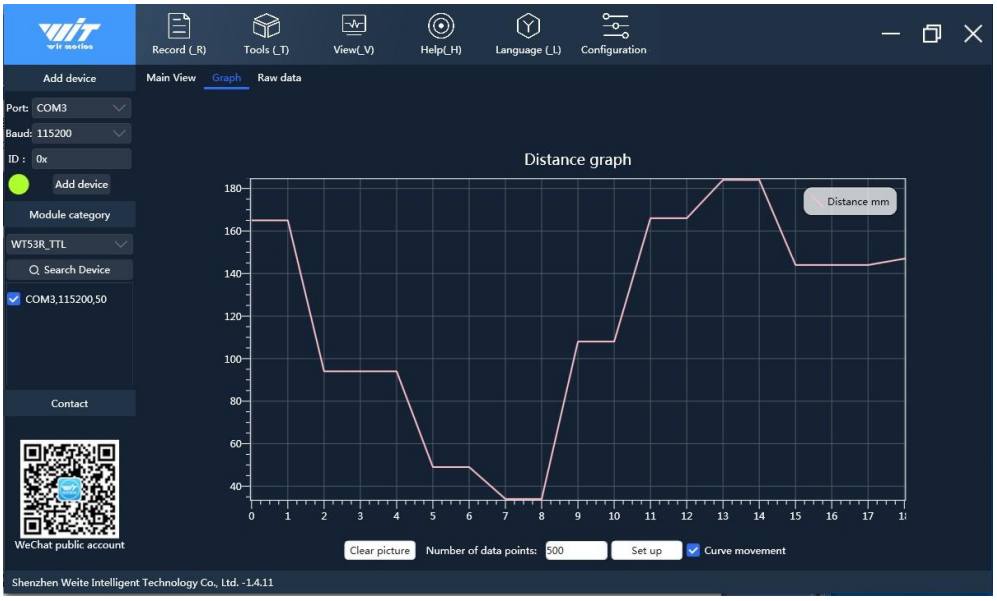
After connecting the sensor normally, click "Configuration" to select the corresponding device and enter the configuration interface.



After entering the device ID, click "Set up". ID can be set in the range 0x00~0x7F.

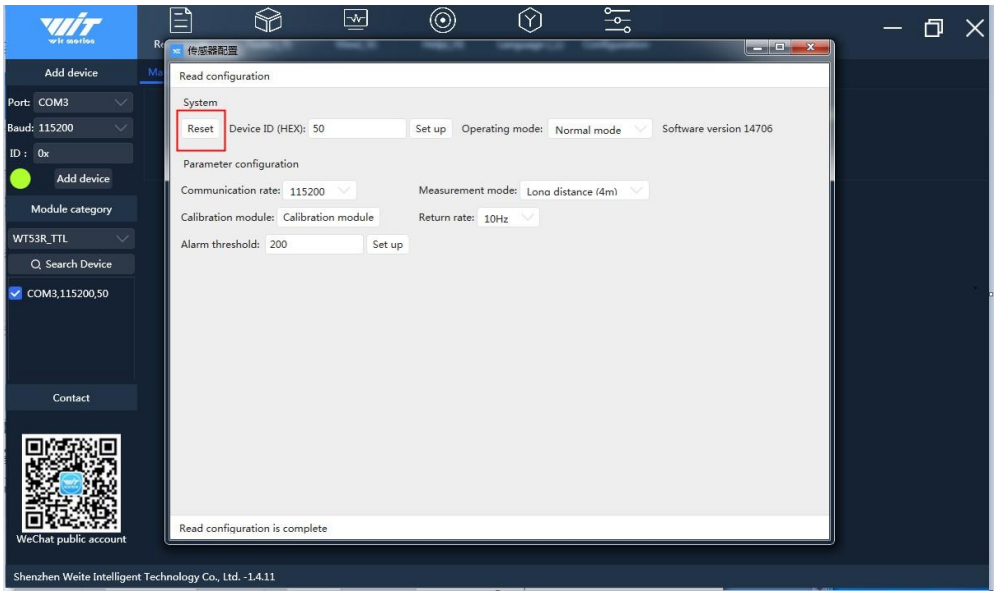


After setting, other parameters cannot be changed due to the change of the device ID. Click "Search Device" to search for the device again.

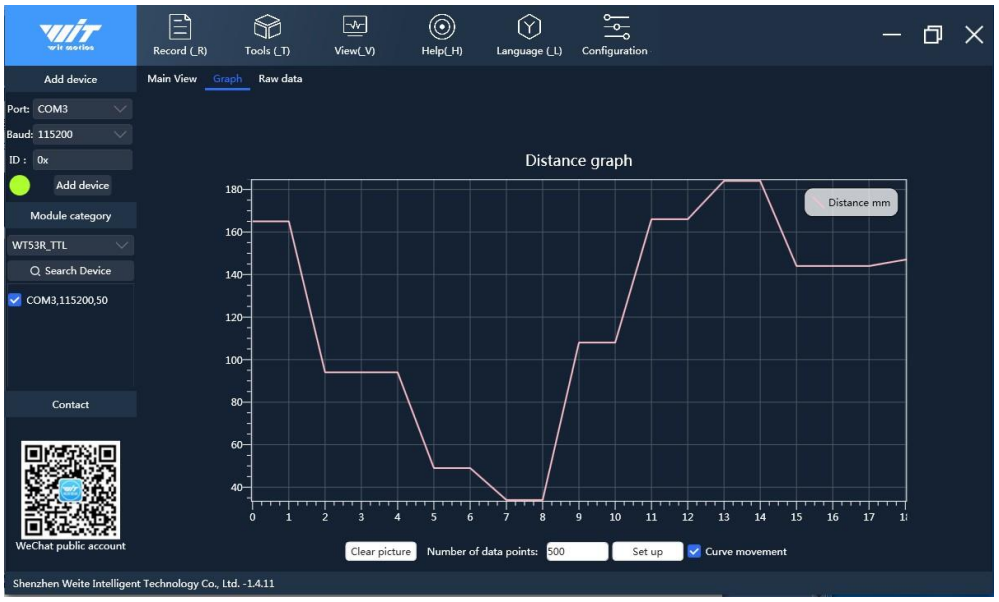


5.4 Reset

Reset will restore all user setting parameters to the default state.
After connecting the sensor normally, click "Configuration" to select the corresponding device, and then enter the configuration interface.



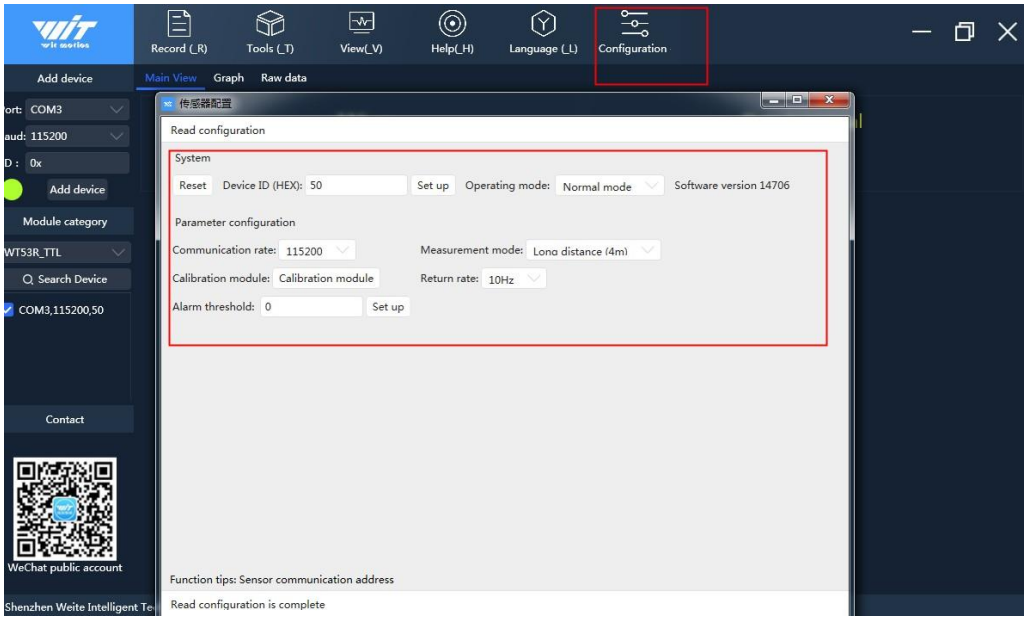
Click " Reset ", if the baud rate or ID is not the default setting (default baud rate: 115200, ID: 0X50), search for the device again.



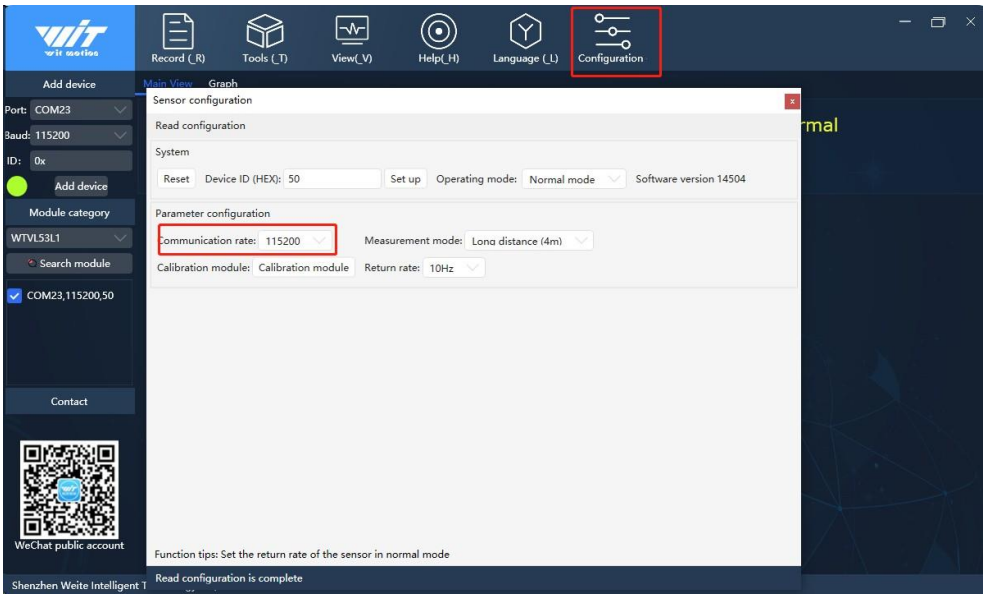
5.5 Baud Rate

After the normal connection, the baud rate can be modified on the host computer. After modifying the baud rate, the baud rate of the serial port needs to be modified manually. Then search for the sensor again. The specific process is as follows:

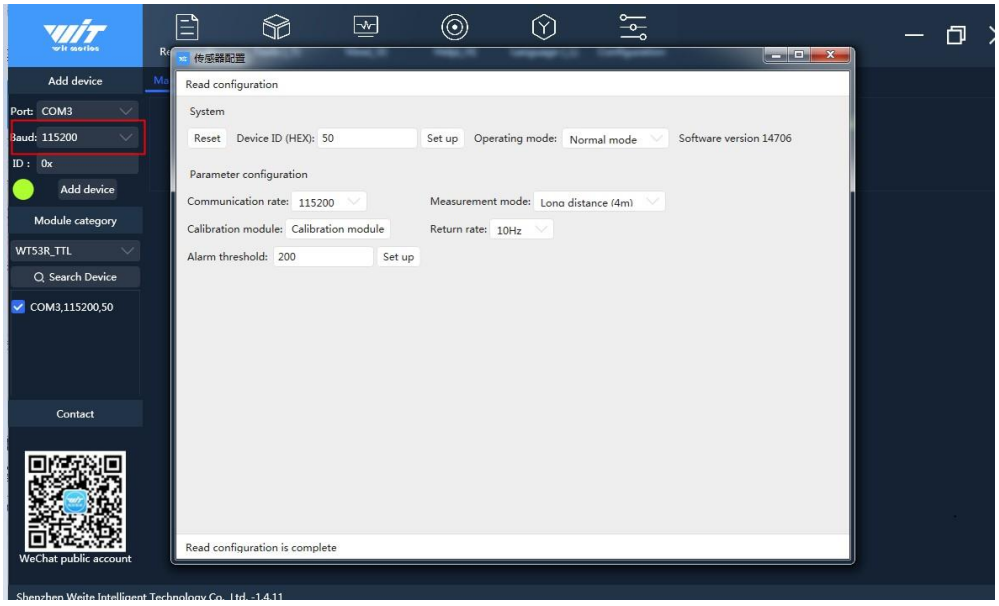
After connecting the sensor normally, click "Configuration" to select the corresponding device and enter the configuration interface.



Click the drop-down box next to “communication rate”, select the baud rate and click.



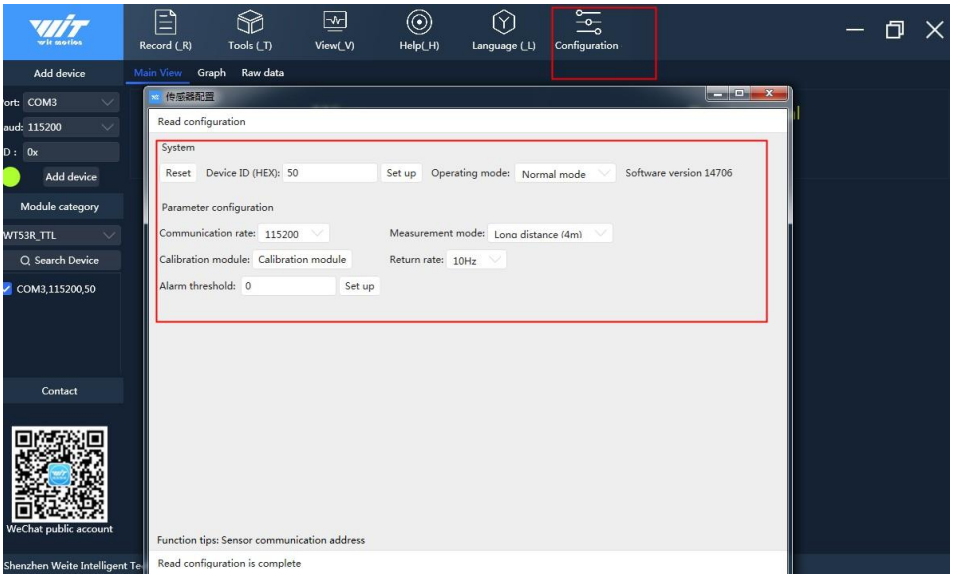
After the setting is completed, the baud rate of the host computer will be automatically modified.



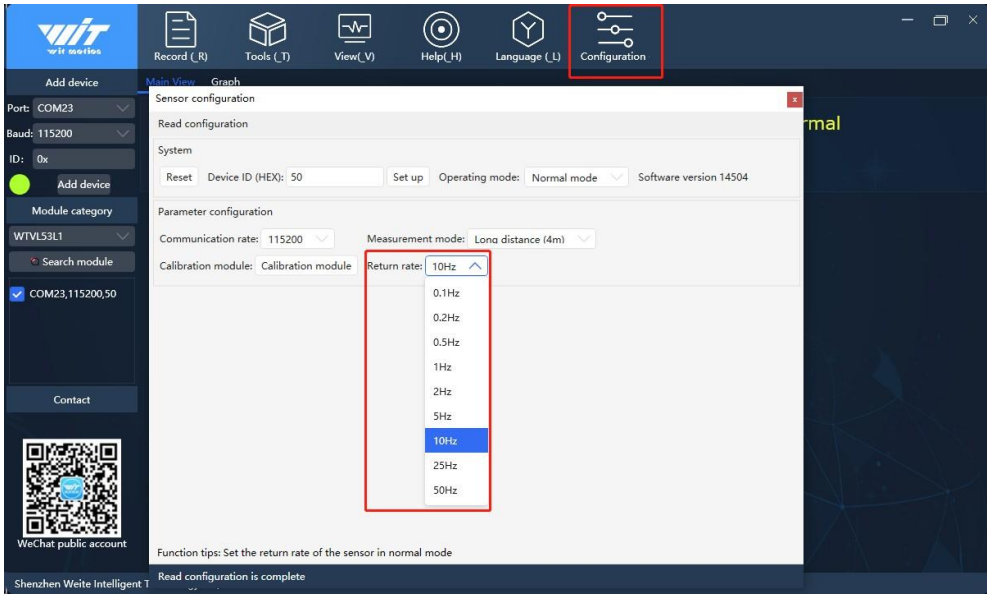
5.6 Return Rate

The sensor can set the automatic return speed of 0.1~100Hz (due to the influence of the measurement distance, the time is not absolutely accurate, and the return rate is useless in Modbus mode.) The setting process is as follows:

After connecting the sensor normally, click "Configuration" to select the corresponding device and enter the configuration interface.



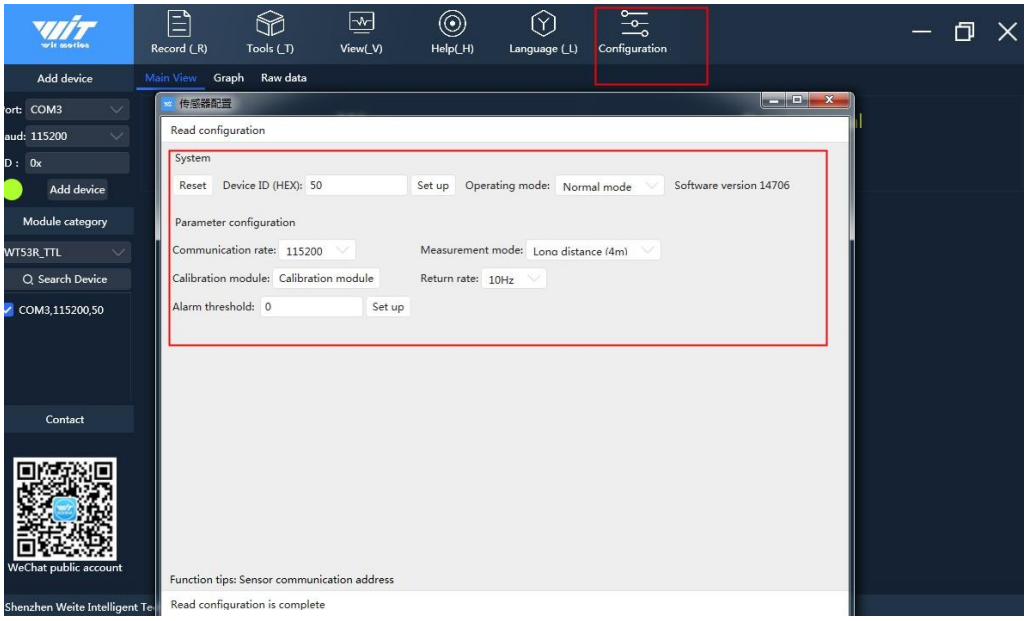
Select the desired backhaul rate from the drop-down list of Backhaul Speed, and click.



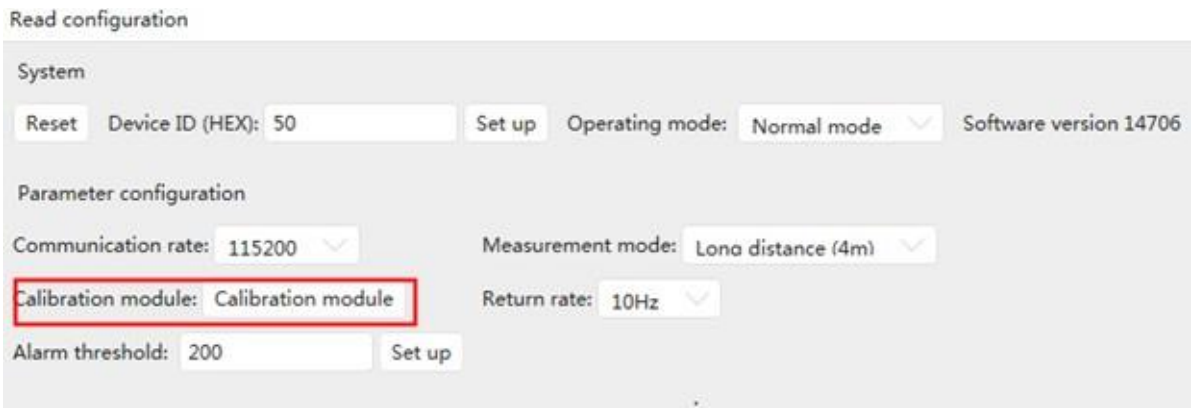
5.7 Calibration Module

The sensor can be calibrated manually, fix the sensor, place a white object at a distance of 14cm (5.512") in front of the sensor and click to calibrate.

After connecting the sensor normally, click "Configuration" to select the corresponding device and enter the configuration interface.



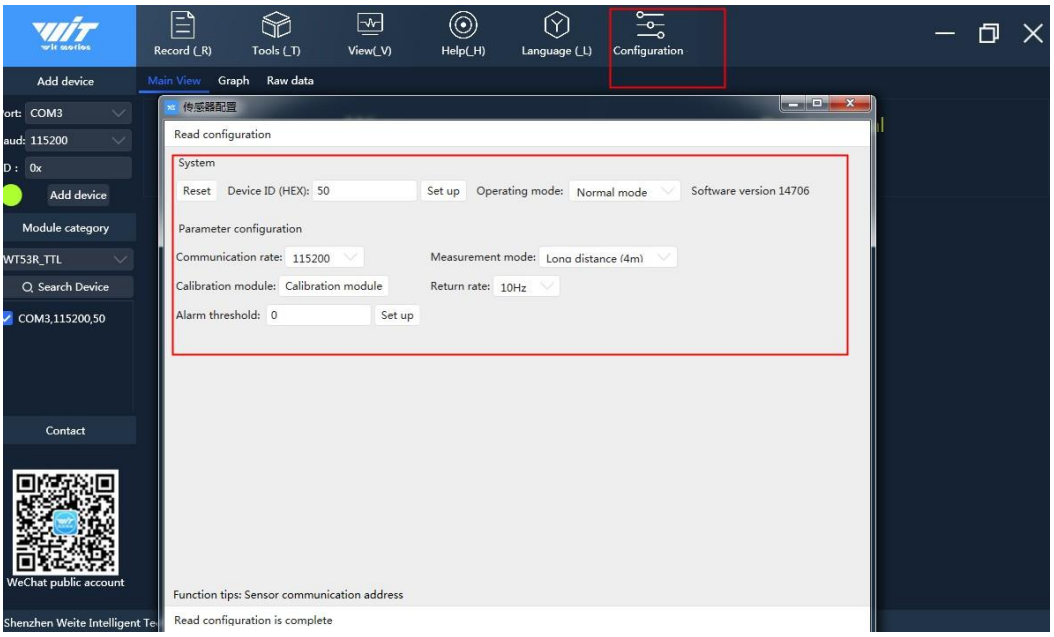
Fix the sensor and calibration object, click "Calibration module".



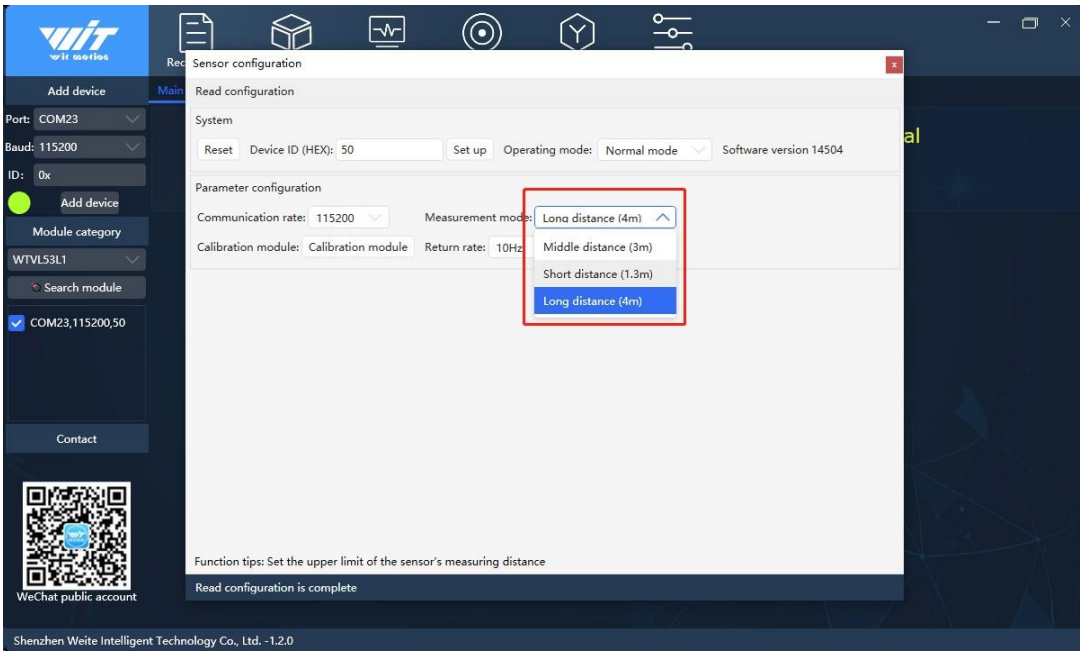
5.8 Measurement Mode

The laser ranging module can set three distance modes, the short-distance mode has a maximum measurement distance of 1.3 meters, the medium-distance mode has a maximum measurement distance of 3 meters, and the long-distance mode has a maximum measurement distance of 4 meters. The default setting is long-distance mode.

After connecting the sensor normally, click "Configure" to select the corresponding device and enter the configuration interface.



Click the drop-down box next to the measurement mode to select the corresponding mode.



Note:
When changing the measurement mode, the host computer automatically changes the setting values of the two registers, register 0x07 (timing preset time) and register 0x08 (measurement interval) according to the mode selection.
The setting values of the host computer are as follows:

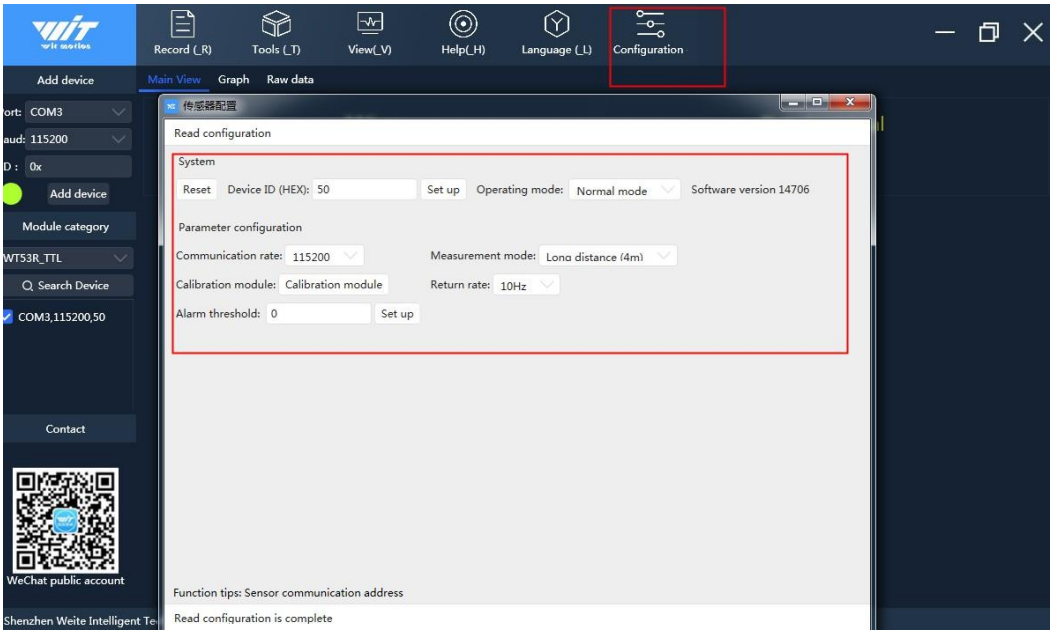
Measurement Mode	Timing Preset Time （0x07）	Measurement Interval （0x08）
Default	20	1
Short-distance	20	1
Medium-distance	250	50
Long-distance	250	50

Example of serial:
MODADDR 06 00 07 00 14 CRCH CRCL // Set register 7 to 20
Time delay100ms
MODADDR 06 00 08 00 01 CRCH CRCL // Set register 8 to 1
Time delay100ms
MODADDR 06 00 36 00 01 CRCH CRCL // Set to short-distance

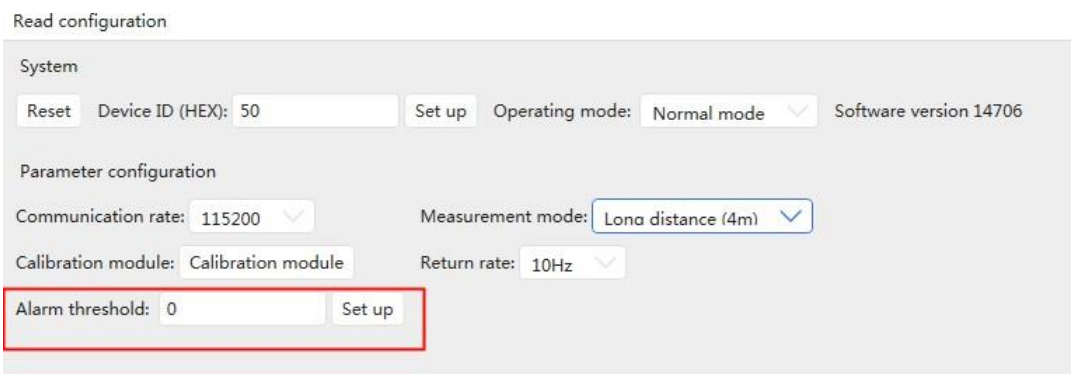
5.9 Alarm Threshold

The sensor has a distance alarm function, and the alarm threshold can be set. When the distance is less than the alarm threshold, the alarm line will generate an alarm level (low level). The process of setting the alarm threshold is as follows:

After connecting the sensor normally, click "Configure" to select the corresponding device and enter the configuration interface.



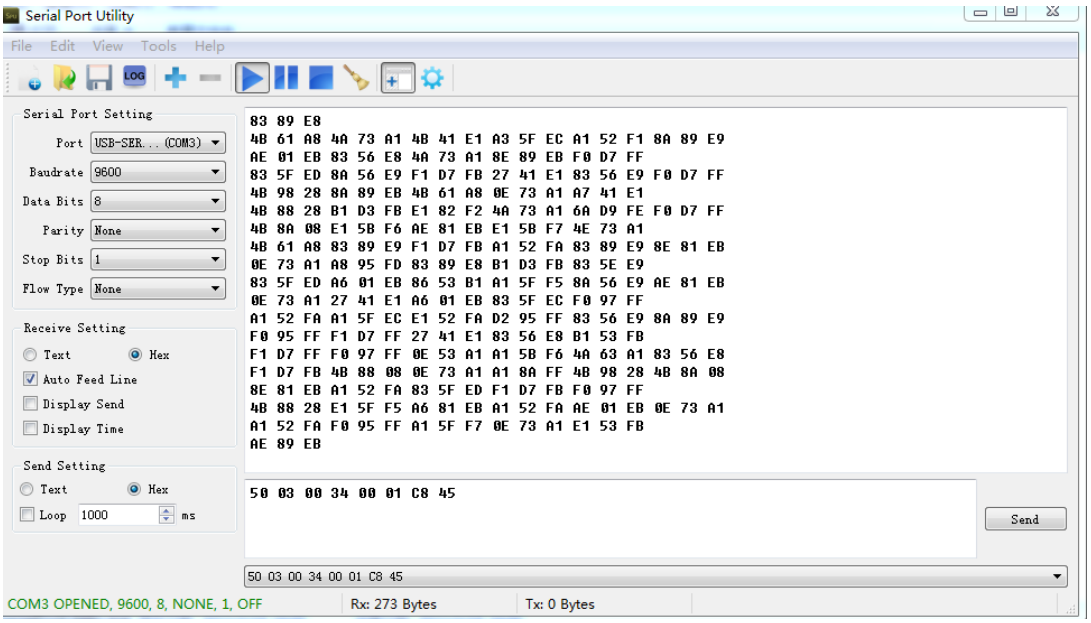
Click “Alarm threshold” after entering the threshold for Alarm Threshold. The alarm threshold setting range is 40~400cm (15.748"~157.480"). As shown below, set it to 1m (39.370"):



6 Communication Protocol

6.1 Serial Mode

The data returned by the sensor is as follows:



For example: d: 490mm 19.291"
State: 7, No Update
d: 490mm 19.291" means measuring distance
State: 7, No Update indicates the status bit of the measurement data

6.2 Modbus Protocol

The sensor adopts the industrial standard Modbus protocol, and the specific reading and writing format is as follows:

Modbus communication, the command number is divided into two kinds of read command and write command, 0x03 (read command) reads the corresponding register data, 0x06 (write command) writes data to the corresponding register.

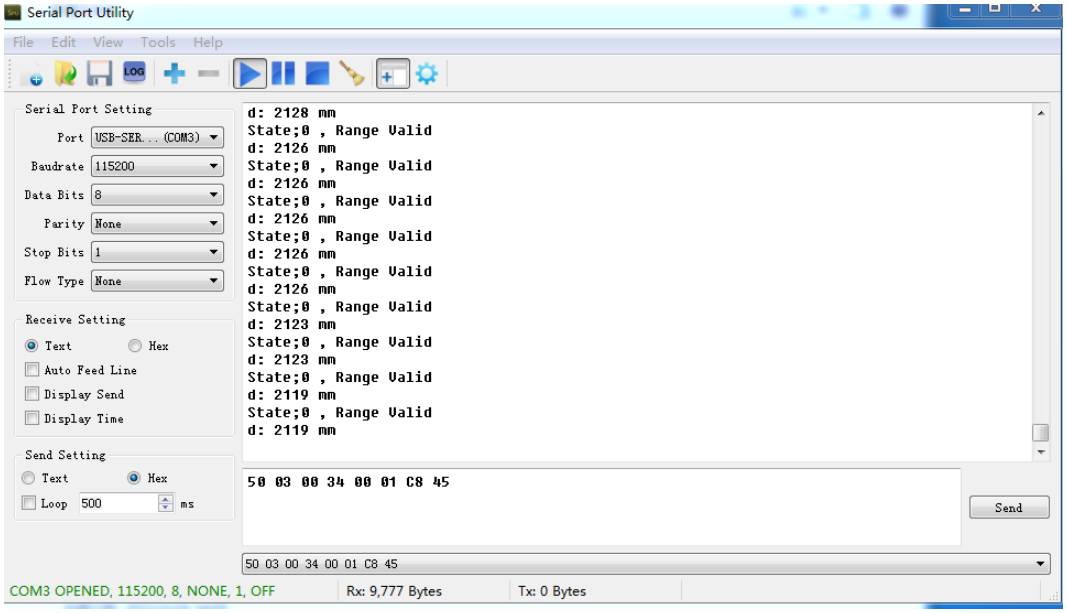
The host computer sends the data frame

ID	Sign	Register high byte	Register low byte	Read length high byte	Read length low byte	CRC Check high byte	CRC Check low byte
ID	CMD	RegH	RegL	LenH	LenL	CRCH	CRCL

For example: the module address is 0x50 (default), the read command is 0x03, the register 0x34 (measurement distance), and the length is one byte.
Command: 50 03 00 34 00 01
Module response frame:

ID	Sign	Data length	Data bit 1 byte	Data bit 1 byte		CRC Check high byte	CRC Check low byte
ID	CMD	LenH	DataH	DataL	.....	CRCH	CRCL

For example: the module address is 0x00, the read command is 0x03, and the length is 2 bits.
Command: 50 03 02 00 1C 44 41
As follows: Read the measured distance



Send command: 50 03 00 34 00 01 C8 45
Accept data: 50 03 02 07 0B 06 7F

Data analysis 0x50 is the Modbus address, 0x03 is sign, 0x02 is the data length, 0x07 0x0B measurement data corresponds to 0x070B is decimal 1803, the measurement distance is 18036mm (710.079"), and 0x06 0x7F is the CRC check byte.

6.3 Modbus Register

Name	Address		Explanation
System Restore	0x00	MODADDR 06 00 00 00 01 CRCH CRCL	Write 0x01, restore default
Alarm Threshold	0x02	MODADDR 06 00 02 MH ML CRCH CRCL	MH alarm threshold high byte and low byte Range 40mm~4000mm Range 1.575" ~157.480"
	0x03	MODADDR 06 00 03 00 00 CRCH CRCL	Write 0x00, return speed 0.1Hz
		MODADDR 06 00 03 00 01 CRCH CRCL	Write 0x01, return speed 0.2Hz
		MODADDR 06 00 03 00 02 CRCH CRCL	Write 0x02, return speed 0.5Hz
		MODADDR 06 00 03 00 03 CRCH CRCL	Write 0x03, return speed 1Hz
		MODADDR 06 00 03 00 04 CRCH CRCL	Write 0x04, return speed 2Hz
		MODADDR 06 00 03 00 05 CRCH CRCL	Write 0x05, return speed 5Hz
		MODADDR 06 00 03 00 06 CRCH CRCL	Write 0x06, return speed 10Hz
		MODADDR 06 00 03 00 07 CRCH CRCL	Write 0x07, return speed 20Hz
		MODADDR 06 00 03 00 08 CRCH CRCL	Write 0x08, return speed 50Hz
		MODADDR 06 00 03 00 09 CRCH CRCL	Write 0x09, return speed 100Hz
VL53L1 Timing preset time (Better not to change , default 20MS)	0x07	MODADDR 06 00 07 TIMEBUDGETH	TIMEBUDGET: 20-1000 MS can be changed 0x0014-0x03e8
VL53L1 Interval	0x08	MODADDR 06 00 08 PERIODH PERIODL	PERIOD ： 1-1000 MS can be changed

(Better not to change , default 1MS)		CRCH CRCL	0x0001-0x03e8
ID settings	0x1A	MODADDR 06 00 1a 00 MODADDRL CRCH CRCL	Write 0x00~0xFE
Data	0x34	MODADDR 03 00 34 00 01 CRCH CRCL	Read, distance high 8 byte and distance low 8 byte
Output state	0x35	MODADDR 03 00 35 00 01 CRCH CRCL	Read: 0x07, Sensor No Update
			Read:0x00，Sensor Range Valid
			Read:0x01，Sensor Sigma Fail
			Read:0x02，Sensor Signal Fail
			Read:0x03，Sensor Min Range Fail
			Read:0x04，Sensor Phase Fail
			Read:0x05, Sensor Hardware Fail
Model	0x36	MODADDR 06 00 36 00 01 CRCH CRCL	Write 0x00, short distance (up to 1.3m, better environmental immunity)
		MODADDR 06 00 36 00 02 CRCH CRCL	Write 0x01, medium distance (up to 3 meters)
		MODADDR 06 00 36 00 03 CRCH CRCL	Write 0x02, long distance mode (up to 4 meters)
Calibration	0x37	MODADDR 06 00 37 00 04 CRCH CRCL	Write 0x04 to enter calibration
		MODADDR 03 00 37 00 01 CRCH CRCL	Read: 0x01, start calibration
			Read: 0x02, calibration failed
			Read: 0x03, calibration complete