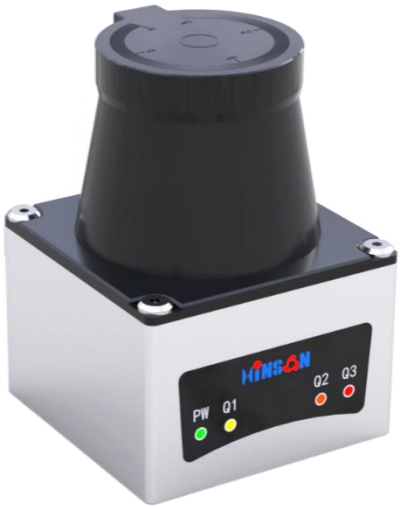
HE-3091F/FA Series

Lidar Sensor

Manual



Thank you for using our company's products. This manual explains the usage and safety matters of the products.

◆Please read this manual carefully and pay attention to safety during use.

◆Please keep this manual and put it in a suitable place for reference at any time.

Guangdong Hinson Technology Co., Ltd.

Version declaration

Version	Add or subtract information
V1.0.0	Published

Contents

1 Safety Precautions

1.1 Attention to applicable environment

Visible particles in steam, smoke, dust and air may cause the sensor to misjudge or even become unusable;

Qualified technicians need to be regularly arranged to check whether the sensor is connected and installed correctly;

The maximum service life of the sensor is 10 years, after which it must be replaced, otherwise it may not meet the required performance requirements;

Sensors should be inspected and cleaned regularly;

This product is only allowed to be used within specified limits and specified technical parameters and operating conditions at any time.

1.2 Pay attention to the wiring environment

Do not connect the power supply reversely or connect it to a voltage higher than the specified maximum working voltage, otherwise the sensor will be damaged;

If the power supply is lower than the minimum working voltage, the sensor will not work or work abnormally;

Please follow the instructions in the manual for wiring, otherwise the sensor may not be able to detect the input signal correctly;

Do not connect the device to the output signal terminal to exceed the load capacity of the sensor, otherwise it will cause sensor failure.

1.3 Note on debugging environment

Only qualified and authorized personnel are allowed to connect, install, commission and set up laser distance sensors;

Confirm that the peripheral equipment associated with the sensor is in a reliable stop operation state;

Confirm that the debugger is in a safe position;

Confirm that other people or objects are outside the range of the device.

2 Preparation

2.1 Packing list

*Please confirm whether the product name and model on the external label of the product packaging box are consistent with what you purchased;

*Determine the product name and model through the external label of the product;

*Please confirm whether the following items are complete after unpacking. If not, please contact our company;

Name	Model	Quantity	Describe
Laser scanning sensor	HE-3091F	1	Sensor Unit
Power supply and IO cables	H8X8L15AX	1	1.5m M8 female cable, 8 core, integrated power supply and I/O, with loose wires on the other end
Ethernet cable	H8X4L20AE	1	2m M8 female cable, 4 cores, RJ45 on the other end

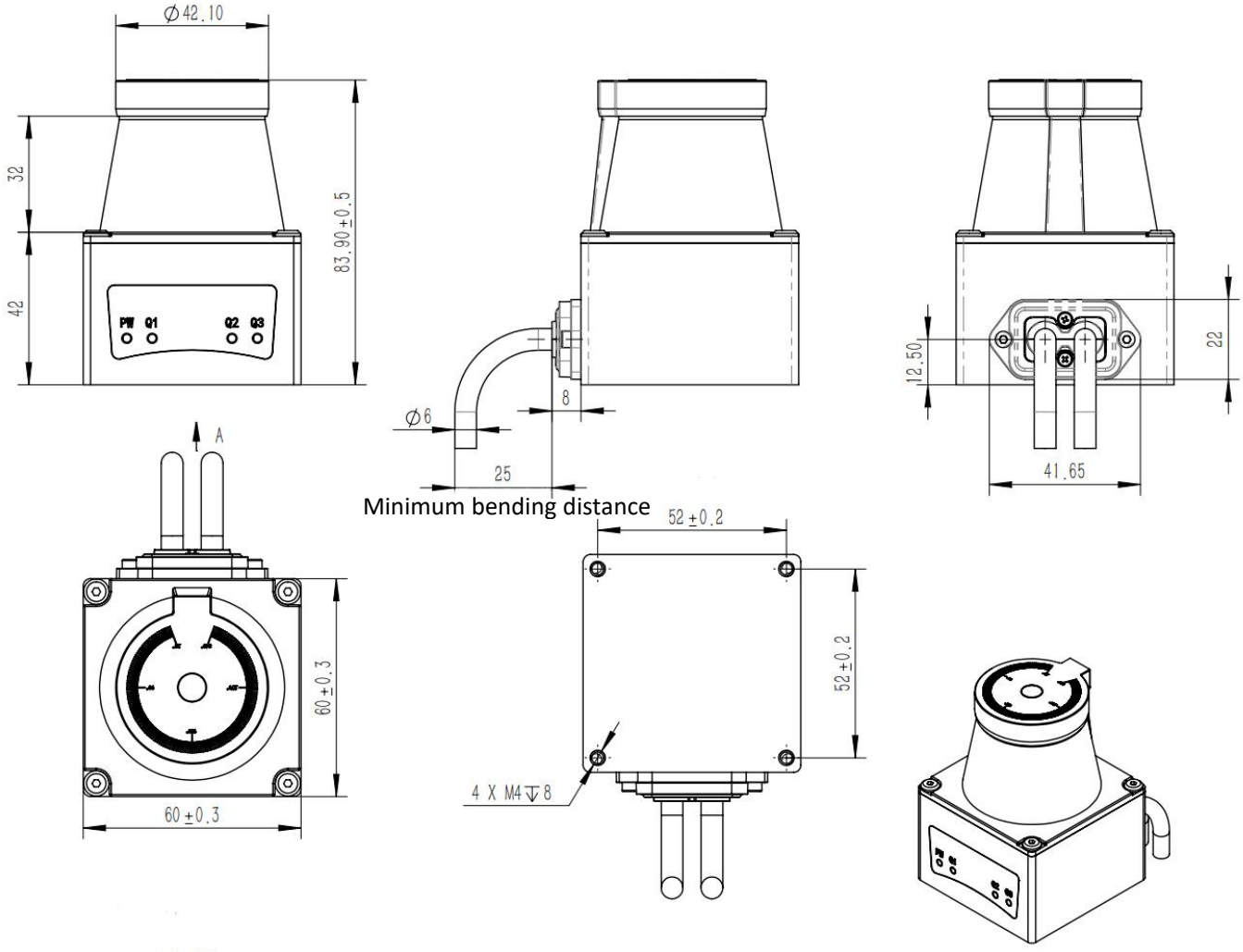
2.2 Debugging tool

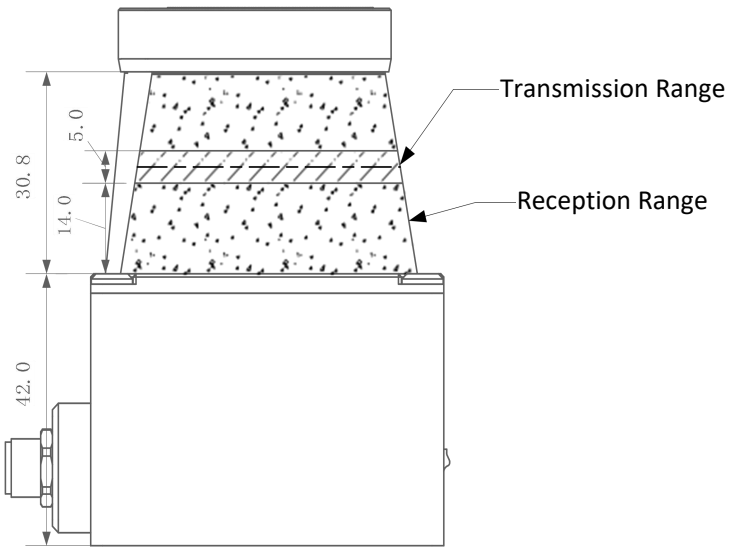
Auxiliary debugging requires the following software and hardware

Software Tools	Software hinson version 1.5.2 or above
Power supply	DC24V power supply
Tool	The computer is configured with RJ45 port (or obtained through conversion)

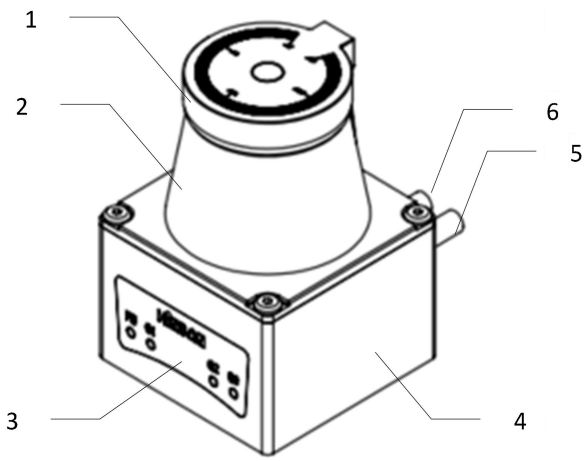
3 Installation

3.1 Dimension parameter



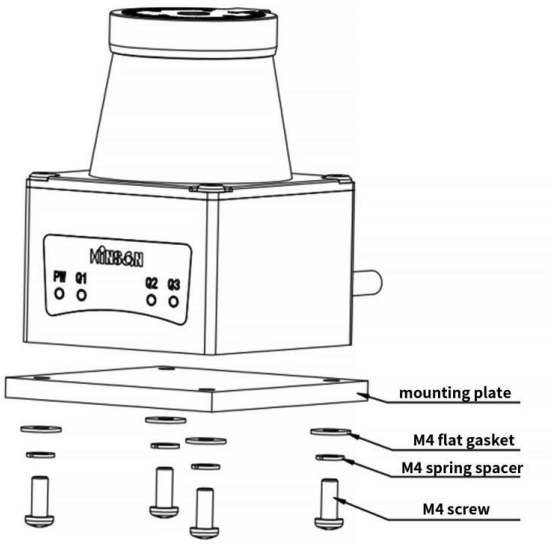
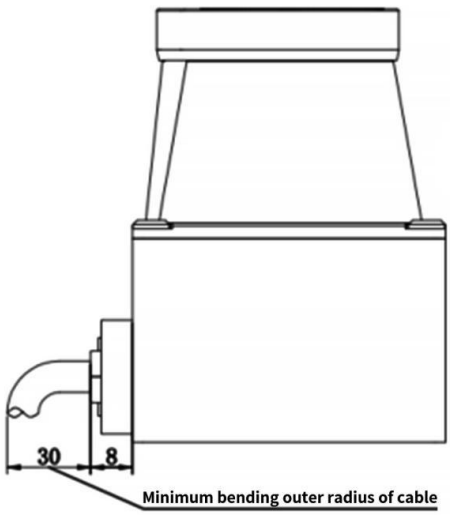


3.2 Parts description



NO	Functional description	Remark
1	Top shell	Mark the scanning range and angle position
2	Sensor detection window	Sensor detection window
3	Indicator light	Show working status
4	Base	Mounting hole position
5	Outlet 1	Ethernet cable connection
6	Outlet 2	Power and IO signal cable connection

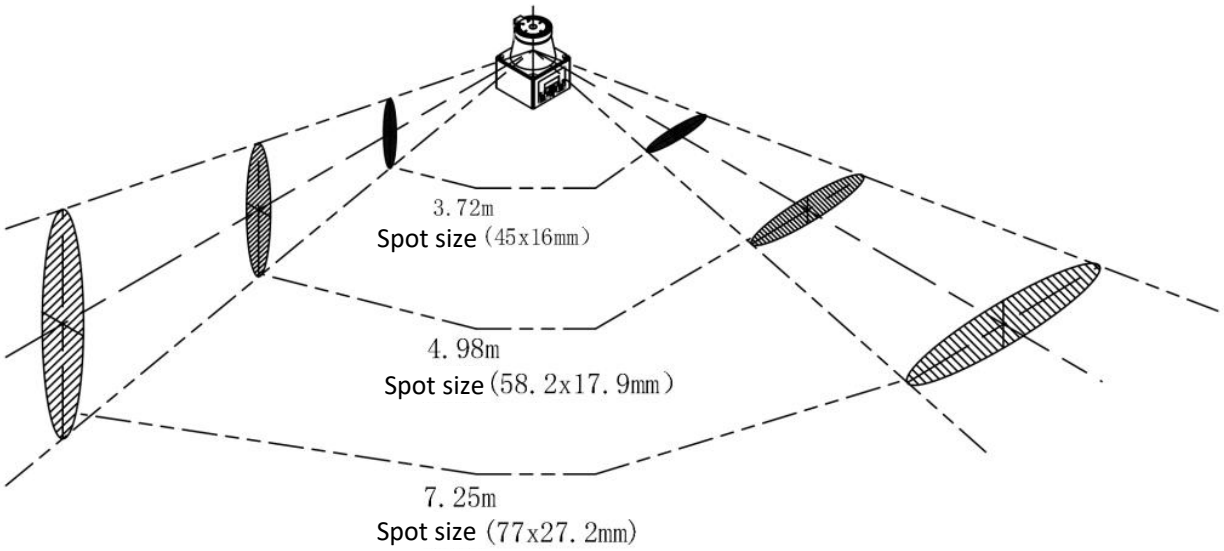
3.3 Installation requirements

	
The fixing screws must have spring washers to prevent them from loosening	Reserve 30mm space at the rear end for cables

3.4 Indicator light description

Logo	Display	Function Description	Operating Instructions
PW	green	Working status indicator light	Green indicator light Off: The sensor is not powered on or not working properly; Always on: The sensor is working normally; Flashing: The sensor detects an internal fault and stops working;
01	yellow	OUT1 output indicator light	Yellow indicator light Off: The sensor is not powered on and no object is detected; Steady on: Intrusion object detected; Flashing: The sensor detects the trigger edge;
02	orange	OUT2 output indicator light	Orange indicator light Off: The sensor is not powered on and no object is detected; Steady on: Intrusion object detected; Flashing: The sensor detects the trigger edge;
03	red	OUT3 output indicator light	Red indicator light Off: The sensor is not powered on and no object is detected; Steady on: Intrusion object detected; Flashing: The sensor detects the trigger edge;

3.5Spot size



4 Specifications

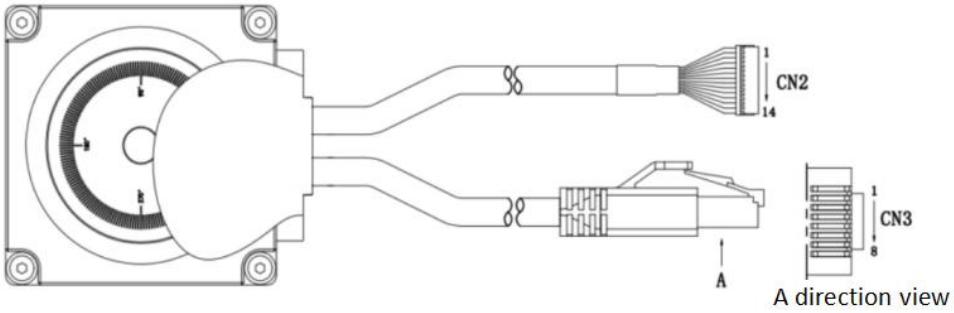
Parameters/Model	HE-3091F	HE-3091FA
Performance		
Detection distance	0.05m-10m（Reflectivity 10%）	
	0.05m-30m（Reflectivity 90%）	
	0.05m-30m（Reflector）	
Detection range	320°	
wavelength	905nm	
Pulse time	5ns	
Measurement method	Pulse ranging technology (PRT)	
Scan motor speed	15HZ、30HZ can be set	
Angular resolution	0.025° to 0.5° (point cloud output), 0.5° to 5° (obstacle detection)	
Absolute accuracy	±20mm	
Repeat accuracy	±20mm（unfiltered）	
Measurement noise	±30mm（unfiltered）	
Measurement resolution	1mm	
Echo function	Single echo function	Supports multi-echo function, supports the first echo, the second echo, the last echo, and the maximum energy
Data interface		
Ethernet	Ethernet TCP/UDP outputs 320° raw measurement data	
Switch quantity	4*NPN output (1 fault state), 4*NPN input	
Electrical/Mechanical		
Operating voltage	DC10 - 30V	
Operating current	＜145mA（DC 24V）	
Power	＜3W	
Working status indicator	Green (PW)	
Output status indicator	Yellow (Q1), orange (Q2), red (Q3)	
Light source	Laser diode	
Display	128*64 pixel OLED screen	
Exit port	M8-4 female cable, Ethernet port	
	M8-8 female cable, power supply and switch ports	
Material	Base, aluminum alloy	
	Scan the window, PUMA	
Environmental		
Ambient temperature for use	-10℃-50℃, indoor use	

Ambient humidity	＜80% RH
Storage ambient temperature	-20℃- 70℃
Ambient light limit	80000Lux
Test/Standard	
Laser grade	Level 1 (IEC 60825- 1:2014, EN 60825- 1:2014)
Protection level	IP65

5 Cable definition

Power supply and switch ports

Function	IO, Power Supply, Ethernet
type	Wire
Terminal specifications	FHG10001-S14M2W1B, RJ45
Number of pins	14 pins
Outgoing method	Direct line



A direction view

Terminal	No	Symbol	Color	Function
CN2	Pin1	+VIN	Brown	Power supply positive input & input common terminal
	Pin2	-VIN	Blue	Power supply negative input & output common terminal
	Pin3	X00	Brown and white	Input 1
	Pin4	X01	Black	Input 2
	Pin5	X02	Orange	Input 3
	Pin6	X03	Yellow	Input 4
	Pin7	Y00	Green	Output 1
	Pin8	Y01	Purple	Output 2
	Pin9	Y02	White and blue	Output 3
	Pin10	Y03	Gray	Output 4
	Pin11	invalid		
	Pin12	invalid		
	Pin13	invalid		
	Pin14	invalid		

Terminal	NO.	Symbol	Color	Function description
CN3	Pin1	ETH TX+	White-red	Ethernet communication TX+
	Pin2	ETH TX-	red	Ethernet communication TX-
	Pin3	ETH RX+	White-green	Ethernet communication RX+
	Pin6	ETH RX-	green	Ethernet communication RX-

6 Port wiring

6.1 Output port

Output Characteristics

When the sensor uses the area detection function, the current detection result can be output from IO;

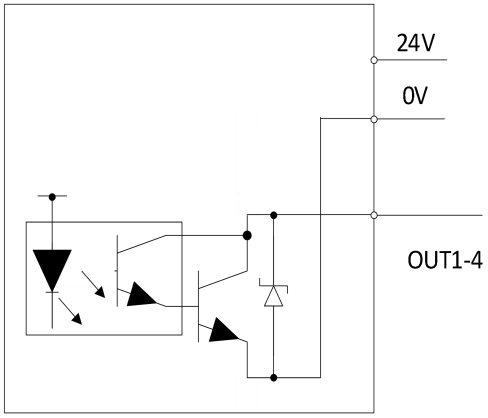
Output signal usage function

Port	Function	Output logic
OUT1	Used for remote tightening and deceleration;	Default: Normally closed, can be changed to normally open through configuration software;
OUT2	Used for proximal tightening and deceleration;	Default: Normally closed, can be changed to normally open through configuration software
OUT3	Used for near-end emergency stop;	Default: Normally closed, can be changed to normally open through configuration software;
OUT4	Used for sensor fault status output,	Default: Normally closed, can be changed to normally open through configuration software

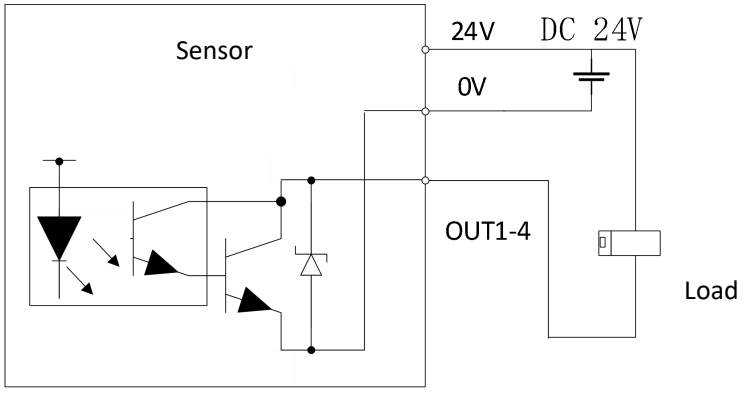
The output is an open collector (NPN) signal, and the output is isolated by optocoupler. When there is a signal, the voltage is 0V-.

The maximum load capacity of the output port is 100mA.

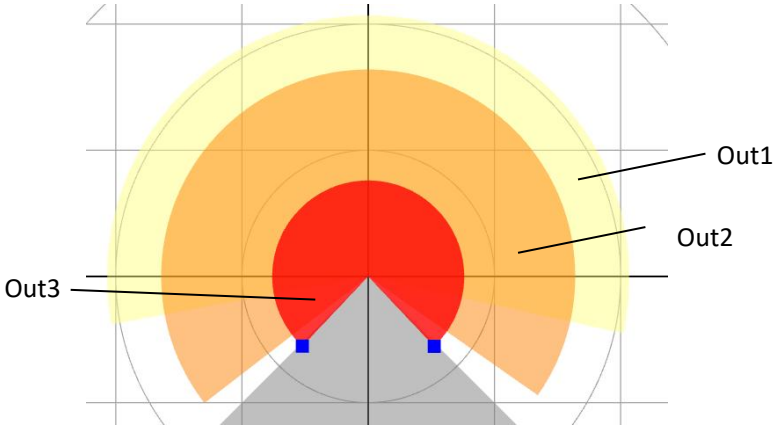
Out-com internally merges to the power supply 0V;



The output ports are NPN outputs. For output schematics, please refer to the following figure:



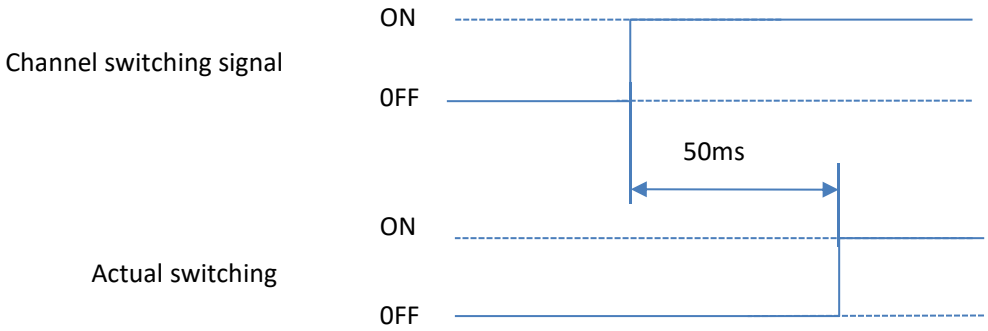
The sensor output port corresponds to the graphic drawn in the configuration software



Notice	
	**There will be detection output only when there is a drawing graphic for the corresponding output;**

switching time

After the sensor receives the channel switching signal, there is a switching delay due to the influence of the scanning period. The switching delay is as shown below.



Notice	**When switching to the graphics channel without graphics, the sensor will maintain the previous graphics channel state output;** **Switch the channel within this scan period (scan period is 50ms), and the output port will remain in the state before switching the channel;**

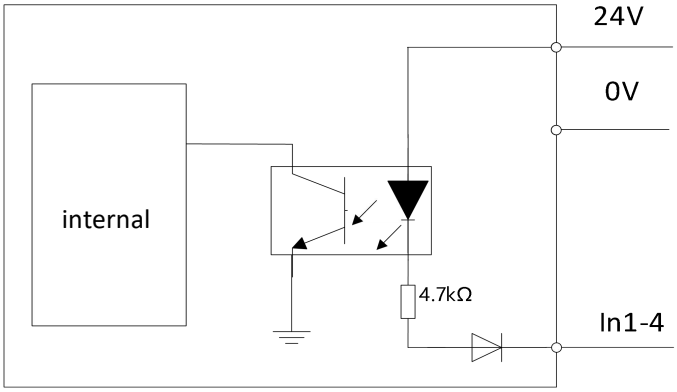
6.2 Input port

Input signal connection

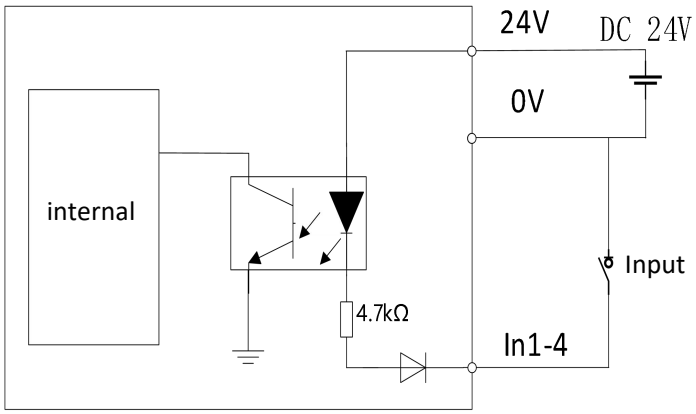
The input is an NPN signal and isolates the input using an optocoupler.

Use external power supply: C0M-input DC24V±20%, above 100mA;

Enter IN-COM internally and to power supply 24V+



Input wiring example



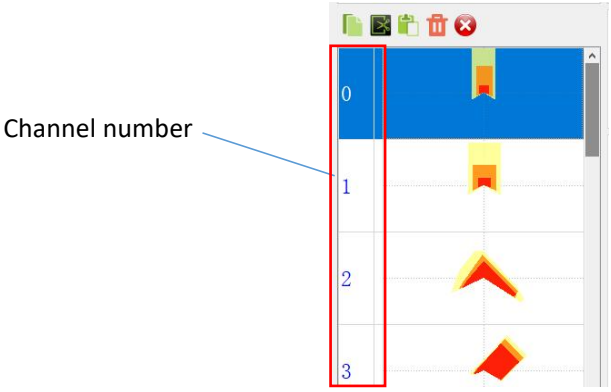
Input signal combination

The sensor has 16 channels, and the signal input combination is switched to the specified numbered channel through 4 IO ports. The detection range of the channel needs to be pre-set through the configuration software. External devices use input signals to select and switch regions.

The sensor provides 4 input ports to combine signals.

ON: There is a signal at the input;

0FF: No signal or open circuit input;

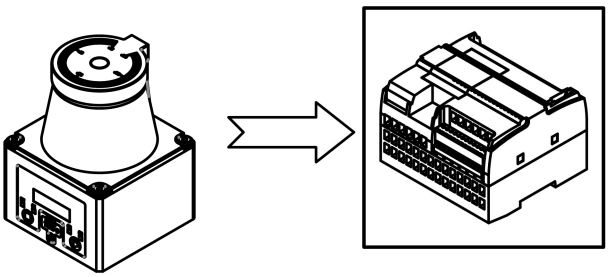


Channel number	IN4	IN3	IN2	IN1
63	OFF	OFF	OFF	OFF
62	OFF	OFF	OFF	ON
61	OFF	OFF	ON	OFF
60	OFF	OFF	ON	ON
59	OFF	ON	OFF	OFF
58	OFF	ON	OFF	ON
57	OFF	ON	ON	OFF
56	OFF	ON	ON	ON
55	ON	OFF	OFF	OFF
54	ON	OFF	OFF	ON
53	ON	OFF	ON	OFF
52	ON	OFF	ON	ON
51	ON	ON	OFF	OFF
50	ON	ON	OFF	ON
49	ON	ON	ON	OFF
48	ON	ON	ON	ON

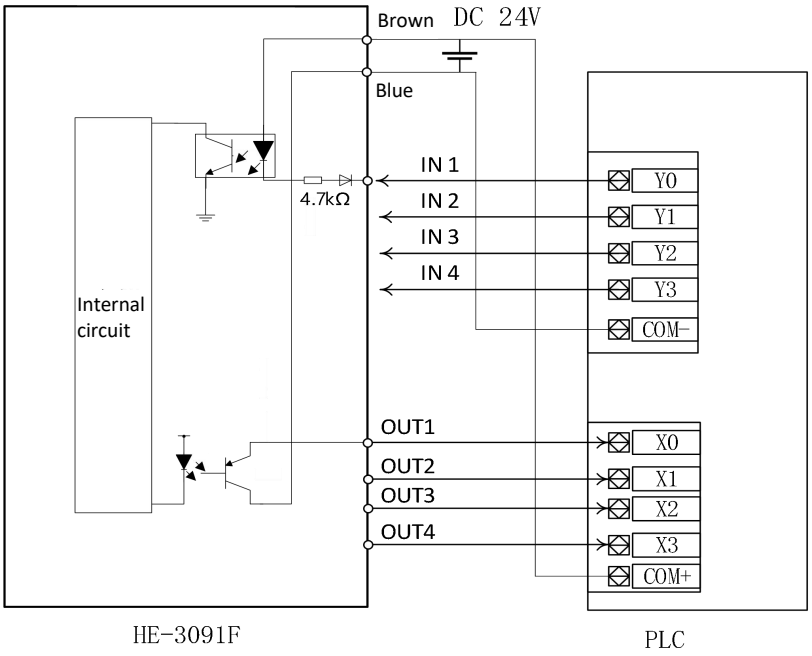
Remind	
	**If all 16 channels are not needed, the input signal can be determined based on the number of channels required;**

6.3 Connection diagram

According to the wiring of all 16 channels and all outputs when all are used.



The picture shows the host computer outputting signals and receiving signals through the NPN tube.



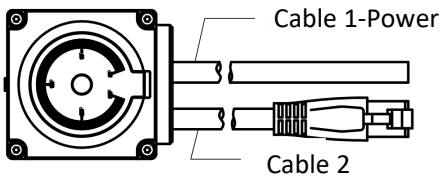
X0-X1 are the signal input ports of the PLC;

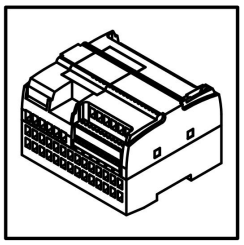
Y0-Y3 are the signal output ports of the PLC;

IN1-IN4 input current is greater than 10mA;

Out1-Out3 output current is less than 100mA;

6.4 Ethernet wiring





Host computer

Network connection specifications

Protocol	TCP(Server)）/UDP
Rate	100M Full duplex
Interface	RJ45

7 Configure software usage

7.1 Sensor connection

Ethernet connection

Connect to the computer using the Ethernet RJ45 port of the sensor

Computer requirements

1) Windows 7 or above systems;

2) Connect to Ethernet, connect to RJ45 port;

3)Set the IP address of the local network connection;

7.2 Configure software operations

Get software

1) Visit the company website to obtain www.hinson-xs.com

2) Consult sales and technical support personnel to obtain

Software running environment

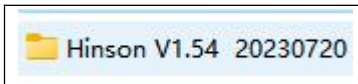
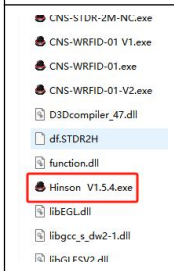
System requirements	Windows 7 or above
Display resolution	1280*720 or above

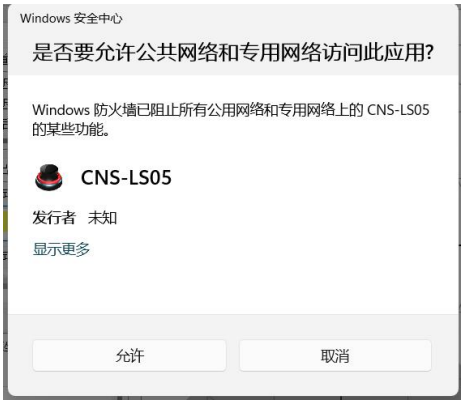
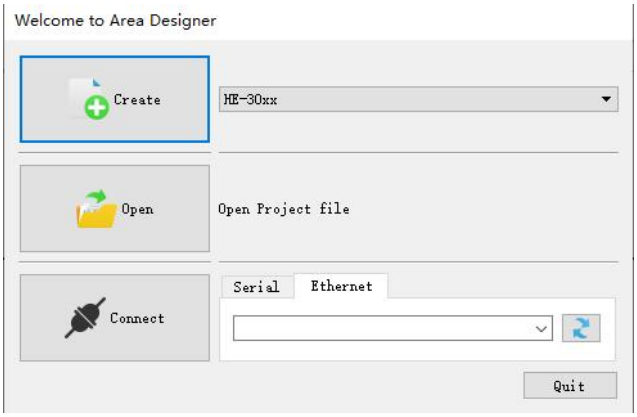
Software decompression

1) Double-click to open;

2) After the file is unzipped, it will be produced in the current directory;

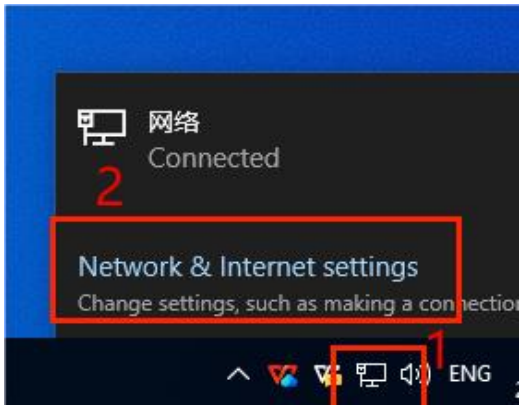
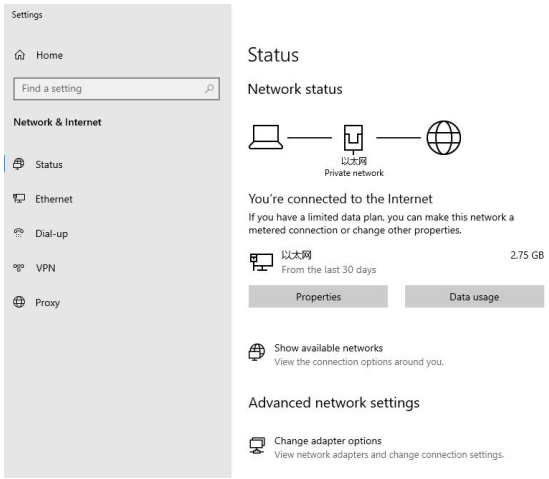
7.3 Run the configuration software

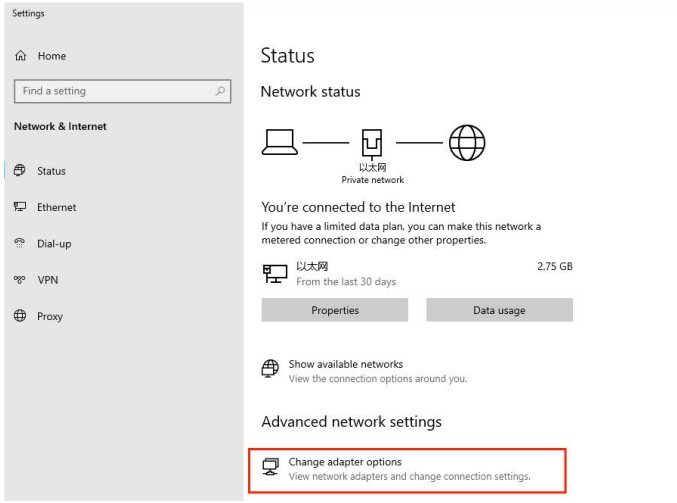
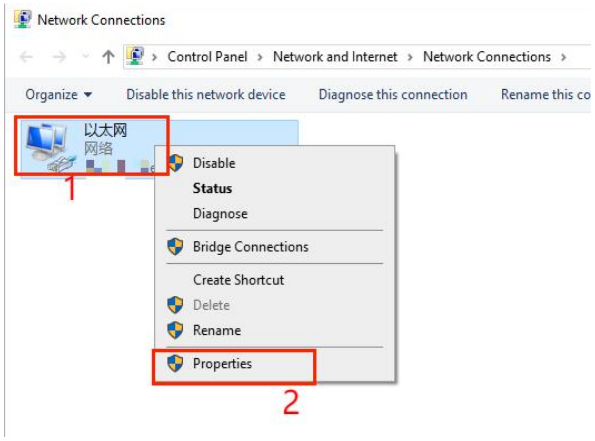
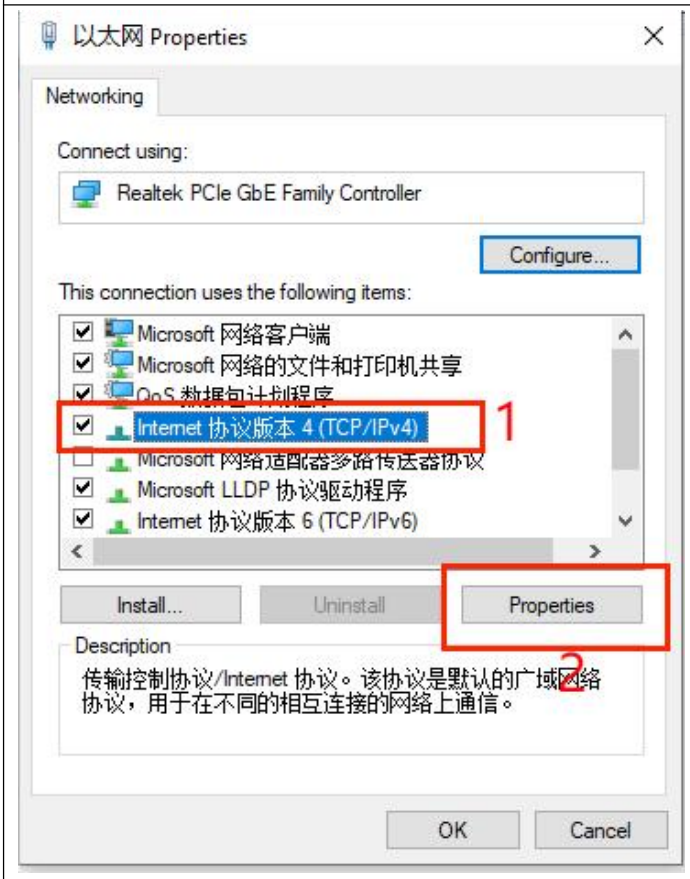
	Unzip the configuration software file
	Open the folder, find the opening configuration software, and open it with the left mouse button;
	Select to HE-XXXX, click to open;

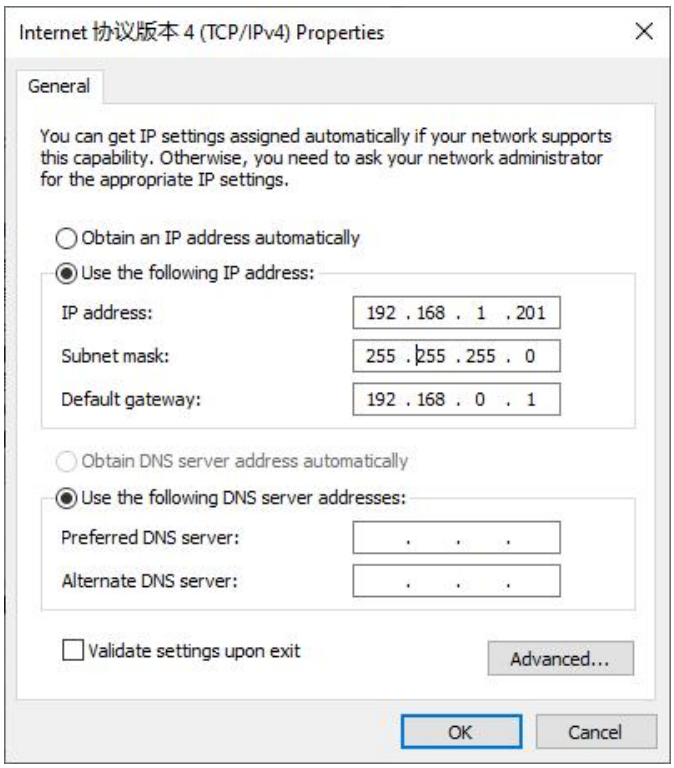
	The first time you open it will prompt
	Select the corresponding HE-30xx series of sensors; Connection: Select Ethernet, the software will automatically search for the current sensor IP address in the network and modify the local network connection IP segment according to the radar IP address; Note: If searchable occurs, 1) Please disable other local network connections and try; 2) Turn off the local network proxy software or VPN software;

Set the local IP address;

Taking Windows 10 as an example, different system versions may have differences; specific setup methods can be searched online;

 	On the computer desktop, find the network icon in the lower right corner, and then right-click; open "Network & Internet Settings";

	Click to Change adapter options.
	1: Find the local connection of the link sensor; 2: Right-click, select Properties in the pop-up dialog box;
	In the local network card attribute interface "This link uses the following items" 1: Select "Internet Protocol Version 4 (TCP/IPv4)"; 2: Click the "Properties" button below;



"Internet Protocol Version 4 (TCP/IPv4) Properties

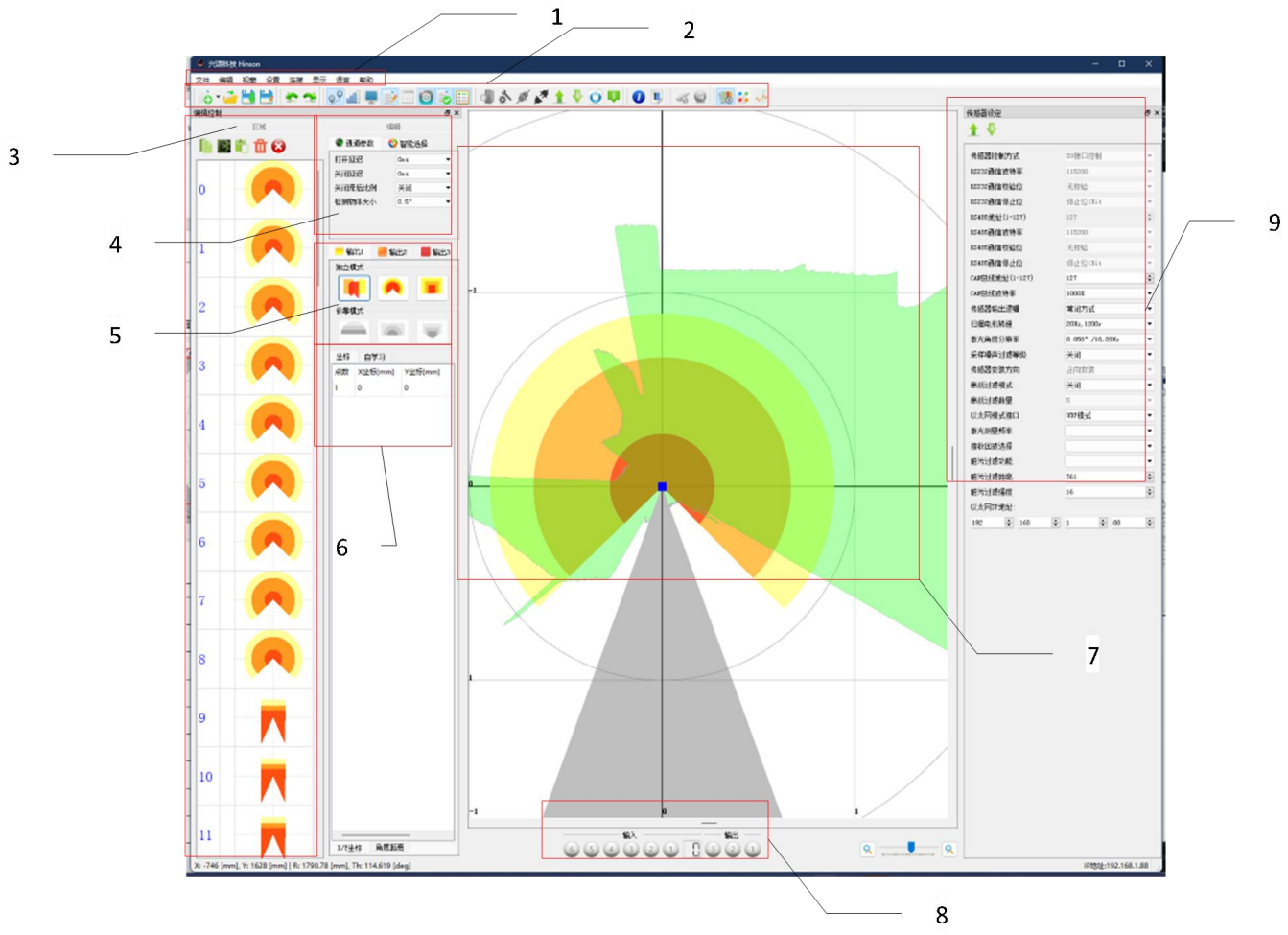
"Tick the interface "Use the following IP address";

Fill in the relevant "IP address, Subnet mask, Default gateway;

After filling in, press the "OK" button to exit.

7.4 Configuration software interface introduction

After connecting to the configuration software, the following interface is displayed:



7.4.1 Menu Bar

Level 1 Menu	Level 2 Menu	Level 3 Menu	Correspond icon	Remark
File	Create file	-		Create a new file
	Open file	-		Open edited file
	Save file	-		Save edited file
	Save as	-		Save edited file as
	Exit	-		Exit current configuration software page
Edit	undo	-		Undo previous operate
	Restore	-		Restore previous operate
	Copy	-		Copy detection channel's detection graphic
	Cut	-		Cut detection channel's detection graphic
	Paste	-		Paste detection channel's detection graphic into another channel
	Delete	-		Delete current choose detection channel graphic
	Delete all	-		Delete all detection channel graphic
	App settings	-		-
Windows	Windows	Edit		Click the icon to configure the software to display the edit function box
		Monitor		Click the icon to configure the software to display the monitoring status
		Sensor set		Click the icon to configure the software to display the sensor parameter setting function box
		I/O simulation		Click the icon to display the sensor input and output simulation function box
		Self-check status		Click the icon to display the sensor self-test status
	Distance	-		Click to close or display the scan profile within the current 120° range of the sensor
	Strength	-		Click to turn off or show the reflective intensity

				of obstacles
	Data list	-		The configuration software does not support the output of distance data for all current detection points, this item is unavailable
Set	Serial port	-		The sensor does not support serial connection configuration software, this item is unavailable
	Ethernet	-		Click to select the Ethernet connection configuration software
	Serial port set	-		The sensor does not support serial connection configuration software, this item is unavailable
	Ethernet set	-		Click to see current status sensor Ethernet address
Connection	Interface	Serial port		The sensor does not support serial connection configuration software, this item is unavailable
		Ethernet		
	Connect device	-		Click to connect sensor and configuration software
	Disconnect device	-		Click to disconnect sensor and configuration software
	Upload date	-		Click to upload the detection channel graph and various parameters that have been set by the sensor
	Download data	-		Click to download the detection channel graph and various parameters
	Restart device	-		After setting the detection channel graph and its parameters, click this icon to restart the sensor, and the parameters will take effect
	Sensor information	-		-
Display	Display graphic	-		Click this icon and the sensor 120° scan profile is displayed in a flat graphic
	Point cloud display	-		Click this icon and the sensor 120° scan profile is displayed as a point cloud
	Line display	-		Click this icon and the sensor 120° scan profile is displayed as a line
Language	Chinese	-		Click this icon, the configuration software is displayed in Chinese

	English	-		Click this icon, the configuration software is displayed in English
Help	About	-		Click this icon to configure the software to display version information
	Guise	-		-

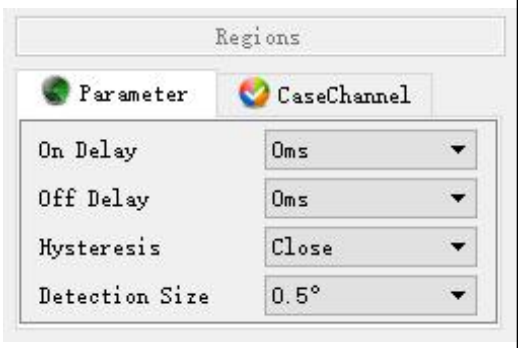
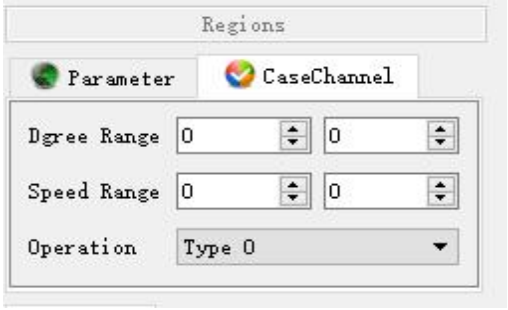
7.4.2 Quick icon

All shortcut icons are explained in the Part 1 menu bar.

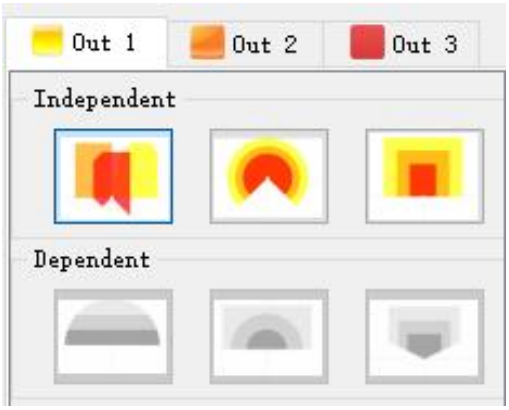
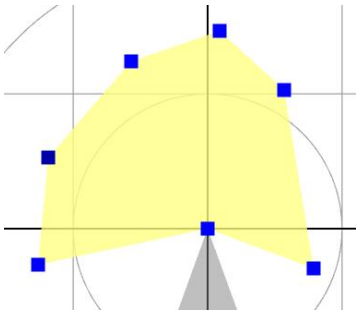
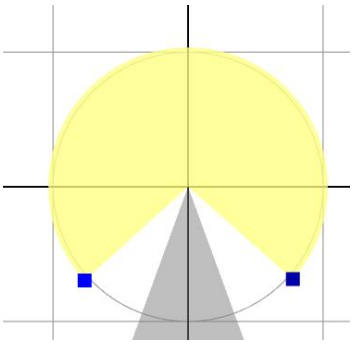
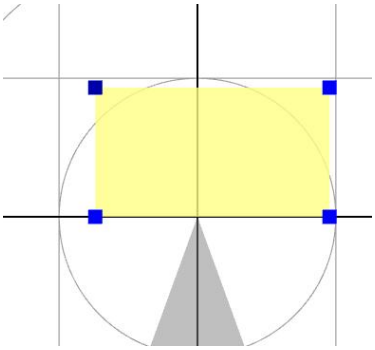
7.4.3 Detection channel graphics editing

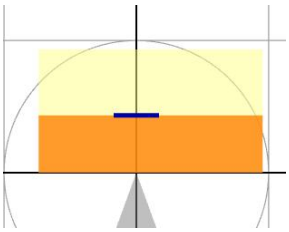
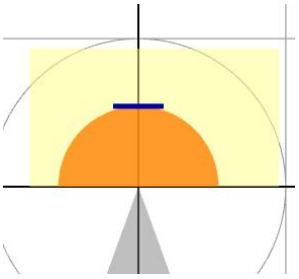
HE series supports detection channels No. 0-63, each detection channel supports 3 areas to detect graphics output.

7.4.4 Channel parameters and intelligent selection

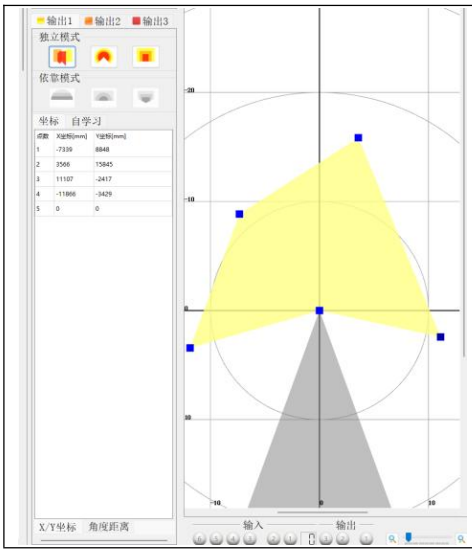
	Open delay: 0-500ms The output signal is output after the object intrusion time is set for the time, which is used to filter objects or interference when flashing; Close delay: 0-500ms, The object invades and outputs the signal, and then the output signal is maintained for the set time after the object leaves, and then the output is restored; It sometimes does not cause frequent jumps in the sensor output port when used in obstacles; Close lag ratio: 0-10%, After the object intrusion is triggered, the object needs to be away from the set proportional distance and restored; Detected object size: 0.5°-5° Adjusting the size of the detected object can reduce the sensor error trigger caused by the unclean mirror of the sensor.
	Group control of channels 0-63 in intelligent selection mode; In the same channel group, the channel switching is automatically switched to the corresponding channel based on the real-time driving angle value and vehicle speed value sent to the sensors sent by the upper computer to the sensor, compared with the preset value, and the sensors within the preset value range. Drive angle range setting value: -180 to +180; Vehicle speed range setting value: -300 to +300; Vehicle channel group: Channel group 0-Channel group 4

7.4.5 Editing mode

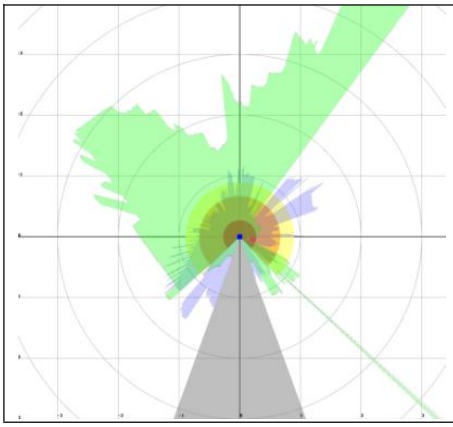
<table>
<tr><td> 
</td><td>Independent mode: draw independent range graphics;
Relying on mode: Fill in the output graphics range;</td></tr>
<tr><td>Independent mode</td><td></td></tr>
<tr><td>  </td><td>Polygon drawing mode, draw irregular detection range; drag the blue coordinate points from the center origin to generate the detection range graph.
  </td></tr>
<tr><td>  </td><td>Fan-shaped drawing mode, draw the fan-shaped detection range;
  </td></tr>
<tr><td>  </td><td>Rectangle drawing mode: draw rectangle detection range;
  </td></tr>
</table>

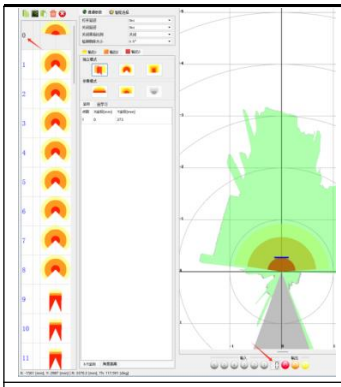
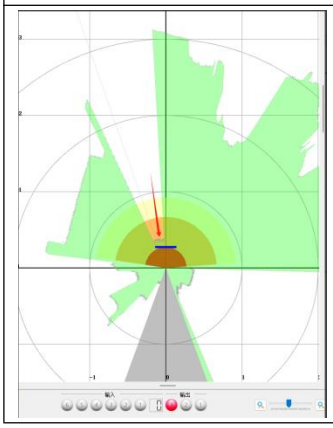
Rely on the mode	
	Rectangle fill mode; 
	Span-shaped fill mode; 

7.4.6 Coordinate value

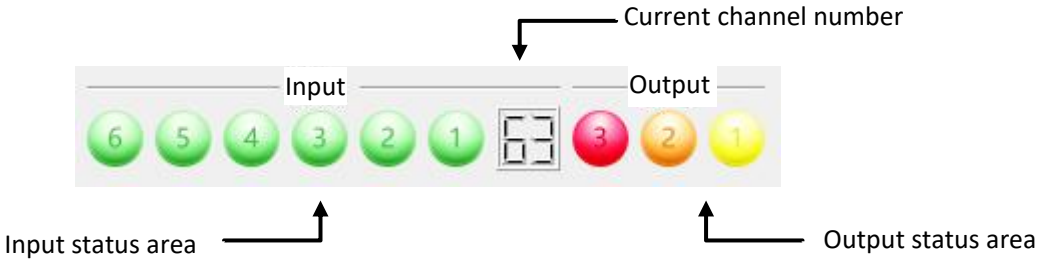
	Coordinates: divided into X/Y coordinates and angular distance; X/Y coordinates: Displays the positions of each endpoint of the figure drawn under the uncartoon coordinate system; Angle distance: Displays the coordinate positions of each endpoint of the drawing in an unpolar coordinate system; Self-learning: No function available;

7.4.7 Scan the screen display window

	1: Green: The unobstructed position scanned by the sensor, and the junction position of the green and white is the actual detected object distance; 2: Purple: It is not necessary to use it during obstacle detection, and the display can be turned off. 3: White: The position cannot be detected after being blocked by an object; 4: Gray: blind spot, outside the sensor detection range area; 5: The value of the edge part of the coordinate: the unit of coordinate value is meters;

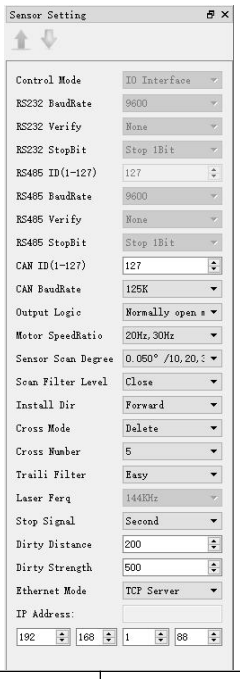
	Currently displaying channel 0 range; There is no intrusion trigger within the set trigger range. The default output logic is: normally closed mode; out1-out2-ou3 both output signals;
	There is a trigger situation at present; Objects invade into the ranges out1 and out2, and out3 does not trigger;

7.5 Sensor status bar



Input status area	Display the current input port status, and the numbers 1-4 represent the IN1-IN4 input status respectively; Green: No signal input; Gray: signal input;
Current channel number	The display value is the channel number where the current sensor is in effect.
Output status area	Display the current output port status, and numbers 1-3 represent the OUT1-OUT3 output status respectively; Related to the parameter setting item sensor output logic: Normally closed mode (default) Color: Object detected; (OUT1-OUT3 is in disconnected) Gray: No object was detected; (OUT1-OUT3 is in conduction state) Normally open method Color: Object detected; (OUT1-OUT3 is in conduction state) Gray: No object was detected; (OUT1-OUT3 is in the off state)

7.5.1 Sensor parameters setting



Sensor control method	IO interface control	When selecting sensor channel in input, select one of IO, Modbus, and Canopen. Only one of them is valid at the same time, and IO is always valid when output (not available)
	Modbus communication control	When selecting sensor channel in input, select one of IO, Modbus, and Canopen. Only one of them is valid at the same time. IO is always valid when output. When Modbus communication control is selected, the Modbus output is valid (not available)
	Canopen communication control	When selecting the sensor channel in input, select one of IO, Modbus, and Canopen. Only one of them is valid at the same time. IO is always valid when output. When selecting Canopen communication control, the Canopen output is valid (not available)
RS485 address (1-127)	1-127	RS485 communication address 1-127 can be set (not available)
RS485 communication baud rate	9600bps	RS485 communication baud rate setting(not available)
	19200bps	
	38400bps	
	57600bps	
	115200bps	
RS485 check digit	No checksum	RS485 check code setting(not available)
	Odd parity	
	even parity	

RS485 communication stop bit	Stop bit 1Bit	RS485 stop bit setting(not available)
	Stop bit 1.5Bit	
	Stop bit 2Bit	
CAN bus address (1-127)	1-127	CAN communication address 1-127 can be set(not available)
CAN bus baud rate	125K	CAN bus baud rate(not available)
	250K	
	500K	
	1000K	
Sensor output logic	Normally open mode	Sensor output normally open and normally closed settings
	Normally closed mode	
Scan motor speed	15HZ(900r/min)	Scan motor speed setting
	30HZ(1800r/min)	
Laser angle resolution	0.025°	Default resolution 0.05°
	0.050°	
	0.100°	
	0.250°	
	0.500°	
Noise filter level	closure	Noise filtering level setting, default is simple
	Simple	
	medium	
	strict	
Sensor installation direction	Forward installation	Parameters are not currently in effect
Crosstalk filtering enabled	Closure	Open by default. Turn on the anti-interference function of other sensors
	Open	
Number of crosstalk filters	3-8	The default is 5, the number of filter points. The more filter points, the better the anti-interference effect, but the image will have certain edge distortion.
Ethernet mode interface	TCP server	Default TCP server
	UDP mode	
Laser measurement frequency	144KHZ	3 types of laser measurement frequencies
	288KHZ	
	576KHZ	
Receive Echo Selection	first	First time: The sensor uses the first return signal; Last time: The sensor uses the last echo signal in the detection window;
	The last time	
	The maximum energy	

<table>
<tr><td></td><td></td><td>Maximum Energy: The sensor uses the signal with the largest energy of all echo signals.

The echo with the largest energy and the last echo can reduce the impact of dust, rain and fog on the sensor.
(The echo detection function will be affected if the echo spacing is less than about 2.4m, making it difficult to detect the second echo. The shorter the spacing, the more serious the impact. If the first echo is less than 1m, only the first echo can be detected)</td></tr>
<tr><td rowspan="3">Ethernet IP address</td><td colspan="5">The sensor (server) port is fixed to 8080</td><td rowspan="3">192.168.1.88</td></tr>
<tr><td></td><td>192</td><td>168</td><td>1</td><td>1</td></tr>
<tr><td>scope</td><td>10-254</td><td>0-255</td><td>0-255</td><td>0-255</td></tr>
</table>

7.6 Icon function

7.6.1 Input output emulation

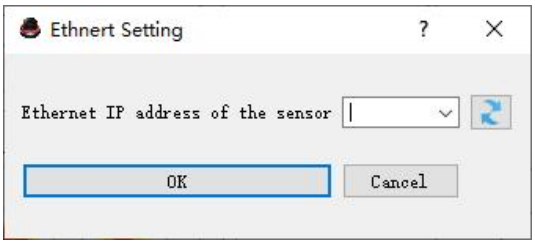
The input and output simulation function is to emulation the operation of the IO port of the laser sensor in the configuration software, or to set the emulation conditions to select the automatic switching port.

<table>
<tr><td>  </td><td> 
</td></tr>
<tr><td>Dynamic scanning settings</td><td>Change the sensor rate and output resolution, and the sensor takes effect in real time;
After the sensor restarts, it will resume running according to the parameter settings;</td></tr>
</table>

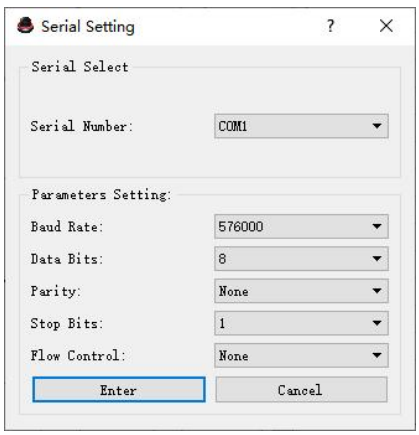
Input Port Emulation	Enable input port emulation function. When the emulation function is enabled, the input port action is invalid. This function can simulate input port switching area channels.
Output Port Emulation	Enable the output port emulation function. When the emulation function is enabled, the output port action does not follow the actual sensing object action. This function can simulate output port action.
Exception state simulation	Enable the exception state port output emulation function. When the simulation function is enabled, the sensor fault output port action does not follow the actual sensor abnormal state. This function can simulate the action of the sensor fault output port.
Intelligent Select Simulation	Check "Intelligent Select Simulation" and enable the intelligent selection emulation function. When the intelligent selection simulation function is enabled, the sensor automatic switching area function is invalid. This feature can simulate intelligently selected conditions to allow the sensor to automatically switch areas.

Tips	When an abnormality in the input and output of the sensor is detected, use the input and output port emulation function to test the sensor.

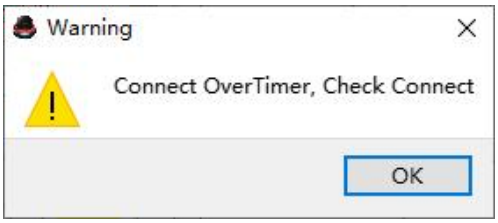
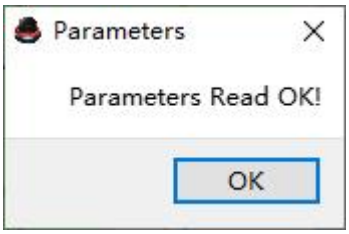
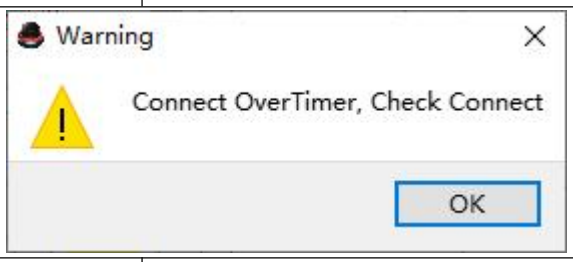
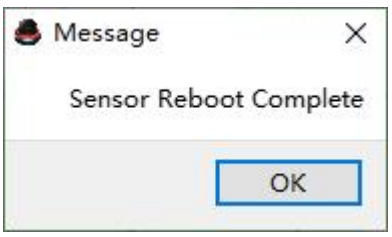
7.6.2 Network port settings

		Automatically find the sensor IP address.

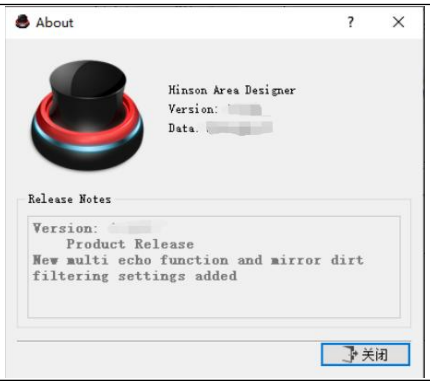
7.6.3 Serial port settings

<table>
<tr>
<td rowspan="8">  </td>
<td rowspan="8">  </td>
<td colspan="2">Set the parameters of the Micro USB configuration port. After the sensor is connected via USB, it is connected to the COM port on the computer system.</td>
</tr>
<tr><td>Parameter</td><td>Parameter information</td></tr>
<tr><td>Serial number</td><td>COM-*</td></tr>
<tr><td>Communication rate</td><td>576000bps</td></tr>
<tr><td>Data bits</td><td>8</td></tr>
<tr><td>Check bit</td><td>None</td></tr>
<tr><td>Stop position</td><td>1 person</td></tr>
<tr><td>Flow control</td><td>None</td></tr>
</table>

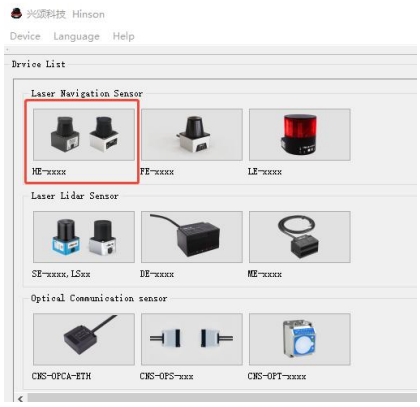
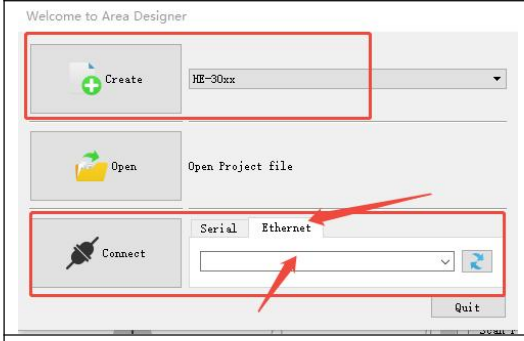
7.6.4 Connection and disconnection

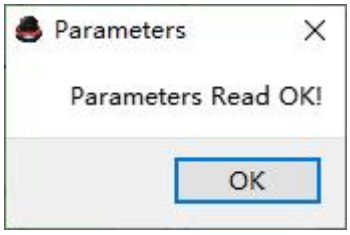
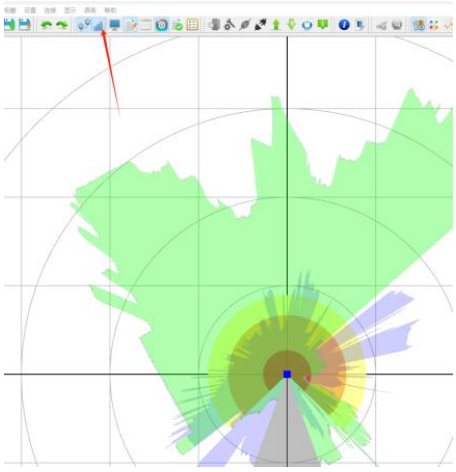
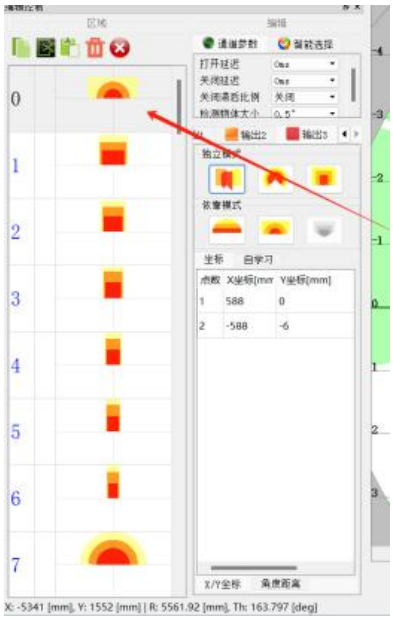
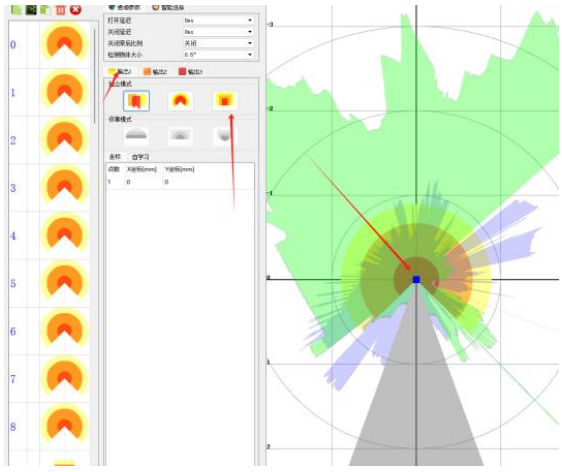
		Connect the device, read the sensor data, and disconnect it from the device. After the connection is successful, start uploading data from the sensor.
		If the device is not connected, a read and write timeout warning will be displayed. After prompting a warning, troubleshoot according to the fault status.
		Upload success prompt; Upload parameters from the sensor and read the current parameters set inside the sensor and the drawn graphic data.
		Download the parameters set by the configuration software and the drawn graphic data into the sensor.
		After the device is not connected to or the connection is disconnected, a read and write timeout warning will be displayed. After prompting a warning, troubleshoot according to the fault status.
		Control sensor restart for sensor initialization and parameter setting to take effect. The restart process is about 5 seconds.

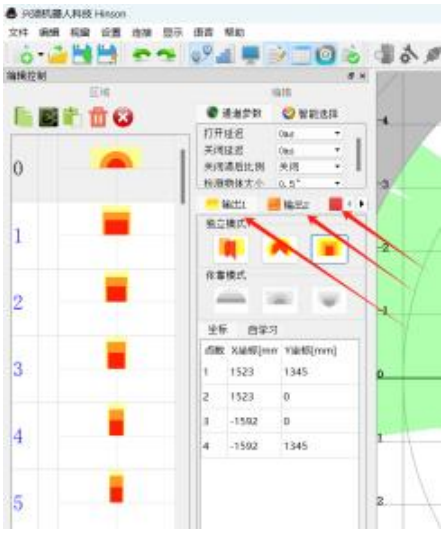
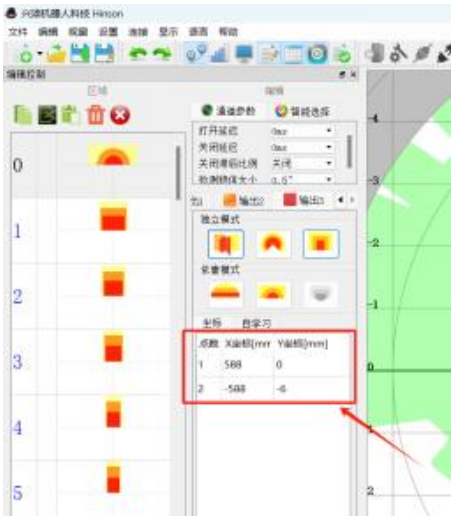
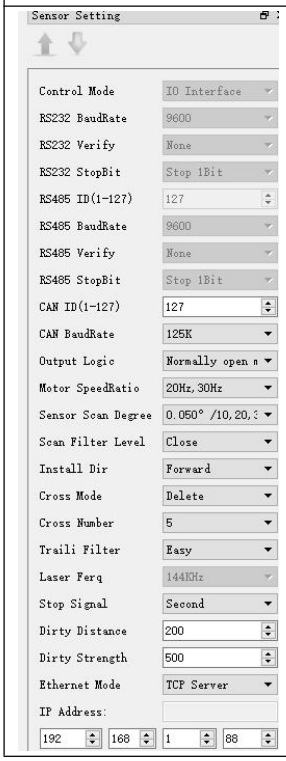
7.6.5 Sensor firmware version

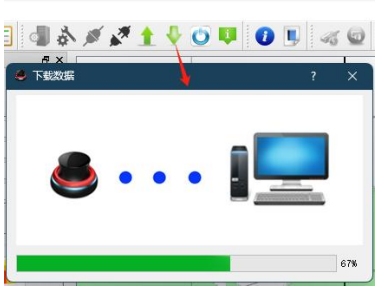
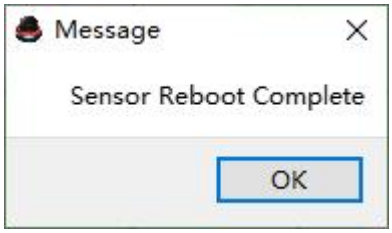
		After connecting to the sensor, click the version get button to get the current sensor version number; Get the firmware version information of the current sensor.

7.7 Quick setup steps

	Open the configuration software
	Select to the HE-XXXX series icon
	Set the connection series model, Set the current connection IP address of the connection; The sensor will automatically search for the IP address; If the IP address cannot be searched, you need to disable other local connections in the Windows system and try it.
	Wait for uploading data;

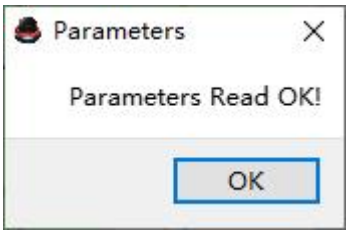
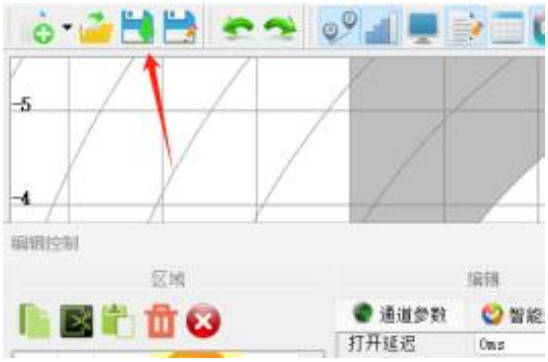
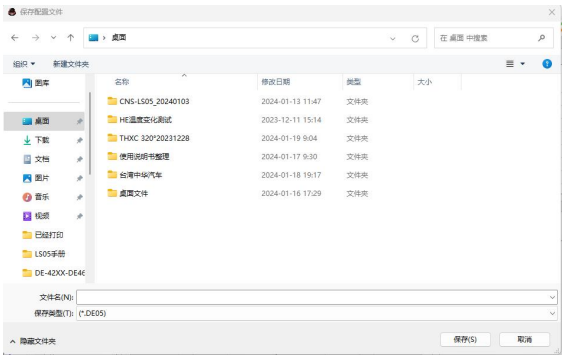
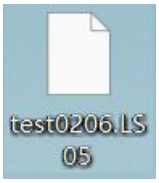
	The sensor connection was successful;
	Turn off signal strength
	Select the default channel; In the selection channel number, edit;
	Select to output 1 Select editing mode;

	According to the electrical wiring and defined area number, click the left mouse button to select the area channel to be edited, and then drag the middle blue dot in the edit area to draw the desired graphics.
	Can customize the position of the blue dot by directly modifying the coordinates.
	Set parameters;

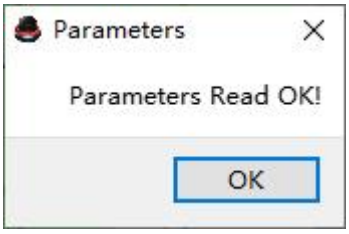
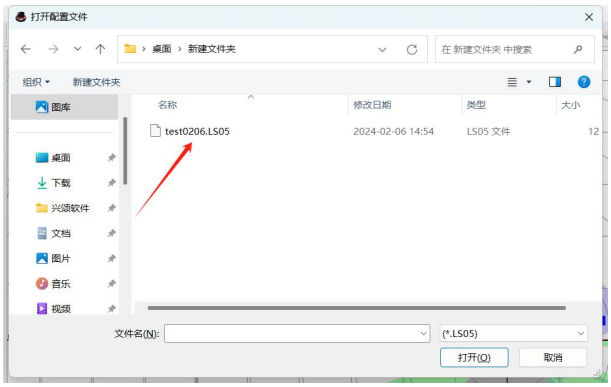
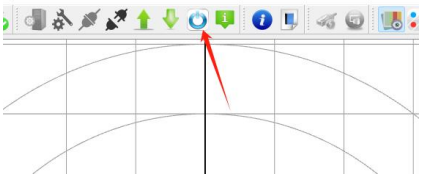
	Download parameters into the sensor.
	The parameters are written successfully;
	Click Restart to take effect;
	After editing is completed, click the "Download Data" button to download the data to the sensor, and then click the "Restart Device" button to restart the laser scanning sensor online.  Note: Restart after downloading to take effect!

7.8 Configuration export and import

7.8.1 Configuration import

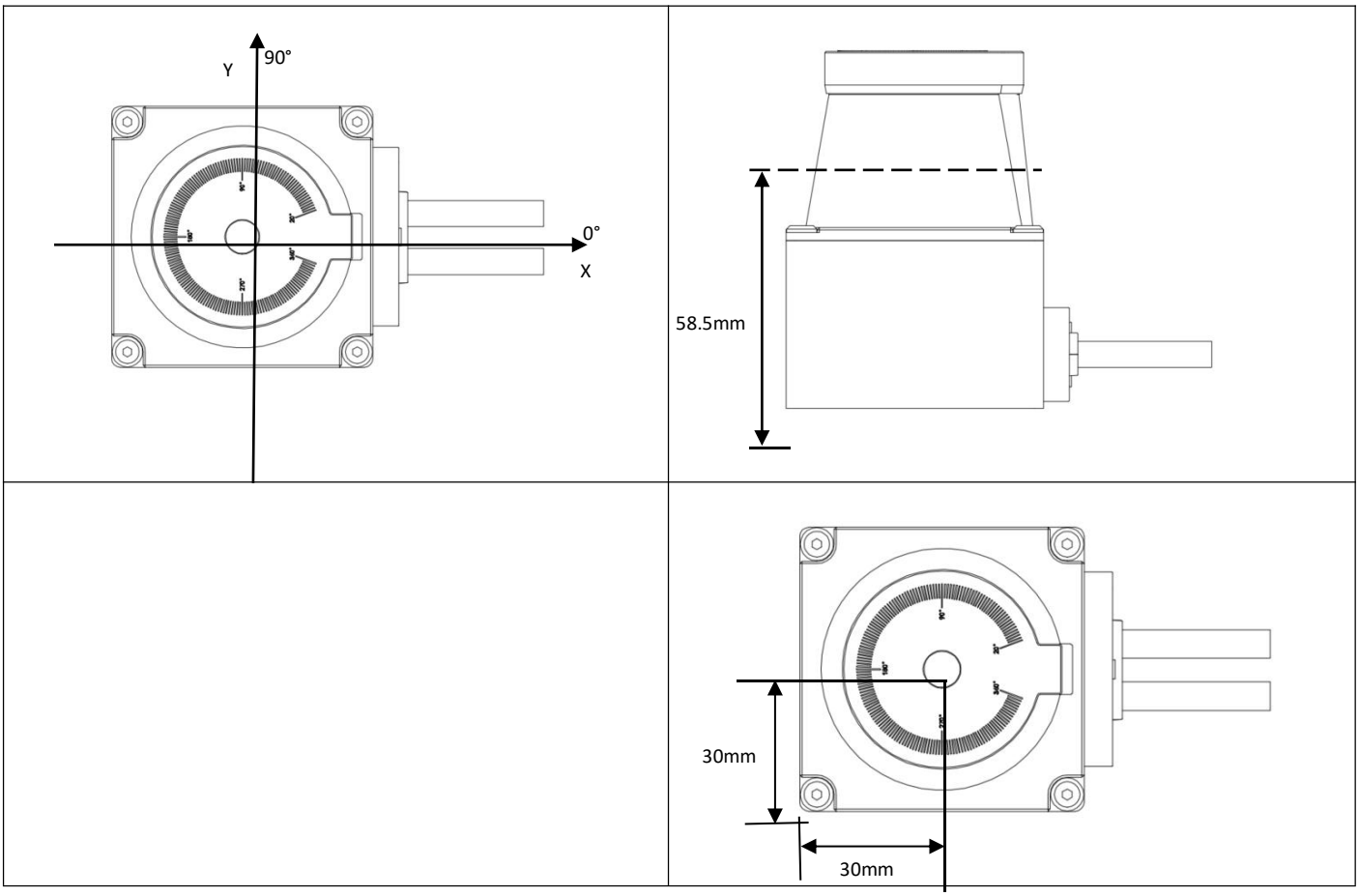
 	Connect the sensor; and prompt that the parameter reading is completed.
	Click on the upper left corner and click Save Configuration as a file;
	Select the path you need to save; Enter the folder name; Click Save;
	Save the file; The file cannot be opened directly and needs to be imported before it can be used.

7.8.2 Configuration export

 	Connect the sensor; and prompt that the parameter reading is completed.
	Select the path to the configuration file; Select the corresponding configuration file Click to open;
	Display the current configuration after opening the configuration;
 	Click to download parameters; Wait for the download progress to complete; After prompting the parameter writing is completed; Download Successful;
	Click the restart button and the parameters take effect;

8 Sensor data description

8.1 Sensor coordinate system

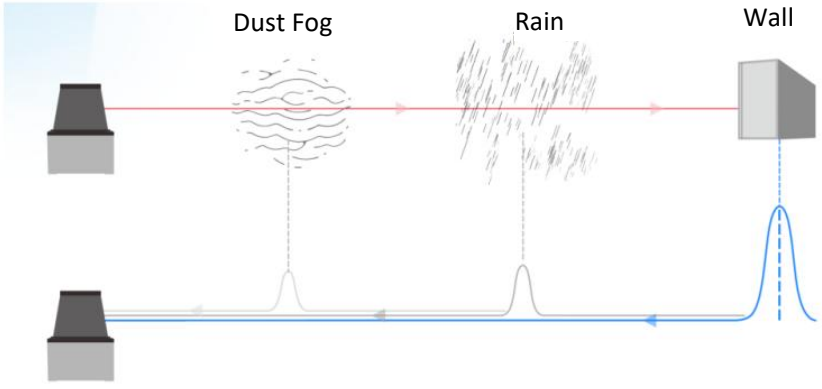


8.2 Multiple echo

8.2.1 Filtering environment and minimum distance

The multi-echo technology detects multiple echo signals per measuring beam. This allows echoes caused by rain or fog, complex structures, etc., in the middle of the transmission beam cycle to be identified and filtered out if necessary.

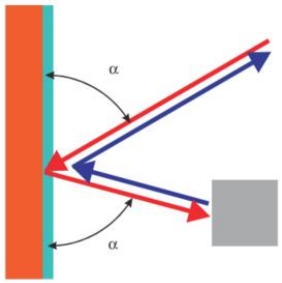
In order to be able to display the echoes as individual measured values, there must be a minimum distance of about 1 m between two objects.



8.2.2 Effect of object surface on measurement

- **Smooth reflective surface**

Cannot detect smooth reflective surfaces, but can detect objects illuminated by the reflected light from smooth reflective surfaces.



Smooth reflective surface

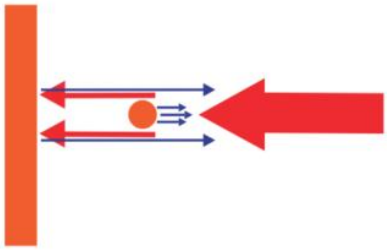
- **Detect small objects or no objects**

If the object to be detected is a small object smaller than the beam diameter, it is possible that

①The small object surface is not reflective enough and there is no background object, so it cannot be detected;

②The small object is not reflective enough, but the background object is reflective enough, so the detection is wrong;

③The small object and the background object are both reflective enough, so the measurement value is distorted;

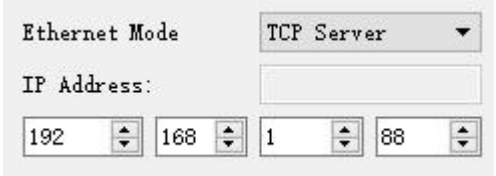


The object is smaller than the laser beam diameter

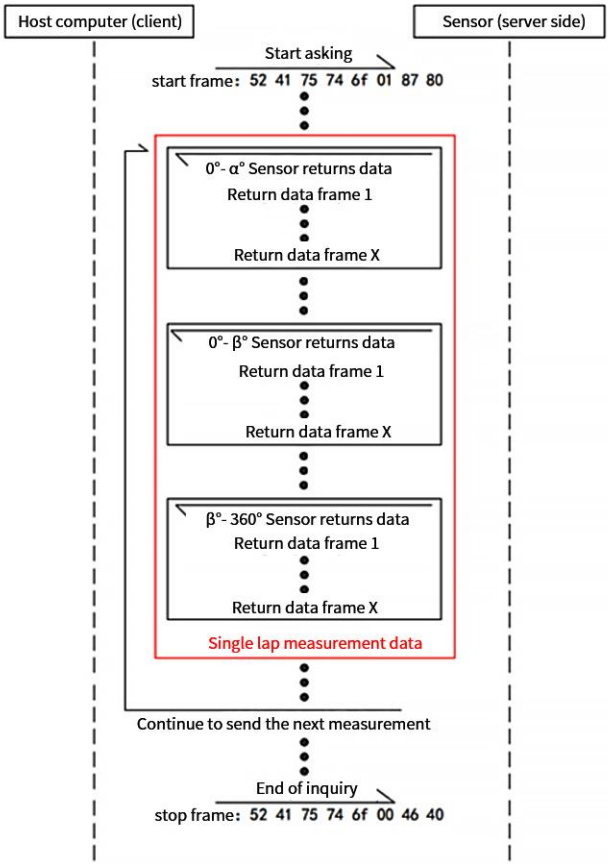
8.3 Ethernet data transmission

◆ Parameter settings

Open the configuration software, enter the sensor (server side) setting interface, and set the following parameters.

<table>
<tr><td rowspan="4"> 
</td><td>Parameter name</td><td>Parameter value</td></tr>
<tr><td rowspan="2">Ethernet mode</td><td>TCP server</td></tr>
<tr><td>UDP mode</td></tr>
<tr><td>Ethernet IP address</td><td>192.168.1.88
Last digit 1-254 can be set. sensor(server) port is fixed as 8080</td></tr>
</table>

After the client initiates a request and establishes a connection, data transmission starts. The transmission method is as follows:



The host computer (client) sends the "start data frame" to the sensor (server), and the sensor returns the measurement data of 20°-340° in several frames. The sensor continues to send the next measurement data until the sensor receives the "stop data frame" sent by the host computer.

8.3.1 Point cloud data acquisition

◆ **Send data frame (Hex)**

Data structure

Start code	Control bit	Check bit
5Byte	1Byte	2Byte

Start code： fixed data is 0x52 0x41 0x75 0x74 0x6F

Control bit：

0x00 The sensor stops sending data;	
0x01 The sensor automatically sends data frame 1;	Without timestamp
0x01 sensor automatically sends data frame 2;	Time NTP timestamp

Check digit: low digit first, high digit last, check digit calculated using Modbus-CRC16 calculation method.

◆ Measurement data frame (Hex)

Data structure

Return data type	Data frame header	Measurement data
Return to data frame 1 format	16Byte	Not fixed length
Return to data frame 2 format	26Byte	Not fixed length

Returns the data frame 1 format (Hex):

NO.	Position	Function	Length
1	0-3	Identifier	4Byte
2	4-5	Starting angle	2Byte(High priority)
3	6-7	Ending angle	2Byte(High priority)
4	8-9	The total number of measurement points in the current data frame	2Byte(High priority)
5	10-11	The sequence number of the last detection point of the current data frame	2Byte(High priority)
6	12-13	The total number of measurement points from the start angle to the end angle	2Byte(High priority)
7	14-15	Time stamp	2Byte(High priority)

1. Identifier（4Byte）： 0x48 0x49 0x53 0x4e

2. Starting angle (2Byte): The starting angle of the currently returned measurement data;

3. End angle (2Byte): The end angle of the currently returned measurement data;

4. The total number of measurement points in the current data frame (2Byte):

Due to different angle resolutions, the total number of measurement points from the start angle to the end angle will be different. The measurement data will be returned in several data frames from the start angle to the end angle. The "Total number of measurement points in the current data frame" is the current The data frame returns the total number of measurement points.

5. The sequence number of the last detection point of the current data frame (2Byte):

For example: the total number of measurement points from the start angle to the end angle is 800, and the measurement data is returned in 2 frames. The current data frame returns the data from the 1st to the 400point, then "the order of the last detection point of the current data frame The value of "Number" is 400. If the current data frame returns data from the 401th to the 800th point, then the value of "Sequential number of the last detection point in the current data frame" is 800.

6. The total number of measurement points in the range from the starting angle to the ending angle (2Byte):

The total number of measurement points in the range from the start angle to the end angle is determined by the current "laser scanning frequency", "scanning motor speed", and "single point sampling "Number" to determine, the following will illustrate.

7.Time stamp (2Byte):

Microcontroller, displays the internal timing time of the current frame transmission, time unit ms, time recording range 0-4,294,967,295ms, and the data is cleared after the record is full.

Return to data frame 2 format（Hex）：

NO.	Position	Function	Length
1	0-3	Identifier	4Byte
2	4-5	Starting angle	2Byte(High priority)
3	6-7	Ending angle	2Byte(High priority)
4	8-9	The total number of measurement points in the current data frame	2Byte(High priority)
5	10-11	The sequence number of the last detection point of the current data frame	2Byte(High priority)
6	12-13	The total number of measurement points from the start angle to the end angle	2Byte(High priority)
7	14-17	Time stamp	4Byte(High priority)
8	18-25	NTP Synchronize time	8Byte(High priority)

1. Identifier（4Byte）： 0x48 0x49 0x53 0x4e

2. Starting angle (2Byte): the starting angle of the currently returned measurement data;

3. End angle (2Byte): the end angle of the currently returned measurement data;

4. The total number of measurement points in the current data frame (2Byte):

Due to different angle resolutions, the total number of measurement points from the start angle to the end angle will be different. The measurement data will be returned in several data frames from the start angle to the end angle. The "Total number of measurement points in the current data frame" is the current The data frame returns the total number of measurement points.

5. The sequence number of the last detection point of the current data frame (2Byte):

For example: the total number of measurement points from the start angle to the end angle is 800, and the measurement data is returned in 2 frames. The current data frame returns the data from the 1st to the 400point, then "the order of the last detection point of the current data frame The value of "Number" is 400. If the current data frame returns data from the 401th to the 800th point, then the value of "Sequential number of the last detection point in the current data frame" is 800.

6. The total number of measurement points in the range from the starting angle to the ending angle (2Byte):

The total number of measurement points in the range from the start angle to the end angle is determined by the current "laser scanning frequency", "scanning motor speed", and "single point sampling "Number" to determine, the following will illustrate.

7.Time stamp (4Byte):

Microcontroller, displays the internal timing time of the current frame transmission, time unit ms, time recording range 0-4,294,967,295ms, and the data is cleared after the record is full.

8. NTP Synchronize time(8Byte):

As a synchronization client service, it will automatically send synchronization messages, send time synchronization messages every 20S, and send synchronization requests once every 1s cycle in case of time not synchronized;

The synchronization time obtained by pointing the NTP protocol is the corresponding upper computer to obtain the NTP server, IP address configuration software settings, and port number 123;

Time analysis

Function segment	Length	Serial number	Function
UTC high bit	4Byte	18-21	Valid after NTP time calibration, unit s
UTC low bit	4Byte	22-25	valid after NTP time calibration, unit to us seconds;

The timestamp content is: e8046864e0d346 fb, the first four digits are UTC high (msw), the unit is seconds, the last four digits are UTC low (Isw), the unit is subsecond, and the conversion into decimal according to the front and back high and low bits is: 3,892,602,980 respectively and 3,771,942,651. First, deal with the UTC high 32 bits. Since the NTP time and UTC time start are different, the time needs to be reduced by 70 years (1900 to 1970) 2208988800 (0×83AA7E80), which is 1.883,614,180. Use the UTC converter to get the time is 2023-5-914:36:20 UTC then process the UTC low bit 32bit, and you need to convert the ps unit to s, the method is: s=Isw*1/(2^32), bringing the above value. To 0.878224s

The time represented by the above timestamp is: 2023-5-9 14:36:20.878224 UTC+8 (Beijing time).

◆ Measurement data analysis（Hex）:

First point measurement data（4Byte）				Second point measurement data （4Byte）				……（4Byte）				Last point measurement data （4Byte）			
Measuring distance (2Byte)		Measure intensity (2Byte)		Measuring distance (2Byte)		Measure intensity (2Byte)		Measuring distance (2Byte)		Measure intensity (2Byte)		Measuring distance (2Byte)		Measure intensity (2Byte)	
L	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H

The unit of measurement distance is mm, and the distance data of the reflection point and the sensor is output.

The measured intensity is reflected in the reflective intensity of the reflection point. The higher the value, the stronger the reflective ability of the object.

The measurement distance and measurement intensity are both low and high and high.

◆ Stop the data frame（Hex）

0x52 0x41 0x75 0x74 0x6F 0x00 0x46 0x40

After the upper computer sends this data frame to the sensor, the sensor will stop returning the measurement data.

◆ Give examples

1、Sensor parameter setting example:

Ethernet mode interface: TCP server

IP address: 192.168.1.88

Scanning motor speed: 10Hz

Scanning angle: 0.1°

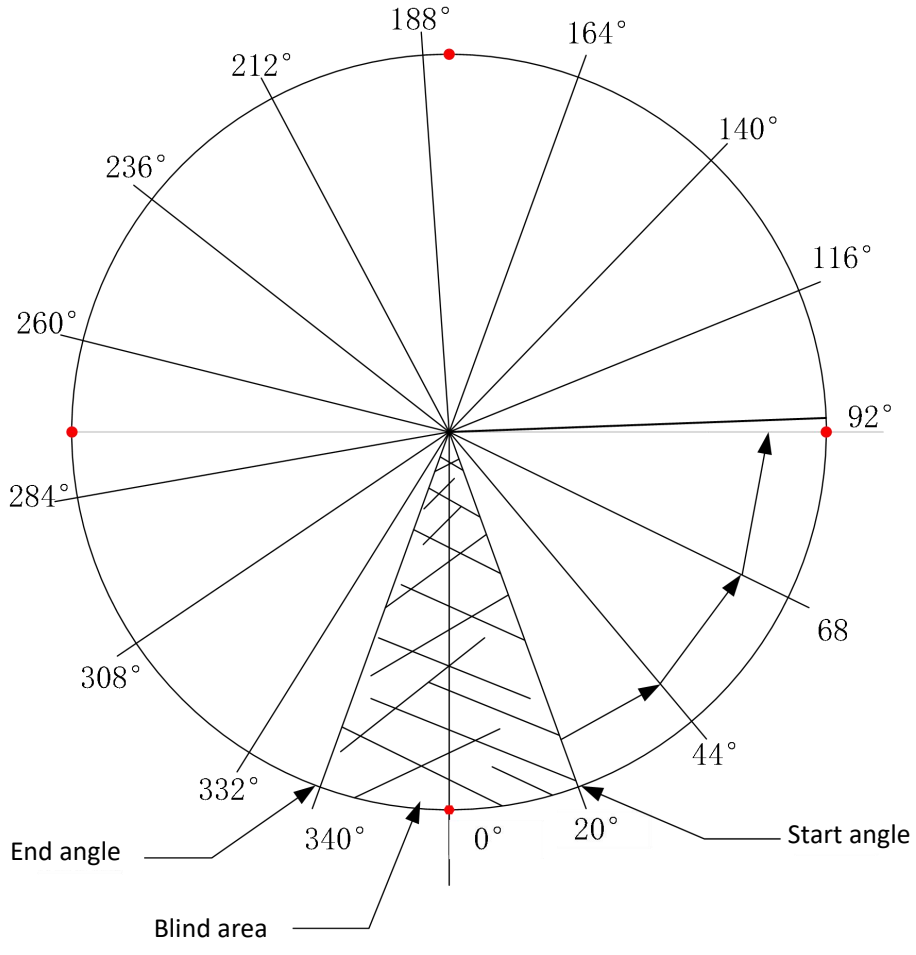
Sensor (server) port: 8080

It should be noted that the sensor (server) port is fixed to 8080, and the connection between the upper computer and the sensor is successfully established.

2、Measure the total number of points = (end angle - start angle) / measure the angle resolution, measure the total number of points and round the decimal point by one bit. According to the sensor design, it is divided into 14 angle range

data blocks. The value of this angle range is a fixed value and does not change with the change of angle resolution. See the picture below for details.

The first measurement		Angle range	The second measurement		Angle range	The third measurement		Angle range	The fourth measurement		Angle range
20°	44°	24°	44°	68°	24°	68°	92°	24°	92°	116°	24°
The fifth measurement		Angle range	The sixth measurement		Angle range	The Seventh measurement		Angle range	The eighth measurement		Angle range
116°	140°	24°	140°	164°	24°	164°	188°	24°	188°	212°	24°
The Ninth measurement		Angle range	The tenth measurement		Angle range	The Eleventh measurement		Angle range	The twelfth measurement		Angle range
212°	236°	24°	236°	260°	24°	260°	284°	24°	284°	308°	24°
The Thirteenth measurement		Angle range	The fourteenth measurement		Angle range						
308°	332°	24°	332°	340°	12°						



8.3.2 Time synchronization function

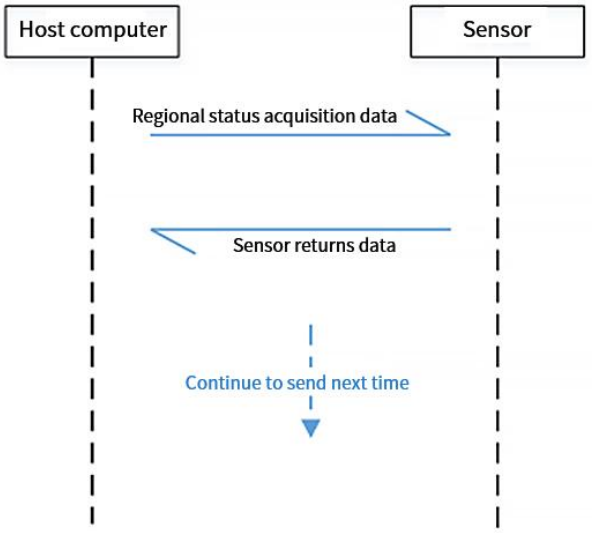
The radar firmware version is greater than 1.7 and supports the time synchronization protocol;

As the synchronization client service, the radar will automatically send synchronization messages to initiate synchronization, sending time synchronization messages every 20 seconds, and sending synchronization requests in 1 seconds if the time is not synchronized;

Synchronized server, IP address: 101.10.1.15 Port number 123;

8.3.3 Area data acquisitio

After the client initiates a request and establishes a connection, data transmission begins, and the transmission method is as follows.



Area status acquisition data

Data Structures

Starting code	Control data	Check digit
5Byte	11Byte	2Byte

Control data:

NO.	Position	Function	Length
1	0-4	Starting code	5Byte
2	5	Sensor operating mode	1Byte
3	6	Sensor channel value	1Byte
4	7-8	Switching angle value in intelligent channel selection mode	2Byte
5	9-10	Switching speed value in intelligent channel selection mode	2Byte
6	11-12	Channel group number	2Byte
7	13-15	Invalid data data bit	3Byte
8	16-17	Parity bit	2Byte

- Start code (5byte)

  The identifier is fixed data: 0x57 0x53 0x69 0x6d 0x75 This data function;

- Sensor working mode (1byte)

  00: Invalid instruction
  01: Channel specified mode
  02: Intelligent channel selection mode

- Sensor channel value (1byte)

  Control the current sensing channel of the sensor, data range 00-63;

- Sensor channel angle (2byte)

  Angle value in channel group mode, data is signed data range -180-180;

- Sensor channel speed value (2byte)

  Speed value in channel group mode, data is signed data range -300-300;

- Sensor channel group number (2byte)

  Control the current sensing channel group number of the sensor, data range 00-04;

- Invalid data (3byte)

  Invalid data, the default data must be sent 0x00;

- Check bit (2byte)

  Data check bit, using modbus low bit first CRC16 check method. The check value is calculated by the check formula. For detailed calculation method, please see the appendix.

Sensor returns data

Data Structures

Starting code	Control data	Check digit
5Byte	16Byte	2Byte

Control data:

NO.	Position	Function	Length
1	0-4	Data identifier	5Byte
2	5	Sensor Channel Value	1Byte
3	6	Invalid	1Byte
4	7	Output State	1Byte
5	8	Invalid	1Byte
6	9-10	Fault State	2Byte
7	11-20	Invalid	10Byte
8	21-22	Check bit	2Byte

- Data identifier (5 bytes)

The identifier is fixed data: 0x57 0x53 0x69 0x6d 0x75 This data function;

- Current channel value (1 byte)

Current channel value of the sensor;

- Invalid data (1 byte)

Invalid data;

- Output status (1 byte)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
Invalid					OUT3	OUT2	OUT1

Related to the parameter setting item sensor output logic:

Normal closed mode (default)

00: object detected;

01: no object detected

Normal open mode

01: object detected;

00: no object detected;

- Invalid data (1 byte)

Invalid data;

- Sensor fault status (2 bytes)

Display the current status of the sensor, with a value range of 00-07;

00: The sensor is in normal state;

01-07: Sensor failure status;

- Invalid data (10 byte)

Invalid data;

- Check digit (2 bytes)

Data check bit uses the modbus low-order CRC16 check method. The check value is calculated by the check formula.

8.3.4 CRC check Algorithm

```
cBuffer:  Array for calculating CRC checksum.
iBufLen:  length of the array.
unsigned int CRC_Verify(unsigned char *cBuffer, unsigned int iBufLen)
{
    unsigned int i, j;                //#define wPolynom 0xA001
    unsigned int wCrc = 0xffff;
    unsigned int wPolynom = 0xA001;
/*-----------------------------------------------------------------------------*
/
    for (i = 0; i < iBufLen; i++)
    {
        wCrc ^= cBuffer[i];
for (j = 0; j < 8; j++)
        {
            if (wCrc &0x0001)
            {   wCrc = (wCrc >> 1) ^ wPolynom;  }
            else
            {  wCrc = wCrc >> 1;  }
         }
     }
return wCrc;
}
```

8.4 ROS driver acquisition

For customers who want to use sensors in the ROS environment, they can use the specially provided drivers. The ROS driver package can be obtained as follows:

Visit: www.hinson-xs.com
Contact Hinson sales and technical support

9 Troubleshooting and Maintenance

9.1 Fault status handling

The sensor is abnormal in working condition, including not limited to the following situations;

Fault status	Handling method
Connection failed	1) Check whether the network connection is normal; 2) Restart the configuration software; 3) Confirm whether the power supply of the sensor is normal; 4) Test after replacing the sensor
Connection timeout	1) Check whether the network connection is normal; 2) Confirm whether the configuration software can sensor the IP address; 3) Confirm whether the IP network segment of the local network is connected to the Windows system on the same IP address as the sensor; 4) Confirm whether other devices are TCP communicating with the sensors; 5) Restart the sensor power and try to recover; 6) Test after replacing the sensor
No output output	1) Confirm whether the sensor is working normally and the green indicator light is always on; 2) If the sensor green indicator light flashes, the sensor will report an error; 3) Restart the sensor power and try to recover; 4) Test after replacing the sensor
The sensor green indicator light flashes	1) Try after restarting the sensor;
The sensor indicator light is not on	1) Check whether the sensor power supply line is normal; 2) Detect whether the sensor supply voltage is normal; 3) Replace and switch sensor test; 4) Test after replacing the sensor
The optical window is scratched, dirty, damaged	1) If the detection does not affect the detection, it can continue to be used, but it needs to be replaced; 2) It affects normal testing and needs to be replaced and returned to the factory for maintenance; 3) Test after replacing the sensor

If none of the above measures can resolve sensor failure, please contact our staff for support.

9.2 Get support

In order to quickly locate the fault, it is difficult to obtain product information and provide it to technical support personnel;

Product model
Approximate usage time
Pictures or videos of fault problems
Reproduction process
Description of fault phenomenon
Current device parameter configuration information

9.3 Repair

Equipment repair and send back to the equipment manufacturer, and professionals are responsible;

9.4 Maintenance

Maintenance plan

Maintenance content	Time interval
Check cables, cable intermediate connectors;	according to the on-site environment, it is recommended: at least 6 months;
Detect optical windows;	decide based on the on-site environment;
Inspect fixing screws and brackets;	according to the on-site environment, it is recommended: at least 6 months;
Detection indicator light display;	decide according to the on-site environment;

9.5 Cleaning

Materials used

Cleaning cloth	Use special wipes for lenses or special wipes for lenses
Cleaning agent	Plexiglass (acrylic) cleaner

10 After-sales information

10.1 Warranty period

Hinson products provides a limited warranty. If the sensor cannot be used normally due to quality problems or design defects during the warranty period, we will provide free after-sales maintenance.

■ Warranty period: 1 year from the date of sale.

10.2 Warranty coverage

If the product is within the warranty period and falls within the warranty conditions, we will repair or replace it free of charge.

■ The warranty and after-sales service of this product are limited to mainland China;

■ The product cannot be used normally due to unpacking during transportation;

■ The product cannot work normally due to damage to its own components;

■ The product cannot be used normally due to design defects;

10.3 Disclaimer

Please pay attention to the following conditions during the use of the product. We will not provide free after-sales and warranty.

■ Failure to install the product correctly according to the instructions, resulting in product damage;

■ Use the product in an unsuitable environment and conditions, resulting in product damage;

■ Product damage caused by failure to operate in accordance with the product manual;

■ Dismantling or repairing the product without the company's permission;

■ Product damage caused by irresistible external forces such as natural disasters and fires.

10.4 Technical Support

Guangdong Hinson Technology Co., Ltd.

Tel: 0757-22218956 (8:30-17:30 on weekdays)

Website: www.hinson-xs.com

Email: hinson@hinson-xs.com

Technical support QQ: 2636178756