



Laser distance sensor

PHR series 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.

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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;

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 Function introduction

2.1 Main features

Parameters/Model	PHR-080100	PHR-120100
Performance		
Detection distance	0.3-80m	0.3-120m
Spot diameter	101mm(80m)	149mm(120m)
Measurement frequency	3KHz	
Repeat accuracy	± 1mm	
Absolute accuracy	± 2mm	
Measurement resolution	0.01mm	
Wavelength	650nm	
Measurement method	Phase ranging method	
Maximum moving speed	12m/s	
SSI clock frequency	50KHz-800KHz	
Data interface		
Network interface	M12 4-pin female straight connector	
GPIO	M12 12-pin male straight connector	
Communication method	CAN、SSI、Ethernet	
Communication protocol	CANOpen、TCP/UDP	
Electrical/Mechanical		
Operating voltage	10-30V	
Power	≤5W	
Light source	Red laser	
PWR indicator light	Distance measurement success indicator (distance value is reliable)	
LM1 status indicator light	Multi-function IO status indicator	
LM2 status indicator light	Multi-function IO status indicator	
SSI indicator light	SSI enable indicator	
LINK indicator light	Ethernet connection status indicator	
Display screen	128*64 pixels, OLED screen	
Product size	137*88*141mm	
Packaging size	185*175*115mm	
Shell material	Aluminum alloy	
Environmental		
Ambient temperature for use	- 25℃-65℃	

Ambient humidity for use	< 80% RH
Ambient storage temperature	-20℃-70℃
Ambient light limitation	When using the product, no other distance-measuring devices operating at the same wavelength should be present within a 3.5-meter radius around the device, as this may interfere with measurement accuracy.
Operating Environment	Indoor
Test	
Laser level	Class 3B (IEC-60825)
Protection level	IP65

3 Preparation

3.1 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;

Phase distance sensor	PHR-080100/ PHR-120100	1
Certificate of conformity	Sensor certificate	1

Optional:

Cables	Ethernet cable & power and IO cables	1
Reflective film	With diamond-grade reflective film	1
Reflective board	Aluminum plate with diamond-grade reflective film	1

3.2 Debugging Tools

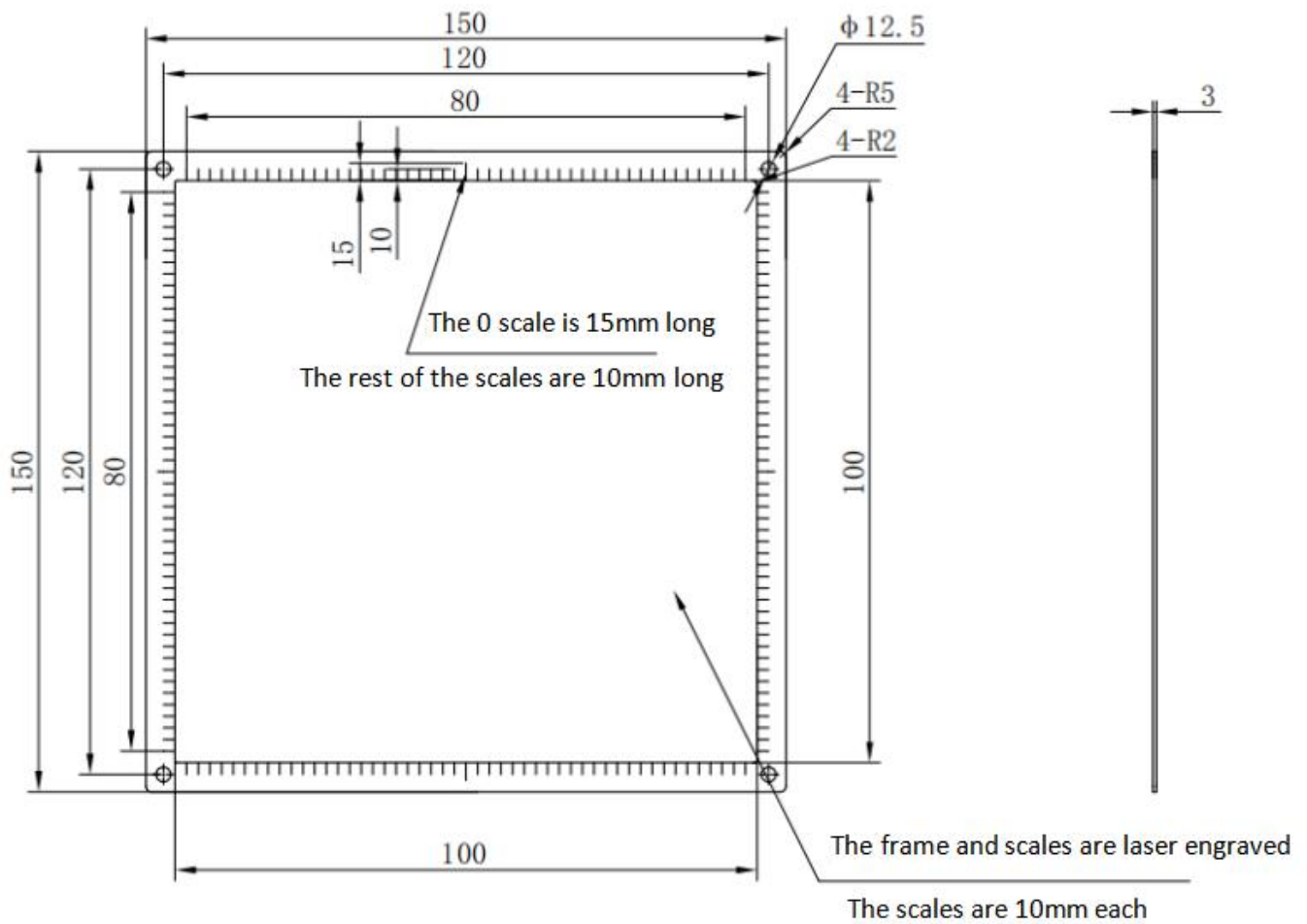
Computer configuration	Running Windows 7 and above	1
Reflective film	Equipped with diamond-grade or above reflective film	1
Configuration software	CNS-PHR-xxx	1

3.3 Accessories description

3.3.1 Reflective film model

Model	Specifications
RF01-100/100	Diamond grade,100mm*100mm;
RF01-300/300	Diamond grade,300mm*300mm;
RF01-600/500	Diamond grade,600mm*500mm;
RF01-600/650	Diamond grade,600mm*650mm;
RF01-800/800	Diamond grade,800mm*800mm;
RF01-850/850	Diamond grade,850mm*850mm;
RF01-1150/950	Diamond grade,1150mm*950mm;
RF01-XXX/XXX	Diamond grade, size can be customized;

3.3.2 Reflective sheet customization

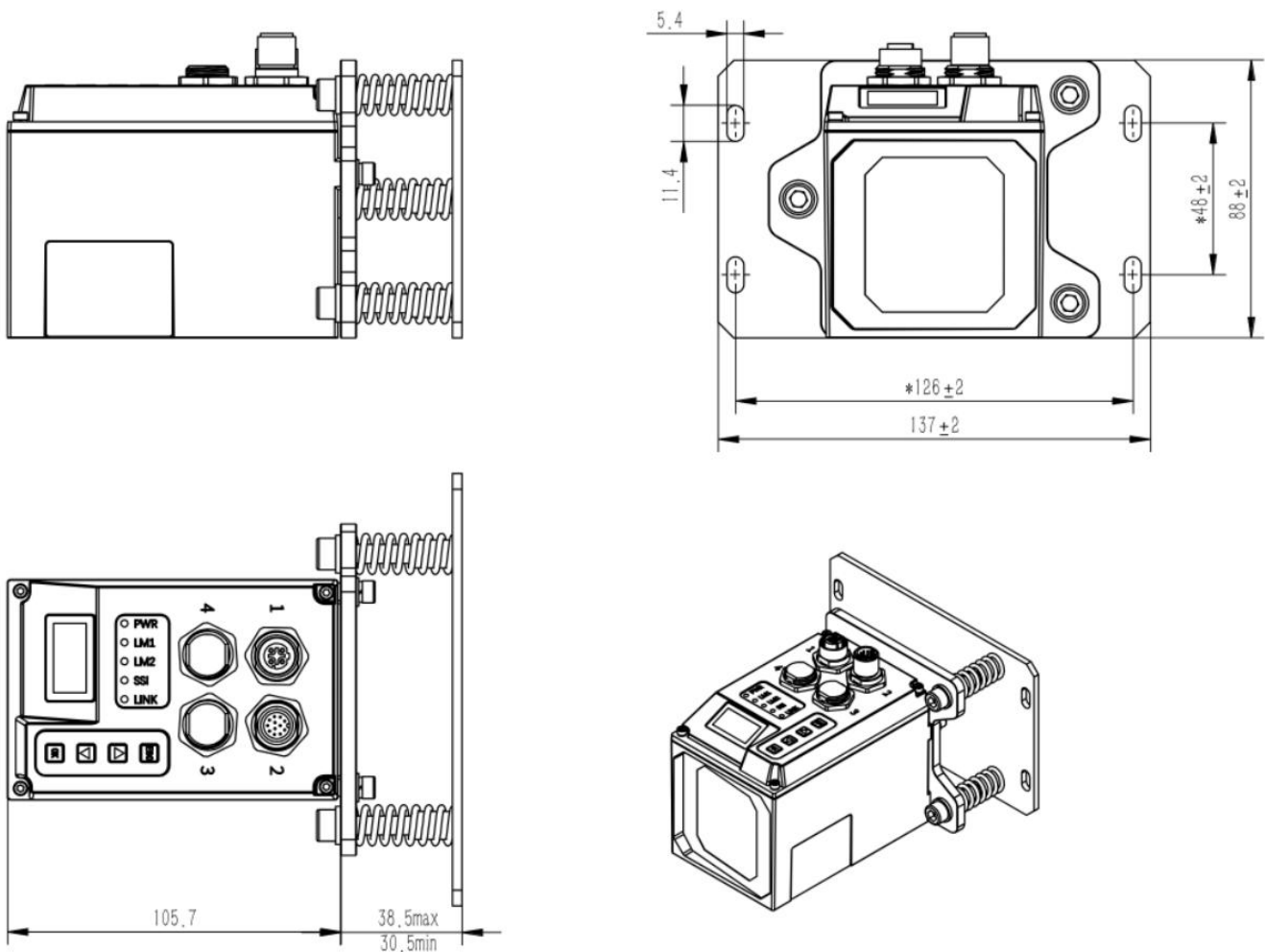


Note:

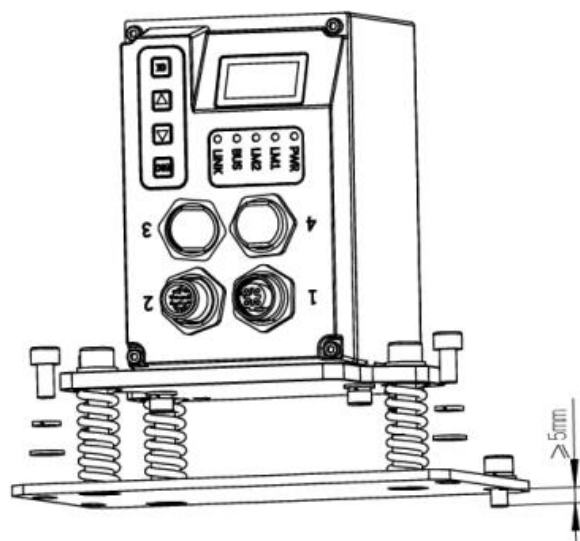
1. The reflective plate size of 150*150mm in the above picture is the standard size, which is suitable for fixing the reflective film of 100*100mm;
2. The reflective plate size is 850*850mm, which is suitable for fixing the reflective film of 800*800mm;
3. The reflective plate material is aluminum;
4. The reflective plate has 4 mounting holes to fix the reflective film;
5. Reflective plates and reflective films can be customized in special sizes

4 Installation

4.1 Size parameters



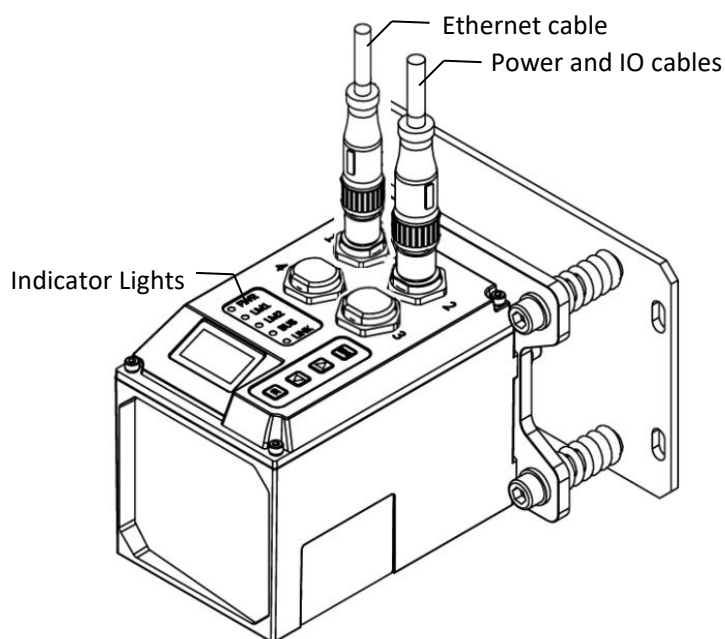
4.2 Installation Steps



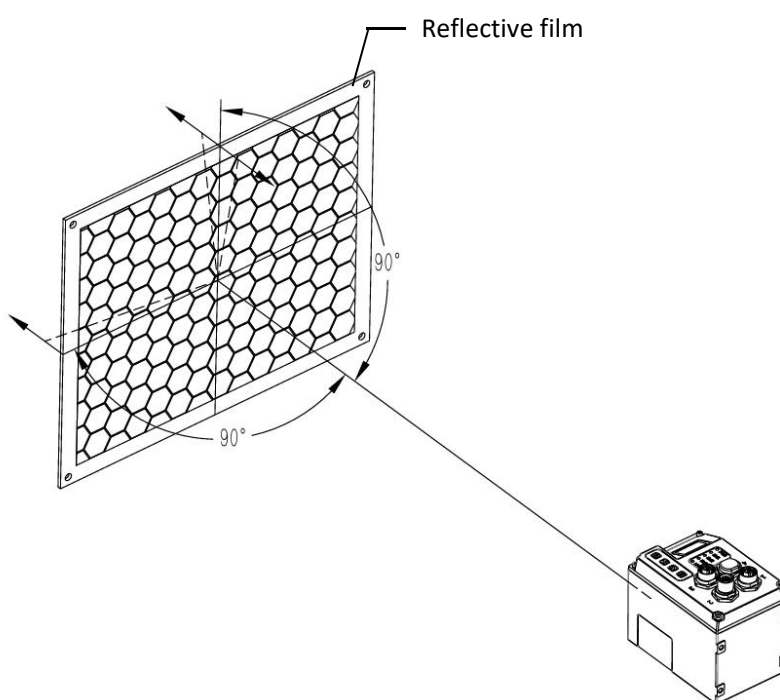
A、Select the installation location and fix it with 4 M5 bolts;

Bolt specifications

Bolt specification	Tightening torque
M5*10mm	0.1N.M

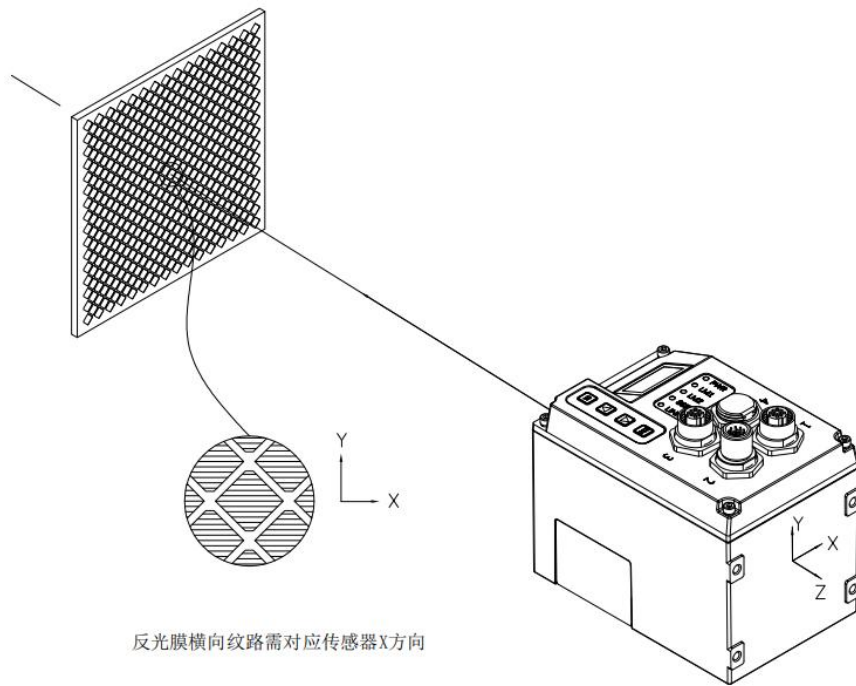


B、 Plug in the Ethernet cable & power and IO cables, turn on the power, the power indicator lights up, and the device starts running;



C、 As shown in the figure above (top view), install the reflector and emit the laser onto the inclined reflective film to avoid light reflection back and forth;

Note: Install the laser measurement system and reflective film together so that the laser spot falls on the center of the reflective film as much as possible without interruption.



d. As shown in the above figure, the transverse texture of the reflective film needs to correspond to the X direction of the sensor.

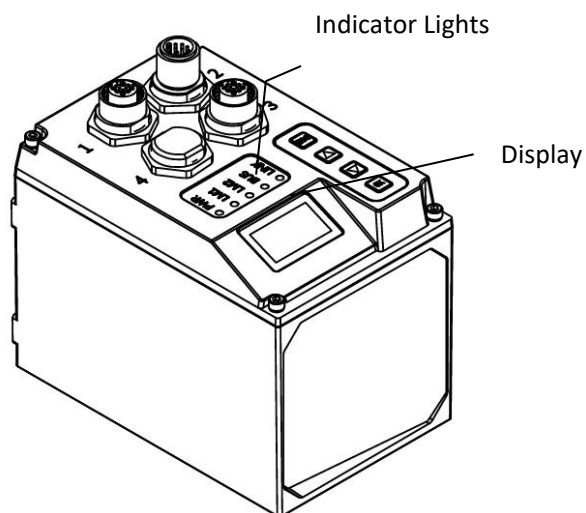
Note: If the installation direction of the reflective film is incorrect, it will reduce the energy received by the sensor, thereby shortening the effective range and reducing the repeatability accuracy at long distances.

(For example: For the 80-meter model, when the reflective film is installed correctly, it can achieve a repeatability accuracy of $\pm 1\text{mm}$ at 80 meters. However, if the reflective film is installed incorrectly, it may not be able to detect 80 meters or the repeatability accuracy may be greater than $\pm 1\text{mm}$ at 80 meters).

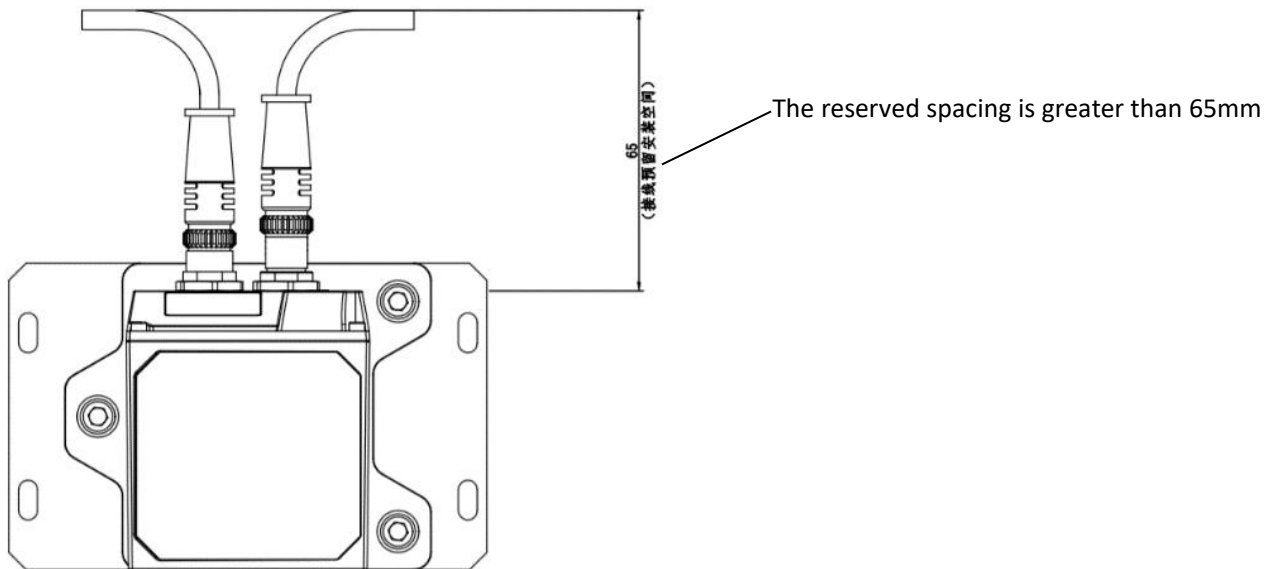
4.3 Installation Requirements

The phase distance sensor has two upward aviation interfaces. The cable position needs to reserve a plug-in position to avoid excessive bending of the cable. A display operation window should be reserved above the phase distance sensor to facilitate button operation and viewing of the display.

*Reserve display space requirements

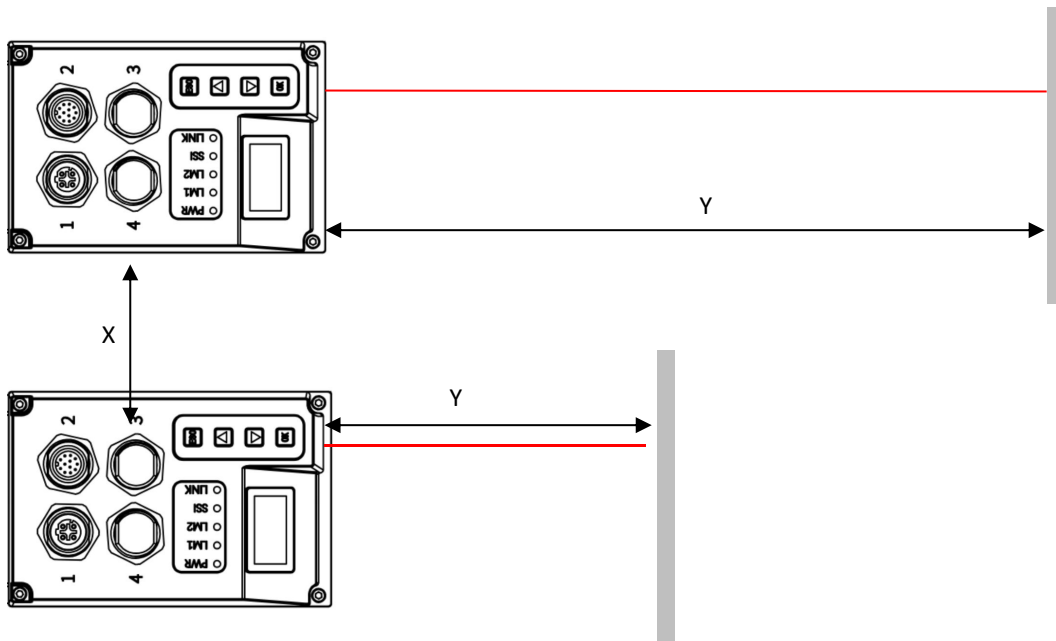


*Requirements for reserved cable plugging space

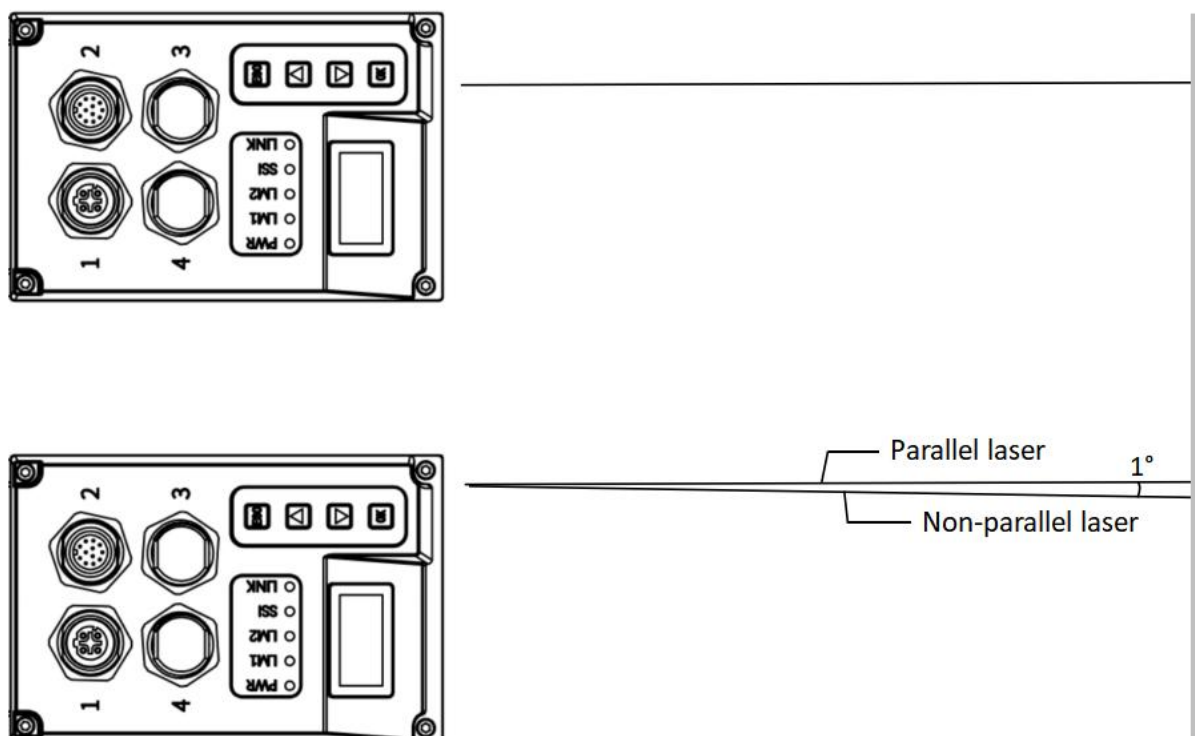


1. When two or more sensors are installed in parallel, it is recommended to be greater than the minimum parallel distance to prevent mutual interference.

Minimum parallel distance $X = \text{maximum measurement distance } Y \cdot \tan 1^\circ$, maximum measurement distance $Y = 80\text{M}/120\text{M}/200\text{M}$

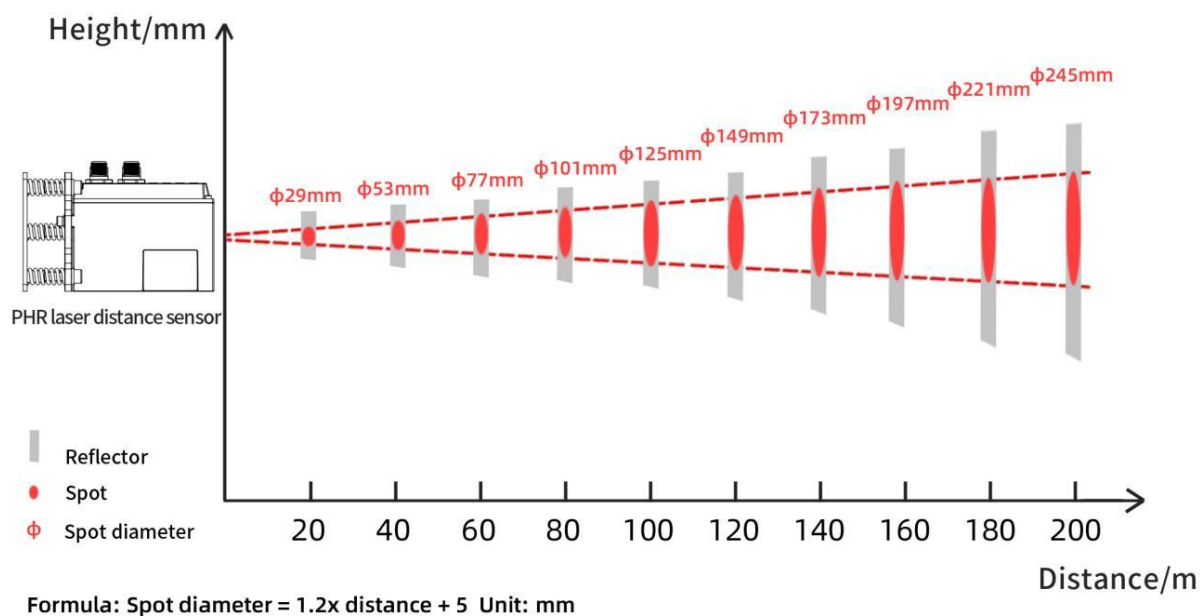


2、 When two or more sensors are installed in non-parallel, it is recommended that the mutual viewing angle is greater than 1° to prevent mutual interference. (No minimum spacing distance)



4.4 Spot diameter

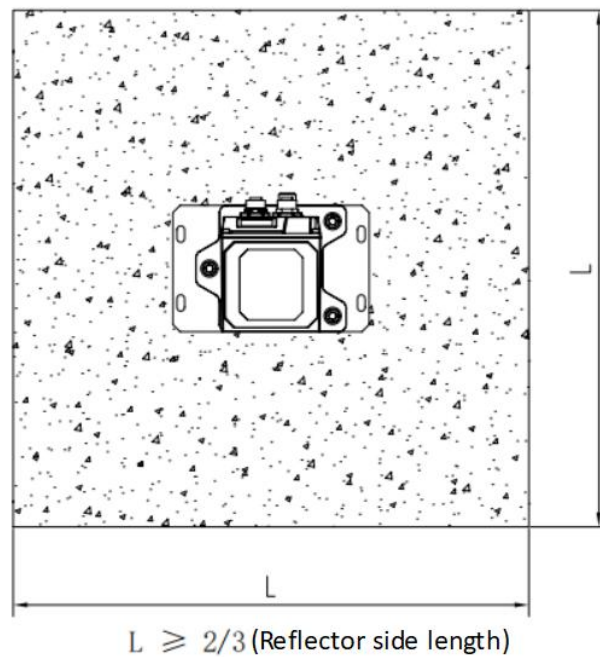
PHR laser distance sensor spot diameter diagram



Note: The light spot shown in the figure is the maximum value of the light spot at a certain distance. The actual light spot size will deviate from the calculated value.

4.5 Installation attention

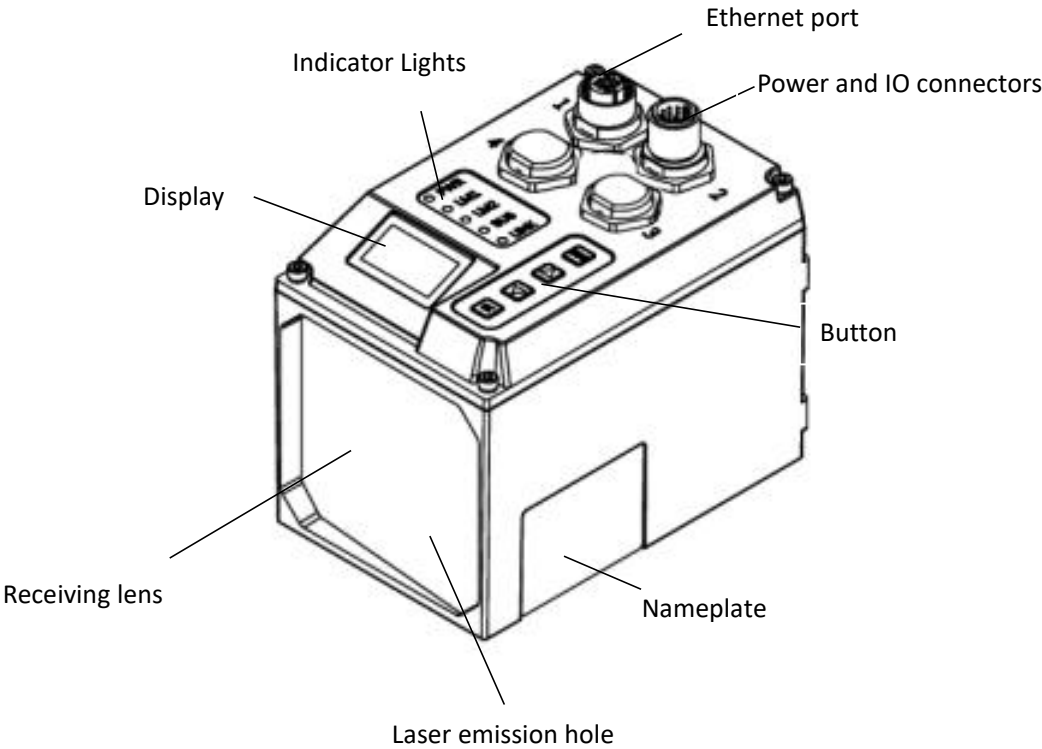
To ensure the measurement accuracy and reliability of the rangefinder, there should be no mirror or high-reflection materials on the installation surface or near the rangefinder (perpendicular to the emission direction). It is recommended to treat matte or diffuse reflection surfaces to prevent unpredictability and absolute accuracy changes caused by multiple surface reflections.



Reflectors are not allowed in the filling area
Matte or diffuse surface is recommended

5 Device Description

5.1 Layout Introduction

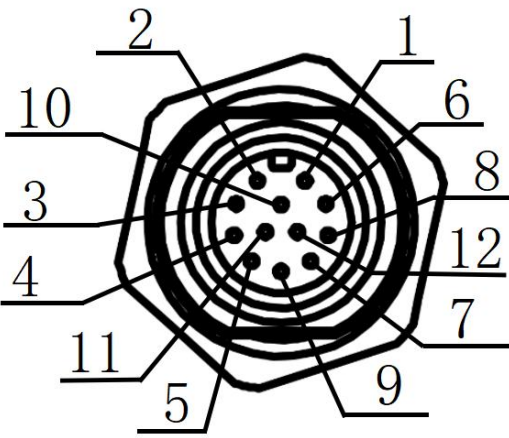


5.2 Indicator lights and buttons

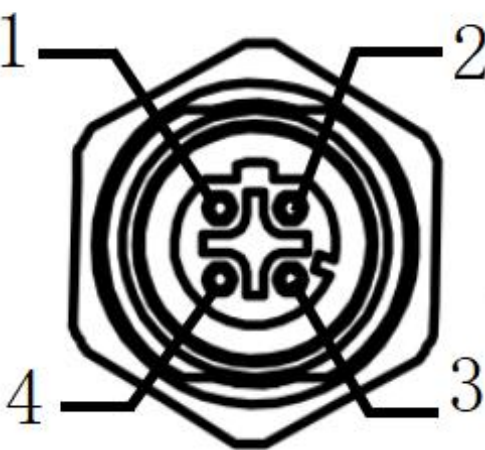
	ESC		Return Button
	▲		Move up
	▼		Move down
	OK		Confirm
	Logo	Color (monochromatic light)	Operation Instructions
	PWR	Green	Always On: Measurement is normal Off: Measurement error
	LM1	Red	Always on: output high level Off: output low level
	LM2	Red	Always on: output high level Off: output low level
	SSI	Yellow	Always on: PN interface is activated Off: PN interface is not activated (Communication switch can be set through the display menu)
	LINK	Green	On: Ethernet is connected Off: Ethernet is disconnected

5.3 Port definition

5.3.1 Power port

 Port 2	1	CAN-H
	2	Positive power input
	3	CAN-L-
	4	Multi-function IO line-
	5	Multi-function IO line+-
	6	Multi-function IO line-
	7	Negative power input
	8	Multi-function IO line+-
	9	Clock Line SSI (Input Electrical Isolation)
	10	Clock Line SSI (output Electrical Isolation)
	11	Data line SSI (output) +
	12	Data line SSI (output)-

5.3.2 Network port

 Port 1		
	1	Ethernet TX+
	2	Ethernet RX+
	3	Ethernet TX-
	4	Ethernet RX-

6 Display screen operation instructions

6.1 Menu Overview

Layer 1	Layer 2	Layer 3	Layer 4
A、Device Information	1. Product name		
	2. Hardware version		
	3. Firmware version		
	4. APP		
	5、Ethernet parameters	/1.IP address	
		/2.Port Number	1-65535
		/3.Subnet mask address	
		/4.Gateway address	
		/5.MAC address	
		/6.Distribution network parameter recovery preset	
		[Use crc16-Modbus verification method]	
		[Save settings]	
		[Restart device]	
	6、CanOpen	/1.Baud rate	125K 250K 500K 1000K
		/2.Node	1-127
		[Save settings]	
		[Restart device]	
B、Parameter	1、Parameter Management	a.Parameter Enable	
		b.Password	/1. Verify password
			/2. Enter password
		《User Manual》	
		c. Restore default parameters	
		d. Restore factory settings	
	2、SSI	a.Activation	
		b.Coding mode	/1. Binary
			/2. Gray code
		c.Number of data bits	/1. 24 bits
			/2. 25 bits
			/3. 26 bits
		d.SSI resolution	/1. 0.001mm
			/2. 0.01mm
			/3. 0.1mm
			/4. 1mm
			/5. 10mm
		e.Error bit	
		f.Error bit function	/1. Overflow
			/2. intensity (ATT)
			/3. temperature(TMP)
			/4. laser(LSR)
			/5. rationality(PLB)
			/6. hardware(ERR)
		g.Refresh rate	/1. 1.7ms
			/2. 0.2ms
		h.Clock frequency	/1. 50KHz-800KHz
	3、Position value	a. Enable inch units	
		b. Reverse counting	
		c. Offset	

		d. Preset (not open)	
		e. Fault delay	
		e1. Delay time (ms)	
		f. Output zero after fault	
		g. Fault recovery delay	
		g1. Delay recovery time (ms)	
	4、I/O	a. Select IO	/1. IO 1
			/2. IO 2
		b. IO port mode	/1. input mode (not open)
			/2. output mode
		c. Input mode selection	/1. no function (not open)
			/2. preset teaching (not open)
			/3. Laser switch (not open)
		d. Input mode activation level	/1, Low level activation (not open)
			/2, High level activation (not open)
		e. Output mode selection	/1, intensity (ATT)
			/2, temperature (TMP)
			/3, laser (LSR)
			/4, rationality (PLB)
			/5, hardware (ERR)
		f. Output mode activation level	/1, low level activation
			/2, high level activation
	5、Filter parameters	Quickly view distance values	
		View filter parameters	
		Distance value application mode	/1. Original data
			/2. Kalman filter
			/3. Complementary filter
		Quick setting: Kalman filter	Current Mode
			Custom
			Fast
			Medium
			Strict
		Kalman filter: Q	
		Kalman filter: R	
		Kalman filter: restore default values	
		Quick Setup: Complementary Filtering	Current Mode
			Custom
			Fast
			Medium
			Strict
		Complementary filter: alpha	
		Complementary filter: restore default value	
		《Parameter Description》	1. Q: Process noise variance
			2. R: Measurement noise covariance
			3. Alpha: Complementary filter coefficient
	6、Other	a. Screen brightness setting	
		b. After-sales service - Ethernet	/1. IP address
			/2.Port Number
			/3.Subnet mask address
			/4.Gateway address

			/5.MAC address
			/6.Distribution network parameter recovery preset
			[Use crc16-Modbus verification method]
			[Save settings]
			[Restart device]
		c. Distance value displayed on the lock screen	/1. Original data
			/2. Kalman filter
			/3. Complementary filter
		d. Lock screen refresh interval	
		e. Screen sleep time	
C. Language	1. Chinese		
	2. English		
D. Diagnosis	1. Status information		
	2. Signal strength		
	3. Temperature °C *100		
E. Xone	1. Xone Boot Mode		
[Restart device]			
[Save settings]			

6.2 Sub-menu default settings

6.2.1 Parameter Management

Layer 3	Layer 4	Options/Description	Default Settings
Parameter Enable		ON/OFF	OFF
Password	/1. Verify password	ON/OFF	OFF
	/2. Enter password		
	《User Manual》		
c. Restore default parameters			
d. Restore factory settings		Continue or not	

6.2.2 SSI settings

Layer 3	Layer 4	Options/Description	Default Settings
Activation		ON/OFF	ON
Coding mode	/1. Binary	ON/OFF	Gray code
	/2. Gray code	ON/OFF	
c. Number of data bits	/1. 24bits	ON/OFF	24bits
	/2. 25 bits	ON/OFF	
	/3. 26 bits	ON/OFF	
d. SSI resolution	/1. 0.001mm	ON/OFF	0.1mm
	/2. 0.01mm	ON/OFF	
	/3. 0.1mm	ON/OFF	
	/4. 1mm	ON/OFF	
	/5. 10mm	ON/OFF	
e. Error bit		ON/OFF	ON
f. Error bit function	/1. Overflow	ON/OFF	Enabled by default ATT、LSR、PLB、ERR
	/2. intensity (ATT)	ON/OFF	
	/3. temperature (TMP)	ON/OFF	
	/4. laser (LSR)	ON/OFF	

	/5. rationality (PLB)	ON/OFF	
	/6. hardware (ERR)		
g.Refresh rate	1. 1.7ms	ON/OFF	1.7ms
	0.2ms	ON/OFF	
h.Clock frequency	/1. 50KHz-800KHz		

6.2.3 Position value output setting

Layer 3	Layer 4	Options/Description	Default Settings
a. Enable inch units		ON/OFF	OFF
b. Reverse counting		ON/OFF	OFF
c. Offset			
d. Preset (not open)			
e. Fault delay		ON/OFF	ON
e1. Delay time (ms)			100
f. Output zero after fault		ON/OFF	ON
g. Fault recovery delay		ON/OFF	ON
g1. Delay recovery time (ms)			5

6.2.4 I/O output setting

Layer 3	Layer 4	Options/Description	Default Settings
a. Select IO	/1、 IO 1	ON/OFF	IO 1
	/2、 IO 2	ON/OFF	
b. IO port mode	/1, Input mode (not open)	ON/OFF	Output Mode
	/2, Output mode	ON/OFF	
c. Input mode selection	/1, No function (not open)		
	/2, Preset teaching (not open)		
	/3, Laser switch (not open)		
d. Input mode activation level	/1, low level activation (not open)		
	/2, high level activation (not open)		
e. Output mode selection	/1, intensity (ATT)	ON/OFF	Enabled by default ATT,PLB
	/2, temperature (TMP)	ON/OFF	
	/3, laser (LSR)	ON/OFF	
	/4, rationality (PLB)	ON/OFF	
	/5, hardware (ERR)	ON/OFF	
f. Output mode activation level	/1, low level activation	ON/OFF	Active low
	/2, high level activation	ON/OFF	

6.2.5 Filter parameters setting

Layer 3	Layer 4	Options/Description	Default Settings
Quickly view distance values			
View filter parameters			
Distance value application mode	/1. Original data		
	/2. Kalman filter		
	/3. Complementary filter		
Quick Set: Kalman Filter	Current Mode	0: Custom /1: Fast /2: Medium	1

		/3: Strict	fast
	Custom	ON/OFF	
	Fast	ON/OFF	
	Medium	ON/OFF	
	Strict	ON/OFF	
Kalman filter: Q			
Kalman filter: R			
Kalman filter: restore default values			
Quick Setup: Complementary Filtering	Current Mode	0: Custom /1: Fast /2: Medium /3: Strict	1
	Custom	ON/OFF	medium
	Fast	ON/OFF	
	Medium	ON/OFF	
	Strict	ON/OFF	
Complementary filter: alpha			
Complementary filter: restore default value			
《Parameter Description》	1. Q: Process noise variance		
	2. R: Measurement noise covariance		
	3. Alpha: Complementary filter coefficient		

6.2.6 Other setting

Layer 3	Layer 4	Options/Description	Default Settings
a. Screen brightness setting		Lv1: 1-251 (± 10 per click)	Lv1: 1
b. After-sales service Ethernet	/1.IP address		
	/2. Port Number	1-65535	
	/3.Subnet mask address		
	/4.Gateway address		
	/5.MAC address		
	/6.Distribution network parameter recovery preset		
	[Use crc16-Modbus verification method]	ON/OFF	OFF
	[Save settings]		
	[Restart device]		
c. Distance value displayed on the lock screen	/1. Original data	ON/OFF	Kalman filter
	/2. Kalman filter	ON/OFF	
	/3. Complementary filter	ON/OFF	
d. Lock screen refresh interval			1ms
e. Screen sleep time		10s-240s	10s

6.3 Lock screen error description

Location information and error messages will always be displayed on the device lock screen;



Normal interface of distance measurement



Distance measurement error interface

Note: The blue filled background indicates an error item;

Error type	Error description
TMP	Unreasonable temperature
LSR	Laser switch status
PLB	Is the current distance value reliable
ATT	Unreasonable laser intensity
ERR	Equipment hardware level failure

For the error types of PLB and ERR, please refer to the host computer instructions;



①: Select which distance to display separately. The default value is the original data value, as shown in the figure above O: 104.76;

Menu settings: B, Parameters → 6, Others → c, Distance value displayed on the lock screen.

②: Represents the type of data sent by SSI, defaulting to output the raw data value;

Menu settings: B, Parameters → 5, Filter parameters setting→ Distance value application mode.

Note: ① and ② are independent of each other.

Application Types of SSI Output	Meaning
O	Original data value
K	Value after Kalman filter
C	Value after complementary filter

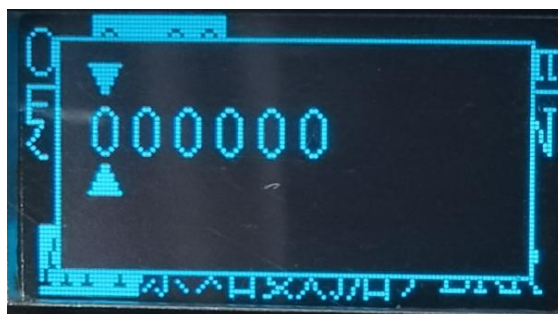
6.4 PHR Rapid Parameter Setting

All function switches in the menu need to be turned on first B.1 Parameters → 1, Parameter Management → a, Parameter Enable;



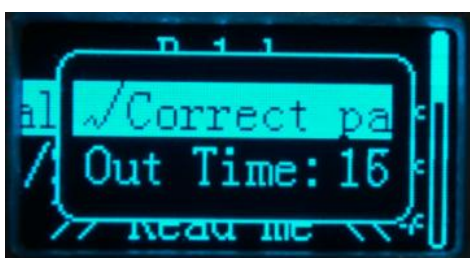
No operation interface

Before "Parameter Enable", you need to go to Parameter B → 1, Parameter Management → Password b → / 2, Enter Password → / 1, Verify Password;



Note: You need to press the OK key to select the numerical position first, then press the up and down keys to select the numerical position, and click the OK key again to exit the selection state; press the Return key after the password input is completed. The default correct password is: 100000.

After entering the password, you need to verify the password: 2, enter the password → /1, verify the password;



Password verification interface



Parameter enable interface

Note: Each time you verify the password, it will be cleared, and you need to re-enter the password for verification;

Complete the above steps to set the device parameters;



After completing the settings of other parameters, you need to return to the first-level menu interface and click [Save Settings] so that the completed parameter settings will not be lost during power failure;



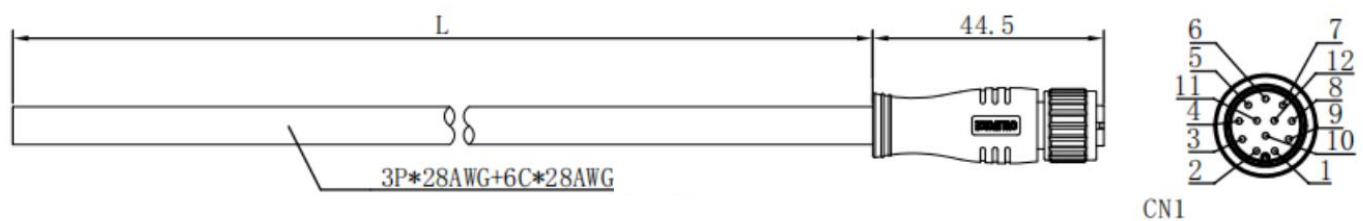
Click [Save Settings] and the interface will change as shown above.

7 Cable definition

7.1 IO power connection port

Ethernet TCP/IP	Output(NPN)	SSI Communication	CAN Communication
Route 1	Route 2	Route 1	Route 1

Function	IO, SSI Communication,Power supply,CanOpen
Type	Connector
Thread specification	M12
Number of pins	12 pins
Corresponding wire model	HCX12L**BX01



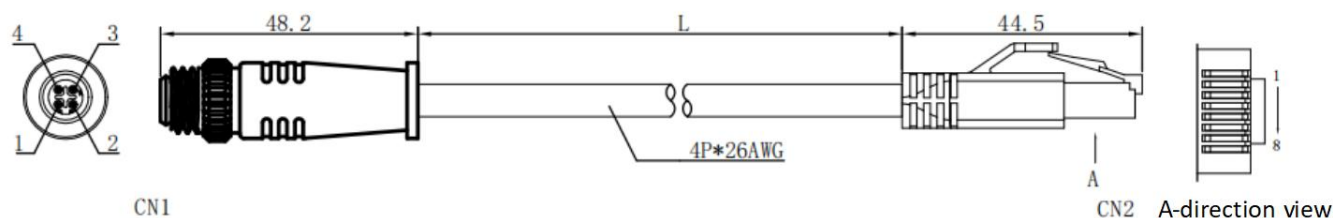
Terminals	Serial number	Symbol	Color	Function
CN1	Pin1	CAN-H	White green	CAN-H
	Pin2	+VIN	Brown	Positive power input
	Pin3	CAN-L	Green	CAN-L-
	Pin4	Y00-	Yellow	Multi-function IO line-
	Pin5	Y00+	Gray	Multi-function IO line+-
	Pin6	Y01-	Pink	Multi-function IO line-
	Pin7	-VIN	Blue	Negative power input
	Pin8	Y01+	Purple	Multi-function IO line+-
	Pin9	RCLK+	Orange	Clock Line SSI (Input Electrical Isolation)
	Pin10	RCLK-	White orange	Clock Line SSI (output Electrical Isolation)
	Pin11	DATA+	Black	Data line SSI (output) +
	Pin12	DATA-	White	Data line SSI (output)-

Cable model selection

Name	Model	Specifications
Cable	HCX12L60BX01	M12 12-core Female connector Straight head Precast 6m 26AWG 12C Shielded PVC cable;
Cable	HCX12L20BX01	M12 12-core Female connector Straight head Precast 2 m 26AWG 12C Shielded PVC cable;
Cable	HCX12L100BX01	M12 12-core Female connector Straight head Precast 10 m 26AWG 12C Shielded PVC cable;
Cable	HCX12LX0BX01	M12 12-core Female connector Straight head Precast X m 26AWG 12C Shielded PVC cable;

7.2 Ethernet port

Function	Ethernet connection
Type	Connector
Thread specification	M12
Number of pins	4 pins
Corresponding wire model	HCX4L**EE



Terminals	Serial number	Color	Symbol	Functional Description
CN1	Pin1	White orange	ETH Tx+	Ethernet TX+
	Pin2	White green	ETH Rx+	Ethernet RX+
	Pin3	Orange	ETH Tx-	Ethernet TX-
	Pin4	Green	ETH Rx-	Ethernet RX-

Cable model selection

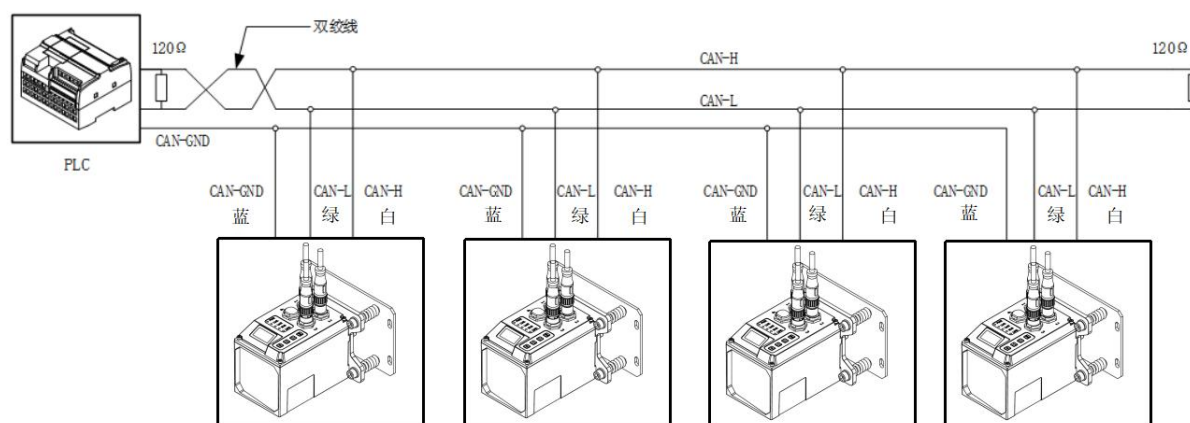
Name	Model	Specifications
Cables	HCX4L20EE;	M12 D-Code 4pin molded male straight connector 2.0M cable, dark green PUR cable, molded RJ45 crystal plug at the end;
Cables	HCX4L60EE;	M12 D-Code 4pin molded male straight connector 6.0M cable, dark green PUR cable, molded RJ45 crystal plug at the end;
Cables	HCX4L100EE;	M12 D-Code 4pin molded male straight connector 10.0M cable, dark green PUR cable, molded RJ45 crystal plug at the end;
Cables (customized)	HCX4LX0EE;	M12 D-Code 4pin molded male straight connector X.0M cable, dark green PUR cable, molded RJ45 crystal plug at the end;

8 Data protocol

The PHR sensor supports the Can open protocol under CAN BUS and the TCP protocol transmission of Ethernet. The sensor data can be output in both Can open mode and Ethernet communication mode.

8.1 CanOpen Communication Protocol

8.1.1 CAN BUS Wiring



- 1) Use twisted pair cables;
- 2) A 120 ohm terminal resistor must be connected
- 3) CAN BUS is a non-isolated port
- 4) Communication distance reference

CAN BUS baud rate	Total cable length
1Mbit/s	less than 20 meters
500Kbit/s	less than 100 meters
250Kbit/s	less than 250 meters
125Kbit/s	less than 500 meters

The cable length is closely related to the baud rate. For example, the baud rate of 1M cannot guarantee that 20m is completely problem-free. In some cases, the baud rate of 1M is used, and the communication distance of 5 meters is the most reliable. However, when using the handshake method to connect, in some cases, the actual application is also normal at 20m. If there is a branch 1M, the maximum length of the branch can only be 0.3m. If it is 500K, the branch line length cannot exceed 0.5m, and the total line length cannot exceed 1.5m.

The lower the baud rate, the stronger the anti-interference ability. When the communication bandwidth ratio is less than 70%, try to use a smaller baud rate.

8.1.2 Basic Concepts

Electronic Data Document (EDS): A directory used to record and describe all parameters of CAN open nodes; through the EDS file, you can obtain all CAN open parameters such as the node type, manufacturer, serial number, version information, baud rate, etc. When using the CAN OPEN function in PLC, you need to import the EDS file first and configure it through the object dictionary recorded in the EDS.

Service Data Object (SDO): SDO is mainly used for the CAN OPEN master station to configure the parameters of the slave node. After each SDO message is sent, there will be a response message to ensure that the message is accurately delivered. In a CAN OPEN communication system, there is usually only one master station as the client, and the slave node responds to the SDO message as the SDO server. The master station client accesses and modifies the corresponding index parameters in the EDS of any node through the SOD message.

Process Data Object (PDO): PDO is used to transmit real-time data, one-way transmission, without receiving a response from the slave node. A PDO message can transmit up to 8 bytes of data, mainly used to transmit real-time data. The master node and the slave node predefine the sending data and receiving data corresponding to the PDO, so there is no need for reconfirmation during the transmission process, and there is no response time and response data, thereby improving bus utilization.

8.1.3 Communication specifications

Communication mode	Bus mode
Communication rate	1000k (default), 500k, 250k, 125k
Communication address	1-127 (default)
TPDO	4
RPDO	4
Online message	Support
Heartbeat message	Support
Heartbeat consumption	Support
SDO	Support

8.1.4 Communication parameter settings

8.1.5 Index Definition

Object index	Object Sub-index	Object Description	Data Type	Property	Default value
0x1017	0x00	Heartbeat control	UNS16	R/W	500
0x1018	0x00	Number of sub-indexes	UNS8	R	4
	0x01	invalid	UNS32	R	
	0x02		UNS32	R	
	0x03		UNS32	R	
	0x04		UNS32	R	
1800	00		UNS08	R	6
	01	TPDO1 responds to CAN ID	UNS32	R/W	\$NODEID+0x180
	02	Synchronous mode	UNS8		254
	03	Prohibited time	UNS16		50
	05	Event time	UNS16		20
	06	Synchronize initial value	UNS16		0
1801	00		UNS08	R	6
	01	TPDO2 responds CAN ID	UNS08	R	6
	02	Synchronous mode	UNS32	R/W	\$NODEID+0x280
	03	Prohibited time	UNS8		254
	05	Event time	UNS16		50
	06	Synchronize initial value	UNS16		20
1802	00		UNS08	R	6
	01	TPDO3 responds CAN ID	UNS08	R	6
	02	Synchronous mode	UNS32	R/W	\$NODEID+0x180
	03	Prohibited time	UNS8		254
	05	Event time	UNS16		50
	06	Synchronize initial value	UNS16		20

1803	00		UNS08	R	6
	01	TPDO3 responds CAN ID	UNS32	R/W	\$NODEID+0x180
	02	Synchronous mode	UNS8		254
	03	Prohibited time	UNS16		50
	05	Event time	UNS16		20
	06	Synchronize initial value	UNS16		0
1A00	00	TPDO1 Mapping	UNS08	R	8
	01		UNS32	R/W	0x20090020
	02		UNS32	R/W	0x200A0020
	03		UNS32	R/W	0
	04		UNS32	R/W	0
	05		UNS32	R/W	0
	06		UNS32	R/W	0
	07		UNS32	R/W	0
	08		UNS32	R/W	0
1A01	00	TPDO2 Mapping	UNS08	R	8
	01		UNS32	R/W	0x20080020
	02		UNS32	R/W	0x20060020
	03		UNS32	R/W	0
	04		UNS32	R/W	0
	05		UNS32	R/W	0
	06		UNS32	R/W	0
	07		UNS32	R/W	0
	08		UNS32	R/W	0

Index (Hex)	Child Index (Hex)	Parameter name	Type	Properties	Description
0x2002	0x00	Sensor internal temperature	int8	Read-only	Unit: °C, for example, data 8000 equals 80°C, data -1500 equals -15°C.
0x2003	0x00	ATT intensity	uint32	Read-only	0 is normal, 1 is too low signal strength, 2 is too high signal strength (range 0-2).
0x2004	0x00	TMP temperature	uint32	Read-only	0 is normal, 1 is less than -15°C, 2 is greater than 80°C (range 0-2).
0x2005	0x00	LSR laser	uint32	Read-only	0 is normal, 1 is abnormal (voltage abnormality, program shutdown output, etc.) (range 0-1)
0x2006	0x00	PLB rationality	uint32	Read-only	0 is normal, non-0 is abnormal
0x2007	0x00	ERR hardware	uint32	Read-only	0 is normal, non-0 is abnormal
0x2008	0x00	Original distance	int32=float*1000	Read-only	The distance value is magnified 1000 times and then output as an integer.

0x2009	0x00	Kalman filter distance	int32=float*1000	Read-only	The distance value is magnified 1000 times and then output as an integer.
0x200A	0x00	Complementary filter distance	int32=float*1000	Read-only	The distance value is magnified 1000 times and then output as an integer.

0x2006 PLB rationality (uint32) definition:

PLB rationality (uint32) equals 0, which means no error (PLB rationality is fine). If there is an error in PLB, the corresponding bit is set to 1:

PLB flag	PLB error description
Bit0	PLB error exists
Bit1	Distance mutation
Bit2	Amplitude is abnormally large
Bit3	Amplitude is abnormally small
Bit4	Distance is maximum

0x2007 ERR hardware (uint32) definition:

ERR hardware (uint32) equals 0, which means no error (hardware ERR is fine). If there is an error in ERR, the corresponding bit is set to 1:

ERR flag	ERR error description
Bit0	Core board data transmission failed or lost
Bit1	FPGA transmission frame rate is less than 1072KHz (frequency = 1 / 932.582us 1.72 MHz)
Bit2	Receiver tube working voltage->high (normal 18v, higher than 20v)
Bit3	Receiver tube working voltage->low (normal 18v, lower than 16v)
Bit4	When the laser power is on, the laser voltage->high (normal 5v, higher than 6v)
Bit5	When the laser power is on, the laser voltage->low (normal 5v, lower than 4v)
Bit6	When the laser power is off, there is still working voltage (not shut down normally)

8.2 Ethernet data transmission protocol

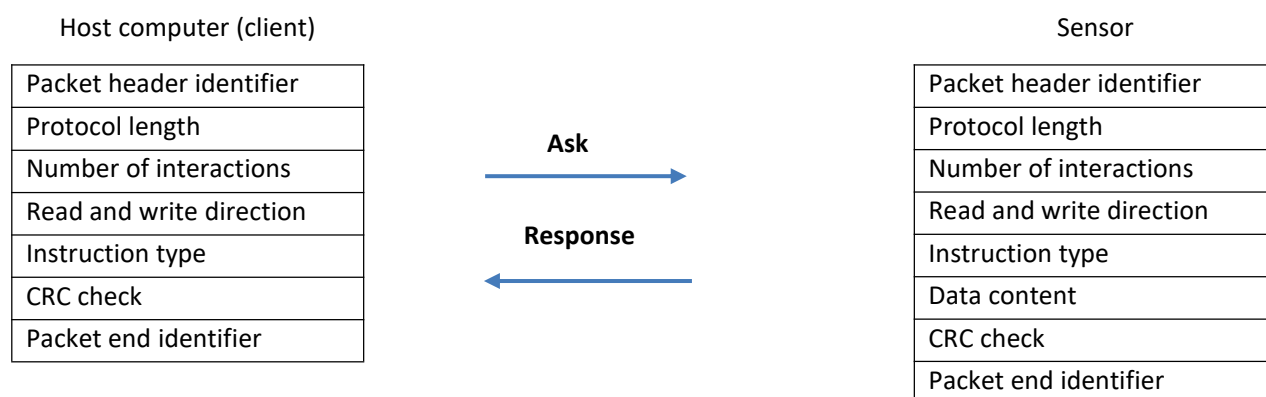
8.2.1 Communication parameter settings

Open the configuration software, enter the sensor (server side) setting interface, set the TCP port settings, and successfully connect the sensor.

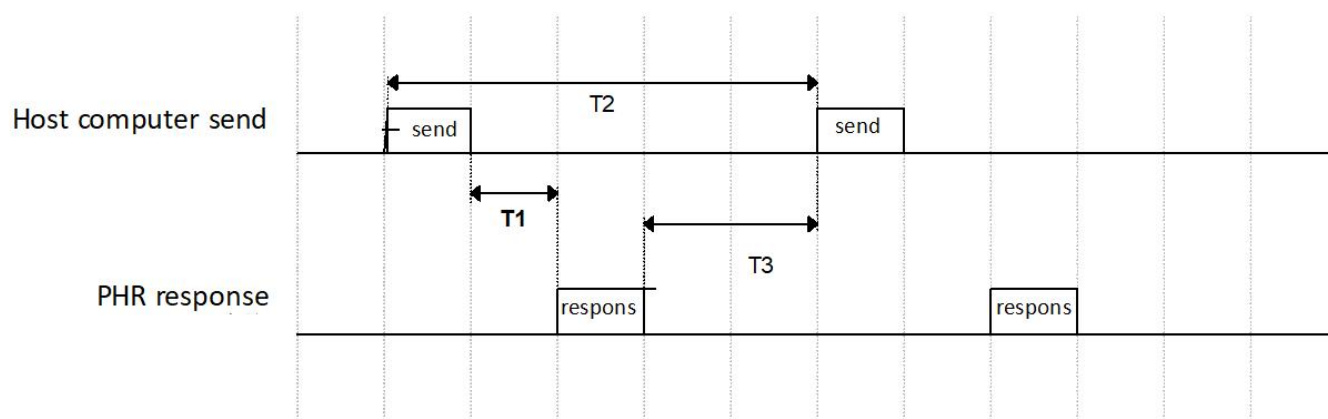
	Parameter name	default value	Parameter description
	Local IP address	192.168.0.x	The local IP address needs to be set to the same network segment as the sensor IP address.
	Local port number	8000	The local port number is set.
	Sensor IP address	192.168.0.x	The sensor IP address needs to be queried on the LCD screen.
	Sensor port number	8080	The sensor port number, the default is 8080.

8.2.2 Communication Timing

After the client initiates a request and establishes a connection, data transmission begins according to the following rules.



The host computer (client) sends "inquiry commands" of different command types to the sensor (server), and the sensor responds with data of the corresponding command type.



T1	Waiting delay, less than 3ms
T2	Send delay greater than 10ms
T3	At least wait for 2 minutes.

8.2.3 Data Format

Sending data format

NO.	Data packet index position	Description	Length
1	0-1	Packet header identifier	2Byte
2	2-3	Protocol length	1Byte (L) 1Byte (H)
3	4	Number of interactions	1Byte
4	5	Read and write direction	1Byte
5	6-7	Command type	1Byte(L) 1Byte (H)
6	8-9	CRC check	2Byte
7	10-11	Packet end identifier	2Byte

Packet header identifier:

Fixed data is 0x55 0x55;

Protocol length:

Low bits first, high bits last. The data is the data length of the sending data structure number 2 to 5. The host computer sends four commands to the sensor, and the fixed data of the protocol length is 0x00 0x06;

Number of interactions:

Customized data, the data of the number of interactions sent by the host computer corresponds to the data of the number of interactions replied by the sensor, which can verify whether the data is lost. It can be set to 0x00, send any data, and respond with the same data;

Read and write direction:

The fixed data is 0x52 (the host computer sends the corresponding "read" direction);

Instruction type:**Send data with the low bit first**

0x00 0x01 The host computer reads the sensor, the current distance value;

0x00 0x02 The host computer reads the sensor, the original distance value, Kalman filter distance, complementary filter distance;

0x00 0x04 The host computer reads the sensor, the filter parameter data;

0x00 0x05 The host computer reads the sensor, the error type parameter;

CRC check:

The verification data only contains the 2-5th serial number data, and the calculation method refers to the 8.5 CRC algorithm;

Packet tail identifier:

Fixed data is 0xAA 0xAA.

Response data format**Data Structure**

NO.	Data packet index position	Description	Length
1	0-1	Packet header identifier	2Byte
2	2-3	Protocol length	1Byte(L)
			1Byte(H)
3	4	Number of interactions	1Byte
4	5	Read and write direction	1Byte
5	6-7	Instruction type	1Byte(L)
			1Byte(H)
6	8-(7+x)	Data content	The data content is assumed to be x Byte
7	(8+x)-(9+x)	CRC check	2Byte
8	(10+x)-(11+x)	Packet end identifier	2Byte

Packet header identifier:

The fixed data of the current packet header identifier replied by the sensor is 0x55 0x55;

Protocol length:

The low position is in front and the high position is in back, and the data is the data length of the transmission data structure number 2 to 6. The sensor currently responds to the three instructions to the host computer, and the protocol length data is shown below.

The command type sent is 0x00 0x01, and the protocol length data replied by the sensor is 0x00 0x0C;

The command type sent is 0x00 0x02, and the protocol length data replied by the sensor is 0x00 0x14;

The command type sent is 0x00 0x04, and the protocol length data replied by the sensor is 0x00 0x12;

The command type sent is 0x00 0x05, and the protocol length data replied by the sensor is 0x00 0x0A;

Number of interactions:

Custom data The data of the sensor reply number of interactions corresponds to the data of the number of interactions sent by the host computer, which can verify whether the data is lost and can be set to 0x00;

Read and write direction:

Fixed data is 0x4F (sensor response corresponds to the "reply" direction);

Instruction type:

0x00 0x01 Sensor responds to the host computer, current distance value command;

0x00 0x02 Sensor responds to the host computer, original distance value, Kalman filter distance, complementary filter distance command;

0x00 0x02 Sensor responds to the host computer, filter parameter data command;

0x00 0x05 Sensor responds to the host computer, error type parameter command;

Data content:

The command type sent is 0x00 0x01, and the response data content length is 6Byte					
8	9	10	11	12	13
Usage Type	Current distance value (float)				Inch Enable
1Byte	1Byte (L)	1Byte	1Byte	1Byte (H)	1Byte

The command type sent is 0x00 0x02, and the response data content length is 15Byte					
8	9	10-13	14-17	18-21	22
Usage Type	Reply parameters	Original distance value (float)	Kalman filter distance value (float)	Complementary distance value (float)	Inch Enable
1Byte	1Byte	4Byte (lowest byte first)	4Byte (lowest byte first)	4Byte (lowest byte first)	1Byte

The command type sent is 0x00 0x04, and the response data content length is 12Byte		
Kalman-process noise covariance Q (float)	Kalman-measurement noise covariance R (float)	Complementary filter coefficient (float)
4Byte (lower byte first)	4Byte (lower byte first)	4Byte (lowest bit first)

The command type sent is 0x00 0x05, and the response data content length is 4Byte			
Error Type	PLB Error Type	ERR Error Type	Spare
1 Byte	1Byte	1Byte	1Byte

Error Type:

Undefined			Optical signal status	Temperature status		Strength Status	
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
			00: Optical signal normal 01: optical anomaly	00: Normal temperature 01: Low temperature warning, when the temperature is below -15° C, the alarm will sound 10: High temperature alarm, when the temperature is above 80° C, the alarm will sound		00: Normal intensity 01: Warning intensity 10: Alarm intensity	

PLB Error Type:

Undefined			Distance Status	Amplitude state		Distance mutation	There is a PLB error
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
			0: Normal; 1: Maximum distance	0: Normal 01: Abnormally large amplitude 02: Abnormally small amplitude		0: Normal; 1: Distance mutation	0: Normal; 1: Error

ERR Error Type:

Undefined	Emission status	Transmitter voltage		Receive voltage status		Internal transmission error	ERR There is an error
Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
	0: Normal; 1: Transmitter is not turned off	00: Normal; 01: Transmitter voltage is too high 10: Transmitter voltage is too low		00: Normal; 01: Received voltage is too high 10: Received voltage is too low		0: Normal; 1: Transmission error	0: Normal; 1: Error

CRC check: The verification data only contains the 2-6th serial number data, and the calculation method refers to the 8.5 CRC algorithm;

Packet end identifier: Fixed data is 0xAA 0xAA.

8.3 Sending data example

8.3.1 Sensor Setting Parameters

Parameter name	Parameter value
Ethernet mode interface	TCP server
Ethernet IP address	192.168.1.88
Sub-net mask	255.255.255.0
Gateway	192.168.1.1
Port number	8080

8.3.2 Use tools

Use TCP debugging assistant software;

Tool acquisition;

Send data

host computer sends the start data frame	Keep the following data (Hex) for 100ms cycle;
55 55 06 00 00 52 01 00 B5 92 AA AA	
0x55 0x55: packet header identifier; 0x06 0x00: Data length is 6Byte; 0x00: Number of interactions; 0x52: Send flag bit; 0x01 0x00: Send read data class; 0xB5 0x92: Verify data; 0xAA 0xAA: packet end identifier;	

Reply data

Sensor returns data frame	Sensor response data (Hex)
55 55 0C 00 00 4F 01 00 01 B7 FF A7 DD 00 4B DD AA AA	
0x55 0x55: packet header identifier; 0C 00: Data length is 6Byte; 0x00: Number of interactions; 0x4F: Send flag bit; 0x00 0x01: Send read data class; 01 : use type B7 FF A7 DD : Current data value; 00 : Inch enabled; 4B DD : Verify data; 0xAA 0xAA: packet end identifier;	

8.4 SSI Interface

8.4.1 SSI working principle

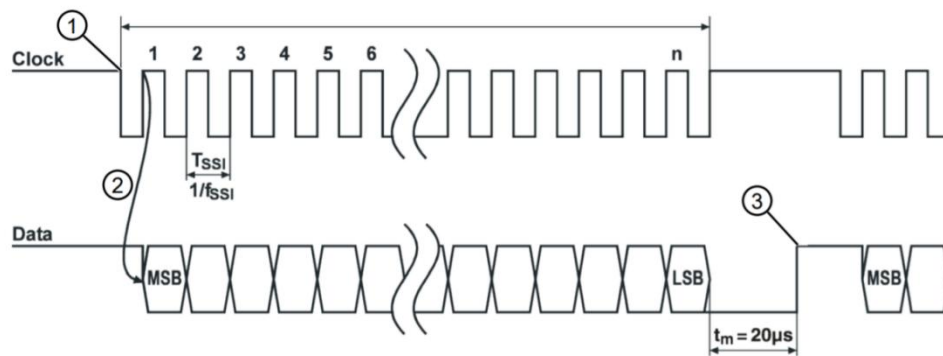


illustration: SSI transmission cycle

The SSI interface uses RS-422 differential transmission for data communication. During transmission, the position value starts from the most significant bit (MSB) and is transmitted synchronously according to the period (clock) specified by the control system.

In the idle state, both the clock line and the data line remain at a high level. On the first rising edge (1), the data in the internal register is saved, ensuring that it does not change during the serial transmission of the value.

As the next clock signal switches from low to high (2), the position value begins to be transmitted from the most significant bit (MSB). Each time the clock signal switches from low to high, the next least significant bit is set as the data line. After outputting the least significant bit (LSB), the data line switches to the low level as the clock signal last switches from low to high level, indicating that the transmission is over.

The monostable trigger triggered by the clock signal determines how long to wait before calling the SSI interface for the next transmission. This also results in the shortest pause time between two consecutive clock sequences. If time $t = 20$ seconds elapses, the data line is reset to a static high level (3), indicating that the data exchange is completely over and is ready to be resent.

Clock interrupt

If the clock interrupt time of the data exceeds $t=20$ s, a completely new transmission cycle will be started at the next clock from the new calculated value. If the new transmission cycle starts before the end of time t ., the previous value will be output again.

Note	
	The SSI interface can only represent positive distance values. If a negative output value is obtained due to offset or counting direction, the output value is zero on the SSI interface. When a digital overflow occurs, all data bits are set to "1".

Data bit

The distance value data is high first (MSB). The distance value data can be transmitted in a Grey code or binary format (default: Grey code). The number of data bits determines the maximum value of the transmitted data. The number of data bits can be set to 24 to 26 bits. (Default: 24 bits).

Error bit

The LSB bit is an error bit in the default settings.

The meaning of the error bit:

By default, the 25th bit error bit (LSB) will be attached to the 24-bit measurement value. The error bit is not included in the grey code of the measured value.

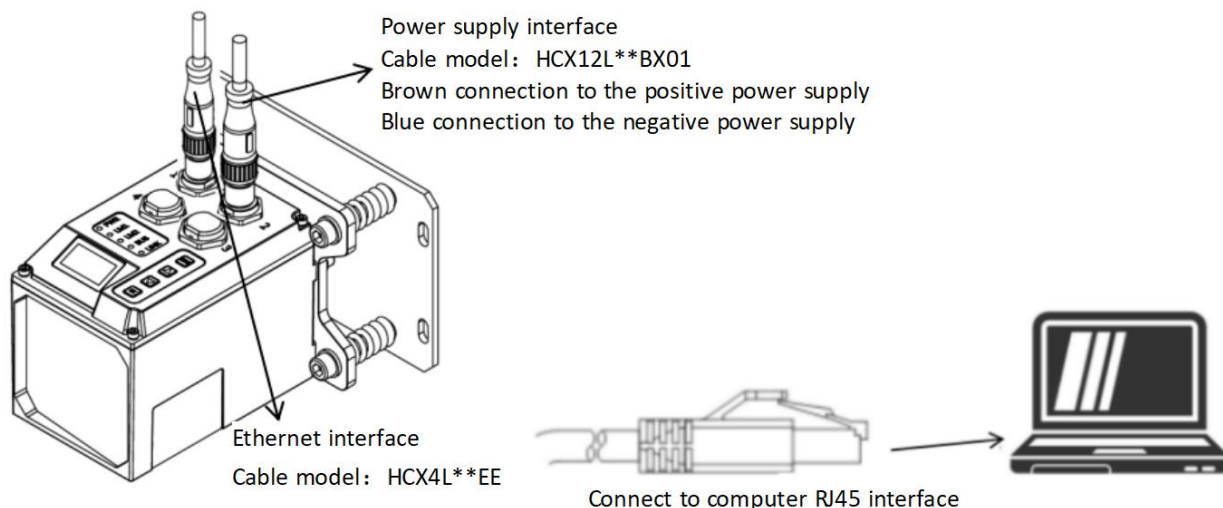
Clock frequency

The default setting is the clock frequency of 50kHz to 800kHz to read data, depending on the parameter settings.

Refresh the measurement value of the SSI interface

The default setting of the measured value refresh of the SSI interface is 1.7ms, which is independent of the clock frequency. You can shorten the interface refresh rate to 0.2ms through B. Parameters → 2.SSI → g. Refresh Rate.

8.4.2 Communication wiring diagram



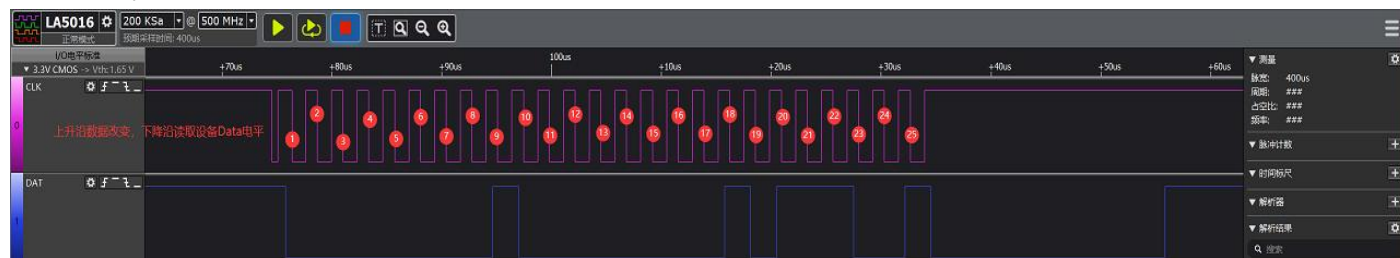
8.4.3 Parameter settings

SSI Parameter settings;

8.4.4 Data description

Configuration: 24-bit data bits + 1-bit error bit Code system: Gray code

Data Example:



24bit data: 00000000100000001011100 (But this is the Gray code, and it needs to be converted into binary to obtain valid data)

Binary data: 00000000111111110010111

Decimal data: 65,431

8.5 CRC algorithm

CRC checksum function definition:

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 0x8005
    unsigned int wCrc = 0xffff;
    unsigned int wPolynom = 0x8005;
    for (i = 0; i < iBufLen; i++)
    {
        wCrc ^= cBuffer[i];
        for (j = 0; j < 8; j++)
        {
            if (wCrc & 0x8000)
            { wCrc = (wCrc >> 1) ^ wPolynom; }
            else
            { wCrc = wCrc >> 1; }
        }
    }
    return wCrc;
}
```

9 Configuration software usage

9.1 Preparation

Software

Name: CNS-PHR-xxx

Software Introduction: HINSON Technology PHR series host computer software, used to obtain PHR sensor parameters, can display distance value, filter distance value and other information in real time, can draw distance value information curve, developed by Hinson Technology Co., Ltd.

Access method: WWW.HINSON-XS.COM. If you have any questions, please contact our sales staff.

Wire:

Model	Name	Specifications
HCX12L60BX01	IO&Power Cable	One end M12 A-coded 12-pin female straight connector; one end no connector With shield
HCX4L60EE	HCX4L60EE	One end M12 D-coded 4-pin male straight connector; one end RJ45 crystal connector

Power supply DC24 rated greater than 1A

Computer requirements: Windows7 and above.

Wiring instructions: PHR sensor is connected to the power supply through the power cord and connected to the computer through the Ethernet communication cable.

Access method: WWW.HINSON-XS.COM. If you have any questions, please contact our sales staff.

The sensor and the host computer use a communication connection method, which supports data transmission under the TCP protocol under Ethernet. The sensor can work in this data output state, and the host computer obtains information according to demand.

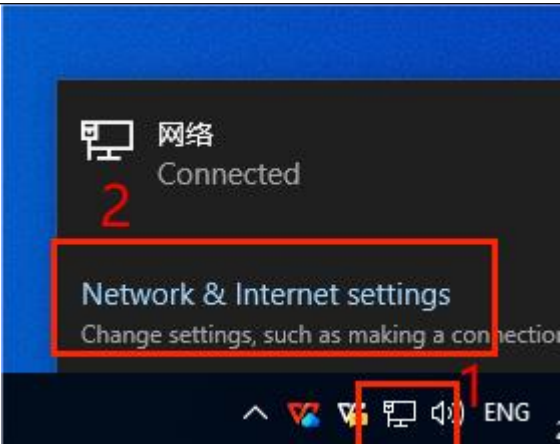
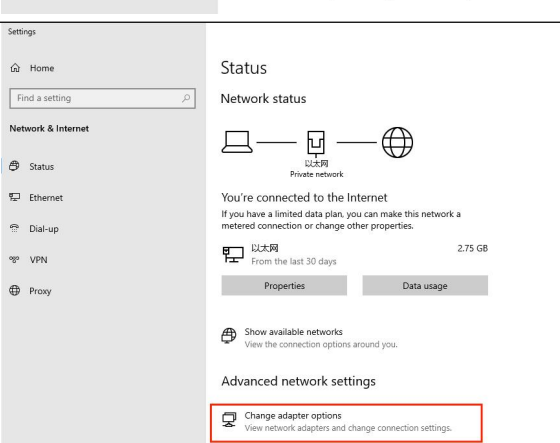
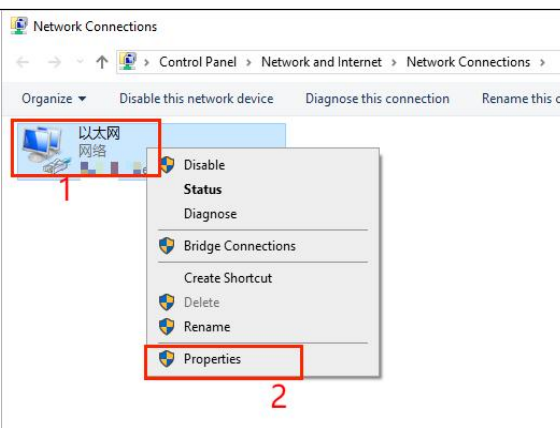
Term explanation

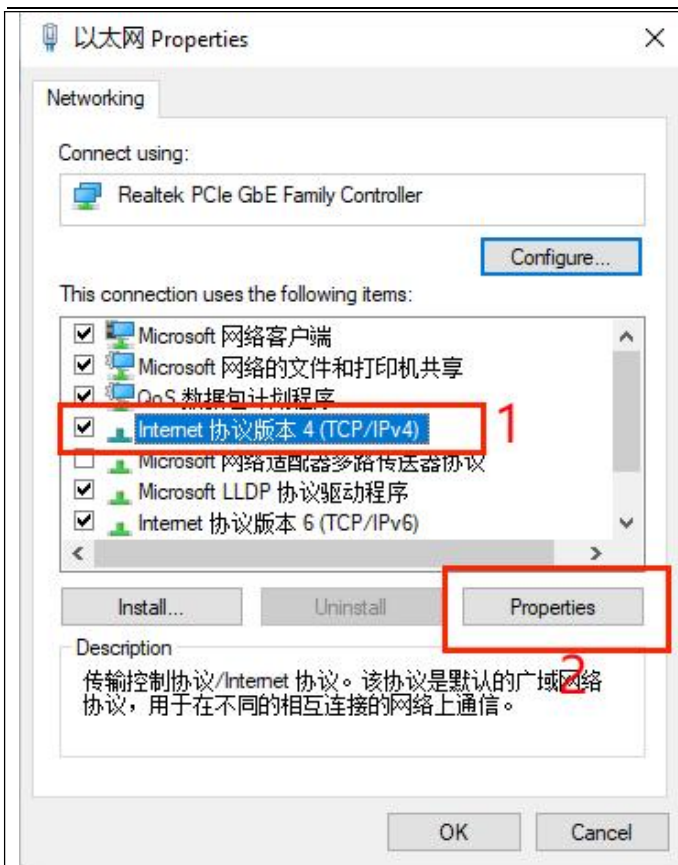
Host computer: It is a client device, the sensor directly controls the end. Generally, it is a PLC, a single-chip microcomputer or an industrial computer device.

9.2 Host computer Connection

Set the local IP address;

As an example, there will be differences in different system versions. The specific setting method can be searched online;

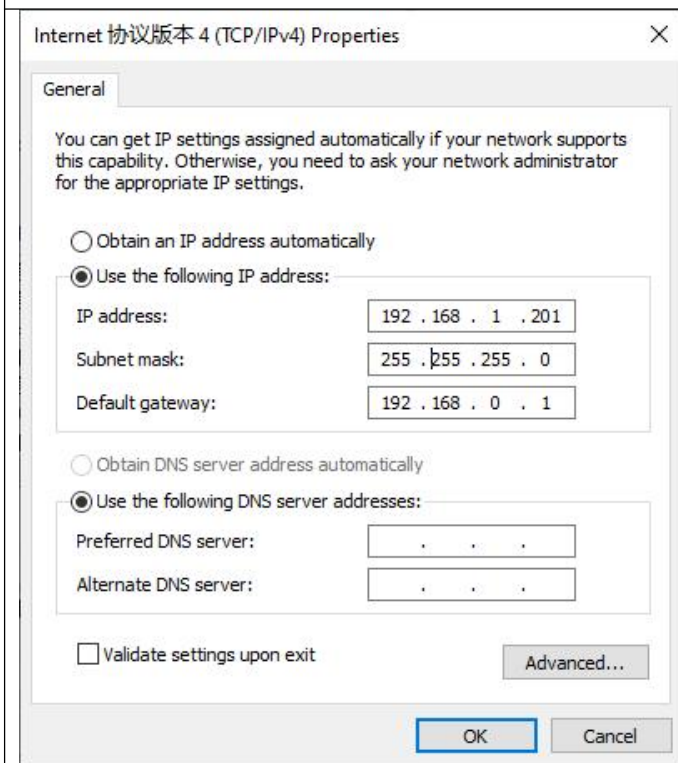
 On the computer desktop, find the network icon in the lower right corner, and then right-click; open "Network & Internet Settings";	
 Click to Change adapter options.	
 1: Find the local connection of the link sensor; 2: Right-click, select Properties in the pop-up dialog box;	



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;

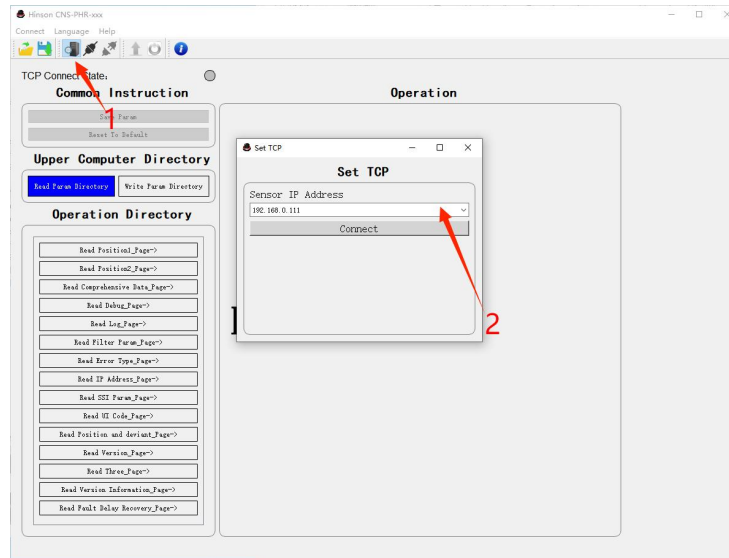
After filling in, press the "OK" button to exit.

9.3 Host computer debugging

9.3.1 TCP Port Settings

Open the PHR series host computer software of Hinson Technology and set the TCP parameters of the host computer, as shown in the figure.

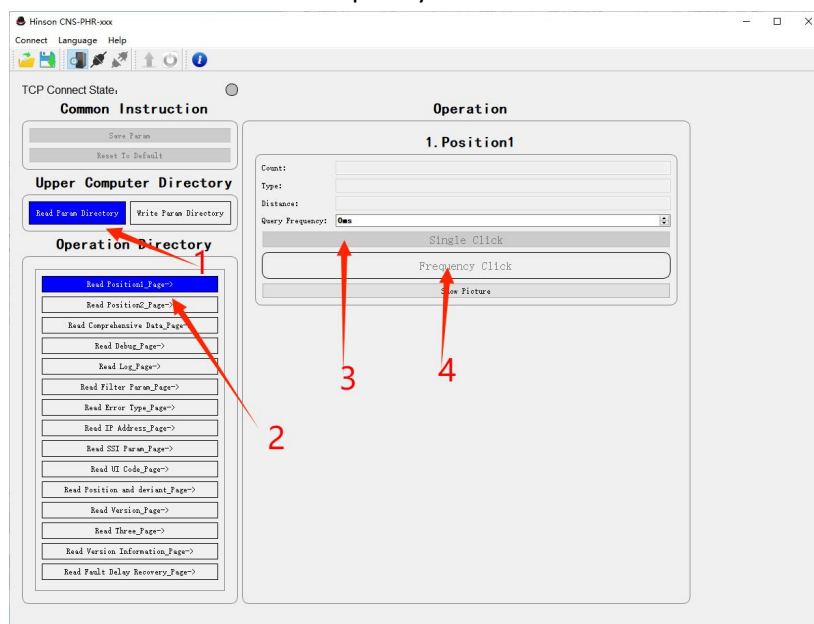
1. Click the TCP setting button of the software to open the TCP port setting interface.
2. Select the sensor IP address, and you need to query the sensor's IP address.



9.3.2 Read sensor parameters

Enter the sensor parameter reading page of the host computer and select the sensor parameters to be read according to user needs.

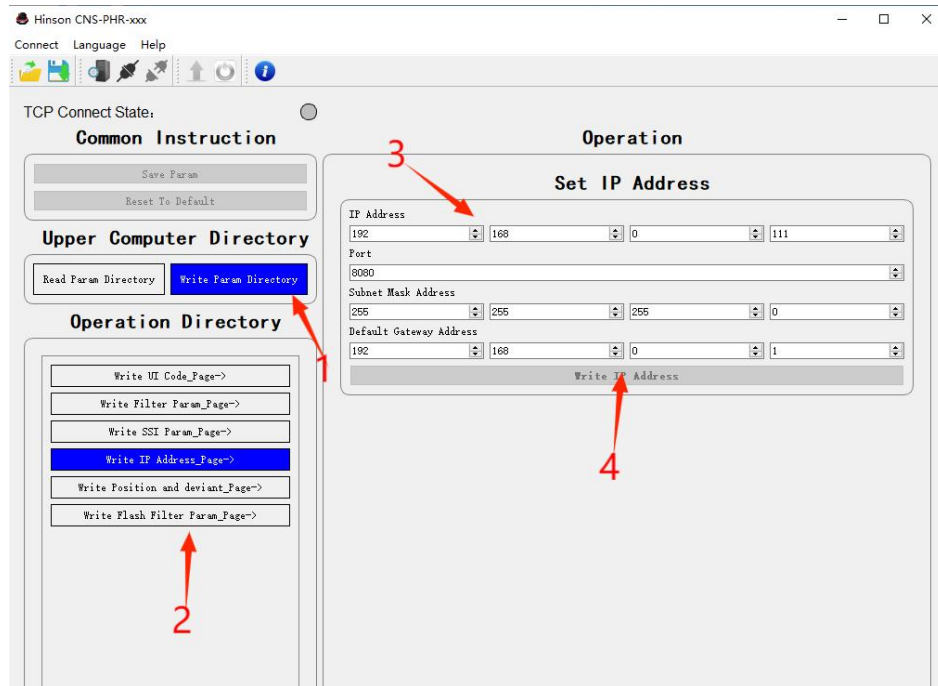
1. Click the read parameter operation button, and the operation directory displays the read parameter directory.
2. Select the sensor parameter that the user needs to read in the directory and enter the corresponding read parameter page.
3. Select single query sensor information.
4. Select to query sensor information at a certain frequency.



9.3.3 Setting sensor parameters

Enter the write sensor parameter page of the host computer and select the sensor parameters to be written according to user needs.

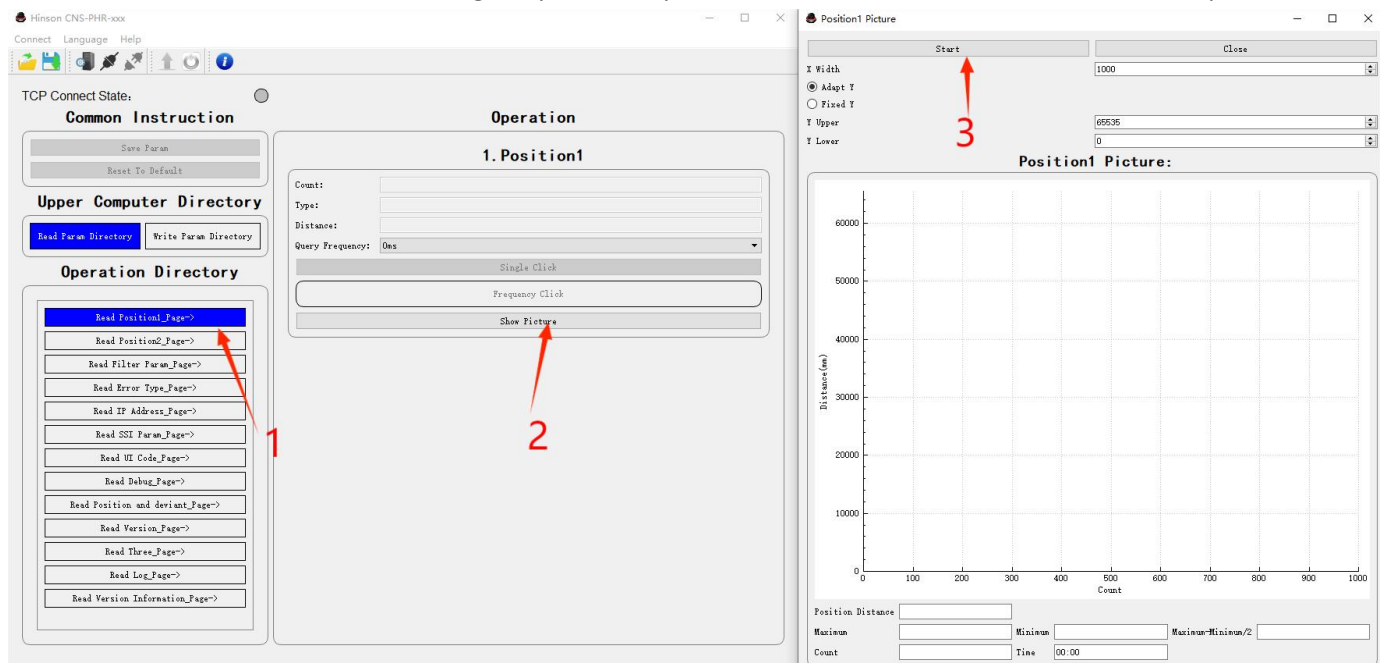
1. Click the write parameter operation button, and the operation directory displays the write parameter directory.
2. Select the sensor parameters that the user needs to write in the directory and enter the corresponding write parameter page.
3. The parameters of the sensor that need to be modified.
4. Click the button to set the sensor parameters.



9.3.4 Plotting sensor parameter curves

After the host computer successfully reads the sensor parameters, the distance curve can be drawn.

1. Enter the query position 1 page.
2. Click the position 1 chart display button to open the query position 1 parameter curve page.
3. Click the start button to start drawing the position 1 parameter curve. The default is the Y-axis adaptive mode.



10 Troubleshooting and Maintenance

10.1 Troubleshooting

Please follow the steps below to troubleshoot problems if SSI reading is abnormal

The SSI default parameters of PHR rangefinder:

- ① Data bit: 24
- ② Unit: 0.1mm
- ③ Code system: Gray code
- ④ Error bit: enable

General settings of user equipment:

- ① Baud rate: between 100-500k
- ② Encoder: Use a single-turn encoder 24-bit, and does not use a multi-turn encoder
- ③ Code system: Gray code
- ④ Error bit: can be turned on (1bit) or turned off (0bit)

Fault status	Possible Causes	Handling method
The screen or laser does not light up	Power supply is abnormal or insufficient	Check whether the power supply is normal Confirm whether the load capacity of the power module is sufficient
Reading is 0	Model mismatch	Confirm whether the PHR model is SSI model; Place a reflective film at 1 meter to observe whether the PHR display value is about 1000.0mm;
The device reads 2 times the PHR display value	CLK line and DATA line are connected in reverse	Check the CLK and DATA line sequence of the SSI interface to ensure correct connection;
The device reading is 1.3~1.5 times the PHR display value	Gray code was mistakenly converted to binary code	Check the code configuration of the device and set it to Gray code
The device reads very large (such as full height 1)	DATA line reverse connection will lead to binary 0 to 1	Check whether the DATA line is reversed;

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

10.2 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

10.3 Repair

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

10.4 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;

10.5 Cleaning

Materials used

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

11 After-sales information

11.1 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.

11.2 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;

11.3 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.

11.4 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



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