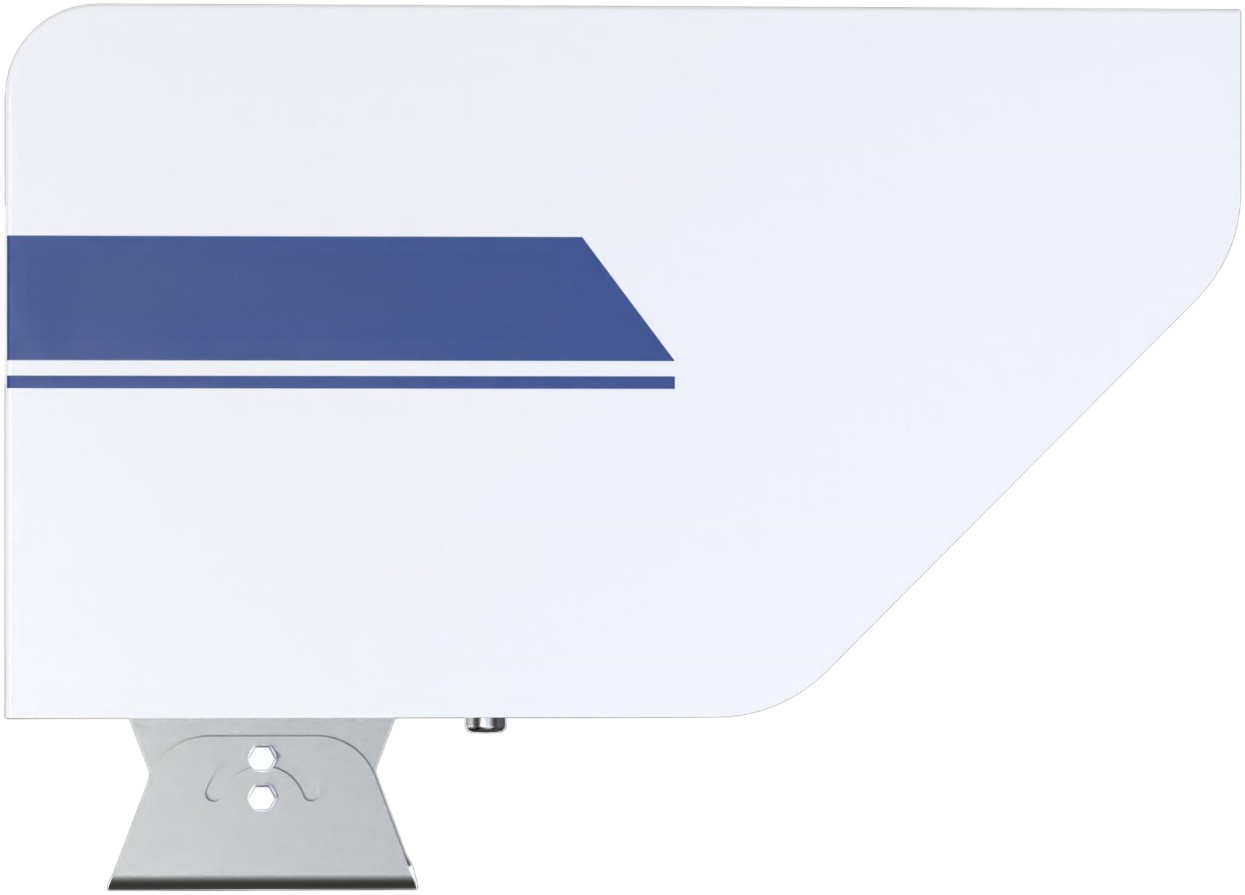
OHTS1120 Road Surface Condition Sensor

1 Product Overview



The OHTS1120 Road Surface Condition Sensor is a non-contact road surface condition monitoring device based on spectral analysis technology. Employing active remote sensing detection principles, the sensor emits monochromatic beams at specific wavelengths and receives reflected spectra from the road surface to achieve real-time analysis of road surface materials and status.

The sensor integrates a laser source and optical receiving system. The emitted light is focused by lenses and projected onto the road surface. By measuring the intensity and spectral characteristic differences of the reflected light, the internal processing unit calculates and outputs road surface condition parameters. The device incorporates a lens heating module to prevent optical window frosting in low-temperature environments, ensuring all-weather continuous monitoring capability.

2 Applicable Scenarios

- Highway road condition monitoring and early warning systems
- Urban road meteorological environment monitoring networks
- Airport runway surface condition real-time monitoring
- Bridge and tunnel entrance road safety monitoring
- Traffic meteorological station road parameter acquisition
- Winter road de-icing and snow removal operation guidance
- Intelligent Transportation Systems (ITS) road condition perception nodes
- Road maintenance management decision support systems

3 Product Features

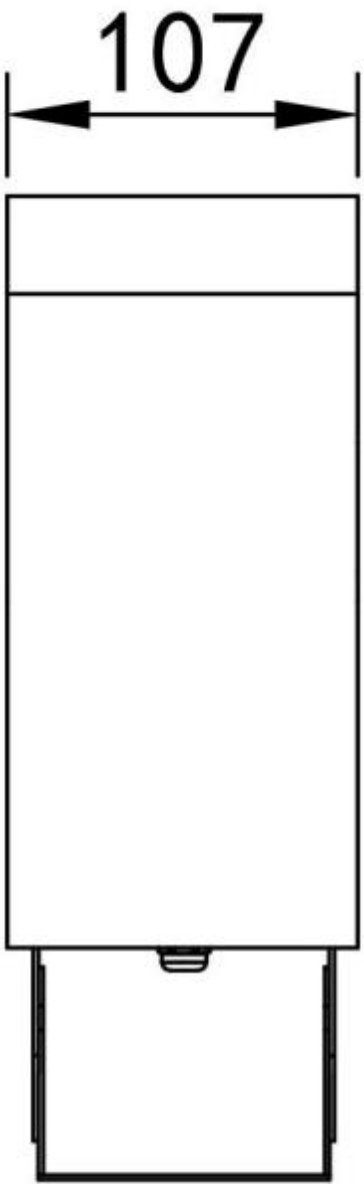
- **Multi-parameter Fusion Detection**: Simultaneously measures road surface conditions (dry/damp/wet/puddled/icy/snowy), water film thickness, ice layer thickness, snow depth, and road surface temperature
- **Non-contact Remote Sensing Detection**: Utilizes optical remote sensing technology without damaging road structures; adjustable measuring distance from 2m to 10m
- **Anti-interference Optical Design**: Laser source paired with narrow-band filters effectively suppresses ambient stray light interference
- **Environmental Adaptability Design**: Device enclosure features anti-corrosion treatment with protection rating suitable for long-term outdoor operation; built-in 13W heating module prevents lens frosting in winter
- **Electrical Protection Functions**: DC power input equipped with reverse polarity protection and self-recovering fuse
- **Standard Industrial Interface**: RS485 communication interface supporting ModBus-RTU protocol with configurable baud rates from 1200 bit/s to 115200 bit/s

4 Technical Specifications

Parameter	Specification
Supply Voltage	11V DC ~ 28V DC
Static Power Consumption	1.5W
Heating Power Consumption	13W
Communication Interface	RS485
Communication Protocol	ModBus-RTU
Baud Rate	1200/2400/4800/9600/19200/38400/57600/115200 bit/s (default: 4800 bit/s)
Data Format	8 data bits, no parity, 1 stop bit
Device Address	1~254 (default: 1)
Measuring Distance	2m ~ 10m
Measuring Spot Diameter	25cm
Installation Angle Range	0° ~ 60° (recommended: 10° ~ 40°)
Road Condition Recognition	Dry, Damp, Wet, Puddled, Icy, Snowy
Water Film Thickness Range	0.00mm ~ 2.00mm
Ice Thickness Range	0.00mm ~ 2.00mm (customizable)
Snow Depth Range	50mm ~ 2500mm (optional function)
Road Surface Temperature Range	-30℃ ~ 60℃
Slipperiness Index	0.00 ~ 1.00 (0=dangerous, 1=dry)
Data Update Interval	20s
Operating Temperature Range	-40℃ ~ 60℃
Operating Relative Humidity	≤95%RH (at 30℃)

5 Physical Specifications

Parameter	Specification
Mounting Method	Cross arm + clamp mounting, compatible with φ75mm pole
Mounting Accessories	Cross arm×1, Clamp×1, M5×55 Hexagon head screws×3, M5 Nuts×3, M8×70 Hexagon head screws×3, M8 Nuts×3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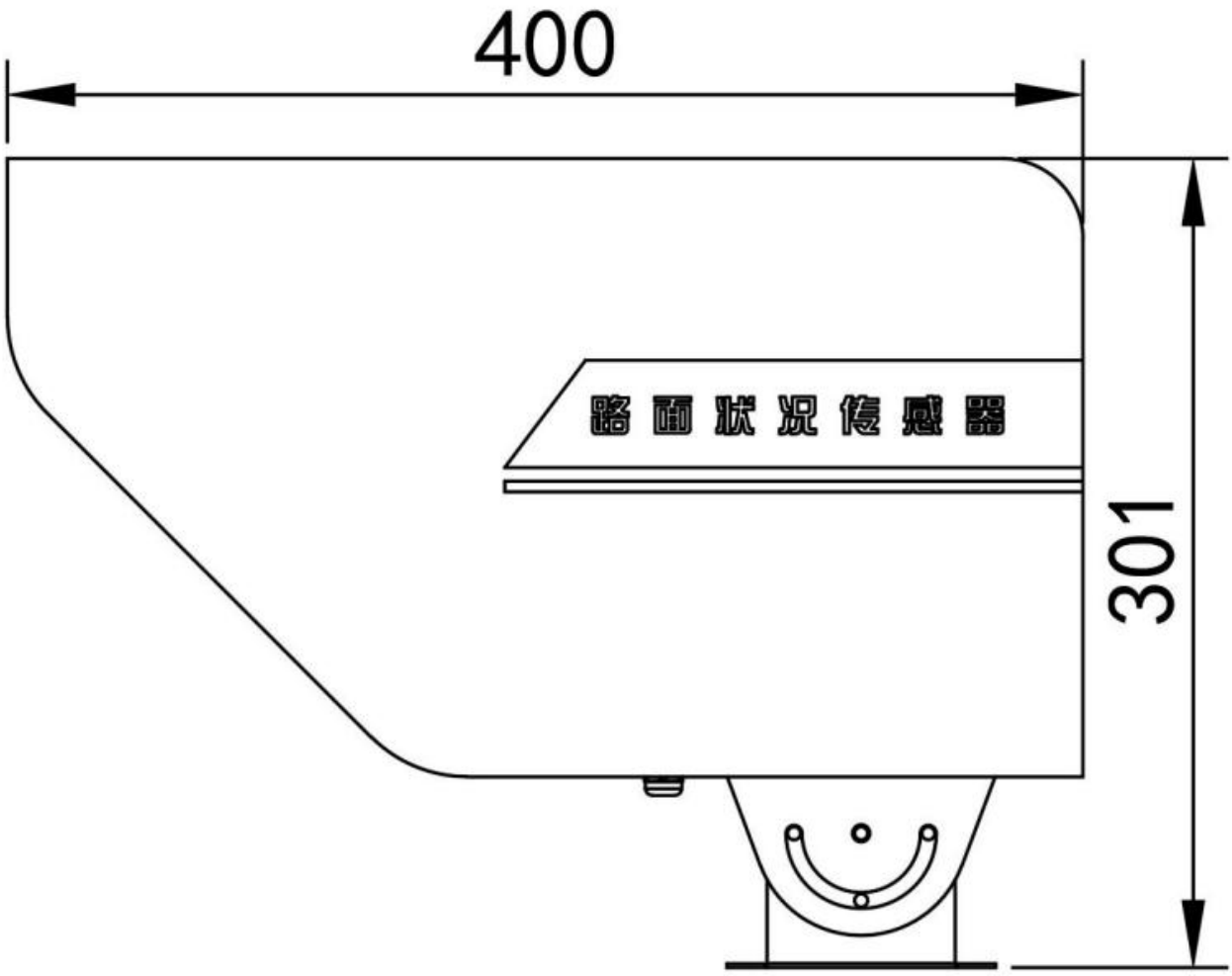


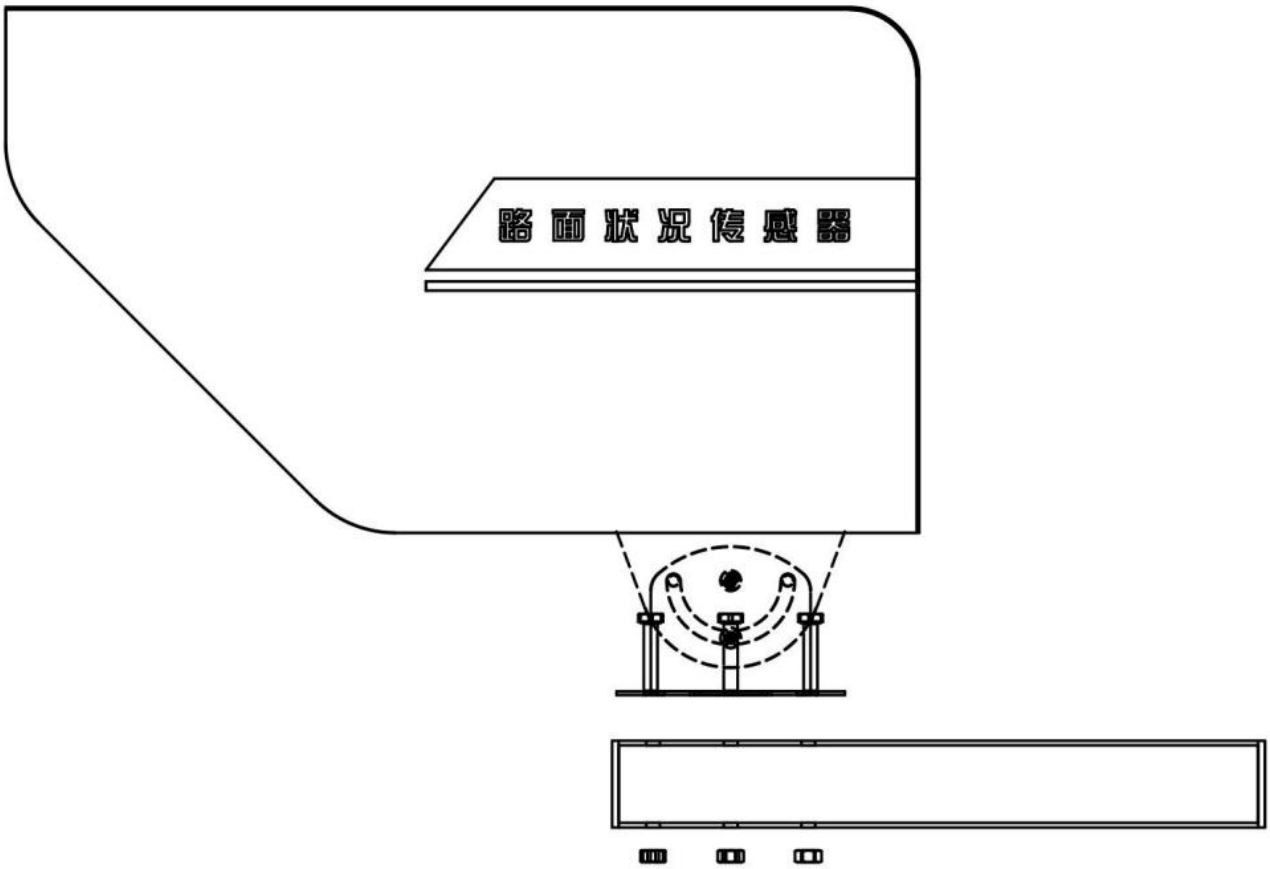
6 Installation Instructions

Pre-installation Checklist:

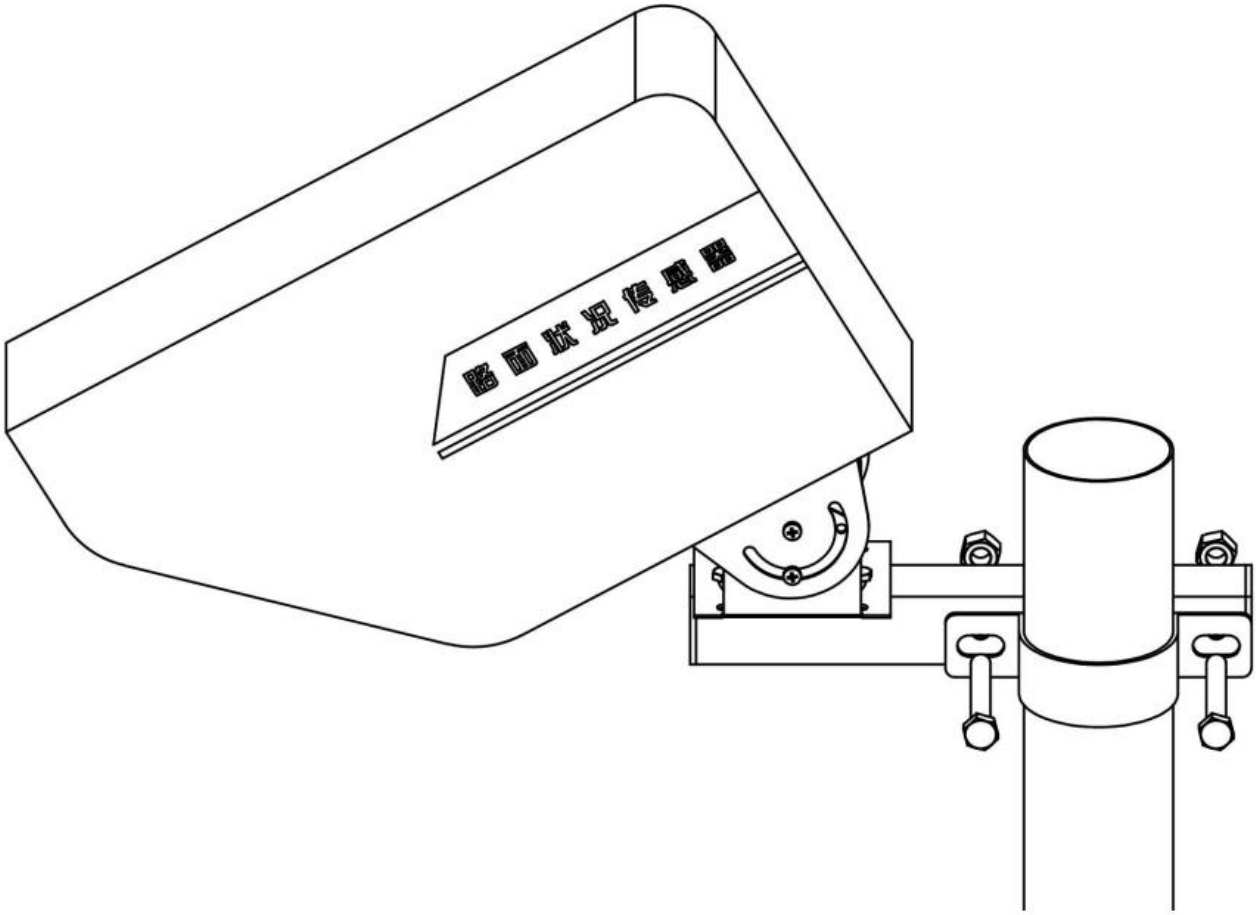
- Road Surface Condition Sensor main unit×1
- Mounting cross arm×1
- Mounting clamp×1
- Fasteners: M5×55 hexagon head screws×3, M5 nuts×3, M8×70 hexagon head screws×3, M8 nuts×3

Installation Steps:

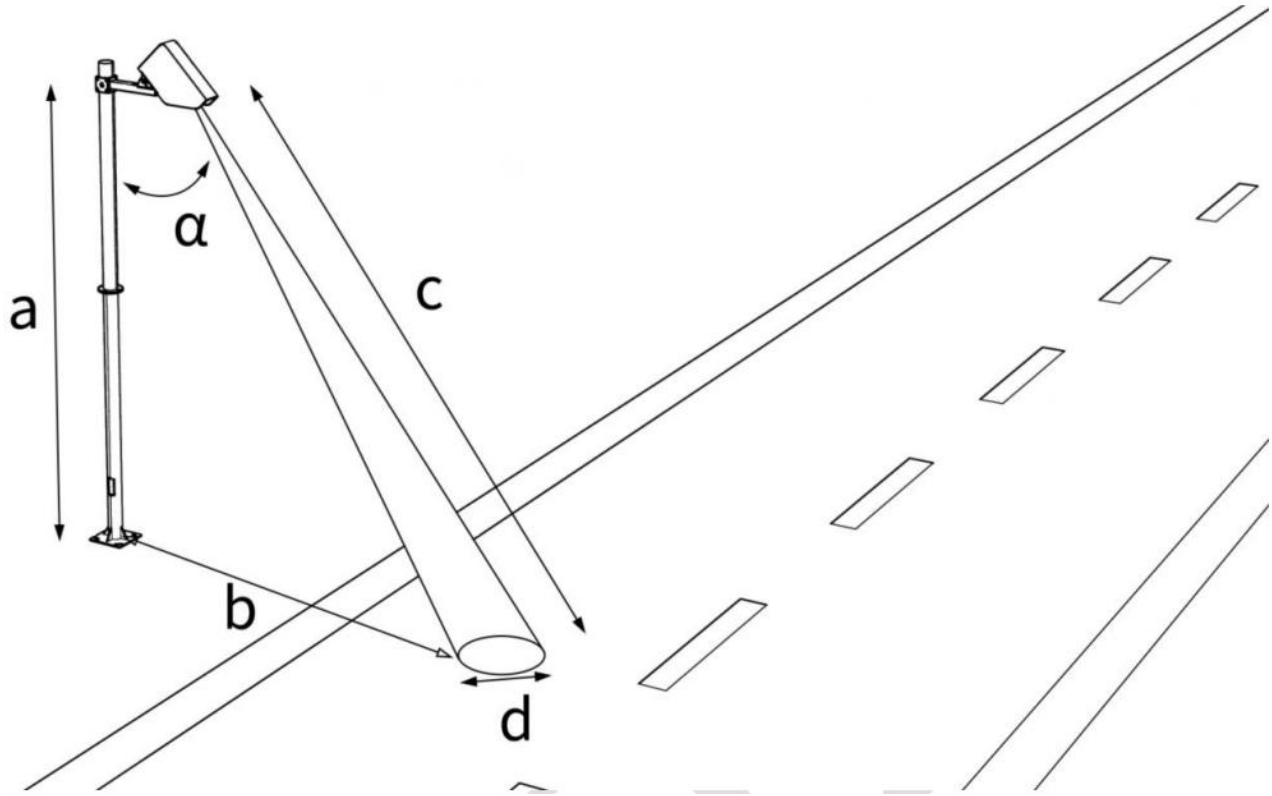
1. Secure the sensor body to the cross arm mounting position using M5 fasteners.



2. Secure the cross arm assembly to the φ75mm pole using the clamp and M8 fasteners.



3. Adjust the sensor pitch angle to ensure the measuring spot falls on the target road surface area. The recommended angle adjustment range is 10°~40°. The current installation angle value can be read through the configuration software.



Measurement Geometry:

$$b = a \times \tan(\alpha)$$

Where: b is the horizontal measuring distance, a is the installation height, and α is the installation angle.

7 Wiring Definition

Wire Color	Definition
Brown	Positive Power Supply (VCC)
Black	Negative Power Supply (GND)
Yellow	RS485-A
Blue	RS485-B

Wiring Precautions:

- Supply voltage range: 11V~30V DC
- Ensure correct A/B wire sequence when connecting to RS485 bus; reverse connection is prohibited
- Multiple devices on the same bus must be configured with different communication addresses to avoid address conflicts

8 Communication Protocol and Data Conversion

Communication Parameters:

- Encoding format: 8-bit binary
- Data bits: 8
- Parity: None
- Stop bits: 1
- Error checking: CRC-16 (Cyclic Redundancy Check)

ModBus-RTU Frame Structure:

Field	Length	Description
Address Code	1 byte	Device address (1~254)
Function Code	1 byte	0x03/0x04 Read registers, 0x06 Write single register, 0x10 Write multiple registers
Data Field	N bytes	Communication data content, 16-bit data high byte first
CRC Check	2 bytes	16-bit CRC check code, low byte first

Register Address Mapping:

Register Address (HEX)	PLC Address	Content Description	Access
0000H	40001	Road Condition (0:Error 1:Dry 2:Damp 3:Wet 4:Puddled 7:Icy)	03/04
0001H	40002	Road Condition (same as above)	03/04
0002H	40003	Water Film Thickness Float High Word	03/04
0003H	40004	Water Film Thickness Float Low Word	03/04
0004H	40005	Ice Thickness Float High Word	03/04
0005H	40006	Ice Thickness Float Low Word	03/04
0006H	40007	Snow Depth Float High Word	03/04
0007H	40008	Snow Depth Float Low Word	03/04
0008H	40009	Road Surface Temperature Float High Word	03/04
0009H	40010	Road Surface Temperature Float Low Word	03/04
000AH	40011	Device Installation Angle Float High Word	03/04
000BH	40012	Device Installation Angle Float Low Word	03/04
000CH	40013	Slipperiness Index Float High Word	03/04
000DH	40014	Slipperiness Index Float Low Word	03/04
0013H	40020	Positioning Enable (0: Laser OFF 1: Laser ON)	03/04/06/10
0015H	40022	Road Surface Calibration Enable (Write 1 to start auto-calibration)	03/04/06/10
0056H	40087	Water Film Thickness Calibration Value (16-bit unsigned, scaled by 100)	03/04/06/10
0057H	40088	Ice Thickness Calibration Value (16-bit unsigned, scaled by 100)	03/04/06/10
0058H	40089	Ice Thickness Calibration Value (16-bit unsigned, scaled by 100)	03/04/06/10
0061H	40098	Laser Snow Depth Calibration (Write 1 to auto-calibrate zero point)	03/04/06/10
07D0H	42001	Device Address (1~254)	03/04/06/10
07D1H	42002	Baud Rate (0:2400 1:4800 2:9600 3:19200 4:38400 5:57600 6:115200 7:1200)	03/04/06/10

Data Conversion Formulas:

1. **Road Condition Parsing (Integer Type):**

$$\text{State} = \text{Register\_Value}$$

Value mapping: 0=Error, 1=Dry, 2=Damp, 3=Wet, 4=Puddled, 7=Icy

2. **Floating Point Parameter Conversion (IEEE 754 Single Precision):**

$$\text{Value} = \text{IEEE754\_Decode}(\text{High\_Word} \times 65536 + \text{Low\_Word})$$

Where IEEE754_Decode represents converting a 32-bit unsigned integer to single-precision floating point. For example, register value 0x3F000000 for water film thickness corresponds to floating point value 0.5.

3. **Calibration Value Conversion (Fixed-point):**

$$\text{Actual Thickness (mm)} = \frac{\text{Register\_Value}}{100}$$

Communication Examples:

Reading road condition (address 0x01):

- Request frame: `01 03 00 00 00 01 84 0A`
- Response frame (Dry condition): `01 03 02 00 01 79 84`

Reading water film thickness (address 0x01):

- Request frame: `01 03 00 02 00 02 65 CB`
- Response frame (0.5mm): `01 03 04 3F 00 00 00 F6 27`

9 Precautions

Safety Warning:
This device is strictly prohibited from being used as a safety device or emergency stop device, nor shall it be used for any other purpose where equipment failure may result in personal injury. Technical manuals must be consulted before installation, operation, or maintenance. Failure to follow these instructions may result in serious injury.

Installation and Usage:

- After initial installation or changing the installation position, road surface condition calibration must be performed. During calibration, ensure the road surface is dry and unobstructed; the calibration process lasts approximately 5 minutes.
- When the snow depth measurement option is selected, snow depth zero-point calibration must be performed after road surface condition calibration is completed; the calibration process lasts approximately 10 seconds.
- During calibration, the device lens will project a red laser spot; the effective calibration area is within the 25cm diameter of the laser spot.
- Unauthorized disassembly, repair, modification, or replacement of internal components is strictly prohibited.
- Avoid contact with water or corrosive substances to prevent internal circuit damage.
- Ensure the device operates within specified temperature, humidity, and electrical parameter ranges.

Communication Debugging:

- When using RS485 parameter configuration software, only a single device is allowed to be connected to the bus.
- The default communication address is 0x01, and the default baud rate is 4800 bit/s.
- If the device address is forgotten, broadcast address 0xFF can be used for inquiry.

10 After-sales Support

Warranty Period: 12 months from the date of purchase (subject to valid proof of purchase).

Warranty Coverage: During the warranty period, free repair and parts replacement services are provided for failures caused by defects in materials and workmanship under normal use and maintenance conditions.

Exclusions from Warranty:

- Damage caused by incorrect installation, use, or operation
- Damage caused by unauthorized disassembly, repair, modification, or alteration by non-authorized technical personnel
- Damage caused by water or other substance infiltration into the device interior
- Failures or damage caused by accidents or natural disasters
- Failures caused by use beyond the operating parameters listed in the product technical specifications

After-sales Support: Lifetime repair services are provided after the warranty period expires (subject to corresponding cost charges).

11 Manufacturer Information

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12 Revision History

Version	Date	Description
V1.0	-	Initial release