

KWS-1000 Online Oil-In-Water Sensor

Introduction

The Kacise KWS-1000 series oil-in-water sensor uses the principle of ultraviolet fluorescence analysis. Compared to several commonly used methods, fluorescence is more efficient, faster, and has better repeatability, enabling real-time online monitoring. The sensor offers outstanding repeatability and stability and can detect dissolved and emulsified oils.

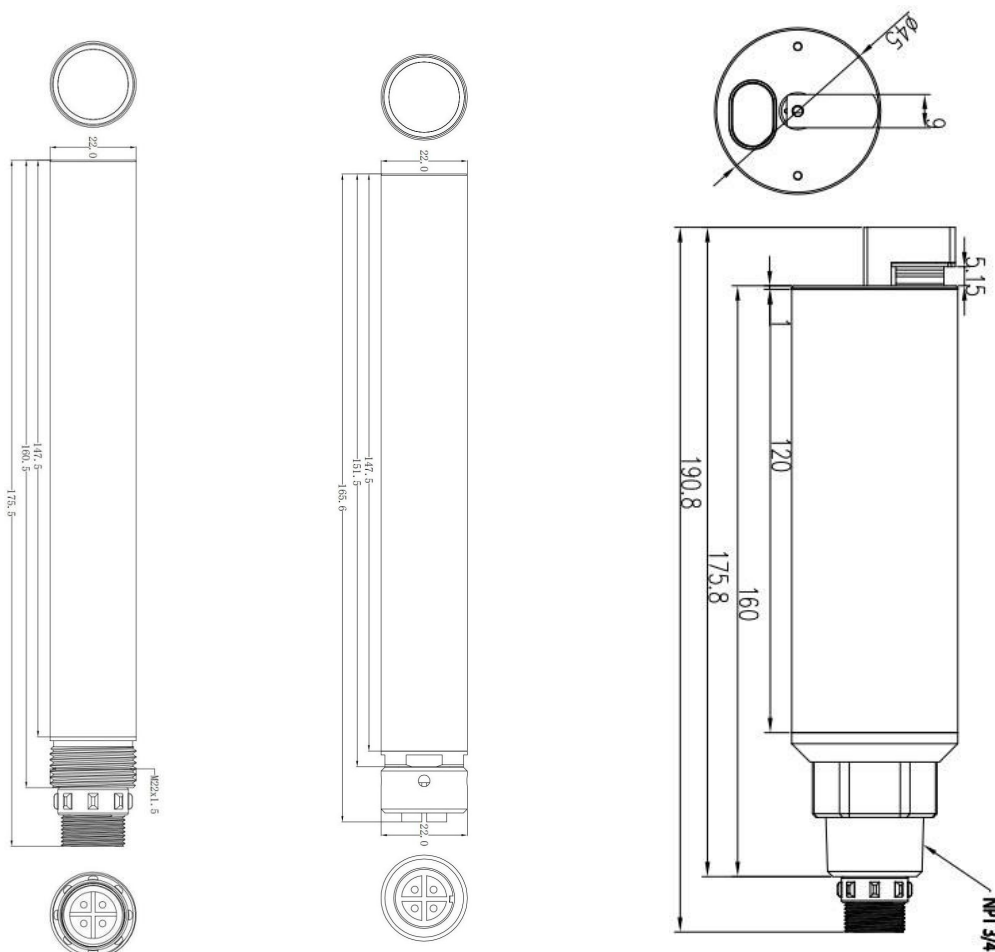
Additionally, the KWS-1003 comes with an automatic cleaning brush that can eliminate bubbles and reduce the impact of contamination on measurements, extending maintenance intervals and ensuring excellent long-term stability even during continuous online use. The Kacise oil-in-water sensor is suitable for various water quality measurement scenarios, including oil field monitoring, pipeline transportation, petrochemicals, and oil pollution.



Principle

The ultraviolet fluorescence method is used to monitor the oil content in water. It quantifies the concentration of oil in water by analyzing the fluorescence intensity emitted after the absorption of ultraviolet light by aromatic hydrocarbons and compounds containing conjugated double bonds in petroleum. The aromatic hydrocarbons in petroleum generate fluorescence under ultraviolet light excitation, and the intensity of this fluorescence is used to calculate the oil concentration in water.

Dimensions



Technical Specification

Item	Without wiper	Without wiper (in multi-probe type)	With wiper
Model	KWS-1001	KWS-1002	KWS-1003
Measuring Range	0-50ppm (0-150ppm optional)		
Principle	fluorescence method		
Resolution	0.01ppm		
The detection limit	According to actual oil sample		
Linearity	$R^2 > 0.999$		
IP Grade	IP68		
Max. pressure	6bar		3bar
Temperature Range	0~50°C		
Output	RS485, Modbus		
Installation	Submersible		
Dimension	Φ22*175.5mm	Φ22*165.6mm	Φ45*190.8mm
Installation	M22*1.5 (optional accessories can be converted to NPT3/4 thread)	Connect with multi-probe sensor female NPT3/4 thread	NPT3/4 thread
Power Consumption	0.2W (DC9-24V, current<50mA)		0.2W(when not wipe); 0.6W(when wipe) DC5-12V, > 500mA
Material	Titanium		316L (Titanium optional)
Cable Length	Standard 10m, customizable		
Calibration	0-point, 1-point, or 2-point calibration		

Note:

The above technical parameters are based on data obtained in a laboratory standard solution environment;

The sensor's lifespan and the frequency of maintenance and calibration depend on actual field conditions.

Wiring

4 wire AWG-24 or AWG-26 shielding wire. OD=5.5mm

Red - power supply (VCC)

White - 485 data _B (485_B)

Green - 485 data _A (485_A)

Black - ground (GND)

Standard Solution Preparation for Calibration

1. Stock Solution Preparation: Weigh 0.1 g of quinine sulfate (CAS: 6119-70-6) and transfer it into a 1000 mL reagent bottle (Bottle A). Add 0.05 mol/L sulfuric acid to make up the volume to 1000 mL, and mix thoroughly.
2. 44 ppm Oil-in-Water Standard Solution Preparation: Transfer 0.5 mL of the stock solution into a 1000 mL reagent bottle (Bottle B). Add 0.05 mol/L sulfuric acid to make up the volume to 1000 mL, and mix thoroughly. The solution in Bottle B corresponds to an oil-in-water concentration of 44 ppm.
3. Other Concentrations: Prepare other concentrations by diluting proportionally. Use the prepared solution within 24 hours for optimal accuracy.

Notes:

Conduct the test in a brown light-shielding bottle to prevent light exposure. During the process of inserting the probe and taking readings, avoid bubbles adhering to the optical window.

Ensure the optical window of the sensor is at least 10 cm above the bottom of the container.

Maintenance Methods

1. Maintenance Schedule

The cleanliness of the measuring window is very important to maintain accurate readings.

It is recommended to clean the sensor light Windows and dry them with a clean cloth before testing.

Maintenance task	Recommended maintenance frequency	
	OIW Sensor	Self-cleaning OIW Sensor
Sensor cleaning	Cleaning every 2 to 3 weeks	Cleaning every 3 to 4 weeks
Calibration sensor	Every 3 to 4 weeks	
Maintenance and inspection of self-cleaning brush	Null	It is recommended to replace the brush skin every three months (depending on the specific working conditions).

2. Maintenance Methods

(1) Sensor Surface Cleaning: Rinse the sensor's exterior surface with tap water. If debris remains, wipe it gently with a damp soft cloth. For stubborn dirt, add a small amount of household detergent to the tap water for cleaning.

(2) Measurement Window Surface: Rinse the sensor's measurement window with tap water. For persistent stains, use a neutral cleaning agent and a soft cloth to scrub gently.

(3) Sensor Cable Inspection: Check for any damage to the cable, such as cracks, compression, or excessive bending. Ensure the cable is not stretched or under tension during installation, as prolonged stress may cause internal wire damage and lead to sensor malfunction.

(4) Cleaning Brush Inspection: Verify that the cleaning brush effectively contacts the optical window, rotates smoothly, and is securely fastened. Replace the brush if it is excessively worn and cannot clean the window effectively. Tighten the brush if it becomes loose.

3. The Matters Needing Attention

(1) The probe contains sensitive optical and electronic components. Ensure that the probe is not subjected to severe mechanical impact. There are no user-maintainable parts inside the probe.

(2) The self-cleaning oil-in-water sensor's cleaning brush contains a reduction motor. Avoid applying external force to rotate the cleaning brush or obstruct its movement. Excessive external force may damage the reduction motor.

Modbus Protocol

The RS485 communication protocol uses MODBUS communication protocol, and the sensors are used as slaves.

Baud rate	9600
Starting position	1
Data bits	8
Stop bit	1
Check digit	N

Read and write data (standard MODBUS protocol).

The default address is 0x01, the address can be modified by register

Reading data

Host call (hexadecimal)

01 03 00 00 00 01 84 0A

Code	Function Definition	Remarks
01	Device Address	
03	Function Code	
00 00	Start Address	See register table for details
00 01	Number of registers	Length of registers (2 bytes for 1 register)
84 0A	CRC checksum, front low and back high	

Slave answer (hexadecimal)

01 03 02 00 xx xx xx xx

Code	Function Definition	Remarks
01	Device Address	
03	Function Code	
02	Number of bytes read	
XX XX	Data (front low and back high DCBA)	See register table for details
XX XX	CRC checksum, front low and back high	

Writing data

Host call (hexadecimal)

01 10 1B 00 00 01 02 01 00 0C C1

Code	Function Definition	Remarks
01	Device Address	
10	Function Code	
1B 00	Register Address	See register table for details
00 01	Number of registers	Number of read registers
02	Number of bytes	Number of read registersx2
01 00	Data (front low and back high DCBA)	
0C C1	CRC checksum, front low and back high	

Slave answer (hexadecimal)

01 10 1B 00 00 01 07 2D

Code	Function Definition	Remarks
01	Device Address	
10	Function Code	
1B 00	Register Address	See register table for details
00 01	Returns the number of registers written	
7D 2D	CRC checksum (front low and back high)	

Calculating CRC Checksum

- (1) Preset one 16-bit register as hexadecimal FFFF (i.e., all 1s) and call this register the CRC register.
- (2) Iso-oring the first 8-bit binary data (both the first byte of the communication information frame) with the lower 8 bits of the 16-bit CRC register and placing the result in the CRC register, leaving the upper 8 bits of data unchanged.
- (3) Shift the contents of the CRC register one bit to the right (toward the low side) to fill the highest bit with a 0, and check the shifted-out bit after the right shift.
- (4) If the shifted out bit is 0: repeat step 3 (shift right one bit again); if the shifted out bit is 1, CRC register and polynomial A001 (1010 0000 0000 0001) for the iso-or.
- (5) Repeat steps 3 and 4 until the right shift is made 8 times so that the entire 8-bit data is processed in its entirety.
- (6) Repeat steps 2 through 5 for the next byte of the communication information frame.
- (7) Exchange the high and low bytes of the 16-bit CRC register obtained after all bytes of this communication information frame have been calculated according to the above steps.
- (8) The final CRC register content is obtained as follows: CRC code.

Register Table

Start address	Command Description	Number of registers	Data format (hexadecimal)
0x1100H	User calibration K/B (read/write) Note: K and B need to be read and written at the same time, and separate reading and writing are not supported.	4	Total 8 bytes 00~03: K 04~07: B To read K for example, read out as 4 bytes of data (low bit in front, DCBA format, need to convert this data to floating point, see below for conversion method) To write k, for example, we need to convert k to 32-bit floating point and write it in (DCBA format)
0x1B00H	Brush power on startup settings	1	2 bytes in total 00~01: 0x0000 does not start on power 0x0100 Power on and self-start
0x2600H	Temperature value/OIW value acquisition	4	8 bytes in total 00~03: Temperature values 04~07: OIW value The reading temperature value/OIW value is 4 bytes of data. (low bit first, DCBA format, this data needs to be converted to floating point number)
0x3000H	Device address (read / write)	1	Total 2 bytes 00~01: Device address Settable in the range 1 to 254 e.g. get data as 02 00 (low bit first means address is 2) To write to address 15, for example, write 0F 00 (lower bit first) to the corresponding address When the current device address is unknown, FF can be used as a generic device address to interrogate the current device address
0x3100H	Brush startup (write only)	0	Send a write command with a write length of 0
0x3200H	Brush repeated start time setting (read / write)	1	2 bytes in total 00~01: Time Take the reading value 1E 00 (default) as an example, the actual value is 0x001E, that is, 30 minutes. For example, if you need to write for 60 minutes, convert it to 3C 00 for writing.