

Moisture in Oil Sensor

EE381



E+E YOUR PARTNER IN SENSOR TECHNOLOGY
ELEKTRONIK[®]
Ges.m.b.H.

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USA / FCC notice:

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the installation manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this device.

CANADIAN / ICES-003 notification: This Device B digital apparatus complies with Canadian ICES-003.

1. General

This manual is a part of the scope of supply and to warrant proper handling and optimal performance of the instrument it should be read before start-up.

In addition, the manual is for everyone who requires knowledge about transport, setup, operation, maintenance and repair.

The manual should not be used without written consent from E+E Elektronik® for the purpose of competition or forwarded to third parties. Copies for personal use are permitted.

All information, technical data and illustrations contained in these instructions are based on information available at the time of publication.

1.1 Explanation of Symbols



This symbol indicates a safety instruction.

These safety instructions should always be followed carefully. By not following these instructions injuries of persons or material damage could happen. Therefore E+E Elektronik® does not accept liability.



This symbol indicates a note.

These notes should be followed to achieve optimum functioning of the equipment.

1.2 Safety Instructions



General Safety Instructions

- Excessive mechanical loads and incorrect usage should always be avoided.
- Take care when unscrewing the filter cap as the sensor element could be damaged.
- The sensing element is an Electro Static Discharge sensitive component (ESD). When touching the sensing element, ESD protective measures should be followed.
- Grip sensing element at the lead wires only.
- Installation, electrical connection, maintenance and commissioning should be performed by qualified personnel only.

1.3 Environmental Aspects

Products from E+E Elektronik® are developed considering all important environmental issues. While disposing of the product environmental pollution should be avoided. To dispose of the sensor the individual components should be sorted with care. The housing consists of metal (die-cast aluminium, AlSi₉Cu₃). The electronic parts should be collected as electronic scrap and disposed of according to the regulations in force.

2. Product Description

2.1 General

E+E EE381 Series is specially designed for the measurement of water content in oil. EE381 is ideal for online monitoring of moisture in lubrication or insulation oil, which is very important for the long-term performance and preventive maintenance of plants and machinery.

Humidity measurement in oil

Similar to the humidity in the air, the water content in oil can be indicated by the absolute value in ppm or by the relative value a_w :

- ppm (mass of water / mass of oil)
- a_w (actual water content as fraction of the water content in saturated oil)

$a_w = 0$ corresponds to water-free oil, while $a_w = 1$ indicates saturated oil. a_w measurement with the EE381 sensor is based on the outstanding long term stability and resistance to pollution of the E+E HMC capacitive sensing elements series.

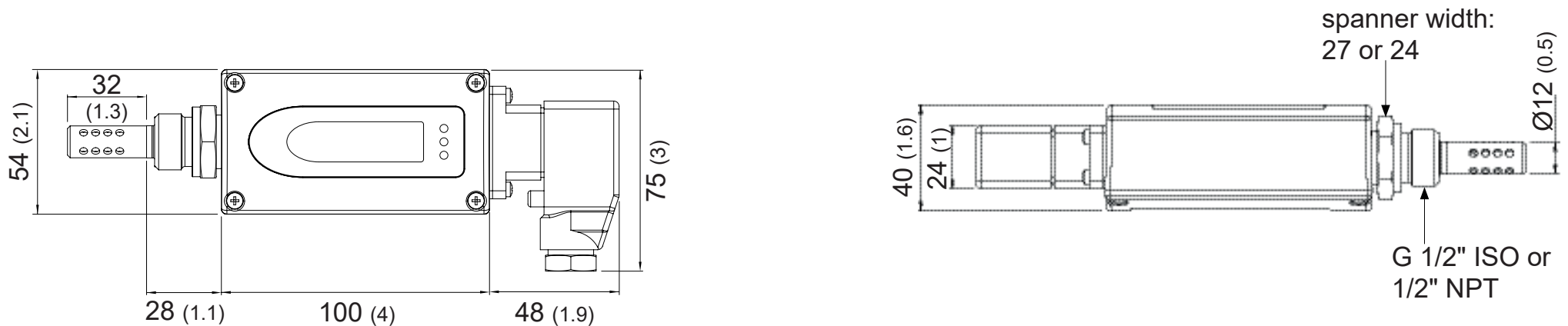
The sensor has two freely selectable and scaleable outputs for water activity, temperature or water content in ppm.

The optional configuration software allows flexible and easy adjustment of the analogue outputs to the respective requirements. The sensor adjustment / calibration can easily be performed.

An optional display for on-site monitoring of the measuring values allows for a quick overview of the prevailing conditions in the process.

2.2 Dimensions

Values are given in mm (inch)



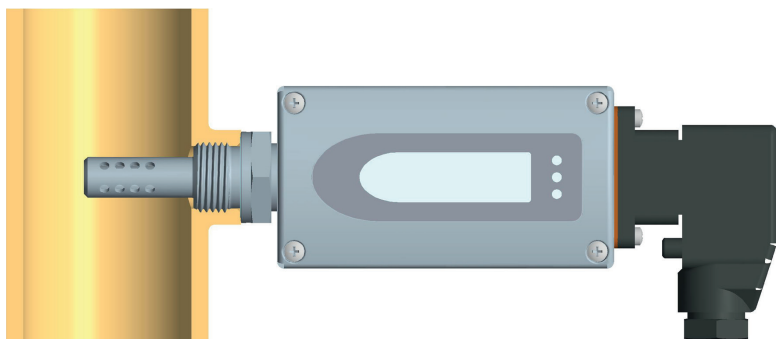
3. Installation

3.1 Installation Location

Select a location that offers optimum measuring conditions. The oil must be able to circulate freely around the sensing element. Mount the sensor directly into the circulating system and not into a reservoir.

3.2 Installing the Probe directly into the Process

When installing a probe directly into the process, there should be a stop valve on both sides of the point of installation. This makes it easy to remove the sensor for maintenance and calibration.



Step 1:

Install the probe with the stop valves closed.

It is not permitted to use a sealing ring with a NPT 1/2" thread. Appropriate PTFE sealing tape or sealant should be used instead.

Step 2:

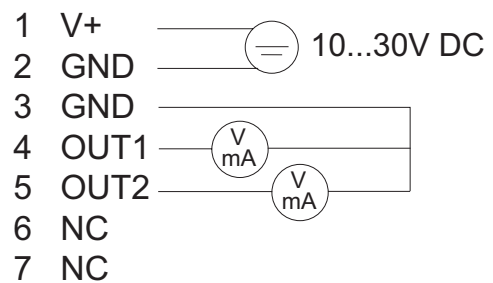
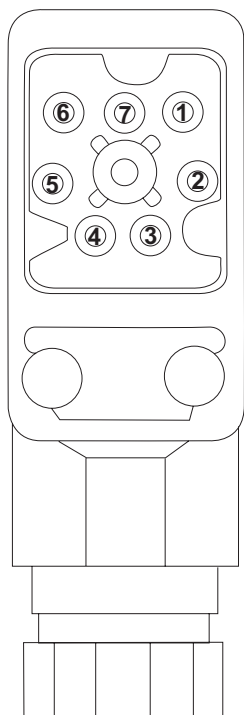
Insert the probe into the process and screw it as tight as possible by hand.

Step 3:

If there is a sealing ring, check it for correct centring and tighten the screw connection with a torque of 30 Nm.

4. Electrical Connection

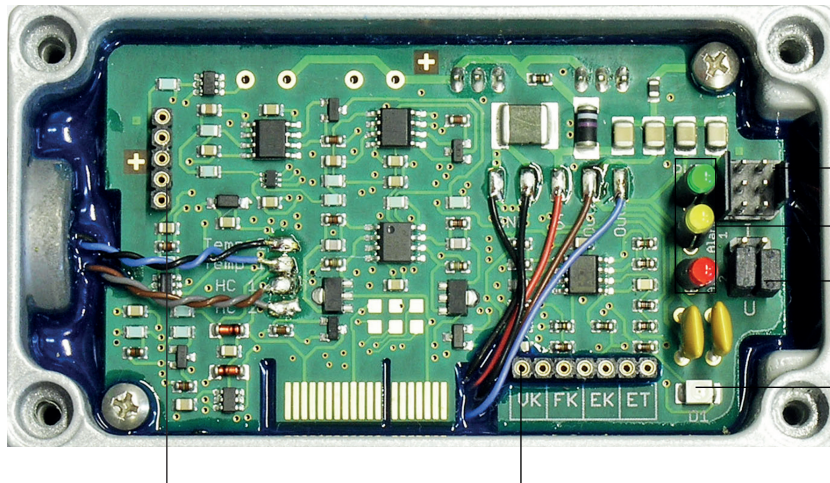
Analogue output:



5. Operating Components

5.1 Circuit Board

After removal of the housing cover, the following operating components on the circuit board may be accessed to configure the sensor to the desired settings:



1. Serial interface
2. Status LEDs
3. Current / voltage output
4. Diagnostic LED
5. Display

1. Serial interface:

Pin connector for serial interface cable (HA010604).

2. Status LEDs:

Provide information about the status of the device. Refer to chapter “5.2 Status LEDs”.

3. Current-/ voltage output:

If the sensor is switched from current to voltage output, using the configuration software, the 2 jumpers must be positioned accordingly:



4. Diagnostic LED:

Visual indication for easy determination of the cause of error. (refer to chapter “6.2 Self-diagnosis and Error Messages”).

5. Display:

These pin connectors are designated for the display module.

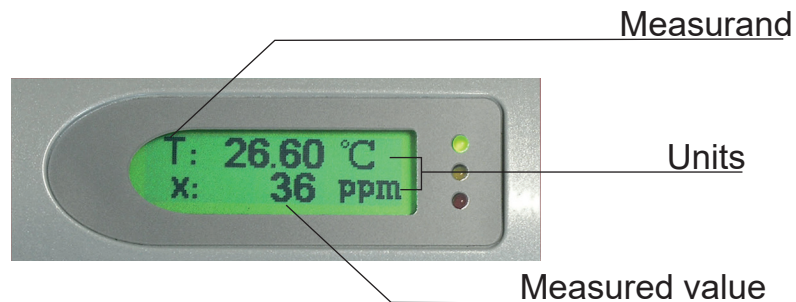
5.2 Status LEDs



Green (Power LED): flashing => supply voltage applied

Yellow / Red: The yellow and red LEDs are deactivated and currently have no function.

5.3 Display Module (Option)



Measurand:		Units:	
		SI	US
T	Temperature	°C	°F
a _w	Water activity		
x	Water content	ppm	ppm

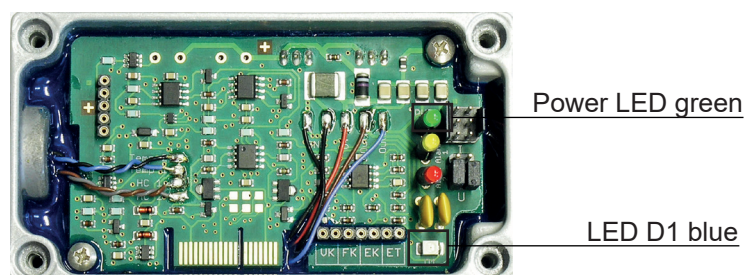
6. Maintenance

6.1 Cleaning the Sensing Head / Filter Replacement

If required, the sensing head can be cleaned. Please find the E+E Cleaning Instructions at www.epluse.com/EE381.

6.2 Self-diagnosis and Error Messages

Self-diagnosis via LED on the circuit board:



Power LED (green):

– flashing → Supply voltage applied / Microprocessor is active

LED D1 (blue):

– constantly lit → sensing element damaged

– flashing → sensing element bedewed (condensation)

Self-diagnosis via display (option):

- Error 1 → Humidity sensing element damaged
- Error 2 → Humidity sensing element bedewed (condensation)
- Error 3 → Temperature sensing element damaged
- Error 4 → Short circuit of temperature sensing element

Further self-diagnosis:

- Error:
 - possible cause
 - measures / help
- Display shows incorrect values:
 - Error during re-adjustment of the sensor
 - Reset to factory calibration and repeat the calibration routine
 - Output configured incorrectly
 - Check output range and output signals in the configuration
- Sensor failure:
 - No supply voltage
 - Check wiring and supply voltage
 - Green LED is illuminated continuously: electronics defect, contact the manufacturer

6.3 Replacement Parts / Accessories

Description	Order code
Stainless steel filter for flow > 1 m/s	HA010110
Display	D08-EE381
Product Configuration Adapter see datasheet (See also the EE-PCA datasheet)	EE-PCA
E+E Product Configuration Software (Free download: www.epluse.com/configurator)	EE-PCS

7. Technical Data

Measurands

Water activity

Measuring range

0...1 aw

Accuracy incl. hysteresis and non-linearity¹⁾

± 0.02 aw (0...0.9 aw) ± 0.03 aw (0.9...1 aw)

Temperature dependence aw:

$\pm(0.00022 + 0.0002 \times \text{aw}) \times \Delta T$ [°C] $\Delta T = T - 20$ °C

T:

± 0.0003 °C/°C

Response time t_{90} in still oil at 20 °C (68 °F), typ.

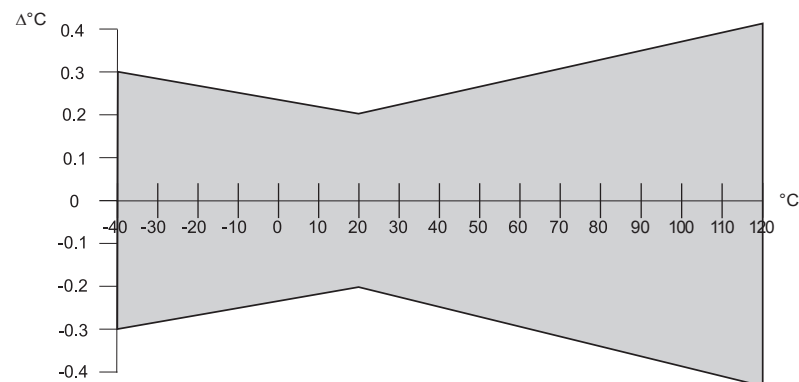
10 min

Temperature

Oil temperature

40...120 °C (-40...248 °F)

Accuracy



Outputs

Two freely selectable and scaleable analogue outputs for aw, T or x [ppm]

0 - 1 V / 0 - 5 V / 0 - 10 V ²⁾

$-1 \text{ mA} < I_L < 1 \text{ mA}$

4 - 20 mA / 0 - 20 mA, 3-wire

$R_L < 500 \text{ Ohm}^2)$

$R_L = \text{load resistance}$

General

Supply voltage		10 - 30 V DC
Current consumption, typ. at 24 V DC	voltage output current output	40 mA 80 mA
Pressure rating		0...20 bar (0...290 psi) 0...100 bar (0...1450 psi)
Enclosure material		Aluminium die-cast (AlSi ₉ Cu ₃)
Protection class		IP65
Electrical connection		7-pole industrial plug: DIN VDE 0627 / IEC 61984 Wire cross-section: 0.25 - 1 mm ² Cable outlet: PG 11
Filter		Stainless steel
Working temperature range		Probe: -40...120 °C (-40...248 °F) Electronics: -40...80 °C (-40...176 °F) Display: -20...50 °C (-4...122 °F)
Storage temperature range		-40...60 °C (-40...140 °F)
Electromagnetic compatibility according to		EN 61326-1 EN61326-2-3ICES-003 ClassB Industrial Environment FCC Part15 ClassB



- 1) The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation).
The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).
- 2) Minimum supply voltage 15 V DC

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