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

# EE381

## Compact Transmitter / Switch for Moisture Content in Oil

E+E Transmitter Series EE381 are 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 plant and machinery.
For instance, moisture affects dramatically the insulation characteristics of electrical transformer oil and therefore continuous monitoring is extremely important.

**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 transmitter is based on the outstanding long term stability and resistance to pollution of the E+E capacitive sensor elements series HC.

The measured physical quantities are water activity $a_w$ and temperature T. With these quantities EE381 calculates the water content x (ppm) in mineral transformer oils. Calculation of water content (ppm) in non-mineral oils and lubrication oils can be achieved by programming the specific parameters of the oil into the EE381.

## Outputs

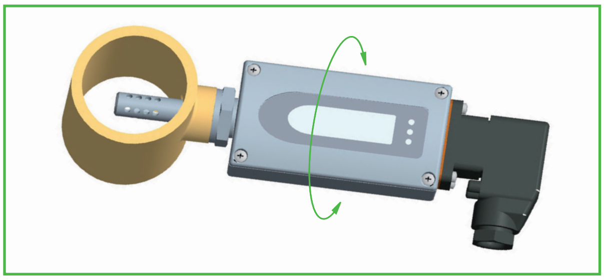
The EE381 transmitter has two freely selectable and scaleable outputs for water activity, water content or temperature.
The EE381 switch with two relay outputs is designed for control and alarm purposes. The status for early warning and main alarm is indicated by LED's.
Adjustment of the $a_w$/T/ppm set point and hysteresis can be achieved with the optional configuration software.

## Configuration Software

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

## Screw Connection for Mounting - 360° positionable

The construction of this screw connection enables any position / rotation of the mounted transmitter.
So an optimal position of the display resp. the cable outlet is guaranteed.



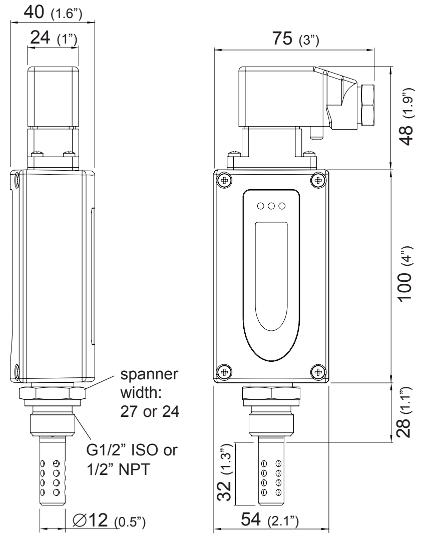
## Typical Applications

**monitoring of**
- **transformer oil**
- **hydraulic oil**
- **ship engines**

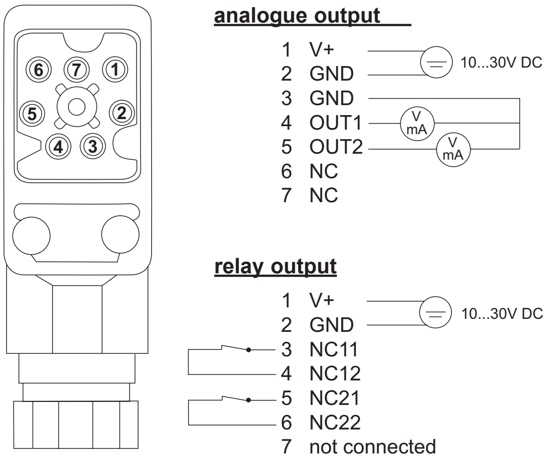
## Features

**measuring range 0...1 $a_w$**
**measurement of water content in ppm**
**medium temperature -40...80°C (-40...176°F)**
**two relay outputs for $a_w$/ppm/T**

## Dimensions in mm



## Connection Diagram



**analogue output**

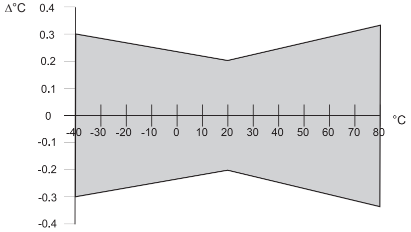
1 V+
2 GND
3 GND
4 OUT1
5 OUT2
6 NC
7 NC

**relay output**

1 V+
2 GND
3 NC11
4 NC12
5 NC21
6 NC22
7 not connected

## Technical Data

### Measurement values

| | | |
|---|---|---|
| **Water activity** | | |
| Humidity sensor | HC1000-400K | |
| Measuring range | 0...1$a_w$ | |
| Accuracy incl. hysteresis and nonlinearity in air* | ±0.02$a_w$ (0...0.9$a_w$) | ±0.03$a_w$ (0.9...1$a_w$) |
| Temperature dependence | $a_w$: ±(0.00022 + 0.0002 x $a_w$) x ΔT [°C]<br>T: ±(0.0003°C/°C) | ΔT = T - 20°C |
| Response time with stainless steel filter at 20°C / $t_{90}$ | typ. 10min in still oil | |
| **Temperature** | | |
| Temperature sensor element | Pt 100 DIN A | |
| Working range sensing probe | -40...120°C (-40...248°F) | |
| Accuracy |  | |

### Outputs

| | | |
|---|---|---|
| **EE381-Tx** two freely selectable and scaleable analogue outputs for $a_w$, T, ppm | 0 - 1V / 0 - 5V / 0 - 10V$^{1)}$<br>4 - 20mA / 0 - 20mA | -1mA < $I_L$ < 1mA<br>$R_L$ < 500 Ohm$^{1)}$ |
| **EE381-Sx** alarm output | 2 potential-free relays (NC)<br>30V DC 0.6A / 35V AC 0.3A (resistive) | |

### General

| | | |
|---|---|---|
| Supply voltage | 10...30V DC | |
| Current consumption at 24V DC | voltage output: typ. 40mA<br>current output: typ. 80mA | |
| Pressure range | 0...20bar (0...290psi) / 0...100bar (0...1450psi) | |
| System requirements for software | WINDOWS 2000 or later; serial interface | |
| Serial interface for configuration | RS232C | |
| Housing / Protection class | Al Si 9 Cu 3 / IP65 | |
| Electrical connection | 7-pole industrial plug: DIN VDE 0627 / IEC 61984<br>cable cross-section: 0.25 - 1 mm$^2$ / cable connection: PG 11 | |
| Sensor protection | stainless steel filter (punched) | |
| Working temperature range | probe:<br>electronic:<br>with LC display: | -40...120°C (-40...248°F)<br>-40...80°C (-40...176°F)<br>-20...50°C (-4...122°F) |
| Storage temperature range | -40...60°C (-40...140°F) | |
| Electromagnetic compatibility according to | EN 61326-1 EN61326-2-3<br>Industrial Environment | ICES-003 ClassB<br>FCC Part15 ClassB |

1) minimum supply voltage 15V DC

*) 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).

# Ordering Guide

| | | EE381- | EE381- |
|---|---|---|---|
| **Hardware Configuration** | | | |
| **Model** | transmitter | T | |
| | switch | | S |
| **Pressure range** | up to 20bar (290psi) | E | E |
| | up to 100bar (1450psi) | I | I |
| **Pressure tight feedthrough** | G1/2" male thread | HA03 | HA03 |
| | 1/2” NPT thread | HA07 | HA07 |
| **Display** | without display | | |
| | with display | D08 | D08 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Software Configuration** | | | | | | |
| **Physical parameters of outputs** | Temperature | T | [°C / °F] (B) | output/relay 1 | select according to Ordering Guide (B,K,L,M) | |
| | Water activity | $a_w$ | [ ] (K) | | | |
| | Water content in mineral transformer oil | x | [ppm] (L) | output/relay 2 | select according to Ordering Guide (B,K,L,M) | |
| | Water content in lubrication or no mineral transformer oil [1] | x | [ppm] (M) | | | |
| **Type of output signals** | 0-1V | | | | 1 | |
| **output signals** | 0-5V | | | | 2 | |
| (only for model T) | 0-10V | | | | 3 | |
| | 0-20mA | | | | 5 | |
| | 4-20mA | | | | 6 | |
| **Temperature unit** | °C | | | | | |
| | °F | | | | E01 | E01 |
| **Scaling of T-output** | -40...60 (T02) | -20...100 (T14) | -40...140 (T83) | | select according to Ordering Guide (Txx) other T-Scaling refer to data sheet „Scaling of the outputs“ | |
| (in °C or °F) | 0...50 (T04) | 0...120 (T16) | 0...250 (T88) | output/relay T | | |
| | 0...100 (T05) | 0...80 (T21) | 32...120 (T90) | | | |
| | -30...70 (T08) | -20...80 (T24) | 32...140 (T91) | | | |
| | -20...120 (T10) | -40...160 (T33) | 32...250 (T94) | | | |
| | -40...120 (T12) | -40...250 (T81) | 32...132 (T96) | | | |
| **ppm Range x** | 0...100ppm (X01) | | | | select according to Ordering Guide | |
| | 0...500ppm (X02) | other measuring range: _______ | | output/relay x | | |
| | 0...1000ppm (X03) | | | | | |
| **Setting of alarm relay outputs** | standard for configuration KK: | R1: 0,8 [ ] | R2: 0,9 [ ] | | | |
| | | H1: 0,05 [ ] | H2: 0,05 [ ] | | | |
| | other set points: | relay 1: _____ | relay 2: _______ | | | SP |
| | | hysteresis 1: ___ | hysteresis 2: _______ | | | |

1) Input of oil specific parameters necessary

# Order Example

## EE381-TEHA03D08/BL2-T05-X01

| | | | |
|---|---|---|---|
| Model: | transmitter | Output 1: | T |
| Pressure range: | up to 20bar (290psi) | Output 2: | x |
| Pressure tight feedthrough: | G1/2" male thread | Output signal: | 0-5V |
| Display: | with display | Temperature unit: | °C |
| | | Scaling of T-output: | 0...100°C |
| | | ppm Range: | 0...100ppm |

## EE381-SEHA03/KK

| | | | |
|---|---|---|---|
| Model: | switch | Relay 1: | $a_w$ |
| Pressure range: | up to 20bar (290psi) | Relay 2: | $a_w$ |
| Pressure tight feedthrough: | G1/2" male thread | Temperature unit: | °C |
| Display: | without display | Setting of alarm output: | standard |

# Scope of Supply

- EE381 Transmitter according to ordering guide
- Mating connector
- Instruction manual
- Inspection certificate according to DIN EN10204 - 3.1

# Accessories

| | |
|---|---|
| - Stainless steel filter cap | HA010110 |
| - Display | D08 |
| - Configuration cable | HA010304 |