

# EE381 Series

## 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

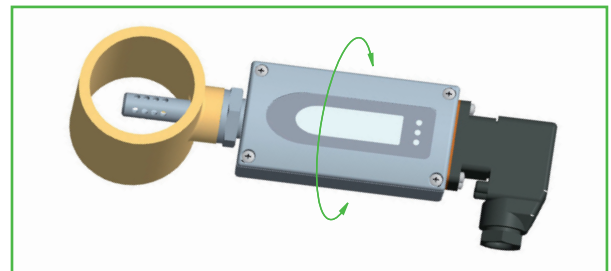
The optional configuration software allows flexible and easy adjustment of the analogue resp. relay outputs to the respective requirements.

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.



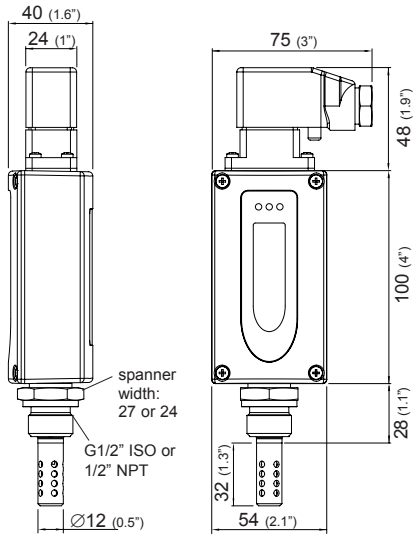
## Typical Applications

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

## Features

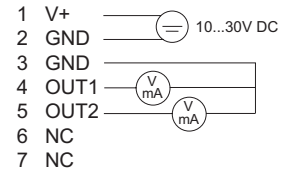
- measuring range 0...1  $a_w$
- measurement of water content in ppm
- medium temperature -40...80°C (-40...176°F)
- two relay outputs for  $a_w/ppm/T$

## Dimensions in mm

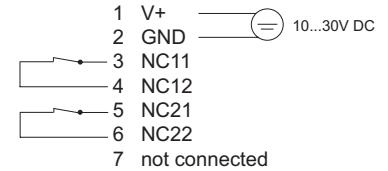


## Connection Diagram

### analogue output



### relay output



## Technical Data

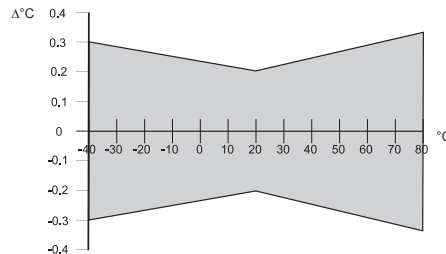
### Measuring values

#### Water activity

Humidity sensor	HMC01
Measuring range	0...1a <sub>w</sub>
Accuracy incl. hysteresis and nonlinearity in air	±0.02a <sub>w</sub> (0...0.9a <sub>w</sub> ) ±0.03a <sub>w</sub> (0.9...1a <sub>w</sub> ) Traceable to intern. standards, administrated by NIST, PTB, BEV...
Temperature dependence	a <sub>w</sub> : ±(0.00022 + 0.0002 × a <sub>w</sub> ) × ΔT [°C]     ΔT = T - 20°C T: ±(0.0003°C/°C)
Response time with stainless steel filter at 20°C / t <sub>90</sub>	typ. 10min in still oil

#### Temperature

Temperatur sensor element	HMC01
Working range sensing probe	-40...120°C (-40...248°F)
Accuracy	



### Outputs

<b>EE381-Tx</b> two freely selectable and scaleable analogue outputs for a <sub>w</sub> , T, ppm	0 - 1V / 0 - 5V / 0 - 10V <sup>1)</sup> 4 - 20mA / 0 - 20mA	-1mA < I <sub>L</sub> < 1mA R <sub>L</sub> < 500 Ohm <sup>1)</sup>
<b>EE381-Sx</b> alarm output	2 potential-free relays (NC) 30V DC 0.6A / 35V AC 0.3A (resistive)	

### General

Supply voltage	10...30V DC
Current consumption at 24V DC	voltage output: typ. 40mA / during autocalibration: 100mA current output: typ. 80mA / during autocalibration: 140mA
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 cable cross-section: 0.25 - 1 mm <sup>2</sup> / cable connection: PG 11
Sensor protection	stainless steel filter (punched)
Working temperature range	probe: -40...120°C (-40...248°F) electronic: -40...80°C (-40...176°F) with LC display: -20...50°C (-4...122°F)
Storage temperature range	-40...60°C (-40...140°F)
Electromagnetic compatibility according to	EN 61326-1    EN61326-2-3    ICES-003 ClassB    FCC Part15 ClassB

1) minimum supply voltage 15V DC

## Ordering Guide

		EE381-	EE381-
<b>Hardware Configuration</b>			
<b>Model</b>	transmitter switch	T	S
<b>Pressure range</b>	up to 20bar (290psi) up to 100bar (1450psi)	E I	E I
<b>Pressure tight feedthrough</b>	G1/2" male thread 1/2" NPT thread	HA03 HA07	HA03 HA07
<b>Display</b>	without display with display	D08	D08
<b>Software Configuration</b>			
<b>Physical parameters of outputs</b>	Temperature T [°C / °F] (B) output/relay 1 Water activity a <sub>w</sub> [ ] (K) Water content in mineral transformer oil x [ppm] (L) output/relay 2 Water content in lubrication or non-mineral transformer oil <sup>1)</sup> x [ppm] (M)	select according to Ordering Guide (B,K,L,M)	
<b>Type of output signals</b> (only for model T)	0-1V 0-5V 0-10V 0-20mA 4-20mA	1 2 3 5 6	
<b>Temperature unit</b>	°C °F	E01	E01
<b>Scaling of T-output</b> (in °C or °F)	-40...60 (T02)    -20...100 (T14)    -40...140 (T83) 0...50 (T04)    0...120 (T16)    0...250 (T88) 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)	output/relay T	select according to Ordering Guide (Txx) other T-Scaling refer data sheet "T-Scalings"
<b>ppm Range x</b>	0...100ppm (X01) 0...500ppm (X02)    other measuring range: _____ 0...1000ppm (X03)	output/relay x	select according to Ordering Guide
<b>Setting of alarm output</b>	standard for configuration KK: R1: 0.8 [ ]    R2: 0.9 [ ] H1: 0.05 [ ]    H2: 0.05 [ ] other set points: relay 1: _____    relay 2: _____ hysteresis 1: _____    hysteresis 2: _____		SP

1) Input of oil specific parameters necessary

## Accessories

- Stainless steel grid (HA010110)
- Display (D08)
- Configuration software + interface cable (HA010604)

## Order Example

### EE381-TEHA03D08/BL2-T05-X01

Model: transmitter  
 Pressure range: up to 20bar (290psi)  
 Pressure tight feedthrough: G1/2" male thread  
 Display: with display

Output 1: T  
 Output 2: x  
 Output signal: 0-5V  
 Temperature unit: °C  
 Scaling of T-output: 0...100°C  
 ppm Range: 0...100ppm

### EE381-SEHA03/KK

Model: switch  
 Pressure range: up to 20bar (290psi)  
 Pressure tight feedthrough: G1/2" male thread  
 Display: without display

Relay 1: a<sub>w</sub>  
 Relay 2: a<sub>w</sub>  
 Temperature unit: °C  
 Setting of alarm output: standard