

## EE360 UL Listed

## High-End Moisture in Oil Sensor

The UL listed EE360 is dedicated for reliable monitoring of lubrication, hydraulic and insulation oils as well as diesel fuel. In addition to highly accurate measurement of water activity (aw) and temperature (T), EE360 calculates the absolute water content (x) in ppm.

### Measurement Performance

The EE360 employs high-end E+E humidity sensing elements manufactured in state-of-the-art thin film technology, which are the prerequisite for outstanding measurement accuracy.

### Process Connection

The sensing probe can be employed up to 180 °C (356 °F), 20 bar (290 psi) and is available with either ISO or NPT slide fitting, which allows for variable immersion depth. Using the optional ball valve, the probe can be mounted or removed even without process interruption.

### Enclosure

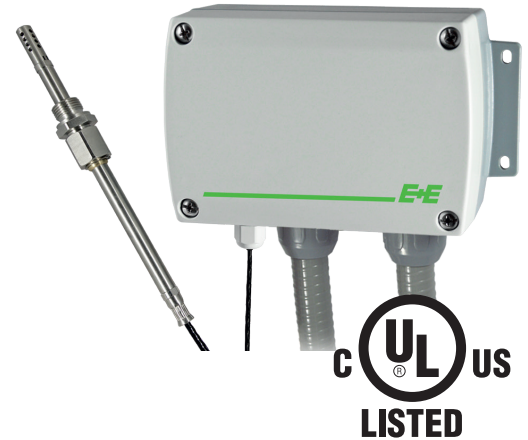
The EE360 features an UL Type 4 polycarbonate enclosure which facilitates installation and maintenance. The enclosure can accommodate a 100...240 V AC supply unit or various extension modules.

### Outputs

The measured data is available on two analogue outputs or on the RS485 (Modbus RTU) interface and on the alarm (relay) outputs.

### Configurable and Adjustable

The configuration and adjustment of the EE360 can be performed using with the free EE-PCS Product Configuration Software via the USB interface.



## Features

### Probe

- » oil temperature -40...180 °C (356 °F)
- » pressure tight up to 20 bar (290 psi)
- » ISO or NPT process connection
- » pluggable probe option

### Enclosure

- » UL Type 4 protection class
- » easy mounting and service
- » screws secured in cover

### Outputs

- » 2 analogue outputs current / voltage
- » error indication according NAMUR
- » Modbus RTU
- » 2 alarm outputs
- » configurable via software

### Ball valve set

- » probe mounting and removal without process interruption

### USB Service Interface

- » perform configuration, adjustment and firmware update
- » 4 status LEDs

Inspection certificate  
according to DIN EN 10204 – 3.1

## Measurement of water activity $a_w$ / water content $x$

The moisture in oil can be expressed in absolute or relative terms.

- » **Water activity  $a_w$**  is the relative measure for moisture in oil. It represents the ratio between the actual amount of dissolved water and the maximum possible amount of dissolved water in the oil at a certain temperature. Independently of the oil type, the water activity shows how close to saturation is the oil at any moment in time.

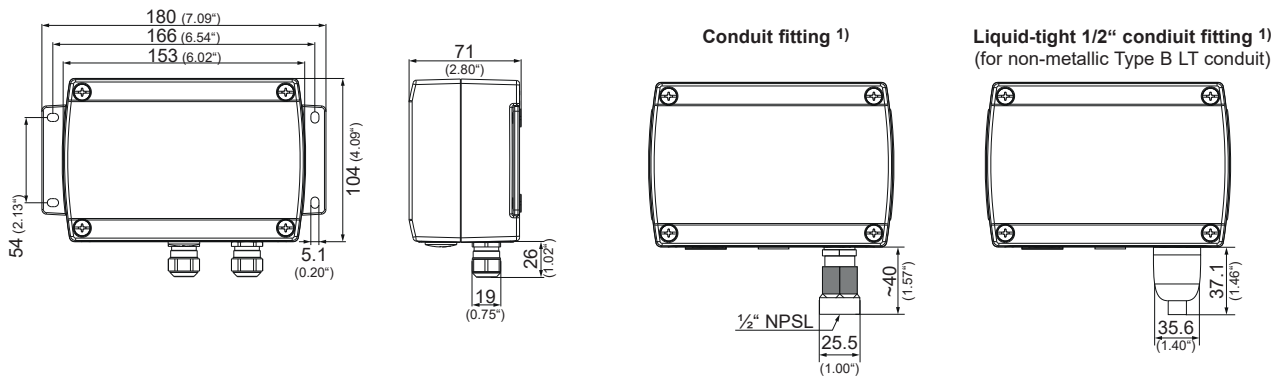
$a_w = 0$  indicates completely dry oil, while  $a_w = 1$  fully saturated oil.  
EE360 measures directly the water activity.

- » The **water content  $x$**  is an absolute measure equal to the amount of water in the oil. The water content is measured in ppm (parts per million) and is independent from the oil temperature. For assessing how far is the oil from saturation,  $x$  must be regarded together with  $T$ .

EE360 calculates  $x$  out of the measured  $a_w$  and  $T$  values. The calculation is oil dependent and requires a set of oil specific parameters.

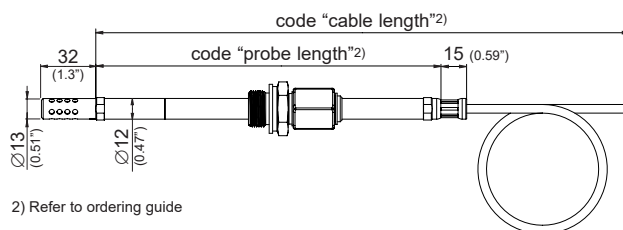
## Dimensions in mm (inch)

### ENCLOSURE



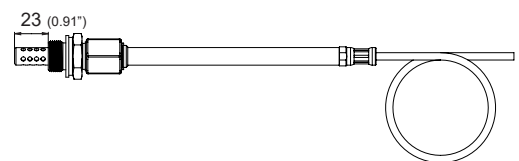
1) Conduit tubing not included

### PROBE

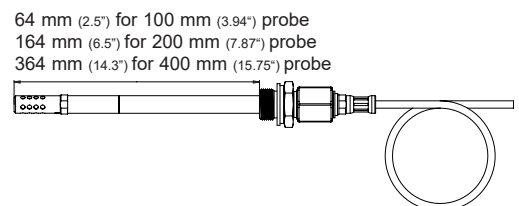


2) Refer to ordering guide

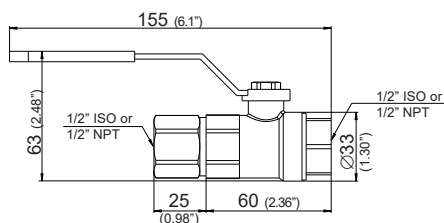
### Minimum insertion depth



### Maximum insertion depth



### Ball valve set 1/2" ISO or NPT



64 mm (2.5") for 100 mm (3.94") probe  
164 mm (6.5") for 200 mm (7.87") probe  
364 mm (14.3") for 400 mm (15.75") probe

## Technical data

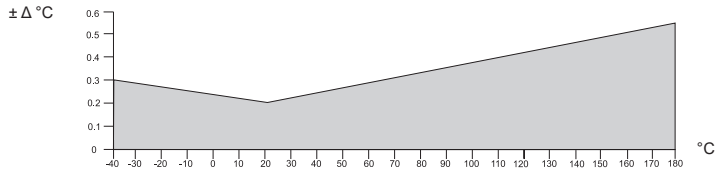
### Measurands

#### Water activity ( $a_w$ ) / Water content (x) <sup>1)</sup>

Measuring range	0...1 $a_w$ / 0...100,000 ppm		
Accuracy <sup>2)</sup> (incl. hysteresis, non-linearity and repeatability)			
-15...40 °C (5...104 °F)	$\leq 0.9 a_w$	$\pm (0.013 + 0.3\% \cdot mv) a_w$	mv = measured value
-15...40 °C (5...104 °F)	$> 0.9 a_w$	$\pm 0.023 a_w$	
-25...70 °C (-13...158 °F)		$\pm (0.014 + 1\% \cdot mv) a_w$	
-40...180 °C (-40...356 °F)		$\pm (0.015 + 1.5\% \cdot mv) a_w$	
Temperature dependence of electronics, typ.	$\pm 0.0001 [1/^\circ\text{C}]$	(typ. $\pm 5.6 \cdot 10^{-5} [1/^\circ\text{F}]$ )	
Temperature dependence of sensing probe, typ.	$\pm (0.00002 + 0.0002 \times a_w) \times \Delta T [^\circ\text{C}]$ $\Delta T = T - 20 \text{ }^\circ\text{C}$		
Response time at 20 °C (68 °F) / $t_{90}$ , typ.	10 min in still oil		

#### Temperature (T)

Working range sensing probe	-40...180 °C (-40...356 °F)
Accuracy <sup>2)</sup>	$\pm \Delta \text{ }^\circ\text{C}$



Temperature dependence of electronics, typ.	$\pm 0.005 \text{ }^\circ\text{C}/^\circ\text{C}$
---	---

### Outputs

Two analogue outputs freely selectable and scalable	0 - 1 / 5 / 10 V 4 - 20 mA      3-wire 0 - 20 mA      3-wire	-1 mA $< I_L < 1$ mA $R_L < 500$ Ohm $R_L < 500$ Ohm
Digital interface / protocol	RS485 / Modbus RTU, max. 32 unit load devices on one bus (EE360 = 1 unit load; factory settings: 9600 bps, parity even, stop bit 1 / slave-ID 231)	

### General

Power supply	<table border="1"> <thead> <tr> <th>input voltage range</th> <th>power requirements</th> <th>conductor temperature rating</th> </tr> </thead> <tbody> <tr> <td>8...35 V DC (LPS)</td> <td>max. 2 W *)</td> <td>min. 75 °C (167 °F)</td> </tr> <tr> <td>indoor use: 12...30 V AC, 50/60 Hz (Class 2 supply)</td> <td rowspan="2">max. 4 VA *)</td> <td rowspan="2">min. 75 °C (167 °F)</td> </tr> <tr> <td>outdoor use: 12...16 V AC, 50/60 Hz (Class 2 supply)</td> </tr> <tr> <td>100...240 V AC, 50/60 Hz<sup>5)</sup></td> <td>max. 5 VA **)</td> <td>min. 75 °C (167 °F)</td> </tr> </tbody> </table> <p>*) including 2 voltage or current outputs and relay option AM2 or AM6                  **) including 2 voltage or current outputs</p>	input voltage range	power requirements	conductor temperature rating	8...35 V DC (LPS)	max. 2 W *)	min. 75 °C (167 °F)	indoor use: 12...30 V AC, 50/60 Hz (Class 2 supply)	max. 4 VA *)	min. 75 °C (167 °F)	outdoor use: 12...16 V AC, 50/60 Hz (Class 2 supply)	100...240 V AC, 50/60 Hz <sup>5)</sup>	max. 5 VA **)	min. 75 °C (167 °F)
input voltage range	power requirements	conductor temperature rating												
8...35 V DC (LPS)	max. 2 W *)	min. 75 °C (167 °F)												
indoor use: 12...30 V AC, 50/60 Hz (Class 2 supply)	max. 4 VA *)	min. 75 °C (167 °F)												
outdoor use: 12...16 V AC, 50/60 Hz (Class 2 supply)														
100...240 V AC, 50/60 Hz <sup>5)</sup>	max. 5 VA **)	min. 75 °C (167 °F)												
Pressure range for pressure tight probe	0.01...20 bar (0.15...300 psi)													
Probe material	stainless steel 1.4404 / AISI 316L													
Enclosure material	polycarbonate, UL94-V0 approved													
Protection class	UL Type 4 <sup>3)</sup> , IP65 <sup>4)</sup>													
Electrical connection	screw terminals max. 1.5 mm <sup>2</sup> (AWG 16)													
Working / storage temperature range of electronics	-40...60 °C (-40...140 °F)													
Working range remote sensing probe cable	-40...150 °C (-40...302 °F)													
Electromagnetic compatibility	EN61326-1      EN61326-2-3	ICES-003 ClassA FCC Part15 ClassA												
Compliance	<b>United States:</b> UL Listed, CCN QUYX, Under UL 61010-1, Process Control Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A <b>Canada:</b> UL Listed, CCN QUYX7, Under CSA C22.2 No. 61010-1, Signal Equipment; Industry Canada Compliant, ICES-003													
Two alarm outputs <sup>5)</sup>	changeover contact 250 V AC / 6 A, conductor temperature rating min. 90 °C (194 °F) 28 V DC / 6 A, conductor temperature rating min. 90 °C (194 °F)													
System requirements for EE-PCS software	Windows XP or higher; USB port													

1) ppm output is valid in the range 0...100 °C (32...212 °F)  
 2) Traceable to intern. standards, administrated by NIST, PTB, BEV... 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).  
 3) Valid only with liquid-tight 1/2" conduit fitting and cable glands. Not valid with M12 plug (E4, E5, E6, E12), conduit fitting E23, option AM2 and AM3.  
 4) IP65 not evaluated by UL.  
 5) Degree of pollution 2, overvoltage category II, altitude up to 3000 m (9843 ft).

## Ordering Guide

		EE360-AP1	
Hardware Configuration	Cable length (incl. probe length)	2 m (6.6 ft) 5 m (16.4 ft) 10 m (32.8 ft)	
	Probe length	100 mm (3.94") 200 mm (7.87") 400 mm (15.75")	
	Process connection	1/2" ISO thread 1/2" NPT thread	
	Electrical connection	cable glands 1 plug for power supply and outputs 1) 1 cable gland / 1 plug for Modbus RTU (requires option J3) 1) 2 plugs for power supply / outputs and for Modbus RTU (requires option J3) 1) 3 plugs for power supply / outputs and Modbus RTU (requires option J3) 1) conduit fitting 2) liquid-tight 1/2" conduit fitting	
	Optional features	RS485 module - Modbus RTU alarm outputs with cable glands for NFPA79 applications 3) integrated power supply 100...240 V AC, 50/60 Hz for NFPA79 applications 3) 4) integrated power supply 100...240 V AC, 50/60 Hz with liquid-tight 1/2" conduit fitting 3) alarm outputs with liquid-tight 1/2" conduit fitting 3)	
Setup - Analogue outputs	Output 1	water activity $a_w$ [ ] other measurand (xx see measurand code below)	
	Output signal 1 5)	0-1 V 0-5 V 0-10 V 0-20 mA 4-20 mA	
		Scaling 1 low	0 value
		Scaling 1 high	1 value
		Output 2	temperature T [°C] other measurand (xx see measurand code below)
		Output signal 2 5)	0-1 V 0-5 V 0-10 V 0-20 mA 4-20 mA
	Scaling 2 low		value
	Scaling 2 high		value

1) For indoor use only. Mating plug included in the scope of supply.

2) For indoor use in dry location only

3) Combination of alarm output (AM2/AM6), and integrated power supply (AM3 / AM5) is not possible. NFPA = National Fire Protection Association

4) Integrated power supply: (AM3) includes 2 plugs for power supply and outputs, other plug options are not possible.

5) Both analogue outputs shall be either voltage or current.

## Measurand Code for output 1 and 2 in the ordering guide

		Mx
Temperature	°C	1
	°F	2
Water activity	aw	67
Water content x in mineral transformer oil	ppm	70
Water content x in customer specific oil	ppm	70PPMxxx

## Order Example

### EE360-AP1J3GA3GB3SBL-40SBH180

Approval: **AP1** UL listed cULus QUXX.E500367  
Cable length: **no code** 2 m (6.6 ft)  
Probe length: **no code** 200 mm (7.87")  
Process connection: **no code** 1/2" ISO thread  
Electrical connection: **no code** cable glands  
Optional features: **J3** RS485 module - Modbus RTU

Output 1: **no code** water activity  
Output signal 1: **GA3** 0-10 V  
Scaling 1 low: **no code** 0  
Scaling 1 high: **no code** 1  
Output 2: **no code** temperature °C  
Output signal 2: **GB3** 0-10 V  
Scaling 2 low: **SBL-40** -40  
Scaling 2 high: **SBH180** 180

## Accessories (for further information, see data sheet "Accessories")

Bracket for installation onto mounting rails HA010203 (Two pieces for each EE360; for polycarbonate enclosure only)  
Determination of oil specific parameters ppm-cal  
Humidity calibration kit refer to data sheet „Humidity calibration kit“  
Ball valve set 1/2" ISO HA050101  
Ball valve set 1/2" NPT HA050104