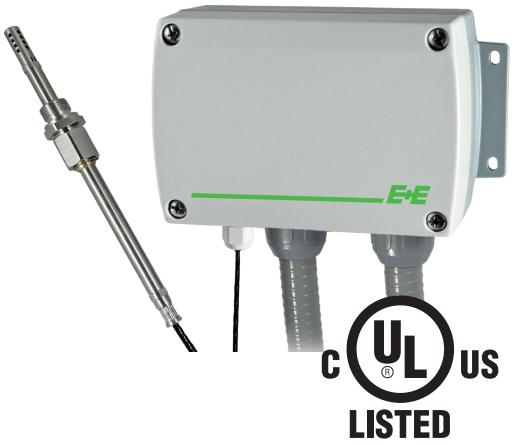
EE360 UL Listed

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.

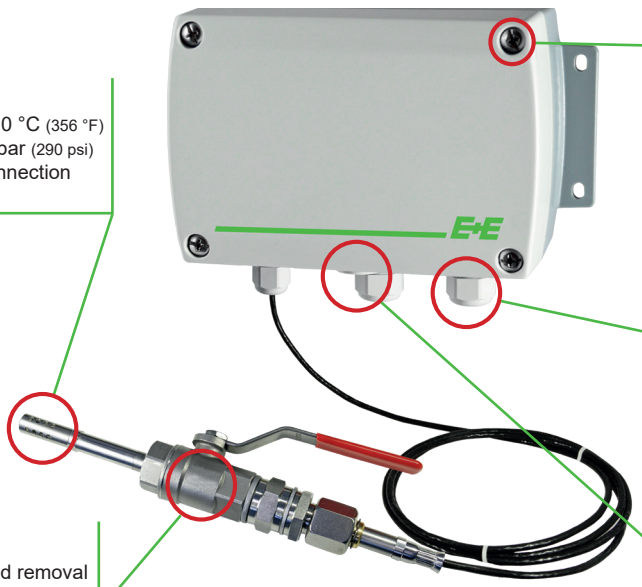
Process Connection
The sensing probe can be employed up to 180 °C (356 °F), 20 bar (290 psi) and is available with either ISO or NPT slide fitting, which allows for variable immersion depth. Using the optional ball valve, the probe can be mounted or removed even without process interruption.

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



Enclosure
» UL Type 4 protection class
» Easy mounting and service
» Screws secured in cover

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

Outputs
» 2 analogue outputs current / voltage
» Error indication according NAMUR
» Modbus RTU
» 2 alarm outputs
» Configurable via software

USB Service Interface
» Perform configuration, adjustment and firmware update
» 4 status LEDs

Ball valve set
» Probe mounting and removal without process interruption

Inspection certificate according to DIN EN 10204-3.1

v1.1 / Modification rights reserved

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.

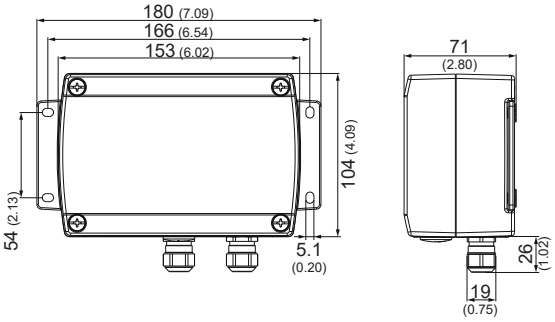
aw = 0 indicates completely dry oil, while aw = 1 fully saturated oil.
EE360 measures directly the water activity.

» 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 aw and T values. The calculation is oil dependent and requires a set of oil specific parameters.

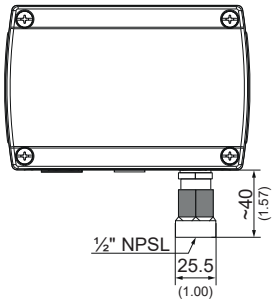
Dimensions

Values in mm (inch)

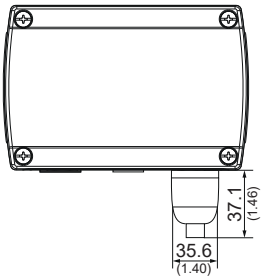
ENCLOSURE



Conduit fitting[1)]

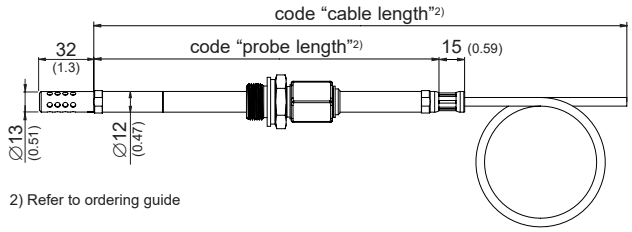


Liquid-tight 1/2" condiuit fitting[1)]
(for non-metallic Type B LT conduit)



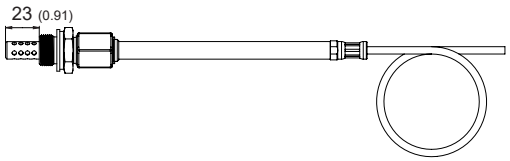
1) Conduit tubing not included

PROBE

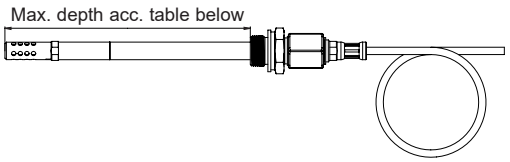


2) Refer to ordering guide

Minimum insertion depth

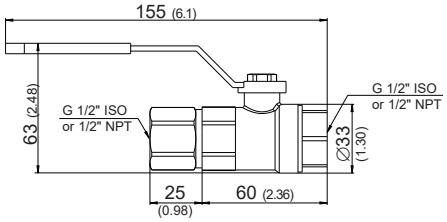


Maximum insertion depth



Probe length [mm (inch)]	Max. insertion depth [mm (inch)]
100 (2.5)	64 (3.9)
200 (6.5)	164 (7.9)
400 (14.3)	364 (15.8)
600 (22.2)	564 (23.6)
800 (30.1)	764 (31.5)
1000 (38.0)	964 (39.4)

Ball valve set G 1/2" ISO or NPT



Technical data

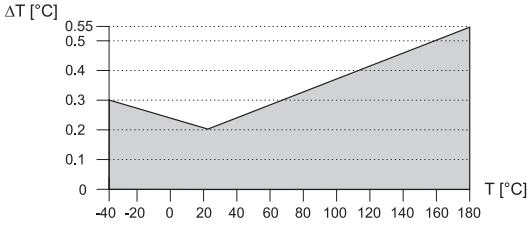
Measurands

Water activity (a_w) / Water content (x)[1)]

Measuring range		0...1 a_w / 0...100 000 ppm
Accuracy[2)] (incl. hysteresis, non-linearity and repeatability)		
-15...40 °C (5...104 °F)	≤0.9 a_w	± (0.013 + 0.3%*mv) a_w
-15...40 °C (5...104 °F)	>0.9 a_w	± 0.023 a_w
-25...70 °C (-13...158 °F)		± (0.014 + 1%*mv) a_w
-40...180 °C (-40...356 °F)		± (0.015 + 1.5%*mv) a_w
Temperature dependence of electronics, typ.		± 0.0001 [1/°C] (typ. ± 5.6 * 10^{-5} [1/°F])
Response time at 20 °C (68 °F) / t_{90}, typ.		10 min in still oil

mv = measured value

Temperature (T)

Working range sensing probe	-40...180 °C (-40...356 °F)
Accuracy[2)]	
Temperature dependence of electronics, typ.	± 0.005°C/°C

Outputs

Two analogue outputs freely selectable and scalable	0 - 1 / 5 / 10 V		-1 mA < I_L < 1 mA
	4 - 20 mA	3-wire	R_L < 500 Ohm
	0 - 20 mA	3-wire	R_L < 500 Ohm
Digital interface / protocol	RS485 / Modbus RTU, EE360 = 1 unit load Factory settings: 9600 bps, parity even, stop bit 1 / slave ID 231		

General

Power supply

Input voltage range	*Power requirments*	*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[5)]	max. 5 VA **)	min. 75 °C (167 °F)

*) including 2 voltage or current outputsand relay option AM2 or AM6
**) including 2 voltage or current outputs

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[3)], IP65[4)]
Electrical connection	Screw terminals max. 1.5 mm² (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	EN 61326-1 Industrial Environment; EN 61326-2-3; ICES-003 ClassA; FCC Part15 ClassA
Compliance	**United States:** UL Listed, CCN QUYX, Under UL 61010-1, Process Control Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A **Canada:** UL Listed, CCN QUYX7, Under CSA C22.2 No. 61010-1, Signal Equipment; Industry Canada Compliant, ICES-003
Two alarm outputs[5)]	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

c UL us LISTED

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)	no code
		5 m (16.4 ft)	K5
		10 m (32.8 ft)	K10
	Probe length	100 mm (3.94")	L100
		200 mm (7.87")	no code
		400 mm (15.75)	L400
		600 mm (23.62")	L600
		800 mm (31,5")	L800
		1 000 mm (39.37")	L1000
	Process connection	G 1/2" ISO thread	no code
		1/2" NPT thread	PA25
	Electrical connection	Cable glands	no code
		1 plug for power supply and outputs[1]	E4
		1 cable gland / 1 plug for Modbus RTU (requires option J3)[1]	E5
		2 plugs for power supply / outputs and Modbus RTU (requires option J3)[1]	E6
		3 plugs for power supply / outputs and Modbus RTU (requires option J3)[1]	E12
		Conduit fitting[2]	E23
		Liquid-tight 1/2" conduit fitting	E24
	Optional features	RS485 module - Modbus RTU	J3
		Alarm outputs with cable glands for NFPA79 applications[3]	AM2
		Integrated power supply 100 - 240 V AC, 50/60 Hz for NFPA79 applications[3][4]	AM3
		Integrated power supply 100 - 240 V AC, 50/60 Hz with liquid-tight 1/2" conduit fitting[3]	AM5
		Alarm outputs with liquid-tight 1/2" conduit fitting[3]	AM6
Setup - Analogue outputs	**Output 1**	Water activity a_w [ ]	no code
		Other measurand (xx see measurand code below)	MA*xx*
	Output signal 1[5]	0 - 1 V	GA1
		0 - 5 V	GA2
		0 - 10 V	GA3
		0 - 20 mA	GA5
		4 - 20 mA	GA6
	Scaling 1 low	0	no code
		Value	SAL*Value*
	Scaling 1 high	1	no code
		Value	SAH*Value*
	Output 2	Temperature T [°C]	no code
		Other measurand (xx see measurand code below)	MB*xx*
	Output signal 2[5]	0 - 1 V	GB1
		0 - 5 V	GB2
		0 - 10 V	GB3
		0 - 20 mA	GB5
		4 - 20 mA	GB6
	Scaling 2 low	Value	SBL*Value*
	Scaling 2 high	Value	SBH*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	[ ]	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 QUYX.E500367	Output 1:	no code	Water activity
Cable length:	no code	2 m (6.6 ft)	Output signal 1:	GA3	0 - 10 V
Probe length:	no code	200 mm (7.87")	Scaling 1 low:	no code	0
Process connection:	no code	G 1/2" ISO thread	Scaling 1 high:	no code	1
Electrical connection:	no code	Cable glands	Output 2:	no code	Temperature °C
Optional features:	J3	RS485 module - Modbus RTU	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 G 1/2" ISO	HA050101
Ball valve set 1/2" NPT	HA050104