EE360

High-End Moisture in Oil Transmitter

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 (a_w) and temperature (T), EE360 calculates the absolute water content (x) in ppm.

The 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.

The rugged polycarbonate enclosure facilitates easy mounting and maintenance. The measured values are available on two analogue outputs and on the Modbus RTU interface. An optional relays module can be used for alarms and process control.

The state of the art TFT colour display can show all measurands simultaneously and offers extensive error diagnostics. The integrated data logging function saves all measured data in the internal memory. The logged data can be displayed in a graph directly on the device or easily downloaded via USB interface.
The EE360 configuration and adjustment can be performed either directly on the device via display and push buttons or with the free EE-PCS software using the USB service interface.

Typical applications

Monitoring of transformer, lubrication, hydraulic or quench oil as well as diesel fuel.

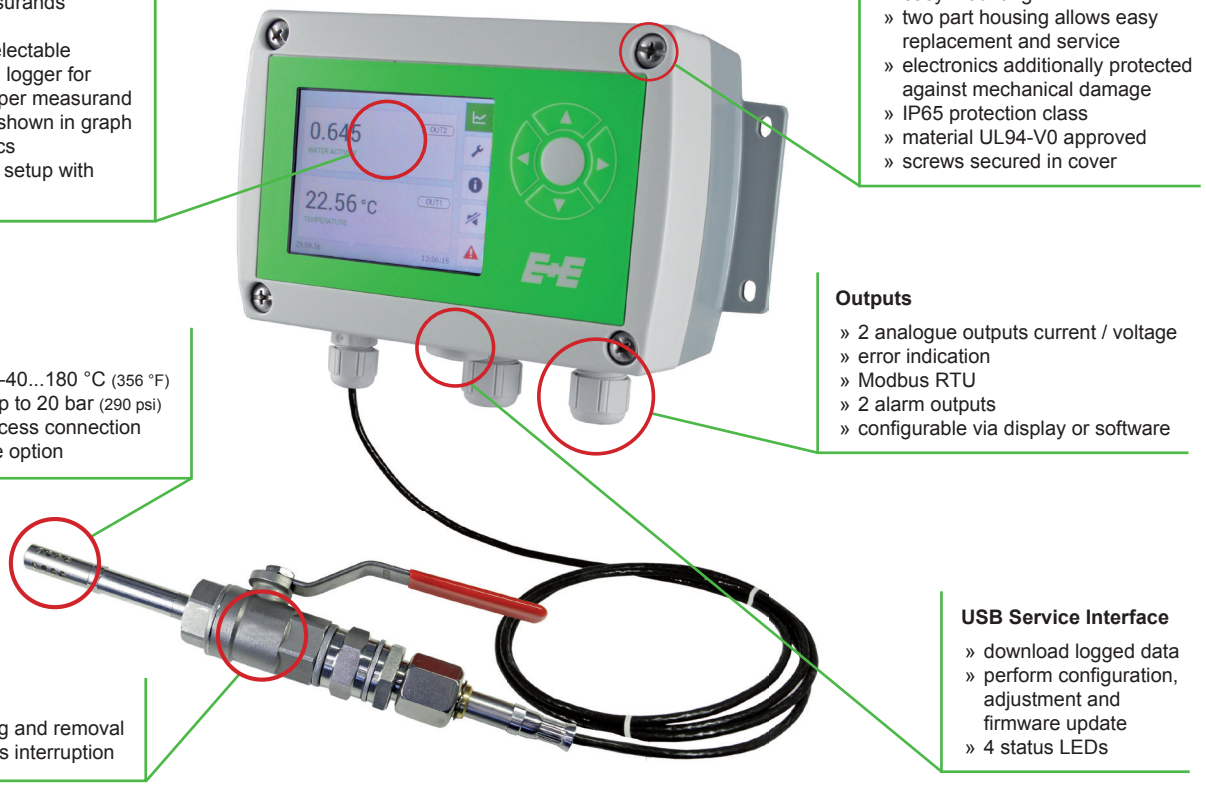
Features

3,5“ TFT Colour Display

- » shows all measurands simultaneously
- » layout freely selectable
- » integrated data logger for 20.000 values per measurand
- » logged values shown in graph
- » error diagnostics
- » intuitive device setup with push buttons

Enclosure

- » easy mounting
- » two part housing allows easy replacement and service
- » electronics additionally protected against mechanical damage
- » IP65 protection class
- » material UL94-V0 approved
- » 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
- » Modbus RTU
- » 2 alarm outputs
- » configurable via display or software

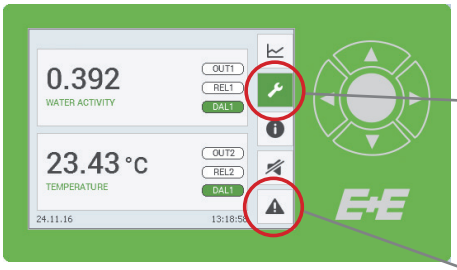
Ball valve

- » probe mounting and removal without process interruption

USB Service Interface

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

TFT colour display with integrated data logger (option D2)



Settings

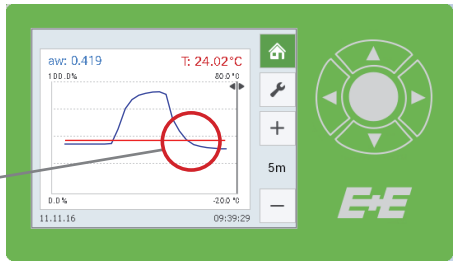
» analogue, digital and alarm output setup
» one and two point adjustment for RH and T
» probe replacement (for pluggable probe)
» password protection for all relevant settings

Error Diagnostics

» error self-diagnosis
» error description
» audible and visual error warnings

Data logger

» 20.000 values saved per measurand
» selectable sampling rates
» view recorded data as graph
» download data via USB port and EE-PCS software

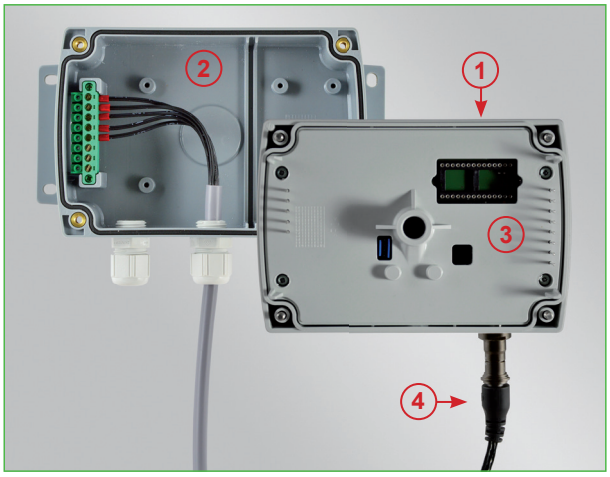


Modular Housing / Pluggable Probe

The upper part of the transmitter **(1),** which accommodates the electronics and the probe, can be plugged off for service or adjustment and can be replaced within seconds. This allows for the bottom part **(2)** to remain mounted with intact cabling.

A polycarbonate cover **(3)** on the inside of the housing protects the electronics during installation or service.

The remote probe models are also available with a pluggable probe **(4)** which can be easily exchanged by a push-pull plug. It is ideal for installation of long probe cables and in applications that might require periodical probe replacements.



Measurement of water activity a_w / water content x

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

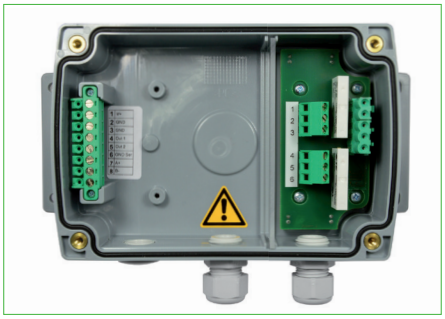
- **Water activity a_w** is the relative measure for moisture in oil. It represents the ratio between the actual amount of dissolved water and the maximum possible amount of dissolved water in the oil at a certain temperature T. Independently of the oil type, the water activity shows how close to saturation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

  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 share of water (dissolved, emulsified or separate) 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.

Alarm outputs (option AM2)

This optional module features two freely configurable relay outputs for control purposes. Various operation modes are available including hysteresis, window and error indication. When error indication is selected, a fault in the humidity or temperature measurement will trigger the alarm output. The measurands at the outputs as well as the thresholds and hysteresis can be set using the EE-PCS software or directly on the device via display and push buttons.



Integrated Power Supply Module (option AM3)

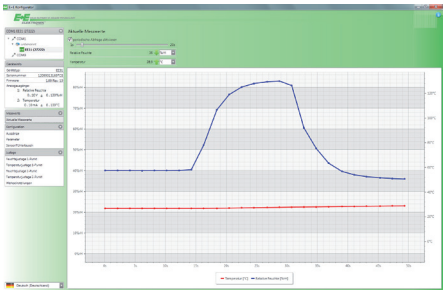
The module allows the device to be powered with 100…240 V AC (50/60 Hz).

E+E Product Configuration Software

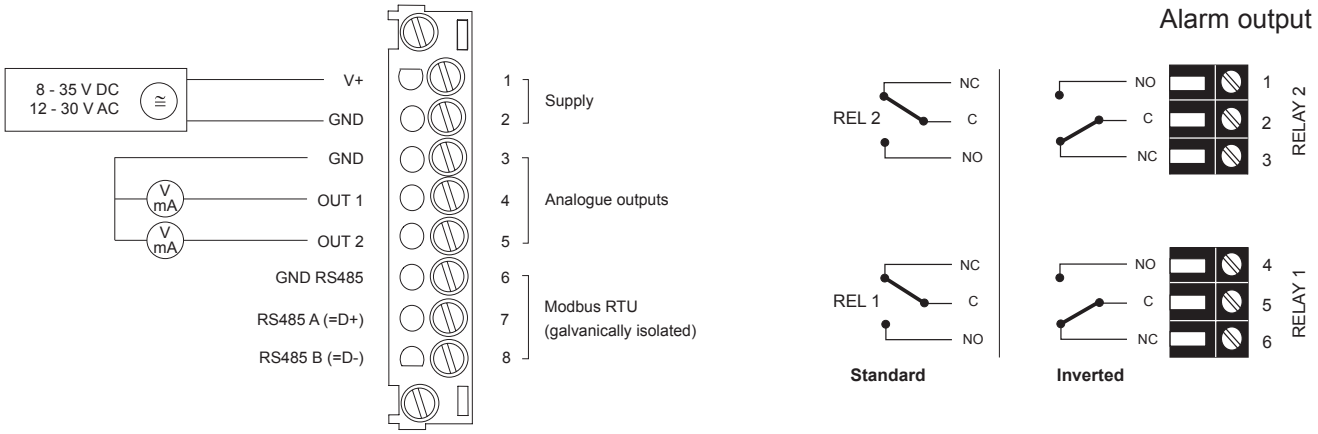
EE-PCS is an intuitive software that allows the user to perform:

- flexible, easy and fast setup of the analogue and alarm outputs
- 1 or 2 point adjustment of humidity and temperature
- replacement of the pluggable sensing probe
- Modbus RTU communication setup
- setup of the display layout
- download logged data
- view error diagnosis information

EE-PCS is available free of charge at: *http://www.epluse.com/configurator*

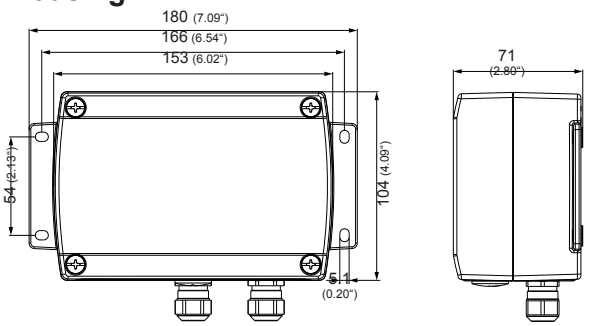


Connection diagram

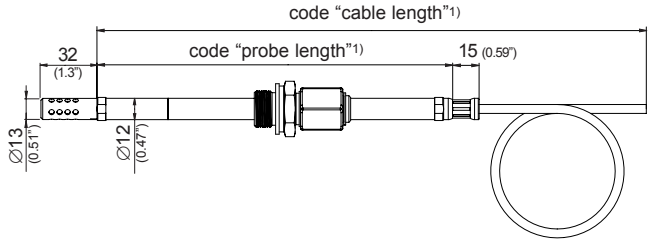


Dimensions (mm/inch)

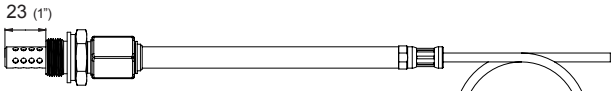
Housing:



Probe:

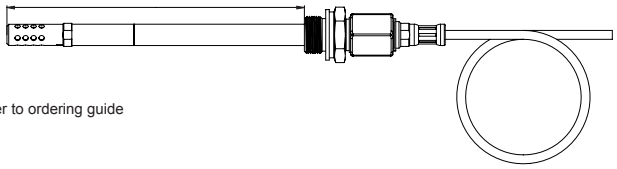


minimum installation depth



maximum installation depth

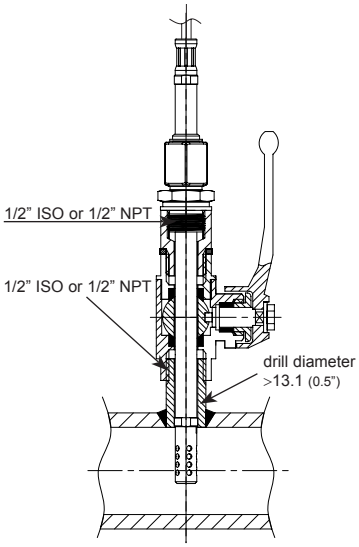
64 mm (2.5") for 100 mm (3.94") probe /
164 mm (6.5") for 200 mm (7.87") probe



1) Refer to ordering guide

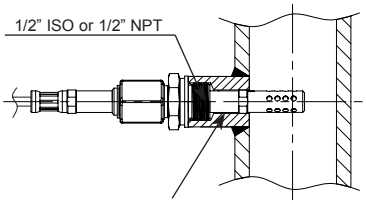
Ball valve installation

pressure-tight up to 20 bar (290 psi)
only for 200 mm (7.87") probe



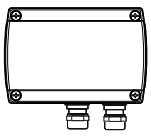
Direct installation

pressure-tight up to 20 bar (290 psi)



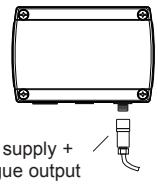
Electrical connection

standard

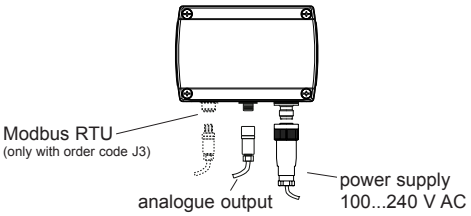


2x M16x1.5

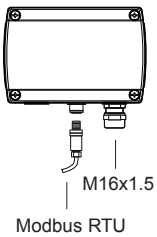
option E4



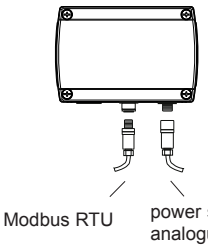
option AM3



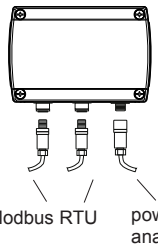
option E5



option E6



option E12



Mating plugs included in the scope of supply

Technical data

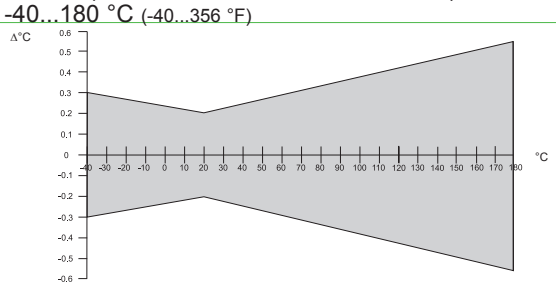
Measuring values

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

Humidity sensor		HC1000-400
Measuring range		0...1 a_w / 0...100,000 ppm
Accuracy[2)]		
-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])
Temperature dependence of sensing probe		typ. ± (0.00002 + 0.0002 x a_w) x ΔT [°C] ΔT = T - 20 °C
Response time at 20 °C (68 °F) / t_{90}		typ. 10 min in still oil

mv = measured value

Temperature (T)

Temperature sensor	Pt1000 (tolerance class A, DIN EN 60751)
Working range sensing probe	-40...180 °C (-40...356 °F)
Accuracy	
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	RS485 with Modbus RTU, up to 32 devices in one bus		

General

Power supply class III ⧫ (EU) / class 2 (NA)	8...35 V DC	12...30 V AC	
	100...240 V AC, 50/60Hz with option AM3 [3)]		
Current consumption - 2x voltage output	for 24 V DC/AC: typ. 40 mA		
- 2x current output	typ. 80 mA		
Pressure range sensing 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	IP65		
Cable gland	M16 x 1.5 for cable Ø 4.5 - 10 mm (0.18 - 0.39")		
Electrical connection	screw terminals up to max. 1.5 mm² (AWG 16)		
Working and storage temperature electronics	-40...60 °C (-40...140 °F) without display		
	-20...50 °C (-4...122 °F) with display		
Electromagnetic compatibility	EN61326-1 Industrial Environment	EN61326-2-3	ICES-003 ClassA FCC Part15 ClassA CE
Alarm outputs (2 relays) [3)]	250 V AC / 6 A		
	28 V DC / 6 A		
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) Including hysteresis, non-linearity and repeatability, 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) Appropriate for outdoor use, wet location, degree of pollution 2, overvoltage category II, altitude up to 3000 m (9843 ft).

Scope of supply

	Included in versions
EE360 according to ordering guide	all versions
Operation manual English*	all versions
Inspection certificate according to DIN EN 10204 – 3.1	all versions
Mating plug for integrated power supply	AM3
Mating plug RKC 5/7	AM3 / E4 / E6 / E12
Mating plug RSC 5/7 (2 pcs. for option E12)	E5 / E6 / E12

*) Other languages can be downloaded at www.epluse.com/EE360

Ordering Guide

				EE360
	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
	Process connection	1/2" ISO thread		no code
		1/2” NPT thread		PA25
	Electrical connection [1]	cable glands		no code
		1 plug for power supply and outputs		E4
		1 cable gland / 1 plug for Modbus RTU		E5
		2 plugs for power supply / outputs and for Modbus RTU		E6
		3 plugs for power supply / outputs and Modbus RTU network		E12
	Optional features	TFT colour display with integrated data logger [2]		D2
		Modbus RTU [3]		J3
		pluggable probe		PC4
		alarm outputs [4] [5]		AM2
		integrated power supply 100...240 V AC, 50/60 Hz [5] [6]		AM3
Setup - Analogue outputs	**Output 1**	water activity a_w	[ ]	no code
		other measurand	(xx see Measurand Code below)	MA*xx*
	Output Signal 1 [8]	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 [8]	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*

Measurand Code

		Mx
Temperature	°C	1
	°F	2
Water activity	aw	67

		Mx
Water content x in mineral transformer oil	ppm	70
Water content x in customer specific oil	ppm	70PPMxxx

1) Plug options E5 / E6 / E12 only in combination with Modbus RTU output, (option J3).
2) Factory setup: the display shows the measurands selected for output 1 and output 2. Default language English, other languages selectable in display menu.
3) Factory settings: baudrate 9600, parity even, stop bit 1 / slave-ID 231 (16 bit integer).
4) Alarm outputs only available with cable glands
5) Combination of alarm output and integrated power supply is not possible
6) Integrated power supply includes 2 plugs for power supply and outputs (other connection options are not possible)
7) Available upon request.
8) Both analogue outputs are either voltage or current.

Order Example

EE360-D2J3GA3GA3GB3SBL-40SBH180

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:	D2	TFT colour display with integrated data logger
	J3	Modbus RTU

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

Accessories / Replacement Parts (for further information, see data sheet "Accessories")

- Replacement filter cap	HA010110
- Replacement probe [1]	refer to operation manual
- Replacement humidity sensor	FE09
- Bracket for installation onto mounting rails [2]	HA010203
- Investigation 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
- RS485 add-on chip [3]	HA010605

1) Only for devices with PC4 option. 2) 2 pieces necessary per device. 3) For upgrade to Modbus RTU interface.