# EE36

## Humidity / Water in Oil Sensor for Maritime Applications

EE36 is dedicated for the accurate and reliable measurement of moisture in lubrication oil in maritime applications and is certified according to the “Germanischer Lloyd (DNV GL)”. The device is specifically approved for use in MAN B&W marine diesel engines for instance.


The outstanding long-term stability and resistance to pollution of the EE36 rests on the high-end E+E capacitive sensing element of the HC series.

**Humidity measurement in oil**

The monitoring of the moisture in lubrication oil is of paramount importance for the long-term performance and predictive maintenance of the machinery. The moisture in oil is described by either the absolute value “water content” x (ppm) or the relative value “water activity” $a_w$:

- The water content x (ppm) represents the ratio between the mass of water and the mass of oil.
- The water activity $a_w$ is the ratio between the actual moisture content and the maximal moisture content of the saturated oil.
  $a_w$ = 0 corresponds to completely dry oil, while $a_w$ = 1 means a fully saturated oil.

EE36 measures the water activity ($a_w$) and the temperature (T) and calculates out of them the water content x. The accurate calculation of the water content of a certain oil requires a set of oil specific parameters.

The measured and the calculated values are available on two free scalable and configurable analogue outputs as well as on the optional display. Additionally, EE36 can be fitted with a relay module for alarms and process control purposes.

**Installation**

The sensing probe of EE36 is designed for continuous online monitoring. In addition to the fix installation, the use of a ball valve allows for insertion and removal of the probe without process interruption.

**Easy Adjustment**

The user can easily readjust the transmitter by using either a simple procedure with two push buttons on the printed circuit board or the free configuration software.

## Product Configuration Software (EE-PCS)

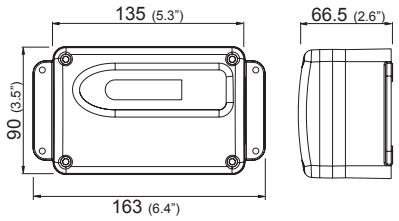
The free configuration software (download at www.epluse.com) allows for easy setup of the analogue and alarm outputs, as well as for the adjustment of the water activity and temperature readings. Furthermore, the EE-PCS facilitate the replacement of the sensing element or of the sensing probe.

## Features of EE36

| | |
|---|---|
| Measurement of $a_w$ and T at pressure up to 20 bar (300 psi) | ✓ |
| Calculation of water content in ppm | ✓ |
| Two free scaleable and configurable analogue outputs | ✓ |
| Probe cable length up to 20 m (66 ft) | ✓ |
| Easy on site adjustment and calibration of $a_w$ and T outputs | ✓ |
| LED indication for operation and sensing probe status | ✓ |
| User configuration of the instrument with PC via RS232 interface | ✓ |
| Configuration software | ✓ |
| Display of $a_w$, T and water content with MIN/MAX function | optional |
| Two free configurable relays outputs | optional |
| Pluggable sensing probe | optional |
| Connector for power supply and outputs | optional |

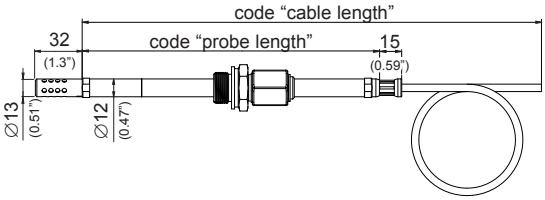
## Dimensions (mm/inch)

### Metal housing:

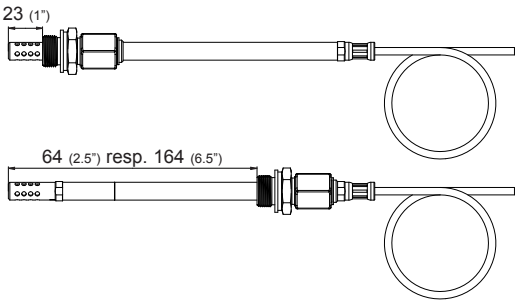



Material: Al Si 9 Cu 3
Protection class: IP65 / NEMA 4

### Probe:




**EE36-xEx**
**Remote probe for T -40...180 °C (-40...356 °F) and pressure-tight up to 20 bar (300 psi)**
probe material: stainless steel

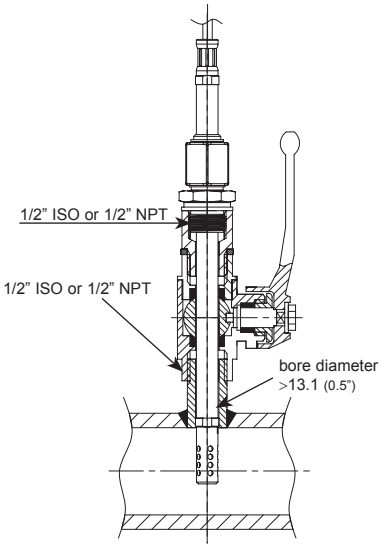



minimum installation depth

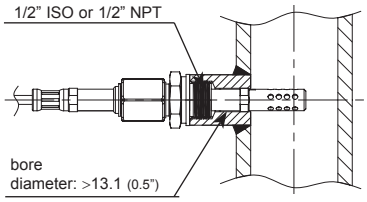
maximum installation depth

## Installation Example

**ball valve installation**
(pressure-tight up to 20 bar/290 psi)

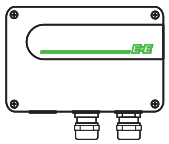



**fixed installation**
(pressure-tight up to 20 bar/300 psi)



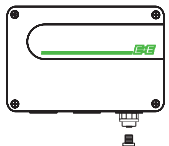

## Electrical connection

**Standard**



2x M16x1.5

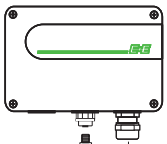
**Plug Option C03**



Lumberg RKC 5/7

power supply + analogue output

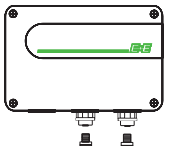
**Plug Option C06**



Lumberg RSC 5/7

M16x1.5

**Plug Option C07**



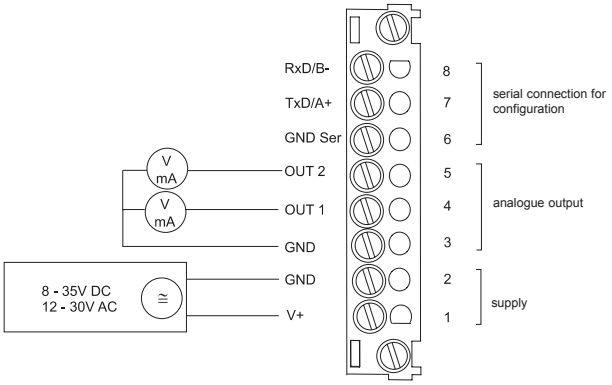
Lumberg RSC 5/7

Lumberg RKC 5/7

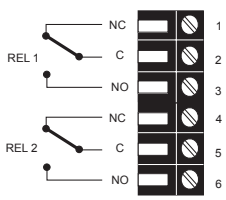
RS232

power supply + analogue output

## Connection Diagram




Terminal configuration - Alarm output



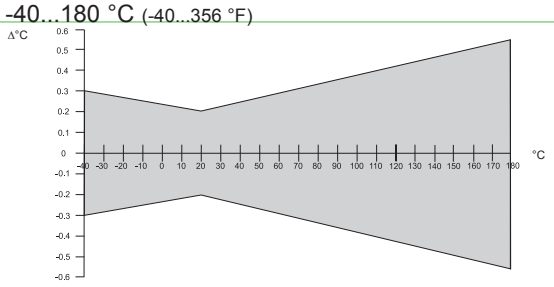
# Technical Data

## Measuring values

### Water activity

| | | |
|---|---|---|
| Measuring range[1] | | 0...1 $a_w$ |
| Accuracy*) (including hysteresis, non-linearity and repeatability, traceable to intern. standards, administrated by NIST, PTB, BEV...) | | |
| -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 with stainless steel filter at 20 °C (68 °F) / $t_{90}$ | | typ. 10 min in still oil |

### Temperature

| | |
|---|---|
| Temperatur sensor element | 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[2]

| | | |
|---|---|---|
| Two freely selectable and scaleable analogue outputs | 0 - 5 V | -1 mA < $I_L$ < 1 mA |
| | 0 - 10 V | -1 mA < $I_L$ < 1 mA |
| | 4 - 20 mA | $R_L$ < 500 Ohm |
| | 0 - 20 mA | $R_L$ < 500 Ohm |

| Adjustable measurement range[2] | | from | up to | units |
|---|---|---|---|---|
| Water activity | $a_w$ | 0 | 1 | |
| Temperature | T | -40 (-40) | 180 (356) | °C (°F) |
| Water content[3] | x | 0 | 100 000 | ppm |

## General

| | | |
|---|---|---|
| Supply voltage | 8...35 V DC | |
| | 12...30 V AC | (optional 100...240 V AC, 50/60 Hz) |
| Current consumption - 2x voltage output | for 24V DC/AC: | typ. 40 mA |
| - 2x current output | | typ. 80 mA |
| Pressure range sensing pobe | 0.01...20 bar (0.15...300 psi) | |
| System requirements for software | WINDOWS 2000 or later; serial interface | |
| Serial interface for configuration[4] | RS232C | |
| Housing / Protection class | Al Si 9 Cu 3 / IP65 / NEMA 4 | |
| Cable gland | M16 x 1.5 | cable Ø 4.5 - 10 mm (0.18 - 0.39") |
| Electrical connection | screw terminals up to max. 1.5 mm² (AWG 16) | |
| Sensor protection | stainless steel filter | |
| Operating temperature range of electronics | -40...60 °C (-40...140 °F) | |
| Working and storage temperature range | | |
| Housing with display | -20...50 °C (-4...122 °F) | |
| Storage temperature | -40...60 °C (-40...140 °F) | |
| Electromagnetic compatibility according to | EN61326-1 Industrial Environment | EN61326-2-3 ICES-003 ClassB FCC Part15 ClassB |
| DNV GL-Certification[5] | Environmental Category D | |

## Options

| | |
|---|---|
| Display | graphical LCD (128x32 pixels), with integrated push-buttons for selecting parameters and MIN/MAX function |
| Alarm outputs | 2 x 1 switch contact: 250 V AC / 6 A and 28 V DC / 6A threshold + hysteresis can be adjusted with configuration software |
| Switching parameters (freely selectable) | $a_w$ Water activity<br>T Temperature<br>x Water content |

1) refer to the working range of the humidity sensor. 2) can be easily changed by software 3) ppm output is valid in the range 0...100°C (32...212°F)
4) no data output
*) 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

| | | | | | | | | EE36-ME |
|---|---|---|---|---|---|---|---|---|
| Hardware Konfiguration | **Cable length (incl. probe length)** | 1 m (3.3 ft) | | | | | | 01 |
| | | 2 m (6.6 ft) | | | | | | 02 |
| | | 5 m (16.4 ft) | | | | | | 05 |
| | | 10 m (32.8 ft) | | | | | | 10 |
| | | 20 m (65.6 ft) | | | | | | 20 |
| | **Probe length** | 100 mm (3.9") | | | | | | 3 |
| | | 200 mm (7.9") | | | | | | 5 |
| | **Pressure-tight feedthrough** | 1/2" male thread | | | | | | HA03 |
| | | 1/2" NPT thread | | | | | | HA07 |
| | **Display** | without display | | | | | | no code |
| | | with display | | | | | | D05 |
| | **Alarm output**[1] | without relay | | | | | | no code |
| | | with relay | | | | | | SW |
| | **Plug** | cable thread | | | | | | no code |
| | | 1 plug for power supply and output | | | | | | C03 |
| | | 1 cable thread / 1 plug for RS232 | | | | | | C06 |
| | | 2 plugs for power supply/outputs and RS232 | | | | | | C07 |
| | **Probe** | fixed | | | | | | no code |
| | | pluggable | | | | | | P01 |
| Software Konfiguration | **Physical parameters outputs** | Temperature | T | [°C / °F] | (B) | | output 1 | select according to Ordering Guide (B,K,M) |
| | | Water activity | $a_w$ | [ ] | (K) | | | |
| | | Water content in lubrication oil[2] | x | [ppm] | (M) | | output 2 | select according to Ordering Guide (B,K,M) |
| | **Type of output signals** | 0-5 V | | | (2) | | | select according to Ordering Guide (2,3,5,6) |
| | | 0-10 V | | | (3) | | | |
| | | 0-20 mA | | | (5) | | | |
| | | 4-20 mA | | | (6) | | | |
| | **Temperature unit** | °C | | | | | | no code |
| | | °F | | | | | | E01 |
| | **T-Scaling** | -40...60 | (T02) | -40...120 | (T12) | | | select according to Ordering Guide (Txx) |
| | | 0...50 | (T04) | -20...100 | (T14) | | | |
| | | 0...100 | (T05) | 0...120 | (T16) | | output T | |
| | | -30...70 | (T08) | 0...80 | (T21) | | | other T-scaling refer to data sheet „T-Scalings" |
| | | -20...120 | (T10) | -20...80 | (T24) | | | |
| | **Water content x** | 0...100 ppm | (X01) | 0...1000 ppm | (X03) | | output x | select according to Ordering Guide (X01-X04) |
| | | 0...500 ppm | (X02) | 0...10000 ppm | (X04) | | | |
| | | | | | other measuring ranges on request | | | |

1) Combination alarm output and plugs is not possible (with cable glands only)

2) On request (Input of oil specific parameters necessary)

## Order Example

**EE36-ME055HA03D05/BM3-T08-X04**

| | | | |
|---|---|---|---|
| Cable length: | 5 m (16.4 ft) | Output 1: | T |
| Probe length: | 200 mm (7.9") | Output 2: | x (mineral transformer oil) |
| Pressure-tight feedthrough: | 1/2" male thread | Type of output signals: | 0 - 10 V |
| Display: | with display | Temperature unit: | °C |
| Alarm output: | without relay | T-Scaling: | -30...70 |
| Plug: | 1 plug for power supply and output | Water content x: | 0...10000 ppm |
| Probe: | pluggable | | |

## Scope of Supply

| | Included in all versions | According to Ordering Guide |
|---|---|---|
| EE36 according to ordering guide | ✓ | |
| Operation manual | ✓ | |
| - Two self-adhesive labels for configuration changes (see user guide at www.epluse.com/relabeling) | ✓ | |
| Inspection certificate according to DIN EN 10204 - 3.1 | ✓ | |
| Allen key 3.0 | ✓ | |
| Mating plug RKC 5/7 | | C03 / C07 |
| Mating plug RSC 5/7 | | C06 / C07 |
| M16 cable gland metal | | except C03, C06 |

## Accessories / Replacement Parts (For further information see data sheet "Accessories")

| | | | |
|---|---|---|---|
| - Display + housing cover | D05M | - Interface cable for PCB | HA010304 |
| - Replacement probe | PExxxx* | - Interface cable for plug C06, C07 | HA010311 |
| - Humidity sensor | FE09 | - Ball valve set 1/2" ISO | HA050101 |
| - Calibration set | HA0104xx | - Ball valve set 1/2" NPT | HA050104 |
| - Sealing element | HA050308 | - Double nibble G1/2" to G3/4" | HA011107 |
| - Stainless steel filter for EE36 | HA010110 | - Enlargement G1/2" to G3/4" | HA011106 |

*Only for Version P01 available