



Operation manual

EE360
Moisture in Oil
Transmitter

YOUR PARTNER IN SENSOR TECHNOLOGY



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USA

FCC notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CANADA

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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

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1 General

This manual is included in the scope of supply and serves to ensure proper handling and optimum performance of the instrument. The manual shall be read before putting the device into operation. The manual is relevant for all staff involved in transport, setup, operation, maintenance and repair. The manual may not be used for the purpose of competition and shall also not be forwarded to third parties. Copies for personal use are allowed. All contents, technical data and illustrations contained in the manual are based on information available at the time of publication.

1.1 Explanation of symbols



This symbol indicates safety information.

It is essential that all safety information is strictly observed. Failure to comply with this information can lead to personal injuries or damage to property. E+E Elektronik® assumes no liability if this happens.



This symbol indicates instructions.

The instructions shall be observed in order to reach optimal performance of the device.

1.2 Safety instructions

1.2.1. General

Excessive mechanical stress and inappropriate usage may lead to failures and shall be avoided. The sensors inside the sensing head (the tip of the sensing probe) is an Electro Static Discharge (ESD) sensitive components and shall be handled as such.

Do not touch the sensing elements inside the sensing head. The replacement of the filter cap shall be done with utmost care not to touch the sensors. Installation, electrical connection, maintenance and commissioning shall be performed by qualified staff only.



The power supply must be switched off before opening the housing!

An existing Ethernet connection must be disconnected before opening the housing!

1.2.2. Alarm module with voltages >50 V (option AM2, AM6)

The optional alarm module is isolated from the low-voltage side of EE360 by a special partition; this must remain fitted at all times in the bottom part of the enclosure.

The EE360 enclosure must be tightly closed during operation. An open enclosure corresponds to IP00 and exposes components carrying dangerous voltage. Any work (maintenance for instance) on the device may be performed by qualified staff only.



AM2 for use in NFPA 79 application only.

1.2.3. Integrated power supply 100...240 V AC (option AM3, AM5)

The EE360 enclosure must be tightly closed during operation. An open enclosure corresponds to IP00 and exposes components carrying dangerous voltage. Any work (maintenance for instance) on the device may be performed by qualified staff only.



AM3 for use in NFPA 79 application only.

1.3 Environmental aspects



Products from E+E Elektronik® are developed and manufactured observing of all relevant requirements with respect to environment protection. Please observe local regulations for the device disposal.



For disposal, the individual components of the device must be separated according to local recycling regulations. The electronics shall be disposed of correctly as electronics waste.

2 Product Description

The UL certified 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 (see also 2.3 *Water activity vs. water content*).

The probe can be employed up to 180 °C (356 °F), 100 bar (1450 psi) and is available with either ISO or NPT slide fitting or cut-in 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.

2.1 Product design



Fig. 1 Product design

- ① Upper enclosure part with electronic / display* and probe cable
- ② 3.5" TFT colour display*
- ③ 5 push-buttons for configuration menu
- ④ Bottom part with electrical connection, alarm + supply module* and mounting holes
- ⑤ Micro USB service interface
- ⑥ Standard cable glands / connectors*
- ⑦ Cable gland / connector* for probe cable

* optional

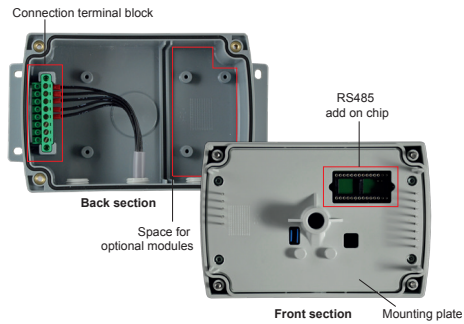


Fig. 2 Modular enclosure



Don't remove the mounting plate. Opening will void warranty!

2.2 Probes

The EE360 remote probe can be employed over the T range -40...180 (-40...356 °F), up to 100 bar (1450 psi) and is available with 100 mm (3.94"), 200 mm (7.87") and 400 mm (15.75") length.

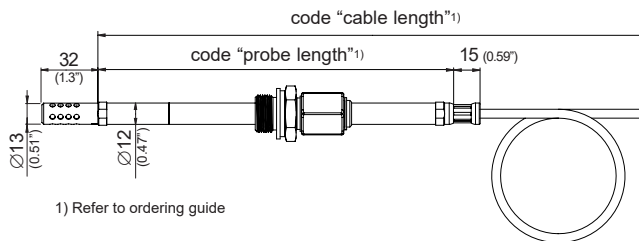


Fig. 3 EE360 probe sliding 20 bar (300 psi)

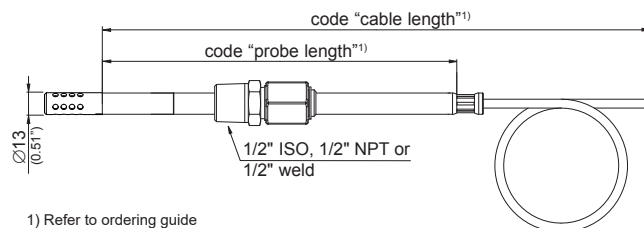


Fig. 4 EE360 probe with cut-in fitting 100 bar (1450 psi)

2.3 Water activity vs. water content

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.

$a_w=0$ 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 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 a_w and T values. The calculation is oil dependent and requires a set of oil specific parameters. (Contact an E+E representative for details.)

2.4 Indoor and Outdoor use



The EE360 is suitable for indoor and outdoor use. Enclosure is in accordance with UL 746C.

3 Installation

3.1 Mechanical installation

3.1.1 Mounting of the polycarbonate enclosure

- Drill the mounting holes according to the mounting template below.
- Mount the bottom part of the enclosure with 4 screws (screw diameter < 4.2 mm (0.2"), not included in the scope of supply).

Polycarbonate enclosure

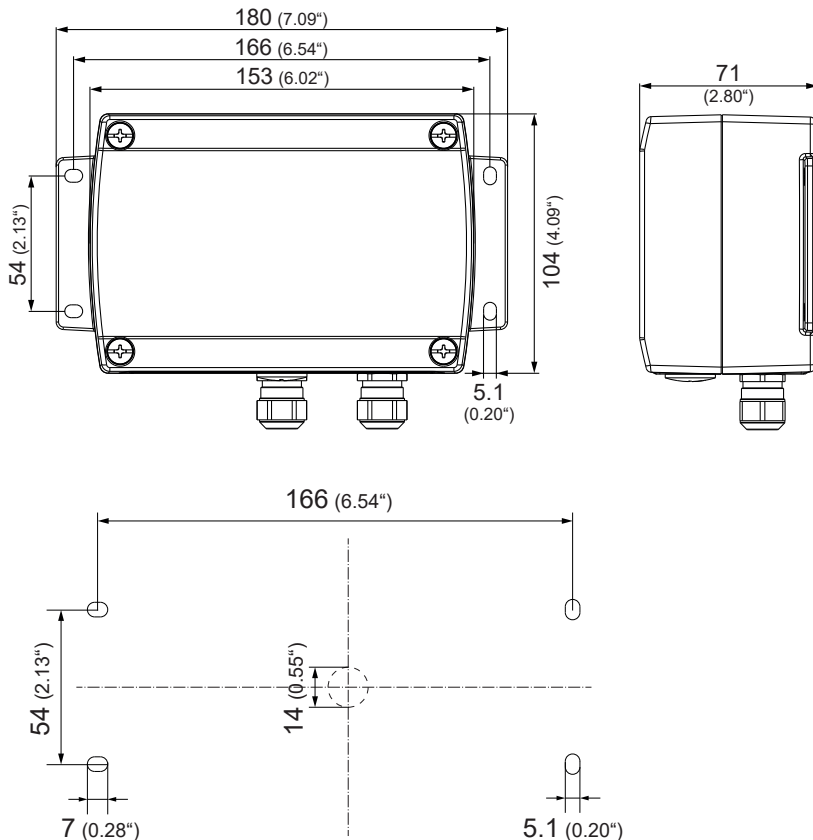


Fig. 5 Dimensions and mounting template of polycarbonate enclosure in mm (inch)



The four housing screws shall be tightened loosely first. Then tighten the screws diagonally with a torque wrench to 2 Nm (18 Lb In.) ± 0.5 Nm (4.4 Lb In.).

3.1.2 DIN rail mounting of the polycarbonate enclosure

- Mount the two DIN rail brackets (to be ordered separately, see chapter 7 Replacement Parts / Accessories) onto the back side of the enclosure.
- Snap in the enclosure onto the DIN rail

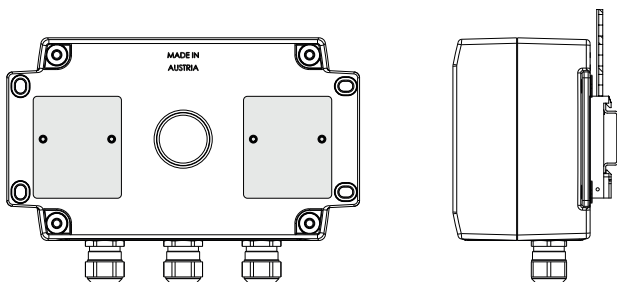


Fig. 6 DIN rail installation

3.2 Electrical connection



The electrical installation of the EE360 shall be performed by qualified personnel only. Observe all applicable national and international requirements for the installation of electrical devices.

Analogue outputs

Both analogue outputs shall be configured to either voltage or current. Measurands, analogue range and scaling are freely selectable. All settings can be performed via display and push buttons or using the EE-PCS Product Configuration Software.

Error indication

The analogue outputs feature an error indication function according to NAMUR NE43. In the case of an error the output signal will freeze at 21 mA or 11 V respectively.



Note

By default the error indication is disabled.

When changing one of the analogue outputs from current to voltage and vice versa, the second output will change automatically as well. The output scaling changes automatically if it is out of physical range (i.e. 20 mA will be changed to 10 V instead of 20 V).



Check output scale after changing between voltage and current output.

3.2.1 Connection diagram M16

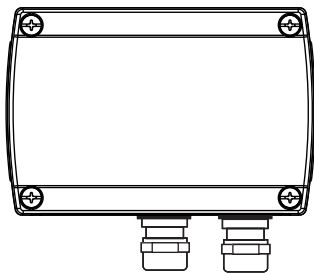


Fig. 7 Standard connection with 2 x M16 cable glands

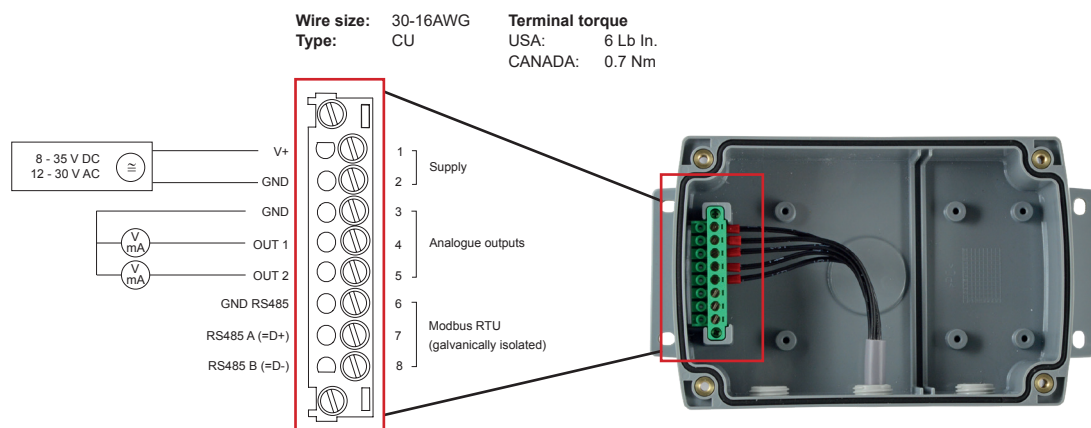


Fig. 8 Electrical connection

Model	Supply Input	Terminals
	Voltage/Frequency	
EE360	Indoor use: 12 to 30Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS) Outdoor use: 12 to 16Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	V+ (1) – GND (2)

Outputs			
Model	Type	Ratings	Terminals
EE360	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 1 (4) – GND (3)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (5) – GND (3)

Model	Type	Ratings	Terminals
EE360 with option J3	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (7) – RS485 B (=D-) (8) – GND RS485 (6)

Tab. 1 Electrical Connections

3.2.2 Connection diagram Option E4

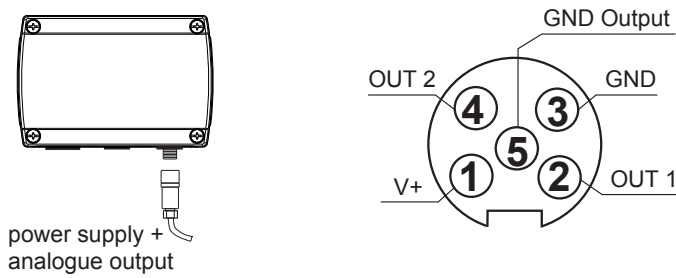


Fig. 9 Plug option E4 for EE360 (front connector view)

Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option E4	Indoor use: 12 to 30Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	Plug pin V+ (1) – GND (3)

Outputs			
Model	Type	Ratings	Terminals
EE360 with option E4	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Plug pin Out 1 (2) – GND (5)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (4) – GND (5)

Tab. 2 M12 connector power supply + analogue output

3.2.3 Connection diagram Option E5

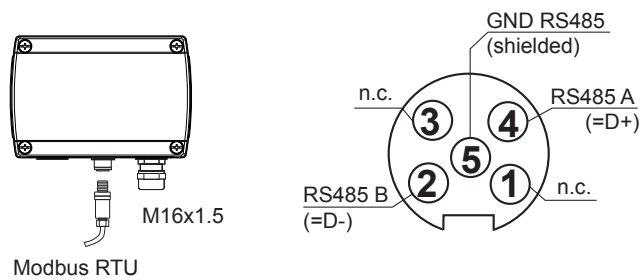


Fig. 10 Plug option E5 for EE360 (front connector view)

Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option E5	Indoor use: 12 to 30Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	Plug pin V+ (1) – GND (2)

Outputs			
Model	Type	Ratings	Terminals
EE360 with option E5	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Plug pin Out 1 (4) – GND (3)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (5) – GND (3)

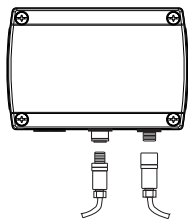
Tab. 3 Cable gland

Outputs			
Model	Type	Ratings	Terminals
EE360 with option E5 and J3	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (2) – RS485 B (=D-) (4) – GND RS485 (5)

Tab. 4 M12 connector Modbus RTU

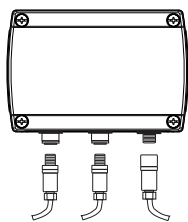
3.2.4 Connection diagram Options E6 and E12

Option E6



Modbus RTU power supply +
analogue output

Option E12



Modbus RTU power supply +
analogue output

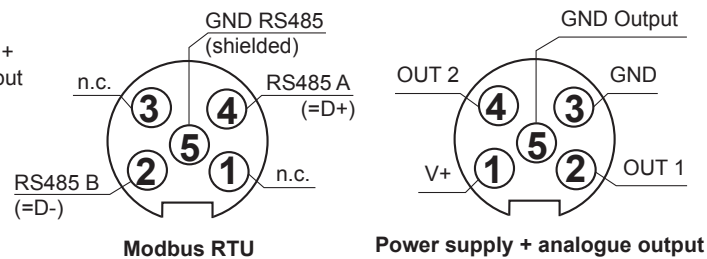


Fig. 11 Plug option E6 and E12 (front connector view)

Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option E4	Indoor use: 12 to 30Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	Plug pin V+ (1) – GND (3)

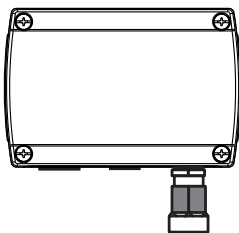
Outputs			
Model	Type	Ratings	Terminals
EE360 with option E4	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Plug pin Out 1 (2) – GND (5)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (4) – GND (5)

Tab. 5 M12 connector power supply + analogue output

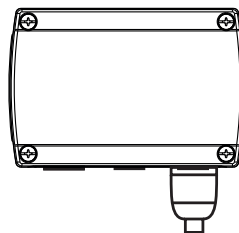
Outputs			
Model	Type	Ratings	Terminals
EE360 with option E5 and J3	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (2) – RS485 B (=D-) (4) – GND RS485 (5)

Tab. 6 M12 connector Modbus RTU 1 and / or 2

3.2.5 Connection diagram Conduit option



Conduit fitting option E23



Liquid-tight conduit fitting option E24

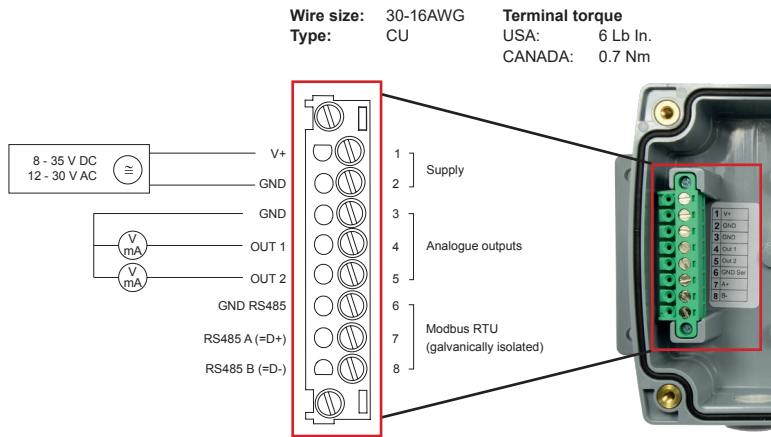


Note for E23:

½" NPSL Flexible Nonmetallic Cord Connector is installed. Cable used for installation shall be suitable flexible listed cord/cable in accordance with NEC. Clamping range grommet 6 to 10mm (0.24 - 0.4"). Local regulation for installation must be observed. Indoor use and dry location only. Not suitable for mains voltage (110 - 240 Vac)

Note for E24:

½" Liquid-Tight Flexible Nonmetallic Conduit Type B (FNMC-B) is installed. Cable used for installation shall be suitable flexible listed cord/cable in accordance with NEC. Local regulation for installation must be observed.



Model	Supply Input	Terminals
	Voltage/Frequency	
EE360	Indoor use: 12 to 30Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS) Outdoor use: 12 to 16Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	V+ (1) – GND (2)

Outputs			
Model	Type	Ratings	Terminals
EE360	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 1 (4) – GND (3)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (5) – GND (3)

Model	Type	Ratings	Terminals
EE360 with option J3	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (7) – RS485 B (=D-) (8) – GND RS485 (6)

Tab. 7 Conduit options E23 / E24

3.2.6 Connection diagram for integrated power supply module AM3



For indoor use, surface mounted according NFPA 79 applications only.



Fig. 12 Option AM3 with M12 connector for analogue outputs

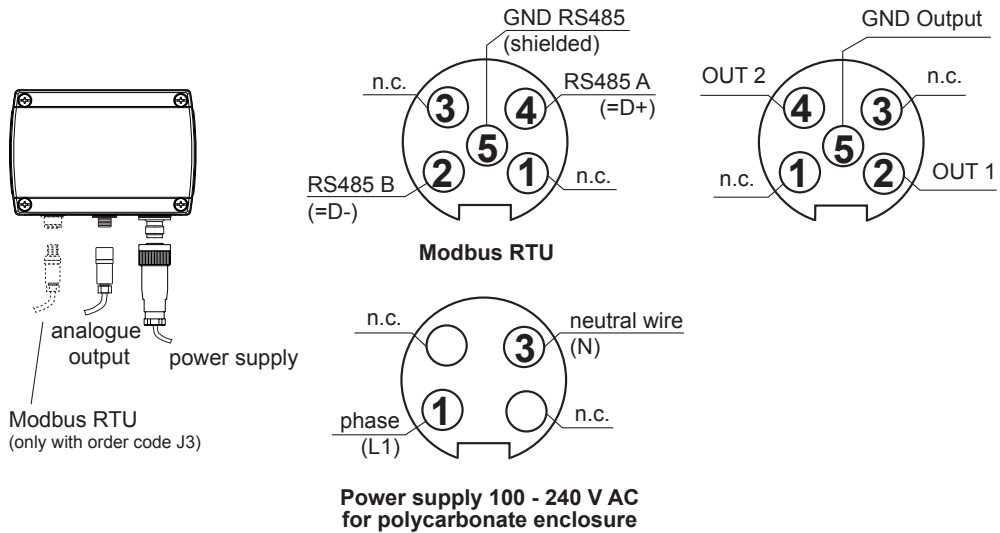


Fig. 13 Plug option AM3 for EE360 (front connector view)



External diameter of the supply cable for option AM3: 10 - 12 mm (0.39 - 0.47").

Maximum wire cross section for AM3 connecting cable: 1.5 mm² (AWG 16) .

External diameter of the cable for Modbus RTU and analogue output female plug: 4 - 6 mm (0.16 - 0.24").

Maximal wire cross section for connecting cable: 0.5 mm² (AWG 21).

Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option AM3	Indoor use: 100 to 240 Vac, 50/60 Hz	Plug pin L1 (1) – N (3)

Outputs			
Model	Type	Rated	Terminals
EE360 with option AM3	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Plug pin Out 1 (1) – GND (5)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Plug pin Out 2 (4) – GND (5)

Model	Type	Rated	Terminals
EE360 with options AM3 and J3	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (4) – RS485 B (=D-) (2) – GND RS485 (5)

Tab. 8 M12 connector analogue and digital output

3.2.7 Connection diagram for integrated power supply module AM5

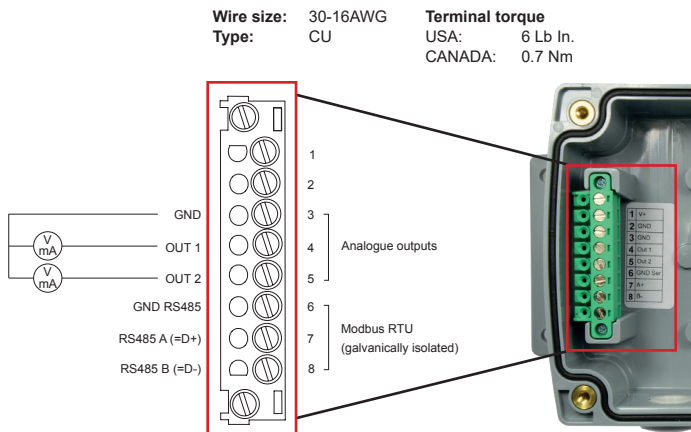


Fig. 14 Option AM5 with liquid-tight conduit fittings



Note:

1/2" Liquid-Tight Flexible Nonmetallic Conduit Type B (FNMC-B) is installed. Cable used for installation shall be suitable flexible listed cord/cable in accordance with NEC. Local regulation for installation must be observed



Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option AM5	Indoor and Outdoor use: 100 to 240 Vac, 50/60 Hz	L1 – N

Outputs			
Model	Type	Ratings	Terminals
EE360 with option AM5	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 1 (4) – GND (3)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (5) – GND (3)

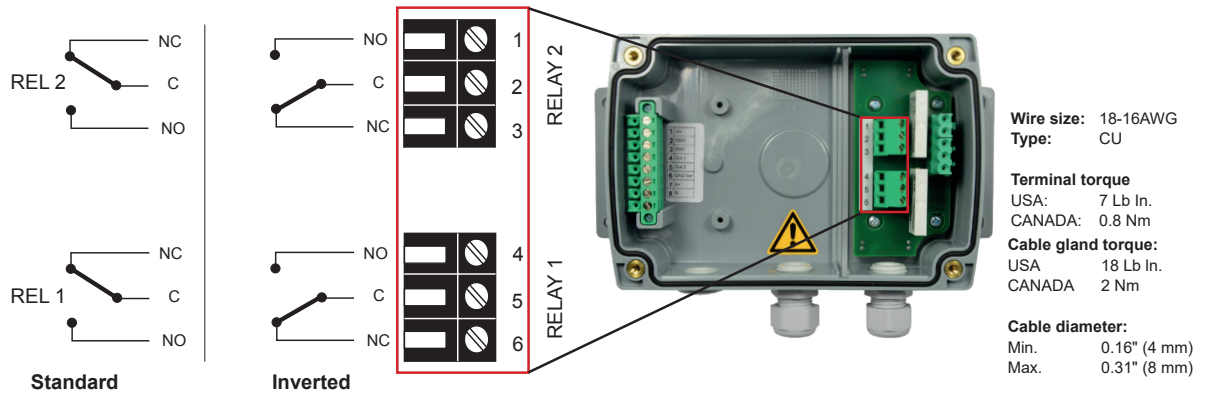
Model	Type	Ratings	Terminals
EE360 with options AM5 and J5	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (7) – RS485 B (=D-) (8) – GND RS485 (6)

Tab. 9 Electrical connection for integrated power supply module AM5

3.2.8 Connection diagram for alarm outputs AM2

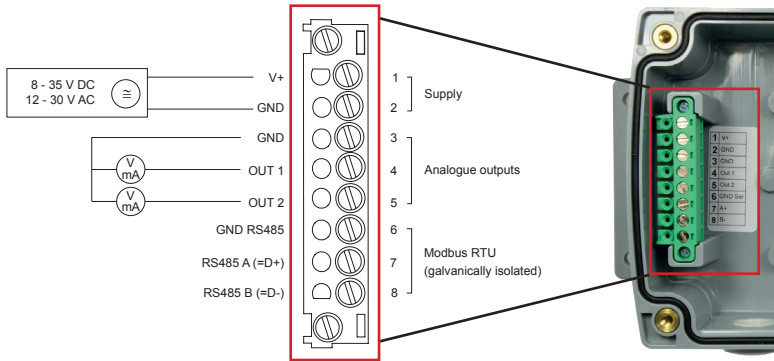


For indoor use, surface mounted according NFPA 79 applications only.



Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option AM2	Relay 1: Max. switch load: 250 Vac / 6 A and 28 Vdc / 6 A Min. switch load: 12 Vac/dc / 100 mA	C (5) - NO (4)
		C (5) - NC (6)
EE360 with option AM2	Relay 2: Max. switch load: 250 Vac / 6 A and 28 Vdc / 6 A Min. switch load: 12 Vac/dc / 100 mA	C (2) - NO (1)
		C (2) - NC (3)

Wire size: 30-16AWG
Type: CU
Terminal torque
 USA: 6 Lb In.
 CANADA: 0.7 Nm

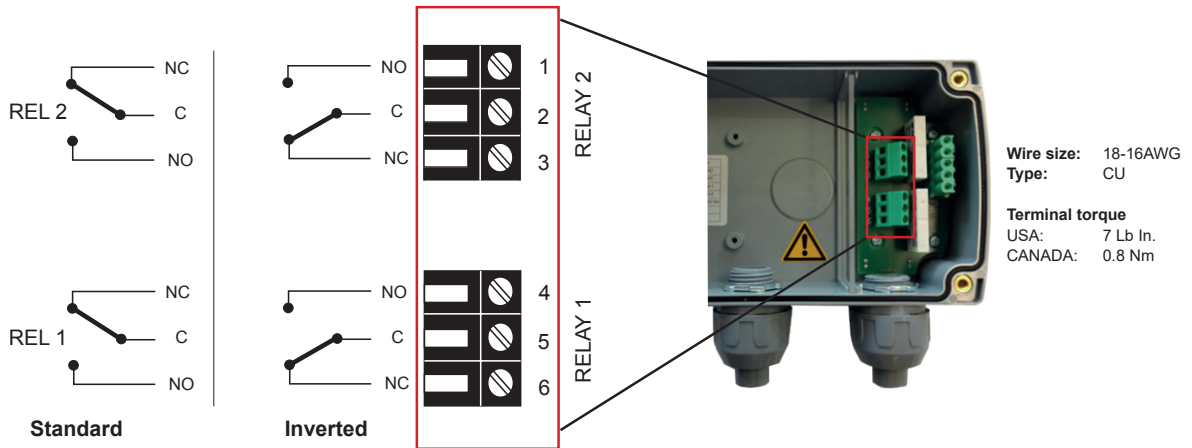


Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option AM2	12 to 30Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	V+ (1) – GND (2)

Outputs			
Model	Type	Ratings	Terminals
EE360 with option AM2	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 1 (4) – GND (3)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (5) – GND (3)

Model	Type	Ratings	Terminals
EE360 with option AM3 and J3	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (7) – RS485 B (=D-) (8) – GND RS485 (6)

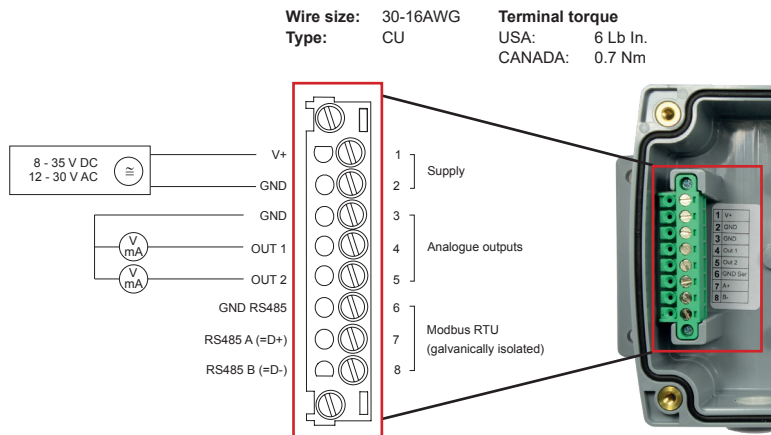
3.2.9 Connection diagram for alarm outputs AM6



Note:

½" Liquid-Tight Flexible Nonmetallic Conduit Type B (FNMC-B) is installed. Cable used for installation shall be suitable flexible listed cord/cable in accordance with NEC. Local regulation for installation must be observed.

Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option AM6	Relay 1: Max. switch load: 250 Vac / 6 A and 28 Vdc / 6 A Min. switch load: 12 Vac/dc / 100 mA	C (5) - NO (4)
		C (5) - NC (6)
EE360 with option AM6	Relay 2: Max. switch load: 250 Vac / 6 A and 28 Vdc / 6 A Min. switch load: 12 Vac/dc / 100 mA	C (2) - NO (1)
		C (2) - NC (3)



Model	Supply Input	Terminals
	Voltage/Frequency	
EE360 with option AM6	Indoor use: 12 to 30Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	V+ (1) – GND (2)
	Outdoor use: 12 to 16Vac, 50/60Hz (Class 2 supply) 8-35Vdc (LPS)	

Outputs			
Model	Type	Ratings	Terminals
EE360	Out 1	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 1 (4) – GND (3)
	Out 2	0-1V 0-5V 0-10V 0-20mA 4-20mA (SELV Limited Energy source)	Out 2 (5) – GND (3)
Model	Type	Ratings	Terminals
EE360	Modbus RTU	0-5V (SELV Limited Energy source)	RS485 A (=D+) (7) – RS485 B (=D-) (8) – GND RS485 (6)

3.3 Probe mounting



The probe shall be mounted horizontally or vertically pointing downwards.

For accurate measurement it is of paramount importance to avoid T gradients along the probe. In case of large T difference between the front and the back of the probe, it is highly recommended to insert the probe completely into the process. Should this not be possible, place a thermal isolation layer on the part of the probe outside the process (on the cable side).



General safety instructions for installation

The installation, commissioning and operation of the EE360 may be performed by qualified staff only. Special attention shall be paid to the correct installation of the probe into the process. In case of inappropriate installation there is the risk for the probe to be suddenly expelled due to the pressure in the process.

Bending over the sensing probe should be avoided under any circumstances!

Make sure that the surface of the probe is not damaged during installation. A damaged probe surface may lead to damaged seals and consequently to leakage and pressure loss.

T working range probe:	-40...+180 °C (-40...176 °F)
cable:	-40...+150 (-40...302 °F)
cable oil resistance:	-40...+80 °C (-40...176 °F)
electronics:	-40...+60 °C (-40...140 °F)
	-20...+50 °C (-4...122 °F) (with display)

3.3.1 Installation depth sliding fitting

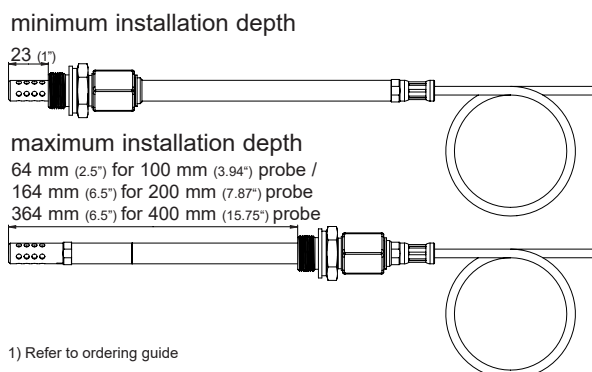


Fig. 15 Max. and min. installation depth

3.3.2 Installation of the probe directly in the process with sliding fitting up to 20 bar

(see Fig. 16 Installation of the EE360 probe directly into the process)

For direct probe installation into a duct stop valves should be provided on both sides of the probe insert. This allows the sensor probe to be easily removed for maintenance and calibration.

For direct installation into a pressure chamber make sure that the pressure in the chamber and the ambient pressure are equal before removing the probe. The temperature during probe installation may deviate by max. $\pm 40\text{ }^{\circ}\text{C}$ ($\pm 72\text{ }^{\circ}\text{F}$) from the regular temperature during normal operation.



Replace the metal sealing ring (see Fig. 16 Installation of the EE360 probe directly into the process) by a new one every time before re-installing the probe.

Probe installation steps

- Close both valves.
- Place the sensor probe into the probe insert and adjust the immersion depth.
- Tighten the lock nut with a torque of 30 Nm.
- Open the valves.



Observe strictly the tightening torque.

A torque lower than 30 Nm results in a smaller retention force of the clamping sleeve. This leads the risk of sudden expulsion of the sensing probe due to the pressure. A torque higher than 30 Nm may lead to permanent deformation of the clamping sleeve and the sensing probe. This would make the removal and re-installation of the probe difficult or even impossible.

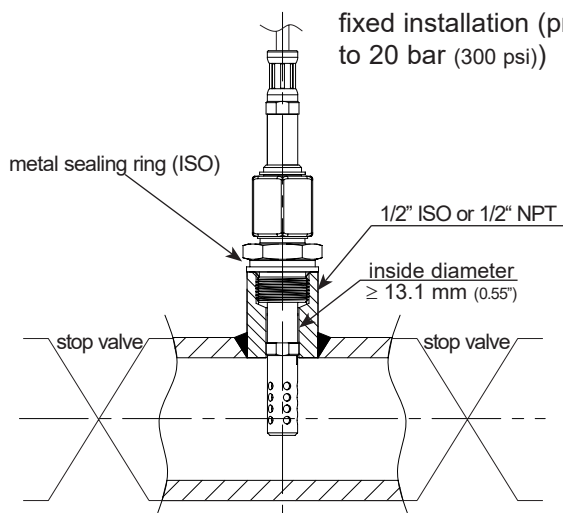


Fig. 16 Installation of the EE360 probe directly into the process

3.3.3 Installation of the probe (sliding fitting up to 20 bar) with ball valve set

The ball valve set allows for installation and removal of the 200 mm (7.87") probe without process interruption. For mounting into a duct, the ball valve shall be installed perpendicular to the flow direction.



The two metal sealing rings (see Fig. 17 Installation of the probe by utilizing the ball valve set) shall be replaced every time prior to re-installing the probe.

The temperature during probe installation may deviate by max. $\pm 40\text{ }^{\circ}\text{C}$ ($\pm 72\text{ }^{\circ}\text{F}$) from the regular temperature during normal operation.

Installation of the probe (see Fig. 17 Installation of the probe by utilizing the ball valve set):

- Install the probe into the ball valve while the ball valve is closed.
- Open the ball valve.
- Slide the probe through the ball valve to the desired immersion depth. Depending on the process pressure additional tools may be necessary for pushing the probe into the process. Make sure not to damage the probe and the cable.
- Tighten the lock nut with a torque of 30 Nm.



Observe strictly the tightening torque. A torque lower than 30 Nm results a smaller retention force of the clamping sleeve. This leads the risk of sudden expulsion of the sensing probe due to the pressure. A torque higher than 30 Nm may lead to permanent deformation of the clamping sleeve and the sensing probe. This would make the removal and re-installation of the probe difficult or even impossible.

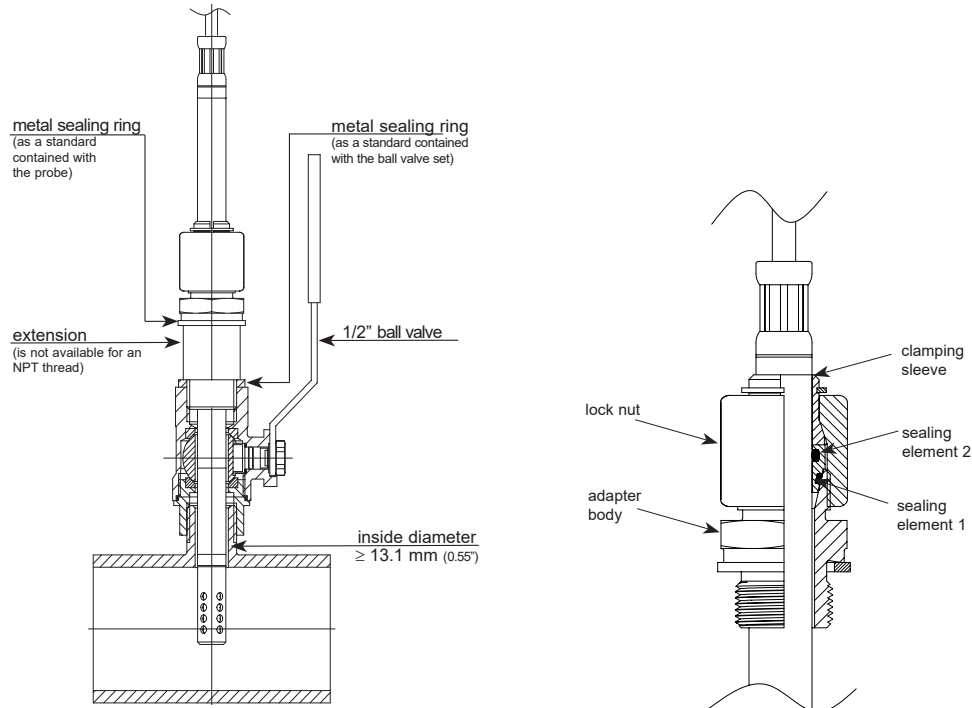


Fig. 17 Installation of the probe by utilizing the ball valve set

Removing the probe

- Hold firmly the probe to avoid it being suddenly expelled when releasing the lock nut. May sure nut to bend and damage the probe cable.
- Loosen slowly the lock nut with a spanner (spanner width 24) only till the probe is pushed out by the overpressure in the process. Do not completely loosen the lock nut, but only as much as necessary for the probe to slide.
- After the probe has been pushed out of the process up to the stop, close the ball valve.
- Remove the probe from the ball valve.



Observe the correct positioning of the sealing element 1 before reinstalling the probe.

Replacement of the sealing element

In case of repeated installations and removals the sealing element 1 can might damaged. It can be replaced by the user.

3.3.4 Installation of the probe with cut-in fitting up to 100 bar (1450 psi)

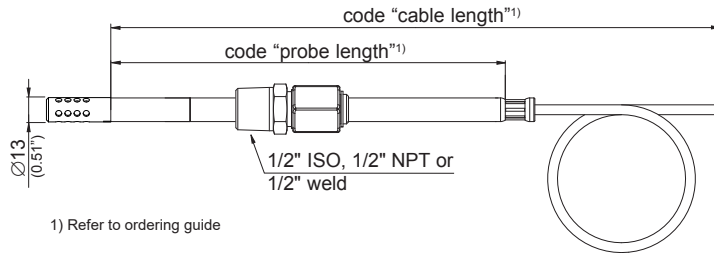


Fig. 18 EE360 probe up to 100 bar



The sensing probe must be mounted horizontally or vertically, pointing downwards. When possible, a drip sheet should be fitted for each mounting.

Mounting the clamping ring screw connection



Safety instructions for pressure-tight screw connection:

- The system must not be vented by releasing the union nuts.
- Do not assemble and tighten pipe screw connections if the system is under pressure.
- Always use the correct thread sealant on conical pipe threads.
- Never rotate the screw connection body. Instead, hold the screw connection body securely and turn the union nut.
- Avoid unnecessary disassembly of unused pipe screw connections.

Installation instructions:

- Tighten the union nuts finger-tight.
- Mark the union nuts at the 6 o' clock position.
- Hold the screw connection body tight and tighten the union nuts with 1 ¼ turns to the 9 o' clock position.

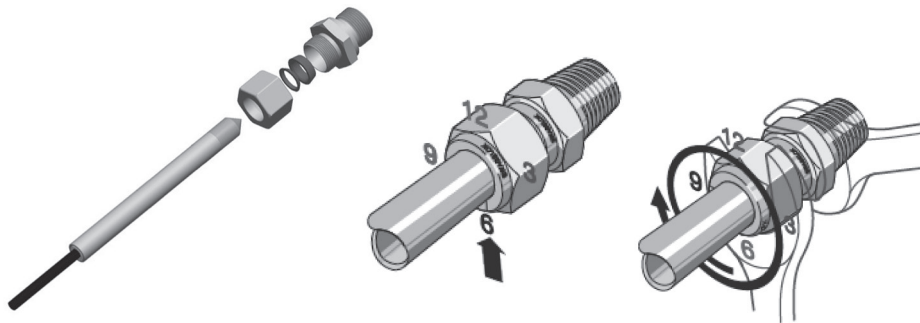


Fig. 19 Clamping ring installation

Assembly with high pressure applications and applications with a high security factor:

- Tighten the union nuts until the pipe can no longer be turned by hand or can no longer be moved axially in the fitting.
- Mark the union nuts at the 6 o' clock position.
- Hold the screw connection body tight and tighten the union nuts with 1 ¼ turns to the 9 o' clock position.

Re-mounting:

- Slide measurement sensor with clamping rings into the fitting as far as it will go.
- Tighten the nut "fingertight", then tighten by approx. a ¼ turn using a spanner.

4 Optional modules

4.1 Alarm module (option AM2, AM6)



For indoor use, surface mounted according NFPA 79 applications only.

The module offers two freely configurable relay outputs for alarm or control purposes. Various operation modes are available including hysteresis, window and error indication.

Max. switch load: 250 V AC / 6 A 28 V DC / 6 A
 Min. switch load: 12 V / 100 mA

No overcurrent and short circuit protection.
 Both relays shall be connected to either high or low voltage.

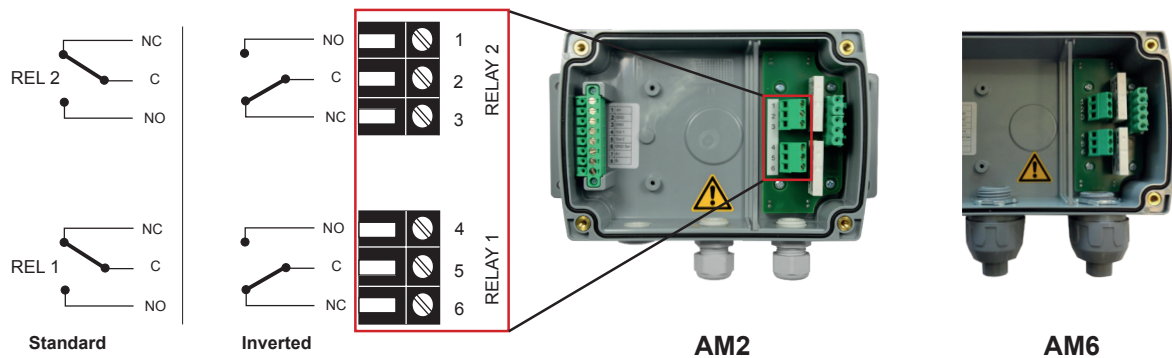


Fig. 20 Alarm module (option AM2, AM6)



AM6 In accordance with NFPA 70, NEC and with CSA C22.1, CEC, Part 1. A switch or circuit-breaker must be included in the installation. It must be marked as disconnecting device for the EE360. Disconnecting means all current-carrying conductors shall be disconnected. Additionally it must be suitably located and easily reached.



When error indication mode is selected, various errors will trigger the alarm output. An alarm output in this operation mode is used for error indication only.

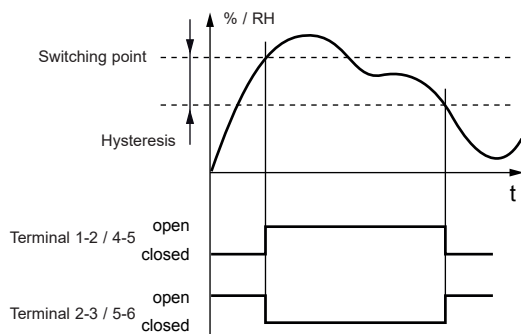


Fig. 21 Example hysteresis mode

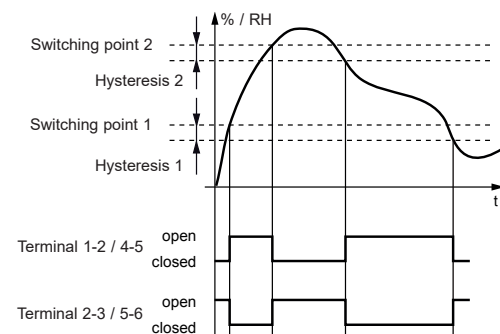


Fig. 22 Example window mode

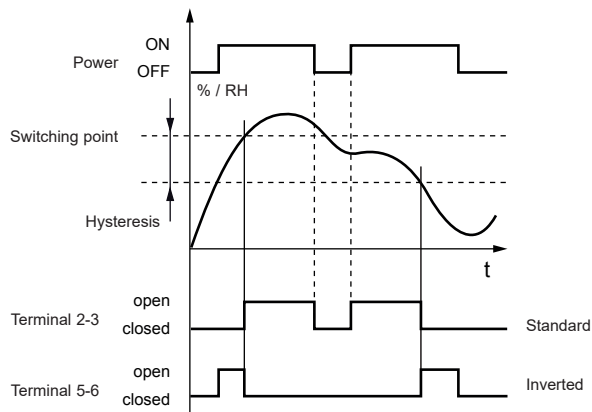
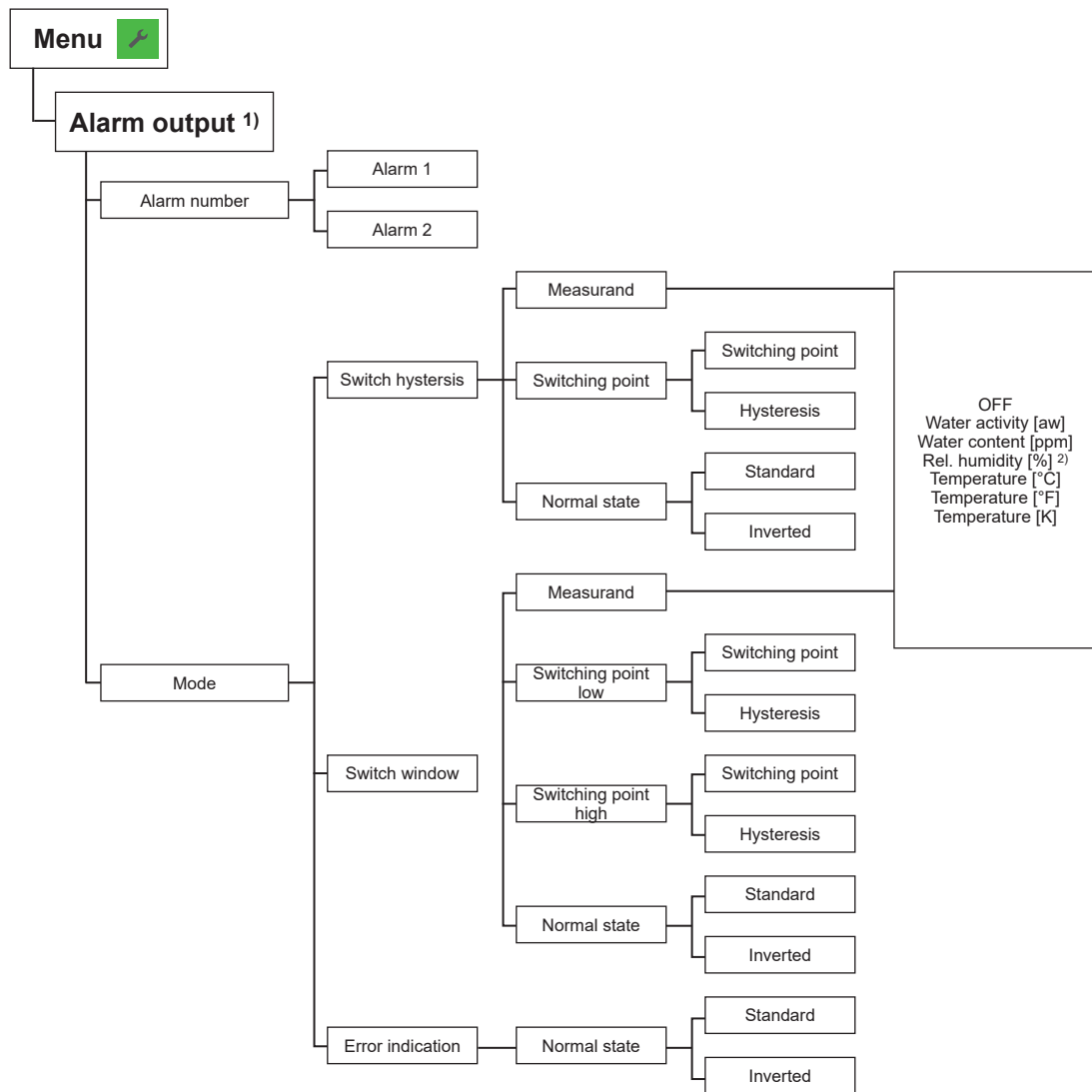


Fig. 23 Example of alarm in case of power supply failure using inverted alarm outputs.

The measurands at the outputs as well as switching points, hysteresis and the default state (standard / inverted) can be set via EE-PCS Product Configuration Software or using the display and the push buttons.



* Menu only available with connected alarm module during EE360 start-up

4.2 Integrated power supply 100...240 V AC (option AM3, AM5)



For indoor use, surface mounted according NFPA 79 applications only.

This module allows the EE360 to be powered with 100...240 V AC, 50/60 Hz, 2 VA.

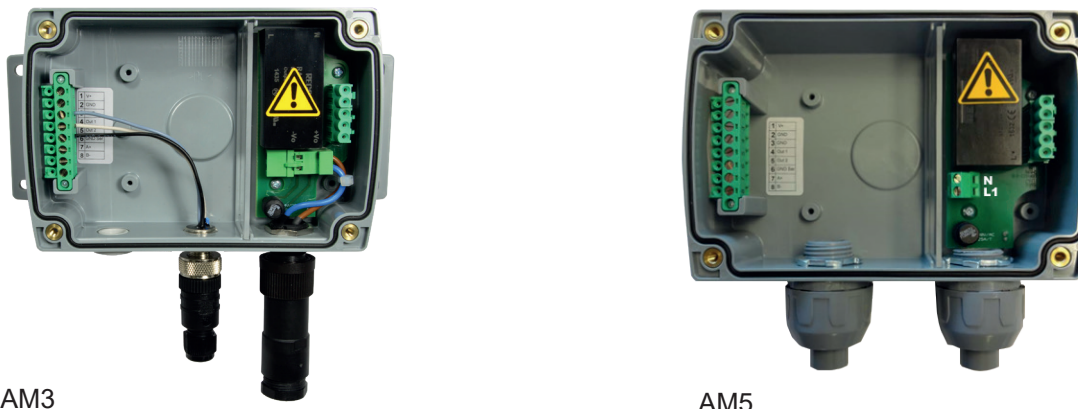


Fig. 24 Power supply module (option AM3, AM5)

Pin assignment of the plug connection see chapter 3.2.2 Connection diagram Option E4.



The AM3 and AM5 options include a 1.25 A time-lag fuse on the 100-240 V side. This fuse may not be replaced by the user, but only by the E+E Service.

The protection of the supply cable against excess current and short-circuit must be designated to a wire cross section of 0.8 mm² (AWG 18) (6A fuse). National regulations for installation must be observed!



AM5 In accordance with NFPA 70, NEC and with CSA C22.1, CEC, Part 1. A switch or circuit-breaker must be included in the installation. It must be marked as disconnecting device for the EE360.

Disconnecting means all current-carrying conductors shall be disconnected. Additionally it must be suitably located and easily reached.

4.3 RS485 Module - Modbus RTU (option J3)

Instructions for Modbus-Protocol-Setup please see Application Note AN0103 (www.epluse.com/EE360).

Up to 32 EE360 transmitters with Modbus RTU interface can be connected in a RS-485 bus system.

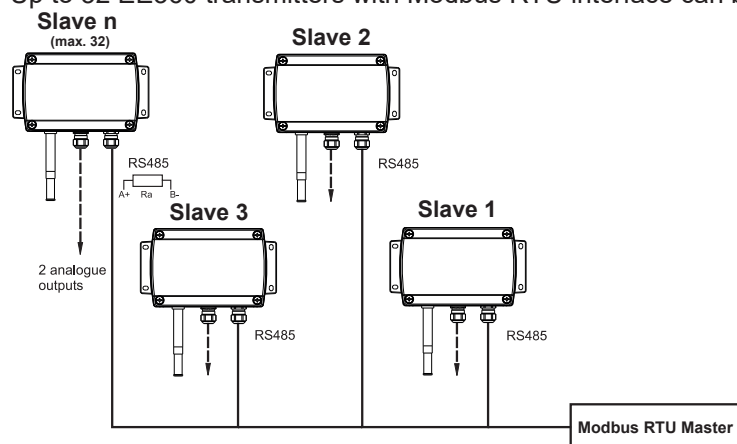
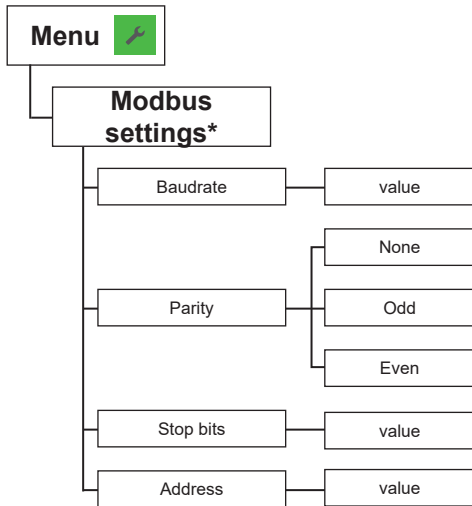


Fig. 25 Two wire RS485 network



Both ends of the network shall be terminated with a resistor $R_a=120\ \Omega$.

The setup of the Modbus RTU communication can be performed via EE-PCS Product Configuration Software or via display and push buttons.



* Menu only available with connected Modbus RTU module during EE360 start-up.

Data transmission

	Factory settings	Selectable values
Baud rate	9600	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 76800
Data bits	8	8
Parity	EVEN	None, odd, even
Stop bits	1	1 or 2
Slave address	231	1...247



The recommended setting for multiple devices in a Modbus RTU network is 9600 8 Even 1.

4.4 Modbus Map

Register [DEC]	Protocol address [HEX]	Measured value	Unit	Type
Read registers: function code 0x03 / 0x04				
31021	3FC	Relative humidity	%	32-bit float
31003	3EA	Temperature	°C	32-bit float
31005	3EC	Temperature	°F	32-bit float
31009	3F0	Temperature	K	32-bit float
31135	46E	Water activity	aw	32-bit float
31141	474	Water content	x	32-bit float
Write registers: function code 0x06 for 16-bit and 0x10 (decimal: 16) for 32-bit				
0001	0	Slave-ID	/	16-bit integer

5 Operation

5.1 Configuration interface

The transmitter can be used for configuration or calibration via the micro USB configuration interface. An additional supply is not necessary. After the USB cable is connected, the transmitter is initialised and the configuration is loaded. The green status LED flashes and indicates proper operation of the electronics.

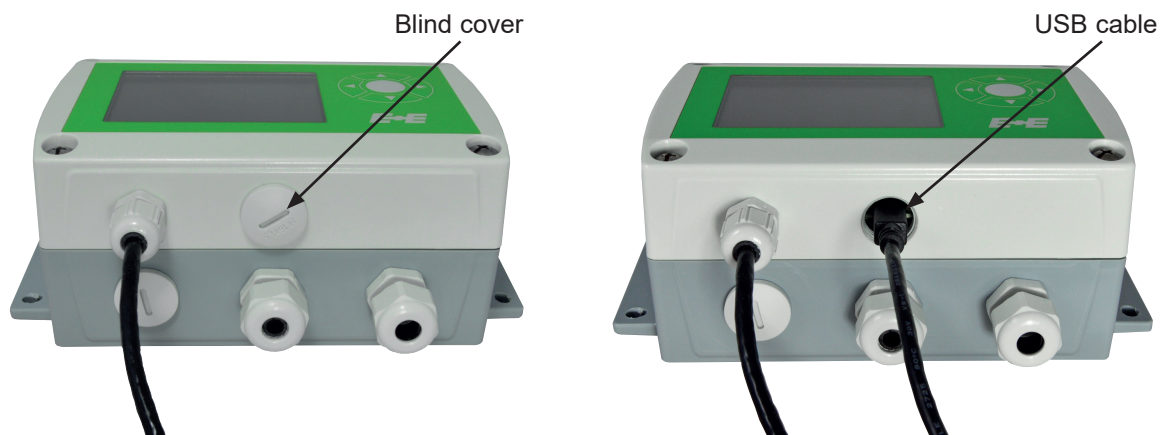


Fig. 26 Remove the blind cover and plug in the USB cable

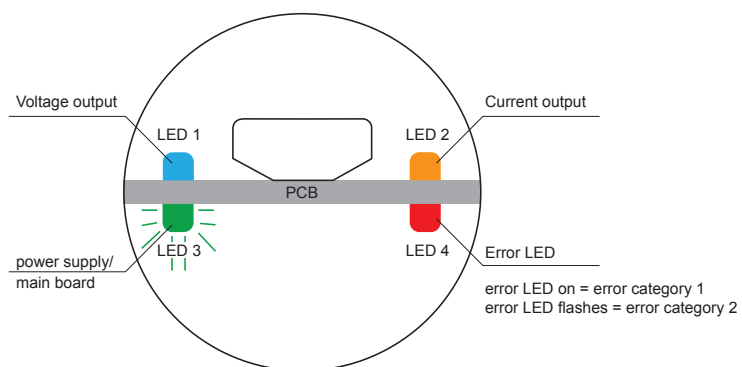


Fig. 27 Status LEDs are located at the USB port

5.2 3.5" TFT Colour Display (optional)

The EE360 display includes a data logger and push buttons for full configuration of the device. Upon start-up of an EE360 with display, the data logger and the configuration menu will be initialised during the first 5 seconds.

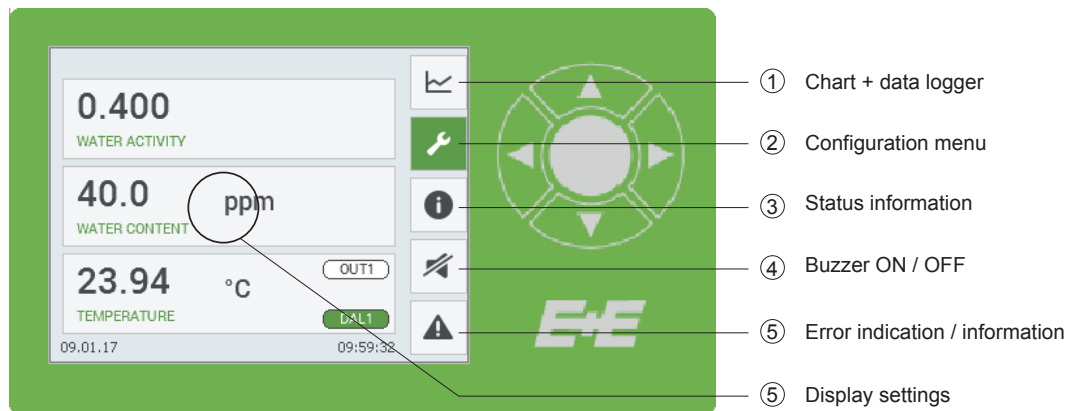


Fig. 28 Display with push buttons

5.3 Chart + Data logger

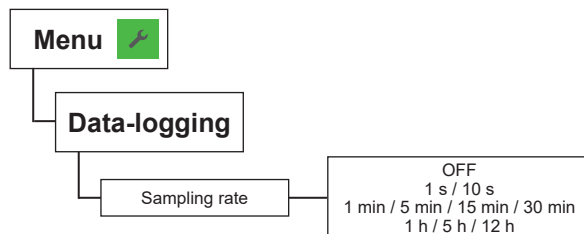
The TFT display with the integrated data logging function saves all measured and calculated values to the internal memory. The data logger has a real time clock (UTC time) with a battery back-up.



Changing the UTC time erases all stored data.

The data logger can save 20.000 values for each measurand. The logging interval is to be set by the user from 1 second to 12 hours.

The data logger setup can be performed via display and push buttons.



The data logger menu is also used to select the logged data to be shown as a graph as well as for scaling the graph.

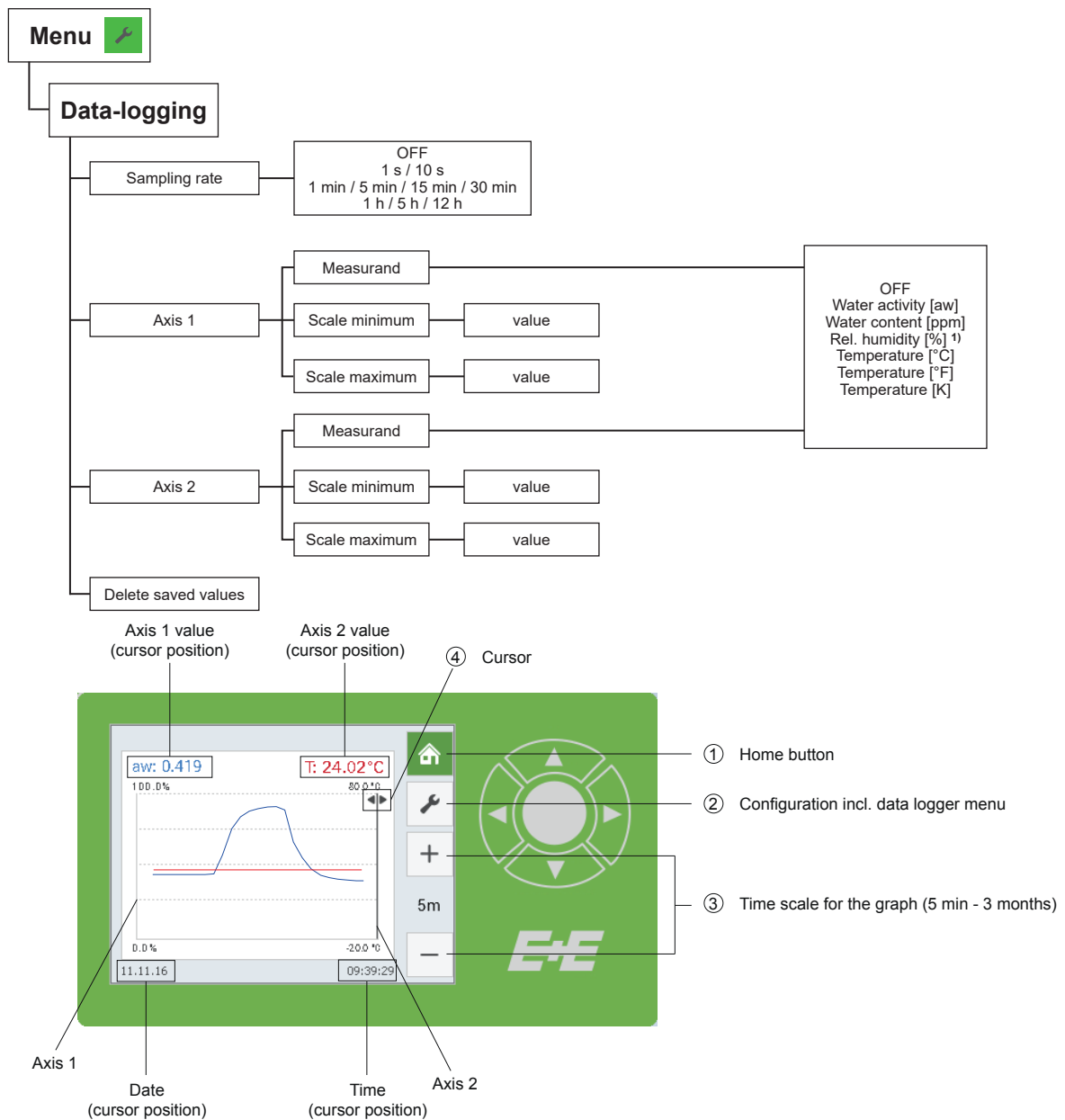
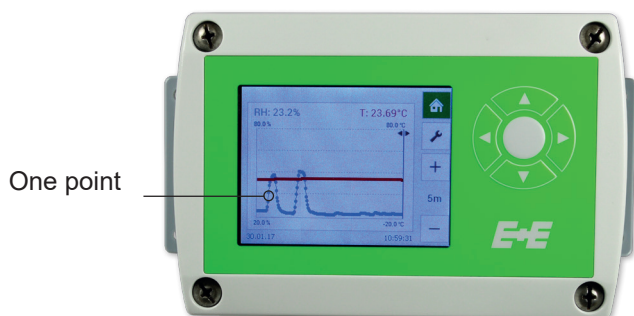


Fig. 29 Data logging

Each point in the graph represents a logged value. The points are connected by a linear interpolation.

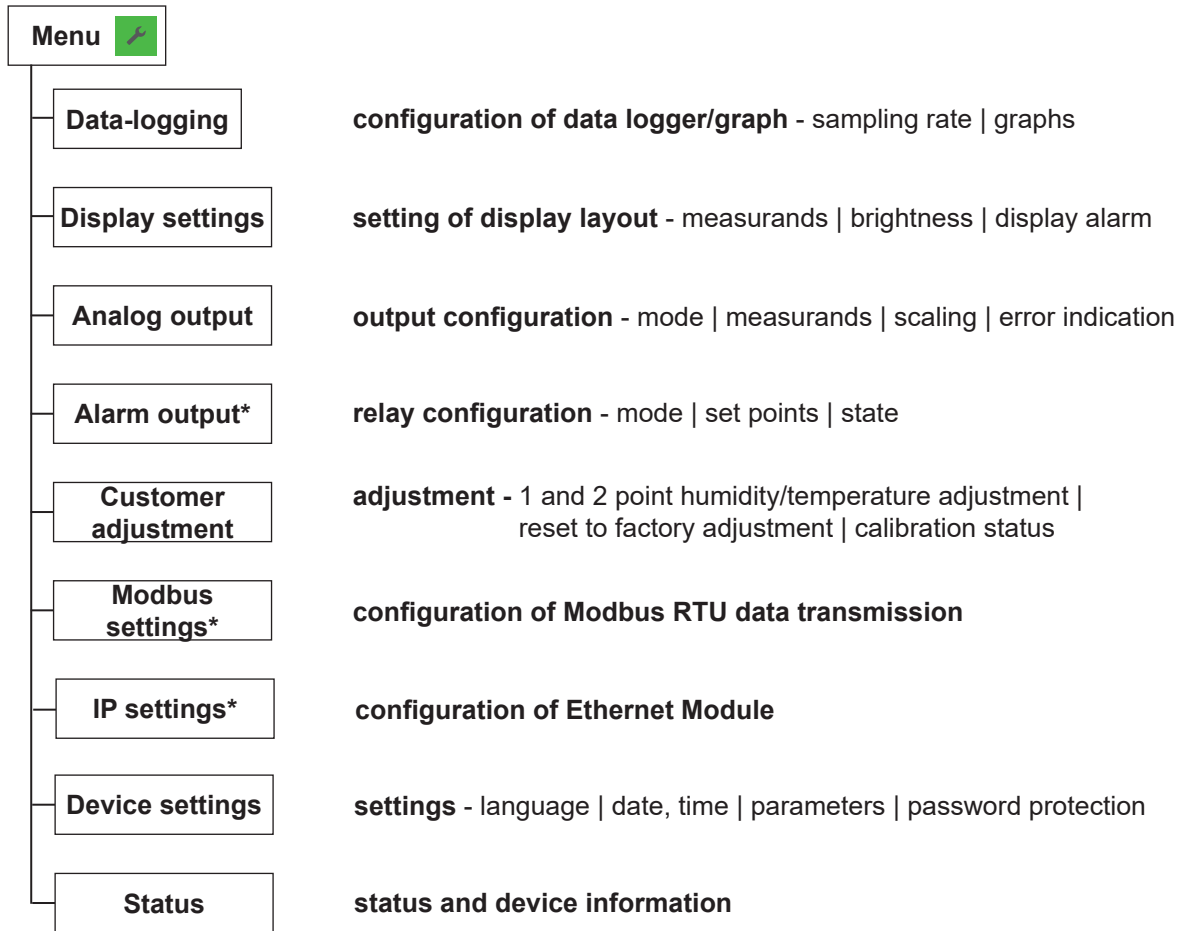


The data logging continues even when the data memory is full; new data is stored while the oldest data is deleted (first in first out memory). The last 20.000 logged values are available in the internal memory.

The logged data can be downloaded with EE-PCS Product Configuration Software as .csv file by choosing the measurands and the time period.

5.4 Configuration Menu

Detailed information to the configuration menu see chapter 10 Appendix.



* Menu only available with connected corresponding modules.

5.5 Status information

The status information shows all actual EE360 settings.

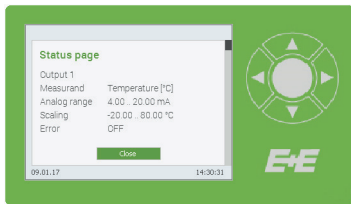


Fig. 30 Status information

5.6 Buzzer ON / OFF



Buzzer ON



Buzzer OFF

5.7 Error indication

When an error occurs, the error indication shows the error code.

6 Maintenance

6.1 Self diagnosis and error messages

6.1.1 Error messages via display

Error description	Error code (display)	Error category	Recommended action
Voltage out short circuit - output 1 only*	1.1	1	Check wiring of outputs
Voltage out short circuit - output 2 only*	1.2		
Voltage out short circuit - both outputs*	1.3		
Current loop open - output 1 only	2.1		Check wiring of outputs
Current loop open - output 2 only	2.2		
Current loop open - both outputs	2.3		
RH sensor dirty	3.x	2	Cleaning sensor
Hardware error	5.x		Return the faulty unit to E+E for service
	6.x		
	8.x		
Temperature measurement failure	7.x		
Humidity measurement failure	9.x		
	10.x		

* not available with 0 - 1 V output

Tab. 10 Overview of error codes

Error category 1 = non-critical error, can be solved by the user

- The display blinks and the buzzer beeps every 10 seconds.
- The red status LED lights continuously.

Error category 2 = critical error, return the device to E+E for service

- The display blinks and the buzzer beeps continuously.
- The red status LED flashes.

6.1.2 Error messages via LEDs

Four status LEDs placed on both sides of a PCB are located close to the USB service interface, under a blind cover.

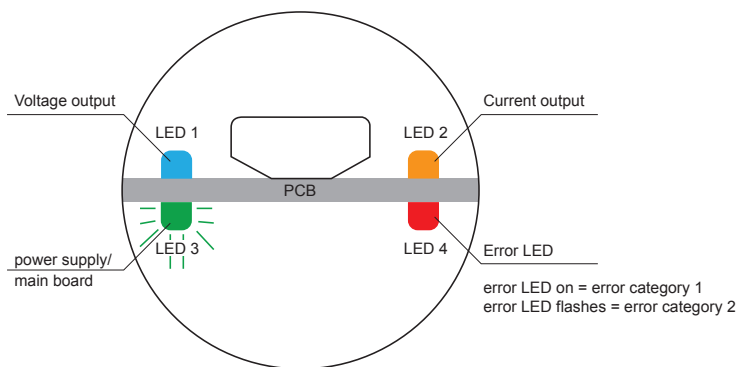


Fig. 31 Status LEDs

LED 1 (blue): analogue output is set to voltage.

LED 2 (orange): analogue output is set to current.

LED 3 (flashing green): supply voltage applied (microprocessor is active).

LED 4 (red): constant lit: error category 1
flashes: error category 2

6.1.3 Solving typical problems

Error description	Likely causes and solutions
Display shows incorrect values	Error during re-adjustment of the transmitter. → Reset to factory calibration and repeat the adjustment routine.
	Filter soiled → Replace filter
Long response time	Output configured incorrectly → check configuration
	Filter soiled → Replace filter
High humidity values - red LED blinks	Inappropriate filter type → Contact E+E representative for advice.
	Water in sensing head → Investigate the cause for water / condensation. Contact E+E representative for advice.
	Inappropriate filter type → Contact E+E representative for advice.

Tab. 11 Self diagnosis

6.2 Sensor replacement

A damaged capacitive humidity sensing element can be replaced by the user against an E+E replacement sensor, see chapter 8 *Replacement parts / Accessories*.

Sensor replacement procedure:

- Switch off supply voltage.
- Loosen the lock of the filter cap with an appropriate tool (see Fig. 32 *Loosen the lock of the filter cap*).
- Remove the filter cap from the tip of the probe with utmost care not to touch the sensors.
- Solder off the damaged humidity sensing element.
- Shorten the leads of the replacement sensor from 10 mm / 0.39" to 6 mm / 0.24".
- Solder in the new humidity sensor, the active side shall face the temperature sensor.
- Screw on a new filter cap with utmost care not to touch the sensors.
- Fix the filter cap by pressing in the lock.
- Perform a 2 point humidity adjustment of the EE360 with the EE-PCS Product Configuration Software or with the display and push buttons.

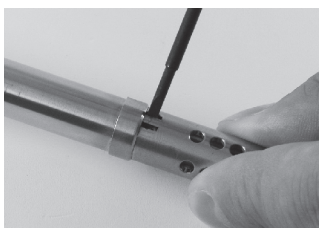


Fig. 32 Loosen the lock of the filter cap

6.3 Cleaning the sensing head / filter replacement

In case of dusty, oily and polluted environment:

- The filter cap shall be replaced once in a while with an E+E original one. A polluted filter cap causes longer response time of the device.
- If needed, the sensing head can be cleaned. For cleaning instructions please see www.epluse.com/EE360.

6.4 RH / T adjustment and calibration

Humidity calibration and adjustment

Depending on the application and the requirements of certain industries, there might arise the need for periodical humidity calibration (comparison with a reference) or adjustment (bringing the device in line with a reference).

Calibration and adjustment at E+E Elektronik

Calibration and/or adjustment can be performed in the E+E Elektronik calibration laboratory. For information on the E+E capabilities in ISO or accredited calibration please see www.eplusecal.com.

Calibration and adjustment by the user

Depending on the level of accuracy required, the humidity reference can be:

- Humidity Calibrator (e.g. Humor 20), please see www.epluse.com/humor20.
- Handheld device (e.g. Omniport30), please see www.epluse.com/omniport30.
- Humidity calibration Kit (e.g. E+E Humidity Standards), please see www.epluse.com/EE360.

Perform 1 or 2 point adjustment via EE-PCS Product Configuration Software or via display (details see below).

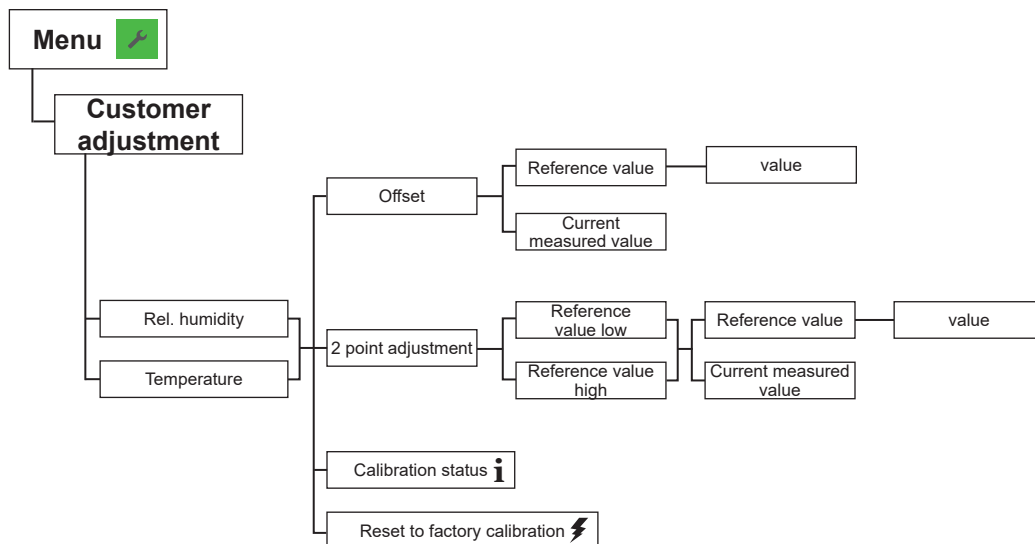


Fig. 33 Adjustment menu

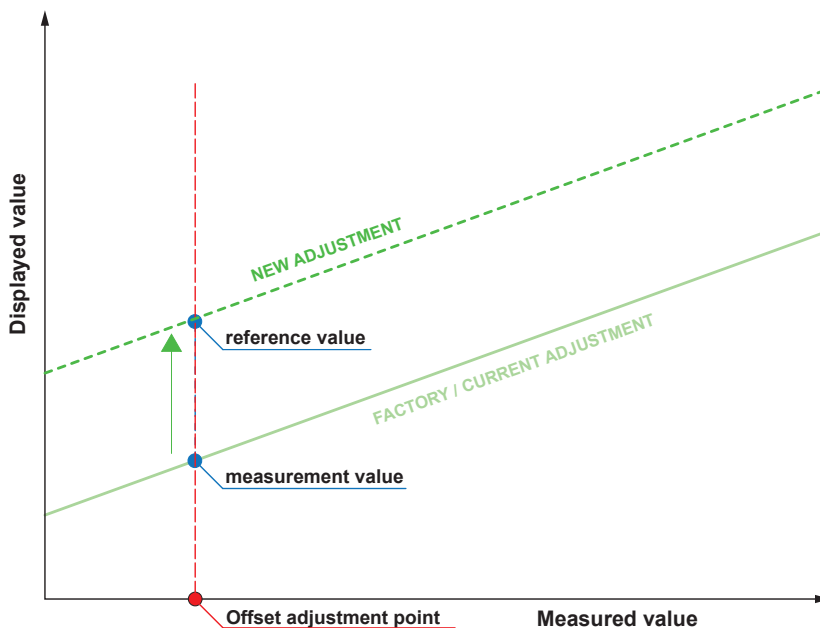


Fig. 34 Offset adjustment

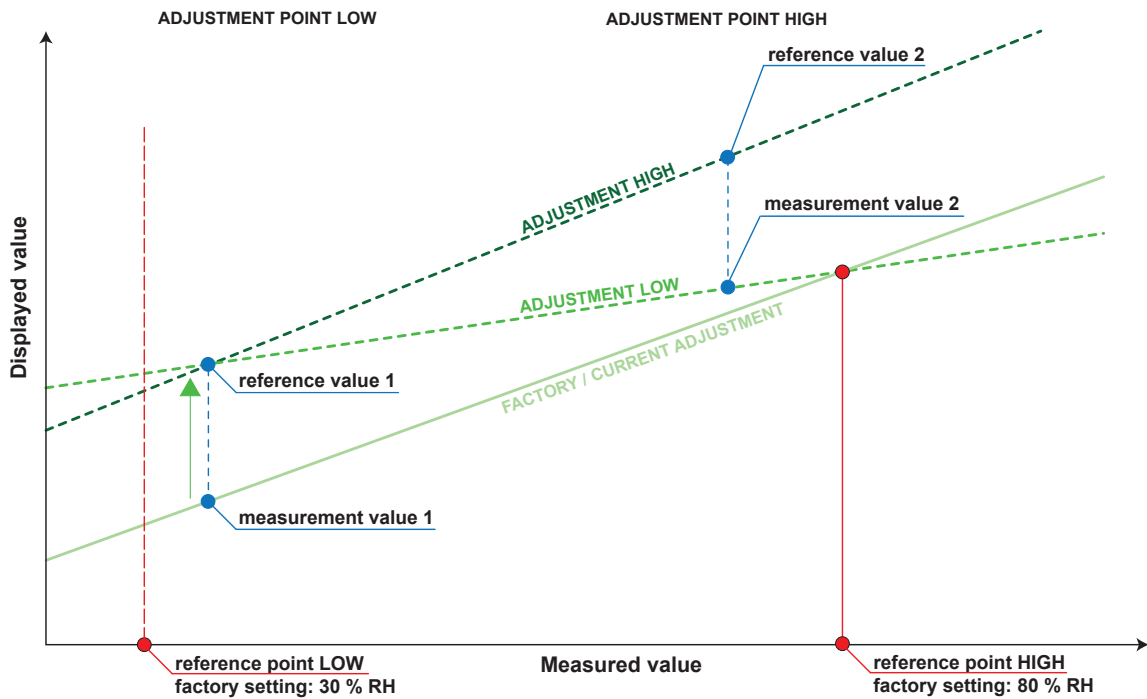


Fig. 35 2 point adjustment procedure

7 Replacement Parts / Accessories

see data sheet "Accessories"

Description

- Replacement oil filter cap
- Replacement humidity sensor
- Bracket for installation onto mounting rails 1)
- Investigation of oil specific parameters
- Humidity calibration kit
- Ball valve set 1/2" ISO
- Ball valve set 1/2" NPT
- RS485 add-on chip 2)

Order code

HA010110
 FE09
 HA010203
 ppm-cal
 refer to data sheet „Humidity calibration kit“
 HA050101
 HA050104
 HA010605

1) 2 pieces necessary per device.

2) For upgrade to Modbus RTU interface.

8 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
Two self-adhesive labels for configuration changes (see user guide at www.epluse.com/relabeling)	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

Tab. 12 Scope of supply

9 Technical Data

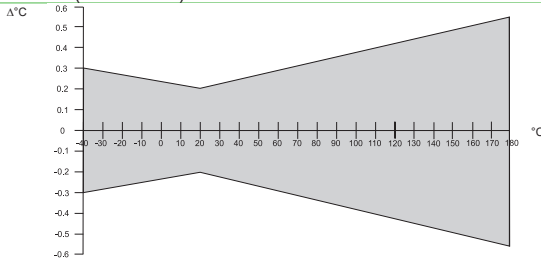
Measuring values

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 4 - 20 mA	-1 mA < I _L < 1 mA R _L < 500 Ohm
Digital interface	RS485 with Modbus RTU, up to 32 devices in one bus	

General

Power supply	Indoor use: 8...35 V DC (LPS), min. 75 °C (167 °F) 12...30 V AC, 50/60 Hz (Class 2 supply), min. 75 °C (167 °F) 100...240 V AC, 50/60 Hz with option AM3, AM5 ³⁾ , min. 75 °C (167 °F) Outdoor use: 8...35 V DC (LPS), min. 75 °C (167 °F) 12...16 V AC, 50/60 Hz (Class 2 supply), min. 75 °C (167 °F) 100...240 V AC, 50/60 Hz with option AM5 ³⁾ , min. 75 °C (167 °F)
--------------	--

Power consumption	8...35 V DC max. 2 W (LPS) 12...30 V AC max. 4 VA (Class 2 supply) Including 2 voltage or current outputs, display and relay option AM2 or AM6
-------------------	--

	AM3 and AM5 option max. 5 VA Including 2 voltage or current outputs and display option
--	---

Pressure range for pressure tight probe	0.01...100 bar (0.15...1450 psi)
Probe material	stainless steel (1.4404 / AISI 316L)
Enclosure material	Polycarbonate UL94-V0
Protection class	IP65 ⁴⁾ , UL Type 4 ⁵⁾
Electrical connection	screw terminals max. 1.5 mm ² (AWG 16)
Working and storage temperature range	-40...60 °C (-40...140 °F) without display -20...50 °C (-4...122 °F) with display

Electromagnetic compatibility	EN61326-1 EN61326-2-3 ICES-003 ClassA Industrial Environment FCC Part15 ClassA
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Compliance	United States: UL Listed, CCN QUXX, Under UL 61010-1, Process Control Equipment; FCC Compliant to CFR47, Part 15, Subpart B, Class A Canada: UL Listed, CCN QUXX7, Under CSA C22.2 No. 61010-1, Signal Equipment; Industry Canada Compliant, ICES-003
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Alarm outputs (2 relays AM2, AM6 ³⁾)	250 V AC / 6 A, min. 90 °C (194 °F) 28 V DC / 6 A, min. 90 °C (194 °F)
System requirements for EE-PCS software	Windows XP or higher; USB port

1) Refer to the working range humidity sensor on next page.

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) Appropriate for outdoor use, wet location, degree of pollution 2, overvoltage category II, altitude up to 3000 m (9843 ft).

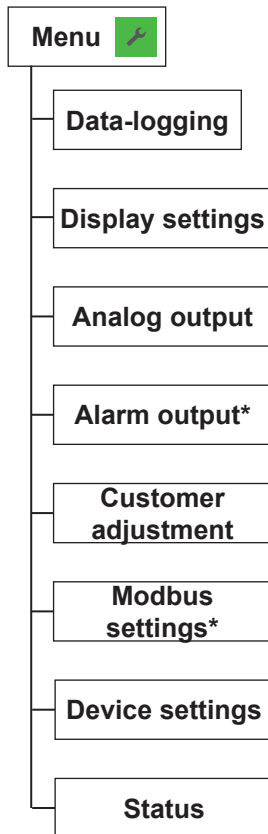
4) IP65 not evaluated by UL.

5) Plastic enclosure, without M12 plug (E4, E5, E6, E12), conduit fitting E23, option D2, AM2, AM3

10 Appendix

10.1 Appendix A

Overview

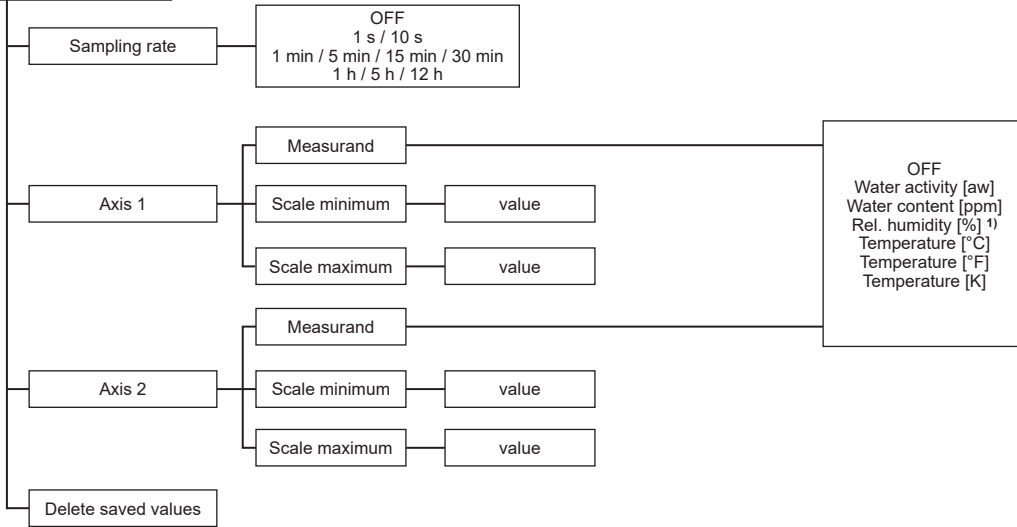


* Menu only available with connected modules.

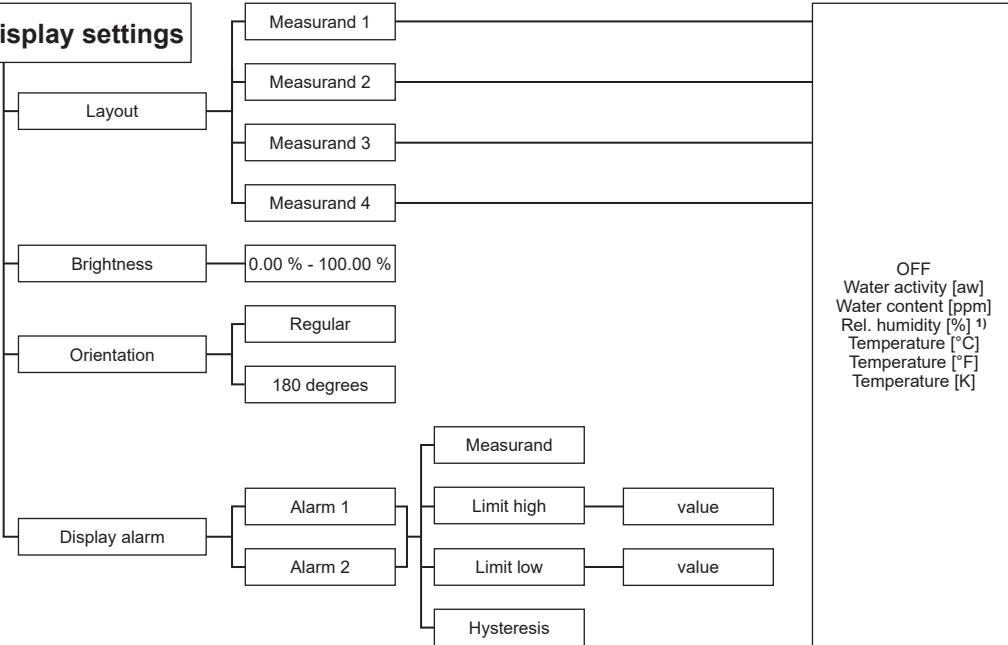
Detailed information

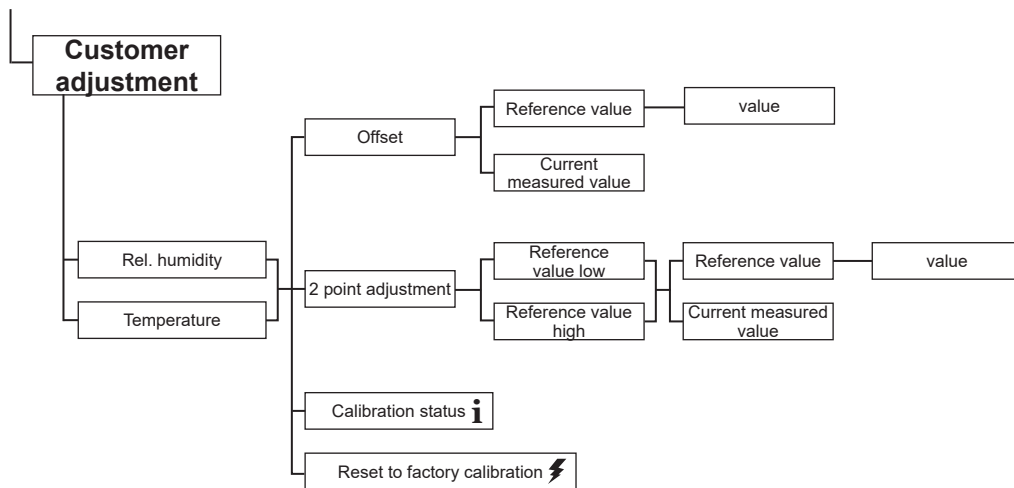
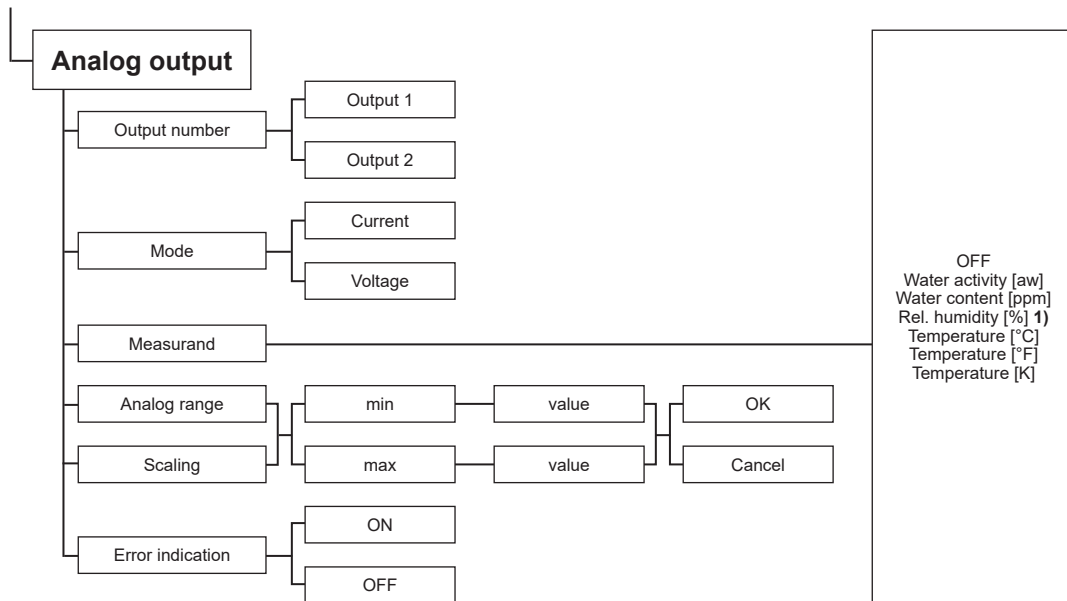
Menu 

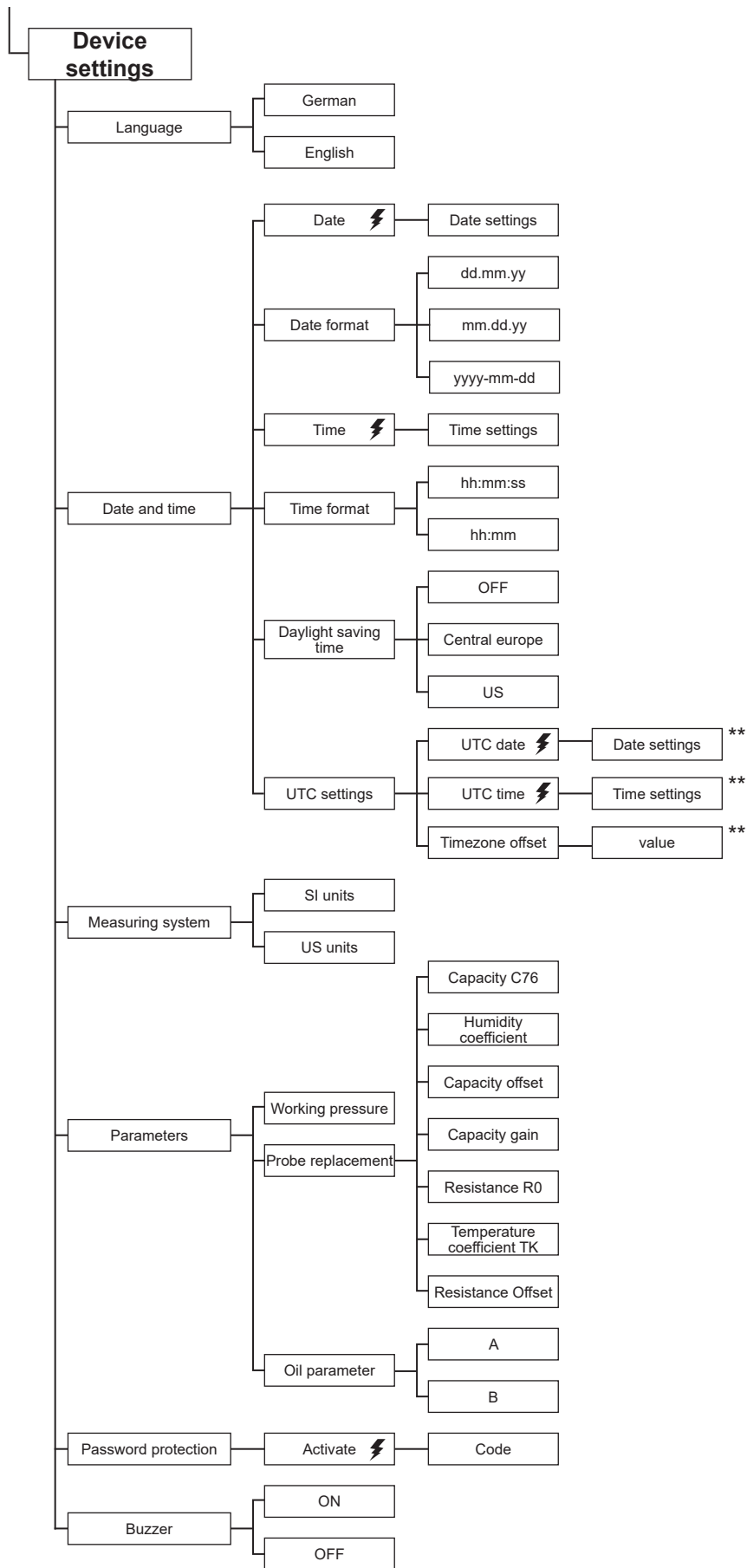
Data-logging

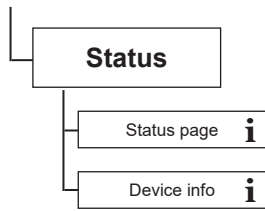


Display settings









Optional menu (only available with plugged in modules during the start up procedure)

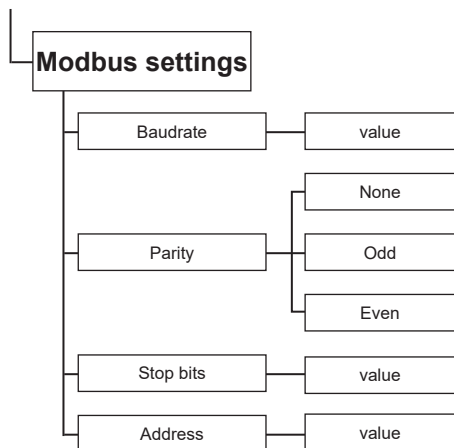
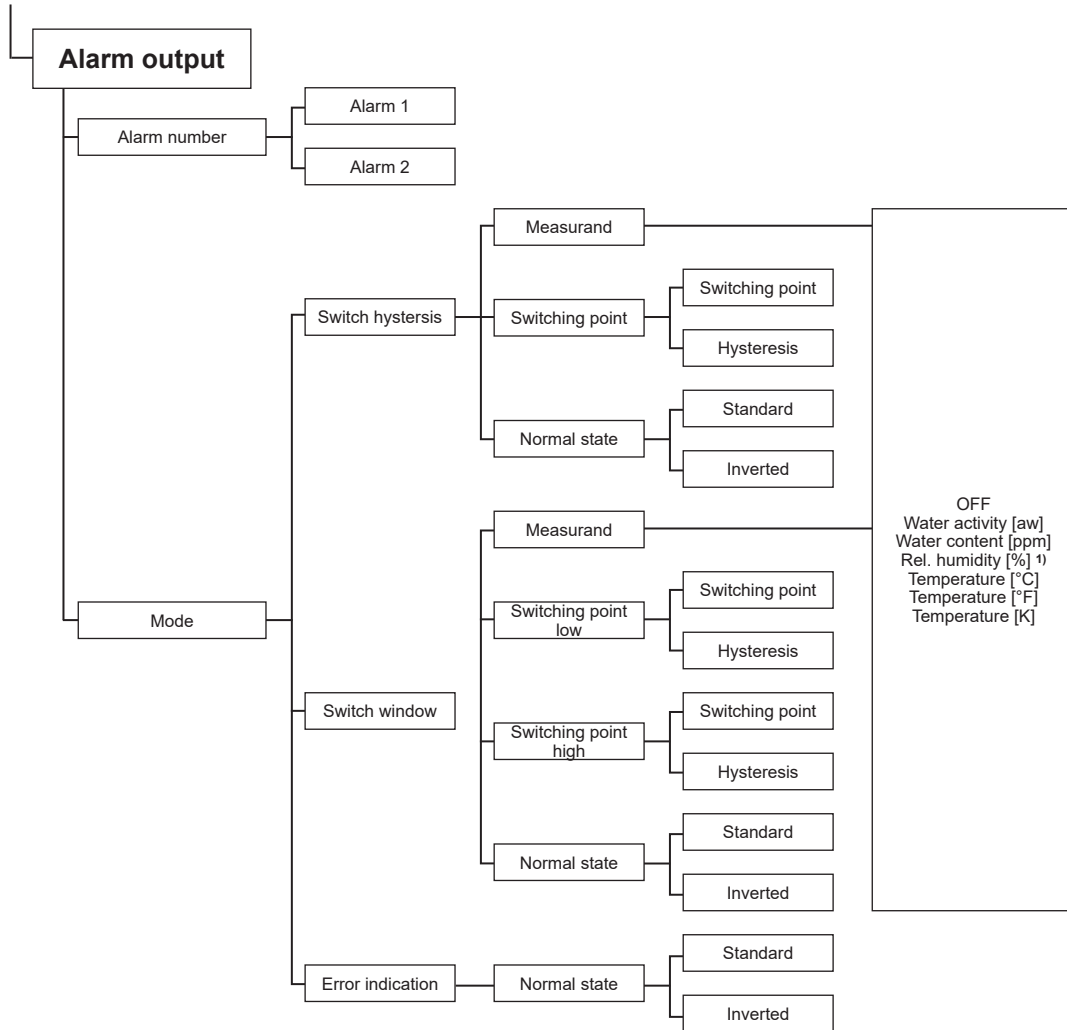


Fig. 36 Configuration menu

11 Ordering Guide

		EE360-				
Hardware Configuration	Approval	without UL-Approval	no code AP1			
	Type	remote probe up to 180 °C (356 °F) remote probe up to 180 °C (356 °F) and 20 bar (300 psi) remote probe up to 180 °C (356 °F) and 100 bar (1435 psi)	T5	no code	T8	
	Filter	plastic - PTFE membrane (up to 180 °C / 356 °F) plastic - metal grid (up to 120 °C / 248 °F) stainless steel sintered PTFE stainless steel - metal grid (up to 180 °C / 356 °F) H ₂ O ₂ oil oil (short)	F2 F3 F4 F5 F9 F12 no code F16			
	Cable length (incl. probe length)	0.5 m (1.64 ft) 1 m (3.3 ft) 2 m (6.6 ft) 5 m (16.4 ft) 10 m (32.8 ft) 20 m (65.6 ft)	K0.5 K1 no code K5 K10 K20			
	Probe length	50 mm (2") 65 mm (2.55") 100 mm (3.9") 200 mm (7.9") 300 mm (11.7") 400 mm (15.8") 600 mm (23.6") 800 mm (31.5") 1000 mm (39.4")	L50 L65 L100 no code L300 L400 L600 L800 L1000	L65 L100 no code L300 L400 L600 L800 L1000	L65 L100 no code L300 L400 L600 L800 L1000	
	Electrical connection ¹⁾	1/2" ISO - cut in fitting; 12 mm (0.47") 1/2" weld - cut in fitting; 12 mm (0.47") 1/2" NPT - cut in fitting; 12 mm (0.47") 1/2" ISO - cut in fitting; 13 mm (0.51") 1/2" weld - cut in fitting; 13 mm (0.51") 1/2" NPT - cut in fitting; 13 mm (0.51")	PA20 PA21 PA22 PA23 no code PA25			
	Optional features	cable glands 1 plug for power supply and outputs 1 cable gland / 1 plug for Modbus RTU 2 plugs for power supply / outputs and for Modbus RTU 3 plugs for power supply / outputs and Modbus RTU conduit fitting liquid-tight 1/2" conduit fitting	no code E4 E5 E6 E12 E23 E24			
	Optional features	TFT colour display with integrated data logger ²⁾ Modbus RTU alarm outputs ^{3) 4)} alarm outputs ^{4) 6)} liquid-tight 1/2" conduit fitting integrated power supply 100...240 V AC, 50/60 Hz ^{4) 5)} integrated power supply 100...240 V AC, 50/60 Hz ^{4) 7)} liquid-tight 1/2" conduit fitting	D2 J3 AM2 AM6 AM3 AM5			
	Setup - Analogue outputs	Output 1	water activity aw [] other measurand (xx see Measurand Code below)	no code MAxx		
		Output Signal 1	0-1 V 0-5 V 0-10 V 0-20 mA 4-20 mA	GA1 GA2 GA3 GA5 GA6		
Scaling 1 low		0 value	no code SALvalue			
Scaling 1 high		1 value	no code SAHvalue			
Output 2		temperature T [°C] temperature T [°F] other measurand (xx see Measurand Code below)	no code MB2 MBxx			
Output Signal 2		0-1 V 0-5 V 0-10 V 0-20 mA 4-20 mA	GB1 GB2 GB3 GB5 GB6			
Scaling 2 low		value	SBLvalue			
Scaling 2 high		value	SBHvalue			

1) Plug options E5 / E6 / E12 only in combination with Modbus RTU 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) Alarm output with cable glands

4) Combination of alarm output and integrated power supply is not possible

5) Integrated power supply includes 2 plugs for power supply and outputs

6) Alarm output with two 1/2" liquid-tight conduit fittings

7) Integrated power supply with two 1/2" liquid-tight conduit fittings

11.1 Measurand Code

		MAxx / MBxx
Temperature	°C	1
	°F	2
Water activity	aw	67

		MAxx / MBxx
Water content x in mineral transformer oil	ppm	70
Water content x in customer specific oil	ppm	70PPMxxx



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E+E ELEKTRONIK Ges.m.b.H.

www.epluse.com
Langwiesen 7
A-4209 Engerwitzdorf
Austria
Tel: +43 7235 605 0
Fax: +43 7235 605 8
info@epluse.com

TECHNICAL OFFICES

E+E CHINA
www.epluse.cn

BEIJING
Tel: +86 10 84992361
info@epluse.cn

SHANGHAI
Tel: +86 21 61176129
info@epluse.cn

E+E GERMANY
www.epluse.de
Tel: +49 6172 13881 0
info@epluse.de

E+E FRANCE
www.epluse.fr
Tel: +33 4 7472 35 82
info@epluse.fr

E+E ITALY
www.epluse.it
Tel: +39 02 2707 8636
info@epluse.it

E+E KOREA
www.epluse.co.kr
Tel: +82 31 732 6050
info@epluse.co.kr

E+E USA
www.epluse.com
Tel: +1 508 530 3068
office@epluse.com

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