User Manual

EE33

Humidity / Temperature Sensor for High Humidity and Chemical Applications

YOUR PARTNER IN SENSOR TECHNOLOGY

E+E ELEKTRONIK® Ges.m.b.H.

E+E Elektronik Ges.m.b.H. does not accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.

The document may contain technical inaccuracies and typographical errors. The content will be revised on a regular basis. These changes will be implemented in later versions. The described products can be improved and changed at any time without prior notice.

EMC note USA (FCC):

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.

EMC note Canada (ICES-003):

CAN ICES-3 (A) / NMB-3 (A)

CONTENT

1 General

This user manual serves for ensuring proper handling and optimal functioning of the device. The user manual shall be read before commissioning the equipment and it shall be provided to all staff involved in transport, installation, operation, maintenance and repair. The user manual may not be used for the purposes of competition without the written consent of E+E Elektronik and may not be forwarded to third parties. Copies may be made for internal purposes. All information, technical data and diagrams included in these instructions are based on the information available at the time of writing.

Please find this document and further product information on our website at www.epluse.com/ee33.

Disclaimer
The manufacturer or his authorized agent can be only be held liable in case of willful or gross negligence. In any case, the scope of liability is limited to the corresponding amount of the order issued to the manufacturer. The manufacturer assumes no liability for damages incurred due to failure to comply with the applicable regulations, operating instructions or the specified operating conditions. Consequential damages are excluded from the liability.

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 Safety Instructions

- Avoid any unnecessary mechanical stress and inappropriate use.
- When replacing the filter cap make sure not to touch the sensing elements.
- The device must be operated with the filter cap on at all times.
- For sensor cleaning and filter cap replacement please see “Cleaning Instructions” at www.epluse.com.
- Installation, electrical connection, maintenance and commissioning shall be performed by qualified personnel only.
- The devices are designed for the operation with class III supply (EU) and class 2 supply (NA).
- The power supply must be switched off before opening the housing.
- Use the EE33 only as intended and observe all technical specifications.
- Do not use EE33 in explosive atmosphere
- This device is not appropriate for safety, emergency stop or other critical applications where device malfunction or failure could cause injury to human beings.

1.2.2 Alarm Module with Voltages >50V (Option AM2)

- The optional alarm module is isolated from the low-voltage side of the EE33 by a special partition; this must remain fitted at all times in the back section of the enclosure.
- The EE33 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.

1.2.3 Integrated power supply 100 - 240 V AC (Option AM3)

- The EE33 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.

1.2.4 Intended Use

The EE33 sensors are designed to meet the highest demands of stable and highly precise measurements of relative humidity (RH) and temperature (T) under the most challenging conditions. EE33 is suitable for a wide range of applications from -40 °C (-112 °F) up to 180 °C (356 °F) and 100 bar (1 450 psi).

With different heating modes of the monolithic RH and T sensing element EE33 can be perfectly tailored to the specific needs of each measuring task.

The device may only be powered as decried in this manual.

The use of the EE33 in any other way than described in this manual bears a safety risk for people and the entire measurement installation and is therefore not allowed.
The manufacturer cannot be held responsible for damages as a result of incorrect handling, installation, and maintenance of the equipment.

In order to avoid damage to the instrument or health hazards, the measuring equipment must never be manipulated with tools that are not specifically described in this manual.

The sensor may only be utilized in accordance with the conditions defined in the technical data. Otherwise, measurement inaccuracies will occur and equipment failures cannot be ruled out.

The steps recommended by the manufacturer for installation, inspections and maintenance work must be observed and carried out for the safety of the user and for the functionality of the equipment.

Unauthorized product modification leads to loss of all warranty claims. This may be accomplished only with an explicit permission of E+E Elektronik!

1.2.5 Mounting, Start-up and Operation

The EE33 humidity and temperature sensor has been produced under state of the art manufacturing conditions, has been thoroughly tested and has left the factory after fulfilling all safety criteria. The manufacturer has taken all precautions to ensure safe operation of the device. The user must ensure that the device is set up and installed in a manner that does not have a negative effect on its safe use. The user is responsible for observing all applicable safety guidelines, local and international, with respect to safe installation and operation on the device. This user manual contains information and warnings that must be observed by the user in order to ensure safe operation.

- Mounting, start-up, operation and maintenance of the device may be performed by qualified staff only. Such staff must be authorized by the operator of the facility to carry out the mentioned activities.
- The qualified staff must have read and understood this user manual and must follow the instructions contained within.
- All process and electrical connections shall be thoroughly checked by authorized staff before putting the device into operation.
- Do not install or start-up a device supposed to be faulty. Make sure that such devices are not accidentally used by marking them clearly as faulty.
- A faulty device may only be investigated and possibly repaired by qualified, trained and authorized staff. If the fault cannot be fixed, the device shall be removed from the process.
- Service operations other than described in this user manual may only be performed by the manufacturer.

1.3 Environmental Aspects

Products from E+E Elektronik are developed and manufactured in compliance with all relevant environmental protection requirements. 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 ESD Protection

The sensing elements and the circuit board are ESD (electrostatic discharge) sensitive components of the device and must be handled as such. The failure to do so may damage the device by electrostatic discharges when touching exposed sensitive components.

3 Scope of Supply

	Included in all versions	With option
EE33 according to ordering guide	✓	
Manual EE33	✓	
Inspection certificate according to DIN EN 10204-3.1	✓	
Allen key 3.0		HS3
Mating plug for integrated power supply		AM3
Mating plug RKC 5/7		AM3 / E4 / E7
Y-junction for network connection		E7 & J3
Mating plug RSC 5/7		E5 / E7
M16 cable gland metal		except for Options E4 / E5 / E7 / AM3
Cut in fitting		EE33-M1T8

4 Product Description

The EE33 is available with 7 remote probe types in various probe and cable lengths. (Please refer to chapter 4.2 for dimensions)

Probe Type	Description
T4	Remote probe up to 120 °C (248 °F)
T5	Remote probe up to 180 °C (356 °F)
T10	Remote probe, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F), with sliding fitting
T8	Remote probe, pressure tight up to 100 bar (1 450 psi) and 180 °C (356 °F), with cut in fitting
T17	Two remote probes, pressure tight up to 20 bar (300 psi) and 180°C (356 °F), with optional cut in fitting
T7	Remote probe for cut-in fitting, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F) with optional cut in fitting
T28	Two remote probes, for meteorological applications

The employed high-end E+E RH and T sensing element is heated autonomously and enables reliable and long-term stable measurements in extremely humid or chemically polluted environments. The monolithic structure of the RH/T sensing element ensures a fast return to normal conditions after condensation or chemical contamination. In addition it is perfectly protected by the E+E proprietary coating.

With a special high-pressure probe the sensor can be used at process pressures up to 100 bar (1 450 psi).

Different heating modes of the monolithic RH and T sensing element allow for best adaption to the specific needs of each measuring task. Furthermore types T7 and T17 offer a dual heating system (Probe body and sensing element are heated) to prevent condensation on the RH sensing element and on the probe body for continuous high humidity operation.

Function	Comment	EE33
Measurement of RH and T		✓
Calculation of h, r, dv, Tw, Td, Tf, e		✓
2 freely scaleable and configurable analogue outputs		✓
On-site adjustment for RH and T		✓
LED indication of sensor status / error diagnosis of probes		✓
RS232 for sensor configuration via PC		✓
2 freely configurable alarm outputs	optional	✓
Data output via RS232 interface		✓
Data output via RS485 interface	optional	✓
RS485 for networking with up to 32 devices	optional	✓
Alternating display with MIN/MAX indication	optional	✓
Connectable sensing probe	optional	✓
ARC module for external triggering of sensor heating	optional	✓

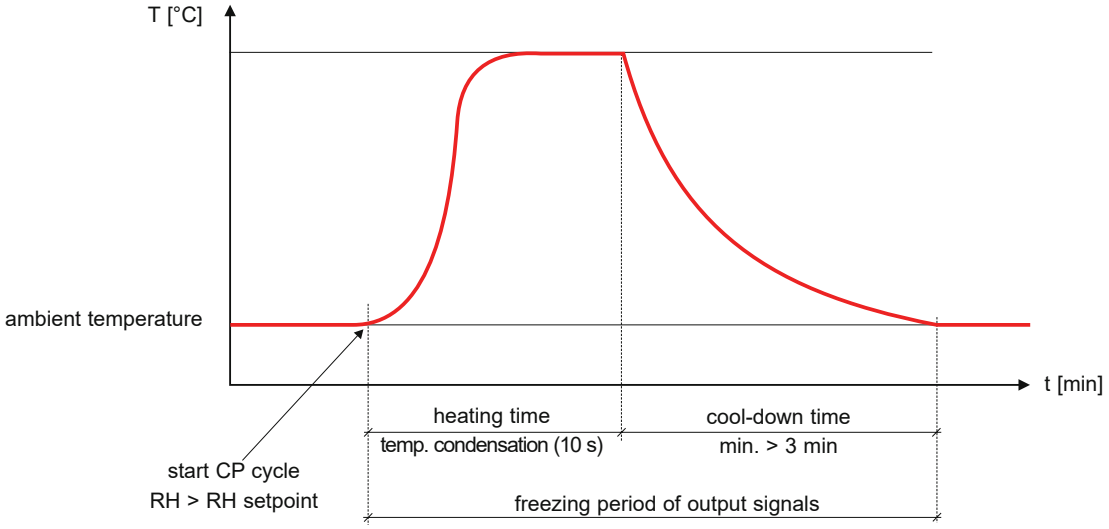
4.1 Heating Modes

4.1.1 Condensation Prevention (CP) Against Temporary Condensation

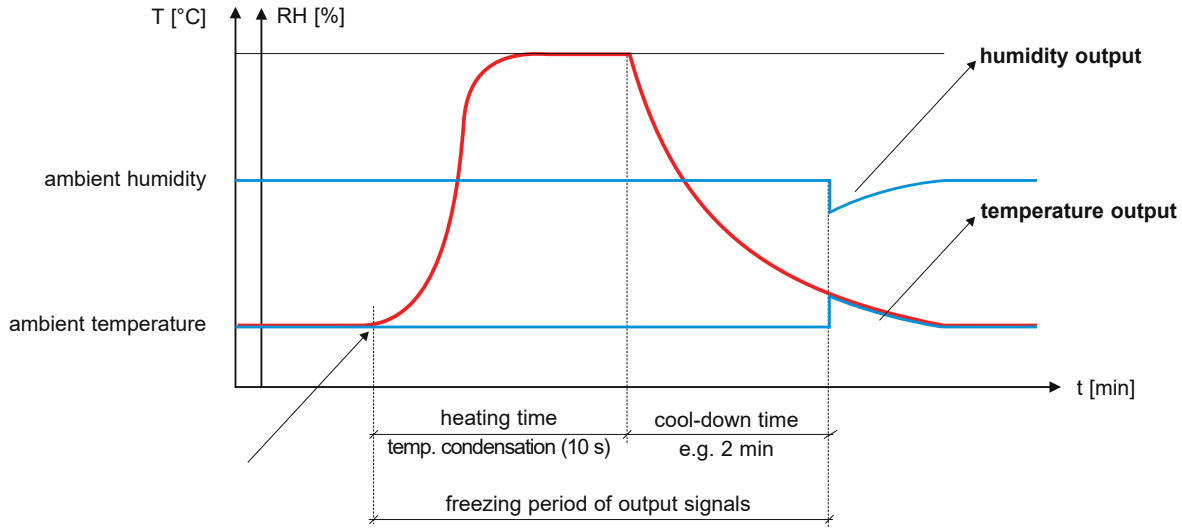
Temporary condensation on the sensing element in highly humid environments is eliminated when a specified RH set point (factory setting: 99 %RH) is reached. By intensive heating of the sensing element for 10 seconds occurring dew is evaporated. Thanks to its monolithic structure, the sensing element cools off quickly within approximately 3 minutes and returns to its measurement function.

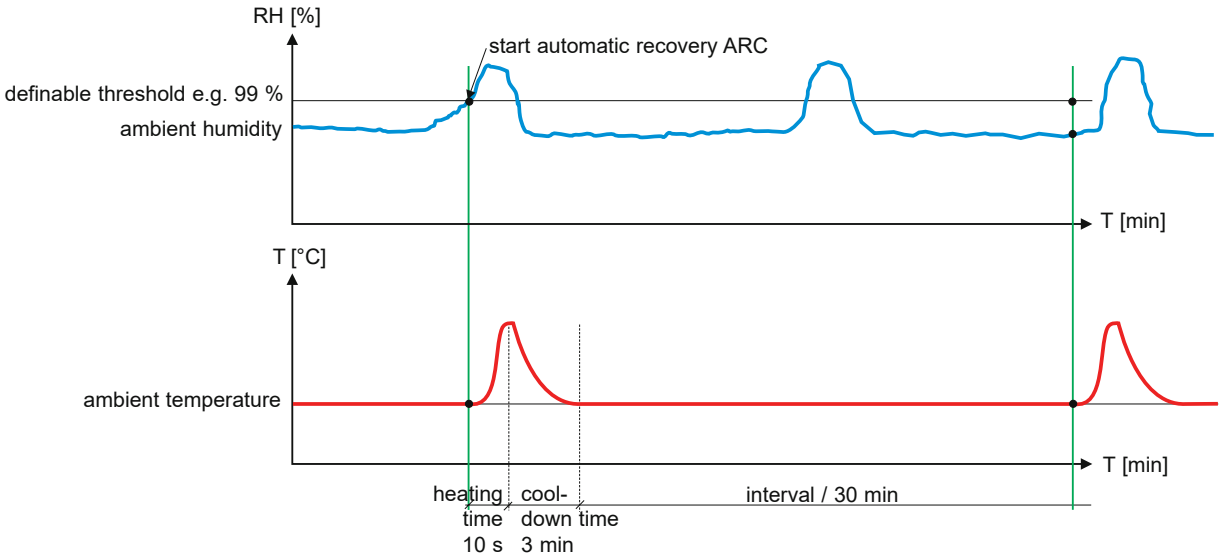
If condensation is still detected after the CP process, it restarts after a cycle time of 30 minutes.

During the complete heating and cool-down process, the values on the 2 analogue outputs are frozen. In other words, the measuring values at the analog outputs are kept constant during the CP cycle.



Please note: If the defined cool-down time is too short, the measurements may be incorrect.





Please note: When heating has ended, the system blocks any subsequent heating for 30 minutes. In other words, if the ambient humidity remains above the defined set point after the initial heating, the next heating starts again after 30 minutes.

The following types support the condensation prevention function: T4/T5/T8/T10.

4.1.2 Automatic ReCovery (ARC) against Chemical Pollution

When capacitive humidity sensing elements are exposed to chemical pollution (e.g. detergent residues), the presence of foreign molecules can distort the measurement reading of the sensor. With the ARC function foreign molecules can be evaporated from the sensing element by brief and intensive heating.

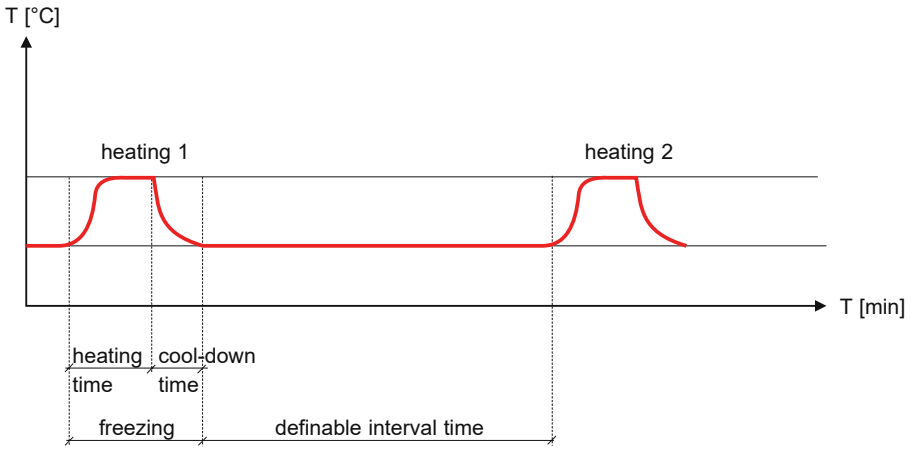
The start of the ARC function can be triggered as follows:

Manual: by pressing the pushbutton S3 on the circuit board (see chapter 7.1 “Circuit Board”). A manual start of the ARC function is recommended when

- chemical pollution on the sensing element is expected (cleaning/sterilization)
- measurement readings deviate significantly from a calibration reference

Cyclic: by using EE-PCS, ARC can be configured to start periodically at a certain time interval.

Periodic heating shall be used to minimize drift effects in applications with high chemical pollution. The ideal cycle time depends on the type of pollution and its concentration and has to be determined empirically.



External: by using the optional ARC module the function can be activated using an external signal see chapter 8.1 “ARC-Module (Option AM1)”.

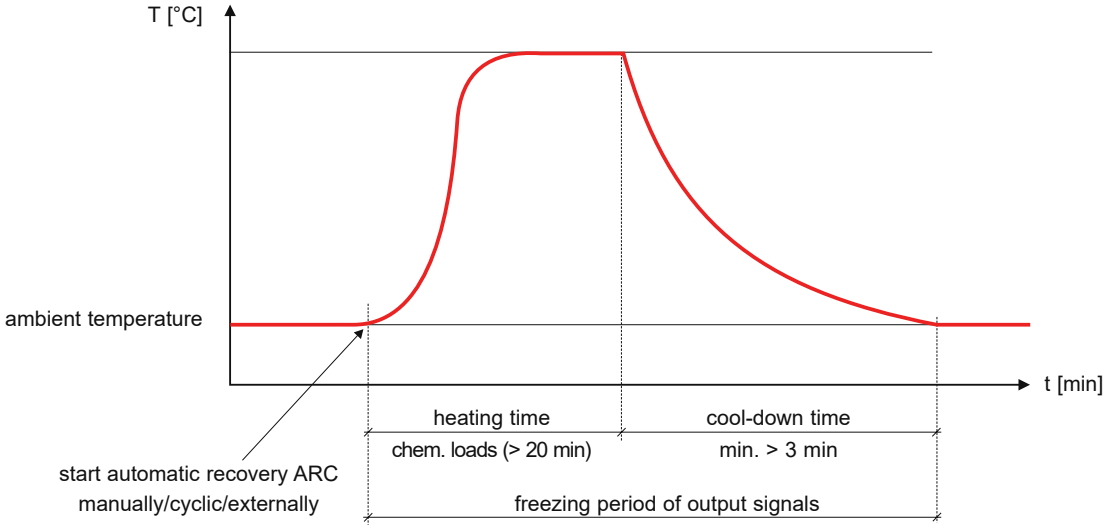
Please note: before a recalibration is done after an ARC cycle, reconditioning of the sensing element is recommended. For best reconditioning, please allow 2 free calibration cycles between 15 %RH and 90 %RH in steps of ~20 %RH and 20 min stabilisation time.

Beside activating and defining the cyclic ARC function EE-PCS allows for further configuration of ARC parameters:

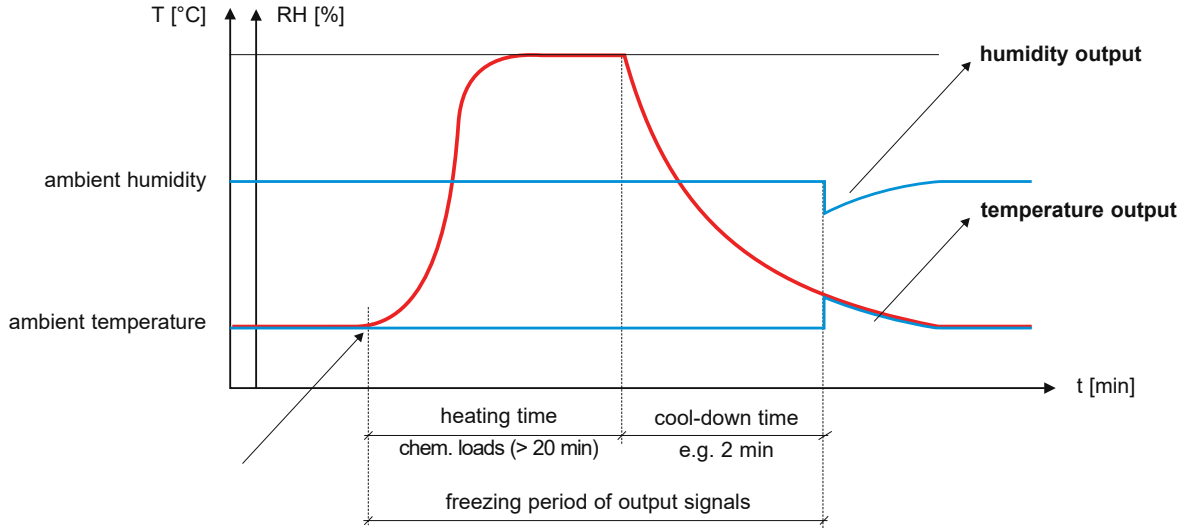
Heating time: Defines the time in which the monolithic measurement cell is intensively heated. A heating time of at least 20 minutes is recommended if chemical pollution has occurred.

Cool-down time: The cool-down time is necessary for the sensing element to cool back down to ambient temperature. The cool-down time should be >3 min. in order to prevent measurement errors.

During the ARC process (heating and cool-down time) the values on the 2 analogue outputs are frozen. In other words, the measuring values at the analog outputs are kept constant during the ARC cycle.



Please note: If the defined cool-down time is too short, the measurements may be incorrect.



All EE33 support the ARC function.

4.1.3 Dual Heating System with Overheating (OH)

In environments with continuous high humidity even the smallest deviations between the temperature of the sensor head and the ambient temperature can cause condensation. Dew on the RH/T sensing element influences the accuracy of the measurement and increases the risk of deposits on the active sensor surface that lead to parallel resistances and parasitic capacitances.

The dual heating system of the EE33 prevents both: condensation on the RH sensing element and on the probe body by a regulated heating strategy. This leads to very short response time and fast recovery after condensation. Furthermore, it enables precise RH measurement even under continuously high humidity and condensing conditions. RH and T of the heated sensing element can be determined precisely thanks to its monolithic structure and the dew point of the environment is calculated. If the relative humidity has to be determined near condensation, the ambient temperature can be measured with an additional T sensor to calculate the relative humidity.

The following EE33 types incorporate the dual heating system:

T7: for Td measurement only

T17: with additional T Sensor included for RH measurement

T28: with additional T Sensor included for RH measurement in meteorological applications

4.1.4 Overview Heating Modes and Types

Heating Mode	Condensation Prevention (CP)	Automatic ReCovery (ARC)	OverHeating (OH) with Dual Heating System
Use	Against temporary condensation	Against chemical pollution	In environments with continuous high humidity and condensation
Function Trigger	RH setpoint*)	Cyclic, externally, manually	Always ON
EE33 Type			
EE33 Type T4/T5/T8/T10	✓	✓	Not available
EE33 Type T7/T17	Not usable due to OH	✓	✓
EE33 Type T28	Not usable due to OH	✓	✓

*) Factory setting: disabled, RH setpoint preset to 99 %.

4.2 Dimensions

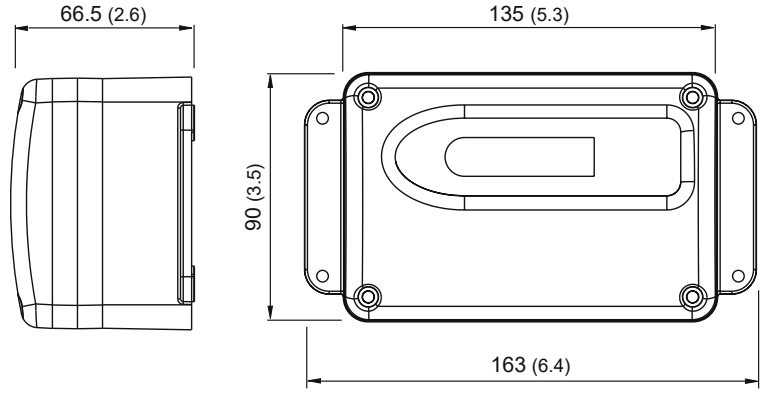


Fig. 1 EE33 metal enclosure

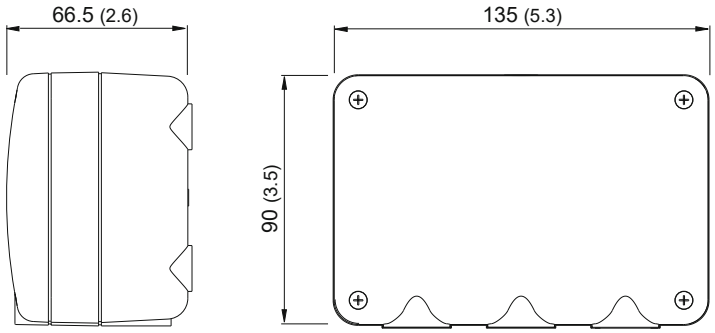


Fig. 2 EE33 polycarbonate enclosure

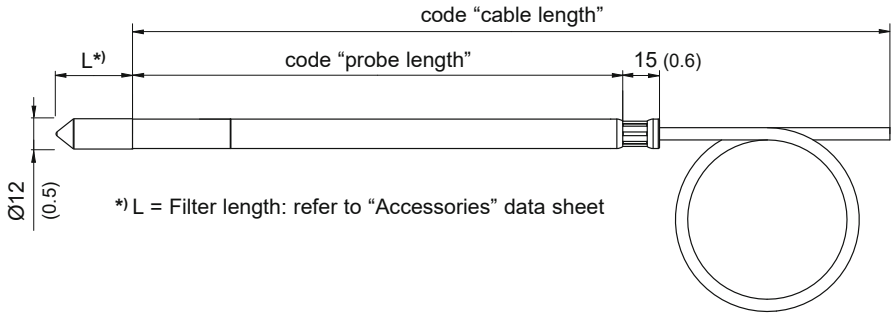
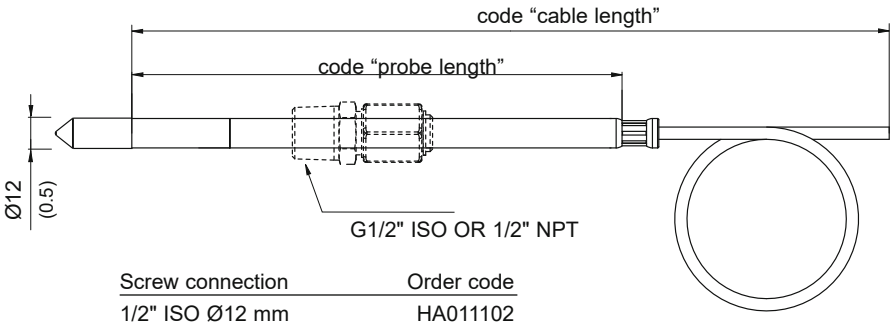


Fig. 3 Type T4 / T5



Screw connection	Order code
1/2" ISO Ø12 mm	HA011102
1/2" NPT Ø12 mm	HA011103

Fig. 4 Type T7, pressure tight up to 20 bar (300 psi) for Td measurement with optional cut in fitting

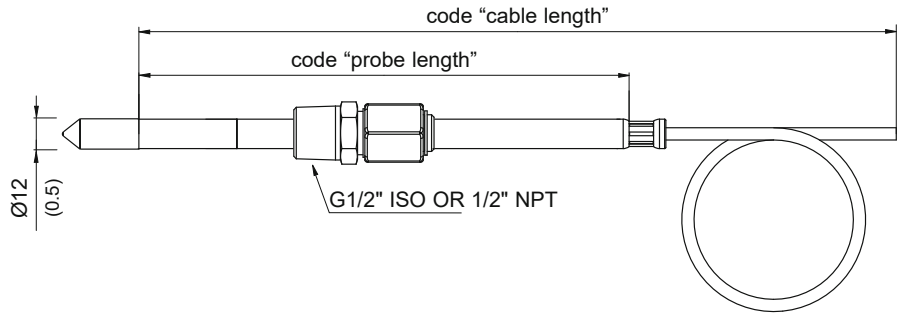


Fig. 5 Type T8, pressure tight up to 100 bar (1450 psi) with cut in fitting

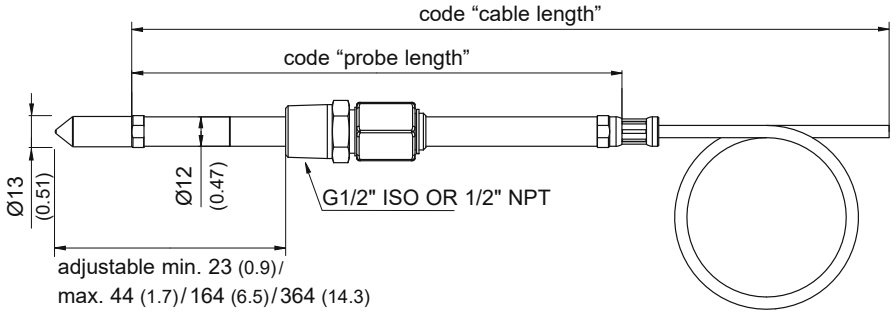
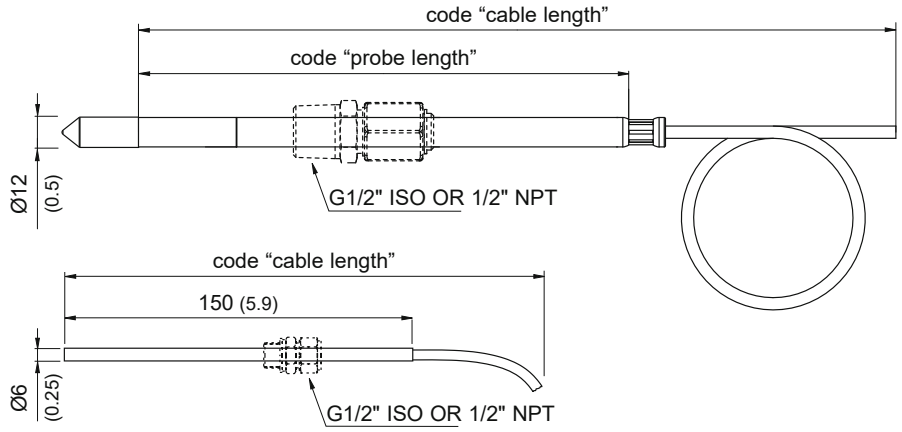


Fig. 6 Type T10, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F), with sliding fitting



Screw connection	Order code
1/2" ISO Ø12 mm	HA011102
1/2" NPT Ø12 mm	HA011103
1/2" ISO Ø6 mm	HA011104
1/2" NPT Ø6 mm	HA011105

Fig. 7 Type T17, two probes, pressure tight up to 20 bar (300 psi) and 180°C (356 °F), with optional cut in fitting

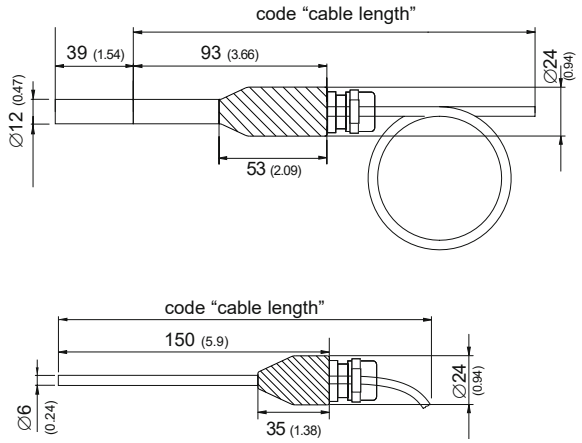


Fig. 8 Type T28, two probes, for meteorological applications

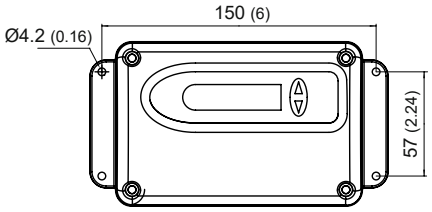
4.3 Electrical Connection

Details are outlined in chapter 6.

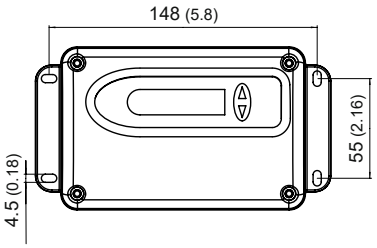
5 Mounting and Installation

5.1 Enclosure

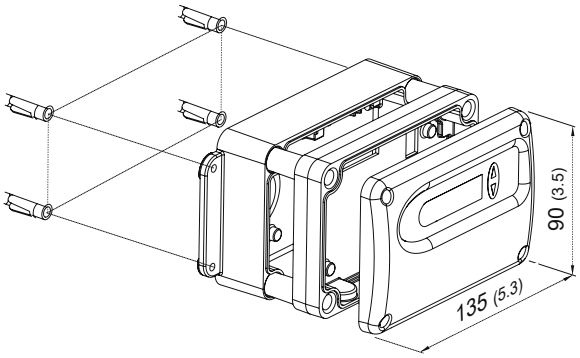
Drilling with round hole:



Drilling with long hole:

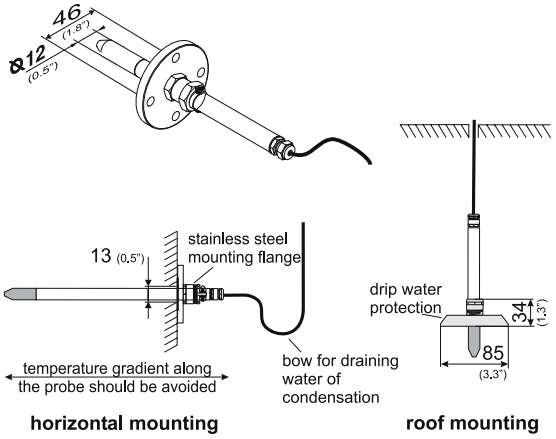


- Drill the mounting holes according to the mounting pattern shown on the left.
- Mount the bottom part of the enclosure with 4 screws (screw diameter < 4.2 mm (0.2”); not included in the scope of supply).



- Establish the electrical connection (see chapter 4.3).
- Mount the middle part and the cover with 4 screws (included in the scope of supply).

5.2 Remote Sensing Probe Type T4, T5



Using the stainless steel mounting flange (refer to accessories) it is possible to mount the probe on the outer wall of the measuring chamber.

The depth of immersion is adjustable.

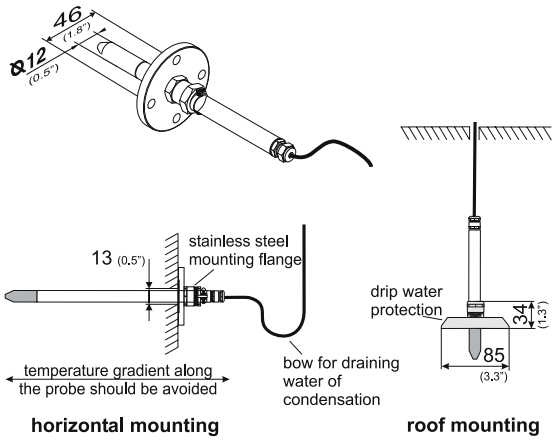
For roof installations use the drip water protection (refer to accessories) to protect the sensor head and elements against condensed water.

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

Temperature range of sensing probe type T4: -40...120 °C (-40...248 °F)

Temperature range of sensing probe type T5: -40...180 °C (-40...356 °F)

5.3 Remote Sensing Probe Type T7



Using the stainless steel mounting flange (refer to accessories) it is possible to mount the probe on the outer wall of the measuring chamber.

The depth of immersion is adjustable.

For roof installations use the drip water protection (refer to accessories) to protect the sensor head and elements against condensed water.

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

Temperature range of sensing probe type T7: -40...180 °C (-40...356 °F)
Pressure range of sensing probe type T7: 0.01...20 bar (0.15...300 psi)

Pressure tight screw connection:
The screw connection for pressure tight installation up to 15 bar (218 psi) is available as an accessory (see chapter 12 Replacement Parts/Accessories). For screw assembly refer to chapter 5.4 Remote Sensing Probe Type T8.

Instructions for installation in a high-humidity environment:

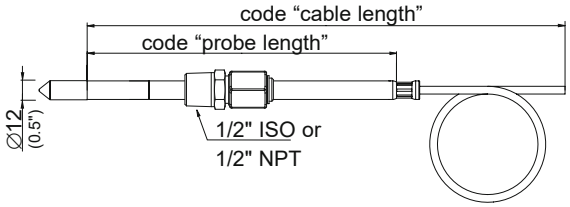
If the process temperature differs significantly from the ambient temperature, the sensing probe should be fully emerged in the process to avoid incorrect measurements and condensation problems on the sensor head due to thermal conductivity.

It is recommended not to bring the sensing probe and colder metal parts in direct contact in order to avoid condensation problems caused by thermal conductivity.

A 12 mm (1/2") mounting flange (HA010201) for the humidity probe is available as an accessories.

A 1/2" ISO (HA011102) and 1/2" NPT (HA011103) screw connection for the sensing probe is available as an accessories.

5.4 Remote Sensing Probe Type T8

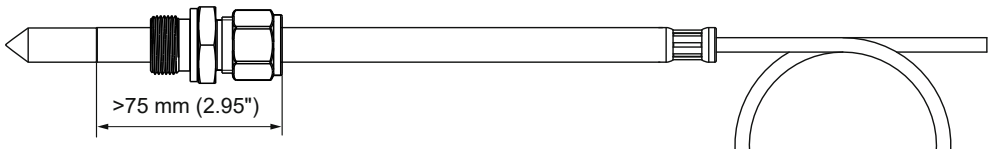


The sensing probe must be mounted horizontally or vertically, pointing downwards. If possible, a drip sheet should be fitted for each mounting.

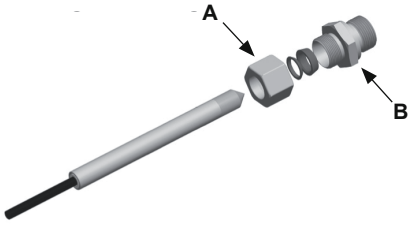
Temperature range of sensing probe: 40...180 °C (-40...356 °F)
Pressure range of sensing probe: 0...100 bar (0...1 450 psi)

Safety instructions for pressure-tight feedthrough:

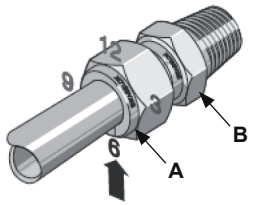
- Do not assemble the probe and tighten the feedthrough if the plant is under pressure.
- The plant must not be vented by releasing the nut (A).
- Use appropriate seal on conical probe threads.
- Never rotate the screw connection body (B) but hold the screw connection body (B) securely and turn the nut (A).
- Avoid unnecessary disassembly of pipe screw connections.
- Position the cut in fitting >75 mm (2.95") from the end of the filter cap to the end of the fitting! For a probe length of 65 mm a cut in fitting is not possible.



Installation instructions

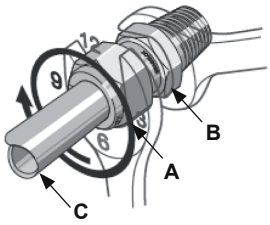


- Tighten the nut (A) finger-tight.
- Mark the nut (A) at 6 o‘clock position.
- Hold the screw connection body (B) tight and tighten the nut (A) with 1 ¼ turns till 9 o’clock position.



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

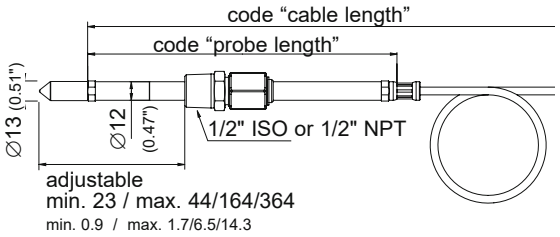
- Tighten the nut (A) until the probe (C) can no longer be turned by hand and moved axially in the feedthrough.
- Mark the nut (A) at 6 o’clock position.
- Hold the screw connection body (B) tight and tighten the nut (A) with 1 ¼ turns to 9 o’clock position.



Re-mounting:

- Slide the measurement probe with clamping ring into the fitting as far as it goes.
- Tighten the nut finger-tight, then tighten by approx. a ¼ turn using a spanner.

5.5 Remote Sensing Probe Type T10



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

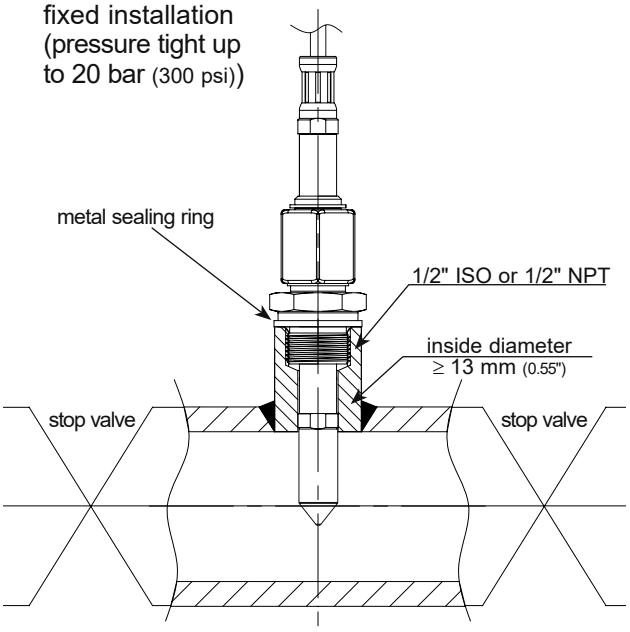
Temperature range of sensing probe: -40...180 °C (-40...356 °F)
Pressure range of sensing probe: 0.01...20 bar (0.15...300 psi)

General safety instructions for installation

Because the sensing probe can be exposed to very high pressures in the measurement environment, there is the risk of sudden, unintentional expulsion of the probe during or after improper installation. Therefore, special precautions should be taken when working on the sensing probe or in its vicinity. Bending over the sensing probe should be avoided under any circumstances!
During the installation of the sensor probe, make sure that the surface of the sensing probe is not damaged! Damaging the probe could lead to damaged seals (consequence: leakage and pressure loss) and to problems during removal (jamming).

Installation of the probe directly in the process

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



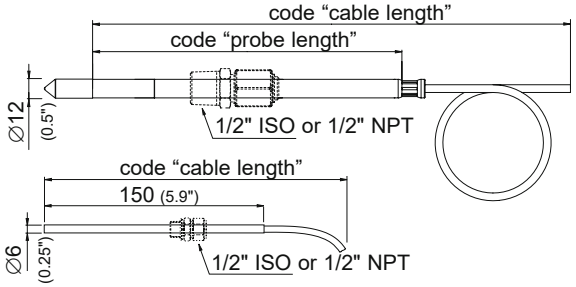
For direct probe installation, a stop valve should be provided on both sides of the probe insert. This allows the sensor probe to be removed for maintenance and calibration without any problems.

If the sensor probe is installed in a pressure chamber, make sure that the pressure in the chamber and the ambient pressure are in equilibrium before you remove the probe.

The temperature during installation may not vary more than ±4 °C (±72 °F) from the operating temperature.

- Step 1:
  Install the probe with the stop valves closed.
- Step 2:
  Insert the sensor probe into the process.
- Step 3:
  To ensure a secure installation of the probe, the lock nut must be tightened to a defined torque of 30 Nm.
  If no torque-spanner is available tighten the lock nut by hand as far as possible. Continue to turn with an open-ended spanner ~50°.

5.6 Remote Sensing Probes Type T17



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

Mounting the two probes, please make sure that the minimum distance is 10 cm (4").

Temperature range sensing probe: -40...180 °C (-40...356 °F)
Pressure range: 0.01...20 bar (0.15...300 psi)

Pressure tight screw connection:

The screw connections for pressure tight installation up to 20 bar (300 psi) are available as accessories (see chapter 12 Replacement Parts / Accessories). For screw assembly refer to chapter 5.4.

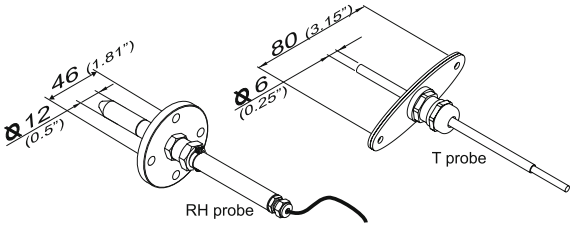
Instructions for installation in a high-humidity environment:

If the process temperature differs significantly from the ambient temperature, the sensing probe should be fully emerged in the process to avoid incorrect measurements and condensation problems on the sensor head due to thermal conductivity.

It is recommended not to bring the sensing probe and colder metal parts in direct contact in order to avoid condensation problems caused by thermal conductivity.

The humidity probe (12 mm (1/2")) and the temperature probe (6 mm (1/4")) must be mounted at the same temperature level respectivily same installation height.

Mounting of sensing probe with flange (accessories):



A mounting flange 12 mm (1/2") for the humidity probe and a mounting flange 6 mm (1/4") for the temperature probe are available as accessories.

Order codes:

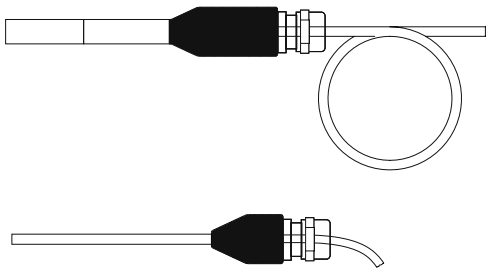
	RH probe (12 mm (1/2"))	T probe (6 mm (1/4"))
Flange	HA010201	HA010207

Mounting of sensing probe with screw connection (accessories):
A 1/2" ISO resp. a 1/2" NPT screw connection is available as an accessories for mounting both sensing probes (6 mm (1/4") and 12 mm (1/2")).

Order codes:

	RH probe (12 mm (1/2"))	T probe (6 mm (1/4"))
1/2" ISO	HA011102	HA011104
1/2" NPT	HA011103	HA011105

5.7 Remote Sensing Probes Type T28



The sensing probes type T28 are optimised for application in meteorology. Their rotation symmetric design allows for mounting in a modern ventilated radiation shields, as it is available with HA010508 (please refer to chapter 12 “Replacement Parts / Accessories”).

6 Electrical Connection

Important note:
The manufacturer cannot be held responsible for personal injuries or damage to property as a result of incorrect handling, installation, wiring, power supply and maintenance of the device.

The electrical installation of the EE33 shall be performed by qualified personnel only. Observe all applicable national and international requirements for the installation of electrical devices as well as for power supply according to EN 61140, class III (EU) and class 2 supply (North America). For EE33 with alarm module (option AM2) or integrated power supply 100 - 240 V AC (option AM3), the metal enclosure must be grounded during operation.

6.1 Cable Glands

For cabling via the cable glands and direct electrical connection within the enclosure, the assignment of the screw terminals in the lower part of the enclosure is as shown in Fig. 9.

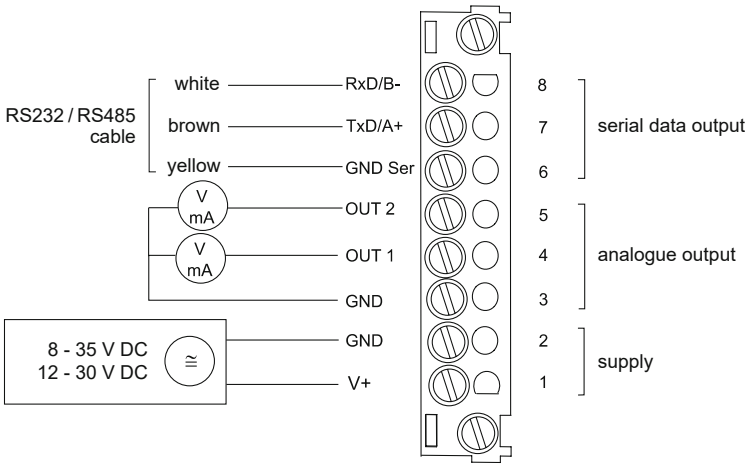


Fig. 9 Pin assignment on screw terminals for electrical connection via cable glands

6.2 Connection on Bottom Part of Enclosure with Plugs (Option E4/E5/E7)

Plug for supply and analogue output
(front view)

Euro-Standard

Description:	Connection assignment:	
V+	5	E4
GND	4	
GND	3	
OUT1	2	
OUT2	1	

Plug for RS232 resp. RS484 connection
(front view)

Euro-Standard

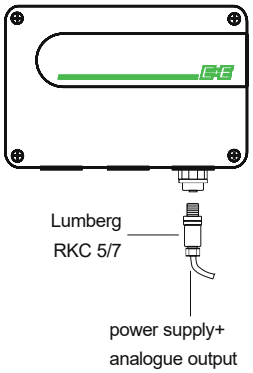
Description:	Connection assignment:	
GND-Ser	5	E5
Rxd/B-	3	
Txd/A+	1	
not assigned	2, 4	

E7

The cable should be connected according to the number stamped in the plug as shown in the above drawings!

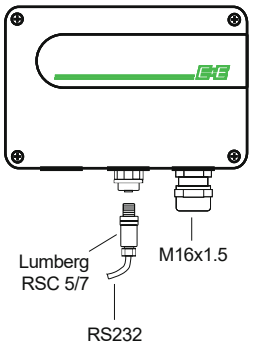
6.2.1 Plug Option E4

1 plug for power supply and outputs



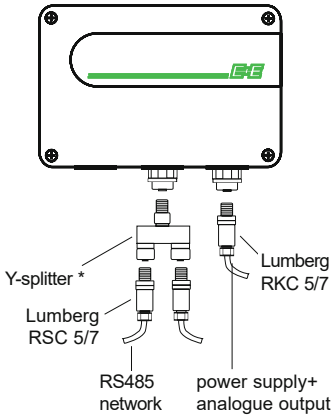
6.2.2 Cable Gland / Plug Option E5

1 cable gland / 1 plug for RS232



6.2.3 Plug Option E7

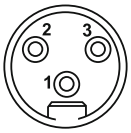
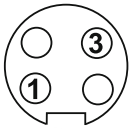
2 plugs for power supply / outputs and RS485 network



* Siemens 6ES7 194-1KA01-0XA0

6.3 Alarm Module Connection Diagram (Option AM2)

6.4 Connection Configuration for Integrated Power Supply (Option AM3)

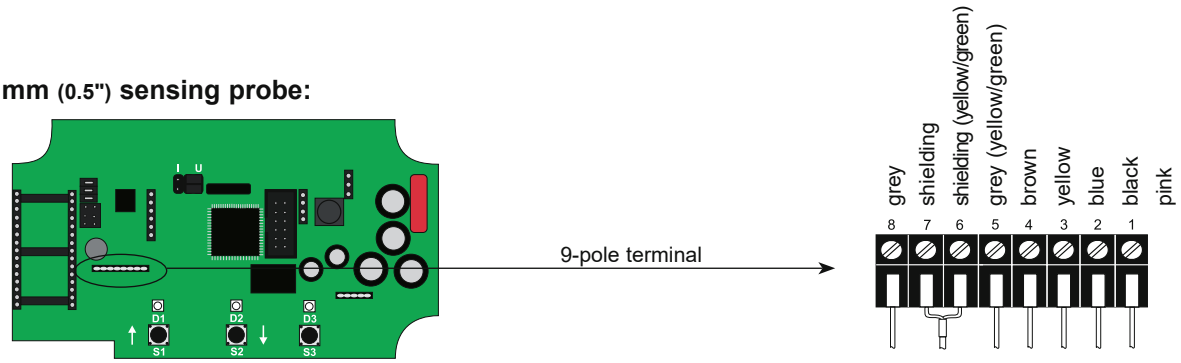
Plug for RS232 and analogue output (front view)	 Euro-Standard	**Description:** RxD / B- TxD / A+ GND OUT1 OUT2	**Connection assignment:** 5 4 3 2 1
Plug for 100-240V metal enclosure (front view)		**Description:** Grounding (PE) Phase (L1) Neutral wire (N)	**Connection assignment:** 1 2 3
Plug for 100-240V polycarbonate enclosure (front view)		**Description:** Phase (L1) Neutral wire (N)	**Connection assignment:** 1 3

External diameter of supply cable: 10-12 mm (0.39-0.47”)
Maximum wire cross section for connecting cable: 1.5 mm² (AWG 16)
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) (6 A fuse).
National regulations for installation must be observed!

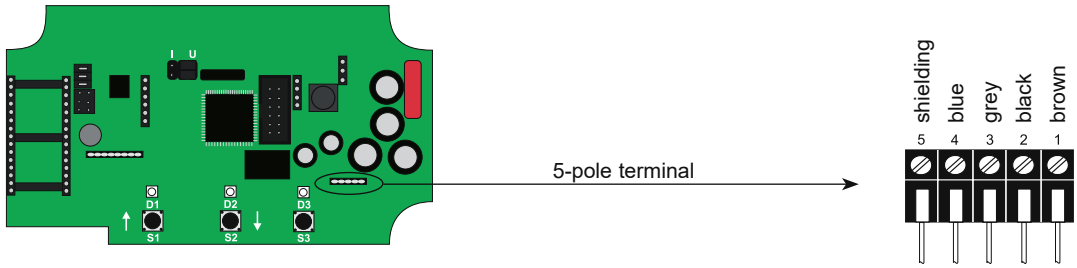
Bottom and middle part of the metal enclosure must be grounded during operation!

6.5 Connection Configuration of Connectable Sensing Probe (Option PC6)

∅12 mm (0.5") sensing probe:



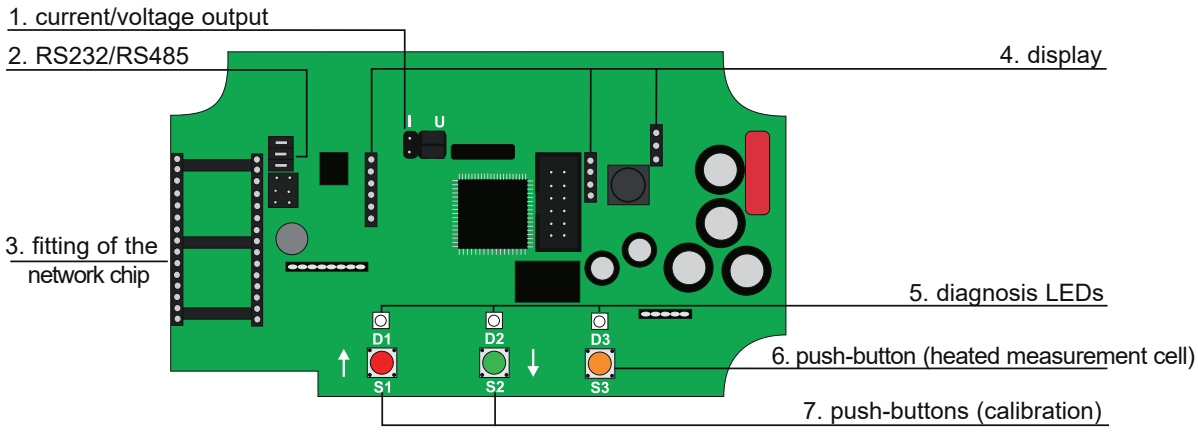
∅6 mm (0.25") sensing probe:



7 Operating Components

7.1 Circuit Board

After removal of the enclosure cover, the following operating components on the circuit board may be accessed.



1. Current/voltage output: If the sensor will be switched from current to voltage output signals using the configuration software, then two jumpers must also be positioned as follows:

for current signal:  for voltage signal: 

2. RS232/RS485: jumper set - RS232:  jumper removed - RS485: 

3. Fitting of the network chip: For refitting to RS485, an IC must be used (available as option J3 or via accessory HA010605).

The notch on the chip must match the receiver slot!

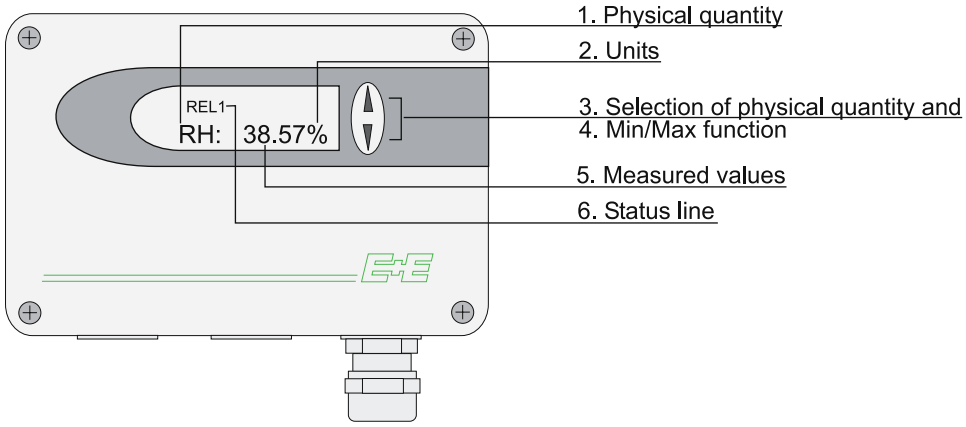
4. Display: Pinboards for connecting the display module.

5. Diagnosis LEDS: refer to *chapter 9 "Humidity / Temperature Calibration"*
refer to *chapter 10.4 "Self Diagnosis and Error Messages"*

6. Push-button (heated measurement cell): refer to *chapter 10.2 "Automatic ReCovery (ARC)"*

7. Push-buttons (calibration): refer to *chapter 9 "Humidity / Temperature Calibration"*

7.2 Display Module (Option D2)



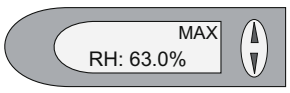
1. PHYSICAL QUANTITY: **2. UNITS:** **3. SELECTION OF PHYSICAL QUANTITY:**

		SI	US
RH	Rel. humidity	%	%
T	Temperature	°C	°F
e	Water vapour partial pressure	mbar	psi
Td	Dew point temperature	°C	°F
Tw	Wet bulb temperature	°C	°F
dv	Absolute humidity	g/m³	gr/ft³
r	Mixture ratio	g/kg	gr/lb
h	Enthalphy	kJ/kg	BTU/lb
Tf	Frost point temperature	°C	°F

Press the Δ or ∇ button to select the desired physical quantity.

4. MIN / MAX FUNCTION:

The MIN / MAX function saves and displays the highest and lowest measured value since the last reset resp. the last interruption of the supply voltage.

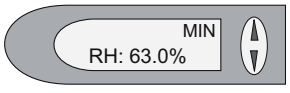


Highest measured value:

1. Select the desired physical quantity.
2. To display the maximum value of the selected physical quantity, press the Δ button for at least five seconds.

3.1. To reset the transmitter to its normal operating status, press the Δ button once again for five seconds.

3.2. If both buttons are pressed for at least five seconds while the maximum value is displayed → the "MAX" symbol disappears → the maximum value will be deleted (Reset).



Lowest measured value:

1. Select the desired physical quantity.
2. To display the minimum value of the selected physical quantity, press the ∇ button for at least five seconds.

3.1. To reset the transmitter to its normal operating status, press the ∇ button once again for five seconds.

3.2. If both buttons are pressed for at least five seconds while the minimum value is displayed → the "MIN" symbol disappears → the minimum value will be deleted (Reset).

5. MEASURED VALUES / MAX. MEASURING RANGE:

The dominant value of the appropriate quantity is displayed in this field. For the factory configuration, the measured values may fall between the measuring ranges shown below.

		Unit	from	to		
				EE33-xT4	EE33-xT5/T8/T10/T17	EE33-xT7
Humidity	RH	%	0	100	100	—
Temperature	T	°C (°F)	-40 (-40)	120 (248)	180 (356)	—
Dew point temperature	Td	°C (°F)	-40 (-40)	100 (212)	100 (212)	100 (212)
Frost point temperature	Tf*)	°C (°F)	-40 (-40)	0 (32)	0 (32)	0 (32)
Wet bulb temperature	Tw	°C (°F)	0 (32)	100 (212)	100 (212)	—
Water vapour partial pressure	e	mbar (psi)	0 (0)	1100 (15)	1100 (15)	—
Mixture ratio	r	g/kg (gr/lb)	0 (0)	999 (9999)	999 (9999)	—
Absolute humidity	dv	g/m³ (gr/ft³)	0 (0)	700 (300)	700 (300)	—
Specific enthalpy	h	kJ/kg (BTU/lb)	0 (0)	2800 (200)	2800 (200)	—

*) Equals Td above 0 °C (32 °F)

The measurement ranges indicated above can be set to individual requirements using the EE-PCS.

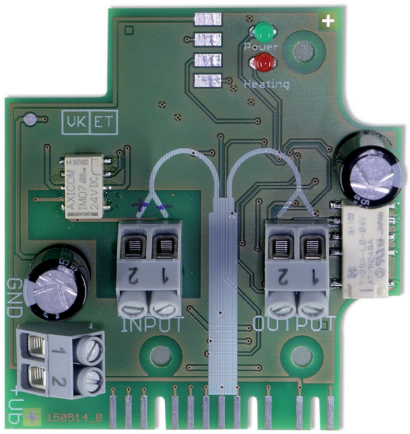
6. STATUS LINE:

MIN; MAX: see point “MIN/MAX Function”, see *chapter 7.2 “Display Module (Option D2)”*
CALIB LOW; CALIB HIGH: indicates the low or high humidity/temperature calibration point.
REL1 / REL2: status relay 1/ relay 2
"ERROR 01....06": see *chapter 10.4 “Self Diagnosis and Error Messages”*

8 Optional Modules

The optional modules are mounted in the lower part. For this reason, only one optional module can be selected at a time.

8.1 ARC-Module (Option AM1)



The additional circuit board located in the lower part of the EE33 enclosure offers the possibiliy to start the ARC heating function with external signal.

During the heating process the orange LED D3 flashes at the main printed circuit board. At the ARC module the red LED "heating" flashes and the relay contact (terminal "output") is closed.

General information on the ARC function see chapter 4.1.2.

Heating process and trigger parameters can be set and changed with the EE-PCS.

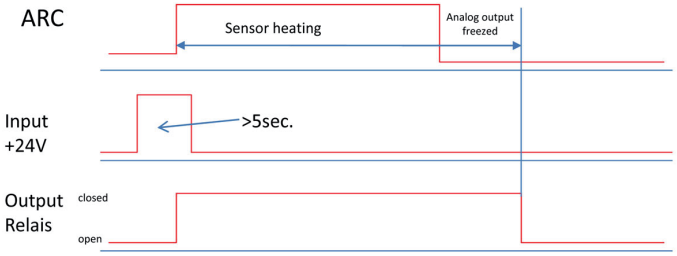
Connection / Operating elements

Terminal “+Ub”:
Supply voltage: 24 V AC / DC ±20%
1 GND
2 +Ub

Terminal “Input”:
1 GND
2 signal (24 V DC; 10 mA)

Terminal “Output”:
1 REL_com
2 Rel_NO
Feedback signal to the external control.
The relay contact is closed during the heating process, otherwise opened.

Timing of switching status



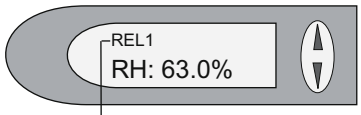
Operating elements:
- LED green: LED flashes = supply voltage is switched on
- LED red: LED flashes = heating process is active

8.2 Alarm Module (Option AM2)

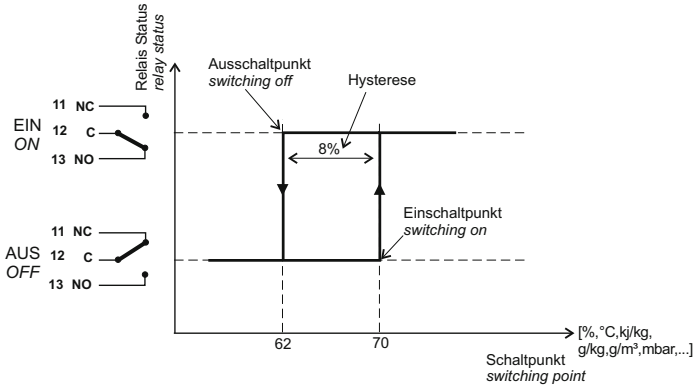
The optional alarm module contains 2 changeover contacts and can be used for alarm and error issues and other simple control functions. The physical quantity to be monitored (RH, T, Td,...), the threshold and hysteresis for each relay can be configured with the EE-PCS.

Max. switched voltage / max. switched current: 250 V AC / 6A
28 V DC / 6A
Minimum load: >100 mA / 12V

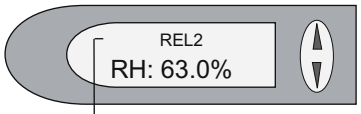
Switching relay 1:



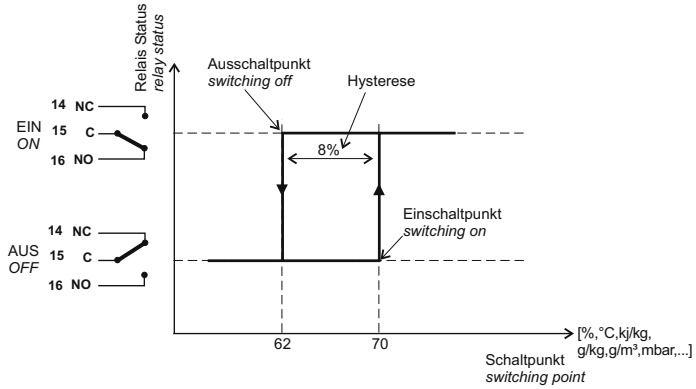
If relay 1 has tripped (ON), then REL1 is displayed.



Switching relay 2:



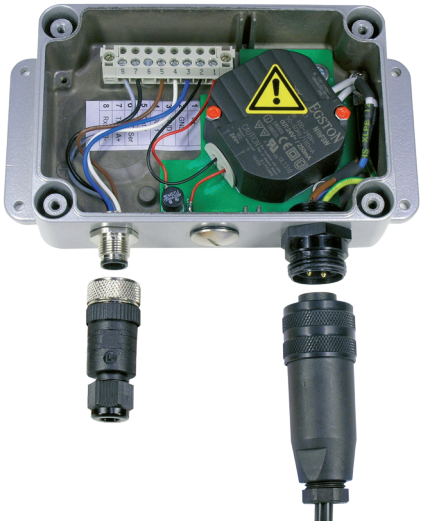
If relay 2 has tripped (ON), then REL2 is displayed.



Switching parameters: freely selectable between		EE33 Type T5/8/10/17	EE33 Type T7
RH	Relative humidity	✓	
T	Temperature	✓	
Td	Dew point temperature	✓	✓
Tf	Frost point temperature	✓	✓
Tw	Wet bulb temperature	✓	
e	Water vapour partial pressure	✓	
r	Mixture ratio	✓	
dv	Absolute humidity	✓	
h	Specific enthalpy	✓	

Tab. 1 Option AM2 selectable switching parameters

8.3 Integrated Power Supply (Option AM3)



AC power supply with 100 - 240 V is possible with this option. Please refer to chapter 6.4 for electrical connection details.

9 Humidity / Temperature Calibration

The EE33 sensor can be calibrated in two ways:

1-point humidity/temperature calibration: quick and simple calibration on a defined humidity/ temperature point (working point).

2-point humidity/temperature calibration: calibration for accurate measuring results over the entire humidity/temperature working range.

- To reach a temperature balance it is recommended to keep the transmitter and the reference chamber (e.g. HUMOR 20,...) for minimum 4 hours in the same room.
- During stabilisation period and calibration procedure it is important to keep the temperature constant in the reference climate chamber.
- For calibration the humidity sensor probe must be stabilised at least 20 minutes into the reference chamber.
- Replace a used dirty filter cap before calibration!

Calibration may be performed

- With the help of the EE-PCS. The EE-PCS leads the user through the procedure step by step.
- Using the pushbuttons directly on the circuit board. The according procedures are explained below.

9.1 2-point Humidity Calibration

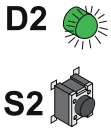
For accurate adjustment over the entire humidity working range a 2-point calibration is recommended.

- Start calibration at the low humidity calibration point!
- The humidity difference between the two points should be > 30 %RH
- Low humidity point < high humidity point

2-point humidity calibration procedure on the circuit board:

low calibration point:

1. Insert the sensor probe into the reference humidity 1 (low calibration point) and stabilise for at least 20 minutes.



2. BUTTON S2: Pressing the button for 5 seconds starts the procedure for the calibration mode RH. The calibration mode is indicated by the lit LED "D2" on the circuit board.

3. BUTTON S2: Pressing the button for 5 seconds starts the procedure for the low calibration point. The calibration mode is indicated by the lit LED "D2" and the symbol "CALIB LOW" will appear on the optional LC display.

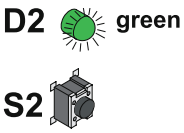
4. BUTTON S1 (up) and **S2 (down)**: Pressing one of the two buttons will adjust the measuring value in steps of 0.1% up or down to the reference value. The actual measuring value is indicated on the display or can be measured with the analogue output. As soon as the measured value is changed, "D1" flashes when pressing S1 or S2.

5. BUTTON S1 (store): Pressing the button for 5 seconds stores the calibration value and the procedure is ended. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" will disappear from the optional LC display.

BUTTON S2 (cancel): Pressing the button for 5 seconds the calibration procedure will be ended without storing the calibration values. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" will disappear from the optional LC display.

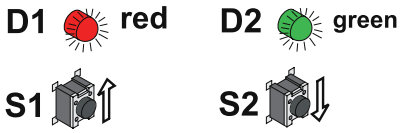
high calibration point:

6. Insert the sensor probe into the reference humidity 2 (high calibration point) and stabilise for at least 20 minutes.

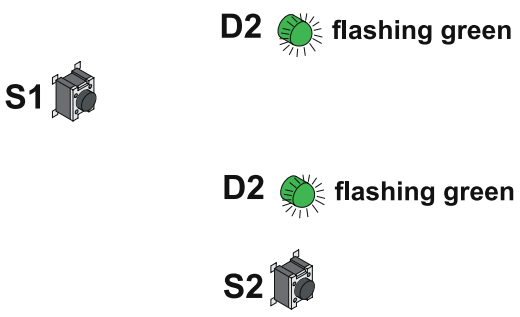


7. BUTTON S2: Pressing the button for 5 seconds starts the procedure for the calibration mode RH. The calibration mode is indicated by the lit LED "D2" on the circuit board.

8. BUTTON S1: Pressing the button for 5 seconds starts the procedure for the high calibration point. The calibration mode is indicated by the lit LED "D2" and the symbol "CALIB HIGH" will appear on the optional LC display.



9. BUTTON S1 (up) and **S2 (down)**: Pressing one of the two buttons will adjust the measuring value in steps of 0.1% up or down to the reference value. The actual measuring value is indicated on the display or can be measured with the analogue output. As soon as the measured value is changed, "D1" flashes when pressing S1 or S2.



10. BUTTON S1 (store): Pressing the button for 5 seconds stores the calibration value and the procedure is ended. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB HIGH" will disappear from the optional LC display.
BUTTON S2 (cancel): Pressing the button for 5 seconds the calibration procedure will be ended without storing the calibration values. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB HIGH" will disappear from the optional LC display.

9.2 2-point Temperature Calibration

- Start calibration at the low calibration point!
- The temperature difference between the two points should be at least 30°C (86°F)!
- Low temperature point < high temperature point

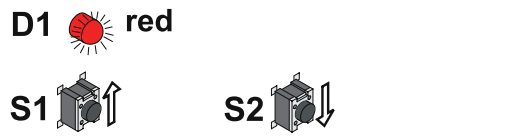
2-point temperature calibration procedure on the circuit board

low calibration point:

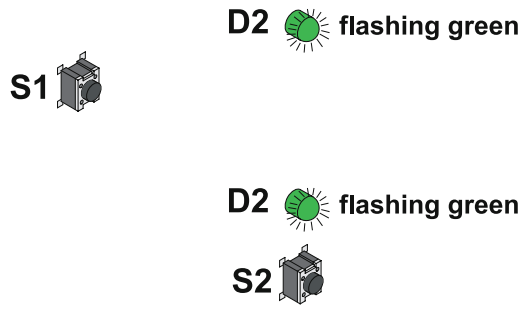
1. Insert the sensor probe into the reference temperature 1 (low calibration point) and stabilise for at least 10 minutes.

2. BUTTON S1: Pressing the button for 5 seconds starts the procedure for the calibration mode temperature. The calibration mode is indicated by the lit LED "D1" on the circuit board.

3. BUTTON S2: Pressing the button for 5 seconds starts the procedure for the low calibration point. The calibration mode is indicated by the symbol "CALIB LOW" on the optional LC display.

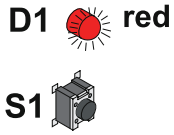


4. BUTTON S1 (up) and **S2 (down):** Pressing one of the two buttons will adjust the measuring value in steps of 0.1 degC up or down to the reference value. The actual measuring value is indicated on the display or can be measured with the analogue output. As soon as the measured value is changed, "D1" flashes when pressing S1 or S2.



5. BUTTON S1 (store): Pressing the button for 5 seconds stores the calibration value and the procedure is ended. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" will disappear from the optional LC display.
BUTTON S2 (cancel): Pressing the button for 5 seconds the calibration procedure will be ended without storing the calibration values. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" will disappear from the optional LC display.

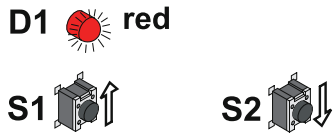
high calibration point:



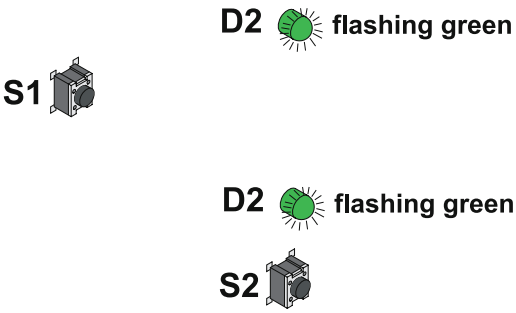
6. Insert the sensor probe into the reference temperature 2 (high calibration point) and stabilise for at least 10 minutes.

7. BUTTON S1: Pressing the button for 5 seconds starts the procedure for the calibration mode temperature. The calibration mode is indicated by the lit LED "D1" on the circuit board.

8. BUTTON S1: Pressing the button for 5 seconds starts the procedure for the high calibration point. The calibration mode is indicated by the symbol "CALIB HIGH" on the optional LC display.



9. BUTTON S1 (up) and **S2 (down):** Pressing one of the two buttons will adjust the measuring value in steps of 0.1°C up or down to the reference value. The actual measuring value is indicated on the display or can be measured with the analogue output. As soon as the measured value is changed, "D1" flashes when pressing S1 or S2.



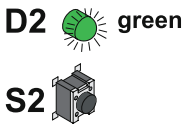
10. BUTTON S1 (store): Pressing the button for 5 seconds stores the calibration value and the procedure is ended. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB HIGH" will disappear from the optional LC display.
BUTTON S2 (cancel): Pressing the button for 5 seconds the calibration procedure will be ended without storing the calibration values. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB HIGH" will disappear from the optional LC display.

9.3 1-point Humidity Calibration

When the working range is limited to a certain more narrow range, a calibration at one humidity point is absolutely sufficient.

- In accordance with the working range, either the high or low calibration point should be selected. (CP > or < 50% RH)
- This calibration causes an extra inaccuracy for the rest of the working range.

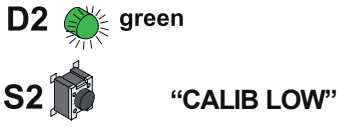
1-point humidity calibration procedure on the circuit board:

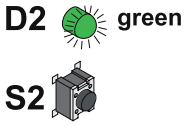


1. Insert the sensor probe into the reference humidity (calibration point) and stabilise for at least 20 minutes.

2. BUTTON S2: Pressing the button for 5 seconds starts the procedure for the calibration mode RH. The calibration mode is indicated by the lit LED "D2" on the circuit board.

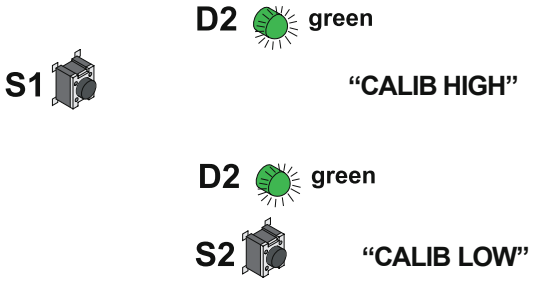
3. BUTTON S1: Pressing the button for 5 seconds starts the procedure. The calibration mode is indicated by the lit LED "D2" and the symbol "CALIB HIGH" will appear on the optional LC display (CP ≥ 50% RH).
or
BUTTON S2: Pressing the button for 5 seconds starts the procedure. The calibration mode is indicated by the lit LED "D2" and the symbol "CALIB LOW" will appear on the optional LCD (CP < 50% RH).



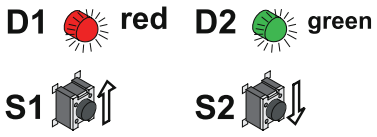


1. Insert the sensor probe into the reference humidity (calibration point) and stabilise for at least 20 minutes.

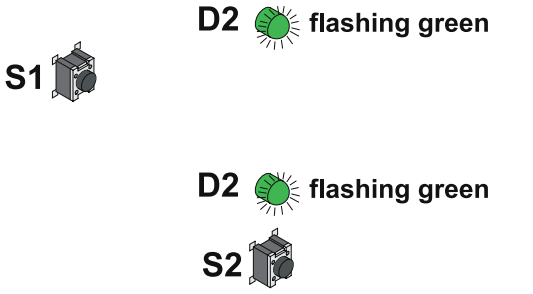
2. BUTTON S2: Pressing the button for 5 seconds starts the procedure for the calibration mode RH. The calibration mode is indicated by the lit LED "D2" on the circuit board.



3. BUTTON S1: Pressing the button for 5 seconds starts the procedure. The calibration mode is indicated by the lit LED "D2" and the symbol "CALIB HIGH" will appear on the optional LC display (CP ≥ 50% RH).
or
BUTTON S2: Pressing the button for 5 seconds starts the procedure. The calibration mode is indicated by the lit LED "D2" and the symbol "CALIB LOW" will appear on the optional LCD (CP < 50% RH).



4. BUTTON S1 (up) and **S2 (down)**: Pressing one of the two buttons will adjust the measuring value in steps of 0.1% up or down to the reference value. The actual measuring value is indicated on the display or can be measured with the analogue output.



5. BUTTON S1 (store): Pressing the button for 5 seconds stores the calibration value and the procedure is ended. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" or "CALIB HIGH" will disappear from the optional LC display.
BUTTON S2 (cancel): Pressing the button for 5 seconds the calibration procedure will be ended without storing the calibration values. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" or "CALIB HIGH" will disappear from the optional LC display.

9.4 1-point Temperature Calibration

When the working range is limited to a certain more narrow range, a calibration at one temperature point is absolutely sufficient.

- In accordance with the working range, either the high or low calibration point should be selected. (CP ≥ or < 45 °C / 113 °F)
- This calibration causes an extra inaccuracy for the rest of the working range.

1-point temperature calibration procedure on the circuit board:

1. Insert the sensor probe into the reference temperature (calibration point) and stabilise for at least 30 minutes.

D1 red

S1

2. BUTTON S1: Pressing the button for 5 seconds starts the procedure for the calibration mode temperature. The calibration mode is indicated by the lit LED "D1" on the circuit board

S1 "CALIB HIGH"

S2 "CALIB LOW"

3. BUTTON S1: Pressing the button for 5 seconds starts the procedure. The calibration mode is indicated by the symbol "CALIB HIGH" on the optional LC display (CP ≥ 45°C / 113°F).
or
BUTTON S2: Pressing the button for 5 seconds starts the procedure. The calibration mode is indicated by the symbol "CALIB LOW" on the optional LC display (CP < 45°C / 113°F).

D1 red

S1 S2

4. BUTTON S1 (up) and **S2 (down)**: Pressing one of the two buttons will adjust the measuring value in steps of 0.1°C up or down to the reference value. The actual measuring value is indicated on the display or can be measured with the analogue output.

D2 flashing green

S1

5. BUTTON S1 (store): Pressing the button for 5 seconds stores the calibration value and the procedure is ended. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" or "CALIB HIGH" will disappear from the optional LC display.

D2 flashing green

S2

BUTTON S2 (cancel): Pressing the button for 5 seconds the calibration procedure will be ended without storing the calibration values. LED "D2" flashes to indicate exiting of the calibration mode and the symbol "CALIB LOW" or "CALIB HIGH" will disappear from the optional LC display.

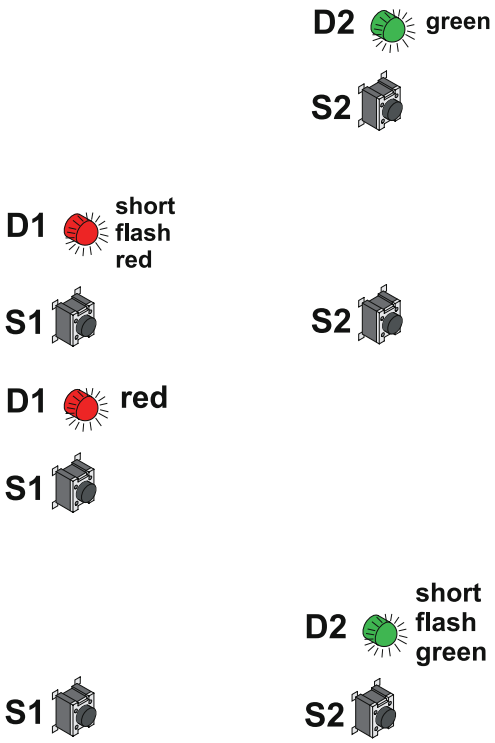
9.5 Resetting the Customer Calibration to the Factory Calibration on the Circuit Board

D1 short flash red

D2 flashing green

S1 S2

1. RH + T RESET: BUTTON S1 and S2: In neutral mode pressing both buttons simultaneously for 10 seconds customer calibration settings are reset to factory calibration.
A short flash of the LED "D1" indicates the reset.
or



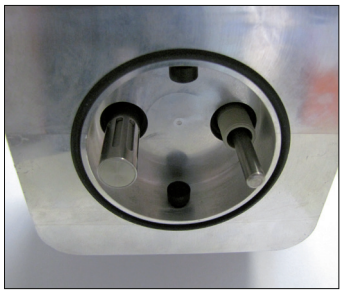
2. RH RESET: BUTTON S2: Pressing the button for 5 seconds starts the procedure for the calibration mode RH. Pressing both buttons simultanously for 10 seconds customer calibration settings are reset to factory calibration.
A short flash of the LED "D1" indicates the reset.
or

3. Temp. RESET: BUTTON S1: Pressing the button for 5 seconds starts the procedure for the calibration mode T. Pressing both buttons simultanously for 10 seconds customer calibration settings are reset to factory calibration.
A short flash of the LED "D2" indicates the reset.

9.6 Adjustment/Calibration of EE33 Type T17

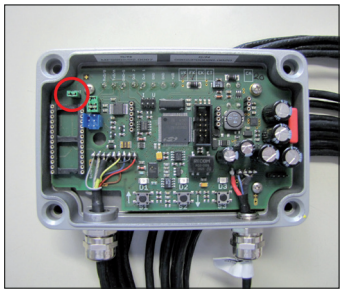
9.6.1 Adjustment/Calibration with Humidity Calibrator HUMOR 20

To be able to calibrate the sensor EE33 Type T17 with the dual probes (Td probe and T probe), a separate available adapter is needed (see chapter 12 „Replacement Parts / Accessories“ - HUMOR 20 adapter for EE33 Type T17, HA020401) to achieve the highest possible calibration result. The following steps describe how the EE33 should be calibrated correctly.



1. Plug both air vents of the cover of the measurement chamber with the plugs supplied with the adapter (see left picture).
2. Insert the Td probe (Ø12 mm) in the measuring chamber through one of the feed-throughs of the cover and tighten the nut.
3. Insert and tighten the T probe (Ø6 mm) in the adapter and insert in the measuring chamber through one of the feed-throughs of the cover and tighten the nut.
4. In case that feed-throughs are not in use, close them with the blind plugs delivered with the cover.

Sensors delivered after June 2009 have the possibility to heat the tube of the probe continuously to avoid condensation. This function must be disabled prior to calibration, by detaching the cover of the transmitter and removing the “heat” jumper in the left top corner of the circuit board (see picture on left side).



5. Connect the test unit to the supply connections of HUMOR 20.
6. Connect the output signal of the test unit(s) to the internal measuring inputs of HUMOR 20 (Unit1 RH, Unit2 RH).
7. Select the measuring ranges in accordance with the output signal of the test units. The temperature of the measuring chamber can be displayed by selecting "Temp." on the measuring range switch.
8. Use the humidity controller to select the setpoint of the humidity.
9. For information on the standard deviations and stabilisation times of the test unit, refer to the manufacturer's documentation (however, a minimum of 20 mins is recommended).
10. Compare the values shown in the display with the output signal of the sensor.

After calibration, make sure that the plugs in the air vents in the cover of the measuring chamber are removed.

9.6.2 Adjustment/Calibration with Various Calibrators

For an exact calibration, note especially point 4 in the chapter above.

10 Maintenance

10.1 Sensor Cleaning

It is easy to clean the sensor if there are particle deposits (e.g. dust) on the surface of the heated measurement cell.

Commercially available isopropyl alcohol is used for cleaning. Unscrew the filter cap and submerge the sensor element in the alcohol for 2 minutes.

Allow the sensor element to dry or blow it dry with oil-free compressed air.

Caution: In order to avoid destroying the active sensor coating, avoid using mechanical aids (e.g. cotton swabs or cloths) for cleaning!

10.2 Automatic ReCovery (ARC)

When capacitive humidity sensors are exposed to chemical pollution (e.g. detergent residue), the presence of foreign molecules can distort the measurement reading.

The foreign molecules can be evaporated by heating the measurement cell briefly and intensively. Reconditioning helps to minimize distorted measurement readings during the calibration interval.

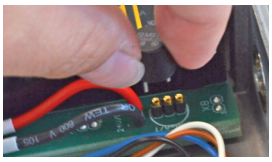
It is recommended to heat the measurement cell by choosing Manual after the cleaning or sterilization process or if distorted measurement readings are suspected.

To start heating, remove the housing cover and press the pushbutton S3 or trigger the ARC-module with the external signal (see chapter 8.1 “ARC-Module (Option AM1)”.

The orange LED D3 is illuminated during heating.

10.3 Fuse Replacement for Integrated Power Supply (Option AM3)

If the green LED on the PCB is not flashing with the supply voltage switched on, check the fuse and replace if required.



Fuse secondary:	250mA / T UL248-14	
Nominal voltage:	250V	
Replacement types:		
Series: MSTU 250	Manufacturer: Schurter	Order No.: 0034.7109
Series: 374	Manufacturer: Littelfuse	Order No.: 374 0250.

10.4 Self Diagnosis and Error Messages

10.4.1 Self diagnosis via LEDs on the circuit board

- **LED D2 (green)**
  Flashing → Supply voltage applied / Microprocessor is active
- **LED D1 (red)**
  Constantly lit → Humidity sensor element damaged
  Flashing → Dew (condensation) at the humidity sensor element
- **LED D3 (orange)**
  Constantly lit → Humidity sensor element will be heated (Automatic ReCovery)
  Flashing → Sensor and threaded element soiled

10.4.2 Self diagnosis via display (optional):

Error 1 → Humidity sensor element damaged

Error 2 → Humidity sensor element moistened (condensation!)

Error 3 → Temperature sensor element damaged

Error 4 → Temperature sensor short-circuit

Error 5 → Pt1000 probe element is damaged

Error 6 → Pt1000 probe short-circuit

] Types T17, T28

10.4.3 Further self diagnosis:

- **Error**
  Possible cause
  → *Measures / Help*
- Display shows incorrect values
  Error during re-adjustment of the transmitter
  → *Reset to factory calibration and repeat the calibration routine*
  Filter soiled
  → *Replace filter*
  Measuring cell contaminated
  → *Automatic ReCovery (ARC)*
  Output configured incorrectly
  → *Check output range and output signals in the configuration*
- **Long response time**
  Filter soiled
  → *Replace filter*
  Incorrect filter type
  → *Filter type should match the application*

- **Sensor failure**

  No supply voltage
  → *Check wiring and supply voltage*
  → Only green LED is illuminated continuously → electronics defect
  → contact the manufacturer

- **High humidity values - red LED blinks**

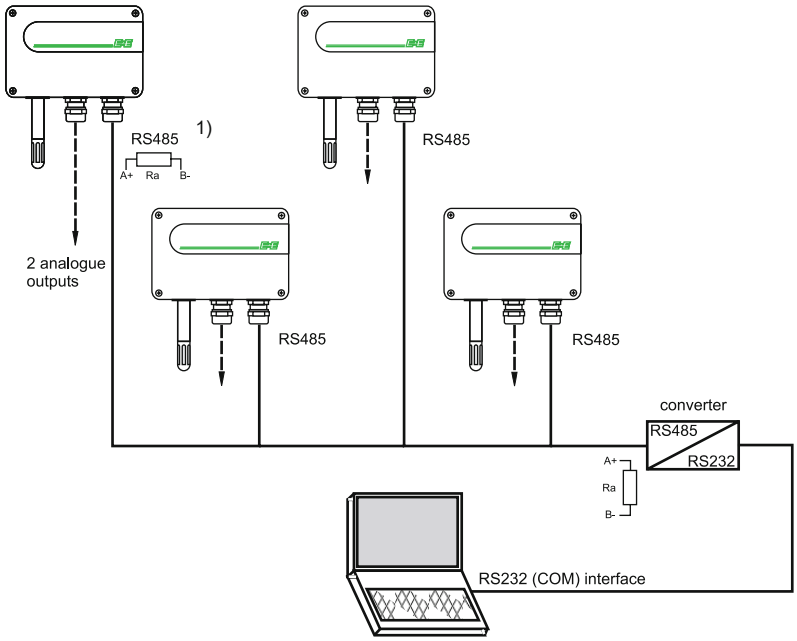
  Dew (condensation) in the sensor probe head
  → *heat the measurement cell and check the mounting of sensor probe*

  Incorrect filter type (e.g. storage of humidity after stainless steel sintered filter condensation)
  → *Filter type should match the application*

11 Network

EE33 sensors with option J3 can be connected in an RS485 bus system EE industry protocol.

Network configuration example:



1) Please note: to enable optimum expansion, both ends of the network shall be terminated with a terminating resistor with Ra=100 Ω.

Technical Data:

- Max. network size: 32 sensors
- Max. network expansion: 1 200m (3 937ft) total length
- Transmission rate: 9 600 Baud

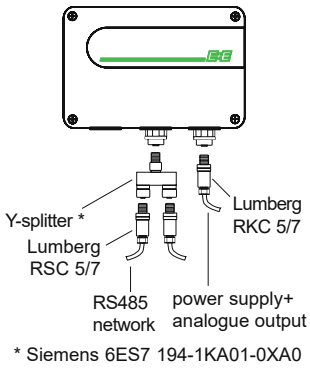
Mounting notes:

Data cables:
- external diameter < 4 mm (0.16")
- 2-core twisted pair
- Typ. 50 pF/m, impedance 100 Ω, non-shielded
- In accordance with the RS485 standard, cables in category 5 (UTP), specified according to EIA/TIA/ANSI 568, meet these requirements.

For high noise emissions, especially for large cable lengths, the use of shielded cables is recommended (Shield laid at GND Ser).

Plug connectors:
To achieve a more flexible network configuration, the sensors should be equipped with plug connectors. (Option E7)

For the network configuration, the following plug connectors are also necessary:
- Y splitter: Siemens 6ES7 194-1KA01-0XA0
- Plug: Lumberg RSC 5/7



RS232/485 converter:
To adapt the RS232 interface on the PC to the RS485 network protocol, a signal converter is required (see schematic “network configuration” above).

12 Replacement Parts / Accessories

Please also refer to the “Accessories“ data sheet.

Filter	
- Sintered stainless steel	HA010103
- PTFE	HA010105
- Metal grid	HA010106
Display + enclosure cover in metal	D05M
E+E Product Configuration Software (free download: www.epluse.com/configurator)	EE-PCS
Configuration cable (for EE-PCS)	HA010304
Interface cable for plug option E5	HA010311
Mounting flange 12 mm (1/2")	HA010201
Mounting flange 6 mm (1/4")	HA010207
1/2" ISO screw connection 12 mm (1/2")	HA011102
1/2" ISO screw connection 6 mm (1/4")	HA011104
1/2" NPT screw connection 12 mm (1/2")	HA011103
1/2" NPT screw connection 6 mm (1/4")	HA011105
M16x1.5 → 1/2" NPT adapter for conduit fittings	HA011101
Drip water protection	HA010503
Humidity calibration kit (free download: www.epluse.com)	HA011xxx
RS485 networking kit (HW + SW)	HA010605
Datalogging and analysis software	HA010602
Adapter M16x1.5 to NPT 1/2	HA011101
Radiation shield for 12 mm RH probe	HA010502
Radiation shield for 6 mm T probe	HA010506
Radiation shield LAM630 for EE33 Type T17 with control unit	HA010508
Mounting set for mast with Ø34 - 54 mm (1.3 - 2.1")	HA010213
HUMOR 20 adapter for EE33 Type T17	HA020401

13 Technical Data

Measurands

Relative humidity

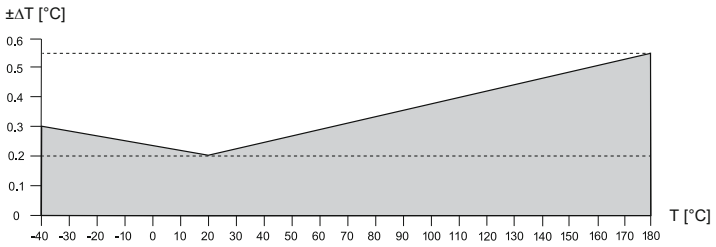
Measuring range		0...100 %RH
Accuracy[1] (including hysteresis, non-linearity and repeatability)		
-15...40 °C (5...104 °F)	≤90 %RH	± (1.3 + 0.003*mv) %RH mv = measured value
-15...40 °C (5...104 °F)	>90 %RH	± 2.3 %RH
-25...70 °C (-13...158 °F)		± (1.4 + 0.01*mv) %RH
-40...180 °C (-40...356 °F)		± (1.5 + 0.015*mv) %RH
Temperature dependency of electronics, typ.		± 0.01 %RH/°C (0.0055 %RH/°F)
Response time t_{90}, typ.		< 15 s
with stainless steel grid filter at 20°C (68°F)		

Temperature

Working range

Enclosure	-40...60 °C (-40...248 °F)
Enclosure with display	-20...50 °C (-4...122 °F)
Probes	
Type T4	-40...120 °C (-40...248 °F)
Type T5/T7/T8/T10/T17	-40...180 °C (-40...356 °F)

Accuracy[1]



Temperature dependency of electronics, typ.	±0.005 °C/°C

Calculated parameters

		Unit	from	to		
				EE33-xT4	EE33-xT5/T8/T10/T17	EE33-xT7
Dew point temperature	Td	°C (°F)	-40 (-40)	100 (212)	100 (212)	100 (212)
Frost point temperature	Tf*)	°C (°F)	-40 (-40)	0 (32)	0 (32)	0 (32)
Wet bulb temperature	Tw	°C (°F)	0 (32)	100 (212)	100 (212)	—
Water vapour partial pressure	e	mbar (psi)	0 (0)	1100 (15)	1100 (15)	—
Mixture ratio	r	g/kg (gr/lb)	0 (0)	999 (9999)	999 (9999)	—
Absolute humidity	dv	g/m³ (gr/ft³)	0 (0)	700 (300)	700 (300)	—
Specific enthalpy	h	kJ/kg (BTU/lb)	0 (0)	2800 (200)	2800 (200)	—

*) Equals Td above 0 °C (32 °F)

Output

Analogue	0 - 1 V / 5 V / 0 - 10 V $-1 < I_L < 1$ mA
2x freely selectable and scalable	0 - 20 mA / 4 - 20 mA (3-wire) Load resistance ≤ 500 Ohm
Digital interface	RS232, RS485 (with Option J3, EE33 = 1 Unit Load)
Protocol	E+E Industrial Transmitter Protocol
Default settings	Baudrate 9600, parity even, 1 stop bit, ID = unique factory set
Alarm outputs	2x changeover contact
with option AM2	250 V AC / 6 A, 28 V DC / 6 A (measurand, threshold and hysteresis configurable via EE-PCS)

General

Power supply class III [3]	8 - 35 V DC 12 - 30 V AC Or 100 - 240 V AC, 50/60 Hz with option AM3[2]
Current consumption, typ.	
at 24 V DC / AC 2x voltage output	40 mA / 80 mA_{rms}
at 24 V DC / AC 2x current output	80 mA / 160 mA_{rms}
Pressure range for pressure tight probe	
Type T7/T10/T17	0.01...20 bar (0.15...300 psi)
Type T8	0.01...100 bar (0.15...1450 psi)

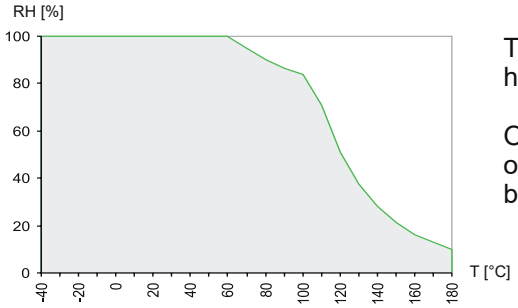
Enclosure material / Protection rating		Polycarbonate / IP65 / NEMA 4X $AlSi_9Cu_3$ / IP65 / NEMA 4
Probe material		Stainless steel 1.4404
Cable gland		M16x1.5 cable Ø4.5 - 10 mm (0.18 - 0.39")
Electrical connection		Screw terminals max. 1.5 mm² (AWG 16)
Electromagnetic compatibility		EN 61326-1 EN 61326-2-3 Industrial Environment FCC Part15 Class A ICES-003 Class A
Storage conditions	without display	-40...60 °C (-40...248 °F), non-condensing
	with display	-20...50 °C (-4...122 °F), non-condensing
Configuration and adjustment		EE-PCS (Product Configuration Software, free download) and configuration cable HA010304

1) Traceable to international 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)

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

3) USA & Canada: class 2 supply required.

Working Range Humidity Sensor



The grey area shows the allowed measurement range for the humidity sensor.

Operating points outside of this range do not lead to destruction of the sensor, but the specified measurement accuracy cannot be guaranteed.

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