

# EE310

## High-End Humidity and Temperature Sensor for Industrial Applications

The EE310 is optimized for best reliability in industrial applications from -80 °C (-112 °F) up to 180 °C (356 °F) and 20 bar (290 psi). In addition to highly accurate measurement of the relative humidity (RH) and temperature (T), the device calculates all other humidity related parameters.

### Measurement Performance

The EE310 employs high-end E+E humidity sensing elements manufactured in state-of-the-art thin film technology, which are the prerequisite for outstanding measurement accuracy.

### Long-Term Stability

The E+E proprietary coating protects the sensing elements against corrosive and electrically conductive pollution, which leads to outstanding long-term stability even in harsh environment. With the appropriate choice of filter cap, the EE310 tackles even challenging industrial applications.

### Versatility

The EE310 is available for wall or duct mount as well as with remote probe. It features an IP65 / NEMA 4X polycarbonate or stainless steel enclosure which facilitates installation and maintenance. The enclosure can accommodate a 100 - 240 V AC supply unit or various interface modules.

### Display and Outputs

The measured data is available on two analogue outputs and on the RS485 (Modbus RTU) or Ethernet-PoE (Modbus TCP) interface. The TFT colour display shows simultaneously up to four measurands and offers extensive setup and diagnosis features. The data logging function saves up to 20 000 measured values for each physical quantity. The logged data can be displayed graphically directly on the device or easily downloaded over the USB interface.

### Configurable and Adjustable

The configuration and the RH and T adjustment of the EE310 can be performed either using the display and the push buttons or with the free EE-PCS Product Configuration Software via the USB interface.



## Features

### 3.5" TFT Colour Display

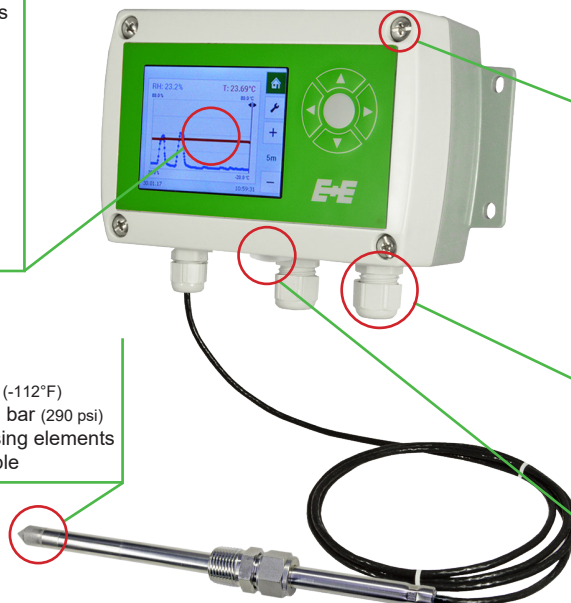
- » Shows up to 4 measurands simultaneously
- » Layout and measurands freely selectable
- » Data logger for 20 000 values per measurand
- » Logged data shown graphically
- » Diagnosis functions
- » Intuitive device setup with push buttons

### Probe

- » Working range from -80°C (-112°F) up to 180°C (356 °F) and 20 bar (290 psi)
- » Protective coating for sensing elements
- » Pluggable versions available

### Inspection certificate

- » According DIN EN 10204-3.1



### Enclosure

- » IP65 / NEMA4X protection rating
- » Polycarbonate or stainless steel
- » Easy mounting and service

### Outputs

- » 2 analogue outputs current / voltage
- » Error indication according NAMUR
- » Modbus RTU / Modbus TCP
- » Configurable via display or software

### USB Service Interface

- » Configuration, adjustment and firmware update
- » Download logged data
- » 4 status LEDs

## Protective sensor coating (option C1)

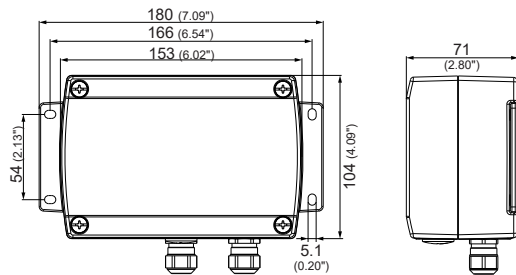
The E+E proprietary sensor coating is a protective layer applied to the sensing elements, their leads and soldering points. The coating substantially extends sensor lifetime and ensures optimal measurement performance in corrosive environment (salts, off-shore applications). Additionally, it improves the sensors' long term stability in dusty, dirty or oily applications by preventing stray impedance caused by deposits on the active sensor surface or on the electrical connections.

## Dimensions

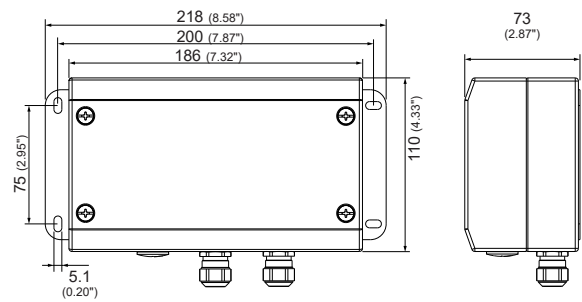
Values in mm (inch)

### ENCLOSURE

#### Polycarbonate

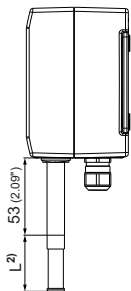


#### Stainless steel

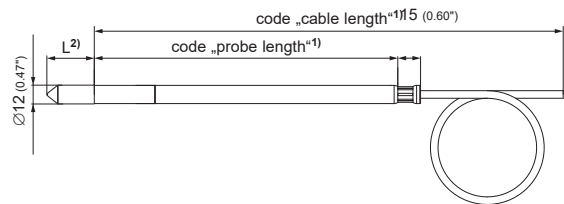


### TYPE

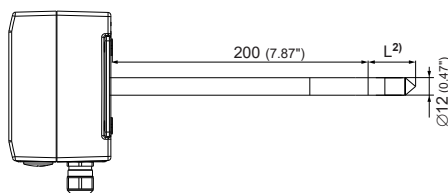
#### T1: Wall mount



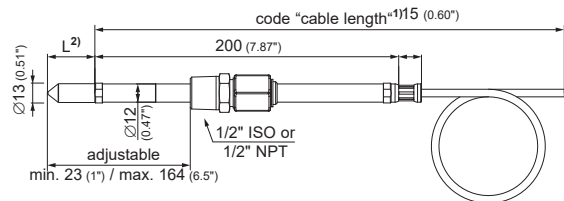
#### T5: Remote probe up to 180 °C (356 °F)



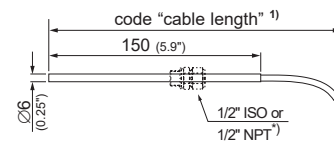
#### T2: Duct mount



#### T10: Pressure tight probe up to 20 bar (300 psi)



#### T24: T only remote probe (M3)



1) Refer to ordering guide

2) L = filter length; refer to data sheet "Accessories"

\*) Not included in the scope of supply:  
1/2" ISO  $\varnothing 6$  mm HA011104  
1/2" NPT  $\varnothing 6$  mm HA011105

## Technical Data

### Measurands

#### Relative humidity (RH)

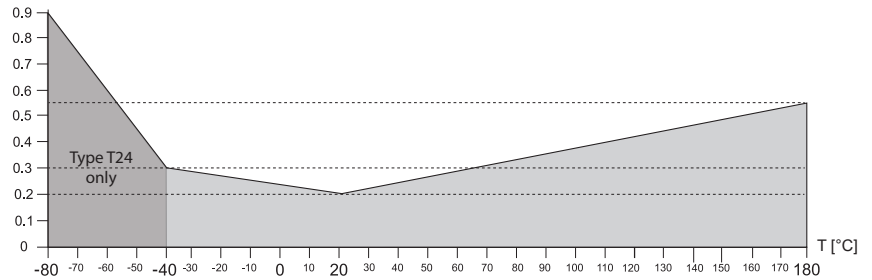
Working range	0...100 %RH	
Accuracy <sup>1)</sup> (incl. hysteresis, non-linearity and repeatability)		
-15...40 °C (5...104 °F) RH ≤90 %	± (1.3 + 0.3 % * mv) %RH	<i>mv = measured value</i>
-15...40 °C (5...104 °F) RH >90 %	± 2.3 % RH	
-25...70 °C (-13...158 °F)	± (1.4 + 1 % * mv) %RH	
-40...180 °C (-40...356 °F)	± (1.5 + 1.5 % * mv) %RH	
Temperature dependence of electronics, typ.	± 0.01 %RH/°C (0.0055 %RH / °F)	
Response time	< 15 s with metal grid filter at 20 °C (68 °F) / t <sub>90</sub>	

#### Temperature (T)

Working range sensing probe	T1, wall:	-40...60 °C (-40...140 °F)
	T2, duct:	-40...80 °C (-40...176 °F)
	T5, remote:	-40...180 °C (-40...356 °F)
	T10, pressure tight:	-40...180 °C (-40...356 °F)
	T24, T only remote probe:	-80...180 °C (-112...356 °F)

Accuracy<sup>1)</sup>

± ΔT [°C]



Temperature dependence of electronics, typ. ±0.001°C/°C

### Calculated parameters

	from		EE310-T1		up to EE310-T2		EE310-T5,T10		unit
Dew point temperature	Td	-40 (-40)	60	(140)	80	(176)	100	(212)	°C (°F)
Frost point temperature	Tf	-40 (-40)	0	(32)	0	(32)	0	(32)	°C (°F)
Wet bulb temperature	Tw	0 (32)	60	(140)	80	(176)	100	(212)	°C (°F)
Water vapour partial pressure	e	0 (0)	200	(3)	500	(7.5)	1100	(15)	mbar (psi)
Mixing ratio	r	0 (0)	425	(2900)	999	(9999)	999	(9999)	g/kg (gr/lb)
Absolute humidity	dv	0 (0)	150	(60)	300	(120)	700	(300)	g/m³ (gr/f³)
Specific enthalpy	h	0 (0)	400	(180)	1000	(450)	2800	(1250)	kJ/kg (BTU/lb)

### Outputs

Two analogue outputs freely selectable and scalable		0 - 1 / 5 / 10 V	-1 mA < I <sub>L</sub> < 1 mA
		4 - 20 mA 3-wire	R <sub>L</sub> < 500 Ω
		0 - 20 mA 3 wire	R <sub>L</sub> < 500 Ω
Digital interface / protocol	option J3	RS485 / Modbus RTU (EE310-UL = 1 unit load)	
Factory settings		9600 Baud, parity even, 1 stop bit, Modbus address 231	
Supported baud rates		9 600, 19 200, 38 400, 57 600 and 76 800	
Digital interface / protocol	option J4	Ethernet-PoE with Modbus TCP	

### General

Power supply class III ⚡ (EU) / class 2 (NA)<sup>2)</sup> 8 - 35 V DC 12 - 30 V AC  
 100 - 240 V AC, 50/60 Hz with option AM3<sup>3)</sup>

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).  
 For model T1 the accuracy data is valid only for air speed higher than 0.2m/s.  
 2) USA & Canada class 2 supply required, max. supply voltage 30 V DC  
 3) Appropriate for outdoor use, wet location, degree of pollution 2, overvoltage category II, altitude up to 3000 m (9843 ft)

Current consumption at 24 V DC/AC, typ.	15 mA / 40 mA <sub>rms</sub> for 2 voltage outputs 35 mA / 100 mA <sub>rms</sub> for 2 current outputs 50 mA / 150 mA <sub>rms</sub> additional for display 30mA / 90 mA <sub>rms</sub> additional for Ethernet		
Pressure range for pressure tight probe	0.01...20 bar (0.15...300 psi)		
Probe material	Stainless steel 1.4404 / AISI 316L		
Enclosure material	Polycarbonate, UL94 V-0 approved or Stainless steel 1.4404 / AISI 316 L		
Protection rating	IP65 / NEMA 4X		
Cable glands	for polycarbonate enclosure	M16 x 1.5, for cable Ø 3 - 7 mm (0.12 - 0.28")	
	for metal enclosure	M16 x 1.5, for cable Ø 4.5 - 10 mm (0.18 - 0.39")	
Electrical connection	Screw terminals max. 1.5 mm <sup>2</sup> (AWG 16)		
Working and storage temperature range of electronics	-40...60 °C (-40...140 °F) without display -20...50 °C (-4...122 °F) with display		
Electromagnetic compatibility	EN 61326-1	EN 61326-2-3	Industrial Environment ICES-003 ClassA
	FCC Part15 ClassA		



## Ordering Guide

		EE310-					
Hardware configuration	<b>Model</b>	RH + T T	no code				M3
	<b>Type</b>	Wall mount	T1				
		Duct mount		T2			
		Remote probe up to 180 °C (356 °F)			T5		
		Pressure tight probe up to 20 bar (300 psi) T only, remote probe Ø 6 mm (0.25")				T10	T24
	<b>Enclosure</b>	Polycarbonate	no code	no code	no code	no code	no code
		Stainless steel	HS2		HS2	HS2	HS2
	<b>Filter</b>	No filter	no code	no code	no code	no code	F0
		Stainless steel sintered	no code	F5	F5	no code	
		PTFE	F5	F5	F5	no code	
<b>Cable length</b> (incl. probe length)	2 m (6.6 ft)			no code	no code	no code	
	5 m (16.4 ft)			K5	K5	K5	
	10 m (32.8 ft)			K10	K10		
	20 m (65.6 ft)			K20	K20		
<b>Probe length</b>	65 mm (2.55")			L65			
	150 mm (5.91")					L150	
	200 mm (7.87")			no code	no code		
	400 mm (15.75")			L400	L400		
<b>Process connection</b>	1/2" ISO thread				PA23		
	1/2" NPT thread				PA25		
<b>Electrical connection</b>	Standard <sup>1)</sup>	no code	no code	no code	no code	no code	
	1 plug for power supply and outputs	E4	E4	E4	E4	E4	
	2 plugs for power supply / outputs and for Modbus RTU (requires option J3)	E6	E6	E6	E6	E6	
<b>Optional features</b>	3.5" TFT display with integrated data logger	D2	D2	D2	D2	D2	
	RS485 module - Modbus RTU	J3	J3	J3	J3	J3	
	Ethernet-PoE with Modbus TCP <sup>2)3)</sup>		J4	J4	J4	J4	
	Pluggable probe <sup>2)</sup>			PC4	PC4		
	Sensor coating	C1	C1	C1	C1		
	Integrated power supply 100 - 240 V AC, 50/60 Hz <sup>3)4)</sup>	AM3	AM3	AM3	AM3	AM3	
Setup - analogue outputs	<b>Output 1</b>	Relative humidity RH	no code				
		Temperature T	MA1				MA1
		Temperature T	MA2				MA2
		Other measurand	MAxx				
	<b>Output signal 1<sup>5)</sup></b>	0 - 1 V	GA1				
		0 - 5 V	GA2				
		0 - 10 V	GA3				
		0 - 20 mA	GA5				
		4 - 20 mA	GA6				
	<b>Scaling 1 low</b>	0 Value	no code SALValue				
<b>Scaling 1 high</b>	100 Value	no code SAHValue					
<b>Output 2</b>	Temperature T	no code					
	Temperature T	MB2					
	Other measurand	MBxx					
<b>Output signal 2<sup>5)</sup></b>	0 - 1 V	GB1					
	0 - 5 V	GB2					
	0 - 10 V	GB3					
	0 - 20 mA	GB5					
	4 - 20 mA	GB6					
<b>Scaling 2 low</b>	Value	SBLValue					
<b>Scaling 2 high</b>	Value	SBHValue					

1) Standard = 2 x M16 cable glands, except for AM3 option: 2 plugs for power supply and outputs

2) Only with polycarbonate enclosure

3) Combination of Ethernet module (J4) and integrated power supply (AM3) is not possible

4) With electrical connection standard only (no other plug options possible)

5) Both analogue outputs shall be either voltage or current

## Measurand Code

For Output 1 and 2 in the Ordering Guide



Please note: no mix of SI/US units allowed

		MAxx / MBxx
Relative humidity	%	10
Temperature	°C	1
	°F	2
Dew point Td	°C	52
	°F	53
Frost point Tf	°C	65
	°F	66
Mixing ratio r	g/kg	60
	gr/lb	61

		MAxx / MBxx
Absolute humidity dv	g/m <sup>3</sup>	56
	gr/ft <sup>3</sup>	57
Wet bulb temperature Tw	°C	54
	°F	55
Water vapour partial pressure e	mbar	50
	psi	51
Specific enthalpy h	kJ/kg	62
	BTU/lb	64

## Order Example

### EE310-T5D2J3C1GA3GB3SBL-40SBH180

Type:	T5	Remote probe up to 180 °C (356 °F)
Enclosure:	no code	Polycarbonate
Filter:	no code	Stainless steel sintered filter
Cable length:	no code	2 m (6.6")
Probe length:	no code	200 mm (7.87")
Electrical connection:	no code	Standard
Optional features:	D2	3.5" TFT display with integrated data logger
	J3	RS485 module - Modbus RTU
	C1	Sensor coating
Output 1:	no code	Relative humidity %
Output Signal 1:	GA3	0 - 10 V
Scaling 1 low:	no code	0
Scaling 1 high:	no code	100
Output 2:	no code	Temperature T [°C]
Output Signal 2:	GB3	0 - 10 V
Scaling 2 low:	SBL-40	-40
Scaling 2 high:	SBH180	180

## Accessories

(for further information, see data sheet "Accessories")

Mounting flange stainless steel	HA010201	
Drip water protection	HA010503	
Bracket for installation onto mounting rails <sup>1)</sup>	HA010203	
Mounting bracket for remote probe	HA010211	
Humidity calibration kit	see data sheet „Humidity calibration kit“	
Stainless steel wall mounting clip Ø 12 mm (0.5")	HA010225	
Mounting flange stainless steel (Ø 6 mm/0.25", T24)	HA010207	
Pressure tight screw connectors Ø 6 mm (0.25") (T24)	1/2" ISO	HA011104
	1/2" NPT	HA011105
Immersion well, stainless steel Ø 6 x 135 mm (0.25 x 5.4") (T24)	1/2" ISO	HA400202
	1/2" NPT	HA400212

1) For polycarbonate enclosure only. Two pieces are necessary for each EE310.