

# EE310

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

The EE310 is optimized for best reliability in industrial applications 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 4 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, on the RS485 (Modbus RTU) or Ethernet-PoE (Modbus TCP) interface and on the alarm (relay) outputs.

The TFT colour display shows simultaneously up to four measurands and offers extensive setup and diagnosis features. The data logging function saves up to 20000 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

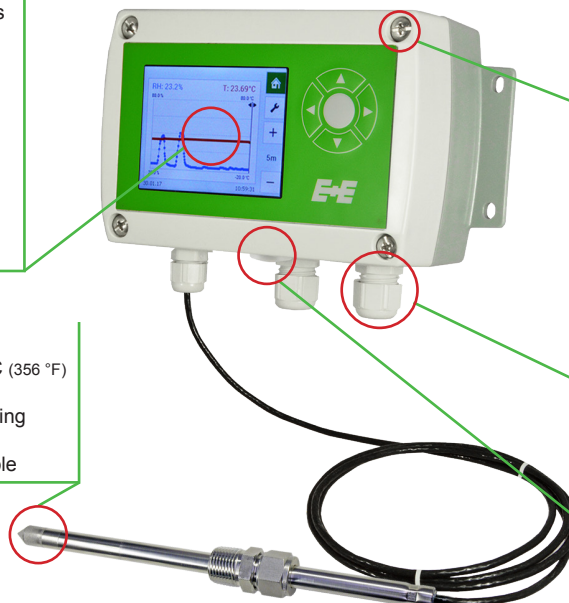
- » shows up to 4 measurands simultaneously
- » layout and measurands freely selectable
- » data logger for 20.000 values per measurand
- » logged data shown graphically
- » diagnosis functions
- » intuitive device setup with push buttons

### Probe

- » working range 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 / NEMA 4 protection class
- » polycarbonate or stainless steel
- » easy mounting and service

### Outputs

- » 2 analogue outputs current / voltage
- » error indication according NAMUR
- » Modbus RTU / Modbus TCP
- » 2 alarm outputs
- » configurable via display or software

### USB Service Interface

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

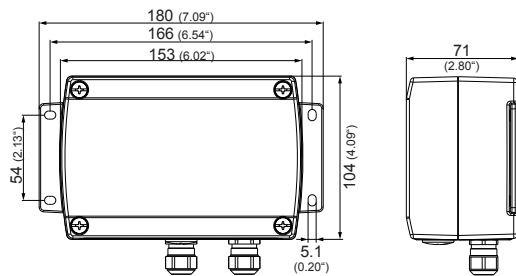
## Protective sensor coating (option C1)

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

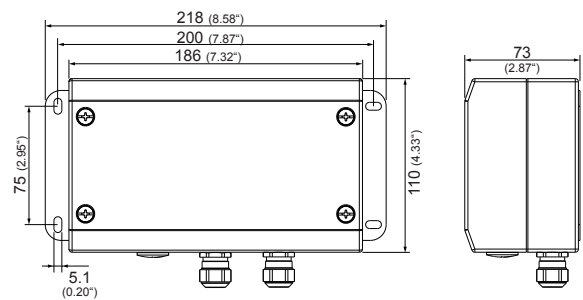
## Dimensions in mm (inch)

### ENCLOSURES

#### Polycarbonate

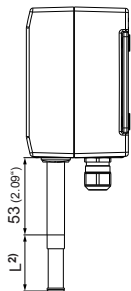


#### Stainless steel

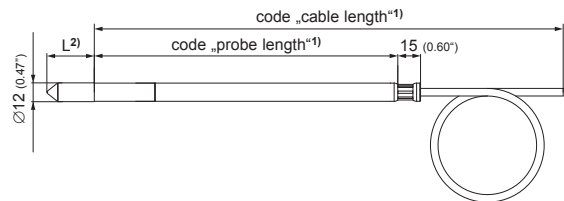


### PROBES

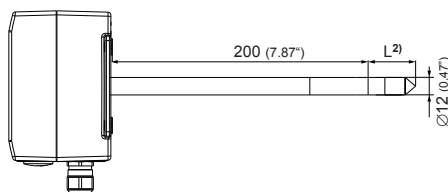
#### T1: Wall mount



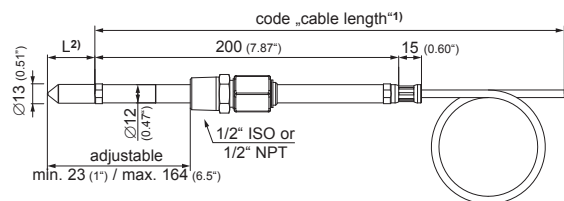
#### T5: Remote probe up to 180 °C (356 °F)



#### T2: Duct mount



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



1) Refer to ordering guide

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

## 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

-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

*mv = measured value*

Temperature dependence of electronics typ. ± 0.01 % RH/°C (0.0055 % RH / °F)

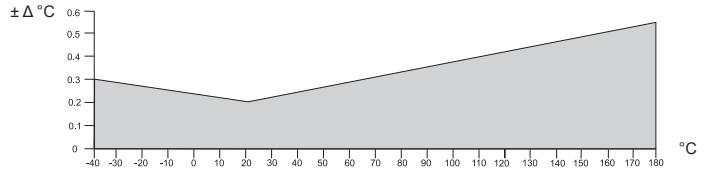
Response time < 15 s with metal grid filter at 20 °C (68 °F) / t<sub>90</sub>

## 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)

Accuracy<sup>1)</sup>



Temperature dependence of electronics

typ. ± 0.005 °C/°C

### Calculated parameters

		from		up to			unit	
				<i>EE310-T1</i>	<i>EE310-T2</i>	<i>EE310-T5, T10</i>		
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/m <sup>3</sup> (gr/ft <sup>3</sup> )
Specific enthalpy	h	0	(0)	400 (50000)	1000 (375000)	2800	(999999)	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 Ohm  
 0 - 20 mA    3 wire      R<sub>L</sub> < 500 Ohm

Digital interface / protocol      option J3

RS485 / Modbus RTU, max. 32 unit load devices on one bus  
 (EE310 = 1 unit load; factory settings: 9600 bps, parity even, stop bit 1 / slave-ID 231)

option J4

Ethernet-PoE with Modbus TCP

### General

Power supply class III (EU) / class 2 (NA)

8...35 V DC      12...30 V AC  
 100...240 V AC, 50/60 Hz with option AM3 <sup>2)</sup>

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-V0 approved or  
 stainless steel 1.4404 / AISI 316 L

Protection class

IP65 / NEMA 4

Cable glands      for polycarbonate enclosure  
                          for metal enclosure

M16 x 1.5, for cable Ø 3 - 7 mm (0.12 - 0.28")  
 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

EN61326-1    EN61326-2-3    ICES-003 ClassA  
 Industrial Environment      FCC Part15 ClassA



Two alarm outputs <sup>2)</sup>

changeover contact  
 250 V AC / 6 A      28 V DC / 6 A

System requirements for EE-PCS software

Windows XP or higher; USB port

1) 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).  
 Accuracy is specified for all models with an airflow > 0.0 m/s, except for Models T1 with an airflow > 0.2 m/s.

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

## Ordering Guide

		EE310					
		T1	T2	T5	T10		
Hardware configuration	Type	wall mount duct mount remote probe up to 180 °C (356 °F) pressure tight probe up to 20 bar (300 psi)					
	Enclosure	polycarbonate stainless steel	no code HS2	no code	no code HS2	no code HS2	
	Filter	plastic - metal grid (up to 120 °C / 248 °F) stainless steel sintered PTFE stainless steel - metal grid (up to 180 °C / 356 °F) H <sub>2</sub> O <sub>2</sub>	F3 no code F5 F9 F12	F3 no code F5 F9 F12	no code F5 F9 F12	no code F9	
	Cable length (incl. probe length)	0.5 m (1.64 ft) 2 m (6.6 ft) 5 m (16.4 ft) 10 m (32.8 ft) 20 m (65.6 ft)			K0.5 no code K5 K10 K20	no code K5 K10 K20	
	Probe length	65 mm (2.55") 200 mm (7.87") 400 mm (15.75")			L65 no code L400	no code L400	
	Process connection	1/2" ISO thread 1/2" NPT thread				PA23 PA25	
	Electrical connection	cable glands 1 plug for power supply and outputs 1 cable gland / 1 plug for Modbus RTU (requires option J3) 2 plugs for power supply / outputs and for Modbus RTU (requires option J3) 3 plugs for power supply / outputs and Modbus RTU (requires option J3) <sup>1)</sup>	no code E4 E5 E6 E12	no code E4 E5 E6 E12	no code E4 E5 E6 E12	no code E4 E5 E6 E12	
	Optional features	3.5" TFT display with integrated data logger RS485 module - Modbus RTU Ethernet module - Modbus TCP <sup>1) 2)</sup> pluggable probe <sup>1)</sup> sensor coating alarm outputs with cable glands <sup>2)</sup> integrated power supply 100...240 V AC, 50/60 Hz <sup>2) 3)</sup>	D2 J3 C1 AM2 AM3	D2 J3 J4 C1 AM2 AM3	D2 J3 J4 PC4 C1 AM2 AM3	D2 J3 J4 PC4 C1 AM2 AM3	
	Setup - analogue outputs	Output 1	relative humidity RH [%] other measurand (xx see measurand code below)	no code MAxx			
		Output signal 1 <sup>4)</sup>	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		100 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 <sup>4)</sup>		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) Only with polycarbonate enclosure.  
2) Combination of alarm output (AM2), Ethernet module (J4) and integrated power supply (AM3) is not possible.  
3) Integrated power supply includes 2 plugs for power supply and outputs, other plug options are not possible.  
4) Both analogue outputs shall be either voltage or current.

## Measurand Code for output 1 and 2 in the ordering guide

		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

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### 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	cable glands
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 (see data sheet "Accessories")

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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

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