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Datasheet EE310

High-End Humidity and Temperature Sensor for Industrial Applications

Modbus

www.epluse.com

EE310

High-End Humidity and Temperature Sensor for Industrial Applications

The EE310 is optimised for best reliability in industrial applications from -80 °C (-112 °F) up to 180 °C (356 °F) and 20 bar (300 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 enable the 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 selection of the appropriate 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.

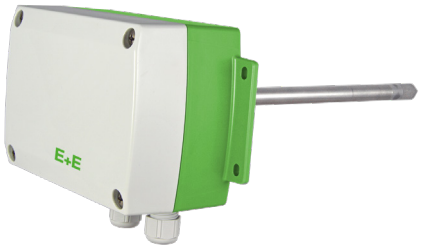
Display and Outputs

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 up to four measurands simultaneously 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 E+E PCS10 Product Configuration Software via the USB interface.

Stainless steel enclosure for wall mounting



Polycarbonate enclosure for duct mounting

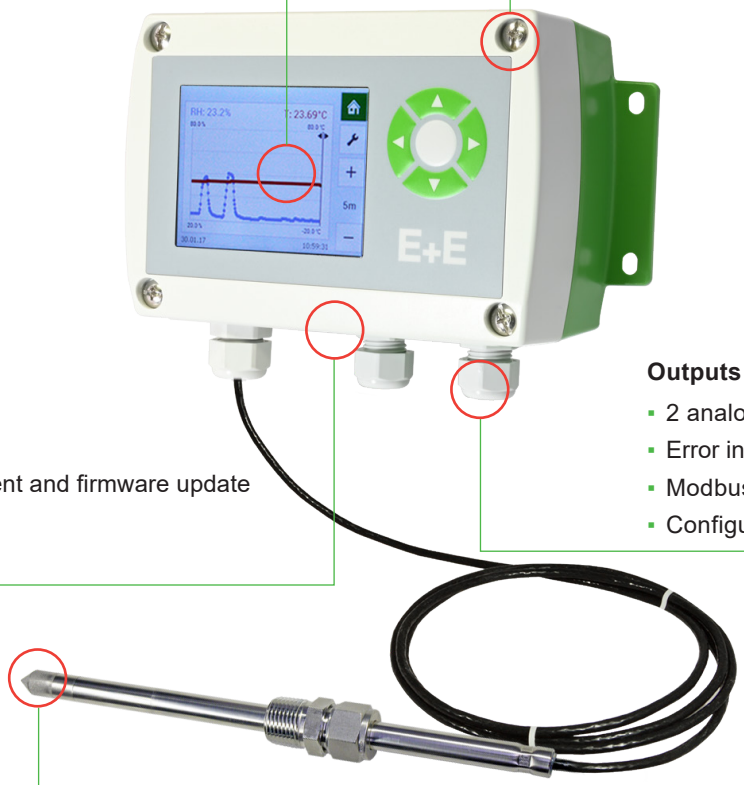
Features

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

Enclosure

- IP65 / NEMA 4X protection rating
- Polycarbonate or stainless steel
- Easy mounting and service



USB service interface

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

Outputs

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

Probe

- Working range from -80 °C (-112 °F) up to +180 °C (+356 °F) and 20 bar (300 psi)
- Protective coating for sensing elements
- Pluggable versions available

Inspection certificate

According to DIN EN 10204-3.1

Features

Protective Sensor Coating

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.

Accredited Traceable Calibration Certificate

Internationally recognised certificates for the calibration of measuring instruments from accredited laboratories document the traceability of the measurements to the International System of Units (SI). The E+E Elektronik calibration laboratory offers two levels of traceable calibrations.

- As a Designated Institute (DI) of the Republic of Austria, the E+E calibration laboratory maintains Austria's national measurement standards for humidity, dew point temperature, air velocity and CO_2. This authorises the E+E calibration laboratory to issue calibration certificates at the level of a National Metrological Institute (NMI).
- The E+E calibration laboratory is accredited by Akkreditierung Austria in accordance with DIN EN ISO/IEC 17025 with the identification number 0608. This allows the laboratory to issue ISO 17025 certificates for the measurands humidity, temperature, dew point temperature, air velocity, flow, pressure and CO_2.

Visit www.eplusecal.com for detailed information on calibration and to enquire a certificate of accredited traceable calibration for the EE310 from the Designated Institute.

ISO 9001 Calibration Certificate

An ISO 9001 calibration certificate documents the comparative measurement of a device against high quality reference equipment (factory level standard). The comparison is performed in accordance with internal procedures that comply with ISO 9001 and provides information on the specimen's measuring accuracy. The reference equipment is traceable to national standards, however, the calibration process is not accredited. Therefore, an ISO 9001 calibration is neither traceable nor internationally comparable.

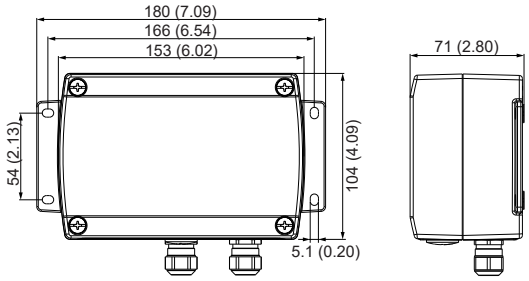
Visit www.epluse.com/iso9001cal for detailed information on calibration and to enquire an ISO 9001 calibration certificate.

Dimensions

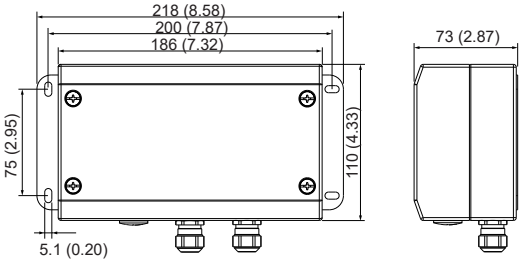
Values in mm (inch)

Enclosure

Polycarbonate

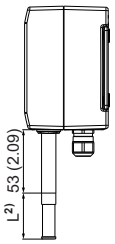


Stainless steel

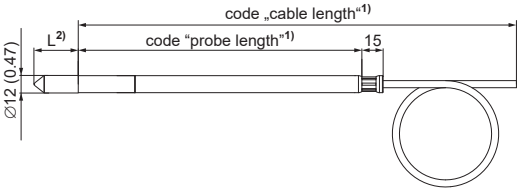


Types

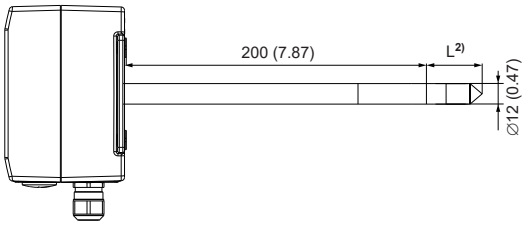
T1: Wall mount



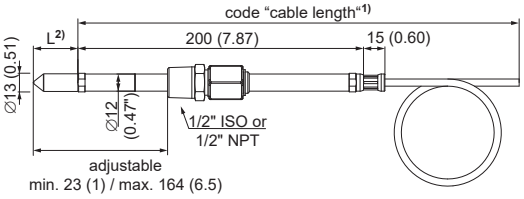
T5: Remote probe up to 180 °C (356 °F)



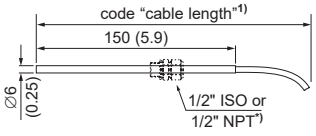
T2: Duct mount



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



T24: T only remote probe (M3)



1) Please refer to ordering guide
2) L = filter length; please refer to the Accessories data sheet

*) Not included in the scope of supply:

1/2" ISO ∅ 6 mm	HA011104
1/2" NPT ∅ 6 mm	HA011105

Technical Data

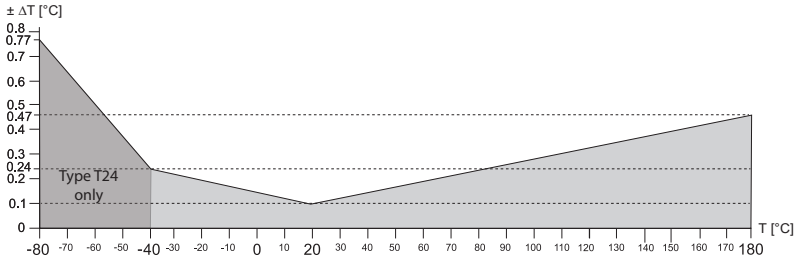
Measurands

Relative Humidity (RH)

Measuring range	0...100 %RH
Accuracy[1], incl. hysteresis, non-linearity and repeatability	
-15...+40 °C (5...104 °F) RH ≤90 %	±(0.95 + 0.0013 * mv) %RH
-15...+40 °C (5...104 °F) RH >90 %	±1.8 %RH
-25...+70 °C (-13...+158 °F)	±(1.05 + 0.0084 * mv) %RH
-40...+180 °C (-40...+356 °F)	±(1.15 + 0.013 * mv) %RH mv = measured value
Factory calibration uncertainty[2] **0...90 %RH**	±(0.7 + 0.003 * mv) %RH
90...100 %RH	±1 %RH mv = measured value
Temperature dependency of electronics, typ.	±0.01 % RH / °C (0.0056 %RH / °F)
Response time t_{90} with metal grid filter at 20 °C (68 °F)	<15 s

1) Defined against E+E calibration reference.
2) Defined at 23 °C with an coverage factor k=2, corresponding to a confidence level of 95 %.

Temperature (T)

Measuring range	
T1, wall mount	-40...+60 °C (-40...+140 °F)
T2, duct mount	-40...+80 °C (-40...+176 °F)
T5, remote probe	-40...+180 °C (-40...+356 °F)
T10, pressure-tight probe	-40...+180 °C (-40...+356 °F)
T24, T only remote probe	-80...+180 °C (-112...+356 °F)
Accuracy[1]	
Factory calibration uncertainty[2] @ 23 °C (73 °F)	±0.1 °C
Temperature dependence of electronics, typ.	±0.001 °C / °C

1) Defined against E+E calibration reference. For type T1, the accuracy data is valid only for air speed higher than 0.2 m/s.
2) Defined at 23 °C with an coverage factor of k=2, corresponding to a confidence level of 95 %.

Calculated Quantities

		from		up to EE310-T1		EE310-T2		EE310-T5, T10		unit	
Dew point temperature[1]	Td	-40	(-40)	60	(140)	80	(176)	100	(212)	°C	(°F)
Frost point temperature[2]	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^3	(gr/ft^3)
Specific enthalpy	h	0	(0)	400	(180)	1000	(450)	2800	(1250)	kJ/kg	(BTU/lb)

1) Td accuracy according to RH and T uncertainties, please use the E+E Humidity Calculator for details.
2) Equals Td above 0 °C (32 °F).

Technical Data

Outputs

Analogue

Two freely selectable and scalable analogue outputs	0 - 1 / 5 / 10 V 0 - 20 mA / 4 - 20 mA (3-wire) Both outputs have the same electrical quantity (voltage, current)	-1 mA < I_L < 1 mA R_L < 500 Ω	I_L = load current R_L = load resistance
Accuracy @ 23 °C (68 °F)	±0.05 % FS		FS = full scale (20 mA, 10 V)
Temperature dependency[1)]	±0.005 % FS/°C		FS = full scale (20 mA, 10 V)

1) Deviating from 23 °C (68 °F), defined at 12 mA or 5 V, respectively.

Digital

Digital interface **Protocol** **Factory settings** **Supported Baud rates** **Measured data types**	**Option J3**	RS485 (EE310 = 1 unit load) Modbus RTU 9 600 Baud, parity even, 1 stop bit, Modbus address 231 9 600, 19 200, 38 400, 57 600 and 76 800 FLOAT32 and INT16
Digital interface **Protocol**	**Option J4**	Ethernet-PoE Modbus TCP

General

Power supply class III ⧫III⧫ USA & Canada: Class 2 supply necessary, max. voltage 30 V DC	8 - 35 V DC 12 - 30 V AC 100 - 240 V AC, 50/60 Hz mit Option AM3[1)]
Current consumption, (typ.) @ 24 V DC / AC **2 voltage outputs** **2 current outputs** **with display additionally** **with Ethernet additionally**	 15 mA / 40 mA_{rms} 35 mA / 100 mA_{rms} 50 mA / 150 mA_{rms} 30 mA / 90 mA_{rms}
Electrical connection	Screw terminals max. 1.5 mm^2 (AWG 16)
Cable glands **for polycarbonate enclosure** **for metal enclosure**	 M16x1.5, for cable Ø3...7 mm (0.12...0.28") M16x1.5, for cable Ø4.5...10 mm (0.18...0.39")
Pressure range for pressure-tight probe	0.01...20 bar (0.15...300 psi)
Temperature range **Operation** **Storage**	 -40...+60 °C (-40...+140 °F) without display -20...+50 °C (-4...+122 °F) with display
Probe **Material** **Protection rating,** probe body	 Stainless steel 1.4404 / AISI 316L IP65
Enclosure **Material** **Protection rating**	 Polycarbonate, UL94 V-0 approved or Stainless steel 1.4404 / AISI 316 L IP65 / NEMA 4X
Electromagnetic compatibility	EN 61326-1 EN 61326-2-3 Industrial Environment FCC Part15 ClassA ICES-003 ClassA
Conformity	CE UKCA
Configuration software	E+E PCS10 Product Configuration Software Free download from www.epluse.com/pcs10

1) Degree of pollution 2, overvoltage category II, altitude up to 3000 m (9843 ft).

Ordering Guide

	Feature	Description	Code				
			EE310-				
Hardware Configuration	**Model**	RH + T	No code				
		T					M3
	Type	Wall mount	T1				
		Duct mount		T2			
		Remote probe up to 180 °C (356 °F)			T5		
		Pressure-tight probe up to 20 bar (300 psi)				T10	
		T only, remote probe Ø6 mm (0.25")					T24
	Enclosure material	Polycarbonate (PC)	No code	No code	No code	No code	No code
		Stainless steel	HS2		HS2	HS2	HS2
	Filter	No filter					F0
		Stainless steel sintered	No code	No code	No code	No code	
		Polytetrafluoroethylene (PTFE)	F5	F5	F5		
		Stainless steel - metal grid (up to 180 °C / 356 °F)	F9	F9	F9	F9	
	Probe cable length (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	
	Probe length	65 mm (2.55")			L65		
		150 mm (5.91")					L150
		200 mm (7.84")			No code	No code	
		400 mm (15.75")			L400	L400	
	Process connection	G1/2" ISO - sliding fitting, Ø13 mm (0.51")				PA23	
		1/2" NPT - sliding fitting, Ø13 mm (0.51")				PA25	
	Electrical connection	Standard[1]	No code	No code	No code	No code	No code
		1 x plug for power supply and outputs	E4	E4	E4	E4	E4
		2 x plugs for power supply + outputs and for RS485 (requires option J3)	E6	E6	E6	E6	E6
	Optional features	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[2)3)]		J4	J4	J4	J4
		Pluggable probe[2)]			PC4	PC4	
		Sensor coating	C1	C1	C1	C1	
		Integrated power supply 100 - 240 V AC, 50/60 Hz[3)4)]	AM3	AM3	AM3	AM3	AM3
Setup Analogue Outputs	**Output 1 measurand**	Relative humidity RH [%]	No code				
		Temperature T [°C]	MA1				MA1
		Temperature T [°F]	MA2				MA2
		Other measurands (*xx* see measurand code)	MA*xx*				
	Output 1 signal[5)]	0 - 1 V	GA1				
		0 - 5 V	GA2				
		0 - 10 V	GA3				
		0 - 20 mA	GA5				
		4 - 20 mA	GA6				
	Output 1 scaling low	0	No code				
		Value	SAL*Value*				
	Output 1 scaling high	100	No code				
		Value	SAH*Value*				
	Output 2 measurand	Temperature T [°C]	No code				
		Temperature T [°F]	MB2				
		Other measurands (*xx* see measurand code)	MB*xx*				
	Output 2 signal[5)]	0 - 1 V	GB1				
		0 - 5 V	GB2				
		0 - 10 V	GB3				
		0 - 20 mA	GB5				
		4 - 20 mA	GB6				
	Output 2 scaling low	Value	SBL*Value*				
	Output 2 scaling high	Value	SBH*Value*				
	Accredited Traceable Calibration Certificate in accordance with DIN EN ISO/IEC 17025		see www.eplusecal.com				
	ISO 9001 Calibration Certificate		see www.epluse.com/iso9001cal				

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

Measurand		Unit	Code
			MAxx / MBxx
Relative humidity		%	10
Temperature		°C °F	1 2
Dew point temperature	Td	°C °F	52 53
Frost point temperature	Tf	°C °F	65 66
Mixing ratio	r	g/kg gr/lb	60 61
Absolute humidity	dv	g/m^3 gr/ft^3	56 57
Wet bulb temperature	Tw	°C °F	54 55
Water vapour partial pressure	e	mbar psi	50 51
Specific enthalpy	h	kJ/kg BTU/lb	62 64

PLEASE NOTE

No mix of SI/US units allowed.

Order Example

EE310-T5D2J3C1GA3GB3SBL-40SBH180

Feature	Code	Description
Model	No code	RH + T
Type	T5	Remote probe up to 180 °C (356 °F)
Enclosure material	No code	Polycarbonate (PC)
Filter	No code	Stainless steel sintered
Probe cable length	No code	2 m (6.6")
Probe length	No code	200 mm (7.87")
Electrical connection	No code	Standard
Optional features	D2 J3 C1	Display with integrated data logger RS485 module - Modbus RTU Sensor coating
Output 1 measurand	No code	Relative humidity RH [%]
Output 1 signal	GA3	0 - 10 V
Output 1 scaling low	No code	0
Output 1 scaling high	No code	100
Output 2 measurand	No code	Temperature T [°C]
Output 2 signal	GB3	0 - 10 V
Output 2 scaling low	SBL-40	-40
Output 2 scaling high	SBH180	180

Accessories

For further information please refer to the Accessories datasheet.

Description		Code
PCS10 Product Configuration Software (Free download: www.epluse.com/pcs10)		**PCS10**
Stainless steel mounting flange Ø12 mm (0.47")		**HA010201**
Drip water protection		**HA010503**
Bracket for DIN rail mounting[1)]		**HA010203**
Humidity calibration kit		**See data sheet** Humidity Calibration Kit
Wall mounting clip, Ø12 mm (0.47") for remote probe		**HA010211**
Stainless steel wall mounting clip Ø12 mm (0.5")		**HA010225**
Stainless steel mounting flange Ø6 - 8 mm (0.24" - 0.31") (T24)		**HA010207**
Pressure-tight feed-through, probe Ø6 mm (0.24") (T24)	**G 1/2" ISO** **1/2" NPT**	**HA011104** **HA011105**
Immersion well, stainless steel Ø6x135 mm (0.24 x 5.3")	**G 1/2" ISO** **1/2" NPT**	**HA400202** **HA400212**

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

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