

EE310

High-End Humidity and Temperature Sensor for Demanding Process Control

The EE310 is optimized for reliable measurement in demanding industrial applications. In addition to highly accurate measurement of relative humidity (RH) and temperature (T), the sensor also calculates parameters such as dew point, absolute humidity and mixing ratio.

Various models are available including wall, duct and remote probe. The remote probe can be used up to 180 °C (356 °F) and the pressure tight probe up to 20 bar (290 psi). The design of the enclosure facilitates easy mounting and maintenance. The EE310 is available with IP65 polycarbonate or stainless steel enclosure.

The measured data is available on two analogue outputs and on the optional digital interface RS485 with Modbus RTU or Ethernet with Modbus TCP.

The state of the art TFT colour display shows up to four measurands simultaneously and offers extensive error diagnostics. The integrated data logging function saves all measured and calculated values to the internal memory. The data can be displayed as graph directly on the device or easily downloaded via USB interface.

The E+E proprietary coating protects the sensor elements against corrosive and electrically conductive pollution.

The outputs can be freely configured and an adjustment performed directly via display or with the free EE-PCS software using the USB service interface.



EE310

Typical applications

- industrial process monitoring and control
- food and pharmaceutical industry
- dryers and humidifiers
- climate and test chambers

Features

3.5" TFT Colour Display

- » shows up to 4 measurands simultaneously
- » layout and measurands freely selectable
- » integrated data logger for 20.000 values per measurand
- » logged values shown in graph
- » error diagnostics
- » intuitive device setup with push buttons

Enclosure

- » easy mounting
- » two part housing allows easy unit replacement
- » IP65 protection class
- » polycarbonate UL94-V0 approved or stainless steel
- » screws secured in cover

Outputs

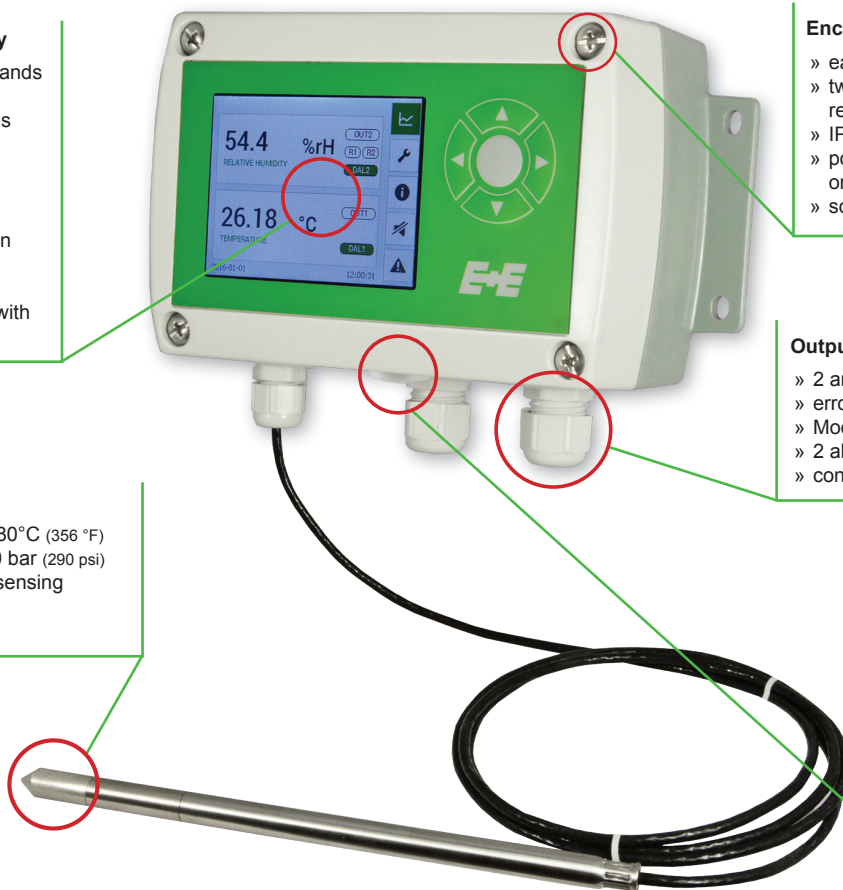
- » 2 analogue outputs current / voltage
- » error indication
- » Modbus RTU / Modbus TCP
- » 2 alarm outputs
- » configurable via display or software

Probe

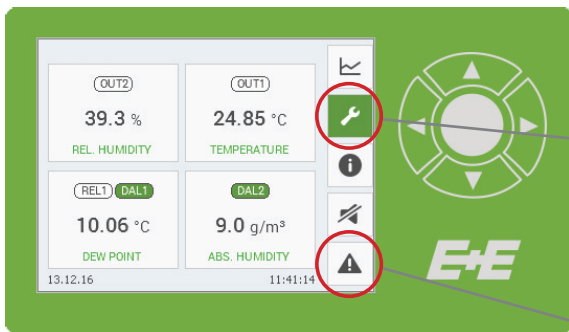
- » working range up to 180°C (356 °F)
- » pressure tight up to 20 bar (290 psi)
- » protective coating for sensing elements
- » pluggable probe

USB Service Interface

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



TFT colour display with integrated data logger (option D2)



Settings

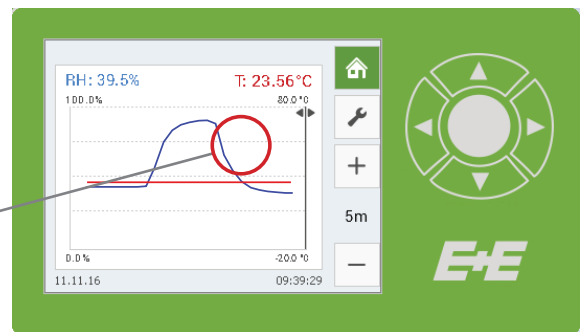
- » analogue, digital and alarm outputs setup
- » one and two point adjustment for RH and T
- » probe replacement (for pluggable probe)
- » password protection for all relevant settings

Error Diagnostics

- » error self-diagnosis
- » error description
- » auditive and visual error warnings

Data logger

- » 20.000 values saved per measurand
- » selectable sampling rates
- » view recorded data as graph
- » download data via USB port and EE-PCS software



Protective sensor coating (option C1)

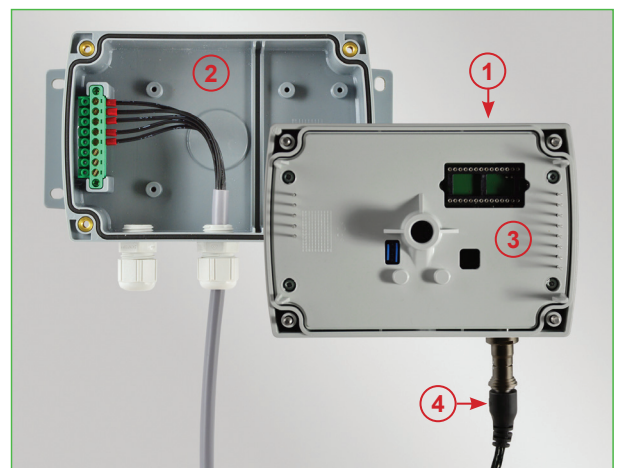
The E+E proprietary sensor coating is a protective layer applied to the active surface and leads of the sensing elements. The coating substantially extends the lifetime and the measurement performance of the E+E sensor in corrosive environment (salts, off-shore applications). Additionally, it improves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

Modular enclosure / Pluggable probe (option PC4)

The upper part of the transmitter (1), which accommodates the electronics and the probe, can be plugged off for service or adjustment and can be replaced within seconds. This allows for the bottom part (2) to remain mounted and with intact cabling.

A cover (3) on the inside of the housing protects the electronics during installation or service.

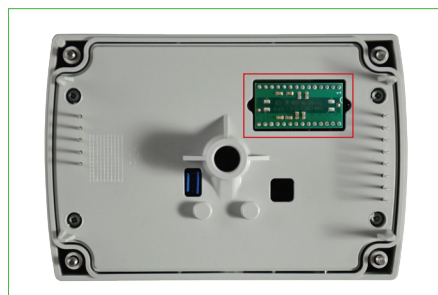
The remote probe models are also available with a pluggable probe (4) which can be easily exchanged by a push-pull plug. It is ideal for installation of long probe cables and in applications that might require periodical probe replacements.



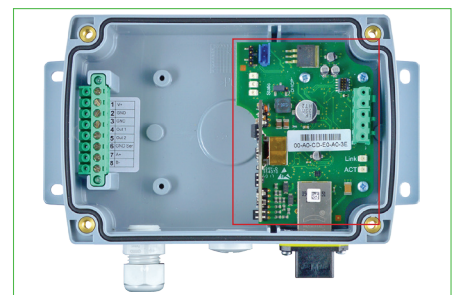
Modbus RTU (Option J3) and Modbus TCP (Option J4)

Additional to the analogue outputs, the EE310 offers an optional digital interface, either RS485 with Modbus RTU or Ethernet with Modbus TCP. The RS485 and Ethernet modules are also available for upgrading existing EE310.

The Ethernet interface features power over Ethernet (PoE) and RJ45 connector with IP65 protection class. It is available for EE310 duct mount and with remote probe (types T2, T5 and T10). Type T5 with 0.5 m (1.6 ft) probe cable can be employed in wall mount applications by fixing the sensing probe onto the wall with the mounting bracket HA010211.



RS485 - Modbus RTU



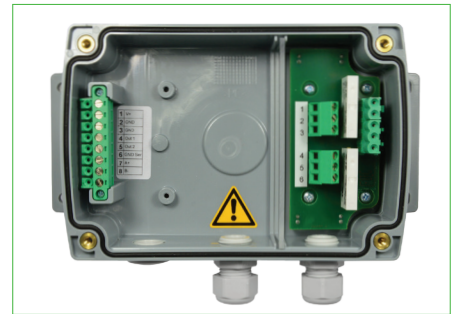
Ethernet - Modbus TCP

Modbus Map

Register [DEC]	Protocol address [HEX]	Measured value	Unit	Type
Read registers: function code 0x03 / 0x04				
31021	3FC	Relative humidity	%	32-bit float
31003	3EA	Temperature	°C	32-bit float
31005	3EC	Temperature	°F	32-bit float
31105	450	Dew point temperature	°C	32-bit float
31107	452	Dew point temperature	°F	32-bit float
31131	46A	Frost point / Dew point temperature	°C	32-bit float
31133	46C	Frost point / Dew point temperature	°F	32-bit float
31113	458	Absolute humidity	g/m ³	32-bit float
31115	45A	Absolute humidity	gr/ft ³	32-bit float
31121	460	Mixing ratio	g/kg	32-bit float
31123	462	Mixing ratio	gr/lb	32-bit float
31109	454	Wet bulb temperature	°C	32-bit float
31111	456	Wet bulb temperature	°F	32-bit float
31125	464	Specific enthalpy	kJ/kg	32-bit float
31129	468	Specific enthalpy	BTU/lb	32-bit float
31127	466	Specific enthalpy	ft lbf/lb	32-bit float
31101	44C	Water vapour partial pressure	mbar	32-bit float
31103	44E	Water vapour partial pressure	psi	32-bit float
31151	47E	Volume concentration	ppm	32-bit float
35001	1388	Air pressure	mbar	32-bit float
Write registers: function code 0x06 for 16-bit and 0x10 (decimal: 16) for 32-bit				
0001	0	Slave-ID	/	16-bit integer
5001	1388	Air pressure	mbar	32-bit float

Alarm outputs (option AM2)

This optional module features two freely configurable relay outputs for control purposes. Various operation modes are available including hysteresis, window and error indication. When error indication is selected, a fault in the humidity or temperature measurement will trigger the alarm output. The measurands at the outputs as well as the thresholds and hysteresis can be set using the EE-PCS software or directly on the device via display and push buttons.



100...240 V AC supply module (option AM3)

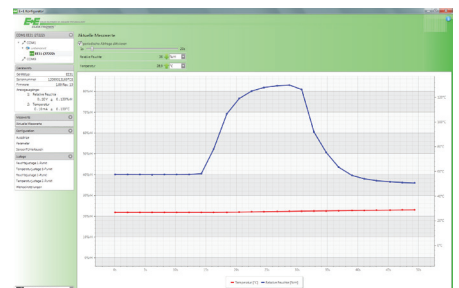
The back cover of EE310 can accommodate the optional supply module for 100...240 V AC (50/60 Hz). With this option, the EE310 features connectors instead of the cable glands for wiring. The matching cable connectors are included in the scope of supply.



E+E Product Configuration Software

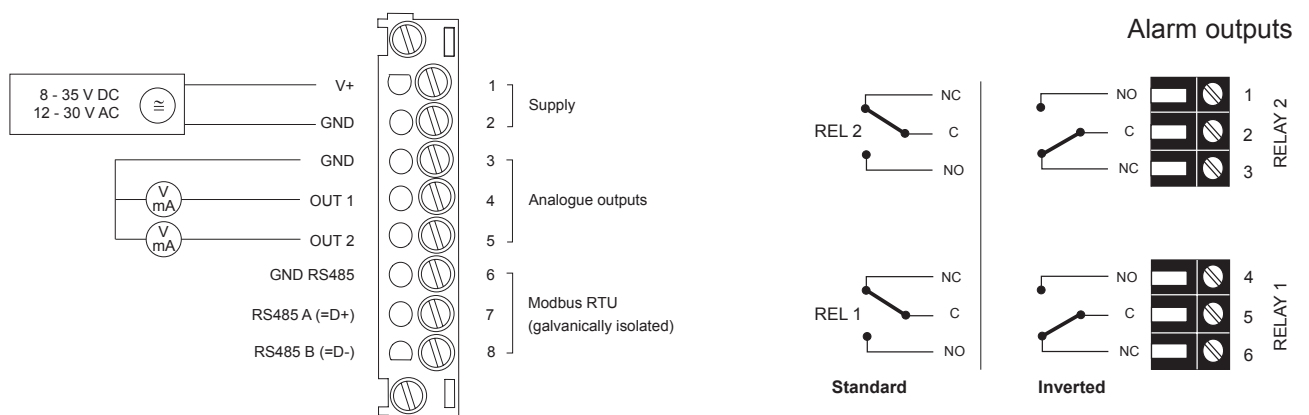
EE-PCS is an intuitive software that allows the user to perform:

- flexible, easy and fast setup of the analogue and alarm outputs
- 1 or 2 point adjustment of humidity and temperature
- replacement of the pluggable sensing probe
- Modbus RTU communication setup
- setup of the display layout
- download logged data
- view error diagnosis information



EE-PCS is available free of charge at: <http://www.epluse.com/configurator>

Connection diagram



Technical data

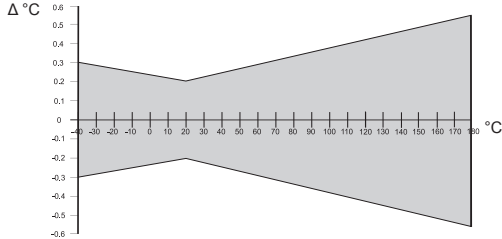
Measured values

Relative humidity (RH)

Sensor	E+E HC1000-400	
Working range ¹⁾	0...100 % RH	
Accuracy ²⁾ (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 ₉₀	

Temperature (T)

Sensor	Pt1000 (Tolerance class A, DIN EN 60751)	
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	
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Temperature dependence of electronics	typ. ± 0.005 °C/°C
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Outputs

Two analogue outputs freely selectable and scalable	0 - 1 / 5 / 10 V 4 - 20 mA 3-wire 0 - 20 mA 3 wire	-1 mA < I _L < 1 mA R _L < 500 Ohm R _L < 500 Ohm
Digital interface	option J3: RS485 with Modbus RTU, up to 32 devices on one bus option J4: Ethernet with Modbus TCP	

General

Power supply class III  (EU) / class 2 (NA)	8...35 V DC 100...240 V AC, 50/60 Hz with option AM3 ³⁾	12...30 V AC	
Current consumption	- 2x voltage output - 2x current output	for 24 V DC/AC: typ. 40 mA typ. 80 mA	
Pressure range for pressure tight probe	0.01...20 bar (0.15...300 psi)		
Probe material	Stainless steel 1.4404 / AISI 316L		
Enclosure material	for plastic enclosure for metal enclosure	Polycarbonate UL94-V0 approved Stainless steel 1.4404 / AISI 316 L	
Protection class	IP65		
Cable glands	for plastic 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 ² (AWG 16)		
Working and storage temperature range	-40...60 °C (-40...140 °F) without display -20...50 °C (-4...122 °F) with display		
Electromagnetic compatibility	EN61326-1 Industrial Environment	EN61326-2-3	ICES-003 ClassA FCC Part15 ClassA 
Alarm outputs (2 relays) with option AM2 ³⁾	250 V AC / 6 A 28 V DC / 6 A		
System requirements for EE-PCS software	Windows XP or higher; USB port		

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

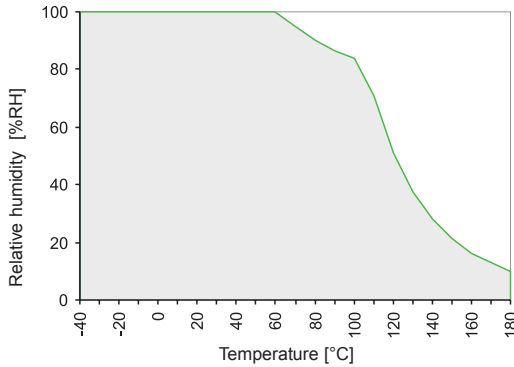
2) Traceable to intern. standards, administrated by NIST, PTB, BEV,...

The accuracy statement includes the uncertainty of the factory calibration with an enhancement factor k=2 (2-times standard deviation).

The accuracy was calculated in accordance with EA-4/02 and with regard to GUM (Guide to the Expression of Uncertainty in Measurement).

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

Working range humidity sensor



The graph shows the allowed measurement range for the humidity sensor.

Operating beyond this range does not damage the sensor, nevertheless the specified measurement accuracy cannot be guaranteed.

Measurement range¹⁾

		from		up to			unit	
				EE310-T1	EE310-T2	EE310-T5, T10		
Humidity	RH	0		100	100	100		% RH
Temperature	T	-40 (-40)		60 (140)	80 (176)	180 (356)		°C (°F)
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 ³ (gr/f ³)
Specific enthalpy	h	0 (0)		400 (50000)	1000 (375000)	2800 (999999)		kJ/kg (Btu/lb)

1) Output scaling is freely selectable and can be easily changed via display or with the EE-PCS software. Refer to accuracies of calculated values (www.epluse.com/humiditymeasurement).

Scope of supply

	Included in the scope of supply of:
EE310 according to ordering guide	all versions
Operation manual english*	all versions
Inspection certificate according to DIN EN 10204 – 3.1	all versions
Mating plug for integrated power supply	AM3
Mating plug RKC 5/7	AM3 / E4 / E6 / E12
Mating plug RSC 5/7 (2 pcs. for option E12)	E5 / E6 / E12
Mating plug HPP V4 RJ45 Cat5	J4

*) Other languages can be downloaded at www.epluse.com/EE310

Accessories / Replacement Parts (see data sheet "Accessories")

- Filter caps HA0101xx
- Mounting flange stainless steel HA010201
- Drip water protection HA010503
- RS485 kit for retrofitting HA010605
- Ethernet Module for retrofitting plastic enclosure HA010606 for remote probe type T5, T10
HA010607 for duct mounting type T2
- Bracket for installation onto mounting rails¹⁾ HA010203
- Mounting bracket for remote probe HA010211
- Replacement humidity sensor FE09
- Replacement humidity sensor with coating FE09-HC01
- Replacement probes²⁾ refer to device manual
- Humidity calibration kit see data sheet „Humidity calibration kit“
- Stainless steel wall mounting clip Ø12 mm (0.5") HA010225

1) 2 pieces are necessary for one EE310. For polycarbonate enclosure only.

2) Only for devices with pluggable probe option PC4.

Measurand Code for order code output 1 and 2

relative humidity	%	MAxx / MBxx
		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

absolute humidity dv	g/m ³ gr/ft ³	MAxx / MBxx
		56
		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

Ordering Guide

		EE310				
Type		T1 wall mounting	T2 ⁸⁾ duct mounting	T5 remote probe up to 180 °C (356 °F)	T10 pressure tight probe up to 20 bar (300 psi)	
Hardware Configuration	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)	F3	F3	no code	no code
		stainless steel sintered	no code	no code	no code	no code
		PTFE stainless steel - metal grid (up to 180 °C / 356 °F)	F5 F9 F12	F5 F9 F12	F5 F9 F12	F9
	Cable length (incl. probe length)	0.5 m (1.64 ft)			K0.5	no code
		2 m (6.6 ft)			no code	no code
		5 m (16.4 ft)			K5	K5
		10 m (32.8 ft)			K10	K10
		20 m (65.6 ft)			K20	K20
	Probe length	65 mm (2.55")			L65	no code
200 mm (7.87")			no code	no code	no code	
400 mm (15.75")			L400	L400	L400	
Process connection	1/2" ISO thread				PA23	
	1/2" NPT thread				PA25	
Electrical connection ¹⁾	cable glands	no code	no code	no code	no code	
	1 plug for power supply and outputs	E4	E4	E4	E4	
	1 cable gland / 1 plug for Modbus RTU	E5	E5	E5	E5	
	2 plugs for power supply / outputs and for Modbus RTU	E6	E6	E6	E6	
Optional features	3 plugs for power supply / outputs and Modbus RTU ⁸⁾	E12	E12	E12	E12	
	TFT colour display with integrated data logger ²⁾	D2	D2	D2	D2	
	RS485 Module - Modbus RTU ³⁾	J3	J3	J3	J3	
	Ethernet Module - Modbus TCP ^{5) 8)}	J4	J4	J4	J4	
	pluggable probe ⁸⁾			PC4	PC4	
	E+E sensor coating	C1	C1	C1	C1	
	alarm outputs ^{4) 5)}	AM2	AM2	AM2	AM2	
	integrated power supply 100...240 V AC, 50/60 Hz ^{5) 6)}	AM3	AM3	AM3	AM3	
Setup - Analogue outputs	Output 1	relative humidity RH [%]		no code		
		other measurand (xx see Measurand Code below)		MAxx		
	Output Signal 1 ⁷⁾	0-1 V			GA1	
		0-5 V			GA2	
		0-10 V			GA3	
		0-20 mA			GA5	
		4-20 mA			GA6	
	Scaling 1 low	0		no code		
		value		SALvalue		
	Scaling 1 high	100		no code		
		value		SAHvalue		
	Output 2	temperature T [°C]			no code	
temperature T [°F]				MB2		
other measurand (xx see Measurand Code below)				MBxx		
Output Signal 2 ⁷⁾	0-1 V			GB1		
	0-5 V			GB2		
	0-10 V			GB3		
	0-20 mA			GB5		
	4-20 mA			GB6		
Scaling 2 low	value		SBLvalue			
Scaling 2 high	value		SBHvalue			

1) Plug options E5 / E6 / E12 only in combination with RS485 Modul - Modbus RTU option J3.

2) Factory setup: the display shows the measurands selected for output 1 and output 2.

Default language English, other languages selectable in display menu.

3) Factory settings: baud rate 9600, parity even, stop bit 1 / slave-ID 231 (16 bit integer).

4) Alarm output only available with cable glands (other plug options are not possible).

5) Combination of alarm output (AM2), Ethernet Modul (J4) and integrated power supply (AM3) is not possible.

6) Integrated power supply includes 2 plugs for power supply and outputs, other plug options are not possible.

7) Both analogue outputs shall be either voltage or current.

8) Only with polycarbonate enclosure

Order Example

EE310-T5D2J3C1GA3GB3SBL-40SBH180

Type: **T5** remote probe for T 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** TFT colour display with integrated data logger
J3 RS485 Modul - Modbus RTU
C1 E+E 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