

EE300Ex-M1

Humidity and Temperature Sensor for Intrinsically Safe Applications



The EE300Ex intrinsically safe sensor reliably measures relative humidity (RH) and temperature (T) in explosion hazard areas. It complies with the classifications for Europe (ATEX), International (IECEX), USA / Canada (FM) and Korea (KCs) for flammable gas and dust applications.

The entire device can be placed in the explosion endangered area. The remote sensing probe allows for classification up to T6.

Measurement performance

The well proven E+E humidity sensors and competence in calibration allow for highly accurate and long term stable measurement over the full range 0...100 % RH and -40...180 °C (-40...356 °F), with pressure rating up to 20 bar (300 psi).

Besides the RH and T measurement, the EE300Ex calculates all humidity related parameters such as dew point temperature (Td), frost point temperature (Tf), absolute humidity (dv) or mixing ratio (r).

Moisture in oil measurement

The EE300Ex with ATEX, IECEx and KCs approval is suitable also for measuring water content (X) in ppm and water activity (aw) in isolation, lubrication and hydraulic oils. Typical applications include oil purifiers and online monitoring of lubrication and hydraulic oils.

Supply and outputs

The device can be powered by any intrinsically safe supply unit or via Zener barriers. The measured or calculated data is available on two 4...20 mA, 2-wire outputs and on the LCD display.

Robust, functional design

The stainless steel enclosure and sensing probe are suitable for harsh environment in challenging industrial applications. The EE300Ex design facilitates the installation as well as the replacement of the measuring section (electronics and probe) without time consuming wiring.

Easy Configuration and Adjustment

The setup of the analogue outputs as well as the adjustment of the RH and T reading can be easily performed with the optional EE-PCA Product Configuration Adapter and the free EE-PCS Product Configuration Software.



Typical Applications

- Chemical process control
- Pharmaceutical applications
- Explosive / hazardous storage rooms
- Flour mills
- Oil purifiers

Features

- Gas and dust in zone 0 / 20 and Div. 1
- Stainless steel enclosure and probe
- Best accuracy up to 180 °C (356 °F)
- Pressure tight up to 20 bar (300 psi)
- Inspection certificate according to DIN EN 10204-3.1

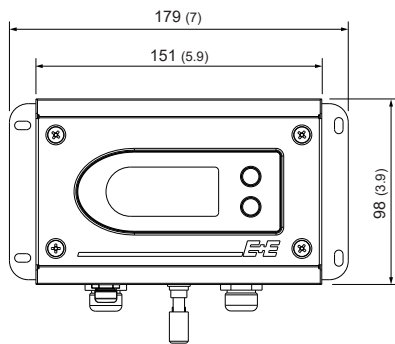
Protective sensor coating

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

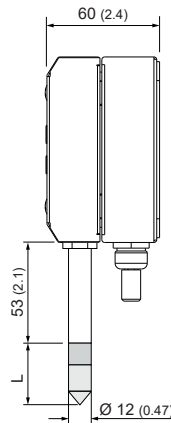
Types

Type	Pressure range	Working range	Probe Ø mm (inch)
T1 Wall mount		-40...60 °C (-40...140°F)	12 (0.47)
T7 Remote probe with cut-in fitting, pressure tight	0.1...20 bar (1.5...300 psi)	-40...180 °C (-40...356°F)	12 (0.47)
T10 Remote probe with sliding fitting for assembly / disassembly under pressure, pressure tight	0.1...20 bar (1.5...300 psi)	-40...180 °C (-40...356°F)	13 (0.51)

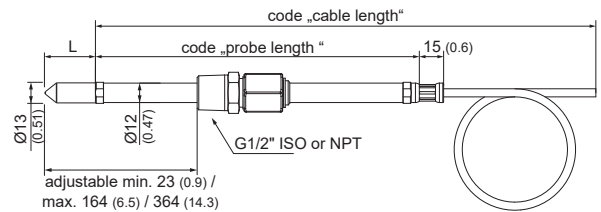
Dimensions in mm (inch)



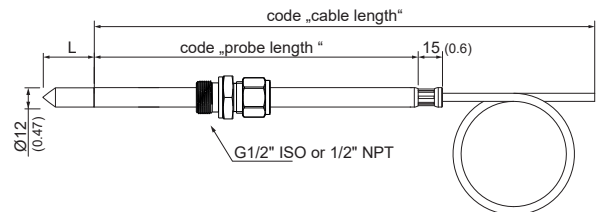
Types: T1 / T7 / T10
Enclosure



Type: T1
Wall mount



Type: T10
Remote probe 20 bar (300 psi) with sliding fitting for assembly / disassembly under pressure



Types: T7
Remote probe 20 bar (300 psi)

L - length of filter	mm (inch)
Stainless steel sintered filter	33 (1.3)
PTFE, H ₂ O ₂ filter	33 (1.3)
Stainless steel grid filter	39 (1.5)
Oil filter	32 (1.26)

Technical Data EE300Ex

Measurands

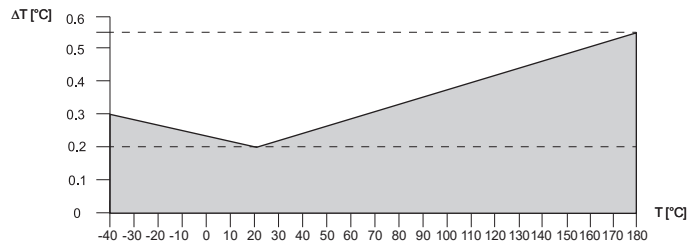
Relative humidity

Measuring range	0...100 % RH		
Accuracy ¹⁾			
(including hysteresis, non-linearity and repeatability, traceable to international standards, administrated by NIST, PTB, BEV...)	-15...40 °C (5...104 °F)	≤90 % RH	± (1.3 + 0.3%*mv) % RH
	-15...40 °C (5...104 °F)	>90 % RH	± 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 electronics, typ.	0.03 % RH/°C		
Response time t_{90}	< 30 s with stainless steel filter at 20 °C (68 °F)		

Temperature

Measuring range	Wall mount:	-40...60 °C (-40...140 °F)
	Remote probe:	-40...180 °C (-40...356 °F)

Accuracy



Temperature dependence of electronics, typ.	0.005 °C/°C
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Calculated parameters

		from	up to		Units
			Wall mount	Remote probe	
Dew point temperature	Td	-40 (-40)	60 (140)	100 (212)	°C (°F)
Frost point temperature	Tf	-40 (-40)	60 (140)	100 (212)	°C (°F)
Wet bulb temperature	Tw	0 (32)	60 (140)	100 (212)	°C (°F)
Water vapour pressure	e	0 (0)	200 (3)	1100 (15)	mbar (psi)
Mixing ratio	r	0 (0)	425 (2900)	999 (9999)	g/kg (gr/lb)
Absolute humidity	dv	0 (0)	150 (60)	700 (300)	g/m ³ (gr/ft ³)
Specific enthalpy	h	0 (0)	400 (150000)	2800 (999999)	kJ/kg (Btu/lb)
Water activity	aw	0	-	1	1
Water content	X	0	-	100000	ppm

Outputs

Freely selectable and scalable outputs	2 x 4-20 mA (2-wire) galvanically isolated	$R_L = (V_{cc} - 9V) / 20mA$
	Output 1 must be connected!	

General

Supply voltage	$V_{cc, min} = (9 + R_L * 0.02) V DC$ $V_{cc, max} = 28 V DC$ $R_L =$ load resistor		
Current consumption	Max. 20 mA per channel		
Protection class of enclosure	IP65 / NEMA 4		
Cable gland	M16 for cable diameter 5 - 10 mm (0.2" - 0.4") M20 for cable diameter 10 - 14 mm (0.4" - 0.6")		
Electrical connection	Screw terminals max. 1.5 mm ² (AWG 16)		
Working temperature range	Probe	according measuring range	
	Electronics without display	-40...60 °C (-40...140 °F)	
	Electronics with display	-20...60 °C (-4...140 °F)	
Storage temperature range	Electronics and probe	-20...60 °C (22...140 °F)	
Electromagnetic compatibility	EN 61326-1	EN 61326-2-3	ICES-003 ClassB FCC Part15 ClassB
Material	Enclosure	stainless steel 1.4404	
	Probe cable	PTFE	
	Probe (without filter)	stainless steel 1.4301	

1) 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).

Ex - Classifications

Europe (ATEX)

Certificate: TPS 13 ATEX 38892 003 X by TÜV SÜD Product Service GmbH
 Safety factors: $U_i = 28V$; $I_i = 100mA$; $P_i = 700mW$; $C_i = 2.2nF$; $L_i \approx 0mH$

Ex-Designation:

Transmitter without display II 1 G Ex ia IIC T4 Ga / II 1 D Ex ia IIIC T80°C Da
 Transmitter with display II 2 G Ex ia IIC T4 Gb / II 1 G Ex ia IIB T4 Ga
 Remote probe II 1 G Ex ia IIC T6-T1 Ga / II 1 D Ex ia IIIC T80°C...220°C Da

International (IECEX)

Certificate: IECEX FMG 14.0017 X by FM Approvals
 Safety factors: $6.4 V_{dc} \leq U_i \leq 28V_{dc}$; $I_i = 100mA$; $P_i = 700mW$; $C_i = 2.2nF$; $L_i = 0mH$

Ex-Designation:

Transmitter without display Ex ia IIC T4 Ta = -40°C to 60°C Ga / Ex ia IIIC T131°C Da
 Transmitter with display Ex ia IIC T4 Ta = -40°C to 60°C Gb / Ex ia IIB T4 Ta = -40°C to 60°C Ga
 Remote probe Ex ia IIC T6-T1 Ta = -70°C to 200°C Ga / Ex ia IIIC T80°C Da

Korea (KCs)

Certificate gas:
 Remote probe: 20-AV4BO-0253X
 Transmitter without display: 20-AV4BO-0254X
 Transmitter with display: 20-AV4BO-0257X (EPL Ga - Zone 0)
 20-AV4BO-0258X (EPL Gb - Zone 1)

Certificate dust:
 Remote probe: 20-AV4BO-0256X
 Transmitter without display: 20-AV4BO-0255X

Safety factors: $6.4 V_{DC} \leq U_i \leq 28 V_{DC}$; $I_i = 100 mA$; $P_i = 700 mW$; $C_i = 2.2 nF$; $L_i = 0 mH$

Ex-Designation:

Transmitter (without display): Ex ia IIC T4 -40°C ≤ Tamb ≤ +60°C
 Ex iaD 20 IP6X T131°C -40°C ≤ Tamb ≤ +60°C
 Transmitter (with display): Ex ia IIC T4 -40°C ≤ Tamb ≤ +60°C (up to Zone 1)
 Ex ia IIB T4 -40°C ≤ Tamb ≤ +60°C (up to Zone 0)
 Remote probe: Ex ia IIC T6-T1 / Ex iaD 20 IP6X T80°C -40°C ≤ Tamb ≤ +60°C

USA (FM)

Certificate: No. FM17US0302X by FM Approvals
Safety factors: $6.4 \text{ Vdc} \leq \text{Vmax (or Ui)} \leq 28\text{Vdc}$; $\text{Imax (or Ii)} = 100\text{mA}$; $\text{Pi} = 700\text{mW}$; $\text{Ci} = 2.2\text{nF}$; $\text{Li} = 0\text{mH}$

Ex-Designation:

Equipment Group I: EE300Ex without display

Class I, II, III, Division 1, Groups A, B, C, D, E, F and G; T4 Ta = -40°C to +60°C; Entity – M1_139080; IP65
Class I, II, III, Division 2, Groups A, B, C, D, E, F and G; T4 Ta = -40°C to +60°C
Class I, Zone 0, AEx ia IIC T4 Ta = -40°C to +60°C Ga; Entity – M1_139080; IP65
Zone 20, AEx ia IIIC T131°C Ta = -40°C to +60°C Da; Entity – M1_139080; IP65

Remote Probe:

Class I, II, III, Division 1, Groups A, B, C, D, E, F and G; T6...T1; Entity – M1_139080; IP65
Class I, II, III, Division 2, Groups A, B, C, D, E, F and G; T6...T1
Class I, Zone 0, AEx ia IIC T6...T1 Ga; Entity – M1_139080; IP65
Zone 20, AEx ia IIIC T80°C Da; Entity – M1_139080; IP65

Equipment Group II: EE300Ex with display

Class I, Division 1, Groups C, and D; T4 Ta = -40°C to +60°C; Entity – M1_139080
Class I, Division 2, Groups A, B, C and D; T4 Ta = -40°C to +60°C; Entity – M1_139080
Class I, Zone 0, AEx ia IIB T4 Ta = -40°C to +60°C Ga; Entity – M1_139080
Class I, Zone 1, AEx ia IIC T4°C Ta = -40°C to +60°C Gb; Entity – M1_139080

Remote Probe:

Class I, II, III, Division 1, Groups A, B, C, D, E, F and G; T6...T1; Entity – M1_139080; IP65
Class I, II, III, Division 2, Groups A, B, C, D, E, F and G; T6...T1
Class I, Zone 0, AEx ia IIC T6...T1 Ga; Entity – M1_139080; IP65
Zone 20, AEx ia IIIC T80°C Da; Entity – M1_139080; IP65

CANADA (FM)

Certificate: No. FM17CA0154X by FM Approvals
Safety factors: $6.4 \text{ Vdc} \leq \text{Vmax (or Ui)} \leq 28\text{Vdc}$; $\text{Imax (or Ii)} = 100\text{mA}$; $\text{Pi} = 700\text{mW}$; $\text{Ci} = 2.2\text{nF}$; $\text{Li} = 0\text{mH}$

Ex-Designation:

Equipment Group I: EE300Ex without display

Class I, II, III, Division 1, Groups A, B, C, D, E, F and G; T4 Ta = -40°C to +60°C; Entity – M1_139080; IP65
Class I, II, III, Division 2, Groups A, B, C, D, E, F and G; T4 Ta = -40°C to +60°C
Zone 0, Ex ia IIC T4 Ta = -40°C to +60°C Ga; Entity – M1_139080; IP65
Zone 20, Ex ia IIIC T131°C Ta = -40°C to +60°C Da; Entity – M1_139080; IP65

Remote Probe:

Class I, II, III, Division 1, Groups A, B, C, D, E, F and G; T6...T1; Entity – M1_139080; IP65
Class I, II, III, Division 2, Groups A, B, C, D, E, F and G; T6...T1
Zone 0, Ex ia IIC T6...T1 Ga; Entity – M1_139080; IP65
Zone 20, Ex ia IIIC T80°C Da; Entity – M1_139080; IP65

Equipment Group II: EE300Ex with display

Class I, Division 1, Groups C, and D; T4 Ta = -40°C to +60°C; Entity – M1_139080
Class I, Division 2, Groups A, B, C and D; T4 Ta = -40°C to +60°C; Entity – M1_139080
Zone 0, Ex ia IIB T4 Ta = -40°C to +60°C Ga; Entity – M1_139080
Zone 1, Ex ia IIB T4 Ta = -40°C to +60°C Gb; Entity – M1_139080

Remote Probe:

Class I, II, III, Division 1, Groups A, B, C, D, E, F and G; T6...T1; Entity – M1_139080; IP65
Class I, II, III, Division 2, Groups A, B, C, D, E, F and G; T6...T1
Zone 0, Ex ia IIC T6...T1 Ga; Entity – M1_139080; IP65
Zone 20, Ex ia IIIC T80°C Da; Entity – M1_139080; IP65

The USA and Canada approvals are valid for air and gas measurement only.

Ordering Guide EE300Ex-M1

		EE300Ex-M1A6HS2				
Hardware Configuration	Type	Wall mount Remote probe with cut-in fitting, pressure tight, 20 bar (300 psi) Remote probe with sliding fitting, pressure tight, 20 bar (300 psi)	T1	T7		T10
	Display¹⁾	Without display With display	D0 D1			
	Electrical Connection	2 x M16 cable gland 1/2" NPT conduit 2 x M20 cable gland	E2 E13 E15			
	Probe Cable Length	Wall mount 1 m (3.3 ft) 2 m (6.6 ft) 5 m (16.4 ft) 10 m (32.8 ft)	K0	K1 K2 K5 K10	K1 K2 K5 K10	
	Probe Length	Wall mount, 50 mm (1.97") 65 mm (2.56") ²⁾ 100 mm (3.95") 200 mm (7.9") 400 mm (15.8")	L50	L65 L100 L200 L400	L200 L400	
	Process Connection (Zone Feedthrough)	Without probe fitting G1/2" ISO - cut-in fitting, Ø 12 mm (0.47") 1/2" weld cut-in fitting, Ø 12 mm (0.47") 1/2" NPT - cut-in fitting, Ø 12 mm (0.47") G1/2" ISO - sliding fitting, Ø 13 mm (0.51") 1/2" NPT - sliding fitting, Ø 13 mm (0.51")	PA0	PA0 PA20 PA21 PA22	PA23 PA25	
	Filter	Stainless steel sintered PTFE ³⁾ Stainless steel grid, stainless steel body, up to 180 °C Catalytic fo H ₂ O ₂ sterilisation ³⁾ Stainless steel with boreholes Ø 3 mm (0.12")	F4 F5 F9 F12	F4 F5 F9 F12	F13 F4 F5 F9 F12	F13 C0
	Sensing Element Protection	Without coating With coating ⁴⁾	C1	C1	C0	C1
	Ex Approval	ATEX (Europe) IECEX (International) FM (USA) KCs (Korea) FM (Canada)	EX1 EX2 EX3 EX5 EX9			
	Setup - analogue outputs	Output 1⁵⁾	Measurand (xx see measurand code below)	MAxx		
Scaling 1 low		Value	SALvalue			
Scaling 1 high		Value	SAHvalue			
Output 2		Measurand (xx see measurand code below)	MBxx			
Scaling 2 low		Value	SBLvalue			
Scaling 2 high		Value	SBHvalue			

1) No display possible for environments with combustible dust, fibers and flyings and in gases with EPL Ga IIC (EX1/EX2) / Gas Groups A, B for Division 1 (EX3/EX9) / Zone 0 IIC (EX5)

2) Allowed only in combination with PA0

3) May not be used in EPL Ga IIC (EX1/EX2) / Gas Groups A, B for Division 1 (EX3/EX9) / Zone 0 IIC (EX5)

4) Not appropriate for moisture in oil measurement, obligatory for all other applications, free of charge

5) Assign the most relevant measurand to output 1

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
Absolute humidity dv	g/m ³	56
	gr/ft ³	57

1) For approval FM (USA / Canada) not allowed.

		MAxx / MBxx
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
Water activity ¹⁾	aw	67
Water content X in mineral transformer oil ¹⁾	ppm	70
Water content X in customer specific oil ¹⁾	ppm	70PPMxxx

Order Example

Example 1:

**EE300Ex-M1A6HS2T7D1E2K10L200PA20F4C1EX1/
MA1SAL-40SAH180MB10SBL0SBH100**

Type:	Remote probe up to 20 bar (300 psi)
Display:	With display
Electrical Connection:	2 x M16 cable gland
Probe Cable:	10 m (32.8 ft)
Probe Length:	200 mm (7.9")
Process connection (Zone Feedthrough):	G1/2" ISO - cut-in fitting, Ø 12 mm (0.47")
Filter:	Stainless steel sintered
Sensing Element Protection:	With coating
Ex Approval:	ATEX (Europe)
Output 1:	Temperature [°C]
Scaling Output 1:	-40...180 °C
Output 2:	Relative humidity [% RH]
Scaling Output 2:	0...100 % RH

Example 2:

**EE300Ex-M1A6HS2T1D0E2K0L50PA0F9C1EX3/
MA2SAL-40SAH140MB53SBL-40SBH140**

Type:	Wall mount
Display:	Without display
Electrical Connection:	2 x M16 cable gland
Probe Cable:	Wall mount
Probe Length:	Wall mount, 50 mm (1.97")
Process connection: (Zone Feedthrough):	Without probe fitting
Filter:	Stainless steel grid
Sensing Element Protection:	With coating
Ex Approval:	FM (USA)
Output 1:	Temperature [°F]
Scaling Output 1:	-40...140 °F
Output 2:	Dew point temperature [°F]
Scaling Output 2:	-40...140 °F

Accessories

Blank cover for enclosure base
 Safety barrier, 1-channel, STAHL 9002/13-280-093-001
 Intrinsically safe supply unit, 1-channel, STAHL 9160/13-11-11
 Intrinsically safe supply unit, 2-channel, STAHL 9160/23-11-11
 Sealing plug for unused M16 cable glands
 Sealing plug for unused M20 cable glands
 Ball valve with 1/2 ISO female thread, ATEX certified
 Product Configuration Software
 Adapter Kit for configuration and adjustment
 (must be ordered together, see datasheet EE-PCA):
 Pos. 1: Product Configuration Adapter
 Pos. 2: Connection cable

HA011401
 HA011410
 HA011405
 HA011406
 HA011402
 HA011404
 HA011403
 EE-PCS (free download: www.epluse.com/configurator)

EE-PCA
 HA011068