

# 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 EE300Ex it is also certified for gas applications according Japan (TIIS) certifications.

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

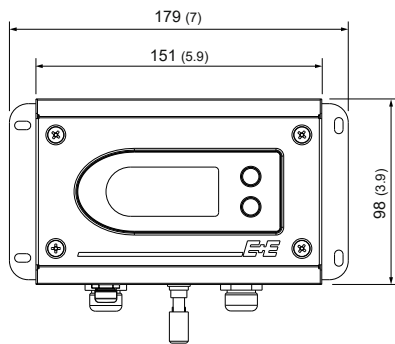
## Protective sensor coating

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.

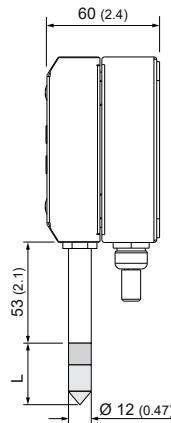
## Types

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)

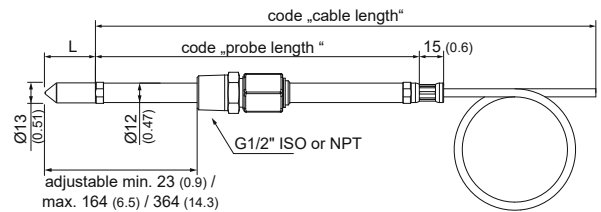
## Dimensions in mm (inch)



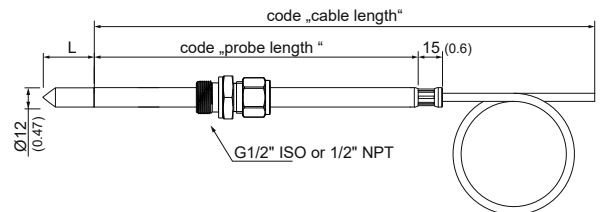
Types: T1 / T7 / T10  
Enclosure



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 <sub>2</sub> O <sub>2</sub> filter	33 (1.3)
Stainless steel grid filter	39 (1.5)
Oil filter	32 (1.26)

## Technical Data EE300Ex

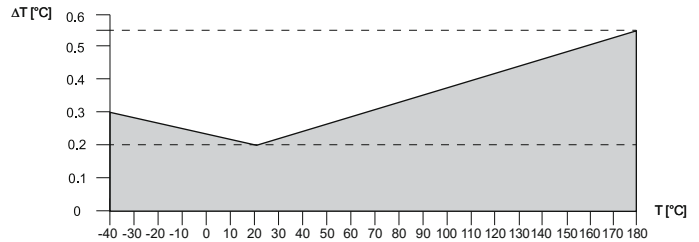
### Measurands

#### Relative humidity

Measuring range	0...100 % RH		
Accuracy <sup>1)</sup>			
(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 <sup>2)</sup>	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 <sup>3</sup> (gr/ft <sup>3</sup> )
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 <sup>2</sup> (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).

2) For TIIS (Japan): model T1, T7, T10: -40...60 °C (-40...140 °F)

## 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

### Japan (TIIS)

Certificate: Nr. TC22061 by TIIS  
 Safety factors:  $U_i = 28V_{dc}$ ;  $I_i = 100mA$ ;  $P_i = 700mW$ ;  $C_i = 2.2nF$ ;  $L_i = 0mH$   
 $T_a = -40°C$  to  $60°C$

**Ex-Designation, only for gas:** Ex ia IIC T4 Gb

## 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	<b>Type</b>	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
	<b>Display<sup>1)</sup></b>	Without display	D0			
		With display	D1			
	<b>Electrical Connection</b>	2 x M16 cable gland	E2			
		1/2" NPT conduit	E13			
		2 x M20 cable gland	E15			
	<b>Probe Cable Length</b>	Wall mount	K0	K1		K1
		1 m (3.3 ft)	K2		K2	
		2 m (6.6 ft)	K5		K5	
		5 m (16.4 ft)	K10		K10	
<b>Probe Length</b>	10 m (32.8 ft)	L50	L65			
	Wall mount, 50 mm (1.97")	L100		L200		
	65 mm (2.56") <sup>2)</sup>	L200		L400		
	100 mm (3.95")	L400		L200	L400	
<b>Process Connection (Zone Feedthrough)</b>	Without probe fitting	PA0	PA0			
	G1/2" ISO - cut-in fitting, Ø 12 mm (0.47")	PA20				
	1/2" weld cut-in fitting, Ø 12 mm (0.47")	PA21				
	1/2" NPT - cut-in fitting, Ø 12 mm (0.47")	PA22				
	G1/2" ISO - sliding fitting, Ø 13 mm (0.51")			PA23		
1/2" NPT - sliding fitting, Ø 13 mm (0.51")			PA25			
<b>Filter</b>	Stainless steel sintered	F4	F4	F4	F4	
	PTFE <sup>3)</sup>	F5	F5	F5	F5	
	Stainless steel grid, stainless steel body, up to 180 °C	F9	F9	F9	F9	
	Catalytic fo H <sub>2</sub> O <sub>2</sub> sterilisation <sup>3)</sup>	F12	F12	F12	F12	
<b>Sensing Element Protection</b>	Stainless steel with boreholes Ø 3 mm (0.12")		F13		F13	
	Without coating	C1	C0	C1	C0	
<b>Ex Approval</b>	With coating <sup>4)</sup>					
	ATEX (Europe)	EX1				
Setup - analogue outputs	IECEX (International)	EX2				
	FM (USA)	EX3				
	KCs (Korea)	EX5				
	TIIS (Japan) <sup>5)</sup>	EX6				
	FM (Canada)	EX9				
	<b>Output 1<sup>6)</sup></b>	Measurand (xx see measurand code below) <sup>7)</sup>	MAxx			
<b>Scaling 1 low</b>	Value	SALvalue				
<b>Scaling 1 high</b>	Value	SAHvalue				
<b>Output 2</b>	Measurand (xx see measurand code below) <sup>7)</sup>	MBxx				
<b>Scaling 2 low</b>	Value	SBLvalue				
<b>Scaling 2 high</b>	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).  
For TIIS (Japan) approval not allowed in models T1, T7 and T10.

- 4) Not appropriate for moisture in oil measurement, obligatory for all other applications, free of charge.
- 5) Only gas Ex up to EPL Gb (Zone 1).
- 6) Assign the most relevant measurand to output 1.
- 7) For TIIS (Japan) approval, models T1, T7, and T10 have a maximum temperature working range of -40...60 °C (-40...140 °F).

## 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 <sup>3</sup>	56
	gr/ft <sup>3</sup>	57

		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 <sup>1)</sup>	aw	67
Water content X in mineral transformer oil <sup>1)</sup>	ppm	70
Water content X in customer specific oil <sup>1)</sup>	ppm	70PPMxxx

- 1) Not allowed for FM (USA / Canada) and TIIS (Japan) approval.

## 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](http://www.epluse.com/configurator))

EE-PCA  
 HA011068