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), China (NEPSI), 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, NEPSI 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

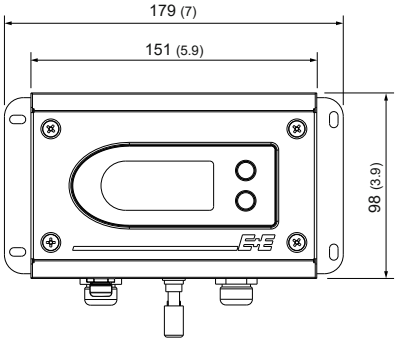
Protective sensor coating

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.

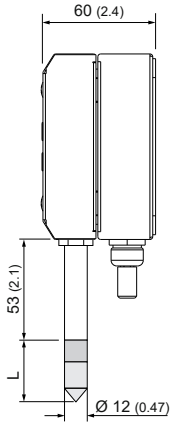
Types

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)

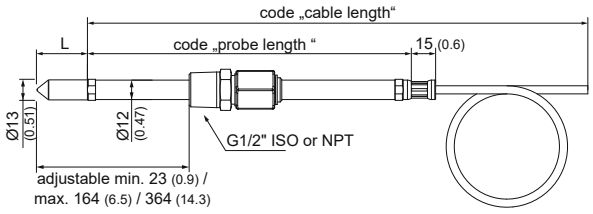
Dimensions in mm (inch)



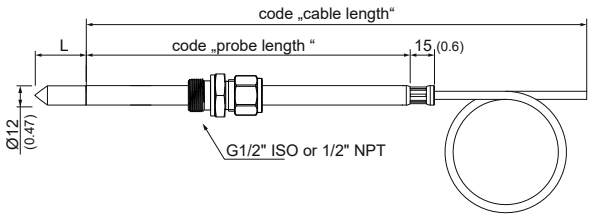
Types: T1 / T7 / T10
Enclosure



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_2O_2 filter	33 (1.3)
Stainless steel grid filter	39 (1.5)
Oil filter	32 (1.26)

Technical Data EE300Ex

Measurands

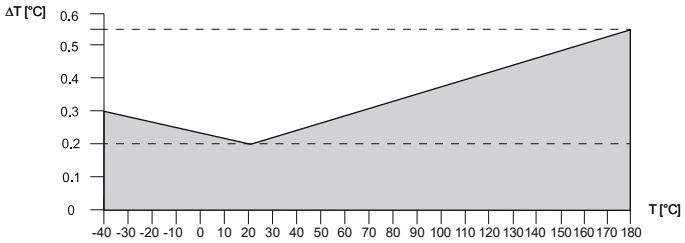
Relative humidity

Measuring range	0...100 % RH		
Accuracy[1]			
(including hysteresis, non-linearity and repeatability,	-15...40 °C (5...104 °F)	≤90 % RH	± (1.3 + 0.3%*mv) % RH
traceable to international standards, administrated by NIST, PTB, BEV...)	-15...40 °C (5...104 °F)	>90 % RH	± 2.3 % RH
	-25...70 °C (-13...158 °F)		± (1.4 + 1%*mv) % RH
mv = measured value	-40...180 °C (-40...356 °F)		± (1.5 + 1.5%*mv) % RH
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[2]	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

Calculated parameters

		from	up to Wall mount	up to Remote probe	Units
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/m³ (gr/ft³)
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 Output 1 must be connected!	$R_L = (V_{cc}-9V)/20mA$

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 mm² (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 Industrial Environment	EN 61326-2-3 ICES-003 ClassB FCC Part15 ClassB
Material	Enclosure	stainless steel 1.4404
	Probe cable	PTFE
	Probe (without filter)	stainless steel 1.4404

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 with order code “EX1”)

Certificate:	TPS 13 ATEX 38892 003 X by TÜV SÜD Product Service GmbH
Safety factors:	Ui = 28V; Ii = 100mA; Pi = 700mW; Ci = 2.2nF; Li ≈ 0mH

Ex-Designation:

Transmitter without display	II 1 G Ex ia IIC T4 Ga / II 1 D Ex ia IIIC T_{200} 80°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 T_{200} 80°C...220°C Da

International (IECEx with order code “EX2”)

Certificate:	IECEx FMG 14.0017 X by FM Approvals
Safety factors:	6.4 Vdc ≤ Ui ≤ 28Vdc; Ii = 100mA; Pi = 700mW; Ci = 2.2nF; Li = 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

China (NEPSI with order code “EX4”)

Certificate:	Cert NO. GYJ16.1417X by NEPSI
Safety factors:	Ui = 28Vdc; Ii = 100mA; Pi = 700mW; Ci = 2.2nF; Li = 0mH

Ex-Designation:

Transmitter without display	Ex ia IIC T4 Ga, Ex iaD 20 T131
Transmitter with display	Ex ia IIC T4 Gb, Ex ia IIB T4 Ga
Remote probe	Ex ia IIC T1~T6 Ga, Ex iaD 20 T80

Korea (KCs with order code “EX5”)

Certificate gas:	
Remote probe:	20-AV4BO-0253X
Transmitter without display:	20-AV4BO-0254X
Transmitter with display:	20-AV4B0-0257X (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 ≤ Ui ≤ 28 V DC; Ii = 100 mA; Pi = 700 mW; Ci = 2.2 nF; Li = 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 with order code “EX6”)

Certificate:	Nr. TC22061 by TIIS
Safety factors:	Ui = 28Vdc; Ii = 100mA; Pi = 700mW; Ci = 2.2nF; Li = 0mH Ta = -40°C to 60°C
Ex-Designation, only for gas:	Ex ia IIC T4 Gb

USA (FM with order code “EX3”)

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

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 with order code “EX9”)

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

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	T1				
		Remote probe with cut-in fitting, pressure tight, 20 bar (300 psi)		T7			
		Remote probe with sliding fitting, pressure tight, 20 bar (300 psi)				T10	
	Display[1]	Without display	D0				
		With display	D1				
	Electrical Connection	2 x M16 cable gland	E2				
		1/2" NPT conduit	E13				
		2 x M20 cable gland	E15				
	Probe Cable Length	Wall mount	K0				
		1 m (3.3 ft)		K1		K1	
		2 m (6.6 ft)		K2		K2	
		5 m (16.4 ft)		K5		K5	
		10 m (32.8 ft)		K10		K10	
	Probe Length	Wall mount, 50 mm (1.97")	L50				
		65 mm (2.56")[2]		L65			
		100 mm (3.95")		L100			
		200 mm (7.9")		L200		L200	
		400 mm (15.8")		L400		L400	
	Process Connection (Zone Feedthrough)	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	
	Filter	Stainless steel sintered	F4	F4		F4	
		PTFE[3]	F5	F5		F5	
		Stainless steel grid, stainless steel body, up to 180 °C	F9	F9		F9	
		Catalytic fo H_2O_2 sterilisation[3]	F12	F12		F12	
		Stainless steel with boreholes Ø 3 mm (0.12")			F13		F13
	Sensing Element Protection	Without coating			C0		C0
		With coating[4]	C1	C1		C1	
	Ex Approval	ATEX (Europe)	EX1				
		IECEx (International)	EX2				
		FM (USA)	EX3				
		NEPSI (China)	EX4				
		KCs (Korea)	EX5				
		TIIS (Japan)[5]	EX6				
		FM (Canada)	EX9				
Setup - analogue outputs	**Output 1**[6]	Measurand (xx see measurand code below)[7]	MAxx				
	Scaling 1 low	Value	SAL*value*				
	Scaling 1 high	Value	SAH*value*				
	Output 2	Measurand (xx see measurand code below)[7]	MBxx				
	Scaling 2 low	Value	SBL*value*				
	Scaling 2 high	Value	SBH*value*				

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/m³	56
	gr/ft³	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[1]	aw	67
Water content X in mineral transformer oil[1]	ppm	70
Water content X in customer specific oil[1]	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	HA011401
Safety barrier, 1-channel, STAHL 9002/13-280-093-001	HA011410
Intrinsically safe supply unit, 1-channel, STAHL 9160/13-11-11	HA011405
Intrinsically safe supply unit, 2-channel, STAHL 9160/23-11-11	HA011406
Sealing plug for unused M16 cable glands	HA011402
Sealing plug for unused M20 cable glands	HA011404
Ball valve with 1/2 ISO female thread, ATEX certified	HA011403
Product Configuration Software	EE-PCS (free download: www.epluse.com/configurator)
Adapter Kit for configuration and adjustment (must be ordered together, see datasheet EE-PCA):	
Pos. 1: Product Configuration Adapter	EE-PCA
Pos. 2: Connection cable	HA011068