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technology.

Datasheet EE33

Humidity / Temperature Sensor for High Humidity and Chemical Applications

www.epluse.com

EE33

Humidity / Temperature Sensor for High Humidity and Chemical Applications

The EE33 sensors are designed to meet the highest demands of stable and highly accurate measurements of relative humidity (RH) and temperature (T) under the most challenging conditions. EE33 is suitable for a wide range of applications from -40 °C (-112 °F) up to 180 °C (356 °F) and 100 bar (1 450 psi).

Outstanding Measurement Performance

The employed high-end E+E RH and T sensing element is heated and enables reliable and long-term stable measurements in extremely humid or chemically polluted environment. The monolithic structure of the sensor allows a fast return to normal conditions after condensation or chemical contamination. In addition it is perfectly protected by the E+E proprietary coating.

Versatility and Robustness

The EE33 is available in six remote probe types and with various probe and cable lengths. With different heating modes of the monolithic RH and T sensing element, the EE33 can be perfectly tailored to the specific needs of each measurement task. It features an IP65 / NEMA 4 polycarbonate or metal enclosure which can accommodate various interface modules and electrical connection options.

Outputs and Configuration

The measured data is available on two freely scalable analogue outputs, on the RS232 or RS485 interface and on the alarm (relay) outputs. The configuration and the RH and T adjustment of the EE33 can be performed either using the push buttons or with the free EE-PCS Product Configuration Software.

Metal enclosure with display

Types of remote probes

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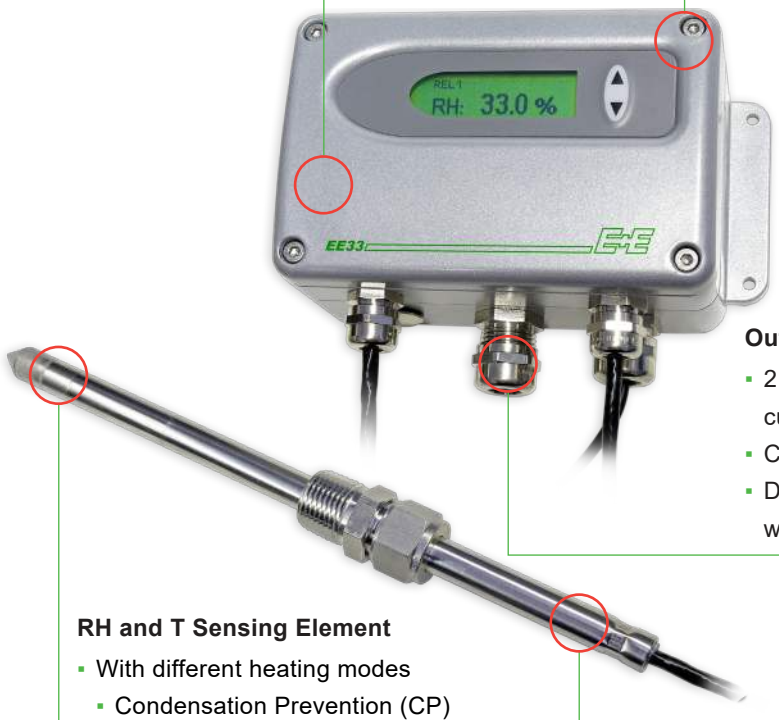
Features

Measurement performance

- High RH / T accuracy
- Working range from -40 °C (-112 °F) up to 180 °C (356 °F) and 100 bar (1 450 psi)
- Designed for conditions with chemical contamination and condensation
- Calculated parameters
  - Dew point temperature (Td)
  - Frost point temperature (Tf)
  - Wet bulb temperature (Tw)
  - Water vapour partial pressure (e)
  - Mixing ratio (r)
  - Absolute humidity (dv)
  - Specific enthalpy (h)

Enclosure

- Polycarbonate IP65 / NEMA 4X
- Metal (AlSi9Cu3) IP65 / NEMA 4
- Display with MIN/MAX function
- Versatile connection options



Outputs

- 2 freely scalable analogue outputs current / voltage
- Configurable via EE-PCS
- Digital RS232 / RS485 interface with E+E industry protocol

RH and T Sensing Element

- With different heating modes
  - Condensation Prevention (CP)
  - Automatic ReCovery (ARC)
  - Overheating (OH)
- Protected by
  - E+E proprietary coating
  - Wide choice of filter caps

Remote probes

- Specific types according to
  - T range
  - p range
  - Environmental condition
- Various probe and cable lengths

Inspection certificate

According to DIN EN 10204-3.1

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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.

Heating Modes

Condensation Prevention (CP) describes an intense heating of the sensing element in order to get rid of temporary condensation. It is triggered by a certain RH setpoint (configurable via EE-PCS).

Automatic ReCovery (ARC) describes an intense heating of the sensing element in order to get rid of chemical pollution. It is triggered either by a certain time interval (configurable via EE-PCS), externally using the ARC module option (AM1) or manually via push button on the PCB.

Overheating (OH) means a continuous, regulated warming of the sensing element and the probe body (dual heating system) to prevent condensation on it. Thanks to the monolithic structure of the sensing element precise RH measurement even under continuously high humidity and condensing conditions is enabled.

Heating Mode	**Condensation Prevention (CP)**	**Automatic ReCovery (ARC)**	**OverHeating (OH) with Dual Heating System**
Use	Against temporary condensation	Against chemical pollution	In environments with continuous high humidity and condensation
Function trigger	RH setpoint***)**	Cyclic, externally, manually	Always ON
EE33 Type			
EE33 Type T4/T5/T8/T10	✓	✓	Not available
EE33 Type T7/T17	Not usable due to OH	✓	✓

*) Factory setting: disabled, RH setpoint preset to 99 %.

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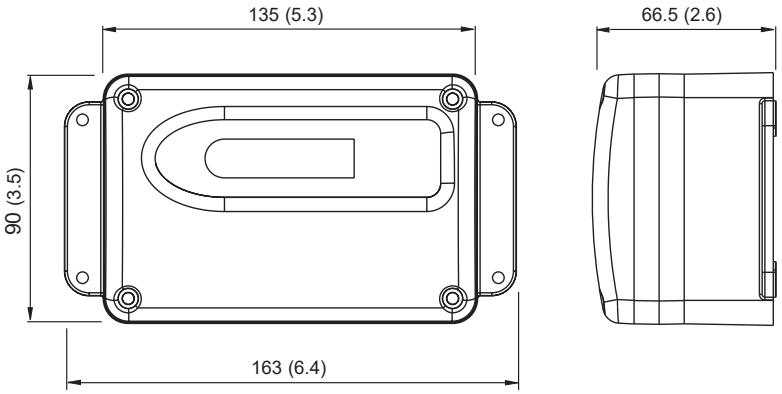
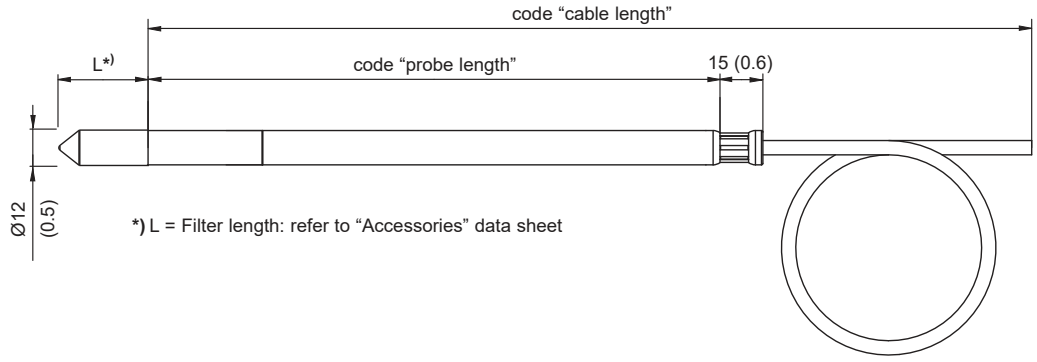
Dimensions

Values in mm (inch)

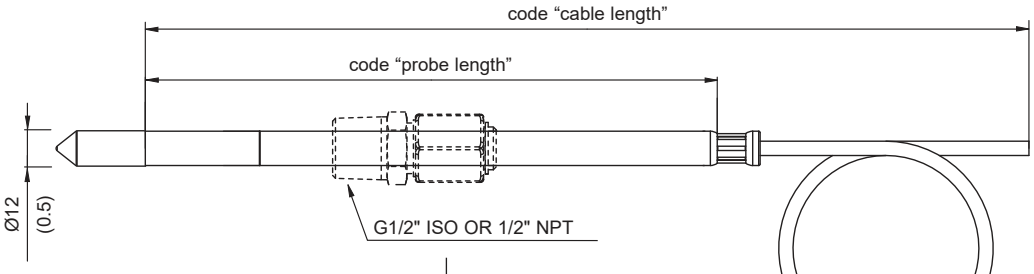
Enclosure



Type T4/ T5



Type T7, pressure tight up to 20 bar (300 psi) for Td measurement with optional cut-in fitting

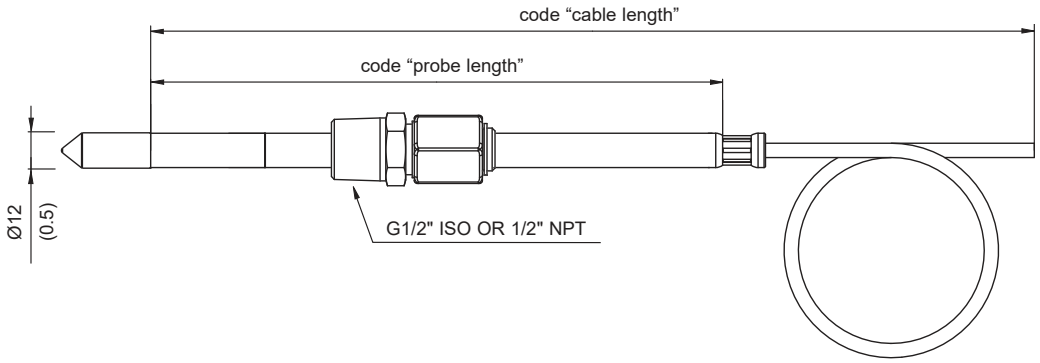


Screw connection	Order code
1/2" ISO Ø12 mm	HA011102
1/2" NPT Ø12 mm	HA011103

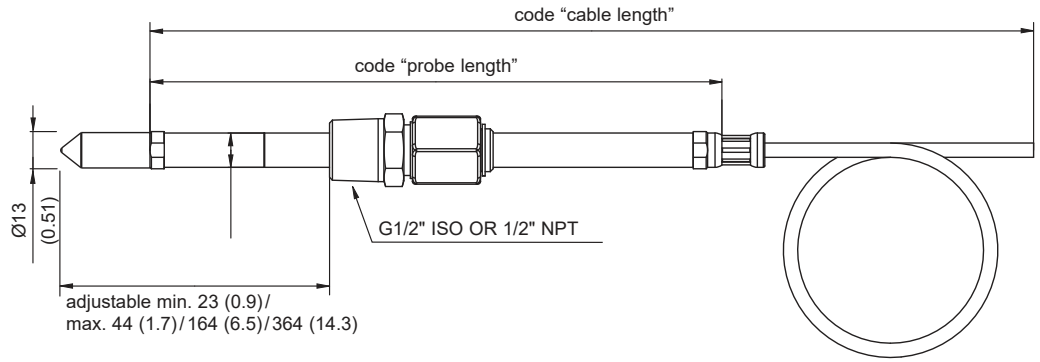
Dimensions

Values in mm (inch)

Type T8, pressure tight up to 100 bar (1 450 psi) with cut-in fitting



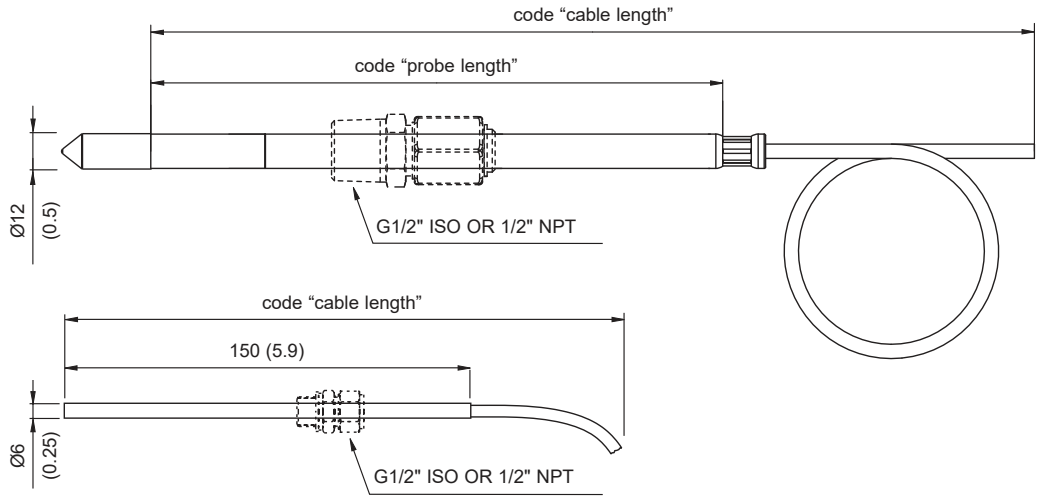
Type T10, pressure tight up to 20 bar (300 psi) with sliding fitting



Dimensions

Values in mm (inch)

Type T17, two remote probes pressure tight up to 20 bar (300 psi) with optional cut-in sliding fitting



Screw connection	Order code
1/2" ISO Ø12 mm	HA011102
1/2" NPT Ø12 mm	HA011103
1/2" ISO Ø6 mm	HA011104
1/2" NPT Ø6 mm	HA011105

Technical Data

Measurands

Relative Humidity (RH)

Measuring range	0...100 %RH
Accuracy[1)] including hysteresis, non-linearity and repeatability **-15...+40 °C (5...104 °F), RH ≤ 90 %** **-15...+40 °C (5...104 °F), RH > 90 %** **-25...+70 °C (-13...+158 °F)** **-40...+180 °C (-40...+356 °F)**	 ±(1.3 + 0.003 * mv) %RH ±2.3 %RH ±(1.4 + 0.01 * mv) %RH ±(1.5 + 0.015 * mv) %RH mv = measured value
Temperature dependency of electronics, typ.	±0.01 %RH/°C (0.0056 %RH/°F)
Response time t_{90}, typ. with stainless steel grid filter at 20°C (68°F)	≤15 s

1) Traceable to international 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).

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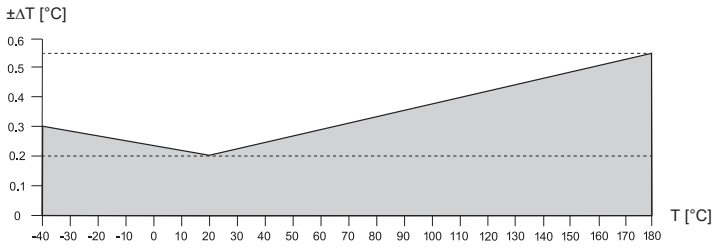
Technical Data

Measurands

Temperature (T)

Probe measuring range	
Type T4	-40...120 °C (-40...248 °F)
Type T5 / T7 / T8 / T10 / T17	-40...180 °C (-40...356 °F)
Accuracy[1)]	
Temperature dependency of electronics, typ.	±0.005 °C/°C (±0.009 °F/°F)

1) Traceable to international 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).

Calculated Measurands

		from		up to						unit	
				EE33-xT4		**EE33-xT5/T8/T10/T17**		**EE33-xT7**			
Dew point temperature	Td	-40	(-40)	100	(212)	100	(212)	100	(212)	°C	(°F)
Frost point temperature[1)]	Tf	-40	(-40)	0	(32)	0	(32)	0	(32)	°C	(°F)
Wet bulb temperature	Tw	0	(32)	100	(212)	100	(212)	–		°C	(°F)
Water vapour partial pressure	e	0	(0)	1100	(15)	1100	(15)	–		mbar	(psi)
Mixing ratio	r	0	(0)	999	(9999)	999	(9999)	–		g/kg	(gr/lb)
Absolute humidity	dv	0	(0)	700	(300)	700	(300)	–		g/m^3	(gr/ft^3)
Specific enthalpy	h	0	(0)	2800	(1250)	2800	(1250)	–		kJ/kg	(BTU/lb)

1) Equals Td above 0 °C (32 °F)

Technical Data

Outputs

Analogue

Two freely selectable and scalable outputs for RH and T	0 - 1 / 5 / 10 V -1 mA < I_L < 1 mA I_L = load current 0 - 20 mA / 4 - 20 mA (3-wire) R_L < 500 Ω R_L = load resistance Both outputs have the same electrical quantity (U, I)
Two alarm outputs with option AM2[1)]	2x changeover contact 250 V AC / 6 A 28 V DC / 6 A Measurand, threshold and hysteresis configurable via EE-PCS

1) Appropriate for outdoor use, wet location, degree of pollution 2, overvoltage category II, altitude up to 3 000 m (9 843 ft)

Digital

Digital interface	RS232 or RS485 (EE33 = 1 unit load)
Protocol **Factory settings**	E+E Industrial Transmitter Protocol 9600 Baud, parity even, 1 stop bit, ID = unique factory set

General

Power supply class III USA & Canada: Class 2 supply necessary, max. voltage 30 V DC	8 - 35 V DC 12 - 30 V AC
Current consumption, typ. **@ 24 V DC / AC 2x voltage output** **@ 24 V DC / AC 2x current output**	 40 mA / 80 mA_{rms} 80 mA / 160 mA_{rms}
Electrical connection	Screw terminals max. 1.5 mm^2 (AWG 16)
Cable gland	M16x1.5 for cable Ø4.5 - 10 mm (0.18 - 0.39")
Pressure range for pressure tight probe **Type T7 / T10 / T17** **Type T8**	 0.01...20 bar (0.15...300 psi) 0.01...100 bar (0.15...1450 psi)
Probe material	Stainless steel 1.4404
Enclosure **Material, protection rating** **Working and storage temperature range** **Without display** **With display**	 Polycarbonate (PC) IP65 / NEMA 4X Metal (AlSi9Cu3) IP65 / NEMA 4 -40...+60 °C (-40...+140 °F), non-condensing -20...+50 °C (-4...+122 °F), non-condensing
Electromagnetic compatibility	EN 61326-1 EN 61326-2-3 Industrial environment FCC Part15 Class A ICES-003 Class A
Conformity	CE UKCA
Configuration and adjustment	PCS10 Product Configuration Software (free download) and configuration cable HA010304

Ordering Guide

	Feature	Description	Code					
			EE33-					
Hardware Configuration	**Model**	RH + T	M1					
		Td						M4
	Type	Remote probe up to 120 °C (248 °F)	T4					
		Remote probe up to 180 °C (356 °F)		T5				
		Remote probe, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F)			T10			
		Remote probe, pressure tight up to 100 bar (1450 psi) and 180 °C (356 °F)				T8		
		Two remote probes, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F)					T17	
		Remote probe for cut-in fitting, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F)						T7
	Enclosure material	Polycarbonate (PC)					No code	
		Metal (AlSi9Cu3)	HS3	HS3	HS3	HS3	HS3	HS3
	Filter	Stainless steel sintered	F4	F4	F4	F4		
		Polytetrafluoroethylene (PTFE)	F5	F5	F5	F5		
		Stainless steel grid, stainless steel body (180 °C / 356 °F)	F9	F9	F9	F9	F9	F9
		PTFE membrane, stainless steel body					F11	F11
	Probe cable length	2 m (6.6 ft)	K2					
		5 m (16.4 ft)	K5					
		10 m (32.8 ft)	K10					
	Probe length	65 mm (2.56")	L65	L65			L65	L65
		80 mm (3.15")			L80			
		200 mm (7.87")	L200	L200	L200	L200	L200	L200
		400 mm (15.75")	L400	L400	L400		L400	L400
	Process connection	G1/2" ISO - sliding fitting, Ø13 mm (0.51")			PA23			
		1/2" NPT - sliding fitting, Ø13 mm (0.51")			PA25			
		G1/2" ISO - cut-in fitting, Ø12 mm (0.47")				PA20		
		1/2" NPT - cut-in fitting, Ø12 mm (0.47")				PA22		
	Electrical connection	Standard[1]	No code					
		1 x plug for power supply and outputs	E4					
		2 x plugs for power supply + outputs and RS485 network	E7					
	Digital Interface	RS232	No code					
		RS485	J3					
	Display	Without display	No code					
		Display with backlight	D2					
	Probe connection	Fixed	No code					
		Connectable on electronics board	PC6					
	Sensing element protection	E+E proprietary coating	C1					
	Additional modules	Without	No code					
		ARC module for external trigger of sensor heating[2)3)]	AM1					
		Alarm output with relay[2)]	AM2					
Software Setup Analogue Outputs	**Output signal**[4)]	0 - 1 V	GA1					
		0 - 5 V	GA2					
		0 - 10 V	GA3					
		0 - 20 mA	GA5					
		4 - 20 mA	GA6					
	Output 1 measurand	Relative humidity RH [%]	No code					
		Other measurand (*xx* see measurand code below)	MA*xx*					MA*xx*
	Output 1 scaling low	0	No code					
		Value	SAL*Value*					SAL*Value*
	Output 1 scaling high	100	No code					
		Value	SAH*Value*					SAH*Value*
	Output 2 measurand	Temperature T [°C]	No code					
		Other measurand (*xx* see measurand code below)	MB*xx*					MB*xx*[5)]
	Output 2 scaling low	-40	No code					
		Value	SBL*Value*					SBL*Value*
	Output 2 scaling high	60	No code					
		Value	SBH*Value*					SBH*Value*

1) Standard = 2 x M16 cable glands
2) With electrical connection standard only (no plug options possible)
3) Sensor needs to be supplied with 24V AC/DC ±20 %, digital interface occupied
4) Applies to both outputs
5) Only with Measurand Codes Mx52/53/65/66

Measurand Code

For Output 1 and 2 in the Ordering Guide

Measurand		Unit	Code
			MAxx / MBxx
Relative humidity	RH	%	10
Temperature	T	°C °F	1 2
Dew point	Td	°C °F	52 53
Frost point	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

EE33-M1T10HS3F9K2L200PA23E4C1GA6

Feature	Code	Description
Model	M1	RH + T
Type	T10	Remote probe, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F)
Enclosure material	HS3	Metal (AlSi9Cu3)
Filter	F9	Stainless steel grid, stainless steel body (180 °C / 356 °F)
Cable length	K2	2 m (6.6 ft)
Probe length	L200	200 mm (7.87")
Process connection	PA23	G1/2" ISO - sliding fitting, Ø13 mm (0.51")
Electrical connection	E4	1 x plug for power supply and outputs
Digital interface	No code	RS232
Display	No code	Without display
Probe connection	No code	Fixed
Sensing element protection	C1	E+E proprietary coating
Additional modules	No code	Without
Output signal	GA6	4 - 20 mA
Output 1 measurand	No code	Relative humidity RH [%]
Output 1 scaling low	No code	0
Output 1 scaling high	No code	100
Output 2 measurand	No code	Temperature T [°C]
Scaling 2 low	No code	-40
Scaling 2 high	No code	60

Order Example

EE33-M1T17F11K5L200D2C1AM1GA3MB52SBL0SBH100

Feature	Code	Description
Model	**M1**	RH + T
Type	**T17**	Two remote probes, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F)
Enclosure material	**HS3**	Metal (AlSi9Cu3)
Filter	**F11**	PTFE membrane, stainless steel body
Cable length	**K5**	5 m (16.4 ft)
Probe length	**L200**	200 mm (7.87")
Electrical connection	**No code**	Standard (2 M16 cable glands)
Digital interface	**No code**	RS232
Display	**D2**	Display with backlight
Probe connection	**No code**	Fixed
Sensing element protection	**C1**	E+E proprietary coating
Additional modules	**AM1**	ARC module for external trigger of sensor heating
Output signal	**GA3**	0 - 10 V
Output 1 measurand	**No code**	Relative humidity RH [%]
Output 1 scaling low	**No code**	0
Output 1 scaling high	**No code**	100
Output 2 measurand	**MB52**	Dew point Td [°C]
Scaling 2 low	**No code**	0
Scaling 2 high	**No code**	100

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Accessories

For further information see datasheet Accessories.

Accessories	Code
E+E Product Configuration Software (free download from www.epluse.com/configurator)	**EE-PCS**
EE33 Configuration cable (for EE-PCS)	**HA010304**
Stainless steel mounting flange Ø12 mm (0.47")	**HA010201**
Stainless steel mounting flange for Ø6 mm (0.24") T probe	**HA010207**
Stainless steel wall mounting clip Ø12 mm (0.47")	**HA010225**
Pressure tight screw connections **G1/2" ISO Ø12 mm** **1/2" NPT Ø12 mm** **G1/2" ISO Ø6 mm** **1/2" NPT Ø6 mm**	 **HA011102** **HA011103** **HA011104** **HA011105**
Humidity calibration kit	**see Humidity Calibration Kit data sheet**
RS232 interface cable for plug option E5	**HA010311**
RS485 kit for network	**HA010605**
Adapter M16x1.5 to NPT 1/2"	**HA011101**
Drip water protection	**HA010503**
Radiation shield for RH probe	**HA010502**
Radiation shield for T probe	**HA010506**

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