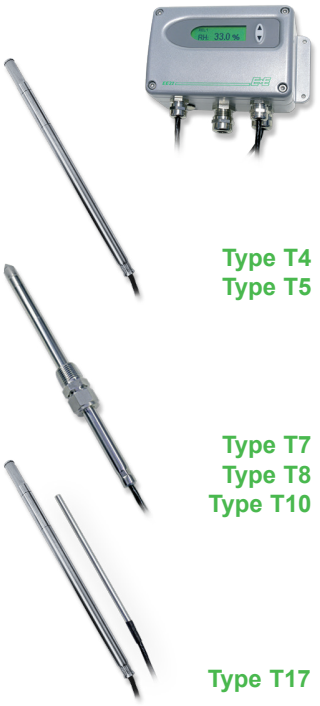
# EE33

## 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 (1450 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

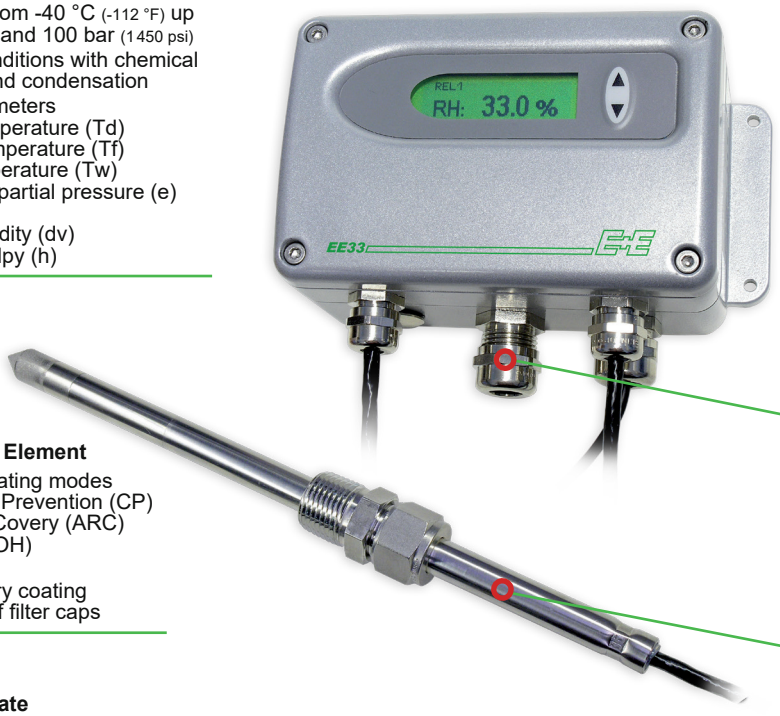
The EE33 is available in six remote probe types and with various probe and cable lengths. With different heating modes of the monolithic RH and T sensing element, the EE33 can be perfectly tailored to the specific needs of each measurement task. It features an IP65/NEMA 4 polycarbonate or metal enclosure which can accommodate a 100 - 240 V AC supply unit, 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.

## Features

**Measurement Performance**
- » High RH/T accuracy
- » Working range from -40 °C (-112 °F) up to 180 °C (356 °F) and 100 bar (1450 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 ($AlSi_9Cu_3$) 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
  - T range
  - P range
  - Environmental condition
- » Various probe and cable lengths

**Inspection certificate**
- » according to DIN EN 10204-3.1

## Protective Sensor Coating

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.

## 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.

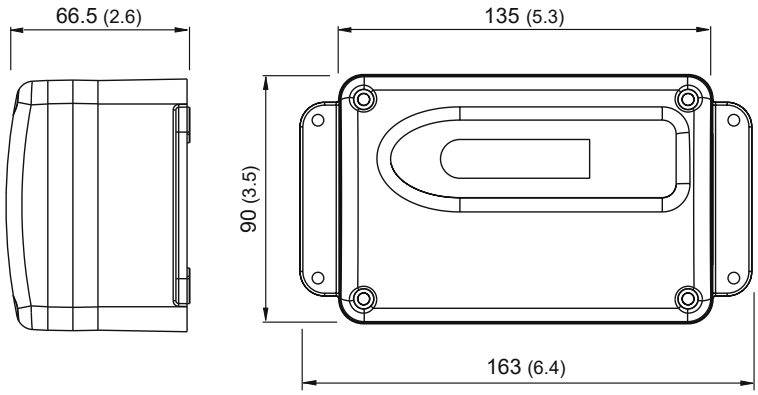
| Heating Mode | Condensation Prevention (CP) | Automatic ReCovery (ARC) | OverHeating (OH) with Dual Heating System |
|---|---|---|---|
| Use | Against temporary condensation | Against chemical pollution | In environments with continuous high humidity and condensation |
| Function Trigger | RH setpoint*) | 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 %.

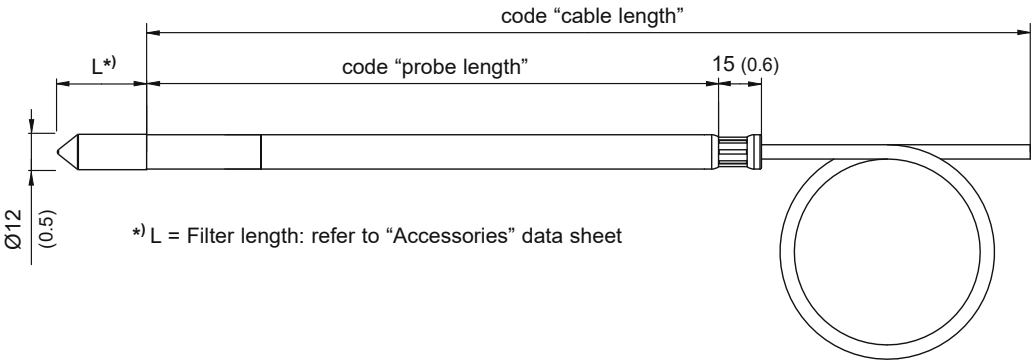
## Dimensions

Values in mm (inch)

### Enclosure

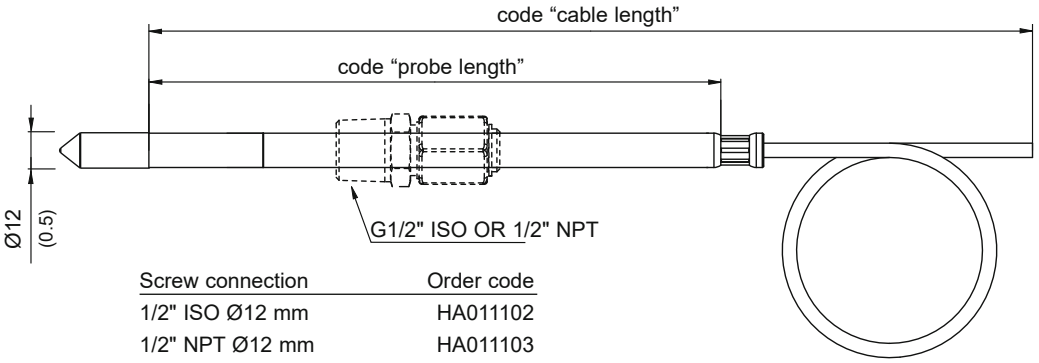


## Type T4/T5



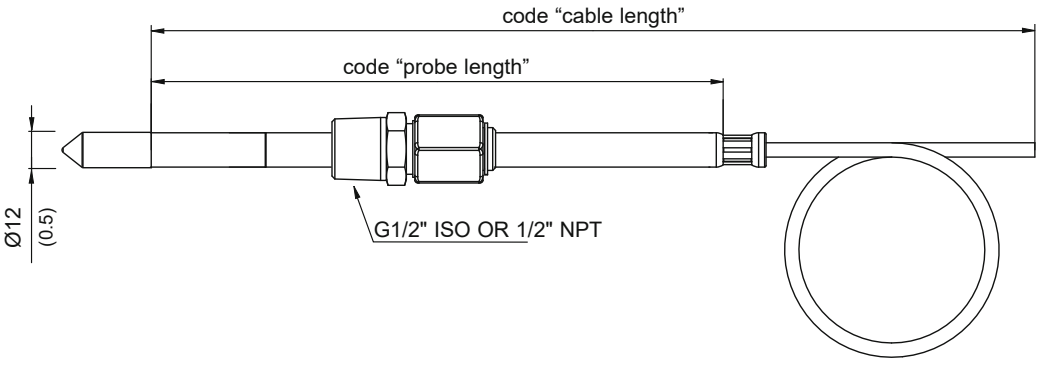

*) L = Filter length: refer to “Accessories” data sheet

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

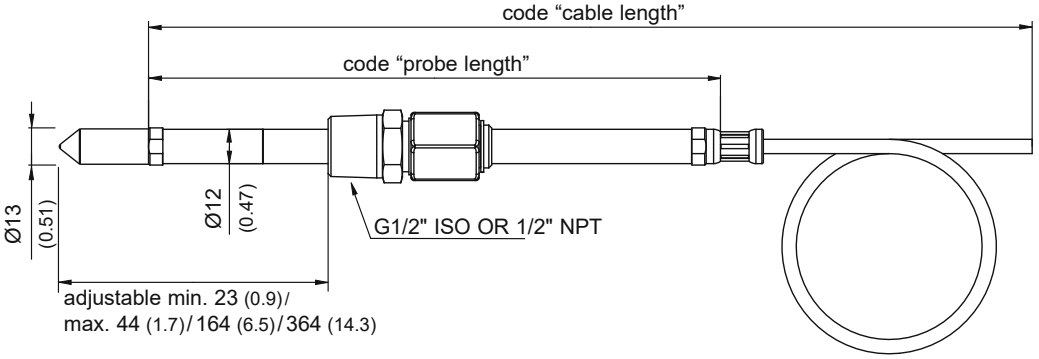



| Screw connection | Order code |
|---|---|
| 1/2" ISO Ø12 mm | HA011102 |
| 1/2" NPT Ø12 mm | HA011103 |

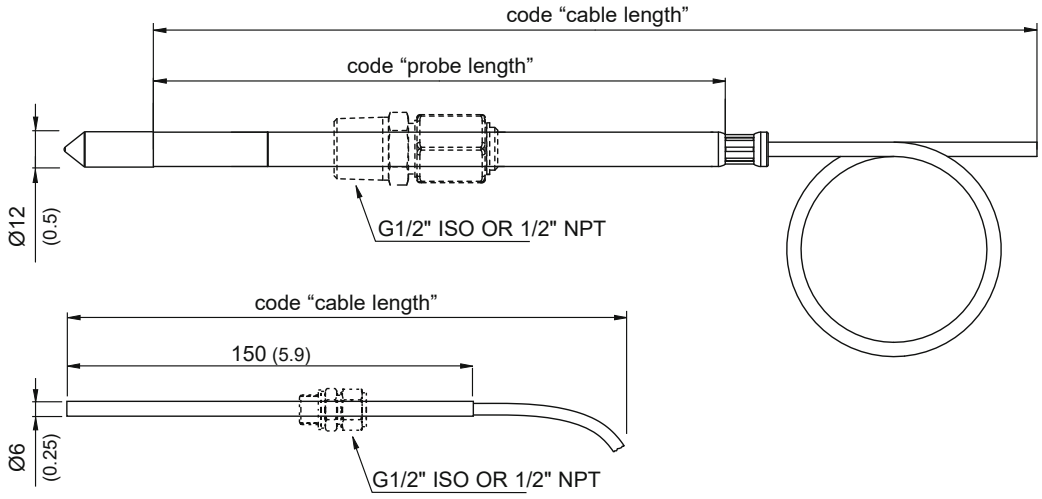
## Type T8, pressure tight up to 100 bar (1450 psi) with cut in fitting




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



### 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

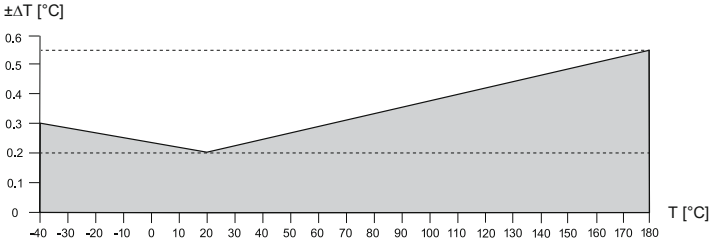
| | | | |
|---|---|---|---|
| Measuring range | | 0...100 %RH | |
| Accuracy[1] (including hysteresis, non-linearity and repeatability) | | | |
| -15...40 °C (5...104 °F) | ≤90 %RH | ± (1.3 + 0.003*mv) %RH | mv = measured value |
| -15...40 °C (5...104 °F) | >90 %RH | ± 2.3 %RH | |
| -25...70 °C (-13...158 °F) | | ± (1.4 + 0.01*mv) %RH | |
| -40...180 °C (-40...356 °F) | | ± (1.5 + 0.015*mv) %RH | |
| Temperature dependency of electronics, typ. | | ± 0.01 %RH/°C (0.0055 %RH/°F) | |
| Response time $t_{90}$, typ. | | < 15 s | |
| *with stainless steel grid filter at 20°C (68°F)* | | | |

#### Temperature

Working range

| | |
|---|---|
| Enclosure | -40...60 °C (-40...140 °F) |
| Enclosure with display | -20...50 °C (-4...122 °F) |
| Probes | |
| Type T4 | -40...120 °C (-40...248 °F) |
| Type T5/T7/T8/T10/T17 | -40...180 °C (-40...356 °F) |

Accuracy[1]




| | |
|---|---|
| Temperature dependence of electronics, typ. | ± 0.005 °C/°C |

### Calculated parameters

| | | Unit | from | to | | |
|---|---|---|---|---|---|---|
| | | | | EE33-xT4 | EE33-xT5/T8/T10/T17 | EE33-xT7 |
| Dew point temperature | Td | °C (°F) | -40 (-40) | 100 (212) | 100 (212) | 100 (212) |
| Frost point temperature | Tf*) | °C (°F) | -40 (-40) | 0 (32) | 0 (32) | 0 (32) |
| Wet bulb temperature | Tw | °C (°F) | 0 (32) | 100 (212) | 100 (212) | — |
| Water vapour partial pressure | e | mbar (psi) | 0 (0) | 1100 (15) | 1100 (15) | — |
| Mixture ratio | r | g/kg (gr/lb) | 0 (0) | 999 (9999) | 999 (9999) | — |
| Absolute humidity | dv | g/m³ (gr/ft³) | 0 (0) | 700 (300) | 700 (300) | — |
| Specific enthalpy | h | kJ/kg (BTU/lb) | 0 (0) | 2800 (99999) | 2800 (99999) | — |

*) Equals Td above 0 °C (32 °F)

## Output

**Analogue**
2x freely selectable and scalable
0 - 1 V / 5 V / 0 - 10 V  -1 < $I_L$ < 1 mA
0 - 20 mA / 4 - 20 mA (3-wire)  Load resistance ≤ 500 Ohm

**Digital interface**
RS232, RS485 (with Option J3, EE33 = 1 unit load)

Protocol
E+E Industrial Transmitter Protocol

Default settings
Baudrate 9600, parity even, stop bits 1, ID = unique factory set

**Alarm outputs**
with option AM2[2)]
2x changeover contact
250 V AC / 6 A, 28 V DC / 6 A (measurand, threshold and hysteresis configurable via EE-PCS)

## General

Power supply class III [3)]
8 - 35 V DC
12 - 30 V AC
Or 100 - 240 V AC, 50/60 Hz with option AM3[2)]

Current consumption, typ.
at 24 V DC / AC 2x voltage output
40 mA / 80 $mA_{rms}$
at 24 V DC / AC 2x current output
80 mA / 160 $mA_{rms}$

Pressure range for pressure tight probe
Type T7/T10/T17
0.01...20 bar (0.15...300 psi)
Type T8
0.01...100 bar (0.15...1450 psi)

Enclosure material / Protection rating
Polycarbonate / IP65 / NEMA 4X
$AlSi_9Cu_3$ / IP65 / NEMA 4

Probe material
Stainless steel 1.4404

Cable gland
M16x1.5 cable Ø4.5 - 10 mm (0.18 - 0.39")

Electrical connection
Screw terminals max. 1.5 mm² (AWG 16)

Electromagnetic compatibility
EN 61326-1  EN 61326-2-3
Industrial Environment
FCC Part15 Class A  ICES-003 Class A

Storage conditions
without display
-40...60 °C (-40...140 °F), non-condensing
with display
-20...50 °C (-4...122 °F), non-condensing

Configuration and adjustment
EE-PCS (Product Configuration Software, free download) and configuration cable HA010304

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)
2) Appropriate for outdoor use, wet location, degree of pollution 2, overvoltage category II, altitude up to 3000 m (9843 ft).
3) USA & Canada: class 2 supply required.

# Ordering Guide

| | | | 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 | | | | | no code | |
| | | Metal ($AlSi_9Cu_3$) | HS3 | HS3 | HS3 | HS3 | HS3 | HS3 |
| | **Filter** | Stainless steel sintered | F4 | F4 | F4 | F4 | | |
| | | PTFE | F5 | F5 | F5 | F5 | | |
| | | Stainless steel - metal grid (up to 180 °C / 356 °F) | F9 | F9 | F9 | F9 | F9 | F9 |
| | | PTFE membrane, stainless steel body | | | | | F11 | F11 |
| | | Catalytic for $H_2O_2$ sterilisation | F12 | F12 | F12 | F12 | | |
| | **Cable length** | 2 m | K2 | K2 | K2 | K2 | K2 | K2 |
| | | 5 m | K5 | K5 | K5 | K5 | K5 | K5 |
| | | 10 m | K10 | K10 | K10 | K10 | K10 | K10 |
| | **Probe length** | 65 mm | L65 | L65 | | | L65 | L65 |
| | | 80 mm | | | L80 | | | |
| | | 200 mm | L200 | L200 | L200 | L200 | L200 | L200 |
| | | 400 mm | 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 plug for power supply and outputs | E4 | | | | | |
| | | 1 cable gland / 1 plug for RS232 | E5 | | | | | |
| | | 2 plugs for power supply / outputs and RS485 network | E7 | | | | | |
| | **Digital interface** | RS232 | no code | | | | | |
| | | RS485 | J3 | | | | | |
| | **Display** | Without display | no code | | | | | |
| | | With display with backlight | D2 | | | | | |
| | **Probe connection** | Fixed | no code | | | | | |
| | | Connectable on electronics board | PC6 | | | | | |
| | **Sensing element protection** | With 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 | | | | | |
| | | Integrated power supply 100 - 240 V AC, 50/60 Hz[2)] | AM3 | | | | | |
| Software Setup | **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 [%] | no code | | | | | |
| | | Other measurand (xx see measurand code) | MAxx | | | | | MAxx[5)] |
| | **Scaling 1 low** | 0 | no code | | | | | |
| | | Value | SAL*Value* | | | | | SAL*Value* |
| | **Scaling 1 high** | 100 | no code | | | | | |
| | | Value | SAH*Value* | | | | | SAH*Value* |
| | **Output 2 measurand** | Temperature [°C] | no code | | | | | |
| | | Other measurand (xx see measurand code) | MBxx | | | | | MBxx[5)] |
| | **Scaling 2 low** | -40 | no code | | | | | |
| | | Value | SBL*Value* | | | | | SBL*Value* |
| | **Scaling 2 high** | 60 | no code | | | | | |
| | | Value | SBH*Value* | | | | | SBL*Value* |

1) Standard = 2 x M16 cable glands, except for AM3 option: 2 plugs for power supply and outputs
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**

Please note: no mix of SI/US units allowed.

| | | MAxx / MBxx |
|---|---|---|
| Relative humidity RH | [%] | 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 |

| | | MAxx / MBxx |
|---|---|---|
| Absolute humidity dv | [g/m$^3$] | 56 |
| | [gr/ft$^3$] | 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 Examples

**EE33-M1T10HS3F9K2L200PA23E4C1GA6**

| | |
|---|---|
| Model: | RH + T |
| Type: | Remote Probe, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F) |
| Enclosure material: | Metal ($AlSi_9Cu_3$) |
| Filter: | Stainless steel - metal grid (up to 180 °C / 356 °F) |
| Cable length: | 2 m |
| Probe length: | 200 mm |
| Process connection: | G1/2" ISO - sliding fitting, Ø 13 mm (0.51") |
| Electrical connection: | 1 plug for power supply and outputs |
| Digital interface: | RS232 |
| Display: | Without |
| Probe connection: | Fixed |
| Sensing element protection: | With E+E proprietary coating |
| Additional modules: | Without |
| Output signal: | 4 - 20 mA |
| Output 1 measurand: | Relative humidity [%RH] |
| Scaling 1 low: | 0 |
| Scaling 1 high: | 100 |
| Output 2 measurand: | Temperature [°C] |
| Scaling 2 low: | -40 |
| Scaling 2 high: | 60 |

**EE33-M1T17F11K5L200D2C1AM1GA3MB52SBL0SBH100**

| | |
|---|---|
| Model: | RH + T |
| Type: | Two remote probes, pressure tight up to 20 bar (300 psi) and 180 °C (356 °F) |
| Enclosure material: | Polycarbonate |
| Filter: | PTFE membrane, stainless steel body |
| Cable length: | 5 m |
| Probe length: | 200 mm |
| Process connection: | Without |
| Electrical connection: | Standard |
| Digital interface: | RS232 |
| Display: | With Display with backlight |
| Probe connection: | Fixed |
| Sensing element protection: | With E+E proprietary coating |
| Additional modules: | ARC module for external trigger of sensor heating |
| Output signal: | 0 - 10 V |
| Output 1 measurand: | Relative humidity [%RH] |
| Scaling 1 low: | 0 |
| Scaling 1 high: | 100 |
| Output 2 measurand: | Dew Point [°C] |
| Scaling 2 low: | 0 |
| Scaling 2 high: | 100 |

## Accessories

**(For further information, see data sheet “Accessories”)**

| | |
|---|---|
| E+E Product Configuration Software<br>(free download: 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 | HA011102 |
| 1/2" NPT Ø12 mm | HA011103 |
| G1/2" ISO Ø6 mm | HA011104 |
| 1/2" NPT Ø6 mm | HA011105 |
| Humidity calibration kit | see data sheet “Humidity Calibration Kit” |
| RS232 interface cable for plug option E5 | HA010311 |
| RS485 kit for network | HA010605 |
| Adapter M16x1.5 to NPT ½" | HA011101 |
| Drip water protection | HA010503 |
| Radiation shield for RH probe | HA010502 |
| Radiation shield for T probe | HA010506 |