

USER GUIDE

EE210 - Humidity and Temperature Sensor for demanding Climate Control Applications

Find this document and further product information on our website at www.epluse.com/ee210.

GENERAL

The EE210 sensor which is available for wall or duct mounting, with remote probe as well as an outdoor version, is designed for highly accurate measurement of humidity and temperature in demanding climate control applications. The EE210 incorporates a state of the art E+E humidity and temperature sensing element.

For use in special applications do not hesitate to contact E+E Elektronik or a local distributor.

CAUTION

- For accurate measurement it is essential that the temperature of the probe and mainly of the sensing head is same as the temperature of the air to measure. Avoid mounting the sensor in a way which creates temperature gradients along the probe.
- The sensor and mainly the sensing head shall not be exposed to extreme mechanical stress.
- The sensor must be operated with the filter cap on at all times. Do not touch the sensing element inside the sensing head.
- While replacing the filter cap (because of pollution for instance) against an original spare one please take very good care to not touch the sensors.

SCOPE OF SUPPLY

Model	EE210 Wall mount / Outdoor (Type T1/T13)	EE210 Duct mount (Type T2)	EE210 with remote probe (Type T3)*	PE210 Remote probe* for Type T3	Additionally for all EE210 with RS485 interface
EE210 according ordering guide	✓	✓	✓	✓	
Cable gland	✓	✓	✓ (2 pcs.)		✓
Mounting materials	✓	✓	✓		
Mounting flange		✓		✓	
Inspection certificate according to DIN EN 10204-3.1	✓	✓	✓	✓	
Quick Guide - EE210 RS485 Setup					✓

* PE210 is not included in the Scope of Supply of the EE210 Type T3

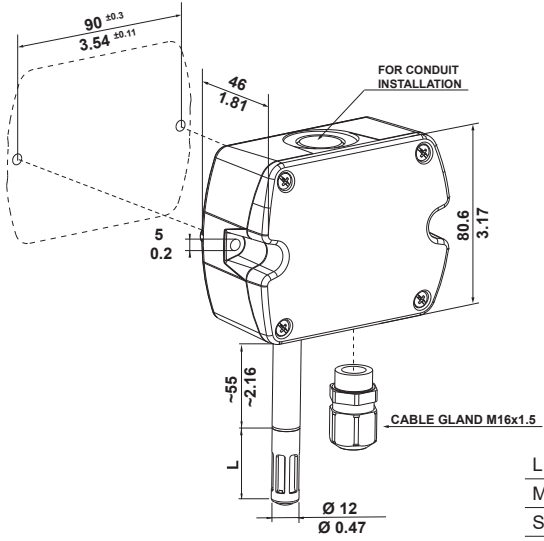
ACCESSORIES

USB configuration adapter
 Product configuration software
 Radiation shield for EE210 Outdoor (Type T13)
 Power supply adapter
 Protection cap for 12 mm probe

HA011066
 EE-PCS (free download: www.epluse.com/ee210)
 HA010501
 V03 (see data sheet Accessories)
 HA010783

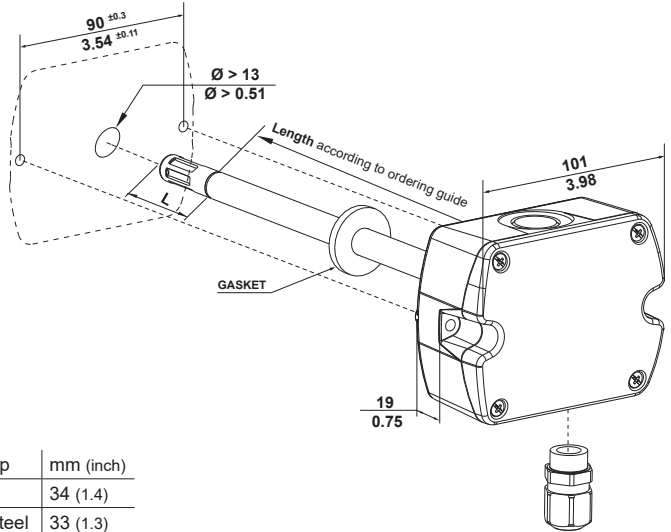
DIMENSIONS / MOUNTING
Values in mm (inch)

Type T1

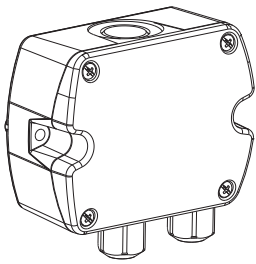


L = filter cap	mm (inch)
Membrane	34 (1.4)
Stainless steel	33 (1.3)
Metal grid	33 (1.3)

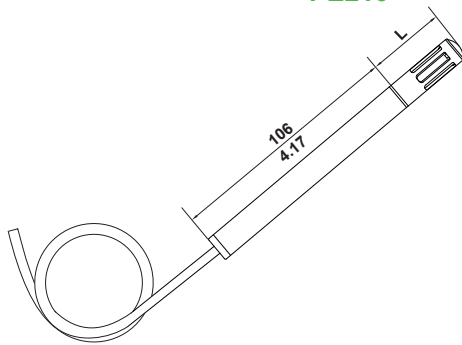
Type T2



Type T3

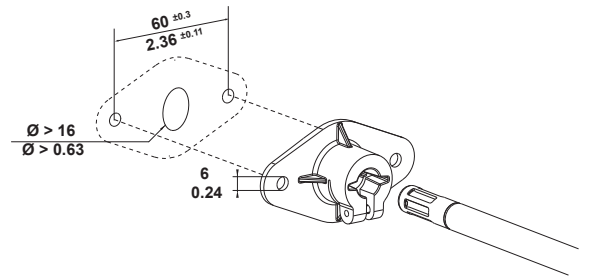


PE210

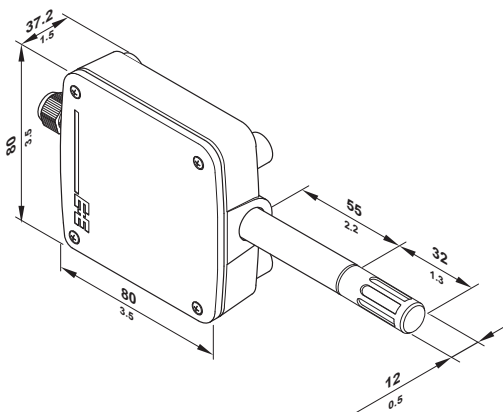


Mounting flange

in the scope of supply for Type T2 and T3

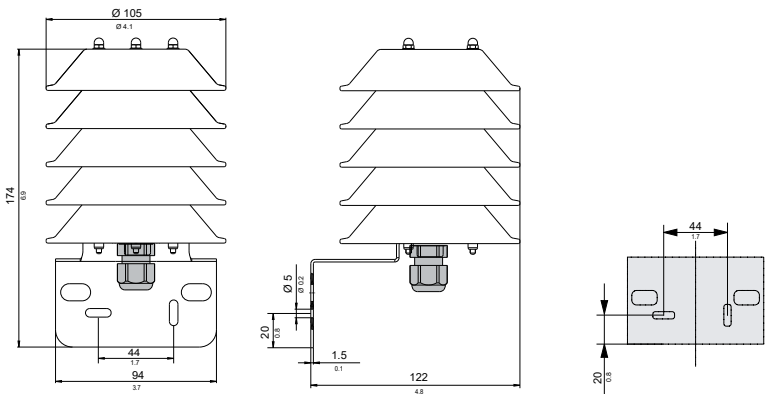


Type T13



Radiation Shield HA010501 for Type T13

(needs to be ordered separately)

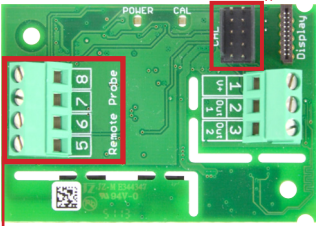


EE210 with cable gland: Use a matching wrench to install the cable gland (in the scope of supply) onto the EE210 enclosure.
EE210 with conduit connection for the North American market: use a flat screwdriver to knock open the blind, carefully, in order to avoid damaging the electronics inside the enclosure. The conduit adapter is not included in the scope of supply. The M16x1.5 opening for the cable gland shall be tightly closed using the blind plug included in the scope of supply.

CONNECTION DIAGRAM

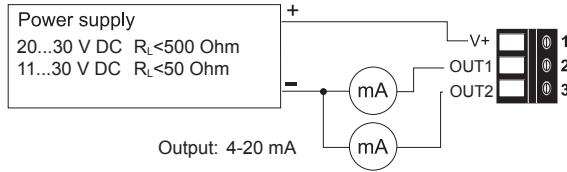
Important note:
The manufacturer cannot be held responsible for personal injuries or damage to property as a result of incorrect handling, installation, wiring, power supply and maintenance of the device.

EE210-M1xA6



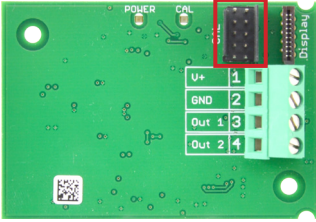
ONLY FOR REMOTE PROBE!

EE210-M1xA6

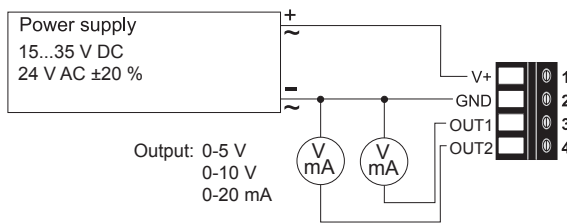


Important: The EE210-M1xA6 (4...20 mA, 2-wire) with display operates correctly only if both outputs are connected.

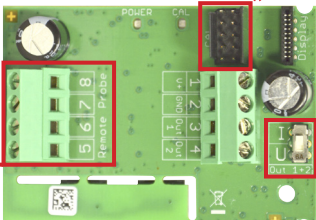
EE210-M1xA3



EE210-M1xA2/3/5



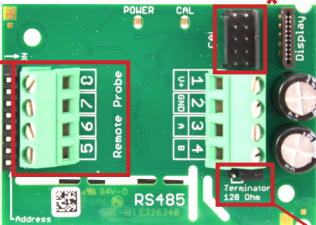
EE210-M1xA2/3/5



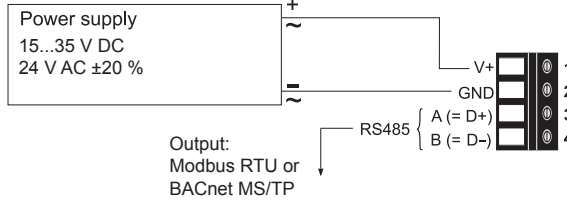
Selection output signal U / I

ONLY FOR REMOTE PROBE!

EE210-M1xJ3



EE210-M1xJ3



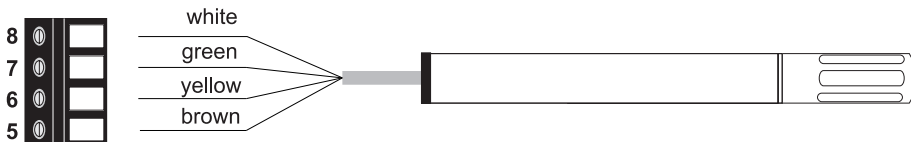
Bus termination resistor 120 Ω (jumper)

* configuration connector

PE210 for Type T3

The PE210 (remote probe for EE210-M1T3x) shall be ordered and it is supplied as separate item. PE210 is to be connected to the EE210 by the user.

- Install first the cable gland (included in EE210 scope of supply) onto the EE210 enclosure.
- Before connecting the probe, disconnect the EE210 power supply.
- Insert the PE210 cable through the cable gland and connect it to the screw terminals according to the connection diagram below.



Please note:

PE210 is an intelligent probe with digital output and as such it is interchangeable. In case the probe or its cable gets destroyed or if a longer cable is needed, please order a replacement probe according to EE210 data sheet. The replacement probe shall be installed as described above.

Important:

Make sure that the cable glands are closed tightly for both PE210 probe cable and for the power supply and outputs cable. This is necessary for assuring the protection class (IP class) of the enclosure according to EE210 specification, as well as for stress relief at the screw terminals on the EE210 board.

LED INDICATION

Green LED

Information during normal operation

- on = everything OK
- flashing = the main board does not recognize the measurement electronics inside the RH probe
- off = no power supply or main board failure

Blue LED

Information during setup with the optional USB configuration adapter HA011066 and the EE-PCS Product Configuration Software

- on = USB stick connected to PC, no communication with EE-PCS
- flashing = communication in progress with EE-PCS
- off = USB stick not connected to PC

DISPLAY

Factory Setup:

The display shows the two parameters selected for output 1 and output 2 (according to ordering code). For digital output versions the display shows RH and T.

User Setup:

The user can change the display layout to 1, 2 or 3 lines and select the parameters to be displayed by using EE-PCS Product Configuration Software (free download from www.epluse.com/configurator) and the optional USB configuration adapter (not included in the scope of supply).

Important: The EE210-M1xA6 (4...20 mA, 2-wire version) with display operates correctly only if both outputs are connected.



SELECTION OUTPUT SIGNAL U/I

The factory setup of the output signal and scaling corresponds to the type number as ordered.

The output signal (voltage or current 3-wire) can be selected with the DIP switch on the main electronics board (see picture PCB EE210-M1xA2/3/5). This does not impact on the scaling of the outputs, which can be changed using USB configuration adapter and the EE-PCS.

Examples

Factory setup: voltage output 0 - 5 V or 0 - 10 V corresponds to 0...100%RH.

After switching from U to I: current output 0...20 mA corresponds to 0...100%RH.

A change of the current output range for instance to 4 - 20 mA (3-wire) can be made subsequently with the USB configuration adapter and EE-PCS.

Factory setup: current output 0 - 20 mA corresponds to -10...50 °C.

After switching from I to U: voltage output 0 - 10 V corresponds to -10...50 °C.

A change of the voltage output range for instance to 0 - 5 V can be made subsequently with the USB configuration adapter and EE-PCS.

DIGITAL SETTINGS

HARDWARE BUS TERMINATION

If required, the bus termination shall be realized with 120 Ohm resistor, jumper on the board.

- Jumper mounted = bus terminated
- Jumper not mounted = bus not terminated

ADDRESS SWITCH

Address Switch



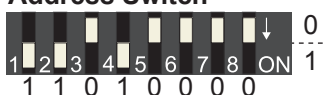
Address setting via EE-PCS Product Configuration Software

All DIP switches at position 0 → address has to be set via Product Configuration Software

Factory setting: 242 (permitted values: 1...247).

Example: Slave address is set via configuration software.

Address Switch



Address setting via DIP switch

Setting the DIP switches to any other address than 0, overrules the slave address set via configuration software (permitted values: 1...247).

Example: Slave address set to 11 (= 0000 1011 binary).

DIGITAL SETTINGS

	Factory settings	Selectable values
Baud rate	9600	9600, 19200, 38400, 57600, 76800, 115200
Data bits	8	8
Parity	EVEN	None, odd, even
Stop bits	1	1 or 2
Slave address	242	1...247

ID address, baud rate, parity and stop bits can be set via:

1. EE-PCS, Product Configuration Software and the appropriate configuration cable.
2. Modbus protocol in the register 60001 (0x00) and 60002 (0x01). See Application Note Modbus AN0103 (available on www.epluse.com/ee210)

The measured values are saved as a 32 bit float value and as 16 Bit signed integer, see the Modbus Register map below.

The serial number as ASCII-code is located at read register address 30001-30008 (16 bit per address).

The firmware version is located at register address 30009 (bit 15...8 = major release; bit 7...0 = minor release).

The sensor name is located at register address 30010.

MODBUS REGISTER MAP

FLOAT 32 bit (read register):			
Function code / Register number ¹⁾ [Dec]	Register address ²⁾ [Hex]	Parameter name	Unit ³⁾
30026	0x19	temperature	[°C], [°F]
30028	0x1B	relative humidity	[%]
30030	0x1D	water vapour partial pressure	[mbar], [psi]
30032	0x1F	dew point temperature	[°C], [°F]
30034	0x21	wet bulb temperature	[°C], [°F]
30036	0x23	absolute humidity	[g/m ³], [gr/ft ³]
30038	0x25	mixing ratio	[g/kg], [gr/lb]
30040	0x27	specific enthalpy	[kJ/kg], [BTU/lb]
30042	0x29	frost point temperature	[°C], [°F]

INTEGER 16 bit (read register):				
Function code / Register number ¹⁾ [Dec]	Register address ²⁾ [Hex]	Parameter name	Unit ³⁾	Scale ⁴⁾
30301	0x12C	temperature	[°C], [°F]	100
30302	0x12D	relative humidity	[%]	100
30303	0x12E	water vapour partial pressure	[mbar], [psi]	100
30304	0x12F	dew point temperature	[°C], [°F]	100
30305	0x130	wet bulb temperature	[°C], [°F]	100
30306	0x131	absolute humidity	[g/m ³], [gr/ft ³]	100
30307	0x132	mixing ratio	[g/kg], [gr/lb]	100
30308	0x133	specific enthalpy	[kJ/kg], [BTU/lb]	100
30309	0x134	frost point temperature	[°C], [°F]	100

INTEGER 16 bit (read and write register):		
Function code / Register number ¹⁾ [Dec]	Register address ²⁾ [Hex]	Parameter name
60001	0x00	Slave-ID ⁵⁾ modbus address
60002	0x01	Modbus protocol settings ⁶⁾

INFO (read register):		
Function code / Register number ¹⁾ [Dec]	Register address ²⁾ [Hex]	Parameter name
30001	0x00	Serial number (as ASCII)
30009	0x01	Firmware version
30010	0x09	Sensor Name

1) Register number starts from 1

2) Register address starts from 0

3) The choice of measurement units (metric or non-metric) must be done in the ordering guide, see EE210 data sheet.

Switching from metric to non-metric or vice versa by using the EE-PCS is not possible.

4) 100 is scale 1:100 (2550 is equivalent to 25.5 °C)

5) If the ID is set via DIP-switch the response will be NAK

6) For Modbus protocol settings please see Application Note Modbus AN0103 (available on www.epluse.com/ee210)

READING EXAMPLE

Example of MODBUS RTU command for reading the temperature (float value) $T = 24.270019\text{ }^{\circ}\text{C}$ from the register 0x19:

Device EE210; slave ID 242 [F2 in Hex]

Reference document, chapter 6.3: http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf

Request [Hex]: F2 03 00 19 00 02 01 0F

	Modbus ID address	Function code	Starting address Hi	Starting address Lo	No. of register Hi	No. of register Lo	CRC	
Request [Hex]:	F2	03	00	19	00	02	01	0F

Response [Hex]: F2 03 04 29 00 41 C2 80 A1

	Modbus ID address	Function code	Byte count	Register 1 value Hi	Register 1 value Lo	Register 2 value Hi	Register 2 value Lo	CRC	
Response [Hex]:	F2	03	04	29	00	41	C2	80	A1

For decoding of float values (stored according standard IEEE754), please refer to AN0103, chapter 7.

Example of decoding:

Response [Hex]:				Value in decimal
Byte 1 (Register 2 - Hi)	Byte 2 (Register 2 - Lo)	Byte 3 (Register 1 - Hi)	Byte 4 (Register 1 - Lo)	
41	C2	29	00	24,270019

TECHNICAL DATA

(Modification rights reserved)

Measured Values

Relative Humidity (RH)

Working range 0...100 %RH

RH accuracy¹⁾ (incl. hysteresis, non-linearity and repeatability)

Type T1 (wall), T2 (duct):

-15...40 °C (5...104 °F) ≤90 %RH ±(1.3 + 0.003*measured value) %RH

-15...40 °C (5...104 °F) >90 %RH ±2.3 %RH

-40...60 °C (-40...140 °F) ±(1.5 + 0.015*measured value) %RH

Type T3 (remote):

at 20 °C (68 °F) ±2.5 %RH

Type T13 (outdoor):

-15...40 °C (5...104 °F) ≤90 %RH ±(1.6 + 0.005*measured value) %RH

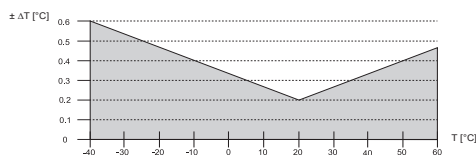
-15...40 °C (5...104 °F) ≥90 %RH ±3 %RH

-40...60 °C (0...140 °F) ±(2.3 + 0.008*measured value) %RH

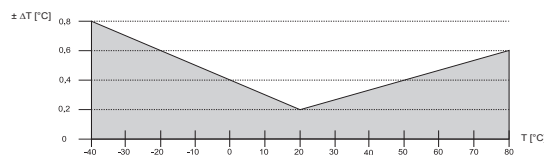
Temperature (T)

T accuracy

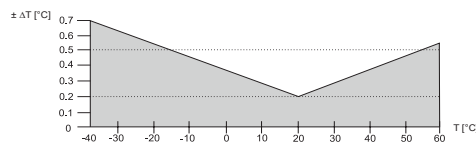
Type T1, T2



Type T3



Type T13



¹⁾ Traceable to intern. 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). For Type T13: at 24 V DC and RL=250 for A6 versions.


Calculated parameters

		from		up to		unit	
Dew point temperature	Td	-40	(-40)	60	(140)	°C	(°F)
Frost point temperature	Tf	-40	(-40)	0	(32)	°C	(°F)
Wet bulb temperature	Tw	0	(32)	60	(140)	°C	(°F)
Water vapour partial pressure	e	0	(0)	200	(3)	mbar	(psi)
Mixing ratio	r	0	(0)	160	(1200)	g/kg	(gr/lb)
Absolute humidity	dv	0	(0)	150	(60)	g/m ³	(gr/ft ³)
Specific enthalpy	h	-40	(-10)	500	(200)	kJ/kg	(BTU/lb)

Outputs

Analogue output	0 - 5 V / 0 - 10 V	-1 mA < I _L < 1 mA
	4 - 20 mA (2-wire)	R _L ≤ 500 Ω
	for Type 13	250 ≤ R _L ≤ 500 Ω recommended
	0 - 20 mA (3-wire)	R _L ≤ 500 Ω
Digital output	RS485 (BACnet MS/TP or Modbus RTU), EE210 = 1 unit load	

General

Power supply (Class III) ²⁾

for 4 - 20 mA, 2-wire

10 V + R_L x 20 mA < V₊ < 30 V DC
for Type T13: 24 V DC ±10 % recommended

for 0 - 20 mA, 3-wire

for 0 - 5 V / 0 - 10 V / RS485

15 - 35 V DC or 24V AC ±20 %

Current consumption at 24 V

Voltage output

DC supply max. 12 mA; with display max. 23 mA
AC supply max. 34 mA_{rms}; with display max. 49 mA_{rms}

Current output

2-wire

3-wire

DC supply max. 40 mA; with display max. 40 mA
DC supply typ. 33 mA; with display max. 44 mA
AC supply typ. 65 mA_{rms}; with display max. 84 mA_{rms}

Digital interface

DC supply typ. 5 mA; with display max. 20 mA
AC supply typ. 15 mA_{rms}; with display max. 35 mA_{rms}

Display³⁾

Available for Type T1/T2/T3
1, 2 or 3 lines, user configurable
Optional with backlight

Electrical connection

Screw terminals, max. 1.5 mm²

Enclosure material

Polycarbonate, UL94 V-0 (with Display UL94HB) approved

Protection rating

IP65 / NEMA 4X

Cable gland

M16 x 1.5

Probe cable (for PE210)

PVC, Ø 4.3 mm, 4 x 0.25 mm², Length: 1.5 or 3 m (4.9 or 9.8 ft)

Electromagnetic compatibility

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



Temperature ranges

Working: -40...60 °C (-40...140 °F) (-40...80 °C / -40... 176 °F for probe PE210)

Without display

Storage: -40...60 °C (-40...140 °F)

Temperature ranges

Working: -20...50 °C (-4...122 °F) (-40...80 °C / -40... 176 °F for probe PE210)

With display

Storage: -20...60 °C (-4...140 °F)

2) USA & Canada: class 2 supply required. max. supply voltage 30 V DC

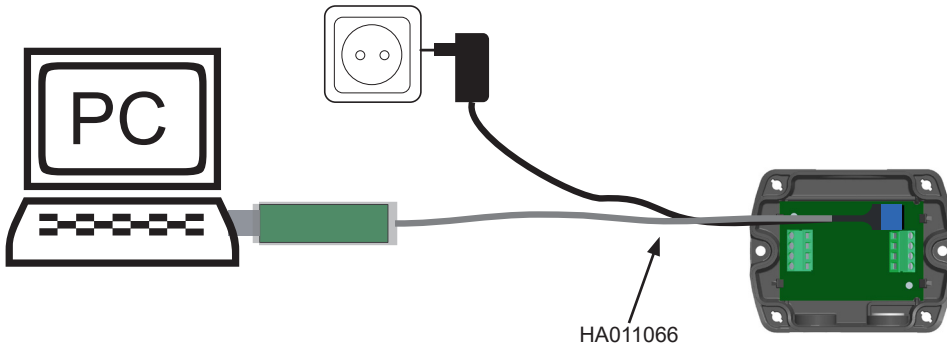
3) For display operation with EE210-M1xA6 (4 - 20 mA, 2-wire) both outputs must be connected

SETUP AND ADJUSTMENT

The EE210 is ready to use and does not require any configuration by the user. The factory setup of EE210 corresponds to the type number ordered. For ordering guide please see data sheet at www.epluse.com/ee210. If needed, the user can change the factory setup by using the USB configuration adapter (HA011066) and the EE-PCS, Product Configuration Software.

The user can change the scaling and the analogue output signal, the digital settings and perform RH and T adjustment.

Note: The EE210 may not be connected to any additional power supply when using the USB configuration adapter HA011066.



EE-PCS PRODUCT CONFIGURATION SOFTWARE

1. Download the EE-PCS Product Configuration Software from www.epluse.com/configurator and install it on the PC.
2. Connect the E+E device to the PC using the USB configuration adapter.
3. Start the EE-PCS software.
4. Follow the instructions on the EE-PCS opening page for scanning the ports and identifying the connected device
5. Click on the desired setup or adjustment mode from the main EE-PCS menu on the left and follow the online instructions of the EE-PCS

MAINTENANCE

Humidity calibration and adjustment:

Depending on the application and the requirements of certain industries, there might arise the need for periodical humidity calibration (comparison with a reference) or adjustment (bringing the device in line with a reference).

- Calibration and adjustment at E+E Elektronik
Calibration and/or adjustment can be performed in the E+E Elektronik calibration laboratory. For information on the E+E capabilities in ISO or accredited calibration please see www.eplusecal.com.
- Calibration and adjustment by the user
Depending on the level of accuracy required, the humidity reference can be:
 - Humor 20 Humidity Calibrator, please see www.epluse.com.
 - Omniport30 handheld device, please see www.epluse.com/omniport30.
 - Calibrated salt solutions, please see www.epluse.com/ee210.

Temperature calibration and adjustment:

Due to the outstanding protection of the Pt1000 temperature sensing element integrated in the E+E RH/T sensing element, a drift of the T measurement is rather unlikely. If adjustment seems necessary, although the user can perform a one or two point T adjustment with USB configuration adapter and EE-PCS against a reference of his choice, it is highly recommended to return the device to the manufacturer for this. The reasons rest on the difficulty of an accurate T calibration in the air. The calibration shall take into account the self-heating of EE210 with closed enclosure, in its real mounting position and in continuous operation, the impact of the output current and of the probe orientation to the self-heating, as well as the cooling effect of the air circulation in a climate chamber possibly used for calibration.

When employed in dusty, polluted environment:

- The filter cap shall be replaced once in a while with an E+E original one. A polluted filter cap causes longer response time of the device.
- If needed, the sensing head can be cleaned. For cleaning instructions please see www.epluse.com/ee210.

EMC note USA (FCC):

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

EMC note Canada (ICES-003):

CAN ICES-3 (A) / NMB-3 (A)

INFORMATION

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