



User Manual

# **EE220**

## **Humidity and Temperature Sensor**

YOUR PARTNER IN SENSOR TECHNOLOGY



**ELEKTRONIK®**  
Ges.m.b.H.

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**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)

# CONTENT

<b>1</b>	<b>General</b> .....	<b>4</b>
1.1	Explanation of Symbols.....	4
1.2	Safety Instructions.....	4
1.2.1	General Safety Instructions.....	4
1.2.2	Mounting, Start-up and Operation.....	4
1.3	Environmental Aspects.....	5
<b>2</b>	<b>Product Description</b> .....	<b>5</b>
<b>3</b>	<b>Scope of Supply</b> .....	<b>5</b>
<b>4</b>	<b>Installation</b> .....	<b>6</b>
4.1	Mounting of the Enclosure.....	6
4.2	Connecting the EE07 Sensing Probes.....	6
4.2.1	EE07 Probes Connected Directly to EE220.....	6
4.2.2	EE07 Probes Connected to EE220 with Extension Cables.....	7
4.2.3	EE07 Duct Mounted.....	7
<b>5</b>	<b>Probe Protection During Cleaning and Sterilizing Operations</b> .....	<b>7</b>
5.2.1	Probe Protection.....	7
5.2.2	Probe Removal.....	7
<b>6</b>	<b>Electrical Connections</b> .....	<b>7</b>
6.1	Connection Diagram.....	8
<b>7</b>	<b>User Interface</b> .....	<b>8</b>
7.1	Display.....	9
<b>8</b>	<b>RH and T Adjustment of the EE07 Probes</b> .....	<b>9</b>
8.1	Definitions.....	9
8.2	EE07 Adjustment with EE220 Basic Device.....	9
8.2.1	2-point RH and T Adjustment.....	9
8.2.2	1-point RH and T Adjustment.....	10
8.2.3	Return to Factory Calibration.....	10
8.3	Loop Adjustment and Calibration in the Field.....	10
8.4	EE07 Individual Adjustment.....	11
<b>9</b>	<b>Functional and Accuracy Check of EE220 Basic Unit</b> .....	<b>11</b>
9.1	EE220 Check Using the Display.....	11
9.2	Check of the EE220 Outputs.....	12
9.3	Humidity Check.....	12
9.4	Temperature Check.....	12
<b>10</b>	<b>EE03 Humidity and Temperature Module</b> .....	<b>13</b>
<b>11</b>	<b>Replacement of the Probes</b> .....	<b>13</b>
<b>12</b>	<b>EE220 Display Replacement or Retrofit</b> .....	<b>13</b>
<b>13</b>	<b>Spare Parts and Accessories</b> .....	<b>14</b>
<b>14</b>	<b>Technical Data EE220</b> .....	<b>15</b>

# 1 General

This operation manual is part of the scope of supply and serves for ensuring proper handling and optimal functioning of the device.

The operation manual shall be read before commissioning the equipment and it shall be provided to all staff involved in transport, installation, operation, maintenance and repair.

The operation manual may not be used for the purposes of competition without the written consent of E+E Elektronik® and may not be forwarded to third parties. Copies may be made for internal purposes. All information, technical data and diagrams included in these instructions are based on the information available at the time of writing.

## 1.1 Explanation of Symbols



**This symbol indicates safety information.**

It is essential that all safety information is strictly observed. Failure to comply with this information can lead to personal injuries or damage to property. E+E Elektronik® assumes no liability if this happens.



**This symbol indicates instructions.**

The instructions shall be observed in order to reach optimal performance of the device.

## 1.2 Safety Instructions

### 1.2.1 General Safety Instructions

- Avoid any unnecessary mechanical stress and inappropriate use.
- When replacing the filter cap make sure not to touch the sensing elements.
- For sensor cleaning please see “Cleaning instructions” at [www.epluse.com/cleaning-instructions](http://www.epluse.com/cleaning-instructions).
- Installation, electrical connection, maintenance and commissioning shall be performed by qualified personnel only.

### 1.2.2 Mounting, Start-up and Operation

The Humidity / Temperature Sensor has been produced under state of the art manufacturing conditions, has been thoroughly tested and has left the factory fulfilling all safety criteria.

The manufacturer has taken all precautions to ensure safe operation of the device. The user must ensure that the device is set up and installed in a manner that does not have a negative effect on its safe use.

The user is responsible for observing all applicable safety guidelines, local and international, with respect to safe installation and operation on the device. This operating manual contains information and warnings that must be observed by the user in order to ensure safe operation.

- Mounting, start-up, operation and maintenance of the device may be performed by qualified staff only. Such staff must be authorized by the plant operator to carry out the mentioned activities.
- The qualified staff must have read and understood this operating manual and must follow the instructions contained within.
- All process and electrical connections shall be thoroughly checked by authorized staff before putting the system into operation.
- Do not install or start start-up a device supposed to be faulty. Make sure that such devices are not accidentally used by marking them clearly as faulty.
- A faulty device may only be investigated and possibly repaired by qualified, trained and authorized staff. If the fault cannot be fixed, the device shall be removed from the system.
- Service operations other than described in this operating manual may only be performed by the manufacturer.

### Disclaimer

The manufacturer or his authorized agent can be only be held liable in case of willful or gross negligence. In any case, the scope of liability is limited to the corresponding amount of the order issued to the manufacturer. The manufacturer assumes no liability for damages incurred due to failure to comply with the applicable regulations, operating instructions or the operating conditions. Consequential damages are excluded from the liability.

## 1.3 Environmental Aspects



Products from E+E Elektronik® are developed and manufactured observing of all relevant requirements with respect to environment protection. Please observe local regulations for the device disposal.



For disposal, the individual components of the device must be separated according to local recycling regulations. The electronics shall be disposed of correctly as electronics waste.

## 2 Product Description

The innovative, modular EE220 humidity (RH) and temperature (T) sensor consists of a basic unit and various pluggable, interchangeable probes.

The basic unit can accommodate one combined EE07 RH and T probe or two separate EE07 probes, one for RH and one for T. The EE07 probes are available in plastic or in stainless steel enclosure, and can be plugged onto the basic unit either directly or with M12 extension cables up to 10 m (32.8 ft) long. An optional kit facilitates the mounting of the probes into duct.

The EE220 basic unit is available with polycarbonate or with metal enclosure, suitable for wall mount or for installation on rails (DIN EN 50022). For pharma and food industry the basic unit features a rear cable inlet.

The measured values are available on two analogue voltage or current (2-wire, 4 - 20 mA) outputs, as well as on the optional display.

One or two point adjustment for RH and T of the sensor can be easily performed with push buttons on the electronics board of the EE220 basic unit. Alternatively, the EE07 probes can be adjusted individually with the EE-PCA Product Configuration Adapter (see EE07 data sheet).

For surface moisture monitoring or for the early detection of condensation danger, EE220 can accommodate the EE03 RH + T module (see data sheet EE03).

## 3 Scope of Supply

**EE220 Basic Unit** (does not include probes or probe cables; these are to be ordered separately)

- EE220 It. according to ordering guide
- Cable gland M16 x 1.5
- Test report according according to DIN EN 10204-3.1
- Operating Instructions

### Probe (EE03 or EE07)

- EE03 or EE07 according to ordering guide
- Test report according according to DIN EN 10204-3.1 (only EE07)

### Probe cable for EE03 or EE07

- Probe cable according to ordering guide

## 4 Installation

### 4.1 Mounting of the Enclosure

Drill the mounting holes according to the mounting template. The polycarbonate enclosure can also be fixed onto mounting rails, see chapter 13 Spare Parts and Accessories.

Fix the back cover of the enclosure with 4 screws, max. diameter 4.2 mm (0.2"), not included in the scope of supply.

Perform the electrical connection according chapter 6 Electrical Connections.

Fix the front cover onto the back cover with the four screws included in the scope of supply.

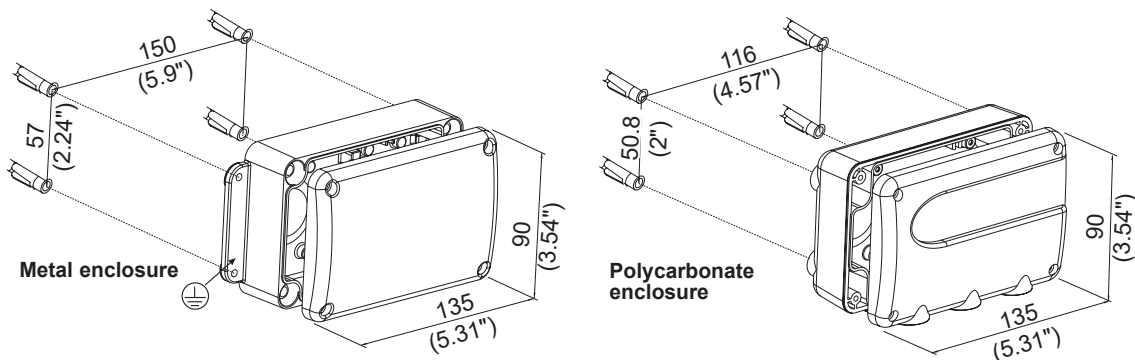


Fig. 1 Mounting of metal and polycarbonate enclosure

### 4.2 Connecting the EE07 Sensing Probes

The humidity (RH) probe or the combined humidity and temperature (RH + T) probe must be connected at position 1. The T probe must be connected at position 2.

**EE220 with fixed probes**

**EE220 with remote sensing probe**

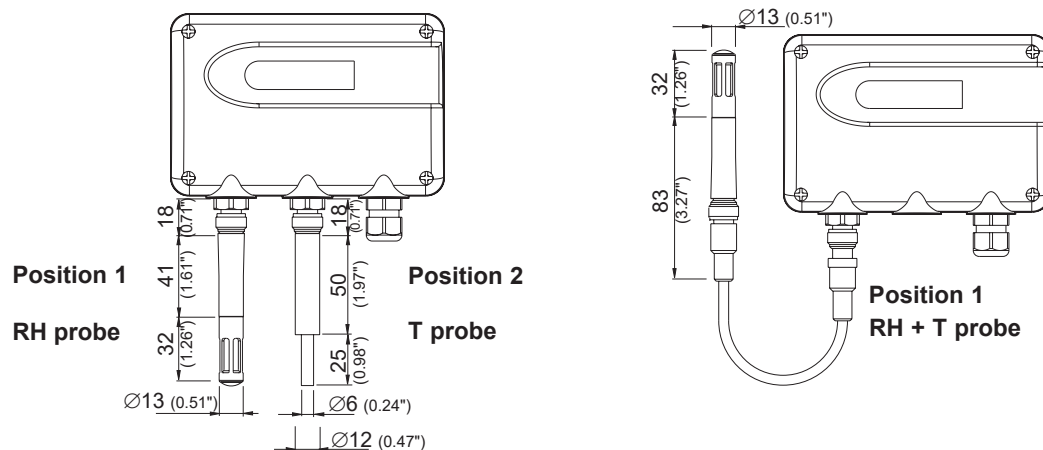


Fig. 2 Connecting the EE07 sensing probes

#### 4.2.1 EE07 Probes Connected Directly to EE220

In order to avoid misreading caused by self-heating, the device shall be installed with the probes pointing downwards. In very humid, condensing environment it is recommended to use the EE220 version with remote probe, please see below.

#### 4.2.2 EE07 Probes Connected to EE220 with Extension Cables

The probes can be also connected to the EE220 enclosure with extension cables, see chapter 13 Spare Parts and Accessories.

The EE07 probe may be mounted pointing upwards or downwards. The probe can be fixed onto a wall with the wall mounting clip HA010211.

For outdoor use each EE07 probe shall be used with a radiation shield, order number HA010502. In very humid, condensing environment the probe should be installed horizontally. Probes pointing downwards shall be protected by the drip water protection, order number HA010503.

#### 4.2.3 EE07 Duct Mounted

The duct mounting kit HA010209 includes an extension (200 mm / 7.9") for the EE07 probe and a mounting flange. It facilitates the EE07 mounting into ducts with thick walls or thermal isolation.

## 5 Probe Protection During Cleaning and Sterilizing Operations

Periodical cleaning and sterilizing operations are common in pharma and food industries, as well as in incubators or hatchers. Cleaning and sterilizing agents may affect the sensors and lead to drift and corrosion. It is highly recommended to either protect or remove the EE07 probes during cleaning and sterilizing.

#### 5.2.1 Probe Protection

Place the plastic protection cap HA010783 on the probe before starting cleaning or sterilizing and remove it after that. This is not necessary for the EE07-M3HS2 metal temperature probe.

#### 5.2.2 Probe Removal

When removing the probes before starting cleaning or sterilizing, use the M12 protection caps for the EE220 probe connectors or cable connector (HA010781) which remain on site. The probe connector can be also protected with the cap HA010782.

## 6 Electrical Connections

See figure *Fig. 5 Voltage output* and *Fig. 6 Current output*



#### EMC recommendations for wiring

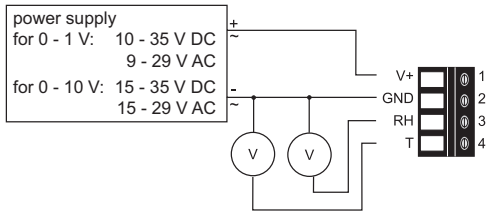
The requirements of EMC standards as specifies in the technical data are only fulfilled with the EE07 probes connected either directly or with E+E original extension cables to EE220.



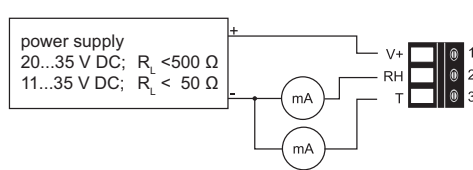
- E220 with metal enclosure must be grounded either at the designated points on the inside, or outside at the mounting plate.  
The EE07 probe may not be grounded; it must be electrically isolated from the GND.
- Locate the EE220, the probe cable and the output cables as far as possible from sources of electromagnetic disturbances.
- For the analogue outputs use either shielded or twisted cable pairs. The shield shall be grounded at one end only, preferably at the controller side.
- Cable loops may impact on the EMC behavior of EE220. Keep all cables as short as possible. Unused wires shall be grounded at both ends. Run all cables as close as possible to the ground potential, for instance close to the walls or steel structure elements.

## 6.1 Connection Diagram

EE220-xA1x  
EE220-xA3x



EE220-xA6x



Option E4



- 1... brown ..... T
- 2... white ..... RH
- 3... blue ..... NC
- 4... black ..... GND
- 5... grey ..... V+

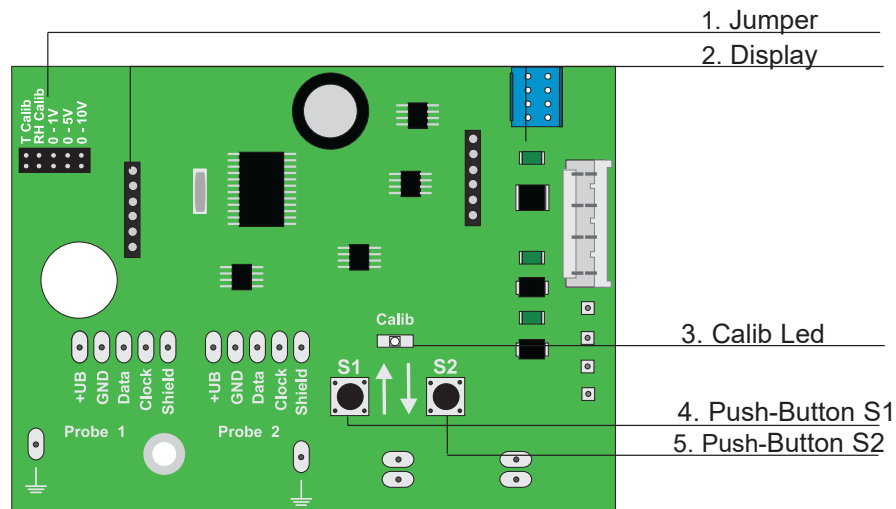
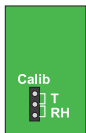


### Important:

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.

## 7 User Interface

4-20 mA version



1. JUMPER:

- Selection of output signals and of calibration mode
- |                     |                |
|---------------------|----------------|
| Voltage output      | 4-20 mA output |
|                     |                |
| Selection of output |                |

2. DISPLAY:

3. CALIB LED:

4. S1 Functions

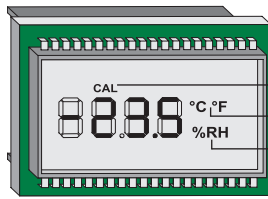
5. S2 Functions

S1+S2 Function:

- Socket for optional display
- Continuously on indicates adjustment mode
- 1 flash confirms reset to factory calibration
- 1-point RH or T adjustment (RH > 50%RH; T within the upper half of the T scale)
- 2-point RH or T adjustment (high calibration point)
- Save adjustment data
- 1-point RH or T adjustment (RH < 50%RH; T within the lower half of the T scale)
- 2-point RH or T adjustment (low calibration point)
- Exit the adjustment mode without saving the data
- Reset to factory calibration



## 7.1 Display



1. CAL
2. °C / °F
3. %RH

- |             |                             |
|-------------|-----------------------------|
| 1. CAL:     | • indicates adjustment mode |
| 2. °C / °F: | • T measuring unit          |
| 3. %RH:     | • RH measuring unit         |

## 8 RH and T Adjustment of the EE07 Probes

### 8.1 Definitions

#### Calibration

The calibration documents the accuracy of a measurement device. The device under test (specimen) is compared with the reference and the deviations are documented in a calibration certificate. During the calibration, the specimen is not changed or improved in any way.

#### Adjustment

The adjustment improves the measurement accuracy of a device. The specimen is compared with the reference and brought in line with it. An adjustment can be followed by a calibration which documents the accuracy of the adjusted specimen.

### 8.2 EE07 Adjustment with EE220 Basic Device

- 1-point RH or T adjustment for optimal performance over a narrow RH or T range.

Example: climate monitoring in a pharma manufacturing site.

RH range: 40...60 %RH → RH adjustment point: 50 %RH

T range: 15...25 °C (59...77 °F) → T adjustment point: 20 °C (68 °F)

- 2-point RH or T adjustment for accurate measurement over a wide RH or T range.

Example: outdoor measurement

RH range: 10 ... 100 %RH → RH adjustment points: 40 %RH, 70 %RH

T range: -30 ... 35 °C (-22...95 °F) → T adjustment points: -10 °C (14 °F), 15 °C (59 °F)

- The adjustment data is saved into the EE07 probes. The EE220 basic unit is not affected by the adjustment procedure. Consequently, it is possible to replace the probes at any moment.
- Start the adjustment procedure with the low point (e.g. 30 %RH) and continue with the high point (e.g. 80 %RH)
- For accurate calibration or adjustment, the specimen and the reference must have same T.
- During calibration or adjustment the T shall remain constant.
- Allow min. 30 min, stabilization time for RH calibration or adjustment.
- If needed, clean the sensors (see "Cleaning Instructions" at [www.epluse.com/cleaning-instructions](http://www.epluse.com/cleaning-instructions)) and replace the filter cap by a new one.



Please note: A display facilitates considerably the calibration and adjustment. An EE220 without display can be easily retrofitted by simply plugging on a display (see chapter 9.1 EE220 Check Using the Display). Furthermore, one and the same display can be plugged onto any EE220 just for adjustment and calibration.

#### 8.2.1 2-point RH and T Adjustment

1. Set the jumper to RH calib or to T Calib.
2. Place the probe into the corresponding calibrator and let it stabilize at the first point (low) for at least 30 minutes.
3. Press and hold S2 for 3 seconds. The LED "Calib" will light and the symbol "CAL<" will appear on the EE220 display.

4. Push S1 (up) or S2 (down) to bring the measured value in line with the reference in steps of 0.1. The actual corrected value is indicated on the display and can be measured at the analogue output.
5. Press and hold S1 for 3 seconds to store the value into EE07 and end the first (low) point adjustment. The LED "Calib" will be deactivated and the display will show "CAL"  
Alternative: Press and hold S2 for 3 seconds to exit the adjustment mode without storing the adjustment data. The LED "Calib" will be deactivated and the symbol "CAL" disappears from the LC display.
6. Set the calibrator for the second (high) adjustment point and let the probe stabilize for at least 30 min.
7. Press and hold S1 for 3 seconds. The LED "Calib" will light and the symbol "CAL>" will appear on the EE220 display.
8. Push S1 (up) or S2 (down) to bring the measured value in line with the reference in steps of 0.1. The actual corrected value is indicated on the display and can be measured at the analogue output. Press and hold S1 for 3 seconds to store adjusted value in the EE07 probe and end the second (high) point adjustment. The LED "Calib" will be deactivated and the display will show "CAL".  
  
Alternative: Press and hold S2 for 3 seconds to exit the adjustment mode without storing the adjustment data. The LED "Calib" will be deactivate and the symbol "CAL" disappears from the LC display.

### 8.2.2 1-point RH and T Adjustment

For best performance, the RH and the T adjustment point shall be selected at the middle of the RH and T measurement range of main interest.

1. Set the jumper to RH calib or to T Calib.
2. Place the probe into the corresponding calibrator and let it stabilize at the selected RH or T value for at least 30 minutes.
3. For adjustment point in the lower half of the output scale, press and hold S2 for 3 seconds. The LED "Calib" will light and the symbol "CAL<" will appear on the EE220 display.

For adjustment point in the upper half of the output scale, press and hold S1 for 3 seconds. The LED "Calib" will light and the symbol "CAL>" will appear on the EE220 display.

4. Push S1 (up) or S2 (down) to bring the measured value in line with the reference in steps of 0.1. The actual corrected value is indicated on the display and can be measured at the analogue output.
5. Press and hold S1 for 3 seconds to store adjusted value in the EE07 probe and end the first (low) point adjustment. The LED "Calib" will be deactivated and the display will show "CAL".

Alternative: Press and hold S2 for 3 seconds to exit the adjustment mode without storing the adjustment data. The LED "Calib" will be deactivate and the symbol "CAL" disappears from the LC display.

### 8.2.3 Return to Factory Calibration

During normal measurement mode of EE220 (NOT during adjustment mode!) press and hold together S1 and S2 for 5 seconds. The return to factory calibration is indicated by one flash of the LED "Calib".

## 8.3 Loop Adjustment and Calibration in the Field

Loop calibration or adjustment in the field, as required by the FDA (Food and Drugs Administration) regulated industries, is easily possible for the EE220 with two separate probes. Use extension cables to drop the EE07 probes into calibrators without dismounting or disconnecting the EE220 basic unit. The illustration shows the EE07 RH probe placed into the Humor 20 high end portable humidity calibrator, and the EE07 T probe in a dry block calibrator.

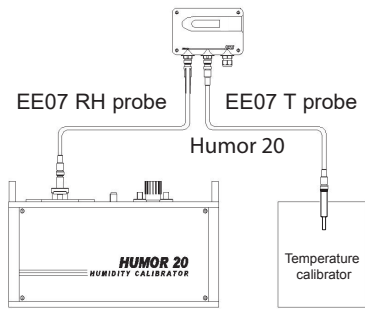


Fig. 3 Loop calibration

## 8.4 EE07 Individual Adjustment

The EE07 probes can be adjusted also individually with the optional EE-PCA Product Configuration Adapter (data sheet at [www.epluse.com/ee220](http://www.epluse.com/ee220)) and the EE-PCS Product Configuration Software (free download at [www.epluse.com/configurator](http://www.epluse.com/configurator)).

## 9 Functional and Accuracy Check of EE220 Basic Unit

The EE220 basic unit can be checked with respect to functionality and accuracy by using the EE220 Reference Probes Set, order number HA010403 (Fig. 4).



Fig. 4 Reference probes

The set consists of two reference probes, which supply each a pair of fix humidity and temperature values as follows:

RH = 10 % , T = 45 °C (113 °F)

RH = 90 % , T = 5 °C (41 °F)

The set includes a test report for each reference probe.

For EE220 basic unit dedicated for only one combined EE07 RH + T probe, both RH and T check shall be performed with each reference probe connected at the single probe connection socket.

For EE220 basic unit dedicated for two separate EE07 RH and respectively T probes, the RH check shall be done with each reference probe connected to the first (left) socket, and then the T check with the same probe connected to the second (right) socket.

### 9.1 EE220 Check Using the Display

If the EE220 basic unit features a display, as soon as the reference probe is connected the display shall show the corresponding RH and T reference values.

If the EE220 basic unit does not feature a display, it is easily possible to plug in a display (see chapter 12 EE220 Display Replacement or Retrofit). It is highly advisable to keep a spare display specifically for this purpose or for easy adjustment of the entire EE220 including EE07 probes (see chapter 8.2 EE07 Adjustment with EE220 Basic Device).

## 9.2 Check of the EE220 Outputs

For the EE220 with voltage output, a voltmeter shall be connected as in Fig. 5.

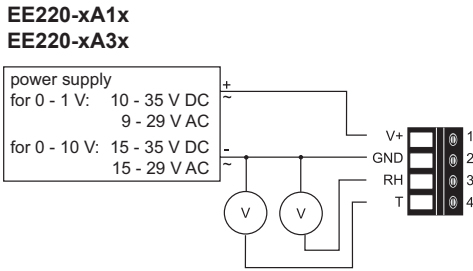


Fig. 5 Voltage output

For the EE220 with current output, an ammeter shall be connected as in Fig. 6.

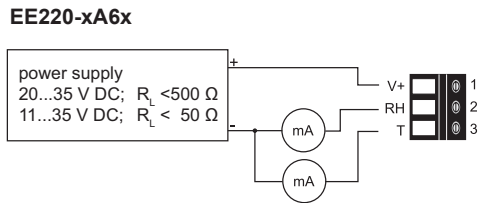


Fig. 6 Current output

Make sure that the supply is appropriate for the output signal.

## 9.3 Humidity Check

The table below shows the output signal for each reference probe.

Humidity reference	Output			
	4...20 mA	0...1 V	0...5 V	0...10 V
Reference probe 1 10 %RH	5.6	0.1	0.5	1.0
Reference probe 2 90 %RH	18.4	0.9	4.5	9.0

Tab. 1 Humidity check

## 9.4 Temperature Check

The output signal depends on the scaling of the temperature output.

For current output:  $I_{out} [mA] = (16 * (Ref/T_{max})) + 4 \text{ mA}$

For voltage output:  $U_{out} [V] = (Abb * (Ref/T_{max}))$

Where:

Abb .....voltage scaling (1 V, 5 V, 10 V)

Ref.....reference value of temperature (45 °C (113 °F) resp. 5 °C (41 °F))

Tmax ...max. temperature scaling (e.g. 50 °C (122 °F))

Temperature reference	Output			
	4...20 mA	0...1 V	0...5 V	0...10 V
Reference probe 1 45 °C (113 °F)	18.4	0.9	4.5	9.0
Reference probe 2 5 °C (41 °F)	5.6	0.1	0.5	1.0

Tab. 2 Output values for temperature scale T04 = 0...50 °C (122 °F)

## 10 EE03 Humidity and Temperature Module

EE220 basic unit can accommodate also the EE03 humidity and temperature module. EE03 is dedicated for the measurement of surface moisture and for detecting the danger of condensation on a surface before the condensation actually occurs.

For technical details, ordering guide and mounting accessories see the EE03 data sheet.

Connect EE03 to the first (left) probe socket of the EE220 using the cables HA010328 or HA010329. EE03 cannot be plugged directly onto EE220. For accurate surface RH measurement the T of the EE03 shall be the same as the surface T, so it is of paramount importance to assure best thermal contact between EE03 and the surface to monitor.

EE03 can be adjusted neither together with the EE220 basic unit, nor individually. With EE03 connected, the S1 and S2 push buttons have no function. An EE03 deemed faulty shall be replaced against a new one.

## 11 Replacement of the Probes

A damaged probe can be replaced by a new one without any EE220 setup change or re-adjustment, as follows:

1. Switch off supply voltage
2. Remove faulty sensor probe
3. Plug in the replacement probe
4. Switch on the supply voltage



Important: Do not mix up the position of the probes! (see chapter 4.2 Connecting the EE07 Sensing Probes)

## 12 EE220 Display Replacement or Retrofit

If needed, a damaged EE220 display can be easily replaced by the user. Furthermore, an EE220 without display can be easily upgraded to an EE220 with display.

The EE220 display is available as spare part. The scope of supply includes the display, the front cover of EE220 (plastic or metal) and a quick user guide.

The ordering numbers for spare EE220 display are:

- D07P plastic front cover
- D07M metal front cover

1. Remove the EE220 front cover.
2. Switch of the power supply or plug off the EE220 screw terminals on the main electronics board.
3. For replacing an existing display: remove the exiting display by pulling it straight upwards.
4. observing its orientation (Fig. 7). Push the display gently straight down to plug it in. Observe the ESD regulations while doing this.

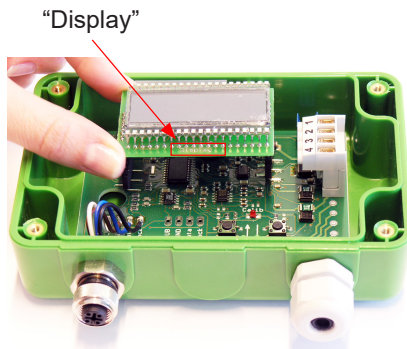


Fig. 7 Display orientation

5. Remove the protection foil from display (Fig. 8).

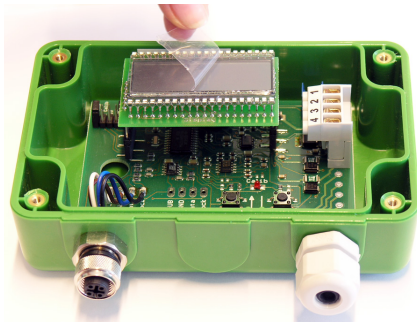


Fig. 8 Remove protection foil from display.

6. Power on the EE220 and check the display functionality.
7. Place back the EE220 front cover and fix it with the four screws.

## 13 Spare Parts and Accessories

See also data sheet "Accessories"

### Description

- Display and metal front cover
- Display and polycarbonate front cover
- Duct mounting kit
- Reference probes set (2 probes)
- Extension cable for EE07 2 m (6.6 ft) / 5 m (16.4 ft) / 10 m (32.8 ft)
- Connection cable for EE03 2 m (6.6 ft) / 5 m (16.4 ft)
- Bracket for rail installation (polycarbonate enclosure only)
- Power supply adapter
- Radiation shield
- Drip water protection
- Plastic protection cap for EE07 probes
- Protection cap for M12 connecting cable female
- Protection cap for M12 probe connector male
- Wall mounting clip Ø 12 mm (0.47") for EE07
- EE-PCA
- EE-PCS

### Order Code


- D07M
- D07P
- HA010209
- HA010403
- HA010801/02/03
- HA010328/29
- HA010203
- V03
- HA010502
- HA010503
- HA010783
- HA010781
- HA010782
- HA010211
- see data sheet „EE-PCA“
- EE-PCS (download at [www.epluse.com/configurator](http://www.epluse.com/configurator))

# 14 Technical Data EE220

## Outputs

(RH: 0...100 %RH; T: see ordering guide)	0 - 1 V	-0.5 mA < I <sub>L</sub> < 0.5 mA
	0 - 10 V	- 1 mA < I <sub>L</sub> < 1 mA
	4 - 20 mA (2-wire)	R <sub>L</sub> < 500 Ω
T dependency, max.	0.2 mV/°C, 1 μA/°C	

## General

Power supply class III  <sup>1)</sup> (EU) / class 2 (NA)	10 - 35 V DC or 9 - 29 V AC	
for 0 - 1 V	15 - 35 V DC or 15 - 29 V AC	
for 0 - 10 V	10 V + R <sub>L</sub> x 20 mA < U <sub>V</sub> < 35 V DC	
for 4 - 20 mA		
Current consumption, typ.	DC supply: 10 mA	
	AC supply: 20 mA <sub>rms</sub>	
Electrical connection	Screw terminals max. 2.5 mm <sup>2</sup>	
Cable feedthrough	Cable gland M16x1.5 cable Ø 4.5 - 10 mm (0.18 - 0.39")	
Enclosure	Material	Polycarbonate
	Protection rating	Metal AlSi <sub>9</sub> Cu <sub>3</sub> IP65/NEMA 4
Electromagnetic compatibility	EN 61326-1:2013	EN 61326-2-3:2013
	Industrial Environment	
	FCC Part15 ClassA	ICES-003 ClassA
Working and storage conditions	-40...60 °C (-40...140 °F) without display	
	-30...60 °C (-22...140 °F) with display	
	0...95 %RH, non-condensing	
	700...1200 mbar	



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

For technical data EE07 and EE03 please see the corresponding data sheets at [www.epluse.com/ee220](http://www.epluse.com/ee220).



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