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User Manual EE371

Compact Dew Point Sensor

Modbus

www.epluse.com

Content

1 General Information

This user manual serves for ensuring proper handling and optimal functioning of the device. The user manual shall be read before commissioning the equipment and it shall be provided to all staff involved in transport, installation, operation, maintenance and repair. E+E Elektronik Ges.m.b.H. does not accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described product(s).

All information, technical data and diagrams included in this document are based on the information available at the time of writing. It may contain technical inaccuracies and typographical errors. The contents will be revised on a regular basis and changes will be implemented in subsequent versions. The described product(s) and the contents of this document may be changed or improved at any time without prior notice.

PLEASE NOTE

Find this document and further product information on our website at www.epluse.com/ee371.

1.1 Explanation of Warning Notices and Symbols

Safety precautions

Precautionary statements warn of hazards in handling the device and provide information on their prevention. The safety instruction labeling is classified by hazard severity and is divided into the following groups:

DANGER

Danger indicates hazards for persons. If the safety instruction marked in this way is not followed, the hazard will verly likely result in severe injury or death.

WARNING

Warning indicates hazards for persons. If the safety instruction marked in this way is not followed, there is a risk of injury or death.

CAUTION

Caution indicates hazards for persons. If the safety instruction marked in this way is not followed, minor or moderate injuries may occur.

NOTICE

Notice signals danger to objects or data. If the notice is not observed, damage to property or data may occur.

Informational notes

Informational notes provide important information which stands out due to its relevance.

INFO

The information symbol indicates tips on handling the device or provides additional information on it. The information is useful for reaching optimal performance of the device.

The title field can deviate from “INFO” depending on the context. For instance, it may also read “PLEASE NOTE”.

1.2 Safety Instructions

1.2.1 General Safety Instructions

NOTICE

Improper handling of the device may result in its damage.

- The EE371 enclosure, the sensing probe and the sensing module shall not be exposed to unnecessary mechanical stress.
- Do not apply the supply voltage to the RS485 data lines.
- Use the EE371 only as intended and observe all technical specifications.

1.2.2 Intended Use

The EE371 is intended for the dew point temperature (Td) measurement of compressed air and other non-corrosive and non-flammable gases at pressures. The sensor can be installed in a pressurized system up to 20 bar (290 psi) and 100 bar (1 450 psi), respectively.

⚠ WARNING

Non-compliance with the product documentation may cause safety risks for people and the entire measurement installation.

The manufacturer cannot be held responsible for damages as a result of incorrect handling, installation and maintenance of the device.

- Do not use EE371 in explosive atmosphere or for measurement in aggressive gases.
- This device is not appropriate for safety, emergency stop or other critical applications where device malfunction or failure could cause injury to human beings.
- The device may not be manipulated with tools other than specifically described in this manual.

NOTICE

Failing to follow the instructions in this user manual may lead to measurement inaccuracy and device failures.

- The EE371 may only be operated under the conditions described in this user manual and within the specification included in chapter 9 Technical Data.
- Unauthorized product modification leads to loss of all warranty claims. Modification may be accomplished only with an explicit permission of E+E Elektronik Ges.m.b.H.!

1.2.3 Mounting, Start-up and Operation

The EE371 has been produced under state of the art manufacturing conditions, has been thoroughly tested and has left the factory after 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 way that does not impair its safe use. The user is responsible for observing all applicable local and international safety guidelines for safe installation and operation of the device. This user manual contains information and warnings that must be observed by the user in order to ensure safe operation.

PLEASE NOTE

The manufacturer or his authorized agent can 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 specified operating conditions. Consequential damage is excluded from liability.

⚠ WARNING

Non-compliance with the product documentation may cause accidents, personal injury or property damage.

- Mounting, installation, commissioning, start-up, operation and maintenance of the device may be performed by qualified staff only. Such staff must be authorized by the operator of the facility to carry out the mentioned activities.
- The qualified staff must have read and understood this user manual and must follow the instructions contained within. The manufacturer accepts no responsibility for non-compliance with instructions, recommendations and warnings.
- All process and electrical connections shall be thoroughly checked by authorized staff before putting the device into operation.
- Do not install or start-up a device supposed to be faulty. Make sure that such devices are not used accidentally by marking them clearly as faulty.
- A faulty device shall be removed from the process.
- Service operations other than described in this user manual may only be performed by the manufacturer.

1.3 Environmental Aspects

PLEASE NOTE

Products from E+E Elektronik Ges.m.b.H. are developed and manufactured in compliance with relevant environmental protection requirements. Please observe local regulations for the disposal of the device.

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 Scope of Supply

- EE371 – Compact Dew Point Sensor
- Inspection certificate according to DIN EN 10204-3.1
- Quick guide

3 Product Description

3.1 General

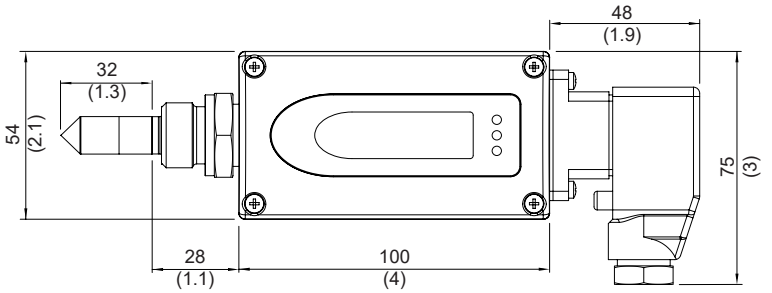
The compact EE371 Dew Point Sensor with a measuring range down to -60 °C Td and a robust stainless steel housing is ideal for OEM applications in compressed air systems, plastic dryers and industrial drying processes. The core of the EE371 is the monolithic measurement cell type HMC200, manufactured in thin-film technology. Due to the excellent long term stability and durability against condensation the EE371 has low maintenance needs.

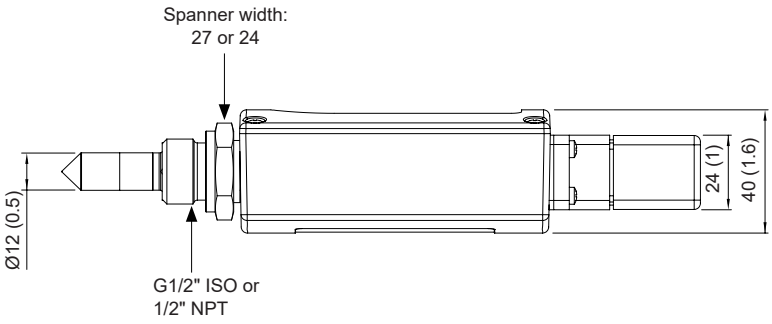
An integrated auto-calibration procedure permits a measurement accuracy of <2 °C Td. The recommended calibration interval is 2 years.

The measured values for dew point, frost point or volume concentration are available on two analogue outputs with 4 - 20 mA or 0 - 10 V.

3.2 Dimensions

Values in mm (inch)





3.3 Electrical Connection

⚠ WARNING

Incorrect installation, wiring or power supply may cause overheating and therefore personal injuries or damage to property.

For correct cabling of the device, always observe the presented wiring diagram for the product version used.

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.

The electrical connection is made via the 7-pin connector DIN VDE 0627 / IEC 61984. A mating connector is included in scope of supply.

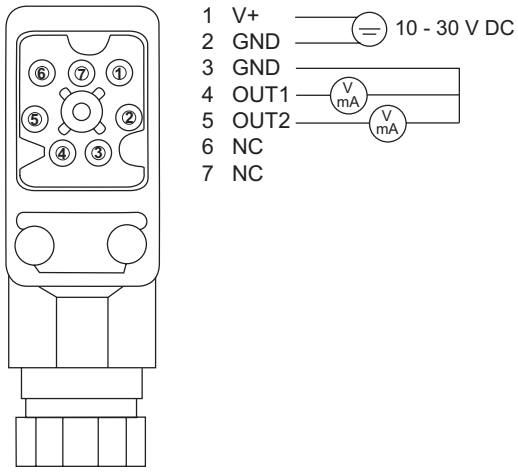


Fig. 1 Analogue output

3.4 Auto-Calibration

Dew point temperatures ranging from -60 to -20 °C (-76...-4 °F) at room temperatures correspond to relative humidities of 0.08 to 5.37 %RH.

To guarantee the accuracy at the lowest humidity, even the smallest drift effects in the humidity sensing element must be compensated.

A special auto-calibration method is used to compensate the usual drift effects, which leads to high-precision measurements even at the lowest dew point temperatures.

Auto-calibration is carried out every 30 minutes and takes approx. 3 minutes.

When putting the device into operation after a long interruption, the regular auto-calibration procedure might require a long time to bring the device within specs. Therefore, an advanced auto-calibration mechanism takes place 5 min after power on.This advanced auto-calibration mechanism takes a little bit longer than the regular auto-calibration and is performed up to 5 times during the first hour of operation.

During auto-calibration, the analogue output switches to the state

- Frozen output signal, keeping the last measured value (default behaviour).

3.5 Measuring Range and Accuracy

The EE371 has an accuracy of ±2 °C specified within the measuring range -60...60 °C dew point.

Measuring signal limitation:
at medium temperature ≤20 °C (≤68 °F): Td limitation = -80 °C (-112 °F)
at medium temperature >20 °C (>68 °F): Td limitation = medium temperature - 100 °C (-148 °F)
e.g. at medium temperature 40 °C (104 °F) the measuring signal is limited at -60 °C (-76 °F) dew point.

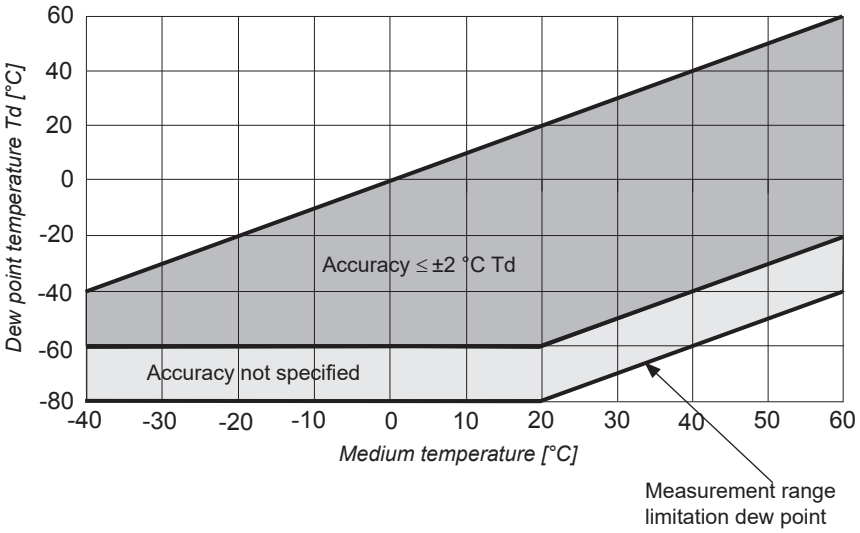


Fig. 2 Dew point measurement range and specified accuracy

The maximum scaling of the analogue output is -100...80 °C (-148...176 °F) dew point.

4 Mounting and Installation

4.1 Installation Location

Select a location that offers optimum measuring conditions. Air must be able to circulate freely around the sensing element.Temperature differences between the process and the location of installation do not affect the dew point measurement. However, attention should be paid to the fact that changes in the pressure of a gas also changes the dew point. If there is a pressure difference between the location of installation and the process, the measurement can be several tens of degrees dew point off.The exact effects of changes in pressure on the dew point can be simulated using the E+E humidity calculator. Please find further details on our website www.epluse.com. Leakage should be avoided, as ingress of moisture from the environment will interfere with the measurement.

PLEASE NOTE

Upon delivery the sensor is protected by a cap that keeps the dew point sensor dry. The cap should only be removed right before installation into the application.

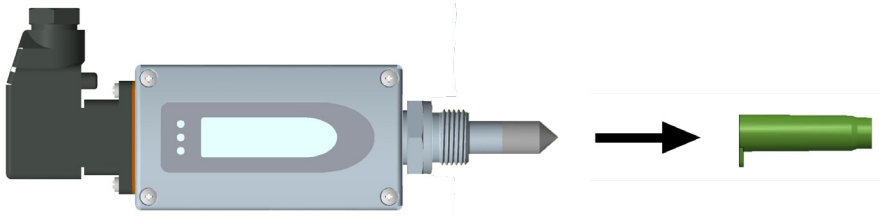


Fig. 3 Remove protection cap

4.2 Installing Directly into the Process

For direct installation in the pipeline, a shut-off valve should be installed on both sides of the process. The sensor can therefore be easily removed for maintenance and calibration work.

PLEASE NOTE

It is not permitted to use a sealing ring with a NPT 1/2” thread. Appropriate PTFE sealing tape or sealant should be used instead.

Insert the sensor into the process and tighten it by hand as far as possible. If available, check the sealing ring for correct centring. Tighten the screw connection to a defined torque of 30 Nm.

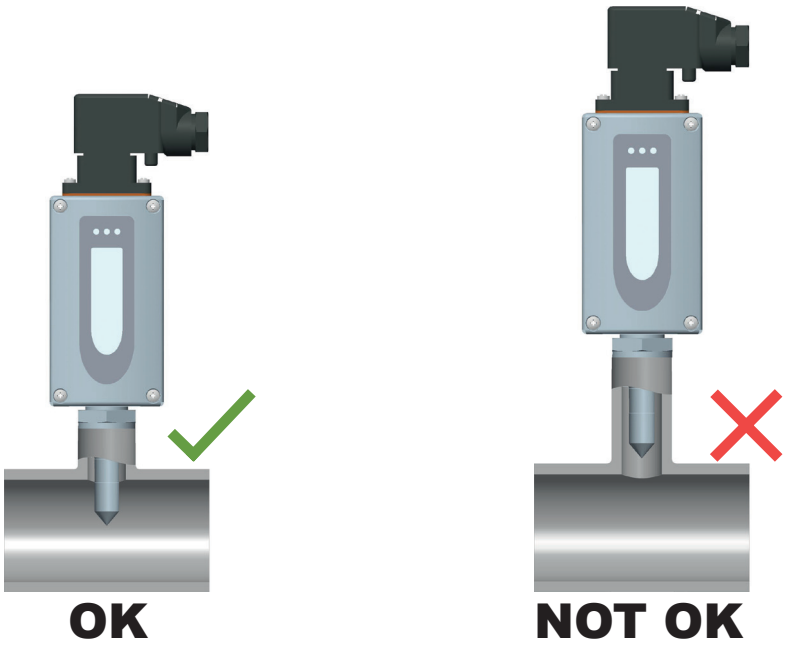


Fig. 4 Direct mounting to the pipe

4.3 Mounting with a Sampling Cell

Sampling is necessary if a direct installation of the sensor in the process is not possible or not required. Reasons may be:

- Process temperature is too high
- Sensor shall be protected against contamination.
- Removing the sensor must not interrupt the process.

PLEASE NOTE

To obtain a representative sample of process gas and to avoid measuring errors, please not the following:

- Differences in pressure between the process and the sampling chamber will result in significant measuring errors.
- Measurements at low dew point temperatures are sensitive to humidity diffusing from the environment due to leaks. Therefore, the sampling system must be pressure-tight.
- Non hygroscopic materials must be used.
- The sampling line should be as short as possible.
- The response time increases if the gas flow is < 1 l/min (0.25 gpm).
- A too low gas flow can result in back-diffusion of humidity from the environment and distort the measurement.

The pipe material does have a significant influence on the response time and the lowest reachable dew point temperature. Fig. 5 illustrates how different tubing materials give off moisture over time when flushed with very dry gas after being at ambient humidity.

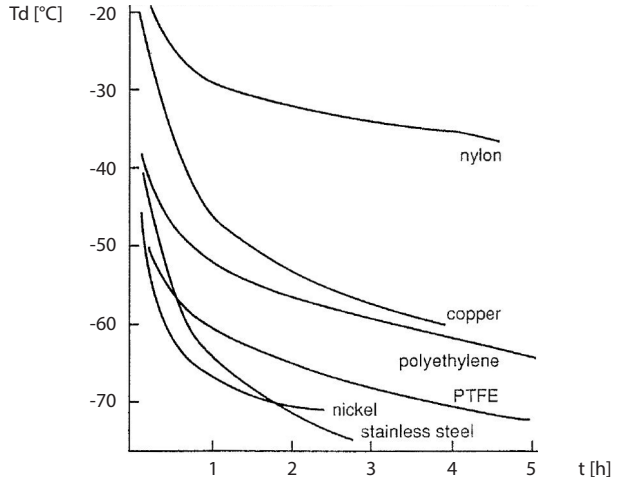


Fig. 5 Moisture given off by different tubing materials (© National Physical Laboratory)

These are several sampling cells available optionally:

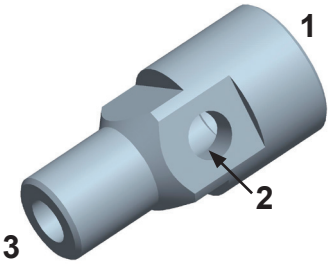
- Basic sampling cell
- Sampling cell with quick connector and bleed screw
- Sampling cell for atmospheric dew point

Please refer to EE371 datasheet and to chapter 8 Accessories of this document.

4.3.1 Basic Sampling Cell

Pressure range: 0...64 bar (0...928 psi)

Order code HA050103 (ISO) HA050105 (NPT)



	ISO	NPT
1	G 1/2"	1/2"
2	G 1/4"	1/4"
3	G 1/4"	1/4"

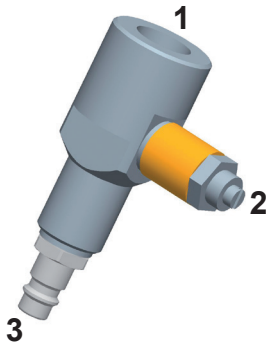
Fig. 6 Basic sampling cell

4.3.2 Sampling Cell with Quick Connector

The sampling cell features a quick-connector suitable for standard compressed air connections DN7.2. It allows the cell to be installed and removed without process interruption.The air (gas) flow along the sensing head of EE371 can be adjusted using the bleed screw.

Pressure range: 0...10 bar (0...145 psi)

Order code: HA050102

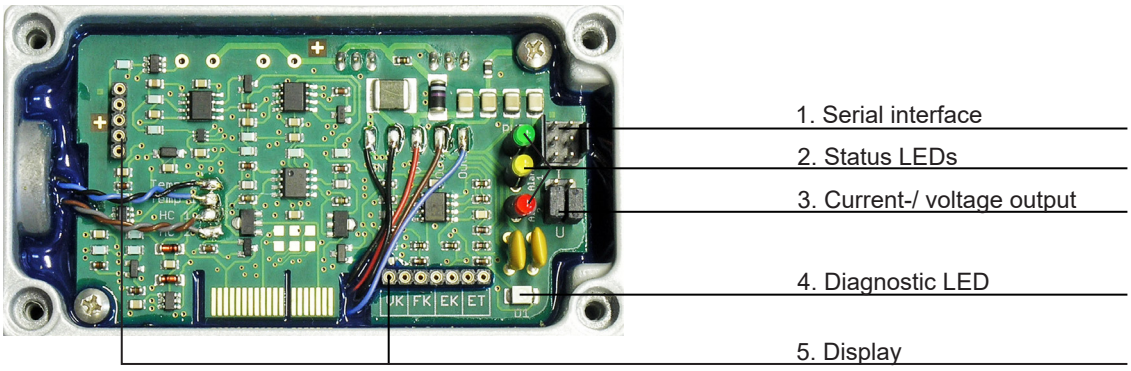


1 G 1/2" ISO
2 Bleed screw
3 Quick connector DN7.2

Fig. 7 Sampling cell with quick connector

5 Operating Components

5.1 Electronics Board



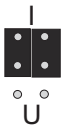
Serial interface:
Connector for serial interface cable HA010304 or EE-PCA Product Configuration Adapter with HA011063. See data sheets EE371, Accessories and EE-PCA at www.epluse.com/ee371.

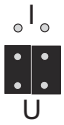
Status LEDs:
Provide information on the status of the EE371.

Green (Power LED): flashing = EE371 is correctly powered.

The yellow and red LEDs don't have a function.

Current-/ voltage output:
Jumpers for selecting the analogue output signal. The change from voltage to current or vice versa shall be performed both via hardware (jumpers) and software (with the EE-PCS Product Configuration Software).

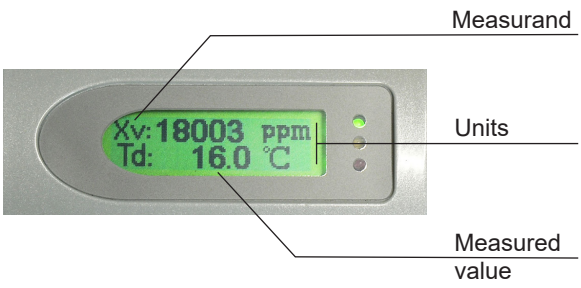
for current signals: 

for voltage signals: 

Diagnostic LED:
Error Indication. See chapter7.3 Self-Diagnosis and Error Messages.

Display:
Connectors for the optional display module.

5.2 Display module (Option)



Measurand		Units SI	Units US
Td	dew point temperature	°C	°F
Tf	frost point temperature	°C	°F
Wv	volume concentration	ppm	ppm

Measured value	
Td	-60...60 °C Td (-112...140 °F Td)
Tf	-60...0 °C Tf*) (-112...32 °F Tf)
Wv	20...200 000 ppm

*) Above 0 °C medium temperature, Td will be displayed

6 Setup and Adjustment

The EE371 probe is ready to use and does not require any configuration by the user. The EE371 factory setup corresponds to the type number ordered. Please refer to the data sheet at www.epluse.com/ee371.

With the help of the free EE-PCS Product Configuration Software and the optional RS232 interface cable (order code HA010304) or with the EE-PCA Product Configuration Adapter and the according connection cable (order code HA011063), the user can carry out sensor adjustment and calibration and change the scaling of the analogue outputs.

6.1 EE-PCS Product Configuration Software

To use the software for changing the digital communication settings and to perform adjustments, please proceed as follows:

1. Download the EE-PCS Product Configuration Software from www.epluse.com/configurator and install it on the PC.
2. Connect the EE371 to the PC using the Modbus configuration cable.
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

6.2 Calibration and Adjustment

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.

The dew point temperature adjustment of EE371 can be performed with the free EE-PCS Product Configuration Software, free download at www.epluse.com/configurator.

6.3 Dew Point Adjustment by the User

Dew point adjustment by the user is possible only at low dew points. The adjustment can only be carried out if the difference between the ambient temperature and the reference dew point temperature is <-60 °C.

Example:

Ambient temperature = 20 °C

Reference dew point temperature must be lower than -40 °C.

7 Maintenance

7.1 Cleaning the Sensing Element

⚠ WARNING

- Never touch the sensing elements
- Any attempt to clean the sensing elements mechanically such as rubbing or brushing leads certainly to their irreversible damage.

Please refer to the “Cleaning the Instructions”, available online at the E+E Download-Center.

7.2 Filter Replacement

A contaminated filter cap should replaced by a new one. The order number for a new filter is HA010103.

When replacing the filter, please note the following:

- Unscrew the filter cap very carefully to avoid damaging the sensing element.
- Handling the filter might clog the pores. Use gloves to screw on the new filter.

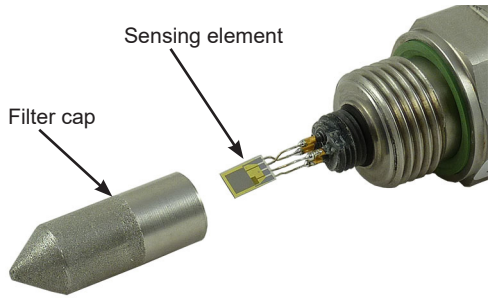


Fig. 8 EE371 filter and sensing element

7.3 Self-Diagnosis and Error Messages

Self-diagnosis via LED on the circuit board:

Power LED (green):

- flashing → EE371 is correctly powered / the microprocessor is active
- constantly lit → Electronics defect => please contact the producer

Diagnostic LED (D1, blue):

- flashing → The sensing element is wet (condensation)
- constantly lit → The sensing element is damaged

Self-diagnostic via display (option):

- Error 1 → The dew point sensing element is damaged
- Error 2 → The sensing element is wet (condensation)
- Error 3 → The temperature sensing element is damaged
- Error 4 → Short circuit on the temperature sensing element

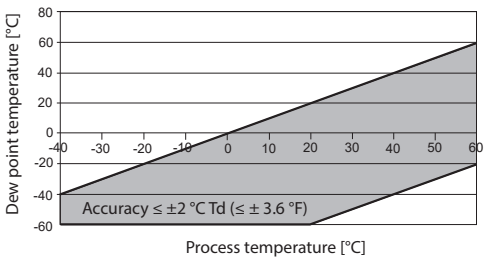
8 Accessories

Description	Code
Product Configuration Software (free download: www.epluse.com/configurator)	**EE-PCS**
Product Configuration Adapter (available at www.epluse.com/ee371)	**EE-PCA**
Sampling cell G 1/2" with quick connector	**HA050102**
Sampling cell NPT with bleed screw	**HA050107**
Sampling cell G 1/2" for atmospheric dew point	**HA050106**
Basic sampling cell G 1/2"	**HA050103**
Basic sampling cell NPT	**HA050105**

9 Technical Data

Measurands

Dew Point Temperature (Td)

Measuring range	-60...+60 °C Td (-76...+140 °F Td)
Accuracy[1)]	
Response time t_{90}	<5 min for step -5 °C Td (+23 °F Td) → -50 °C Td (-58 °F Td) <20 s for step -50 °C Td (-58 °F Td) → -5 °C Td (-23 °F Td)

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).

Volume Concentration (Wv)

Measuring range @ 1 013 mbar (14.7 psi)	20...200 000 ppm
Accuracy @ 20 °C (68 °F) and 1 013 mbar (14.7 psi)	±(5 ppm + 9 % from measured value)

Outputs

Analogue

Two freely selectable and scaleable outputs[1)] **Td, Tf or Wv**	0 - 10 V 4 - 20 mA (3-wire)	0 mA < I_L < 1 mA R_L < 500 Ω[1)]	I_L = load current R_L = load resistance

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).

General

Power supply class III USA & Canada: Class 2 supply necessary, max. voltage 30 V DC		15 - 30 V DC
Current consumption, typ. @ 24 V DC	**Voltage output** **Current output**	40 mA / during auto-calibration: 100 mA 80 mA / during auto-calibration: 140 mA
Electrical connection		
	7-pole industrial plug **wire cross-section** **cable outlet**	DIN VDE 0627 / IEC 61984 0.25 - 1 mm^2 PG 11
Filter		Stainless steel sintered
Pressure working range		0...20 bar (0...290 psi) 0...100 bar (0...1 450 psi)
Temperature working range	**Medium (air)** **Electronics** **Display**	-40...+70 °C (-40...+158 °F) -40...+60 °C (-40...+140 °F) -20...+50 °C (-4...+122 °F)
Storage condition		-40...+60 °C (-40...+140 °F)
Enclosure		
	Material **Protection rating**	Aluminium die-cast (AlSi9Cu3) IP65
Electromagnetic compatibility		EN 61326-1 EN 61326-2-3 Industrial environment FCC Part15 Class B ICES-003 Class B
Conformity		CE UKCA
Configuration and adjustment		EE-PCS Product Configuration Software (free download: www.epluse.com/configurator) and configuration adapter

10 Conformity

10.1 Declarations of Conformity

E+E Elektronik Ges.m.b.H. hereby declares that the product complies with the respective regulations listed below:

CE European directives and standards.

and

UKCA UK statutory instruments and designated standards.

Please refer to the product page at www.epluse.com/ee371 for the Declarations of Conformity.

10.2 Electromagnetic Compatibility

EMC for industrial / basic environment.

Our sensors are group 1 devices and correspond to class A.

⚠ WARNING

This device is not intended for use in residential areas and cannot ensure adequate protection of radio reception in such environments.

10.3 FCC Part 15 Compliance Statement

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.

10.4 ICES-003 Compliance Statement

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

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