



User Manual

**EE355**  
**Dew Point Sensor**  
**down to -60 °C Td**

YOUR PARTNER IN SENSOR TECHNOLOGY



**ELEKTRONIK®**  
Ges.m.b.H.

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 products.

The document may contain technical inaccuracies and typographical errors. The content will be revised on a regular basis. These changes will be implemented in later versions. The described products can be improved and changed at any time without prior notice.

**© Copyright E+E Elektronik Ges.m.b.H.  
All rights reserved.**

**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	Intended Use .....	4
1.2.3	Mounting, Start-up and Operation .....	5
1.3	Environmental Aspects .....	5
<b>2</b>	<b>Scope of Supply</b> .....	<b>5</b>
<b>3</b>	<b>Product Description</b> .....	<b>6</b>
3.1	General .....	6
3.2	Dimensions .....	6
3.3	Electrical Connection .....	6
3.4	Auto-calibration .....	7
3.5	Measuring Range and Accuracy .....	7
<b>4</b>	<b>Installation</b> .....	<b>8</b>
4.1	Installation Location .....	8
4.2	Installing directly into the Process .....	8
4.3	Installing the Sensor in a Sampling System .....	8
<b>5</b>	<b>Setup and Adjustment</b> .....	<b>9</b>
5.1	EE-PCS Product Configuration Software .....	10
5.2	Dew Point Adjustment by the User .....	10
<b>6</b>	<b>Digital Interface RS485 with Modbus RTU Protocol</b> .....	<b>10</b>
6.1	Modbus Setup .....	10
6.2	Modbus Register Map .....	11
<b>7</b>	<b>Maintenance</b> .....	<b>11</b>
7.1	Filter Replacement .....	11
7.2	Cleaning the Sensing Element .....	11
7.3	Spare Parts .....	12
<b>8</b>	<b>Accessories</b> .....	<b>12</b>
<b>9</b>	<b>Technical Data</b> .....	<b>13</b>

# 1 General

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. The user 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 achieve 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.
- The device must be operated with the filter cap on at all times.
- For sensor cleaning and filter cap replacement please see the “Cleaning Instructions” at [www.epluse.com](http://www.epluse.com).
- Installation, electrical connection, maintenance and commissioning shall be performed by qualified personnel only.
- Use the EE355 only as intended and observe all technical specifications.
- Do not use EE355 in explosive atmosphere or for measurement of aggressive gases.
- Do not apply the nominal voltage to the data lines.

### 1.2.2 Intended Use

The EE355 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 80 bar (1 160 psi). The probe is pressure-tight and has leak rate B according to EN 12266-1.

The use of the EE355 in any other way than described in this manual bears a safety risk for people and the entire measurement installation and is therefore not allowed.

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

In order to avoid damage to the instrument or health hazards, the measuring equipment must never be manipulated with tools that are not specifically described in this manual.

The sensor may only be utilized in accordance with the conditions defined in the technical data. Otherwise, inaccuracies of the measurement will occur and equipment failures cannot be ruled out.

The steps recommended by the manufacturer for installation, inspections and maintenance work must be observed and carried out for the safety of the user and for the functionality of the equipment.

Unauthorized product modification lead to loss of all warranty claims. This may be accomplished only with an explicit permission of E+E Elektronik®!

The device is constructed for the operation of separated extra-low voltage (SELV).

### 1.2.3 Mounting, Start-up and Operation

The EE355 dew point sensor has been designed and 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 actions to assure safe operation. The user has to make sure that the equipment is positioned and installed in such a way that safe operation is not impaired. The user is responsible for observing all applicable safety guidelines, local and international, with respect to safe installation and operation on the device.

This manual contains information and notes of caution, which have to be followed by the user to ensure safe operation.

- Mounting, electrical installation, putting into operation and maintenance may be performed by qualified personnel 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 manual and must follow the instructions contained within.
- All process and electrical connections shall be thoroughly checked by authorized staff before putting the device into operation.
- Do not put damaged products into operation and protect them from accidental commissioning. Mark the damaged product as defective.
- 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 process.
- Service operations other than described in this user manual may only be performed by the manufacturer.

#### Disclaimer of Liability

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 specified operating conditions. Consequential damages are excluded from any 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 Scope of Supply

- EE355 – Dew Point Sensor
- M12x1 cable connector, 5 pole socket, straight (included if order code AC2 is selected)
- Inspection certificate according to DIN EN 10204-3.1
- Quick user guide

# 3 Product Description

## 3.1 General

The compact EE355 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 EE355 is the monolithic measurement cell type HMC200, manufactured in thin-film technology. Due to the excellent long term stability and durability against condensation the EE355 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 an analogue 4 - 20 mA and a digital Modbus RTU output.

## 3.2 Dimensions

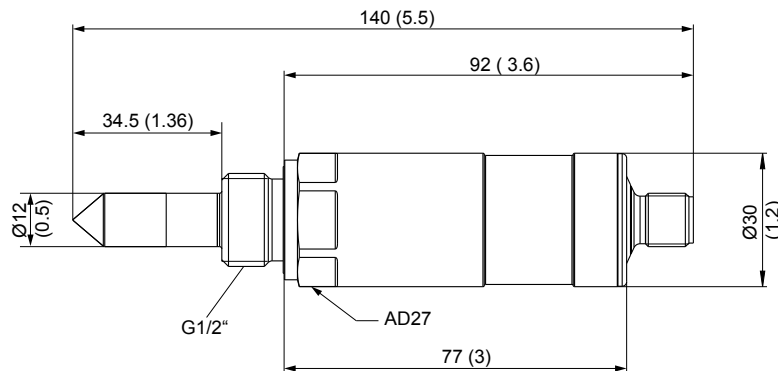


Fig. 1 EE355 Dimensions G ISO Thread in mm (inch)

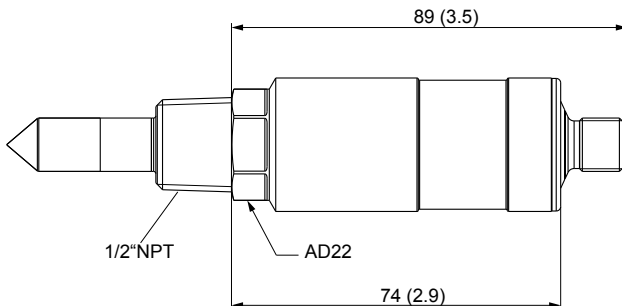
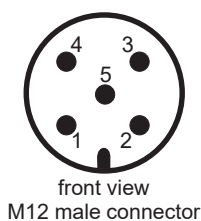


Fig. 2 EE355 Dimensions NPT Thread in mm (inch)

## 3.3 Electrical Connection

The electrical connection is made via the M12x1 5 pole connector. An attachable connector with a 5 pole socket is included.



Pin number	Function	Wire colors for accessory: - Connection cable HA010819/20/21
1	Supply voltage	brown
2	Output 4 - 20 mA	white
3	GND	blue
4	RS485 A (D+)	black
5	RS485 B (D-)	grey



To meet the EMC Directive 2014/30/EU a shielded cable must be used. The connection cable mentioned above (accessory HA0108xx ,5 pole, M12x1 socket – free ends, PUR insulation), has a shielding included and is available in several lengths (refer to chapter 7.3).

### 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 can switch to one of two states:

- Frozen output signal, keeping the last measured value (default behaviour)
- or
- 1 mA during advanced auto-calibration and 2 mA during standard auto-calibration

The auto-calibration behaviour depends on the sensor configuration which can be changed with the help of the EE-PCS Product Configuration Software. Please refer to chapter 5 (Setup and Adjustment).

### 3.5 Measuring Range and Accuracy

The EE355 has an accuracy of  $\pm 2$  °C specified within the measuring range -60...60 °C dew point.

Measuring signal limitation:

at medium temperature  $\leq 20$  °C: Td limitation = -80 °C

at medium temperature  $> 20$  °C: Td limitation = medium temperature - 100 °C

e.g. at medium temperature 40 °C the measuring signal is limited at -60 °C dew point.

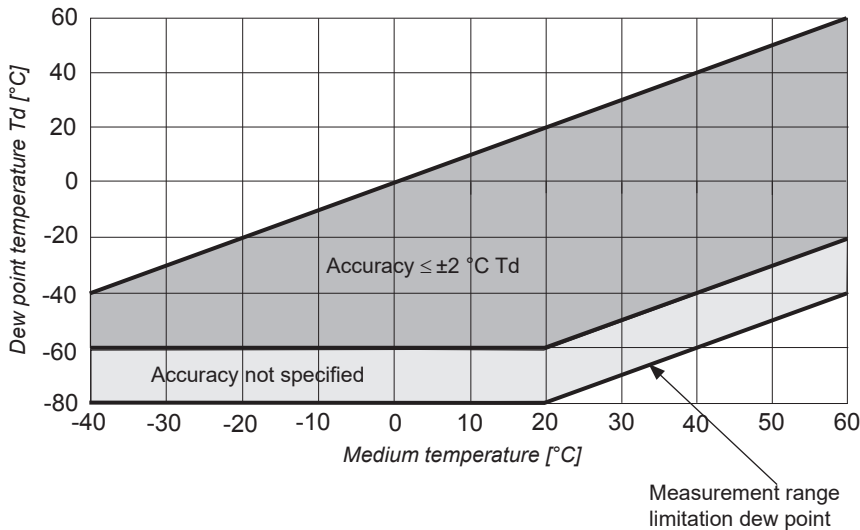


Fig. 3 Dew point measurement range and specified accuracy

The maximum scaling of the analogue output is -100...80 °C dew point.

## 4 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](http://www.epluse.com).

Leakage should be avoided, as ingress of moisture from the environment will interfere with the measurement.



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.

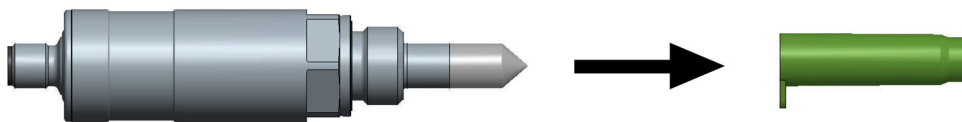


Fig. 4 Remove protection cap

### 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.



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.

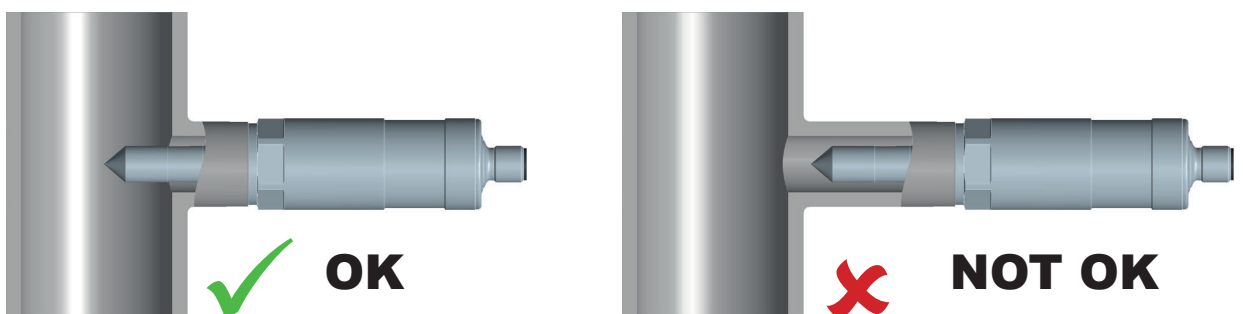


Fig. 5 Installing directly into the pipe

### 4.3 Installing the Sensor in a Sampling System

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.





To obtain a representative sample of the process gas and to avoid measuring errors, please note 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. 6 illustrates how different tubing materials give off moisture over time when flushed with very dry gas after being at ambient humidity.

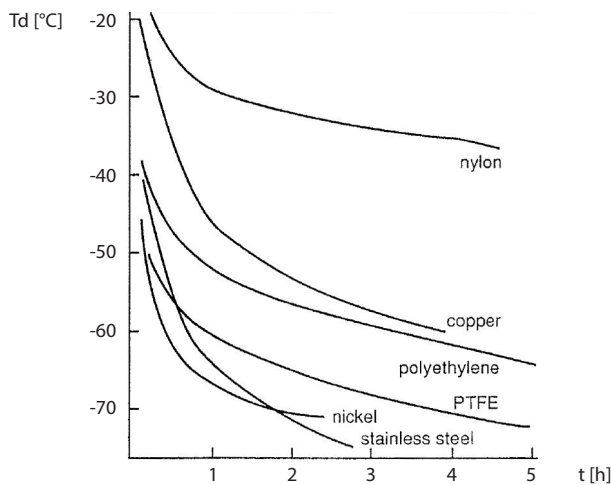


Fig. 6 Moisture given off by different tubing materials (© National Physical Laboratory)

There 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 the EE371 datasheet and to chapter 8 (Accessories) of this document.

## 5 Setup and Adjustment

The EE355 is ready to use and requires no configuration by the user. Its factory setup corresponds to the to the type number ordered. Please refer to the data sheet at [www.epluse.com/EE355](http://www.epluse.com/EE355).

With the help of the free EE-PCS Product Configuration Software and the optional Modbus configuration adapter (order code HA011013) the user can adjust the sensor, set the Modbus parameters, change the scaling of the analog output and select the behaviour of the analogue output during the auto-calibration. For the auto-calibration behaviour, refer to chapter 3.4 (Auto-calibration).

## 5.1 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](http://www.epluse.com/configurator) and install it on the PC.
2. Connect the EE355 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

## 5.2 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.

# 6 Digital Interface RS485 with Modbus RTU Protocol



- The EE355 can be used in Modbus networks based on RS485. Therefore, the RS485 specifications have to be observed, especially regarding unit loads and bus termination.
- For proper function the power supply must be strong enough to ensure supply voltage within the specified range (see technical data) at any time and at all devices in the bus. This is particularly relevant when using long and thin cables which can cause high voltage drop.

## 6.1 Modbus Setup

	Factory settings	User selectable values (via EE-PCS)
<b>Baud rate</b>	9600	9600, 19200, 38400
<b>Data bits</b>	8	8
<b>Parity</b>	Even	None, even, odd
<b>Stop bits</b>	1	1, 2
<b>Slave address</b>	243	1...247

The recommended settings for multiple devices in a Modbus RTU network are 9600, 8, even, 1.

The EE355 represents 1 unit load on an RS485 network.

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

1. EE-PCS Product Configuration Software and the Modbus configuration adapter HA011018.  
The EE-PCS can be downloaded free of charge from [www.epluse.com/configurator](http://www.epluse.com/configurator)
2. Modbus protocol in the register 60001 (0x00) and 60002 (0x01).  
See Modbus Application Note AN0103 (available on [www.epluse.com/EE355](http://www.epluse.com/EE355))

The serial number as ASCII-code is located in the register addresses 0x00...0x07 (16 bits per address).



Please note: When reading the serial number or the sensor name, it is always necessary to read all 8 registers, even if the desired information requires less.



Please note: For obtaining the correct floating point values, both registers have to be read within the same reading cycle. The measured value can change between two Modbus requests, therefore, exponent and mantissa may get inconsistent.

## 6.2 Modbus Register Map

The measured data is saved as 32 bit floating point values (data type FLOAT) and as 16 bit signed integer values (data type INTEGER). Depending on the measurement unit selected, the measurements are saved in SI or US/GB units. Measurement unit selection is made by means of the ordering code or with the help of the EE-PCS Product Configuration Software.

FLOAT 32 bit:				
Parameter	SI Unit	US/GB Unit	Register number <sup>1)</sup> [Dec]	Register address <sup>2)</sup> [HEX]
<b>Read register: function code 0x03 / 0x04</b>				
Temperature T	°C	°F	26	0x19
Relative humidity RH, Uw	% RH	%	28	0x1B
Water vapour partial pressure e'	mbar	psi	30	0x1D
Dew point temperature Td	°C	°F	32	0x1F
Frost point temperature Tf	°C	°F	42	0x29
Volume concentration Wv	ppm	ppm	60	0x3B
INTEGER 16 bit:				
Parameter	SI Unit	US/GB Unit	Register number <sup>1)</sup> [Dec]	Register address <sup>2)</sup> [HEX]
<b>Read register: function code 0x03 / 0x04</b>				
State of auto-calibration				
0 ... normal operation			501	0x1F4
1 ... auto-calibration active				
<b>Write register: function code 0x06</b>				
Modbus address (Slave ID)			1	0x00
RS485 Data Transmission			2	0x01

1) Register number starts from 1  
2) Register address starts from 0

## 7 Maintenance

### 7.1 Filter Replacement

A contaminated filter cap should be replaced by a new one. The order number for new filters 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.

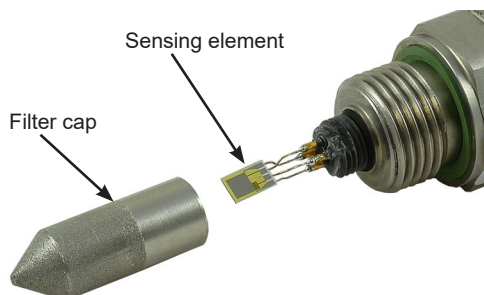


Fig. 7 EE355 Filter and Sensor

### 7.2 Cleaning the Sensing Element



Caution:

- 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 observe the E+E “Cleaning Instructions”.

## 7.3 Spare Parts

Description	Order code
Stainless steel sintered filter	HA010103

## 8 Accessories

Description	Order code
Modbus configuration adapter	HA011013
E+E Product Configuration Software (Free download: <a href="http://www.epluse.com/configurator">www.epluse.com/configurator</a> )	EE-PCS
Connection cable, 5 pole, M12x1 socket - free ends, PUR insulation	
1.5 m (4.9 ft)	HA010819
5 m (16.4 ft)	HA010820
10 m (32.8 ft)	HA010821
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

Please refer also to the "Accessories" data sheet.

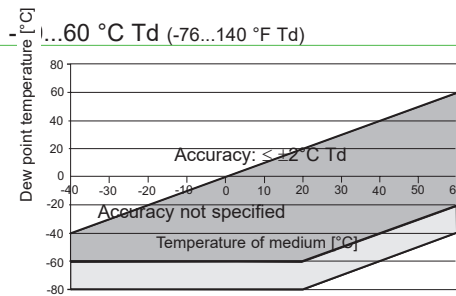
# 9 Technical Data

## Measurands

### Dew point (Td)

Measurement range

Accuracy<sup>1)</sup>



Response time  $t_{90}$  < 5 min for step -20 °C Td (-4 °F Td) → -60 °C Td (-76 °F Td)

< 15 s for step -60 °C Td (-76 °F Td) → -20 °C Td (-4 °F Td)

### Volume fraction of water vapour (Wv)

Measurement range

20...200 000 ppm

Accuracy at 20 °C (68 °F)

and 1 013 mbar (14.7 psi)

$\pm(5 \text{ ppm} + 9 \% \text{ from measured value})$

## Outputs<sup>2)</sup>

### Analogue output (scalable)

4 - 20 mA (3-wire technology) RL < 500 Ohm

Resolution

2  $\mu\text{A}$

Maximum adjustable scaling range

-100...80 °C Td (-148...176 °F Td)

### Digital interface

RS485 (EE355 = 1 unit load)

Protocol

Modbus RTU

Default settings

Baudrate 9600<sup>3)</sup>, parity even, stop bits 1, slave ID 243

Temperature dependence

$\pm 5 \text{ ppm of the measuring range / } ^\circ\text{C}$  (Deviating from 20 °C)

## General

Supply voltage (Class III) 18 - 28 V DC

18 - 28 V DC

Current consumption at 24 V DC

< 20 mA + load current /  
100 mA + load current during auto-calibration

Pressure range

0...80 bar (0...1 160 psi)

Enclosure / protection class

Stainless steel 1.4404 (AISI 316L) / IP65 / NEMA 4.x

Electrical connection

M12x1, 5 poles, stainless steel 1.4404

Filter

Stainless steel sintered

Operating conditions

-40...70 °C (-40...158 °F) / 0...100 % RH

Storage conditions

-40...60 °C (-40...140 °F) / 0...95 % RH non-condensing

Electromagnetic compatibility

EN 61326-1 EN 61326-2-3 Industrial environment  
FCC Part 15 ICES-003 ClassB



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).

2) The EE355 simultaneously features an analogue current output and the RS485 interface.

3) Supported baud rates: 9 600, 19 200 and 38 400; find more details about communication setting in the User Manual and the Modbus Application Note at

[www.epluse.com/ee355](http://www.epluse.com/ee355)



#### HEADQUARTERS

##### **E+E Elektronik Ges.m.b.H.**

Langwiesen 7  
4209 Engerwitzdorf  
Austria  
Tel.: +43 7235 605-0  
E-mail: [info@epluse.com](mailto:info@epluse.com)  
Web: [www.epluse.com](http://www.epluse.com)

#### SUBSIDIARIES

##### **E+E Elektronik China**

18F, Kaidi Financial Building,  
No.1088 XiangYin Road  
200433 Shanghai  
Tel.: +86 21 6117 6129  
E-mail: [info@epluse.cn](mailto:info@epluse.cn)

##### **E+E Elektronik France**

47 Avenue de l'Europe  
92310 Sèvres  
Tel.: +33 4 74 72 35 82  
E-mail: [info@epluse.fr](mailto:info@epluse.fr)

##### **E+E Elektronik Germany**

Schöne Aussicht 8 C  
61348 Bad Homburg  
Tel.: +49 6172 13881-0  
E-mail: [info@epluse.de](mailto:info@epluse.de)

##### **E+E Elektronik Italy**

Via Alghero 17/19  
20128 Milano (MI)  
Tel.: +39 02 2707 86 36  
E-mail: [info@epluse.it](mailto:info@epluse.it)

##### **E+E Elektronik Korea**

Suite 2001, Heungdeok IT  
Valley Towerdong, 13,  
Heungdeok 1-ro, Giheung-gu  
16954 Yongin-si, Gyeonggi-do  
Tel.: +82 31 732 6050  
E-mail: [info@epluse.co.kr](mailto:info@epluse.co.kr)

##### **E+E Elektronik USA**

333 East State Parkway  
Schaumburg, IL 60173  
Tel.: +1 847 490 0520  
E-mail: [office@epluse.com](mailto:office@epluse.com)

YOUR PARTNER IN SENSOR TECHNOLOGY



**ELEKTRONIK®**  
Ges.m.b.H.