User Manual

EE072
Humidity and Temperature Probe
with Digital Interface

Modbus

CANopen
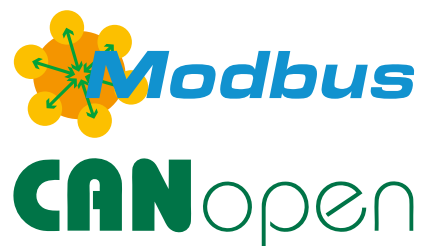
YOUR PARTNER IN SENSOR TECHNOLOGY **E+E**
ELEKTRONIK®
Ges.m.b.H.

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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.

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

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.

Please find this document and further product information on our website at www.epluse.com/ee072.

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.
- The device must be operated with the filter cap on at all times.
- Installation, electrical connection, maintenance and commissioning shall be performed by qualified personnel only.
- Use the EE072 only as intended and observe all technical specifications.
- Do not use EE072 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 EE072 is intended for highly accurate humidity (RH) and temperature (T) measurement in demanding process applications. The measured values and the calculated parameters are availabe on Modbus RTU or CANopen.

The use of the EE072 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 hold 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, measurement inaccuracies 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 leads to loss of all warranty claims. This may be accomplished only with an explicit permission of E+E Elektronik®!

1.2.3 Mounting, Start-up and Operation

The EE072 humidity and temperature probe 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 user 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 user 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 install or 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 process.
- Service operations other than described in this user manual may only be performed by the manufacturer.

Disclaimer of Liability

The manufacturer or their delegated representative is only liable in case of intent or gross negligence. The accountability is limited to the value of the order issued at the time to the manufacturer. The manufacturer is not liable for damages, originated from disregarding the safety instructions or violating the instructions of the manual or 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

- EE072 – Humidity and Temperature Probe with Digital Interface according to ordering code
- Inspection certificate according to DIN EN 10204-3.1
- Quick guide (for Modbus version only)

3 Product Description

3.1 General

The EE072 is a robust probe for relative humidity and temperature measurement. Its IP65 rating and the E+E proprietary protective sensor coating make it ideal for highest requirements. This is also underlined by the wide humidity and temperature working ranges of 0...100 %RH and -40...80 °C. The EE072 is typically implemented in demanding process and climate control applications like in agriculture, life stock, food, pharma or clean rooms. A wide choice of filter caps allow for versatile options in challenging industrial applications. Installation is simplified by various mounting options which are supported by E+E accessories.

The EE072 is available with two different interface versions, either with CANopen/CAN or with Modbus RTU over RS485. The M12x1 connector links the probe to the digital infrastructure.
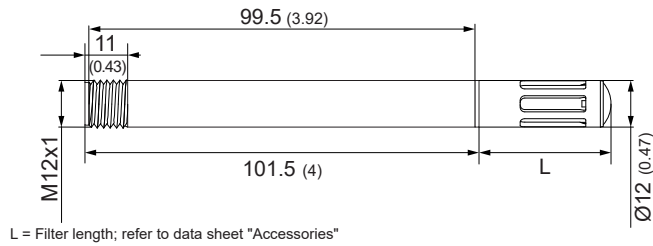
3.2   Dimensions

L = Filter length; refer to data sheet "Accessories"

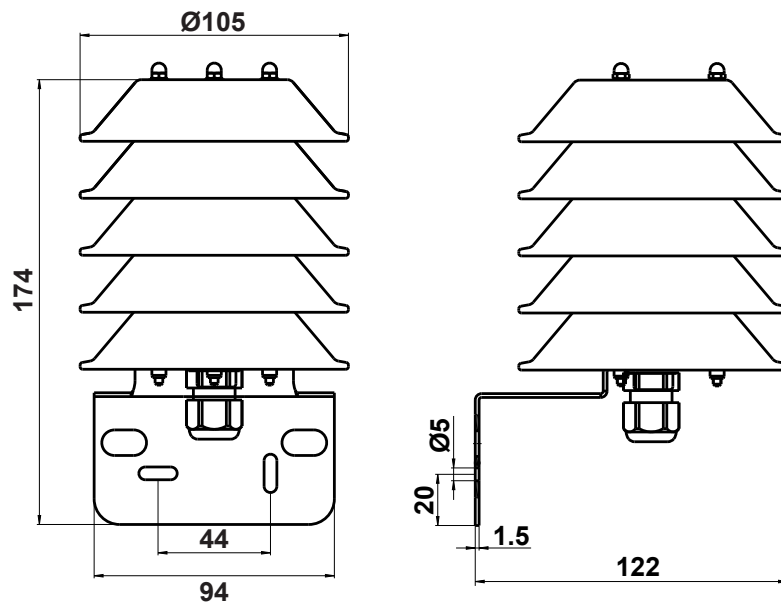Fig. 1   Dimensions of EE072 in mm (inch)

Fig. 2   Dimensions of optional radiation shield (ordering code HA010502) in mm

3.3   Electrical Connection

⚠ **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.

The relations of electrical potential between a bus system and an EE072 humidity/temperature sensor are characterized by the following properties:
- The bus connection is not electrically isolated from the supply connection
- The individual EE072 node is not electrically isolated from the supply voltage
- Each EE072 humidity/temperature sensor can be supplied separately

3.3.1   Modbus RTU Version

M12 device plug
front view
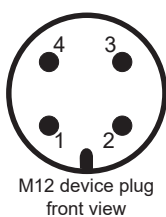
Pin number	Function	Wire colors for accessories: - Coupling flange HA010705 - Connection cable HA010819/820/821
1	Supply voltage	brown
2	B RS485 (D-)	white
3	GND	blue
4	A RS485 (D+)	black

Tab. 1   Connection to the EE072 Modbus RTU version

3.3.2 CANopen Version

front view
M12 device plug

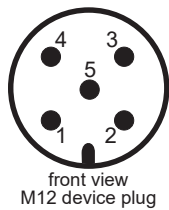| Pin number	Function	Wire colors according to ISO 11898:
1	CAN_SHLD	Not in use
2	CAN_V+	brown
3	CAN_GND	white
4	CAN_H	green
5	CAN_L	yellow

Tab. 2   Connection to the EE072 CANopen version, in accordance with CiA-303-1

⚠ In order to ensure a stable CANopen communication, the supply voltage must exceed the lower supply voltage limit of 10 V DC within two seconds after power-on.

ℹ The EE072 triggers an alarm message if the supply voltage is outside the supply limits. The lowest detectable voltage is 9 V and the highest 35 V.

3.4 Specification of the CAN Lines

The cables used for connecting the CAN bus nodes must comply with ISO 11898. Therefore, the lines must have the following characteristics:

Parameter — Bus system overall length	< 300 m	< 1000 m
Cable type	LIYCY 2 x 2 x 0.5 mm^2 twisted pair with shielding	CYPIMF 2 x 2 x 0.5 mm^2 twisted pair with shielding
Line resistance	≤ 40 Ω/km	≤ 40 Ω/km
Line capacitance	≤ 130 nF/km	≤ 60 nF/km
Connection	Pair 1 (white / brown): CAN_GND and CAN_V+ Pair 2 (green / yellow): CAN_H and CAN_L	

Tab. 3   CAN cable specification

- Only use cables that have an additional pair of wires for CAN_GND.
- Trouble-free operation of the CAN bus is only possible with correctly connected CAN_GND.
- Connect the bus termination resistors. A 120 Ω terminating resistor must be connected at each physical end of the bus system (main trunk).

4 Installation

4.1 Wall and Ceiling Mount

Best measurement performance is achieved when the entire probe is located inside the environment to be monitored.

In such a case, the EE072 may be for instance fixed onto a wall with the mounting clip HA010211 (not included in the scope of supply, see data sheet "Accessories"), or freely hang from the ceiling on the connection cable.

Fig. 3   Optional wall and ceiling mount (ordering code HA010211)

4.2 Duct Mount

The probe also can be installed into a duct using the plastic flange HA010202 or the stainless steel flange HA010201 (not included in the scope of supply, see data sheet "Accessories").

Fig. 4   Optional plastic flange (ordering code HA010202)

Fig. 5   Optional stainless steel flange (ordering code HA010201)

4.3 Recommendations for accurate Humidity and Temperature Measurement

■ In case the EE072 probe is not entirely located in the environment to be monitored, large temperature differences along the probe will lead to temperature gradients. These will have an influence on the accuracy. Therefore, it is of paramount importance to minimize the temperature gradients. The biggest part of the probe shall be located in the target environment and the rest shall be thermally well insulated.

■ For outdoor applications the EE072 shall be equipped with a radiation shield (HA010502) which provides protection from rain, snow and ice. This also causes a natural ventilation which largely prevents overheating of the probe in the sun and thus a distortion of the measured values.

■ For highest accuracy of the measured humidity and the calculated parameters (e.g. wet bulb temperature, dew point and others), the user can set the barometric pressure at the operating point, using the PCS10 Product Configuration Software (see "7.5 Configuration Interface), via Modbus protocol (see 5.1 Modbus Setup) or via CANopen protocol. The factory setting is 1013.25 mbar.

■ Best accuracy is achieved with a velocity of min. 0.2 m/s of the air surrounding the probe. Depending on the installation position, flow direction and flow velocity, the accuracy may decline. The following table gives a concise overview. Please note that the vertical positioning with the sensing element upside is the most sensitive one concerning accuracy. Because of possible self heating due to the sensor electronics, it is crucial to have the indicated air flow velocity.

Flow direction of medium		
←	> 0.2 m/s	> 0.2 m/s
→	Polycarbonate > 0.2 m/s Stainless steel > 2 m/s	> 0.2 m/s
↑	> 0.2 m/s	Polycarbonate > 0.2 m/s Stainless steel > 2 m/s
↓	> 0.2 m/s	> 0.2 m/s

Tab. 4   Mounting position, air velocity and accuracy

5 Modbus

5.1 Modbus Setup

	Factory settings	Selectable values (via PCS10)
Baud rate	9600	9600, 19200, 38400, 57600, 76800, 115200
Data bits	8	8
Parity	Even	None, odd, even
Stop bits	1	1, 2
Slave address	234	1...247

Tab. 5   Modbus default settings

Device address, baud rate, parity and stop bits can be set via:
1. PCS10 Product Configuration Software and the Modbus configuration adapter HA011018.
    The PCS10 is available free of charge at www.epluse.com/pcs10
2. Modbus protocol in the register 60001 (0x00) and 60002 (0x01).
    See Application Note Modbus AN0103 (available on www.epluse.com/ee072)

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

i **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.

i **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.

Communication settings (INTEGER 16 bit)		
Parameter	**Register number[1] [DEC]**	**Protocol address[2] [HEX]**
Write register: function code 0x06		
Slave-ID Modbus address	0001	0x00
Modbus protocol settings[3]	0002	0x01

1) Register number starts from 1.
2) Protocol address starts from 0.
3) For Modbus protocol settings see Application Note Modbus AN0103 (available on www.epluse.com/ee072).

INFO (read register)		
Parameter	**Register number[1] [DEC]**	**Protocol address[2] [HEX]**
Read register: function code 0x03 / 0x04		
Serial number (as ASCII)	0001	0x00
Firmware version	0009	0x08
Sensor Name	0010	0x09

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

Air pressure		
Parameter	**Register number[1] [DEC]**	**Register address[2] [HEX]**
Read and write register: function code 0x03 / 0x10		
Air pressure[3]	5001	0x1388

1) Register number starts from 1
2) Register address starts from 0
3) Ambient pressure in mbar, with 2 decimal digits (e.g. 1008.25), (Default value 1013.25 mbar)

5.2 Modbus Register Map

The measured data is saved as a 32 bit floating point values (data type FLOAT) and as 16 bit signed integer values (data type INTEGER).

FLOAT (read register):

Parameter	Unit	Register number[1] [Dec]	Register address[2] [HEX]
Read register: function code 0x03 / 0x04			
Temperature T	°C	1003	0x3EA
	°F	1005	0x3EC
	°K	1009	0x3F0
Relative humidity RH, Uw	%RH	1021	0x3FC
Water vapour partial pressure e	mbar	1101	0x44C
	psi	1103	0x44E
Dew point temperature Td	°C	1105	0x450
	°F	1107	0x452
	°K	1147	0x47A
Wet bulb temperature Tw	°C	1109	0x454
	°F	1111	0x456
	°K	1145	0x478
Absolute humidity dv	g/m³	1113	0x458
	gr/ft³	1115	0x45A
Mixing ratio r	g/kg	1121	0x460
	gr/lb	1123	0x462
Specific enthalpy h	kJ/kg	1125	0x464
	ft lbf/lb	1127	0x466
	BTU/lb	1129	0x468
Frost point temperature Tf	°C	1131	0x46A
	°F	1133	0x46C
	°K	1149	0x47C
Ice bulb temperature Ti	°C	1237	0x4D4
	°F	1239	0x4D6
	°K	1241	0x4D8

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

INTEGER (read register):

Parameter	Unit	Scale[3]	Register number[1] [Dec]	Register address[2] [HEX]
Read register: function code 0x03 / 0x04				
Temperature T	°C	100	4002	0xFA1
	°F	50	4003	0xFA2
	°K	50	4005	0xFA4
Relative humidity RH, Uw	%RH	100	4011	0xFAA
Water vapour partial pressure e	mbar	10	4051	0xFD2
	psi	1000	4052	0xFD3
Dew point temperature Td	°C	100	4053	0xFD4
	°F	100	4054	0xFD5
	°K	100	4074	0xFE9
Wet bulb temperature Tw	°C	100	4055	0xFD6
	°F	100	4056	0xFD7
	°K	100	4073	0xFE8
Absolute humidity dv	g/m³	10	4057	0xFD8
	gr/ft³	10	4058	0xFD9
Mixing ratio r	g/kg	10	4061	0xFDC
	gr/lb	10	4062	0xFDD
Specific enthalpy h	kJ/kg	1	4063	0xFDE
	ft lbf/lb	1	4064	0xFDF
	BTU/lb	1	4065	0xFE0
Frost point temperature Tf	°C	100	4066	0xFE1
	°F	100	4067	0xFE2
	°K	100	4075	0xFEA
Ice bulb temperature Ti	°C	100	4119	0x1016
	°F	100	4120	0x1017
	°K	50	4121	0x1018

1) Register number starts from 1
2) Register address starts from 0
3) Examples: For scale 100, the reading of 2550 means a value of 25.5. For scale 50, the reading of 2550 means a value of 51.

5.3 Device Status Indication

If a critical error occurs, all Modbus values are set to NaN (according to IEEE754 for data type FLOAT32) or to 0x8000 (INT16). It is possible to read out all status and error information via Modbus register 602 (0x259). Errors are displayed in bit-coded form. If an event is present, the corresponding bit is set to 1.

Measured values outside the measuring range are limited with the corresponding limit value.

Error Bits	Description	Recommended action
Bit 0	Error: Sensor not adjusted	Return the unit to E+E Service
Bit 1	Error: ADC value incorrect	Return the unit to E+E Service
Bit 2	Error: Temperature below minimum limit	Observe the lower working range limit
Bit 3	Error: Temperature above maximum limit	Observe the upper working range limit
Bit 4	Error: Temperature value = infinite	Return the unit to E+E Service
Bit 5	Error: Capacity faulty	Return the unit to E+E Service
Bit 6	Error: Humidity below minimum limit	Observe the lower working range limit
Bit 7	Error: Humidity above maximum limit	Observe the upper working range limit
Bit 8	Error: Humidity value = infinite	Return the unit to E+E Service

Tab. 6   Device status indication register

5.4 Modbus RTU Example

Example of MODBUS RTU command for reading the temperature (float value) T = 26,953624 °C from the register 0x3EA

- Device EE072; slave ID 234 [0xEA]
  Reference document, chapter 6.3: www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf
- See Application Note Modbus AN0103 (available on www.epluse.com/ee072)

	Modbus ID address	Function code	Starting address Hi	Starting address Lo	No. of register Hi	No. of register Lo	CRC	
Request [Hex]:	EA	03	03	EA	00	02	F2	A0

	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]:	EA	03	04	A1	06	41	D7	12	CE

Decoding of floating point values:

Floating point values are stored according IEEE754 standard. The byte pairs 1, 2 and 3, 4 are inverted as follows:

MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM
Byte 3	Byte 4	Byte 1	Byte 2

Example:

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	D7	A1	06	26.953624

6   CANopen

6.1   CANopen Setup

	Factory settings	Selectable parameters	Configurable via
Baud rate	125 kBit/s	125 kBit/s, 250 kBit/s, 500 kBit/s, 800 kBit/s, 1MBit/s	PCS10 or LSS
Node ID	64	1...127	PCS10 or LSS
TPDO 1	T in [°C], Uw in [%]	T, Uw, e, Td, Tw, dv, r, h, Tf, Ti	CAN SDO
TPDO 2	Td in [°C],Tw in [°C]	T, Uw, e, Td, Tw, dv, r, h, Tf, Ti	CAN SDO
TPDO 3	r in [g/kg], h in [kJ/kg]	T, Uw, e, Td, Tw, dv, r, h, Tf, Ti	CAN SDO
TPDO 4	Tf in [°C], Ti in [°C]	T, Uw, e, Td, Tw, dv, r, h, Tf, Ti	CAN SDO
TPDO data type	REAL32	REAL32, INTEGER16	CAN SDO

Abbreviations: TPDO   Transceive Process Data Object
                PCS10   E+E Product Configuration Software (see chapter 7.5 Configuration Interface)
                LSS   Layer Setting Services (see chapter 6.4 Layer Setting Services (LSS))
                CAN SDO   Service Data Object

Tab. 7   CANopen default settings

Parameter	Symbol	Condition	Units
Temperature	T		[°C, °F, K]
Relative humidity	Uw, RH		[%]
Water vapour partial pressure	e		[mbar, psi]
Dew point temperature	Td		[°C, °F, K]
Wetbulb temperature	Tw	Tw ≥ 0 C	[°C, °F, K]
Water vapour density (absolute humidity)	dv		[g/m³]
Mixing ratio	r		[g/kg]
Specific enthalpy	h		[kJ/kg]
Frost point temperature	Tf	Tf ≤ 0 °C	[°C, °F, K]
Ice bulb temperature	Ti	Ti ≤ 0 °C	[°C, °F, K]

Tab. 8   Selectable parameters

6.2   Function overview

The EE072 humidity/temperature probes have a standardised CANopen interface according to CiA DS-301 and a device profile according to CiA DSP-404. All measured values and parameters are accessible via the object directory (OD). The individual configuration can be saved in the internal permanent memory (EEPROM).

The following CANopen functions are available:
- Transceive Process Data Objects (TPDO1 - 4) in four possible operating modes:
    - individual query via Remote Transmit Request (RTR)
    - cyclic transmission by interval time
    - event-controlled transmission on measurand change
    - synchronized transmission after receipt of a SYNC telegram
- Service Data Object (standard SDO)
- Error messages via Emergency Object (EMCY) with support:
    - the general error register (Error Register)
    - the manufacturer-specific status register (Manufacturer Status)
    - the error list (Pre-defined Error Field)
    - supply range alarm
- Monitoring mechanisms Heartbeat and Nodeguarding/Lifeguarding
- Save and restore function for all parameters (Store and Load Parameter Field)
- Setting the Node ID and the baud rate via LSS
- In addition to the CiA DS-301 functionality, there are further manufacturer or profile specific features:
    - Setting of pressure compensation parameter (object 2205_h - default value 1013.25 mbar)
    - Supply voltage monitoring
    - Read calibration date (factory and customer)

6.3 Electronic Datasheet (EDS)

An electronic data sheet (EDS) is available for the EE072 CANopen (download free of charge at E+E's EE072 webpage) .
It contains a complete description of the object dictionary and facilitates a convenient integration into a CANopen engineering software.

6.4 Layer Setting Services (LSS)

In order to use the LSS functionality, LSS data is required which clearly identifies the sensor. This is the Identity Object (Index 1018_h).

Designation	Object	Sub-Index	Value for EE072
Vendor ID	1018_h	01_h	$000004C8_h$
Product code	1018_h	02_h	$0x00_h$
Revision number	1018_h	03_h	$0x00_h$
CANopen serial number	1018_h	04_h	device specific (LLS – 04h: 0x….)

The sensor specific identifier (LLS – 04h) is printed on each EE072.
Example of sensor labeling including LSS data:

EE072 TT2
CANopen / LSS – 04h: 0x20220503
Supply: 10 - 28 V DC

7 Maintenance and Service

EE072 does not require any special maintenance, nevertheless for high accurate measurements especially over wide RH and T ranges it is recommended to calibrate the probe every 12 months. If needed, the enclosure may be cleaned and the device may be re-adjusted as described below.

7.1 Cleaning

Use a damp soft cloth to remove deposits of dust or dirt from the exterior of the probe. Do not use any solvents or abrasive cleaning agents.

In case of dusty, oily and polluted environment:
- Use a damp soft cloth to remove deposits of dust or dirt from the exterior of the probe. Do not use any solvents or abrasive cleaning agents.
- The filter cap shall be replaced once in a while with an E+E original one (see below).
- If needed, the sensing element of the humidity probe can be cleaned by the user (see cleaning in-struction - www.epluse.com/cleaning-instructions).

7.2 Filter Cap Replacement

In a dusty or polluted environment it might be necessary to replace the filter cap once in a while. In most of the cases, a clogged filter shows visible contamination or dirt. Longer response time of the humidity measurement also indicates a clogged filter cap. In such cases, replace the filter by a new, original one, see chapter 7.7 Spare Parts.

Procedure
- Turn the filter cap counter-clockwise for removing it.
- Install the new filter cap finger tight by turning it clockwise.

While replacing the filter cap take very good care to not touch or rub the sensing element.

7.3 Protection during Site Cleaning Operations

⚠️ During site cleaning or sterilization process, if the EE072 remains on the measuring site the sensing head can be protected with the optional protection cap for 12 mm (0.47") probe (HA010783, see datasheet "Accessories").
In case the probe is removed from the site, it is recommended to apply the protection cap for the M12 cable socket (HA010781) and the one for the EE072 M12 plug of (HA010782).

Fig. 6   Protection cap for Ø12 mm (0.47") probe (ordering code HA010783)

Fig. 7   Protection cap M12 female connector (ordering code HA010781)

Fig. 8   Protection cap M12 female connector (ordering code HA010782)

7.4 Repairs

Repairs may be carried out by the manufacturer only. The attempt of unauthorized repair excludes any warranty claims.

7.5 Configuration Interface

The EE072 is ready to use and does not require any configuration by the user. The user can change the factory setup by using the configuration adapter (Modbus: HA011018 / CAN: HA011021) and the PCS10 Product Configuration Software.

With the PCS10, it is possible to change the digital communication settings and to perform a RH and T adjustment in the form of an offset or as a 2-point adjustment. For the purpose of pressure compensation, the barometric air pressure at the operating site may be set.

PCS10 PRODUCT CONFIGURATION SOFTWARE
1. Download the PCS10 Product Configuration Software from www.epluse.com/pcs10 and install it on the PC.
2. Connect the E+E device to the PC using the appropriate configuration cable.
3. Start the PCS10 software.
4. Follow the instructions on the PCS10 opening page for scanning the ports and identifying the connected device.
5. Click on the desired setup or adjustment mode from the main PCS10 menu on the left and follow

HA011018/HA011021
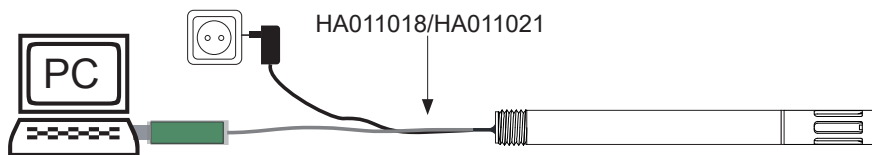
the online instructions of the PCS10.

7.6 RH / T Adjustment and Calibration

Definition
- Adjustment
  the specimen is brought in line with the reference.
- Calibration
  the specimen is compared with a reference and its deviation from the reference is documented.

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:
■ Humidity calibrator (e.g. Humor 20), please see www.eplus.com/humor20.
■ Handheld device (e.g. Omniport 30), please see www.eplus.com/omniport30.
■ Humidity standards (e.g. Humidity Calibration Kit), please see www.eplus.com/ee072.

7.7 Spare Parts

Description	Order code
Filter caps for probes with Ø 12 mm	**Please refer to the datasheet "Accessories"**

8 Accessories

General	Order code
E+E Product Configuration Software (Download: www.eplus.com/pcs10)	**PCS10**
Protection cap for the M12 cable socket	**HA010781**
Protection cap for the M12 plug of EE072	**HA010782**
Protection cap for 12 mm probe	**HA010783**
Stainless steel mounting flange	**HA010201**
Plastic mounting flange	**HA010202**
T-coupler M12 - M12	**HA030204**
Wall mounting clip	**HA010211**
Radiation shield for probes with Ø12mm	**HA010502**
Drip water protection	**HA010503**
Modbus	**Order code**
M12 cable connector for self assembly, 4 pole	**HA010707**
Modbus configuration adapter	**HA011018**
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**
CAN	**Order code**
M12 cable connector for self assembly, 5 pole	**HA010708**
Connection cable CAN with 120 Ω termination, M12, 1.8 m (5.9 ft)	**HA010850**
CAN configuration adapter	**HA011021**

9 Technical Data

Measurands

Relative Humidity (RH)

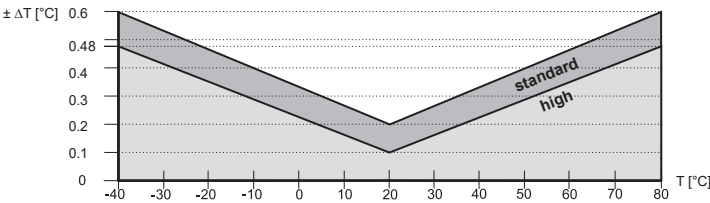| Measuring range	0...100 %RH	

Accuracy[1]
incl. hysteresis, non-linearity and repeatability
    RH ≤ 90 %   -15...+40 °C (5...+104 °F)
    RH > 90 %   -15...+40 °C (5...+104 °F)
                 -40...+80 °C (-40...+176 °F)
	
	±(1.3 + 0.3 % *mv) %RH
	±2,3 %RH
	±(1.5 + 1.5 % *mv) %RH
		
		mv = measured value

Response time t_{90}, typ. @20 °C (68 °F)	≤15 s with stainless steel grid filter	
Measuring interval	1 s	
Resolution	0.01 %RH	

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).
   For Modbus, the accuracy is defined at a 12 V DC supply, baud rate 9 600, without termination resistor, a polling interval ≥1 s and a flow velocity
   > 0.2 m/s. For CANopen, the accuracy is defined at a flow velocity > 0.2 m/s.

Temperature (T)

Measuring range	-40...+80 °C (-40...176 °F)
Accuracy[1]	
Measuring interval	1 s
Resolution	0.01 °C

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).
For Modbus, the accuracy is defined at a 12 V DC supply, baud rate 9 600, without termination resistor, a polling interval ≥1 s and a flow velocity
> 0.2 m/s (39 ft/min). For CANopen, the accuracy is defined at a flow velocity > 0.2 m/s (39 ft/min).

Outputs

Digital

Digital interface	RS485 (EE072 = 1 unit load)
Protocol Factory settings[1] Supported Baud rates Measured data types	Modbus RTU 9 600 Baud, parity even, 1 stop bit, Modbus address 234 9 600, 19 200, 38 400, 57 600, 76 800 and 115 200 FLOAT32 und INT16
Protocol / Profile Connector Factory settings Supported Baud rates	CANopen / device profile CiA 404 M12x1, 5 poles, pin assignment according to CiA 303-1 Data rate 125 kBit/s[2], node ID 64 125 kBit/s, 250 kBit/s, 500 kBit/s, 800 kBit/s, 1 MBit/s

1) For more details about communication setting see User Manual and Modbus Application Note at www.epluse.com/ee072.
2) For further information on the configuration see software instruction manual and the EDS file (Electronic Data Sheet).

General

Power supply class III USA & Canada: Class 2 supply necessary	10 - 28 V DC
Current consumption, typ.	3 mA (RS485, without termination resistor) 8 mA (CAN)
Storage conditions	-40...80 °C (-40...176 °F) 0...95 %RH, non-condensing
Enclosure 　　　　　　　　　Material 　　　　　Protection rating	Polycarbonate RAL 7035 Stainless steel 1.4404 / AISI 316 IP65 (when plugged into an appropiate M12x1 socket)
Electromagnetic compatibility	EN 61326-1:2013　　EN 61326-2-3:2013　　Industrial environment FCC Part15 Class B　ICES-003 Class B
Conformity	CE　UK CA
Configuration and adjustment	PCS10 Product Configuration Software Free download from www.epluse.com/pcs10

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