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User Manual HTS201

Room Sensor for Humidity and Temperature



Modbus

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1 General Information

This user manual is intended to ensure 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. accepts no liability for any warranty or liability claims arising from this publication or improper handling of the product(s) described.

All information, technical data and diagrams included in this document are based on the information available at the time of writing. The document 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 product(s) described and the contents of this document may be changed or improved at any time without prior notice.

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PLEASE NOTE

Find this document and further product information on our website at www.epluse.com/hts201.

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.

Informative notes

Informative notes provide important information that is characterised by 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 HTS201 enclosure and the electronics board inside shall not be exposed to unnecessary mechanical stress.
- Do not apply the supply voltage to the RS485 data lines.
- The HTS201 electronics are sensitive to electrostatic discharge (ESD). Take appropriate protective measures when touching it.
- Use the HTS201 only as intended and observe all technical specifications.

1.2.2. Intended Use

⚠ WARNING

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

The manufacturer is not liable for damage caused by improper handling, installation and maintenance of the device.

- Do not use HTS201 in explosive atmosphere or for measurement of 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 HTS201 may only be operated under the conditions described in this user manual and within the specification included in chapter 8 Technical Data.
- Any unauthorized product modification will invalidate all warranty claims. Modifications may only be carried out with express authorisation of E+E Elektronik Ges.m.b.H.!

1.2.3. Mounting, Start-up and Operation

The HTS201 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 to observe 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 in order to ensure safe operation.

ⓘ PLEASE NOTE

The manufacturer or his authorised 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 only be carried out by qualified staff. This must be authorised 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 must be thoroughly checked by authorised staff before commissioning the device.
- Do not install or start-up a device suspected to be faulty. Mark it clearly as faulty and remove it 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 all 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.

1.4 ESD Protection



The sensing elements and the electronics board are ESD (electrostatic discharge) sensitive components of the device and must be handled as such. The failure to do so may damage the device by electrostatic discharges when touching exposed sensitive components.

2 Scope of Supply

- HTS201 Room Sensor for Humidity and Temperature
- Mounting set
- Quick Guide for digital version

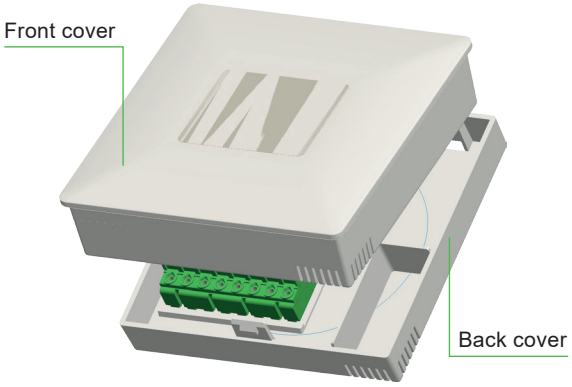
3 Product Description

3.1 General

The HTS201 is a room sensor for RH and T in demand controlled ventilation and building automation. It is designed for indoor wall mounting in residential and commercial applications.

Depending on the target market, the sensor is available with an EU or US enclosure. For the market specific dimension details, please refer to chapter 3.2 Dimensions.

The electronics of HTS201 are located in the front cover, which can be easily snapped on and off once the back cover has been fixed onto the wall and wired. The back cover contains just the push-in terminals. No tools are needed for mounting or changing the active part.



RH and T can also be read on the optional display. Please refer to chapter 3.4 Display.

The HTS201 is available with analogue outputs or with a digital interface:
The **analogue versions** deliver the measurands according to the ordering code. The model, measurement units (metric or non-metric) and output scaling can not be changed by the user.

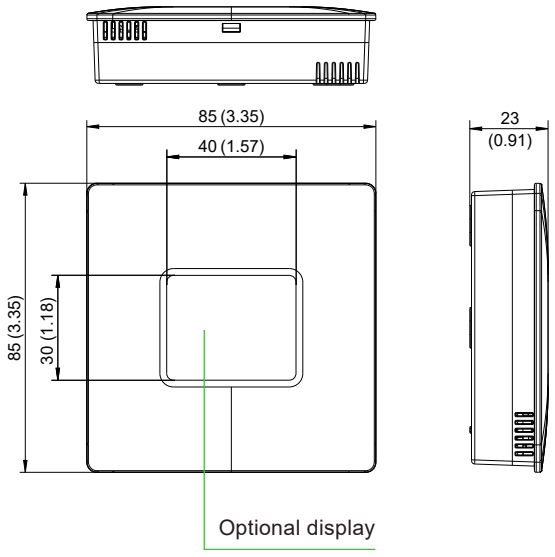
The **digital interface versions** deliver all available quantities. For further information, please refer to chapter 5.3.5. Modbus Register Map and chapter 8 Technical Data. The RS485 termination resistor can be enabled or disabled using a jumper. For BACnet, please refer to PICS (Product Implementation Conformance Statement), which is available at www.epluse.com/hts201.

For a non-default setup, the digital HTS201 can be configured manually with the free PCS10 Product Configuration Software and an optional configuration adapter. Refer to chapter 5 Setup and Configuration for details.

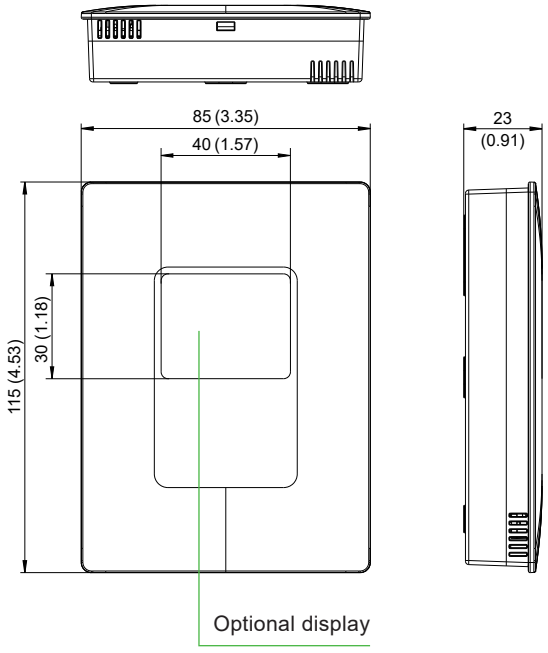
3.2 Dimensions

Values in mm (inch)

Enclosure
EU format



Enclosure
US format



3.3 Electrical Connection

The TES201 is equipped with push-in spring terminals with a maximum cross section of 1.5 mm^2 (AWG 16) to connect the power supply and outputs. The cables are fed into the enclosure via the rear side.

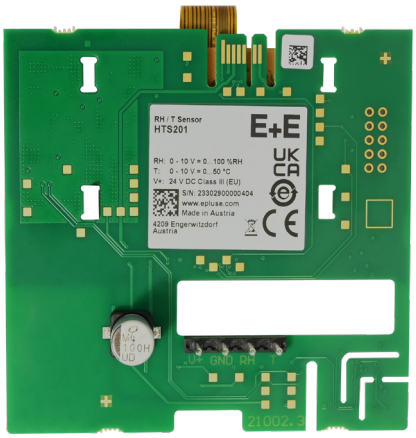
⚠ WARNING

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

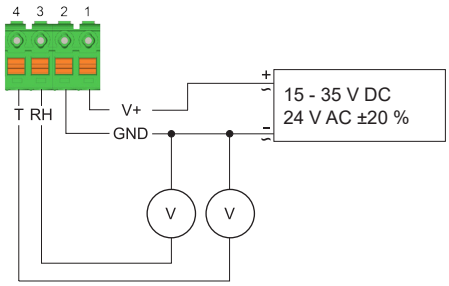
Ensure that the cables are not under voltage during installation. Do not apply voltage when connecting or disconnecting the product. For correct cabling of the device, always observe the presented wiring diagram for the product version used.

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

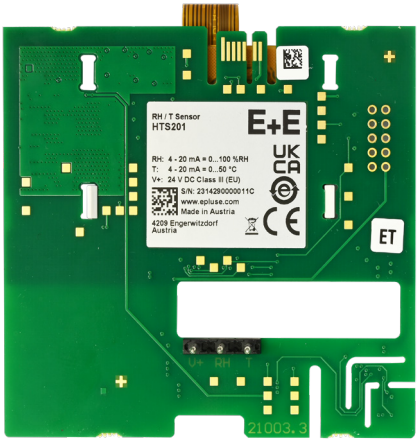
HTS201 voltage output



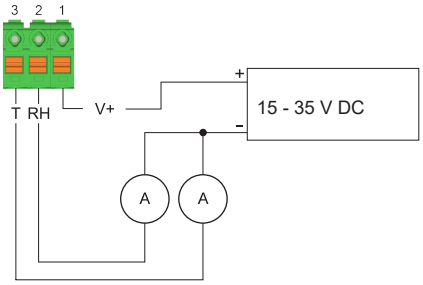
Connection scheme



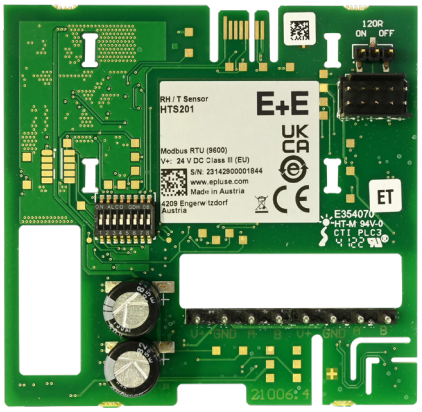
HTS201 current output



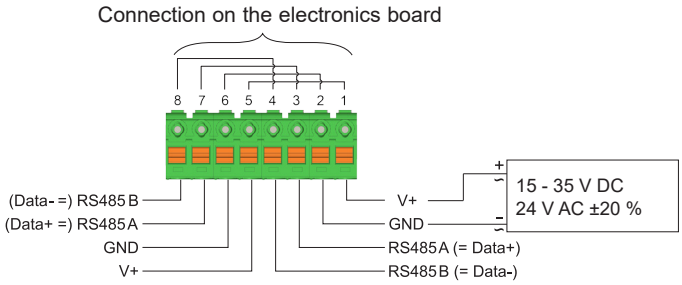
Connection scheme



HTS201 digital interface



Connection scheme



Connection assignment appropriate for daisy-chain wiring

3.4 Display

The optional display shows the measured values (according to ordering code) and the measurement unit. The temperature unit is selected via order code. Tab. 1 shows how measurands are displayed.

Line	Measurand
1	Humidity
2	Temperature

Tab. 1 Order of displayed measurands

4 Mounting and Installation

The room sensor is always mounted onto a conduit box. To obtain accurate measurement results, it is important to seal the conduit box tightly. This prevents false air ingress into the enclosure via the cable ducts in the wall.

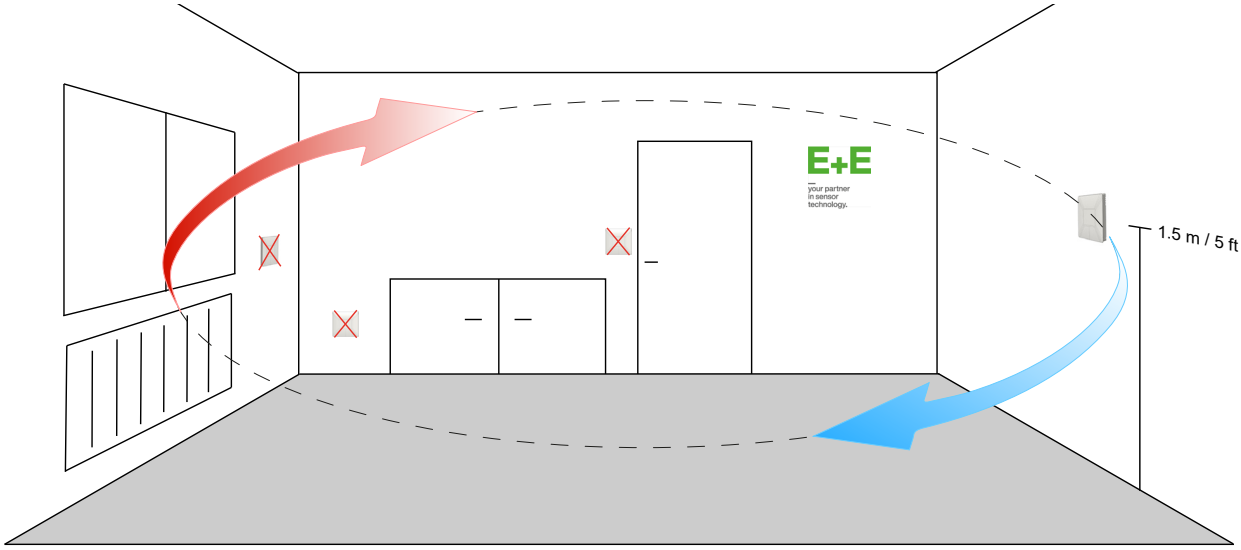
PLEASE NOTE

To protect the front cover and the electronics from typical construction site pollution, the front cover should only be snapped on after all construction work has been completed.

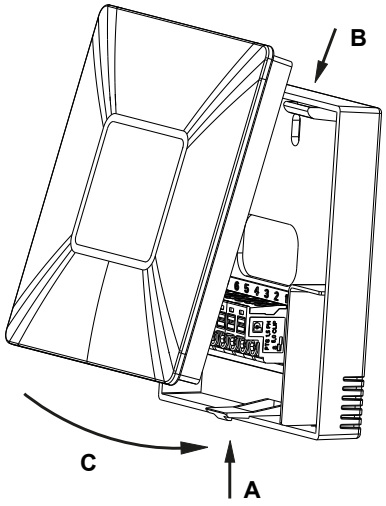
Please mind the following rules for sensor positioning:

Mount the sensor

- 2 m (6.6 ft) away from inlets and outlets
- At a height of 1.5 m (5 ft) (half of room height)
- Away from direct sunlight through a window
- In a place where the air can circulate freely
- Not in the proximity of heat sources
- Not in places where heat accumulation may occur
- Not in places where draughts may occur



The electronics are located in the front cover, which can be easily snapped on/off once the back cover has been fixed to the wall and wired.



Opening the enclosure

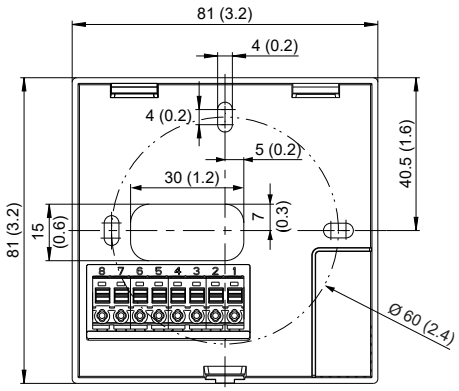
Press to release the latch **A** till the enclosure can be opened.

Closing the enclosure

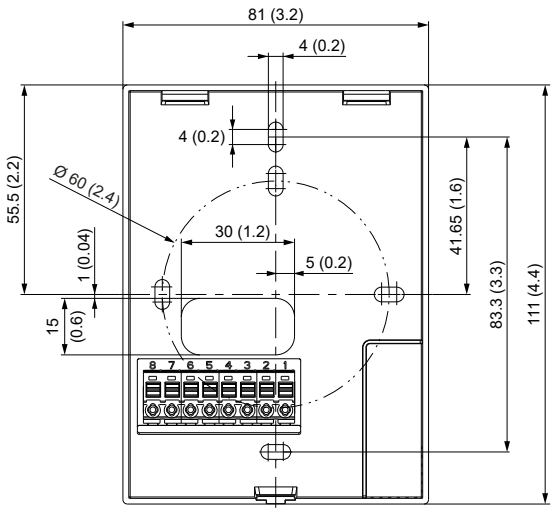
Place the front cover into flutes **B**, turn it as described in **C** and press it onto the back cover until the latch **A** snaps in.

Mounting Dimensions, values in mm (inch)

EU format



US format



5 Setup and Configuration

The HTS201 is ready to use and does not require any configuration by the user. The factory setup of the HTS201 corresponds to the specified order code. Please refer to the datasheet at www.epluse.com/hts201. While the room sensors with analogue output have no configuration interface, the digital versions offer some options for configuration. If needed, the factory setup can be changed using the free PCS10 Product Configuration Software and the USB-C configuration stick (HA011070).

The following settings can be performed with the help of the PCS10:

- Changing the interface communication parameters
- Setting up and editing the customised Modbus map
- Setting individual device names

The PCS10 displays

- Basic device data, e.g. serial number, firmware version, ...
- Device status register in the form of a device error list
- Measurand(s) as a live graph

Furthermore, the device configuration can be exported and imported. It is possible to reset the device to factory settings and to update the firmware.

5.1 PCS10 Product Configuration Software

To use the software, please proceed as follows:

1. Download the PCS10 Product Configuration Software from www.epluse.com/pcs10 and install it on the PC.
2. Connect the HTS201 to the PC using the USB-C configuration stick/USB configuration adapter.
3. Start the PCS10 software.
4. Follow the instructions on the PCS10 opening page to scan the ports and to identify the connected device.
5. Click on the desired setup or adjustment mode from the main PCS10 menu on the left. Follow the PCS10 online instructions displayed when clicking on the “Tutorial” button.
6. Upload changes to the device by pressing the “Sync” button.

5.2 Product Configuration

5.2.1. HTS201 Configuration using HA011070 (For Digital Types)

NOTICE

- The stick galvanically isolates the USB interface of the PC from the supply voltage of the TES201.
- An external power supply is required when using the USB-C configuration stick HA011070.

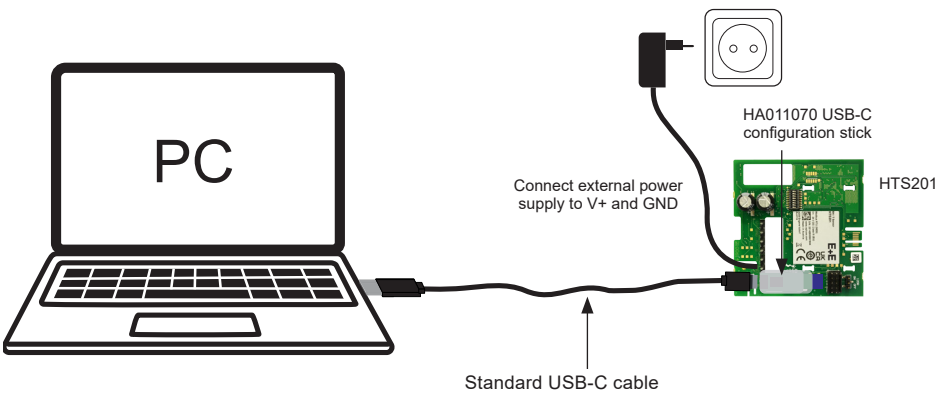


Fig. 1 HTS201 configuration using the HA011070 USB-C configuration stick

5.2.2. HTS201 Configuration using Legacy USB Configuration Adapter HA011066 (Not Intended for New Designs)

NOTICE

The HTS201 may not be connected to an additional power supply when using the HA011066 USB configuration adapter.

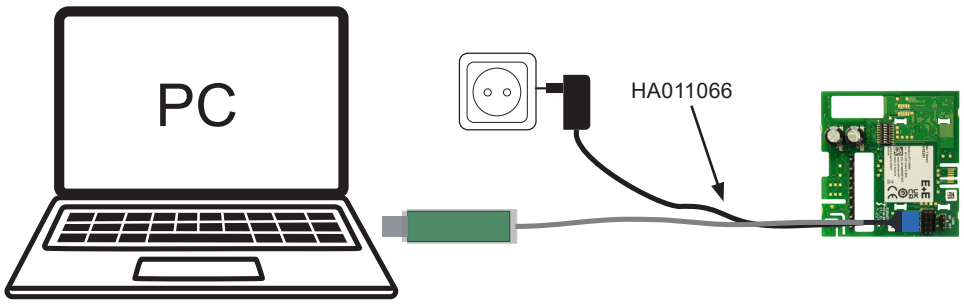


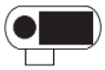
Fig. 2 HTS201 connected to a PC running PCS10

5.3 RS485 Digital Interface

5.3.1. Hardware Bus Termination

E+E room sensors with digital interface feature an internal 120 Ω resistor for bus termination, which can be activated using the jumper on the electronics board (refer to chapter 3.3 Electrical Connection for details).

Jumper not mounted, (right position = factory setup)
Bus is not terminated



Jumper mounted, (left position)
Bus is terminated

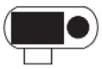
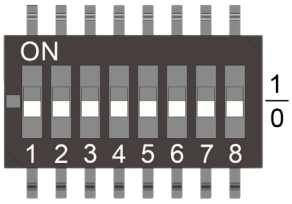
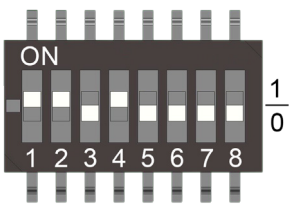


Fig. 3 Jumper position for RS485 bus termination resistor

5.3.2. Device Address

Address Switch	Option
	**Address setting via PCS10 Product Configuration Software (= factory setting)** All DIP switches at position 0 → factory-set default address (45_{DEC}, 0x2D) applicable, can be changed via software (PCS10 or Modbus protocol, permitted values: 1…247). Example: Address is set via configuration software.
	**Address setting via DIP switches** DIP switches in any other position than 0 indicate the effective Modbus address which overrules the factory setting and any Modbus address set via PCS10 or Modbus command (permitted values: 1…247). Example: Address set to 11_{DEC} ($0000\ 1011_{BIN}$).

5.3.3. BACnet Protocol Settings

	Factory settings	User selectable values (via EE-PCS)
Baud rate	As ordered via order code	9 600, 19 200, 38 400, 57 600, 76 800, 115 200
Data bits	8	8
Parity	None	None
Stop bits	1	1
BACnet address	45	0…127

Tab. 2 BACnet protocol settings

PLEASE NOTE

The recommended settings for multiple devices in a BACnet MS/TP network are 38 400, 8, none, 1.

The HTS201 PICS (Product Implementation Conformance Statement) is available on the E+E website at www.epluse.com/hts201.

BACnet address and baud rate can be set via:
- PCS10 Product Configuration Software and the USB-C configuration stick HA011070.
  The PCS10 can be downloaded free of charge from www.epluse.com/pcs10.
- BACnet protocol, refer to PICS.

5.3.4. Modbus RTU Protocol Settings

	Factory settings	User selectable values (PCS10)
Baud rate	As ordered via order code[1)]	9 600, 19 200, 38 400, 57 600, 76 800, 115 200
Data bits	8	8
Parity	Even	None, odd, even
Stop bits	1	1, 2
Modbus address	45	1...247

1) Please refer to datasheet; not all user selectable values are available ex works.

Tab. 3 Modbus RTU protocol settings

PLEASE NOTE

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

Device address, baud rate, parity and stop bits can be set via:
- PCS10 Product Configuration Software and the USB-C configuration stick HA011070.
  The PCS10 can be downloaded free of charge from www.epluse.com/pcs10.
- Modbus protocol in the register 1 (0x00) and 2 (0x01).
  Refer to Application Note Modbus AN0103 (available at www.epluse.com/hts201).

The serial number as ASCII-code is located in read-only registers 1 - 8 (0x00 - 0x07, 16 bits per register).
The firmware version is located in register 9 (0x08) (bit 15...8 = major release; bit 7...0 = minor release).
The sensor name is located in registers 10 - 17 (16 bits per register).

NOTICE

When reading information that spans multiple registers, it is always necessary to read all registers, even if the desired information requires less.

NOTICE

To obtain the correct floating point values, both registers have to be read within the same read cycle. The measured value can change between two Modbus requests. This can cause inconsistencies in the exponent and mantissa.

Communication settings (INT16)

Parameter	Register number[1] [Dec]	Register address[2] [Hex]	Size[3]
Write register: function code 0x06			
Modbus address[4]	1	00	1
Modbus protocol settings[4]	2	01	1

Device information (INT16)

Parameter	Register number[1] [Dec]	Register address[2] [Hex]	Size[3]
Read register: function code 0x03 / 0x04			
Serial number (as ASCII)	1	00	8
Firmware version	9	08	1
Sensor name (as ASCII)	10	09	8
Device status (bit decoded)[5]	602	259	1

1) Register number (decimal) starts from 1.
2) Register address (hexadecimal) starts from 0.
3) Number of registers.
4) For Modbus address and protocol settings refer to Application Note Modbus AN0103 (available at www.epluse.com/hts201).
5) Refer to chapter 5.3.7 Device Status Indication and Error Monitoring.

Tab. 4 HTS201 registers for device setup

5.3.5. Modbus Register Map

The measured data is saved as a 32 bit floating point values (data type FLOAT32) and as 16 bit signed integer values (data type INT16).

FLOAT32

Parameter	Unit[1]	Register number[2] [DEC]	Register address[3] [HEX]
Read register: function code 0x03 / 0x04			
Temperature T	°C	1003	3EA
	°F	1005	3EC
	K	1009	3F0
Relative humidity RH, Uw	%	1021	3FC
Dew point temperature Td	°C	1105	450
	°F	1107	452
	°K	1147	47A

INT16

Parameter	Unit[1]	Scale[4]	Register number[2] [DEC]	Register address[3] [HEX]
Read register: function code 0x03 / 0x04				
Temperature T	°C	100	4002	FA1
	°F	50	4003	FA2
	°K	50	4005	FA4
Relative humidity RH, Uw	%RH	100	4011	FAA
Dew point temperature Td	°C	100	4053	FD4
	°F	100	4054	FD5
	°K	100	4074	FE9

1) The choice of measurement units (metric or non-metric) must be made according to the ordering guide, refer to HTS201 datasheet. It is not possible to switch from metric to non-metric or vice versa by using the PCS10.
2) Register number (decimal) starts from 1.
3) Register address (hexadecimal) starts from 0.
4) 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.

Tab. 5 HTS201 FLOAT32 and INT16 measured data registers

5.3.6. Configurable Custom Modbus Map

It is possible to map measured value/status registers arbitrarily in a block with up to 20 registers provided for this purpose. This means that registers of interest may be mapped in an area with consecutive registers, so that important values can be queried with a single command in one block.

The register block for the configuration of the customisable Modbus map consists of the registers 6001 (0x1770) to 6010 (0x1779). For the blockwise query of the measured values behind Modbus registers 3001 (0xBB8) to 3020 (0xBCB), the firmware accesses this configuration area and thus gets the information which measured value/status registers are to be output. A maximum of 10 user-defined registers can be mapped. The table below shows an example:

Registers ...		**... with these assigned measurands ...**			**... map to registers ...**		**... mirrored from source registers**	
Dec	**Hex**	**Meas.**	**Unit**	**Type**	**Dec**	**Hex**	**Dec**	**Hex**
Function code 0x10					***Function code 0x03 / 0x04***			
6001	1770	T	°C	FLOAT32	3001	BB8	1003	3EA
			°C	FLOAT32	3002	BB9		
6002	1771	T	°F	FLOAT32	3003	BBA	1005	3EC
			°F	FLOAT32	3004	BBB		
6003	1772	T	K	FLOAT32	3005	BBC	1009	3F0
			K	FLOAT32	3006	BBD		
6004	1773	RH	%	FLOAT32	3007	BBE	1021	3FC
			%	FLOAT32	3008	BBF		
6005	1774	T	°C	INT16	3009	BC0	4002	FA1
6006	1775	RH	%	INT16	3010	BC1	4011	FAA
					3011	BC2		
					3012	BC3		
					3013	BC4		
					3014	BC5		
					3015	BC6		
					3016	BC7		
					3017	BC8		
					3018	BC9		
					3019	BCA		
					3020	BCB		

Tab. 6 Custom Modbus map example

The custom map can be configured via:

- PCS10 Product Configuration Software and the USB-C configuration stick HA011070.
  The PCS10 can be downloaded free of charge from www.epluse.com/pcs10.
- Modbus protocol commands, refer to the example in chapter 5.3.8. Modbus RTU Examples.

5.3.7. Device Status Indication and Error Monitoring

Modbus

The HTS201 features a status register that contains all status and error information. The status information can be read from Modbus register 602 (0x259). Errors are displayed in bit-coded form. If an event is present, the corresponding bit is set to 1.

If a critical error occurs, all Modbus values are set to NaN (according to IEEE754 for data type FLOAT32) or to 0x8000 (INT16).

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

Error bits	Description	Recommended action
Bit 0	Temperature below lower limit	1. Check the actual temperature with the temperature output scaling of the ordered sensor 2. Service recommended, check the repair possibilities with the E+E service
Bit 1	Temperature above upper limit	1. Check the actual temperature with the temperature output scaling of the ordered sensor 2. Service recommended, check the repair possibilities with the E+E service
Bit 2	Temperature value = infinite	1. Check the wiring 2. Service recommended, check the repair possibilities with the E+E service
Bit 3	Humidity below lower limit	1. Check the actual relative humidity with the humidity output scaling of the ordered sensor 2. Service recommended, check the repair possibilities with the E+E service
Bit 4	Humidity above upper limit	1. Check the actual relative humidity with the humidity output scaling of the ordered sensor 2. Service recommended, check the repair possibilities with the E+E service
Bit 5	Humidity value = infinite	1. Check the wiring 2. Service recommended, check the repair possibilities with the E+E service
Bit 6	-	-
Bit 7	-	-
Bit 8	-	-
Bit 9	RH / T element not accessible	Service recommended, check the repair possibilities with the E+E service
Bit10	-	-
Bit 11	Display communication broken	Service recommended, check the repair possibilities with the E+E service
Bit 12	-	-
Bit 13	-	-
Bit 14	-	-
Bit 15	-	-

Tab. 7 Device status indication register

PCS10

In the Information section, the PCS10 Product Configuration Software displays possible errors and states. Please refer to chapter 6.2 Error Messages in PCS10.

BACnet

In the event of a serious error, the “Present Value” of each analogue input object is set to NaN and “Reliability” is set to NO_SENSOR. The „Event State“ Property is set to FAULT.
Please refer to the HTS201 PICS (Product Implementation Conformance Statement) at www.epluse.com/hts201.

5.3.8. Modbus RTU Examples

The HTS201 Modbus address is 46 [0x2E].

Please refer to

- MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b3, chapter 6: www.modbus.org/docs/Modbus_Application_Protocol_V1_1b3.pdf
- E+E Application Note Modbus AN0103 (available at www.epluse.com/hts201)

Read the temperature (FLOAT32) T = 23.4400005340576171875 °C from register address 0x3EA

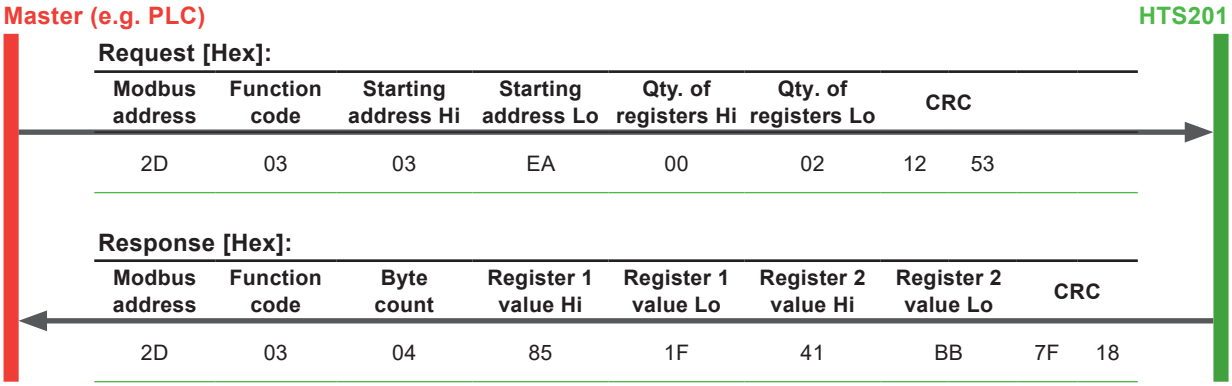


Fig. 4 Example temperature query

Decoding of floating point values

Floating point values are stored according to IEEE754. The byte pairs 1, 2 and 3, 4 are transformed as follows (numbers taken from the T reading Modbus request/response example above):

Modbus response [Hex]			
Byte 3	Byte 4	Byte 1	Byte 2
85	1F	41	BB
MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM

Tab. 8 Modbus response

IEEE754			
Byte 1	Byte 2	Byte 3	Byte 4
41	BB	85	1F
0100 0001	1011 1011	1000 0101	0001 1111
SEEE EEEE	EMMM MMMM	MMMM MMMM	MMMM MMMM
Decimal value: 23.4400005340576171875			

Tab. 9 Data representation according to IEEE754

Read register from unconfigured custom Modbus map address 0xBB8-0xBB9

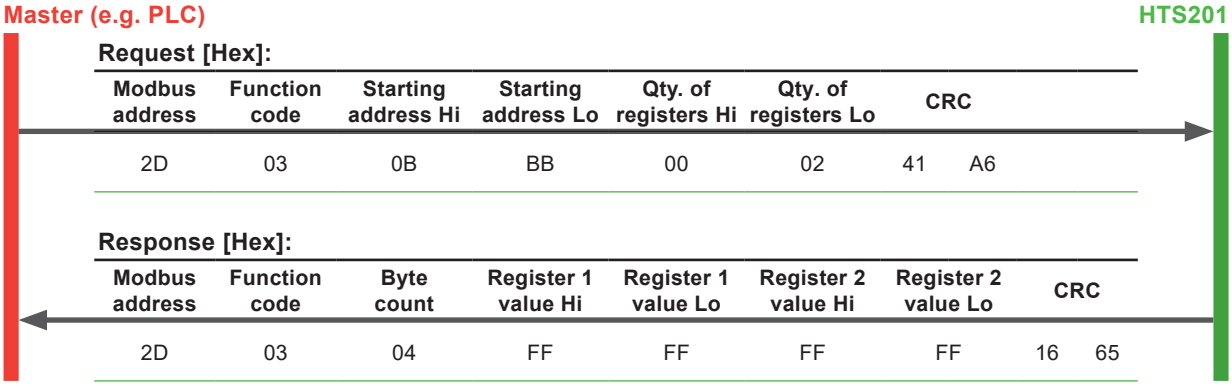


Fig. 5 Query of an unconfigured custom Modbus map

Mapping a simple custom Modbus map

assign RH [%] (address 0x3FC) and T [°C] (address 0x3EA) to the map, starting address 0xBB8:

Master (e.g. PLC) → **HTS201**

Request [Hex]:

Modbus address	Function code	Starting address Hi	Starting address Lo	Qty. of registers Hi	Qty. of registers Lo	Byte count
2D	10	17	70	00	02	04

Register 1 value Hi	Register 1 value Lo	Register 2 value Hi	Register 2 value Lo	CRC	
03	FC	03	EA	CA	E0

Response [Hex]:

Modbus address	Function code	Starting address Hi	Starting address Lo	Qty. of registers Hi	Qty. of registers Lo	CRC	
2D	10	17	70	00	02	42	0B

Fig. 6 Mapping a simple custom Modbus map

Query register address 0xBB8 (RH [%] mapped)

Master (e.g. PLC) → **HTS201**

Request [Hex]:

Modbus address	Function code	Starting address Hi	Starting address Lo	Qty. of registers Hi	Qty. of registers Lo	CRC	
2D	03	0B	B8	00	02	41	A6

Response [Hex]:

Modbus address	Function code	Byte count	Register 1 value Hi	Register 1 value Lo	Register 2 value Hi	Register 2 value Lo	CRC	
2D	03	04	0A	3D	42	56	25	7B

Fig. 7 Read RH value

Query consecutive registers, addresses 0xBB8-0xBBD (RH [%] and T [°C] mapped, one register empty)

Master (e.g. PLC) → **HTS201**

Request [Hex]:

Modbus address	Function code	Starting address Hi	Starting address Lo	Qty. of registers Hi	Qty. of registers Lo	CRC	
2D	03	0B	B8	00	06	40	65

Response [Hex]:

Modbus address	Function code	Byte count	Register 1 value Hi	Register 1 value Lo	Register 2 value Hi	Register 2 value Lo	Register 3 value Hi
2D	03	0C	14	7B	42	5D	33

Register 3 value Lo	Register 4 value Hi	Register 4 value Lo	Register 5 value HI	Register 5 value Lo	Register 6 value Hi	Register 6 value Lo	CRC	
33	41	C1	FF	FF	FF	FF	74	63

Fig. 8 Read several values with a single query

6 Maintenance and Service

6.1 Basic Cleaning

Response times exceeding the specified limit values may indicate contamination. In this case, clean the ventilation slots by blowing air from inside out.

6.2 Error Messages in PCS10

The PCS10 information section contains error messages from TES201, if errors occur. The following table shows the error codes and their meaning. Please note that this table directly corresponds to Tab. 7 Device status indication register in chapter 5.3.7.

Error code	Description	Recommended action
7.x	Temperature measurement incorrect	1. Check the actual temperature with the temperature output scaling of the ordered sensor, check the wiring 2. Service recommended, check the repair possibilities with the E+E service
9.x	Humidity measurement incorrect	1. Check the actual temperature with the temperature output scaling of the ordered sensor, check the wiring 2. Service recommended, check the repair possibilities with the E+E service
19.x	Sensing element not accessible	Service recommended, check the repair possibilities with the E+E service
21.x	Display communication faulty	Service recommended, check the repair possibilities with the E+E service

Tab. 10 Possible error messages for HTS201

6.3 Repairs

PLEASE NOTE

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

7 Accessories

Description	Code
PCS10 Product Configuration Software (Free download from www.epluse.com/pcs10)	**PCS10**
USB-C configuration stick	**HA011070**

8 Technical Data

Measurands

Relative Humidity (RH)

Measuring range	0...100 %RH, non-condensing
Accuracy[1)] incl. hysteresis, non-linearity and repeatability **0...100 %RH**	 ±(2 + 0.003 * mv) %RH mv = measured value
Temperature dependency of electronics, typ.	0.008 % RH / °C (0.004 %RH / °F)
Factory calibration uncertainty[2)] @ 23 °C (73 °F) **0...90 %RH** **>90...100 %RH**	 ±(0.7 + 0.003 * mv) %RH mv = measured value ±1 %RH

1) Defined against E+E calibration reference at 23 °C (73 °F). With supply voltage 24 V DC, 0.2 m/s (39. 4 ft/min) medium flow and load resistor 250 Ω for version with current output.
2) Defined at with an coverage factor k=2, corresponding to a confidence level of 95 %.

Temperature (T)

Measuring range	-30...+60 °C (-22...+140 °F)
Accuracy[1)] **0- 10 V, RS485** **4 - 20 mA (2-wire)**	 ±0.25 °C (±0.45 °F) ±0.38 °C (±0.68 °F)
Temperature dependency of electronics, typ.	0.006 K/K
Factory calibration uncertainty[2)] @ 23 °C (73 °F)	 ±0.1 °C (±0.18 °F)

1) Defined @ 23 °C (73 °F) against E+E calibration reference. With supply voltage 24 V DC, 0.2 m/s (39. 4 ft/min) medium flow and load resistor 250 Ω for version with current output.
2) Defined with a coverage factor k=2, corresponding to a confidence level of 95 %.

Calculated Physical Quantity

		from	up to	unit
Dew point temperature	Td	-30 (-22)	60 (140)	°C (°F)

Outputs

Analogue

T: acc. to ordering guide **RH: 0...100 %**	0 - 10 V 4 - 20 mA (2-wire)	-1 mA < I_L < 1 mA R_L < (V+ - 10) / 0.02 < 500 Ω	I_L = load current R_L = load resistance

Digital

Digital interface	RS485 (HTS201 = 1 unit load)
Protocol **Factory settings** **Supported Baud rates**[1)] **Measured data type**	Modbus RTU Baud rate according to ordering guide, 8 data bits, parity even, 1 stop bit, Modbus address 45 9 600, 19 200 and 38 400 FLOAT32 and INT16
Protocol **Factory settings** **Supported Baud rates**[1)]	BACnet MS/TP BACnet address 45 9 600, 19 200, 38 400, 57 600, 76 800 and 115 200

1) Ex works: refer to the ordering guide.

General

Power supply class III USA & Canada: Class 2 supply necessary, max. voltage 30 V DC			
0 - 10 V, RS485 **4 - 20 mA (2-wire)**	15 - 35 V DC or 24 V AC ±20 % 10 + 0.02 x R_L < V+ < 35 V DC (R_L < 500 Ω)		R_L = load resistance
Current consumption, typ.		**@ 24 V DC**	**@ 24 V AC**
	0 - 10 V	6 mA	14 mA_{rms}
	4 - 20 mA	Acc. to output current	
	RS485	5 mA	12 mA_{rms}
Electrical connection		Push-in spring terminals max. 1.5 mm^2 (AWG 16)	
Display		1.8" LCD, dot-matrix, 2 lines, visible area 38 x 31 mm (1.5" x 1.2")	
Humidity range **Operation** **Storage**		 0…100 %RH non-condensing 0…95 %RH non-condensing	
Temperature range, operation and storage **without display** **with display**		 -30...+60 °C (-22...+140 °F) -20...+60 °C (-4...+140 °F)	
Enclosure **Material** **Protection rating**		 PC (Polycarbonate), RAL 9003 (signal white), UL94 HB approved IP30	
Electromagnetic compatibility		EN 61326-1 FCC Part15 Class B	EN 61326-2-3 ICES-003 Class B Industrial environment
Shock and vibration		Tested according to EN 60068-2-64 and EN 60068-2-27	
Conformity		CE UKCA	
Configuration[1)]		PCS10 Product Configuration Software (free download) and optional configuration adapter	

1) With digital versions only.

Accuracy of E+E Humidity and Temperature Sensors

The measurement accuracy depends both on the performance of the measuring instrument and on the correct installation in the application.

For best accuracy, every E+E RH and T sensor is multipoint factory adjusted and calibrated in a highly stable RH / T reactor. Using a high-precision dew point mirror as reference, the overall uncertainty of the factory calibration U_{cal} is minimal.

The total measurement uncertainty U_{total} for E+E sensors is calculated in accordance with EA-4/02 (European Accreditation, Evaluation of the Measurement Uncertainty in Calibration) and with GUM (Guide to the Expression of Uncertainty in Measurement) as follows:

$$U_{total} = k \bullet \sqrt{\left(\frac{U_{cal}}{2}\right)^2 + \left(\frac{u_{accuracy}}{\sqrt{3}}\right)^2}$$

U_{total} .....total accuracy incl. factory calibration
U_{cal}.....uncertainty of the factory calibration
$u_{accuracy}$.....accuracy of the measurement device
k.....coverage factor k=2, corresponding to a confidence level of 95 %.

For external calibrations, U_{total} is to be used as the evaluation criterion. The calculation does not include effects due to long-term drift or chemical exposure.

As designated laboratory (NMI) responsible for maintaining National Standards in Austria, E+E Elektronik represents the highest level in calibration. For further details, please refer to www.epluse cal.com.

9 Conformity

9.1 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/hts201 for the Declarations of Conformity.

9.2 Electromagnetic Compatibility

EMC for industrial environment.
The sensor is a group 1 device and corresponds to class B.

9.3 FCC Part 15 Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the installation manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

9.4 ICES-003 Compliance Statement

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

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

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