Modbus CDS201 Room Temperature and Humidity Sensor User Manual

Contents

Modbus CDS201 Room Temperature and Humidity Sensor

Product Information

The CDS201 is a room sensor designed to measure CO2 levels, temperature, and relative humidity. It is equipped with a RS485 digital interface and can be configured using the PCS10 Product Configuration Software. The sensor is compatible with both BACnet and Modbus RTU protocols.

Product Usage Instructions

1. **Scope of Supply:** Refer to section 2 of the user manual for details on what is included in the package.
2. **Mounting and Installation:** Follow the instructions provided in section 4 of the user manual for proper mounting and installation of the CDS201 room sensor.
3. **Setup and Configuration:** Use the PCS10 Product Configuration Software as described in section 5.1 of the usermanual to configure the sensor. Additionally, refer to section 5.2 for information on RS485 digital interface, hardware bus termination, device address, and protocol settings.
4. **Maintenance and Service:** Section 6 of the user manual provides instructions on basic cleaning, error messages in PCS10, and repairs.
5. **Accessories:** Refer to section 7 of the user manual for information on available accessories for the CDS201 room sensor.
6. **Technical Data:** Section 8 of the user manual contains detailed technical specifications for the CO2, humidity, and temperature room sensor.

Please note that further product information and this user manual can be found on our website at www.epluse.com/cds201.

General Information

This user manual serves for ensuring proper handling and optimal functioning of the device. The user manual

shall be read before commissioning the equipment and it shall be provided to all staff involved in transport, installation, operation, maintenance and repair. E+E Elektronik Ges.m.b.H. does not accept warranty and liability claims neither upon this publication nor in case of improper treatment of the described products.

This 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 product(s) can be improved and changed at any time without prior notice. The user manual may not be used for the purposes of competition without the written consent of E+E Elektronik Ges.m.b.H. 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 NOTE: Find this document and further product information on our website at **www.epluse.com/cds201**.

Explanation of Warning Notices and Symbols

Safety precautions

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

DANGER

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

WARNING

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

CAUTION

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

NOTICE

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

Informational notes

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

INFO

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

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

Safety Instructions

General Safety Instructions

NOTICE: Improper handling of the device may result in its damage.

- The CDS201 enclosure, the sensing modules 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 CDS201 electronics is sensitive to electrostatic discharge (ESD), appropriate protective measures shall be taken when touching it.
- Use the CDS201 only as intended and observe all technical specifications.

Intended Use

- The CDS201 is a CO2, temperature and humidity (CO2, T and RH) room sensor for integration in demand controlled ventilation and building automation in residential and commercial applications. It is designed for indoor wall mounting.

WARNING

Non-compliance with the product documentation may cause safety risk for people and the entire measurement installation. The manufacturer cannot be held responsible for damages as a result of incorrect handling, installation, and maintenance of the device.

- Do not use CDS201 in explosive atmosphere or for measurement of aggressive gases.
- This device is not appropriate for safety, emergency stop or other critical applications where devicemalfunction 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 CDS201 may only be operated under the conditions described in this user manual and within the specification included in chapter 8 Technical Data.
- Unauthorized product modification leads to loss of all warranty claims. Modification may be accomplished only with an explicit permission of E+E Elektronik Ges.m.b.H.!

Mounting, Start-up and Operation

The CDS201 has been produced under state of the art manufacturing conditions, has been thoroughly tested and has left the factory after fulfilling all safety criteria. The manufacturer has taken all precautions to ensure safe operation of the device. The user must ensure that the device is set up and installed in a way that does not impair

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

PLEASE NOTE

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

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

- Mounting, installation, commissioning, start-up, operation and maintenance of the device may be performed by qualified staff only. Such staff must be authorized by the operator of the facility to carry out the mentioned activities.
- The qualified staff must have read and understood this user manual and must follow the instructions contained within.
- 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 shall be removed from the process.
- Service operations other than described in this user manual may only be performed by the manufacturer.

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.

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.

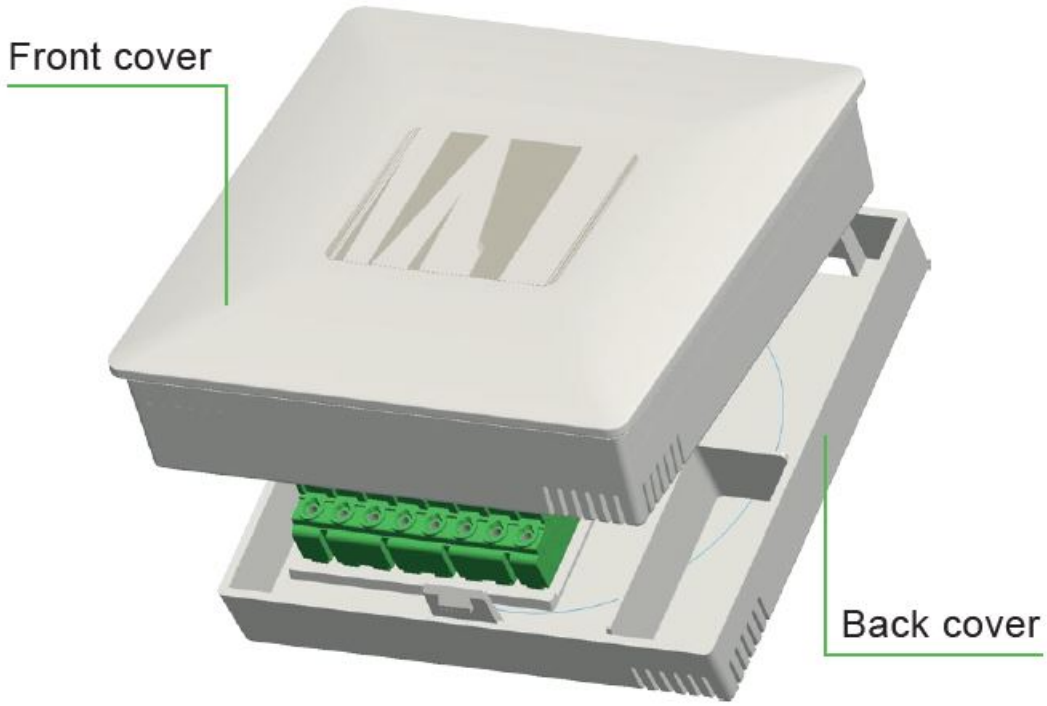
Scope of Supply

- CDS201 Room Sensor for CO2, Temperature and Humidity according to ordering guide
- Mounting set
- Quick Guide for digital version

Product Description

General

The CDS201 is a room sensor for CO2, T and RH for demand controlled ventilation and building automation. It is designed for indoor wall mounting in residential and commercial applications. Depending on the model ordered, the room sensor measures CO2, T and RH (M12) or CO2 and T (M11). Depending on the target market, the sensor is available with an EU or US enclosure. For dimensions, please refer to chapter 3.2 Dimensions. The electronics of CDS201 is located in the front cover, which can be easily snapped on/off once the back cover is 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.



The room sensor incorporates the E+E dual wavelength NDIR CO2 sensor, which compensates for ageing effects, is highly insensitive to pollution and offers outstanding long-term stability. A multiple point CO2 and T factory adjustment procedure leads to excellent CO2 measurement accuracy over the entire T working range. CO2, T and RH can also be read on the optional display. Please refer to chapter 3.4 Display.

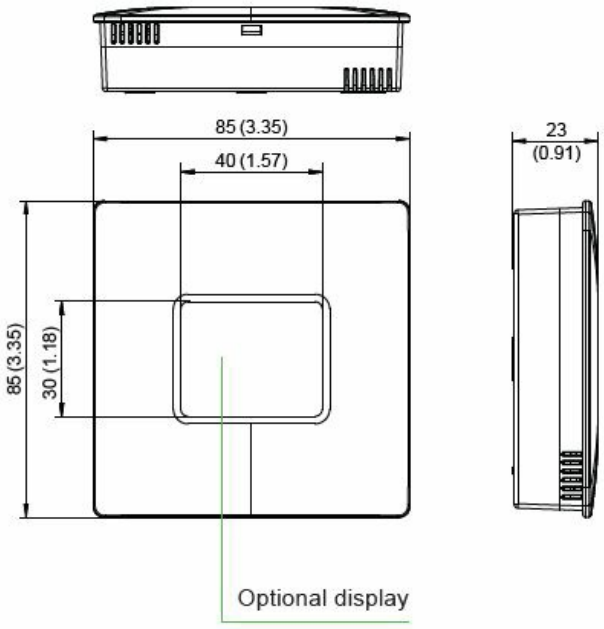
The measured data is available on two types of output:

The analogue versions deliver the measurands according to the ordering code. Model, measurement units (metric or non-metric) and output scaling can not be changed by the customer. The versions with digital interface supply all available quantities. For further information, please refer to chapter 5.2.5. Modbus Register Map and chapter 8 Technical Data. By means of a jumper, the RS485 termination resistor can be set on or off. For BACnet, please see the PICS (Product Implementation Conformance Statement), which is available at **www.epluse.com/cds201**. For a setup deviating from default, the digital CDS201 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.

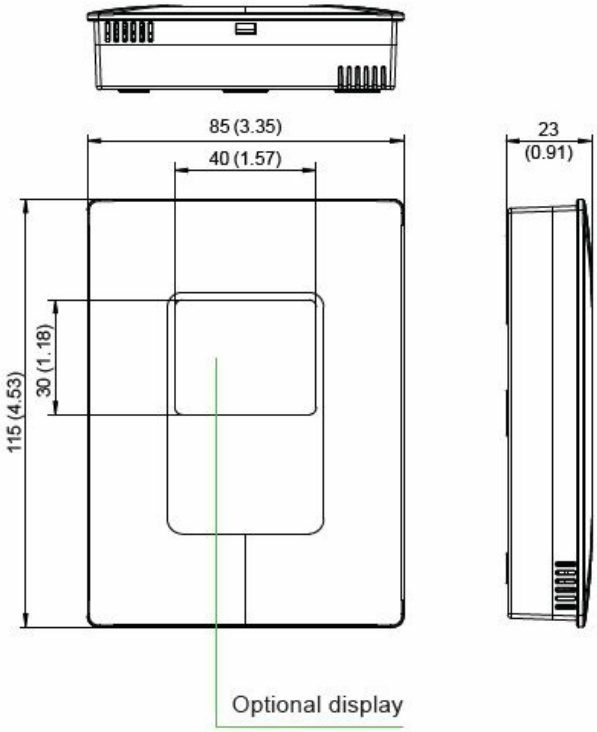
Dimensions

Values in mm (inch)

Enclosure
EU format



Enclosure
US format



Electrical Connection

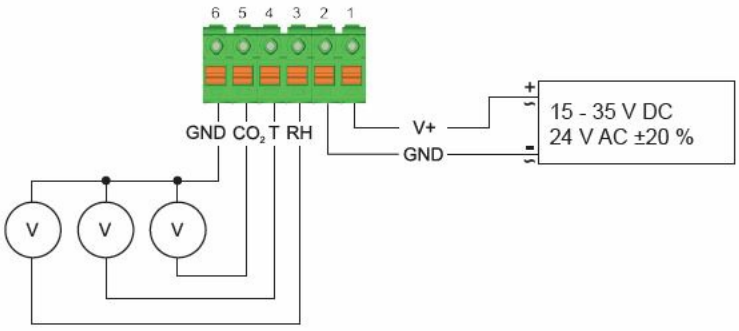
- For connecting the power supply and the outputs, the CDS201 features push-in spring terminals for max. 1.5 mm2 (AWG 16). The cables are fed into the enclosure via the rear side.

WARNING

- Incorrect installation, wiring or power supply may cause overheating and therefore personal injuries or damage to property.
- For correct cabling of the device, always observe the presented wiring diagram for the product version used.

CDS201 voltage output

Connection scheme



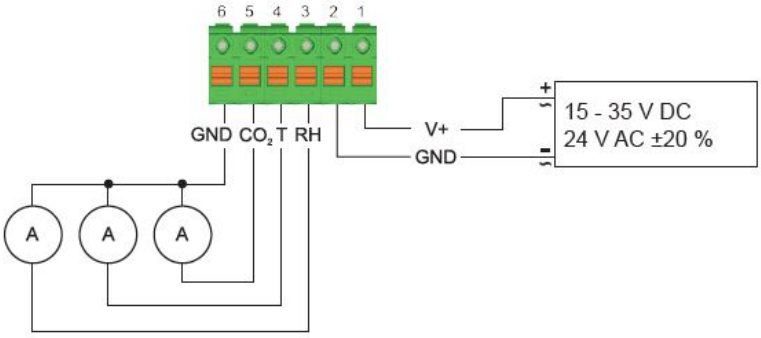
- The manufacturer cannot be held responsible for personal injuries or damage to property as a result of

incorrect handling, installation, wiring, power supply and maintenance of the device.

NOTICE

CDS201 current output

Connection scheme

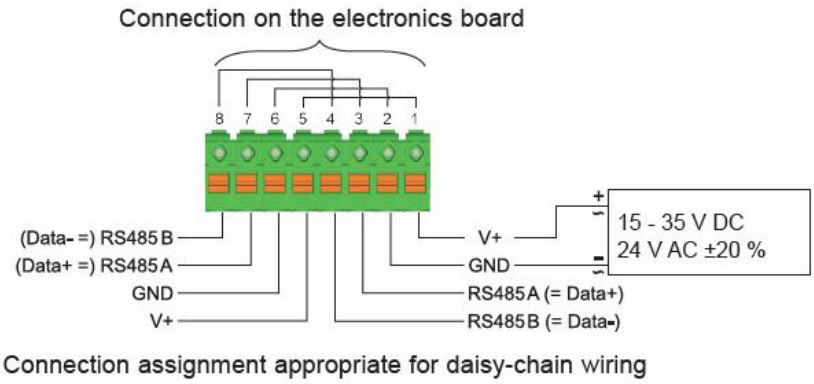


- The supply GND and the measurement GND of the CDS201 with voltage output must be wired separately.
- For failure-free operation and performance according to the specifications, the supply GND and the measurement GND of CDS201 with voltage output must be wired separately.

NOTICE

CDS201 digital interface

Connection scheme



- The supply GND and the measurement GND of the CDS201 with voltage output must be wired separately.
- For failure-free operation and performance according to the specifications, the supply GND and the measurement GND of CDS201 with voltage output must be wired separately.

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 the way measurands are displayed.

Tab. 1: Order of displayed measurands

Line	Measurand
1	CO_2
2	Model M11: Temperature Model M12: Humidity
3	Model M11: None Model M12: Temperature

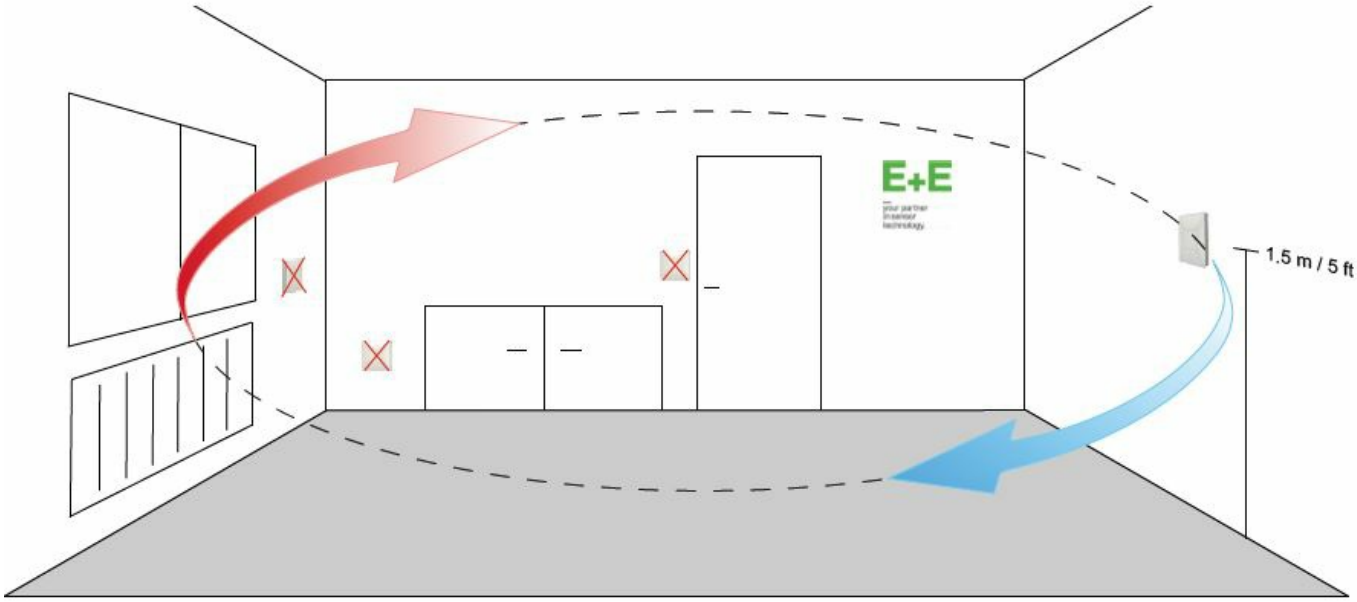
Mounting and Installation

As the room sensor is generally mounted onto a conduit box, for accurate measurement results it is important to tighten the conduit box for avoiding false air ingress (along the electrical tubes inside the wall) into the room sensor enclosure.

PLEASE NOTE

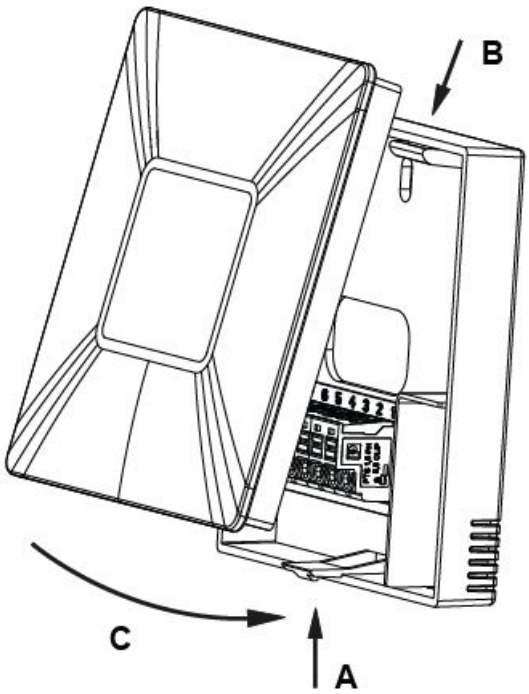
- In order to protect the front cover and the electronics from typical construction site pollution the front cover should be snapped on only after the construction works are completed.
- Please allow min. 2 minutes for the device to reach a valid CO2 measurement performance.

Please mind the following rules of thumb for sensor positioning:



- Mount the sensor 2 m (6.6 ft) away from outlets and intakes
- Mount the sensor at a height of 1.5 m (5 ft) (half of room height)
- Avoid direct sunlight from window
- Avoid restricted airflow
- Avoid close proximity to heat sources
- Avoid heat accumulation
- Avoid draught

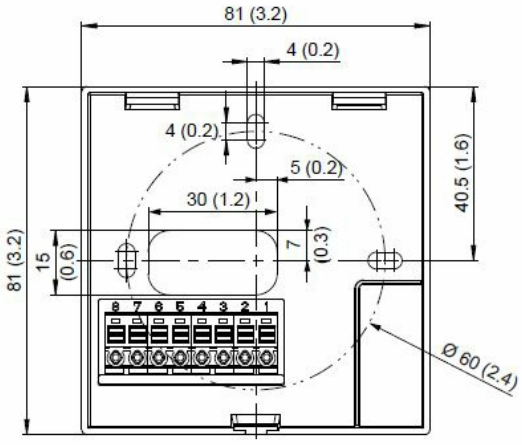
The electronics is located in the front cover, which can be easily snapped on/off once the back cover is fixed onto the wall and wired.



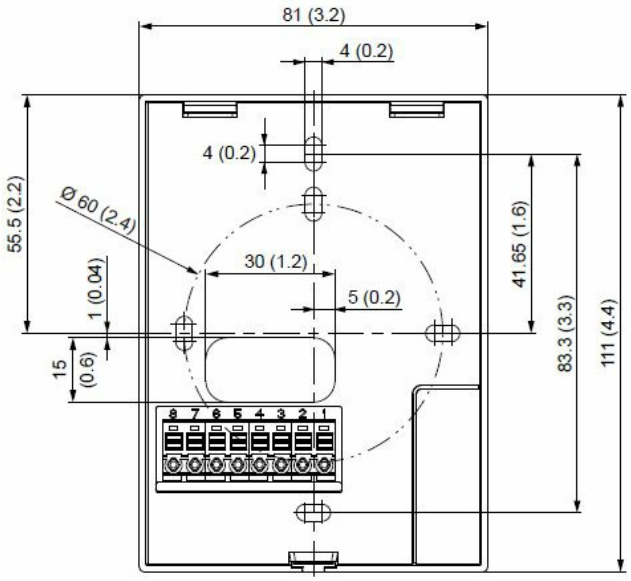
- Opening the enclosure
  - Press to release the latch A till the enclosure can be opened.
- Closing the enclosure
  - Set the front cover into flutes B, rotate it like C and press it onto the back cover till the latch A snaps in.

Mounting Dimensions, values in mm (inch)

EU format



US format



Setup and Configuration

The CDS201 is ready to use and does not require any configuration by the user. The factory setup of CDS201

corresponds to the type number ordered. Please refer to the datasheet at www.epluse.com/cds201. While the room sensors with analogue output do not provide a configuration interface, the digital versions offer some options for customization. If needed, the user can change the factory setup with the help of the free PCS10 Product Configuration Software and the optional USB configuration adapter (HA011066).

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

- Change interface communication parameters
- Setup and edit the custom Modbus map
- Set individual device name

The PCS10 makes visible the

- 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.

PCS10 Product Configuration Software

To use the software for changes in settings, 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 CDS201 to the PC using the USB configuration adapter.
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 mode from the main PCS10 menu on the left. Follow the online instructions of the PCS10 which are displayed when clicking the “Tutorial” button.
6. Changes are uploaded to the sensor by pressing the “Sync” button.

NOTICE

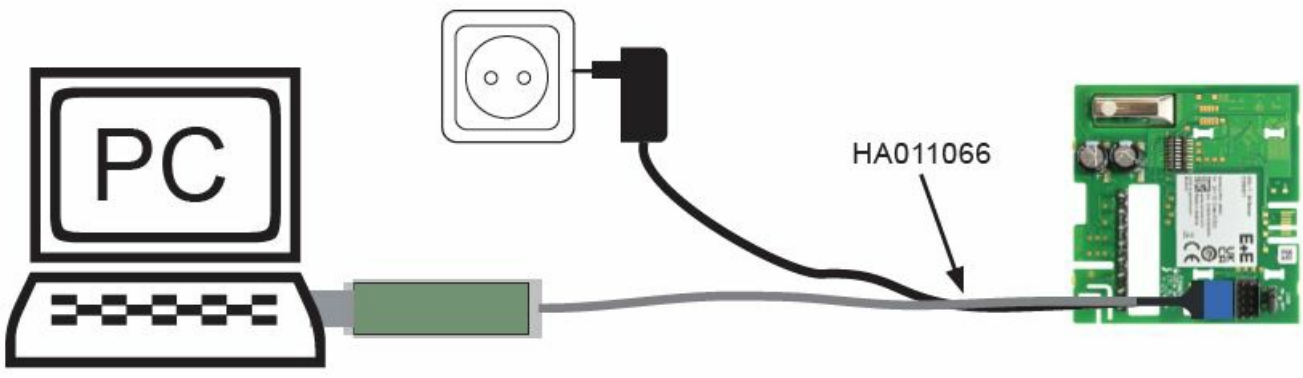


Fig. 1 CDS201 configuration setup

- The CDS201 may not be connected to any additional power supply when using the USB configuration adapter HA011066.

RS485 Digital Interface

Hardware Bus Termination

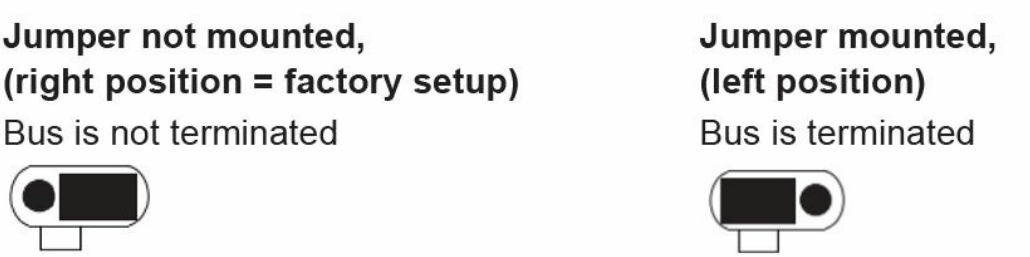
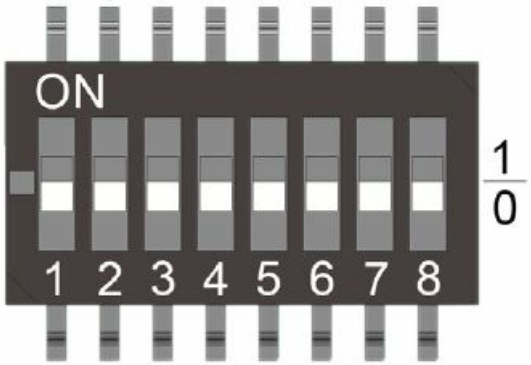


Fig. 2 Jumper position for RS485 bus termination resistor

- E+E room sensors with digital interface feature an internal 120 Ω resistor for bus termination CDS201 which can be activated using the jumper on the electronics board (see also chapter 3.3 Electrical Connection for details).

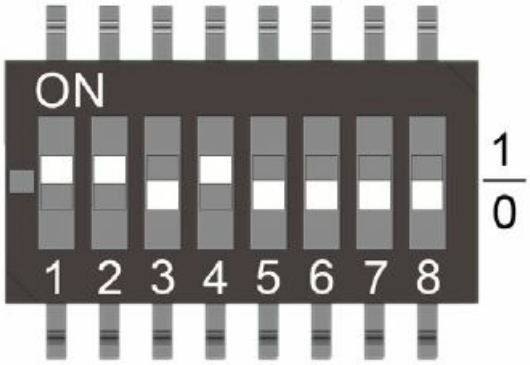
Device Address

Address setting via PCS10 Product Configuration Software



- All DIP switches at position 0 → address has to be set via PCS10
- **Modbus (slave device):** factory setting 45 (permitted values: 1…247).
- **BACnet (master device):** factory setting 45 (permitted values: 0…127).
- **Example:** Address is set via configuration software = factory setting.

Address setting via DIP switch



- **Modbus (slave device):** Setting the DIP switches to any other address than 0, overrules the Modbus address set via PCS10 (permitted values: 1…247).
- **BACnet (master device):** Setting the DIP switches to any other address than 0, overrules the BACnet address set via configuration software. BACnet note: permitted values are 0…127. The 8th bit of the DIP switches is ignored (ID 127 = 0111 111). To set address 0 via DIP switches, the 8th bit shall be set to 1 (ID 0 = 1000 0000).
- **Example:** Address set to 11 (= 0000 1011 binary).

BACnet Protocol Settings

Tab. 2: BACnet protocol settings

	Factory settings	**User selectable values (via PCS10)**
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

PLEASE NOTE

- The recommended settings for multiple devices in a BACnet MS/TP network are 38 400, 8, none, 1.
- The CDS201 PICS (Product Implementation Conformance Statement) is available on the E+E website at www.epluse.com/cds201.

BACnet address and baud rate can be set via

- PCS10 Product Configuration Software and the USB configuration adapter HA011066.
  - The PCS10 can be downloaded free of charge from www.epluse.com/pcs10.
- BACnet protocol, see the PICS.

Modbus RTU Protocol Settings

Tab. 3: 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.

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

- EE-PCS Product Configuration Software and the USB configuration adapter HA011066.
  - The PCS10 can be downloaded free of charge from **www.epluse.com/pcs10**.
- Modbus protocol in the register 1 (0x00) and 2 (0x01).

See Application Note Modbus AN0103 (available at **www.epluse.com/cds201**).
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 the serial number or the sensor name, it is always necessary to read all 8 registers, even if the desired information requires less.

NOTICE: 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, exponent and mantissa may get inconsistent then.

Communication settings (INT16)

Tab. 4: CDS201 registers for device setup

Communication settings (INT16)		
Parameter	**Register number[1)] [Dec]**	**Register address[2)] [Hex]**
Write register: function code 0x06		
Modbus address	1	0x00
Modbus protocol settings[3)]	2	0x01

Device information (INT16)

Parameter	Register number[1] [Dec]	Register address[2] [Hex]
Read register: function code 0x03 / 0x04		
Serial number (as ASCII)	1	0x00
Firmware version	9	0x08
Sensor name (as ASCII)	10	0x09
Device status (bit decoded)[4]	602	0x259

1. Register number starts from 1.
2. Protocol address starts from 0.
3. For Modbus protocol settings see Application Note Modbus AN0103 (available at www.epluse.com/cds201).
4. See chapter 5.5 Device Status Indication.

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).

Tab. 5: CDS201 FLOAT32 and INT16 measured data registers

FLOAT32

FLOAT32			
Parameter	**Unit[1]**	**Register number[2] [DEC]**	**Register address[3] [HEX]**
Read register: function code 0x03 / 0x04			
Temperature T	°C	1003	0x3EA
	°F	1005	0x3EC
	K	1009	0x3F0
Relative humidity RH, Uw	%	1021	0x3FC
CO_2 average	ppm	1061	0x424
CO_2 raw	ppm	1063	0x426
Dew point temperature Td	°C	1105	0x450
	°F	1107	0x452
	°K	1147	0x47A

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	0xFA1
	°F	50	4003	0xFA2
	°K	50	4005	0xFA4
Relative humidity RH, Uw	%RH	100	4011	0xFAA
CO_2 average	ppm	1	4031	0xFBE
CO_2 raw	ppm	1	4032	0xFBF
Dew point temperature Td	°C	100	4053	0xFD4
	°F	100	4054	0xFD5
	°K	100	4074	0xFE9

1. The choice of measurement units (metric or non-metric) must be done according to the ordering guide, see CDS201 datasheet. Switching from metric to non-metric or vice versa by using the PCS10 is not possible.
2. Register number starts from 1
3. Register address 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.

Freely 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 custom map can be configured via:

- PCS10 Product Configuration Software and the USB configuration adapter HA011066.
- The PCS10 can be downloaded free of charge from **www.epluse.com/pcs10**.
- Modbus protocol commands, refer to the examples in chapter 5.2.8. ModBus RTU Examples.

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:

Tab. 6: Custom Modbus map 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	0x1770	T	°C	FLOAT32	3001	0xBB8	1003	0x3EA
			°C	FLOAT32	3002	0xBB9		
6002	0x1771	T	°F	FLOAT32	3003	0xBBA	1005	0x3EC
			°F	FLOAT32	3004	0xBBB		
6003	0x1772	T	K	FLOAT32	3005	0xBBC	1009	0x3F0
			K	FLOAT32	3006	0xBBD		
6004	0x1773	RH	%	FLOAT32	3007	0xBBE	1021	0x3FC
			%	FLOAT32	3008	0xBBF		
6005	0x1774	T	°C	INT16	3009	0xBC0	4002	0xFA1
6006	0x1775	RH	%	INT16	3010	0xBC1	4011	
6007	0x1776	CO_2 raw	ppm	INT16	3011	0xBC2	4032	0xFBE
6008	0x1777	CO_2 raw	ppm	FLOAT32	3012	0xBC3	1063	0x426
			ppm	FLOAT32	3013	0xBC4		
6009	0x1778	CO_2 avg	ppm	FLOAT32	3014	0xBC5	1061	0x424
			ppm	FLOAT32	3015	0xBC6		
					3016	0xBC7		
					3017	0xBC8		
					3018	0xBC9		
					3019	0xBCA		
					3020	0xBCB		

Device Status Indication and Error Monitoring

Modbus

- The CDS201 features a status register which contains all status and error information. It is possible to read it from Modbus register 602 (0x259).
- If a critical error occurs, all Modbus values are set to NaN (according to IEEE754 for data type FLOAT32) or to 0x8000 (INT16). 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.

Tab. 7: Device status indication register

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	CO_2 below lower limit	1. Check the actual CO_2 value with the CO_2 measuring range of the ordered sensor 2. Service recommended, check the repair possibilities with the E+E service
Bit 7	CO_2 above upper limit	1. Check the actual CO_2 value with the CO_2 measuring range of the ordered sensor 2. Service recommended, check the repair possibilities with the E+E service
Bit 8	CO_2 value = infinite	1. Check the wiring 2. Service recommended, check the repair possibilities with the E+E service
Bit 9	RH / T element not accessible	Service recommended, check the repair possibilities with the E+E service
Bit10	CO_2 element not accessible	Service recommended, check the repair possibilities with the E+E service
Bit 11	Display communication broken	Service recommended, check the repair possibilities with the E+E service

PCS10

- In the Information section, the PCS10 Product Configuration Software displays possible errors and states. Please refer to chapter 6.2.2. 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 CDS201 PICS (Product Implementation Conformance Statement) at **www.epluse.com/cds201**.

ModBus RTU Examples

The CDS201 Modbus address is 45 [0x2D].

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/cds201**)

Read the temperature (FLOAT32) T = 23.4400053405761718 75 °C from register address 0x3EA:

Fig. 3: Example temperature query

aster (e.g. PLC)								**CDS201**
Request [Hex]:								
Modbus address	**Function code**	**Starting address Hi**	**Starting address Lo**	**Qty. of registers Hi**	**Qty. of registers Lo**	**CRC**		
2D	03	03	EA	00	02	12	53	
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	85	1F	41	BB	7F	18

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 T reading Modbus request/response example above):

Tab. 8: Modbus response

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

Tab. 9: Data representation according to IEEE754

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

Read register from unconfigured custom modbus map address 0xBB8-0xBB9:

Fig. 4: Query of an unconfigured custom Modbus map

Master (e.g. PLC)								**CDS201**
Request [Hex]:								
Modbus address	**Function code**	**Starting address Hi**	**Starting address Lo**	**Qty. of registers Hi**	**Qty. of registers Lo**	**CRC**		
2D	03	0B	BB	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	FF	FF	FF	FF	16	65

Mapping a simple custom Modbus map

assign CO2 avg [ppm] (address 0x424) and T [°C] (address 0x3EA) to the map, starting address 0xBB8:

Fig. 5: Mapping a simple custom Modbus map

Master (e.g. PLC)							**CDS201**
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**	
		04	24	03	EA	4B	AF
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

Query register address 0xBB8 (CO2 avg mapped)

Master (e.g. PLC)

Fig. 6: Read CO2 avg value

Master (e.g. PLC)								**CDS201**
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	B9	D4	44	39	81	87

Query consecutive registers, addresses 0xBB8-0xBBD (CO2 and T mapped, one register empty)

Fig. 7: Read several values with a single query

Master (e.g. PLC)									**CDS201**
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	DB	77	44	41		AE	
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**	
14	41	BB	FF	FF	FF	FF		62	84

Maintenance and Service

Basic Cleaning

- If the response times are longer than specified, this may be due to contamination. In this case clean the ventilation slots by blowing from inside out.

Error Messages in PCS10

The PCS10 information section includes error messages from CDS201, if there are any errors present. 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 5.2.7.

Tab. 10: Possible error messages for CDS201

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
15.x	CO_2 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

Repairs

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

Accessories

Description	Code
E+E Product Configuration Software (Free download from **www.epluse.com/pcs10**)	**PCS10**
USB Configuration Adapter for CDS201 digital	**HA011066**

Technical Data

Measurands

CO2

Measurement principle	Dual wavelength non-dispersive infrared technology (NDIR)
Measuring range	0…2 000 / 5 000 ppm
Accuracy[1)] **0…2 000 ppm** **0…5 000 ppm**	 < ±(60 ppm +2 % of measured value) < ±(60 ppm +3 % of measured value)
Temperature dependency, typ.	±(1 + CO_2 concentration [ppm] / 1 000) ppm/°C ±(1 + CO_2 concentration [ppm] / 1 800) ppm/°F
Residual pressure dependency in the range of -20…45 °C (-4…113 °F) , related to 1 013 mbar	0.14 % of measured value/mbar
Long-term stability under normal operating conditions in a t ypical building automation environment	<20 ppm / year
Response time t_{63}, typ.	<180 s

1. @ 20 °C (68 °F), with supply voltage 24 V DC, 0.2 m/s (39.4 ft/min) circulation and load resistor 250 Ω for version with current output.

Relative Humidity (RH)

Measuring range	0…100 %RH, non-condensing
Accuracy[1)] incl. hysteresis, non-linearity and repeatability **0…80 %RH** **>80…100 %RH**	 ±(2.8 + 0.003 * mv) %RH mv = measured value ±4.1 %RH
Temperature dependency of electron ics, 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 with an enhancement 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**	 ±0.35 °C (±0.63 °F) ±0.7 °C (±1.26 °F)
Temperature dependency of electron ics, 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 an enhancement factor k=2, corresponding to a confidence level of 95 %.

Calculated Physical Quantity

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

Outputs

Analogue

Analogue	
CO_2: 0…2 000 / 5 000 ppm **T: acc. to ordering guide RH: 0…100 %**	0 – 10 V -1 mA < I_L < 1 mA I_L = load current 4 – 20 mA (3-wire) R_L < 500 Ω R_L = load resistance

Digital

Digital	
Digital interface	RS485 (CDS201 = 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: see ordering guide.	

General

Power supply class III USA & Canada: Class 2 supply necessary, max. voltage 30 V DC	15 – 35 V DC or 24 V AC ±20 %		
		@ 24 V DC	**@ 24 V AC**

Current consumption, typ.	**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 or 3 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 EN 61326-2-3 FCC Part15 Class B 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 sensing element is factory adjusted and calibrated in a highly stable RH / T reactor. Using a high-precision reference, the overall uncertainty of the factory calibration Ucal is minimal. The total measurement uncertainty Utotal 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:

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

- **Utotal**……..total accuracy incl. factory calibration
- **Ucal**……the uncertainty of the factory calibration
- **uaccuracy**……the accuracy of the measurement device
- **k**…….enhancement factor k=2, corresponding to a confidence level of 95 %.

For external calibrations, Utotal 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 the National Standard for humidity and temperature in Austria, E+E Elektronik represents the highest instance in humidity and temperature calibration.

FCC STATEMENT

Conformity

Declarations of Conformity

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

- European directives and standards.
- UK statutory instruments and designated standards.

Please refer to the product page at **www.epluse.com/cds201** for the Declarations of Conformity.

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.

ICES-003 Compliance Statement

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

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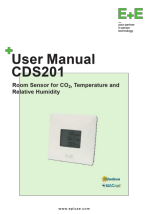
Documents / Resources

	Modbus CDS201 Room Temperature and Humidity Sensor [pdf] User Manual CDS201, CDS201 Room Temperature and Humidity Sensor, Room Temperature and Humidity Sensor, Temperature and Humidity Sensor, Humidity Sensor, Sensor