USER'S GUIDE

EE850 – CO_2, Humidity and Temperature Duct Sensor

SCOPE OF SUPPLY

- EE850 transmitter according ordering guide
- Cable gland
- Mounting flange + seal
- Mounting materials
- Two self-adhesive labels for configuration changes (see user guide at www.epluse.com/relabeling)
- Test report according to DIN EN10204 - 2.2

CAUTION

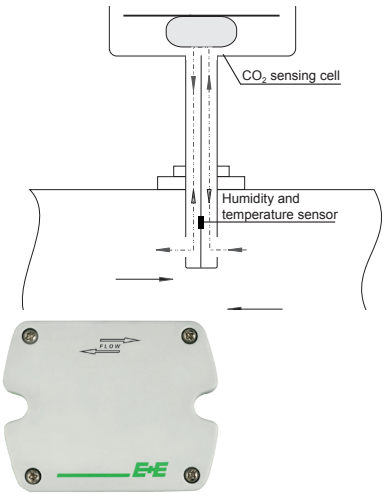
The device shall not be exposed to extreme mechanical or thermal stress.
This EE850 is not appropriate for safety, emergency stop or other critical applications where device malfunction or failure could cause injury to humans and other living beings.

OPERATION PRINCIPLE

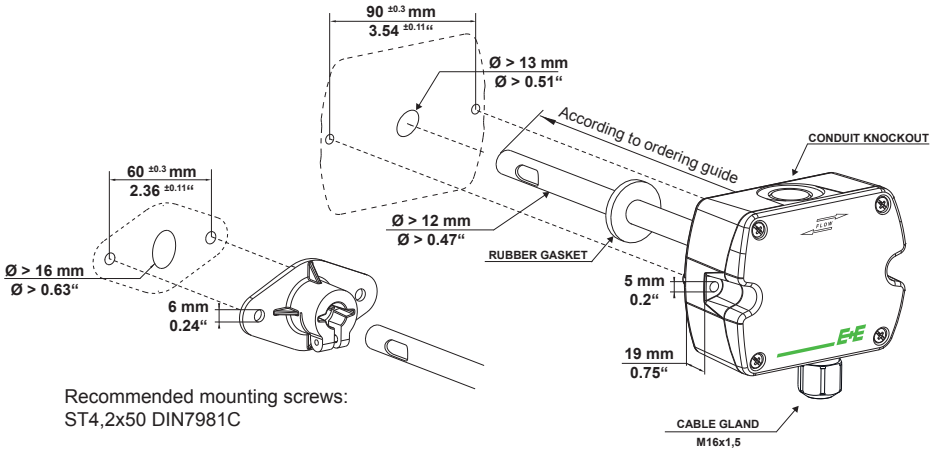
Installed into a duct, a small amount of air will flow through the divided probe into the EE850 enclosure, where the CO_2 sensing cell is located, and back into the duct. The RH and T sensing elements are placed inside the probe.

Very important
For accurate measurement the cover of EE850 as well as the cable outlet – cable glad or conduit adapter - must be tightly closed. This is essential for avoiding ingress of air other than from the duct into the EE850 enclosure, which would falsify the measurement.

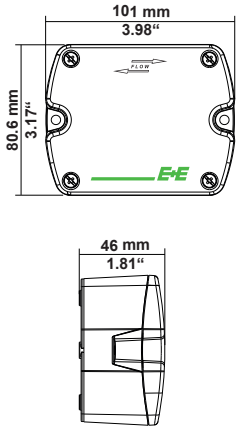
The direction of the air flow in the duct shall correspond to the direction indicated with arrows on the cover of EE850.



INSTALLATION

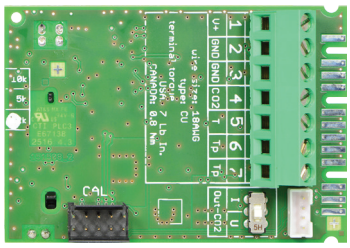


Recommended mounting screws:
ST4,2x50 DIN7981C



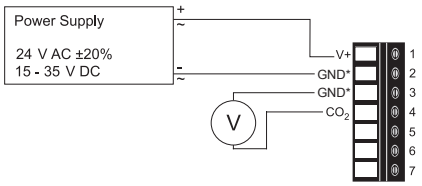
EE850 with conduit connection for the North American market: use a flat screwdriver to carefully to break open the plastic knockout at the marked location, in order to avoid damaging the electronics inside the enclosure. The conduit adapter is not included in the scope of supply.

CONNECTION DIAGRAMS

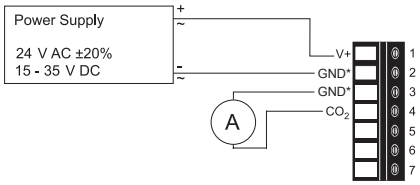


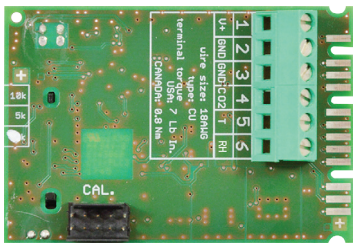
EE850-M10 and EE850-M11

EE850-M10 / voltage output



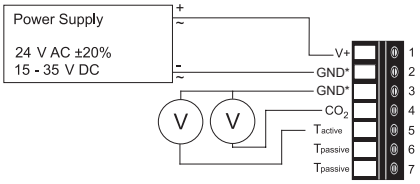
EE850-M10 / current output



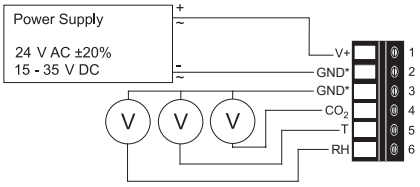


EE850-M12

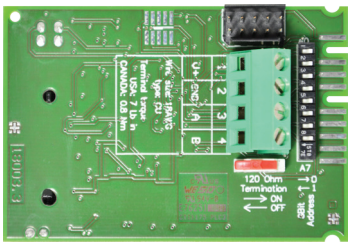
EE850-M11 / voltage output



EE850-M12 / voltage output

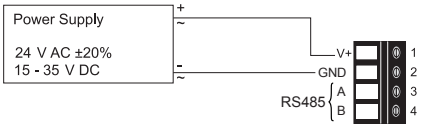


* **Very important:** For failure-free operation and performance according to the specs the supply GND and the measurement GND must be wired separately.



EE850-M1xJ3

EE850-M1xJ3 / digital output



TECHNICAL DATA

(Modification rights reserved)

Measurands

CO_2

Measurement principle	dual wavelength non-dispersive infrared technology (NDIR)	
Measuring range	0...2000 / 5000 / 10000 ppm	
Accuracy at 25 °C (77 °F)	0...2000 ppm:	< ± (50 ppm +2% of measured value)
and 1013 mbar (14.7 psi)	0...5000 ppm:	< ± (50 ppm +3% of measured value)
	0...10000 ppm:	< ± (100 ppm +5% of measured value)
Response time t_{63}	< 100 seconds at 3 m/s (590 ft/min) air speed in the duct	
Temperature dependency	typ. ± (1 + CO_2 concentration [ppm] / 1000) ppm/°C, for -20...45 °C (-4...113 °F)	
Calibration interval [1]	> 5 years	
Measuring interval	approx. 15 seconds	

Temperature

Working range	-20...60 °C (-4...140 °F)
Accuracy at 20 °C (68 °F)	±0.3 °C (±0.54 °F)
Response time t_{63}	< 50 seconds

Relative Humidity

Working range	0...95 % RH
Accuracy at 20 °C (68 °F)	± 3 % RH (20...80 % RH)
Response time t_{63}	< 10 seconds

Outputs

Analogue

CO_2: 0...2000 / 5000 / 10000 ppm	0-5 V / 0-10 V	-1 mA < I_L < 1 mA
	4-20 mA	R_L < 500 Ohm
T scale: according ordering guide **RH** scale: 0...100 % RH	0 - 5 V / 0 - 10 V	-1 mA < I_L < 1 mA
Digital Interface Protocol	RS485 with max. 32 devices on one bus Modbus RTU or BACnet MS/TP	
Passive temperature, 2-wire	T sensor type according ordering guide	
Wire resistance (terminal - sensor)	typ. 0.4 Ohm	

General

Power supply class III		24 V AC/DC ± 20 % 15-35 V DC
Current consumption	average	typ. 15 mA + output current
	peak	max. 350 mA for 0.3 seconds
Minimum air speed in the duct		1 m/s (196 ft/min)
Enclosure material		polycarbonate, UL94V-0 approved
Protection class		enclosure: IP65 / NEMA 4 probe: IP20
Cable gland		M16 x 1.5
Electrical connection		screw terminals max. 2.5 mm² (AWG 14)
Electromagnetic compatibility		EN61326-1 EN61326-2-3 Industrial Environment FCC Part 15 ICES-003 ClassB
Working and storage conditions		-20...60 °C (-4...140 °F) 0...95 % RH (non-condensing)

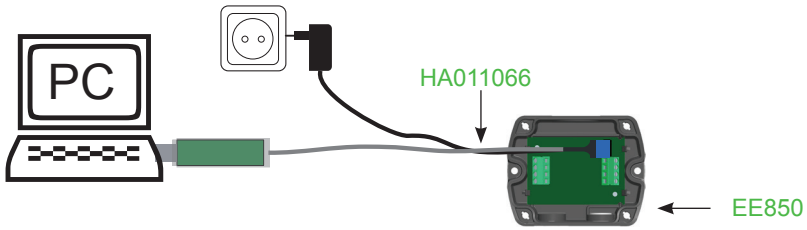
1) under normal operating conditions

SETUP AND ADJUSTMENT

The EE850 is ready to use and does not require any configuration by the user. The factory setup of EE850 corresponds to the type number ordered. For ordering guide please see data sheet at www.epluse.com/EE850.

If needed, the user can change the factory setup by using the optional USB Configuration Adapter (HA011066) and the Product Configuration Software (EE-PCS). One can change the CO_2 output signal, the scaling of the outputs and perform CO_2, RH and T adjustment/calibration.

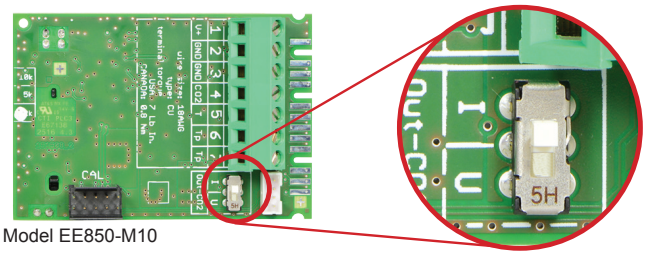
Note: The EE850 may not be connected to any additional power supply when using the USB Configuration Adapter (HA011066).



MODEL EE850-M10:

Select the CO_2 output signal:
The output signal can be changed from voltage to current or vice-versa.

Set the output signal selection switch to I for current 4 - 20 mA output or to U for voltage 0 - 10 V output. The original CO_2 output range does not change and the calibration data remains valid.



Model EE850-M10

Example:
Factory setup: voltage output (U), output scale: 0 - 10 V = 0...5000 ppm
User setup (after setting the output signal selection switch to I): current output (I), output scale: 4 - 20 mA = 0...5000 ppm.

MODELS EE850-M11 and EE850-M12:

Changing the CO_2 and T output scale:
The scaling of the output can be changed by using USB Configuration Adapter (HA011066) and Product Configuration Software (EE-PCS).

Example:

The initial scaling of the outputs is:	*The output scale after the change is:*
CO_2: 0 - 10 V = 0...5000 ppm	*CO_2: 0 - 10 V = 400...4000 ppm*
T: 0 - 10 V = 0...50 °C	*T: 0 - 10 V = 40...100 °F*
RH: 0 - 10 V = 0...100 % RH	*Td: 0 - 10 V = -20...40 °C*

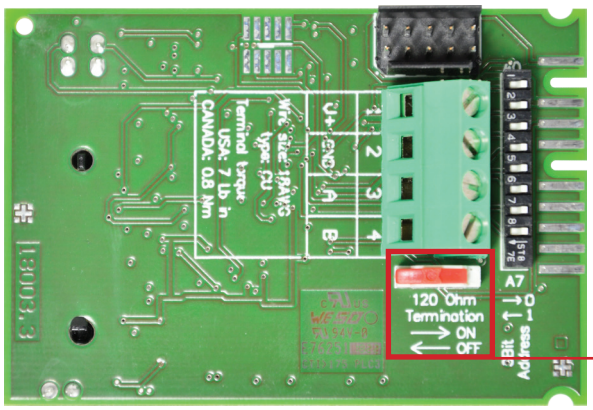
Important:
- After changing the factory setup (output signal and/or output scale) the original type number on the EE850 identification label loses its validity; it does not match any longer the device setup.
- The return to factory setup function of EE-PCS restores the original adjustment/calibration of the device, but does not affect the user setup for output signal and output scale.

The Product Configuration Software (EE-PCS) is available for free download at www.epluse.com/configurator.

DIGITAL SETTINGS

Bus Termination Resistor

Hardware:
The bus termination shall be realized with the 120 Ohm resistor (slide switch on the board).

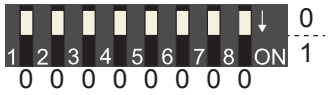


Bus termination resistor 120 Ω (ON-OFF slide switch)

Very important:
For proper function the power supply must be strong enough to ensure supply voltage within the specified range (see technical data) at any time and at all devices in the bus. This is particularly relevant when using long and thin cables which can cause high voltage drop. Please note that a single EE850 requires peak current of 350 mA.

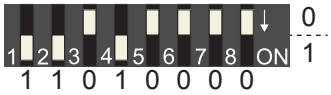
Address Setting

Address Switch



Address setting via EE-PCS Product Configuration Software:
All DIP switches at position 0 → address has to be set via PCS
Modbus (Slave device): factory setting EE850: 67 (permitted values: 1…247).
BACnet (Master device): factory setting EE850: 67 (permitted values: 0…127).
Example: Slave address is set via configuration software.

Address Switch



Address setting via DIP switch:
Modbus (Slave device): Setting the DIP switches to any other address than 0, overrules the slave address set via configuration software (permitted values: 1…247).
BACnet (Master device): Setting the DIP switches to any other address than 0, overrules the slave 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: Slave address set to 11 (= 0000 1011 binary).

BACnet Setup

Please see PICS (Product Implementation Conformance Statement) - available on www.epluse.com/EE850

Modbus Setup

The measured values are saved as a 32 bit float value and 16 bit signed integer.

The EE850 factory setting for the slave-ID (Modbus address) is 67 as an integer 16 bit value.

This ID can be changed by the user in the register 60001 (0x00), permitted values are 1…247.

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

The firmware version is located at register address 30009 (bit 15...8 = major release; bit 7...0 = minor release).

FLOAT (read register):

Function code / Register number[1] [Dec]	Register address[2] [HEX]	Parameter name	
31003	0x3EA	Temperature	[°C]
31005	0x3EC	Temperature	[°F]
31021	0x3FC	Relative Humidity	[%]
31061	0x424	CO_2 average	[ppm]
31063	0x426	CO_2 RAW	[ppm]
31101	0x44C	Water vapour partial pressure	[mbar]
31103	0x44E	Water vapour partial pressure	[psi]
31105	0x450	Dew point temperature	[°C]
31107	0x452	Dew point temperature	[°F]
31113	0x458	Absolute humidity	[g/m³]
31115	0x45A	Absolute humidity	[gr/ft³]
31121	0x460	Mixing ratio	[g/kg]
31123	0x462	Mixing ratio	[gr/lb]
31125	0x464	Specific enthalpy	[kJ/kg]
31127	0x466	Specific enthalpy	[ft lbf/lb]
31129	0x468	Specific enthalpy	[BTU/lb]
31131	0x46A	Frost point temperature	[°C]
31133	0x46C	Frost point temperature	[°F]

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

INTEGER (read register):

Function code / Register number[1] [Dec]	Register address[2] [HEX]	Parameter name	
34002	0xFA1	Temperature	[°C] * 100
34003	0xFA2	Temperature	[°F] * 50
34011	0xFAA	Relative Humidity	[%] * 100
34031	0xFBE	CO_2 average	[ppm] * 1
34032	0xFBF	CO_2 RAW	[ppm] * 1
34051	0xFD2	Water vapour partial pressure	[mbar] * 10
34052	0xFD3	Water vapour partial pressure	[psi] * 1000
34053	0xFD4	Dew point temperature	[°C] * 100
34054	0xFD5	Dew point temperature	[°F] * 100
34057	0xFD8	Absolute humidity	[g/m³] * 10
34058	0xFD9	Absolute humidity	[gr/ft³] * 10
34061	0xFDC	Mixing ratio	[g/kg] * 10
34062	0xFDD	Mixing ratio	[gr/lb] * 10
34063	0xFDE	Specific enthalpy	[kJ/kg] * 1
34064	0xFDF	Specific enthalpy	[ft lbf/lb] * 1
34065	0xFE0	Specific enthalpy	[BTU/lb] * 1
34066	0xFE1	Frost point temperature	[°C] * 100
34067	0xFE2	Frost point temperature	[°F] * 100

*__xxx__ is the facory scaling of stored value
*100 is the scale 1:100 (e.g. 2550 is equivalent to 25.5 °C)
*50 is the scale 1:50 (e.g.: 2550 is equivalent to 51 °F)
*10 is the scale 1:10 (e.g.: 135 is equivalent to 13.5 mbar)
*1 is the scale 1:1 (e.g.: 800 is equivalent to 800 ppm)

INTEGER (write register):

Function code / Register number[1] [Dec]	Register address[2] [HEX]	Parameter name
60001	0x00	Slave-ID (modbus address)*
60002	0x01	Modbus protocol settings**

* If the ID is set via DIP-Switch the response will be NAK.
** For Modbus protocol setting please see Application Note Modbus AN0103 at www.epluse.com

INFO (read register):

Function code / Register number[1] [Dec]	Register address[2] [HEX]	Parameter name
30001	0x00	Serial number (as ASCII)
30009	0x08	Firmware version

MODBUS RTU EXAMPLE

Example of MODBUS RTU command for reading the CO_2 (float value) CO_2 = 1288,34375 ppm from the register 0x424

Device EE850; slave ID 67 [43 in HEX]
Reference document, chapter 6.3: http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf

Request [Hex]: 43 03 04 24 00 02 8A 12

	Modbus ID address	Function code	Starting address Hi	Starting address Lo	No. of register Hi	No. of register Lo	CRC	
Request [Hex]:	43	03	04	24	00	02	8A	12

Response [Hex]: 43 03 04 0B 00 44 A1 68 AB

	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]:	43	03	04	0B	00	44	A1	68	AB

Mobus floating point format

For decoding of float values (stored according standard IEEE754), please refer to AN0103, chapter 7

7.2 Modbus floating point format

E+E devices use the Modbus floating point format. 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
44 A1 0B 00	1288.34375

Protocol setting:
Address, baudrate, parity and stop bits can be set via:
1. Product Configurator Software (available on www.epluse.com/ee850)
2. Modbus protocol (please see Application Note Modbus (available on www.epluse.com/ee850)

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)

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