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USER GUIDE

EE872 – Modular CO_2 Probe for Demanding Applications

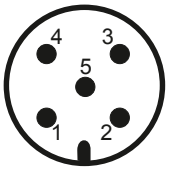
SCOPE OF SUPPLY

- EE872 probe according ordering guide
- Test report according to DIN EN10204 - 2.2

CAUTION

- The EE872, and most of all the sensing module and the filter cap shall not be exposed to extreme mechanical or thermal stress.
- The device must be operated with properly mounted filter cap at all times.
- The EE872 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.

CONNECTION DIAGRAM



front view
device plug

Pin number	*Function*	*Wire colors for accessories: - Couplig flange HA010705 - Connection cable HA010819/820/821*
1	supply voltage	brown
2	B RS485 (D-) or voltage output	white
3	GND	blue
4	A RS485 (D+) or current output	black
5	configuration pin	gray

SELECTION BETWEEN ANALOGUE OUTPUT AND RS485 INTERFACE

EE872 originally set to analogue output (factory setup or via EE-PCS, see „Setup and Adjustment“ below).
If the configuration pin is not connected, the RS485 interface is active for the first 10 seconds after power on, and awaits connection with the EE-PCS Product Communication Software. This allows for setup changes or adjustment of the EE872. If the connection to EE-PCS is not established during 10 seconds, the device changes automatically to analogue output.

If the configuration pin is connected to the GND, EE872 features analogue output starting from power on.

EE872 originally set to RS485 interface (factory setup or via EE-PCS, see „Setup and Adjustment“ below).
If the configuration pin is not connected, the EE872 features always RS485 interface.

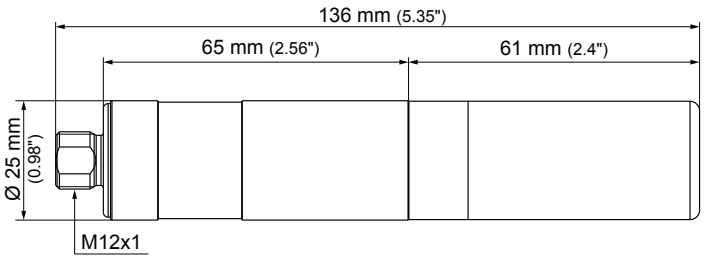
If the configuration pin is connected to the GND, EE872 features analogue output starting from power on.

FACTORY SETUP ANALOGUE OUTPUTS

Analogue outputs factory settings according ordering guide (see datasheet at www.epluse.com/EE872):

Order code	*Voltage output*	*Current output*
GA7	0-10 V	4-20 mA
GA11	0-5 V	0-20 mA

DIMENSIONS



INSTALLATION

Best measurement performance is achieved when the entire probe is located inside the environment to be monitored.
In such a case, the EE872 may be for instance fixed onto a wall with the **mounting clip HA010227** (not included in the scope of supply, see data sheet “Accessories”), or freely hang from the ceiling onto the connection cable.

The probe can be installed also into a partition wall using the stainless steel **mounting flange HA010226** (not included in the scope of supply, see data sheet “Accessories”).
For large temperature (T) difference between the two sides of the wall, T gradients may appear along the probe. Although the CO_2 measurement is T compensated, large T gradients may still impact on the accuracy.
For minimizing this effect place thermal isolation material around the probe looking out of the wall (on the connector side).

EE872 with mounting flange HA010226

EE872 with mounting clip HA010227

SETUP DIGITAL INTERFACE RS485 / MODBUS RTU

ID address, baud rate, parity and stop bits can be set via:
1. EE-PCS, Product Configuration Software and the appropriate configuration cable.
2. Modbus protocol in the register 60001 (0x00) and 60002 (0x01).
   See Application Note Modbus AN0103 (available on www.epluse.com/EE872)

The EE872 factory setting for the slave-ID (Modbus address) is 237 as an integer 16 bit value.
The measured values are saved as a 32 bit float value.
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	
31061	0x424	CO_2 average	[ppm]
31063	0x426	CO_2 RAW	[ppm]

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
30008	0x08	Name

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[3]

1) Register number starts from 1 2) Register address starts from 0
3) For Modbus protocol setting please see Application Note Modbus AN0103 at www.epluse.com

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 EE872; slave ID 237 [ED in HEX]
Reference document, chapter 6.3: http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1b.pdf

	Modbus ID address	Function code	Starting address Hi	Starting address Lo	No. of register Hi	No. of register Lo	CRC	
Request [Hex]:	ED	03	04	24	00	02	93	9C

	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]:	ED	03	04	0B	00	44	A1	27	61

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.

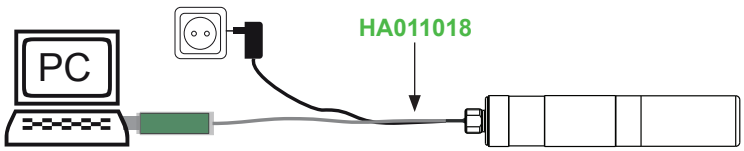
MMMMMMMM	MMMMMMMM	SEEEEEEE	EMMMMMMM
Byte 3	Byte 4	Byte 1	Byte 2

Example:

Response [Hex]				Value in decimal
Byte 1 (Register 2 - Hi)	Byte 2 (Register 2 – Lo)	Byte 3 (Register 1 - Hi)	Byte 4 (Register 1 - Lo)	
44	A1	0B	00	1288.34375

SETUP AND ADJUSTMENT

The EE872 is ready to use and does not require any configuration by the user. The factory setup of EE872 corresponds to the type number ordered. For ordering guide please see data sheet at www.epluse.com/EE872. If needed, the user can change the factory setup by using the USB configuration adapter (order code HA011018) and the EE-PCS, Product Configuration Software.
One can change the CO_2 output signal (analogue to digital and vice versa), the scaling of the analogue outputs, the digital settings and perform CO_2 adjustment.
In addition, is it possible to enable or disable the pressure compensation (factory setting: enabled), the NAMUR error indication (factory setting: disabled) and the heating of sensing module (factory setting: enabled).



EE-PCS PRODUCT CONFIGURATION SOFTWARE

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

ERROR INDICATION ON THE ANALOGUE OUTPUT (NAMUR)

The EE872 features an error indication on the analogue output according to NAMUR recommendations (factory settings: disabled)
The feature can be enabled with the EE-PCS Product Configuration Software, see above.

Output signal	*NAMUR signal level*
0-5 V	5.5 V
0-10 V	11 V
4-20 mA	21 mA
0-20 mA	21 mA

MAINTENANCE

REPLACING THE SENSING MODULE EE872S

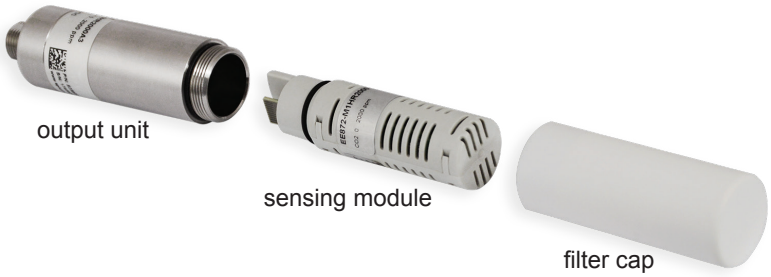
If needed, the sensing module can be replace with new one:

		EE872S-
Model	CO_2	M10
CO_2 range[1)]	0...2000 ppm	HV1
	0...5000 ppm	HV2
	0...1% (10000 ppm)	HV3
	0...3% (30000 ppm)	HV5
	0...5% (50000 ppm)	HV6

1) The CO_2 range of the EE872S must be the same as of the original EE872 probe.

Very important: The sensing module EE872S must feature same CO_2 measuring range as the original EE872 probe! If the measuring range of the replacement module and of the original EE872 probe are different, the analogue output will stay at 4 mA, 0 V or NAMUR error indication while the CO_2 reading via RS485 interface will be 0 ppm.

- Remove the filter cap by turning it counter-clockwise.
- Remove the sensing module by pulling it straight out from the output unit.
- Plug the new EE872S sensing module into the output unit
- Screw the filter cab fingertight onto the probe.



CHANGING THE FILTER CAP

In a dusty, polluted environment it might be necessary to replace the filter cap once in a while. In most of the cases, a clogged filter shows visible contamination or dirt. Longer response time of the CO_2 measurement also indicates a clogged filter cap. In such cases, replace the filter by a new, original one, see data sheet " Accessories":

- PTFE filter cap **HA010123**
- Catalytic filter cap for H_2O_2 sterilization **HA010124**

Turn the filter cap counter-clockwise for removing it.
Install the new filter cap fingertight by turning it clockwise.

EE872 ADJUSTMENT OR CALIBRATION WITH REFERENCE CO_2 GAS

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

For EE872 calibration or adjustment with reference CO_2 gas use the calibration adapter HA010785 (not included in the scope of supply, see data sheet "Accessories").
- Remove the filter cap and install the calibration adapter onto the probe.
- Connect the calibration gas to one of the two connection nipples. The gas fed into the calibration adapter will freely flow out through the second nipple.


calibration adapter
HA010785


rubber caps

Note:
The calibration adapter can also be used as a **protection cap**, for instance during cleaning operations.
For this, close both nipples with the supplied with rubber caps.

TECHNICAL DATA

Measurand

CO_2 measurement principle	Dual wavelength non dispersive infrared (NDIR)	
Measurement range Accuracy at 25 °C (77 °F) and 1013 mbar (14,69 psi)	0...2000 ppm: 0...5000 ppm: 0...10000 ppm:	< ± (50 ppm + 2 % mv) *mv = of the measured value* < ± (50 ppm + 3 % mv) < ± (100 ppm + 5 % mv)
	0...3 %: 0...5 %:	< ± (1.5 % from full scale + 2 % mv)
Response time t_{63} [1)]	90 s	
T dependency, typ. (-20...45 °C) (-4...113 °F)	± (1 + CO_2 concentration [ppm] / 1000) ppm/°C, for CO_2 <10000 ppm -0.3 % mv / °C, for CO_2 > 10000 ppm	
Residual pressure dependency [2)]	0.014 % mv / mbar (ref. to 1013 mbar)	
Measurement interval	15 s (user adjustable from 15 s to 1 h)	
Long term stability, typ. at 0 ppm CO_2	20 ppm / year	

Outputs

Analogue	0 - 5 V / 0 - 10 V 0 - 20 mA / 4 - 20 mA (3-wire)	-1 mA < I_L < 1 mA R_L ≤ 500 Ohm R_L = load resistance
Digital interface	RS485, max. 32 unit load devices on one bus (EE872 = 1/10 unit load)	
Protocol	Modbus RTU	

General

Supply voltage	15 - 35 V DC for current output 12 - 30 V DC for voltage output and RS485 interface
Average current consumption at 12 V DC and 15 s measurement inverval	45 mA for 20 mA output current 25 mA for voltage output and RS485 interface
Peak current	max. 200 mA
Enclosure material	plastic (PET), UL94HB approved or stainless steel 1.4404
Filter cap material	PTFE, UL94V-0 approved
Protection class	IP65
Electrical connection	M12 x 1, stainless steel 1.4404
Electromagnetic compatibility (Industrial enviroment)	EN61326-1 EN61326-2-3
Operating and storage conditions	-40...60 °C (-40...140 °F) 700...1100 mbar (10.15...15.95 psi) 0...100 % RH (operation, with enabled heating) 0...95 % RH non condensing (storage)

1) With data averaging algorithm for smooth output signal. Faster response time available upon request.
2) The pressure dependency of a device without pressure compansation: 0.14 % mv / mbar.

USA
FCC notice:

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 thereceiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CANADIAN
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