P4000 Particulate matter probe Installation manual

Ver	Date	Modification / Update
V1	Initial	Version Initial/Initial version
V2	04/2015	Stop bits settable for RTU version
V3	27/04/2015	EnOcean version added
V4	26/10/2015	White board and DC only

Summary

1. Security

WARNING
Danger of death, risk of electric shock and fire!
The installation should only be undertaken by a qualified electrician!

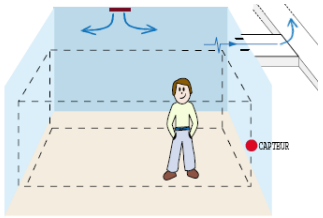
To apply for correct bus and power cables and to activate the device, comply with the state of the art and standards.

Any intervention or modification to the device will invalidate any warranty claim.

• Use the probe only with secured low voltages!
• Use an external 12 to 24VAC or DC power supply capable of delivering 60mA per probe and ensuring a peak voltage under 40V.

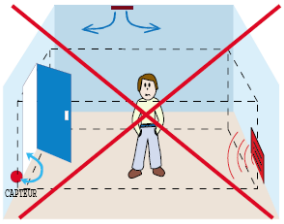
2. Positioning

The position of the probe is crucial vis-à-vis efficiency and energy savings for ventilation.



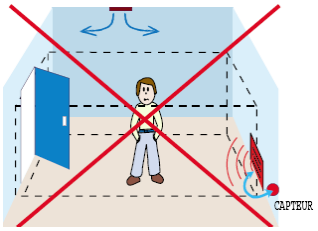
• The probe is designed to ensure air quality; it must be placed in the area of occupancy of the premise served by outlet vents, on a wall at eyes level (breathing human level, between 1.5 and 1.8m).

• Avoid drafts (near openings, blowing air, doors, outlet vents) and dead zones (niche, shelves and curtains).



• Avoid orthogonal walls (corners of room in particular)

• Avoid heat sources and the proximity of occupants (radius of 1 m from workstation).



• Avoid direct exposure to sunlight.

• Position the sensor vertically on a wall or partition.
This device is not intended for installation in duct or ceilings.

Any work not in accordance with this documentation or changes to the device will invalidate all warranty claims.

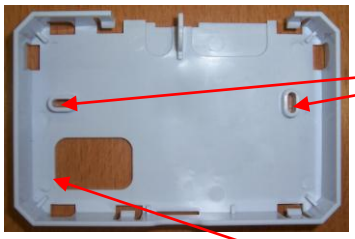
3. Installation

Remove the printed circuit board

Attach to the wall through two holes in the case.

TOP

Take care of case orientation (TOP –BOTTOM)



Screws with flat heads, diameter 3mm

BOTTOM

Make sure to position the hole of cables path at the case bottom

Be careful from white mother board in L versions, and no longer the green version in U (May 2015), the fixing screws are located under the electronic board. You shall make sure that the screw heads do not exceed 1.5 mm to avoid touching the card. Flat head screws are recommended.

4. Wiring

Be careful, wiring must be sealed. Incoming air, even slight, would seriously jam the temperature, humidity and air quality measures.

When the switchboard is located in the heated volume: caulk arrivals between cables and ducts at the switchboard level.

When the switchboard is out of the heated volume, caulk between cables and ducts before entering the heated volume. A sealing plug must also be placed between duct and cable reaching the P4000 probe to prevent air entry.

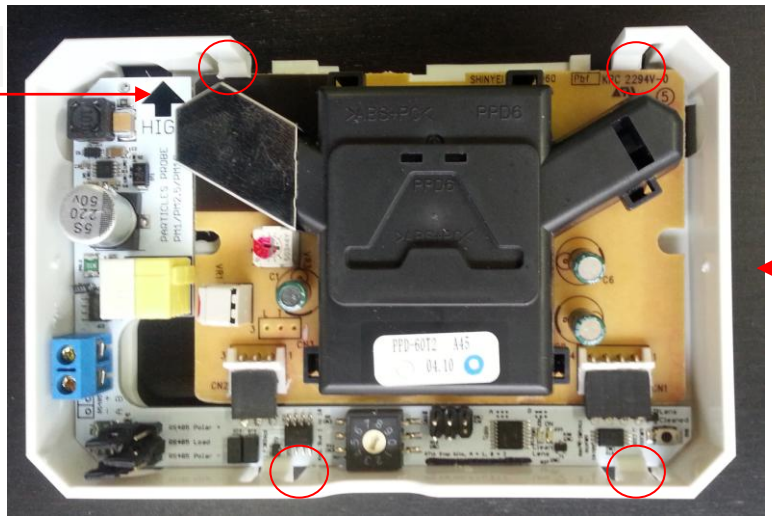
When the sealing of the duct is not possible, use a specific sealant.

In case of use of electrical box, select an airtight case with sealing membrane from which the duct passes through. If the case crosses through the sealing plane (plasterboard), seal between the casing and panel with a special sealant without silicone and VOC.

5. Motherboard preparation

Clip the mother board into the case

The arrow on the board indicates the top position



Case

6. Connecting

6.1. Power Supply

6.1.1. Power Supply Characteristics

Use a power supply between 12 and 33V DC with a fluctuation of max value of less than 10%, preferably a DIN rail regulated one.

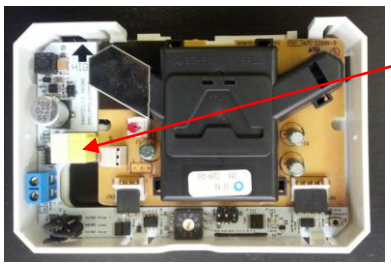
AC compatibility is available on request.

Make sure the voltage does not overpass 33V DC before connecting to the P4000 probe.

Take into account the voltage drop in cable to assess the consumption of each sensor.

Consumption is about 1W. This power is primarily used to heat the air thanks to a resistor for generating an upward air flow in the sensor.

6.1.2. Power supply connection

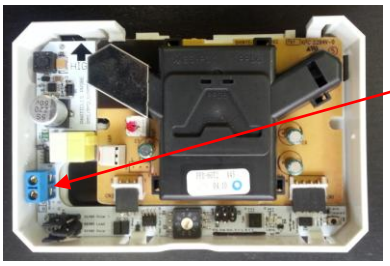


Power supply connector
From 12 to 33V DC

It is recommended to connect one pole of the power supply to the ground.

The power supply connector is designed for monofilament cables from 0,6 to 0,8 mm of Ø. Reveal the wire on 5 mm. Respect the polarity.

6.2. Connecting to the Bus



Measures and orders are transmitted via the RS485 Modbus. The cable must be twisted. For the selection of cable refer to §Choosing Bus Cable page 9.

For more details on the connection, see annex § Installation of BUS connections.

7. Powering

When switched on, the red status LED flashes once quickly for the ASCII version, twice for the RTU version and once for the EnOcean version.

This LED is used to indicate if the optical needs to be cleaned.

8. EnOcean Pairing

For the EnOcean version once the probe started, a short press on the push button sends a pairing telegram. The maintenance LED flashes briefly one time. For this step, the LED indicating the need to clean the lens must be turned off.

9. EnOcean Transmission rate

The coding wheel is used to manage the transmission rate of the EnOcean telegrams. In normal mode (position 0) the probe emits every 30 seconds and the sensor heater is continuously powered. Other modes wake the sensor at a defined rate:

Position	Operating mode	10measures every: Lifetime of the sensor	
0	Normal (permanent)	continuous	7 years
1	Intermittent	15mn	10 years
2	Intermittent	30mn	28 years
3	Intermittent	1h	> 40 years
4	Intermittent	2h	> 40 years
5	Intermittent	3h	>> 40 years
6	Intermittent	6	>> 40 years
7	Intermittent	12h	>> 40 years
8	Intermittent	24	>> 40 years
9	Intermittent	48h	>> 40 years

At each wake up, the probe waits 5 minutes to stabilize the airflow and sends a measurement every 30 seconds 10 times (so during 5 minutes) and then returns to sleep mode.
Be careful the rotary switch is read at startup and cannot be changed when powered

10. Completion of installation

By clipping the cover (the cover is symmetric and therefore can be mounted upside down)

11. Maintenance

The more the sensor is exposed to dust the more it shall be serviced (cleaning lenses with a wet cotton swab). Do not use alcohol or solvents. Use only clean water.
This sensor does not have a reference beam to compare with the one exposed to dust using therefore cumulative sensor exposure to dust is used to determine preventive maintenance timing. When cumulative exposure is exceeded, an LED indicates the need for cleaning.
After cleaning the lens, the counter will be reset by pressing a button (more than 10 seconds). Acknowledgement is indicated by the turn off of the LED.

The service time is:

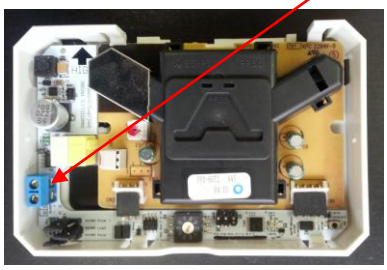
PM2.5 Average	**Each**
< 5 µg/m^3	5000 Days
< 10 µg/m^3	2500 Days
< 25 µg/m^3	1000 Days
< 50 µg/m^3	500 Days

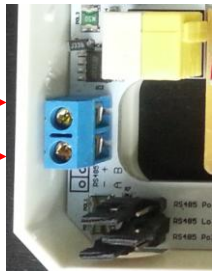
ANNEXES

1. Installation of BUS connections

1.1 RS485

RS485 Modbus





<u>*: It is possible to connect to the « - » of the power supply</u>

RS485 Modbus connection is not optically isolated. Therefore, you must pay special attention during the installation procedures that they do not cause communication failures or does not damage the RS485 coupler. Follow the points in the table below to ensure proper operation of your communication.

1 Use a shielded bus cable and connect one end of the shield to ground. Make sure, wherever possible, that there is no break in the cables. If this is not possible, you must have shield continuity consistent with the EMC at the connection points.

2 Keep RS485 cables away from other cables like power cables for example.

3 <u>Connect the shielding to one end grounded</u> to ensure equipotentiality of the shield.
No other grounding is required.
It is possible to connect the shield to ground by connecting to the 0V of the power supply. This can be achieved by connecting the cable shield of the bus to the – of the power terminal.

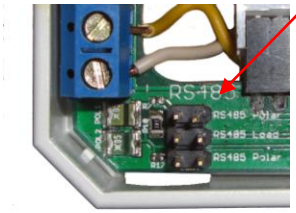
THE SHIELD BUS CAN BE CONNECTED TO THE "-" OF THE BUS.

4 Make sure electrical signals are correct for the bus cable. This sets the resting level of the signal between two posts and is important for identifying the beginning of a message. The P4000 probe produces a 5V electrical signal. The voltage between the data lines + (B) and - (A) should be between 0.5 and 1V.

5 For bus cable lengths over 100m, make sure to activate the bus termination at both ends. A bus termination on one side only is sufficient for short distances. Bus termination, on P4000 probe side, is provided by a jumper (see picture below).

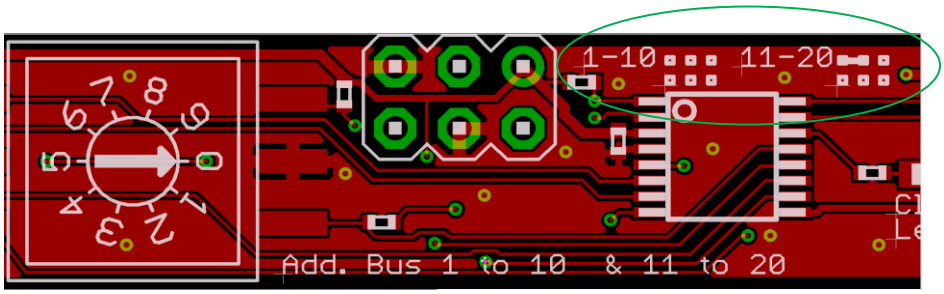
6 The polarization of the bus is also highly recommended using the two other jumpers.
RS485 standard requires a differential level of 200 mV for the signal detection. If the RS485 is not polarized, this level will not be reached at rest (without communication on the line) and then the operation will not be guaranteed. For this, a bias is applied <u>to only one point of the bus</u>. It is preferably applied to the master side.

Activation of the bus 485 termination and polarization by placing three jumpers.



1.2 Programming the physical address

It is possible to program directly the probe address by using the rotary switch.
The bus address is selectable from 1 to 20 for the ASCII version and 1 to 10 for the RTU version
The zero of the encoder is either 10 or 20
ASCII version:
To go in the 11-20 range, the jumper shall be positioned as shown below.
Warning: the address is determined at startup. Any change under voltage will not be taken into account.



1.3 Control On Off

The probe can be turned in sleeping mode by a BUS command. By default, at power On, the sensor is in continuous operation. During the sleeping period, consumption is reduced and the sensor is no longer powered. For each controlled wake up, the probe waits 5 minutes to stabilize the air flow and during the stabilization timeof the air flow, the measurements returned by the sensor are at zero.
The sensor life is extended according to the rhythm of wakes. See EnOcean transmission rate chapter 9.

1.4 Stop bits setting

For the RTU version, the here above jumper is used to set the number of Stop bits:

- No jumper: 1 stop bit
- Jumper : 2 stop bits

Warning: the configuration is determined at startup. Any change under voltage will not be taken into account.

1.5 Choice between RTU and ASCII

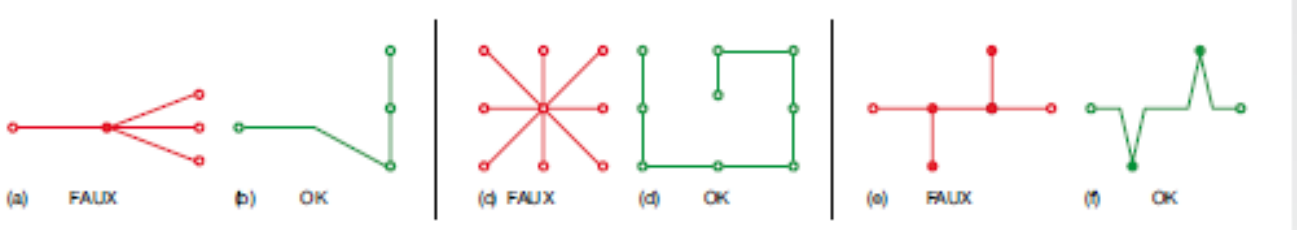
The choice between RTU and ASCII must be determined in the purchase order and depends on the firmware. It is not possible to change the firmware without a special programming tool..

1.6 Choosing Bus Cable

The RS422 standard recommends 24AWG (0.23mm2) twisted pair cable with a capacity of 16 pF shunt per foot and 100 ohm characteristic impedance. Although the standard does not specify anything for RS485 wiring, the cable can perfectly be used for RS485.

1.7 Topology

The topology of RS485 cabling must be observed. The cable must go to the first bus coupler device, leave the first device to the second, etc. .. until the last device.
The topologies in tree, branch or star are not allowed.



For diagram (e) however a diversions greater than 30 cm is tolerated (vertical links in the diagram (e)).

2. Specification

Interface:

- Digital output RS485 Modbus (see document on the Modbus protocol for details)
  Modbus ASCII or RTU (to be specify when ordering)
  E4000 IAQ probe compatible for EnOcean, LON or KNX interface (ASCII only)
  20 selectable BUS addresses (1 to 10 and 11 to 20 with a jumper in ASCII only).
  Number of stop bits selectable (1 or 2 with a jumper in RTU version only)

- EnOcean
  EEP: 4BS: A5-09-07
  Pairing with push button.

Densities of PM1, PM2.5 and PM10 expressed in µg/m^3
Density of PM1, PM2.5 and PM10 also expressed in number/m^3 (but EnOcean)
Measuring range 0-950 µg/m3 and 0-65 535 000 particles /m^3
Resolution 1µg/m^3 and 1000 particles per m^3
Running average on 30 seconds
The sensor cannot see particles below 0.5µm
Power supply 12 to 24V DC or AC
Power: 1W
Operating Temperature: 0 to 45 °C
Storage temperature: -30 to 60 °C
Lifespan: 7 years (in continuous)

The unit complies with European Directives 73/23/EEC (Low Voltage Directive) and 89/336/EEC (EMC Directive).

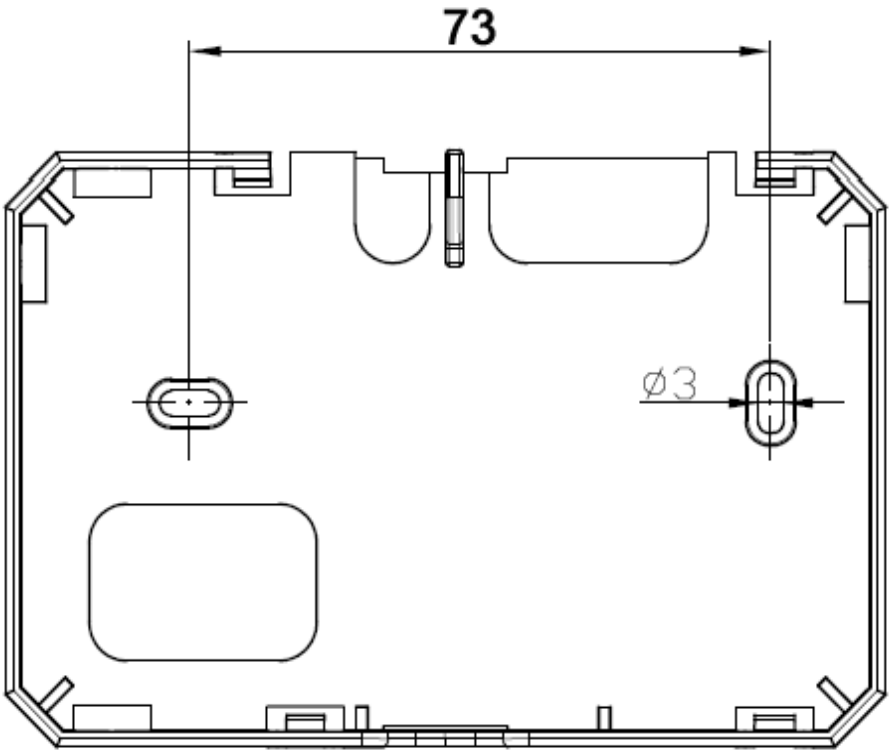
3. EnOcean Profile

RORG	**A5**	**4BS Telegram**
FUNC	**09**	**Gas Sensor**
TYPE	**07**	**Particles**

Status: Approved Aug 16, 2011

Offset	Size	Bitrange	Data	ShortCut	Description	Valid Range	Scale	Unit
0	9	DB3.7...DB2.7	Particles	Part	Particles < 10µm (PM10)	0 .. 511	0..511	µg/m3
9	9	DB2.6...DB1.6	Particles	Part	Particles < 2.5µm (PM2.5)	0 .. 511	0..511	µg/m3
18	9	DB1.5...DB0.5	Particles	Part	Particles < 1.0µm (PM1)	0 .. 511	0..511	µg/m3
27	1	DB0.4						
28	1	DB0.3	LRN bit	LRNB	LRN Bit	Enum: 0 : Teach-in telegram 1 : Data telegram		
29	1	DB0.2				0/1 : PM10 active (*)		
30	1	DB0.1				0/1 : PM2.5 active (*)		
31	1	DB0.0				0/1 : PM1 active (*)		

DRILLING



This drawing is at scale one and can be use directly for drilling in removing the sheet.

