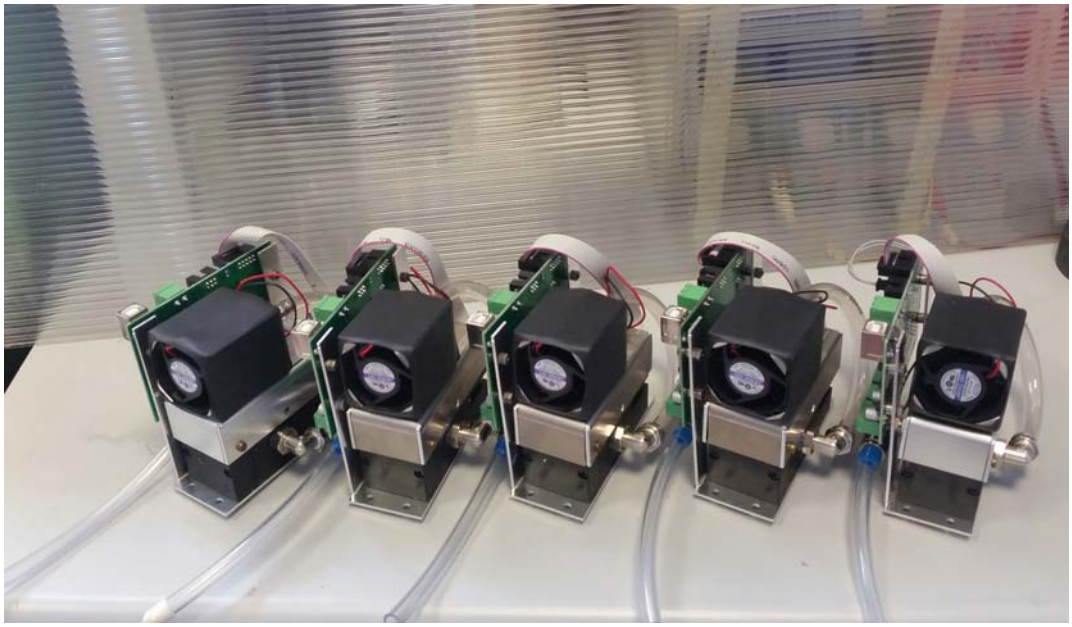
PM (particulate matter) O.E.M. sensor

Technical Note



Measuring Method

Qbit O.E.M. PM sensors are based on “Laser Light Scattering” measurements. Particulate Matter under test (selected by a filter) is flown inside an interaction cell and the scattered light from a stable laser source is precisely measured. This method enables a real-time detection of the Particulate Matter concentration but it is not a direct measurement of the PM mass. The level of scattered light is in fact proportional to the PM density given precise chemical and physical properties and given a stable dimensional distribution.

The electro-optic level value has to be converted into a mass concentration via a calibration procedure. The PM mass concentration value precision is thus related to the precision with which the calibration sample is close to the samples under test in the site and at the time of the measurements.

Operating specs

Parameter	**Value**	**Unit**	**Note**
Supply Voltage	5 e 12	V_{dc}	
Maximum Power Load (5V)	<0.5	W	For control electron ics supply
Maximum Power Load (12 V)	<2	W	For fan and laser supply
Measure Time Interval	1-600	sec	FW selectable
Zero Drift	<0.15	($\mu g/m^3$)/°C	Manual calibration procedure

Resolution & Accuracy of the Measurement Signals

Quantity	Value	Unit	Note
PM signal resolution	1/4096	Full scale	(1)
PM signal accuracy	<1%	Full scale	On the full range of measure times (2)
Maximum PM range	10000	µg/m^3	Factory selectable (3)
Temperature resolution	0.01	°C	(4)
Temperature accuracy	0.3	°C	(4)
Pressure resolution	0.01	kPa	(4)
Pressure accuracy	0.5	kPa	(4)
Rel. Humidity resolution	0.04	%	(4)
Rel. Humidity accuracy	+/- 2	%	(4) For rel. humidity in the range 20% - 80%

(1) As previously pointed out, resolution and accuracy are referred to the electronic measurement signal produced by the PM sample flown in the optical cell. The corresponding specs defining the mass value of the PM originate from a calibration procedure that is related to the nature of the sample dust tested (for instance carbon particles, typical in winter atmosphere in towns, produce an optical signal higher that the silicon-dioxide based dusts more common in summer). Mass concentration accuracy in a specific site and in a specific period, has to be evaluated referencing the optical measurement to a primary (gravimetric method) instrument on a time interval of several hours.

(2) The longer is the measuring time interval the better results the measurement accuracy. For measure time intervals longer than 10 seconds, accuracy can be better than 10^{-3} of the full scale.

(3) The standard (factory selected) range corresponds to a full scale concentration of 1500 µg/m^3 . Thus considering note (2) we obtain:
Measurement accuracy better than 2 µg/m^3 on intervals of 10 sec and above;
Measurement accuracy better than 0.5 µg/m^3 on hourly averages.

(4) Optional.

Dimensions and weight

O.E.M. sensor (optical cell+fan+PCB) 85 mm x 100 mm x 110 mm

Weight 500 g (approx.)

Standard O.E.M. purchase:

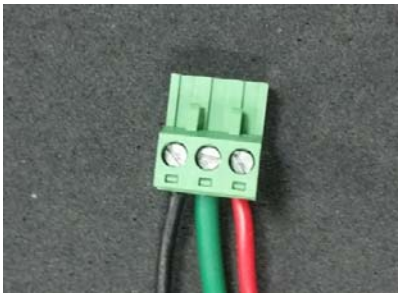
- **1 year warranty**

ELECTRIC WIRING:

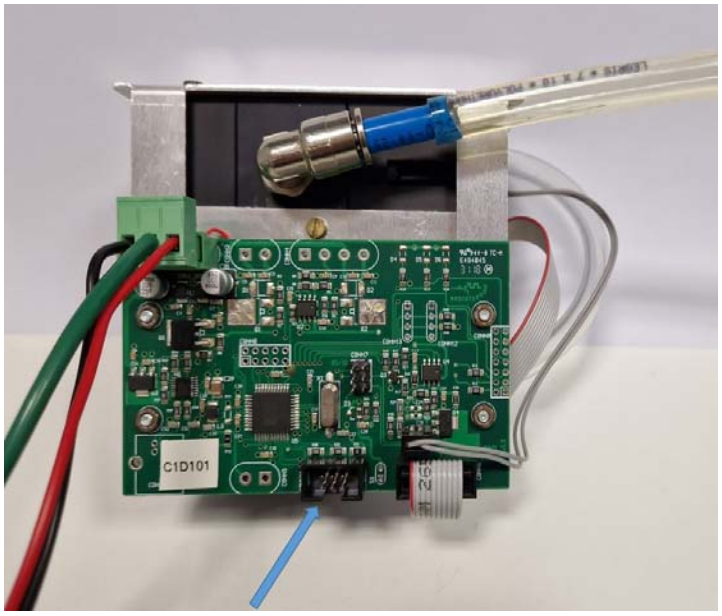
Power supply:

5V (> 50 mA) PCB power supply

12V (> 150mA) Fan power supply

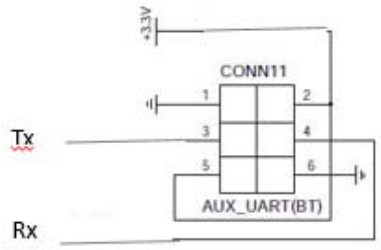


On the three-way plug-in connector shown in the figures:
Black = GND ; Green = 5V ; Red=12 V



UART (3.3V):

on the black “box header” connector (6 pins) shown in the lower side of the figure (blue arrow). See the electric scheme reported in the following figure.

	The 3.3 V is an output pin that can be used to supply external USB or BLUETOOTH shields or other devices. Do not connect this pin if the device has its own power supply.

PNEUMATIC CONNECTIONS FOR SAMPLED AIR:

The laser sensor is equipped with two pneumatic fittings: the air outlet is directly connected to the fan case (which provides air exhaust). The other one is the sampled air inlet.

In the figure reported below, the (transparent) inlet tube is terminated with a zero-pass filter (with blue tube reduction). The use of such input filter allows the operator to perform the initial background calibration procedure, according to the following procedure.

1 Stop measurement session with the command "stop<CR><LF>"
2 Insert the zero-pass filter on the inlet tube
3 Calibrate the sensor with the command "c<CR><LF>". (duration approximately 12 times the measuring interval)
4 Remove the zero-pass filter
5 Re-start the measurement session with the command "start<CR><LF>"