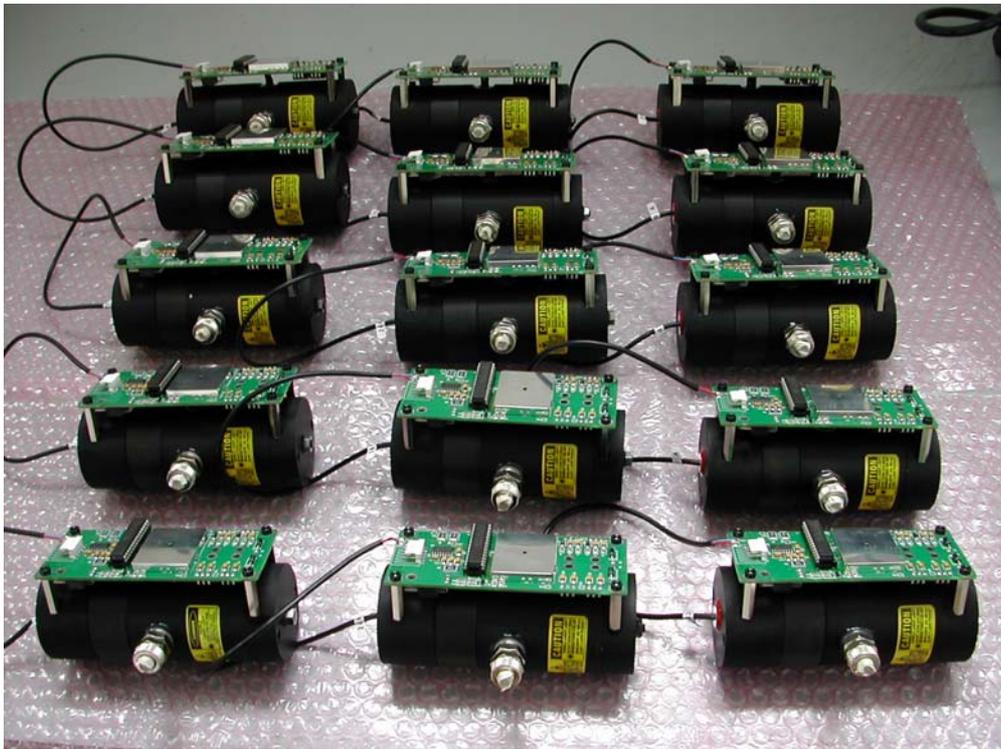


# OEM Laser scattering SENSORS for aerosol or micro-Dust concentration Measurements



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## **SENSOR SPECIFICATIONS :**

DETECTABLE Dust particles:

PM1 - PM10 depending on the mounted filters or cyclone-selectors.

Minimum detectable dust concentrations	PM 2.5	5 ( $\mu\text{g}/\text{m}^3$ )
	PM 10	1 ( $\mu\text{g}/\text{m}^3$ )
Measuring range	1- 10000 ( $\mu\text{g}/\text{m}^3$ )	
Response time	0.5- 1 (sec)	(1)
Gas flow	3 l/min	(2)
Gas Connections	Inlet diam. = 10 mm Outlet diam. = 6 mm	
Power Supply	+15/-15/0 V - 200 mA	
digital I/O	RS232	(3)

(1) the sensor response time can be set on customer demand. A faster response time means a lower detector precision.

(2) Sensor parameters are factory set for this flow rate. Particulate size determines the requested flow with Cyclone-selectors.

(3) Standard Baud-rate 19200 (it can be differently set on customer demand).

( Baud rate: 19200, Data bits: 8, Parity: none, Stop bits: 1, Device control: no)

### WARM-UP:

- Precise measures are reached after a 4 minutes warm-up time.

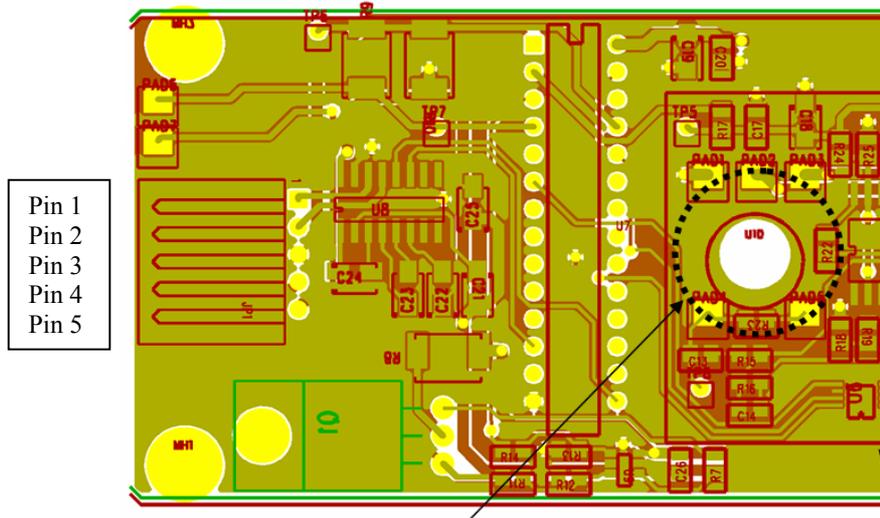


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## **BOARD CONNECTIONS:**



### **Sensor Board TOP View (connector JP1)**

- Pin #1:** RS232 tx from sensor board = rx from master PC (pin 2 RS232 std. connector)  
**Pin #2:** RS232 rx from sensor board = tx from master PC (pin 3 RS232 std. connector)  
**Pin #3:** GND = P.S. ground and RS232 ground (pin 5 RS232 std. connector)  
**Pin #4:** P.S. +15V  
**Pin #5:** P.S. -15V



## RS-232 command list:

INPUT	COMMAND DESCRIPTION	SENSOR OUTPUT
<b>M</b>	<b>Sensor Model:</b>	Sensor answers with its type and serial number. (e.g. <b>Mod. P-00XX</b> for Particulate measuring sensor s/n 00XX)
<b>r</b>	<b>Reset processor:</b> carries out diagnostics and sets parameters to factory values.	Sensor answers <b>rok</b> in case of positive diagnostics. It sends an error code <b>E00</b> if the detector signal optimization and diagnostics was not complete (ended with a time-out) (sensor operation is still possible) It sends an error code <b>E02</b> if the Laser source is not properly working and an error code <b>E03</b> if the Optical receiver is not properly working.
<b>c</b>	<b>Calibration:</b> carries out a manual zero setting (to be done in clean air ) lasts typically 30 seconds.	Sensor answers <b>cok</b> at the end of the calibration procedure.  When the detector answers with a warning message <b>W03</b> (or <b>W04</b> ), the measuring range will be reduced to 90% (80%) due to source and detector aging. (resolution will be reduced correspondingly).
<b>d</b>	<b>Detector zeroing:</b> carries out a fast zero setting( to be done in clean air ) lasts typically 2-3 second.	Sensor answers <b>dok</b> at the end of the calibration procedure.  When the detector answers with a warning message <b>W03</b> (or <b>W04</b> ), the measuring range will be reduced to 90% (80%) due to source and detector aging. (resolution will be reduced correspondingly).
<b>l</b>	<b>Low res. Measurement:</b> dust detection command. Answers in 0.5 seconds.	Sensor answers with a four digit string corresponding to the measured concentration in $\mu\text{g}/\text{m}^3$ (e.g. <b>0055</b> for $55 \mu\text{g}/\text{m}^3$ ) for factory settings of PM2.5 cyclone filter. <b>Different flow rates and filter settings quest for a scale recalibration.</b>  If the measurement was performed with a contaminated calibration, sensor sends a warning code <b>W05</b> , (thus a calibration cycle has to be performed in clean air).
<b>h</b>	<b>High res. Measurement:</b> precise dust measurement command. Answers in 1 second (different resolutions and response times available on request [factory selectable]).	Sensor answers with a four digit string corresponding to the measured concentration in $\mu\text{g}/\text{m}^3$ (e.g. <b>0055</b> for $55 \mu\text{g}/\text{m}^3$ ) for factory settings of PM2.5 cyclone filter. <b>Different flow rates and filter settings quest for a scale recalibration.</b>  If the measurement was performed with a contaminated calibration, sensor sends a warning code <b>W05</b> , (thus a calibration cycle has to be performed in clean air).

Please note that a correct detector zeroing must be performed with clear air passed through a proper filter (particle size cut  $0.2 \mu\text{m}$ ) such as Millipore SLFG05010 (see [www.millipore.com](http://www.millipore.com) ).

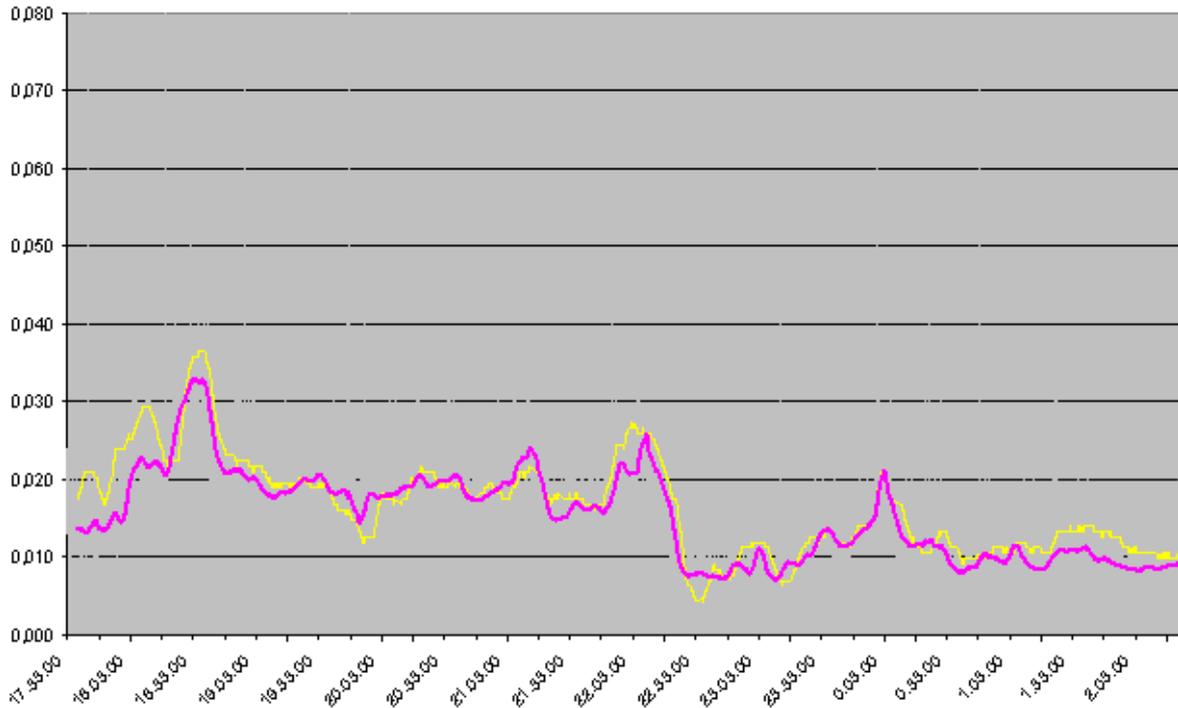


## ERROR & WARNING Message List:

Warning Message	Meaning	Counter-measure
<b>E00</b>	The RESET procedure ended with a time-out.	Please repeat one or more reset cycles. If the problem persist contact the factory.
<b>E01</b>	Laser source is working at a low radiation level.	Please repeat one or more reset cycles. If the problem persist contact the factory.
<b>E02</b>	The Optical receiver is not properly working	Please repeat one or more reset cycles. If the problem persist contact the factory.
<b>W03</b>	After the zeroing procedure a reduced Laser signal is detected.	The measuring range will be reduced to 90% due to source and/or detector aging. Resolution will be reduced correspondingly.
<b>W04</b>	After the zeroing procedure a reduced Laser signal is detected.	The measuring range will be reduced to 80% due to source and/or detector aging. Resolution will be reduced correspondingly.
<b>W05</b>	The measurement is not consistent with the zeroing procedure (the latter was probably affected by a polluted environment)	A zeroing procedure (either C or D command) in clean air (e.g. with a zero-dust filter) is to be performed.



Typical Data Samples (PM 2.5 concentration in air):



y-axis: PM 2.5 concentration [mg/m<sup>3</sup>]  
x-axis: time [h:m:s]

