Revised December 1st, 2003

Operation principle of dust-sensor technology

1 Operation Principle

Our **MAC*View***® Particles Sensor 2.02d operates on the principle of light scattering method. Emitted light from LED (located upper/right) has been focused with lens toward the sensing point (center).

The Particle sensor unit has a resistor (heater) to generate heat. Heat creates updraft (upward current of air)which draw air outside of the sensor into the sensor, and then air together with air-borne particles pass through the sensing point.
When particles pass from bottom to top with updraft, receptor (located upper/left) receives the flash from the particle. Receptor creates the pulse depending on each received flash from the sensing point. Pulse per unit time is proportional to the air-borne particles concentration.

Our sensor is designed to detect the particles whose size is over 0.85 micro meter, which means it can detect all circulating dust that that is dangerous for human lungs. This dust can stay in the lungs of human as well it can be breath out. Most of the dust such as tick, spore of mildew are over 1 micro meter.

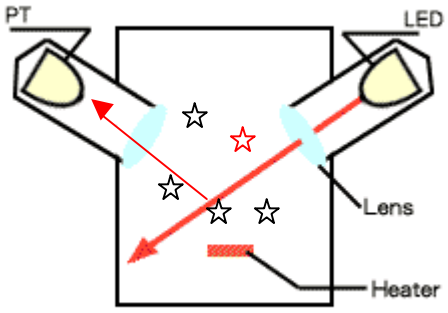


Figure 1 - Model of dust sensor

Raiffeisenstraat 24
4697 CG Sint-Annaland
The Netherlands

t +31 (0) 166 65 72 00
f +31 (0) 166 65 72 10

e info@macview.info
I www.macview.info

2 Calibration

The sensor unit has a small cap to cover the sensing area when it is shipped from us, in order to protect lens from dust. You may use this cap as it is to make completely dark condition in the sensing area, or you remove the cap and you will have a kind of door to fit it.

The lens needs to be cleaned depending on the condition. (Once a six months) Dust or for example cigarette tar or welding tar on the lens should affect the sensitivity of the sensor. Wet one side of the swab with water and rub the lens with it and then dry the lens with the other end of swab.

Our production process of the **MAC*View***®-Particles Sensor 2.02d includes calibration of every unit.

Figure 2 - **MAC*View***®-Particles Sensor 2.02d

Environmental Monitoring Systems (EMS) BV has done some calibrations on the 16th of November 2001 in a laboratory in Swiss

This laboratory is accredited by the Swiss Calibration Service SCS. The calibrations took up more than a day. In October 2001 we took up a day as well for several tests. After the final calibrations it was obvious that we appealed to the extreme accuracy of the calibration-formation.

The inaccuracy of the measurements of the **MAC*View***®-Particles Sensor 2.02d was within the absolute range of the measure error of the used calibration-formation. The results where far within the results necessary for applications as for example measuring in cleanrooms.

Raiffeisenstraat 24
4697 CG Sint-Annaland
The Netherlands

t +31 (0) 166 65 72 00
f +31 (0) 166 65 72 10

e info@macview.info
I www.macview.info

The calibration in Spiez was according the following procedure:

- First we made aerosols. This is a very good reproducible dust-like material.

  The advantage of this material is that the size and the amount is very good reproducible. Other materials does not have this specifications at all.
  The size of the aerosols is reproducible on several nanometers accuracy.

- An amount of aerosols is flowing through a big tube. This is important to get a good homogenous density of the aerosols. After this is mixed a sample is taken from the tube and is lead in a sampling system.

- This sample is then measured with an laser-beam. The dust particles or aerosols are count by a computer system.

- The dust is flowing through our MACView measurement device.

- During the measurement we compare the readout values of the calibration system with the readout values of the MACView measurement device. Errors which are measured are then compensated until the readout of the calibration system is equal with the readout of the MACView.

- This complete process is repeated for several other concentrations of aerosols.

In our own calibration system we compare the signals of the MACView which must be calibrated with the calibrated MACView version in Spiez. The signals are then adjusted until they have equal values.

In terms of absolute accuracy, an accuracy has been reached of +-7%. This is equal to the accuracy in the laboratory of Spiez which is a maximum of +- 7% overall accuracy. In terms what is permitted according to dust measurements an deviation of a number of ten times under or above in relation to the actual value is permitted. This implies that +-7% is far inside the admissible borders.

Raiffeisenstraat 24
4697 CG Sint-Annaland
The Netherlands

t +31 (0) 166 65 72 00
f +31 (0) 166 65 72 10

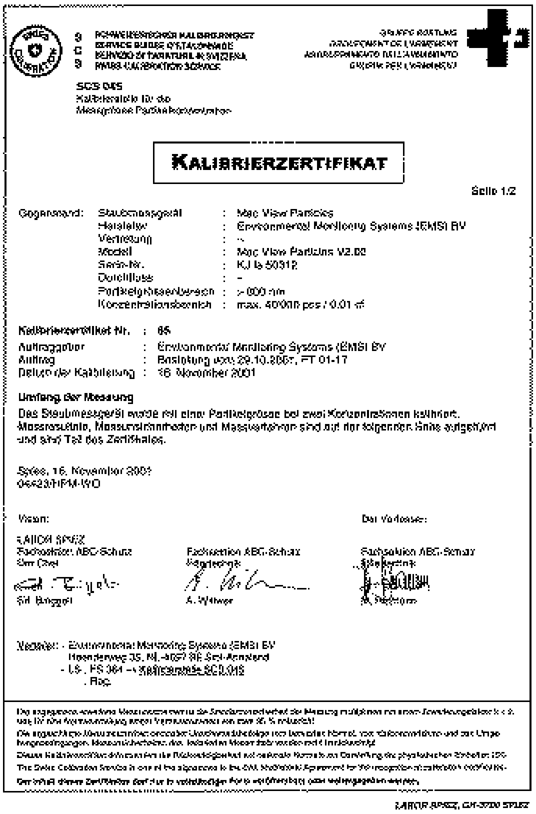
e info@macview.info
I www.macview.info

Figure 3 - The calibrations carried out on the 16th of November 2001 in Swiss.

Raiffeisenstraat 24
4697 CG Sint-Annaland
The Netherlands

t +31 (0) 166 65 72 00
f +31 (0) 166 65 72 10

e info@macview.info
I www.macview.info



SCS 045

KALIBRIERZERTIFIKAT

Seite 1/2

Gegenstand:	Staubmessgerät	:	Mac View Particles
	Hersteller	:	Environmental Monitoring Systems (EMS) BV
	Vertretung	:	-
	Modell	:	Mac View Particles V2.02
	Serie-Nr.	:	KJ Is 50312
	Durchfluss	:	-
	Partikelgrössenbereich	:	> 600 nm
	Konzentrationsbereich	:	max. 40'000 pcs / 0.01 ft³

Kalibrierzertifikat Nr. : 65
Auftraggeber : Environmental Monitoring Systems (EMS) BV
Auftrag : Bestellung vom 29.10.2001, FT 01-17
Datum der Kalibrierung : 16. November 2001

Umfang der Messung

Das Staubmessgerät wurde mit einer Partikelgrösse bei zwei Konzentrationen kalibriert. Messresultate, Messunsicherheiten und Messverfahren sind auf der folgenden Seite aufgeführt und sind Teil des Zertifikates.

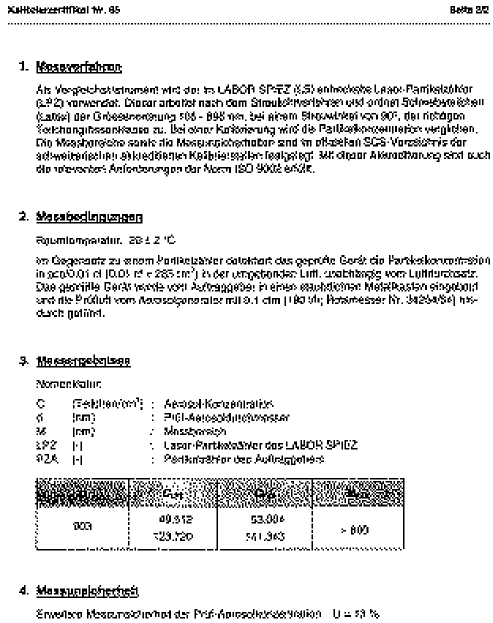
Spiez, 16. November 2001

Visum: LABOR SPIEZ

Der Verfasser:

[illegible]

LABOR SPIEZ, CH-3700 SPIEZ



Kalibrierzertifikat Nr. 65 — Seite 2/2

1. **Messverfahren**

[illegible] ... ISO 9002 erfüllt.

2. **Messbedingungen**

Raumtemperatur: 20 ± 2 °C

[illegible]

3. **Messergebnisse**

Nomenklatur:

C	[Teilchen/cm³]	:	Aerosol-Konzentration
d	[nm]	:	PSL-Aerosoldurchmesser
M	[nm]	:	Messbereich
LPZ	[-]	:	Laser-Partikelzähler des LABOR SPIEZ
PZA	[-]	:	Partikelzähler des Auftraggebers

[illegible]	[illegible]	[illegible]	[illegible]
903	49.512 523.720	53.004 541.343	> 600

4. **Messunsicherheit**

Erweiterte Messunsicherheit der Prüf-Aerosolkonzentration U = ±3 %

Figure 4 - Calibration certificates.

Raiffeisenstraat 24
4697 CG Sint-Annaland
The Netherlands

t +31 (0) 166 65 72 00
f +31 (0) 166 65 72 10

e info@macview.info
i www.macview.info