



EN 16450 approved fine dust measurement device for simultaneous measurement of PM2.5 and PM10

Model Variations



Fine dust measurement device Fidas® 200 E

EN 16450 approved fine dust aerosol spectrometer for simultaneous measurement of PM2.5 and PM10, featuring a separate sensor for existing ceiling glands



Fine dust measurement device Fidas® 200 S

EN 16450 approved fine dust aerosol spectrometer for simultaneous measurement of PM2.5 and PM10, in weatherproof cabinet for outdoor installation

Description



Fig. 1: Fidas® 200

The fine dust measurement device Fidas® 200 is an aerosol spectrometer developed specifically for regulatory air pollution control. It analyzes continuously the fine dust particles present in the ambient air in the size range 180 nm – 18 µm and calculates simultaneously the immission values PM10 and PM2.5 to be monitored by law. At the same time PM1, PM4, PMtot, the particle number concentration C_n , and the particle size distribution are calculated and recorded. It thus delivers comprehensive information about the fine dust particles, as only provided by a counting, single particle measuring principle.

The Fidas® 200 version displayed here is a 19" rack mount device designed for installation in air conditioned monitoring stations (temperature range 5 – 40 °C). Variants are the Fidas 200® E with separate sensor (for easier integration in stations with existing ceiling glands) and the Fidas® 200 S for outdoor installation (including a stainless steel cabinet).

Fidas® 200 as well as its functionally identical variations Fidas® 200 E and Fidas® 200 S are currently the only optical single particle measuring devices that are type approved for simultaneous monitoring of PM10 and PM2.5 according to standards VDI 4202-1, VDI 4203-3, EN 12341, EN 14907, EN 16450, and the EU Equivalence Guide GDE and certified in compliance with standards EN 15267-1 and -2. Type approval declaration of the Fidas® 200 was published first in the German Federal Gazette BAnz AT 02nd April 2015 B5 in chapter IV, notification 14. The [certificate of product conformity according to EN 15267¹](https://qal1.de/15267/0000040212_05_palas_Fidas200S_en.pdf) issued by TÜV Rheinland and the German Federal Environmental Agency, as well as the [measuring system test report²](https://qal1.de/report/0000040212_21227195C_palas_Fidas200S_en.pdf) for the version Fidas® 200 S compiled by TÜV Rheinland are published at [www.qal1.eu](https://qal1.eu).³

¹Link to the certificate: https://qal1.de/15267/0000040212_05_palas_Fidas200S_en.pdf

²measuring system test report : https://qal1.de/report/0000040212_21227195C_palas_Fidas200S_en.pdf

³[www.qal1.eu](https://qal1.eu): <https://qal1.de/en/hersteller/palas.htm>



Fig. 2: EN 15267 certificate for Fidas® 200

Beyond that the fine dust measurement devices Fidas® 200 as well as Fidas® 200 E and Fidas® 200 S are also type approved and certified in the UK (Defra Approval) in compliance with the requirements of "MCERTS Performance Standards for CAMS" and "MCERTS for UK Particulate Matter". The respective ⁴

MCERTS/DEFRA Approval⁵ certificate as well as the test report⁶ are publicly available.

Fig. 3: MCERTS/DEFRA Approval for Fidas® 200

The fine dust measurement device Fidas® 200 utilizes the acknowledged principle of single particle light scattering size analysis and is equipped with an LED light source of high intensity ($d_{p,min} = 180 \text{ nm}$), highly stable light output and long lifetime. The calibration of the instrument can be verified and, if necessary, adjusted easily and quickly at any time even when installed on site, using a monodisperse test aerosol.

The sampling system of the Fidas® 200 operates with a volume flow of approximately $0.3 \text{ m}^3/\text{h}$. It is equipped with a Sigma-2 sampling head according to VDI 2119-4, which allows representative sampling even under strong wind conditions, and a drying line which prevents condensation from causing measurement errors. The drying line (Intelligent Aerosol Drying System – IADS) is controlled based on ambient air temperature, pressure, and relative humidity. These data are provided by a weather station; optionally wind velocity, wind direction, and precipitation data can be provided as well. A filter holder for circular plane filters (47 mm dia.) is integrated into the sampling system, which allows, e. g., subsequent chemical analysis of the aerosol composition.

The fine dust measurement device Fidas® 200 offers numerous communications options and allows full remote control and maintenance of the system as well as online data access via palas.de⁷. The software provided along with the system offers versatile options for evaluation (e. g., comprehensive statistics and averaging) and export of measurement data.

The actual aerosol sensor is an optical aerosol spectrometer which determines the particle size using Lorenz-Mie scattered light analysis of single particles. The particles travel individually through an optically confined measurement volume which is

⁴MCERT certificate-2021: <https://www.csagroupuk.org/wp-content/uploads/2017/02/MC16029003.pdf>

⁵MCERT certificate-2021: <https://www.csagroupuk.org/wp-content/uploads/2017/02/MC16029003.pdf>

⁶Link to test report: <http://www.csagroupuk.org/wp-content/uploads/2016/04/MCERTSCCPMT6PALASPM10PM2.5V10.4.pdf>

⁷User area on palas.de: <http://www.palas.de/en/user>

homogeneously illuminated with polychromatic light. Every particle generates a scattered light impulse that is detected at an angle between 85° and 95°. The particle number is determined based on the number of scattered light impulses. Particle size is derived from the level of a scattered light impulse.

Precise optics, high light output from the polychromatic LED used, and powerful signal processing electronics using logarithmic A/D conversion allow detection of particles down to 180 nm diameter. The detection of small particles, which can be found in high concentration in particular close to roads, is of importance, e. g., for the correct determination of PM_{2.5}. The influence of the lower particle size detection limit is illustrated in Fig. 4 in comparison with a system which has a lower detection limit of 300 nm.

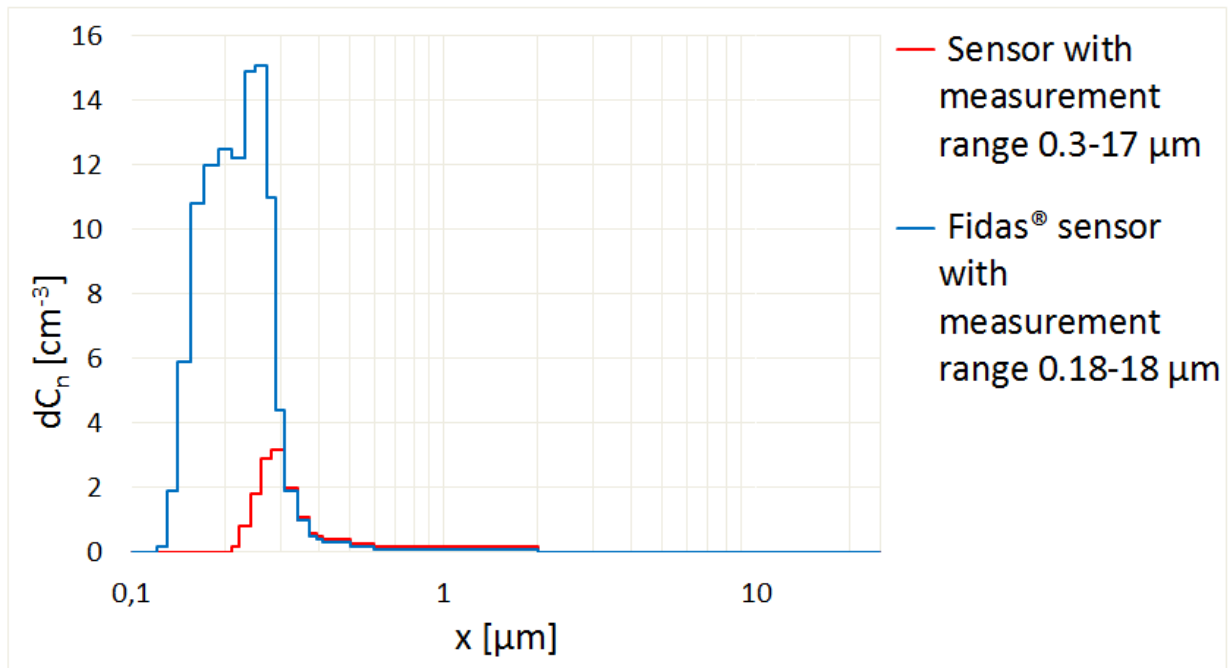


Fig. 4: Higher sensitivity with the Fidas® fine dust measurement device in the size range 0.18 – 18 μm

The better the classification precision and the resolution of a particle sizing instrument, the more accurately the particle size distribution can be determined. The Fidas® 200 light source allows for an unambiguous calibration curve, and thus very high particle size resolution, resp., accuracy of classification. The measurement volume of the Fidas® sensor is precisely optically delimited using the patented T-aperture technique, which allows particle sizing without border zone errors and so contributes to sizing accuracy. Powerful digital signal processing makes it possible to identify and, if required, compensate coincident readings (caused by concurrent presence of multiple particles).

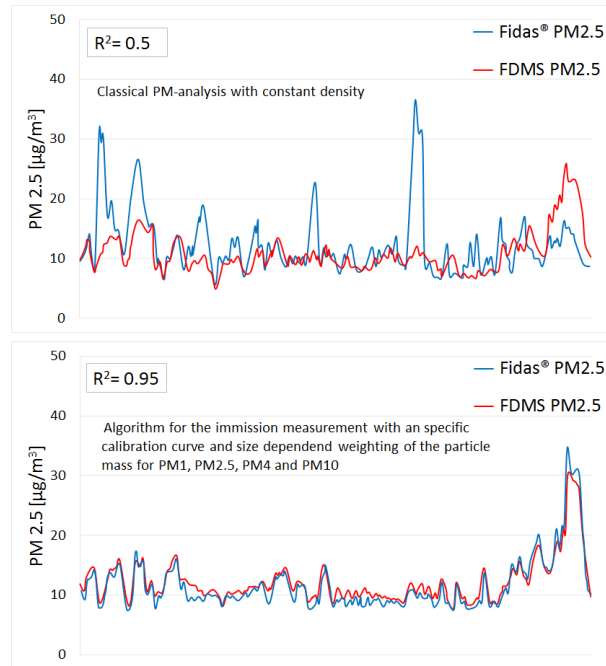


Fig. 5: Comparison of algorithms for converting particle size distribution data to PM values

For calculating mass or a mass fraction from measured data the particle size distribution is processed with a (yet particle size dependent) conversion factor (see Fig. 5). This takes into account that, depending on particle size, ambient aerosol is composed of particles from different sources (such as combustion aerosols, tire attrition, pollen). A mass fraction like, e. g., PM10, is finally determined by applying the associated separation curve (see EN 481) to the particle size distribution data. Even though the optical measuring technique determines particle mass indirectly (equivalence method), which means that exact identity with gravimetric results is not guaranteed in each and any case, the empirical knowledge used in processing the measured data ensures a very good correlation with the standard reference method (see Fig. 6), as shown during type approval testing.

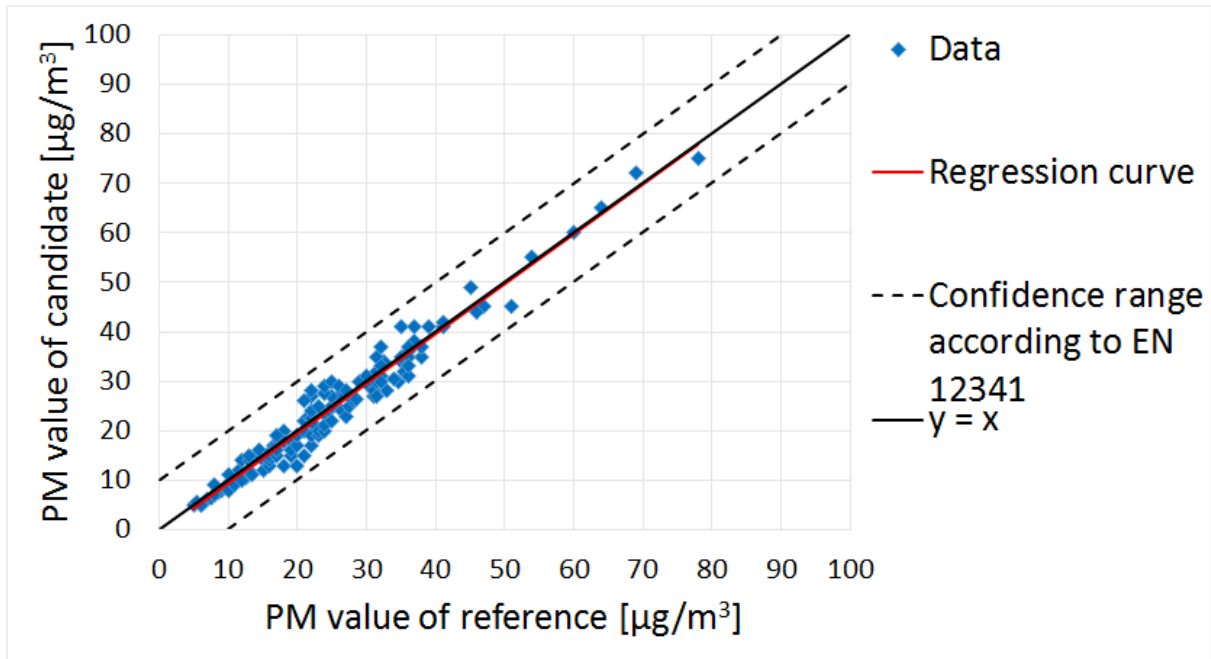


Fig. 6: PM_{10} reference equivalence function of the Fidas® 200 S in comparison with a reference small-filter device during the course of suitability testing from the "Report on supplementary testing of the Fidas® 200 S respectively Fidas® 200 measuring system manufactured by PALAS® GmbH for the components suspended particulate matter PM_{10} and $\text{PM}_{2.5}$, TÜV report no.: 936/21227195/B".

Multiple separation curves can be applied simultaneously to the same size distribution data which allows simultaneous calculation and output of, e. g., PM_{10} and $\text{PM}_{2.5}$ and other mass fractions.

Benefits

- Type-approved and certified according to latest EN requirements (EN 15267)
- Continuous and simultaneous real-time measurement of multiple PM values
- Additional information on particle number concentration and particle size distribution
- Adjustable time resolution from > 1 s to 24 h
- Light source: LED with high stability and long lifetime
- Long service life
- Low maintenance
- External check of calibration on site possible
- Intuitive and easy to operate
- Reliable function, very high data availability (> 99 %)
- 2 pumps in parallel operation for additional operational safety due to redundancy
- Permanent monitoring of status, among others online monitoring of calibration
- Remote monitoring, maintenance and control easily possible
- Cloud zone via Palas server for worldwide data retrieval
- No radioactive material
- No consumables
- Low energy consumption
- Reduces your operating expenses

Datasheet

Parameter	Description
Interfaces	USB, Ethernet (LAN), RS232, Wi-Fi
Measurement range (size)	0.18 – 18 μm
Size channels	3 measurement ranges 64 (32/decade)
Measuring principle	Optical light scattering of single particles
Measurement range (number C_N)	0 – 20.000 particles/ cm^3
Time resolution	1 s – 24 h Under certified operation: 15 min
Volume flow	4.8 l/min $\hat{=}$ 0.3 $\text{m}^3/\text{h} \pm 3\%$ (24h), compliant with EN 16450
Data acquisition	Digital, 20 MHz processor, 256 raw data channels
Light source	LED
User interface	Touchscreen, 800 • 480 pixel, 7" (17.78 cm)
Power supply	115/230 V, 50/60 Hz
Housing	Table housing, optionally with mounting brackets for rack-mounting
Dimensions	450 • 320 • 180.5 mm (H • W • D), 19"
Weight	Control unit: 9.3 kg Sample head: 2.25 kg Sample tube: 4.50 kg
Operating system	Windows
Data logger storage	Capacity for 2 years continuous operation at 60 s storage interval
Software	PDAnalyze Fidas®
Measurement range (mass)	0 – 10 000 $\mu\text{g}/\text{m}^3$
Installation conditions	+5 – +40 °C
Sampling head	Passive collector Sigma-2
Response time (sensor)	< 2s
Linearity	1.06 for $\text{PM}_{2.5}$ 1.03 for PM_{10} (against gravimetry according to EN16450, TÜV Report)
Accuracy	9.7 % for $\text{PM}_{2.5}$ 7.5 % for PM_{10} (expanded measurement uncertainty according to EN16450, TÜV Report)
Sampling System	Drying of the aerosol by IADS (Intelligent Aerosol Drying System)
Data	PM_1 , $\text{PM}_{2.5}$, PM_4 , PM_{10} , PM_{Total} , C_n , particle size distribution, air pressure, air temperature, relative humidity
Noise emission	< 70 dB(A)
Fuse	T2A
Resolution	0.1 $\mu\text{g}/\text{m}^3$
Power consumption	Normal operation: 60 W Maximal: 200 W

Applications

- Regulatory pollution control in monitoring networks
- Ambient air monitoring campaigns
- Long-term studies
- Emission source attribution
- Emission dispersion studies (e.g. fires, volcanoes)

Palas GmbH
Partikel- und Lasermesstechnik
Greschbachstrasse 3 b
76229 Karlsruhe
Germany

Managing Partner:
Dr.-Ing. Maximilian Weiß, Udo Fuchslocher
Commercial Register:
register court: Mannheim
company registration number: HRB 103813
USt-Id: DE143585902



Contact: E-Mail: mail@palas.de Internet: www.palas.de Tel: +49 (0)721 96213-0 Fax: +49 (0)721 96213-33