FIDAS® FROG



The fine dust measurement device Fidas® Frog allows for a fast, reliable, and quality-assured determination of fine dust, e.g., monitoring within the scope of Health, Safety, and Environment (HSE) management at workplaces (exposure assessment) or in the range of indoor air quality measurements . It simultaneously measures the environmentally relevant mass fractions PM_1, $PM_{2.5}$, PM_4, PM_{10}, and TSP, as well as the particle number and the particle size distribution within the particle size range of 0.178 – 17.8 (extended to 93 μm). The very compact and light design as a portable hand-held monitor with either battery or mains power operation and the operation time of up to 8 hours per battery charge allow for a flexible application at any measurement sites.

OPERATION PRINCIPLE

PORTABLE FINE DUST MEASUREMENT DEVICE

Fidas® Frog communicates via WLAN with its wireless operator´s panel (Tablet). By this, it is possible to perform measurements with a distance between the measurement site itself and the operator of the Fidas® Frog, e.g., for sites challenging to access. This concept furthermore allows for integrating one or more Fidas® Frog in an existing network and controlling® Frog in an existing network and controlling the connected devices from one central PC, e.g., for area-wide monitoring of a production facility.

Fidas® Frog uses the recognized measurement technology of optical light scattering of single particles and is equipped with a LED light source with high intensity (dp min = 180 nm), highly stable output, and a long lifetime. The sensor and the evaluation routines of the Fidas® Frog are also used in the Fidas® 200, which is certified for monitoring of $PM_{2.5}$ and PM_{10} in ambient air by TÜV/Umweltbundesamt and which have been validated in comprehensive comparison campaigns versus the gravimetric reference method. By implementing this well-approved technique and by the numerous measures for quality assurances during production (e.g., comparison of each Fidas® Frog with a certified Fidas® 200), precise and quality-assured measurements can be ensured.

The system's calibration can be checked and adjusted, if necessary, easily and quickly under field conditions on-site at any time with the help of a monodisperse test powder.

Fidas® Frog operates with a volume flow of 1.4 l/min and is equipped with sensors for environmental conditions, temperature, atmospheric pressure, and relative humidity.

The actual aerosol sensor is an optical aerosol spectrometer that determines the particle size using Lorenz-Mie scattered light analysis of single particles. The single particles move through an optically differentiated measurement volume that is homogeneously illuminated with white light. Each particle generates a scattered light impulse

detected at an angle of 85° to 95° degrees. The particle number is measured based on the number of scattered light impulses. The level of the scattered light impulse is a measure of the particle size diameter.

The lower detection limit for immission measurement could be reduced to 180 nm through improved optics, higher light density using a new white LED as the light source, and improved signal analysis (logarithmic analog, digital converter). This enables greatly improved detection, especially of smaller particles mainly found at high concentrations near roadsides (see Fig. 1).

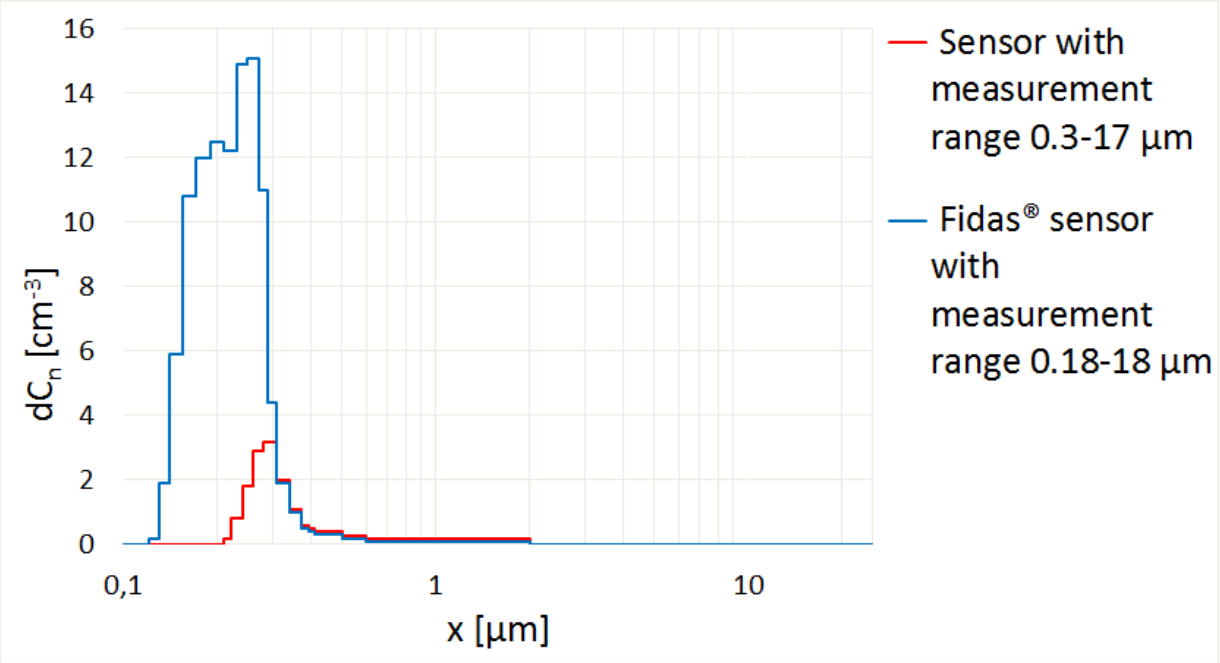


Fig. 1: Higher sensitivity with the Fidas® fine dust measurement system for the 0.178 – 17.8 (extended to 93 μm) particle size range

The better the classification accuracy and the resolution capacity, the more accurate the definition of the particle size distribution.

A white light source enables a precise and unambiguous calibration curve, resulting in an extremely high size resolution. The patented T-stop provides a precisely defined optical measurement volume and enables particle measurement without border-zone errors, resulting in a precise size measurement. The new digitized electronic signal analysis system enables the rapid identification and correction of coincidence, as necessary.

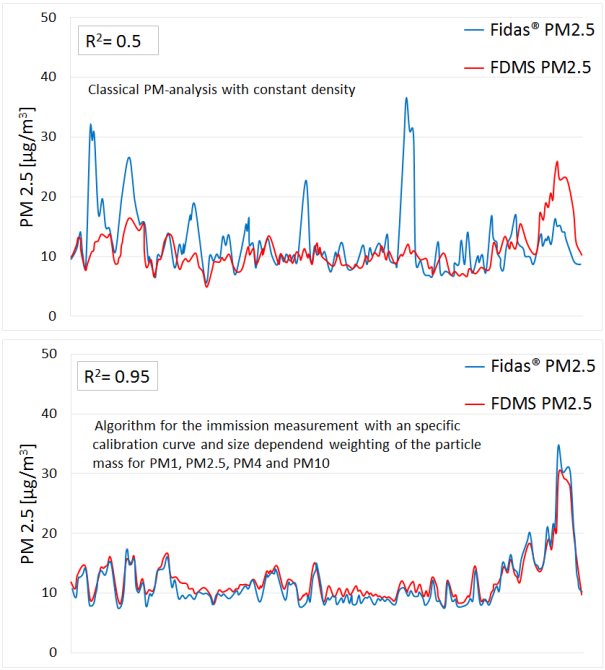


Fig. 2: Comparison of the algorithms for conversion of the particle size distribution by PM values

To convert the measured values into a mass or mass fraction, the high-resolution particle size distribution in each value is multiplied by a correlation factor that reflects the different sources (e.g., combustion aerosols, tire wear, pollen) of the environmental aerosol (see Fig. 2). A mass fraction is obtained by additionally applying the separation curve to the determined particle size distribution. Multiple separation curves can be used simultaneously for the same size distribution, which enables the simultaneous output of PM_{10}, $PM_{2.5}$, PM_1 (and others). For example, the Fidas® Frog can be operated with the same conversion algorithm, which has also been implemented in the type-approved and certified ambient air monitoring system Fidas® 200 for regulatory monitoring of ambient $PM_{2.5}$ and PM_{10} concentrations.

The operation of the Fidas® Frog is intuitive and simple. All measured data can be evaluated and compared directly with the operator interface. Already during the measurement, messages on exceeded limit values are possible. These limit values can be defined based on legal requirements or individual needs (see limit values in Fig. 3).

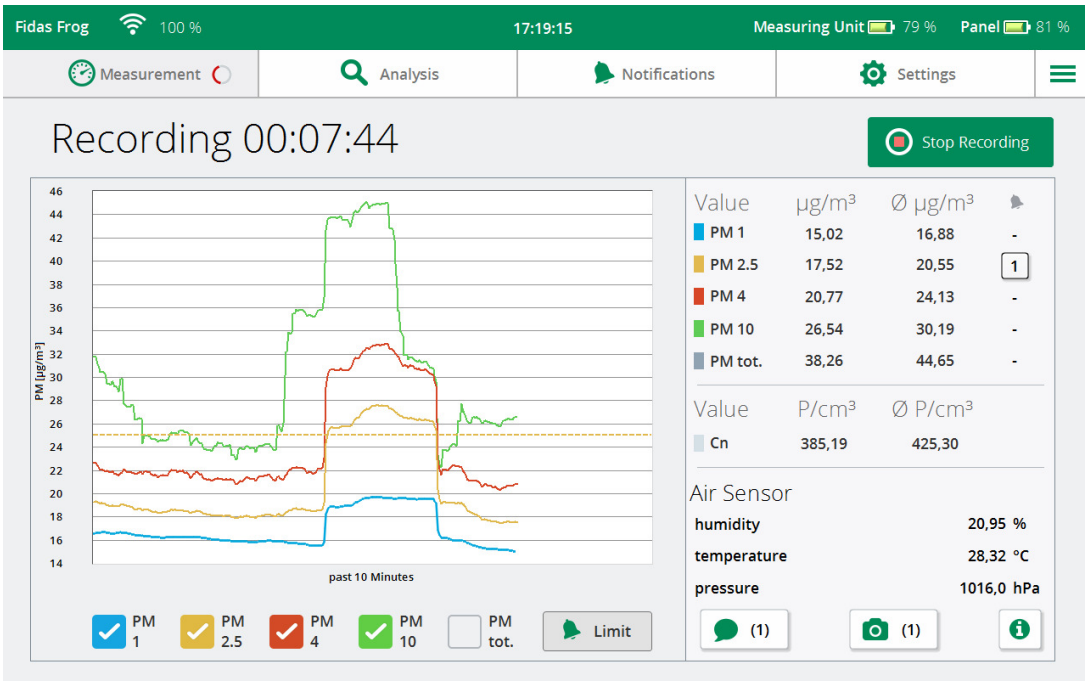
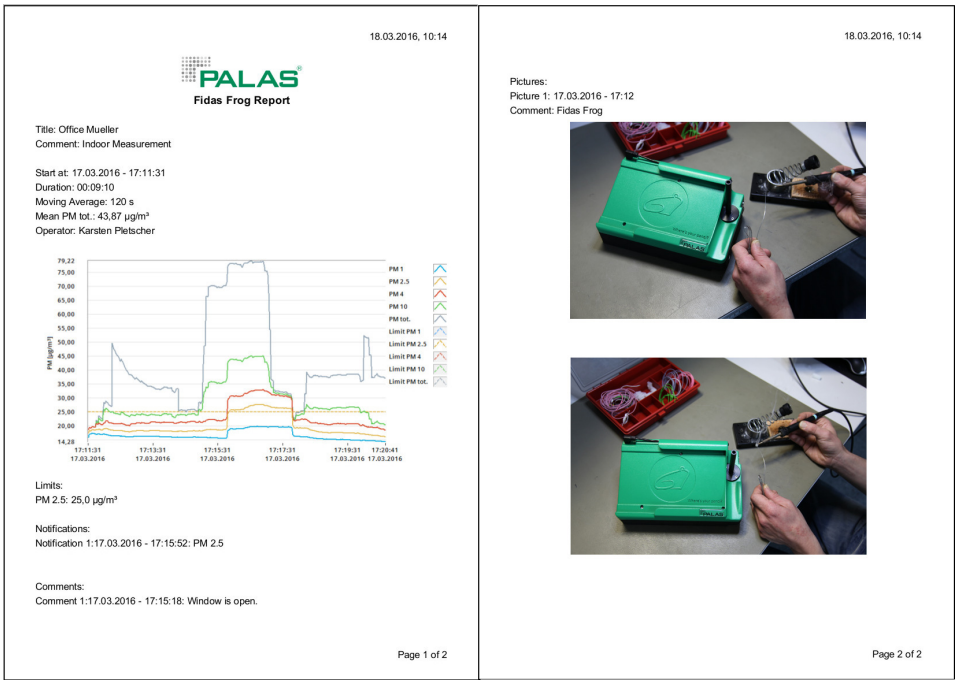


Fig. 3: Display of measured values during a measurement

An integrated camera documents the measurement setup. By this, pictures can be added for documentation directly and comfortably to the measured data set or the measurement report in pdf generated by the device itself. Fig. 4 shows such a measurement report in pdf, including data of the measurement conditions saved by the user and a graphical evaluation of the measurement data. Pictures of a workplace measurement have also been attached to this report.



18.03.2016, 10:14

PALAS

Fidas Frog Report

Title: Office Mueller
Comment: Indoor Measurement

Start at: 17.03.2016 - 17:11:31
Duration: 00:09:10
Moving Average: 120 s
Mean PM tot.: 43,87 µg/m³
Operator: Karsten Pletscher

Limits:
PM 2.5: 25,0 µg/m³

Notifications:
Notification 1:17.03.2016 - 17:15:52: PM 2.5

Comments:
Comment 1:17.03.2016 - 17:15:18: Window is open.

Page 1 of 2

18.03.2016, 10:14

Pictures:
Picture 1: 17.03.2016 - 17:12
Comment: Fidas Frog

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Fig. 4: Example for a measurement report (pages 1 and 2)

The measured data can be directly printed or transferred to an USB stick via the micro-USB-port and processed on an external PC. In this case, the evaluation software PDAnalyze Fidas® offers various data evaluations, especially for the particle size distribution, and it gives possibilities for export.

BENEFITS

- Continuous and simultaneous real-time measurement of PM_1, $PM_{2.5}$, PM_{10} and TSP-values, particle number concentration and size distribution
- Adjustable time resolution from 1 s
- Direct comparison of different measurements
- Configuration of limit values possible
- Separation of the measuring device and the Tablet-PC for control (communication via WLAN)
- Ergonomic design and low weight
- Intuitive and simple operation
- Integrated camera for documentation of the measurement
- Export function for measured data in various formats
- Remote monitoring and control via network integration easily possible

NORMS AND CERTIFICATES

EN 481:1993, ISO 21501-1

DATASHEET

Measuring principle	Optical light scattering at single particles, 90° sideways scattering
Reported data	PM_1, $PM_{2.5}$, PM_4, PM_{10}, TSP, C_N, T, rH, p,particle size distribution
Measurement range (number C_N)	0 – 20,000 particles/cm³
Measurement range (size)	0.178 – 17.8 (extended to 93 µm)
Measurement range (mass)	0 – 100 mg/m^3
Measurement uncertainty	Approximately 12% for $PM_{2.5}$, approximately 12% for PM_{10}
Volume flow	1,4 l/min (Time-Of-Flight)
Size channels	Max. 256 raw data channels (32 size channels/decade)
Time resolution	Rolling average 1s - 600s adjustable, interval 1.5, 10, 60s, distribution 5, 10, 30, 60s, UDP 1.5, 10, 60s interval
Interfaces	USB, Ethernet (LAN) via adapter, Wi-Fi
User interface	Touchscreen, 1,280 • 800 pixel, 8″ (20.32 cm)
Protocols	UDP, MODBUS RTU
Data logger storage	Approx. 16 GB
Data acquisition	Max. 256 raw data channels (32 size channels/decade)
Light source	Polychromatic LED
Housing	Plastic housing with tablet
Operating system	Windows 10
Power supply	115–230 V, 50/60 Hz, output: 19 V
Power consumption	13 W
Installation conditions	0 – +40 °C
Battery operation	Li-ion batteries, non-removable, base unit: 77 Wh (14.8 V; 5,200 mAh), 8 cells tablet: 20 Wh (3.8 V; 5,200 mAh), 2 cells
Sampling head	Rohr DN 10
Dimensions	100 • 240 • 150 mm (H • W • D)
Weight	Approx. 2.1 kg (operating panel: 0.4 kg, measuring unit: 1.7 kg)
Resolution	0,1 µg/m³

APPLICATIONS

- Fine dust monitoring at alternating locations or in movement
- Air quality monitoring indoors, at the workplace, or inside vehicles
- Use as an aerosol spectrometer in setups where space is limited

Mehr Informationen:
https://www.palas.de/en/product/fidasfrog