Ideal for experts involved in advanced air conditioning technology

testo 400 multi-function measuring instrument

Accuracy and efficiency are top priority for Peter Kunert, engineering expert. The traceability of the measured result to the standard, as proven by the calibration certificate, is indispensable. Testo's reference measuring instruments provide you with accurate and reliable readings; making them ideal for expert reports, approvals and inspections.

Peter Kunert, a qualified engineer, is a publicly appointed and sworn expert for Indoor Air technology and asbestos materials in the ventilation and heating technology sector and is also a recognised expert for inspections on ventilation and air conditioning systems in compliance with Federal building stipulations. He is DIN EN 45001 accredited and is affiliated to the DPÜ (German Institute for Tests and Inspections). The main focus of his work is on approvals and inspections worldwide for HVAC systems as well as expert reports which are used in court. Training in planning and building including quality assurance on large-scale building sites at home and abroad is also part of his job profile. Inspections are necessary during building projects and enable the know-how gathered worldwide to be included in the planning phase and during execution resulting in lower costs and improvements in quality. Training can be used to quickly recognise weak points thus preventing deficiencies at a later stage.

Many of the tasks connected closely with HVAC technology involve asbestos material which was used in buildings until 1990. The main focus is on training the operating staff to recognise materials containing asbestos as well as providing technical support when air and negative pressure measurements are required during clearing-up measures involving asbestos. Fire prevention from the ventilation viewpoint is also closely connected with HVAC technology. For example, it is required to measure differential pressures between rooms or air flows and de-smoking flows. Hygiene processes in VAC systems corresponding to VDI 6022 are subject to comfort level and safety stipulations in buildings. A series of standards and guidelines, such as workplace stipulations, define the basic conditions for HVAC systems on a national and international level. The existing standards are adapted to the respective region and are usually at a high level. For this reason, accurate and reliable measurements are required to check and prove the functionality, quality and safety of VAC systems.

Peter Kunert, Engineer, was interviewed by Testo on this topic.

Testo: What are the most important measurement tasks and stipulations for an Indoor Air Quality technology expert in the field?

Kunert: Mainly air flows in rooms and ventilation ducts are measured. Other parameters such as pressure, temperature, humidity, CO_2 or CO levels are also measured. There are a number of national or international stipulations and standards which must be taken into consideration, depending on the job. The DIN EN 12599 "Test and measurement procedures for the approval of built-in technical ambient air systems" or the Ashrae USA standard are applied to air volume flow measurements which are frequently carried out. One other area involves comfort level measurements based on DIN 1946 Part 2.

Testo: The above-mentioned stipulations and standards place high demands on accuracy and efficiency when taking measurements. Are special instruments needed to fulfill these requirements?

Kunert: The testo 400 multi-function instruments are ideal for electronic measurements on VAC systems. You have the option of adapting different probes based on modules. In this way, the whole range of measurement tasks is covered with one instrument. The accuracy and efficiency of the Testo sensors are of major significance. Sensor accuracies, such as those of the patented humidity sensor with ±1 %RH or the 100 Pa pressure sensor with an accuracy of ±0.3 Pa +0.5 % of the reading speak for themselves. Regular calibration of the sensors by

Testo CAL, as a DKD accredited calibration laboratory guarantee the traceability of the measured results to the standard.

Testo: Standard guidelines for limits are usually linked with detailed specifications for measurements and calculations. One example are the extensive calculations required when measuring ducts, with respect to error calculation or profile or location inaccuracy. Testo has also developed the first automatic measurement procedure which meets the requirements of these standards. Does it make the daily work easier for an expert working in this area?

Kunert: The automation of the measurement procedure with testo 400 saves a huge amount of time; starting with the automatic calculation of the measurement points in the duct and includes the calculation of quadrant mean values for flow and volume flow at the touch of a button and without additional instruments. The automatic error calculation function also facilitates a fast and objective on-site assessment of a system. The time-consuming input of all measurement data into your PC is no longer necessary. Last but not least, the automatic generation of standardized measurement logs also serves to reduce your workload.

Testo: Are there any other measuring instruments apart from testo 400 required to assess technical ambient air systems?

Kunert: In the case of on-site long-term measurements, it is necessary for economic reasons to take readings over a specified time period. This is where the testostor 171 logger comes in. It is attached on location, and logs and saves measurements in programmable cyles.

Testo: Again, you rely on instruments from Testo to do this work. Why?

Kunert: In addition to the efficiency and accuracy already mentioned, Testo stands out on account of its features which are ideal for applications in the field. This applies particularly to testo 400 with its unique automation function and standardized documentation. The testostor 171 data loggers have practical highlights with their newly developed Palm interface for easy data transfer and on-site programming.

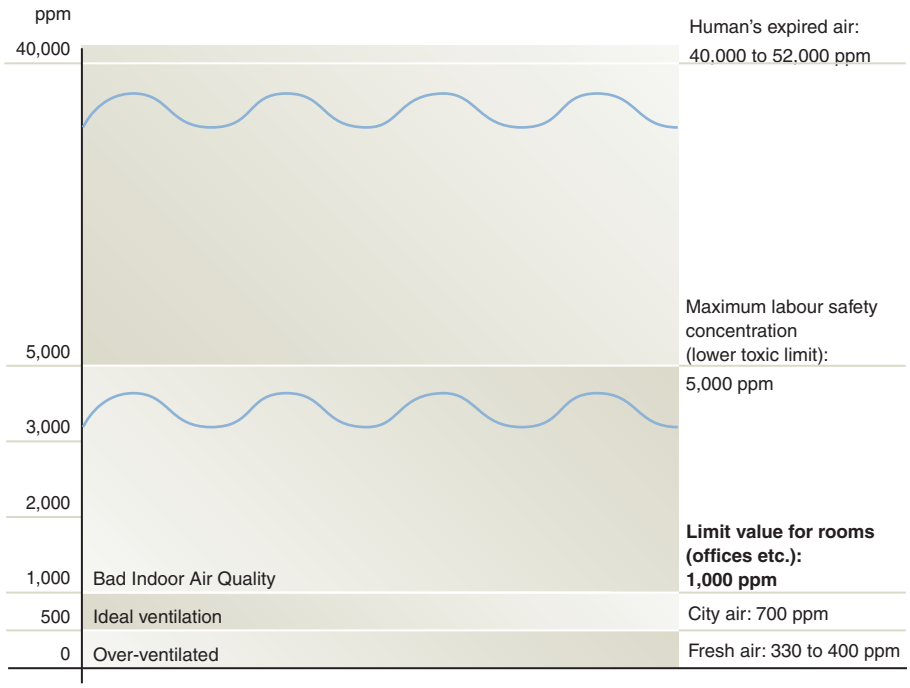
Why CO_2 measurement?

CO_2 concentration is used as an indicator when assessing indoor air quality. If the CO_2 concentration in indoor air is too high (limit value: 1000 ppm), the air feels “stuffy and stale”.

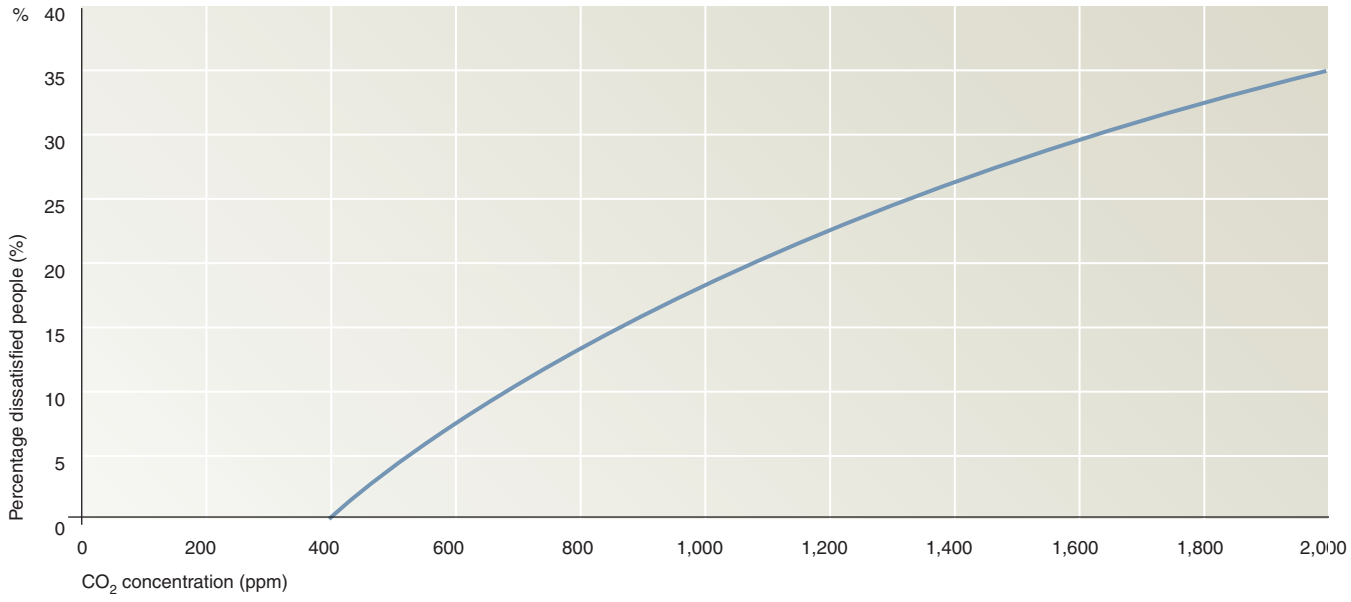
Bad air quality in rooms (e.g. offices) can lead to tiredness, lack of concentration and illness (Sick Building Syndrome SBS) and is caused, in many cases, by insufficient ventilation.

The CO_2 concentration in demand controlled ventilating (DCV) systems is used to regulate the supply of fresh air. Stationary CO_2 transmitters are used and should be checked on a regular basis using hand-held measuring instruments.

CO_2 concentrations



Indoor Air Quality



Percentage of people who are unhappy with indoor air quality at a specific CO_2 concentration.

Light measurement technology

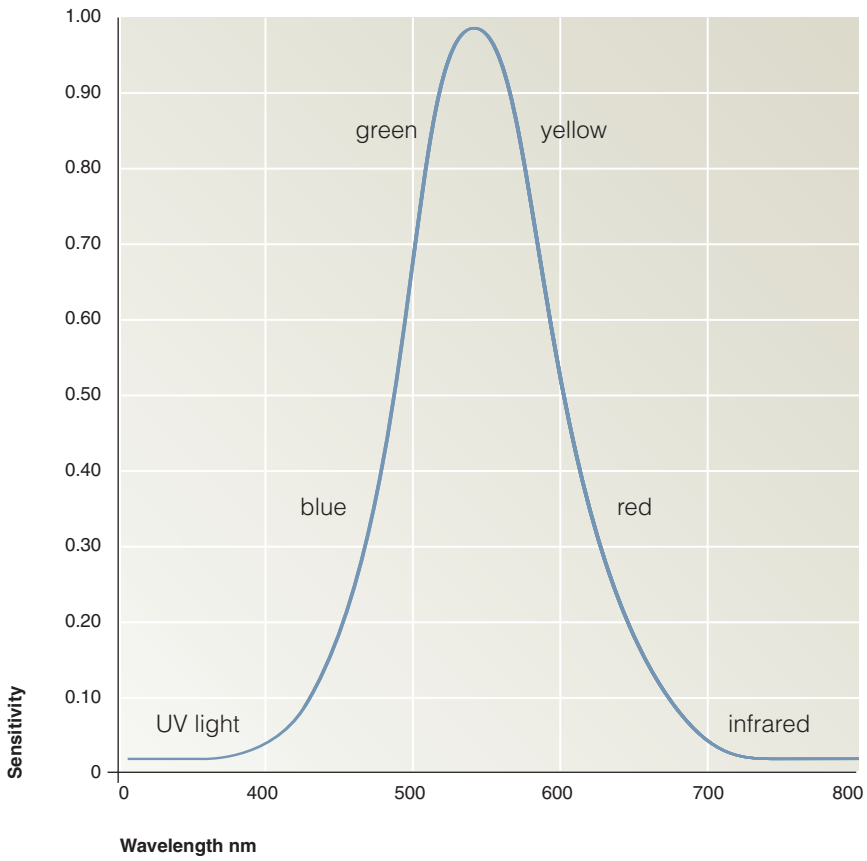
The Light parameter
Approximately 80% of all sensations are experienced by the eye. Light is required for this purpose. 25% of human energy is needed for the seeing process.

Spectral response of the eye:
Light is made up of very high electromagnetic oscillation between 380 and 770 nm. They are experienced by the eye as light.

Light intensities:
Humans are day beings, i.e. we are used to a light intensity such as that which is available during the day. Values lie between approx. 5000 Lux on a dull Winter´s day and approx. 100 000 Lux on a sunny Summer´s day.

The light intensity of artificial lights is usually between 100 and 1000 Lux.

Spectral response of the eye



Effects
Fatigue on account of too little light occurs more in the organism as a whole than in the eye itself. For this reason, insufficient or bad lighting conditions cannot be identified as the cause of accidents or fatigue.

According to the documentation available approx. 30% of all accidents result directly or indirectly from inadequate lighting. In the interest of accident prevention it is imperative that steps are taken to monitor the situation.

Different light intensities are recommended by standards bodies, depending on the task. Light intensities of approx. 100 to 250 Lux are sufficient for simple tasks.
A minimum of 1000 Lux is required for precision work.

Examples of light intensities:

Sunny Summer's day outside	Approx. 100,000 lx
Overcast sky in Summer	Approx. 20,000 lx
Sunny Winter's day outside	Approx. 10,000 lx
Dull Winter´s day	Approx. 3,000 lx
Good workplace lighting	1,000 lx
Good street lighting	40 lx
Full moon night	0.25 lx
Starlight	0.01 lx

A light intensity measuring instrument must be able to reconstruct exactly the response of the human eye. This is achieved by special optic filters. A special measuring cell (photo diode) converts the incident light into an electric signal which is then displayed.

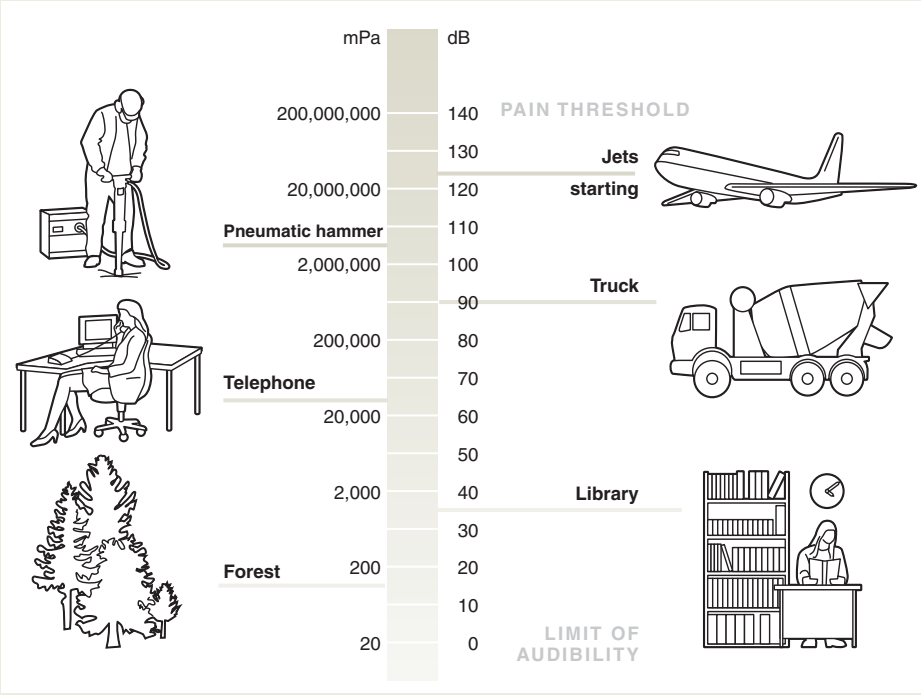
Light intensity:
Unit: Lux
Light instensity is the ratio of the light flux on an area to the area.

Light flux:
Unit: lumen (lm).
Light flux is the total radiation power emitted from a light source and photometrically assessed.

$$\text{Light intensity (lx)} = \frac{\text{light flux (lm)}}{\text{area (m}^2\text{)}} \qquad E = \frac{\Phi}{A}$$

The Sound parameter

Sound waves are fluctuations in the air pressure. If they are audible to the human ear we talk about audible sound. The fluctuations in pressure occurring with audible sound are extremely low. At a normal pressure of 1013 mbar even changes in the µPa range can stimulate the human ear. A suitable pressure sensor with the appropriate sensitivity is the microphone.



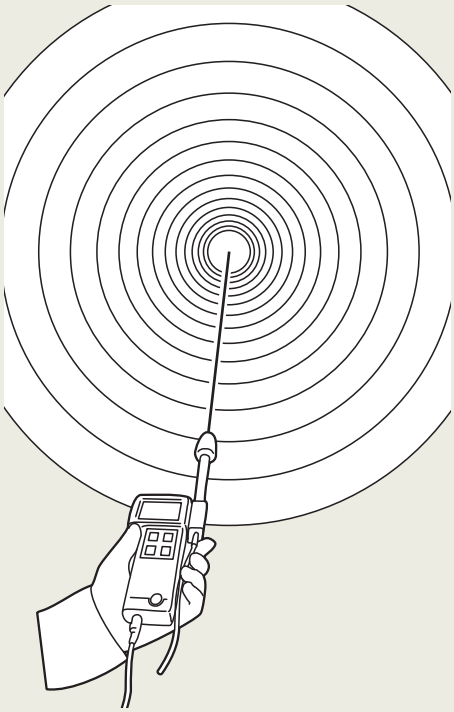
Calibration

Ideally the instrument should be calibrated before and after measurement. If measuring frequently, calibration should be carried out at least once a week.

Sound has the unfortunate characteristic of reflecting off walls, ceilings and off the user´s body.

Handling

Measurement errors can occur if incorrectly handled. In order to avoid measurement errors when using sound level meters watch out for the following: According to DIN/IEC guidelines, a sound level meter must be positioned at a 0° angle to the noise source (See Fig.). This means that the microphone points directly in the direction of the noise source.
The instrument housing and the presence of the user may not only hinder the sound coming from a certain direction but they may even produce reflections causing many measurement errors. We recommend that you hold the instrument at least 30 cm – even better 50 cm – from your body.



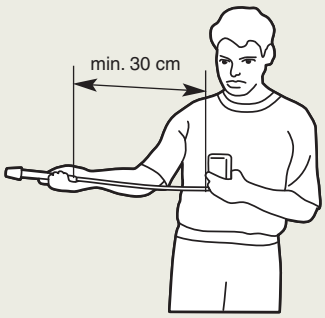
Send for the Sound Technical Manual.

Measuring tips

Measuring conditions are ideal if there are absolutely no interfering objects in the sound field. This would be the case, for example, on top of a mountain. Because there are no walls or ceilings on which sound can be reflected, free dispersion is guaranteed (free field). In a closed room there is usually a wall opposite the noise source. This can cause reflections which distort the measured result (reverberant field).

The microphone in the 815 sound level meter is detachable.

This has the advantage that the user can move out of the sound field by holding the microphone with his arm streched out in the direction of the sound source (See Figure). This is the best way to avoid reflection errors.



Sound level meters have been designed for measurements in the free field. There is also a free field if the level falls by 6 dB per duplication of the distance from the source. This is the case in most rooms.

Example:

– Office with carpet, curtains and partitions = Free field !

– Cellar with concrete walls, without furniture, highly reverberant = Reverberant field !