

Ozone gas analysis with the ULTRA.sens[®] based on selective UV light-emitting diodes

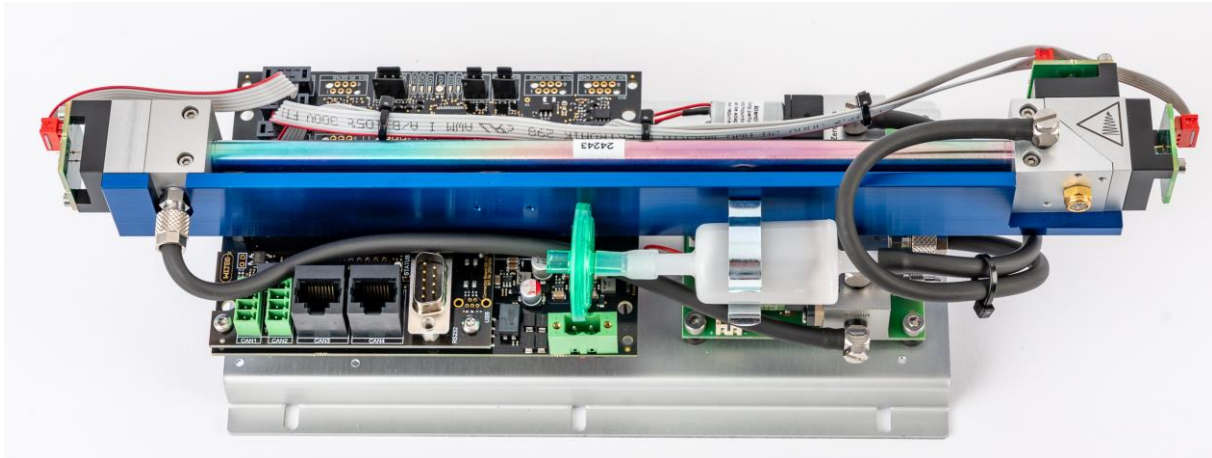


Figure 1: [ULTRA.sens[®]](#) ozone measurement module with integrated auto-zero function (AZF)

Ozone O_3 is an unstable gas that is formed by adding energy with oxygen. The service life (half-life) of ozone is approx. 20-100 hours, after which it decomposes back into oxygen O_2 . Ozone must therefore be produced in an ozone generator before use. Appropriate gas sensors are required to control the ozone concentration. Until now, toxic mercury vapour lamps have been used as the radiation source in these gas sensors. [Wi.Tec-Sensorik GmbH](#) has now succeeded in developing a gas sensor based on UV LEDs that is mercury-free and delivers excellent measurement results.

Ozone is used to sterilise surfaces, water and air, as it is a strong oxidising agent and therefore kills viruses, bacteria, fungi, etc. Its intense odour makes it perceptible even in very low concentrations ($\ll 1$ ppm). The odour threshold is around 0.02 ml/m^3 (0.02 ppm). Ozone measuring devices must therefore be able to detect even the smallest concentrations in the ppb range. With the ULTRA.sens[®] AK250, measuring ranges of 0-1000ppb O_3 can be realised with a detection limit of <5 ppb O_3 .

NDUV ULTRA.sens®

Wi.Tec-Sensorik GmbH uses a special UV photometer (ULTRA.sens®) for this purpose, which utilises different UV light-emitting diodes (UV LEDs) as radiation sources in the range from 230 nm to 400 nm. In the UV photometer, the gas sample to be analysed is irradiated by pulsed UV radiation and the proportion of absorption in the cuvette is measured. The concentration in the cuvette can be calculated very precisely from this absorption using the Lambert-Beer law. This calculation is supplemented by additional algorithms so that the analysis result is independent of the current air pressure (300-1200hPa) and the current ambient temperature (5-45°C).

The ULTRA.sens® series has a modular design so that different analyser cells can be installed. For low O₃ concentrations, cuvette lengths from 250mm (AK250) to 550mm (AK550) are used. For high concentrations, correspondingly shorter cuvettes (e.g. 10mm) are available. As ozone in high concentrations (vol.%) is also very corrosive, these cuvettes can be supplied in a [process version](#) with different materials.

Furthermore, the selection of the light-emitting diode can also be adjusted to the required measuring range. Two gases can be measured independently of each other in the ULTRA.sens®. In addition to ozone (O₃), sulphur dioxide (SO₂), nitrogen dioxide (NO₂), chlorine (Cl₂), hydrogen sulphide (H₂S), etc. can also be measured with an additional light-emitting diode. The Ozone ULTRA.sens® can also be combined with an NDIR measurement (INFRA.sens®) so that multi-gas analysis in complex gas mixtures is also possible.

Auto-Zero-Funktion

Zero-point stability plays a particularly important role with low ozone concentrations. For this purpose, an additional reference measurement is integrated in the ULTRA.sens® that compensates for changes in the radiation intensity of the UV LED. Nevertheless, additional effects can cause the zero values drifts over time, so that a correction with zero gas is required at regular intervals. In the simplest case, this is done manually. However, to become independent of the personal for longer measurement series, an automatic zero-point adjustment is recommended. Figure 2 shows such an arrangement. A solenoid valve is switched from sample gas to zero gas via a timer integrated in the ULTRA.sens® electronics. After a preset dwell time, the zero point is readjusted and then immediately switched back to sample gas. During this purge time, the last measured value is always held (frozen) and updated after the adjustment.

For the ozone measurement, ambient air is used as the zero gas, which was previously passed through an ozone absorber (ozone scrubber).

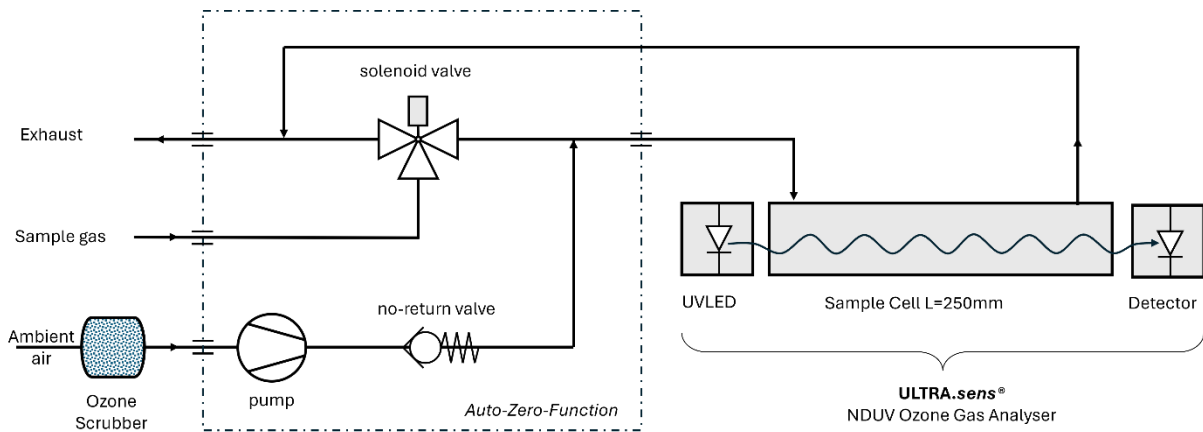


Figure 2: Gas flow diagram with upstream auto-zero function (AZF)

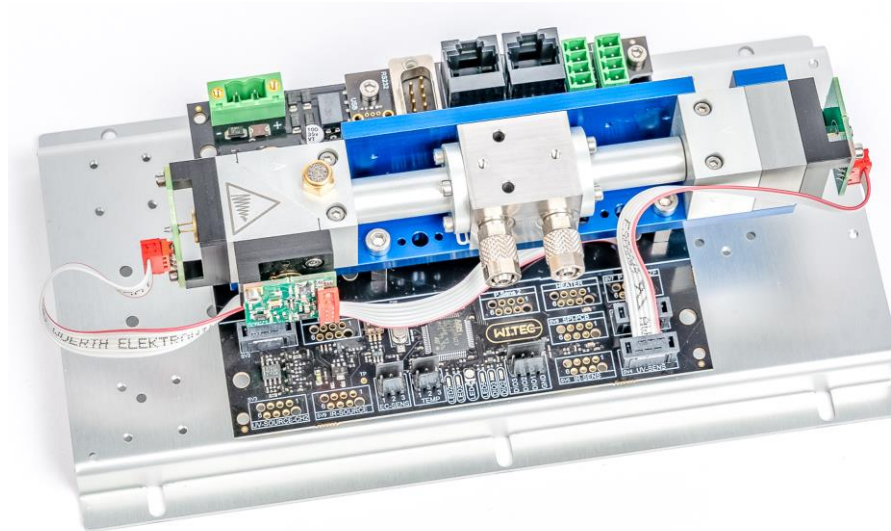


Figure 3: ULTRA.sens® with a 25 mm long analyser cuvette (AK25) in process version (stainless steel) for detecting high ozone concentrations in the vol.% range.

Data Sheet: [ULTRA.sens O3-Gasanalyse](#)

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