

Open-path remote sensing instrument (series OP-UV2-LED3-200R)

FAST AND ACCURATE SPECTRAL TRACE GAS MEASUREMENTS USING ACTIVE SPECTROSCOPY



Open Path telescope unit, mounted on a roof top (telescopes are customised and may look different).



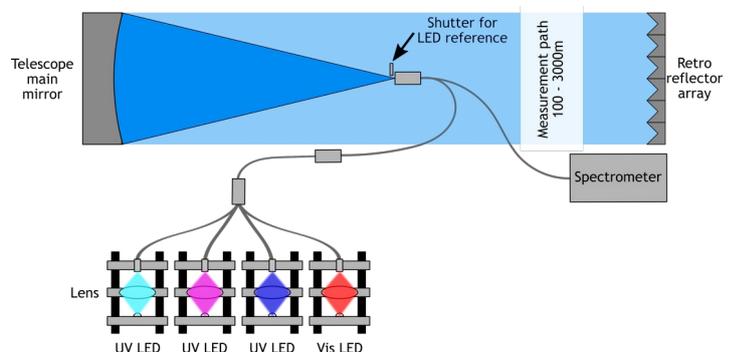
Retro reflector array to be placed at the end of the measurement path to reflect light back to telescope. Water proof IP67 housing with changeable desiccant.

The Airyx open-path remote sensing instrument allows monitoring a wide range atmospheric trace gases (NO₂, SO₂, O₃, HCHO, HONO, H₂O, BrO, OCIO, Aromatic compounds (Benzaldehyde, p-Cresol)) based on the method of Differential Optical Absorption Spectroscopy (DOAS). Light emitted by High Power LEDs (centred at 280, 325, and 365 nm) covering the UV/vis range from 280 to 380 nm are coupled into a fibre telescope and sent through the atmosphere along light paths of several 100 m and up to 3 km length. The instrument measures the average concentration along the path with high precision (sub ppb range) and high time resolution (several seconds,

depending on visibility). Applications are operational monitoring of emissions from industry complexes, ship emission monitoring at rivers or harbour entrances or urban air quality monitoring. Further, scientific tasks can be addressed, e.g., validation of satellite data or chemical transport models or comparison studies against other measurement techniques like in situ or passive remote sensing. Calibration gases are not needed since trace gas quantification is obtained via spectral absorption data. Automated, frequent lamp reference measurements ensure drift-free, long term operation at highest precision.

APPLICATIONS

- Spatially averaged trace gas measurement along light paths from several hundred meters to several kilometres
- Emission monitoring (e.g. SO₂, NO₂, HCHO, HONO)
- Air quality monitoring
- Scientific studies of atmospheric trace gas chemistry (e.g. O₃, H₂O, halogen compounds BrO, OCIO), e.g. volcanic plume chemistry or polar halogen chemistry
- Traffic emission monitoring (SO₂, NO₂) at time resolution of several seconds
- Validation studies for satellite data, passive remote sensing, in situ and spatially high resolved chemistry modelling



Scheme of the open path instrument. Besides the UV LEDs an additional Vis LED (red) supports the alignment of the telescope with respect to the retro reflector.

OPTIONS

- Extension of OP-telescope for motorised elevation change (0 to 30°) for application of several vertical light paths
- Extension of OP-telescope for motorised azimuth rotation (-130° to 130°) for application of several horizontal light paths

PROPERTIES (TYPICALLY)

Spectrometer specifications (typ.)*¹	Range[nm] 270-380 Ultra low straylight configuration	FWHM [nm] ~0.45	Additional sensors: Temperature ambient location telescope spectrometer electronics	Pressure ambient	Humidity spectrometer telescope
Quantum efficiency	UV: ~60% with back thinned detectors				
Noise & Accuracy	10 ⁻⁴ at 1000 scans (~60 s int. time) Measurement accuracy depends on measurement time and light path length		Retro reflectors²	Arrays of 20 x 1 inch fused silica corner cube reflectors (waterproof IP67 housing) with desiccant drying unit (changeable reservoir)	
Measured Gases	SO ₂ , O ₃ , HCHO, HONO, H ₂ O, BrO, OCIO, Aromatic compounds (Benzaldehyde, p-Cresol)		Measurement software	Included, customizable measurement routine (time resolution, spectral averaging)	
Wavelength calibration	Manually using mercury line emitter (optional)		Data analysis	Data analysis package provided for standard trace gases	
Light sources	3 high power LEDs centred at 280, 325 and 365nm, (covers ranges for given trace gases)		Data communication	USB 2.0 Measurement PC (Notebook) included	
Spectrometer/light source temperature	Spectrometer and light sources are temperature stabilised to 25°C for stable spectral measurement conditions (set temperature can be adapted)		Power consumption	< 70 W, 12 V	
Telescope specifications	Focal length: 800mm Mirror diameter: 200mm Field of view: ~0.05° (plum mirror diameter)		Weight	~ 15 kg (telescope) ~ 14 kg (spec./light source unit)	
Light path alignment	Built-in webcam for manual coarse alignment. Automatic fine alignment during measurement routine via x-y-z high precision stepper motors.		Size spectrometer unit	~ 40 x 44 x 13 cm ³	
Fibre configuration	Fibre bundle merges LED light 6 single fibre send light to the telescope 1 fibre receive reflected light and transmit to spectrometer		telescope unit	~ 100 x 35 x 32 cm ³	
Reference (I₀) measurement	With reference plate in the telescope automatically during measurement		Operation temperature range (telescope & retro reflector unit)	-20°C to 40°C	
			Telescope mounting options	Aluminium rail system for simple installation tripod mount + tripod (optional)	
			Mechanical stability	Robust for harsh environmental conditions water proof (IP 66)	

COMMENTS:

¹ Spectrometers are equipped with colour filters to reduce stray light, ² Number of required arrays depends on application and desired length of light path.. within certain boundary conditions By reducing the measurement range better precision and LOD can be achieved to guarantee optimum spectroscopic measurements

ADVANTAGES

BENEFITS

INNOVATION

High measurement accuracy	<ul style="list-style-type: none"> • Ultra-low stray light spectrometers • Stable spectrometer temperatures, low noise • Non-linear spectrometer characterization included • Continuous measurement and automatic reference measurement • Measurement routine adaptable
Simple setup & operation	<ul style="list-style-type: none"> • Simple instrument setup and start up • Automated measurement routine incl. adjustment • Low maintenance, easy cleaning of optics • No calibration needed, gas quantification based on spectral absorption data
Long lifetime	<ul style="list-style-type: none"> • No outside moving parts • Water proof with IP67, snow resistant • Designed for long term operation • water proof retro reflector array with simply change of desiccant for optimum light reflection

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