

## SkySpec 1D Instrument v.250

FAST AND ACCURATE SPECTRAL OBSERVATIONS OF SCATTERED SUN LIGHT



SkySpec 1D components



Telescope unit on tripod



Telescope unit mounted to mast

The SkySpec instrument series allow users to perform fast, efficient and reliable atmospheric observations with the passive DOAS (Differential Optical Absorption Spectroscopy) method (according to VDI standard 4212). Ultra violet (UV) and visible (Vis) radiation spectra of direct and scattered sunlight in multiple viewing directions are acquired and analysed to obtain information on the spatial distributions of various trace gases (e.g. NO<sub>2</sub>, SO<sub>2</sub>, HCHO) and aerosols.

The instrument's spectrometer unit houses two spectrometers and the control electronics for installation in the lab. The separated telescope unit is connected via glass fibre, power and data cables (typically 10 m) and is installed outside. This setup guarantees optimum stability and spectral data quality. The instrument is operated from an external PC connected over USB. The use of two spectrometers allows a broader spectral range (UV and Vis) measuring more trace gases and aerosol properties while achieving a high spectral resolution and avoiding spectral under-sampling (with FWHM > 5 pixel). The covered spectral range and resolution

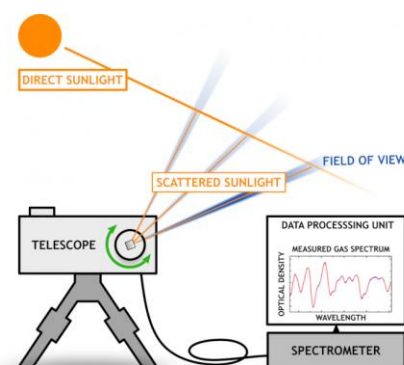
of the instruments can be adapted to the needs of the user. The ultra-low stray light spectrometers are temperature stabilized with a precision better than 0.02°C to allow stable and reliable recording of spectral data. The motorised prism telescope can realise viewing elevation angles from -10° to 190° and includes an inclination sensor with automatic elevation adjustment. This allows for fast deployment without the need for levelling the instrument and even for real-time elevation correction on moving platforms.

The telescope has no outside moving parts which guarantees a long life system and operation also at hard environmental conditions (e.g. snow). The integrated telescope heating activates below 5°C and avoids snow and ice on the optics.

With the new model 250, the telescope can also be used separately with RS232 communication. Different telescopes can be switched between systems, providing flexibility also with regards to high precision spectroscopic applications other than passive DOAS. Humidity is now monitored in both, spectrometer and telescope unit, to reduce maintenance efforts.

### APPLICATIONS

- Passive DOAS especially MAX (Multi Axis) - DOAS measurements
- Air quality monitoring and trace gas measurements in urban, rural, polar, and pristine environments
- Vertical profiles of NO<sub>2</sub>, SO<sub>2</sub>, HCHO, aerosol optical depth
- Long term measurements with low maintenance
- Emission monitoring of power plants, industrial complexes or volcanoes
- Scientific studies involving measurements of NO<sub>2</sub>, SO<sub>2</sub>, HCHO, HONO, Glyoxal, BrO, IO, Ozone
- Zenith sky measurements for stratospheric measurements of Ozone, NO<sub>2</sub>, BrO
- Spectral analysis of surface reflection
- Applications on moving platforms (e.g. ships, airplanes)



Scheme of SkySpec 1D measurement geometry and principle.

## PROPERTIES (TYPICAL)

<b>Spectrometer specifications (typ.)<sup>1,2</sup></b>	Config.	Range [nm]	FWHM [nm]	Filter
	UV-I	300-405	0.45	BG3
	UV-II	300-460	0.6	BG3
	Vis	420-565	0.6	BG40
<b>Noise</b>	10 <sup>-4</sup> at 1000 scans (= 60 s integration time)			
<b>Quantum efficiency</b>	UV: 60% with back-thinned detectors Vis: up to 80%			
<b>Spectrometer temp. stability</b>	20 °C (adjustable), ± 0.02 °C			
<b>Wavelength calibration</b>	Highly stable in-house calibration (typ. shifts < 0.01 nm), optionally: build in mercury-lamp or manual calibration			
<b>Operation temperature range</b>	Spectrometer unit: -10 °C to 40 °C Telescope: -30 °C to 50 °C			
<b>Elevation range and accuracy</b>	-10° to 190°, ± 0.2° automatic elevation correction			
<b>Field of view FWHM, vertical x horizontal</b>	≈ 0.3° x 1°			
<b>Telescope mounting options</b>	Wall mount, tripod or mast			

<b>Mechanical stability</b>	Robust for harsh environmental conditions, water proof (IP 64)	
<b>Additional Sensors</b>	Temperature:	1 °C accuracy, ambient, telescope, spectrometers, electronics
	Pressure:	0.5% accuracy, ambient
	Humidity:	± 3% accuracy in relative humidity, Spectrometer and telescope unit.
<b>Measurement software</b>	Included, customizable measurement routine (angles, time resolution)	
<b>Start-up time</b>	< 2 min	
<b>Data communication</b>	USB 2.0	
<b>Power consumption</b>	Typ. < 30 W (max. 100 W), 12 V	
<b>Weight</b>	Spectrometer unit	≈ 8 kg
	Telescope unit	≈ 4 kg
	Full setup (incl. Laptop, fibres, cables)	≈ 17 kg
<b>Size</b>	Spectrometer unit	40 x 35 x 13 cm <sup>3</sup>
	Telescope unit	37 x 23 x 13 cm <sup>3</sup>

<sup>1</sup>Spectrometers are equipped with colour filters to reduce stray light, <sup>2</sup>Custom specifications with different wavelength ranges are possible.

## OPTIONAL COMPONENTS & CONFIGURATIONS

- Custom spectrometer configuration and systems with only one spectrometer
- Integrated, wide FOV camera (2 cameras cover 0° to 180° elevation) to monitor measurement conditions
- Integrated mercury (HG) wavelength calibration lamp system and shutter
- Fibre and cable length of 15 or 20 m
- Telescope mounting frame / tripod + adapter
- Spare parts and maintenance set
- Pre-configured measurement PC (Notebook / Desktop)
- Spectral data analysis package
- Online installation and support service

## ADVANTAGES

BENEFITS	INNOVATION
<b>High measurement accuracy</b>	<ul style="list-style-type: none"> <li>• Coverage of large spectral range with high spectral resolution (no undersampling)</li> <li>• Ultra-low stray light spectrometers</li> <li>• Stable spectrometer temperatures, low noise</li> <li>• Spectrometer characterization included: wavelength calibration, offset, dark current, non-linearity</li> <li>• Real-time monitoring and automatic correction of telescope elevation for applications on moving platforms</li> <li>• Small telescope field of view (FOV)</li> </ul>
<b>Simple setup &amp; operation</b>	<ul style="list-style-type: none"> <li>• Simple instrument setup and start up</li> <li>• Fast, accurate and reproducible due to built-in inclination sensor</li> <li>• Low maintenance, easy cleaning of optics</li> <li>• Telescopes can be switched between systems</li> <li>• Easily adaptable measurement routine</li> </ul>
<b>Long lifetime</b>	<ul style="list-style-type: none"> <li>• No moving parts on the outside</li> <li>• Water proof with IP64, snow resistant</li> <li>• Designed for long term operation</li> <li>• Spectrometer drying unit to avoid water condensation</li> </ul>

Dated: 30/05/22

© 2022 Airyx GmbH. All rights reserved. Justus-von-Liebig-Str. 14, 69214 Eppelheim/Heidelberg/Germany, airyx.de



FIND MORE INFORMATION ON SKYSPEC PRODUCTS AND PERFORMANCE IN THE GENERAL SKYSPEC INSTRUMENT DESCRIPTION.