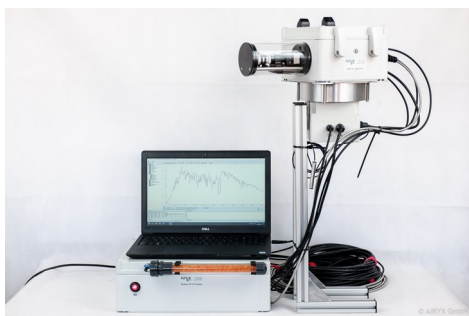


## SkySpec 2D Instrument v.210

FAST AND ACCURATE SPECTRAL OBSERVATIONS OF SCATTERED AND DIRECT SUN LIGHT



SkySpec 2D Spectrometer and telescope units



SkySpec2D on tripod mount

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. Observations of scattered and direct sunlight are possible. These measurements provide information on the tropospheric (and stratospheric) distribution of various trace gases, e.g. NO<sub>2</sub>, SO<sub>2</sub>, formaldehyde, and aerosols. Also other high precision spectroscopic applications are possible.

The SkySpec 2D consists of a spectrometer unit housing two spectrometers and the 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 visible) 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 an accuracy of less than 0.02 °C to allow stable and reliable recording of spectral data.

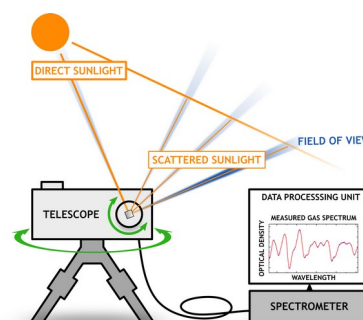
The prism elevation telescope can measure in a range from -10° to 190° and includes an inclination sensor with automatic elevation adjustment. This allows fast deployment without the need for levelling the instrument and even elevation correction on moving platforms.

The 2D system allows additionally horizontal rotation: The telescope can point to any direction in the sky. Direct sun measurements are also possible where a light diffuser system is moved into the optics to reduce light intensity and realise a homogeneous sun spectrum essential for good spectral data quality. The system can simply switch between direct sun and scattered sunlight measurements.

The telescope features only a few moving parts on the outside, which guarantees low maintenance and long system life. The integrated telescope heating activates below 5 °C and avoids snow and ice on the optics.

### 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/direct sun measurements for stratospheric measurements of Ozone, NO<sub>2</sub>, BrO
- Spectral analysis of surface reflection
- Trace gas measurements in multiple viewing directions



Scheme of SkySpec2D measurement geometry and principle.

## PROPERTIES (TYPICALLY)

Spectrometer specifications (typ.) <sup>*1,2</sup>	Conf.	Range[nm]	FWHM [nm]	Filter	Additional sensors: Temperature Pressure Humidity	
	UV-I	300-405	0.45	BG3		ambient
	UV-II	300-460	0.6	BG3		ambient
	Vis	420-565	0.6	BG40	location spectrometer electronics	
Noise	10 <sup>-4</sup> at 1000 scans ( -60s int. time)					
Quantum efficiency	UV: 60% with back thinned detectors Vis: up to 80%				Measurement software	Included, customizable measurement routine (angles, time resolution)
Spectrometer temperature stability	20°C, adjustable ± 0.02°C				Start-up time	< 2 min
Wavelength calibration	Build in mercury (HG)-lamp or manually (optional)				Data communication	USB 2.0
Operation temperature range (telescope unit)	-30°C to 50°C				Power consumption	Typ. < 30 W (max. 100W), 12 V
Elevation range, accuracy	-10° to 190°, 0.2° automatic elevation correction				Weight	~ 14 kg
Vertical field of view	~ 0.3°				Size spectrometer unit	40 x 35 x 13 cm <sup>3</sup>
					telescope unit	37 x 23 x 32 cm <sup>3</sup>
					Telescope mounting options	Wall mount, tripod or mast
					Mechanical stability	Robust for harsh environmental conditions water proof (IP 67)

### COMMENTS:

<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 camera (2 cameras cover 0° to 180° elevation)
- Telescope light diffuser system for direct sun measurements with integrated mercury (HG) wavelength calibration lamp system
- Fibre and cable length of 15 or 20 m
- Heated Azimuth 2D motor (enables low temperature operation)
- 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

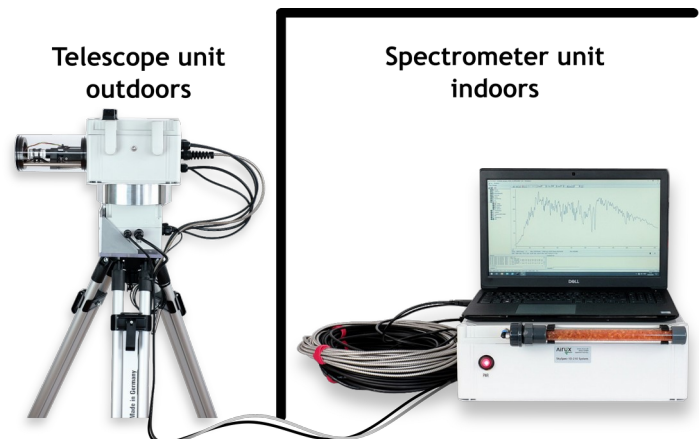


Illustration of setting up the SkySpec21D.

## ADVANTAGES

### BENEFITS

#### High measurement accuracy

- Coverage of large spectral range with high spectral resolution (no undersampling)
- Ultra-low stray light spectrometers
- Stable spectrometer temperatures, low noise
- Nonlinear spectrometer characterization included
- Continuous measurement and fast automatic correction of telescope elevation
- Small telescope field of view (FOV)
- High spectral quality in direct sun mode
- Measurement routine adaptable

#### Simple setup & operation

- Simple instrument setup and start up
- Fast, accurate and reproducible due to built-in inclination sensor
- Automatic azimuth adjustment with direct sun search
- Low maintenance, easy cleaning of optics

#### Long lifetime

- Minimum outside moving parts
- Water proof with IP67, snow resistant
- Designed for long term operation
- Spectrometer drying unit to avoid water condensation

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