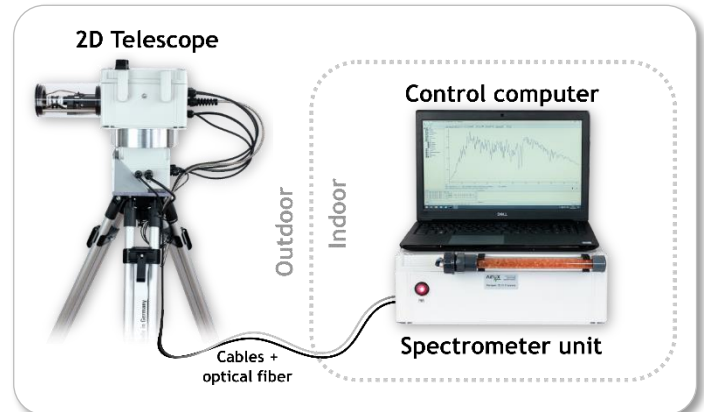


# SkySpec 2D Instrument v.250

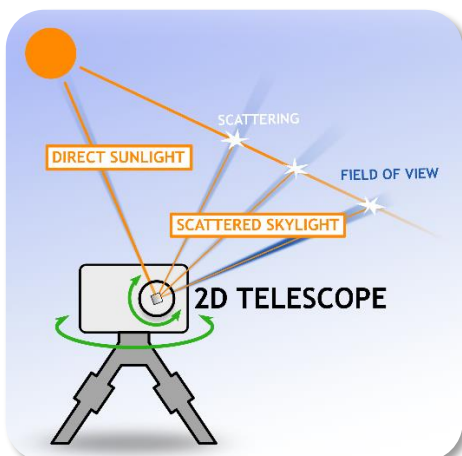
## TELESCOPE-SPECTROMETER SYSTEM FOR PASSIVE REMOTE SENSING



- Telescope-spectrometer system for direct-sun and scattered skylight spectrum acquisition
- Optimized for UV/Vis-aerosol and trace gas remote sensing with the DOAS method
- Other applications are possible
- Detectable gases: NO<sub>2</sub>, HCHO, SO<sub>2</sub>, O<sub>4</sub>, O<sub>3</sub>, H<sub>2</sub>O, HONO, Glyoxal, BrO, IO, ...
- Modular and customizable to meet your specific requirements
- Software packages for spectral analysis, post-processing and data visualization available

### TELESCOPE:

- Two motorized axes → automatic pointing to anywhere in the sky hemisphere
- Automatic correction of telescope viewing elevation via integrated inclination sensor
- Narrow field of view
- Rugged and weather-proof design with minimum outside moving parts
- Integrable wide angle cameras for monitoring purposes



### SPECTROMETER:

- Grating spectrometer in compact and rugged enclosure
- Characterized and calibrated
- Active temperature stabilization
- Low straylight design
- Sub-nm spectral resolution
- High spectral sampling
- Homogenized slit illumination
- Available with backthinned CCD detector to maximize UV sensitivity

**For measurement principle, example applications and data, see SkySpec overview datasheet!**

## HIGHLIGHTS

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### Measurement accuracy

- Individual in-house spectrometer fine adjustment to optimize spectral properties
- Spectrometer characterization included: wavelength calibration, offset and dark current spectra, detector non-linearity function
- Active spectrometer temperature stabilization ensures stable properties
- High spectral sampling prevents quantization errors
- Low noise and high precision in narrow-band optical density
- Color filters and optical bench design minimize spectrometer stray-light
- Cross-section converting fiber bundle for maximum light throughput and homogeneous spectrometer illumination
- Real-time correction of telescope elevation via inclination sensor, ideal for measurements on moving platforms (ships, cars) or in changing environments
- Prism deflector and optical fiber setup prevent polarization induced biases
- Small vertical field of view ( $< 0.3^\circ$ ) optimized for vertical profiling applications
- Optional motorized diffusor attenuates and homogenizes the incoming radiation during direct-sun observations
- Optional integrated mercury lamp for spectrometer calibration monitoring

### Setup, lifetime & maintenance

- Quartz glass tube design minimizes outside moving parts for:
  - ▶ long lifetime even under harsh environmental conditions
  - ▶ simple cleaning
- Integrated telescope heating (activates at  $< 5^\circ\text{C}$ ) prevents:
  - ▶ freezing of mechanical components
  - ▶ water condensation, snow and ice on quartz cylinder and other optics
- Weather proof and UV resistant IP64 housings
- 12V/DC power supply with low consumption, ideal for mobile operation via battery or car-cigarette-lighter
- Easily adaptable measurement routines
- Fast instrument power-up
- Various mounting options (tripod, rail and mast adapters available)
- Switching between direct-sun and scattered skylight observations within seconds

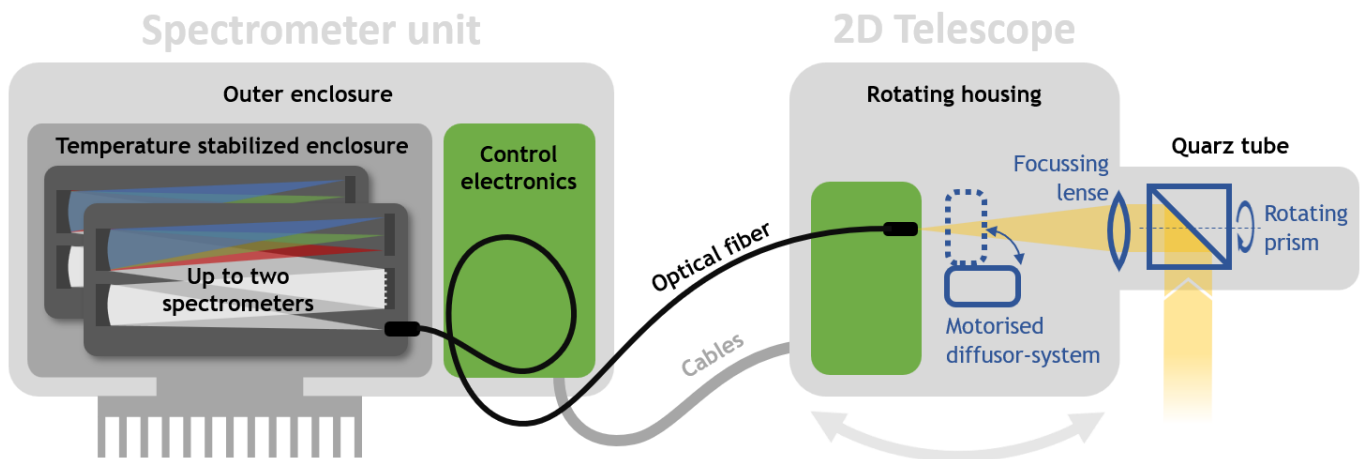
### Customization

- Individual spectrometer configurations to best meet your spectral requirements
  - Various optical fiber configurations
  - Different fiber and cable lengths available
  - Integrable opto-mechanical components for direct-sun observations and calibration monitoring purposes
  - Stand-alone operation of separate spectrometer and telescope units for integration in arbitrary spectroscopic measurement system
-

## TYPICAL SPECIFICATIONS

<b>Spectrometer specifications (typical)</b> <sup>*1,*2</sup>	Config.	Range [nm]	FWHM [nm]	Filter
	UV-I	300-408	< 0.5	BG3
	Vis	408-553	< 0.6	BG40
	UV-II <sup>*3</sup>	300-460	< 0.7	BG3
<b>Noise</b>	< $3 \cdot 10^{-4}$ at $10^3$ scans ( $\approx 60$ s integration time)			
<b>Spectral sampling</b>	> 6 points over slit function FWHM			
<b>Quantum efficiency</b>	UV: > 50 % with back-thinned detectors Vis: up to 80 %			
<b>Spectrometer temp./stability</b>	Temperature: 20 °C (adjustable) Stability better than $\pm 0.03$ °C			
<b>Wavelength calibration</b>	Highly stable in-house calibration (typ. shifts < 0.01 nm), optionally: built-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°, 0.1° resolution, automatic correction with < 0.2° accuracy ( $1\sigma$ )			
<b>Azimuth range and accuracy</b>	-5° to 185°, 0.1° resolution, $\pm 2$ ° accuracy (360° virtually available due to > 180° elevation range)			
<b>Field of view FWHM, vertical x horizontal</b>	Scattered light: < $0.3^\circ \times 1^\circ$ Direct Sun <sup>*4</sup> : $\approx 10^\circ \times 10^\circ$			
<b>Telescope optic</b>	focal length (internal): 75 mm clear aperture: 22.5 mm			
<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:	$\pm 3$ % 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			
	Spectrometer unit	$\approx 8$ kg		
<b>Weight</b>	Telescope unit	$\approx 7$ kg		
	Full setup (incl. Laptop, fibres, cables)	$\approx 20$ kg		
<b>Size</b>	Spectrometer box (WxDxH)	Box: 40 x 35 x 13.2 cm <sup>3</sup>		
	Telescope unit (WxDxH)	Box:	20 x 20 x 29 cm <sup>3</sup>	
		Tube (LxD):	16 cm x 8 cm	
<b>Telescope mounting options</b>	Wall mount, tripod or mast			

<sup>\*1</sup> Spectrometers equipped with color filters to reduce stray light, <sup>\*2</sup> Custom specifications are possible, <sup>\*3</sup> Replaces UV-I, max 2 spectrometers, <sup>\*4</sup> FOV widened due to diffusor system

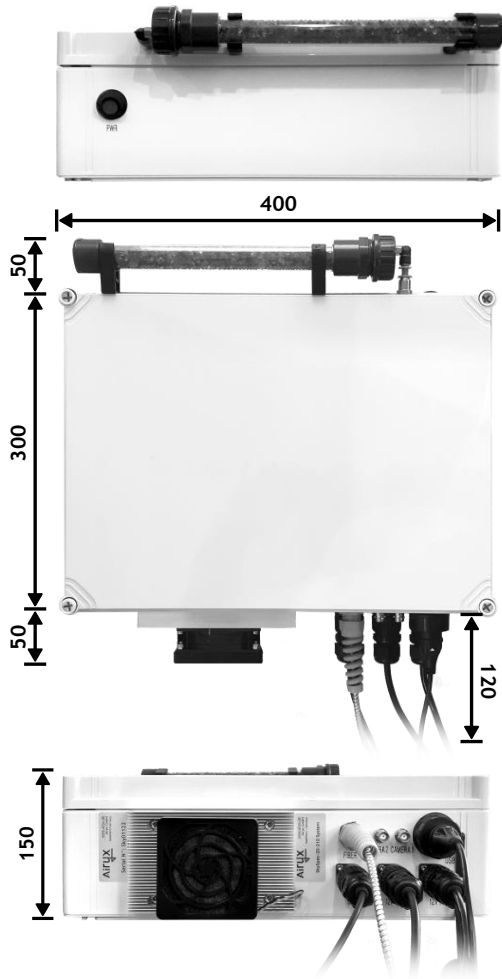


## OPTIONAL COMPONENTS & CONFIGURATIONS

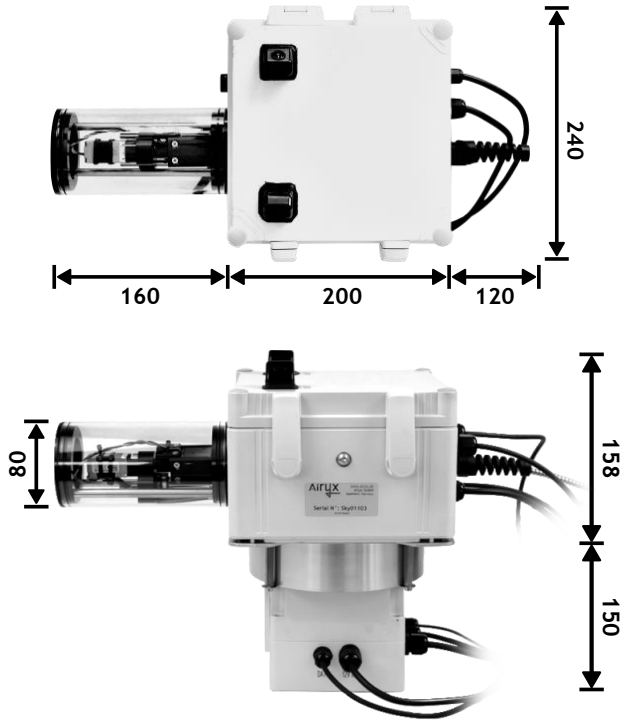
- Custom spectrometer configuration and systems with only one spectrometer
- Integrated, wide FOV camera (2 cameras cover 0° to 180° elevation) to monitor measurement conditions
- Integrated mercury (HG) wavelength calibration lamp system
- Integrated diffusor system for homogenisation of direct Sun light
- Fibre and cable length of 15 m or 20 m
- Azimuth motor heating (for low temperature operation)
- Tripod and various mounting adapters (rails, masts, ...)
- Spare parts and maintenance set
- Pre-configured measurement PC (notebook/desktop)
- Spectral data analysis and imaging software packages
- Online installation and support service

## DIMENSIONS

### SPECTROMETER BOX:



### TELESCOPE UNIT:



All dimensions in mm