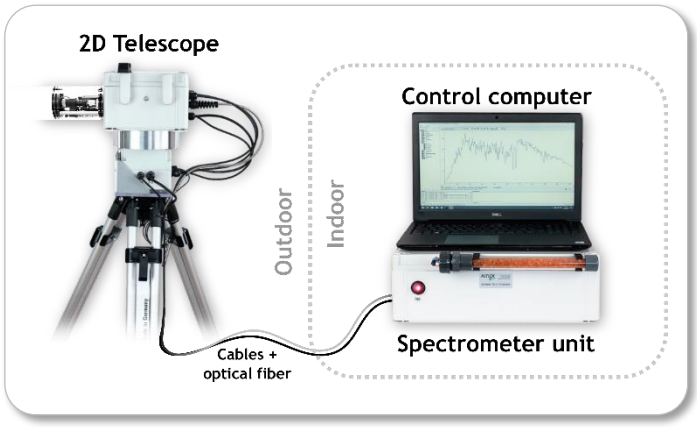
# SkySpec 2D Instrument v.260

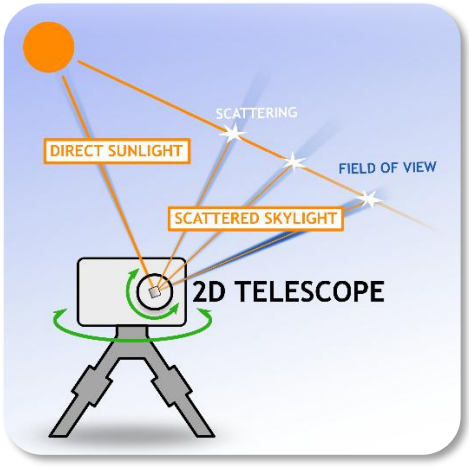
## TELESCOPE-SPECTROMETER SYSTEM FOR PASSIVE REMOTE SENSING




- 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: $NO_2$, HCHO, $SO_2$, $O_4$, $O_3$, $H_2O$, 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

**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°) 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°C) prevents:
  - water condensation, snow and ice on quartz cylinder and other optics
  - freezing of mechanical components
- 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**

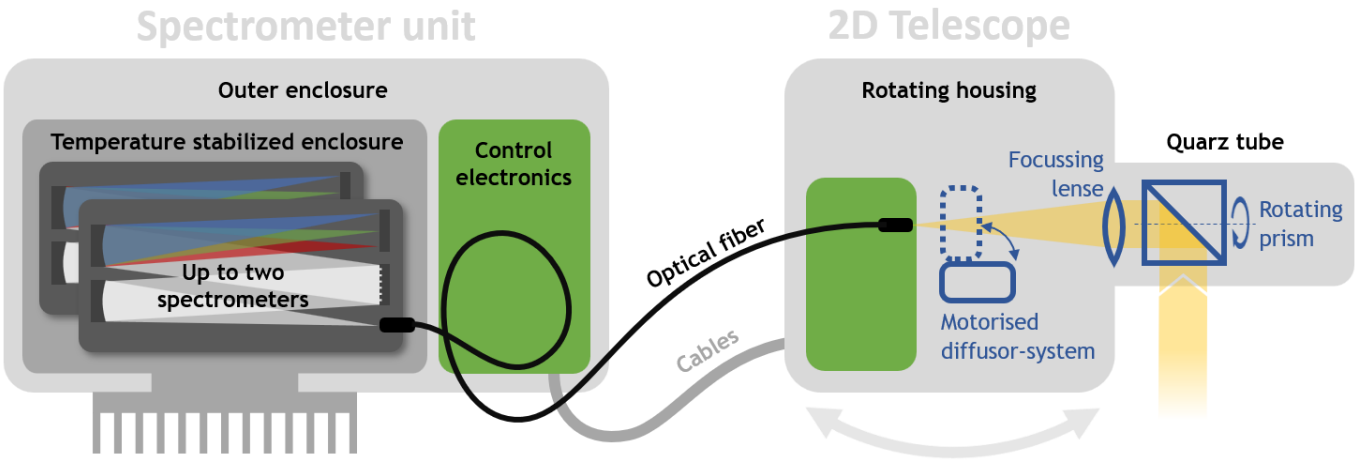
- Individual spectrometer configurations to best meet your spectral requirements
- Various optical fiber configurations
- Different fiber and cable lengths available
- Integrable opto-mechanical components for direct-sun observations and calibration monitoring purposes
- Stand-alone operation of separate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

# TYPICAL SPECIFICATIONS

| | | | | |
|---|---|---|---|---|
| **Spectrometer specifications (typical)** *1,*2 | Config. | Range [nm] | FWHM [nm] | Filter |
| | UV-I | 300-408 | < 0.5 | BG3 |
| | Vis | 408-553 | < 0.6 | BG40 |
| | UV-II *3 | 300-460 | < 0.7 | BG3 |
| **Noise** | < $3 \cdot 10^{-4}$ at $10^3$ scans (≈60s integration time) | | | |
| **Spectral sampling** | > 6 points over slit function FWHM | | | |
| **Quantum efficiency** | UV: > 50 % with back-thinned detectors<br>Vis: up to 80 % | | | |
| **Spectrometer temp./stability** | Temperature: 20°C (adjustable)<br>Stability better than +/-0.03°C | | | |
| **Wavelength calibration** | Highly stable in-house calibration (typ. shifts < 0.01 nm), optionally: built-in mercury-lamp or manual calibration | | | |
| **Operation temperature range** | Spectrometer unit: -10°C to 40°C<br>Telescope: -30°C to 50°C | | | |
| **Elevation range and accuracy** | -10° to 190°, 0.1° resolution, automatic correction with < 0.2° accuracy (1σ) | | | |
| **Azimuth range and accuracy** | -5° to 185°, 0.1° resolution, ± 2°accuracy (360° virtually available due to > 180° elevation range) | | | |
| **Field of view FWHM, vertical x horizontal** | Scattered light: < 0.3° x 1°<br>Direct Sun *4: ≈ 10° x 10° | | | |

| | | |
|---|---|---|
| **Telescope optic** | focal length (internal): 75 mm<br>clear aperture: 22.5 mm | |
| **Mechanical stability** | Robust for harsh environmental conditions, water proof (IP 64) | |
| **Additional Sensors** | Temperature: | 1°C accuracy, ambient, telescope, spectrometers, electronics |
| | Pressure: | 0.5 % accuracy, ambient |
| | Humidity: | ± 3 % accuracy in relative humidity, Spectrometer and telescope unit |
| **Measurement software** | Included, customizable measurement routine (angles, time resolution) | |
| **Start-up time** | < 2 min | |
| **Data communication** | USB 2.0 | |
| **Power consumption** | Typ. < 30 W (max. 100 W), 12 V | |
| **Weight** | Spectrometer unit | ≈ 8 kg |
| | Telescope unit | ≈ 7 kg |
| | Full setup (incl. Laptop, fibres, cables) | ≈ 20 kg |
| **Size** | Spectrometer box (WxDxH) | Box: 40 x 35 x 13.2 $cm^3$ |
| | Telescope unit (WxDxH) | Box: 20 x 20 x 29 $cm^3$<br>Tube (LxD): 12.3 cm x 8 cm |
| **Telescope mounting options** | Wall mount, tripod or mast | |

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



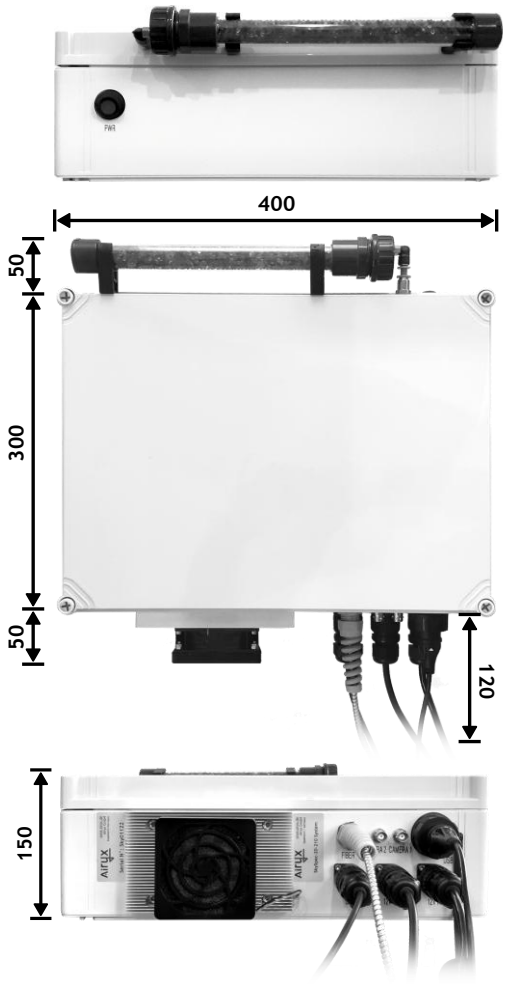

# OPTIONAL COMPONENTS & CONFIGURATIONS

- 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 10 m, 15 m or 20 m
- 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

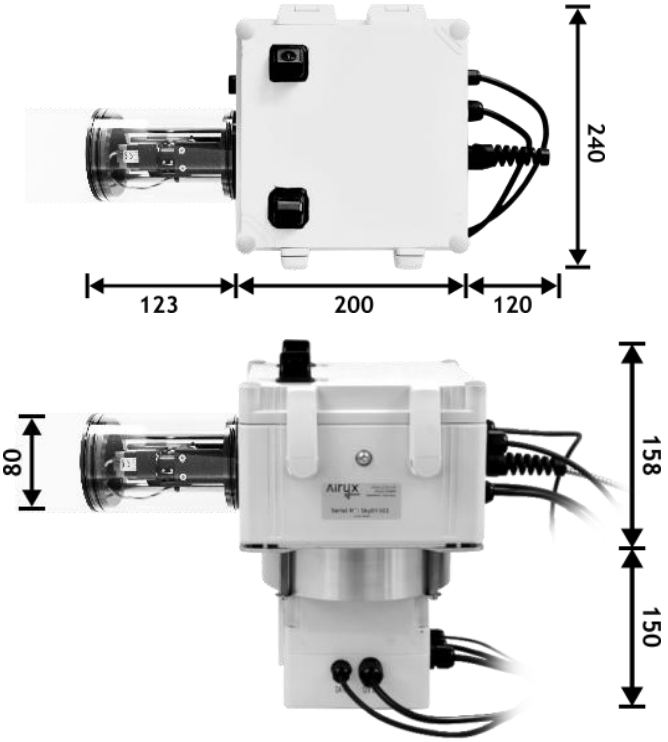
 

# DIMENSIONS

## SPECTROMETER BOX:




## TELESCOPE UNIT:




*All dimensions in mm*