



# EM 27/SUN Series

- For Atmospheric Measurements



The new EM27/SUN Series spectrometers represent FTIR Remote Sensing analyzers dedicated for atmospheric measurements. They quantify gases such as carbon dioxide and methane in the atmosphere by analyzing the radiation of the sun utilizing the CAMTracker system. This is an innovative camera-based feedback system following the sun as light source.

The EM27/SUN Series spectrometers provide a very compact and robust design, relatively low weight, and an intuitive user interface. They are highly portable and hence ideally suited for long term measurement campaigns in remote areas with little infrastructure.

### **Key Features**

- CAMTracker controlled SolarTracker
- Portable and easy to set up
- Permanently aligned
- Maintenance free
- High precision atmospheric gas analysis

### CAMTracker:

- High accuracy automatic control system
- Always aligned
- Insensitive to distortions e.g. from clouds or obstructive objects

### CAMTracker

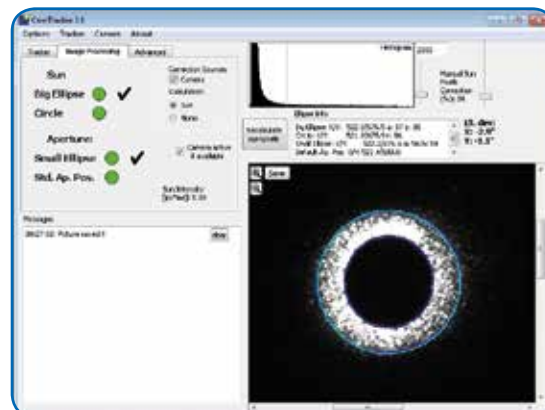
The EM27/SUN Series features the new CAMTracker system which is an improved version of the well-known SolarTracker and gives outstanding performance. It utilizes an innovative camera-based feedback system to follow the movement of the sun, which is used as the light source. The outstanding tracking accuracy is the basis for high-precision quantifications.

A camera observes an image of the sun inside the spectrometer. The CAMTracker system records this image, and uses image-processing algorithms to determine the exact SolarTracker orientations to ensure the correct positioning of the solar image. This principle makes the tracking very precise and insensitive to distortions, e.g. thin clouds.

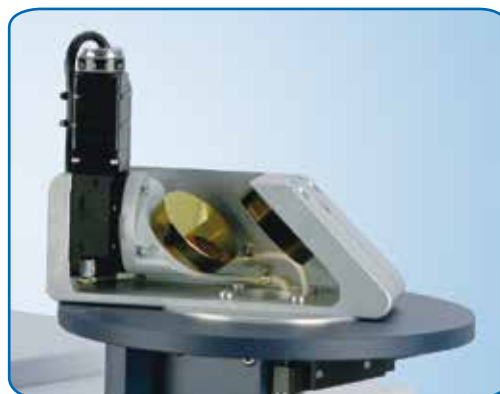
The EM 27/SUN Series determines the gas amount in the complete atmosphere, from the ground up to space, and not only at the position where the instrument is located. This is of high value for detecting changes in the atmosphere.

### Advantages

- Direct line-of-sight information
- Easy setup
- No special optical elements
- Insensitive to inhomogeneous illumination



CAMTracker system to follow the movement of the sun.



CAMTracker of the EM 27/SUN

### Spectral Range

The EM 27/SUN is available in an NIR version covering the spectral range from 5.000 to 14.500  $\text{cm}^{-1}$  and in an MIR version covering the range from 750 to 5.200  $\text{cm}^{-1}$ . For the MIR version we also offer a high-resolution option with 0.2  $\text{cm}^{-1}$  instead of 0.5  $\text{cm}^{-1}$  resolution.



EM 27/SUN (NIR)



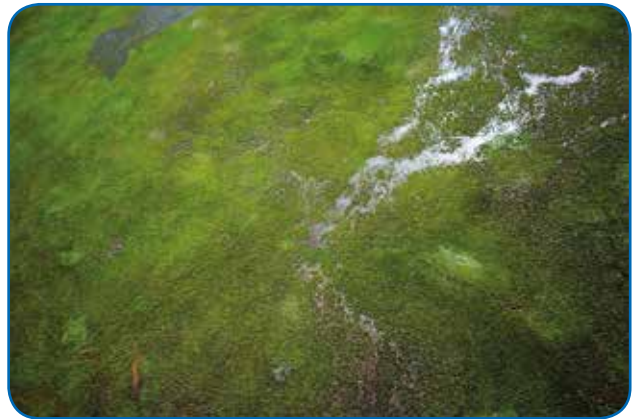
EM 27/SUN (MIR)

## ● Application

The EM 27/SUN Series represents mobile analyzers dedicated to atmospheric studies with outstanding performance.

It is used by universities and research institutions, for example in urban sites to determine the impact of human activities e.g. on greenhouse gas concentrations, but also in remote sites to investigate natural gas sources such as bush fires or gases emitted from melting permafrost or from swamps.

By positioning several EM 27/SUN around such potential sources for greenhouse gases, their source strength can be detected and even be quantified.<sup>[1]</sup>

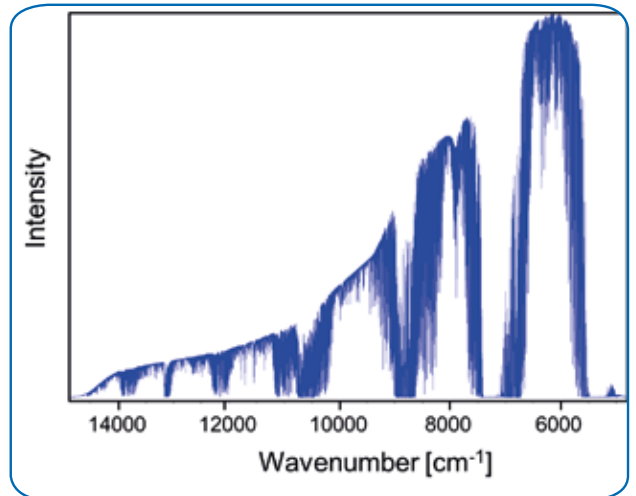


### Outstanding performance combined with maximum mobility

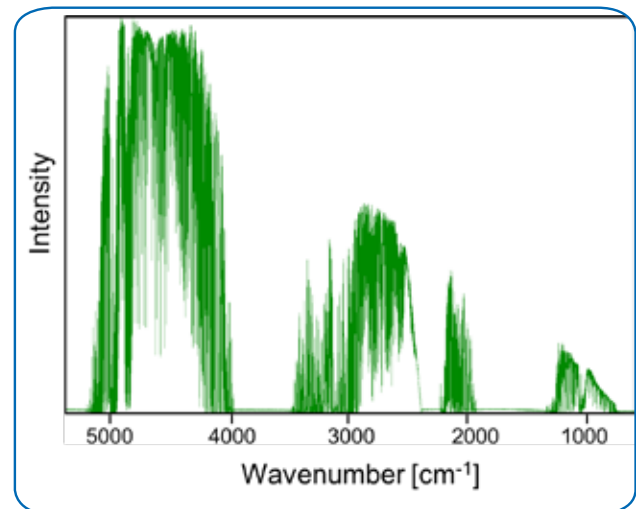
Global measurements of the concentrations of greenhouse gases like carbon dioxide and methane are recorded within the Total Carbon Column Observing Network (TCCON) using the high-resolution FTIR spectrometer IFS 125HR from Bruker. In areas with little infrastructure it is very challenging to set-up such a high-resolution spectrometer due to its size and weight. Here the EM 27/SUN serves as the perfect solution due to its compact and robust design inducing maximum mobility.

The carbon dioxide concentrations retrieved with the EM27/SUN are in excellent agreement to the values that were simultaneously recorded with the high-resolution TCCON spectrometer IFS 125HR ( $0.014 \text{ cm}^{-1}$ ), as shown in the image on the lower right.<sup>[2]</sup>

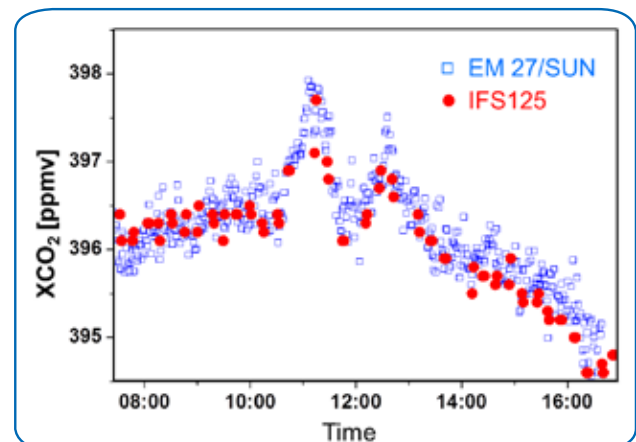
The IFS 125HR allows to investigate the height-profiles in the atmosphere, whereas the compact and easy transportable EM27/SUN is ideally suited for the investigation of column densities.



Example spectrum that was taken with an EM 27/SUN (NIR). Other spectral ranges are optionally available.



Example spectrum that was taken with an EM 27/SUN (MIR). Other spectral ranges are optionally available.



Comparison of the carbon dioxide concentration in the atmosphere retrieved with the EM 27/SUN and the IFS 125HR spectrometer from Bruker. The retrieved concentrations are in excellent agreement.<sup>[2]</sup>

Further scientific measurements performed with the EM 27/SUN can be found for example in the following publications:

<sup>[1]</sup> F. Hase, M. Frey, T. Blumenstock, J. Groß, M. Kiel, R. Kohlhepp, G. Mengistu Tsidu, K. Schäfer, M. K. Sha, and J. Orphal, *Atmos. Meas. Tech.* 8, 3059-3068 (2015)

<sup>[2]</sup> M. Gisi, F. Hase, S. Dohe, T. Blumenstock, A. Simon, and A. Keens, *Atmos. Meas. Tech.* 5, 2969-2980 (2012)

## ● Specifications

	<b>EM 27/SUN (NIR)</b>	<b>EM 27/SUN (MIR)</b>
Spectral range:	5.000 - 14.500 $\text{cm}^{-1}$ (other spectral ranges optional)	750 - 5.200 $\text{cm}^{-1}$ (other spectral ranges optional)
Spectral resolution:	0.5 $\text{cm}^{-1}$	0.5 $\text{cm}^{-1}$ 0.2 $\text{cm}^{-1}$ with high-resolution option
Beamsplitter:	Quartz	ZnSe
Internal source:	NIR source	Blackbody
Interferometer:	RockSolid™ permanently aligned	RockSolid™ permanently aligned
CAMTracker resolution:	< 1.2 arc sec = 0.006 mrad	< 1.2 arc sec = 0.006 mrad
CAMTracker controlled via:	TCP/IP	TCP/IP
Size:	~ 620 x 360 x 475 $\text{mm}^3$	~ 800 x 430 x 475 $\text{mm}^3$





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Bruker Optics is the leading manufacturer and worldwide supplier of Fourier Transform Infrared, Near Infrared and Raman spectrometers for various industries and applications. For years, we set new standards on the market when it comes to precision and efficiency, ergonomics and ease of operation, consulting and services.

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Our success stems from our commitment and dedication to provide you the proper analytical tool you require to solve a demanding research problem or run daily quality control routine procedures.

## Related Bruker Optics Instrumentation



### IFS 125HR

- The IFS 125HR spectrometer is designed as an ultra-high resolution FTIR spectrometer. It provides outstanding performance not only for R&D laboratory application, but also for highly accurate atmospheric trace gas analysis, atmospheric emission studies and remote monitoring of atmospheric pollutants.

### EM 27 Remote Sensing FTIR

- The EM 27 is a ruggedized remote sensing system providing high performance spectroscopy in the field. The EM 27 can easily be deployed in the field for various air monitoring applications. Emissions from smoke stacks, waste disposal and hazardous emissions from chemical accidents can be observed with an operating range of typically several kilometers.



### SIGIS 2 Scanning Imaging Remote Sensing System

- SIGIS 2 is a scanning imaging remote sensing system that allows rapid identification, quantification and visualization of gas clouds from long distances. The system maps a predefined area and results of the analysis are visualized by a video image, overlaid by a chemical image. SIGIS systems are applied in environmental applications, atmospheric research, volcanology, and industrial facility surveillance and are part of the equipment of emergency response forces around the world.

### HI90 Hyperspectral Imaging System

- The HI 90 is a high performance imaging Fourier transform spectrometer based on a focal plane array detector that allows for real-time identification, quantification and visualization of gas clouds from long distances. Each pixel of the array records an interferogram from the corresponding field of view. A spectrum is obtained by Fourier transformation and contains the infrared signature of the scene.



### OPS Open Path Air Monitoring System

- The open path air monitoring system allows identification and quantification of airborne pollutants and atmospheric gases. Infrared radiation is modulated by an interferometer and transmitted to an array of retroreflectors positioned at a distance of typically several hundred meters. Typical applications include air monitoring at industrial, construction or municipal sites and high-precision quantification of atmospheric gases.

### MATRIX-MG Series

- The MATRIX-MG Series represents high performance FTIR gas analysers in a compact and rugged housing designed for the automated, high precision and real-time monitoring of gas concentrations in many different process applications. The target gas is measured in a gas cell for high sensitivity automated compound analysis.



**Bruker Optics is ISO 9001 and ISO 13485 certified.**

Laser class 1

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● **Bruker Optics Inc.**

**Bruker Optik GmbH**

**Bruker Shanghai Ltd.**

Billerica, MA · USA  
Phone +1 (978) 439-9899  
Fax +1 (978) 663-9177  
info.bopt.us@bruker.com

Ettlingen · Germany  
Phone +49 (7243) 504-2000  
Fax +49 (7243) 504-2050  
info.bopt.de@bruker.com

Shanghai · China  
Phone +86 21 51720-800  
Fax +86 21 51720-899  
info.bopt.cn@bruker.com

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