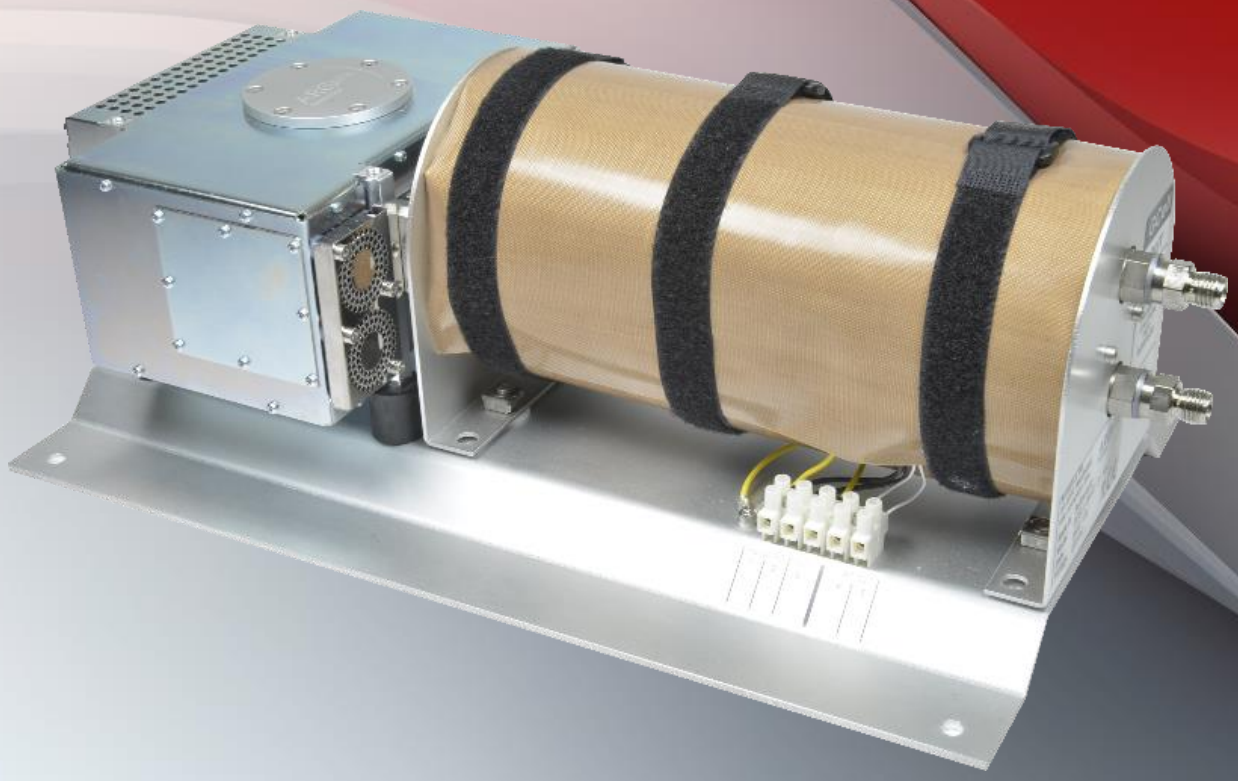
ARCoptix
Switzerland

GAS ANALYZERS CATALOG



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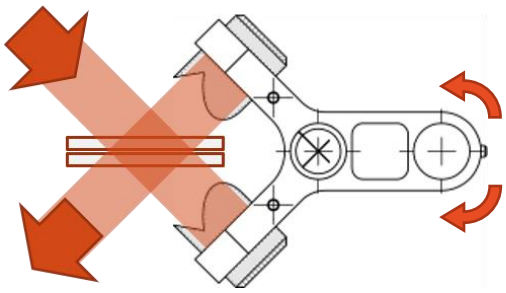
ARCOPTIX S.A.

Who are we ?

ARCoptix S.A. is a swiss company active in the field of optical spectroscopy. Founded in 2006, our facilities are spread between our sales offices in Neuchâtel, located on the shore of lake Neuchâtel, and our production line in Tramelan, which lies in the beautiful region of the Jura mountains. Our core line of business is Fourier-transform infrared (FT-IR) spectroscopy, which can address a wide range of applications in the near-infrared (NIR) and mid-infrared (MIR) regions of the electromagnetic spectrum. With hundreds of instruments operating worldwide for more than a decade, our teams have an extensive expertise in the manufacturing and qualification of benchtop and original equipment manufacturer (OEM) FT-IR spectrometers.

What do we do ?

FT-IR spectrometers analyze the spectrum of light thanks to the scanning of an interferometer that lies at the core of the instrument. Our instruments rely on a permanently aligned interferometer, which consists in a pair of reflective corner-cubes mounted on a common swinging arm. This Y-shaped pendulum rotates on a wear-free flexure pivot, ensuring a long-lived operation by avoiding mechanical wear.



Dual corner cube mounted on a common swinging arm

Our OEM010 series featuring an internal light source, interferometer and detector.

This robust design paired with high quality, carefully selected optical components allow us to produce extremely compact, reliable and accurate analyzers with competitive performances with respect to other solutions found on the market of Fourier-transform spectroscopy. Besides standard products, we have a fast-prototyping capability that make possible the quick implementation and testing of custom configurations tailored to your specific application.

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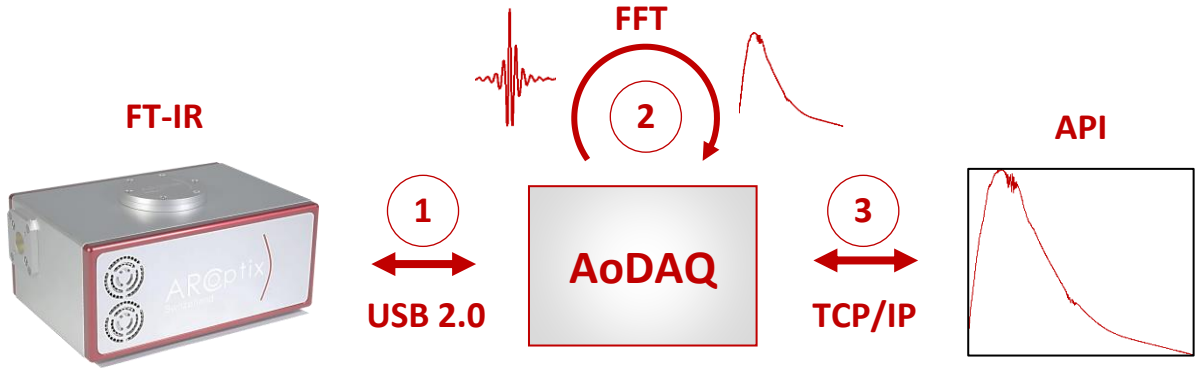
SOFTWARE

Our software – your application

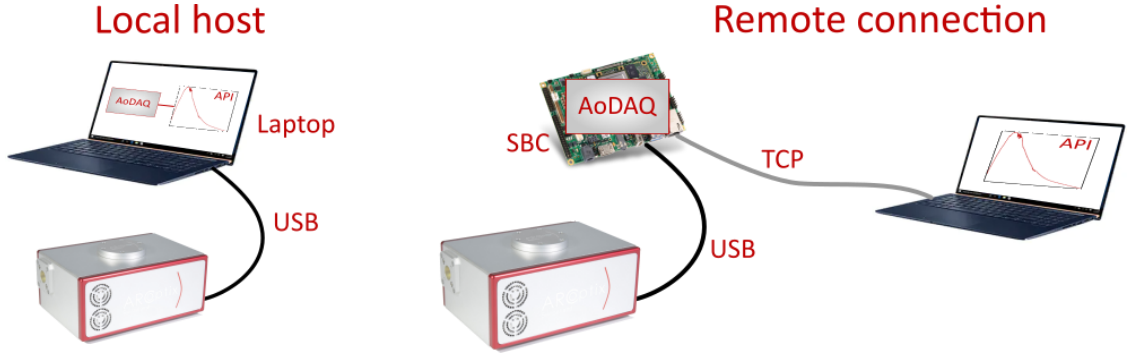
At ARCoptix, we fully appreciate and value the multiple benefits that a dedicated, performant and reliable software can bring to your application. Automatic data collection, parameters changes, status diagnosis and many other essential tasks should be implemented as simply and as efficiently as possible in order to get the most out of your spectrometer. This philosophy led to the development of a multi-threading, cross-platform and versatile software application, the ARCoptix digital acquisition system or AoDAQ.



The AoDAQ simultaneously takes care of:

1. Handling communication with the FT-IR via USB
2. Processing raw signals to deliver a spectrum
3. Running a TCP Ethernet server

The AoDAQ can be installed on all sorts of computers, from desktop machines to embedded, low-power single board computers. Thanks to the hosting of a TCP server, the instrument data and parameters can be accessed locally and/or remotely. All communication with the instrument eventually reduces to a set of TCP/IP commands that allow to quickly acquire data, adjust parameters, monitor the instrument status etc. using the programming environment of your choice.



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A MATTER OF RESOLUTION

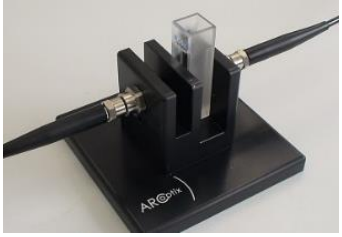
Which resolution for your application ?

The resolution of an optical spectrometer is without doubt one of its most crucial parameters. Higher resolving power means better discrimination of closely positioned spectral features, which intuitively speaking should enable retrieving more detailed information from a given measurement. While this is true to some extent, some applications do not benefit further from a better resolution beyond a certain point. Besides, the resolution of an FT-IR cannot be improved without trading other parameters such as acquisition time or signal-to-noise ratio, thus degrading other important signal metrics. Overall, what matters most is to operate at the *right* resolution, not at the sharpest available one.

At ARCoptix, our instruments are classified in two distinct categories. Standard resolution instruments offer tunable resolutions up to 2cm^{-1}, which is ideal for the study of condensed matter in general, as it matches the width of the spectral features observed in solids and liquids in the mid and near infrared. High resolution instruments can reach resolution up to 0.5cm^{-1}, which enable resolving the finer structure of individual molecules in a gas mixture or can provide more insight on the emission of a given source such as a laser.

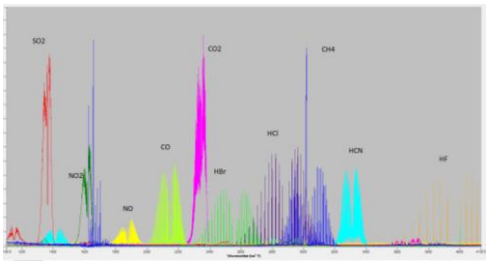
Standard resolution (up to 2cm^{-1}), recommended for:

Solid measurements

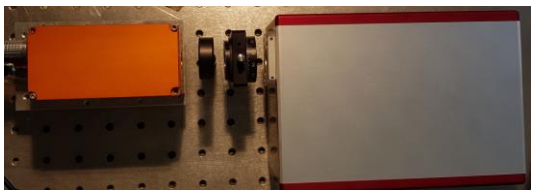


Liquid measurements

High resolution (up to 0.5cm^{-1}), recommended for:



Gas spectroscopy



Laser characterization

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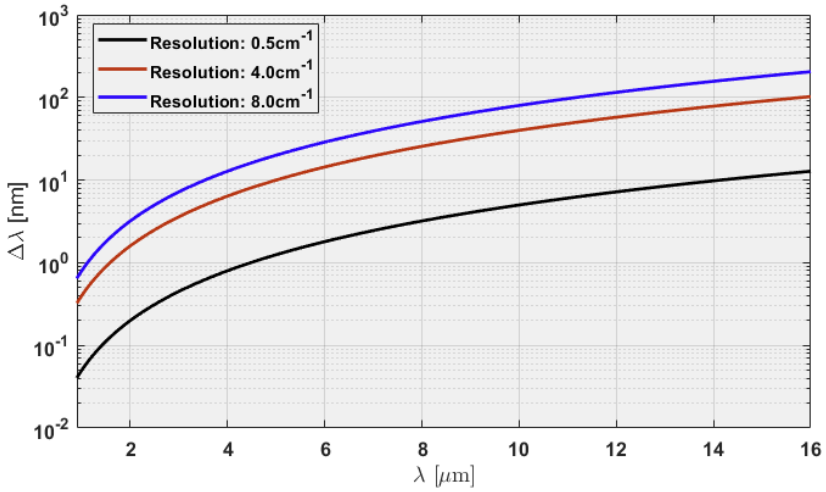
FREQUENTLY ASKED QUESTIONS

What is the equivalent wavelength resolution of my FT-IR ?

Owing to its operating principle, a FT-IR delivers a spectrum uniformly sampled over a given spectral range in wavenumbers (ν), with units of cm^{-1}. The wavenumber is simply defined as the inverse of the wavelength (λ). The resolution of an FT-IR is constant in wavenumber (Δν), but varies with wavelength (Δ λ) due to the inverse relationship between these two units. The equivalence is given by the following rule:

$$\Delta \lambda = \frac{\Delta \nu}{\nu^2}$$



Resolution in [nm] as a function of wavelength in FT-IR systems

What is the typical emission of my ARCLIGHT-MIR/NIR ?

The ARCOptix ARCLIGHT lamps are thermal sources, which behave to a good approximation like blackbodies at a temperature of 2'850 °K (ARCLIGHT-NIR) and 1'50 °K (ARCLIGHT-MIR), the spectral radiances of which are illustrated below. The typical total power emitted by both version of the ARCoptix ARCLIGHT source are shown in the following table.

	ARCLIGHT-NIR	ARCLIGHT-MIR
w/o fiber coupler	360 mW	180 mW
w/ fiber coupler	110 mW	40 mW
w/ optical fiber	20 mW	4 mW

Total optical power of the ARCLIGHT in different configurations

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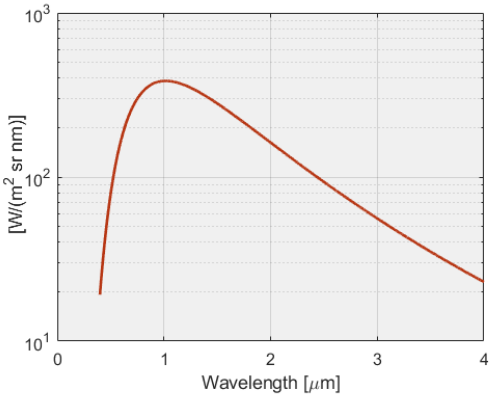
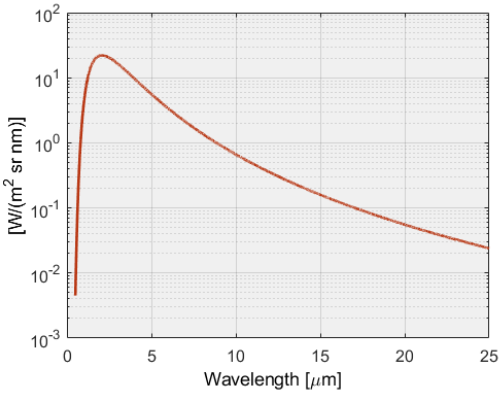


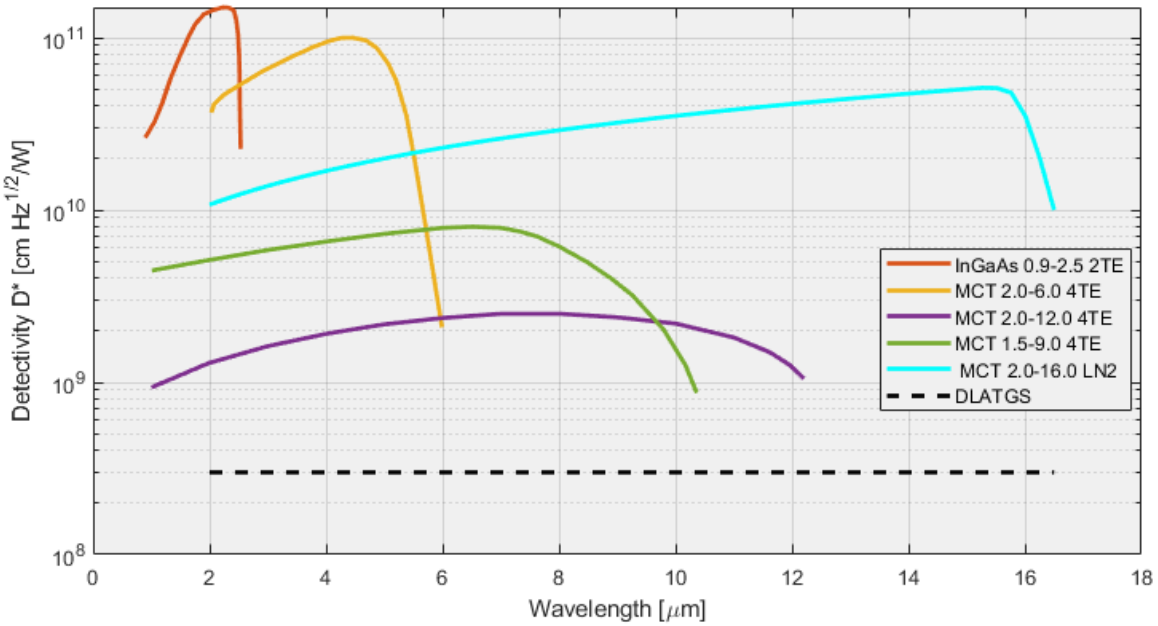
Typical radiance of the ARLIGHT-NIR



Typical radiance of the ARCLIGHT-MIR

How to choose the best detector for my application ?

The choice of a detector is a most sensitive one as it contributes to a large extent to the overall quality of your measurement. ARCoptix offers several types and models of detectors, namely extended InGaAs detectors (2 stage thermo-electric cooling), HgCdTe (MCT) detectors with either thermoelectric cooling (4 stages) or liquid nitrogen cooling as well as pyroelectric (DLATGS) detectors. Selection of a given detector is application driven, and depends on the spectral signatures that you are willing to analyze. In order to deliver a faire comparison between various types of photodetectors (or thermal detectors), the most widespread metric is the specific detectivity (labelled D*), which is given in the figure below for all of our available detectors.



Specific detectivity (D*) of ARCoptix detectors

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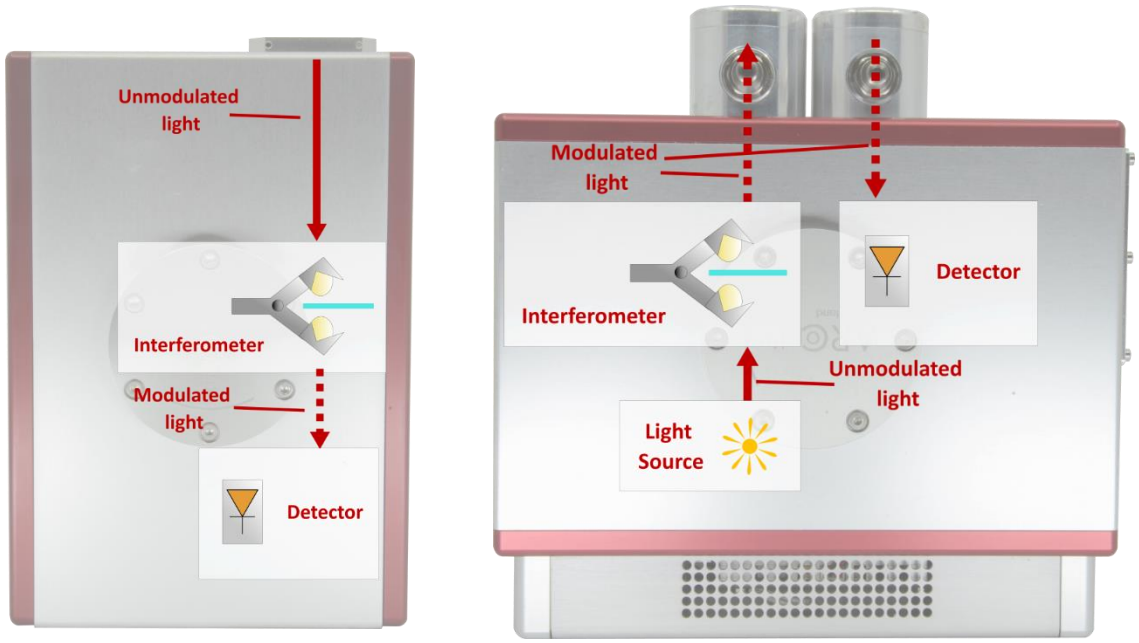
What configuration should I select for my application?

ARCoptix offers two distinct classes of spectrometers: FTIRs without a built-in light source, such as the **FTMIR-L1-120-4TE**, and FTIRs which integrate a built-in emitter, such as the **FTMIR-FC-120-4TE**. Source-free instruments can be used to characterize both samples (relative measurements) and optical sources (absolute measurements). FTIR with built-in sources can only be used to perform relative measurements, as light is modulated by the interferometer before being output. This configuration has the advantage of being robust to signal modification induced by stray-light or background thermal radiation-



Light routing in the FTMIR-L1 -120-4TE (left) and the FTMIR-FC-120-4TE (right)

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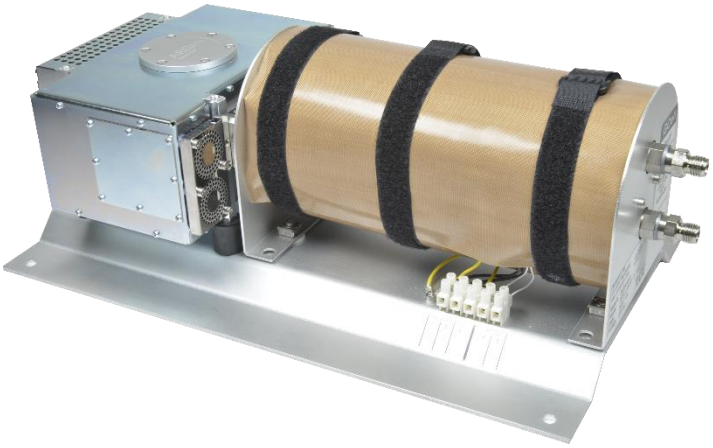
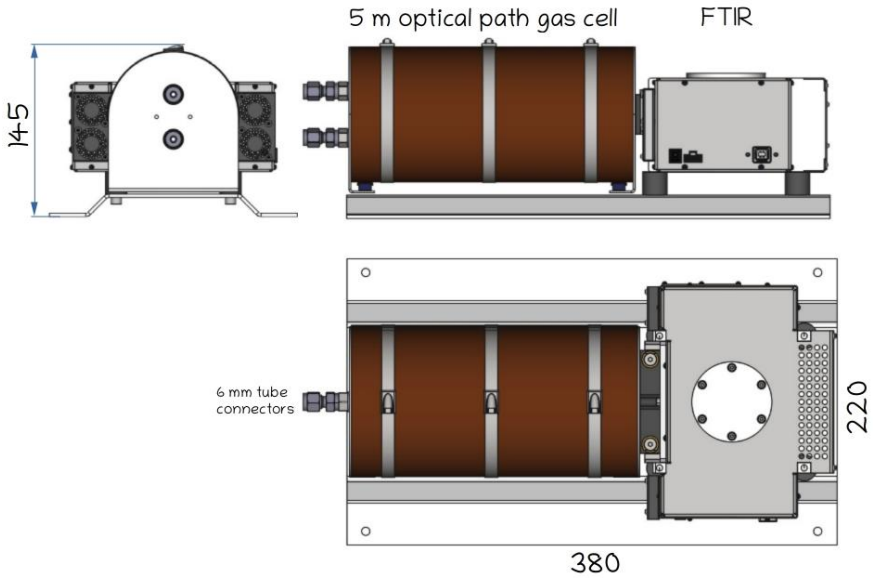
ARCOPTIX GASEX OEM



The GASEX OEM STANDARD is the optimal solution for system integrators who need to measure complex gas mixtures. The complete GASEX OEM represents a highly efficient, rugged and fully integrated solution for gas spectroscopy in our product portfolio. Our high resolution (0.5cm^{-1}) OEM010 FITR module is coupled to a low volume (0.2L) heated (up to 200°C) gas cell, in which light experiences multiple reflections, resulting in a total optical path of 5m with more than 50% zero gas transmission. The cell's internal optics is rhodium and gold coated, making it fully resistant against most chemicals including acid gases such as SO2, H2S HF, HCl, HBr. For high concentration application (in the % range), a short optical path cell (0.2 m) is available.

Dimensions



Features

- **Compact & lightweight**
- **TE or LN2 cooled MCT detector, also available in dual detector configuration**
- **0.2L volume, 5m optical path heated gas cell**
- **Rhodium protected internal optics**
- **Complete module for gas spectroscopy**
- **High resolution of 0.5cm^{-1}**
- **Wear free moving parts for extended lifetime**
- **No purging of the interferometer required**
- **Temperature controlled reference laser**
- **USB 2.0 connection**

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Specifications

	FTIR		
Internal optics	ZnSe		
Interferometer type	Permanently aligned with dual retro-reflector		
Resolution (unapodized) [cm^{-1}]	0.5 (nominal), other resolutions available on request		
Wave-number repeatability	<10 PPM		
Scan frequency	2 Hz @ 0.5cm^{-1}		
Internal reference laser	Temperature controlled solid-state @850nm		
A/D Converter	24 bit		
Built-in light source	SiC globar @1'550 K		
Power requirement (FTIR only)	< 35W @ 12 V		
Communication interface	USB 2.0, Ethernet		
Software interface	Windows 7/10/11		
	Detector		
Detector type	4 TEC MCT		LN2 MCT
Spectral Range [cm^{-1}]	5'000 - 1'660	5'000 - 830	5'000-650
Spectral Range [µm]	2-6	2-12	2-16
Detector Peak D* [cm $Hz^{1/2}W^{-1}$]	>1x10^{11}	> 4x10^{9}	>5x10^{10}
Signal-to-noise ratio	>55'000:1[i]	>35'000:1[i]	> 70'000:1
	Combinable in dual configuration		
	GAS CELL		
Path length	5m		
Internal volume	0.2L		
Total transmission	50%		
Internal temperature [°C]	20-200 (not condensing)		
Mirrors	Rhodium & gold coating		
Windows material	BaF2		
Gas inlet/outlet connector	6mm or ¼" (custom on request)		
Power requirement (cell only)	400 W (peak), 20 W (steady-state) @ 110-230 VAC or 12 VDC		
Dimensions FTIR+cell [mm]	380x220x145		
Total weight [kg]	3.9		

[i] Measured with a silicon carbide (SiC) source (~1550K), 60s measurement time, around peak sensitivity wavelength, Norton-Beer weak apodization, linearly corrected baseline, resolution setting 0.5 cm^{-1}SPECIFICATIONS ARE SUBJECT TO CHANGES WITHOUT NOTICE. Please contact **info@arcoptix.com** for more information.

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Additional information

Detector choice – our recommendation

1. The 4-TEC 2-12 µm MCT detector can be considered the best choice for a general application. It is covering a broad spectral range while proposing a high detectivity.

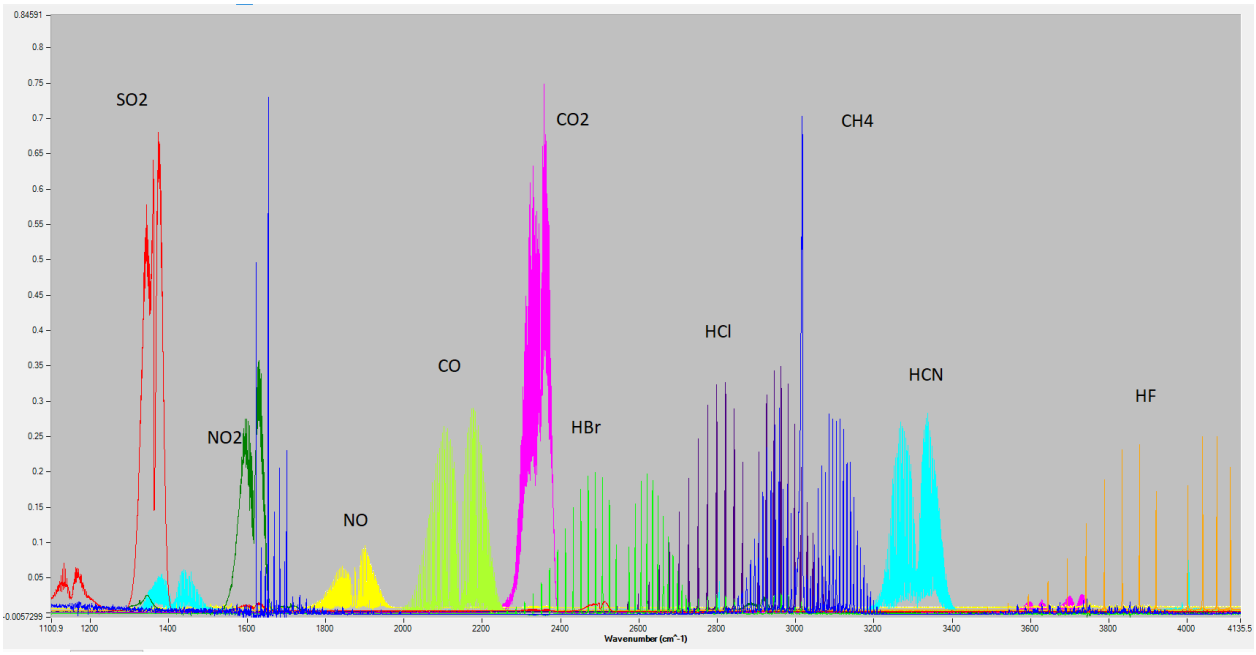
2. The 4-TEC 2-6 µm MCT detector is offered for specific applications where a narrower spectral range is not a handicap and a higher detectivity is required (for instance fast response of a low concentration of a chemical species).

3. Dual channel – dual detector option connects the advantages of both options (1 and 2). This design is comprising both detectors, while the optical signal is split using a dichroic filter. The two respective detector signals are then separately processed into spectra and the two respective spectra are stitched together to form one final spectrum.

4. A liquid nitrogen cooled 2-16 microns MCT detector is mostly used in laboratory practice, or applications where the infrastructure to supply and handle liquid nitrogen is available. A spectrometer equipped with this detector allow for reaching deeper into the fingerprint region of the organic species. The high detectivity allows for a very low detection threshold.

Measurement example

The picture below shows the absorption spectra of 10 gases with concentrations varying from 25 ppm to 1000 ppm.



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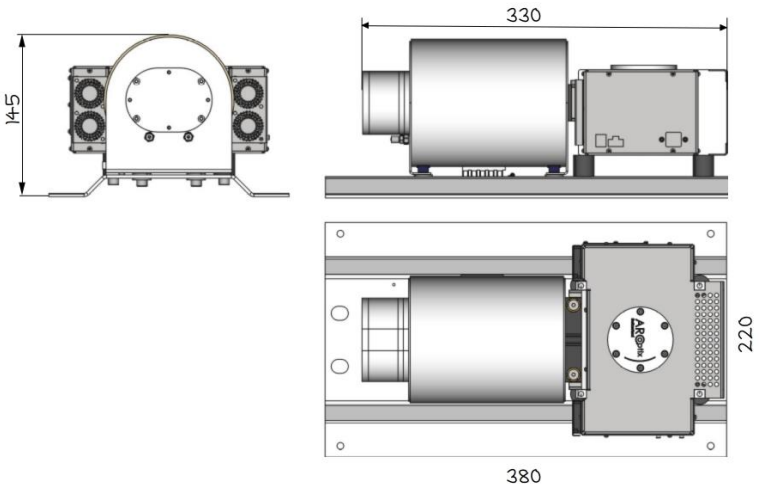
ARCOPTIX GASEX OEM SC

The GASEX OEM SC is optimized for gas spectroscopy of highly concentration gases – in the % range. It features a modular cell with a standard optical path length of 20 cm. The technology allows for customization of the path length within a certain margin around the 20 cm. The complete GASEX OEM represents a highly efficient, rugged and fully integrated solution for gas spectroscopy in our product portfolio. Our high resolution (0.5cm^{-1}) OEM010 FITR module is coupled to a low volume (0.2L) heated (up to 200°C) gas cell, in which light experiences multiple reflections, resulting in a total optical path of 5m with more than 50% zero gas transmission. The cell's internal optics is rhodium and gold coated, making it fully resistant against most chemicals including acid gases such as SO2, H2S HF, HCl, HBr.

Dimensions



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- **Wear free moving parts for extended lifetime**
- **No purging of the interferometer required**
- **Temperature controlled reference laser**
- **USB 2.0 connection**

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Measurement example

The picture below shows the absorption spectra of 200 ppm of Nitric oxide (NO) gas in nitrogen, taken with our standard GASEX spectrometer with a 5 meters optical path cell (black curve) and with the 0.2 meters optical path short cell (red curve).