



Pharma



BioTech



Chemicals



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Developing advanced in-line UV/Vis analyses using our range of flow cells with adjustable optical paths



■ Introduction

By using a flow cell, you can analyze liquid samples continuously in real time, with significant advantages in terms of accuracy, sensitivity and resource savings. It meets the requirements in multiple sectors, including pharmaceuticals, biotechnology, chemicals, industry and fundamental research, depending on the diversity of optical paths and/or spectral ranges used.

In the context of this innovative technology, INDATECH is offering its flow cell with variable optical paths in "single path length" (SPL) or "multi path length" (MPL) versions, enabling measurements of up to 3 channels simultaneously. When coupled with spectrometers, it offers a comprehensive multiple path length solution dedicated to non-destructive measurements for in-line inspections or R&D in the UV-Visible and near-infrared (NIR) ranges.



Measure up



▪ A versatile tool which can adapt to your industrial and R&D environments

This type of flow cell is unique on the market because it provides up to 3 simultaneous measurements, with each one benefiting from an adjustable optical path length, covering different spectroscopic ranges according to the light sources and the measuring equipment to which it is coupled. It has been specially designed for in-line integration in an industrial process, an R&D environment or a test bench, taking advantage of its dedicated support and its compatibility with various types of connections. Because it is composed of suitable contact materials with a robust, hygienic design, it guarantees optimum cleanability to satisfy the GMP requirements of the pharmaceutical and biotech industries. Lastly, this cell can be used in Ex environments, guaranteeing continuous analytical stability over time and in the sometimes drastic conditions imposed by measurements in industrial circuits (temperature, pH, humidity, etc.).

Several configurations

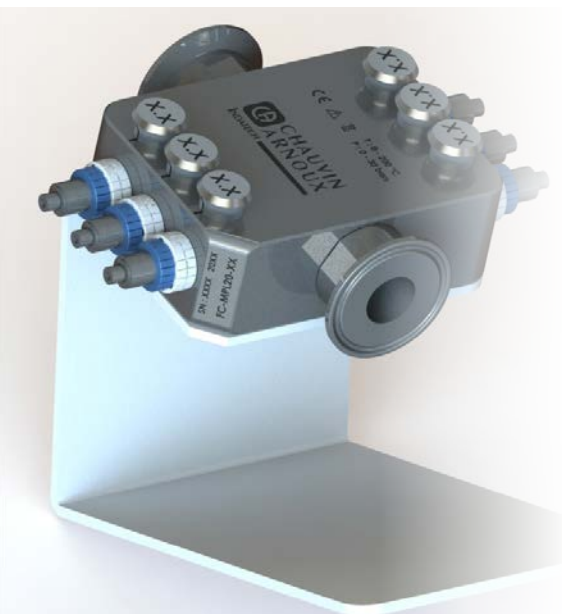
Various cell configurations have been defined. First of all, users have a choice between a single-channel cell or a multi-channel cell (3), depending on the objectives and the end-application sought. Indeed, the streamlined, simplified design of the single-channel cell makes it ideal for analyses which do not require extreme sensitivity or for samples within a reasonable range of concentrations. However, the multi-channel cell remains the optimum configuration for more precise analyses, the detection of traces or quantification across relatively large ranges. The choice between a single-channel flow cell and a multi-channel flow cell depends on the specific requirements of the application.



Figure 1: Presentation of the single-channel and multi-channel Flow Cells

The innovative design of the flow cell with variable path length allows to:

- **Extend the detection range:** modulation of the optical path length makes it possible to detect very low concentrations of compounds of interest while also extending the quantitative range analyzed
- **Diversify the fields of application:** the fact that the cell's optical system is applicable to wider analytical ranges (200-1700 nm) means that several intra- and inter-atomic interactions can be brought into play, thus allowing characterization of a large number of molecules of interest, as well as complex media
- **Perform continuous analysis:** continuous circulation of the sample allows real-time analysis, which is particularly useful for industrial processes or kinetics studies
- **Reduce the sample volumes:** this makes it possible to analyze small-volume samples, thus cutting the costs and the sample requirements



The single-channel and multi-channel flow cells are available in two sizes

For the single-channel cell, users can choose between an internal volume of 3 or 12 mL. For the multi-channel cell, internal volumes of 6 or 24 mL are proposed. Each cell is delivered with a set of spacers.

Made of anodized aluminum, these spacers are used to vary the optical path lengths between 0.5 and 20 mm according to the application and the concentration measured.

As an option, a base is proposed which can be used to raise the flow cell and facilitate its integration in the process. Various fittings may also be supplied for the same purpose.

Possible applications

- In-line qualification of various steps in the downstream process (purification, ultra/diafiltration, chromatography, etc.)
- Studying the optimal path length for a given formulation at an R&D level prior to fixing the ideal path length for application in production
- Kinetics studies of the chemical and enzymatic reactions
- Detection of pollutants or industrial waste such as heavy metals or pesticides in water
- Verification of the effectiveness of the cleaning process (detection of traces of the API, detergent, solvents, etc.)

Example: Slope spectroscopy study of a protein of interest (bovine serum albumin) in solution

Slope spectroscopy is based on measuring and analyzing the absorbance variations as a function of the optical path length (L).

The graph of the equation $Abs = f(L)$ can be used to determine the coefficient of extinction ϵ of the molecule of interest, which will then be re-used to quantify new samples of unknown concentration with $C = Abs/L \cdot \epsilon$. Compared with classic spectroscopy, this technique allows:

- More accurate quantification of the concentration, using a multipoint measurement instead of a classic measurement
- Greater detectability of the subtle variations in the absorption spectra for higher analytical sensitivity
- Elimination of the need to dilute the samples, making it more robust

For multiple markets



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• Technical specifications of the flow cells



	Single-channel		Multi-channel	
Maximum temperature	Up to 200 °C (392 °F)			
Relative humidity	5 – 90%			
Number of measurement channels	1		3	
Internal volume	3 (2.4 mL < V _{int} < 3.14 mL)	12 (9.58mL < V _{int} < 15.7 mL)	6 (4.5 mL < V _{int} < 6.75 mL)	25 (9.9 mL < V _{int} < 28.3 mL)
Range of optical path lengths	0.5 – 10 mm	0.5 – 20 mm	0.5 – 10 mm	0.5 – 20 mm
External dimensions	132 x 84 x 38 mm	182 x 92 x 50 mm	130 x 129 x 55 mm	182 x 132 x 50 mm
Weight	1 kg	2 kg	1.5 kg	3.5 kg
Maximum pressure	30 bar (725 Psi)			
Fiber optic connection	SMA type 905			
Spectral range	200 – 1700 nm			
Contact materials	AISI 316L stainless steel; Kalrez® 6230; silica glass or sapphire			
Cleaning	Cleaning and sterilization in place with a flow rate ≥ 200 mL/min			
Compatible with Ex environment	Yes (Group II, Ex zone 1, 2, 21, 22)			

FITTINGS*

Description	Size	Reference
Clamp fitting	DN 10	FC-CL10
Swagelok® tube fitting	1/4--inch tube	FC-SW10-14
	3/8--inch tube	FC-SW10-38
Fitting for flexible hoses	3/8--inch hose	FC-FL10
Materials	AISI 316L	

* Standard fittings, others available on request