



# Flame ionization detector.

## Gas chromatography with HiQ® specialty gases.

### Gas chromatography

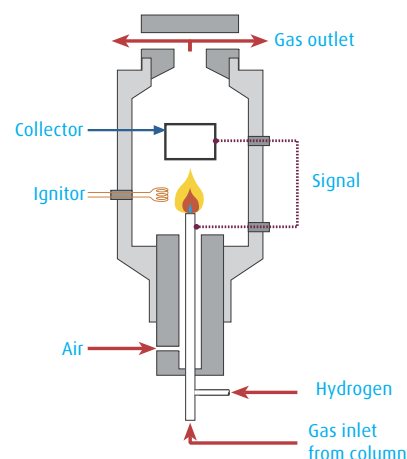
Information about gas chromatography in general can be found in the application sheet "Gas chromatography" (GC).

### Flame ionization detector

The flame ionization detector (FID) is one of the most used detectors for gas chromatography (GC). The application area is wide. For example, petrol for airplanes, kerosines, are carefully analyzed with the FID as a routine control. The composition of the kerosines is of great importance for the energy conversion. A completely different area is the packaging of food. Your take-away hamburger comes in an insulating polystyrene box. During the processing of polystyrene, different hydrocarbons are added to create the end-product. When polystyrene is used within the food industry, it is crucial that the product is analyzed for any residues of the hydrocarbons, since they can influence the quality of the food and harm your health.

### Analysis using the FID

The FID is well suited for analysis of hydrocarbons, such as methane, ethane, acetylene etc., but also for organic substances containing hydrocarbons and for volatile organic compounds (VOCs). In an FID, the sample undergoes combustion in a hydrogen/synthetic air flame. Ions and free electrons are formed in the flame. The charged particles produce a measurable current flow in the gap between two electrodes in the detector. The resulting current flow is of greater strength than the signal produced by the pure carrier gas and the fuel gas flame alone. This signal differential provides information about the sample. The current is proportional to the ion formation which depends on the composition of the separated sample.



The FID is a general detector which, after additional configurations, can be used for more specific components. For example, by placing a methanizer ahead of the FID, components containing carbon can undergo transformation to methane and thereby become suitable for further FID analysis. CO and CO<sub>2</sub> are commonly analyzed this way.

For the determination of organic nitrogen/phosphorus compounds, a different FID configuration is needed. The sample passes a heated alkali source, where charged particles are formed in contact with the alkali source. This method is normally named alkali flame ionization, but it is also referred to as thermionic detection. The detector used for this method belongs to the group of detectors in which thermal energy is used as source for ionization. This method is often also called nitrogen/phosphorous detection; the acronym for the corresponding detector is NPD.

Flame ionization detectors are extremely sensitive and have a wide range of linearity. Their only disadvantage is that they consume the sample.

### Gases

An important facet of the FID is the use of a carrier gas to transfer the sample from the injector through the column and into the FID. The carrier gas must be inert and may not be adsorbed by the column material. Helium or nitrogen are normally used as carrier gases for the FID, sometimes hydrogen is also used.

The detector gases, hydrogen and synthetic air, respectively serve as fuel gas and oxidizing gas during the combustion process. Since hydrocarbon impurities, moisture and oxygen produce a greater baseline noise which has an adverse effect on the detection limit, these impurities in the detector gases should be kept as low as possible.

Like all chromatographic analytical processes, gas chromatography is a relative method, i.e. calibration with a standard mixture is required, both to check linearity and as calibration for the sample.

### HiQ® product program

The HiQ® specialty gas product program offers a wide range of pure gas qualities, calibration mixtures and equipment as well as components that fulfill the requirements in terms of analytical techniques, such as gas chromatography using a flame ionization detector (FID).

## Carrier and detector gases

## Carrier gases

To obtain optimal analytical results, Linde recommends the following gas qualities for analysis using an FID:

Instrument helium 4.6	Product code 2057
Instrument nitrogen 5.0	Product code 2093

## Fuel gas

## Oxidizing gas

Instrument hydrogen 4.5	Product code 2056
Instrument synthetic air 5.0	Product code 2141

## Specifications

	Instrument He 4.6	Instrument N <sub>2</sub> 5.0	Instrument H <sub>2</sub> 4.5	Instrument synthetic air 5.0
O <sub>2</sub>	≤ 5 ppm	≤ 3 ppm	≤ 5 ppm	
CO				≤ 1 ppm
CO <sub>2</sub>				≤ 1 ppm
C <sub>n</sub> H <sub>m</sub>	≤ 1 ppm	≤ 1 ppm		≤ 0.1 ppm
H <sub>2</sub> O	≤ 5 ppm	≤ 3 ppm	≤ 5 ppm	≤ 3 ppm
Product code	2057	2093	2065	2141

For research and special quality control analysis, higher purities are available, e.g. the 'detector' qualities. You will find those and other purities in the HiQ® product program.

Reduce the number of cylinders or H<sub>2</sub> volume in your lab

Alternatives are:	N <sub>2</sub> chrocar 40 %	(40 % H <sub>2</sub> in N <sub>2</sub> )	Product code 2536
	He chrocar 8.5 %	(8.5 % H <sub>2</sub> in He)	Product code 2534
	He chrocar 40 %	(40 % H <sub>2</sub> in He)	Product code 2535

## Calibration mixtures

Linde can offer a range of calibration and test gases for the FID to measure and calibrate the linearity of the detector, reproducibility and lifetime performance of the columns:

## Composition

CH <sub>4</sub> , C <sub>2</sub> H <sub>6</sub> , C <sub>3</sub> H <sub>8</sub> , n-C <sub>4</sub> H <sub>10</sub> & i-C <sub>4</sub> H <sub>10</sub> in N <sub>2</sub>		C <sub>2</sub> H <sub>4</sub> , C <sub>3</sub> H <sub>6</sub> , i-C <sub>4</sub> H <sub>8</sub> , cis-2-C <sub>4</sub> H <sub>8</sub> , & t-2-C <sub>4</sub> H <sub>10</sub> in N <sub>2</sub>	
Name	Product code	Name	Product code
Alkane chrocal 10 ppm	2542	Alkene chrocal 10 ppm	2545
Alkane chrocal 100 ppm	2543	Alkene chrocal 100 ppm	2546
Alkane chrocal 1000 ppm	2544	Alkene chrocal 1000 ppm	2547

For other calibration mixtures, please look into the HiQ® product catalog or ask your local sales representative.

## Recommended central gas supply

REDLINE® central specialty gas supply systems for inert and non-reactive gases.  
Group green for single gas supply panels designed for pure gases and mixtures.

Group blue for single stage supply panels with internal purging designed for high-purity gases and mixtures including flammable gases.



## Recommended cylinder regulator

The REDLINE® single stage regulator C200/1 for carrier and auxiliary gases. For calibration gases, the REDLINE® two stage regulator C200/2 provides a stable secondary outlet pressure. C200 regulators can be plain or equipped with a shut-off valve (type A) or a needle valve (type B).

For the use of an FID, we recommend a C200 regulator in brass with a shut-off valve.

REDLINE®		Outlet pressure		Product code
		bar	psi	
Single stage	C200/1 A, brass	0.2-3	3-45	3100
Single stage	C200/1 A, brass	0.5-6	8-85	5467
Two stage	C200/2 A, brass	0.2-3	3-45	5482

## More information

Please look into our HiQ® catalog 'Biotech, chemical, petrochemical & pharmaceutical', visit our website <http://hiq.linde-gas.com> or contact your local Linde sales representative.

