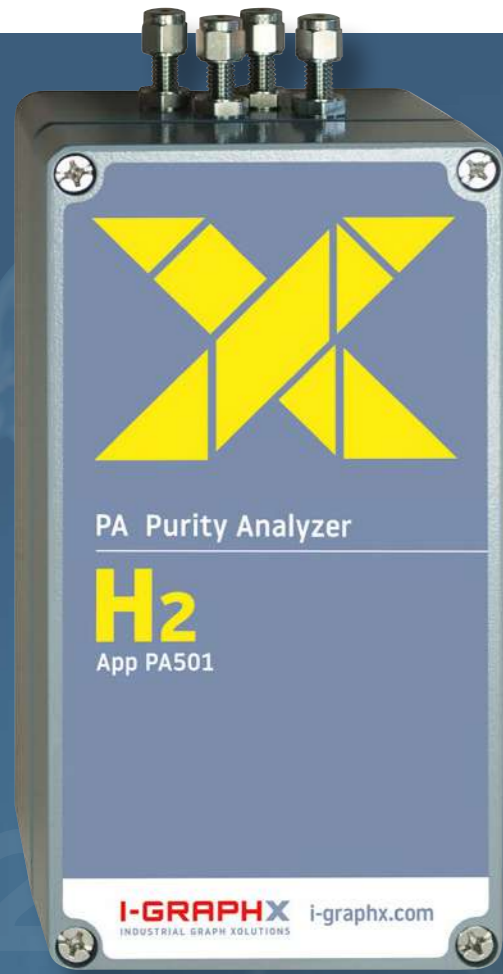


# Xolutions for more Efficiency

Innovative micro gas chromatography,  
H<sub>2</sub> sensors and blending systems





# 5.0 H2 Purity ANALYZER

Ensuring Quality and Safety, in the renewable Energy Market

Purity Grade: **99.999 %**

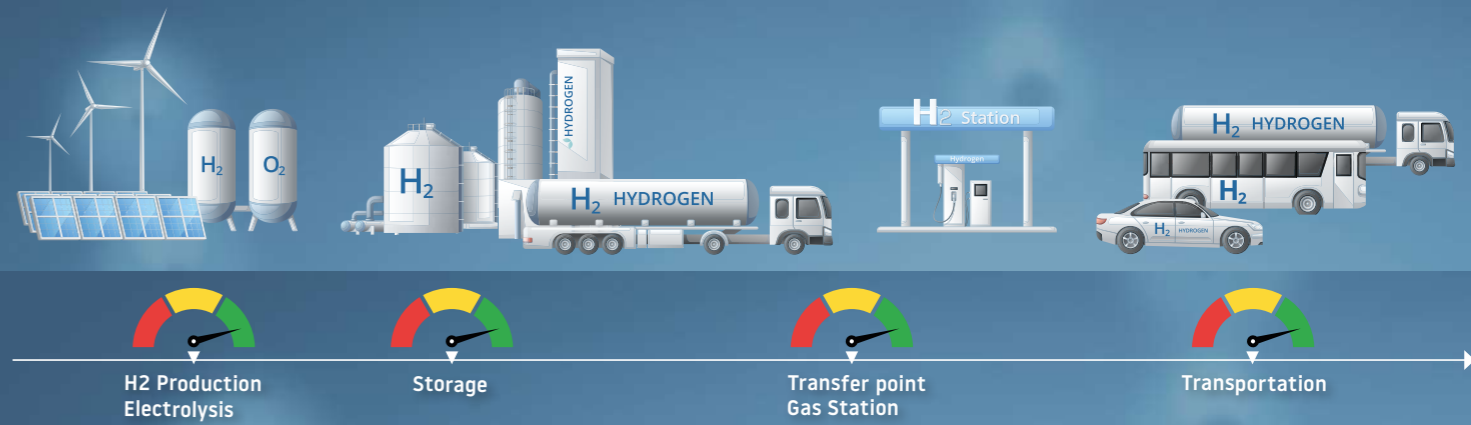
Pollution Sensitivity: **10 ppm**

Small, Fast, Online: **< 10 sec.**

Data exchange: **MODBUS, 20 mA**

More Products: Micro gas chromatography | H2 analyzers | Micro dosing | Electronic pressure control units | Accessories

**Biomass / Renewable Energy / Storage / Electrolysis / Pyrolysis / FuelCell / Carbon capturing / Syngas / Synthesis / E-Fuels / Methanol**



Knowing is better than guessing

H2 Quality insurance with I-GRAPHX Purity Analyzer



Hydrogen purity measurement – measuring the smallest impurities very easily

The PA Purity Analyzer measures hydrogen contamination in ppm-Range quickly and easily up to a gas purity of 99.999% (Grade 5.0).

On the way to greenhouse gas neutrality, the energy source H<sub>2</sub> will play an important role in the future. The exact determination of the hydrogen quality therefore plays a major role in many areas of industry as many machines, engines and industrial applications require a high degree of purity of the sustainable energy carrier H<sub>2</sub>. So far, precise online measurement of hydrogen purity has only been possible with highly complex analytical methods, or time-consuming samples have to be sent to laboratories for analysis. An economical, fast, precise and comprehensive recording of the H<sub>2</sub> quality was not possible until now.

Our Purity Analyzer PA, which can be used universally in all production processes, transfer and filling stations related to hydrogen makes affordable precise H<sub>2</sub> online Analyzing possible by now. The measuring section used in the PA is an in-house development of I-GRAPHX GmbH. Like all our analysis systems, it is manufactured using MEMS technology. This special structure enables fast and high-precision continuous measurement of the H<sub>2</sub> quality. The miniaturization and use of the analytical connection technology enable the problem-free use of the PA Analyzer for the very volatile hydrogen.

Optionally, the PA Analyzer can also be used for other high-purity gases such as Helium in order to carry out quick measurements of the total contamination.

**Properties:**

- Accurate and long-term stable analysis
- Monitoring of continuous processes
- Very fast H<sub>2</sub> detection
- Low operating costs, minimal maintenance

**Technical data:**

- Electronic pressure regulation
- Measurement range: 10 ppm to 100 %
- Measurement results: Vol % resolution 1 ppm
- Power supply: 24 VDC, 0.5 A
- Ambient temperature: -10 °C to +50 °C
- Accuracy: < 0.1 % v.M

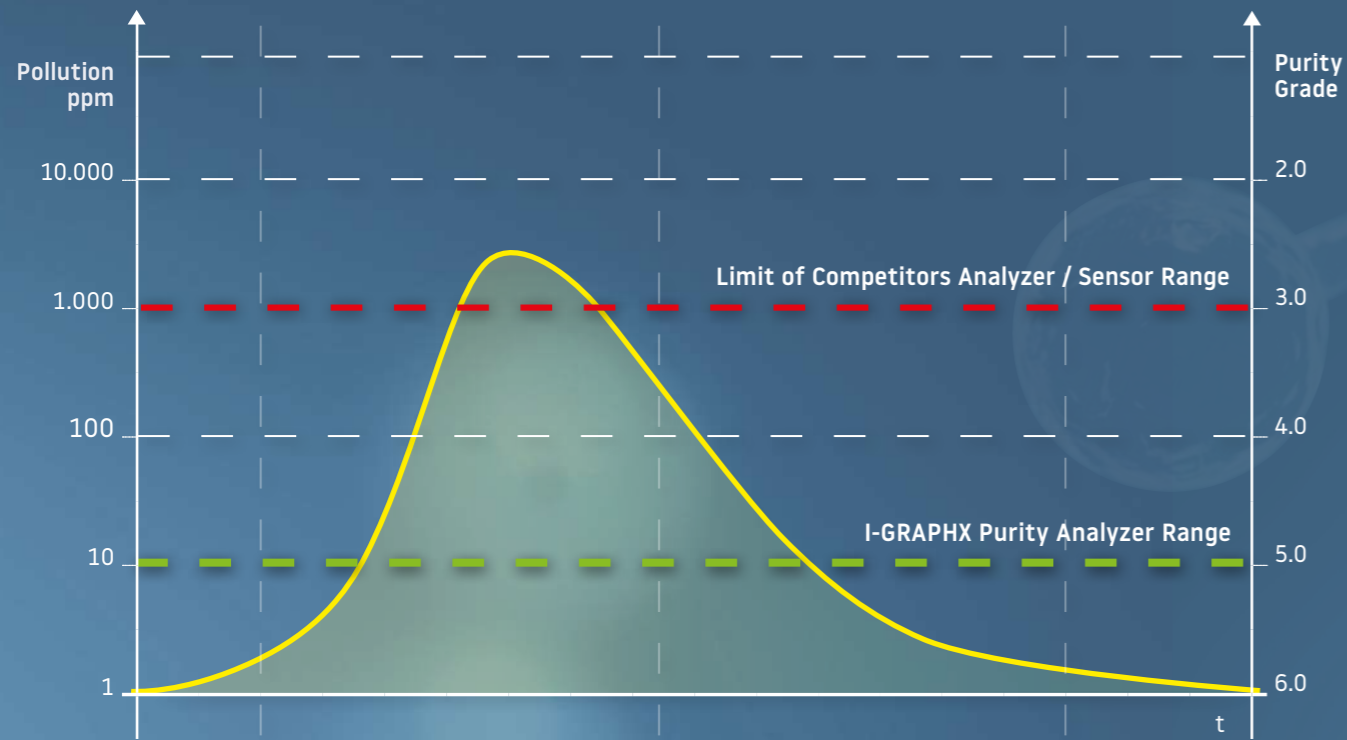
**Connections:**

- Media: tube fitting (others on request)
- Connections: USB (internal), RS485 (Modbus RTU, GC Manager)
- Monitoring: via web server through optional HMI
- Analog OUT: 4-20 mA (1 channel)

**Unit size:**

- W x H x D: 220 x 120 x 90 mm
- Weight: ca. 2.5 kg

## The I-GRAPHX PA Designed to assure the H2 Quality of 99.999 % at industrial Environment



Measurement with our I-GRAPHX PA Analyzer in a continuous process with concentration shift.

## The I-GRAPHX Samplegas Preparation UNIT 100 % ready for industrial Integration



- H2 Purity Grade: 99.999 %
- Pollution Sensitivity: < 10 ppm
- Small, Fast, Online: < 10 sec.
- Data Exchange: MODBUS, 4-20 mA

### Measured and totalled components are:

Water (gas phase), NMKW (No Methane HC), argon, oxygen, nitrogen, methane, carbon monoxide, carbon dioxide, ammonia, sulphur, formaldehyde, formic acid, halogen compounds.

### Suitable for: CGC / CA / PA

Base plate with pressure regulation and membrane filter for sample gas

Example hydrogen market:

**PA:** Sum of all impurities in H2, (sum peak from 10 ppm)

**CGC 404:** Analysis of: H2, O2, N2, CO, CO2, He, CH4

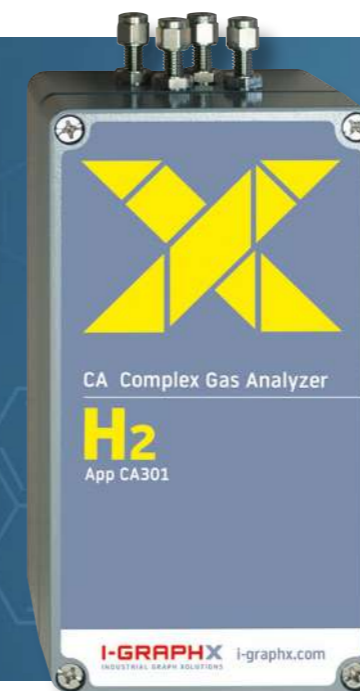
Example electrolysis research:

**CGC 410:** Analysis of: He, H2, O2, N2, CH4, CO

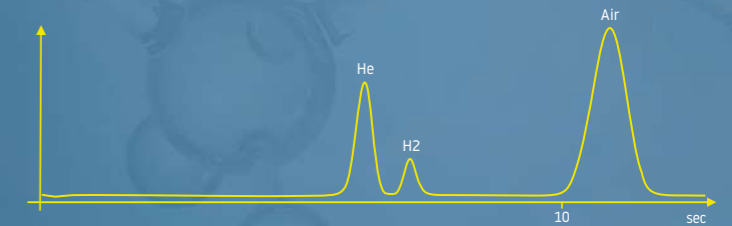
**CGC 411:** Analysis of: H2S, NH3, H2, N2, C2's, C3's, MeOH, EtOH



## I-GRAPHX CGC COMPACT - GC



## I-GRAPHX CA COMPLEX GAS ANALYZER



### High-speed chromatography – measures selectivity and with high precision in seconds.

The **CGC Compact GC** measures the quality and quantity of up to 10 gas components quickly, safely and with high accuracy.

Our smallest gas chromatograph is the most compact on the market and can be configured for a large number of applications. The **CGC** is universal for all applications in plant construction and independent systems, where fast and precise gas analysis is required. Its chromatographic separation ensures that there is no irritation of the measurement signal by cross-sensitivity interference components.

The Micro Dual Channel Thermal Conductivity Detector used in the **CGC** is an in-house development of I-GRAPHX GmbH. It is made with Microchip Technology (MEMS) and uses the unique specific physical heat conduction of each gas component.

A combination of MEMS Chip separation columns and/or classic capillary separation columns enable quick and efficient analysis on a Single-Channel system with the smallest media consumption.

#### Typical applications:

CGC401 – Hythan, Biogas, CCS, PEM, Fuel Cell	CGC406 – Fluegas
CGC402 – LNG, LPG	CGC410 – Perm. Gas2
CGC403 – Biogas, Natural Gas	CGC411 – Solvents, Alcohols
CGC404 – Perm. Gas1, Syngas	CGC412 – Light HC's, Natural Gas
Biogas enlaged, Landfill	

#### Properties:

- Fast Selective Chromatography
- Qualitative and quantitative high-precision gas analysis
- Monitoring of continuous processes
- Low operating costs due to minimal maintenance effort

#### Technical data:

- 2 point or multi-point calibration
- Electronic pressure regulation
- Measuring range 10 ppm - 100 %
- Display Vol. %, resolution up to 1 ppm (web server application)
- Accuracy: < 0.1 % of meas.
- Power supply: 24 VDC, 3 A
- Ambient temperature range: -10° C to + 50° C

#### Connections:

- Media: tube fitting (others on request)
- Connections: USB (internal), RS485 (Modbus RTU, GC Manager)
- Monitoring: via web server through optional HMI
- Analog OUT: 4-20 mA (1 channel)

#### Unit size:

- W x H x D: 220 x 120 x 90 mm
- Weight: about 2.5 kg

*Changes of technical data, unit size, weights and other changes may occur.*

### Gas measurement (f.e. H<sub>2</sub>) very precise and selective

The **CA Complex Analyzer** can measure the amount of a gas, e.g. hydrogen (H<sub>2</sub>) in any mixture of gases. It is fast and very accurate.

On the way to CO<sub>2</sub> neutrality, Hydrogen (H<sub>2</sub>) will be the most important energy source in the future. The right quality of hydrogen (e.g. 5.0) will be very important for industry and H<sub>2</sub> mobility.

The **I-GRAPHX CA** can be used to detect and measure Hydrogen (or another gas component) in any type of gas mixture.

The chromatography gas separation technique makes sure that there are no irritants from other components.

The dual-channel thermal conductive detector is an in-house development of I-GRAPHX GmbH. The detector is constructed utilising microchip technology (MEMS) and uses the specific heat conduction of different gases. This construction enables a fast and continuous measurement.

This special design makes the unit react very quickly. The sensor is glass passivated, which means it is protected against aggressive gases and can be used in harsh environments for a long time. The thermal conductivity detector is highly reliable, with no moving parts and is insensitive to vibrations.

#### Properties:

- Accurate and long-term stable analysis
- Monitoring of continuous processes
- Very fast H<sub>2</sub> detection
- Low operating costs, minimal maintenance

#### Technical data:

- 2 point or multipoint calibration
- Integrated temperature compensation
- Electronic pressure regulation
- Measurement range: 10 ppm to 100 %
- Measurement results: Vol % resolution 1 ppm
- Power supply: 24 VDC, 0.5 A
- Ambient temperature: -10 °C to +50°C
- Accuracy: < 0.1 % v.M

#### Connections:

- Media: tube fitting (others on request)
- Connections: USB (internal), RS485 (Modbus RTU, GC Manager)
- Monitoring: via web server through optional HMI
- Analog OUT: 4-20 mA (1 channel)

#### Unit size:

- W x H x D: 220 x 120 x 90 mm
- Weight: ca. 25 kg

*Changes of technical data, unit size, weights and other changes may occur.*

# Products for transformation Ideas

I-GRAPHX Product-Range – with a solution-oriented approach for the greatest possible measuring



I-GRAPHX S



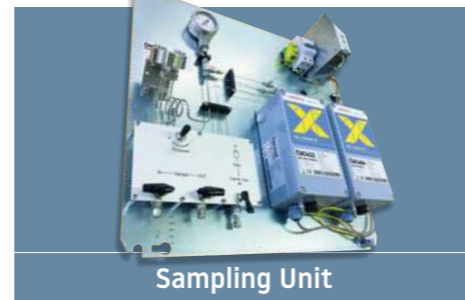
I-GRAPHX PR



I-GRAPHX PA



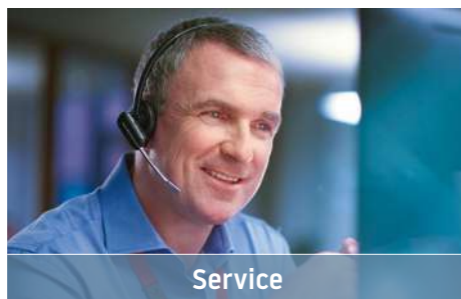
CGC & CA



Sampling Unit



HMI communication Unit



Service

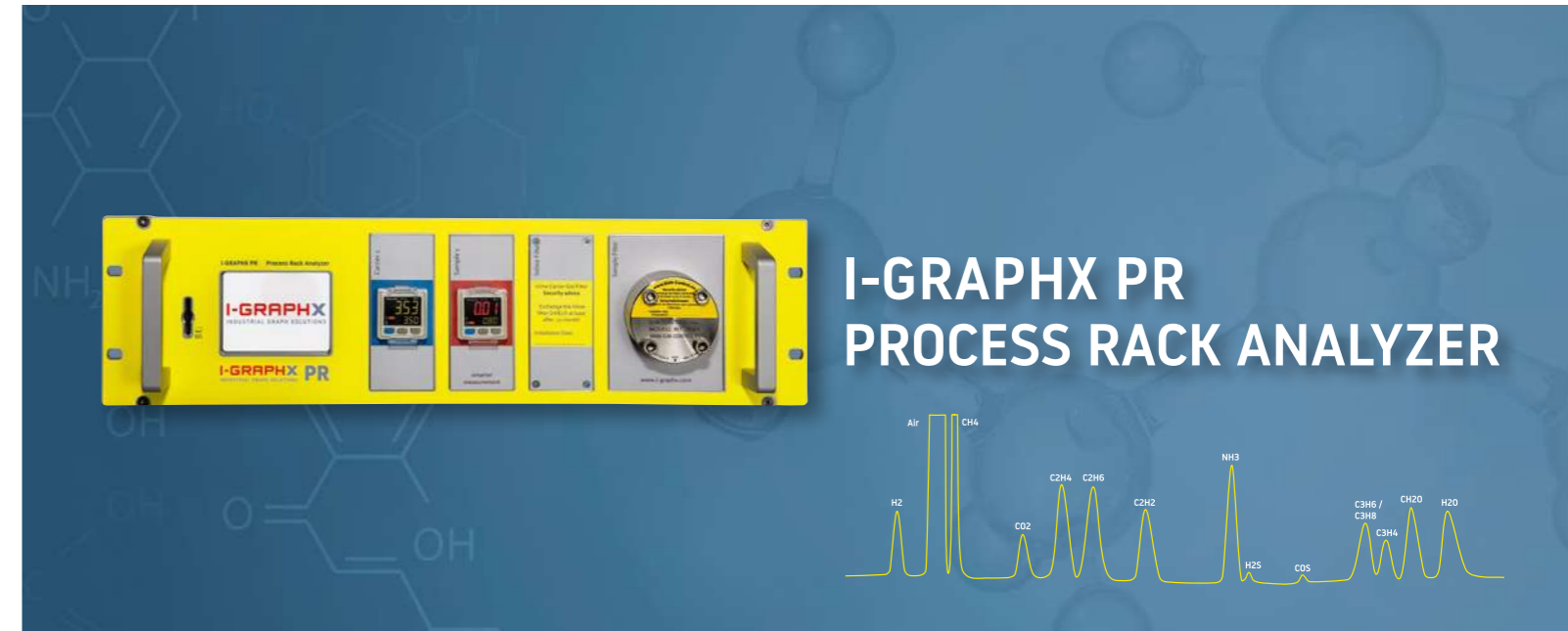


Micro Dosing Unit

## Your advantages:

Our products are manufactured to your specifications using a variety of well-known and tested technologies. The I-GRAPHX team is very fast, even when we are meeting special customer requests – and this in addition to our standard product range.

- Low maintenance costs
- Extremely short analysis times
- Very small, light and robust
- For Gas or dissolved gases from liquids
- Innovative micro-process gas chromatographs



## I-GRAPHX PR PROCESS RACK ANALYZER

### Highly sensitive and selective Gas analysis for your application.

The I-GRAPHX PR analyzer is our process analyzer for stationary applications in the standardized, compact 19" rack, 3U format.

The I-GRAPHX PR selectively analyses gases and gases dissolved in liquids. The gas chromatography module can be built entirely from MEMS chips, which results in a very short analysis time. Optionally, the I-GRAPHX PR can be equipped with a dual analyser, two analysis paths and up to four columns. These two analysis paths can be connected in parallel or in series.

As an option, the I-GRAPHX PR can be equipped with a dual carrier gas supply for the use of two different carrier gases. Inline filters protect the analyser from dirt in the gaslines.

The sample gas is either pressurised or supplied to the analyser via a configurable bypass using the built-in switchable suction pump.

#### Typical applications:

- Chemical Synthesis processes
- Electrolysis, Catalysis processes
- Solvent
- Process monitoring
- Refinery gases
- Sulfur gases

#### Properties:

- Qualitative and quantitative high-precision gas analysis
- Monitoring of continuous processes and measuring points
- Module for analysis of gases dissolved in liquid (optional)

#### Technical data:

- Electronic pressure regulation
- Inlet pressure monitoring with color change at over or falling below
- Measuring range 1 ppm - 100 %\*
- Accuracy: < 0.05 % of meas.\*
- Carrier gas consumption 1-5 ml/min\*
- Power supply: 24 VDC, 6 A
- Ambient temperature range: -5°C to +50°C

#### Connections:

- Media: 1/16 Swagelok tube fitting (optional)
- 1/8", 3/4", 3mm, 6mm, VICI1/16" ZDV PEEK fittings
- USB (others on request)
- Control via GC Manager software
- Integrated status display
- DSub25 I/O connector

#### Unit size: \*

- W x H x D: 19" x 3U x 370 mm
- Weight: approx. 6 kg\*

#### Protection class:

- IP20

\*depending on configuration

Changes of technical data, unit size, weights and other changes may occur.



## I-GRAPHX S DESKTOP ANALYZER SMALL AND PORTABLE

### Highly sensitive and selective Gas analysis in your application.

The I-GRAPHX S Analyzer is our desktop process analyzer for mobil and stationary applications.

The I-GRAPHX S selectively analyses gases and gases dissolved in liquids. The gas chromatography module can be built entirely from MEMS chips, which results in a very short analysis time. Optionally, the I-GRAPHX S can be equipped with a dual analyser, two analysis paths and up to four columns. These two analysis paths can be connected in parallel or in series.

The I-GRAPHX S can be equipped with a mobile lightweight carrier gas supply upon request. Sample gas is supplied by overpressure or is sucked in by the built-in pump.

#### Typical applications:

- Electrolysis-, catalysis procedures
- Chemical synthesis processes
- Purity measurements
- Process monitoring
- Environmental management, landfill gases, bio gases
- Fast analyses of fuel in tank storage

#### Properties:

- Qualitative and quantitative high-precision gas analysis
- Monitoring of continuous processes and measuring points
- Module for analysis of gases dissolved in liquid (optional)

#### Technical data:

- Electronic pressure regulation
- Inlet pressure monitoring with color change at over or falling below
- Measuring range 1 ppm - 100 %\*
- Accuracy: < 0.05 % of meas.\*
- Carrier gas consumption 1-5 ml/min\*
- Power supply: 24 VDC, 6 A
- Ambient temperature range: -5°C to +50°C

#### Connections:

- Media: VICI 1/16" fitting or self-closing
- USB (others on request)
- Control via GC Manager software
- Output 4-20mA (optional Modbus RTU)
- Integrated status display
- DSub25 I/O connector

#### Unit size: \*

- W x H x D: 310 x 120 x 290 mm
- Weight: approx. 4,7 kg\*

#### Protection class:

- IP20

\*depending on configuration

Changes of technical data, unit size, weights and other changes may occur.



Mobile solution for the I-GRAPHX S

#### Gas in Liquid Analysis:



#### FuelCell:



### Applications



P2X - Power to X is currently the global term for usability of renewable energies and to minimizing the greenhouse effect.

The I-GRAPHX S is utilised in a variety of applications at P2X, including the electrolysis of renewable energy to produce hydrogen. Additionally, it is employed in the catalytic reaction of H<sub>2</sub> and CO<sub>2</sub>, which is used to form methane.

The I-GRAPHX S is a tool that can be utilised in a number of different ways. It can be used to monitor various chemical processes, for example when producing synthetic fuels or raw materials for the chemical industry such as ammonia or methanol. The analyser has many applications, including fuel cell technology, purity measurement and quality control.

The I-GRAPHX S is also used to monitor waste pyrolysis and for measuring exhaust gases of different solid fuels. Another area of application is analysing the exhaust gas flows that arise during the energy production from biomass.

The I-GRAPHX S can be equipped with a special module that separates dissolved gases in liquids to analyse for example gases in alcoholic beverages such as beer. Another application of this technology is the rapid analysis of fuels in tank farms, as well as to check the quality of new synthetic fuels (e-fuels), which mainly consist of lower alcohols.

#### A selection of further applications:

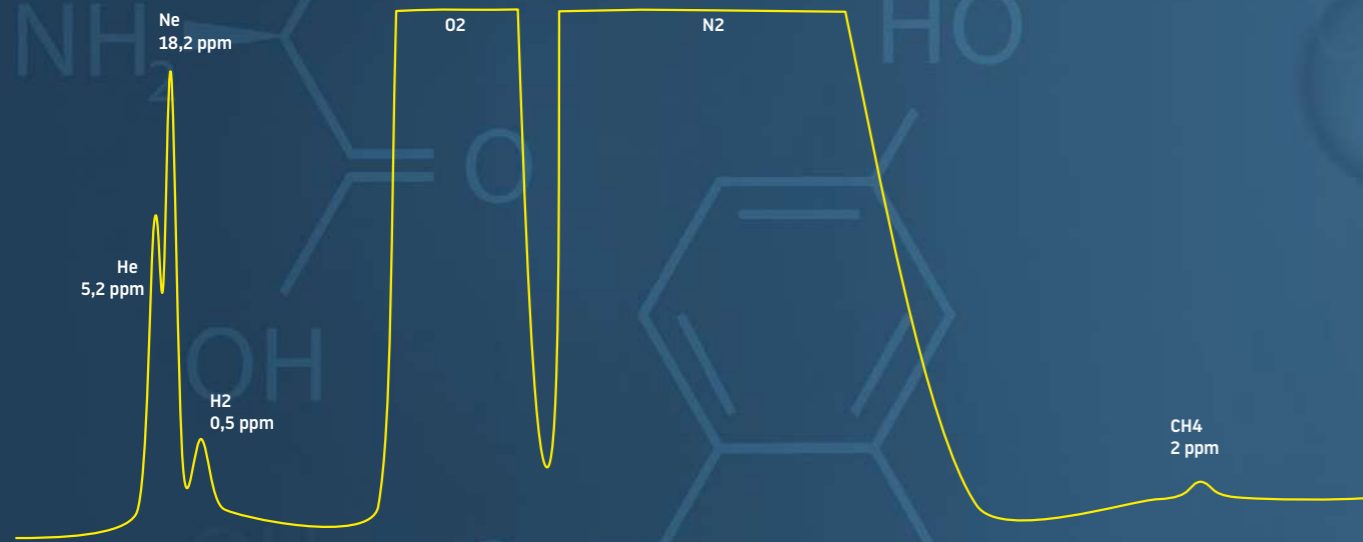
- |                                |                            |
|--------------------------------|----------------------------|
| ■ Permanent gases, Noble gases | ■ Environmental management |
| ■ Natural gases, LNG, Hythane  | ■ Landfill gas, Biogas     |
| ■ Hydrocarbons                 | ■ Permanent gas analysis   |
| ■ Research                     | ■ VOC's / BTEX             |



## Gas analysis with innovative Micro Gas Chromatography ...

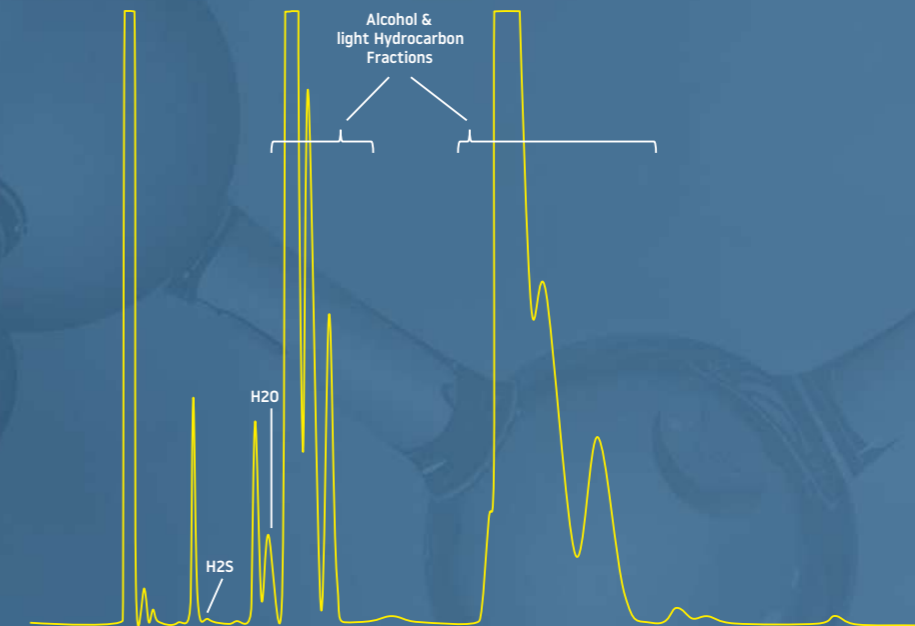
### Media: Gas

#### Ambient Air

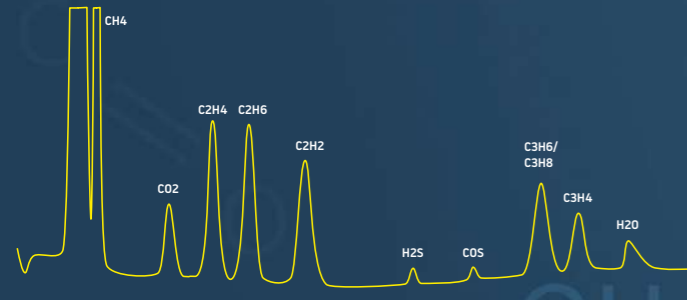


### Media: Liquid

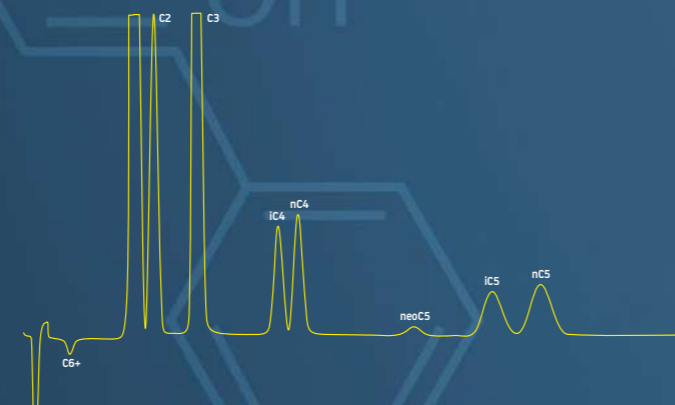
#### Gasoline E5



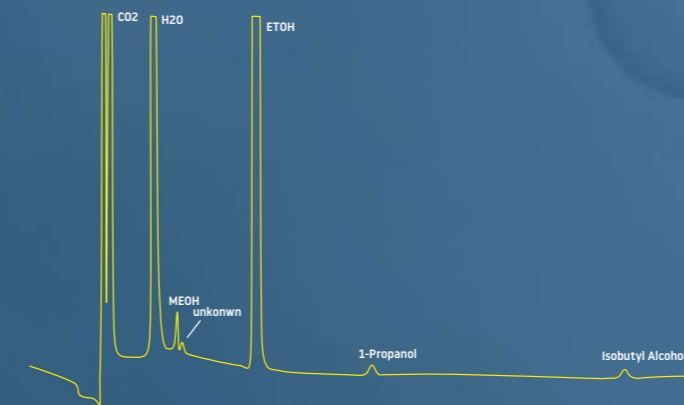
#### Light Hydrocarbons



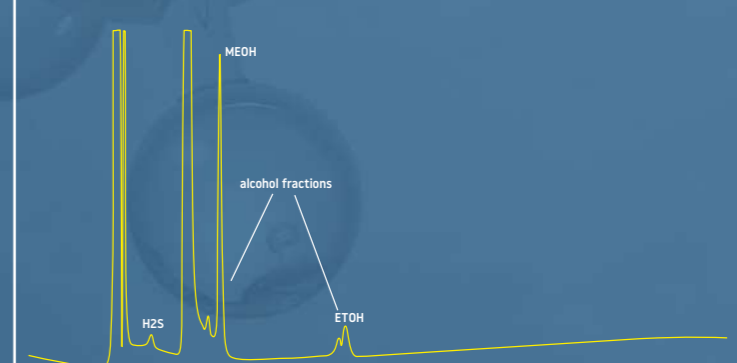
#### Natural Gas C6+



#### Beverage (Beer)



#### BIODIESEL



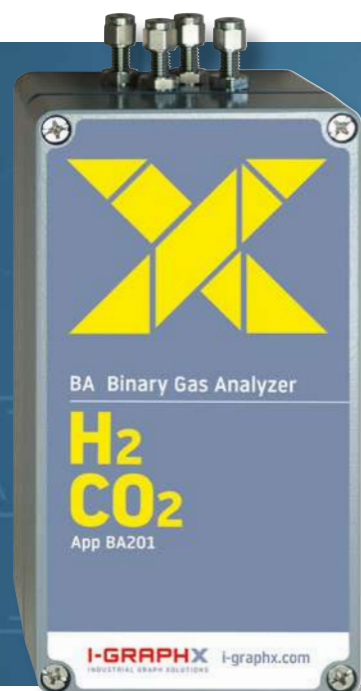
The combination of a unique separation module with our analyser enables the analysis of dissolved gases in liquids using a single instrument.

#### I-GRAPHX ANALYSIS OPTIONS

- Single stream
- Parallel stream
- Column switch
- Pre column backflush to vent
- Pre column backflush to detector
- Pre concentrator (TRAP)
- Dissolved gas out of liquides

#### I-GRAPHX Applications from A-Z

- |                       |                         |                   |
|-----------------------|-------------------------|-------------------|
| ■ Aromatics           | ■ Landfill gas          | ■ Refinery        |
| ■ Amine derivative    | ■ Mud logging           | ■ Solvents        |
| ■ Synthese gases      | ■ Natural gas           | ■ Sulphur         |
| ■ Biogas / Biomethane | ■ Nobel gases           | ■ Synthesis       |
| ■ Flare gas           | ■ Oil & Gas exploration | ■ Transformer gas |
| ■ Gasoline            | ■ Permanent gases       | ■ VOC's / BTEX    |
| ■ Greenhouse gases    | ■ Power to gas          | ■ Waste gas       |
| ■ Hydrogen production | ■ Pyrolysis gases       | ■ FuelCell        |
| ■ Hydrocarbons        | ■ Reaction gases        | ■ Hythan          |



## I-GRAPHX BA BINARY GAS ANALYZER

### Measurement of hydrogen and binary gas mixtures

The device has been engineered to detect the presence of for example hydrogen (H<sub>2</sub>) in binary gas mixtures, such as H<sub>2</sub> in N<sub>2</sub> or CO within CH<sub>4</sub>. The analyzer can be used for the generation of H<sub>2</sub> with electrolysis, within air separation units, during the production of syngas and in the development of fuel cells. In addition, there are many more applications.

The dual-channel thermal conductive detector is an in-house development of I-GRAPHX GmbH. The detector is constructed with microchip technology (MEMS) and uses the specific heat conduction of different gases.

This special design makes the unit react very quickly. The sensor, which is glass passivated is protected against aggressive gases and can be used in harsh environments over extended periods.

The unit is equipped with advanced compensation mechanisms for temperature and pressure. Therefore, the device rarely needs to be calibrated. The sensor is characterised by its durability, the absence of moving parts, and its resistance to vibration and other environmental influences.

#### Properties:

- Accurate and long-term stable analysis
- Monitoring of continuous processes
- Very fast H<sub>2</sub> detection
- low operating costs, minimal maintenance

#### Technical data:

- 2 point or multipoint calibration
- Integrated temperature compensation
- Electronic pressure regulation
- Measurement results: Vol % resolution 1 ppm
- Power supply: 24 VDC, 0.5 A
- Ambient temperature: -10°C to +50°C
- Accuracy: < 0.2 % v.M and <0.5 % v.E

#### Connections:

- Media: tube fitting (others on request)
- Connections: USB (internal), RS485 (Modbus RTU, GC Manager)
- Monitoring: via web server through optional HMI
- Analog OUT: 4-20 mA (1 channel)

#### Unit size:

- W x H x D: 220 x 120 x 90 mm
- Weight: ca. 2.5 kg

*Changes of technical data, unit size, weights and other changes may occur.*



## X-VIEW The SMART VISUALIZER

### Visualisation and control of analysis processes

The recently developed X-View is establishing a new standard in the field of process data visualisation. It shows data exactly and adapt them to the specific requirements of the user.

The numerous integrated interfaces support the following protocols: CAN-Bus, MODBUS, TCP and other proprietary protocols. Furthermore, the X-View has been developed to facilitate the visualisation and analysis of analogue and digital inputs. Beyond that, the unit is capable of controlling processes.

The example above illustrates the data from a connected quantity counter, which are then shown and evaluated.

The data from an additional connected H<sub>2</sub> analyser is displayed as a quality value ion the screen. It is important to note that all data can be shown and limits will be monitored.



Data transfer via integrated web server to any device with browser connectivity (i.e. tablet)

#### Properties:

- Visualization of analyzed data
- Control of processes
- Distribution of measurement data
- Data changer:
  - digital to analog
  - analog to digital
- 7" graphic display
- Lighted keyboard with optical feedback
- WEB Server
- Embedded Linux OS

- Analog inputs
- Analog outputs
- Digital inputs (optocouplers)
- Digital outputs (optocouplers)
- Digital outputs (power outputs)
- Ethernet
- WLAN
- MODBUS
- CAN-Bus
- IP 65 protection

*Changes of technical data, unit size, weights and other changes may occur.*



## I-DOG MICRO BLENDING SYSTEM

### I-DOG – fully automated blending system

The I-DOG is a fully automated blending system for liquids. It was developed to dose minimal quantities of liquid and to inject them into additional fluids. The unit can suck the liquid on its own and will get the amount value, from a flow meter or a control unit. Its specialism is adding additives to fuel.

When the additive injection is finished, all the injection data will be checked and saved. Even if the power is lost, the data will still be saved in the internal flash memory. If you use a service application, you can read out all the data and store new values in the I-DOG.



Control cabinet with storage bottle and I-DOG

#### Technical data:

- Injection values: 1 ppm to 50 ppm (max 300 l/minute)
- Self-sucking
- High quality internal fluid pass also for sensitive material
- Power supply: 24 V DC /230 V AC
- Additive supply control 2 calculated values or sensor signal
- Status display with LED
- Two switches for service

#### Connections:

- Micro USB
- RJ45 network connector
- Liquid connection 3 mm tube
- Power connector
- Input for external release (electrically separated)
- Error output (electrically separated)

#### Unit size:

- W x H x D: 300 x 400 x 210 mm
- Weight: 8,8 kg

*Changes of technical data, unit size, weights and other changes may occur.*

## I-GRAPHX Technology has been developed to measure small Amounts of Substances in a very short Time.

The key parts of this micro gas chromatograph, like the injector, separation column and detector, are made of silicon Pyrex chips. These MEMS components (Micro-Electro-Mechanical Systems) are essential for analysing very small amounts of substances very quickly.

## This unique MEMS Module is your Benefit

The most important part of the analyzer is the gas chromatography module. This component is the only one in the world which is designed with MEMS technology. This means that the analytical setup can represent nearly any gas chromatographic configuration that you could possibly imagine. It can be equipped with up to four separation columns.

Depending on the application, the I-GRAPHX gas chromatographs can give you results in seconds. This is essential for process monitoring (inline analysis) and process controlling.

The very low energy and media consumptions enable also the mobile (portable) use of our micro-GCs



## CUSTOMIZING & ACCESSOIRES

### I-GRAPHX Customizing & Accessories – individual solutions according to your needs

#### I-GRAPHX Accessories

I-GRAPHX offer besides the already known main products, a wide range of other useful equipment which complement I-GRAPHX existing analyzer or that can be purchased separately for other uses.

#### Your Advantages:

- Direct from the manufacturer
- Matched accessories
- Fits perfectly
- Available at short-notice
- Receiving value and guarantee

### I-GRAPHX Customizing – special solutions for special requirements, developed to your wishes

# Innovative Sensors and Analyser Systems for the Power to Gas Transformation

**With the analyzer to the sample and not the other way around.**

Why waste time? And why risk having your samples get lost on the way to the lab? You don't have to carry samples manually to the analyser any more. The I-GRAPHX GmbH has developed a new micro process gas chromatography and analyzer system that is not only stationary but also portable. Both versions use the latest microtechnology and offer powerful laboratory-grade gas chromatography. They have low maintenance and cost requirements. The compact devices are small and can give you fast results.

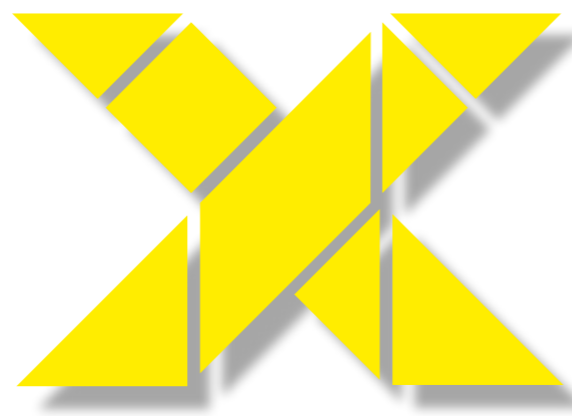
**Individual tasks require individual solutions**

The company has many years of experience in many different analytical fields. This is the reason we offer a growing number of applications for about six main industries.

I-GRAPHX offers with Industrial Graph Xolutions a modular applicable solution concept. For each task of our customers, a method will be provided that is tailored to the individual's precise requirements. This ensures the highest possible measuring efficiency. Our X stands for a modular system to solve any task. Being efficient is something you can measure, and it will always be worth the effort.

- Plenty of applications in several industry sections
- Worldwide in use in more than 26 countries
- For over 20 years chromatography expertise

**I-GRAPHX – smarter measurement**



Chemistry



Energy



Laboratory



Petrochemistry

**Modular use: always the right Xolution**



Science



Environment

# INDUSTRIAL GRAPH XOLUTIONS



Chemistry



Energy



Laboratory



Petrochemistry



Science



Environment

## I-GRAPHX – Your Benefits:

- You, the customer, are our focus!
- High flexibility and fast response due to small company size
- A solution-oriented approach to your needs and requirements
- Maximum measurement efficiency thanks to the modular system – Industrial Graph Xolution.
- The best individual solution for each of your tasks.
- Maximum flexibility at lower cost

## I-GRAPHX – xmarter measurement



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