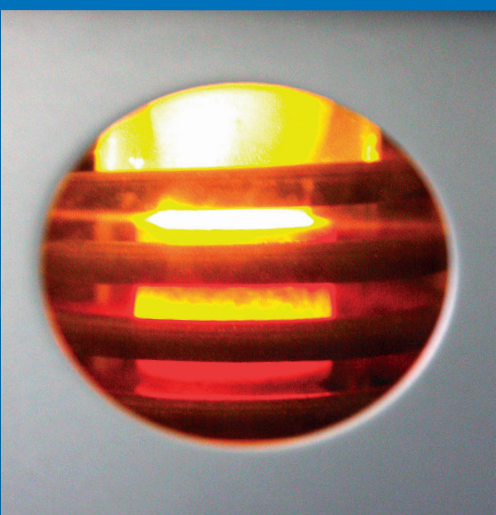
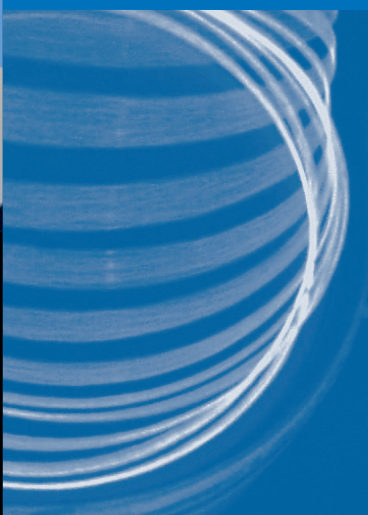




G4 ICARUS HF

- Simultaneous Determination of Carbon and Sulfur in Solids

High Performance Carbon & Sulfur Analyzer

Combustion Method with High-Frequency Furnace and Infrared Detection

The G4 ICARUS HF combustion analyzer is the ideal instrument for the rapid, precise and simultaneous determination of carbon and sulfur in numerous material types, such as: steel, iron, cast iron, alloys, non-ferrous metals, aluminum, titanium and alloys, zirconium and alloys, ores, ceramics, cement, limestone, and many more.

The G4 ICARUS HF is virtually maintenance free and easily operated via intuitive PC-based software. The solid sample is combusted in a high-frequency furnace in a flow of oxygen.

The carbon and sulfur components in the sample are oxidized to CO_2 and SO_2 , respectively, and transported with the oxygen carrier gas through a solid-state NDIR detector system with two measuring ranges for both carbon and sulfur of maximum selectivity and stability.

The system is characterized by its high analytical speed, precision and sensitivity combined with ease of use and almost maintenance free operation.

By introducing key technology advances, the G4 ICARUS HF creates a new dimension of usability and productivity.

The innovative combustion zone design utilizes a gas extraction nozzle (pat. pend.) to ensure a high oxygen excess at the sample with instant removal of liberated gases and formed metal oxide dust. A unique, fully automatic cleaning system with brush-free dust removal, ensures simultaneous cleaning of the inline dust filter and gas extraction nozzle while transferring accumulated dust into the (used) crucible for disposal. In conjunction with a new type, temperature stabilized dust filter these innovations create unrivaled characteristics and performance.

The sample, placed in a ceramic crucible, is introduced into a HF induction furnace and combusted in an oxygen stream. The resulting reaction gases CO_2 and SO_2 are measured by selective and sensitive NDIR detectors.



Special Features and Benefits G4 ICARUS HF

- Advanced, high frequency induction furnace technology with long life oscillator tube (3-year warranty)
- Innovative furnace design with gas extraction nozzle (pat. pending), lancefree operation; virtually eliminating dust and splatters; thus reduced maintenance, higher productivity
- Unique fully automatic cleaning system with vacuum-free, noiseless and brush-free dust removal into the used crucible; no routine maintenance, no hazardous dust handling; cleaning time less than 5 seconds
- Double dual range solid-state NDIR detector (no moving parts); unique 3-year warranty
- Electronic pressure and flow monitoring; fully automatic leak check; zero-flow mode saves oxygen during break periods
- Graphical on-line display of signals during analysis provides immediate feedback
- Clearly and simply structured Bruker „One-4-all“ software interface with intuitive operation; data storage for subsequent review of all analyzes; data transfer via FTP or local network connection possible

● Benefits

High-Frequency Induction Furnace

The power level of the HF furnace is adjustable in order to achieve optimum combustion. The combustion process of the sample material inherently produces byproducts, primarily as oxide dust. Another process inherent with the vigorous combustion is the rapid ejection of particles from the crucible due to the efficient high frequency energy transfer to the metallic material.

This can lead, especially with conventional furnace designs using a lance, to a significant accumulation of splattered byproducts on the interior walls of the quartz combustion tube, which can compromise its integrity and possibly cause breakage.



Unlike conventional furnaces, the G4 ICARUS HF features an innovative design with a gas outlet nozzle positioned directly above the ceramic crucible (pat. pend.) for efficient removal of the reaction gases and metal oxide byproducts.

This leads to drastically reduced contamination of the combustion tube, resulting in a considerably longer lasting quartz tube and, due to the automatic, brushless cleaning device, much less maintenance work.

A built-in glass window enables a direct view into the combustion zone of the furnace to visually following the combustion process.

Unique automatic cleaning system

The unique, fully automatic cleaning system ensures simultaneous cleaning of the inline dust filter and gas extraction nozzle while transferring accumulated dust into the (used) crucible for disposal.

In addition to the temperature-stabilized and reduced dead volume design, this innovation provides unrivaled characteristics and performance.

The interior dust filter has high retention efficiency even for very small particles. The pressure drop at the filter is monitored with an alarm so the user is alerted when to clean or replace the filter insert.

The complete automatic cleaning procedure only requires less than 5s, so there is minimal impact on the sample throughput.

The innovative combination of extraction nozzle and automatic cleaning leads to a cleaner furnace, dust filter and environment than achievable with vacuum cleaner systems. Utmost analytical stability is achieved with noiseless operation and without routine maintenance.

Electronic Flow Control and Pressure Monitoring, Leak Test

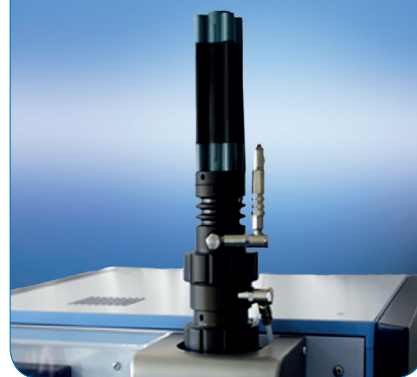
The combustion/carrier gas flow and the system pressure are two essential parameters that need to be monitored for highest repeatability and reliability. The G4 ICARUS HF is equipped with an electronic flow control and pressure monitoring with additional display on the front panel of the analyzer and automatic fault indication on the monitor. Flow and pressure control enable a fully automatic leak test which can be invoked via the software.

The zero-flow stand-by mode saves oxygen during break periods. During stand-by the system is closed against the atmosphere to prevent consumption of the reagents by ambient air intrusion.

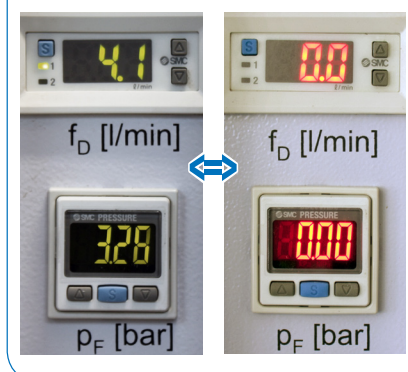
Connected Balance

The input of the sample weight can be made either manually or by direct transfer from an optionally connected balance by simply pressing a print button.

Automatic Furnace Cleaning



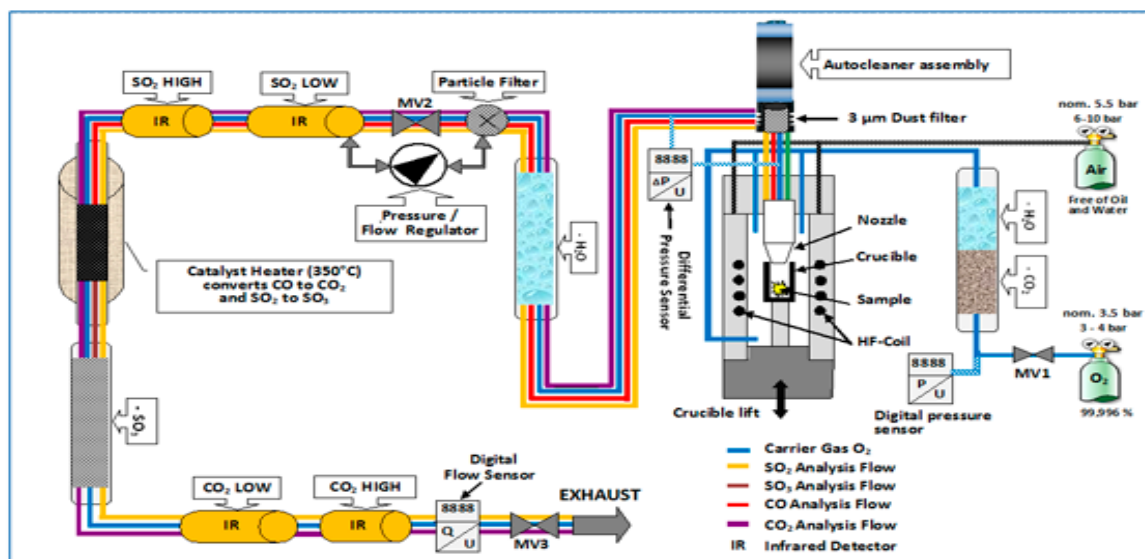
Dynamic Digital Display



Benefits

See how quickly an investment in the G4 ICARUS HF will pay back:

- Less dust contamination in the furnace
- Easy to use, comprehensive software package
- Reduced operating expenses
- Reproducible analysis conditions
- Flexible, cost-saving maintenance intervals
- Substantial time savings
- Unique configuration settings for many applications



Working Principle

The operating principle is based on a closed-flow system with pneumatic control of the sample loading pedestal. The solid sample, placed in a ceramic crucible together with accelerator material is combusted in the high frequency furnace in an oxygen stream.

Due to the applied HF power the sample is directly heated by induction in pure oxygen ensuring a complete combustion. Thus the carbon and sulfur compounds in the sample are combusted and oxidized to form gaseous CO_2 and SO_2 which are swept by the carrier gas O_2 through the solid state NDIR detectors. The response of these highly-sensitive and selective detectors is recorded over time.

Detection Principle

The G4 ICARUS analyzers are equipped with selective solid-state NDIR detectors without any moving parts (i.e., no mechanical chopper) and have as standard two measuring ranges for both, carbon (CO_2) and sulfur (SO_2). Narrow-band optical filters in front of the respective sensor only allow to pass the specific wavelength of the infrared light which can be absorbed by CO_2 respectively SO_2 to eliminate interferences.

All ranges are simultaneously recorded, and the optimal measuring range is automatically evaluated by the computer. The graphical on-line display of the signals during analysis provides immediate feedback.

The software calculates from the sample peak areas the concentrations taking into account the sample weight and the previously established calibration values. The results can be reported in ppm or percent. Report printing, complete with results, detector signals and operating parameters, is supported for archival purposes.

Calibration

The calibration of the analyzer is made by analyzing certified reference materials. Single-point or multi-point calibrations can be selected with automatic determination and reporting of the calibration factors.

Storage of Configurations/Methods

Analysis parameters, or methods, for each sample application are stored with fully-customizable names. These parameters can be easily recalled when needed for future application work.

Analysis Software

The analysis software of the G4 ICARUS shares commonality with all other gas analyzer products offered by Bruker. The primary tasks are organized into individual screens to maximize convenience and productivity:

Analysis. Primary view for intuitive operation of the analyzer; graphical display of the sample peak profile in real-time during each analysis; recall of any analysis from the list of results to display signals

Parameters. Configurations are defined and saved in this pane under freely selectable names for different applications and methods with complete set of data. The individual methods can be easily recalled depending on the desired application.

Statistics. This tab provides the ability to statistically evaluate the analysis results and to print and archiver the statistical data

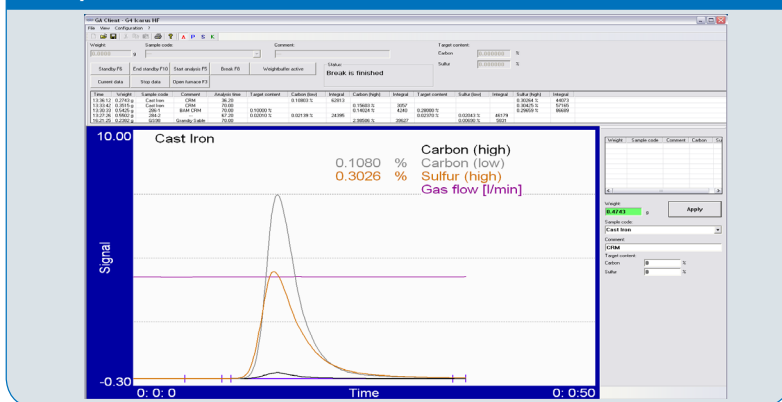
Calibration. Screen which allows the instrument to be calibrated with results from pure substances or certified reference materials via single-point, two-point or multi-point calibrations.

At your Service



For additional information about the G4 ICARUS HF, or any other Bruker gas analyzer, please visit our website or call the local Bruker division in your territory. We will be glad to assist you with any questions you may have.

Analysis Screen



All analysis and peak manipulation tasks can be performed on the Analysis screen. Peak profiles of the current analysis are displayed graphically, while previous analyses can also be recalled and displayed on this screen.

Program settings

The Program settings screen includes the following sections:

- Configuration:** Configuration name (Cast Iron), Comment (G4 ICARUS HF, Bruker Elemental).
- Analysis:** Time (s), Purge (5), Standby (5), Baseline check (5), Analysis time 1 (45), Analysis time 2 (15), Baseline check (5).
- Detector:** Carbon (low), Sulfur (low), Gas (low), Carbon (high), Sulfur (high), Furnace pressure (low).
- Instrument:** Gas flow rate (400), Oxidation furnace (430), Standby after (15), Enable cleaning (Purge and hold ALL FID while cleaning), Cleaning reminder after (10).

All method properties, such as furnace power and integration time, is defined in the Parameter settings screen. The parameters can be stored as a customizable name and then recalled in the future as needed.

Statistics

The Statistics screen displays the following table of analysis results:

Selected	Date	Time	Weight	Sample code	Comment	Analysis time	Target content	Carbon (high)	Integral
Selected	10.03.2011	16:35:51	0.2681 g	0598	Gravimetry	70.00	0.0000 %	2.9773 %	44995
Selected	10.03.2011	16:35:51	0.2681 g	0598	Gravimetry	70.00	0.0000 %	2.9635 %	44677
Selected	10.03.2011	16:21:25	0.2681 g	0598	Gravimetry	70.00	0.0000 %	2.9651 %	39627

Below the table, statistical data is provided:

- Number of points: 3
- Average: 2.9819
- Standard deviation: 0.0041
- Variance: 0.0000
- Variance coefficient: 0.1389
- Minimum: 2.9772
- Maximum: 2.9851

The Statistics screen shows the evaluation of all analyses: Values for average, standard deviation, variance, variance coefficient, minimum and maximum values will automatically be displayed on the screen. An attached printer allows the easy printout of all data and statistics.

Specifications



■ Measuring ranges¹⁾

Carbon: up to 6 %

Sulfur: up to 0.5 %

¹⁾Based on 0.5 g sample weight

Two ranges for both, CO₂ and SO₂, ranges can be extended by reducing the sample weight

■ Nominal Sample Weight

0.5 - 1.0 g

■ Analysis time²⁾

approx. 40 s

²⁾Depending on sample material and weight

■ Resolution

0.1 ppm

■ Repeatability³⁾

Carbon: ± 1 ppm or 1.0 % RSD (whichever is greater)

Sulfur: ± 2 ppm or 1.5 % RSD (whichever is greater)

³⁾Depending on purity of carrier gas, crucibles and accelerator

■ Carrier Gas

Oxygen 99.95 % purity⁴⁾, 3.5 bar (~50 psi) min. pressure

⁴⁾Recommended for low carbon concentrations: 99.995 %

■ Compressed Air

5 bar (~72.5 psi) min. pressure, must be oil-, water- and particle-free

■ Dimensions & Weight

630 x 640 x 480 mm (WxDxH); 75 kg

24.8 x 25.2 x 18.9 inches; 165.3 lbs

Height overall: 770 mm, 30.3 inches (incl. cleaning device)

Depth overall: 770 mm, 30.3 inches (incl. HF furnace)

■ Electrical Supply

230 VAC ± 10 %, 50/60 Hz, 16 A, 2.7 kVA

■ System Requirements

Standard WindowsTM-PC, operating system Windows⁵⁾ XP/7

HDD > 200 GB, DVD drive, 2 serial ports RS 232

⁵⁾Windows is a registered trademark of Microsoft Corporation

● Bruker Elemental GmbH

Kastellstrasse 31-35

47546 Kalkar, Germany

Tel. +49 (2824) 97650-0

Fax +49 (2824) 97650-10

info@bruker-elemental.com

Bruker AXS Inc.

40 Manning Road

Billerica, MA 01821, USA

Tel. +1 (978) 663-3660

Fax +1 (978) 667-5993

elemental@bruker-axs.com