# // XPREP C-IC

TE Instruments introduces the world's first automated independent sample preparation system for Combustion Ion Chromatography: the XPREP C-IC. This unique configuration redefines automated combustion IC analysis through its innovative design and functionalities.

## Independent Sample Preparation System

Besides full control over sample combustion, the XPREP C-IC not only collects the oxidized gas stream, but also automatically transfers a fraction of the absorbance liquid to any renowned IC system. The ideal solution to cover the increasing demand for analysis of corrosive halogens (Fluor, Chlorine, Bromine, Iodine) and sulfur compounds (e.g. Sulfate, Sulfite, Thiosulfate) in different matrices. These analytes need to be monitored because they are corrosive, poison catalysts, damage industrial equipment, and are harmful to the environment.

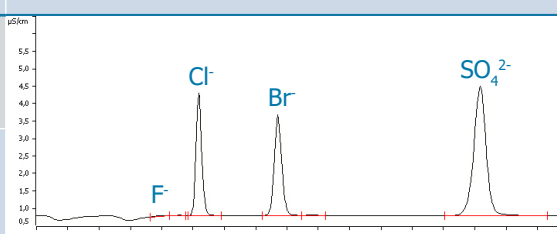

## New Standard in Automated C-IC Analysis

The analysis of speciated halides and sulfur in complex matrices like petrochemicals and solids is difficult and requires extensive sample preparation with conventional offline methods. Oxidative Microcoulometry is an alternative detection technique which provides results as a sum-parameter. Combustion IC enables the determination of individual halides and sulfur by a single analysis while eliminating the complex and time-consuming sample preparation steps of conventional offline digestion/combustion methods.

TE Instruments developed a fully automated, extremely compact sample preparation system covering the oxidative pyrohydrolytic combustion, fraction collection, and sample injection towards the IC. The XPREP C-IC can introduce samples both via direct injection (liquids module) and boat-inlet (boat module) into a horizontal furnace. This automated sample-prep solution reduces complexity of sample transfer and improves user convenience.

**Key features include:**

- Small Footprint (half the size compared to existing C-IC configurations)
- Fully automated sample introduction by means of robust sampling systems
- Controlled sample introduction by direct injection- or boat inlet system
- Oxidative pyrohydrolitic combustion of solids, liquids, gas and LPG
- 65 position fraction collection unit
- Integrated sampling system fully controls dosing of reagents
- Accurate injection of combusted sample into IC
- Speciated halide and sulfur analysis by any renowned IC

## Principle of Operation

| Sample | Combustion | Collection | IC Analysis |
|--------|-----------|-----------|-------------|
| Sulfur | $SO_x$ | $SO_4^{2-}$ |  |
| Halogens | H-X, $X_2$ | $X^-$ | |

# 1.    Introduction

Sample introduction is done fully automated by means of robust sampling systems for liquid, viscous, solid, gas and LPG samples. The auto samplers have a proven track-record for controlled and accurate sampling of all kinds of matrices.

TE Instruments offers two introduction modules: the liquids introduction module (direct-injection) and boat introduction module (boat-inlet). Switching between introduction modules and auto samplers is done within minutes, which gives the operator a high degree of flexibility in the analysis of different matrices.

The liquids module is specifically designed for the direct injection of liquid samples with a final boiling point up to 420 °C, which corresponds with the scope of e.g. ASTM D7359 and UOP 991. International test methods that focus on the analysis of Total Sulfur and Total Chloride stipulate direct injection as a viable sample introduction technique.

XPREP C-IC is the only combustion system capable of introducing samples for combustion both via direct injection (liquids module) and boat-inlet (boat module) into a horizontal furnace. Introduction of low boiling liquid samples by direct injection has multiple benefits compared to boat-inlet:

| Features Liquids Module | Benefits |
|---|---|
| Temperature controlled (500 °C) Sample dispense up to 1 µL p/s by automated syringe | • Controlled evaporation of liquid sample into the gas phase, transferred by the inert carrier gas into the combustion zone.<br><br>• Controlled sample combustion prevents soot or coke formation, a result of incomplete combustion.<br><br>• Improves the repeatability for automated C-IC analysis.<br><br>• Eliminates the need for a boat program, decreases time of analysis. |
| Enables a larger sample volume up to 100 µL | • Improves IC-detection limit compared with boat introduction (limited sample volume).<br><br>• Multiple injections from the same sample can be introduced, combusted and absorbed for a single IC analysis. |

# 2.    Combustion

Every sample is completely oxidized by pyrohydrolitic combustion in an oxygen-rich environment at high temperature. TE Instruments provides a 5-year warranty on the robust dual-zone furnace. All glassware, including combustion tubes and introduction modules, are designed, developed and manufactured by TE Instruments. The specially developed pyrohydrolitic combustion tube includes a single-stage capturing and collision flow technique.
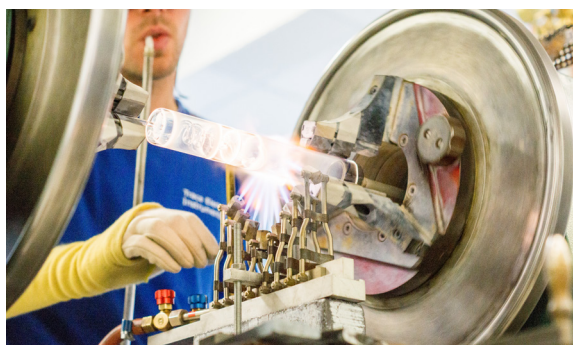
Incomplete sample combustion may lead to the formation of soot. The single stage capturing filter protects the downstream flow path against soot deposition. The capturing filter is "self-cleaning", as it continuously regenerates itself by the high temperatures and presence of oxygen flow. The collision flow technique provides a secondary oxygen flow that collides with the oxidizing gas stream and replaces some of the depleted oxygen. Resulting in more oxidation power for samples which are difficult to oxidize.

## 3.      Collection

IAfter combustion, absorber solution is added to the output gas stream to guarantee a complete absorption of the analytes in the fraction collection unit. In this process the H-X, $X_2$ and $SO_x$ are converted to $F^-$, $Cl^-$, $Br^-$, $I^-$ and $SO_4^{2-}$. All these negatively charged ions will be separated in the IC column.

The integrated low maintenance sampling system operates with a dual-channel needle. One channel is used for dosing of the required reagents and absorption of the combustion gas, the other transfers the sample from the collection unit to the IC. Up to 65 combusted samples can be absorbed and stored in the individual absorption vials. Continuously rinsing a single absorption tube is no longer required. The collected samples can be transferred to the IC immediately or stored for analysis at a later stage.

## 4.      Injection

Once sample preparation has been finalized, the absorbent containing the analytes is automatically transferred from the fraction collection unit towards any renowned IC. The internal syringe pumps of the collection unit load and rinse the IC sample loop. A six-way-valve and 100 µL sample loop are by default integrated at the front of the fraction collection unit. The sample loop may be used to fill the pre-concentrator when present in the IC.
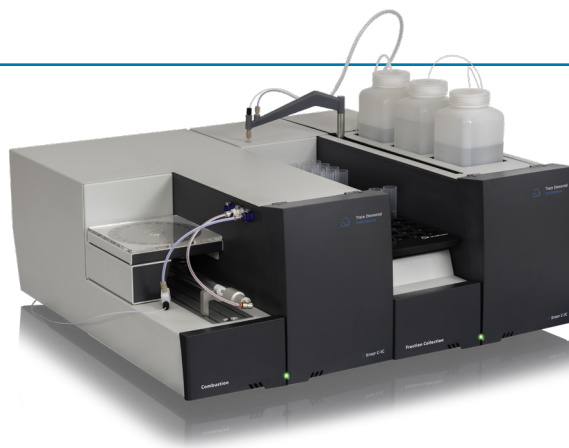
## Typical Applications

- Petrochemicals
- (Bio)Fuels
- LPG & Gas
- Lubricants
- Organic Solvents & Chemicals
- Polymers

- Environmental Monitoring
- Electronic Components (e.g. RoHS compliance)
- Foods
- Minerals
- Coloring agents
- Polishing agents

## The Combustion Experts

TE Instruments has a rich history in the development and production of trace elemental combustion solutions. Since 1993, our home base in Delft, the Netherlands, facilitates a strong network of well-integrated departments such as Application Development, Research & Development, Glass Manufacturing and Production. This allows us to quickly respond to customer needs. TE Instruments controls the entire production process of its analyzers, starting from fundamental research up to shipment from our warehouse. We are fully dedicated to the development of targeted solutions for elemental combustion analysis with the quality you expect and the attention you deserve.

## TEIS Software

TEIS Analytical Software enables smooth instrument control and application handling. The intuitive user interface hardly needs any explanation. Modify sample lists and evaluate data in just a few clicks. Sensor readings and generated log files help the user to handle day to day operation efficiently. TEIS Software is able to run in slave mode for any renowned IC that is connected to the XPREP C-IC.

- Method Manager     - Use default methods or create perfect application settings
- Visual Devices       - Status overview of every device
- Sample Manager     - Drag & drop the columns you want to see
- Task Manager       - Prepare sample queues in seconds

# Autosamplers

## // ARCHIE
**Robotic liquids XYZ auto sampler**

| Sample | Liquids |
| --- | --- |
| Volume | 5 – 100 µL |
| Sample positions | 105 by default, optionally 210 |
| Optional | Conditioned Sample Tray (Cooling & Heating) |

## // GLS
**Safe & Advanced Pressurized Gas & LPG sampler**

| Sample | Pressurized Gas & LPG |
| --- | --- |
| Sample loops | 10 mL gas; 100 µL liquefied gas (or customized) |
| Primary pressure gas sample | up to 50 bar, 725 psi (or customized) |
| Primary pressure LPG sample | up to 25 bar, 363 psi (or customized) |
| Optional | Automatic Safety Lock |
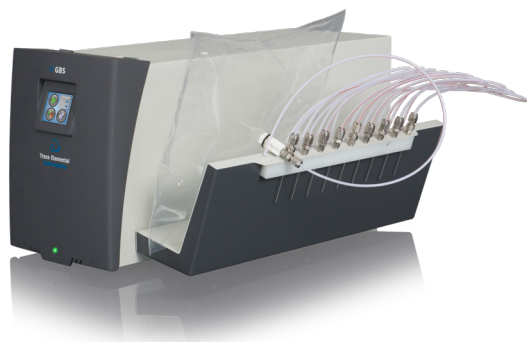
## // GBS
**Flexible Non-Pressurized Gas Sampler**

| Sample | Non-pressurized Gas |
| --- | --- |
| Volume | 10 – 1000 mL |
| Sample positions | Up to 10 Tedlar® bags |
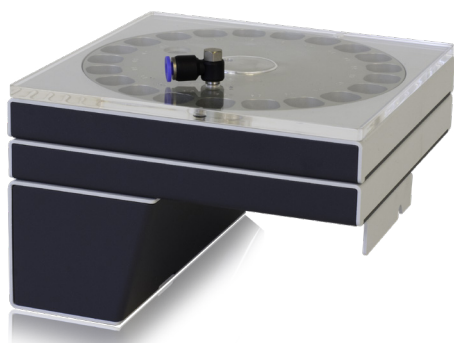
## // NEWTON
**Robust Solids auto sampler with Stackable Trays**

| Sample | Solids |
| --- | --- |
| Sample positions | 20 (one tray), 40 (two trays), 60 (three trays) |
| Sample amount | 5 – 250 mg |

## Specifications

| | |
|---|---|
| **Sample introduction** | Liquid, Gas & LPG samples by heated liquids introduction module (direct injection) Solid and Liquid samples by quartz boat introduction module (boat-inlet) |
| **Compliance** | Compliant with the performance standards of international test methods like ASTM, UOP, ISO, DIN, EN, JIS, KS. |
| **Sample Types** | Solid, Liquid, Gas, LPG |
| **Typical Sample Amount** | 10 - 250 mg (solids), 5 - 250 µL (liquids), 10 – 250 mL (gas), 100 - 500 µL (LPG) |
| **Sample pyrolysis** | XPREP C-IC Combustion Tube |
| **Furnace voltage** | Dual zone, low voltage |
| **Furnace temp.** | Max. 1150 °C, 2100 °F |
| **Gases** | Oxygen 99.6% (2.6), Argon 99.99% (4.0) or Helium 99.99% (4.0) |
| **Input gas pressure** | 3-10 bar (45-150 psi) |
| **Absorbent tube** | 23 mL - 65 positions (optional 40 mL) |
| **Injection to IC** | Variable, default 100 µL |
| **Flow path material** | PTFE, PEEK |
| **Remote control** | Configurable Remote Start/Stop |
| **Voltage** | 100 - 240 VAC, 50 - 60 Hz |
| **Software** | TEIS Software |
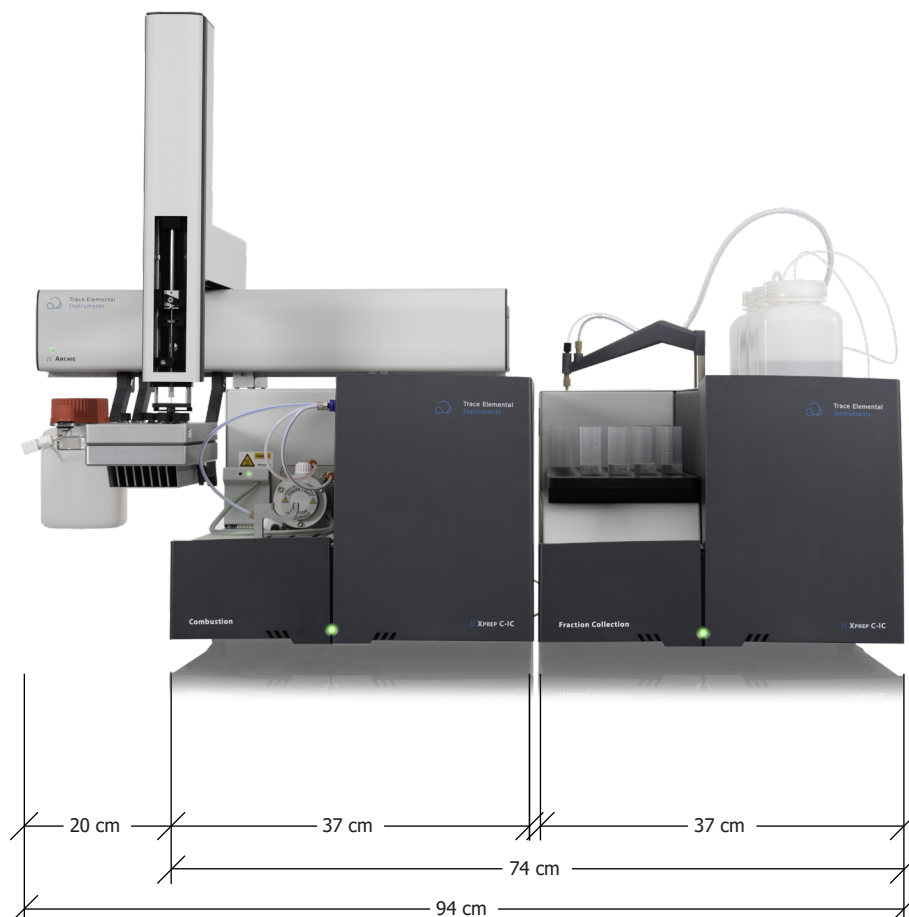


Used images are examples of configurations which may deviate from ordered configurations.