Hyper-fast GC

Analysis in seconds with the new HyperChrom GC
This hyper-fast GC is based on a fundamentally new design. It is the first commercial Thermal Gradient GC.

What does ‘Thermal Gradient GC’ mean?

In contrast to conventional temperature ramp GC systems, a continuous thermal gradient is applied across the separation column from the inlet to the outlet. This creates a velocity gradient, focusing a peak at lower separation temperatures.

HyperChrom technology takes advantage of the ‘Flow-Field’ principle to create a thermal gradient (patent-registered). This is achieved by placing a resistively heated capillary sheath in a helical channel cooled by forced air flow onto the sheath.

Technological Highlights

The FF-TG-GC is extremely fast. Direct resistive heating of the separation column enables controlled heating rates of up to 6000 °C/min. Due to low thermal mass, cooling can be achieved in less than 10 seconds!

The HyperChrom GC has integrated back-flushing built into the flow scheme. The separation column, guard column and detector transfer line are connected via innovative purged connectors allowing flow and flow directions to be controlled independently.

Flow-Field Thermal Gradient Gas Chromatography

Creating a smooth thermal gradient along a separation column is a challenging task. A ‘Flow-Field’ is achieved by placing a flow resistance between an air fan and the helical channels and heated capillary sheath. Thermal loss of the resistively heated separation column is dependent on the air flow velocity. This forms the basis of the HyperChrom thermal gradient GC.

Flexible programming of both the air flow and heating current allows control of the temperature and magnitude of the thermal gradient. This new degree of freedom enables novel measurement methods.
Temperature curve is programmed on a seconds scale as opposed to the minutes scale of conventional GC. Multiple ramps, iso-thermal phases and even negative ramps are possible. The temperature gradient can be increased or decreased depending on the requirements of the method.

**Peak Focusing**

In classical GC peaks are broadened by diffusion. This effect is counteracted through the peak focusing achieved by the thermal gradient applied on the separation column.

The thermal gradient creates a velocity gradient within the separation column where the front is slower than the tail. Consistent Gaussian-form peaks are achievable with FF-TG-GC!

Drastically reduced elution temperatures are advantageous when analysing unstable substances. Lower operating temperatures also extend column lifetime and stability.

**Temperature & Gradient Programming**

Temperature curve is programmed on a seconds scale as opposed to the minutes scale of conventional GC. Multiple ramps, iso-thermal phases and even negative ramps are possible. The temperature gradient can be increased or decreased depending on the requirements of the method.

<table>
<thead>
<tr>
<th>Fast Results</th>
<th>Low Cost of Ownership</th>
<th>High Sophistication</th>
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<tbody>
<tr>
<td>Full temperature range chromatograms below 60 seconds</td>
<td>Compatibility with standard fused silica separation column</td>
<td>Precisely controlled temperature and gradient programming</td>
</tr>
<tr>
<td>Controlled heating rates up to 6000 °C/min</td>
<td>Simple and fast column change</td>
<td>No off-column peak broadening due to integrated purged connectors</td>
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<td>Significantly reduced elution temperatures</td>
<td>No expensive replacement parts</td>
<td>Electronic pressure control facilitates backflushing of column and injector</td>
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<tr>
<td>Enhanced resolution with short separation columns</td>
<td>Extended column lifetime</td>
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**HyperChrom GC Advantages**

High throughput experimentation – Fast screening – Rapid method development

- Full temperature range chromatograms below 60 seconds
- Controlled heating rates up to 6000 °C/min
- Significantly reduced elution temperatures
- Enhanced resolution with short separation columns
- Cooling from 350 to 30°C within 10s

- Compatibility with standard fused silica separation column
- Simple and fast column change
- No expensive replacement parts
- Extended column lifetime

- Precisely controlled temperature and gradient programming
- No off-column peak broadening due to integrated purged connectors
- Electronic pressure control facilitates backflushing of column and injector
HyperChrom transforms traditional GC runtime from half an hour to less than one minute. The so-called ultra-fast GC is often hyped as chromatography in minutes. HyperChrom, in contrast, delivers chromatography in seconds, which is a true hyper-fast GC!

### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>Dimensions</td>
<td>50(W) × 55(H) × 45(D) cm</td>
</tr>
<tr>
<td>Weight</td>
<td>27 kg</td>
</tr>
<tr>
<td>Linear Heating Rate</td>
<td>up to 6000°C/min</td>
</tr>
<tr>
<td>Cooling Time</td>
<td>10s from 350 to 30°C</td>
</tr>
<tr>
<td>Temperature Program</td>
<td>9 steps</td>
</tr>
<tr>
<td>Pressure Setting Range</td>
<td>50 – 950 kPa</td>
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**Invented and made in Germany**

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**Partners & References**

[Markes International](https://www.markes.com)  
[five technologies](https://www.fivetech.com)  
[SepSolve Analytical](https://www.sep.solve.com)
BTX-measurement

- BTX and Alkane standard
- Multi ramp temperature program
- Near baseline resolution of Ethylbenzene, p-Xylene and m-Xylene
FAME measurement

- FAME (fatty acid methyl ester) standard
- Multi ramp temperature program
Thermally labile explosives

- Explosives and taggant mixture
- 40 s temperature ramp (35 to 320 °C)
- Reduced degradation of thermally labile components
Reduced elution temperatures

- C7 to C40 alkane standard
- High peak capacity
- Reduced elution temperatures with gradient
- Elution temperature minus 55°C for C40
Pesticides

- Pesticide standard mixture
- Comparison of conventional vs. hyper-fast GC
- Speed gain: 46 seconds vs. 32 minutes
ASTM D7798

- ASTM D2887 reference gas oil
- Measurement time 60s