

UNITY–Air Server-xr

**Automated, cryogen-free, unattended
on-line air monitoring system**



UNITY–Air Server-xr™

Introducing UNITY–Air Server-xr – a cryogen-free thermal desorption system for round-the-clock on-line monitoring of volatile and very volatile organic compounds ((V)VOCs) in air using GC and GC–MS.

UNITY–Air Server-xr is a robust, autosampler for unattended on-line monitoring of ambient air or industrial processes. Its leading performance has been demonstrated in multiple independent laboratory and field trials.

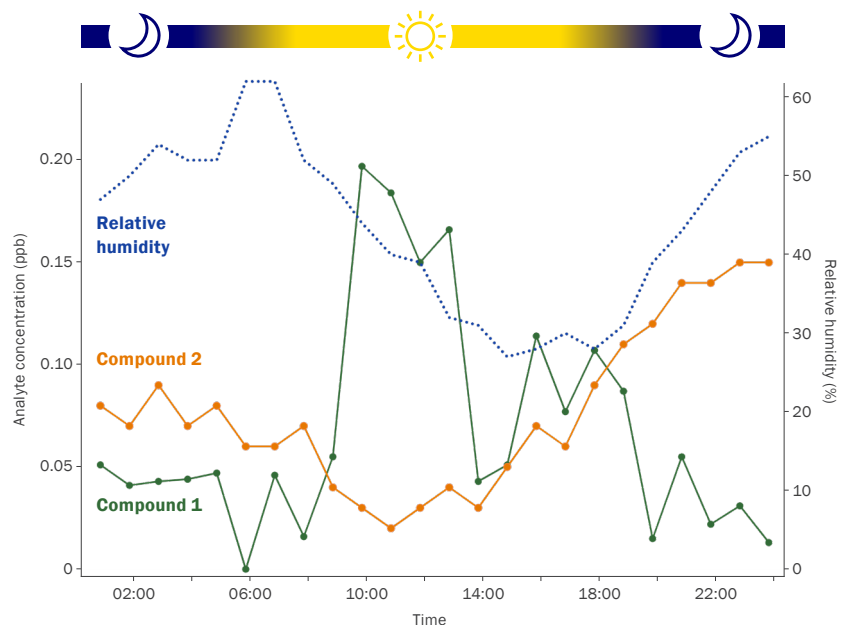
Key benefits:

- **Throughput and reliability:** Cryogen-free operation, fast cycle times and automated sequencing between at least three channels (sample, standard, blank) minimise user intervention and deliver optimum data coverage.
- **Best-available sensitivity:**
 - Quantitative retention of C₂ hydrocarbons from up to 1L of air to enhance ozone precursor monitoring.
 - Uniquely fast trap desorption delivers sharp peaks and optimum detection limits for critical trace air pollutants.
- **Versatility and robustness:**
 - Mass flow controlled sampling provides precise sample volumes and highly reliable data.
 - Splitless and high-split options extend the sample concentration range.
 - Completely inert flow path offers compatibility with the most challenging analytes.
 - Method-compliant tube desorption offered as standard. Upgradable to 100-tube automation.
- **Sophisticated water management – Options for every application and budget:**
 - Permeable membrane dryers provide cost-effective water removal for non-polar target lists.
 - Dry-Focus3™ – The ultimate cryogen-free drying option. Selectively eliminates water while preserving the recovery of polar VOCs, ultra-volatiles and reactive species.



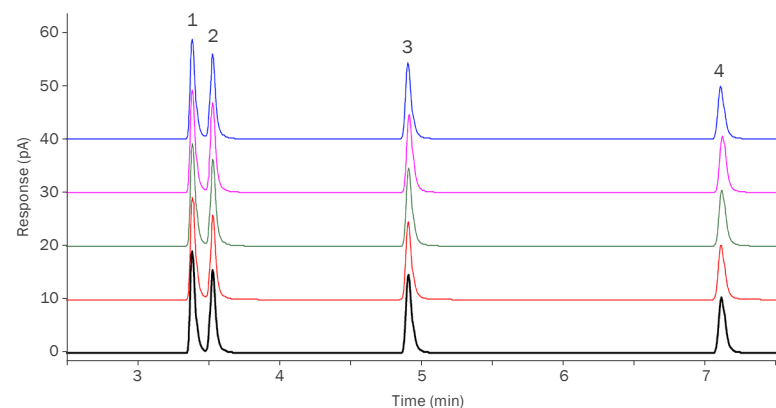
High-productivity on-line monitoring

On-line TD-GC(-MS) is ideal for monitoring processes or for time-profiling concentrations of common pollutants such as ozone precursor hydrocarbons, odorous sulfur species and greenhouse gases. UNITY-Air Server-xr systems are expertly designed for reliable unattended operation and exceptional analytical performance.

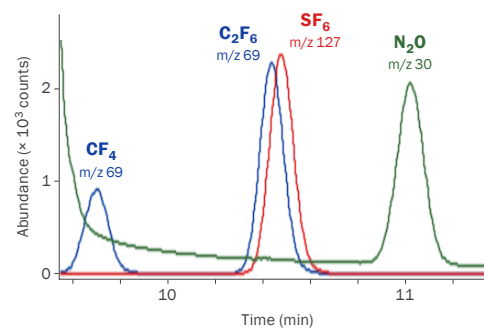
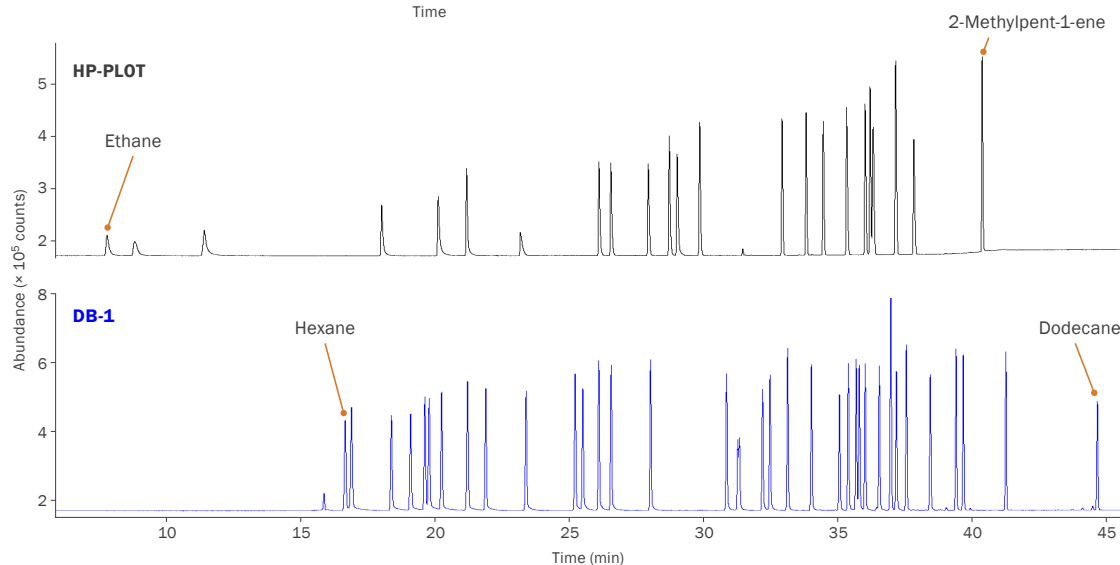


Unattended, round-the-clock TD-GC-FID monitoring of 'ozone precursors' allows researchers to track hourly variations in key pollutants. Top: Analysis of diurnal variations in pollutants suggests that compound 1 spikes at times of high traffic, while compound 2 increases at higher humidity. Bottom: Dual-column FID analysis of ozone precursor compounds.

No.	Compound	t_R RSD (%)	Reponse RSD (%)	R^2
1	Hydrogen sulfide	0.03	1.1	0.9937
2	Carbonyl sulfide	0.01	1.6	0.9936
3	Methanethiol	0.01	2.3	0.9981
4	Ethanethiol	0.03	2.9	0.9929



Reactive odorous sulfur compounds are quantitatively analysed using UNITY-Air Server-xr, here demonstrated in combination with GC-flame photometric detection (FPD). A fully inert system and the use of relatively low flowpath temperatures ensure superior retention time and response reproducibilities, as well as excellent linearity – results that underpin the suitability of UNITY-Air Server-xr for continuous monitoring with minimal time spent on data review.



Efficient splitless desorption and cryogen-free trapping combine in UNITY-Air Server-xr, to provide a simple solution to monitoring ultra-volatile greenhouse gases with sub-ppt detection limits.

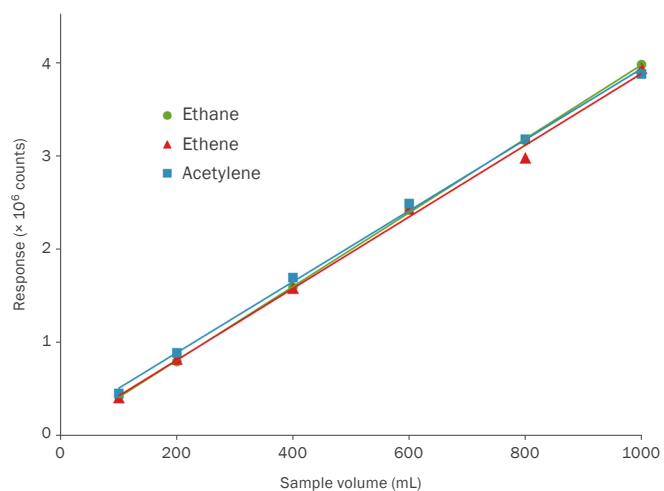
Exceptional trapping functionality

Combining high performance and practicality

The powerful focusing trap at the heart of UNITY–Air Server-xr has been refined over two decades and is used at thousands of locations globally.

The perfect balance of performance and productivity is achieved by:

- Quantitative retention of ultra-volatile compounds such as acetylene from up to 1 L of air.
- Electrical cooling of the focusing trap, which allows savings of up to \$15K per year and removes the risk of ice blockages typical of legacy systems using liquid nitrogen.
- Fast trap heating rates delivering sharp chromatographic peaks for optimum sensitivity and resolution.
- Overlap mode: Collection of the next sample can start while GC analysis of the previous sample continues, typically allowing data capture for up to 45 minutes per hour to maximise data coverage.

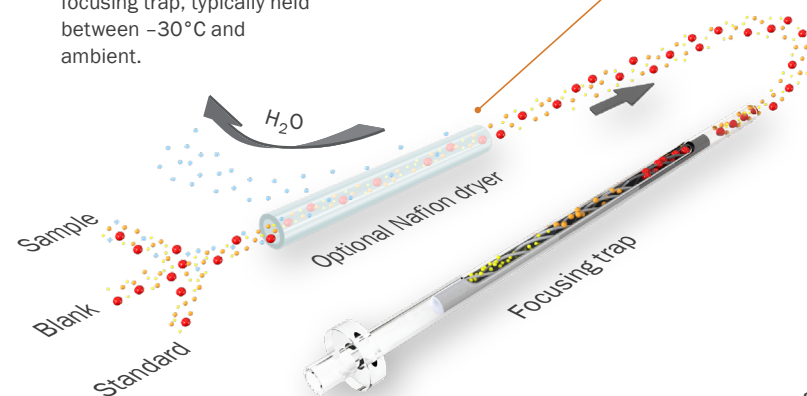


The excellent performance of the focusing trap at the heart of all Markes' TD instruments is demonstrated by the linearity obtained for high volumes of ultra-volatile C₂ hydrocarbons, sampled using the UNITY–Air Server-xr.

How sample trapping works:

1 Sample preconcentration

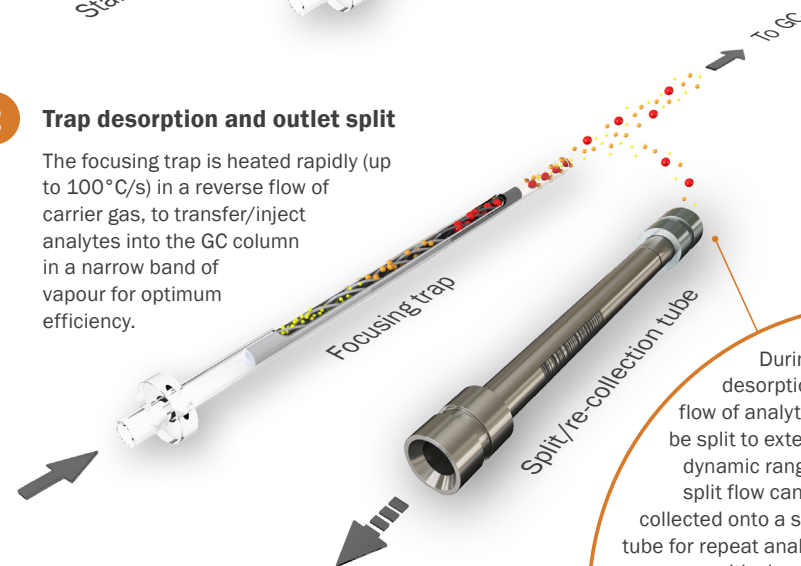
The sample is (optionally) passed through a Nafion™ dryer, and then onto an electrically-cooled focusing trap, typically held between -30°C and ambient.



Markes' range of on-line drying technologies includes options to suit every application and budget.

2 Trap desorption and outlet split

The focusing trap is heated rapidly (up to 100°C/s) in a reverse flow of carrier gas, to transfer/inject analytes into the GC column in a narrow band of vapour for optimum efficiency.



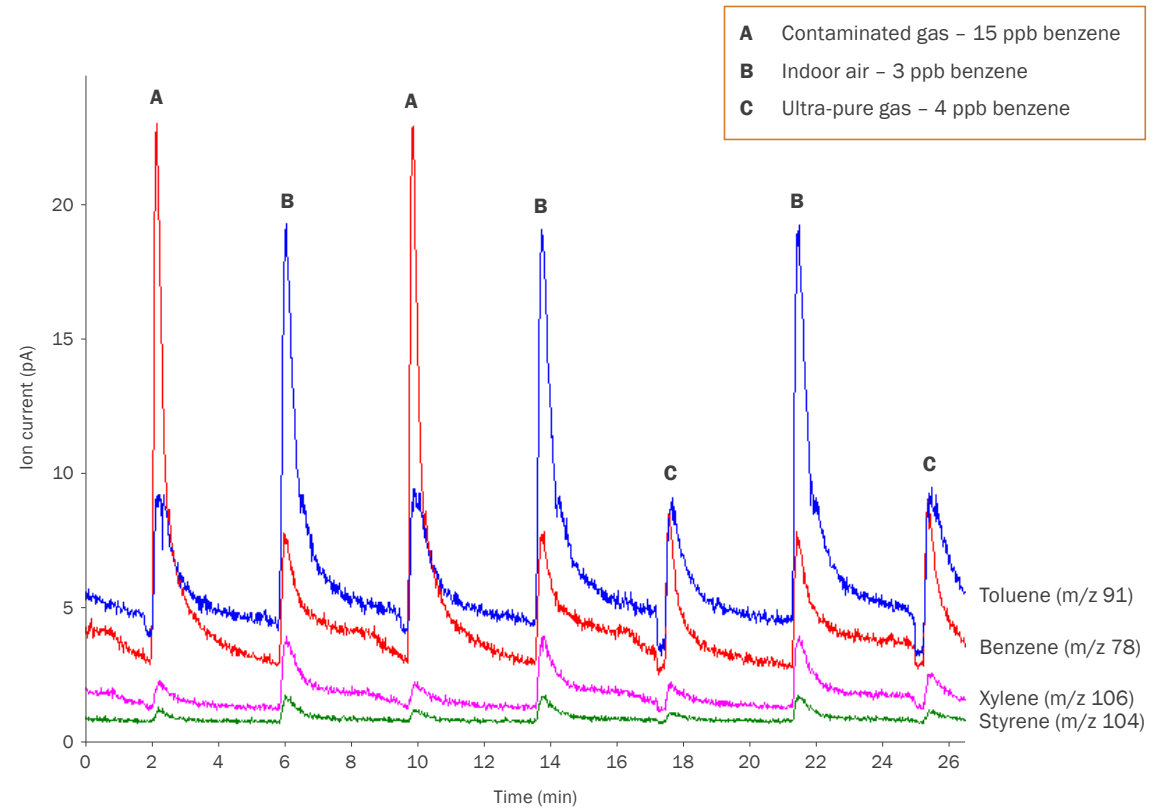
During trap desorption, the flow of analytes can be split to extend the dynamic range. The split flow can be re-collected onto a sorbent tube for repeat analysis of critical samples.

Leading technology for unattended on-line monitoring

As adopted in hundreds of mobile laboratories and field stations around the world

Engineered to operate in the lab or field, UNITY–Air Server-xr offers:

- **A small footprint** for easy installation in confined situations on ships, vans or even planes.
- **Fully integrated Peltier-cooled trapping** eliminates the need for large dewars and liquid cryogen supply logistics, enabling continuous, unattended monitoring in remote locations.
- **Flexible sequencing** allows samples to be scheduled at specific times or time intervals (e.g hourly) with automated switching between standard, blank and sample streams, all without user intervention.
- **Onboard diagnostics** maximise instrument up-time, with predictive maintenance warnings and built-in instrument self-checking routines optimised for remote troubleshooting.
- **Short, reproducible cycle times** (as low as 5 minutes) provide maximum sampling coverage and high time resolution. Combining the preconcentration power of UNITY–Air Server-xr with on-line mass spectrometers provides the ideal solution for fast-cycle emergency response monitoring or process control.
- **Advanced water management options** provide on-line drying of sample streams, delivering highly stable retention times and minimising data review requirements. Column and detector lifetimes are also extended increasing maintenance intervals for unattended systems.



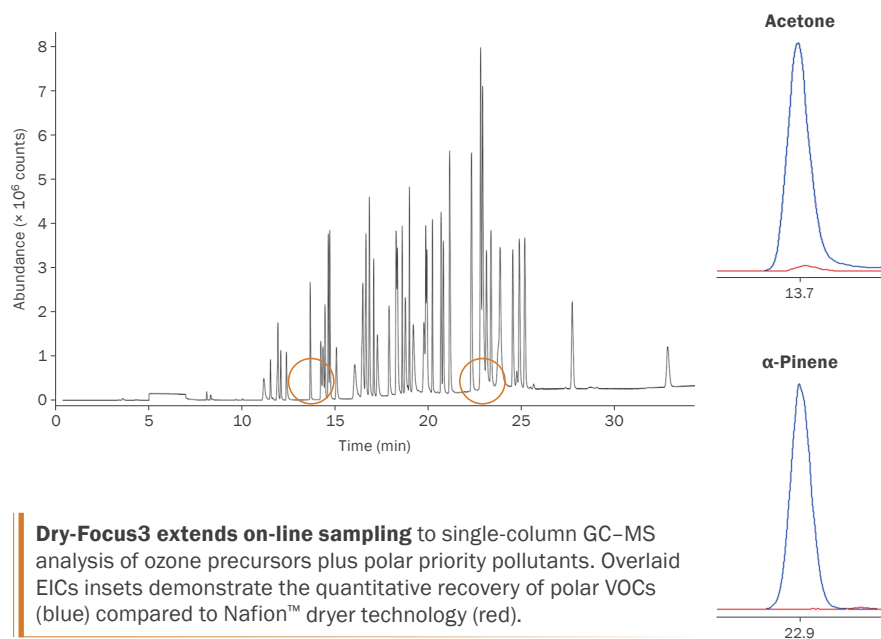
The highly efficient desorption and cooling of UNITY–Air Server-xr, here interfaced directly to on-line MS detection, results in the short cycle times needed for highly time-resolved monitoring of contaminants in process gas streams.

Extend on-line monitoring with Dry-Focus3™ water management

Unlike conventional membrane dryers, advanced Dry-Focus3 technology, requiring the addition of Kori-xr, allows selective water removal while ensuring full transfer of very volatile, non-polar and polar organic compounds to the focusing trap.

Use Dry-Focus3 to:

- Extend the analyte range to include monoterpenes and oxygenates alongside VVOC and VOCs.
- Characterise unknown atmospheres in combination with GC-MS.
- Reduce detection limits by sampling larger volumes.

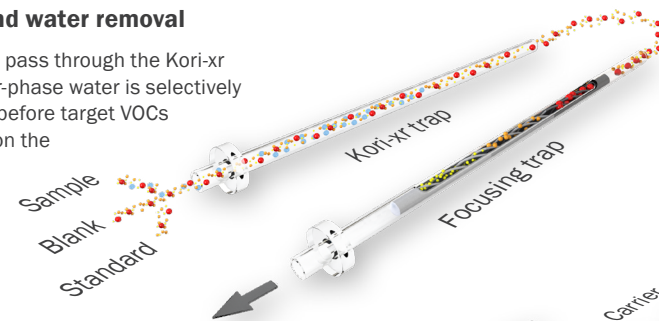


Dry-Focus3 extends on-line sampling to single-column GC-MS analysis of ozone precursors plus polar priority pollutants. Overlaid EICs insets demonstrate the quantitative recovery of polar VOCs (blue) compared to Nafion™ dryer technology (red).

How Dry-Focus3 works:

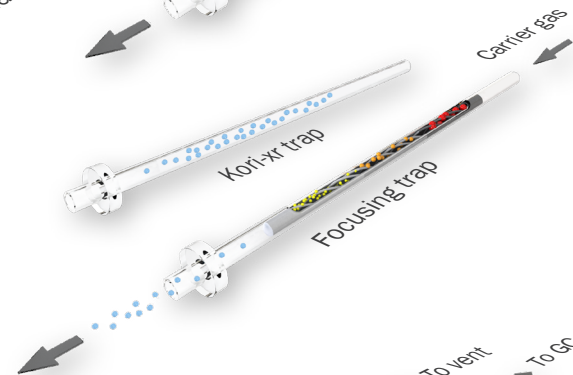
1 Air sampling and water removal

Whole-air samples pass through the Kori-xr trap (where vapour-phase water is selectively deposited as ice), before target VOCs are concentrated on the focusing trap.



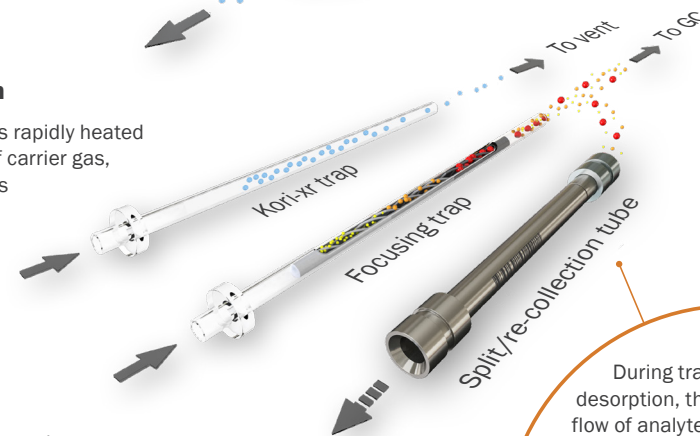
2 Purging of residual water

Optional temperature-programmed dry-purging of the focusing trap selectively eliminates any residual water while retaining 100% of target analytes.



3 Trap desorption

The focusing trap is rapidly heated in a reverse flow of carrier gas, to transfer analytes to the GC.



Simultaneously, the Kori-xr trap is heated in a flow of gas to expel the trapped ice and regenerate it for the next sample.

During trap desorption, the flow of analytes can be split and re-collected on a clean sorbent tube.

Versatile tube analysis

At any time, you can upgrade UNITY-Air Server-xr to automate analysis of 100 tubes with the ULTRA-xr, and maximise return on investment with high productivity for a wide range of sample types.

- **Tube automation** is fully compliant with standard methods including US EPA methods such as TO-17 and 325, as well as ISO 16000-6, EN14662-1, ASTM D6196 and other key standards.
- **On-line automation** is fully compliant with standard methods including US EPA PAMS.
- **Run complementary analyses on a single system** (and even in a single sequence) with no user intervention and without compromising analytical performance or sample-to-sample cycle time.
- **Re-collect onto sorbent tubes** for repeat analysis of unique samples.
- **Adapt your system** to seasonal applications or wide-ranging sample types.



US EPA TO-17



US EPA PAMS



US EPA 325



Odorous sulfur compounds

Comprehensive portfolio of sampling accessories

As well as our wide range of instrumentation, Markes International offers sampling equipment and supplies to serve every customer need – shown below is just part of our extensive portfolio.



Micro-Chamber/Thermal Extractor
for off-line dynamic headspace sampling



MTS-32
multiple-tube sampler



Easy-VOC
grab-sampler



ACTI-VOC low-flow
pump



VOC-Mole soil-gas
sampler



HiSorb high-capacity
sorptive extraction probes



Sorbent tubes,
caps and TubeTAG

Markes International – The TD experts

World-leading instruments, technical expertise and unmatched applications experience

Markes International has been at the forefront of thermal desorption design and innovation for over 20 years. Our 'xr' series of TD instruments sets the benchmark for product quality and delivers the best-available analytical performance across all TD-GC and TD-GC-MS application areas:

Environmental monitoring



Consumer environmental health



Food and drink



Automotive studies



Fragrance and odour profiling



Biological profiling



Defence and forensic



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