MARKES international

TD100-xr

Confident, high-throughput automated thermal desorption

THE QUEEN'S AWARDS FOR ENTERPRISE: INNOVATION 2019

TD100-xr™

Introducing the TD100-xr automated thermal desorber for GC and GC–MS – a high-performance, high-throughput platform for the analysis of sub-ppt to percent levels of volatile and semi-volatile organic compounds in air and materials.

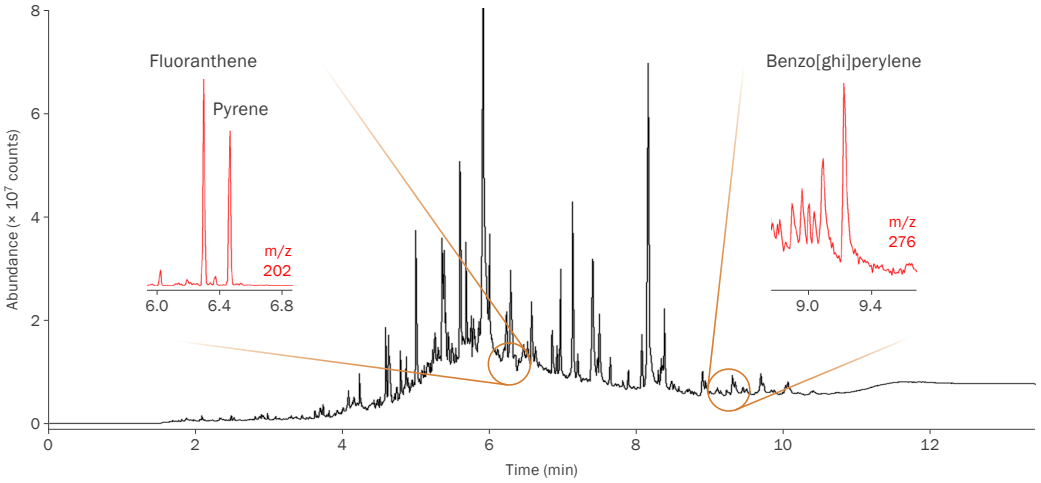
Markes International has pioneered major technical innovations for analytical thermal desorption (TD) for over 20 years. We now present TD100-xr – the world's most advanced and reliable system dedicated to the automated TD–GC(–MS) analysis of sample tubes.

Unique combination of advantages:

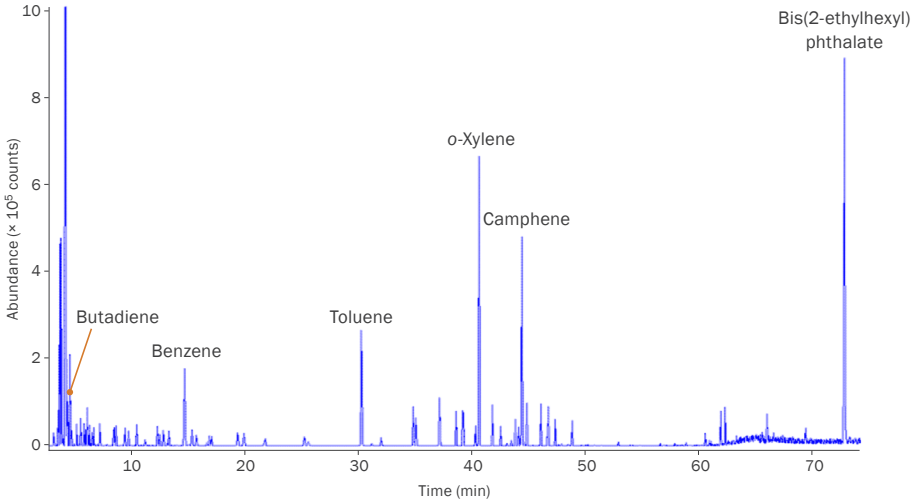
- **Productivity and reliability:** Mechanically-simple automation, 100-tube capacity, sample overlap and cryogen-free focusing deliver robust operation and optimum sample throughput.
- **Future-proof:** Multi-gas enabled TD100-xr systems are independently certified for use with helium, nitrogen and **hydrogen** carrier gases, offering enhanced throughput.
- **Versatility:** TD100-xr allows simultaneous analysis of VOCs and SVOCs, and accommodates every tube-based TD application on a single platform – from C_3 to n-C_{44} plus reactive compounds. TD100-xr can also be installed onto any make of GC or GC–MS running with hydrogen, helium or nitrogen carrier gas.
- **Peace of mind:**
  - Automated and quantitative sample re-collection for repeat analysis overcomes the 'one-shot' limitation of less-advanced TD systems and simplifies TD method validation.
  - Enhanced tube traceability with RFID tag and barcode options for tubes.
- **Superior data quality:**
  - Quantitation of the widest possible concentration range, through flexible splitting options.
  - Full compliance with standard methods, with features such as leak testing, tube sealing, re-collection and internal standard addition.
  - Simple method and data validation through use of automated repeat analysis.

Putting TD100-xr through its paces

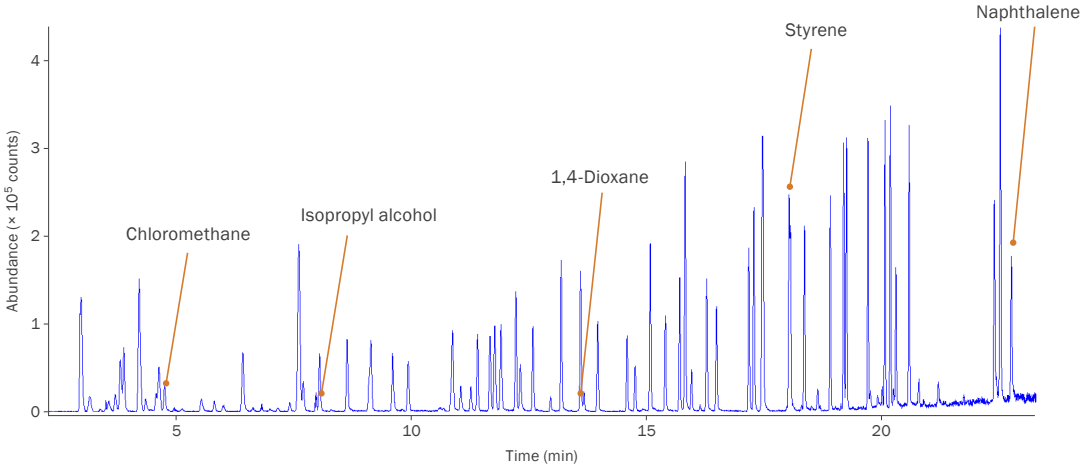
The high-throughput solution to every TD application – routine or challenging



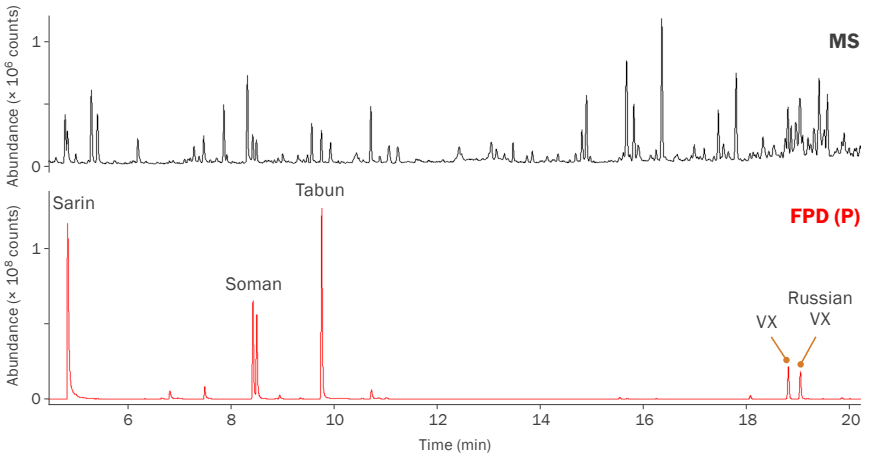
Excellent recovery of trace-level semi-volatiles can be achieved even from complex matrices using TD100-xr, as shown for this sample of diesel exhaust particulates, analysed quickly and conveniently using direct desorption.



Laboratory productivity is enhanced by using TD100-xr to analyse very volatile, volatile and semi-volatile compounds in a single run.



Analysis of air toxics from ppt to ppm levels is routine on TD100-xr, with its efficient trapping and flexible splitting options offering optimum chromatographic performance.



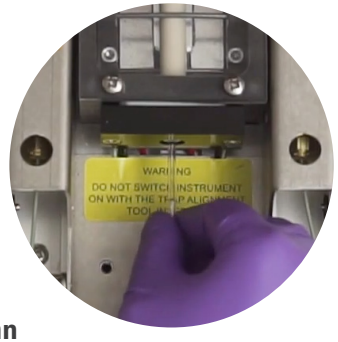
The most challenging TD applications – including analyses of reactive compounds such as these nerve agents – are easy using TD100-xr.

Exceptional trapping functionality

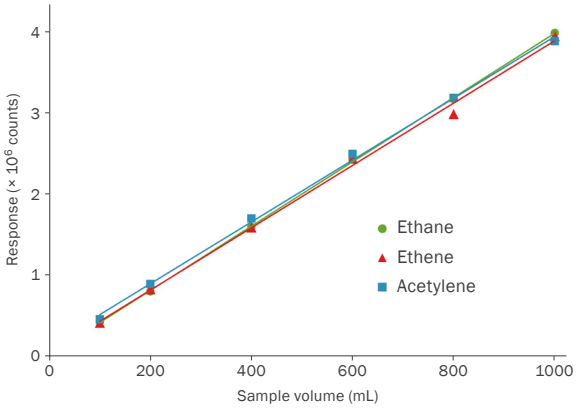
Combining performance and practicality

For over 20 years, Markes has been at the forefront of innovation for thermal desorption. Using our engineering expertise, the trap and flowpath at the heart of every 'xr' series instrument have been optimised for outstanding capillary GC performance and ease-of-use.

Key innovations include:



- **The focusing trap** of TD100-xr allows simultaneous analysis of VOCs and SVOCs, and typically provides over 12 months of continuous use. It's also simple to change (right), and does not require any tools or special training.
- **The short flowpath**, **valve** and **capillary column interface** are all ultra-inert and uniformly heated, meaning that the most challenging trace organic chemicals pass through the system without degradation or deposition.
- **Electrical trap cooling** means that the cost and inconvenience of cryogen – and the associated risk of ice blockages – is completely avoided, while fast trap cooldown means short cycle times and optimum productivity.



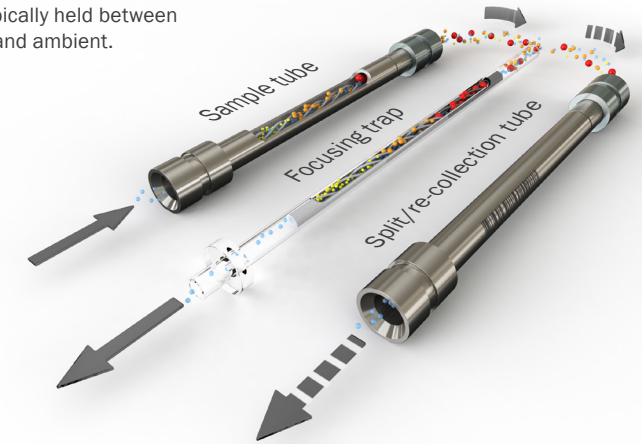
The excellent performance of the focusing trap at the heart of all Markes' TD instruments is demonstrated by the linearity obtained for high volumes of ultra-volatile C_2 hydrocarbons. (Such compounds should only be sampled on-line or using canisters, but we show this data here to demonstrate the power of the trapping technology in TD100-xr).

How two-stage thermal desorption works

Sample tubes and traps can contain multiple sorbent beds for analysing samples with a wide boiling range.

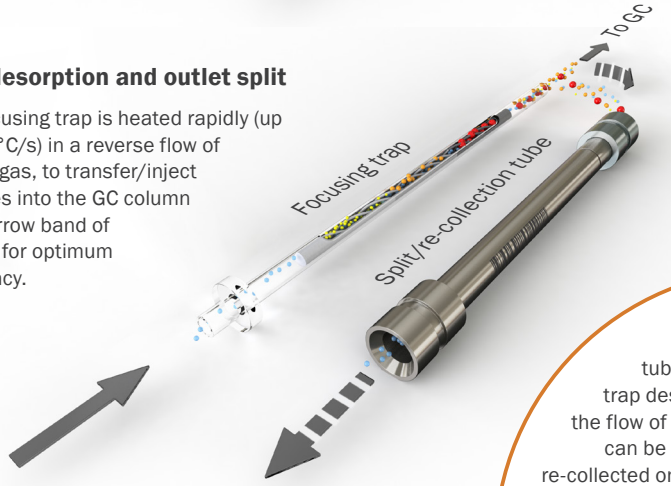
1 **Tube desorption and inlet split**

The sample tube is heated in a flow of carrier gas and the analytes are swept onto an electrically-cooled focusing trap, typically held between –30°C and ambient.



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

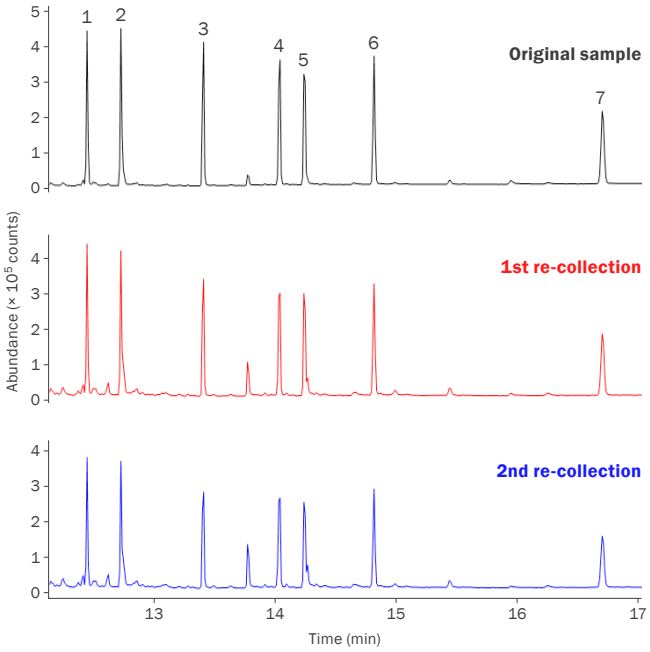
Quantitative sample re-collection for automated repeat analysis

Simple method validation AND extended dynamic range

TD100-xr features powerful quantitative re-collection and repeat analysis capabilities for eliminating data losses, confirming results and simplifying checks on analyte recovery, in compliance with international standard methods.

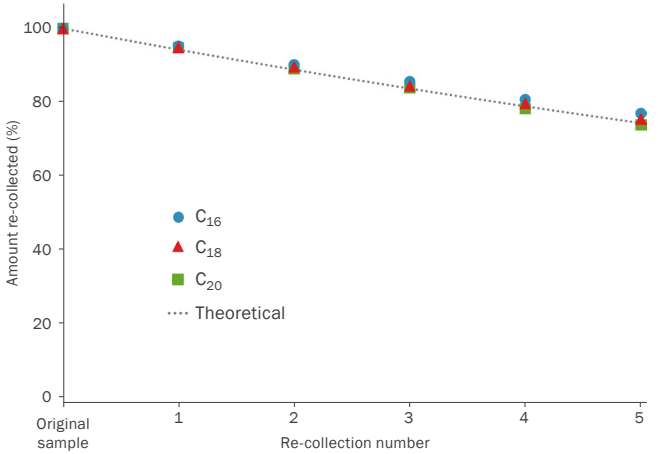
- **Automated re-collection*** of split flow during trap desorption/GC injection (onto the same or a fresh sorbent tube), allows samples to be archived, or re-analysed in a completely unattended fashion. For example, 'High/Low' analysis allows quantitative measurement of trace and major sample components in the same sample.
- **Manual re-collection** of both inlet and outlet split flows allows validation of double-split TD methods.

* Patent number GB 2395785. Automated re-collection is only available with TD100-xr Advanced models.

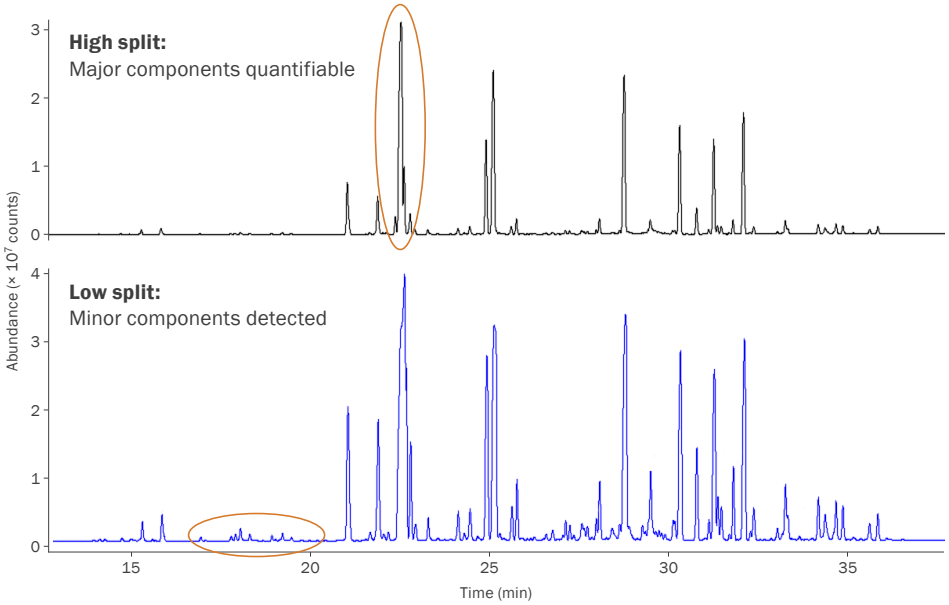


1 PCB-28
2 PCB-52
3 PCB-101
4 PCB-138
5 PCB-153
6 PCB-180
7 PCB-209

Quantitative recovery of these challenging semi-volatile compounds is confirmed by the perfect agreement in profile shape between the original sample and subsequent re-collections.



Complete, reproducible transfer of compounds through TD100-xr is validated by the close agreement between theoretical and actual results for a series of re-collections – a level of performance that underpins the value of re-collection for easy method validation.



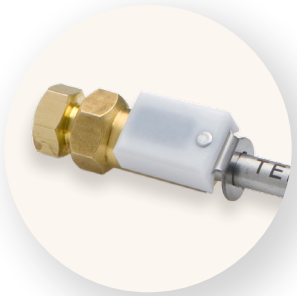
Major and minor components from the same sample can be quantified using re-collection to extend the dynamic range ('High/Low' analysis).

Smart design

Delivering outstanding productivity and reliability

From robust mechanical operation to intuitive software, TD100-xr is designed by TD users for TD users.

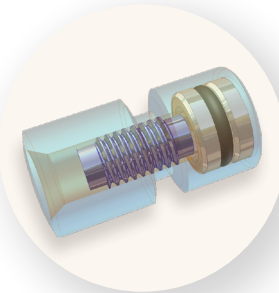
- **Sample integrity:** Patented DiffLok caps (pictured right) allow TD100-xr to produce reliable data without analyte loss or artefact ingress. Inadequate tube seals are a major limitation of other TD autosamplers, allowing artefacts from laboratory air to contaminate sample tubes during a sequence.
- **Mechanical simplicity:** DiffLok caps eliminate unreliable tube uncapping/recapping operations, for maximum uptime and high productivity.
- **Efficient technologies for tube and trap cooling:** Combined with robust sample overlap, these minimise analytical cycle times and optimise sample throughput.
- **Enhanced productivity:** Overlap mode boosts sample throughput by desorbing the next sample while GC analysis of previous sample is ongoing. Productivity is further optimised when using hydrogen carrier gas in the Multi-Gas enabled units.
- **Advanced operations:** Smart electronics automate and simplify troubleshooting, maximising system uptime. TD100-xr integrates seamlessy with the electronic pneumatic of all GCs for rapid method development and exceptional retention time stability.
- **Data security:** TD100-xr allows read/write of TubeTAG electronic tube labels* (pictured right) during the analytical sequence, eliminating the risk of transcription errors.

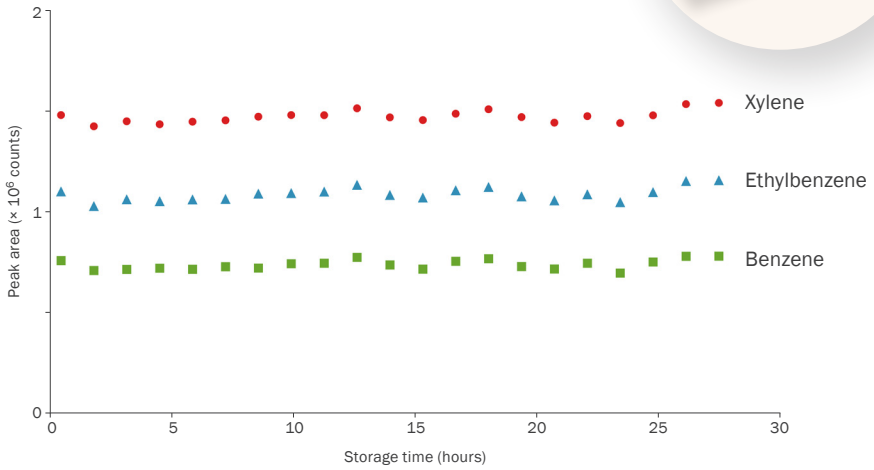


* Patent number GB 2362464.

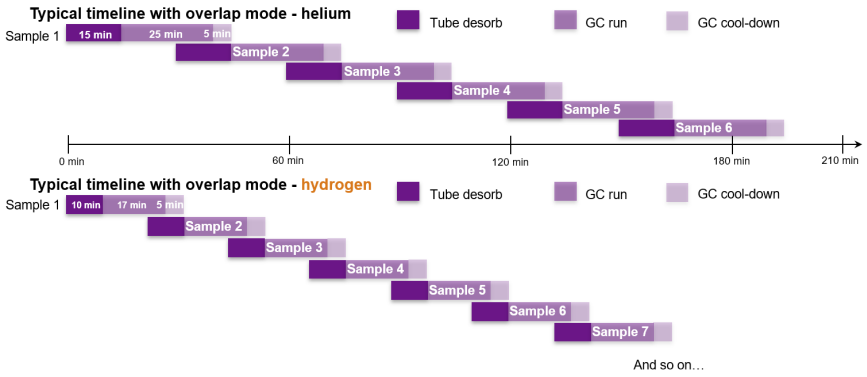
	Comment	Tube	Re-collection type	Re-collection tube	Trap Fire Time	Re-collected from Tube	Tube Number	Tube Status
1	Sample	1	Tube	2	2019/03/05 08:24:09	0	379294	Re-collected
2	Re-collected sample1	2	Tube	3	2019/03/05 08:34:23	379294	257661	Re-collected
3	Re-collected sample2	3	Tube	4	2019/03/05 08:44:35	257661	343753	Re-collected
4	Re-collected sample3	4	Tube	5	2019/03/05 08:54:49	343753	379291	Re-collected

Samples are easily tracked through a sequence of analyses, re-collections and repeats, using TubeTAG RFID tags to automatically collect sample and tube data.





Sample integrity is maintained throughout extended sequences using DiffLok caps, as shown by the stability of response from three volatile compounds over a period of over 24 hours. The RSDs of <3.5% in each case are impressive for manually-spiked tubes.



Fast returns on investment are achieved by the use of overlap mode to maximise sample throughput. Productivity is optimised further by using Multi-Gas enabled TD100-xr with hydrogen carrier gas.

Compliance with all major thermal desorption standards

TD100-xr offers full compliance with all the major tube-based TD standards across a wide range of applications, ensuring maximum system utilisation and complete peace of mind.

Relevant standards are published by leading international agencies such as ISO, CEN, US EPA, ASTM, NIOSH, Chinese EPA and JSA, and include methods for:

- Trace contaminants in ambient and indoor air.
- Monitoring high-level industrial emissions or workplace air.
- Release of chemicals from products and materials.
- Soil gas and vapour intrusion.

Most of the critical functions listed in standard methods are essential for reliable TD–GC–MS analysis, and all are included as standard on TD100-xr. Key examples include:

- Stringent leak testing of all tubes before desorption/re-collection.
- Pre-purge of air to vent and automated water management.
- Backflush desorption of the focusing trap.
- Robust tube sealing.
- Quantitative sample re-collection for validation of recovery.
- Internal standard addition (to tube or trap).

Each TD instrument from Markes International comes with several pre-built standard methods, for quicker lab implementation and rapid instrument familiarisation.

Comprehensive portfolio of TD systems and sampling accessories

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

UNITY-xr™ single-tube thermal desorber

UNITY–CIA *Advantage*–ULTRA-xr™ automated tube & canister preconcentrator

UNITY–Kori–Air Server-xr™ on-line sampler

MTS-32™ multiple-tube sampler

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

ACTI-VOC™ low-flow pump

Easy-VOC™ grab-sampler

HiSorb™ high-capacity sorptive extraction probes

Sorbent tubes, caps and **TubeTAG™**

VOC-Mole™ soil-gas sampler

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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