

# UNITY-ULTRA-xr Pro

Ultimate productivity in automated  
thermal desorption analysis



# UNITY-ULTRA-xr Pro<sup>TM</sup>

Introducing the UNITY-ULTRA-xr Pro thermal desorber for automated high-throughput TD-GC(-MS) analysis of volatile and semi-volatile organic compounds (VOCs and SVOCs). UNITY-ULTRA-xr Pro combines high-productivity sorbent tube automation with the most comprehensive sample re-collection capability for enhanced sample security.

## Key benefits:

- **Productivity:** Automated, cryogen-free operation for up to 199 industry-standard sorbent tubes.
- **Future-proof:** Multi-Gas enabled UNITY-ULTRA-xr Pro systems are independently certified for use with helium, nitrogen and **hydrogen** carrier gases, offering enhanced throughput.
- **Enhanced data security:**
  - UNITY-ULTRA-xr Pro uniquely delivers automated re-collection of both inlet and outlet split flows for quantitative repeat analysis of single- and double-split TD samples, overcoming the 'one-shot' limitation of older systems.
  - Field-proven, mechanically simple automation, automated intelligent diagnostics and predictive maintenance monitoring combine to maximise instrument up-time.
  - Enhanced tube traceability with RFID TubeTAG<sup>TM</sup> and barcode options.
- **Versatility:** The inert, uniformly heated flow path design accommodates every tube-based TD application, from C<sub>3</sub> to n-C<sub>44</sub> including reactive compounds.
- **Outstanding performance:**
  - Quantitation of the widest possible concentration range, from ppt to percent levels, through flexible splitting options.
  - Simple method and data validation through use of automated repeat analysis.
  - Full compliance with standard methods with features such as leak testing, tube sealing, dry-purging and internal standard addition.



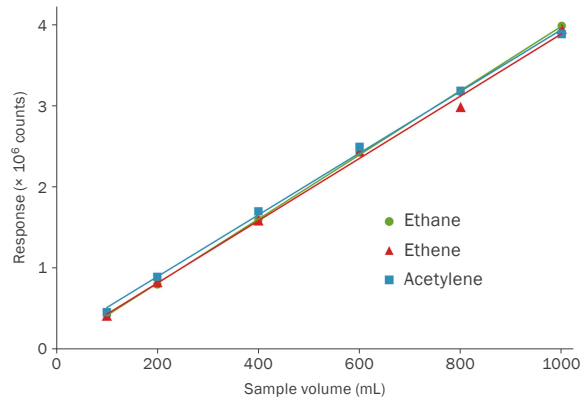
# Exceptional trapping functionality

## Combining performance and practicality

For over 20 years, Markes has been at the forefront of TD innovation and using this expertise, the focusing trap and flow path at the heart of the UNITY-ULTRA-xr Pro have been optimised for outstanding capillary GC performance and ease of use.

Key features:

- **The 4th-generation focusing trap module** in every UNITY-xr offers super-fast desorption in a reverse ('backflush') flow of carrier gas. This optimises transfer/injection of the widest range of analytes, enabling simultaneous analysis of VOCs and SVOCs with the best available sensitivity. Each focusing trap typically provides 12 months' use and is easy to change (see inset), with no tools or special training required.
- **The short flow path, valve and capillary column interface** are all ultra-inert and uniformly heated, meaning that the most challenging 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 – are completely avoided, while fast trap cool-down means short cycle times and optimum productivity.

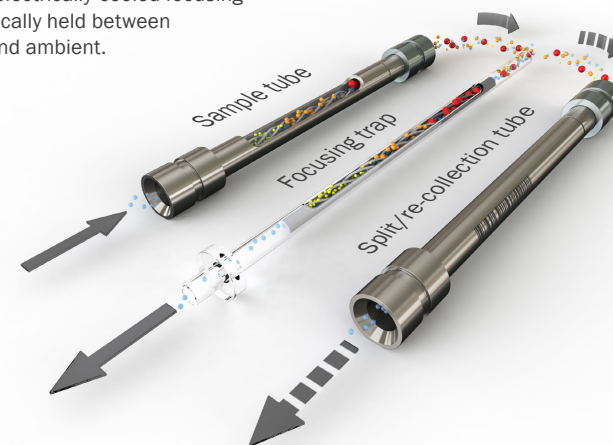


**The excellent performance of the focusing trap** at the heart of all Markes' TD systems is demonstrated by the linearity obtained for high volumes of ultra-volatile C<sub>2</sub> hydrocarbons. (Such compounds should only be sampled on-line or using canisters, but we show this data here to demonstrate the power of the trapping technology in UNITY-ULTRA-xr Pro.)

## How two-stage thermal desorption works

### 1 Tube desorption and inlet split

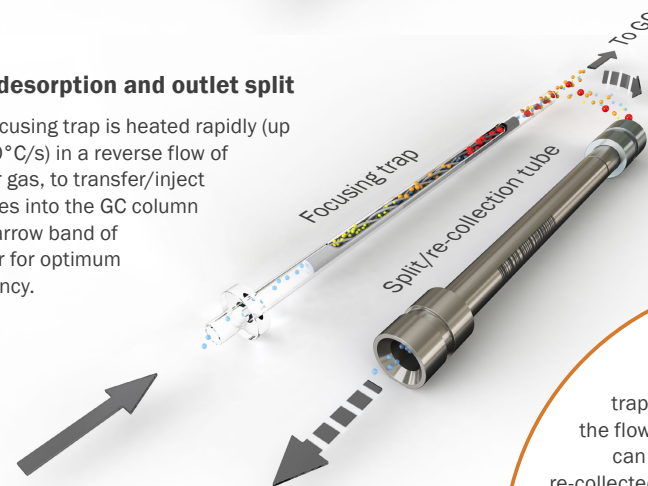
The sample tube is heated in a flow of carrier gas and the analytes are swept onto an electrically-cooled focusing trap, typically held between -30°C and ambient.



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

### 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.

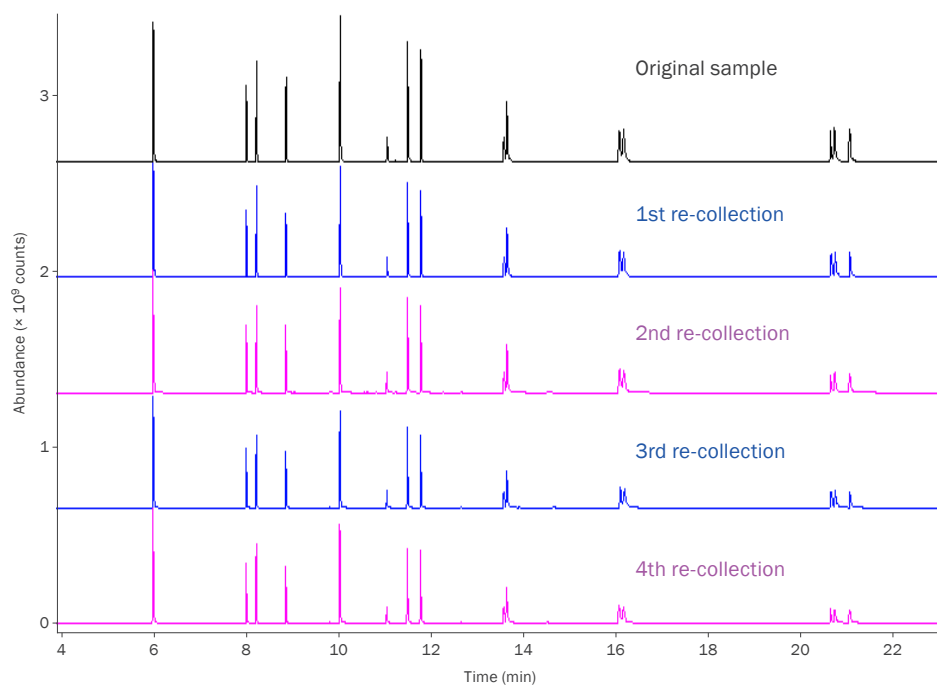
# Quantitative sample re-collection for automated repeat analysis

## Simple method validation and extended dynamic range

The UNITY-ULTRA-xr Pro features powerful, completely flexible, quantitative re-collection and repeat analysis capabilities. Inlet and outlet split flows can be automatically re-collected onto clean sorbent tubes for archiving and automated repeat analysis.

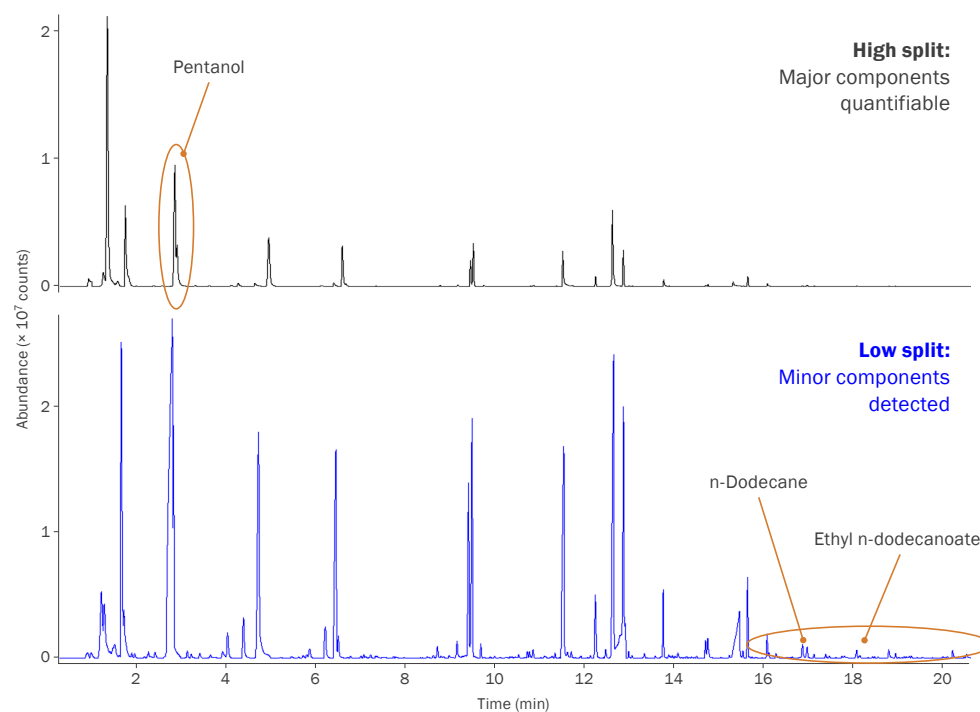
Re-collection allows TD users to:

- Reliably repeat sample analysis under the same or different conditions.



**Automated double-split re-collection** of high-boiling polycyclic aromatic hydrocarbons (PAHs) shows perfect recovery through the flow path and demonstrates the unique power of UNITY-ULTRA-xr Pro in automatically re-collecting and re-analysing inlet and outlet split flows.

- Archive critical samples for future analysis.
- Easily validate analytical methods for analyte recovery using a series of re-collection experiments in compliance with many standard methods.
- Extend the dynamic range using 'High/Low' analysis: Samples are first analysed under high-split conditions to quantify major components without overloading the detector. The split flow is then automatically re-collected and can then be re-analysed under low-split conditions to gain sensitivity for minor components of the same sample.



**Major and minor components from the same sample** can be automatically quantified using re-collection and automated re-analysis with a lower split flow to extend the dynamic range, as shown for this wine sample.

# Superior analytical performance

## Key features of UNITY-ULTRA-xr Pro for enhancing data quality and confidence in results

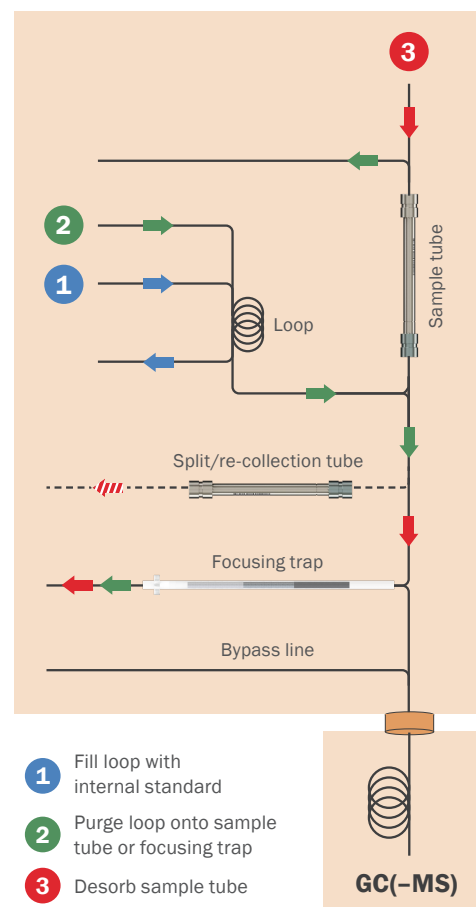
### Internal standard addition option

Internal standard addition is widely used for quality checking and involves automatically transferring a precise aliquot of gaseous standard to:

- The sampling end of a sorbent tube, either before sampling or before desorption of the sampled tube.
- The focusing trap (before tube desorption), to monitor GC response stability. This is particularly useful for direct desorption.

### Dry-purging of sorbent tubes

Dry-purging on the UNITY-ULTRA-xr Pro is carried out with gas flowing in the sampling direction as part of the automated sequence. This minimises water interference and is recommended by standard methods.



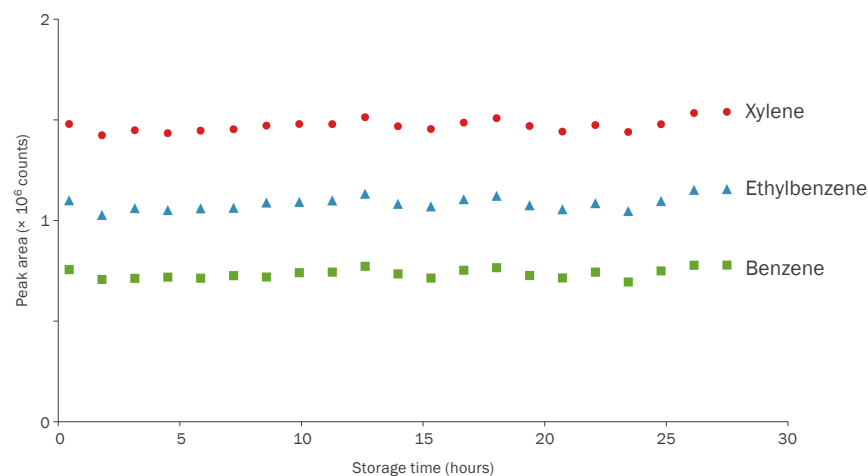
**For versatile method validation,** internal standards can be added to tubes or focusing traps on all UNITY-ULTRA-xr Pro systems.

### DiffLok™ caps for stringent sample sealing

Patented DiffLok caps (pictured) allow UNITY-ULTRA-xr Pro to produce reliable data. A long, narrow helical channel limits diffusion and prevents 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. DiffLok caps are simply pushed on to both ends of every tube and remain in place throughout automated TD sequences, overcoming the need to uncaps and recaps tubes.



**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 followed by TD-GC-MS analysis.

# Smart design

## Delivering outstanding productivity and reliability

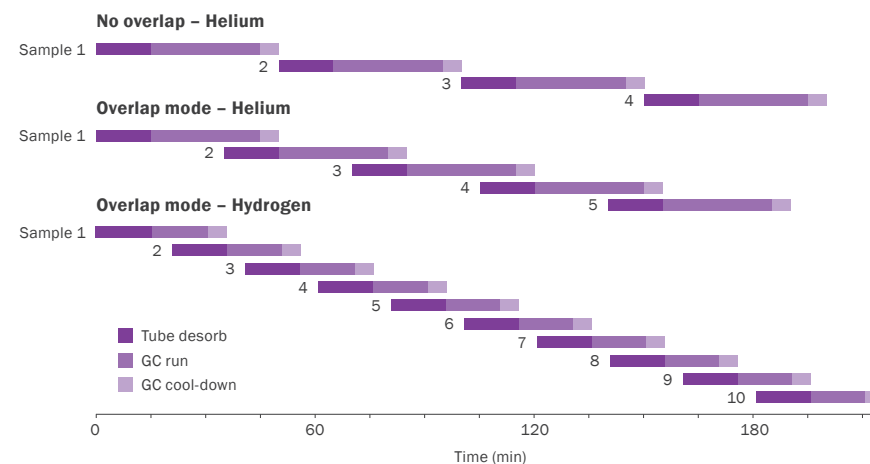
From robust mechanical operation to intuitive software, UNITY-ULTRA-xr Pro is designed by TD users for TD users.

- **Mechanical simplicity:** DiffLok caps eliminate unreliable tube uncapping/recapping operations, for maximum up-time and high productivity, while onboard sensors monitor tube loading and unloading to prevent tubes jamming.
- **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 the 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 up-time. UNITY-ULTRA-xr Pro integrates seamlessly with the electronic pneumatic of all GCs for rapid method development and exceptional retention time stability.
- **Data security:** UNITY-ULTRA-xr Pro 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.



**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 UNITY-ULTRA-xr Pro systems with hydrogen carrier gas.



## Compliance with all major thermal desorption standards

UNITY-ULTRA-xr Pro 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 UNITY-ULTRA-xr Pro. 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**



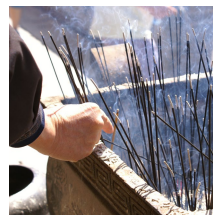
**Food and drink**



**Automotive studies**



**Fragrance and odour profiling**



**Biological profiling**



**Defence and forensic**



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