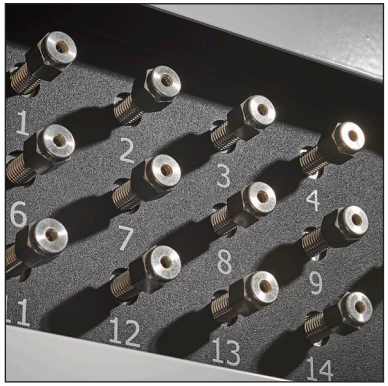
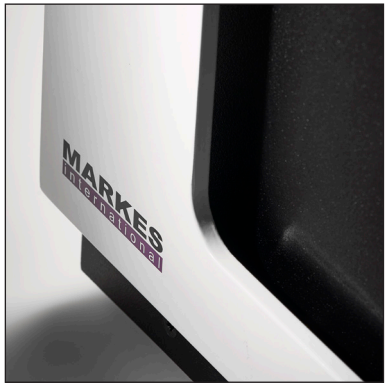
MARKES international

CIA *Advantage*-xr

Cryogen-free automated canister and whole-air sampling system





THE QUEEN'S AWARDS FOR ENTERPRISE: INTERNATIONAL TRADE 2015

CIA *Advantage*-xr™

Introducing the CIA *Advantage*-xr – a cryogen-free system for the automated GC and GC–MS analysis of trace-level volatile and semi-volatile organic compounds (VOCs and SVOCs) from canisters and whole-air samples.

Since 1997, Markes International has pioneered many breakthroughs in analytical instrumentation, making it the world leader in thermal desorption. We now present the CIA *Advantage*-xr – a multi-channel accessory that connects to the UNITY-xr, Markes' manual thermal desorption instrument, offering robust, high-throughput, method-compliant analysis for both canister and tube samples.

Like other instruments in Markes International's world-leading 'xr' series, the UNITY–CIA *Advantage*-xr offers:

- **Ex**tended **r**e-collection
- **Ex**tended analyte **r**ange
- **Ex**tended **r**eliability.

Efficient cryogen-free trapping

Electrically-cooled focusing trap eliminates the cost of liquid nitrogen and ensures fast sample throughput.

Quantitative sample splitting and re-collection

Quantitative sample re-collection of split flow enables repeat analysis of critical samples and method validation.

Dry-Focus3™: Trouble-free sampling of humid air

New Kori-xr water management enables simultaneous sampling of C_2 and polar VOCs.

Precise quantitative analysis

Internal standard capability is compliant with international methods.

Unparalleled analyte range

Inert, optimised flow paths allow quantitative recovery of C_2 to C_{44}, including reactive and thermally labile species.

Outstanding productivity

Up to 27 samples at high and low concentrations can be analysed in one unattended sequence.

Innovative technology for maximum laboratory efficiency

High-productivity canister analysis of ambient air

CIA *Advantage*-xr allows high-sensitivity analysis of very volatile organic compounds (VVOCs), polar species and oxygenates in humid samples.

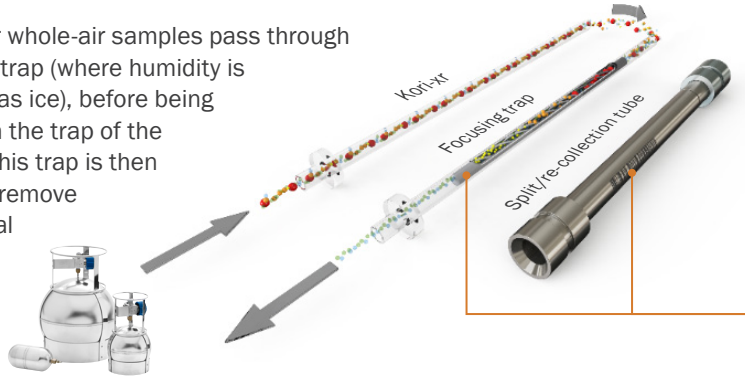
CIA *Advantage*-xr systems offer key advantages for busy laboratories:

- **Reduced running costs** – Dry-Focus3 and cryogen-free operation of the entire system overcomes the limitations of traditional liquid-nitrogen-cooled technology for canister analysis, such as high costs and flow path blocking caused by ice formation.
- **Increased number of samples per day** – Heated internal lines and efficient purging combine to eliminate carryover, resulting in a need for fewer blanks and boosting productivity.
- **Minimal sample preparation** – Electronic sample splitting and the option of small-volume gas-loop sampling enhances compatibility with high-concentration samples, so removing the need for time-consuming sample preparation and eliminating introduction of external contaminants.
- **High-throughput operation** – Addition of an optional CIA Satellite-xr module adds 13 more sampling channels, enabling automated, unattended analysis of up to 27 canisters.

How the UNITY–CIA *Advantage*–Kori-xr works

1 Air sampling and water removal with Dry-Focus3

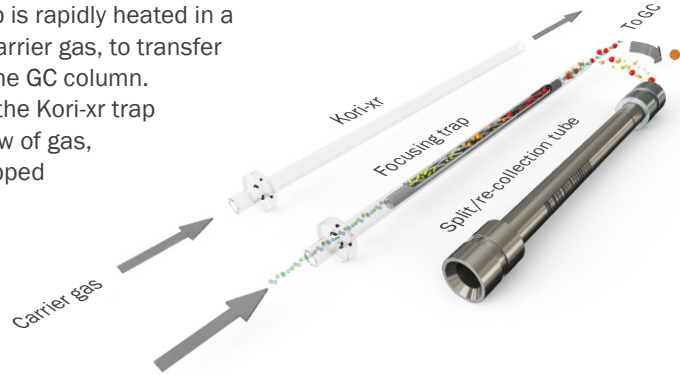
Canister or whole-air samples pass through the Kori-xr trap (where humidity is deposited as ice), before being focused on the trap of the UNITY-xr. This trap is then flushed to remove any residual water.



Tubes and traps can contain multiple sorbents, for analysis of an extended range of analytes.

2 Trap desorption, water purging, and outlet split

The focusing trap is rapidly heated in a reverse flow of carrier gas, to transfer the analytes to the GC column. Simultaneously, the Kori-xr trap is heated in a flow of gas, expelling the trapped water.



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

The perfect solution for canister analysis

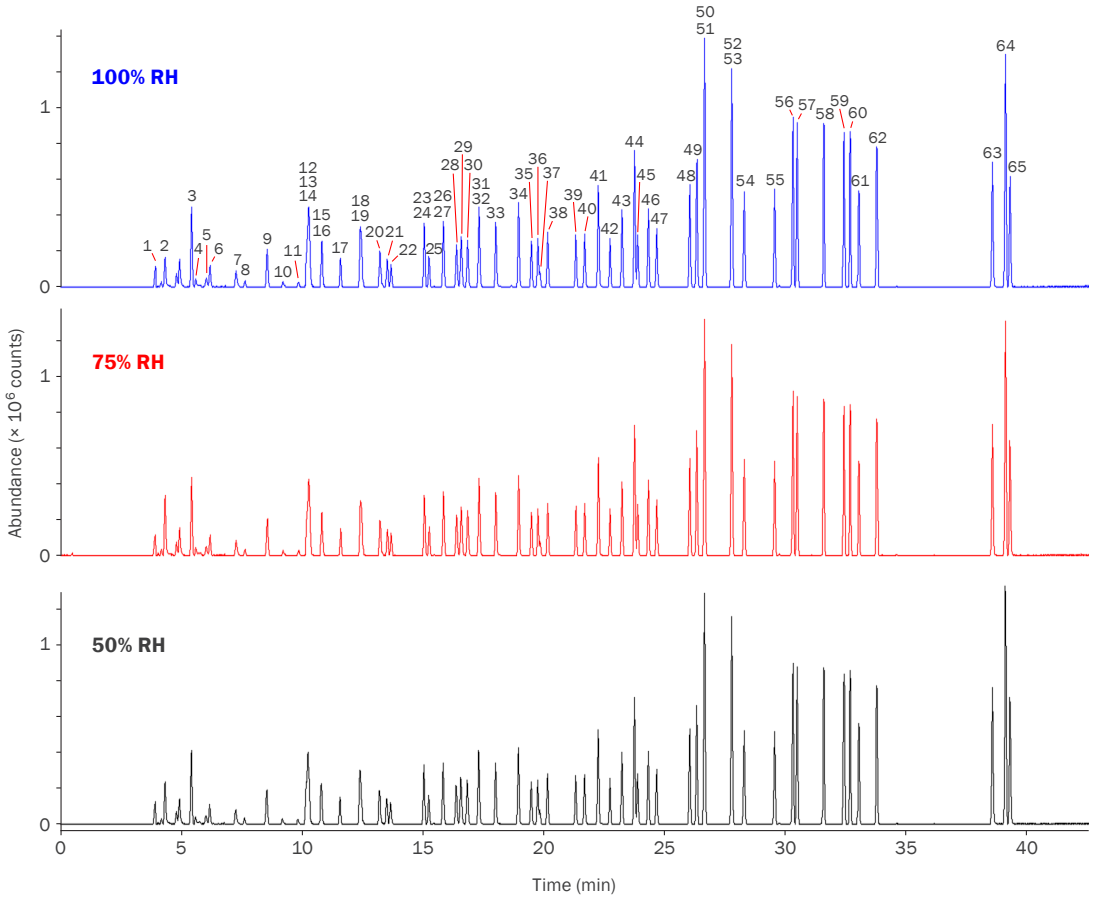
Full compliance with key standard methods

The CIA *Advantage*-xr has been specifically designed for analysis of multiple canisters (and bags) used to monitor volatile organic hazardous air pollutants – 'air toxics' as specified in US EPA Method TO-15 and Chinese EPA Method HJ 759.

The UNITY–CIA *Advantage*-xr system has been proved to have:

- **Outstanding system linearity:** Analysis of air streams at up to 100% relative humidity (RH).
- **Part-per-trillion-level method detection limits (MDLs):** Compatible with trace-level TD–GC–MS analysis.
- **Excellent reproducibility:** Area and retention-time reproducibilities are well within mandated limits, for rapid data reviewing and reporting.

TO-15 analysis of high-humidity air



Excellent peak shapes and interference-free monitoring of early-eluting polar compounds (●) can be achieved using the UNITY–CIA *Advantage*–Kori-xr system, as shown by this analysis of a 65-component TO-15 mix at 50, 75 and 100% relative humidity.

1 Propene
2 Dichlorodifluoromethane
3 Dichlorotetrafluoroethane
4 Chloromethane
5 Vinyl chloride
6 Butadiene
7 Bromomethane
8 Chloroethane
9 Trichlorofluoromethane
● 10 Ethanol
● 11 Acrolein
12 1,1-Dichlorethene
13 1,1,2-Trichlorotrifluoroethane
● 14 Acetone
● 15 Isopropanol
16 Carbon disulfide
17 Dichloromethane
18 1,2-Dichloroethene
● 19 *tert*-Butyl methyl ether
20 Hexane
21 1,1-Dichloroethane
● 22 Vinyl acetate
23 *trans*-1,2-Dichloroethene
● 24 Methyl ethyl ketone
● 25 Ethyl acetate
26 Chloroform
● 27 Tetrahydrofuran
28 1,1,1-Trichloroethane
29 Cyclohexane
30 Tetrachloromethane
31 1,2-Dichloroethane
32 Benzene
33 Heptane
34 Trichloroethene
35 1,2-Dichloropropane
36 Methyl methacrylate
37 *p*-Dioxane
38 Bromodichloromethane
39 *cis*-1,3-Dichloropropene
40 4-Methylpentan-2-one
41 Toluene
42 *trans*-1,3-Dichloropropene
43 1,1,2-Trichloroethane
44 Tetrachloroethene
45 Methyl n-butyl ketone
46 Chlorodibromomethane
47 1,2-Dibromoethane
48 Chlorobenzene
49 Ethylbenzene
50 *m*-Xylene
51 *p*-Xylene
52 *o*-Xylene
53 Styrene
54 Tribromomethane
55 1,1,2,2-Tetrachloroethane
56 4-Ethyltoluene
57 1,3,5-Trimethylbenzene
58 1,2,4-Trimethylbenzene
59 1,2-Dichlorobenzene
60 1,4-Dichlorobenzene
61 Benzyl chloride
62 1,3-Dichlorobenzene
63 1,2,4-Trichlorobenzene
64 Hexachlorobutadiene
65 Naphthalene

Versatile modules for extended analytical capabilities

Options for high- and low-concentration analysis

Two models of the CIA *Advantage*-xr are available – Trace (T) and High/Low (HL):

- **CIA *Advantage* T-xr** – A four-channel system dedicated to the analysis of trace-level components.
- **CIA *Advantage* HL-xr** – A versatile 14-channel system for the analysis of both high- and low-concentration samples. Gas-loop sampling in addition to mass flow control makes this system ideal for screening unknowns and preventing system overload.

Increased capacity

The **CIA Satellite-xr** module adds 13 more sampling channels to both the T and HL models.

Monitoring polar species in humid samples

When analysing humid air samples, it is necessary to remove the moisture before the gas flow reaches the GC column and detector, in order to avoid poor chromatography. However, certain ultra-volatile and polar species can be lost when using conventional water-management approaches such as a trap dry-purge or a Nafion™ dryer.

Dry-Focus3 is a unique, triple-step focusing and water management mechanism that operates entirely without liquid cryogen. It leverages the Kori-xr™ option, also compatible with on-line air monitoring applications like PAMS, and a programmable trap dry-purge to selectively remove vapour-phase water prior to analyte injection – guaranteeing high-sensitivity, automated air analysis.

Options for water management compared

Analyte type	Nafion™ dryer	Trap set at 25°C	Dry-Focus3
C_2 compounds	✓	✗	✓
Non-polar C_3+	✓	✓	✓
Monoterpenes	✗	✓	✓
Polar VOCs	✗	✓	✓
Sulfur compounds	✓	✓	✓

Kori-xr was developed in collaboration with the National Centre for Atmospheric Science (NCAS) at the University of York. It was co-funded by the UK's innovation agency (Innovate UK), the Natural Environment Research Council (NERC) and the Welsh Government under the Knowledge Transfer Partnership program.

Options for enhanced method validation

Internal standard addition

The internal standard capability of the CIA *Advantage*-xr, included in all configurations, transfers a precise aliquot of the gaseous standard to the focusing trap prior to sampling.

Fully method-compliant tube-based analysis

In addition to automated canister analysis, the CIA *Advantage*-xr has the ability to run sorbent tube analysis across a variety of application areas, in compliance with standard methods such as US EPA Method TO-17.

Sorbent tubes extend the airborne analyte range beyond the limitations of canisters and other whole-air containers, to include critical semi-volatile pollutants such as PAHs, phthalates, chemical agents and PCBs. They also facilitate the complete recovery of compounds up to n-C_{44}.

Automated sample re-collection

Adding an ULTRA-xr to the UNITY–CIA *Advantage*-xr is possible at any time due to the modular nature of all Markes' systems.

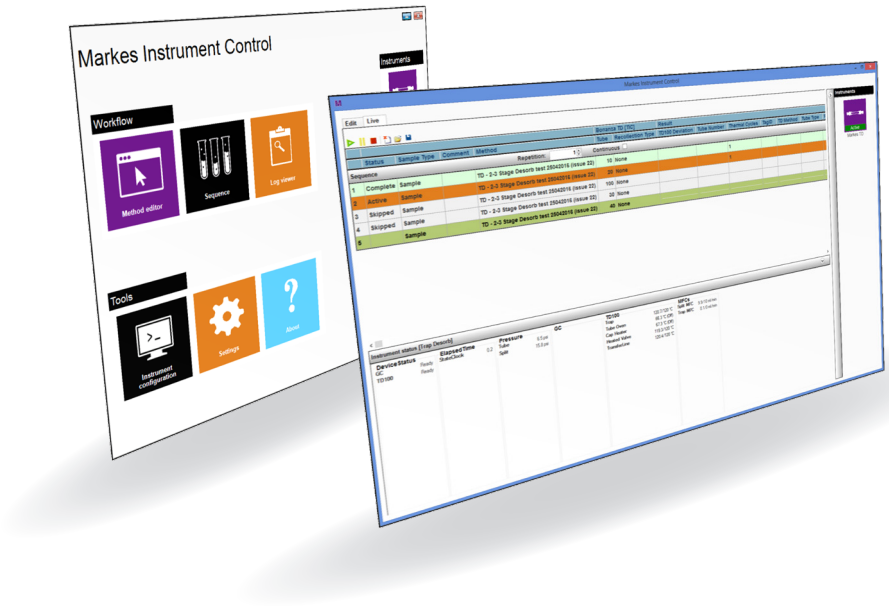
This upgrade facilitates automated analysis of up to 100 sorbent tubes, as well as automated sample re-collection from sorbent tubes and canisters.

Options for method-compliant canister and tube analysis

The modular nature of CIA *Advantage*-xr systems means that options for tube analysis and sample re-collection are easily configured – complementing the capability for addition of internal standards inherent to every instrument.

Markes Instrument Control

Easy-to-use software for the new ‘xr’ series



The new software used to control the CIA *Advantage*-xr and the other members of the ‘xr’ series offers the following features for enhanced laboratory productivity:

- **Automated, unattended sequencing** of tube and on-line samples.
- **Editing of active sequences,** for greater flexibility and ease of use.
- **Rapid set-up of TD methods** using pre-programmed parameters for standard methods including VDA 278, US EPA TO-17 and PAH analysis.
- **Pre-loading of an internal standard** on a tube or trap, for enhanced quantitation.
- **System self-checking,** for improved diagnostics.

Unmatched product range

A comprehensive range of sorbent tubes and sampling accessories for every TD application

Markes International – The TD experts

World-leading instruments and unmatched expertise in VOC and SVOC monitoring

Markes International has for 20 years been at the forefront of innovation for enhancing the measurement of trace-level VOCs and SVOCs by thermal desorption–gas chromatography. Our suite of instruments for thermal desorption sets the benchmark for quality and reliability:

TD100-xr™
High-throughput 100-tube automated thermal desorber.

UNITY-xr™
Single-tube thermal desorber featuring sample re-collection of all split flows.

UNITY–Air Server-xr™
Versatile on-line VOC monitoring system.

ULTRA-xr™
High-throughput 100-tube autosampler for UNITY-xr.

TT24-7™
Twin-trap instrument for near-real-time on-line monitoring.

TC-20™ & TC-20 TAG™
Cost-effective systems for off-line multi-tube conditioning and dry-purging.

Micro-Chamber/Thermal Extractor™
Unique sampling device for emissions of VOCs and SVOCs from products and materials.

Since 1997
20 YEARS

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