

UNITY-CIA Advantage-xr™

Specification sheet

The CIA Advantage-xr is a multi-channel module that connects to the UNITY-xr, and which allows analysis of whole-air and gas samples collected using canisters and Tedlar bags, as well as continuous monitoring of air or gas streams.

UNITY-xr Thermal Desorbers are compatible with most GC and GC-MS applications and accommodate any workflows with the choice of manual or electronic control of gases: helium, nitrogen, and hydrogen (H₂ available with the Multi-Gas enabled range only).



1. System features

- **Two models are available**, the CIA Advantage T-xr and CIA Advantage HL-xr.
- **The UNITY-CIA Advantage T-xr** is a dedicated system for analysis of trace-level components.
 - Sample volumes: 5 mL upwards.
 - Sample channels: 4.
 - Upgradeable to 17 channels with CIA Satellite-xr.
- **The UNITY-CIA Advantage HL-xr** is a versatile system for the analysis of both high- and low-concentration samples and for screening unknowns.
 - Sample volumes: 0.5 mL upwards (using sample gas loop), and 5 mL upwards (using MFC).
 - Sample channels: 14.
 - Upgradeable to 27 channels with CIA Satellite-xr.
- **Method-compliant:** Complies with US EPA Method TO-15 and Chinese EPA Method HJ 759 for canister-based analysis of air.
- **Cryogen-free operation and low gas consumption** for robust operation and high uptime.
- **Internal standard capability** allows either a precise aliquot (via a 1 mL loop) or a metered volume (5–500 mL) of gaseous standard to be added to the focusing trap prior to sampling.
- **Electronic mass flow control** is used for sample and split flows. Set and actual sampling flows are displayed and continuously updated in the software.
- **Heated, inert internal sample flow paths** eliminate risk of condensation and carryover.
- **Compatible with gas-phase samples** ranging in pressure from below atmospheric to 50 psig.
- **Sample stacking:** Combine multiple samples, channels and standards onto the focusing trap before injection into the GC column.
- **Tube desorption capability** in compliance with US EPA Method TO-17 and other standard methods. Single-tube desorption is performed manually on the UNITY-xr, or desorption of up to 100 tubes can be automated with the addition of an ULTRA-xr.

2. System controls

2.1 Control software

- **Markes Instrument Control (MIC)** allows:
 - Automated, unattended sequencing of tube, on-line and canister/bag samples*.
 - Addition, insertion or skipping of samples in active sequences.
 - Rapid set-up of methods using pre-programmed parameters for: (a) standard methods including US EPA TO-15, PAMS, US EPA TO-17, VDA 278, US EPA 325, PAMS + TO-15 + OVOCS, and PAH analysis; (b) conditioning methods for popular sorbent tubes and focusing traps.
 - Automated, intelligent system self-checking diagnostics, including leak isolation.
 - Preventative maintenance feedback with usage counter – indicates when parts could be replaced to avoid instrument downtime.
 - Export of sequence history to .csv and .pdf files.
 - Set-up in English, French, Japanese or Chinese languages.

2.2 Pre-desorption checks and controls

- **Selection of carrier gas type:** Three carrier gas options (helium, hydrogen (Multi-Gas models), and nitrogen) are available and user-defined in the software.
- **Electronic mass flow control** is used for all sampling and split flows, which are settable between 2–500 mL/min (helium and hydrogen) and 2–250 mL/min (nitrogen).
- **Leak test:** Leak test of the entire UNITY-CIA Advantage-xr internal flow path run as part of a sample method.
- **Sample purge:** This ensures that individual sample lines leading up to the CIA Advantage-xr, as well as the entire flow path inside the system, are swept with the current sample before the beginning of sample collection. The sample purge flow is all directed to the split line.
- **Sample purge flow:**

* Not available if installing on a UNITY 2. Automated sequencing between tubes and on-line/canister samples also requires the ULTRA-xr to be configured.

- Range: 2–500 mL/min.
- Adjustable in 1 mL/min increments.
- **Sample purge time:**
 - Range: 0–60.0 min.
 - Adjustable in 0.1 min increments.
- **Internal standard addition:** Gaseous internal standard can be added automatically via a 1 mL inert sample loop or metered between 5–500 mL using the MFC.
- **Sample gas selection:** Air, helium, hydrogen (Multi-Gas models), or nitrogen sample gas can be selected.
- **Sample volume/time:** After the leak test (if selected) and sample purge, the flow of sample air/gas is directed to the electrically-cooled focusing trap of the UNITY-xr until the desired volume is collected, or for a defined sample time.
 - Sample volume range (HL model): 0.5–15,000 mL, adjustable in 0.1 mL increments.
 - Sample volume range (T model): 5–15,000 mL, adjustable in 0.1 mL increments.
 - Sample time range (both models): 0–99.9 min, adjustable in 0.1 min increments.
- **Sample flow:** This determines the flow rate of sample air/gas into the focusing trap for the sampling time. It is controlled by the mass flow controller and is independent of the pressure of the sample.
 - Range: 2–250 mL/min (nitrogen or air) 2–500 mL/min (helium and hydrogen).†
 - Adjustable in 1 mL/min increments.
- **Post-sampling purge:** The flow path of the UNITY-CIA Advantage-xr is purged with clean gas (humidified or carrier) to eliminate any remaining sample, thereby preventing carryover into subsequent analyses.
- **Post-sampling purge time:**
 - Range: 0–99.9 min.
 - Adjustable in 0.1 min increments.

† Sampling flow rates ≥ 250 mL/min may not be attainable under all operational conditions. Factors affecting the maximum sampling flow rate will include the type of focusing trap and any sampling accessories connected to the sample inlet.

• **Post-sampling purge flow:**

- Range: 2–500 mL/min.
- Adjustable in 1 mL/min increments.

• **Trap dry-purge:** The UNITY-xr focusing trap is purged with dry carrier gas after sample collection and before the trap is desorbed. The purge flow is directed through the focusing trap, in the trapping (sampling) direction, to sweep any remaining oxygen, water and/or other residual sample matrix gas from the trap to vent. This step is part of the Dry-Focus3 process.

• **Trap dry-purge time:**

- Range: 0 to 99.9 min.
- Settable in 0.1 min increments.

• **Trap dry-purge flow:**

- Range: 2–500 mL/min.
- Settable in 1 mL/min increments.

• **Trap dry-purge temperature:**

- Range: -30°C to 50°C.
- Adjustable in 1°C increments.
- Temperature limits are user-settable within the stated range.

• **Trap desorption:**

- Default setting is ballistic heating, which reaches rates of 100°C/s during the first critical stages of secondary (trap) desorption.
- Alternatively, a range of programmed trap heating rates from 1°C/s to 40°C/s can be selected.

• **Flow path:** The entire inert sample flow path is heated to eliminate risk of contamination or carryover.

- Range: 50–200°C.
- Settable in 1°C increments.
- Temperature limits are user-settable within the stated range.

• **Cycle time (overlap):** The start of collection of another sample onto the focusing trap can overlap with analysis of the previous sample, to optimise the overall cycle time.

2.3 Inlet sampling options

- **Inlet selection:** 4 or 14 sample inlet options are available depending on the model chosen. Each can be extended to 17 or 27 respectively, by adding a CIA Satellite-xr.
- The start of each new sample collection time can be programmed to begin:
 - as soon as the trap has re-cooled to its trapping temperature (250°C to -30°C in <5 min);
 - at a fixed time interval;
 - at an absolute time, e.g. 12:00, 13:00, 14:00.

2.4 Automatic sequencing of inlets

- A sequence of samples can be entered by the user into the sequence table on the PC user interface.
- An entire sequence can be repeated any number of times.
- Individual samples can be identified as 'calibrant', 'blank', 'sample' or as a user-defined name.
- A log file is produced as a sequence progresses and is automatically maintained and saved. Any sequence deviations are recorded in the log file.
- If any deviations occur in a sequence, the GC run is initiated to keep the analytical system 'in sync' with the desorber.
- Sequences can be stored and recalled for re-use if necessary.
- No manual change-over is needed between CIA Advantage-xr samples and ULTRA-xr tube desorption. Both sample types can be sequenced without user intervention.

3. System specification

The CIA Advantage-xr mounts on the right-hand side of the UNITY-xr and connects through either the 'tube' or 'split' side of the UNITY-xr flow path.

3.1 Dimensions and weight

CIA Advantage-xr:

- Height: 42 cm (16.5").
- Width: 24 cm (9.4").
- Depth: 54 cm (21.3").

- Weight: 21 kg (46 lb).

UNITY-CIA Advantage-xr:

- Height: 46 cm (18.1")

- Width: 40 cm (15.7")

- Depth: 54 cm (21.3")

- Weight: 37 kg (81 lb).

• UNITY-CIA Advantage-CIA Satellite-xr:

- Height: 46 cm (18.1")

- Width: 64 cm (25.2")

- Depth: 54 cm (21.3")

- Weight: 58 kg (128 lb).

3.2 Recommended ambient operating conditions

- Temperature: 15°C to 30°C.
- Relative humidity: 5–95% RH (non-condensing).

3.3 Power requirements

- 100–240 V, 50/60 Hz, 900 W (CIA Advantage-xr self-adjusts to local voltage input).

3.4 Pneumatic requirements

- Pressure-controlled 0–60 psig (0–415 kPa) supply of helium, hydrogen or nitrogen carrier gas under manual or electronic control. (This is in addition to the UNITY-xr carrier gas supply).
- Pressurised supply of dry air/nitrogen at 50–60 psig (340–415 kPa). The gas is used for pneumatic actuation of valves. (This is in addition to the UNITY-xr dry gas supply).

3.5 Minimum PC specification

For TD control:

- CPU: 1 GHz 64-bit dual-core or better.
- RAM: 4 GB.
- Hard disk space: 2 GB.
- Graphics card: DirectX 9 or later.
- Display: 1024 × 768 display.
- Operating system: Windows 10 or 11, 64-bit, English.
- Other requirements: Windows-compatible keyboard and mouse; one free USB per CIA Advantage-xr module (in addition to the port requirements for the UNITY-xr).

3.6 Safety and regulatory certifications (for UNITY-CIA Advantage-xr)

- The instrument is designed and manufactured under a quality system registered to ISO 9001.
- The instrument complies with the essential requirements of the following applicable European and North American Directives, and carries the CE/UKCA marks:
 - Low Voltage Directive 2014/35/EU.
 - EMC Directive 2014/30/EU.
 - ROHS Directive 2015/863/EU.
- The instrument conforms to the following product safety standards:
 - IEC 61010-1:2010/AMD1:2016.
 - IEC 61010-2-010/EN 61010-010:2014.
 - IEC 61010-2-081/EN 61010-2-081:2015.
 - Canada: CSA C22.2 No.61010-1:2012.
 - USA: ANSI/UL 61010-1:2012.
- The instrument conforms to the following regulation on electromagnetic compatibility (EMC):
 - IEC 61326-1/EN 61326-1:2013.

4. System options

- **CIA Satellite-xr** (U-CIASAT-2S or U-CIASAT-H-XR): The CIA Satellite-xr provides capacity for an additional 13 channels.
 - CIA Advantage T-xr with CIA Satellite-xr provides 17 channels.
 - CIA Advantage HL-xr with CIA Satellite-xr provides 27 channels.
- **Kori-xr water management option** (U-KORI-XR or U-KORI-H-XR): Uses an empty trap to remove water from humid air streams prior to analyte focusing, allowing simultaneous analysis of ultra-volatiles, polar species, oxygenates and pinenes.
- **In-line Nafion dryer** (U-ASDRY) for monitoring ultra-volatile, non-polar compounds in humid atmospheres (not suitable for polar species): Requires a pressure-regulated (~15 psig) supply of 150–200 mL/min dry air or nitrogen with a dew point below -50°C (as required for UNITY-xr).

- **ULTRA-xr 100-tube autosampler (U-ULTRA-XR or U-ULTRA-H-XR):** Both CIA Advantage-xr and ULTRA-xr can be installed onto the same UNITY-xr, allowing automated re-collection of the outlet split from both tube and canister/on-line samples.
- **Pump (U-ASPM1/U-ASPM2/U-ASPM3 or U-ASPM1-H/U-ASPM2-H (for Multi-Gas models)):** If the sample/standard gas is pressurised (>10 psig), the controlled flow through the entire system is driven by this pressure.[†] If the sample is at low (<10 psig) pressure, a pump is required to draw the gas-phase sample through the system. The pump includes a power cord to connect to the mains supply, silicone rubber tubing and a copper tube adaptor.
- **Heated sample lines (U-HTLNKT or U-HTLNKT-T):** Recommended for the analysis of compounds that can condense at room temperature.
- **Humidifier (U-HUMID):** Supplies humidified carrier gas to flush the flow path, thereby reducing carryover.
- **Canister rack (U-RACK02):** Markes' floor-mounted Maxi Rack holds up to 15 canisters (14 samples and one internal standard) up to 6 L in size. See separate specification sheet.

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