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Markes International UNITY 2™ thermal desorber

Specification Sheet February 2008

SYSTEM SUMMARY

UNITY 2 is a cryogen-free two-stage manual thermal desorber for tagged or untagged tubes. It is used for sampling, concentrating, extracting and analyzing volatile and semi-volatile organic compounds from a range of real-world sample matrices.

UNITY 2 uniquely provides a **universal TD platform –** compatible with every TD application. It incorporates a patented, inert heated valve ensuring recovery of the broadest range of analytes: C_2 to n-C_{40} hydrocarbons **and** reactive species such as mercaptans.

UNITY 2 **complies with all the recommendations of international standard methods** for analytical TD (*e.g.* US EPA Methods TO-17 & TO-15, ASTM D6196-03, ISO 16017 Parts 1 & 2, ISO 16000 series, etc.).

The system is compatible with single, industry-standard ¼-inch (6.4 mm) O.D. x 3½ inch (89 mm) long sample tubes with or without TubeTAG™ RFID tags. The sample tubes are available, with or without sorbent packing, in stainless-steel, inert-coated stainless steel or glass.

UNITY 2 uniquely offers quantitative re-collection of both tube and trap desorption split flow to allow repeat analysis (SecureTD-Q™) This overcomes the one-shot limitation of older TD systems and simplifies TD method/data validation per standard methods.

UNITY 2 acts as an additional, stand-alone injector that may be connected to any make of GC(MS) and does not interfere with other GC accessories. It is typically interfaced to the GC via a direct coupling to the analytical column. For example, with Agilent GCs (6890 or 7890A), the back pressure regulated electronic pneumatic control (**EPC**) module of a S/S injector can be used to control the carrier gas flow through the entire TD-GC(MS) system. This **'locks' retention times**, independent of split flow, desorption temperature and other analytical settings.

Flexible upgrade routes: UNITY 2 upgrade options include:

- one or two **integrated MFCs** for control of split and/or desorb flows
- ULTRA 2 for **100 tube automation**. Unattended operation all week end
- accessories for manual or automated **headspace-trap** analysis
- options for automated, multi-channel **canister** / bag analysis or round-the-clock **on-line air monitoring**.

A range of sorbent tubes and accessories is also available including:

- **TubeTAG kit**– RFID tags for sorbent tubes and hand held tag read/write devices - Record sample information and track tube history

Additional UNITY 2 features include:

- An electrically-cooled focusing trap offering uniquely effective **cryogen-free** retention of ultra-volatiles (e.g. acetylene from >1.5 L of air), quantitative recovery of semi-volatiles (n-C_{40}, PAHs, etc), fast cooling, compatibility with reactive species and easy maintenance *(easy-change, low dry gas flow, transparent trap box cover, etc)*
- A stringent, method-compliant (no flow / ambient temperature) **leak test** is carried out on every sample. Failed tubes are retained intact.
- Trap heating rates up to 100°C/sec and backflush desorption combine to facilitate splitless operation at flows below 2 ml/min thus **optimizing sensitivity**
- Single and double splitting options and less than 0.1% carryover ensure **compatibility with samples over a wide concentration range (ppt to %)**
- Pre-purge of air to vent and selective elimination of water and solvents **minimize analytical interference**.

- PC control in most 32-bit Windows™ operating environments provides an intuitive user interface
- Allows the desorption of a subsequent sample to begin while a previous sample is still running (overlap mode) – **optimizes productivity**.
- **Small footprint** for operation in mobile labs or other confined environments

SYSTEM SPECIFICATION

Analytical Range:

UNITY 2 provides a 'universal' TD platform allowing analysis of compounds over a wide boiling range AND the ability to select low flow path temperatures for compatibility with labile compounds……..

- Quantitative retention of acetylene from up to 1.5 L air without liquid cryogen
- Quantitative recovery of n-C_{40}
- Quantitative recovery of labile compounds – mercaptans, CS gas, free-VX, amines, etc.
- Backflush desorption of the UNITY 2 focusing trap also allows simultaneous analysis of volatiles and semi-volatiles
- Recovery from sorbent tubes can be demonstrated on UNITY 2 using SecureTD-Q

Desorption Modes

- Tube Conditioning Mode - desorption of the sample tube for cleaning purposes with all the effluent directed to vent *i.e.* away from the cold trap and other important components of the sample flow path
- 2(3) stage desorption mode – normal two stage desorption of a sample with the additional option of an elevated temperature purge
- On-line monitoring, direct sampling, automation *etc.* are available when the system is configured with one of the appropriate accessories
- 'Direct sampling' mode for headspace-trap operation. Available when the system is configured with one of the appropriate accessories

Primary (Tube) Desorption Oven

- Temperature range 35°C to 425°C settable in 1°C increments. [Note that the tube oven heats from ambient to the selected temperature at the start of tube desorption in order to minimize risk of flash vaporization & split discrimination when analyzing samples with unknown water/solvent content]
- Desorption time 0 to 999.9 minutes settable in 0.1 min increments

Secondary Focusing (Cold) Trap

- Quartz cold trap: 2 mm I.D where packed and 0.9 mm I.D. at the sample input/output end. Collar at non-sampling end makes trap easy to change.
- Central 60 mm packed with between 1 and 4 sorbents. Backflush desorption ensures quantitative retention and release of wide boiling range samples
- Low temperature range -30°C to +50°C settable in 1°C increments. Uniform electrical cooling applied over full 60 mm length of sorbent bed. Will quantitatively retain acetylene from over 1500 ml of air (if packed with appropriate sorbents).
- High temperature range 35°C to 425°C settable in 1°C increments. Uniform heating applied over full 60 mm length of sorbent bed during trap desorption allowing quantitative release of semi-volatiles such has n-C_{40}, di-decylphthalate and benzo-a-pyrene
- Heating rate: default setting is ballistic heating which reaches rates of 100°C/sec during the first critical stages of secondary (trap) desorption. Minimum trap desorption flow for high resolution capillary chromatography 2 ml/min without on-column focusing or 1 ml/min with on-column focusing
- Alternatively, programmed trap heating rates from 1°C/sec to 40°C/sec can be selected
- Time held at top temperature 0 to 999.9 minutes settable in 0.1 min increments
- Trap may be independently heated for conditioning purposes and for obtaining a system blank

Sample Flow Path

- Temperature range of sample flow path: valve 50°C to 210°C and transfer line 50°C to 225°C, both settable in 1°C increments. Uniform heating.
- Constructed entirely of inert materials: PTFE, quartz, inert-coated stainless steel and uncoated, deactivated fused silica.
- Allows quantitative recovery of both semi-volatiles (including n-C_{40}) and reactive compounds.

Pneumatics

- Requires pressure controlled 0-60 psig (0-415 kPa) supply of He, N_2 or H_2 carrier gas under manual or electronic control.

- Requires a pressure controlled supply of 40-80 ml/min **dry** (dew point -45°C or below) compressed air or nitrogen in the range 50 to 60 psig (340 to 415 kPa). The dry gas is used for both pneumatic actuation of the valve and for purging the cold trap box. *Helium cannot be used as the dry gas supply*

Pre-desorption checks and controls

- Leak test: each tube is pressurized and subjected to a stringent, ambient temperature leak test without carrier gas flow. Failed tubes are not desorbed, but are preserved intact for operator attention
- Pre-purge: Each tube is purged with carrier gas (in the desorption direction) at ambient temperature to remove oxygen before desorption. The air is purged to vent and non of it is allowed to reach the analyzer *e.g.* GCMS. Ambient purge time 0 to 99.9 minutes settable in 0.1 min increments
- An additional carrier gas pre-purge can be carried out at elevated temperature to remove water or other interfering solvent if required
- The cold trap may be selected to be in or out of line during either of the pre-purge stages
- The split may be selected to be open or closed during either of the pre-purge stages

Sample splitting and SecureTD-Q (quantitative re-collection for repeat analysis)

The UNITY 2 splitter may be operated in the following modes:

- During primary (tube) desorption
- During secondary (trap) desorption
- During both desorption stages *i.e.* double splitter operation
- During neither desorption stage *i.e.* splitless option

The splitter may be selected on or off during system standby and at any stage during pre- or dry purge.

The split and desorb flows are controlled by needle and solenoid valves downstream of the sample flow path. Alternatively the split flow may be controlled by electronic mass flow control (MFC) using the U-MFC100-2S, U-MFC200-2S or series 2 Air Server / CIA 8 accessories. With any of these accessories fitted, different split flows can be selected for each stage of operation (standby, pre-purge, tube desorb and trap desorb) and split & desorb flow settings may be stored and recalled as part of the desorption method.

The split vent line contains a charcoal filter in front of the control valves (and MFC) to prevent contamination of the valves/MFC and laboratory atmosphere. The charcoal filter has the same external dimensions as a standard sorbent tube. The flow path between the main UNITY 2 heated valve and the charcoal filter is a mirror-image of the short, inert heated flow path connecting the sample tube to the heated valve. When required, the charcoal filter may be replaced with a conditioned sorbent tube to quantitatively re-collect the split effluent from tube & trap desorption (inlet **and** outlet split). This is called SecureTD-Q. SecureTD-Q allows repeat analysis, method / data validation and archiving of critical samples.

Dimensions and Weight

- Height: 40 cm (15.7 in)
- Width: 16 cm (6.3 in)
- Depth: 51 cm (20 in)
- Weight: 16 Kg (24 lb)

Environmental Conditions

- Ambient operating temperature 15°C to 30°C
- Ambient operating humidity 5 to 95%, non-condensing

Power Requirements

- 90 to 253V, 47/63 Hz, 650W (UNITY 2 self-adjusts to local voltage input *e.g.* UK 220-250V, US 110-120V)
- Power supply unit rated to 650W.
- Input inrush current of <40 amps

UNITY 2 Safety and Regulatory Approvals

- EN 60950-1
- EN 61010-1
- CE marked and compliant with the Low Voltage Directive (73/23/EEC) EN60950

EMC Performance

- IEC 61326:2002
- EN 61326:1997 + A1:1998 + A2:2001 + A3:2003

Designed and manufactured under a quality system registered to ISO 9001.

UNITY 2 power supply unit (PSU) conforms to the following approvals

- UL60950-1 & CSA22.2 No. 60950-1 – UL Recognised. C-UL for Canada
- IEC/EN60950-1 BSI Kitemark and CE mark.
- IEC/EN61010-1 and IEC/EN60601-1. CB Report and BSI Kitemark

- UL60601-1 & UL61010-1-UL Recognized, C-UL for Canada

Data System – Minimum PC Specification

UNITY 2 software will run on most 32-bit versions of Windows™, however use of currently supported versions of Windows is strongly recommended. In general a PC with sufficient resources to run 32-bit Windows should have enough performance to control UNITY 2. The following defines the recommended minimum PC specification:

- 400 MHz processor
- 256 MB RAM
- Minimum of 10 MB of free disc space (for the UNITY SERIES 2 software installation)
- Minimum XGA (1024x768 pixel) screen resolution, 256 color

The PC should have a free spare serial COMs port for communication with UNITY 2. Alternatively, PCI or USB options are available

GC remote cable connections

UNITY 2 includes a GC interface cable which connects to the ready output and start input of your GC(MS) and data handling systems. The cable supports automatic start of the entire analytical system when the UNITY 2 cold trap desorbs and allows UNITY 2 to check the ready status of the analyzer and associated data handling. The UNITY 2 cold trap will not desorb unless and until it receives a ready signal from the GC(MS) system.

UNITY 2 accessories and upgrade options include

- ULTRA 2, 100 tube autosampler
- Manual or automated headspace-trap operation
- Integrated electronic mass flow control of split and / or desorb flow. MFCs available in 2-100 ml/min or 5-200 ml/min flow ranges.
- Series 2 Air Server™ options (3- or 8-channel) for continuous on-line air/gas monitoring or method-compliant analysis of multiple canisters/bags
- *Kits to interchange between 3.5- and 4.5-inch tube versions of UNITY 2(available from Markes)*

For further information

For more information about our thermal desorption products and services please visit our web site at www.markes.com.