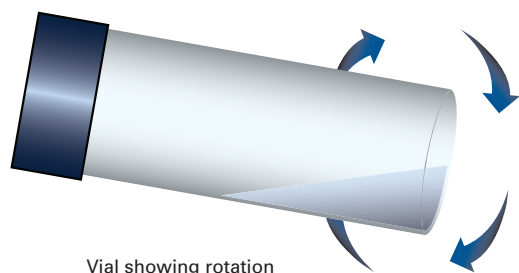


The HS9000 is the fastest, most sensitive, versatile, and easy to use static and dynamic headspace autosampler available for any VOC application.

Traditional static-only headspace techniques provide a clean and automated injection from nearly any type of sample matrix by simply injecting a small amount of the gas vapors above the sample into the GC. However, because static headspace analysis only injects a portion of the gas vapor it could never provide the sensitivity achieved with dynamic sweeping and trapping of the headspace vapors. The Markelov HS9000 makes BOTH possible.

With over 200 years of combined GCMS experience, EST Analytical is proud to introduce the Markelov HS9000 Static and Dynamic Headspace Autosampler, the most technically advanced headspace system available today.



VERSATILITY

Various Modes of Sampling for Qualitative and Quantitative Work

The HS9000 delivers the flexibility to perform traditional fixed loop injections and time-based injections within a single system. Whatever you need to make—a highly reproducible timed injection, a known/fixed volume loop injection, or a concentrated injection for improved sensitivity, the HS9000 is the right instrument for you.

- **Static Loop Injection**

A fixed volume loop available in various sizes is filled with the headspace vapor to inject a known volume of sample into the GC.

- **Static Time-based Injection** (optional)

The headspace vapor is directed to the GC for a programmed period of time. This mode minimizes the number of components in the sample pathway.

- **Dynamic Headspace Trap Injection** (optional)

The headspace vapor is continually displaced from the sample vial and collected on an adsorbent trap for a concentrated injection.

The same needle is used to perform both traditional static and dynamic headspace injections. Therefore, users have the ability to make both static and dynamic injections within the same sample schedule.

SENSITIVITY

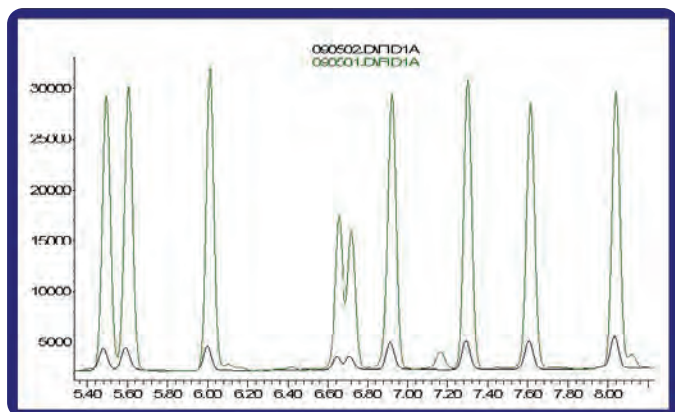
% Level to Single Digit PPT Results

The HS9000 comes standard with a patented dual sample needle (a needle within a needle). Users have the ability to continually sweep the headspace of a sample and concentrate the analytes onto an optional adsorbent trap to increase sensitivity up to 100 times.

This patented dual needle trapping technique provides a level of detection of compounds previously unobtainable by headspace techniques.

- The sealed sample is heated and mixed with horizontal rotary mixer to reach equilibrium.
- The sample vial is placed onto the dual needle.
- Inert gas flows at a programmed rate for a programmed period of time through one passage of the needle, displacing the headspace in the vial.
- The analytes are carried out of the vial and concentrated onto a multi-bed, adsorbent trap.
- The adsorbent trap is then heated and backflushed with the GC carrier gas transporting the analytes to the GC column.

The HS9000 delivers improved sensitivity with the dynamic sweeping and the proven technology of static equilibrium headspace analysis all in the same instrument.



TIC Overlay of Static Injection Versus Dynamic Injection

- Static Headspace sensitivity proportional to headspace equilibrium
- Dynamic Headspace sensitivity proportional to total mass of analyte in headspace

EASE OF USE

Continuous Unattended Operation

The HS9000 comes standard with an integrated 90-position autosampler and 12-position platen which allows up to 12 samples to be heated simultaneously. Samples can be run as fast as the GC will allow.

“Constant Heat” mode assures that each sample is heated the exact amount of time as programmed in the method. The use of platen loading algorithms maximizes sample throughput and delivers superior reproducibility.

Intuitive Graphical User Interface

All system parameters and settings are graphically displayed for quick and easy set-up requiring minimal user training. Simple sequence building and editing features with priority sampling from any position in the tray delivers unmatched automation. The software utilizes a sample logbook to provide sample parameter reporting and error tracking.

Electronic Flow and Pressure Control with Built-in Integrity Checks

The HS9000 has electronic flow and pressure control to improve user productivity and to assure data quality. Flow rates and pressurization set points are parameters. Methods can be run in the same sequence with varied flow and pressure settings.

Both the vial pressurization and the loop fill pressurization settings are monitored to assure the set points are maintained for improved accuracy and reproducibility.

Any deviations are flagged and recorded in the error log.

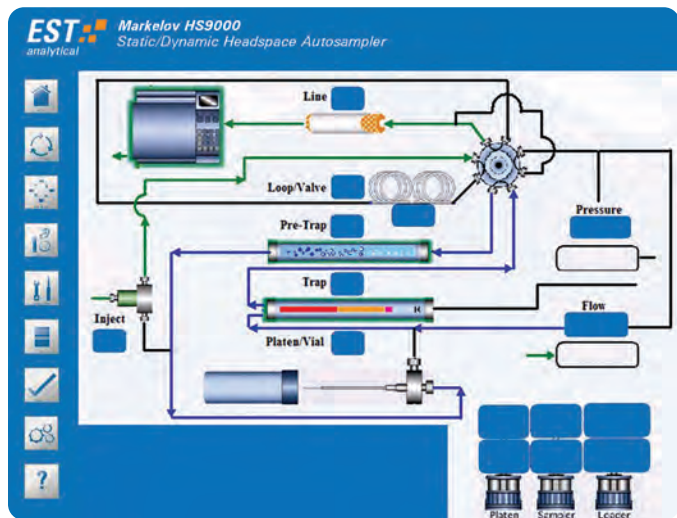
Method Development Mode

All time, temperature, flow, and pressure method parameters can be varied in specified increments to determine the optimum set of conditions during the method validation process.

Simply choose the parameter to be varied, the increment you wish to vary with each sample, how many vials you would like to run, and the schedule automatically creates a sample sequence designed to optimize your method.

Simple Maintenance and Diagnostics

The HS9000 is easy to maintain. Automated, single-button leak checking and manual control of all valves, heaters, and motors maximize user productivity. The system is built onto a drawer so the entire sample pathway and platen can be easily accessed.



Run screen shows flow path in different modes of operation



APPLICATIONS

The HS9000 is the ideal tool when:

- Multiple methods and applications are run on a single instrument,
- Improved sensitivity is ideal,
- Speed and flexibility are important,
- The potential for thermal breakdown exists,
- Viscous matrices are being sampled,
- Better reproducibility is needed,
- Exact temperature control is important,
- Fast method development is necessary,
- High sample throughput is required, and/or
- An intuitive interface, simple maintenance, and easy controls and operations are highly valued.

Polymer and Consumer Product Analysis

Benefits of the HS9000, such as the horizontal rotary mixing and the dynamic headspace sampling techniques, provide a powerful tool to measure trace levels of residual monomers and other volatile compounds in solid matrices.

- Residual monomer
- Residual solvents
- Packaging
- Odor analysis

Environmental Analysis

The dynamic headspace sampling technique of the HS9000 now makes it possible to achieve the low levels of detection required by the EPA. The results generated with the HS9000 can be used to report final analytical results per method 5021 or used as a screening tool to accurately predict dilution levels prior to traditional purge and trap analysis.

- VOC Screening
- RSK Analysis

Aroma and Flavor Analysis

The HS9000 is ideal for this type of analysis, delivering the benefits of shorter equilibration times and reducing the potential of thermal breakdown. Utilizing the horizontal rotary mixing technique is especially beneficial for reducing the analysis time of viscous matrices such as oils, butters, and honey. The short inert sample pathway and the dynamic headspace technique are also ideal for the analysis of aromas and flavors.

- Odor Characterization
- Quality Control

To download applications, go to www.estanalytical.com and click on the "Applications" section. Some examples of our online applications are listed on the back cover.

SPEED AND FLEXIBILITY

Patented Rotary Mixing Technology

The HS9000 utilizes a patented horizontal rotary evaporation mixing technique. This unique mixing feature places the sample vials in a nearly horizontal position to expose more of the sample to the headspace.

Horizontally rotating the vial allows more surface area to be exposed for a faster and more efficient evaporation. Cutting the thickness of the sample in half reduces the equilibration time by a factor of four.

This technique is especially useful to speed up the equilibrium times for viscous materials like oils which are difficult to agitate by shaking.

These shorter equilibration times also reduce the potential of thermal breakdown.

Several other mixing options include variable speed and an "Agitate" mode which only partially rotates the vial.

ACCURACY AND REPRODUCIBILITY

• Completely Closed Sample Introduction System

The HS9000 utilizes a closed sample introduction system. Unlike syringe injection systems, the loss of the headspace vapor during the injection process due to vapor changes is never a concern. Results are always highly reproducible.

• Temperature Control

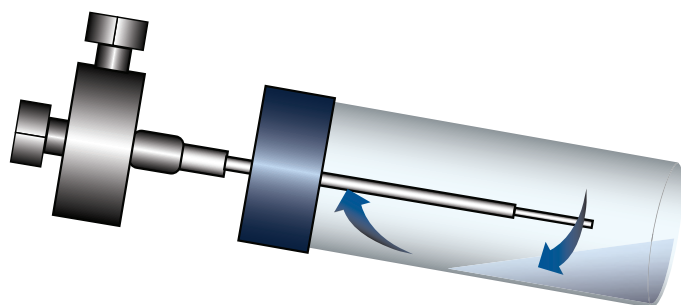
Control of sample temperature is the most critical headspace method parameter to assure accurate and reproducible results. A change of 1°C could change the partition coefficient (K) by as much as 10%. To maintain thermal uniformity throughout the critical equilibration and sampling process the HS9000 enables the sample vial to remain in the heated platen during sampling. Reducing temperature variations significantly improves reproducibility.

• Maximum Inertness

The inert Sulfinert® sample pathway from the sample needle to transfer line protects against sample loss and carryover, delivering superior accuracy. Even the most chemically active compounds can be analyzed without the need to change any of the sample pathway.



10 ml or 20 ml crimp top or screw cap vials can be used in the same sequence



Patented Dual Needle Dynamic Headspace

APPLICATION NOTES

- An Evaluation of the Analytical Advantages of a Versatile Static and Dynamic Headspace System
- Efficient Headspace Analysis of Viscous Matrices
- VOC Analysis of Packaging in the Food Industry
- Headspace Techniques for Flavor Characterization and Off-Odor Detection
- Trace Level Analysis of Benzene in Beverages

MARKELOV HS9000 SPECIFICATIONS

Sample Capacity

90-position carousel, 12 equilibrium heating positions

Sample Pathway

Inert sample pathway from sample needle to GC transfer line for analysis of the most active compounds.

Modes of Sampling

- Loop Injection
- Time Based/Pressure Balanced Injection (optional)
- Dynamic Extraction Mode to Built-in Trap (optional)

Horizontal Rotary Mixing (patented)

Mixing can be set to Off, Low, Medium, High and Agitate. Vials are rotated horizontally, decreasing equilibrium times by exposing more sample to the available headspace.

Constant Heating Mode

12 equilibrium heating positions to ensure constant heating of each sample vial

Programmable Temperature Ranges

Valve Oven: 40°C to 275°C in 1 degree increments

Transfer Line: 40°C to 350°C in 1 degree increments

Platen: 40°C to 260°C in 1 degree increments

Trap: Ambient to 450°C in 1 degree increments

Pneumatic Control

Electronic pressure controlled

Instrument Control

Built-in WindowsXP™ operating system, color display, keyboard and mouse

Method Storage

30 methods

Priority Samples

Every sample position can be scheduled as a priority sample

Method Development Mode

Methods Development Tool used to increment method parameters for optimization

GC Communication

Handshaking through relay closures, TTL Logic and LAN



Dimensions

23.5"H x 29"D x 20.5"W (59.7cm H x 73.7cm D x 52cm W)

Weight

90 lbs. (40.8 kg)

Power Requirements

100-120/240VAC +/- 10%, 50-60 Hz Current <15 Amps

Environmental Specifications

Operating Temperature 10 to 32°C

Storage Temperature -20 to 60°C

Relative Humidity 10 to 90%

Gas Supply

Ultra High Purity (99.999%) Helium or Nitrogen

Incoming Gas Pressure

20-60 psi

ADDITIONAL OPTIONS

Integrated Analyte Adsorbent Trap

Adsorbent Trap option to allow compounds to be concentrated before injection, improving sensitivity 100x (dual needle configuration patented)

Time-Based/Pressure Balanced Injection

Touch Screen Interface