

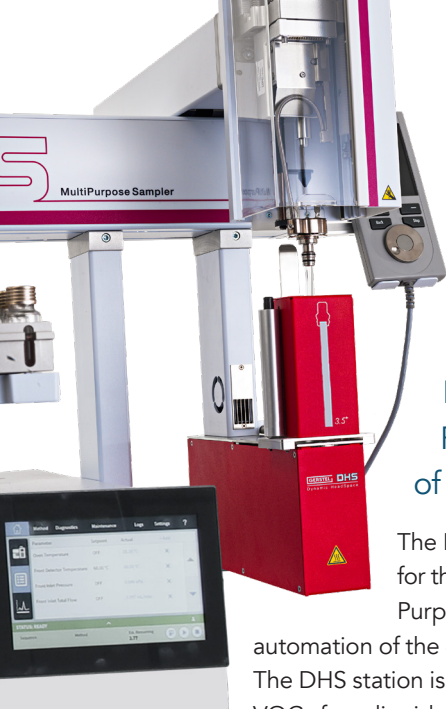
**GERSTEL**

MAKING LABS WORK

# Automated Dynamic Headspace

**DHS**





## Dynamic Headspace DHS

Dynamic Headspace combines the sensitivity and low detection limits of Purge and Trap with the ease of handling, high productivity and ruggedness of Headspace analysis.

The Dynamic Headspace (DHS) option for the industry standard GERSTEL Multi-Purpose Sampler MPS, offers complete automation of the dynamic headspace technique. The DHS station is used to extract and concentrate VOCs from liquid or solid samples placed in standard headspace vials. The headspace above the sample is purged and analytes are concentrated on a user selectable sorbent-filled trap. Analytes are subsequently introduced into a gas chromatographic system by thermal desorption of the trap in a GERSTEL Thermal Desorption Unit (TDU), or Thermal Desorber TD 3.5+, resulting in maximum recovery, and lowest possible detection limits. DHS 3.5 in combi-

nation with TD 3.5+ offers up to 4 times more sorbent for improved recovery and LODs when performing DHS large or determining VVOCs. DHS offers improved performance for a wide variety of sample types, such as food, beverages, polymers, personal care products and pharmaceuticals.

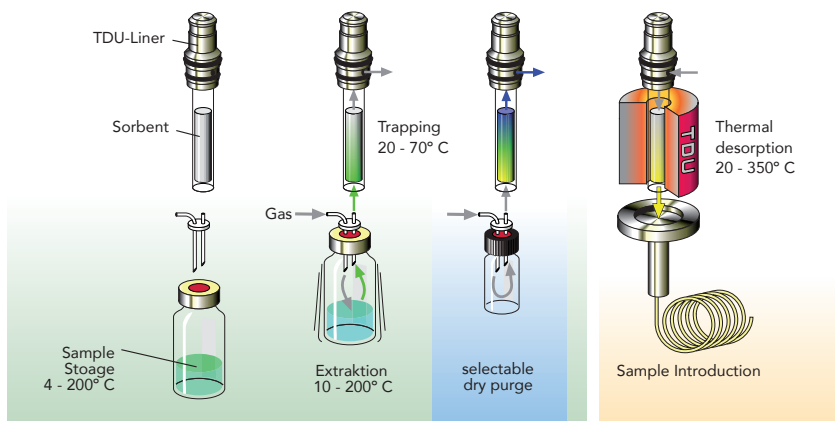
GERSTEL exclusive MAESTRO software enables fully integrated control of the complete process from extraction and analyte collection to GC/MS analysis. Just one method and one sequence table is required, minimizing the risk of errors and enabling fastest possible setup. Intelligent software control ensures that the DHS process is performed during the GC run of the preceding sample, thereby optimizing productivity and system utilization.



### Sorbents

For most applications, Tenax TA sorbent can be used in the trap. If your application requires another sorbent, you can choose from a selection of prepacked and conditioned tubes. Since the trap is backflushed during desorption, multibed sorbent tubes can be used in order to cover a wide range of analyte boiling points and polarities in one analysis for improved flexibility and productivity. Whenever more sorbent is needed, for example for DHS large or for VVOCs, the DHS 3.5 enables use of 3.5" tubes with up to 4 times more sorbent.

### The DHS process from extraction to sample introduction



## DHS Background and System Overview

The DHS station provides sample thermostating and agitation combined with purging of the sample headspace with a controlled flow of inert gas. The result is fast, efficient and reproducible extraction of analytes from liquid or solid samples. Extracted compounds are trapped and concentrated on a replaceable sorbent-filled trap, which is subsequently thermally desorbed in the integrated GERSTEL Thermal Desorption Unit (TDU) followed by determination of the analytes using GC/MS.

While in the GERSTEL MPS autosampler, samples are stored in standard headspace vials at ambient temperature. Optionally, samples can be stored at controlled temperatures between

4 °C to 200 °C. Lower sample temperatures can help reduce decomposition of heat sensitive samples such as food and biological materials. Higher temperatures can be used to simulate sample behavior under "stress" conditions. During extraction, samples can be agitated to enhance and speed up the extraction process. The temperature of the sorbent tube during the DHS process can be independently controlled from 20 °C to 70 °C for optimal trapping of the analytes of interest. The sorbent tube can be dry purged for water removal to ensure the best possible chromatography and MS stability. A new sorbent tube can be used for every sample, eliminating the risk of cross contamination, or the same tube can be used for multiple samples as in standard Purge and Trap instruments.



## DHS Benefits:

### Low detection limits

- Exhaustive purge of the sample headspace
- Efficient trapping on user defined sorbent tubes
- Direct split or splitless transfer from trap to GC/MS system
- Lower detection limits than static headspace, SPME, and other widely used techniques

### Reliable and reproducible

- Inert, unique valve free sample path: No analyte discrimination, no cross contamination
- A new trap can be selected for every sample to eliminate any risk of cross contamination
- Headspace purge technique, no risk of system contamination from sample foaming
- Automated standard addition for improved Quality Control
- Integrated GERSTEL MAESTRO control of the complete system minimizes risk of errors

### High productivity through high throughput design

- Complete automation from sample extraction to introduction
- Fast, simple analysis setup, just one integrated method and one sequence table
- Agitation and gas purge provide fast extraction and short analysis cycles
- Optimized system utilization with GERSTEL PrepAhead function
- High throughput, up to 120 samples in one sequence (custom systems with higher sample capacity available)

### Highly Flexible

- User defined extraction time, flow and temperature
- Samples can be heated, cooled and agitated
- Large sorbent trap covers a wide concentration range
- Any sorbent can be used for analyte trapping
- A new trap can be used for every sample
- Sorbent trap can be heated or cooled for better efficiency
- Multimethod sequences for method development and flexibility

### Solvent free extraction

- Saves on costly solvents and disposal fees
- Less environmental impact, improved occupational safety
- Improves detection limits by eliminating solvent dilution factor

### Multiple water management options

- Subambient extraction temperature limits water evaporation
- Trap temperature and sorbent type can be varied to reduce trapping of water
- Automated dry purge

### Convenient, user friendly operation

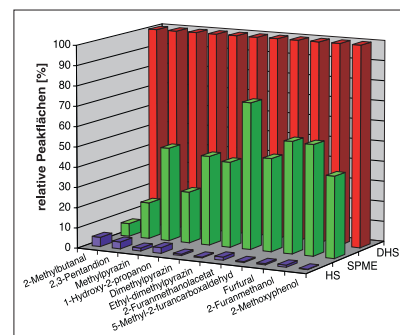
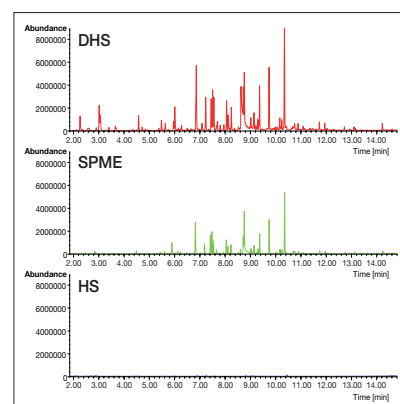
- GERSTEL "Sample Prep by Mouse-Click"
- Control of complete system including GC/MS through one method and one sequence table
- Easy sample handling using standard HS vials
- No solvents required

## Analysis of coffee powder using DHS, HS-SPME and Static Headspace

## Comparison of gas phase extraction techniques

In order to compare different gas phase extraction techniques, 100 mg samples of a ground coffee were analyzed using static headspace, headspace-SPME and DHS. Comparable extraction conditions were chosen: Extraction temperature: 40 °C; Extraction time: 30 min (HS, SPME), 10 min (DHS); DHS gas flow: 20 mL/min; Sorbent: DVB/Carboxen/PDMS (SPME), Tenax (DHS)

It can be seen from the sample chromatograms and the bar graph showing relative peak areas (DHS response normalized to 100%), that DHS provided the highest response for the determined analytes. For most analytes, DHS provided relative standard deviations well below 5%, which is equal to or better than the other techniques





### GERSTEL-DHS<sup>large</sup>

The DHS and DHS 3.5 can be extended with the DHS<sup>large</sup> module to perform analysis of large or inhomogeneous bulk samples. For example, consumer products, packaging or flooring material can be placed directly in sample containers up to 1L in volume. Sample holders are available for flooring material, eliminating interfering emissions from the edges of the cut sample. Purge periods can be introduced to simulate air exchange conditions in environmental chambers. A series of analyses can be performed on a sample to determine emission behavior over time. DHS operation or DHS<sup>large</sup> operation is selected by mouseclick.

DHS<sup>large</sup> sample containers with pressure valves are available in the sizes: 250 mL, 500 mL, and 1 L

### GERSTEL-DHS<sup>large</sup>-Autosampler

The DHS<sup>large</sup> Autosampler enables unattended analysis of up to 11 samples in containers up to 1L in volume. Series of samples can be analyzed using the Prep-Ahead function: Sample conditioning and analyte extraction are performed in parallel with GC/MS analysis for best possible productivity and system utilization. Automated screening with the DHS L can eliminate tedious, time consuming, and expensive chamber work. Other application areas are determination of volatiles in bulky consumer products or packaging, from which small representative samples cannot easily be taken.



### GERSTEL MAESTRO Software

MAESTRO optimizes performance and throughput

- Stand-Alone operation, fully integrated in the Agilent Software, or integrated with the Thermo Scientific® Xcalibur™ sequence table
- Sample Prep by Mouse-Click using PrepBuilder functions
- Scheduler for easy planning of sequences and of laboratory workflow
- PrepAhead / Multiple Sample Overlap: Automated overlapping of sample preparation and analysis for maximum throughput
- Priority samples can be added at any point in the analysis sequence
- LOG file and Service LOG file functions ensure traceability
- Automated E-mail notification if the sequence is stopped
- Realtime monitoring of all modules and parameters
- Interactive help function



GERSTEL GmbH & Co. KG  
Eberhard-Gerstel-Platz 1  
45473 Mülheim an der Ruhr  
Germany

[www.gerstel.com](http://www.gerstel.com)



Subject to change. GERSTEL®, GRAPHPACK®, TWISTER® and TWICESTER® are registered trademarks of GERSTEL GmbH & Co. KG. Copyright by GERSTEL GmbH & Co. KG. Agilent® is a registered Trademark of Agilent Technologies, Inc.

