


**GERSTEL**


## Thermal Desorber

# TD 3.5<sup>+</sup>

## Specifications

### Thermal Desorber TD 3.5<sup>+</sup>

#### Use

The Thermal Desorber TD 3.5<sup>+</sup> is part of the versatile and flexible GERSTEL thermal desorption platform. It is designed to work with 3.5 inch tubes which are often used in the analysis of air using sorbents. Although this size of tube is common for air analysis, solid samples may also be placed into tubes without adsorbent for analysis by direct desorption. GERSTEL Twister stir-bar sorptive extractors are also compatible with the TD 3.5<sup>+</sup>. Analytes are transferred to the Cooled Injection System (CIS) for refocussing and subsequent GC or GC/MS analysis.

#### Supported Techniques

- Thermal desorption of analytes that have been concentrated on a GERSTEL Twister® or on an adsorbent tube, for example used for air sampling
- Direct thermal extraction of analytes from solid or liquid samples
- Hot Headspace/SPME Injection and Trapping (HIT) for analyte concentration and improved recovery of high-boiling compounds.
- Dynamic Headspace (DHS) using the optional modules DHS 3.5<sup>+</sup>, DHS Large and DHS Large Autosampler

#### System Configuration

- Compatible with all standard GCs
- GERSTEL Cooled Injection System CIS fitted with a special CIS/TD liner is used for analyte focusing and enrichment prior to GC or GC/MS analysis

#### CIS Cooling Options \*

- GERSTEL Universal Peltier Cooling UPC Plus
- GERSTEL Dual Channel Cryostatic Cooling Device CCD 2
- LN<sub>2</sub> Cooling

#### CIS Minimum Temperatures

- +10 °C (using the UPC Plus)
- -40 °C (using the CCD 2)
- -150 °C (using LN<sub>2</sub> cooling)

#### TD 3.5<sup>+</sup> Cooling Options

- GERSTEL Dual Channel Cryostatic Cooling Device CCD 2
- GERSTEL Universal Peltier Cooling UPC Plus

#### TD 3.5<sup>+</sup> Minimum Temperatures

- +10 °C (using the CCD 2)
- +30 °C (using the UPC Plus, lower temperatures possible, depending on the transfer temperature)

#### TD 3.5<sup>+</sup> Cooling Rate

- From 300 °C to 30 °C in <60 seconds (using the UPC Plus)

#### TD 3.5<sup>+</sup> Temperature Programming

- Up to 2 temperature ramps for thermal desorption or for combined sample conditioning/dry purge and thermal desorption.
- Heating rate maximum 400 °C/min
- Initial temperature 10 ... 350 °C \*\*
- 1. hold temperature 10 ... 350 °C \*\*
- 2. hold temperature 10 ... 350 °C \*\*
- Hold time maximum 650 min for each hold temperature

\* For further information see separate spec sheet

\*\* Initial temperature depends on cooling option



### Sample Transfer Modes to the CIS

- Split
- Splitless
- Solvent venting

### Transfer Temperature

- Maximum 350 °C
- Fixed or in TD tracking mode (with max. 120 °C/min)

### Sample Mode

- Retain tube - Standby Cooling  
The tube remains in the TD after desorption, the TD is cooled to the standby temperature.
- Retain tube - no Cooling  
The tube remains in the TD after desorption, cooling is switched off when the GC run is started.
- Remove tube - Standby Cooling  
The tube is removed from the TD after desorption, the TD is cooled to the standby temperature.
- Remove tube - no Cooling  
The tube is removed from the TD after desorption, cooling is switched off when the GC run is started.

### Pneumatics

- Controlled through the TD pneumatics control box
- Pressure release for sample loading and unloading
- Flow, pressure and split ratio controlled through the optional GERSTEL ePneumatics or through the integrated GC pneumatics.
- Sample transfer from the CIS to the column in low split mode possible

### Control

- Based on the controller C506
- In combination with the GERSTEL MAESTRO software, either in stand-alone mode or integrated in selected Agilent® Technologies chromatography data systems (CDS), or coupled to selected CDS from Thermo Scientific®
- Only one method and one sequence table required for the complete system when integrated in a CDS

### Automation

- TD 3.5<sup>+</sup> Automation Option for processing of up to 240 TD tubes using the GERSTEL MultiPurpose Sampler MPS robotic

### Operating Conditions

- 15 ... 35 °C
- Relative humidity max. 50-60 %, non-condensing
- Max. 4615 m above sea level

### Storage Conditions

- -20 ... 50 °C
- Relative humidity max. 90 %, non-condensing
- Max. 4615 m above sea level

### Dimensions (W × H × D)

- 75 × 115 × 90 mm

### Weight

- 0.45 kg

### Power Consumption

- Max. 190 W

### Tube Types

- Dimensions: 89 × 6.4 × 5 mm (L × OD × ID)
- TD tubes with glass frit for GERSTEL Twister® or solid samples up to 40 mm, for example for thermal extraction
- TD tubes, packed
- Special microvials for up to 100 µL sample volume available
- More detailed information is available in the TD supplies catalogue

### TD Pneumatic Control Box

- Controls the split flow of the TD
- Controls the pneumatic release function for sample loading and unloading
- Low split option for sample injection with fixed low split ratio
- 4 LEDs provide quick status overview
- Compressed air input
- Interface for additional pneumatic control boxes
- Dimensions 200 × 100 × 175 mm (W × H × D)
- Weight 1.5 kg

### Accessories and Options

- TD 3.5<sup>+</sup> Automation Option  
For automated tube exchange and liquid injection with the MPS robotic
- MPS HIT  
For analyte concentration and improved recovery of high-boiling compounds using hot Headspace/SPME injection
- DHS 3.5<sup>+</sup>  
For automated dynamic headspace analysis of up to 120 samples in standard HS vials with the MPS robotic
- DHS Large  
For DHS analysis of larger samples placed in sample vessels with up to 1L volume in combination with the DHS 3.5<sup>+</sup> option. Examples include material emissions work, environmental chamber simulation or extractables & leachables screening of packaging used for pharmaceutical products.
- Tube Conditioner TC 2  
For simultaneous thermal conditioning of up to 10 TD tubes or up to 60 Twisters® under a flow of inert gas



## Supported Techniques

### Standard Thermal Desorption/ Twister®-Desorption

#### Principle

Analytes that have been concentrated on a GERSTEL Twister® or on a sorbent placed in a TD tube are thermally desorbed in the TD.

#### Features

- No transfer line or valve in the sample pathway. Analytes are transferred directly from the TD to the Cooled Injection System (CIS) for analyte concentration prior to GC/MS analysis
- Short cycle times and limited power requirement due to small thermal mass of the TD
- Venting of low boiling compounds or solvent possible

#### Applications

- Thermal desorption of analytes that have been concentrated onto an adsorbent, for example for flavor and fragrance work. Also for air monitoring using either direct pumped sampling or automated Dynamic Headspace (DHS)
- Thermal desorption of analytes that have been concentrated on a GERSTEL Twister®, for example to determine flavors or off-flavors in beverages or foods

#### Direct Liquid Addition

- A reagent or standard is directly injected into the TD tube that holds the sample inside the TD
- Improved quantitation and quality control using an internal standard or system test
- Analyte derivatization

#### Required Supplies

- Adsorbent filled TD tubes or TD tubes with glass frit for desorption of GERSTEL Twisters®
- For direct liquid addition, transport adapters for liquid injection are required

#### Commonly Used Adsorbents

- Tenax™ TA
- Tenax™ GR
- Carboxpack™ B + X
- Carbotrap® 300
- PDMS or EG Silicone coated magnetic stir bar, GERSTEL-Twister®

#### Types of Twisters®

- Length 10 mm, coating 0.5 mm, PDMS volume 24 µL
- Length 10 mm, coating 1.0 mm, PDMS volume 63 µL
- Length 20 mm, coating 0.5 mm, PDMS volume 47 µL
- Length 20 mm, coating 1.0 mm, PDMS volume 127 µL
- Length 10 mm, EG/Silicone volume 32 µL

#### Automation

- Using TD 3.5<sup>+</sup> Automation Option and MultiPurpose Sampler MPS robotic
- Max. 240 samples per sequence
- Also for direct liquid injection

### Direct Thermal Extraction

#### Principle

Samples kept inside TD tubes are thermally desorbed. Up to 240 tubes are stored in sealed trays. The samples are either placed in microvials inside the TD tube or are kept in place by a glass frit inside the TD tube.

#### Features

- Samples are loaded into TD tubes offline
- No cross-contamination since a new TD tube is used for every sample
- Venting of low boiling compounds or solvent possible

#### Applications

- Direct thermal extraction of samples, which are not compatible with direct introduction to the GC/MS system by syringe injection. Examples are solids and highly viscous liquids.

#### Direct Liquid Addition

- A reagent or standard is directly injected into the TD tube that holds the sample inside the TD
- Improved quantitation and quality control using an internal standard or system test
- Analyte derivatization

#### Required Supplies

- TD tubes with microvials or TD tubes with glass frit
- For direct liquid addition, transport adapters for liquid injection are required

#### Automation

- Using TD 3.5<sup>+</sup> Automation Option and MultiPurpose Sampler MPS robotic
- Max. 240 samples per sequence
- Also for direct liquid addition



### Direct Headspace and SPME Injection

#### Principle

The sample is injected through the hot TD using the MPS and the Hot Injection and Trapping (HIT) mode. Analytes are concentrated in the cold CIS.

#### Features

- Direct injection without having to remove the TD
- Headspace or SPME sampling combined with injection into the TD
- No discrimination of high boiling compounds, improved chromatography of low boiling compounds
- Concentration of analytes from multiple Headspace injections for improved LODs

#### Required Supplies

- Liquid injection transport adapters
- TD tubes, empty

#### Automation

- Using MultiPurpose Sampler MPS Robotic with Headspace or SPME option

### Liquid Sample Injection into TD Tubes

#### Principle

The liquid sample is injected into a TD tube inside the TD immediately prior to the extraction.

#### Features

- Sample injection into a closed TD system
- Direct injection of liquids without first removing the TD
- Sample can be injected without having to use programmed speed
- No loss of analytes from the TD tube through evaporation prior to thermal extraction
- No contamination of the TD tray
- Automated introduction of a standard can be performed by the MPS Robotic
- Automated introduction of a derivatization reagent can be performed by the MPS Robotic

#### Applications

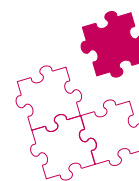
- One shot analysis of large volume samples including solvent vent step
- Dynamic Headspace of liquid sample volumes of up to 100  $\mu$ L

#### Required Supplies

- Transport adapters for liquid injection
- TD tubes with glass frit or TD tubes packed with glass wool

#### Automation

- Using TD 3.5<sup>+</sup> Automation Option and MultiPurpose Sampler MPS Robotic
- Max. 240 samples per sequence



### Site Prep Requirements

The TD is usually cooled with the GERSTEL UPC Plus, but the GERSTEL Cryostatic Cooling Device CCD 2 can be used as well. Cooling options are therefore not included with the TD and must be ordered separately. The site prep requirements for the cooling options are mentioned on the separate site prep sheet for cooling options.

- GC with GERSTEL CIS installed
- MPS robotic with TD 3.5<sup>+</sup> Automation Option for automation
- Compressed air connection, 1/8", max. pressure 8 bar
- Cooling Option