


**GERSTEL**


## Thermal Desorption Unit

# TDU 2

## Specifications

### Thermal Desorption Unit TDU 2

#### Use

The GERSTEL Thermal Desorption Unit (TDU) efficiently desorbs analytes from adsorbents, or directly from liquid or solid samples. Analytes are transferred to a Cooled Injection System (CIS) for refocusing 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 placed in a TDU 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.
- Injection of liquid samples with a heavy matrix load into microvials placed in the TDU, followed by thermal extraction
- Dynamic Headspace (DHS) or DHS Large using optional DHS modules
- Pyrolysis using the optional PYRO module

#### System Configuration

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

#### Cooling Options

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

#### Minimum Temperatures

- +10 °C (using the CCD 2)
- +20 °C (using the UPC Plus, depending on the transfer temperature)

#### Cooling Rate

- From 300 °C to 30 °C in <120 seconds (using the UPC Plus)

#### Temperature Programming

- Up to 2 temperature ramps for thermal desorption or for combined sample conditioning / dry purge and thermal desorption.
- Heating rate maximum 12 °C/s
- 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

#### Sample Transfer Modes to the CIS

- Split
- Splitless
- Solvent venting
- Low split option

#### Transfer Temperature

- Maximum 350 °C
- Fixed or in TDU tracking mode (with max. 2 °C/s)



## Thermal Desorption Unit TDU 2

### Desorption Mode

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

### Control

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

### Automation

- Automated Tube Exchange (ATEX) Option for processing of up to 196 TDU tubes using the GERSTEL MultiPurpose Sampler MPSxt or 240 tubes using the 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)

- 95 × 94 × 77 mm

### Weight

- 0.4 kg

### Power Consumption

- Max. 110 W

### Tube Types

- TDU tubes, empty, for GERSTEL Twister®  
60 × 6 × 5 mm (L × OD × ID)
- TDU tubes, packed, 60 × 6 × 4 mm (L × OD × ID)
- Length of heated area approximately 20 mm
- Conditioned or unconditioned
- Special micro vials for up to 100 µL sample volume available
- Pyrolysis sample tubes for use with GERSTEL PYRO
- More detailed information is available in the TDU supplies catalogue

### TD Pneumatic Control Box

- Controls the split flow of the TDU
- 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

- ATEX Option  
For automated tube exchange and liquid injection into the TDU liner with the MPS or MPS robotic
- MPS HIT  
For analyte concentration and improved recovery of high-boiling compounds using hot Headspace/SPME injection
- DHS  
For automated dynamic headspace analysis of up to 64 samples in standard HS vials with the MPSxt or 120 samples 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 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 TDU tubes or up to 60 Twisters® under a flow of inert gas
- PYRO Pyrolysis module for TDU  
Enables pyrolysis of solid or liquid samples at temperatures of up to 1000 °C. Examples include structural elucidation of polymers and biomasses. Prior to pyrolysis a thermal desorption step can be performed.



## Supported Techniques

### Standard Thermal Desorption/ Twister®-Desorption

#### Principle

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

#### Features

- No transfer line or valve in the sample pathway. Analytes are transferred directly from the TDU 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 TDU
- 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 TDU tube that holds the sample inside the TDU
- Improved quantitation and quality control using an internal standard or system test
- Analyte derivatization

#### Required Supplies

- Adsorbent filled TDU tubes or empty TDU tubes for desorption of GERSTEL Twisters®
- For direct liquid addition, transport adapters for liquid injection are required

#### Commonly Used Adsorbents

- Tenax TA™, Tenax GR™
- Carboxen® 1000
- Carbosieve SIII™
- Shincarbon-X
- PDMS
- 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 ATEX Option and MultiPurpose Sampler MPS or MPS robotic
- Max. 240 samples per sequence
- Also for direct liquid injection

## Direct Thermal Extraction

#### Principle

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

#### Features

- Samples are loaded into TDU tubes offline
- No cross-contamination since a new TDU 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 TDU tube that holds the sample inside the TDU
- Improved quantitation and quality control using an internal standard or system test
- Analyte derivatization

#### Required Supplies

- TDU tubes with micro-vials or TDU tubes with glass frit
- For direct liquid addition, transport adapters for liquid injection are required

#### Automation

- Using ATEX Option and MultiPurpose Sampler MPS or 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 TDU 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 TDU
- Headspace or SPME sampling combined with injection into the TDU
- 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
- TDU tubes, empty

#### Automation

- Using MultiPurpose Sampler MPS or MPS robotic with Headspace or SPME option

### Liquid Sample Injection into Micro-Vials or TDU Tubes

#### Principle

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

#### Features

- Sample injection into a closed TDU system
- Direct injection of liquids without first removing the TDU
- Sample can be injected without having to use programmed speed
- No system contamination since sample matrix is removed with the used micro-vial and the used TDU tube
- No loss of analytes from the TDU tube through evaporation prior to thermal extraction
- No contamination of the TDU tray
- Automated introduction of a standard can be performed by the MPS
- Automated introduction of a derivatization reagent can be performed by the MPS

#### Applications

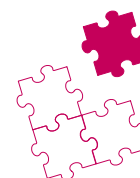
- Analysis of samples with a heavy matrix load, such as edible oils
- One shot analysis of large volume samples including solvent vent step
- Dynamic Headspace of liquid sample volumes of up to 100  $\mu$ L

#### Required Supplies

- Transport adapters for liquid injection
- TDU tubes with micro-vials
- TDU tubes with glass frit or TDU tubes packed with glass wool

#### Automation

- Using ATEX Option and MultiPurpose Sampler MPS or MPS robotic
- Max. 240 samples per sequence



### Site Prep Requirements

The TDU 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 TDU 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 with ATEX Option for automation
- Compressed air connection, 1/8", max. pressure 8 bar
- Cooling Option