# Hot Disk® Instruments

Thermal Constants Analyser




# TPS 3500

# TPS 3500

The Hot Disk® TPS 3500 is a state-of-the-art instrument for measuring the thermal conductivity, thermal diffusivity, thermal effusivity and specific heat capacity of tiny, highly thermally conductive samples. The capabilities of the TPS 3500 extend well beyond those of other available instruments, covering a thermal conductivity range of 0.005 to 1800 W/m/K, handling slab samples as thin as 10 micrometres, and supporting measurements from cryogenic temperatures up to 1000°C.

It also has the unique ability to analyse the anisotropic thermal transport properties of both uniaxial and biaxial materials, using specialized Hot Strip® sensors in the latter case.

The TPS 3500 complies with ISO 22007-2, ISO 22007-7 and ASTM E3088-25 and is CE marked.

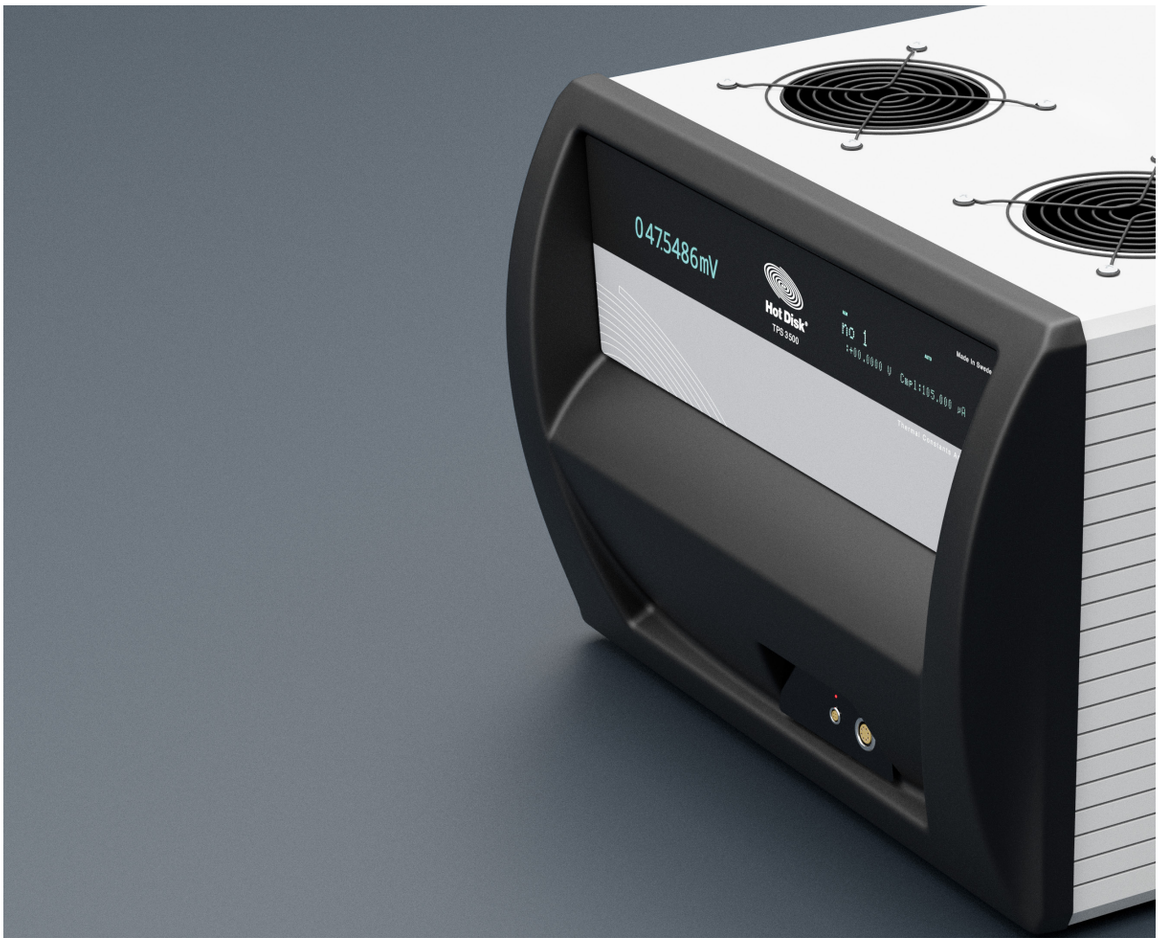




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## For testing the extreme

In addition to its advanced capabilities for small and highly conductive samples, the TPS 3500 is a versatile, general-purpose R&D instrument for analysing the thermal transport properties of a wide range of solids and liquids, including bulks, pellets, grains, powders, pastes, gels, foams, oils, insulation materials and textiles. Its extended measurement capabilities make it particularly suited to applications involving extremely thin samples and complex anisotropic materials. The instrument can measure slab samples as thin as 10 micrometres, enabling thermal characterization of materials and structures that are beyond the practical sample-thickness range of more conventional TPS instruments.

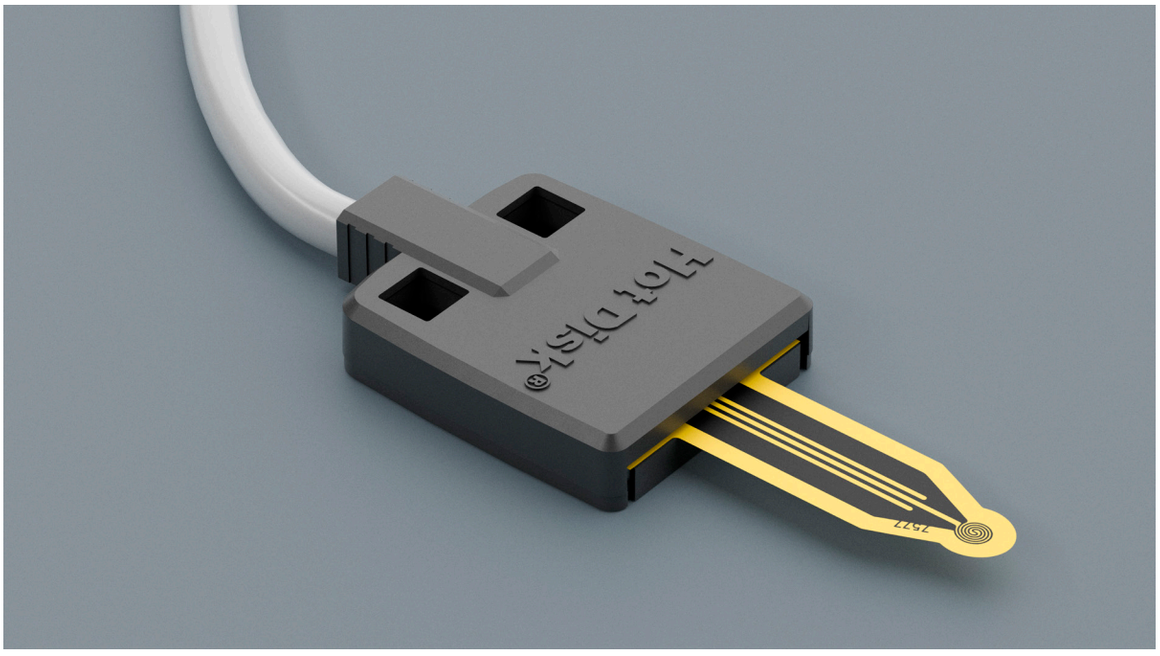



The TPS 3500 also extends anisotropic analysis beyond uniaxial materials. Using specialized Hot Strip® sensors, it can characterize biaxial materials with different thermal transport properties along three principal directions. This enables a more complete description of three-dimensional anisotropic thermal behaviour in advanced materials, layered structures and other direction-dependent systems.

Solid samples may be dense, porous or powdered; isotropic or anisotropic; conductive or insulating; transparent or opaque. Liquid samples may range from low-viscosity solvents to thick, highly viscous materials.

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A comprehensive selection of measurement modules further extends the application range of the TPS 3500. Depending on sample type, geometry and thermal properties, the instrument can be configured for isotropic materials (Isotropic module), rod-shaped specimens (One-dimensional module), thin films, coatings and adhesive layers (Thin Film module), highly conductive sheets and slabs (Slab module), extremely lightweight and highly insulating materials (Low-density/Highly-insulating module), textiles (Thermal Effusivity module), and anisotropic or layered materials (Anisotropic module). Together with the TPS 3500's capabilities for exceptionally thin samples and biaxial anisotropic analysis, these modules provide a flexible platform for both routine material characterization and demanding R&D applications across the electronics, battery, automotive, aerospace, nuclear, chemical, construction and textile industries.




All measurements are performed without the need for contact fluids, light-absorbing sample surfaces or fixed sample geometries. For high measurement accuracy, the TPS 3500 uses Hot Disk® Instruments trademarked double-spiral sensors.

The TPS 3500 complies with ISO 22007-2, ISO 22007-7 and ASTM E3088-25, providing a standardized and well-established platform for thermal transport measurements.

Each Hot Disk® TPS 3500 instrument can be configured according to specific application requirements and paired with a selection of temperature control unit (TCU) accessories.

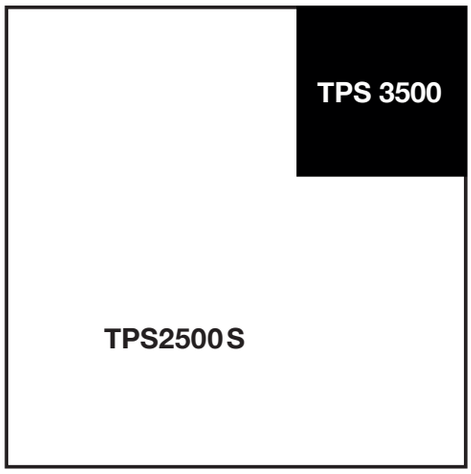
For dedicated specific heat capacity measurements, the TPS 3500 can also be used with our Hot Cell® sensors. This enables testing of samples and objects that are large compared with those typically used in conventional methods such as DSC, including complex composites and batteries.

The Hot Disk® Desktop App for the TPS 3500 instrument includes tools for automated measurements and automatic temperature control. It also supports exporting results to third-party software such as Microsoft Excel for further processing and statistical analysis. For precise and automatic temperature readings, an optional PT100 temperature sensor is available.

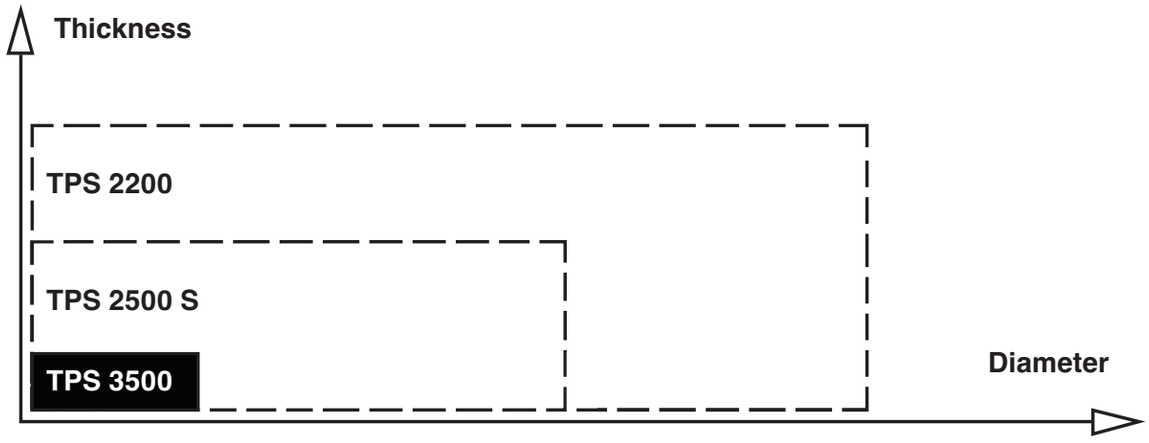

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## Relative minimum sample dimensions as determined by measurement time

**Top view of bulk or slab sample**




**Side view of bulk sample**




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# **TPS 3500** Specifications[1]

## Measurement

| | |
|---|---|
| **Sample Types** | Bulks, rods, slabs, wafers, sheets, foils, films, laminates, composites, minerals, batteries, textiles, pellets, granules, beads, grains, powders, pastes, creams, gels, liquids, foams and insulators. |
| **Evaluation** | |
| **Anisotropy** | Yes, both 2D anisotropic (uniaxial) materials and 3D anisotropic (biaxial) materials can be characterised, using optional Anisotropic Measurement Module. |
| **One-Dimensional** | Yes, axial estimations possible for a complex sample configuration. |
| **Sample Dimensions** | |
| **Smallest** | Bulk sample: 0.5 mm thick x 2 mm wide (circle or square). |
| | Rod sample: 5 mm long x 2.5 mm wide (circle or square). |
| | Slab sample: 42 µm thick x 8 mm wide (circle or square). |
| | Thin film sample: 10 µm thick x 22 mm wide (circle or square). |
| **Largest** | Bulk sample: unlimited. |
| | Rod sample: unlimited length x 60 mm wide (circle or square). |
| | Slab sample: 20 mm thick x unlimited wide (circle or square). |
| | Thin Film sample: 500 µm thick x unlimited wide (circle or square). |
| **Sample Temperature Range** | -253°C (20 K) to 1000°C. |
| **Core Instrument** | RT. |
| **With Optional TCU** | -253°C (20 K) to 1000°C. |
| | Low-to-High Temperature Chamber: -60°C to 300°C |
| | Bath Circulator: -40°C to 200°C. |
| | Convection Oven: RT to 600°C. |
| | Muffle Furnace: RT to 800°C. |
| | Tubular Furnace: RT to 1000°C (gas purging for >400°C, and inert gas flow for >800°C is recommended). |


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| | |
|---|---|
| **Measurement Time**[2] | 0.1 to 2560 seconds (depending on sample material and sensor dimensions). |
| **Measurement Range** | |
| **Thermal Conductivity** | Bulk sample: 0.005 to 500 W/m/K. |
| | Rod sample: 1 to 1800 W/m/K. |
| | Slab sample: 5 to 1800 W/m/K. |
| | Thin Film sample: 0.01 to 5 W/m/K. |
| **Thermal Diffusivity** | Bulk sample: 0.01 to 400 $mm^2/s$. |
| | Rod sample: 1 to 1400 $mm^2/s$. |
| | Slab sample: 5 to 1400 $mm^2/s$. |
| | Thin Film sample: 0.02 to 2 $mm^2/s$. |
| **Thermal Effusivity** | 20 to 55000 $W\sqrt{s}/m^2/K$. |
| **Specific Heat Capacity** | Up to 5 $MJ/m^3/K$. |
| **Measurement Accuracy** | |
| **Thermal Conductivity** | Better than 5%. |
| **Thermal Diffusivity** | Better than 10%. |
| **Measurement Reproducibility**[3] | |
| **Thermal Conductivity** | Typically better than 2%. |
| **Thermal Diffusivity** | Typically better than 5%. |
| **Measurement Repeatability**[4] | |
| **Thermal Conductivity** | Typically 0.11% (Stainless Steel bulk sample, Kapton-insulated Hot Disk® sensor model 5501, and 22°C sample temperature) |
| **Thermal Diffusivity** | Typically 0.44% (Stainless Steel bulk sample, Kapton-insulated Hot Disk® sensor model 5501, and 22°C sample temperature). |
| **Measurement Sensitivity**[5] | |
| **Temperature** | Typically 43 µK (Stainless Steel sample, Kapton-insulated Hot Disk® sensor model 5501, and 22°C sample temperature). |

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# General

| | |
|---|---|
| **Meets ISO Standard 22007-2** | Yes. |
| **Meets ISO Standard 22007-7** | Yes. |
| **Meets ASTM Standard E3088-25** | Yes. |
| **Measurement Modules** | |
| **Included** | Isotropic, Single-Sided Testing, One-Dimensional, Thermal Effusivity, Structural Probe, and Automation. |
| **Optional** | Anisotropic, Slab, Thin Film, Low-Density/Highly Insulating, and Specific Heat Capacity. |
| **Sensor Models** | |
| **Hot Disk® sensor – Kapton-insulated** | All models. |
| **Hot Disk® sensor – Teflon-insulated** | All models. |
| **Hot Disk® sensor – Mica-insulated** | All models. |
| **Hot Strip® sensor – Kapton-insulated** | All models. |
| **Hot Cell® sensor – Cell size <250 mm** | All models. |
| **Hot Cell® sensor – Cell size >250 mm** | Please inquire. |
| **Instrument Environment** | |
| **Operating** | 15°C to 30°C. |
| **Storage** | -20°C to 45°C. |
| **Instrument Line Power** | |
| **Supply Voltage** | 100 – 240 VAC, 50 – 60 Hz. |
| **Power Consumption** | 70 W typical, 305 W maximum. |
| **Instrument Warm-Up** | 2 hours to rated measurement performance. |
| **Instrument Input and Output** | |
| **Rear Panel** | USB type B connector (female) for connectivity. |
| **Front Panel** | LEMO 8 pin connector (female) for Hot Disk®, Hot Strip® or Hot Cell® sensor. |
| | LEMO 4 pin connector (female) for optional PT100 temperature sensor. |


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| | |
|---|---|
| **Instrument Dimensions** | 325 mm high x 455 mm wide x 615 mm deep. |
| **Instrument Weight** | 29 kg. |
| **Instrument CE Marking** | Yes. |

Notes:

1. Hot Disk® Instruments reserves the right to make changes without prior notice, whether due to misprints, improved hardware, or extended software capabilities.
2. Time of transient temperature reading. An additional temperature settling time that depends on the sample material and TCU (if applied) is required to ensure isothermal condition before the reading.
3. Comparing measurements performed by different instrument set-ups.
4. Variation in consecutive measurements performed by a single instrument set-up. Note that this value depends on sample material, sensor model, and sample temperature.
5. Standard deviation in fitting $\Delta T(\tau)$-function to the transient temperature reading. Note that this value depends on sample material, sensor model, sample temperature, and can vary considerably.

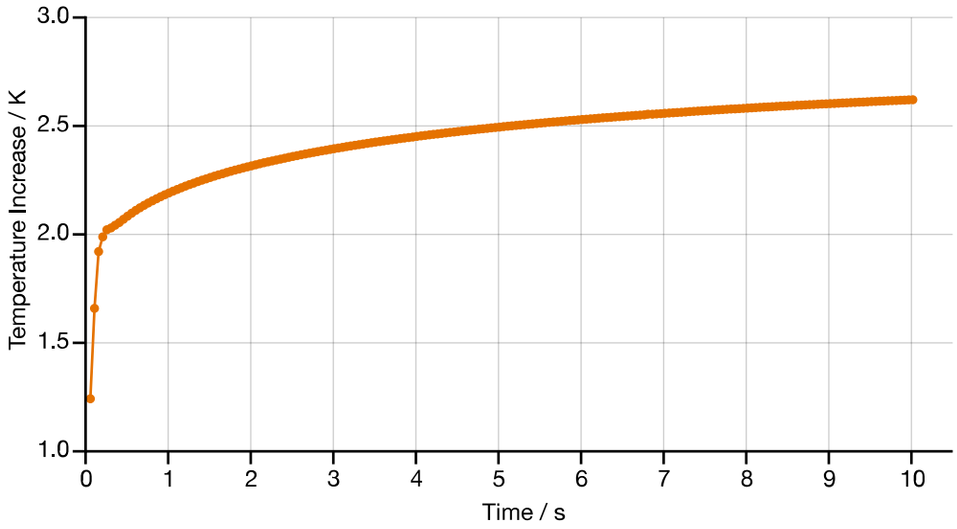
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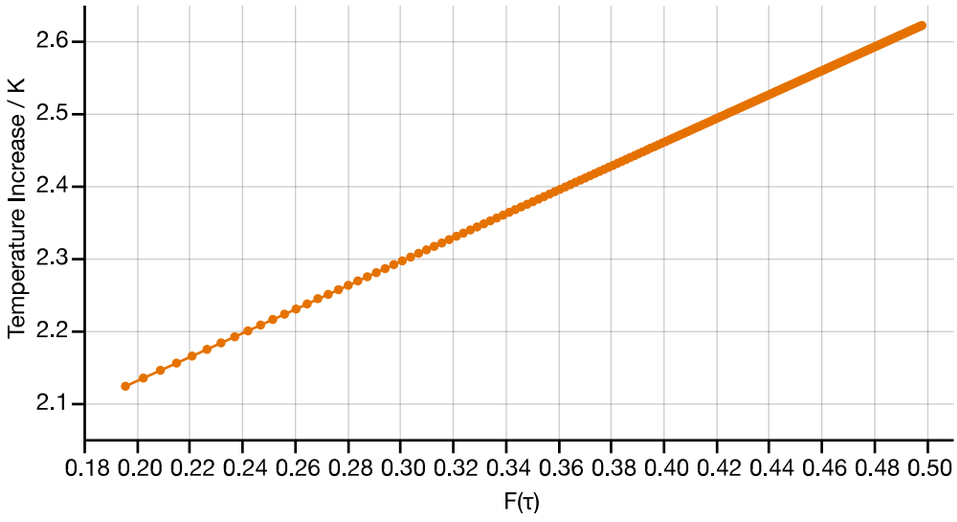
# **TPS 3500** Measurement Demonstration

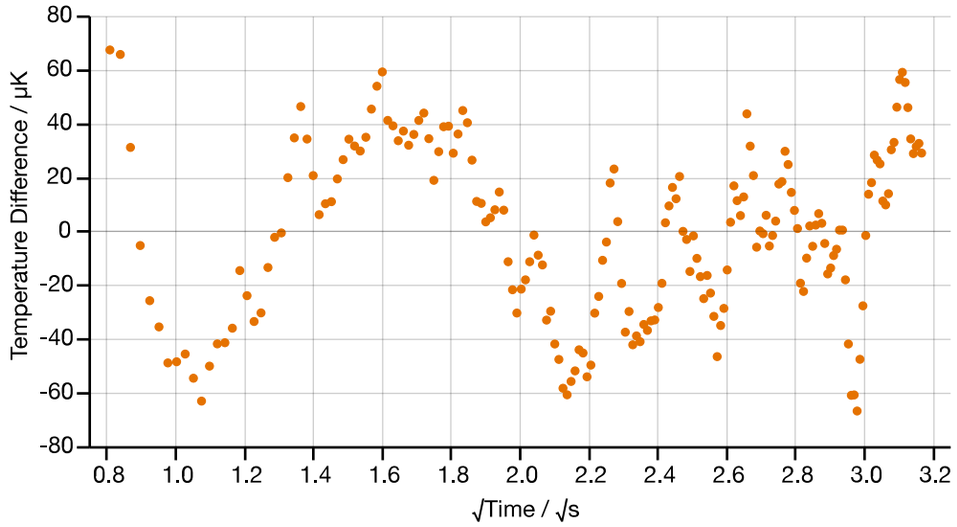
## Stainless Steel

| | |
|---|---|
| **Sample** | |
| **Material** | Stainless Steel, AISI 316/316L. |
| **Type** | Bulk. |
| **Temperature** | 21°C |
| **Measurement Parameters** | |
| **Measurement Module** | Isotropic. |
| **Sensor Model** | Kapton-insulated Hot Disk® sensor 5501 (radius 6.4 mm). |
| **Measurement Time** | 10 s. |
| **Heating Power** | 800 mW. |
| **Measurement Results** | |
| **Data Points** | 13-200. |
| **Thermal Conductivity** | 13.67 W/m/K. |
| **Thermal Diffusivity** | 3.647 $mm^2/s$. |
| **Specific Heat Capacity** | 3.748 $MJ/m^3/K$. |
| **Probing Depth** | 12.1 mm. |
| **Temperature Increase** | 0.5098 K. |
| **Standard Deviation in Fitting $\Delta T(\tau)$** | 31 µK. |


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# Included with the TPS 3500 Instrument

**Basic Option**

- 6 x Measurement Modules: Isotropic, Single-Sided Testing, One-Dimensional, Thermal Effusivity, Structural Probe, and Automation.
- 1 x Kapton-insulated Hot Disk® or Hot Strip® sensor: Model free of choice, with cable.

**Regular Complete Option:**

- 10 x Measurement Modules: Isotropic, Single-Sided Testing, Anisotropic, Slab, Thin Film, One-Dimensional, Thermal Effusivity, Specific Heat Capacity, Structural Probe, and Automation.
- 10 x Kapton-insulated Hot Disk® or Hot Strip® sensors: Models free of choice, with cable.

**Extended Complete Option:**

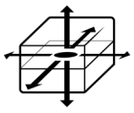
- 11 x Measurement Modules: Isotropic, Anisotropic, Slab, Thin Film, Low-Density/Highly Insulating, Single-Sided Testing, One-Dimensional, Thermal Effusivity, Specific Heat Capacity, Structural Probe, and Automation.
- 10 x Kapton-insulated Hot Disk® or Hot Strip® sensors: Models free of choice, with cable.

**Always included:**

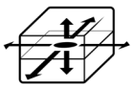
- Hot Disk® Desktop App software (latest version)
- 1 x Stainless Steel verification bulk sample.
- 1 x Single-sided background insulation (single-sided testing).
- 1 x Room temperature sample holder (protective hood included).
- Instructions manual.
- Instrument test protocol.
- Power supply cord and USB cable.


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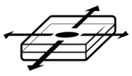
# Available measurement modules for the TPS 3500



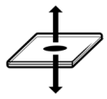
**Isotropic (Standard)**



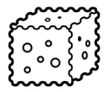
**Anisotropic**



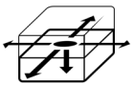
**Slab**



**Thin Film**



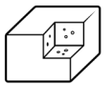
**Low-Density / Highly-Insulating**



**Single-Sided Testing**



**One-Dimensional**



**Structural Probe**



**Automation**



**Specific Heat Capacity**



**Thermal Effusivity**

# Available sensors for the TPS 3500



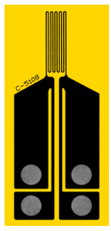
Kapton-insulated
**Hot Disk® sensor**
All models.



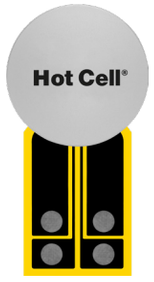
Teflon-insulated
**Hot Disk® sensor**
All models.



Mica-insulated
**Hot Disk® sensor**
All models.



Kapton-insulated
**Hot Strip® sensor**
All models.
(Works only with the One-Dimensional Measurement Module.)




Aluminium & Gold
**Hot Cell® sensor**
All models.

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# **Hot Disk® Instruments**
# Instrument Portfolio

A wide range of Hot Disk® instrument models is available for measuring thermal conductivity, thermal diffusivity, thermal effusivity and specific heat capacity in accordance with ISO 22007-2, ISO 22007-7 and ASTM E3088-25.

Our instruments offer broad measurement capabilities, while the top-of-the-line models extend the range even further. Their ability to capture ultra-short transient temperature responses enables measurements on sub-millimetre-thick samples and highly thermally conductive materials, with selected configurations covering thermal conductivity values beyond 1800 W/m/K.

Another key advantage of Hot Disk® instrumentation is that no external calibration is required. This eliminates the need to return instruments for routine recalibration, helping to reduce downtime and simplify long-term operation.

Each Hot Disk® instrument is equipped with two LEMO connector ports: one for the applicable Hot Disk®, Hot Strip® or Hot Cell® sensor, and one for the optional PT100 ambient temperature sensor.




**TPS 3500**
For testing the extreme.




**TPS 2500 S**
The benchmark instrument.




**TPS 2200**
For day-to-day testing.




**TPS 1500**
For heavy-duty testing.


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**TPS 500 S**
For the small-scale lab.



**TPS 500**
For the economical lab.



**M1**
Portable and educational.




**TPS 1000**
For cost-effective quality assurance.

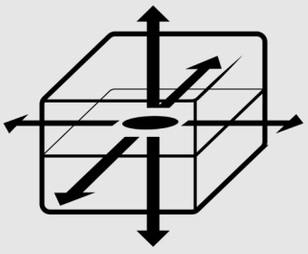
Notes

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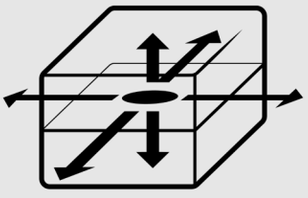
# **Hot Disk® Instruments**
## Measurement Modules

Our instruments can be configured to meet specific testing requirements through both sensor selection and a broad range of measurement modules. These modules extend the instrument's capabilities to accommodate different sample geometries, thermal conductivity ranges and material types.

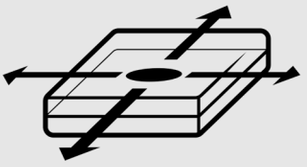
The Isotropic module is the standard module for bulk sample measurements and is included with all instruments. Additional modules further expand the application range, enabling measurements on, for example, anisotropic materials, slabs and thin films.



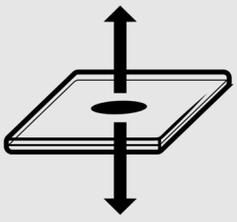
**Isotropic (Standard)**
All-round testing of bulk samples.



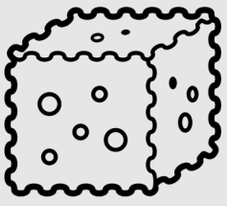
**Anisotropic**
Testing samples with direction dependent properties.



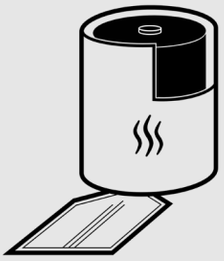
**Slab**
Testing highly thermal conductive slab or sheet samples.



**Thin Film**
Testing thermal insulating thin film samples.



**Low-Density / Highly-Insulating**
Testing the lightest and most insulating samples.

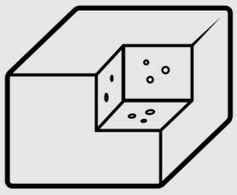


**Specific Heat Capacity**
Testing Cp of complex samples and batteries.

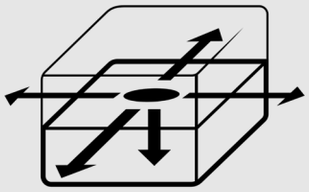

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**One-Dimensional**
Testing rod-like samples.



**Structural Probe**
Identify defects and structural changes inside samples and components.



**Single-Sided Testing**
Rapid production line QC testing.



**Thermal Effusivity**
Testing textiles and fabrics.



**Automation**
Remote-controlled testing.

Notes

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# **Hot Disk® Instruments**
## Sensors

We offer three sensor types for use with our instruments and Measurement modules. All use a TPS element – a patterned nickel foil with electrically insulating cladding – for simultaneous transient heating and precise temperature measurement.

The patented Hot Disk® sensor is our standard sensor for measuring Thermal Conductivity and Thermal Diffusivity in isotropic and 2D anisotropic samples, such as uniaxial crystals and layered composites.

The patented Hot Strip® sensor complements the Hot Disk® sensor for 3D anisotropic samples, including biaxial crystals and fiber composites with direction-dependent properties.

The Hot Cell® sensor, developed in-house, measures Specific Heat Capacity in materials and components of virtually any type, shape, or size, with a particular focus on batteries.



Kapton-insulated
**Hot Disk® sensor**



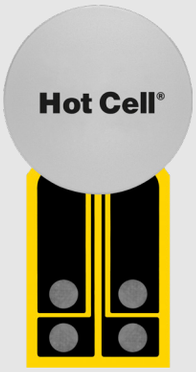
Teflon-insulated
**Hot Disk® sensor**



Mica-insulated
**Hot Disk® sensor**



Kapton-insulated
**Hot Strip® sensor**




Aluminium & Gold
**Hot Cell® sensor**


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Notes

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