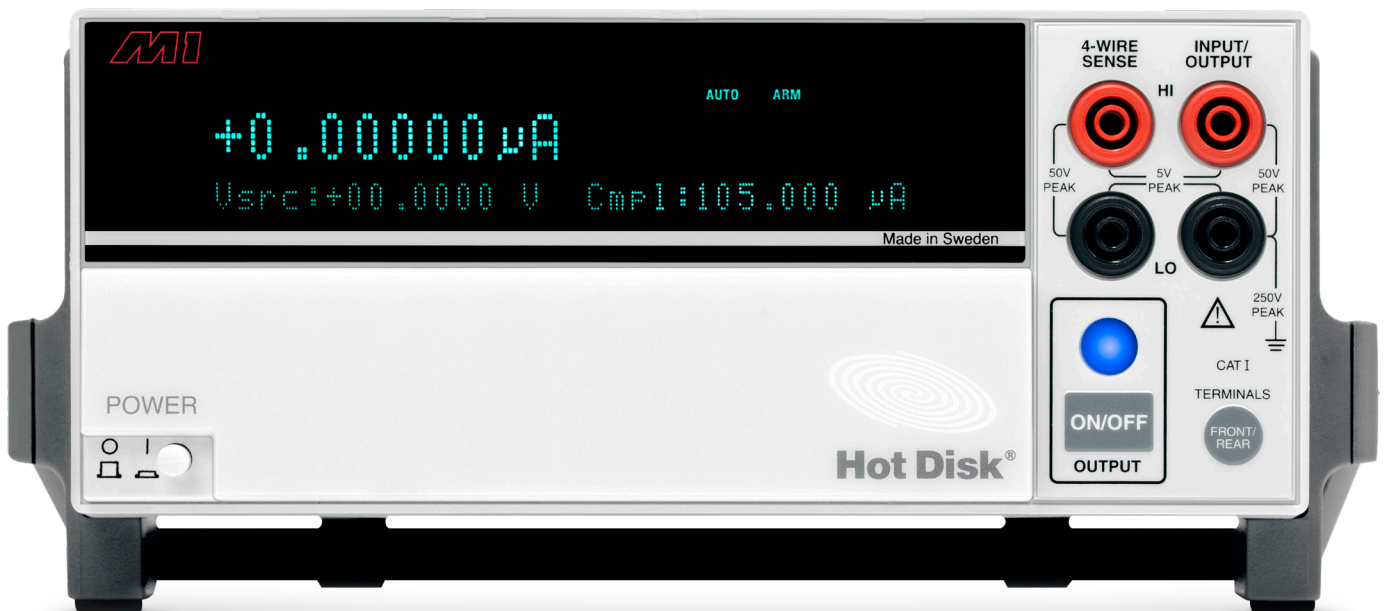


Hot Disk[®] Thermal Constants Analyser



M1



Hot Disk[®] Instrument M1

The Hot Disk[®] M1 is a basic thermal conductivity meter which nevertheless offers high accuracy and measurement repeatability. With the M1, solids, powders and pastes in the Thermal Conductivity range of 0.03 to 40 W/m/K are readily tested. Sample sizes down to a thickness of one centimeter can be handled, and the temperature range is 10°C to 40°C. The M1 is partly based on ISO 22007-2 and is CE marked.

Portable and educational

The Hot Disk[®] M1 can test thermal conductivity and diffusivity of modestly sized isotropic samples, with a minimum diameter (or square) of 40 mm and a thickness of at least 10 + 10 mm. Larger samples are easily tackled without any further preparations than one plane surface on each of the two sample specimens, to sandwich the sensor between. It is also possible to test single sample pieces using an insulating sensor support.

The Hot Disk[®] M1 is controlled from the same powerful Windows based software used for Hot Disk's more advanced instruments. This gives access to in-depth data analysis not commonly seen for instruments in this class. Optionally, the Hot Disk[®] M1 can be operated via a wireless connection through a RS-232 to WiFi adapter, allowing maximum portability. The M1 constitutes a complete package with the core M1 unit, a Hot Disk[®] Kapton sensor (#8563, radius 9.9 mm), sample holder, verification samples of stainless steel and Windows software. Additional WiFi accessory is now available upon request.

The simplicity of the M1 device and the quick-start guide makes it possible to begin measurements within minutes. To further add to its flexibility, the compact design of the M1 instrument makes it easy to move between measurement stations or other locations of interest.



M1 Specifications¹

Measurement

Sample Types	Bulks, fine granules, powders, pastes, creams, gels, and foams.
Evaluation	
Anisotropy	No.
One-Dimensional	No.
Sample Dimensions	
Smallest	10 mm thick x 40 mm wide (circle or square).
Largest	Unlimited.
Sample Temperature Range	10°C to 40°C.
Core Instrument	RT.
Measurement Time ²	2.5 to 160 seconds (depending on sample material).
Measurement Range	
Thermal Conductivity	0.03 to 40 W/m/K.
Thermal Diffusivity	0.1 to 20 mm ² /s.
Thermal Effusivity	40 to 12500 W√s/m ² /K.
Specific Heat Capacity	0.1 to 4.5 MJ/m ³ /K.
Measurement Accuracy	
Thermal Conductivity	Better than 5%.
Thermal Diffusivity	Better than 10%.
Measurement Reproducibility ³	
Thermal Conductivity	Typically better than 3%.
Thermal Diffusivity	Typically better than 10%.
Measurement Repeatability ⁴	
Thermal Conductivity	Typically 0.038% (Stainless Steel bulk sample and 22°C sample temperature).
Thermal Diffusivity	Typically 0.21% (Stainless Steel bulk sample and 22°C sample temperature).
Measurement Sensitivity ⁵	
Temperature	Typically 31 μK (Stainless Steel sample and 22°C sample temperature).

General

Meets ISO Standard 22007-2	Partly.
Measurement Modules	
Included	Isotropic and Single-Sided Testing.
Optional	Automation.
Sensor Models	
Hot Disk® sensor – Kapton-insulated	Models 8563.
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	18 W typical, 190 W maximum.
Instrument Warm-Up	2 hours to rated measurement performance.
Instrument Input and Output	
Rear Panel	RS232 connector (female) for connectivity or optional WiFi adaptor.
Front Panel	LEMO 8 pin connector (female) for Hot Disk® sensor
Instrument Dimensions	105 mm high x 240 mm wide x 380 mm deep.
Instrument Weight	3.4 kg.
Instrument CE Marking	Yes.

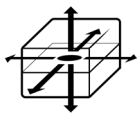
Notes

1. Hot Disk AB 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 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, sample temperature, and can vary considerably.

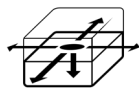
Included with the M1 instrument

- 2 x Measurement Modules: Isotropic and Single-Sided Testing.
- 1 x Kapton-insulated Hot Disk® sensor: Model 8563, with cable.
- 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 platform.
- Instructions manual.
- Instrument test protocol.
- Power supply cord and RS-232 to USB cable (RS-232 to WiFi adaptor optional).

Available measurement modules for the M1



**Isotropic
(Standard)**



**Single-Sided
Testing**



Automation

Available sensors for the M1

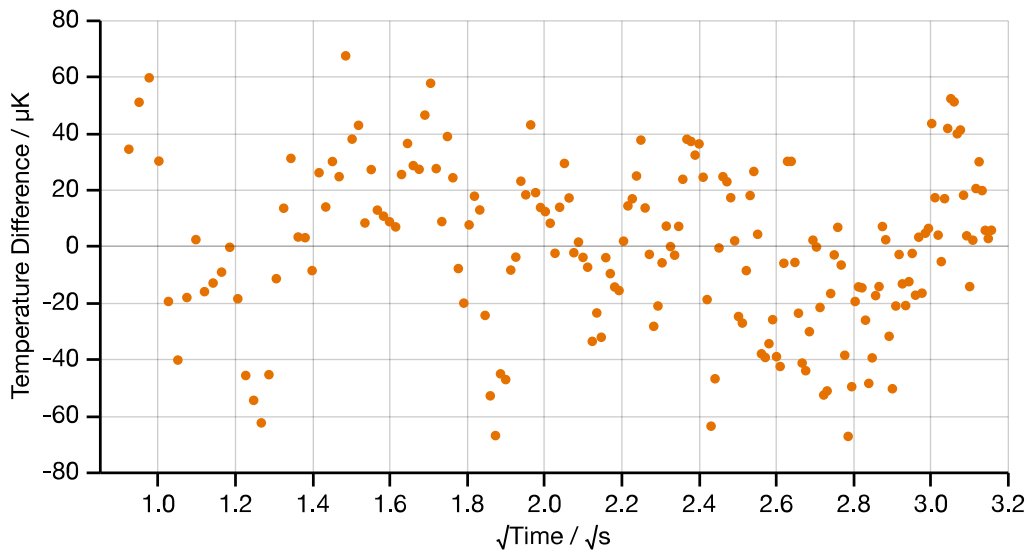
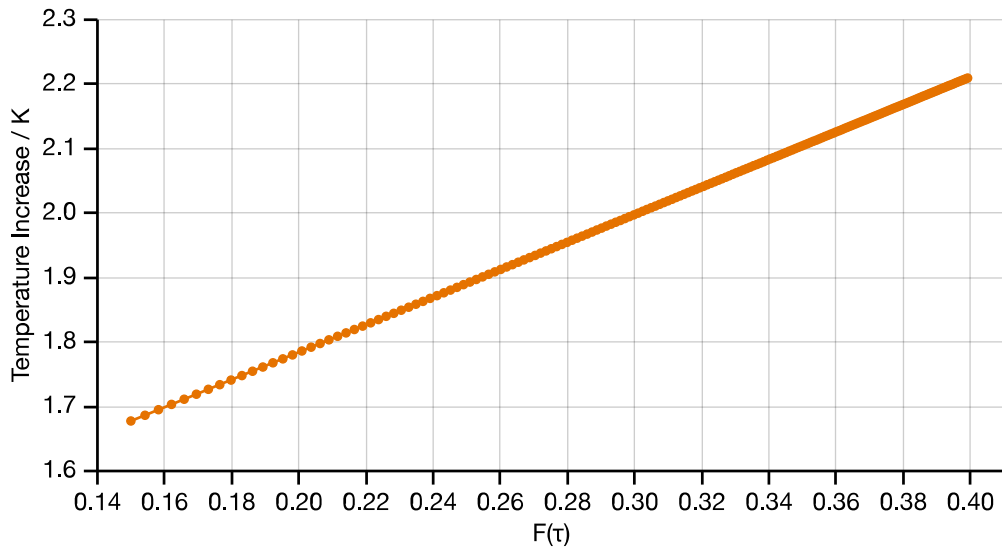
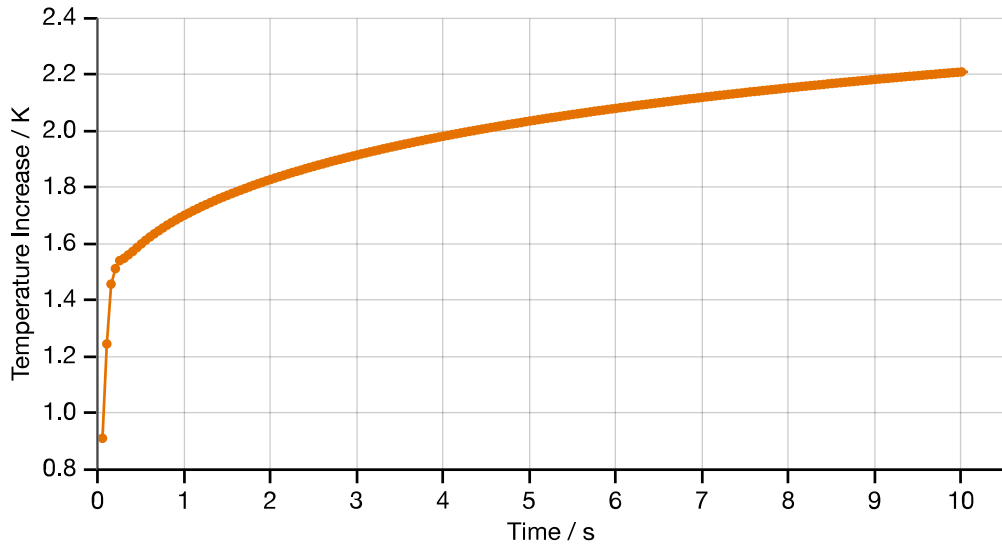


Kapton-insulated
Hot Disk® sensor
Models 8536.

M1 Measurement Demonstration

Stainless Steel

Sample	
Material	Stainless Steel, AISI 316/316L.
Type	Bulk.
Temperature	22°C
Measurement Parameters	
Measurement Module	Isotropic.
Sensor Model	Kapton-insulated Hot Disk® sensor 5501 (radius 9.9 mm).
Measurement Time	10 s.
Heating Power	1.6 mW.
Measurement Results	
Data Points	17-199.
Thermal Conductivity	13.59 W/m/K.
Thermal Diffusivity	3.586 mm ² /s.
Specific Heat Capacity	3.790 MJ/m ³ /K.
Probing Depth	11.9 mm.
Temperature Increase	0.5414 K.
Standard Deviation in Fitting $\Delta T(\tau)$	28 μ K.



Hot Disk®

Instrument Portfolio

A wide range of Hot Disk® instrument models is available for testing and measuring Thermal Conductivity, Thermal Diffusivity, Thermal Effusivity and Specific Heat Capacity following ISO 22007-2. While typically generous of measurement spectrum, our top-of-the-line instruments are unique in monitoring ultra-short transient temperature readings, thereby tackling sub-millimeter-thick samples and highly-thermal conducting materials, beyond 1800 W/m/K. A further unique feature of our instrumentation is that it requires no external calibration. Our clients can confidently continue its employ, without worrying over the inconvenience of being obliged to return their instruments for re-calibration at regular intervals. Each Hot Disk® instrument includes two LEMO connector ports: one for the relevant Hot Disk® sensor, and one for the optional PT100 ambient temperature sensor. Please consult our interactive links below, to help determine which Hot Disk® instrument is best suited to your intended applications and needs.



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.



TPS 500S
For the small-scale lab.



TPS 500
For the economical lab.



M1
Portable and educational.



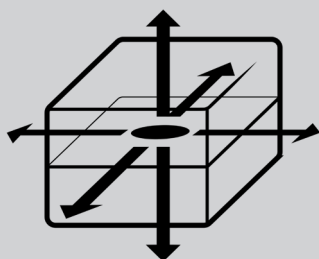
TPS 1000
For cost-effective quality assurance.

Notes

Hot Disk®

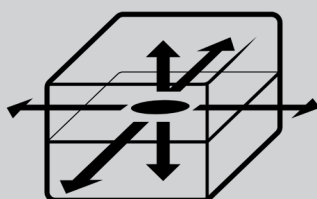
Measurement Modules

Hot Disk® instruments can be tailored to specific testing needs not only by the selection of sensors, but also by the wide range of measurement modules available. These modules allow for the testing of samples of special geometries, thermal conductivity ranges and material types. The Isotropic Module is the standard module for measuring bulk samples, and is included in all instruments. The add-on modules in turn extend the capabilities of your instrument, for example to tackle anisotropic-, slab-, or thin film samples. Based on long client experience, Hot Disk conveniently offers its clients clustered configurations along with many instrument models, via grouping several modules of related interest together, or by providing for the full available range. In effect, this means Hot Disk customers have the option of ordering several add-on modules at a quantity discount. Please contact your local Hot Disk sales representative for available cluster options.



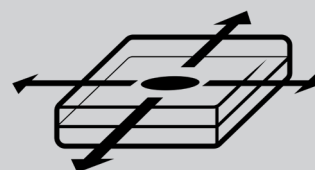
Isotropic (Standard)

All-round testing of bulk samples.



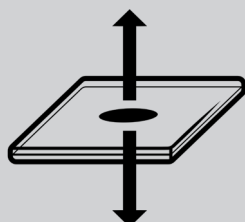
Anisotropic

Testing samples with direction dependent properties.



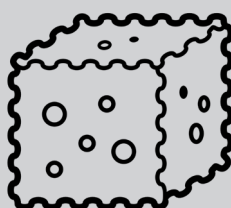
Slab

Testing highly thermal conductive slab or sheet samples.



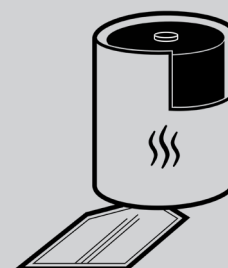
Thin Film

Testing thermal insulating thin film samples.



Low-Density / Highly-Insulating

Testing the lightest and most insulating samples.

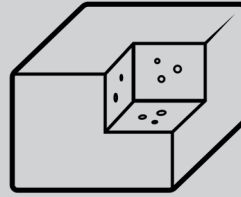


Specific Heat Capacity

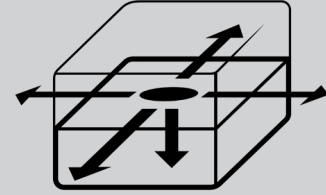
Testing Cp of complex samples and batteries.



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.



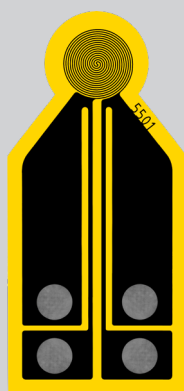
Automation
Remote-controlled testing.

Notes

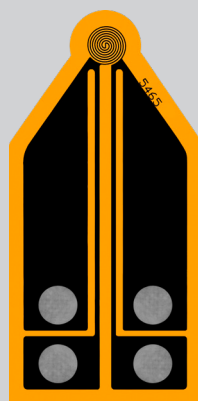
Hot Disk[®] Sensors

We currently supply three different types of sensors to be used with our Hot Disk[®] instruments – configured in tandem with our range of Measurement Modules. All three sensor types make use of a TPS element – a patterned Nickel foil with electrically insulating cladding – that is used for simultaneous transient heating and precise temperature reading.

Our patented Hot Disk[®] sensor is our baseline sensor for measuring Thermal Conductivity and Thermal Diffusivity of isotropic samples. It is also used for testing 2D anisotropic samples, e.g. uniaxial crystals and layered composites with different properties in the in- and through-plane directions. Our patented Hot Strip[®] sensor is used as complement to our Hot Disk[®] sensor, primarily for testing 3D anisotropic samples, e.g. biaxial crystals and fiber composites with different properties along, across, and through the fiber orientation direction. Our Hot Cell[®] sensor is our newest type addition, developed in-house to measure the Specific Heat Capacity of materials or components (with focus on batteries) of arbitrary type, shape, and size.



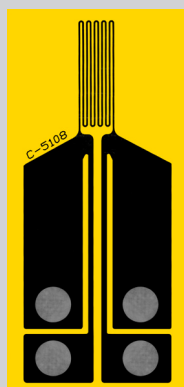
Kapton-insulated
Hot Disk[®] sensor



Teflon-insulated
Hot Disk[®] sensors



Mica-insulated
Hot Disk[®] sensors



Kapton-insulated
Hot Strip[®] sensor



Aluminium & Gold
Hot Cell[®] sensors



Notes

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