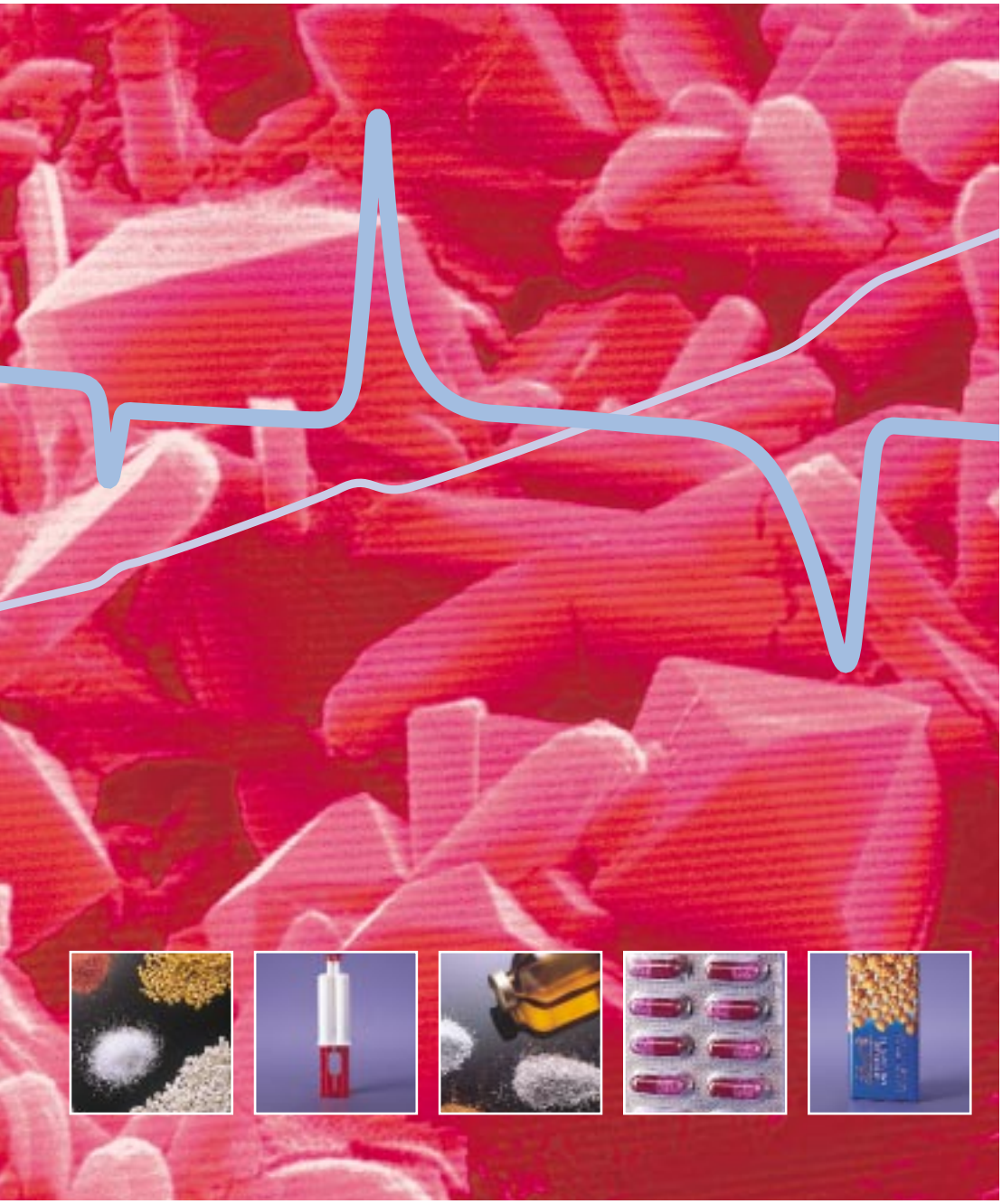
Differential scanning calorimetry for all requirements.



DSC822^{e} Module

METTLER TOLEDO

METTLER TOLEDO
DSC822^{e} Measuring module

Outstanding performance, simple and easy to operate.

Differential scanning calorimetry is a measurement technique which can provide answers to many questions. It is used in the plastics and adhesive industries, in safety technology, as well as in the chemical and pharmaceutical industries. Also provides valuable results in the electronics, automotive, aircraft and food industries.

- Large measurement range (±350 mW at RT)
- High resolution (0.04 µW at RT)
- Temperature range (–150 °C to max. 700 °C)
- High temperature accuracy (±0.2 °C)
- Excellent peak recognition thanks to low signal time constant (2.3 s)
- Suitable for small and large sample volumes
- Future-oriented owing to modular construction
- Automatable with sample robot (34 samples)

Thanks to the modular construction, the DSC822^{e} is suitable for manual or automatic operation, from quality assurance and production through to research and development.

FRS5 ceramic sensor with 56-fold AuAuPd termopile

Measurement principle

A highly sensitive ceramic sensor is used to measure the difference between the heat flows to the sample and reference crucibles based on the Boersma principle.

Excellent measurement performance and high signal resolution

In combination with the DSC sensor, the furnace with its optimized construction makes outstanding measurement performances possible. The small size of the furnace also assures a low furnace time constant. This allows complex temperature programs to be run (alternating DSC technique). Without range switching of the amplifier, 16 000 000 points are always available. With a measurement range of ±350 mV, this means a resolution of 0.04 µW.

High temperature accuracy

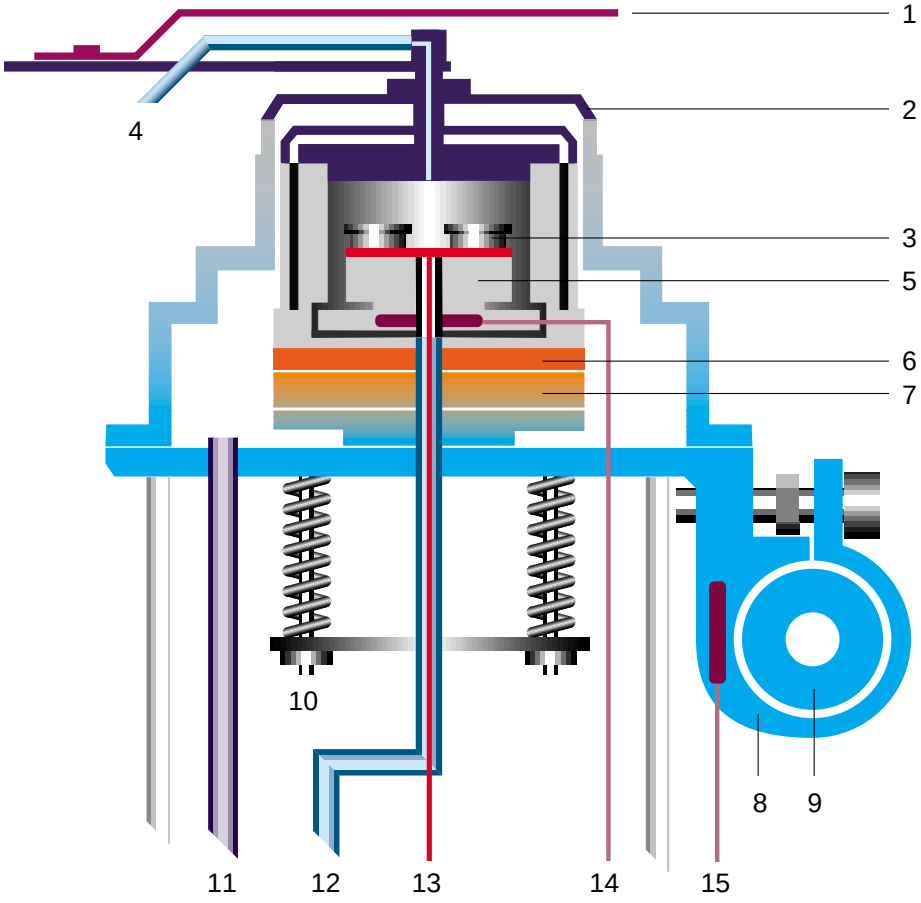
The DSC sensor records the melting temperatures of pure metals very accurately. Together with the furnace temperature sensor, the temperatures can be calibrated exactly. Even with different rates heating, the onset and peak temperatures are practically identical as in reality.

Unique heat flow sensor

The extremely rugged and corrosion resistant ceramic heat flow sensor can easily be changed should the need arise. With the low signal constant of less than 3 seconds, informative peak separation has now really become possible. Thanks to the exchangeability of the sensor, you can also profit from new developments or improvements in the future. And you also save money should the sample once decompose explosively and damage the sensor: There is no need to replace the entire furnace, only the sensor.

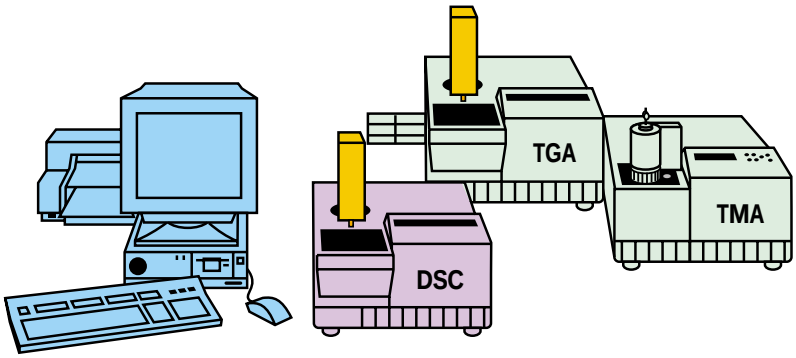
Automatic sample chamber opening

An automatic device allows the sample chamber to be opened and closed at a keystroke. The three lids ensure that the surroundings have no influence on the measurement. The results are thus highly reproducible and operation is very much simpler and quicker.



1 Heat shield
2 Automatic furnace lid
3 Crucible on DSC sensor
4 Purge gas outlet with connection for pump
5 Silver furnace
6 Flat heater between two insulating disks
7 Thermal resistance for cooler
8 Cooling flange
9 Cold finger
10 Compression spring construction
11 Dry gas inlet
12 Purge gas inlet
13 DSC raw signal for amplifier
14 Pt100 of furnace
15 Pt100 of cooling flange

Flexible solutions meeting individual demands.



Future-proof investment

You start with the instrument configuration which covers your immediate needs. Expansion with an option or other accessories, for instance for automation or a larger temperature range at a later date couldn't be simpler.

Control of external devices

External devices are simply attached to the measuring cells. With the appropriate peripheral control card, their startup and shutdown (e.g. nitrogen cooling) can be controlled by the program.

Computer control

The entire measurement sequence can be developed on a computer with a few commands and extensions and modifications can easily be entered. At the same time, the program checks the entries for correctness. All generated data are automatically stored in a database and are always available for documentation purposes even years later. A large number of software options will facilitate your work or even handle a large part of it for you.

On the level of maximum automation, sample feed, measurement, evaluation and result assessment up to the printout are automatically performed by the system. As the system can be used in 24-hour operation, for you this means greater efficiency and reproducible results; you have more time for careful interpretation of the measurement.

Programmable gas switching

The automatic operation can be supported by the gas controller. The TSO800GC Gas Controller measures and monitors the gas flow electronically. Deviations are recorded and shown on the experimental curve. Traceability of events occurring during the measurement in compliance with GLP is thus possible at all times.

Local module control

If the measuring module is not in the immediate vicinity of the PC, you can use the module keys and the display to implement individual routines and information inquiries directly.

The right accessory for every type of measurement.

Automatic and efficient

Up to 34 samples can be automatically processed with the TSO801RO Sample Robot. A different method or a different crucible can be used for each sample. A unique feature of the sample robot is its ability to open the crucible before the measurement. This excludes ambient influences on the sample during the wait time on the sample turntable.

Various cooling options

Depending on the temperature range, you can match your system exactly to your requirements. If you later need a wider temperature range, this can easily be achieved by changing the cooling option. The furnace is so constructed that the various cooling systems can be connected to the furnace by a simple flange. Air cooling, cryostat or Intra Cooler and liquid nitrogen cooling systems are available.

Save power

As your measurement system is possibly not in continuous use, for the sake of the environment you would like to switch off external devices (e.g. cryostat) after the measurement. This you can implement with a power output which can be switched on and off under control by the method. In addition to this power output, the furnace heating can be switched off. The module thus switches to a power saving condition which remains in force until a new experiment is started.

All combination possibilities at a glance

Option → required option	Power amplifier 200 W	Power amplifier 400 W	Automatic furnace lid	Local module control	Peripheral option board	Switched line socket	Air	Cryostat	Intra Cooler	Liquid nitrogen
DSC822^{e} (500 °C)	●						●	●	●	●
DSC822^{e} (700 °C)		●					●	●	●	●
Sample robot (34)			●	●						
Automatic furnace lid				●						
Gas controller				●	●					
Cryostat/Intra Cooler						●				
Liquid nitrogen cooling					●					

● Must ● Advisable ● Either/or ● Included

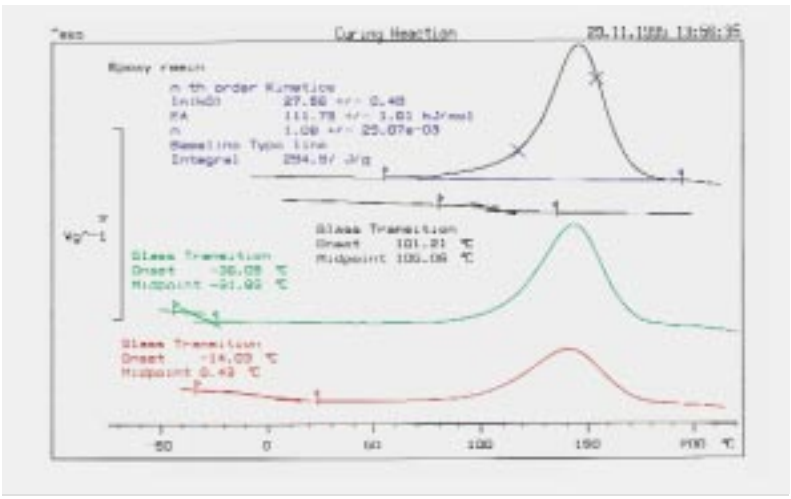
Differential scanning calorimetry for countless applications.

The differential scanning calorimetry allows a clear characterization of your product although only small sample amounts are analyzed. The results derived from the measurements range from single temperature values to the description of complex kinetic reactions.

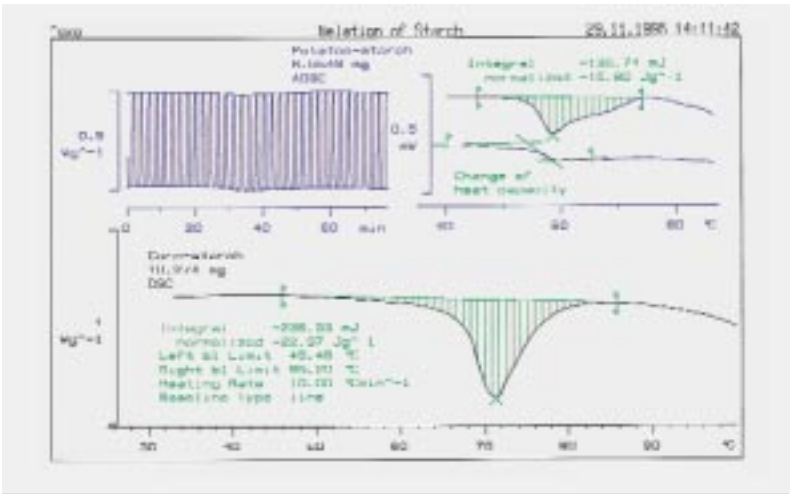
The applications are numerous, either for routine quality control measurements, where automation capability and simple operation is required, or in research where high sensitivity and flexibility are important aspects. Examples of investigations are

– Melting Behavior
– Glass Transition
– Crystallisation
– Oxidation Stability
– Kinetics
– Purity
– Specific Heat

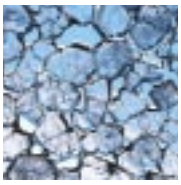
Differential scanning calorimetry is a technique which is used in most analytical labs, e.g. is located in Polymer, Pharmaceutical, Chemical or Food Industry.

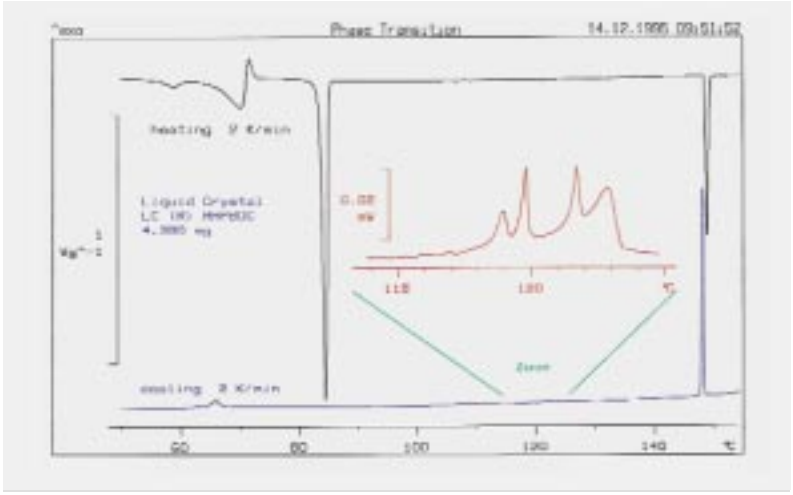


The exothermal curing reaction of an **epoxy resin** allows the determination of the kinetic parameters. They are used to predict the reaction at other curing temperatures. A second measurement of the same sample shows the glass transition temperature of the cured resin. The two curves below are obtained from partially cured resins. With increasing degree of cure the glass transition temperature increases from –32 to +105 °C. Thus, valuable information on the application of thermosets is obtained.

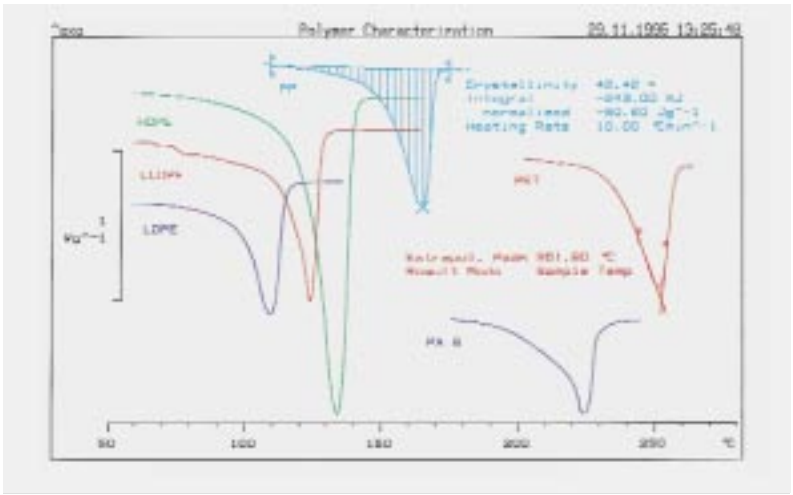


The **gelatinization of starch of different origin** in water can be characterized by DSC. Heating at a constant rate results in an endothermal peak indicating the enthalpy change and the temperature range of swelling (bottom curve).
ADSC (top left) with the separated reversing and non reversing curve (top right) gives more information: enthalpy of gelatinization on the non reversing curve, change of heat capacity on the reversing curve.





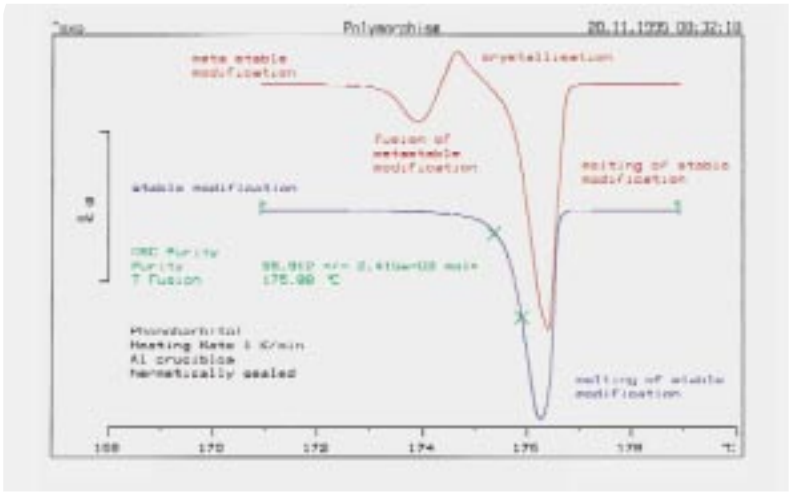
Liquid crystals are capable of forming different mesophases stable in a certain temperature range. The detection of these mesophases and their transitions requires a DSC with a very good resolution (short time constant) and an extremely small noise level. The sample has been heated to 155 °C (top curve) and cooled down subsequently (bottom curve). The mesophase transitions are clearly visible by zooming the cooling curve even though the enthalpy changes and the temperature range are quite small.



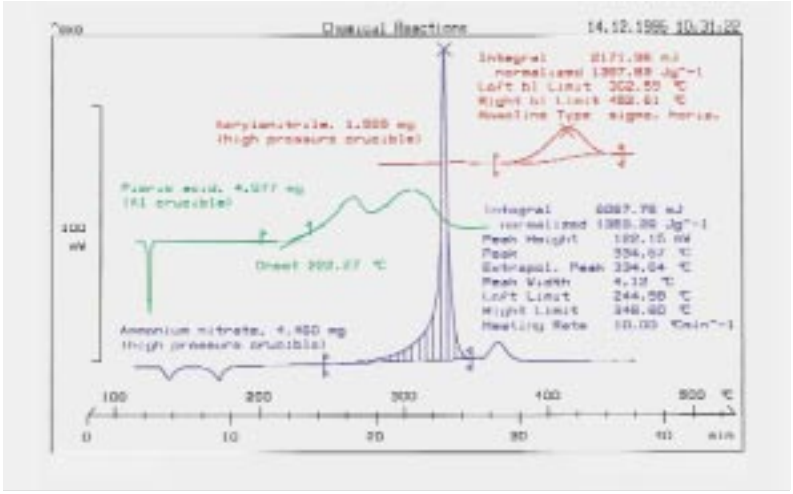
Important properties to characterize **semicrystalline polymers** are melting behavior and crystallinity. The important class of polyolefines is shown on the left.

LDPE Low density polyethylene
LLDPE Linear low density polyethylene
HDPE High density polyethylene
PP Polypropylene.

At higher temperature for example polyamide 6 and polyethylene terephthalate melt. The DSC peak temperature is called “crystalline melting point” and commonly used for qualitative analysis (identification).



In the **pharmaceutical industry** melting point determination and purity analysis are the most important applications of DSC. Some substances can exist in various crystal modifications with different melting points (polymorphism). For example the metastable phenobarbital melts at approx. 173 °C yet the melting point of the stable modification is 175.9 °C. The drug properties are much influenced by polymorphism. DSC purity analysis is performed on the melting peak of the stable modification.



When handling **chemicals** knowledge of their hazard potential is vital. This covers any exothermal reaction occurring on heating such as decomposition. DSC safety screening detects these reactions and answers questions regarding maximum power, enthalpy change and temperature range.

The shape of the reaction peak allows an insight into the reaction kinetics. Consecutive isothermal measurements provide additional information, e. g. on autocatalytical behavior.

Technical data – quality – service

DSC822[e]

Temperature data:	Temperature range:	air cooling	RT…500 °C or 700 °C:
		cryostat cooling	–50 °C…450 °C or 700 °C
		Intra Cooler	–65 °C…450 °C or 700 °C
		liquid nitrogen cooling	–150 °C…500 °C or 700 °C
	Temperature accuracy:		±0.2 °C
	Temperature reproducibility:		±0.1 °C
	Heating rate:	RT…500 °C or 700 °C	7 or 5 min
	Cooling rate:	air cooling (maximum…100 °C)	8 or 9 min
		cryostat cooling (100 °C…0 °C)	5 min
		Intra Cooler (100 °C…0 °C)	5 min
		liquid nitrogen cooling (100 °C…–100 °C)	15 min
Calorimetric data:	Sensor type:	ceramic sensor with 56-fold AuAuPd thermopile, exchangeable	
	Signal time constant:		2.3 s
	Measurement range:	100 °C	±350 mW
		300 °C	±250 mW
		700 °C	±200 mW
	Digital resolution:		16 million points
	Resolution:		0.04 µW
Sampling:	Sampling rate:		maximum 10 values/second
	Intra Cooler from LabPlant: (RP-100 MT) or Haake (EK90-MT)		
Approvals:	Electrical safety:	S+, CSA, EN61010-1, CAN/CSA-C22.2 No. 1010.1/-92	
	Electromagnetic compatibility:	EN55011 (B), FCC Part 15J, EN50082-1	
	Perturbations in power supply systems:	EN 60555-2, EN60555-3	
	Conformity mark:	CE	

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SERVICE

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Our quality products are developed, produced and tested in accordance with mandatory international standards. The affiliated companies in Greifensee, Schwerzenbach (CH) and Albstadt (D) have been awarded the ISO 9001 quality assurance certificate thus proving that their quality assurance system satisfies the highest level of requirements.

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