

# LABSYS evo

TGA  
STA  
DTA / DSC  
by Setaram



A trademark of KEP Technologies group

# LABSYS evo



LABSYS evo is a user friendly, robust and highly powerful thermal analysis platform.

## HIGHLIGHTS include:

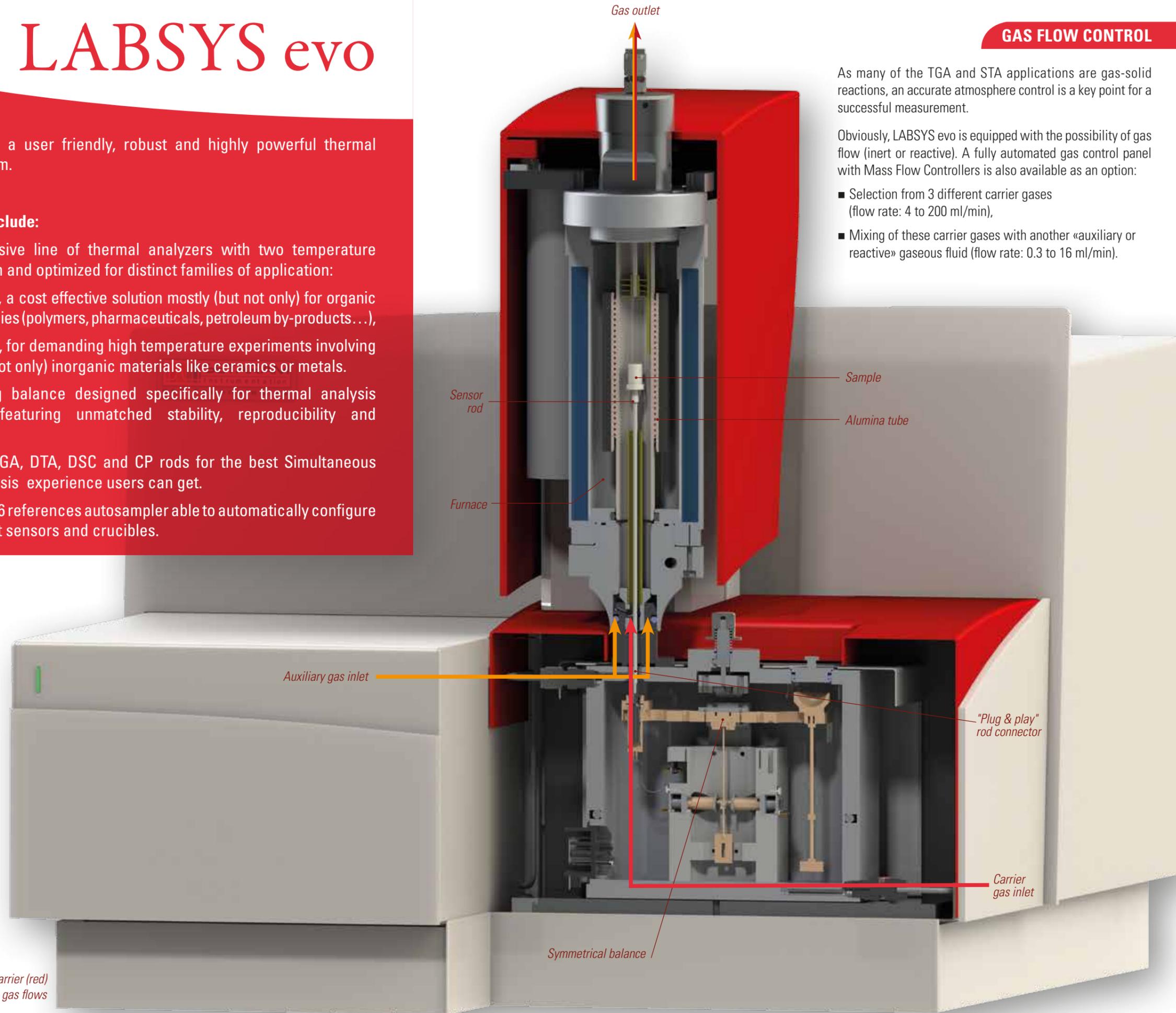
- A comprehensive line of thermal analyzers with two temperature ranges chosen and optimized for distinct families of application:
  - RT – 1 150 °C, a cost effective solution mostly (but not only) for organic materials studies (polymers, pharmaceuticals, petroleum by-products...),
  - RT – 1 600 °C, for demanding high temperature experiments involving mostly (but not only) inorganic materials like ceramics or metals.
- A top loading balance designed specifically for thermal analysis applications featuring unmatched stability, reproducibility and accuracy.
- Plug & play TGA, DTA, DSC and CP rods for the best Simultaneous Thermal Analysis experience users can get.
- A 30 samples/6 references autosampler able to automatically configure to the different sensors and crucibles.

## GAS FLOW CONTROL

As many of the TGA and STA applications are gas-solid reactions, an accurate atmosphere control is a key point for a successful measurement.

Obviously, LABSYS evo is equipped with the possibility of gas flow (inert or reactive). A fully automated gas control panel with Mass Flow Controllers is also available as an option:

- Selection from 3 different carrier gases (flow rate: 4 to 200 ml/min),
- Mixing of these carrier gases with another «auxiliary or reactive» gaseous fluid (flow rate: 0.3 to 16 ml/min).



## THERMOBALANCE & FURNACE

At the heart of the LABSYS evo is an advanced coiled metal furnace existing in two distinct temperature ranges (1 150 °C and 1 600 °C). It has been designed to provide a homogeneous temperature zone covering both the sample crucible and the measurement rod area. It is a key point for an accurate temperature determination of thermal events, and for stable DTA/DSC signals. The crossing furnace is ideally designed to be efficiently coupled to a gas analyzer.

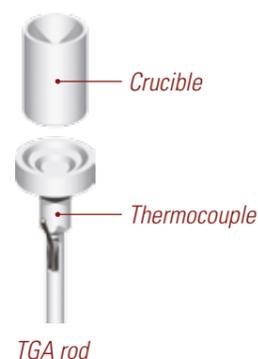
The top loading, thermostated balance of LABSYS evo was specifically designed for thermogravimetric analysis measurements and is manufactured in our workshops. It is based on the technique of a beam articulated around a torsion band, the most appropriate design for a stable and robust balance. It guarantees a reliable and sensitive measurement.

Schematic representation of the carrier (red) and auxiliary (orange) gas flows

# LABSYS EVO TGA

**Thermogravimetric Analysis (TGA)** measures the mass loss or gain of a sample of material as a function of time or temperature when it is heated or cooled under a certain temperature profile and atmosphere control.

LABSYS evo **TGA sensor** is an alumina based rod held by the balance and equipped with a **sample temperature measurement** thermocouple. The sample is held in an alumina (440 or 1 000 $\mu$ L) or platinum (500  $\mu$ L) crucible.



The state-of-the-art Calisto **data treatment software** allows for numerous automatic operations like **blank subtraction** for hassle free buoyancy effect correction, **DTG signal calculation** for easier identification of start and end temperatures of mass variations, **signals overlay** for data comparison, and all the features necessary to treat data routinely according to recommended **ASTM, ISO** or other testing standards.

**LABSYS evo TGA 1150** is typically applied to polymers, pharmaceuticals, biomaterials and other organic substances like coal, oils, lubricants...

Studied phenomena range from desorption, solid-gas reactions, to decomposition, (pyrolysis, combustion...) in order to determine:

- Compositional analysis: ashes, carbon, fillers, additives' contents and their effect on thermal stability / material quality / product performance,
- Moisture, solvent contents of pharmaceuticals,
- Volatiles analysis: absorbed, bound, or occluded,
- Loss on drying of VOC in metal working fluids, lubricants...
- Kinetics, thermal ageing/endurance.

High temperature **LABSYS evo TGA 1600** is particularly necessary to characterize inorganic materials like ceramics, glasses, cermets, nano-materials, metals, alloys, cements, plaster, minerals, composites...

Based on the variations of the TGA signals due to dehydration, dehydroxylation, decarbonation, oxidation and other typical phenomena, it becomes possible to study:

- Their composition and its influence on their thermal stability / resistance,
- The efficiency of their synthesis routes,
- Regeneration / coke content of catalysts,
- Corrosion resistance properties.



# LABSYS EVO STA

**LABSYS evo STA 1150** applies mostly to organic materials when a **more in-depth understanding** of their thermal behavior is necessary. Identifying the thermal phenomena is made easier thanks to the DTA or DSC signals. **Transitions** like melting, crystallization, glass transition and solid-solid transitions, or **reactions** like curing and oxidation (OIT: oxygen induction time) can then be characterized together with the phenomena involving mass variations.

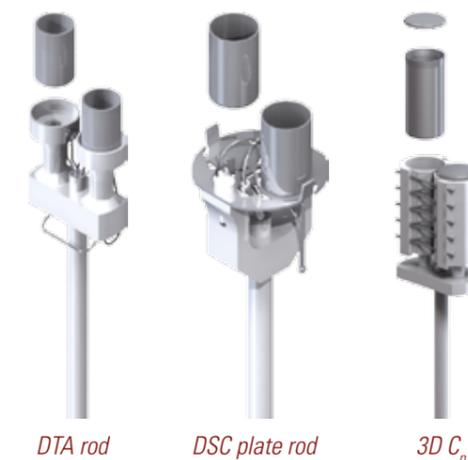
**LABSYS evo STA 1150** is also an ideal tool to screen thermal hazards linked with energetic materials.

**Simultaneous Thermal Analysis (TG-DTA or TG-DSC)** additionally allows qualifying or quantifying the heat effects occurring during a mass variation or any transition not related to a mass change.

The different **LABSYS evo STA rods** (DTA, DSC, 3D  $C_p$ ) are **changed within seconds** using our unique "plug & play" connector and the automatic identification system of the rod type.



**LABSYS evo STA 1600** is the ultimate solution when temperatures as high as 1600 °C are concerned. It is the perfect tool to understand the thermal behavior of materials that are exposed to **extreme temperatures during their production, service, or recycling**. There are numerous examples but one can cite the determination of the sintering temperatures of metal powders, the determination of the thermal characteristics and ageing of refractory materials or the incineration of industrial wastes. The **LABSYS evo STA 1600** can also be used with the 3D  $C_p$  rod which, on top of heat capacity measurements, allows for accurate quantification of heat transition effects.



## Crucibles

**DTA** is available with 80, 90 or 100  $\mu$ l crucibles made of aluminum, alumina, quartz or platinum.

**Plate type DSC** is available with 80, 90 or 100  $\mu$ l crucibles made of aluminum, alumina, quartz or platinum.



See LABSYS evo application notes

View the application notes in your field, available for download, by visiting [www.setaram.com!](http://www.setaram.com!)

The database is in the [application library area](#) of our website. The search engine will enable you to find the most applicable data.

## DTA / DSC

**LABSYS evo DTA/DSC** relies on the ideal design of the LABSYS evo furnaces - both 1150 °C and 1600 °C versions - and gas flow control unit, with a perfectly centered rod, locked in that position.

While DTA is mostly used to determine the temperature at which heat effects occur, properly calibrated DSC rods lead to more accurate determination of the amount of heat, whereas the 3D  $C_p$  rod is ideal for heat capacity.

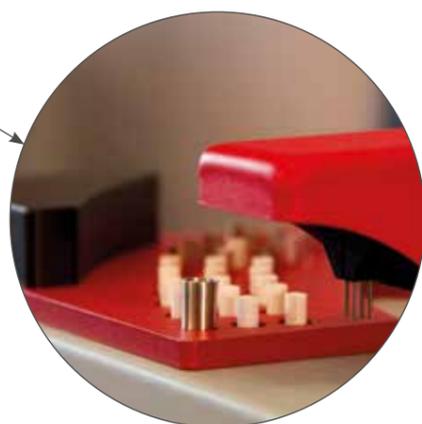
Curie points, glass transitions, phase transitions, crystallinity, crystallization temperatures and kinetics, and heat capacity are typical measurements achieved by the **LABSYS evo DTA/DSC**.

## AUTO SAMPLER



The autosampler is able to handle up to 30 samples and 6 reference crucibles and is a perfect complement for the LABSYS evo TGA or STA.

The 4-prong gripper automatically configures to the different sensors and crucibles to give you the most user-friendly system available.



## $C_p$ ROD

To increase the sensitivity of  $C_p$  measurements it is necessary to increase the mass, the sensitivity of the sensor and the heating rate of the furnace. This is made possible thanks to the 3D  $C_p$  rod because of the large size of its crucibles (380  $\mu$ l), the high sensitivity of its 3D Calvet type sensor (up to 0.5  $\mu$ V/mW), which is composed of 10 thermocouples in series, and the high heating and cooling rate of the LABSYS evo furnaces (100 °C/min). It is now possible to have  $C_p$  measurements  $C_p$  measurement with the best accuracy, on the whole temperature range (RT – 1 600 °C).



3D  $C_p$  Sensor

## EVOLVED GAS ANALYSIS

Evolved Gas Analysis (EGA) has proved particularly interesting for the investigation of the chemistry of a reaction or thermal decomposition owing to the **identification of the evolved species**. LABSYS evo offers a plug & play gas analyzer coupling device, enabling simultaneous MS and FTIR connections. The **coupling device is heated up to 300 °C** to avoid any gas condensation and is completely insulated for safe handling. LABSYS evo can also be equipped with the state-of-the-art heated **Autoinjector** interface (up to 350 °C) for TG-GC/MS experiments.

### TGA or STA-MS

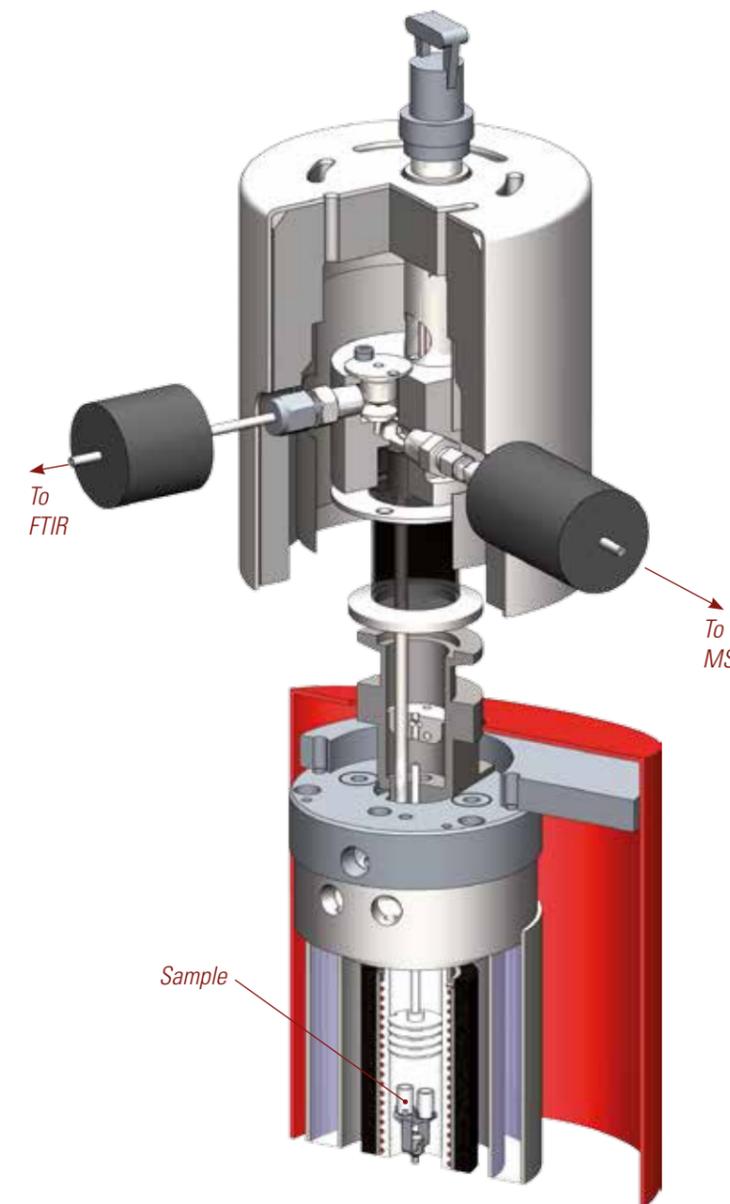
Mass spectrometry identifies the evolved molecules after their ionization based on the  $m/z$  ratio of the main ions and their fragments. It can be applicable to **small mass variations** and is **easy to setup**.

### TGA or STA-FTIR

Chemical functions of the evolved molecules are identified according to their specific absorption of IR light wavelengths. It can be applicable to the **detection of families of substances in complex gas blends** evolved from the decomposition of organic samples.

### TGA or STA-GC/MS

TG-GC/MS is becoming increasingly popular, as gas chromatography allows a first separation of the evolved species, before their identification by the mass spectrometer. It is particularly well suited to the **identification of substances in complex gas blends** evolved from the decomposition of organic samples.



Typical application area	Materials
Gasification, pyrolysis, combustion	Coal, biomass and wastes
Adsorption, desorption, calcination	Catalysts, sorbents, minerals
Dehydration, dehydroxylation, decarbonation	Cements, minerals, ceramics, pharmaceuticals
Thermal stability, compositional analysis	Pharmaceuticals, polymers, cements, minerals, ceramics
Oxidation	Metals, alloys
Residual solvents	Pharmaceuticals
Polycondensation, curing	Polymers

We are resellers of the most reliable gas analyzer suppliers for each EGA technique.

## STANDARDS

LABSYS evo TGA and STA were designed to fulfill the requirements of international standards concerning polymers, rubber, plastics, oils, lubricants and other commonly tested materials. It includes **ISO11358-1&2** on thermogravimetry of polymers, **ASTM D6370** and **E1131** on compositional analysis, **ASTM E1582** and **ASTM E2440** on calibration, and **ASTM E1641, ASTM E1868, E1877, E2008, E2402, E2403, E2550**. Consult us for more information.

## SPECIFICATIONS

LABSYS evo	TGA	STA	DTA / DSC
Temperature range		Room temperature to 1 150 °C Room temperature to 1 600 °C	
Isothermal temperature accuracy		+/- 1 °C	
Programmable temperature scanning rate (heating and cooling)		0.01 to 100 °C.min <sup>-1</sup>	
Furnace cooling		30 min (1 150 °C to 50 °C) 32 min (1 600 °C to 50 °C)	
Maximum balance capacity		20 g	
Weight range	+/- 1 000 mg; +/- 200 mg		-
Weighing precision	+/- 0.01 %		-
TG Resolution	0.2 µg; 0.02 µg		-
Auto Sampler	30 samples and 6 references 4-prong gripper		-
DSC rod - Resolution	-	0.4 µW / 10 µW dependent on sensor	
3D Cp rod - Cp Accuracy	-	< 2 % <sup>a</sup>	
Vacuum	< 10 <sup>-1</sup> mbar. Option for operations under controlled vacuum down to 30 mbar.		
Evolved Gas Analysis	MS, FTIR, GC/MS coupling		
Gas Flow Control	Two inlets for gas scanning (inert or reactive) Option: 3 carrier gases (MFC from 4 to 200 ml/min) and 1 auxiliary or reactive gas (MFC from 0.3 to 16 ml/min)*		
Weight	55 kg / 121 lbs		
Dimensions (Height / Width / Depth)	56 closed, 76 opened / 53 / 58 cm (22.0 closed, 29.9 opened / 20.8 / 22.8 in)		
Power requirements	230 V - 50/60 Hz		

\*MFC = Mass Flow Controller

Option : AKTS Thermokinetics software for comprehensive investigation of reaction or decomposition



<sup>a</sup>Value depends on tested material type

## CONTACTS



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