SHIMADZU

Solutions for Science
since 1875

ISO9001
Registered

SHIMADZU
Thermal Analysis Instruments
60 Series

Outstanding Technology and Design

MILLENNIA THERMAL ANALYSIS

SHIMADZU
Thermal Analysis Instruments
60 Series

SHIMADZU has been pursuing what thermal analysis instruments should be since it developed the DT-1 in 1958, the first differential thermal analyzer in Japan.

The solutions we obtained through research and development are reflected in our products by features such as "Micro DTA", "Multi-channel" and "Stand-alone" design.

These features help our customers solve problems. SHIMADZU presents the new thermal analysis instruments "60 series" in which market needs, learned through research over the years, have been realized with up-to-date technology.

We introduce the 60 Series with confidence, as the thermal analysis instruments for the 21st century.
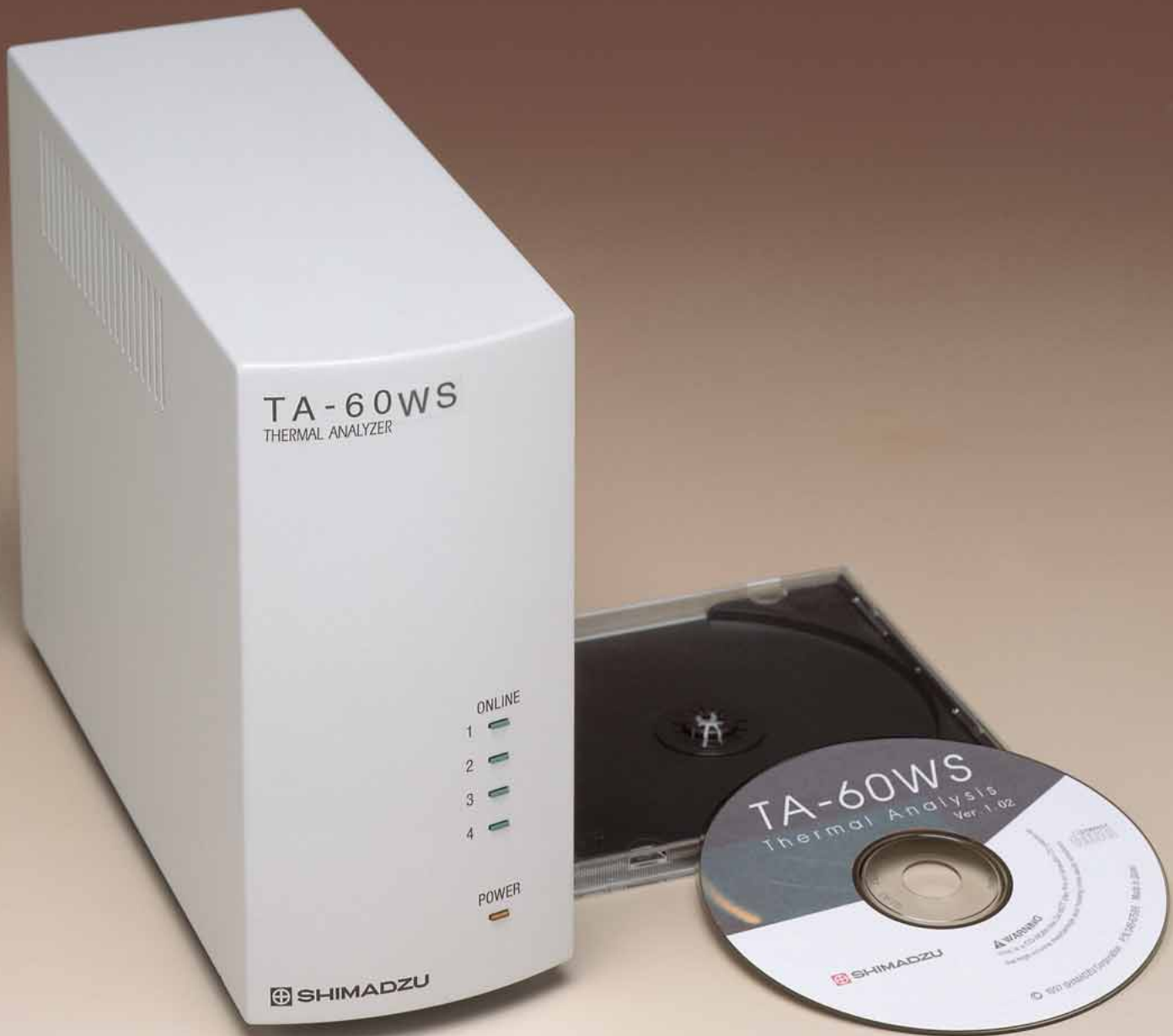
- **Excellent performance/price ratio**
- **Multi-channel link up to 4 units**
- **Full multi-tasking capabilities**
- **Compact design for space saving**
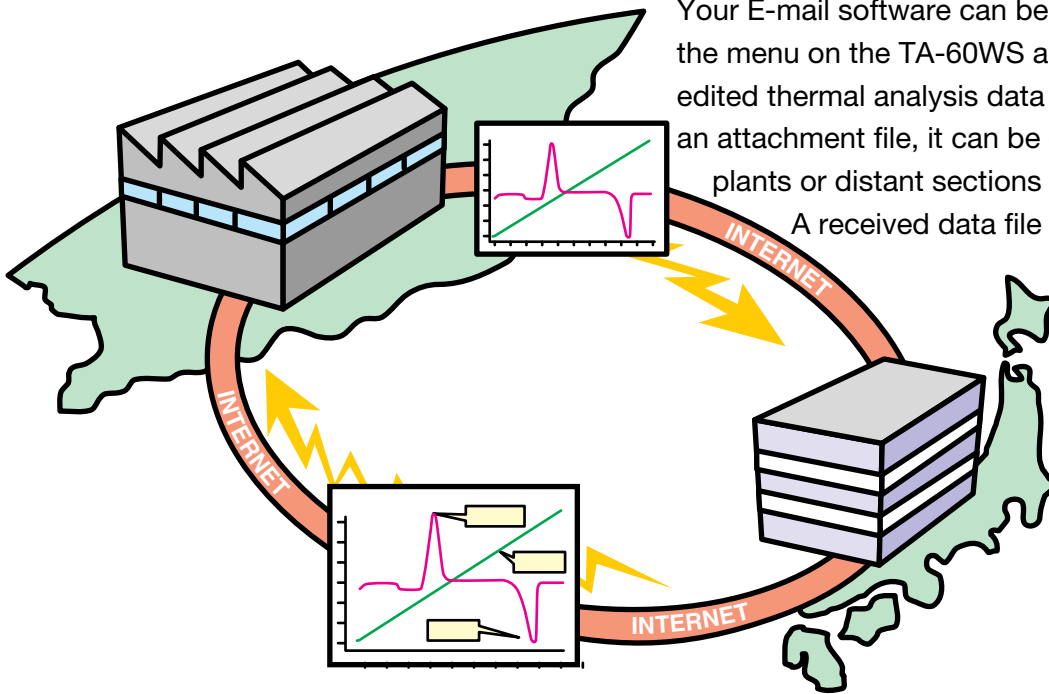- **Compatible with the 50 Series**

TA-60WS

Heart of the 60 Series

- **Full 32-bit MS-Windows® compatibility**
- **Multi-tasking operation of measurement and analysis**
- **Variety of application software**

The Advanced Software in Thermal Analysis

Global data transfer via Internet mail

Your E-mail software can be started simply by selecting the menu on the TA-60WS analysis screen. Since edited thermal analysis data are immediately added as an attachment file, it can be directly sent to overseas plants or distant sections in your company.

A received data file can be opened on the analysis screen simply by double-clicking it, and also can be re-analyzed, output or transferred. (To transfer data, Internet mail environment is required.)

Simplified report creating procedure using general-purpose software

Microsoft® Word®

Re-analysis depending on TA-60WS

Use the Microsoft® Excel®

Supporting OLE, the thermal analysis software starts simply by clicking the required thermal analysis data inserted in the MS-WORD® or MS-EXCEL® file, and gets ready for re-analysis and modification of the data. The reports and study summaries are linked to the inserted thermal analysis data. Thus, when saving the report file, its thermal analysis data is automatically saved to facilitate document management.

Personal screens and printing formats

You can set the graph size, line type and width of data curves, division intervals, length of additional lines and number of digits for numeric values as you like to create your own layout and format.

With the print preview function, you can foresee the print imaging and eliminate unnecessary printout.

You can change the axis, data and many other parameters.
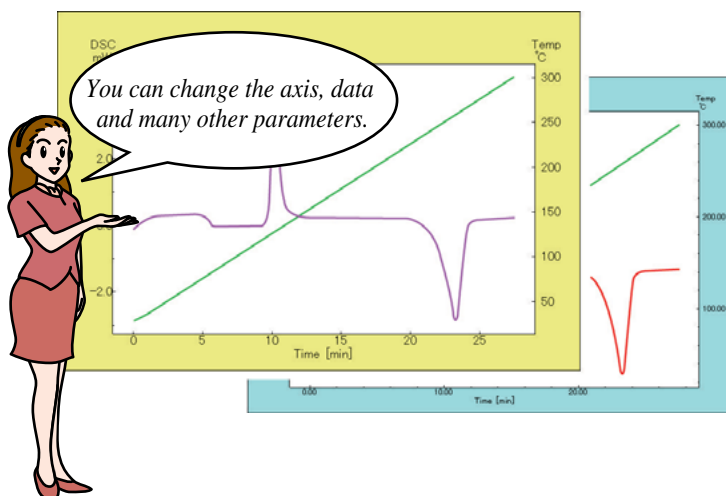
Data calibration and traceability

To correct the measured data, you can use functions, such as the data processing including smoothing, baseline drift and temperature correction or calculation of the differentiated curve.

Correction history is inserted to the data file and displayed on the screen/report as required to ensure traceability and GLP conformity.

Smoothing   30Points
Temperature Correction   In.
T=(-0.1000+0.0000T+0.0000T^2)+T

Data correction history
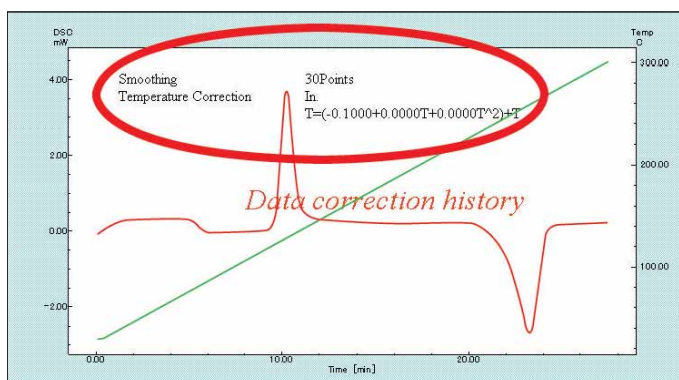
Simultaneous analysis of overlaid data curves

When analyzing thermal analysis data, you may often overlay a series of measured data curves in a single graph sheet in order to clarify the difference between the samples. Unlike the conventional software packages, the TA-60WS software can perform simultaneous analysis of the superposed curves for all the items, e.g., melting temperature of the respective samples.

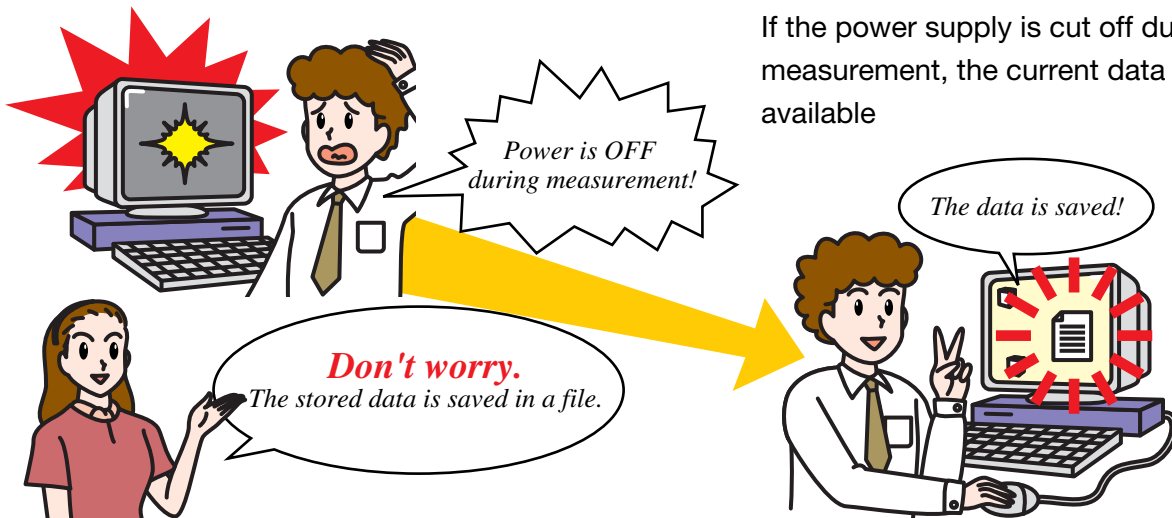Isothermal crystallization of polypropylene
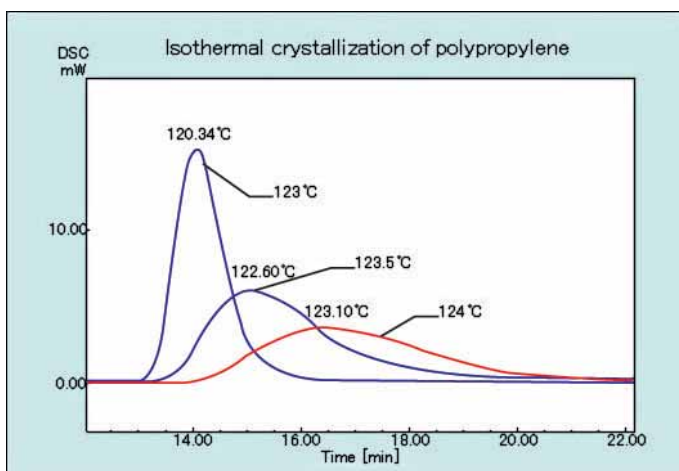
Full Windows® 95/98/NT/Me compatibility
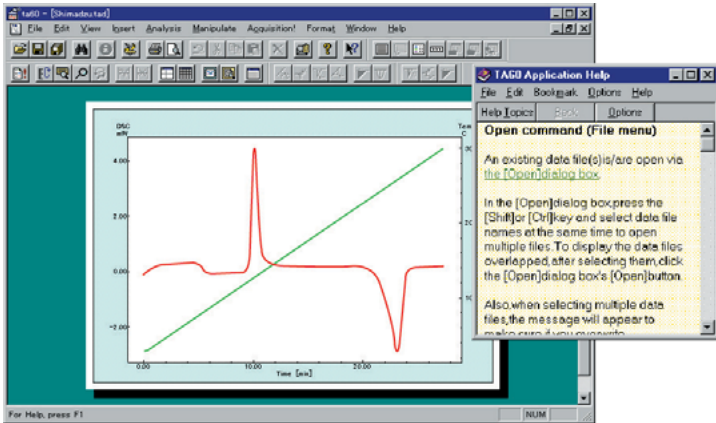
Windows® 95/98/NT/Me has excellent functions and features such as situation-dependent help, shared folder, drag & drop, and page setup. The TA-60WS software can use these functions and features because of its compatibility with Windows®.

In addition, its operating environment is common to other software for general use or instrument control.

Data security

Power is OFF during measurement!

Don't worry.
The stored data is saved in a file.

The data is saved!

If the power supply is cut off during measurement, the current data are still available

Compatible with general-purpose software
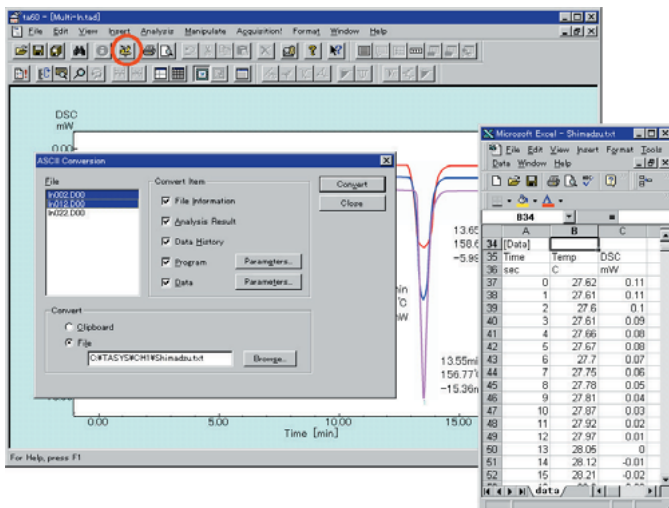
The TA-60WS software allows the specified items, such as file information, measurement parameters, analysis results, to be converted to ASCII format and output to the clip board or saved as a file.
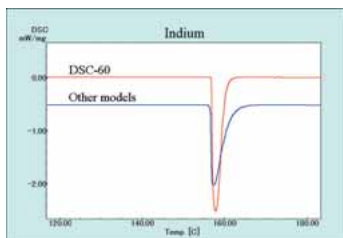
DSC-60

Integration of up-to-date functions

SHIMADZU now introduces the new DSC-60 making full use of the technology cultivated through development of power compensation type DSC and heat flux DSC.
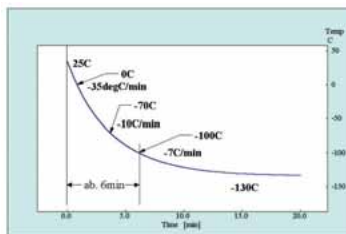
Outstanding Performance

Double DSC sensitivity

Along with development of the new detector featuring both heat measurement precision and durability, the DSC peak height has increased to almost double of the conventional DSC technique to accomplish high sensitivity.
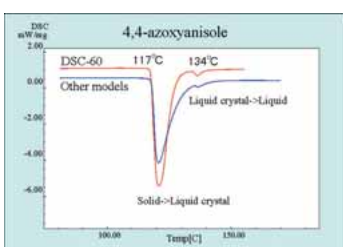
Fast cooling

The DSC-60 has attained fast cooling by dramatically reducing furnace heat capacity and combining the furnace and the cooling device in one unit. The sample is cooled by 35℃/min at 0℃ and by 10℃/min at -70℃.
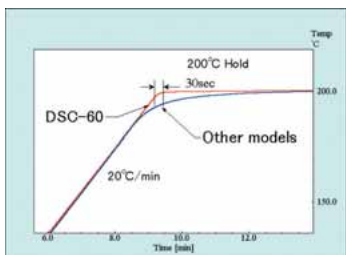
Double resolution

By optimizing the thermal resistance of the new detector, thermal conductivity from the furnace to the sample has improved and thus the time constant has reduced significantly.
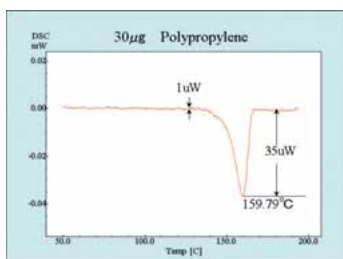
Precise temperature control

As result of the new development of a new furnace and temperature control unit based on the "heating while cooling" concept, precise temperature control became available. This enables users to create multiple step temperature programs for various applications.
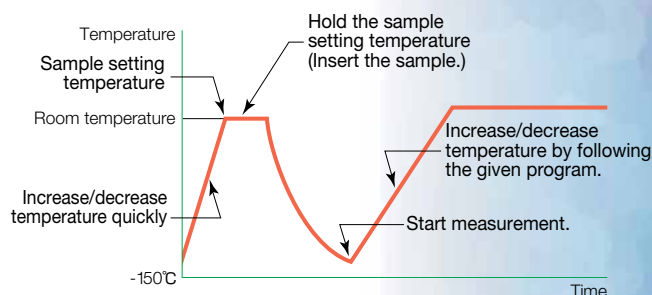
DSC noise of less than 1μW

The DSC-60 realizes noise level of less than 1μW by using the high-resolution A/D converter, reexamining the temperature control theory, and improving thermal conductivity from the heater. Accordingly, a trace of sample can be measured and a slight change can be detected as a large peak.

Sample setting temperature option

Temperature
Sample setting temperature
Room temperature
Hold the sample setting temperature (Insert the sample.)
Increase/decrease temperature by following the given program.
Increase/decrease temperature quickly
Start measurement.
-150℃
Time

When the furnace temperature is below the ambient temperature, it is generally difficult to set a sample pan without causing frost formation on the furnace surface. To solve such inconvenience, the DSC-60 provides a new sample setting temperature option.

Auto-cleaning run
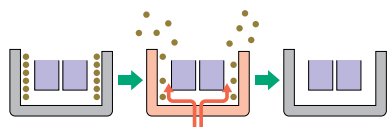
The contaminated detector and furnace can be cleaned by heating.

The furnace and sensor are often contaminated due to sample decomposition and overflow.
By executing the cleaning run program regularly you can ensure optimum performance.

DTG-60/60H

Simultaneous TG/DTA improves ease of operation, sensitivity and analytical accuracy of conventional standalone systems

If flexibility and high performance is needed in various applications, the new DTG-60/60H combines them all: Basic functions required by simultaneous thermogravimetry/differential thermal analysis (TG/DTA) measurements are improved. Atmosphere control is programmable. As in DSC, the TA-60WS provides advanced acquisition, analysis and report functions which ensure comfortable simultaneous measurements.
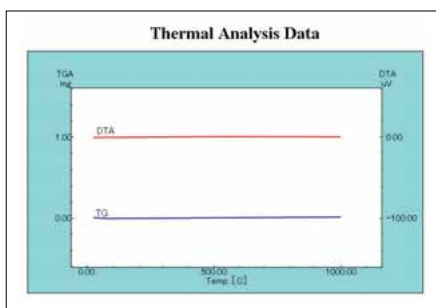
DTG-60

The balance assembly is the heart of every thermogrametric analyzer. The newly designed X-shaped fulcrum provides high sensitivity and excellent vibration-proof structure because of the light weight and extremely reduced friction and resistance. New A/D technology allows the DTG-60/60H to operate in a very large dynamic mass range. DTG-60/60H has the unique feature of differential weight measurement.
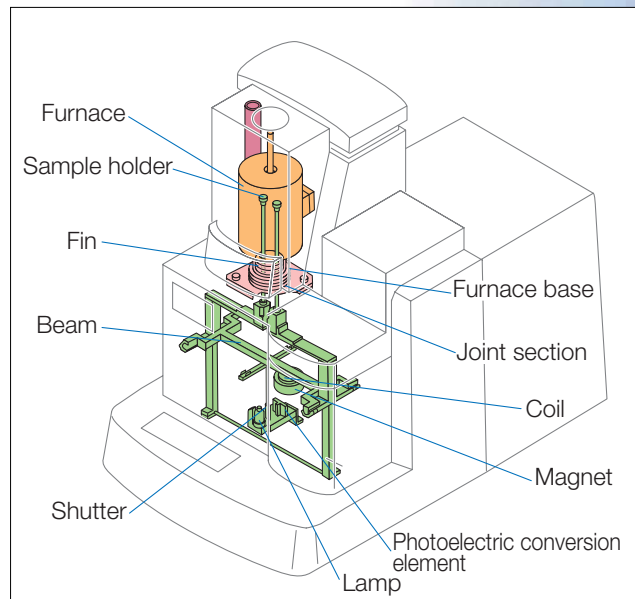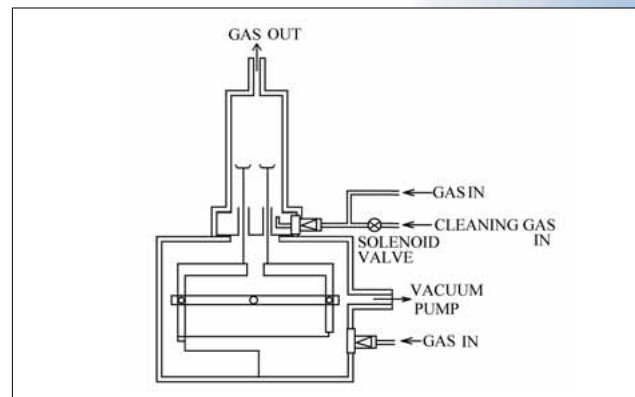
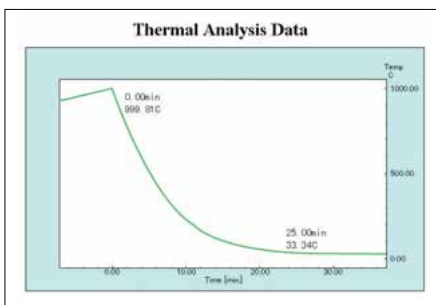## Improved baseline stability

Thermal Analysis Data

DTG-60/60H provides a true DTA setup. The sample and the reference position are located at the ends of the balance beam. This differential balance system minimizes baseline drifts caused buoyancy or convection during the heating process, ensuring a stable baseline even at high temperatures.

High sample throughput

Thermal Analysis Data

The built-in cooling fan and the low-mass furnace allow very efficient cooling times. After the completion of the measurement, the cooling starts automatically and stops when the furnace has reached a preset temperature. Now the next analysis can be started. Cyclic and cooling runs are under full instrument control.

Furnace
Sample holder
Fin
Furnace base
Beam
Joint section
Coil
Magnet
Shutter
Photoelectric conversion element
Lamp

Fully controlled atmospheres for various applications

GAS OUT
GAS IN
CLEANING GAS IN
SOLENOID VALVE
VACUUM PUMP
GAS IN

During TG/DTA measurements, qualitative and quantitative analysis, examination of reaction mechanisms and evaluation of heat resistance are performed by studying various reactions and interactions between a sample and special atmospheres. The unique channel structure of the DTG-60/60H offers the solution for these applications. While an inert gas purges the balance, reactive gases are directly connected to the reaction pan. In combination with the FC-60A the measurement is fully software controlled.

High sensitivity DTA detector

The DTA detector of DTG-60/60H is well balanced between contradictory factors "sensitivity" and "resolution". Since symmetrical arrangement of two detectors in the furnace provides excellent temperature distribution, even very small DTA signals such as noise and drift are well matched. Using the convenient plug-in method, the DTA detector can be quickly replaced.

Automatic TA

The Thermal Analyzer with built-in "tweezers" will be the future standard.

The DSC-60A and DTG-60A/60AH is a new automatic TA
which defines new standards in autosampler technology.
The built-in automatic sampler can easily be
operated and programmed, compared to the
complicated operation and setup of conventional
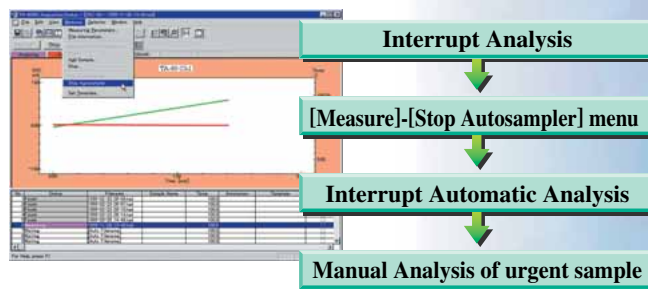autosamplers.

The built-in autosampler requires no additional space.

13cm
13cm
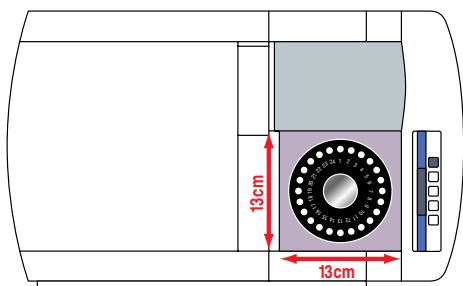
Externally mounted autosamplers are bulky, occupy much bench space and can cause trouble in operation. However, DSC-60A and DTG-60A/60AH provides a compact built-in autosampler which does not require more space than a stand-alone thermal analyzer.

Emergency samples can be analyzed any time

Interrupt Analysis

↓

[Measure]-[Stop Autosampler] menu

↓

Interrupt Automatic Analysis

↓

Manual Analysis of urgent sample

When an emergency sample needs to be analyzed, the autosampler can be stopped after the current analysis. The sample will be manually inserted for measurement. After its completion the autosampler program will continue as it has been setup.

## Set up samples for more than 24 hours of analysis.

Up to 24 samples can be set up for analysis and additional sample trays can be used to quickly reload the autosampler, providing more than 24 hours of fully automatic analysis at one time.

The autosampler table provides quick status check.
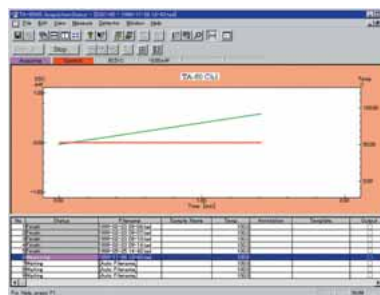
The autosampler table shows the sample names, analytical conditions and templates. The process of the current analysis is monitored. All preset conditions can be changed before the analysis of the samples is started.

"Fully automatic analysis and report functions."

Using Template file

Analysis
Customize
ReportStyle

Previous

After
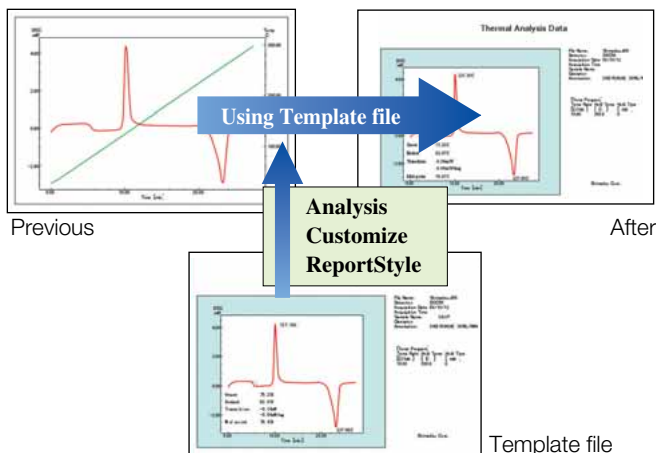
Template file

While conventional automatic TAs need skilled operators to create complicated macros for operation, DSC-60A and DTG-60A/60AH offers the comfort of a smart macro using a template for automatic analysis and reporting. Once a master file has been stored, DSC-60A and DTG-60A/60AH will perform automatic analysis and printing according to the preset conditions of this template, simplifying the operation to a one-key procedure.

Enhanced safety functions

The DSC-60A and DTG-60A/60AH provides enhanced safety functions, such as detection of mechanical errors of the arm and the furnace lid, verification of proper setting and return of the sample pan, emergency stop of the trays at abnormal or limit temperatures, and detection of damaged thermocouples. Analysis can be continued depending on the error condition. Additionally the system will stop temporarily when the furnace or tray cover is opened.
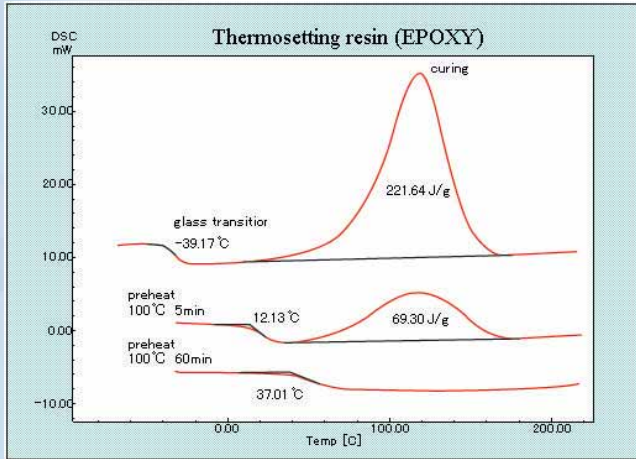
Accessories for Automatic TA

*1 346-66963-91	Al crimp pan for autosampler, φ5.8×3 (100/set.)

*1 Needs SSC-30 (201-52000-90) and AUS adapter (346-68077-91) for crimping.

Application

Thermosetting resin (EPOXY)

In the quality control of thermosetting resins, the degree of curing is an important material constant. It is determined by the glass transition temperature and the reaction exotherm. Moreover the temperature is affected by thermal history, plasticity and blend of the material.


PEEK
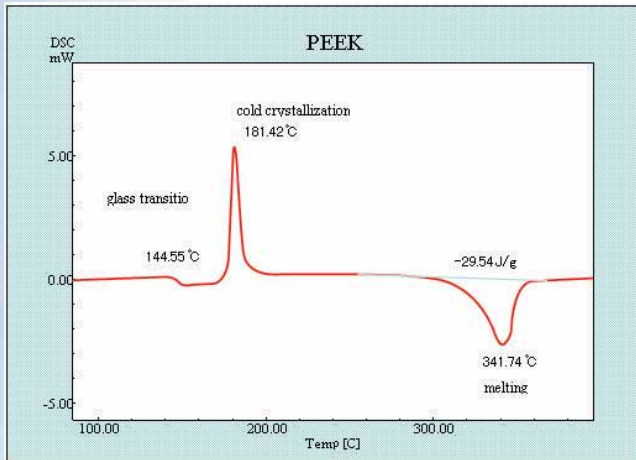
Crystalline polymers are characterized by their melting behavior. The melting temperature is not only used for the identification of the polymer but also for the calculation of the degree of crystallinity. Depending on the cooling process, semicrystalline polymers such as PET or PEEK very often show glass transition and cold crystallization.

Polymorphism (sulfathiazole)
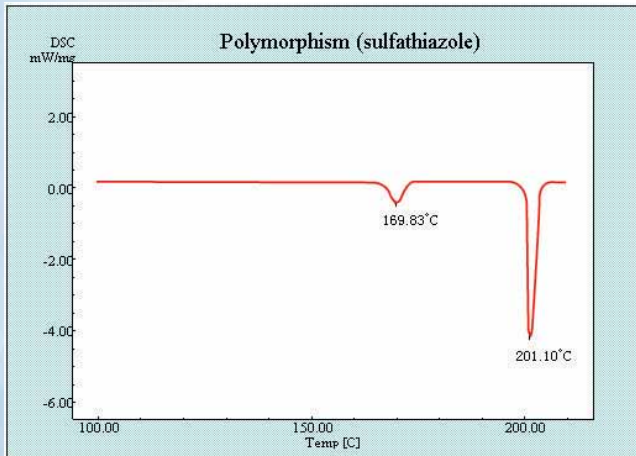
In the pharmaceutical industry the study of polymorphism of raw materials is very important. DSC-60 is the fastest and most precise technique for the analysis of polymorphism because it detects individual melting points with high sensitivity and precision.
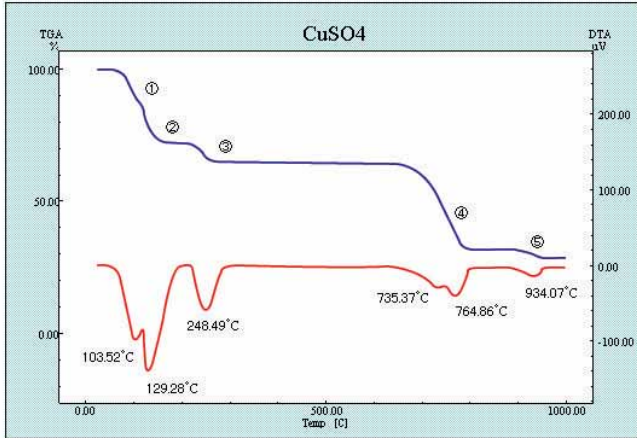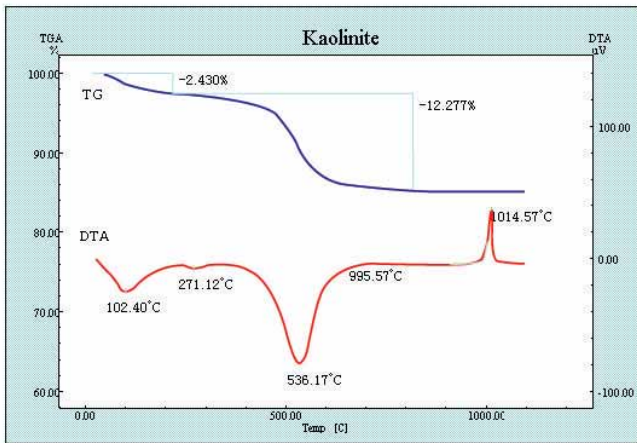
Copper sulfate: Five steps of weight loss are observed on TG curve. Each reaction is as follows:

① $CuSO_4 \cdot 5H_2O \rightarrow CuSO_4 \cdot 3H_2O + 2H_2O$

② $CuSO_4 \cdot 3H_2O \rightarrow CuSO_4 \cdot H_2O + 2H_2O$

③ $CuSO_4 \cdot H_2O \rightarrow CuSO_4 + H_2O$

④ $CuSO_4 \rightarrow CuO + SO_3$

⑤ $2CuO \rightarrow Cu_2O + 1/2O_2$

Kaolinite: the endothermic peak at 102℃ corresponds to the dehydration of absorbed water. The endotherm at 536℃ results from the dehydration of crystalline water (OH molecules). At 1015℃ the exothermic peak origins from a phase transition because the TG curve does not show any weight loss.
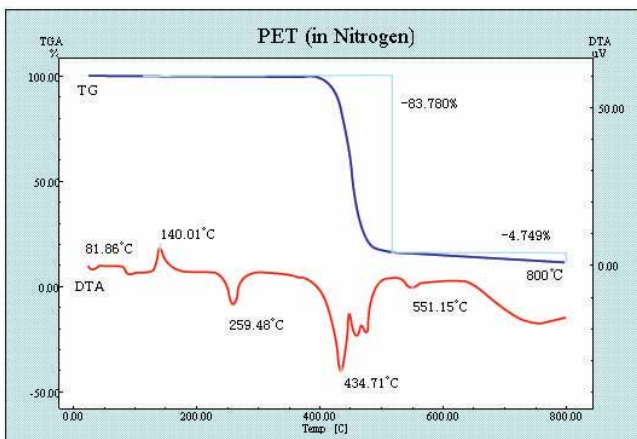
PET is measured in Nitrogen. The step change on DTA at 82℃ corresponds to glass transition.
The exothermic peak at 140℃ is crystallization. The endothermic peak at 259℃ is melting.
The endothermic peak over 400℃ is decomposition. Up to 380℃ no weight loss can be observed.
Above 380℃ the TG curve shows a one-step decomposition process.

OPTION

Sample sealer/crimper SSC-30 (P/N:201-52000-90)

Used to crimp sample pans (1) or to seal sample pans (8) (10).

Sealer adapter for pressure hermetic pan
(P/N:222-01450-91)

Used to seal 5 MPa pressure-proof Al pans (10).

Handpress SSP-10A (P/N:200-64175)

Used to seal 5 MPa pressure-proof stainless steel pans (9).

Sealer adapter for pressure stainless steel hermetic pan (P/N:222-01875-91)

Used to seal 5 MPa pressure-proof stainless steel pans (9).

TA-60WS Software package (P/N:346-67450-92)

Required for off-line analysis.

Application Software

Partial area analysis program   (P/N:346-68330-92)
Purity determination program*   (P/N:346-65481-02)
Specific heat analysis program*   (P/N:346-65548-02)
Stress-Strain analysis program*   (P/N:346-65553-02)
Kinetics analysis program for TGA*   (P/N:346-65762-02)
Kinetics analysis program for DSC*   (P/N:346-65763-02)

(* The TA-50WS format is partly used.)

Flow controller FC-60A (P/N:346-67995-92/93)

The FC-60A flow controller is used for the DSC-60/60A and DTG-60/60 A/60H/60AH to control the flow rate of atmosphere gases (of two channels).
Since the gas ON/OFF control is performed according to a temperature program, the atmosphere can be automatically changed during a measurement.

(*-92:for AC120V, -93:for AC230V)

Shimadzu automated cooling for DSC TAC-60i (P/N:346-68050-92)

Cooling measurement at a temperature of down to $-50℃$ is enabled simply by connecting a commercially-available intracooler (mechanical cooling unit). Since this cooling system does not use liquid nitrogen, it can easily and safely be operated. Using this cooling system together with the DSC-60A enables automatic cooling measurement.

🔵 Sample pan

P/N
① 201-52943 Al crimp pans+lids $\phi6\times1.5$ (50/set)
② 201-51976 Platinum pan $\phi6\times2.5$
③ 201-56927 Platinum lid $\phi5.7$
④ 201-54321 Alumina pan $\phi6\times2.5$
⑤ 201-53102-84 Nickel pans $\phi6\times2$ (50/set)
⑥ 201-58294-90 Copper pans $\phi6\times1.5$ (50/set)
⑦ 201-54439 Quartz pan $\phi5.7\times2.5$

P/N
⑧ 201-53090 Al hermetic pans
$\phi6\times1.6$ (50/set) limit pressure:0.3 MPa
⑨ 222-02067-92 Pressure-proof stainless steel hermetic pans
$\phi6\times5$ (50/set) limit pressure:5 MPa
⑩ 222-01701-91 Pressure-proof Al hermetic pans
$\phi6\times5$ (10/set) limit pressure:5 MPa

P/N
⑪ 201-57268-90 Al macro pans $\phi6\times5$ (50/set)
⑫ 201-53843 Pt macro pan $\phi6\times5$
⑬ 201-56782-90 Quartz macro pan for TGA (crucible)
$\phi11\times13.5$
⑭ 201-56825-90 Alumina macro pan for TGA (crucible)
$\phi10\times14$

🔵 Other Pan
P/N
⑮ 346-66963-91 Al crimp pans and lids for autosampler
$\phi5.8\times3$ (100/set)
⑯ 346-68334-91 Copper pans for autosampler $\phi6\times3$ (100/set)
⑰ 201-56569-01 Pt mesh pan for TGA $\phi11\times12$

Thermal analysis workstation

Model	TA-60WS (P/N:346-67200-92/93) *-92:for AC120V, -93:for AC230V
Number of links	4 modules
Operating System	Windows® 95/98/NT/Me
Dimensions	W:85 D:220 H:180 (mm)
Weight	2.5 kg
Required power supply	AC100, 120, 230V, 200VA, 50/60Hz

Differential scanning calorimeter

Model	DSC-60 (P/N:346-66800-92/93) *-92:for AC120V, -93:for AC230V
Measurement principle	Heat-flux type
Temperature range	−140 to 600 ℃
Measuring range	±40mW
Cooling time	Approx. 6 minutes (600 ℃ to 40 ℃)
Noise level	1 μW
Dimensions	W:320 D:500 H:290 (mm)
Weight	21 kg
Required power supply	AC100, 120V, 800VA, 50/60Hz

Simultaneous TG/DTA System

Model	DTG-60	(P/N 346-68750-92/93)
	DTG-60H	(P/N 346-68700-92/93)
		* -92:for AC120V, -93:for AC230V
Balance type	Parallel guide differential top pan type	
Measured temperature range	DTG-60	Room temperature to 1100℃
	DTG-60H	Room temperature to 1500℃
Measurable range	±500mg	
Measurable range	±1000 μ V	
Readability	0.001mg	
Sample quantity	1g max. in gross weight	
Dimensions	W:367 D:650 H:453 (mm)	
Weight	35kg	
Required power supply	DTG-60	AC100, 120V 1300VA 50/60Hz
	DTG-60H	AC100, 120V 1500VA 50/60Hz

Automatic TA

Model	DSC-60A	(P/N 346-67300-92/93)
	DTG-60A	(P/N 346-68600-92/93)
	DTG-60AH	(P/N 346-68820-92/93)
		* -92:for AC120V, -93:for AC230V
Number of positions	24 samples per tray	
Reference	Fix	
Analysis and printing	Automatic analysis and print for template format	
Dimensions	DSC-60A	W:320 D:500 H:290 (mm)
	DTG-60A/60AH	W:367 D:650 H:453 (mm)
Weight	DSC-60A	24kg
	DTG-60A/60AH	40kg
Required power supply	DSC-60A	AC100, 120V 800VA 50/60Hz
	DTG-60A	AC100, 120V 1300VA 50/60Hz
	DTG-60AH	AC100, 120V 1500VA 50/60Hz

Installation requirements

●Space

TA-60WS	DSC-60/DSC-60A	DTG-60/DTG-60A/DTG-60H/DTG-60AH

TA-60WS: 180mm, 220mm, 85mm

DSC-60/DSC-60A: 290mm, 500mm, 320mm

DTG-60/DTG-60A/DTG-60H/DTG-60AH: 453mm, 650mm, 367mm
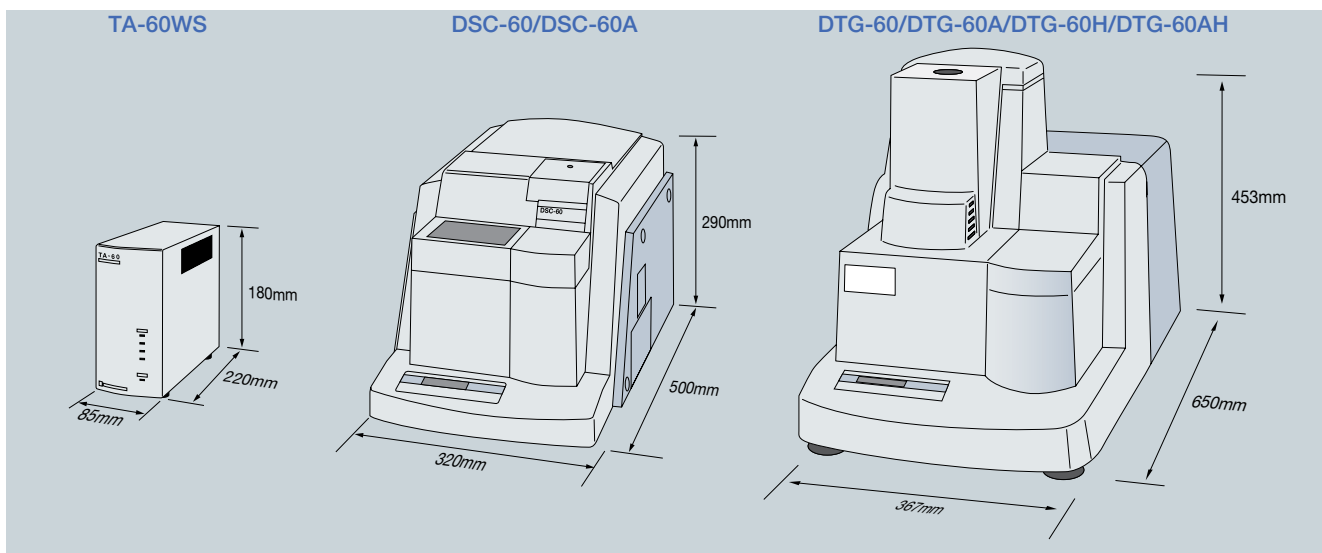
●Analytical balances

To weigh the sample, prepare a large analyzer bottle which allows the precise reading up to 0.01mg.

●Gas

Purge gas (atmospheric gas to be used)

Cleaning air tank or air compressor

NOTE〉·To perform cooling measurement with the DSC-60/60A, dry gas (nitrogen or dry air) is additionally required.
·The DTG-60/60A/60H/60AH provides a reaction gas supply port, in addition to the purge gas supply port.
·Prepare a tank, pressure reducer and gas flow rate regulator separately.

●Personal computer requirements

CPU	Pentium® 133MHz or better	OS	Windows® 95/98/NT/Me
RAM	32MB or better	Display	15 inch min.
Hard Disk	This software requires at least 50 MB	Mouse/Keyboard	
Capacity	to operate	CD-ROM Drive	Use for install
Serial Port	This software needs RS-232C port for data acquisition.		

●Printer

Any Microsoft® Windows® Supported Device

●Other

Do not install the device in a place exposed to direct sunlight, a place exposed to direct wind from an air conditioner, a dusty place, a place subject to large vibrations, or a place subject to large temperature fluctuation.

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