

Thermal Analysis Instruments

60 Series



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Millennia Thermal Analysis

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 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.



Equipped standard with
cooling chamber

DSC-60 Plus Series

With high sensitivity
differential balance

DTG-60 Series

High-performance and
multi-functional

TMA-60 Series

- Excellent performance/price ratio
- Multi-channel link up to 4 units
- Full multi-tasking capabilities
- Compliant with GLP and GMP
- Compatible with the 50 series
- Compact design for space saving





DSC-60 Plus series

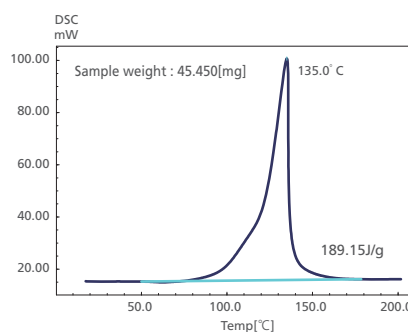
Differential Scanning Calorimeter

DSC-60 Plus addresses the various DSC applications.

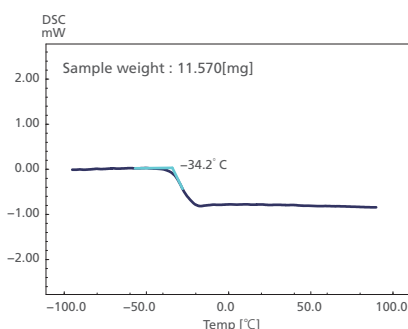
The DSC-60 Plus is an indispensable thermal analyzer for materials characterization in R&D and quality control applications in such areas as polymers, pharmaceuticals, electronic parts, foods, etc. It offers the sensitivity and easy operation required for the development of high-performance, highly functional new materials.

High-sensitivity analysis across the entire measured temperature range

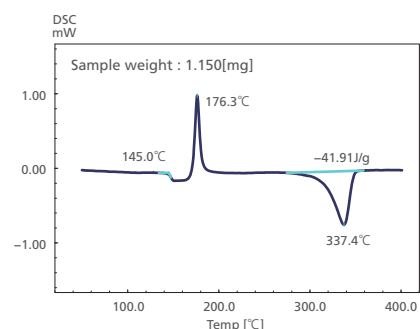
The new detector in the DSC-60 Plus series and the unique furnace construction achieve a stable baseline across the entire measured temperature range (-140-600°C) as well as top-class calorimetric sensitivity for a DSC. It features a wide dynamic measurement range of ± 150 mW.



Adhesive Hardening Reaction

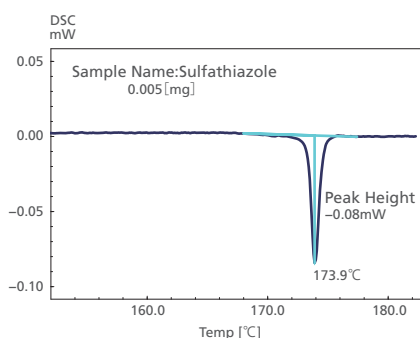


Glass Transition of NBR Rubber

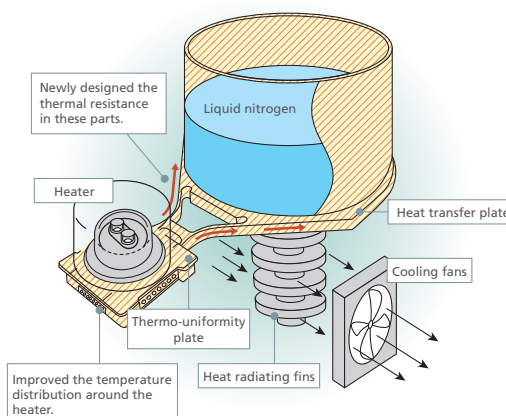


Measurement of Engineering Plastic (PEEK)

High-Sensitivity Measurements of Trace Samples



Structure of the DSC-60 Plus Furnace



The new detector and new unique furnace construction achieves a noise level of less than $0.5\mu\text{W}$, ensuring a stable baseline. A stable baseline and S/N performance enable the detection of a minute calorimetric change during trace analysis.

Diverse Measurements by Simple Operations

The DSC-60 Plus series features a cooling chamber as standard. Measurements below room temperature can be performed by pouring liquid nitrogen through the inlet into the chamber to lower the temperature. This is extremely convenient, as it eliminates the need to install special accessories. It achieves 10 °C/minute performance at -100 °C, which is adequate for measurements during a controlled cooling process.

Eco-Friendly

The newly designed furnace unit reduces energy consumption by over 20 % when heating from room temperature to 300 °C at a 20 °C/minute heating rate (compared to previous Shimadzu instruments). When making measurements below room temperature, the liquid nitrogen consumption savings exceed 30 % (compared to previous Shimadzu instruments). The instrument footprint has also been minimized.

DSC-60A Plus Automatic Differential Scanning Calorimeter Capable of Continuous Unattended Measurement

The built-in compact autosampler permits automated measurement, analysis, and report printout for up to 24 loaded samples. It improves the efficiency of screening during product development and the efficiency of quality control activities.

Specifications

	DSC-60 Plus	DSC-60A Plus
Measurement principle	Heat-flux type	
Temperature range	-140~600°C (With standard cooling chamber and using liquid nitrogen)	
Calorimetric measurement range	±150mW	
Noise level	Less than 0.5µW (RMS, when held at 150°C)	
Atmosphere	Nitrogen, inert gas, dry air gas flow	
Autosampler	—	24 samples/tray
Size	W 320 × D 500 × H 290 mm	
Weight	28kg	31kg
Power supply	AC100V, 120V, 230V 50/60Hz MAX 800VA	

Detailed brochure C160-E013

Options

Liquid Nitrogen Auto-cooling System TAC-60L

Consecutive Measurement with liquid nitrogen is enabled at a temperature from -130 to 500°C. the cooling capacity is -10°C/min. (at -80°C). The tank internal pressure is optimally controlled according to the residual amount of liquid nitrogen in the tank to keep the supply flow rate constant. Pulsation is reduced, and the DSC baseline remains stable even during cooling measurement.

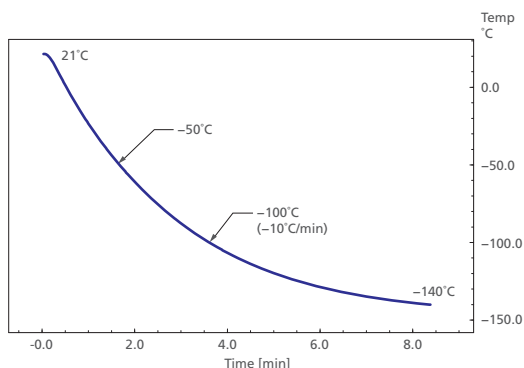
*Requires a separate FC-60A controller



Electric Auto-cooling Attachment TAC-60i

Consecutive measurement at a temperature from -50 to 500°C is enabled by connecting a commercially available immersion cooler. Since this cooling system does not use liquid nitrogen, it can be easily and safely operated. Using this cooling system together with the DSC-60A Plus enables automatic cooling measurement.

* Does not include an intracooler
* Requires a separate FC-60A controller



Cooling Performance with Liquid Nitrogen

Specialized Tray



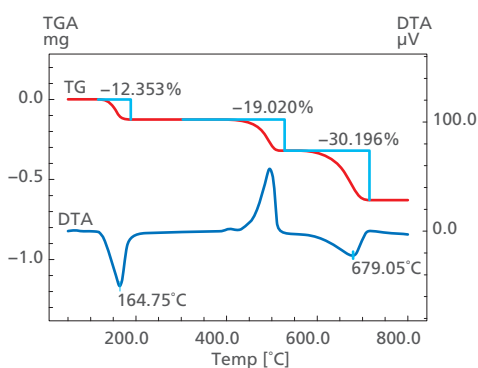


DTG-60 Series

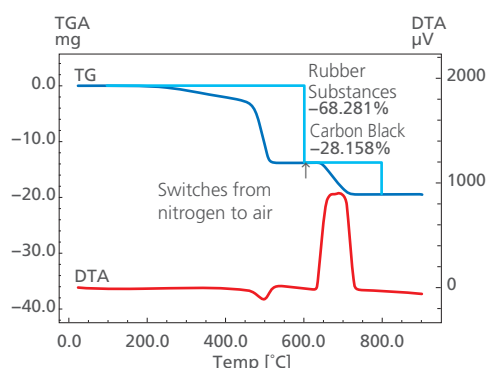
Simultaneous TG/DTA

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.



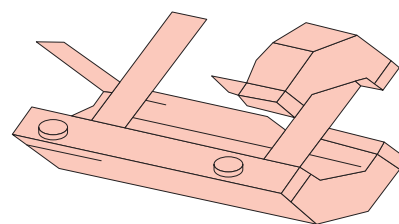
Measurement of trace CaC_2O_4



Measurement of carbon black in SBR

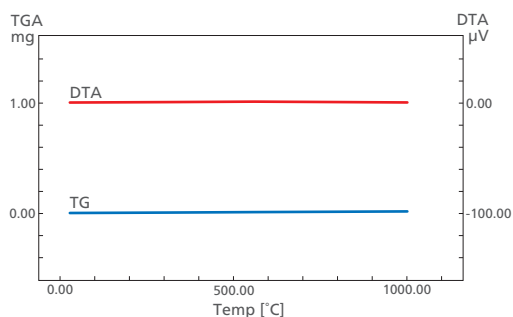
High sensitivity and high precision of balance is equivalent to dedicated single-function instruments

Model DTG-60 series has a unique balance mechanism (Roberval mechanism) that prevents changes in sensitivity from factors such as thermal expansion and allows high precision thermogravimetric measurements. Furthermore, the fulcrum used for the balance is made from thin alloy metal strips that have tiny thermal coefficients and are crossed to form an "x" shape. This fulcrum (X-shaped fulcrum) is lightweight and has extremely low friction and resistance. Using this fulcrum configuration allows incorporating a highly sensitive balance and is even highly resistant to vibration.

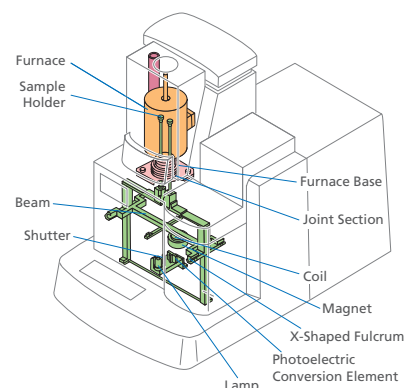


X-Shaped Fulcrum

Improved baseline stability

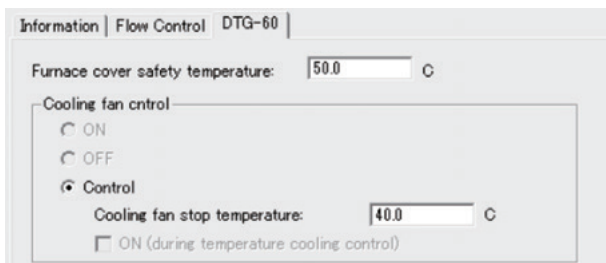


DTG-60 series provides a true DTA setup. The sample and the reference position are located at the ends of the balance beam. This differential balance system minimizes baseline drifts caused by buoyancy or convection during the heating process, ensuring a stable baseline even at high temperatures.



High sample throughput

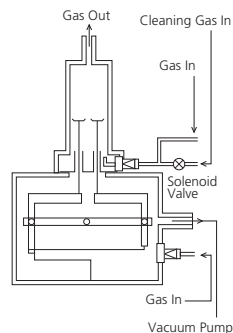
The built-in cooling fan and the low-mass furnace allow very efficient cooling times. After the completion of the measurement, the cooling starts automatically and stops when the furnace has reached a preset temperature. Now the next analysis can be started. Cyclic and cooling runs are under full instrument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



Setting for the Cooling fan control parameter (Detector properties box)

Fully controlled atmosphere for various applications

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 series offers the solution for these applications. While an inert gas purges the balance, reactive gases are directly connected to the reaction pan.



DTG-60A/60AH provides a compact built-in autosampler

Up to 24 samples can be setup for analysis. In addition, the weight of empty cell and sample can be measured automatically.



High sensitivity DTA detectors



Specifications

	DTG-60	DTG-60H	DTG-60A	DTG-60AH
Balance principle	Parallel guide differential top pan type			
Temperature range	Ambient to 1100℃	Ambient to 1500℃	Ambient to 1100℃	Ambient to 1500℃
Measurable range (TG)	±500mg			
Measurable range (DTA)	±1000μV			
Weight readability	0.1μg			
Sample quantity	1g Max. in gross weight			
Atmosphere	Air and inert gas			
Auto sampler	—		24 samples / tray	
Standard sample	—		Fixed	
Analysis / Print	—		Automatic analysis and automatic report printout	
Size	W 367xD 650xH 453mm			
Weight	35kg		40kg	
Power supplySpecifications	AC 100 V, 120 V, 230 V, 1300 VA, 50/60 Hz	AC 100 V, 120 V, 230 V, 1500 VA, 50/60 Hz	AC 100 V, 120 V, 230 V, 1300 VA, 50/60 Hz	AC 100 V, 120 V, 230 V, 1500 VA, 50/60 Hz



TMA-60 Series

Thermomechanical Analyzer

High precision measurement accomplished using simple operations. Even more functions.

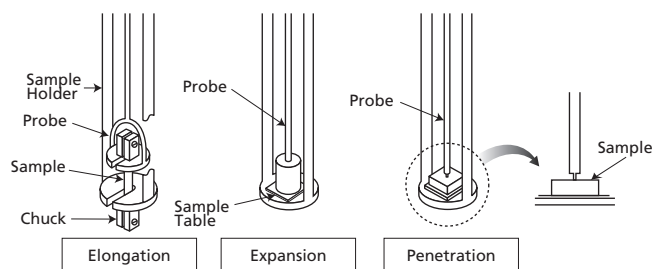
The TMA-60 series thermomechanical analyzer accommodates a wide variety of samples and is able to use various types of measurement methods* (expansion, elongation, or penetration) to thoroughly evaluate sample characteristics. Newly function, such as the automatic length measurement and safety features, were incorporated into development, resulting in high performance, high functionality and ease-of-use in many dimensions.

* Model TMA-60 is capable of the total expansion method and

* Model TMA-60H the differential expansion method.

Easy operation

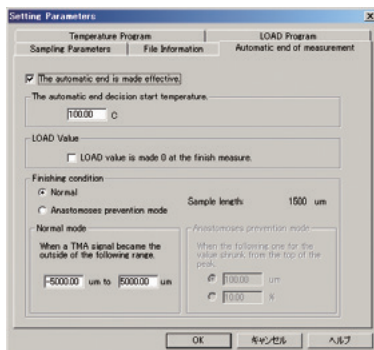
Changing between measurement mode is easy and maintainability is outstanding thanks to the use of a bayonet type sample holder that can be attached or removed in one step and plug-in type temperature sensors.



TMA measurement mode

Probe Safety Function

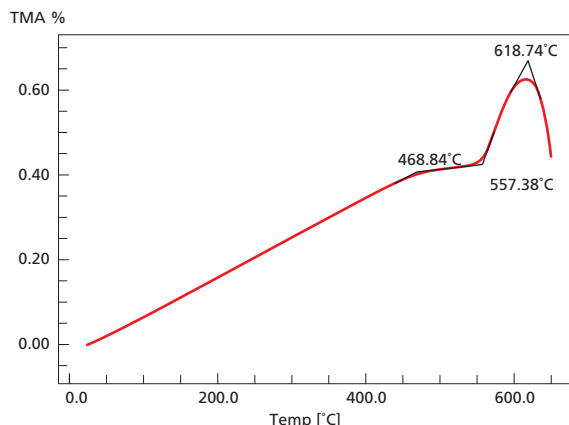
TMA-60 is programmed with a safety mechanism to prevent sample from sticking to detection probe, such as when heating glass. When displacement exceeds a set range, such as due to a sample melting, the measurement is immediately stopped and the load is removed from the sample.



Flexible Parameter Settings

High precision and Wide dynamic range

Measurement precision was increased dramatically by using a specialized high precision digital displacement sensor. At the same time, a wide span of ± 5 mm is possible (twice as much as previous), allowing high precision measurements of deformations ranging from tiny to large.

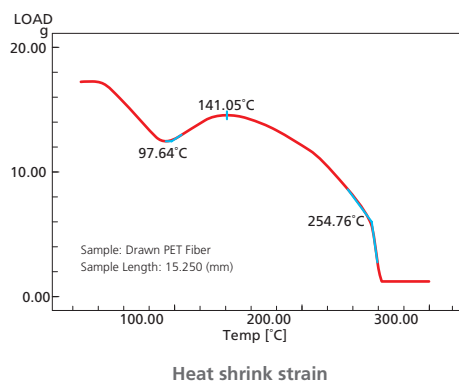


Accurate automatic length measurement

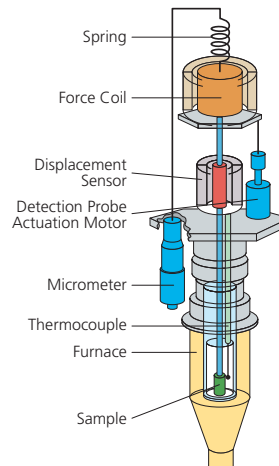
The high precision displacement sensor can be used to measure the length of the sample. Compared with the other methods calculated from the moving distance of motor, more accurate length measurement is possible.

A Wide Variety of Loading Programs

In addition to applying static loads to samples, constant rate loading, constant rate elongation or cyclic loading programs can be selected. Therefore, it is able to measure stress-strain curves or thermal stresses in film or fiber samples.



Theory and operation of the TMA-60



Thermo mechanical analysis is the measurement of a materials behavior, expansion and/or contraction, as a function of an applied load or temperature. A scan of dimensional changes related to time or load provides invaluable information about the samples mechanical properties. The advanced design of the TMA-60 provides a wide dynamic measuring range through superior integration of detection probe, displacement sensor and force coil.

Options

Low-Temperature Furnace LTB-60 for TMA-60 Analyzers (P/N 347-65002-93)

Used with a TMA-60 analyzer, it allows measurements between -150 and 600°C . Liquid nitrogen gas is used below room temperature.



Specifications

	TMA-60	TMA-60H
Temperature range	Ambient to 1000°C (Expansion Mode) -150 to 600°C (using LTB-60)	Ambient to 1500°C
Measurement range	Displacement: ± 5 mm, Load: ± 5 N	
Sample load	$0 - \pm 5$ N (500 gf)	
Sample size (Film Samples)	$\varnothing 8$ mm x 20 mm or less (5 mm wide x 1 mm thick x 20 mm long or less)	$\varnothing 5$ mm diameter or less 5 - 20 mm length
Probe/Support tube	Quartz	Alumina
Measurement mode	Expansion, Elongation, or Penetration	Differential expansion
Loading Mode	Constant rate Load up to 50 steps Constant rate Elongation up to 50 steps Shrink Stress Cyclic Load 0.01-1 Hz Frequency	
Atmosphere	Air and inert gas	
Dimensions and weight	W 367 x D 624 x H 880 (mm), 45 kg	
Power supply	AC 100 V, 120 V, 230 V 1000 VA, 50/60 Hz	AC 100 V, 120 V, 230 V 1500 VA, 50/60 Hz



TA-60WS

Thermal Analyzer

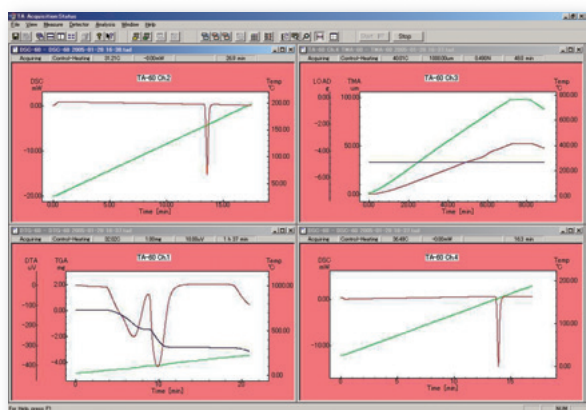
The advanced software in the thermal analysis industry, boasting easy-to-use controls and high performance

The TA-60WS software, compatible with the latest versions of Windows can be operated intuitively for smoothly performing everything from measurements to analysis and report output. In addition, it is capable of exporting data to Word, Excel, or other commercial software, using OLE and ASCII conversion functions. User management features and audit trail functions for any parameters support customer to comply with GLP/GMP. Shimadzu thermal analyzer can provide the integrated management of analytical data collaborated with various analytical instruments by using network system.

Multi Channel Control

Simultaneous control of up to 4 TA units

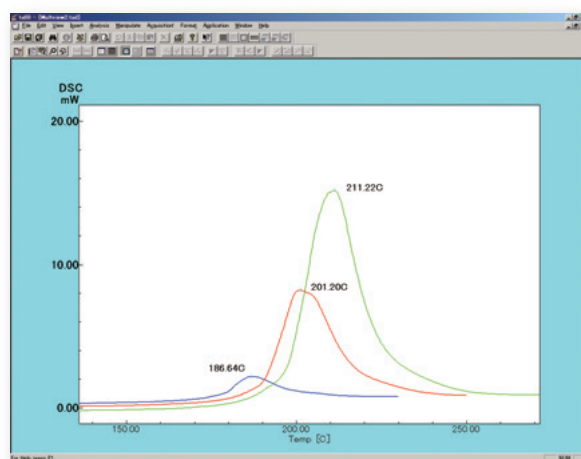
Up to four thermal analyzer units can be controlled simultaneously, allowing data to be analyzed during measurements. (Snap shot feature)



Wide Variety of Data Analysis Features

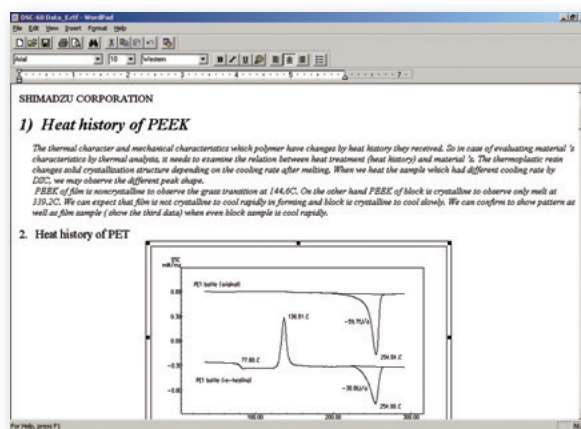
Overlay Data Analysis

This allows analyzing data by overlaying the same or differing types of data (unlimited sets of data). Overlaid data can also be analyzed collectively as a single set.



Compatible with general-purpose software

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.



Microsoft Word

GLP and GMP Compliance

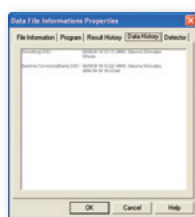
Various requirements must be satisfied, such as analytical instrument reliability and electronic record managements, in order to comply with control and regulatory standards such as GLP or GMP. Version 2 the TA-60WS software allows selecting from three operating modes - the standard "Normal" "Security", and "ER/ES" Mode. Note: Optional "Part 11 Compliance Package" software is required to operate in the ER/ES Mode.

Prevents unauthorized access via the Login window

Access to the thermal analysis system can be restricted in the "Security" and "ER/ES" modes, by requiring a user name and password for login.

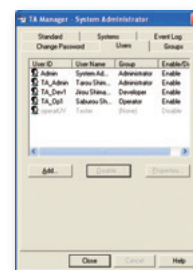
Ensures traceability of measurement results

Data files include information about the instrument, such as serial number and calibration coefficient of the instrument, and information about the raw data, such as measurement parameters. In addition, a correction and analysis history for the raw data is recorded in data files, ensuring that traceability is maintained.



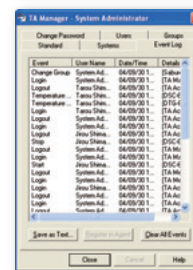
User management features allow setting operating rights for operators

After logging in, operating rights are managed on a group basis. Each user can be assigned to a group based on their job description. Appropriately controlling the operating rights of users provides additional support to managing and operating the system.



Instrument history is saved as the event log

A history of events, such as login, logout and measurement start/stop events, and any changes to instrument parameters is saved as the event log using the audit trail function. If any problems arise with respect to the system or measurement results, this log makes it easy to trace the cause.



Integrated Management of Analytical Data by CLASS-Agent



Specifications

Compatible Operating Systems	Windows 10 / 7/ Vista
Data Acquisition	Number: Max. 4 units Sampling Interval: 0.1 to 999 seconds
Analysis Parameters	Common to all analysis: Temperature, time, tangent, peak top, signal differential, and peak height DSC and DTA analysis also includes: Heat quantity, glass transition, and automatic DSC peak TG analysis includes above and also: Weight loss, automatic weight loss, loss rate -> temperature TMA analysis includes above and also: Expansion, mean expansion Group display of analytical results, overlay analysis (same data type, different data analysis, unlimited data, and collective analysis features)
Data Correction	Smoothing, baseline correction (blank and temporary lines), temperature correction (above common to all), heat correction (DSC, DTA include the above), total expansion correction, differential expansion correction (TMA includes all the above)
GLP/GMP	Audit trail features, security features, Part 11 compliance features (optional)
Others	OLE features, ASCII conversion features (data, file information, measurement program, analytical results, and correction history), text file save feature
Size	W 85xH 220xD 180mm

* Windows, Word and Excel are registered trademarks of Microsoft Corporation (U.S.A.).

Options

TA-60WS software package

(P/N 222-10202-92)
Required for off-line analysis.

Application software for TA-60WS

- Partial area analysis program (P/N 346-68330-92)
- Purity determination program (P/N 346-69100-92)
- Specific heat analysis program (P/N 347-65156-92)
- Stress-Strain analysis program (P/N 347-65160-92)
- Kinetics analysis program for TGA (P/N 347-65164-92)
- Kinetics analysis program for DSC (P/N 347-65168-92)
- Dynamic Temperature Control Program (P/N 347-65148-92)
- Part 11 Compliance Package (P/N 222-10108-92)

TGA & DTA

Thermogravimetric Analyzer TGA-50 Series Micro and Macro Series of Thermogravimetric Analyzers with Advanced Thermobalance Design

The TGA-50 series is equipped with a lightweight balance mechanism and taut band fulcrum. These have outstanding vibration resistance and provide for stable high sensitivity measurements. These instruments have an extremely wide applicability range, from measuring large-volume samples that cannot be measured using TG/DTA systems, or allowing the use of a variety of sample cell sizes.

Specifications

Temperature range	TGA-50, TGA-51 : Ambient to 1000°C TGA-50H, TGA-51H: Ambient to 1500°C
Measuring range	± 20 mg, ± 200 mg (TGA-50/50H) ± 20 mg, ± 200 mg, ± 2 g, (TGA-51/51H)
Weight Readability	0.1µg
Sample mass	1 g including tare (TGA-50/50H) 10 g including tare (TGA-51/51H)
Atmosphere	Air and inert gas
Dimensions and weight	TGA-50/50H W: 173 x D: 550 x H: 500 (mm), 23 kg TGA-51/51H W: 173 x D: 600 x H: 540 (mm), 25 kg
Power supply	TGA-50 AC 100 V, 120 V, 230 V 1000 VA 50/60 Hz TGA-51/50H 1200 VA, TGA-51H 1500 VA

Detailed brochure C160-E012A



Differential Thermal Analyzer DTA-50 High Temperature Heat Flux DTA, provides Quantitative Calorimetry Measurements

With a unique high sensitivity dumbbell detector, which has an extremely low heat capacity, high sensitivity and excellent versatility, the DTA-50 offers the high sensitivity performance of the DSC system. It is the ideal instrument for characterizing materials such as glass or ceramics.

Specifications

Temperature range	Ambient to 1500°C
Measuring range	0.2 to 1000 V / 0.2 mW~
Atmosphere	Air and inert gas
Dimensions and weight	W: 173 x D: 550 x H: 550 (mm), 23 kg
Power supply	AC 100 V, 120 V, 230 V, 1200 VA, 50/60 Hz



Options

Flow controller FC-60A

(P/N 346-67995-92: for 120V, -93: for 230V)

The FC-60A flow controller is used 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.

Specifications

Primary pressure	0.6MPa max.
Flow rate	PURGE side: 0~500ml/min (calibrated for N ₂) DRY side: 0~500ml/min (calibrated for N ₂)
Flow line	PURGE: 2 IN, 1 OUT DRY: 1 IN, 1 OUT
Size and weight	W 180 × D 200 × H 90mm, approx. 3kg
Power supply	90~130V AC or 210~230 V AC, 100VA



Sample Sealing Crimp Press SSCP-1

(P/N 222-13130-91)

Samples are prepared with six types of pans (①, ⑧, ⑩, ⑮, ⑯, ⑰) for Shimadzu thermal analyzers by using the SSCP-1 in combination with the attachment specifically for the pan to be used (sold separately).



The attachment specifically for the pan to be used SSCP-1

Handpress SSP-10A

(P/N 200-64175)

Used to press 5 MPa Stainless steel (SUS) pressure-proof pans ⑨.



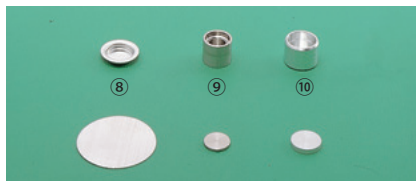
Sealer adapter for stainless steel (SUS) pressure-proof pan

(P/N 222-01875-91)

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



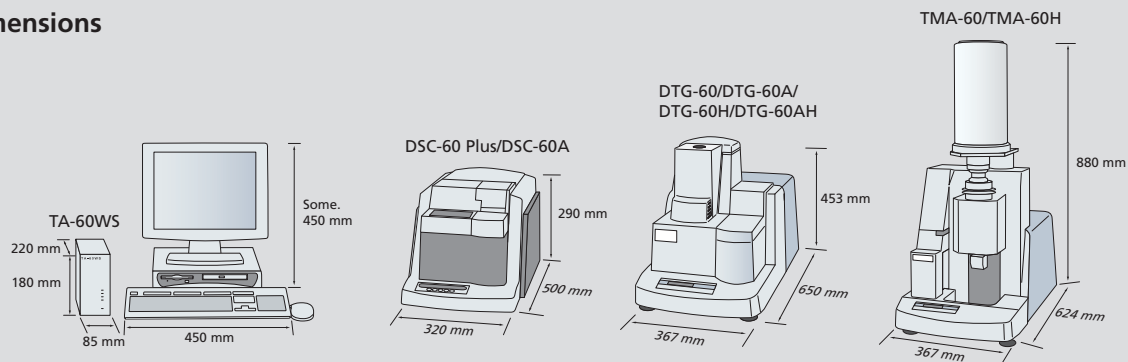
Sample pans



P/N	Description
①201-52943	Al crimp pans + lids, ø6 × 1.5 (50/set)
②201-51976	Pt pan, ø6 × 2.5
③201-56927	Pt pan lid, ø6
④201-54321	Alumina pan, ø6 × 2.5
⑤201-53102-84	Ni pans, ø6 × 2 Max.300C° (50/set)
⑥201-58294-90	Cu pans, ø6 × 1.5 Max.300C° (50/set)
⑦201-54439	Quartz pan, ø6 × 2.5
⑧201-53090	Al hermetic pans, ø6 × 1.6 (50/set), limit pressure: 0.3 MPa
⑨222-02067-92	Stainless steel (SUS) pressure-proof pans ø6 × 5 Max.500C° (50/set), limit pressure: 5 MPa
⑩222-13073-91	Al pressure-proof pans ø6 × 5 Max.300C° (10/set), limit pressure: 5 MPa
⑪201-57268-90	Al macro pans, ø6 × 5 (50/set)
⑫201-53843	Pt macro pans, ø6 × 5
⑬201-56782-90	Quartz macro cell for TGA (crucible), ø11 × 13.5
⑭201-56825-90	Alumina macro cell for TGA (crucible), ø10 × 14
Other pans	
⑮346-66963-91	Al crimp pans and lids for autosampler, ø6 × 3 (100/set)
⑯346-68518-91	Al hermetic pans and lids for autosampler (DSC), ø4.4 × 4 (100/set), limit pressure 0.3 MPa
⑰346-68796-91	Al hermetic pans and lids for autosampler (DTG), ø6 × 4 (100/set), limit pressure 0.3 MPa
⑱346-68334-91	Cooper pans for Autosampler, ø6 × 3 (100/set) Max.300C°
⑲201-56569-01	Pt mesh cell ø11 × 12 (for TGA)
⑳201-54321-01	Alumina macro pan, ø6 × 5

Installation Requirements

Dimensions



Analytical balances

To weigh the sample, prepare an analytical balance which allows the precise reading up to 0.01 mg.

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.

* Windows is registered trademark of Microsoft Corporation.

Gas

Purge gas (atmospheric gas to be used)

Cleaning air tank or air compressor

- Note) • To perform cooling measurement with the DSC-60 Plus/DSC-60A Plus, 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.



Shimadzu Corporation

www.shimadzu.com/an/

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