Access to your success
SHIMADZU

C10G-E013

Instruments for Evaluations Rubber and Plastics

Providing total support for a wide variety of property evaluations methods

Testing,Weighing and Analytical Instruments

For Rubber and Plastics

For the performance evaluation of rubber

Rubber and plastic products are used in a wide variety of areas. Evaluations of their basic performance and the components that determine their performance are indispensable for product development and quality control.
Shimadzu not only offers a wide array of evaluation instruments, it also provides comprehensive support from application to after-sales service.

Shimadzu's analytical and measuring instruments

Evaluation of rheology properties

- Dynamic viscoelasticity
- Viscosity properties
- Viscosity curves

P4

Observation and measurement

- Observation of internal defects
- Measurement of internal structure

P10

Evaluation of thermal properties

- Heat absorption and generation
- Specific heat capacity
- Reaction speed
- Evaporation and decomposition
- Gas absorption
- Moisture content
- Heat resistance
- Coefficient of thermal expansion/contraction
- Softening point

P5

Material evaluation, quality control, research and development

- Material evaluation
- Color mesurement
- Molecular weight distribution

P11

Evaluation of additives and harmful materials

- Identification of additives
- Residual solvents
- Heavy metals
- Quantitative determination of additives
- Formaldehyde
- Analysis of trace elements

P6～9

Evaluation of particle and powder properties

- Particle size distribution

P12～13

and plastics...

provide the help you need.

Mass evaluation

- Specific gravity, density
- Mass
- Moisture
- Volatile matter

P14~15

Dynamic balance evaluation

- Crossflow fans
- CD-ROMs, DVDs
- Standard fans

P22

Evaluation of static strength properties

- Tensile properties
- Compression properties
- Bending properties
- Hardness
- Surface properties

P16~19

Customer Support Center

- Provides both hardware and software support.

P23

Evaluation of dynamic strength properties

- Fatigue testing
- Magnetic micro-testing
- Fatigue testing based on SEM-image observation
- Dynamic properties of rubber for preventing/damping vibrations
- High-speed puncture

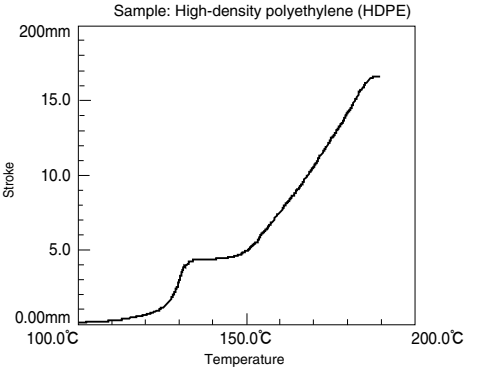
P20~21

Evaluation of Rheology Properties

Dynamic viscoelasticity, viscosity properties, viscosity curves

Rheology evaluation instruments provide essential information for research, development, and quality control, including information on the various properties that determine processability, such as viscoelasticity, a property peculiar to polymers, as well as viscosity, fluidity, and rate of volume change.

Applicable JIS standards:
K7210: Plastics -- Determination of the melt mass-flow rate (MFR) and the melt volume-flow rate (MVR) of thermoplastics
K7311: Testing methods for thermoplastic polyurethane elastomers



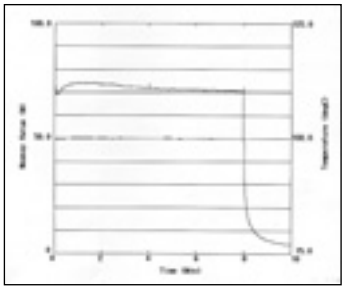
CFT-500D/100D
Constant-rate temperature-rise measurement test result

•Capillary Rheometer Flow Tester CFT-500D

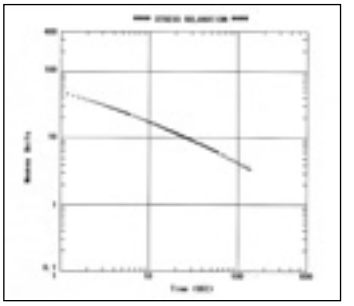
A device for evaluating the viscosity properties of fluid materials, such as resin, from the relationship between the temperature, pressure, and flowrate. This device is available as a stand-alone type, which offers very high operability and cost-effectiveness, and a PC type, which enables high-level data processing.

Applicable standards:
JIS K6300-1: Rubber, unvulcanized -- Physical property -- Part 1: Determination of Mooney viscosity and pre-vulcanization characteristics with Mooney viscometer
ISO 289
ASTM D1646

■Mooney viscosity curve



■Stress relaxation graph



Test: After an 8-minute Mooney test
Stress relaxation test:
2 minutes (SMV-300RT)
Sample: Butyl rubber

Stress relaxation measurement makes it possible to obtain differences in processability that could not be expressed with only Mooney viscosity. By combining the usual Mooney viscosity with the stress relaxation result, the viscous behavior of raw rubber and compounded rubber can be grasped with greater accuracy.

•Automatic Mooney Viscometer SMV-300/300RT

A cutting-edge instrument consisting of a microcomputer built into a measurement control device. It incorporates a thermal printer/plotter and can record viscosity curves and print numerical data. It can also perform the evaluation of stress relaxation (RT only).

Evaluation of Thermal Properties

Heat absorption and generation, specific heat capacity, reaction speed, evaporation and decomposition, gas absorption, moisture content, heat resistance, coefficient of thermal expansion/contraction, softening point

Plastics are heated up in a variety of ways during formation and processing. This thermal history has a direct influence on product quality and so it is necessary to grasp the thermal properties and perform optimum temperature control in the manufacturing process. Evaluating the thermal properties of a substance involves the evaluation of the dependency of its physical properties on temperature. The physical properties include mass, temperature, enthalpy, dimensions, and strength, and different types of thermal analyzer are used to evaluate different properties.

•Thermal Analyzer 60 Series

These analyzers are fully compatible with Windows 95, 98, NT, 2000, and XP. Up to 4 analyzers (50/60 series) can be connected. They are equipped with multi-channel, multi-task functions that enable measurement and analysis to be performed at the same time.

•Automated Differential Scanning Calorimeter DSC-60/60A

An auto-DSC equipped with an autosampler. Up to one day's worth of samples (24) can be set, each with different measurement conditions. Template-based automatic analysis and automatic printing make for easy operation.

•Simultaneous DTA-TG DTG-60/60A

A DTA-TG simultaneous measuring instrument equipped with a differential top-loading balance, which uses the Roberval mechanism to prevent fluctuations in balance sensitivity due to inconsistencies in the position of the sample, and a plug-in high-sensitivity thermocouple. Sample masses of up to 1 g can be measured and the DTA sensitivity at high temperatures has been improved.

•Thermogravimetric Analyzer TGA-50/50H/51/51H

Shimadzu's well-established high-sensitivity thermobalances. Their lightweight hanging balance mechanism and delicate taut-band fulcrum ensure a surprising level of sensitivity (reading limit: 1µg) and excellent vibration resistance, making them very effective for measuring extremely small changes in mass. The maximum sample mass for 50/51 models is 10 g, making them indispensable for researching catalysts and thin films.

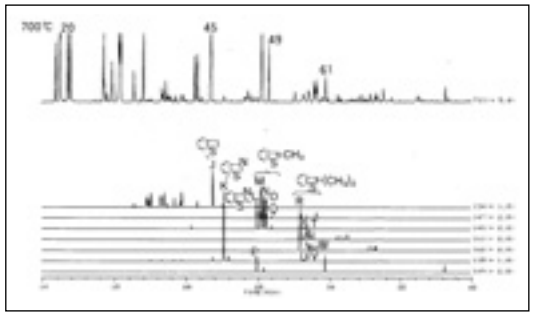
•Thermomechanical Analyzer TMA-60/60H

This analyzer can handle a wide variety of samples and measurement methods and a large temperature range to perform thorough measurement of the mechanical properties of materials. A high-precision digital sensor allows displacement measurement with a low drift in a wide range.

Evaluation of Additives and Harmful Substances

Identification of additives, residual solvents, heavy metals, quantitative determination of additives, formaldehyde, analysis of trace elements

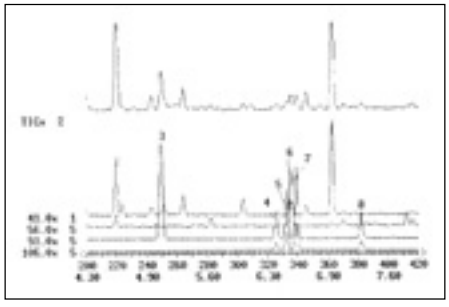
Shimadzu provides a wide variety of evaluation instruments to assist in, for example, the evaluation and management of additives that influence the performance and properties of polymer materials. We also offer instruments for the quantitative analysis of harmful substances, which have become a major point of concern recently because of the effect on public health.



■Chromatogram of tire rubber

•GCMS-QP2010 Pyrolisis Measurement System (for testing rubber and plastic additives)

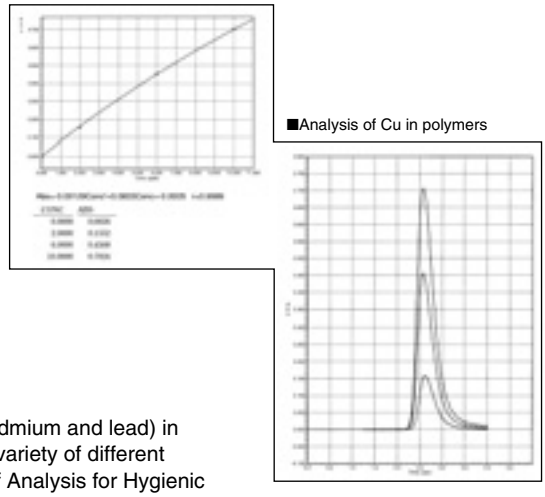
Polymer compounds, such as plastics, rubber, and resin, are thermally decomposed at temperatures greater than 500°C and the products are analyzed using GC-MS. These products reflect the structure of the original polymer compounds and so they can be used to perform polymer identification and high-order structure analysis. Database search software is also available to assist with polymer identification.



■Analysis of components dissolved in polymers

•GCMS-QP2010 Headspace Analysis System (for testing residual solvents in polymers)

The analysis of solvents and volatile components in solids is possible using the headspace. Volatile components, especially those with low boiling points, can be found in the upper region (i.e., the “headspace”) of liquids and solids. The headspace sampler is a device that obtains samples of a fixed amount at a fixed temperature and injects them into the GC-MS instrument. This system can be used for the measurement of volatile components in polymers and packing materials and for the qualitative and quantitative analysis of odors given off by chemical products.

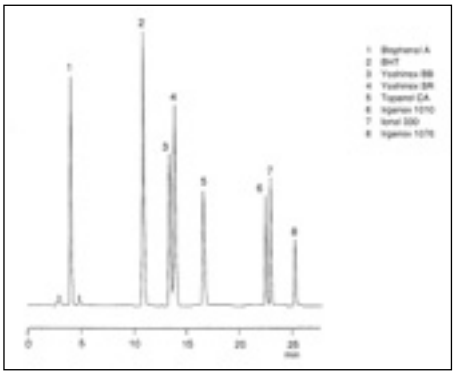


■Analysis of Cu in polymers

•Atomic Absorption Spectrophotometer AA-6800/6300

This spectrophotometer is very effective for the measurement of heavy metals (e.g., cadmium and lead) in rubber and plastics and for the measurement of silicon deposits. It is widely used for a variety of different purposes, such as Pharmacopoeia, and Food Sanitation Law and Standard Methods of Analysis for Hygienic Chemists.

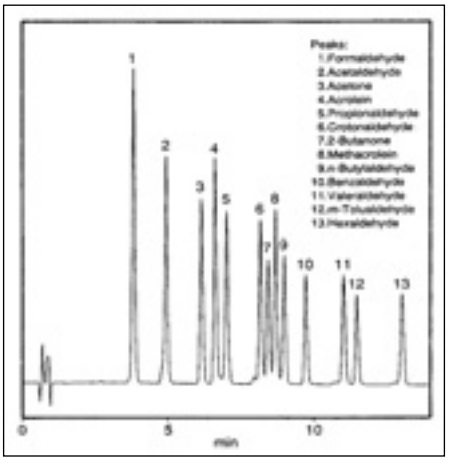
Sample	Concentration of solution	Sample collected	Diluted volume	Concentration of undiluted solution
Polypropylene	6.8ppb	2.0g	50mL	170ppb



■Analysis of phenolic antioxidant

•High-performance Liquid Chromatograph LC-VP System

Performs high-sensitivity quantitative determination of additives, such as plasticizers and antioxidants, with a high degree of accuracy.



■Simultaneous analysis of aldehydes and ketones

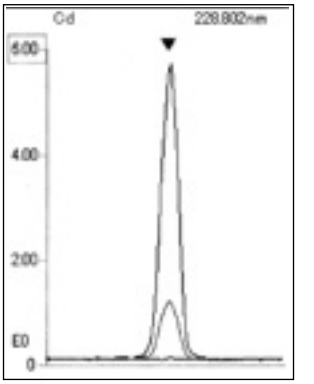
•High-performance Liquid Chromatograph LC-2010 Formaldehyde Analysis System

A system that analyzes the formaldehydes given off by sheet building materials used to decorate walls and floors. Operation is completely automatic to ensure easy analysis.

•Inductively Coupled Plasma Spectrometer ICPS Series

The ICP (inductively coupled plasma) and AA (atomic absorption) analysis are methods for measuring the element concentration in samples at the micro level with a high level of accuracy. They can be used for a wide variety of samples in a number of different areas, such as rubber, plastics, materials for electrical components, pharmaceuticals, food products, soil environments, and wastewater.

The ICP and AA analysis methods are effective for measuring elements of 1-ppm (µg/g) level in solid samples, such as plastics.

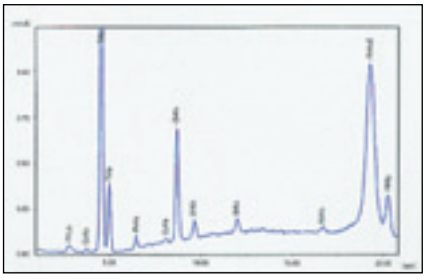


■Analysis of cadmium in plastics

Pretreatment	Dry ashing		Wet digestion		High-pressure decomposition
	Measured value	CV(%)	Measured value	CV(%)	Measured value
Sample A	6.5	0.9	5.6	1.31	5.6
Sample B	32	0.16	30	0.54	29

Evaluation of Additives and Harmful Substances

Identification of additives, residual solvents, heavy metals, quantitative determination of additives, formaldehyde, analysis of trace elements



■Analysis of plastic materials

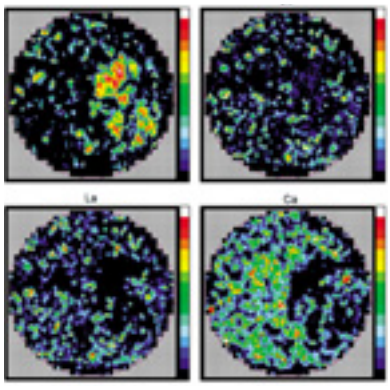
In fields of chemistry that mainly handle samples comprising of light elements as principal component, energy dispersive X-ray fluorescense spectrometer is effective analysis method, as it can achieve the sensitivity and precision close to those of wavelength dispersion. In particular, it makes it easier to do frequent measurement of liquid sample, compared with wavelength dispersion. It is also effective for analyzing catalysts and organic pellets for which pressure formation is difficult.

•Energy Dispersive X-ray Fluorescence Spectrometer EDX Series

Simple, non-destructive analysis of solids, powders, and liquids is possible without pretreatment.

[Main Applications]

Analysis of additives, acceptance inspection of raw materials, inspection of harmful elements, control of quantities of additives added in processes, failure analysis, etc.



■Element mapping analysis

The 250-μm display allows easy data comparisons. Analysis of the content distribution and intensity distribution of nonuniform samples is possible.

•Sequential X-ray Fluorescence Spectrometer XRF-1800

A high-resolution, high-precision, high-grade, general-purpose instrument. This can analyze light elements from beryllium to fluorine, that EDX hardly can analyze. 250-μm mapping display is possible.

[Main Applications]

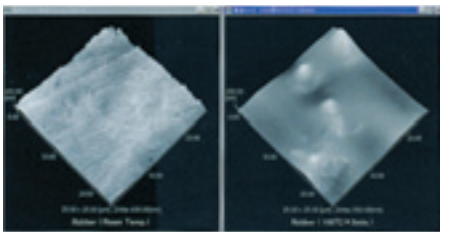
Analysis of additives, acceptance inspection of raw materials, control of quantities of additives added in processes, failure analysis, etc.

•Scanning Probe Microscope SPM-9500J3

High-resolution observation even of non-conductive sample is possible in air without pretreatment, and high-precision measurement of topographical images and material surface roughness are possible with high magnification factors ranging from several thousand to several million.

[Main Applications]

Topographic observation, viscoelasticity measurement, “sea-island” structure analysis, lamella structure analysis, folded structure observation, shape observation of heated samples, research and development, failure analysis, etc.



■Analysis of rubber materials

These are images of special phase-changing of special rubber observed at room temperature (left) and after being heated for 5 minutes at 100°C (right). The changes in the surface shape can be clearly observed. (Sample heating unit used.)

•Scanning Electron Microscope SSX-550

The SSX-550 is a cutting-edge SEM-EDS combined system that enables micro-level shape observation and elemental analysis for surfaces in a comfortable operating environment.

With a design putting weight on low-acceleration voltage observation, non-conducting samples can be observed without troublesome pretreatment. Also, low-vacuum observation functions enable non-evaporation EDS analysis.

[Main Applications]

Topographic observation, analysis of additives, acceptance inspection of raw materials, failure analysis, handling complaints, etc.

•Electron Probe Microanalyzer EPMA-1600/1610

Observation and high-sensitivity elemental analysis of samples is possible at the micron level. The EPMA-1610 can perform analysis at the sub-micron level.

[Main Applications]

Analysis of the distribution and precipitation of additional elements and solid solution elements, observation and analysis of treated surfaces (e.g. wiper surfaces), failure analysis (e.g., observation of surface deterioration), product development, etc.

Observation and Measurement

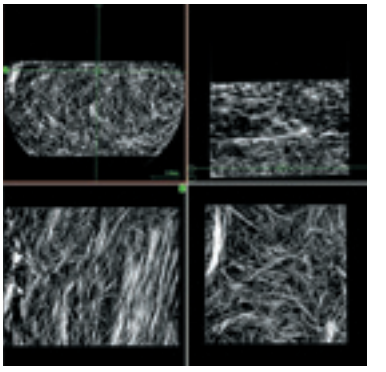
Observation of internal defects, Measurement of internal structure

These instruments allow the non-destructive observation of the interior of products, such as resin products, using X-rays to check for defects, such as voids, and to check the internal state. They are effective for quality control and failure analysis.

■Internal observation of bottle caps
The state of the sealing between a glass bottle and its resin cap can be checked by displaying any cross section desired. Also, gaps in the sealing and resin bubbles can be observed and measured using 3D display.

•Microfocus X-ray CT System SMX-130CT-SV

Internal tomograms and 3D images of sample interiors can be obtained easily without destroying the samples. Non-destructive shape observation, dimension measurement, and density observation of sample interiors makes this system effective for failure analysis and quality control.



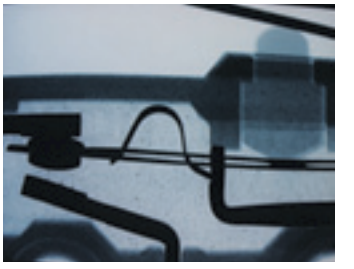
■ICT image of GFRP (fiber diameter: 18 μm)

•Microfocus X-ray CT System SMX-225CT-SV

This system uses micro x-rays with focus dimensions of 4μm and sample interiors can be viewed with magnification factors ranging from 3 to 65 or, by changing the system configuration and using image processing, more than 260. CT (computerized tomography) images and 3D images can be obtained easily.

•Microfocus X-ray TV System SMX-130

Ideal for the evaluation and measurement of the internal structure of engineering plastics, fine ceramics, and composite materials.

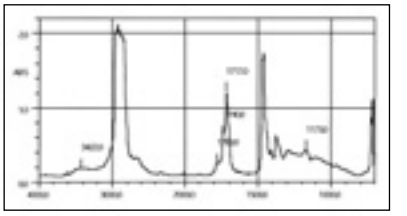


■Fluoroscopic image of microswitch
The state of microswitch contacts can be observed (e.g., for whiskers)

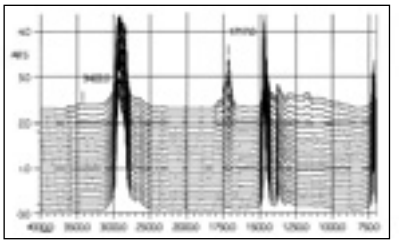
Material Evaluation, Quality Control, Research and Development

Material evaluation, color measurement, molecular weight distribution

We have a lineup of instruments that can be used for material evaluation, component analysis and color measurement, evaluation for quality control, and research and development work, such as the measurement of molecular weight distributions for polymers.



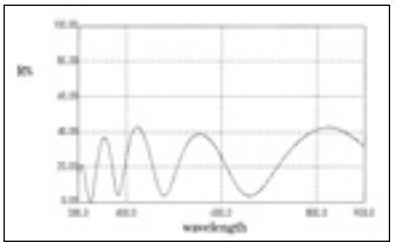
■Spectrum of reverse-side layer of thermally oxidized polyethylene



■Spectra of layer in thermally oxidized polyethylene

•Fourier Transform Infrared Spectrophotometer IRPrestige-21

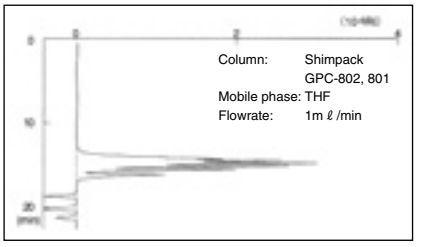
Allows material evaluation, component analysis, and deterioration analysis of rubber and plastics to be performed easily. It is also effective for partial structural analysis when used in combination with a microscope.



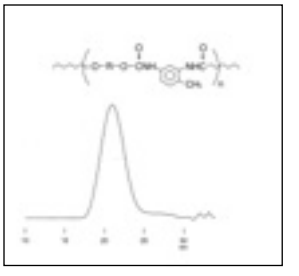
■Measurement of a 0.5μm photoresist film (on a silicon wafer)

•UV-VIS Spectrophotometer UV-2450/2550

Non-destructive thickness measurement is possible for a wide variety of films.



■Measurement of polyethylene glycol



■Analysis of polyurethane resin

•High-performance Liquid Chromatograph GPC System

A system for measuring the molecular weight distribution of polymers. It is equipped with visual, easy-to-use calibration curve creation functions, simple graph overwriting functions, and ASCII conversion functions. Also, using features such as time correction based on internal standard peaks, detector delay correction, and sensitivity correction for refractive index detector, it is possible to adjust the whole system and thereby perform accurate molecular weight calculations.

Evaluation of Particle and Powder Properties

Particle size distribution

Powders are collections of particles distinct from solids and liquids; they have properties and exhibit behaviors that would put them somewhere between solids and liquids. For this reason, measurement of particle size distribution, specific surface area, and pore distribution is usually performed using instruments specifically for the evaluation of the surface properties of powders.

•Laser Diffraction Particle Size Analyzer SALD-3100

[Model for Analyzing Coarse and High-density Particles]

Measurement range: 0.05 to 3,000 μm

Light source: Red semiconductor laser (wavelength: 690 nm)

The sampler is equipped with a powerful pump that ensures the reliable circulation of coarse and high-density particles, making this analyzer suitable for the particle distribution analysis of soil and sand. It is ideal for research into environmental problems and measures for disaster prevention.

•Laser Diffraction Particle Size Analyzer SALD-2100

[SALD-series Standard Model]

Measurement range: 0.03 to 1,000 μm

Light source: Red semiconductor laser (wavelength: 680 nm)

The successor to the SALD-2000 Series, which has proved to be one of the most popular product lineups in this field. Consistency and compatibility with the SALD-2000 Series was given high priority in its development.

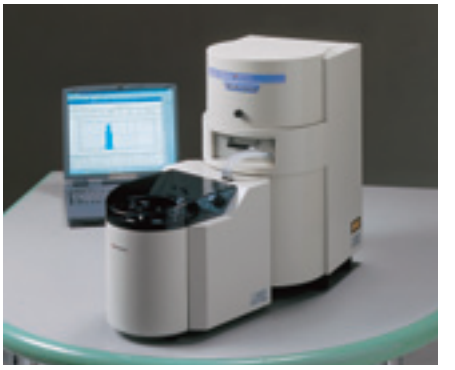
•Laser Diffraction Particle Size Analyzer SALD-7000

[Model for Analyzing Ultrafine Particles]

Measurement range: 0.015 to 500 μm

Light source: Blue-violet semiconductor laser (wavelength: 405 nm)

Performs accurate measurement of ultrafine particles using laser diffraction and scattering. It is a wet-type instrument that reliably captures blue and black fine/ultrafine particles, a task that was difficult with earlier methods.



•Laser Diffraction Particle Size Analyzer SALD-300V

[Standard Model for Analyzing Sub-micron Particles]

This analyzer uses a blue-violet semiconductor laser (wavelength: 405 nm), which allows it to measure sub-micron particles. It is a wet-type instrument that is ideal for the measurement of samples with relatively small specific gravities, such as food products, drinks, pharmaceuticals, cosmetics, emulsions, pigments, and paints. It reliably captures blue and black fine/ultrafine particles, a task that was difficult with earlier methods.

- •Model 1 (measuring unit only)
  Measurement range: 0.1 to 50 μm
  Cell: Dedicated batch cell
- •Model 2 (measuring unit and sampler)
  Measurement range: 0.1 to 350 μm
  Cell: Batch cell/flow cell

•Laser Diffraction Particle Size Analyzer SALD-200VER

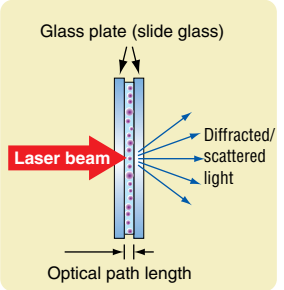
[Standard Model]

A high-performance, low-cost, space-saving, wet-type instrument that is ideal for the measurement of samples with relatively low specific gravities, such as food products, drinks, pharmaceuticals, cosmetics, and emulsions.

- •Model 1 (measuring unit only)
  Measurement range: 0.25 to 50 μm
  Cell: Dedicated batch cell
- •Model 2 (measuring unit and sampler)
  Measurement range: 0.25 to 350 μm
  Cell: Batch cell/flow cell

A high-concentration sample measurement system is available as an option for the SALD Series.

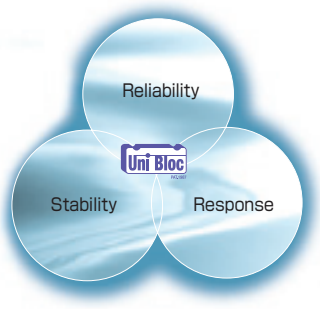
Principle of High-concentration Sample Measurement System



The influence of multiple scattering is avoided by enclosing the sample between two glass plates, thereby making the optical path length as short as possible. This system allows samples for which the particle size distribution changes due to dilution to be measured in the undiluted state, or with the absolute minimum dilution, and real images of the samples to be obtained.

Mass Evaluation

Mass is one of the most fundamental physical properties of an object. Shimadzu's over eighty years of weighing expertise is integrated with the newest technology to satisfy any requirements of precision weighing.



UniBloc Family Balances

Shimadzu commercially introduced one-piece force cell technology as early as 1989, installed in EB-K / EB-KW series precision platform balances. Recent achievements successfully extended the application of this technology. Now, ranging from 0.01mg up to 52kg, UniBloc one-piece force cell technology brings superb stability, fast response and long operational life to precision balances.

AUW-D/AUW/AUX/AUY Series

Model	Capacity	Minimum display	PSC	Clock-CAL	GLP/GMP/ISO calibration report	Windows Direct
AUW220D	220g/82g	0.1mg/0.01mg	●	●	●	●
AUW120D	120g/42g	0.1mg/0.01mg	●	●	●	●
AUW320	320g	0.1mg	●	●	●	●
AUW220	220g	0.1mg	●	●	●	●
AUW120	120g	0.1mg	●	●	●	●
AUX320	320g	0.1mg	●		●	●
AUX220	220g	0.1mg	●		●	●
AUX120	120g	0.1mg	●		●	●
AUY220	220g	0.1mg				●
AUY120	120g	0.1mg				●

AUW-D/AUW/AUX/AUY Series

AUW-D dual-range analytical balances are the world's first semi-micro balances with the advantages of UniBloc technology. Together with the single-range AUW/AUX/AUY series, they offer unrivalled response, zero-return and stability. Accurate measurement is maintained with two modes of fully-automatic calibration; PSC (temperature based) and Clock-CAL (by time setting). Built-in clock supports automatic calibration report that meets GLP/GMP/ISO requirements. Shimadzu's unique WindowsDirect function allows handy yet secure data transmission to any of user's Windows applications without additional software. Density and specific gravity can be computed with the standard software. Dedicated specific gravity measurement kit (option) enhances efficiency even further.

UW Series

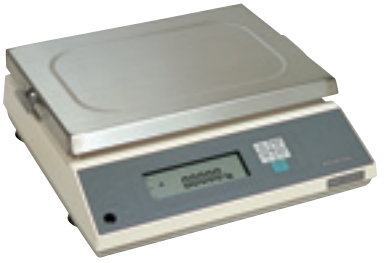
Model	Capacity	Minimum display	PSC	Clock-CAL	GLP/GMP/ISO calibration report	Windows Direct
UW220H	220g	0.001g	●	●	●	●
UW420H	420g	0.001g	●	●	●	●
UW620H	620g	0.001g	●	●	●	●
UW2200H	2200g	0.01g	●	●	●	●
UW4200H	4200g	0.01g	●	●	●	●
UW6200H	6200g	0.01g	●	●	●	●
UW420S	420g	0.01g	●	●	●	●
UW820S	820g	0.01g	●	●	●	●
UW4200S	4200g	0.1g	●	●	●	●
UW8200S	8200g	0.1g	●	●	●	●

UX Series

Model	Capacity	Minimum display	PSC	Clock-CAL	GLP/GMP/ISO calibration report	Windows Direct
UX220H	220g	0.001g			●	●
UX420H	420g	0.001g			●	●
UX620H	620g	0.001g			●	●
UX2200H	2200g	0.01g			●	●
UX4200H	4200g	0.01g			●	●
UX6200H	6200g	0.01g			●	●
UX420S	420g	0.01g			●	●
UX820S	820g	0.01g			●	●
UX4200S	4200g	0.1g			●	●
UX8200S	8200g	0.1g			●	●

UW/UX Series

Shimadzu's newest top-loading balance series provides the supreme combination of performance and innovative features. Weighed result is displayed instantly and stands still. Excellent durability also meets repeated use in production sites. Choice of auto print modes and Shimadzu's unique WindowsDirect function enhance productivity without optional software. Checkweighing modes for quality control purposes and display back light are also useful features in factory use. Measurement administration is also given good consideration. Calibration report can be automatically output to meet international standards. UW is equipped with built-in calibration weight and PSC, Clock-CAL fully- automatic calibration functions are standard.
Specific gravity measurement software is already installed and optional measurement kit allows more efficient measurements.



BW-K/BX-K Series

BW-K/BX-K Series

Model	Capacity	Minimum display	Built-in calibration weight	GLP/GMP/ISO calibration report	Windows Direct
BW12KH	12kg	0.1g	●	●	●
BW22KH	22kg	0.1g	●	●	●
BW32KH	32kg	0.1g	●	●	●
BW32KS	32kg	1g	●	●	●
BW52KS	52kg	1g	●	●	●
BX12KH	12kg	0.1g		●	●
BX22KH	22kg	0.1g		●	●
BX32KH	32kg	0.1g		●	●
BX32KS	32kg	1g		●	●
BX52KS	52kg	1g		●	●

Large capacity with fine readability offer various possibility for industries. Weighing precious materials in bulk, efficient but precise compounding, confirming small parts not missing in a large assembly, etc. UniBloc technology gives fast response, display stability and endurance, all of which are essential for large capacity industrial balances. Auto print, WindowsDirect and various productivity functions are ready for use as standard features. BW-K has a large-size built-in calibration weight to ensure utmost accuracy.

AW/AX/AY Series

AW/AX/AY Series

Model	Capacity	Minimum display	PSC	Clock-CAL	Motor-driven calibration weight	GLP/GMP/ISO calibration report	Windows Direct
AW320	320g	0.1mg	●	●	●	●	●
AW220	220g	0.1mg	●	●	●	●	●
AW120	120g	0.1mg	●	●	●	●	●
AX200	200g	0.1mg			●	●	●
AX120	120g	0.1mg			●	●	●
AY220	220g	0.1mg					●
AY120	120g	0.1mg					●

Equipped with the WindowsDirect function, enabling measurement data to be transferred to any Windows application with just one cable. Spacious weighing chamber provides ease in weighing any objects. AW/AX series are equipped with a motor-driven calibration weight, which makes it fairly easy to maintain weighing accuracy all the time. AW series also offers two types of fully-automatic span calibration functions. PSC is based on temperature detection, and Clock-CAL, is performed at user pre-set times of the day. GLP/GMP/ISO-compliant calibration report can be automatically output, supported by the built-in clock (AW/AX series).

BL Series

BL Series

Model	Capacity	Minimum display	Description
BL220H	220g	0.001g	
BL320H	320g	0.001g	
BL2200H	2200g	0.01g	
BL3200H	3200g	0.01g	
BL3200HL	3200g	0.01g	Display backlight
BL320S	320g	0.01g	
BL620S	620g	0.01g	
BL3200S	3200g	0.1g	

Compact and affordable, though, high accuracy that is brought by the electro-magnetic system is the same as analytical balances'. Their quick response is appreciated particularly in production and quality control sites. Unit conversion, percentage conversion and piece counting are standard features. BL3200HL model is equipped with display back light.

EL/ELB Series

EL Series

Model	Capacity	Minimum display	Rechargea ble battery (option)	Dry battery operation (standard)
EL120	120g	0.01g	●	N/A
EL200	200g	0.01g	●	N/A
EL300	300g	0.01g	●	N/A
EL600	600g	0.05g	●	N/A
EL600S	600g	0.1g	●	N/A
EL1200	1200g	0.1g	●	N/A
EL2000	2000g	0.1g	●	N/A
EL3000	3000g	0.1g	●	N/A
EL6000S	6000g	1g	●	N/A
EL12K	12000g	1g	●	N/A

ELB Series

Model	Capacity	Minimum display	Rechargea ble battery (option)	Dry battery operation (standard)
ELB120	120g	0.01g	N/A	●
ELB200	200g	0.01g	N/A	●
ELB300	300g	0.01g	N/A	●
ELB600	600g	0.05g	N/A	●
ELB600S	600g	0.1g	N/A	●
ELB1200	1200g	0.1g	N/A	●
ELB2000	2000g	0.1g	N/A	●
ELB3000	3000g	0.1g	N/A	●
ELB6000S	6000g	1g	N/A	●
ELB12K	12000g	1g	N/A	●

Handy low cost balances, but there is no compromise in accuracy. Reliable strain-gauge load cell brings resolution up to 30,000. One-second response comes with accuracy and stability. Piece counting, percentage, unit conversions and specific gravity software are all standard features. Now all these advantages are available with dry battery operation (ELB). Easy battery replacement feature and long battery life make this series the most user-friendly balances for field use.

Evaluation of Static Strength Properties

Tensile properties, compression properties, bending properties, hardness, surface properties

A variety of tests are carried out to test material strength properties. For example, tensile tests, compression tests, and bending tests are used as basic static strength tests to obtain the relationship between the external force and deformation, dynamic fatigue tests are used to obtain information on the durability, and rheology tests are used to obtain processability properties. From high-performance measurement to automatic labor-saving measurement, Shimadzu provides a wide variety of products to meet testing requirements.

AG-100kNIS

AG-10kNIS

AGS-J

•Autograph AG-IS Series

A load cell-type high-precision universal tester designed with an emphasis on functionality and operability. A highly rigid frame and 1.25-ms ultrahigh-speed sampling enable high-precision measurement of elasticity and breaking points. This tester has a wide testing speed range of 0.00005 to 1,000 mm/min (ultralow-speed model), allowing use for a wide variety of materials. Data processing and control can be performed using software (Trapezium2) with a user interface that was designed utilizing feedback from users all over the world to ensure a high level of operability.

•Autograph AGS-J Series

A table-top autograph with finely tuned basic functions that offers a high level of operability through computer control and an easy-to-use operating panel.

■Major Applicable Standards

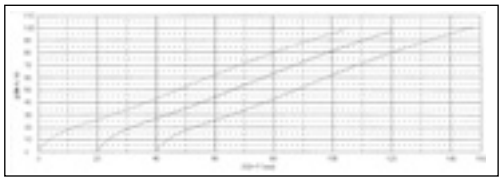
Plastics

JIS K 7161	Plastics–Determination of tensile properties Part 1: General principles (ISO 527-1, ASTM D5938)
JIS K 7162	Plastics–Determination of tensile properties Part 2: Test conditions for moulding and extrusion plastics (ISO 527-2, ASTM D5937)
JIS K 7171	Plastics–Determination of flexural properties (ISO 178, ASTM D5943)
JIS K 7127	Plastics–Determination of tensile properties–Part 3: Test conditions for films and sheets (ISO 527-3)
JIS K 7181	Plastics–Determination of compressive properties (ISO 604)

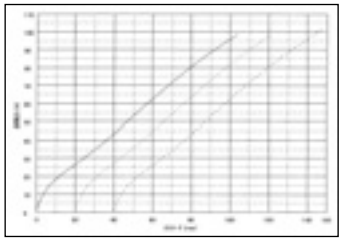
Rubber

JIS K 6251	Tensile testing methods for vulcanized rubber (ISO 037)
JIS K 6252	Rubber, vulcanized or thermoplastics–Determination of tear strength (ISO 34-1, -2)
JIS K 6254	Vulcanized rubbber–Determination of stress-strain properties at low deformation
JIS K 6256	Adhesion testing methods for rubber, vulcanized or thermoplastic
JIS K 6257	Accelerated aging test methods for vulcanized rubber

Examples of Data Created with an Autograph

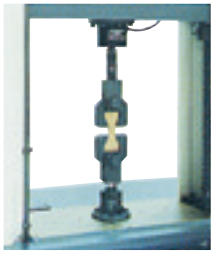


Display during testing



Graph of test force against stroke

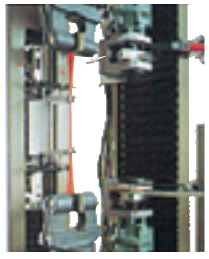
Tensile, Compression, Bending, and Environmental Tests



Tensile test for plastics

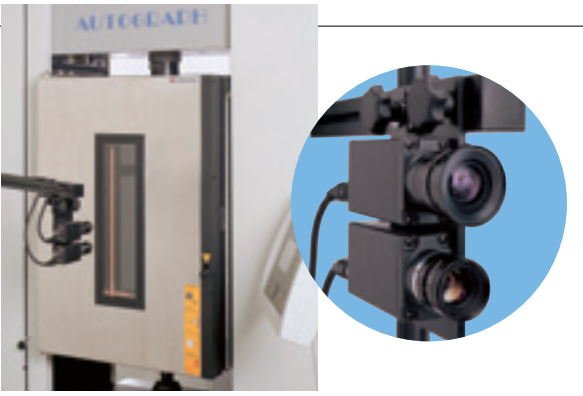
Compression test for foam rubber

Bending test



Gauged extension measurement

Environmental test

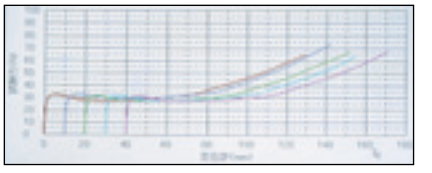


•Autograph with Video Extensometer DVE-101/201

The DVE-101/201 non-contact video extensometers enable accurate extension measurement over a wide measurement range without affecting the samples. They can even be used for the extension measurement of film, a difficult task with contact-type extensometers. These instruments offer a level of precision corresponding to class 1 of JIS B7741.

•Fully Automatic Tensile Test System for Rubber

This system enables the automation and continuous 24-hour operation of all tasks, including measurement of the test-piece dimensions, feeding to the tester, gripping, gauged extension measurement, and data processing. It can be used to advance the laboratory automation of material testing.



■Tensile test data

•Fully Automatic Bending Test System for Plastics

A system capable of performing fully automated tensile and bending tests for plastics. It allows the continuous operation of all tasks, including measurement of the sample dimensions, feeding to the testers, and data processing. It also conforms to the following testing standards for plastics: JIS K7161, K7171, ISO 178, 527.

Evaluation of Static Strength Properties

Tensile properties, compression properties, bending properties, hardness, surface properties

Hardness measurement is the simplest type of material test. From the hardness, it is possible to obtain a rough idea of the strength properties, and thereby make simple pass/fail judgments. Choose the instrument to suit your application, whether it be rubber testing or hardness measurement of surface films.

Applicable JIS standards:
Z2245: Rockwell type hardness test — Test method
K6911: Testing methods for thermosetting plastics
K7202: Plastics — Determination of hardness
— Part 2: Rockwell hardness

•Rockwell Type Hardness Tester DXT Series

A Rockwell type hardness tester equipped with a scale for resin as a standard feature. In keeping with the broadband age, this tester is equipped with the functionality to send data directly to a PC. It has many other advanced features, such as an auto-start function and digital display capability, that ensure a high level of operability and reliability.

Applicable JIS standards:
K6253: Hardness testing methods for rubber, vulcanized or thermoplastic

•Rubber Hardness Tester (Type-A Durometer)

Measures the hardness of commonly used rubber materials and products simply and quickly.

HMV-2 with Auto Detection System(Optional)

Applicable JIS standards:
Z2244: Vickers hardness test — Test method
Z2251: Knoop hardness test — Test method

•Micro Hardness Tester HMV-2

Equipped with an automatic switching function that allows test, load, and load holding time selection to be performed with touch panel operations. Select from different system configurations to suit your application. For example, it is possible to have an electromotive revolver automatically perform lens-indenter changeover and other test operations, or the touch panel can be used at eye-line level with the externally mounted LCD system.

Applicable JIS standards:
Z2244: Vickers hardness test — Test method
Z2251: Knoop hardness test — Test method

•Semi-Vickers Hardness Tester HSV-30

A Vickers hardness tester that is capable of a wide load range of 1.96 to 294 N. It can perform the Vickers harness test for both small and large components as well as metallic materials. The user interface is a large LCD touch panel that allows easy, fast operation.

•Dynamic Ultra Micro Hardness Tester DUH-W201

A tester that can perform deterioration evaluation for plastics and rubber, hardness tests for resin film, and the evaluation of Young's modulus. This is a new system that enables hardness evaluation at the micro level, such as for semiconductors, LSIs, ceramics, hard disks, thin film deposits, and thin coating layers, areas that cannot be handled by conventional testers.

Applicable JIS standards:
Z8841: Granules and agglomerates
— Test methods for strength

•Micro Compression Testing Machine MCT-W Series

An instrument that tests the compression-rupture strength of particulate matter (diameter: 1 to 500 μm). It can be used to perform compression-rupture tests for plastics, ceramics, pigments, food products, and pharmaceuticals at the particle stage of their development; these tests have a significant bearing on the performance of the finished product.

Applicable JIS standards:
R3255: Test methods for adhesion of thin films on glass substrate

•Scanning Scratch Tester SST-W101

An instrument that tests the adhesive strength of resin films. It can be used to evaluate the tribological properties of sample surfaces, such as the abrasion characteristics and the adhesive strength. It uses a stylus-based scratching method and ensures high reproducibility of measurement results.

Evaluation of Dynamic Strength Properties

Fatigue testing, magnetic fatigue micro-testing, fatigue testing based on SEM-image observation, properties of rubber for preventing/damping vibrations, high-speed puncture

Strength is one of the basic properties of material. Shimadzu provides a variety of instruments to measure a wide range of properties, such as basic static strength measurement, fatigue strength with respect to repeated load applications, impact strength with respect to applied shock, and the dynamic behavior of components.

EHF-LM20kN

EHF-EM100kN

•Fatigue Testing System Servopulser

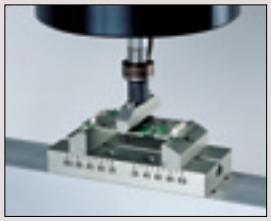
A system for testing the durability of materials and products. The lineup includes low-capacity models that are ideal for testing rubber and plastics. There are several types of controller available, including cutting-edge, high-grade, fully digital models that perform PID control with two degrees of freedom and compact table-top models.

•Magnetic Micro Testing System Microservo MMT-101NB-10

A system that can perform the static and dynamic evaluation of rubber and plastic materials and products with micro-level testing force and displacement. It can run on a 100-V power supply and has an environment-friendly design that does not use coolant or hydraulic fluid.

Jig for tensile tests

Jig for compression tests



Jig for 3-point bending tests

Jig for key-press tests

SEM

•SEM Image Observation Fatigue Testing System SEM Servopulser

Material failure mechanisms can be analyzed at the micro level. Combining a scanning electron microscope (SEM) and a fatigue tester allows microscopic, real-time observation of the fatigue that occurs at sample surfaces.

•Anti-vibration Rubber Testing System

A system for measuring the important properties of anti-vibration rubber: the dynamic spring constant, the damping coefficient, and the loss coefficient. Measurement values are processed and the required values are output.

Shear load testing system for testing vibration-damping rubber

•Vibration-damping Rubber Testing System

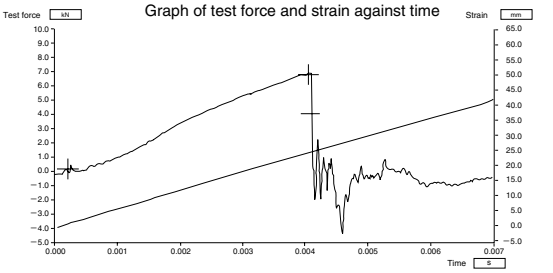
Vibration-damping rubber is used to reduce the vibrations that occur in tall buildings during earthquakes. The restoring force, the spring constants, and the absorbed energy when a perpendicular testing force of 15 MN (1,500 tf) and a shearing force of 4 MN (400 tf) are applied to laminated vibration-damping rubber are measured. This system can be used for the research and development of vibration-damping rubber and for checking product performance.

•High-speed Punching Out Type Impact Testing Machine

Hydroshot

This system performs high-speed (20 m/s max.) puncture testing of plastic flat-plate test pieces.

Graph of test force and strain against time



Testing speed: 6 m/s

Dynamic Balance Evaluation

Crossflow fans, CD-ROMs, DVDs, standard fans

If rotating objects are not dynamically balanced, vibrations and noise can occur during rotation and the specified performance characteristics may not be attained. Dynamic balancing machines can be used to measure the level of dynamic imbalance and the objects can be corrected with an optional corrective device.

•Dynamic Balancing Machine for Crossflow Fans SDB-3L

A horizontal, soft-type, high-precision balancing machine that tests the dynamic balance of air-blowing components in crossflow fans.

•Dynamic Balancing Machine for CD-ROMs and DVDs VG-03TKL

Performs measurement for thin disk-shaped components.

•Dynamic Balancing Machine for Air-conditioner Fan Assemblies VG2-10KL

Performs vertical, double-sided measurement for a variety of fans. Self-driving operation is used for workpiece rotation.

•Dynamic Balancing Machine for Fans VG-10KL

A balancing machine that tests the dynamic balance of thin fans using vertical, single-sided measurement.

Control Software for the DBM-G Dynamic balancing machine

A new series of control software for the DBM-G dynamic balancing machine has arrived. Comprehensive imbalance measurement and management of all items can be performed using the new Balance Studio control software package.

Fully compatible with mouse and keyboard

Easy-to-view screen

Simultaneous 3-side/4-side display supported as standard feature

■Measurement screen

SHIMADZU CUSTOMER SUPPORT CENTERS —— THE FOREFRONT OF DEVELOPMENT OF APPLICATION TECHNIQUES

Customer Support Center

Shimadzu has customer support centers in the USA, Germany, China and Singapore, as well as inJapan. There, we carry on research and development for a wide variety of application techniques, while contributing to dissemination of application techniques through lecture meetings, service training course, and consultations on analytical applications and so on.

Hadano Works

Technical Center

Shimadzu Overseas Customer Support

To support customers engaged in the rubber and plastic product development and quality control, Shimadzu has established a global service network incorporating customer support, training and service centers in the USA, Germany, China and Singapore, as well as in Japan. Shimadzu provides comprehensive support services including instrument maintenance, training workshops and the provision of relevant information to meet customer needs regarding both software and hardware.

- OVERSEAS SUBSIDIARIES
- OVERSEAS OFFICES
- JOINT VENTURES
- CUSTOMER SUPPORT CENTERS

SHIMADZU CORPORATION. International Marketing Division
3. Kanda-Nishikicho 1-chome, Chiyoda-ku, Tokyo 101-8448, Japan Phone: 81(3)3219-5641 Fax. 81(3)3219-5710
Cable Add.:SHIMADZU TOKYO

SHIMADZU SCIENTIFIC INSTRUMENTS, INC.
7102 Riverwood Drive, Columbia, Maryland 21046, U.S.A.
Phone: 1(410)381-1227 Fax. 1(410)381-1222 Toll Free: 1(800)477-1227

KRATOS ANALYTICAL INC.
100 Red Schoolhouse Road, Building A6 Chestnut Ridge, New York 10977, U.S.A
Phone: 1(845)426-6700 Fax. 1(845)426-6192

SHIMADZU DEUTSCHLAND GmbH
Albert-Hahn-Strasse 6-10, D-47269 Duisburg, F.R. Germany Phone: 49(203)7687-0 Fax. 49(203)766625

KRATOS ANALYTICAL LTD.
Wharfside, Trafford Wharf Road, Manchester M17 1GP U.K.
Phone: 44(0)161-888-4400 Fax: 44(0)161-888-4402

SHIMADZU (ASIA PACIFIC) PTE LTD.
16 Science Park Drive #01-01 Singapore Science Park, Singapore 118227, Republic of Singapore
Phone: 65-778 6280 Fax. 65-779 2935

SHIMADZU SCIENTIFIC INSTRUMENTS (OCEANIA) PTY. LTD.
Units F, 10-16 South Street Rydalmere N.S.W. 2116, Australia
Phone: 61(2)9684-4200 Fax. 61(2)9684-4055

SHIMADZU DO BRASIL COMERCIO LTDA.
Rua Cenno Sbrighi, 25, Agua Branca, Sao Paulo, CEP 05036-010, BRAZIL
Phone: (55)11-3611-1688 Fax. (55)11-3611-2209

SHIMADZU (HONG KONG) LIMITED
Suite 1028 Ocean Center, Harbour City, Tsim Sha Tsui, Kowloon HONG KONG
Phone: (852)2375-4979 Fax. (852)2199-7438

Overseas Offices
Istanbul, Beijing, Shanghai, Guangzhou, Shenyang, Chengdu, Moscow

URL http://www.shimadzu.com
Website http://www.kratos.com

Printed in japan 2310-07304-50ATD