

MITSUBISHI
CHEMICAL

Trace Sulfur Analyzer Model TS-100



CE

Trace amounts of sulfur can be measured rapidly by a completely dry technique with a sulfur detector employing an ultraviolet fluorescent method. The use of database software for data processing allows all aspects of measurement to be managed with a database for easy retrieval of data.

Features

1 Highly Sensitive Analysis of Sulfur and Nitrogen

The TS-100 Trace Sulfur Analyzer is a completely dry analyzer that uses an oxidation decomposition and ultraviolet fluorescence method. The sulfur detector of the TS-100 offers a high level of sensitivity that enables stable measurement of sulfur content down to the ppb level. Addition of an optional nitrogen detector using the field-proven oxidation decomposition and chemiluminescence method enables simultaneous detection of both sulfur and nitrogen.

This analysis is used in the certified methods indicated below.

Oxidation decomposition and ultraviolet fluorescence
ASTM-D5453

Oxidation decomposition and chemiluminescence
JIS-K2609
ASTM-D4629, D5176, D5762 and D6069

3 Outstanding Ease of Operation and Improved Functions Using Windows®95/98



The system can be operated easily simply by using a mouse. All measurement conditions are contained in the database, allowing samples to be measured simply by selecting the optimum conditions. In addition, a full range of help functions are available that can be used as a supplement to the instruction manual.

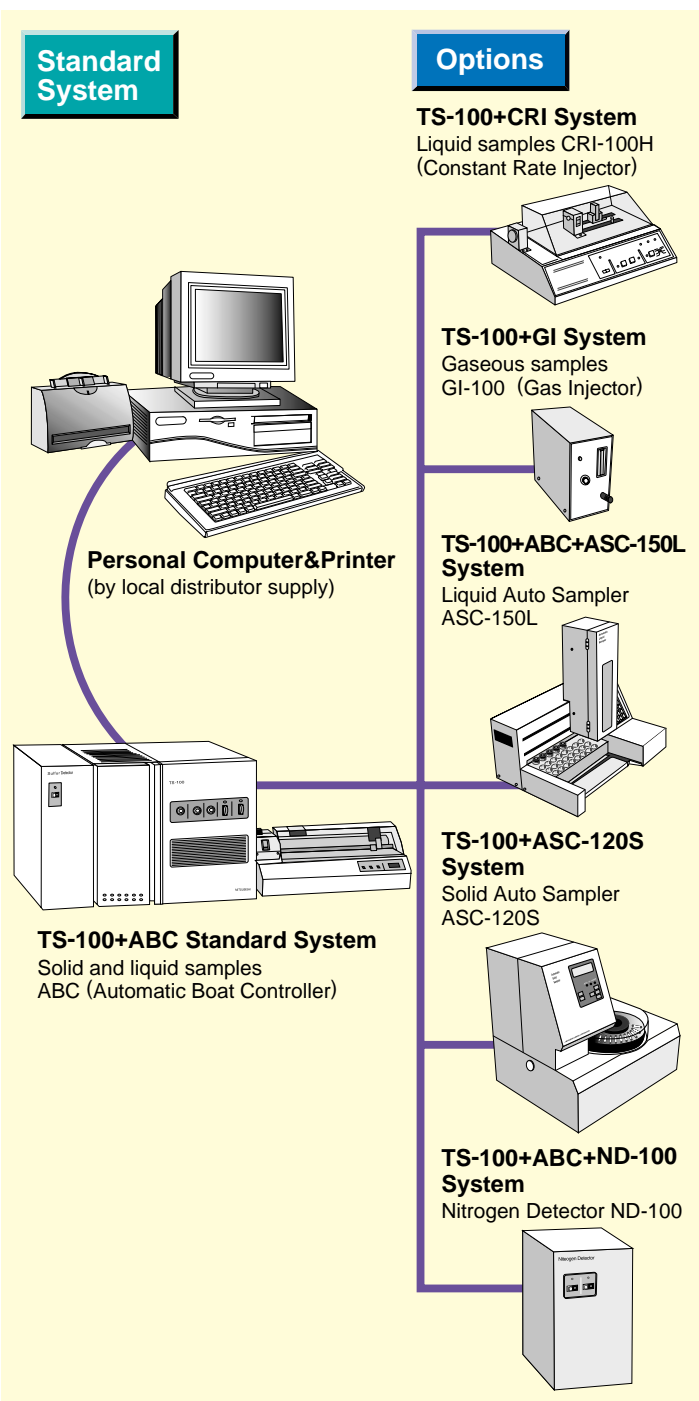
4 High-Speed Analysis Through the Use of Automatic Boat Controller (ABC)



Operation is started simply by placing a sample in the sample boat. Analysis is performed automatically in about 6-12 minutes. The standard system enables sample analysis to be performed with outstanding reproducibility. Since the sample inlet box is provided with a cooling function (electronic cooling), the sample boat can be cooled in a short time.

2 System Configuration Corresponding to the Purpose of Use

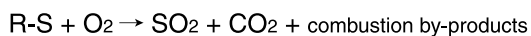
The system can be configured exactly as required by using various options according to the particular sample.



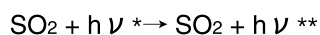
Measurement Principle

Sulfur

The sample is injected into a reaction tube maintained at a high temperature (800-1000°C) using argon gas for the carrier gas. Sulfur compounds in the sample are broken down by pyrolysis and then oxidized by O₂ gas resulting in the formation of SO₂ at a constant ratio.



When SO₂ is irradiated with ultraviolet light *(190-230 nm), the ultraviolet rays are absorbed and SO₂ molecules in the resulting excited state emit energy generated in the form of fluorescent ultraviolet rays after which they return to the ground state.



These ultraviolet fluorescent rays**(300-450nm) are captured with a photomultiplier and converted into an AREA value following waveform processing. The total sulfur concentration in the sample is then determined using a calibration curve prepared in advance with a standard solution.

Nitrogen

The sample is injected into a reaction tube maintained at a high temperature (800-900°C) using argon gas for the carrier gas. Nitrogen compounds in the sample are broken down by pyrolysis followed by oxidation by O₂ gas yielding NO. The NO gas that is formed is removed of moisture with a dryer and reacted with O₃ gas resulting in the occurrence of oxidation reaction as indicated with the reaction equation below.



Light having a wavelength of 590-2500 nm is emitted during the course of this reaction. The intensity of this light is proportional to NO concentration over a broad range. The emitted light is captured with a photomultiplier tube and converted to an AREA value after waveform processing. The total nitrogen concentration in the sample is then determined using a calibration curve prepared in advance with a standard solution. Furthermore, although inhibiting substances such as SO_x and CO₂ are formed during the course of decomposition into NO depending on the sample, the use of a reduced pressure, chemiluminescence method minimizes their effects.

Applications

Sample Name	Sample Volume(μl)	Sulfur			Nitrogen		
		No. of Measurements	Measured Value(ppm)	RSD(%)	No. of Measurements	Measured Value(ppm)	RSD(%)
Naphtha	10	5	181	0.6	3	1.9	2.9
Gas oil	10	3	133	0.6	3	10	1.9
Kerosene	10	3	25	1.2	3	3.5	1.9
Gasoline	10	3	145	1.8	3	35	1.8
Lubricating oil	10	5	2870	1.2	5	5.6	1.2
Fuel oil	10	3	1340	0.5	3	99	0.2
LPG	5 ml	5	1.4	2.2	5	0.7	4.8
PBT	30 mg	5	303	2.6	5	3.3	3.6

Automated Measurement System



TS-100 Total Sulfur Analyzer Non-Aqueous Sample Automated Measurement System

TS-100 Main Unit Sulfur Detector Automatic Boat Controller ND-100 Nitrogen Derector(option)
Liquid Auto Sampler ASC-150L (option) Personal Computer&Printer (by local distributor supply)

Windows®95/98 operating system and database management software combine to demonstrate a wide range of function ranging from basic to the latest functions.

TS-100 System Program

Combining the TS-100 main unit with a personal computer makes it possible to set up all devices required for measurement. The use of Windows®95/98 for the operating system of the personal computer lets the system be operated easily by practically anyone.



Input of Measurement Data Using the Method File

Operation

Calibration and sample measurement information are processed by this method file. Operating data for multiple sample types can be entered easily in cases, for example, of using an auto sampler.

Complete Data Management

Database

All data relating to measurement is stored in a database. In addition to calibration and measurement data, data queries can be made using the names of accessories used. This database allows data to be used by commercially available spreadsheet software, enabling reports to be prepared in any desired format.



System Diagnostic Function

QC Programs

Two QC programs are provided for determining system status. These programs contain a system check that confirms the linearity of reaction values, and a drift check that monitors circadian variations in reaction values. These QC programs are especially useful when assessing the time for maintenance.



Nitrogen Detector Model ND-100

Connecting this nitrogen detector to the TS-100 system allows measurement of total nitrogen in non-aqueous systems and solid samples.



Detection method	Oxidation decomposition, chemiluminescence
Measuring range	(reduced pressure) 0.5-5,000 ppm
Power supply	AC 100/115/230/240 V, 50/60 Hz, 194 VA
Dimensions	Approx. 260(W) x 360(D) x 430(H) mm
Weight	Approx. 17 kg

Liquid Auto Sampler Model ASC-150L

Liquid samples are measured, injected and rinsed automatically using a microsyringe. Up to 50 sample vials can be placed in the sampler, and 50 samples can be processed automatically, including sampling, measurement, data processing and report generation. Furthermore, this sampler is used in combination with the Automatic Boat Controller provided as standard equipment.



Sample	Aqueous and/or Nonaqueous Samples
Syringe	SGE 25 μl , 50 μl , 100 μl /Gastight Microsyringe(Special made) Standard attachment; 50 μl
Precision	Within 1%/ Full scale
Injection Rate	Low; 0.4-2.0 $\mu\text{l}/\text{sec}$ High; 10-50 $\mu\text{l}/\text{sec}$
Fill Rate	2, 5, 10, 20 $\mu\text{l}/\text{sec}$
Sample Vial	5 ml / 50 places
Rince Vial	28ml / 1 or 2 places
Sample Inj. Times	1-30 times / 1 vial
Multi Inj. Times	1-10 times / 1 vial
Rincing Function	Initial Rinse ; 0-5 times Sample Rinse ; 0-5 times Normal Rinse ; 0-5 times
Injection Mode	Flush, Spike
Power Supply	AC 100/115/230/240 V, 50/60 Hz, 60VA
Dimensions	Approx. 460(W) x 320(D) x 450(H)mm
Weight	Approx. 16 kg

Constant Rate Injector Model CRI-100H(for ND-100*)



Liquid samples are injected at a constant rate using a microsyringe. Even samples that burn with difficulty can be measured with high accuracy by controlling the injection rate.

Syringe	50 μl , 100 μl , 250 μl (gas-tight microsyringes)
Injection rate	0.4-2.0 $\mu\text{l}/\text{sec}$.
Injection volume	Max. 250 μl
Power supply	AC 100/115/230/240 V, 50/60 Hz, 40 VA
Dimensions	Approx. 320(W) x 270(D) x 173(H) mm
Weight	Approx. 6 kg

(Sample injection rate is normally 1.0 $\mu\text{l}/\text{sec}$.)

* Maximum injection volume for TS-100 is 50 μl . CRI-100H is used for nitrogen analysis.

Gas Injector Model GI-100



This system is used for analysis of sulfur and nitrogen in gaseous samples.

Applicable samples	Gaseous samples
Sample size	Standard sample size: Max. 20 μl (gas-tight microsyringe) Gas sample: Max. 10ml(gas-tight microsyringe)
Gas requirements	Argon (purity: 99.98% or more, 290-490 kPa)
Power supply	AC 100/115/230/240 V, 50/60 Hz, 30 VA
Dimensions	Approx. 120(W) x 250(D) x 235(H) mm
Weight	Approx. 4 kg

Solid Auto Sampler Model ASC-120S



Up to 20 solid samples can be measured automatically. The main unit contains a built-in automatic boat controller, and samples weighed in the quartz boats are measured according to pre-determined combustion conditions.

Sample	Solids/ Viscous Liquid Samples
Sample Size	Less than 30mg
Sample Boat	20 Places Quartz Sample Boat or Ceramic Sample Boat
Sample Introduction	Built-in Automatic Boat Controller (ABC)
Stop Points	3 Points + End Point + Cooling Point
Boat Cooling	Peltier Cooler
Power Supply	AC 100/115/230/240V, 50/60 Hz, 60VA
Dimensions	Approx. 440(W) x 360(D) x 430(H) mm
Weight	Approx. 20 kg

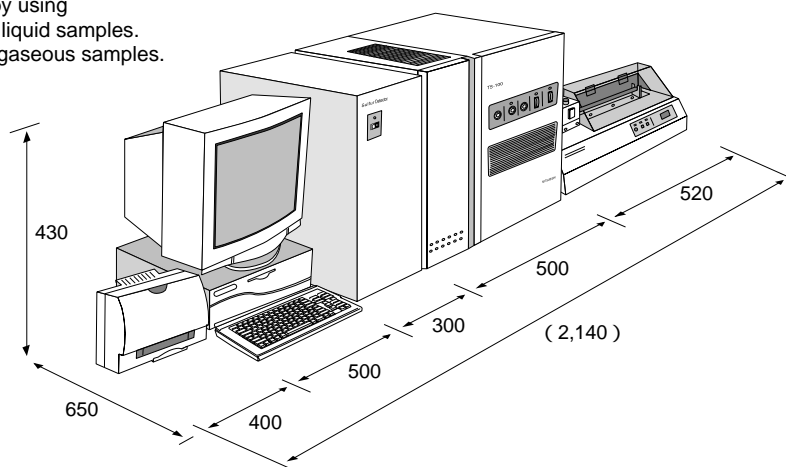
TS-100 Standard Specifications

Item	Sulfur Measurement (Standard)	Nitrogen Measurement (Option)				
Samples	Solid, liquid and gaseous samples					
Analytical method	Oxidative pyrolysis-ultraviolet fluorescence method	Oxidative pyrolysis-chemiluminescence method				
Sample introduction method	Automatically introduced using sample boat (using automatic boat controller)					
Sample size	Solid samples: 1-30mg, liquid samples: 5-50 μ l * ₁ , gaseous samples: 1-10ml * ₂					
Measuring range	0.05-10,000ppm	0.5-5,000ppm				
Measurement precision	Concentration (ppm)	Sample size (μ l)	RSD (%)	Concentration (ppm)	Sample size (μ l)	RSD (%)
	0.05	50	35	0.5	50	15
	0.5	10	15	5	10	5
	50	10	3	50	10	3
	1,000	10	2	100	10	3
	10,000	10	5	1,000	10	3
	* Detection lower limit: 0.02 ppm (BKL3 σ) (Data when using dibutylidissulfide for the standard solution)			(Data when using pyridine/toluene for the standard solution)		
Measurement time	3-10 min./measurement					
Data processing function	Using a personal computer					
Display function	Displayed on System PC					
Printing function	Printout using an external printer					
Keyboard	PC full keyboard					
Interface	Balance input (RS232C)					
Furnace temperature	Max. 1,100°C					
Analog output	0-1 V DC					
Gas requirements	Argon (purity: 99.98% or more, 290-390 kPa) Oxygen (purity: 99.97% or more, 290-390 kPa) * ₃					
Power supply	Main unit : AC 100/115/230/240 V, 50/60 Hz, 1400 VA Sulfur detector : AC 100/115/230/240 V, 50/60 Hz, 52 VA Automatic boat controller : AC 100/115/230/240 V, 50/60 Hz, 40 VA					
Dimensions and weight	Main unit : Approx. 500(W) x 360(D) x 430(H) mm, approx. 33 kg Sulfur detector : Approx. 260(W) x 360(D) x 430(H) mm, approx. 19 kg Automatic boat controller : Approx. 440(W) x 250(D) x 180(H) mm, approx. 11 kg					

Personal Computer (System Requirements to run TS-100 System)

Processor	Pentium®133MHz (Windows®95/98 pre-installed) or higher
RAM	32MB or higher
HD	Requires at least 100MB of available disk space
Drive	3.5-inch floppy disk drive and CD-ROM drive
Display	Display resolution at least 640x480
Printer	Windows®95/98-compatible printer

- * 1: The amount of sample injected can be increased up to 250 μ l by using the optional constant rate injector (CRI-100H) when measuring liquid samples.
- * 2: The optional gas injector (GI-100) is required when measuring gaseous samples.
- * 3: 1 kg/cm² = 98.066 kPa
- * All company and product names listed in these specifications are the trademarks or registered trademarks of each firm.
Company and product names contained herein are the trademarks or registered trademarks of the companies concerned.



Note:
Follow the instructions on the Manual to correctly install, connect and operate the instruments.
Content of the Catalogue is subject to change without prior notice when improvements are made in the performance.
The actual colors of the machine may appear different from colors printed in the Catalogue.

Dimensions (mm)

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