NSX-5000V: List of relevant standard test method

Element	Method	Number	Scope
Sulfur by UVFL	ASTM	D5453	Light hydrocarbons, Fuels, Oils
	ASTM	D6667	LPG, Gaseous hydrocarbons
	ASTM	D7183	Aromatic hydrocarbons
	ASTM	D7551	Gaseous hydrocarbons, LPG & NG
	DIN/EN/ISO	20846	Petroleum products
	JIS	K2541-6	Crude oil and petroleum products
	UOP	987 Part-A	Very volatile liquid hydrocarbons
Nitrogen by CLD	ASTM	D4629	Trace contents, Liquid petroleum hydrocarbons
	ASTM	D6069	Aromatic hydrocarbons
	ASTM	D7184	Ultra-traces, Aromatic hydrocarbons
	JIS	K2609	Crude oil and petroleum products
	UOP	936	LPG
	UOP	971	Light aromatic hydrocarbons
	UOP	981	Very volatile liquid hydrocarbons
Chlorine by coulometry	ASTM	D5808	Aromatic hydrocarbons
	ASTM	D4929	Crude oil
	ASTM	D7457	Aromatic hydrocarbons
	IP/EPA	9076	New and used petroleum products
	UOP	779	Petroleum products
	UOP	910	LPG and gases
Sulfur by coulometry	ASTM	D3120	Light petroleum hydrocarbons
	ASTM	D3246	LPG
	DIN/EN/ISO	16591	Petroleum products
	JIS	K2541-2	Crude oil and petroleum products
	JIS	K2240	LPG

Note: Follow instructions in manuals to correctly install, connect and operate the instruments. Contents of catalogues are subject to change without prior notice when inprovements are made in performance. The actual color of the goods may appear defferent from color printed. All screen images are inset synthesis. * Company and product names contained herein are the trademarks or registared trademarks of the company concerned.

⚠ Safety Precautions	● Read through the users' manual first before installing, piping, wiring, and operating this instrument, then always follow the manual for proper operation.

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Trace Elemental Analyzer

NSX-5000V SERIES

Vertical Furnace System

Nittoseiko Analytech Co.,Ltd.

NSX-5000V

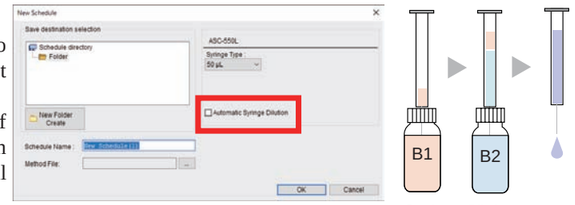
NSX-5000V contributes to monitor environmental impacts using advanced technologies.Measurement of trace nitrogen, sulfur and chlorine in liquid and gaseous samples is possible fully automatically to meet highest expectations towards sensitivity and safety.The wide range of applications includes for example quality control of petroleum/chemical/recycled products, automotive fuels and environmental analysis.

Features

Automatic syringe dilution (ASC-550L)

The patented Auto Syringe Dilution (ASD) technology allows to accurately and repeatedly perform automatic dilutions using lowest amounts of sample and solvents.
This simplifies automatic preparation of calibration curves out of one stock standard solution and reduces organic wastes when diluting samples into calibration range, thus reducing environmental impact and running costs.

※ **EUROPEAN PATENT No. EP 3 141 895 A1**



User-friendly software

The improved user interface can be adjusted to the requirements of different operators

Simple mode

Simple mode allows easy operation in a routine environment, using predefined methods and guided start-up and shutdown procedures.

Advanced mode

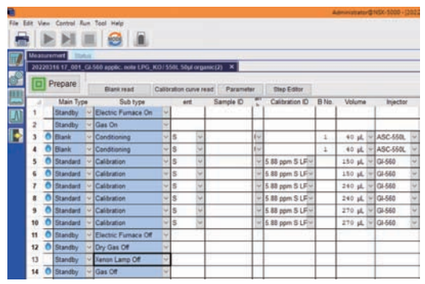
Advanced mode gives full flexibility for method development, customization and access to quality control and audit trail functions.

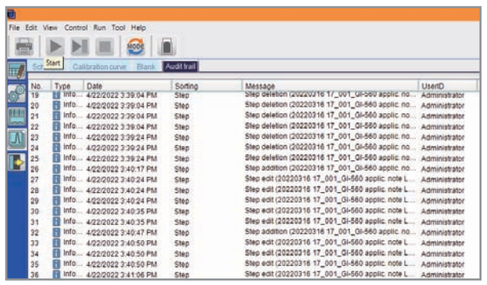
Automatic start-up and shut-down

Instrument start-up and shut-down procedures can be automated including flexible temperature and gas flow settings.

Audit trail

All operations and instrument conditions are recorded and allow full traceability of the measurement process.



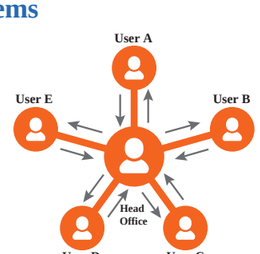


Import/Export function

Measurement related data and software related settings can be exported and (re-)imported.
This is not only for data security and backups, but makes transferring methods and user settings to other computers and instruments easy.

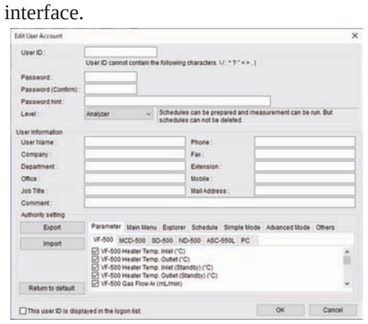
Imported/Exported items

- **Schedule**
- **Calibration curve**
- **Blank**
- **Method**
- **Measurement results** (CSV)
- **Combustion program**
- **Audit trail**
- **Authority setting**



User management

Multiple users with different access levels help to protect data from unintended changes and support an clean and easy to operate user interface.



Features

Wide detector sensitvity range

Two overlapping detector sensitivity ranges allow to measure nearly all samples without having to change methods.

		High sensitivity	Low sensitivity
ND-500		0.03～250 µg/mL	1～10,000 µg/mL
SD-500		0.02～100 µg/mL	1～10,000 µg/mL
MCD-500	Chlorine	0.05～200 µg/mL	1～5,000 µg/mL
	Sulfur	0.1～1,000 µg/mL	

※ For NSX-5000V/MCD chlorination, a high-density electrolyte solution is used for quantitation of 10µL or more in a single measurement.

Liquid sample temperature control system
STC-500L (Option)

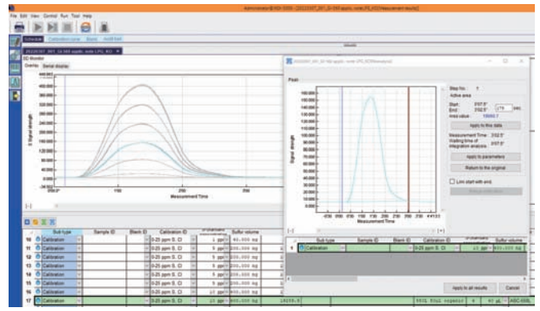
Temperature control of both sample rack and syringe allow precise sampling of volatile liquids (cooling mode) or viscous samples (heating mode).

Easy daily maintenance

Unique openable furnace and user friendly connectors make routine visual checks and maintenance of the pyrolysis tube a matter of seconds, thus increasing consumable lifetime and performance.

Reanalysis function ※Available at SD-500 or ND-500

Manual peak reintegration is possible after measurement to correct and optimize results as required.



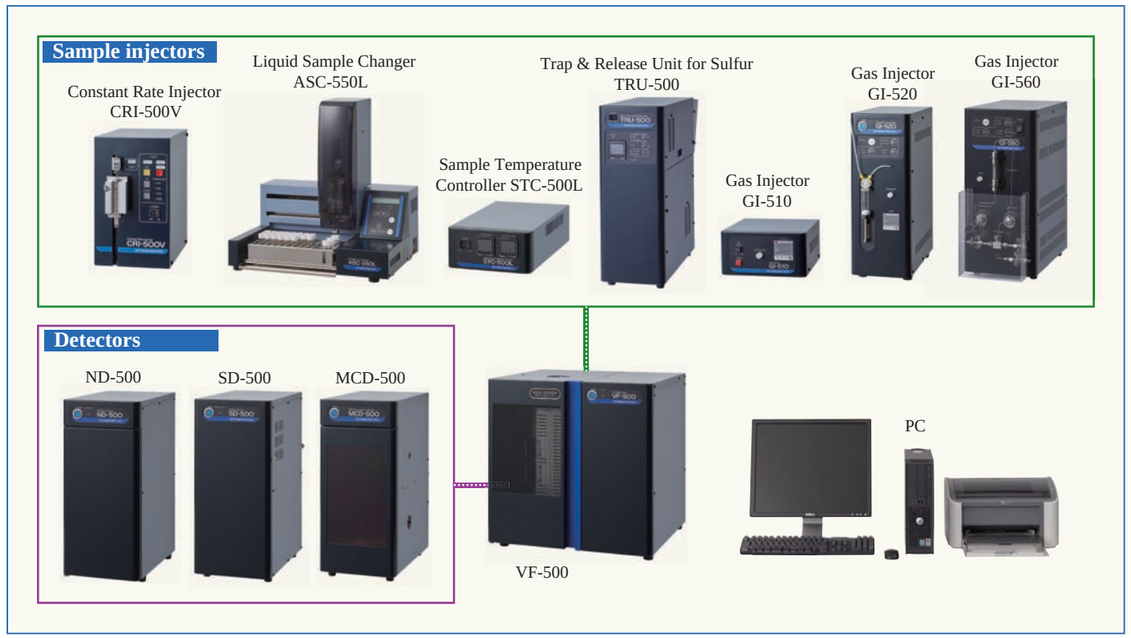
Low running cost

Less gas consumption than before. It is also available to shutoff the gas at the end of measurement automatically.

LINK to LIMS

Automatic output of measurement data to the network allow seamless integration into laboratory data management.

System configuration



NSX-5000V MEASUREMENT PRINCIPLE

UV fluorescence sulfur detector SD-500

Sulfur Measurement

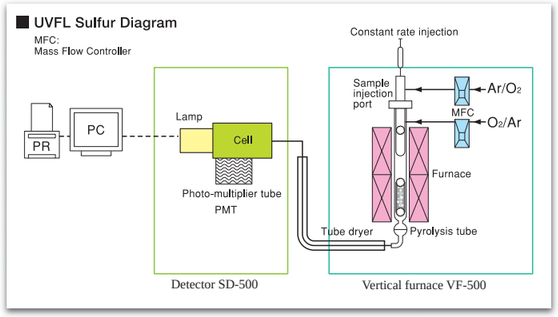
Sample is injected into a heated (800 to 1100 °C) pyrolysis tube with argon carrier gas. After sulfur compounds in the sample are pyrolyzed, they are oxidized by O_2 gas.

$$R\text{-}S + O_2 \rightarrow SO_2 + SO_3 + \text{combustion product}$$

The produced SO_2 gas is excited by irradiating the ultraviolet light v1 (190 to 230 nm). On returning to ground state, this SO_2* emits energy as fluorescent ray.

$$SO_2 + hv1 \rightarrow SO_2^* \rightarrow SO_2 + hv2$$

This fluorescent ultraviolet light v2 (300 to 400 nm) is receivedby the sulfur photomultiplier tube and the signal is integrated.
The sulfur concentration is obtained using a calibration curve preliminarily drawn with standard solutions.



■Sulfur (UVFL) sample application, n=3

	Volume, µL	Result, µg/mL	RSD, %
Diesel	40	9.54	0.4
Bio diesel	40	7.69	0.9
Kerosene	40	6.89	0.4
Lubricant*1	20	1020 (µg/g)	0.3
Heavy oil*1	20	0.101 (wt%)	0.2
Toluene*2	500	0.032	2.2
LPG*3	20 (mL)	7.02 (wtppm)	1.2
CO_2 gas*4	600 (mL)	21 (wtppb)	1.6

*1 Diluted by Toluene
*2 Equip with ASC-550L and TRU-500
*3 Equip with GI-520
*4 Diluted by Toluene

■SD-500 Detector

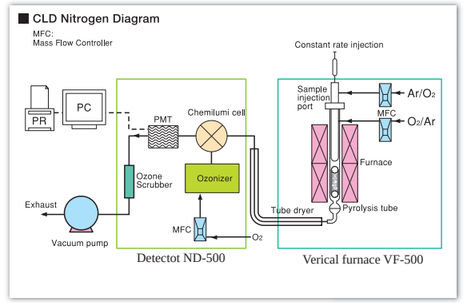
Chemiluminescence nitrogen detector ND-500

Nitrogen measurement

Sample is injected into a high-temperature (900 to 1000 °C) pyrolysis tube by argon carrier gas. After nitrogen compounds in the sample are pyrolyzed, it is combusted, oxidized, and converted to nitric oxide (NO). After removing moisture from the combustion gas by a dehumidifier (tube dryer), the following oxidation reaction occurs by the reaction of NO with ozone.

$$NO + O_3 \rightarrow NO_2 + O_2 + hv$$

By this reaction, 590 to 2,500 nm of emitting light is generated. The optical intensity of this light is proportional to the NO concentration at a wide wavelength range. After emitted light is detected by a photomultiplier tube and signal processing is performed, an area value is obtained. Using the calibration curve, the total nitrogen concentration in the sample is calculated. CO_2 and SOx generated during oxidative combustion can cause interferences. However, the interference can be decreased to an irrelevant level by applying reduced pressure inside the reaction chamber.



■Nitrogen (CLD) sample application, n=3

	Volume, µL	Result, µg/mL	RSD, %
Diesel	90	1.21	0.3
Kerosene	40	1.97	0.1
Lubricant*1	40	184 (µg/g)	0.9
Heavy oil*1	10	0.111 (wt%)	0.1

■Nitrogen (CLD) aqueous application, n=3

	Volume, µL	Result, µg/mL	RSD, %
Seawater*2	90	0.211	1.8
Brackish water	40	1.87	0.4
River water	40	9.15	0.8
H_2O_2 Solution	40	3.49	0.4

*1 Diluted by Toluene
*2 Equip with seawater measurment set

■ND-500 detector with vacuum pump

Specification for Trace Sulfur Analyzer NSX-5000V/SD(/ND)

	Sulfur measurement	Nitrogen measurement (optional)
Sample	Liquid/Gas	
Analytical method	Oxidative combustion and UV fluorescence detection	Oxidative combustion and chemiluminescence detection
Furnace	Max. 1,100 °C, Openable electric furnace, 2 heating zones	
Measuring range	2 to 20,000 ng (up to 10,000 µg/mL) LOQ: 0.02 µg/mL*	Non-aq. 3 to 20,000 ng (up to 10,000 µg/mL) Aq. 1 to 10,000 ng (up to 5,000 µg/mL) LOQ: Non-aq. 0.03 µg/mL*, Aq. 0.01 µg/mL *
Sample volume	Liquid: Max 200 µL	
Measurement time	less than 3 min	
Vacuum pump	—	Diaphragm type dry vacuum pump
Gas supply	Argon: Purity 99.98 % or more, 0.3 ± 0.1 MPa , Oxygen: Purity 99.7 % or more, 0.3 ± 0.1 MPa	
Power supply	VF-500: AC100 / 115 V (50 / 60 Hz), 1100 VA, AC230 / 240 V (50 / 60 Hz), 1800 VA SD/ND-500: AC100-240 V 300 VA	
Mass and weight	VF-500: 500(W) ×430(D)×500(H) mm, approx. 35 kg SD-500: 220(W) ×375(D)×500(H) mm, approx. 21 kg ND-500: 220(W) x 375(D) x 500(H) mm, approx. 22 kg Vacuum pump: 160 (W) × 320 (D) × 220 (H) mm, approx. 7.5 kg	

* Actual measurement range depends on the sample volume, the matrix, the purity of reagents and the condition of the unit.

Specification for Trace Nitrogen Analyzer NSX-5000V/ND

	Nitrogen measurement (non-aqueous system)	Nitrogen measurement (aqueous system)
Sample	Liquid/Gas	
Analytical method	Oxidative combustion and chemiluminescence detection	
Furnace	Max. 1,100 °C, Openable electric furnace, 2-heating zones	
Measuring range	3 to 20,000 ng (up to 10,000 µg/mL) LOQ: 0.03 µg/mL* Liquid: Max. 200 µL	1 to 10,000 ng (up to 5,000 µg/mL) LOQ: 0.01 µg/mL * Liquid: Max. 100 µL
Sample volume	Liquid: Max 200 µL	Liquid: Max 100 µL
Measurement time	less than 3 min	
Vacuum pump	Diaphragm type dry vacuum pump	
Gas supply	Argon: Purity 99.98 % or higher, 0.3 ± 0.1 MPa , Oxygen: Purity 99.7% or more, 0.3 ± 0.1 MPa	
Power supply	VF-500: 100/115 VAC, 50/60 Hz: 1,100 VA, 230/240 VAC, 50/60 Hz: 1,800 VA ND-500: 100/115/230/240 VAC, 50/60 Hz: 300 VA	
Mass and weight	VF-500: 500(W) ×430(D)×500(H) mm, approx. 35 kg ND-500: 220(W) ×375(D)×500(H) mm, approx. 22 kg Vacuum pump: 160 (W) × 320 (D) × 220 (H) mm, approx. 7.5 kg	

* Actual measurement range depends on the sample volume, the matrix, the purity of reagents and the condition of the unit.

MEASUREMENT PRINCIPLE

Micro coulometry detector MCD-500

Chlorine analysis

Samples are combusted in an argon/oxygen atmosphere.
The resulting hydrogen chloride is transferred into a titration cell whereit is automatically titrated by silver ions generated by electrolysis. The amount of chlorine is calculated from the quantity of electrical charge required for the titration.

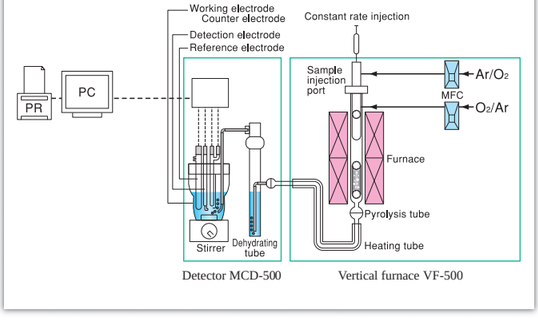
$$HCL + Ag^{+} \rightarrow H^{+} + AgCl \text{ (titration)}$$
$$Ag \rightarrow Ag^{+} + e^{-} \text{ (electrolysis)}$$

Sulfur analysis

Samples are combusted in an argon/oxygen atmosphere.
The resulting sulfur dioxide is transferred into a titration cell where it is automatically titration by triiodide ions generated by electrolysis. The amount of sulfur is calculated from the quantity of electrical charge required for the titration.

$$SO_2 + I_3^{-} + H_2O \rightarrow SO_3 + 3I^{-} + 2H^{+} \text{ (titration)}$$
$$3I^{-} \rightarrow I_3^{-} + 2e^{-} \text{ (electrolysis)}$$

■ Microcoulometric Titration Diagram



■MCD-500 detector

● **Sample applications**

■ Chlorine (MCD) sample application, n=3

	Volume, µL	Result, µg/mL	RSD, %
Bio diesel	90	1.68	1.6
Kerosene	90	4.66	0.6
Lubricant*1	200	2.12 (µg/g)	0.6
Palm oil*1	200	6.21 (µg/g)	0.3
Engine oil*1	90	2.81 (µg/g)	1.2

*1 Diluted by Toluene

■ Sulfur (MCD) sample application, n=3

	Volume, µL	Result, µg/mL	RSD, %
Diesel	15	40.9	0.9
Bio diesel	40	6.93	0.9
Kerosene	40	6.03	0.9
Lubricant*1	15	975 (µg/g)	0.2
Heavy oil*1	15	0.453 (wt%)	0.8

*1 Diluted by Toluene

Specification for Trace Chlorine/Sulfur Analyzer NSX-5000V/MCD

	Chlorine measurement	Sulfur measurement
Sample	Liquid/Gas	
Analytical method	Oxidative combustion and microcoulometric detection	
Furnace	Max. 1,100 °C, Openable electric furnace, 2 heating zones	
Detection electrode	Silver electrode	Platinum electrode
Measuring range	10 to 500,000 ng (up to 5,000 µg/mL) LOQ: 0.05 µg/mL*	20 to 50,000 ng (up to 1,000 µg/mL) LOQ: 0.1 µg/mL*
Sample volume	Liquid: Max 200 µL	
Measurement time	less than 10 min	
Gas supply	Argon: Purity 99.98 % or more, 0.3 ± 0.1 MPa , Oxygen: Purity 99.7 % or more, 0.3 ± 0.1 MPa	
Power supply	VF-500: 100/115 VAC, 50/60 Hz: 1,100 VA, 230/240 VAC, 50/60 Hz: 1,800 VA MCD-500: 100/115/230/240 VAC, 50/60 Hz: 300 VA	
Mass and weight	VF-500: 500(W) ×430(D)×500(H) mm, approx. 35 kg MCD-500: 220(W) ×375(D)×500(H) mm, approx. 14 kg	

* Actual measurement range depends on the sample volume, the matrix, the purity of reagents and the condition of the unit.

Option

Liquid Sample Changer ASC-550L

Sample	Liquid (non-aqueous, aqueous)
Injection	Gastight microsyringes: 25, 50, 100, 250 µL
Rinse vial	28 mL vials with septum
Number of samples	50 or 105 bottles
Vial size / Sample tray	6 mL / 50 bottles 4 mL / 50 bottles 2 mL / 50 bottles 2 mL / 105 bottles
Power	100/115/230/240 VAC (50/60 Hz) 180 VA
Dimensions and mass	460(W) ×320(D)×470(H) mm Approx. 16 kg

Sample Temperature Controller STC-500L

Sample	Liquid
STC vial rack	2 mL vial / 24 bottles 4 mL vial / 24 bottles 6 mL vial / 24 bottles
Rinse vials	2 pcs. 28 mL
Cooling temperature	STC vial rack: 15 °C to room temperature STC syringe holder: 10 °C to room temperature
Power	100/115/230/240 VAC (50/60 Hz) 400 VA
Dimensions and mass	Temperature controller: 220 (W) × 375 (D) × 100 (H) mm, 4 kg
	STC vial tray: 2.7 kg
	STC syringe holder: 0.45 kg

Constant Rate Injector for Vertical Furnace CRI-500V

Sample	Liquid(non-aqueous)
Syringe	Gastight microsyringe 25, 50, 100 and 250 µL
Injection	Minimum injection volume 10 µL Maximum injection volume 200 µL (with 250 µL gas-tight microsyringe)
Injection rate	0.4~1.6 µL/sec
Power	100/115/230/240 VAC (50/60 Hz) 30 VA
Dimensions and mass	150 (W) × 248 (D) × 240 (H) mm 5.6 kg

Gas Injector GI-510

Sample	Non-pressurized gas, Volatile liquid
Injection	Gas: 10 mL with gastight syringe Liquid: 10 µL with gastight microsyringe
Carrier gas	Argon (Purity 99.98 % or more, 300±100 kPa)
Heater	80 °C for vaporization of liquid
Power	AC100-240 V(50/60 Hz) 45 VA
Dimensions and mass	220(W) ×250(D)×110(H) mm
	4 kg

Gas Injector GI-520

Sample	Non-pressurized gas, Volatile liquid
Injection	1-10 µL liquid 2-25 mL gas (max. 999 mL)
Carrier gas	Argon (purity 99.9 8 % or more, 300±100 kPa)
Heat	80 °C for vaporization of liquid
Power	AC100-240 V(50/60Hz) 70 VA
Dimensions and mass	180(W) ×360(D)×500(H) mm
	13 kg

Gas Injector GI-560

Sample types	(1) Gas (Use a gastight syringe.) Nitrogen, sulfur, and chlorine in gas (2) Volatile liquid (Use a gastight microsyringe.) Nitrogen, sulfur, and chlorine in volatile liquid (3) Liquefied petroleum gas (Use an LPG cylinder.) Nitrogen, sulfur, and chlorine in liquefied petroleum gas (LPG) * Liquefied natural gas (LNG) is not acceptable.
Injection	Gas: Syringe port (max. 10 mL/ min) Volatile liquid: Syringe port (max. 10 µL) LPG: 30 µL sampling loop
Carrier gas	Argon
Heater temperature	From room temperature to 105 °C (Recommended value: 85 °C)
Sample gas pressure	6.5 MPa or less
Power	100/115/230/240 VAC (50/60 Hz) 108 VA
Dimensions and mass	220 mm (W) × 370 mm (D) × 490 mm
	18 kg

Trap & Release Unit for Sulfur TRU-500(SD-500)

Sample	Liquid, Gas
System	SO_2 Gas Adsorption and Desorption
Measuring range	5 ppb to 1 ppm
Temperature	100～1,050 ℃
Power	100/115/230/240 VAC (50/60 Hz) 1500 VA
Dimensions and mass	180 (W) × 540 (D) × 500 (H) mm
	16 kg