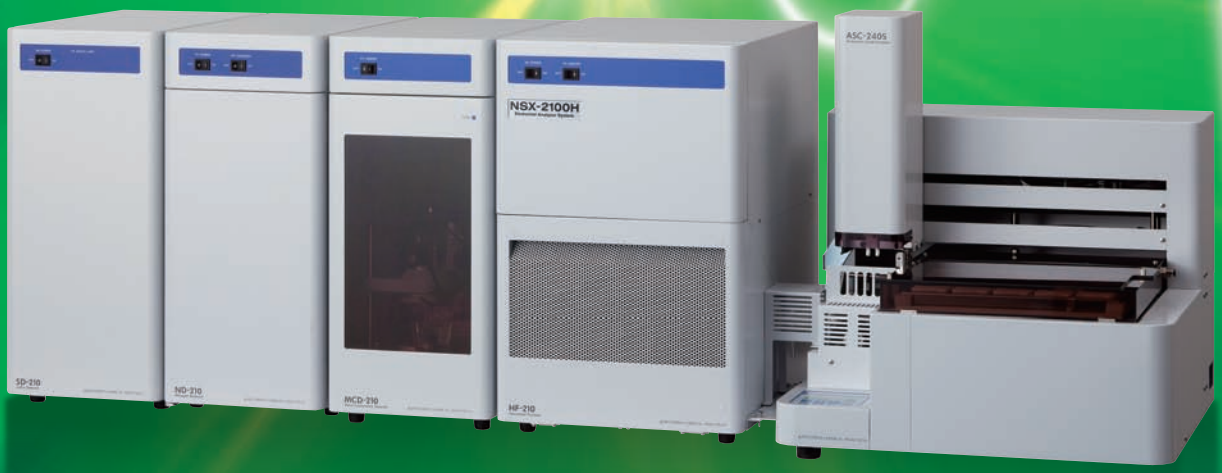
NSX-2100H

Trace Elemental Analyzer
Horizontal System



Analysis for Solution

MITSUBISHI CHEMICAL ANALYTECH CO., LTD.

Instruments Division

NSX-2100H

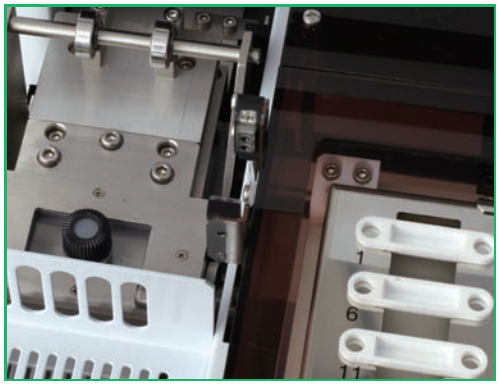
Fuel, Oil, Lubricant, LPG, Plastics, Powder, Rubber, Coal, Inorganics for the industries of Energy, Chemical, Environment, Electronics, Automobile.
Oxidative combustion technique has been widely recongized and utilized for various purposes.

NSX-2100H: 4 different detectors can be connected to 1 furnace depending on your requirement.

- Nitrogen: Chemiluminescence.
- Sulfur: UVFL, Coulometry.
- Chlorine: Coulometry.
- S, F, Cl, Br, I: Ion Chromatography.

● 40 boats for Solid automation

● Both liquid/solid at auto sampler



● Open/Close furnace for daily maintenance

■TWO SENSITIVITY RANGES, EASY TO USE.

Simpler sensitivity selection of detector.

µg/g	Sulfur	Nitrogen
High sense	0.05 - 10	0.5 - 50
Low sense	1 - 10,000	1 - 5,000

■HANDLING LIQUID WITH SOLID SAMPLER.

Solid sampler ASC-240S can handle liquid sample by liquid port.
No need to change set up for urgent sample request.

■EASY DAILY MAINTENANCE.

Unique Open/Close furnace facilitates daily maintenance and preparation.

■LOW RUNNING COST.

Less gas consumption than before by newly designed detector.

■MODULARITY, FLEXIBILITY.

Customizable systems for today's requirement and for future possibility.

Sample injectors

Detectors

Furnace

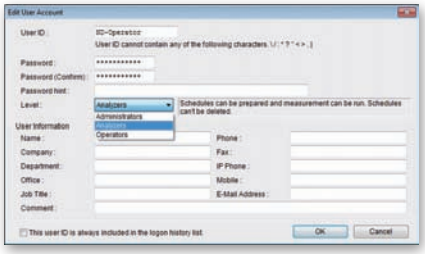
C-IC prep station

Software

Intuitive advanced software will increase usability of protection, operation, and integration.

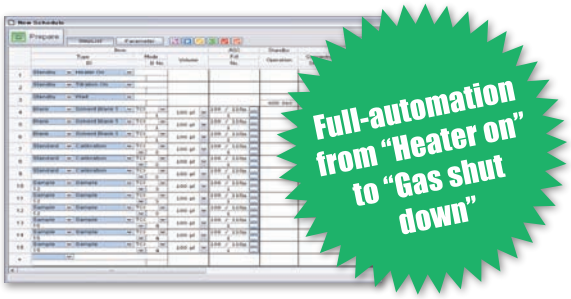
■PROTECTION

Three level login function can protect method and data from unintended change.

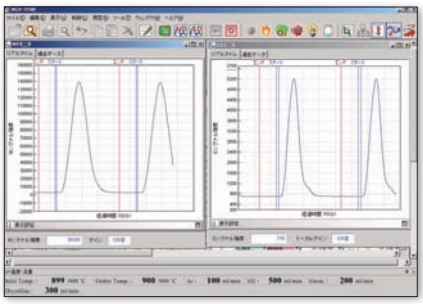


■OPERATION

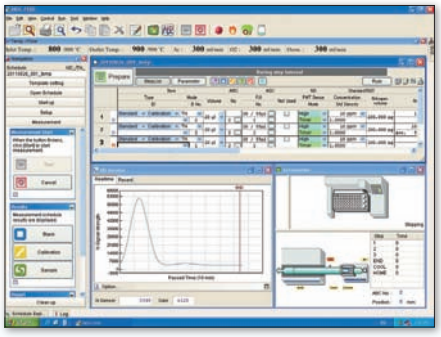
[Stand by] heating, [Auto shut down] function increase operability and save energy.



■REAL TIME MONITOR OF PEAK PROFILE



■CUSTOMIZABLE DISPLAY LAYOUT AS REQUIRED, SIMPLE or DETAILED.

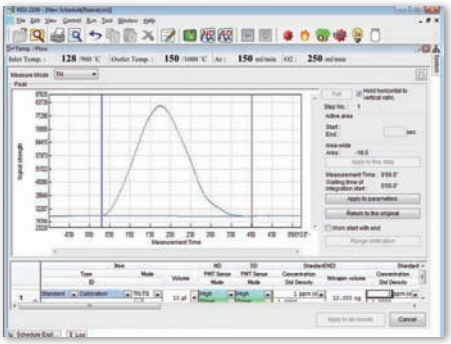


■LINK to LIMS

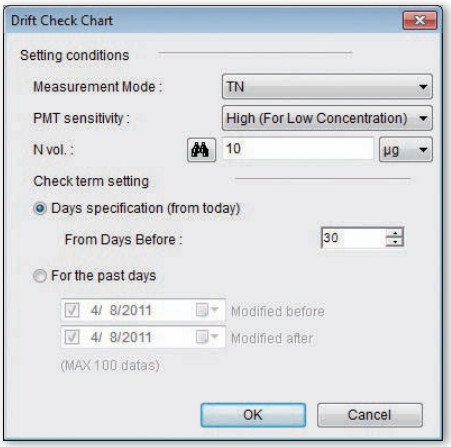
Software Add-in will make data handling easier. Output in various file formats (CSV, txt) and via serial port signal (RS-232C) possible.

■RECALCULATION. SAVING TIME, SAMPLE and WASTE

Stored peak can be recalcurated, reduce necessity of re-analysis.



■STABILITY CHECK



●Methods in Petroleum Products

Element	Sulfur	Nitrogen	Chlorine	Sulfur
Method of detection	Ultraviolet Fluorescence	Chemiluminescence	Coulometric titration	
ASTM	D5453, D6667, D7183, D7551	D4629, D5176, D6069, D7184, D5762	D4929, D5808, D6721, D7457	D3120, D3246
UOP	——	971-00, 936-95	910-07, 779-08	——

MEASUREMENT Principle

UVFL Sulfur (SD-210 detector)

■Sulfur Measurement

Sample is injected into a high-temperature (800 to 1000 °C) pyrolysis tube by argon carrier gas. After sulfur compounds in the sample are pyrolyzed, it is oxidized by O_2 gas.

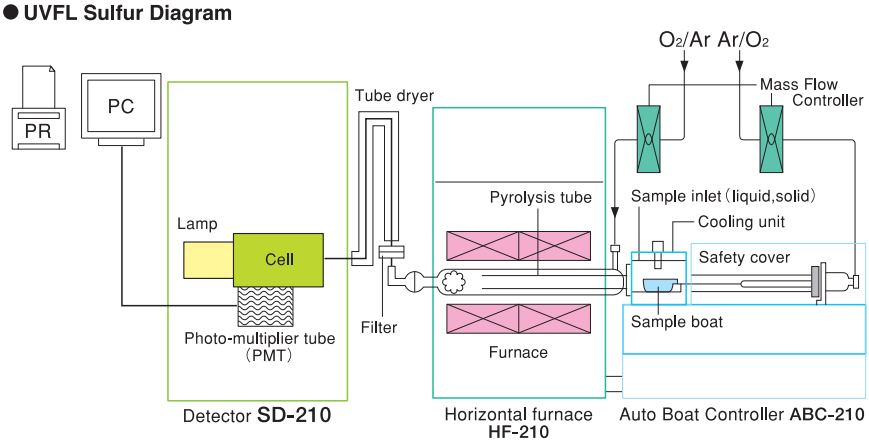
$$R\text{-}S + O_2 \rightarrow SO_2 + SO_3 + \text{combustion product}$$

The produced SO_2 gas is excited (SO_2^*) by irradiating the ultraviolet ray $\nu 1$ (190 to 230nm). Then, SO_2^* emits the energy (fluorescent ultraviolet ray) and returns to the ground state.

$$SO_2 + h\nu 1 \rightarrow SO_2^* \rightarrow SO_2 + h\nu 2$$

This fluorescent ultraviolet ray $\nu 2$ (300 to 400nm) is received by the photomultiplier tube and AREA value is obtained. The sulfur concentration is obtained by a calibration curve preliminarily drawn with standard solutions.

● UVFL Sulfur Diagram



■UVFL Sulfur Applications

Sample	Sample siz (µl)	Rep	Sulfur		Nitrogen	
			Result (ppm)	RSD (%)	Result (ppm)	RSD (%)
Naphtha	10	5	181	0.6	1.9	2.9
Light Oil	10	3	133	0.6	10	1.9
Kerosene	10	3	25	1.2	3.5	1.9
Gasoline	10	3	145	1.8	35	1.8
Lubricant Oil	10	5	2870	1.2	5.6	1.2
Heavy Oil	10	3	1340	0.5	99	0.2
Pulp	5mg	3	206	1.6	420	0.7
Polybutylene Terephthalate (PBT)	30mg	5	303	2.6	3.3	3.6

■SD-210 Detector

Microcoulometry (MCD-210 detector)

■Chlorine Analysis

Samples are combusted in an argon/oxygen atmosphere. The resulting hydrogen chloride is led into a titration cell where it is automatically titrated by silver ions generated coulometrically. The amount of chlorine is calculated from the quantity of electricity required for the titration.

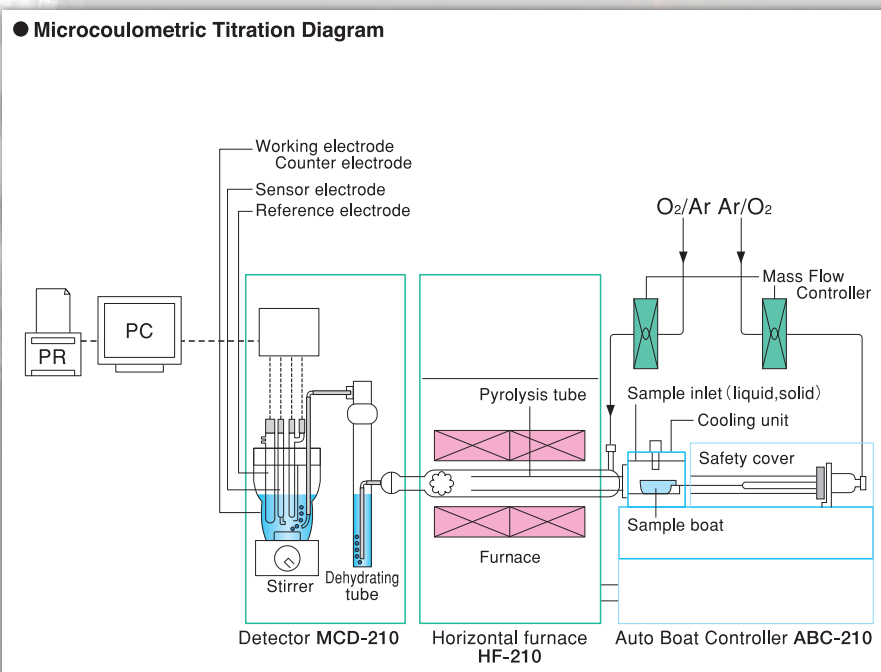
$$HCl + Ag^+ \rightarrow H^+ + AgCl \text{ (titration)}$$
$$Ag \rightarrow Ag^+ + e^- \text{ (electrolysis)}$$

■Sulfur Analysis

Samples are combusted in an argon/oxygen atmosphere. The resulting sulfur dioxide is led into a titration cell where it is automatically titrated by triiodide ions generated coulometrically. The amount of sulfur is calculated from the quantity of electricity 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



Chemiluminescence Nitrogen (ND-210 detector)

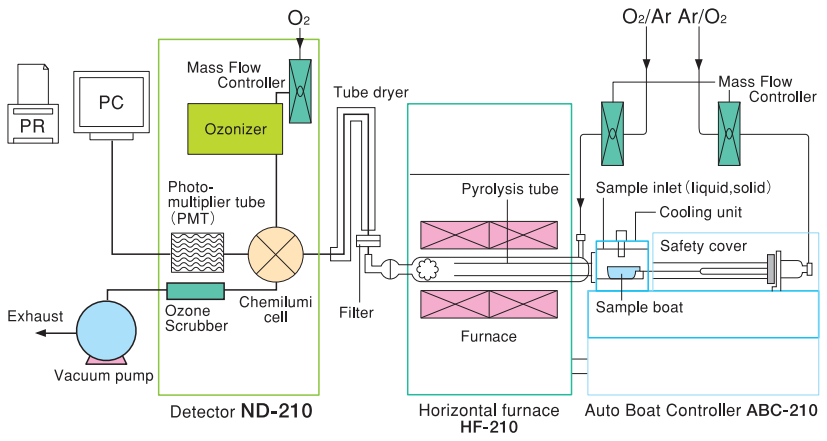
■Nitrogen Measurement

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 reaction of NO with ozone.

$$NO + O_3 \rightarrow NO_2 + O_2 + h\nu$$

By this reaction, 590 to 2,500mm wavelength light is generated. The optical intensity of this light is proportional to the NO concentration at a wide frequency range. After emitted light is detected by a photomultiplier tube and signal processing is run, an area value is obtained. Using the relation between area and concentration (calibration curve) obtained from standard solutions, the total nitrogen concentration in the sample is calculated. Though some samples generate interfering substances such as SOx and CO in the process of decomposition to NO, there is little influence on measurement by chemiluminescence method by reduced pressure method.

● **CLD Nitrogen Diagram**



■Chemiluminescence Nitrogen Applications

Sample	Sample Size (mg)	Rep	Result (ppm)	RSD (%)
Light Oil	20µl	3	52	2.1
Heavy Oil	20µl*	3	2350	1.6
Lubricant Oil	20ul*	3	375	1.8
Polyethylene	12	5	27	3.8
Polycarbonate	13	5	2.5	4.5
Epoxy resin	11	5	31	1.2
Pulp	3	5	3750	2.1
Toner	8	5	355	1.5
Rubber	5	3	270	1.2

*Diluted by toluene

■ND-210 Detector with Vacuum Pump

■Microcoulometry Applications

■Chlorine

Sample	Sample Size (mg)	Rep	Result (ppm)	RSD (%)
Toluene	100µl	3	0.14	12.3
Naphtha	100µl	3	0.17	14.1
Lubricant Oil	50µl	3	34	4.2
Crude Oil	10	3	7.5	3.2
Rubber	10	3	580	2.1
Polycarbonate	20	3	7.9	3.4
Foil	20	3	5.5	6.5
Waste Oil	15ul	3	3600	3.2
Cement	10	3	280	4.1

■Sulfur

Sample	Injection (mg)	Rep	Result (ppm)	RSD (%)
Lubricant Oil A	5µl	3	1.20%	3.5
Lubricant Oil B	10µl	3	0.76%	3.5
Lubricant Oil C	10µl	3	520	4.3
Rubber	15	3	740	3.2
Resin	15	3	130	2.4
Crude Oil	5	3	120	3.1
Coal	10	3	320	6.1
Coke	10	3	570	3.2

■MCD-210 Detector

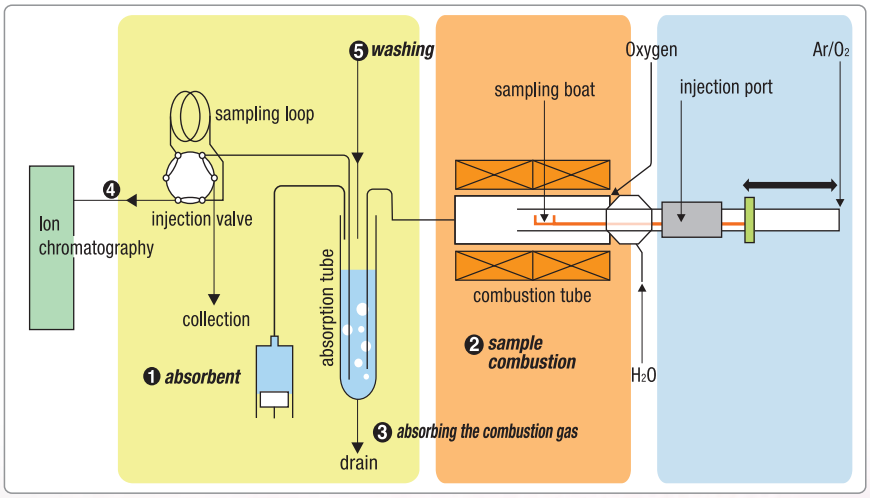
APPLICATION and OPTION

■Prep-station for combustion-IC (Sulfur and Halides) analysis.

Measuring Principle

After samples are thermally decomposed in Argon atmosphere they are combusted with oxygen and H_2O. Sulfur in the samples changes to SO_x and Halogens turn to Hydrogen Halide and Halogen gas. These elements will be trapped by the absorbent solution, then injected for IC analysis.

Sample	In the combustion tube	In the absorbent	
Sulfur	SO_x	SO_4^{2-}	→ Ion Chromatograph
Halogen	HX, X_2	X^-	



Process Flowchart

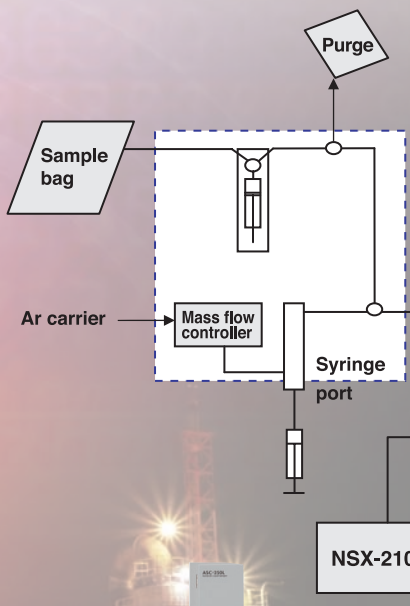
1. set absorbent
2. pyrohydrolytic combustion of sample
3. combusted gas is absorbed by absorbent
4. absorbent is injected into the Ion chromatograph
5. clean absorption tube

ASTM: D5987, D7359
ISO:2828
JIS: K7392, R1616, R1603, Z7302
KS: M0180
JEITA: ET-7304A
UOP: 991-11

■Gas Injector Model GI-220

High level of safety for flammable gases due to automatic injection.

MODEL	GI-220 Gas injector
Sample	Non-pressurized gas, Volatile liquid
Injection	1 - 10 µl liquid, 2 - 25 ml gas (max 999 ml)
Carrier	Argon
Heat	80℃ for liquid
Power	100 - 240VAC, 50/60Hz, 70VA
Dimension	180(W) x 360(D) x 500(H) mm
Mass	13 kg



OPTION

ABC-210

MODEL	ABC-210 Auto Boat Controller
Sample	Solid, Liquid
Amount of sample	Solid 150 mg Liquid 100 µl
Boat	quartz, disposable ceramic
Boat cooling	Peltier
Power	100 - 240VAC, 50/60Hz, 40VA
Dimension	445(W) x 250(D) x 180(H) mm
Mass	9 kg

ASC-240S

MODEL	ASC-240S Solid Sample Changer
Sample	Solid, liquid (manual)
Amount of sample	Solid 150 mg Liquid 100 µl
Boat, number of sample	ceramic, 40 pos.
Sample injection	Auto boat control
Boat cooling	Peltier
Power	100 - 240VAC, 50/60Hz, 80VA
Dimension	480(W) x 460(D) x 520(H) mm
Mass	31 kg

ASC-250L

MODEL	ASC-250L Liquid sample changer
Sample	Liquid (non-aqueous, aqueous)
Injection	max 150µl (depend on sample)
Inj. speed	0.4 - 50µl/sec (depend on sample)
number	50pos in each 2, 4, 6ml vial tray.
Power	100 - 240VAC, 50/60Hz, 180VA
Dimension	460(W) x 320(D) x 470(H) mm
Mass	16 kg

GI-210

MODEL	GI-210 Gas injector
Sample	Non-pressurized gas, Volatile liquid
Injection	10µl for liquid, 10ml for gas
Carrier	Argon
Heater	80℃ for liquid
Power	100 - 240VAC, 50/60Hz, 20VA
Dimension	220(W) x 200(D) x 110(H) mm
Mass	4kg

GI-250

MODEL	GI-250 Gas/LPG injector (Sulfur, Nitrogen)
Measurement Sample	(1)Gastight syringe port: Gaseous or volatile liquid (2)LPG port: Liquefied Petroleum Gas
Injection Volume	(1)Gastight syringe port: 10ml (gas),10µl (volatile liquid). (2)LPG port: 30µl fixed.
Operation	(1)By manual operation (2)Sampling injection by 6 way manual valve.
Heater	max. 105 ℃: ASTM D6667
Max. pressure of LPG port	6.5MPa.
Power	AC100V/115V/230V/240V, 50/60Hz, 80VA
Dimension	280(W) x 300(D) x 410(H) mm
Weight	13kg

OTHER OPTION

GA-210

gas absorption unit for Ion Chromatography analysis

Elements	Sulfur and Halogen compounds
Function	gas absorption of pyrohydrolytic combusted sample
Sample introduction to analyzer	loop, 6-way valve
Absorption tube	10,20 ml
Dispensor	5ml gastight syringe pump
Drain	peristaltic pump
Sample line	PTFE, PEEK
Communication	contact signal to analyzer
Power	100 - 240VAC, 50/60Hz, 50VA
Dimension	250(W) x 430(D) x 500(H) mm
Mass	22Kg

ES-210

MODEL	ES-210 External Solution Selector
Sample	Liquid
Number of sample	max 4
Sample injection	PC control

*Some options are in preparation, please ask local distributor.

NSX-2100H

STANDARD SPECIFICATION

Model NSX-2100H

Trace Nitrogen, Sulfur and Halogen Analyzer system utilizing oxidative sample combustion.

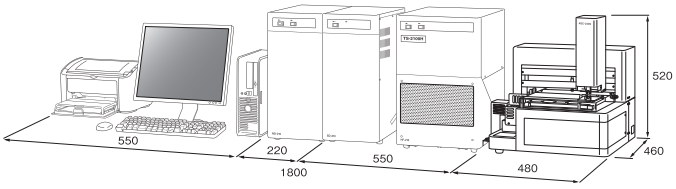
	Trace Elemental Analyzer NSX-2100H	
Samples	Solid, Non-aqueous liquid, Gaseous, LPG	
Analytical method	Oxidative Pyrolysis and detection	
Furnace	Max. 1,100℃, two part independent controlled. Horizontal electric furnace HF-210. Open/Close type.	
Detector	Ultraviolet Fluorescence (UVFL) for Sulfur	- Model SD-210. temperature controlled cell
	Chemiluminescence (CLD) for Nitrogen	- Model ND-210. temperature controlled cell
	Microcoulometry for Chlorine and Sulfur	- Model MCD-210.
Measuring range	UVFL-Sulfur	solid: 0.05-10,000µg/g. liquid: 0.05 - 5,000µg/ml
	CLD-Nitrogen	solid: 0.5-5,000µg/g. liquid: 0.2 - 5,000µg/ml
	Coulometry Chlorine	0.01 - 500µg (0.1 - 5,000µg/ml)
	Coulometry Sulfur	0.05 - 50µg (0.5 - 500µg/ml)
Typical sample size	Solid	30mg (up to 150mg)
	Non-aqueos liquid	50µl (up to 100µl)
Measuring time	UVFL/CLD	3-10min. (simultaneous Nitrogen/Sulfur available)
	Coulometry	less than 10min
Gas	Ar and O_2	
Others	Vacuum pump for ND-210	
Electric	100-240VAC 50/60Hz	

Module specfication	Power consumption	Dimension WDH mm	Mass
Furnace HF-210	1000 VA	320 x 430 x 500	25Kg
Detector SD-210	150 VA	220 x 375 x 500	21Kg
Detector ND-210	300 VA	220 x 375 x 500	22Kg
Detector MCD-210	150 VA	220 x 375 x 500	14Kg

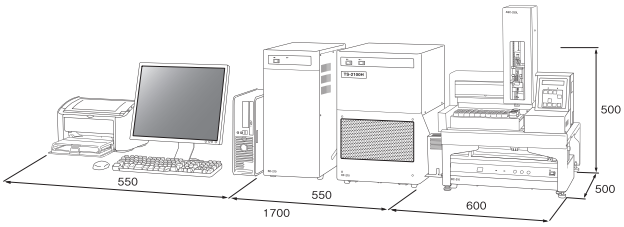
PC	
OS	Microsoft Windows®7 professional (32/64 bit)
Processor	2.4 GHz or more
Memory	2 GB or more
HD	160 GB or more
Drive	one CD-ROM disk drive
Display	1024 x 768 or higher
Printer	Compatible to OS
Port	1 serial port (RS-232C, D-sub9)

●Configuration and dimension examples (unit: mm)

Two detector system with solid sampler



One detector system with ABC+liquid sampler



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CAT No.1302NSX2100H1K