NSX-2100V

Trace Elemental Analyzer
Vertical System

Analysis for Solution

MITSUBISHI CHEMICAL ANALYTECH CO., LTD.

Instruments Division

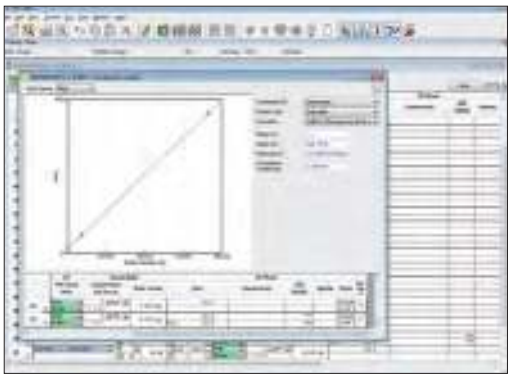
NSX-2100V

Protection from catalyst poisoning will enhance efficiency of plant operation. NSX-2100V trace analyzer will ensure modern catalyst control.

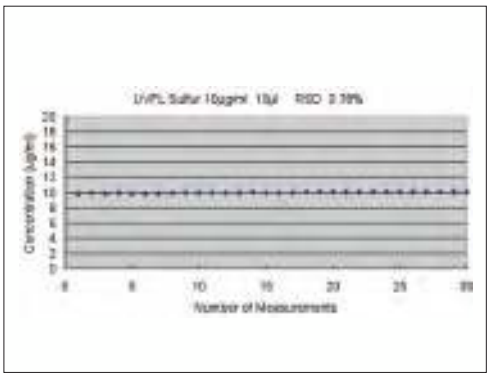
HIGH END PERFORMANCE, ROBUSTNESS, RELIABILITY, STABILITY.

Real ppb level analysis, Improved trace analysis by temperature controlled cell system.

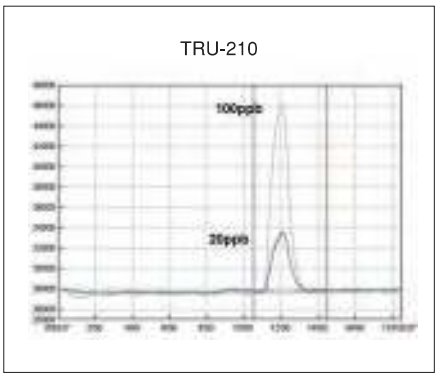
●High sensitivity



●Excellent stability



●Ultra trace sulfur option



■ULTRA TRACE SULFUR.

Trap & Release Unit TRU-210 can enhance performance to 5ppb liquid analysis.

■HIGH PRODUCTIVITY, LOW RUNNING COST.

40% faster, 40% less gas consumption than before by newly designed detector.
Easy to use by just 2 range sensitivity.

■EASY DAILY MAINTENANCE.

Open/ close furnace for easy visual check of tube condition.

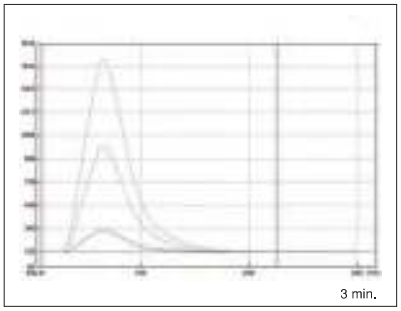
■UNIQUE OPTION.

Liquid cooling option enables accurate results for very high volatile samples.

■MODULARITY, FLEXIBILITY.

Customized system for today's requirement and for future possibility.

●Faster analysis



Sample injectors

Detectors

Furnace

Software

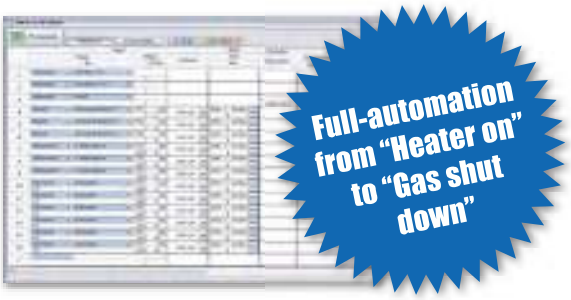
Intuitive advanced software will increase usability of protection, operation, and integration.

■PROTECTION

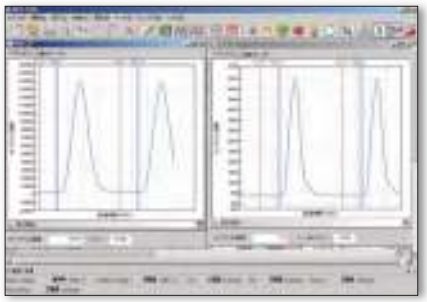
Three level login function can protect method and data from unforeseen change.

■OPERATION

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



■REAL TIME MONITOR OF PEAK PROFILE



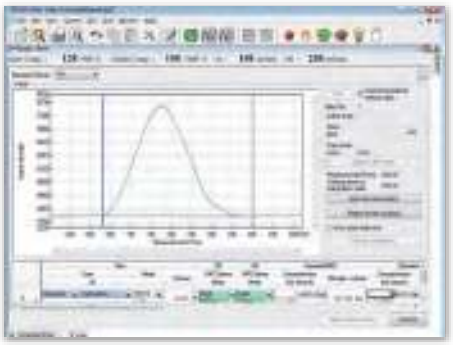
■CUSTOMIZABLE DISPLAY LAYOUT AS REQUIRED, SIMPLER or DETAIL.

■LINK to LIMS

Software Add-in operation will help data handling easier. It can output result data simultaneously in various style as serial port (RS-232C) or file format (CSV, TXT).

■RECALCULATION. SAVING TIME, SAMPLE and WASTE

Stored peak can be recalcurated, reduce 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	D4929, D5194, D5808, D7457	D3120, D3246
UOP	987-11	981-10	910-07	——

MEASUREMENT PRINCIPLE

UVFL Sulfur (SD-210 detector)

■Sulfur Measurement

The sample is injected with argon carrier gas into the pyrolysis tube of high temperature (900 to 1000°C). Sulfur compound in the sample is pyrolyzed and oxidized with O_2 gas.

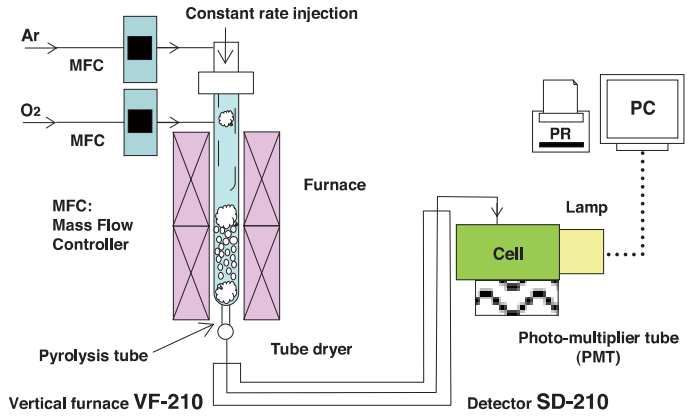
$$R\text{-}S + O_2 \rightarrow SO_2 + SO_3 + \text{combustion product}$$

The produced SO_2 gas is excited (SO_2^*) by irradiating the ultraviolet ray $\nu 1$ (190-230nm). 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 $\nu 2$ (300-400nm) is received by the photomultiplier tube and AREA value is obtained. The sulfur concentration is obtained by calibration curve preliminarily drawn with the standard solution.

●UVFL Sulfur Diagram



■UVFL Sulfur Applications

	Injection (µl)	Analysis (ppm)	RSD (%)
Diesel	40	9.95	0.43
Kerosene	40	1.41	2.95
Gasoline	40	3.79	0.38
BDF	40	1.01	7.07
BTX	40	0.60	0.50
Desulfured light naphtha	40	0.61	6.77
Propane	10ml	2.77	0.76
Butane	25ml	0.18	2.97

■Simultaneous Nitrogen and Sulfur

	N (ppm)	RSD (%)	S (ppm)	RSD (%)
Heavy oil	0.32%	0.84	0.48%	1.47
Lub oil	2.11	2.61	7.72	1.42
Diesel	2.91	0.41	9.79	0.27
Gasoline	6.92	0.19	3.79	0.38
Naphtha	4.6	1.78	26.4	0.42

■Liquid cooling option for autosampler

By preventing sample vaporization during syringe handling, cooling option is very effective for high volatile sample.

Low B.P. sample	Sample Temperature Control	
	OFF (22°C)	ON (15°C)
Result (n=5) ppm	3.59	7.54
RSD (%)	21.1%	1.0%

■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.

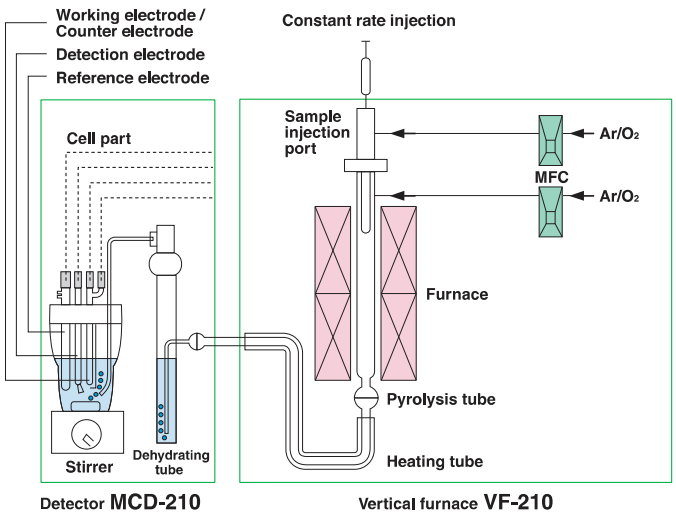
$$HCl + Ag^+ \rightarrow H^+ + AgCl \text{ (titration)}$$
$$Ag \rightarrow Ag^+ + e^- \text{ (electrolysis)}$$

■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)

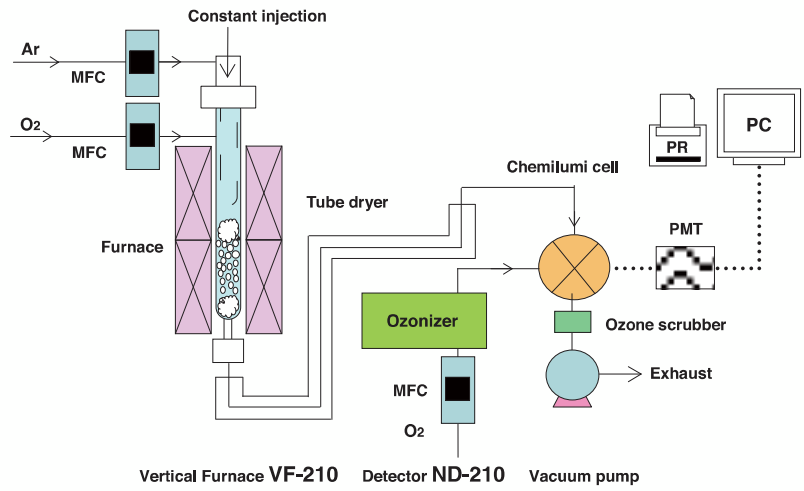
■Nitrogen Measurement

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



■Nitrogen, Standard samples

	Recovery (%)	RSD (%)
10.0 ppm Quinoline	98.5	0.9
0.32% Heavy oil	99.1	0.7
0.11% Heavy oil	104.0	0.1
0.0064% Heavy oil	100.6	0.1

■Nitrogen, Application samples

	Analysis (ppm)	RSD (%)
Naphtha	0.8	4.2
Kerosene	3.2	2.2
Diesel	4.1	1.7
Gasoline	2.5	1.7

■Nitrogen Aqueous Applications

	Analysis (ppm)	RSD (%)
River Water	3.1	1.70
Factory Disposal	2.6	2.10
Seawater*	0.2	4.80
Sewage Plant (Treated Sewage)	2.2	1.80

* Sea water option

■ND-210 Detector with Vacuum Pump

●Sample Applications

■Chlorine

	Injection (µl)	Analysis (ppm)	RSD (%)
Naphtha	200	0.08	9.8
Gasoline	200	0.53	5.3
Kerosene	200	0.09	5.0
Lub oil	90	1.35	3.2
Diesel 1	200	0.18	7.6
Diesel 2	200	0.05	13.5
Xylene	90	2.47	3.1

■Sulfur

	Injection (µl)	Analysis (ppm)	RSD (%)
High Octane	50	7.3	2.3
Gasoline	50	5.5	1.7
Kerosene	50	13.7	1.3
Diesel	50	1.3	3.9
Lub oil 1	50	126	2.1
Lub oil 2	50	37	1.2
Lub oil 3	50	13	2.3

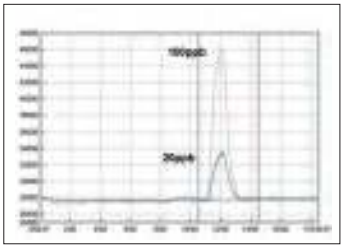
■MCD-210 Detector

APPLICATION and OPTION

■Trap & Release Unit for Sulfur, Model TRU-210

For liquid samples below than 10ppb liquid.
Enrichment and separation by trap column
for Sulfur analysis (SD-210)

●Ultra trace 20ppb

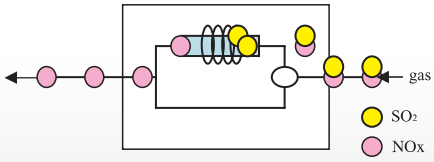


MODEL	TRU-210 Trap & Release unit
Sample	Liquid, Gaseous
System	SO_2 gas adsorption and desorption
Temperature	100 - 1050℃
Power	100 -240VAC, 50/60Hz, 1500VA
Dimension	180(W) x 540(D) x 500(H) mm
Weight	16 kg

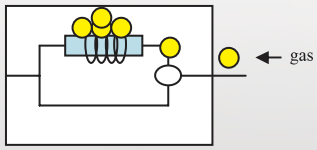
*Simultaneous measurement of nitrogen option with Trap and Release is not possible.
*For sample injeciton, ASC250L or GI220 required.

●TRU use this feature as enrichment of SO_2 and separation of NOx

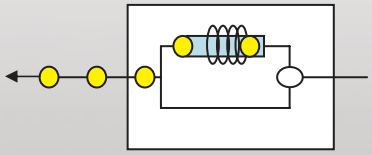
❶Trap: Separation of SO_2 and NOx



❷Trap: Enrichment by multiple injection



❸Release: Measurement



Applications ●TRU-210

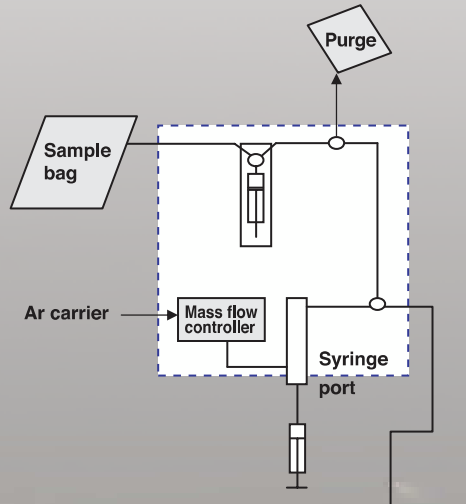
Sample	ppb	RSD (%)
Toluene (commercial)	10	4.2
Toluene (Refining)	5.2	5.5
Isopropyl alcohol	10	4.8
Isooctane	14	8.9
N-decan	27	9.2

■Gas Injector Model GI-220 (SD-210, ND-210, MCD-210)

Operator safety in flammable gas handling and automatic injection.

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

*Multiple injection by pump is possible when utilized with TRU-210 up to 200ml.



Appications ●GI-220

(UVFL Sulfur)

Sample	Volume (ml)	n	ppm	RSD (%)
LPG (evaporated)	10	3	2.6	1
Buthane	10	3	0.3	4
Propane (pure)	10	3	0.6	2

Appications ●GI-220 + TRU-210

(UVFL Sulfur)

Sample	Volume (ml)	n	ppb	RSD (%)
Ethylene	100	3	27	9.5
Methane	200	3	34	6.7

OPTION

ASC-250L

MODEL	ASC-250L Liquid sample changer
Sample	Liquid (non-aqueous, aqueous)
Injection	max 200 µl (depend on sample)
Inj. speed	0.4 - 50 µl/sec (depend on sample)
number	50 pos in each 2, 4, 6 ml vial tray.
Power	100 -240VAC, 50/60Hz, 180VA
Dimension	460(W) x 320(D) x 470(H) mm
Weight	16 kg

CRI-210V

MODEL	CRI-210V Constant rate injector for vertical furnace
Sample	Liquid (non-aqueous)
Injection	max 200 µl (depend on sample)
Inj. speed	0.4 - 1.6 µl/sec (depend on sample)
Syringe	Gastight, 25, 50, 100, 250 µl
Power	100 -240VAC, 50/60Hz, 30VA
Dimension	150(W) x 250(D) x 240(H) mm
Weight	5.6 kg

GI-210

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

GI-240

MODEL	GI-240 Gas/LPG injector	
Sample	Gaseous	LPG
Injection	10 ml loop	30 µl loop
Calibration	Standard gas, Liquefied standard gas.	
Carrier	Argon	Argon Nitrogen (back pressure,1MPa)
Max. pressure	0.1 MPa	5 MPa
Dimension	240(W) x 300(D) x 500(H) mm	
Weight	8 kg	

GI-300

MODEL	GI-300 Gas injector
Measurement Sample	(1)Gastight syringe port: Gaseous or volatile liquid (2)LPG port (direct connection with LPG cylinder): 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	For the vaporization of liquid standard sample and liquefied gas 85±20℃: ASTM D6667
Gas	Argon: Purity 99.98% or more, 300±100kPa.
Max. pressure of LPG port	1MPa.
Power	AC100V/115V/230V/240V, 50/60Hz, 80VA
Dimension	280(W) x 300(D) x 410(H) mm
Weight	13kg

OTHER OPTION

STC-210L

MODEL	STC-210L Sample temperature controller
Sample	liquid
Number of sample	24 positions
Control	Peltier temperature control for tray and syringe
Cooling	10℃ below than room temperature
Power	100 -240VAC, 50/60Hz, 200VA
Dimension	260(W) x 260(D) x 100(H) mm
Weight	4 kg

NSX-2100V

STANDARD SPECIFICATION

Model NSX-2100V

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

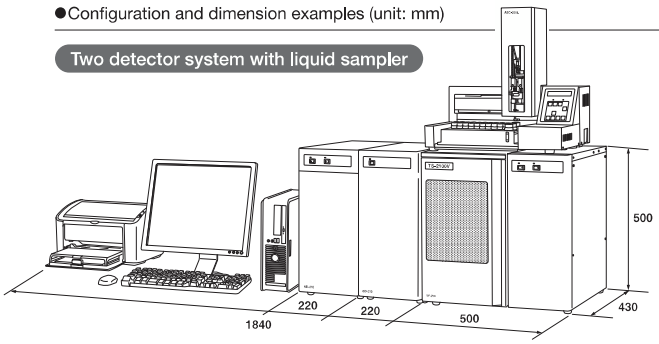
	Trace Elemental Analyzer NSX-2100V	
Samples	Non-aqueous liquid, Gaseous, LPG, Aqueous (Nitrogen)	
Analytical method	Oxidative Pyrolysis and detection	
Furnace	Max. 1,100℃, two part independent controlled. Vertical Electric Furnace VF-210. Open/Close type.	
Detector	Ultraviolet Fluorescence (UVFL) for 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	0.02 - 10,000µg/ml (dilute more than 5,000)
	CLD-Nitrogen	non-aqueous: 0.05 - 10,000µg/ml (dilute more than 5,000)
	CLD-Nitrogen	Aqueous: 0.01 - 5,000µg/ml
	Coulometry Chlorine	0.01 - 50µg (0.05 - 1,000µg/ml)
	Coulometry Sulfur	0.02 - 50µg (0.1 - 1,000µg/ml)
Sample size	non-aqueos liquid	max. 200µl (aqueous: max. 100µl)
	gaseous	SD-210: max 25ml/GI-220, 10ml/GI-210
	gaseous	ND-210: max 25ml/GI-220, 10ml/GI-210
	gaseous	MCD-210: max 100ml/GI-220, 10ml/GI-210
	gas/LPG loop	10ml/30µl loop (GI-240, GI-300)
Measuring time	UVFL/CLD	ca. 3 min. (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	Weight
Furnace VF-210	1000 VA	500 x 430 x 500	35Kg
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

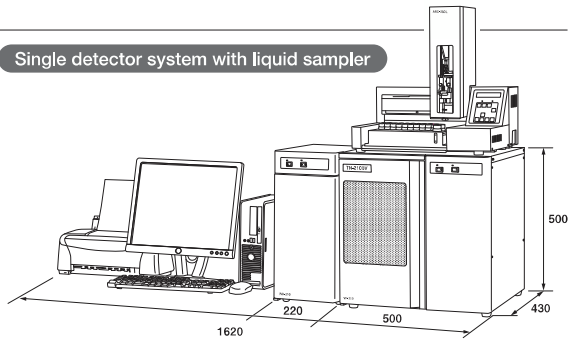
PC	
OS	Microsoft Windows 7 professional 32bit
Processor	32bit processor, more than 1GHz
Memory	more than 1GB
HD	more than 200GB
Drive	CD-ROM or DVD drive
Display	1024 x 768 or higher
Printer	windows compatible.
Port	1 serial port (RS-232C, D-sub9)

●Configuration and dimension examples (unit: mm)

Two detector system with liquid sampler



Single detector system with liquid sampler



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