



*Focused Photonics Inc.*

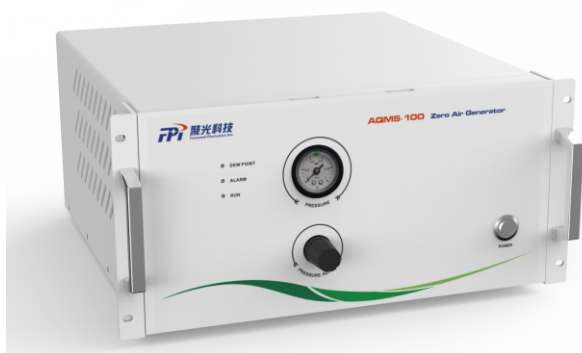


# ***Air Quality Monitoring System***

**Focused Photonics Inc.**

## AQMS-100 Zero Air Generator

**F**PI AQMS-100 provides ultra pure pollutant-free zero air for analytical purpose. Remote monitoring and configuration can also be achieved through digital access.



### Key Features

- ❖ Ultra high purity zero air output
- ❖ Integrated dew point sensor
- ❖ Regenerative dryer utilizing molecular sieve to perform maintenance free advantage
- ❖ High performance scrubbers to remove hydrocarbon, CO, SO<sub>2</sub>, NO, NO<sub>2</sub> and Ozone
- ❖ Remote display and configuration on key functions

### Principle

The AQMS-100 generates clean and dry zero air by removing components which will cause interference on monitoring results.

#### Regenerative scrubber

The scrubber is filled with molecular sieve which has multiple holes and filters only water molecule with certain diameter.

A second molecular sieve will be alternate for raw air diversion while the other is under regeneration by injecting compressed air to remove moisture.

#### HC/CO/NO scrubber

To remove hydrocarbon, CO and NO, three dependent scrubbers applying catalytic reaction are used, where HC and CO will be converted into CO<sub>2</sub> which does not interfere analysis and NO will be converted into NO<sub>2</sub> which will then be removed by purifier.

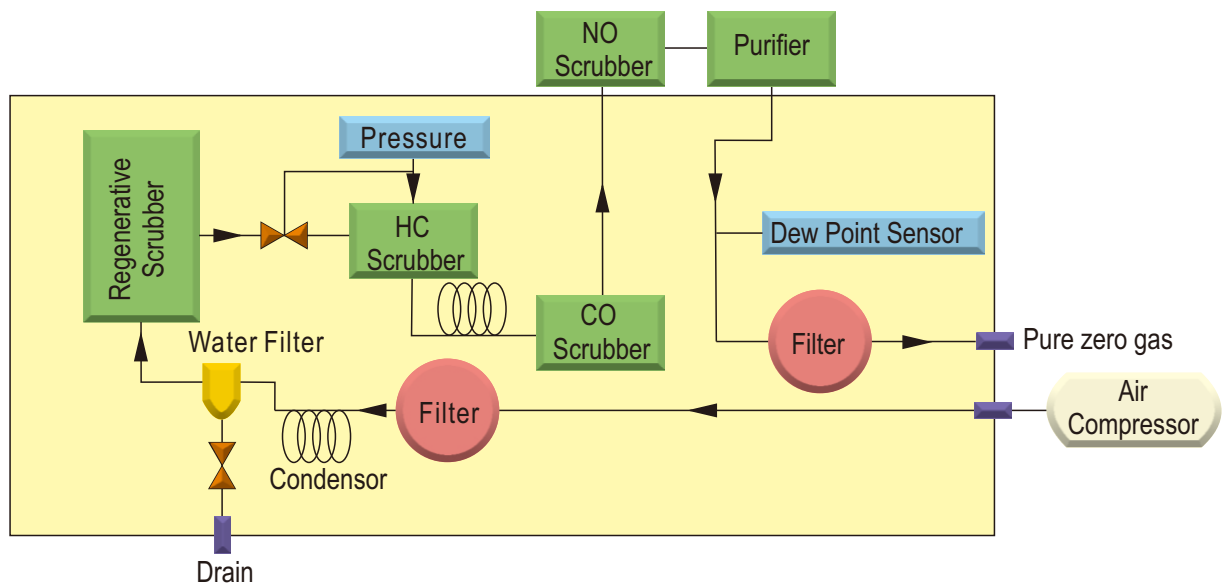


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## Technical Data

Output	20 SLPM at 30 psig
Dew Point	-30 °C
Output Concentration	SO <sub>2</sub> : <0.025 ppb NO: <0.025 ppb NO <sub>2</sub> : <0.025 ppb O <sub>3</sub> : <0.3 ppb CO: <10 ppb CH <sub>4</sub> : <5 ppb Other HC: <0.25 ppb
Power Requirement	100~240 VAC, Converter applicable
Operating Temperature	0~40 °C
Dimensions	221mm(H) x 482mm(W) x 554mm(D)

## System Drawing



\*Molecular sieve are utilized in regenerative scrubber

\*Activated carbon are utilized in purifier

# AQMS-200

## Dynamic Dilution Calibrator

**F**PI AQMS-200 multi-gas calibrator utilizes mass flow controller to perform standard zero and span calibration with up to 4 gas sources.



### Key Feature

- ❖ Stable trace level ozone output down to 0.1 ppm
- ❖ Optional ozone generator, gas phase titration and photometer for independent ozone calibration
- ❖ User selectable output include RS232 and ethernet
- ❖ High performance mass flow controller provides stable and linearized output

### Technical Data

Dilution System	Flow Accuracy	$\pm 1\%F.S.$
	Repeatability	$\pm 0.2\%F.S.$
	Linearity	$\pm 0.5\%F.S.$
	Response Time	$< 60s (T98)$
	Flow of Dilution Air	0~5 SLPM, 0~10 SLPM, 0~20 SLPM
	Flow of Span Air	0~50, 0~100, 0~200 cc/min
	Calibration Gas Input	4
	Diluent Gas Input Ports	1



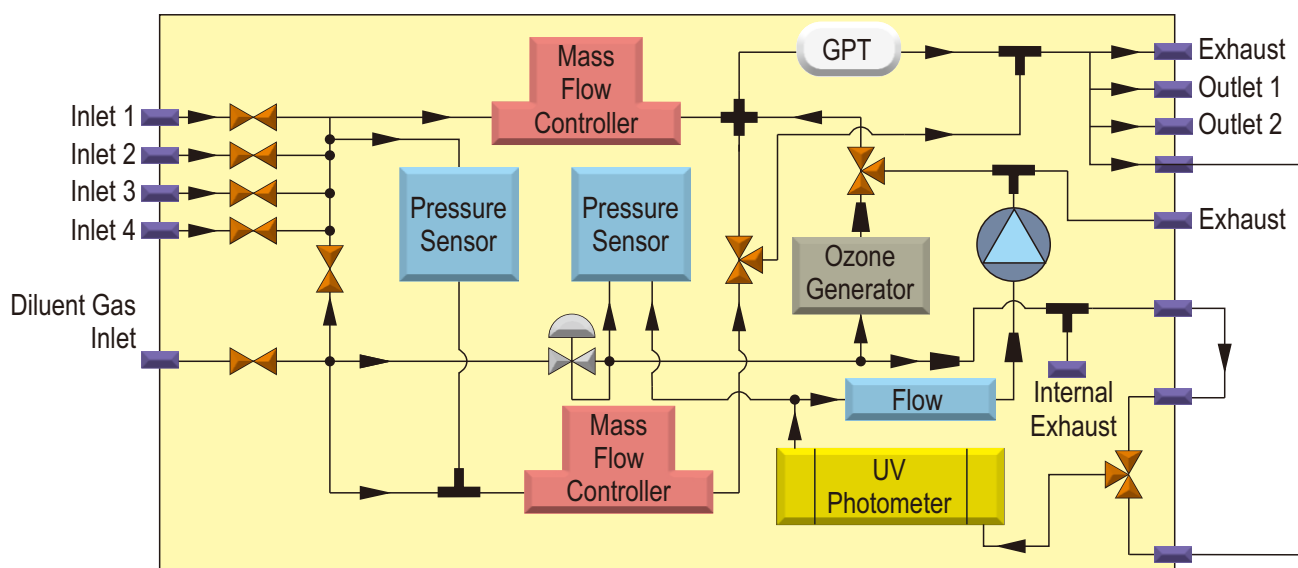
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## Technical Data

Ozone Generator (Optional)	Output	0.1~6 ppm
	Stability (7 days)	± 1%
UV Photometer (Optional)	Range	0~100 ppb to 0~10 ppm (Selectable)
	Precision	1 ppb
	Linearity	± 1%F.S.
	Rise/Fall Time	< 20s (photometer response)
	Response Time	< 180s (T98)
	Zero Drift (7 days)	1 ppb
Physical and Communication	Power Requirement	100~240 VAC, 45~55 Hz
	Dimensions and Weight	178mm x 432mm x 604mm, 15kg
	Operating Temperature	5~40°C
	Communication	RS232, RS485, Ethernet

## System Drawing



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# AQMS-300 Ozone Analyzer

**F**PI AQMS-300 Ozone ( $O_3$ ) analyzer measures ambient  $O_3$  concentration in ppb level by utilizing UV photometric absorption technology.



## Key Features

- ❖ Accurate direct UV absorption with reference comparison
- ❖ Compliance with US EPA reference method
- ❖ Various outputs include ethernet and Rs232
- ❖ User friendly interface with large screen
- ❖ Continuous system diagnosis with alarm
- ❖ Multi-tasking software allows viewing test variables while operating
- ❖ Temperature and pressure compensation
- ❖ Internal data logging with 1 min to 365 day multiple averages

## Principle

The concentration of ambient ozone is proportional to UV light absorption since there is a significant characteristic absorption for ozone on wavelength of 254nm.

Periodical diversion on sample flow passing through the ozone scrubber will generate reference measurement, which is compared with sample measurement to provide stable and representative result.

## Ozone scrubber

The ozone scrubber is filled with  $MnO_2$  as catalyst, which will convert  $O_3$  to  $O_2$  to form reference gas. Meanwhile, the presence of other components remains the same.

## Data storage and analysis

Stored data are easily retrievable through the serial or ethernet port via PC client software, allowing operators to perform predictive diagnostics and enhanced data analysis by tracking parameter trends.

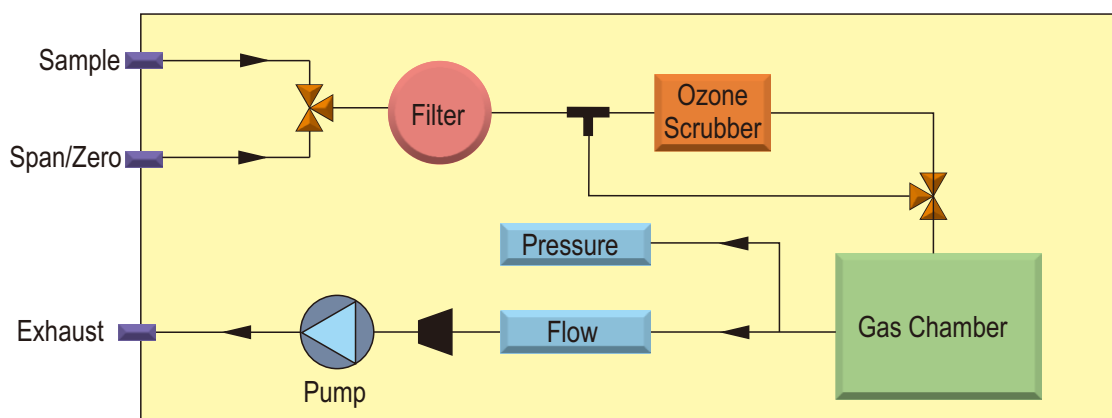


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## Technical Data

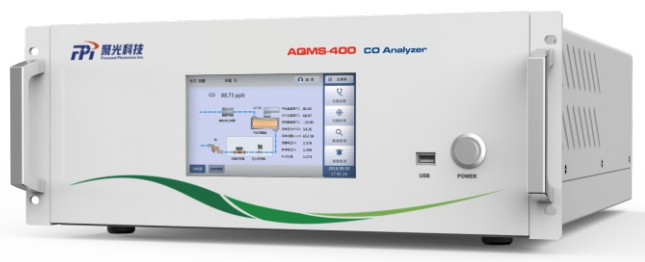
Standard Range	Min: 0~100 ppb F.S. Max: 0~10 ppm F.S. (Selectable)
Zero Noise	< 0.3 ppb (RMS)
Span Noise	< 0.5% of reading (RMS) above 100 ppb
Lower Detectable limit	< 0.6 ppb (RMS)
Zero Drift (24 hours)	< 1 ppb
Span Drift	< 1% F.S.
Response Time	< 20s (T95)
Precision	< 0.5%
Linearity	< 1% F.S.
Sample Flow Rate	800 cc/min $\pm$ 10%
Operating Temperature	20~30°C range (per US EPA guidelines). Instrument may be safely operated over the range of 5~40°C
Power Requirement	100~240 VAC, Converter applicable
Dimensions and Weight	178mm(H) x 432mm(W) x 609mm(D), 15kg

## System Drawing



# AQMS-400 Carbon Monoxide Analyzer

**F**PI AQMS-400 carbon monoxide (CO) analyzer measures ambient CO concentration by employing non-dispersive infrared with gas filter correlation method technology



## Key Features

- ❖ 14 meters optical path to perform high reliability
- ❖ Five years guarantee on GFC wheel
- ❖ Compliance with US EPA reference method
- ❖ Various outputs include ethernet and Rs232
- ❖ User friendly interface with large screen
- ❖ Continuous system diagnosis with alarm
- ❖ Multi-tasking software allows viewing test variables while operating
- ❖ Temperature and pressure compensation
- ❖ Internal data logging with 1 min to 365 day multiple averages

## Principle

Infrared energy emitted by light source is passed through gas chamber containing the air sample, and the quantitative absorption of energy by CO in the sample cell is measured by corresponding detector.

## GFC

GFC (Gas filter correlation) technology is utilized to remove interference caused by moisture and other backgrounds.

Two gas filled chambers are mounted on a rotating disc, which pass through an IR beam alternately. The measure chamber is filled with nitrogen while the reference chamber is filled with high concentration CO. IR beam then passes through the sample gas cell. The difference in absorbance is measured and provides a direct output of the gas concentration.

## Data storage and analysis

Stored data are easily retrievable through the serial or ethernet port via PC client software, allowing operators to perform predictive diagnostics and enhanced data analysis by tracking parameter trends.



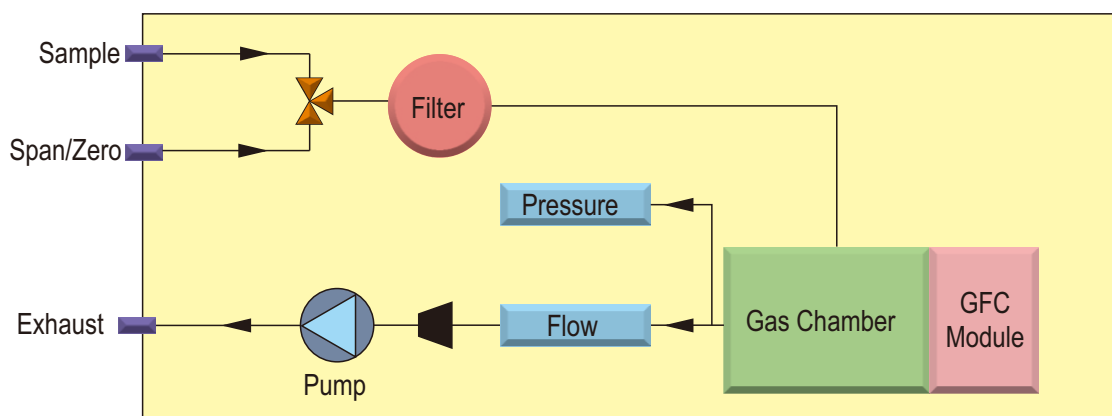
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## Technical Data

Standard Range	Min: 0~50 ppm F.S. Max: 0~1,000 ppm F.S. (Selectable)
Zero Noise	< 0.04 ppm (RMS)
Span Noise	< 0.25 ppm
Lower Detectable limit	< 0.08 ppm
Zero Drift (24 hours)	< 0.1 ppm
Span Drift	< 1% F.S.
Response Time	< 60s ( <i>T90</i> )
Precision	< 0.5%
Linearity	< 1% F.S.
Sample Flow Rate	800 cc/min $\pm$ 10%
Operating Temperature	20~30°C range (per US EPA guidelines). Instrument may be safely operated over the range of 5~40°C
Power Requirement	100~240 VAC, Converter applicable
Dimensions and Weight	178mm x 432mm x 609mm, 25kg

## System Drawing



## AQMS-500 Sulfur Dioxide Analyzer

**F**PI AQMS-500 sulfur dioxide ( $\text{SO}_2$ ) analyzer applies UV fluorescence technology recommended by US EPA as federal reference method for trace level  $\text{SO}_2$  measurement.



### Key Features

- ❖ Compliance with US EPA reference method
- ❖ Various outputs include ethernet and RS232
- ❖ User friendly interface with large screen
- ❖ Continuous system diagnosis with alarm
- ❖ Multi-tasking software allows viewing test variables while operating
- ❖ Temperature and pressure compensation
- ❖ Internal data logging with 1 min to 365 day multiple averages
- ❖ Critical orifices provide flow stability

### Principle

AQMS-500 measures the intensity of the characteristic fluorescence released by  $\text{SO}_2$  in an ambient air sample contained in the gas chamber when the air sample is irradiated by ultraviolet light passed through the chamber.

### UV source

The pulsing of the UV source lamp serves to increase the optical intensity whereby a greater UV energy throughput and lower detectable concentration are realized.

### Removal of interferences

The permeation scrubber acting as hydrocarbon kicker removes aromatic hydrocarbon such as xylene and naphthalene which causes interference.

Optical filtering are employed to improve the rejection of interference from high nitrogen oxides.

### Data storage and analysis

Stored data are easily retrievable through the serial or ethernet port via PC client software, allowing operators to perform predictive diagnostics and enhanced data analysis by tracking parameter trends.

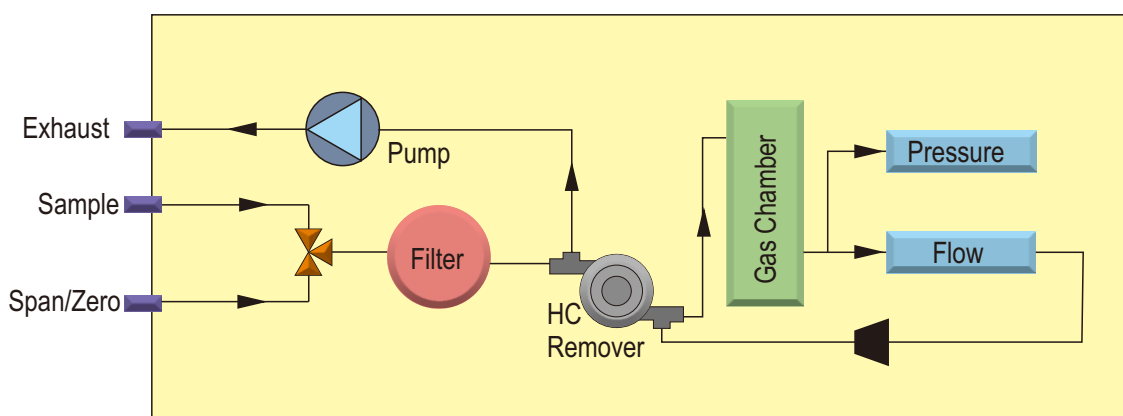


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## Technical Data

Standard Range	Min: 0~100 ppb F.S. Max: 0~20 ppm F.S. (Selectable)
Zero Noise	< 0.4 ppb (RMS)
Span Noise	< 2.5 ppb
Lower Detectable limit	< 0.5 ppb
Zero Drift (24 hours)	< 1 ppb
Span Drift	< 1% F.S.
Response Time	< 80s ( <i>T90</i> )
Precision	< 1%
Linearity	< 1% F.S.
Sample Flow Rate	650 cc/min $\pm$ 10%
Operating Temperature	20~30°C range (per US EPA guidelines). Instrument may be safely operated over the range of 5~40°C
Power Requirement	100~240 VAC, Converter applicable
Dimensions and Weight	178mm(H) x 432mm(W) x 597mm(D), 22kg

## System Drawing



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## AQMS-600 Nitrogen Oxides Analyzer

**F**PI AQMS-600 nitrogen oxides ( $\text{NO-NO}_2\text{-NO}_x$ ) analyzer utilizes chemiluminescence technology indicated by US EPA as federal reference method for monitoring on multiple forms of nitrogen oxides.



### Key Features

- ❖ Permeation dryer on Ozone generator
- ❖ Catalytic Ozone scrubber
- ❖ Independent ranges for  $\text{NO}_x$ , NO and  $\text{NO}_2$
- ❖ Compliance with US EPA reference method
- ❖ Various outputs include ethernet and RS232
- ❖ User friendly interface with large screen
- ❖ Continuous system diagnosis with alarm
- ❖ Multi-tasking software allows viewing test variables while operating
- ❖ Temperature and pressure compensation
- ❖ Internal data logging with 1 min to 365 day multiple averages

### Principle

Nitrogen oxides in ambient are measured indirectly by photometrically measuring the light intensity, resulting from the chemiluminescent reaction of nitric oxide (NO) with ozone ( $\text{O}_3$ ).

$\text{NO}_2$  is first quantitatively reduced to NO by means of a converter. NO, which commonly exists in ambient air together with  $\text{NO}_2$ , passes through the converter unchanged causing a resultant total  $\text{NO}_x$  concentration equal to  $\text{NO} + \text{NO}_2$ .

### PMT

The optical filter(660nm) attached on PMT provides reliable measurement, and temperature are controlled between  $6\sim 8^\circ\text{C}$  with only  $0.1^\circ\text{C}$  fluctuation by a thermoelectric cooler, ensure the measurement stability.

### Ozone generation

Permeation dryer are introduced in ozone generation to provide long system durability without any replacement.

An catalytic ozone scrubber is standard for maximum safety and pump life before exhaust.



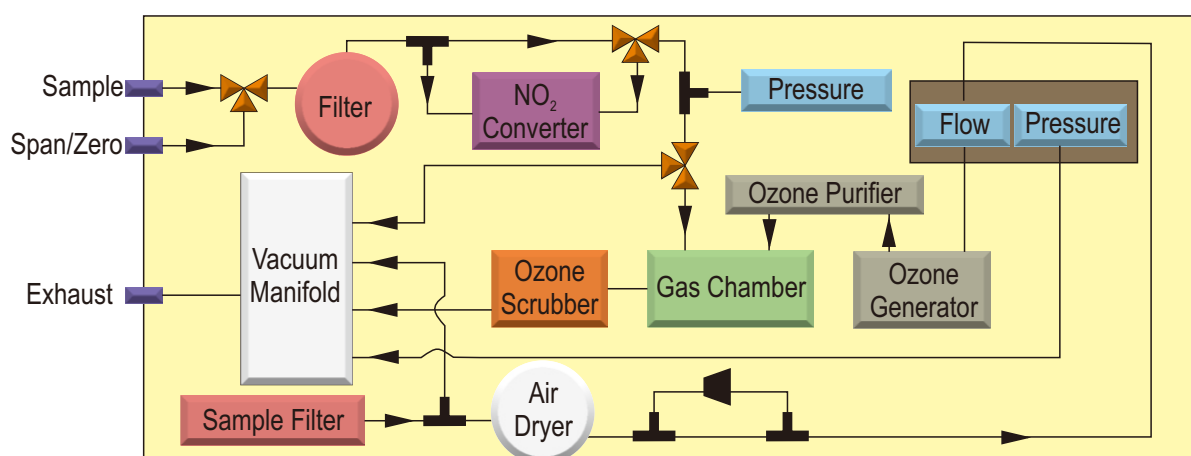
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## Technical Data

Standard Range	Min: 0~100 ppb F.S. Max: 0~20 ppm F.S. (Selectable)
Zero Noise	< 0.4 ppb (RMS)
Span Noise	< 2.5 ppb
Lower Detectable limit	< 0.4 ppb
Zero Drift (24 hours)	< 0.4 ppb
Span Drift	< 1% F.S.
Response Time	< 40s ( <i>T90</i> )
Precision	< 1%
Linearity	< 1% F.S.
Sample Flow Rate	500 cc/min $\pm$ 10%
Operating Temperature	20~30°C range (per US EPA guidelines). Instrument may be safely operated over the range of 5~40°C
Power Requirement	100~240 VAC, Converter applicable
Dimensions and Weight	178mm(H) x 432mm(W) x 609mm(D), 22kg

## System Drawing



# BPM-200 Continuous Particulate Monitor

The BPM-200 measures ambient particulate by using well applied beta ray attenuation technology. PM2.5 measurement can also be achieved by introducing corresponding cyclone.

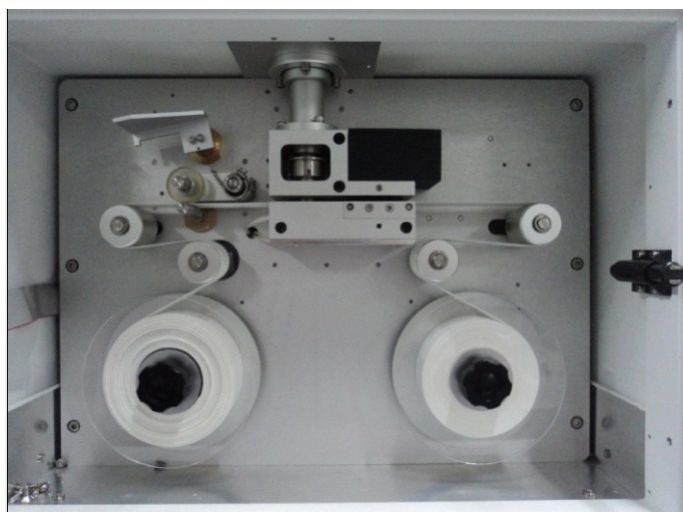
## Key Feature

- ❖ Compliance with US EPA equivalent method
- ❖ Automatic continuous operation up to 60 days
- ❖ Auto zero and span calibration
- ❖ Low maintenance and operation requirement
- ❖ User selectable measurement cycle
- ❖ Various output with serial printer and GPRS as optional
- ❖ Stable and long life time radiation source

## Principle

Particulate matter sample is pulled by a vacuum pump and concentrated on filter tape spot, the concentrated sample is advanced to measuring position where between beta ray source and detector.

An attenuation signal of beta ray is detected which represents the mass of sample particulate. Particulate concentration can be determined by dividing mass to volume which has been strictly controlled during sampling with fixed flow rate.



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## Technical Data

Principle	Beta ray attenuation	
Performance Specification	Resolution	1 $\mu\text{g}/\text{m}^3$
	Lower Detectable Limit	1 $\mu\text{g}/\text{m}^3$
	Reproducibility	< 7%
	Range	1 $\text{mg}/\text{m}^3$ to 10 $\text{mg}/\text{m}^3$ Selectable
	Sample Cycle	1~360 min
	Sample Flow Rate	16.7 L/min
	Flow Accuracy	$\pm 1\%$ F.S.
	Flow Stability	$\pm 2\%$ F. S.
	Beta Source	$^{14}\text{C}$ (Carbon -14), 10 $\mu\text{Ci}$
	Beta Detector Type	GM tube
	Filter Tape	Glass fiber filter tape, 60 days of
Environmental	Operating Temperature	5~40°C
	Ambient Humidity	0~90% RH, noncondensing
	Ambient Pressure	86~116 kPa
Physical and Electrical	Power Supply	220 $\pm$ 10% VAC, 50 $\pm$ 1 Hz
	Power Consumption	350W with pump and heater
	Dimensions and Weight	310mm x 430mm x 400mm, 25kg
Communication	Communication Port	RS232, RS485
	Digital I/O	Two digit input, four-digit output
	Analog I/O	Two (4~20)mA , 1~5V/0~5V output Two (4~20)mA input
	Other	Optional serial printer and GPRS



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