

## Particulate Measurement System

PROCESS & EMISSIONS MONITORING SYSTEMS



### SPECIFIC FEATURES:

- Continuous Particulate Monitoring-based *ProScatter*® Forward-scatter technology with a minimum detection limit of  $<0.05 \text{ mg/m}^3$  and a measurement range of  $0\text{-}300 \text{ mg/m}^3$
- For use as PM-CPMS or PM-CEMS that need to comply with PS-11
- *ProScatter*® technology provides improved measurement due to reduced cross-sensitivity in particle type and size
- Forward-scatter measurement technique with automatic zero and upscale checks that fully challenge the system's ability to measure forward-scattered light and satisfy daily drift checks
- Robust and rugged for challenging high-temperature  $930^\circ \text{F}$  stack conditions and Ex hazardous zones



For Dry applications  
As a PM-CPMS or PM-CEMS  
needing to comply with PS-11

# TECHNOLOGY / APPLICATION

## SYSTEM OVERVIEW

The PCME STACK 181 is suitable for measuring particle emissions after both bagfilter and electrostatic precipitator (ESP) arrestment plant.

The PCME STACK 181 utilizes ENVEA's patented *ProScatter*<sup>®</sup> forward-scatter measurement technique for measuring particulate concentration levels, typically between 0.05 mg/m<sup>3</sup> and 300 mg/m<sup>3</sup>.

The *ProScatter*<sup>®</sup> forward-scatter measurement technique offers improved levels of performance when compared to other forward-scatter systems, which makes the PCME STACK 181 eminently suitable for use as a PM-CPMS or PM-CEMS that needs to comply with US EPA PS-11 for site operators looking to satisfy the recent MACT and MATS rules.

Due to the inherent rugged design the PCME STACK 181 *ProScatter*<sup>®</sup> particulate monitoring system is suitable for use in a wide range of applications within the Power Incineration, Cement, Chemical, Metal, Mineral and Petrochemical industries.



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## PRINCIPLE OF OPERATION

The PCME STACK 181 utilizes an improved forward-scatter technique *ProScatter*<sup>®</sup> featuring patented options for enhanced reliability. As particles travel through a beam of light, the particle scatters light in all directions with the strongest intensity of light being scattered in a forward direction (Figure 1).

ENVEA's patented *ProScatter*<sup>®</sup> forward-scatter sensor uses a beam of light transmitted by a laser along the probe and through the measurement area. The beam of laser light then continues through a concave mirror to the beam dump (Figure 2). The forward-scattered light collected by the concave mirror is then focused onto a quartz rod where the light is transmitted towards the light detector positioned within the electronic enclosure located outside the stack. The amount of light detected is proportional to the particulate concentration.

The PCME STACK 181 *ProScatter*<sup>®</sup> technique benefits from improved levels of performance when compared to other forward-scatter systems due to its increased area of detection (more than 10x larger) and smaller angles of incidence, thus reducing variability in sensitivity and measurement due to particle type and size as found in other scatter monitors.

Figure 1: Principle of Scattered Light

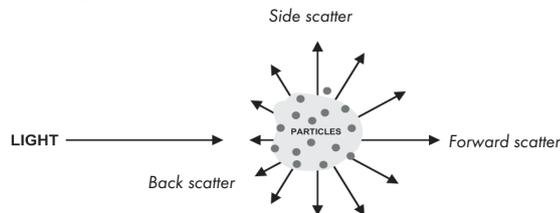
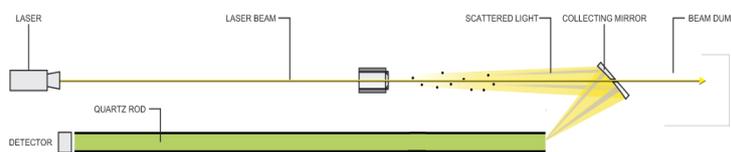


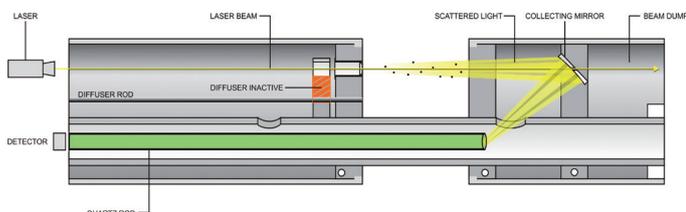
Figure 2: ENVEA's *ProScatter*<sup>®</sup> Sensor



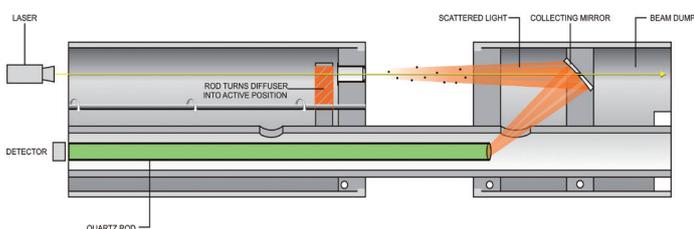
**Class 3R Laser Product – AVOID DIRECT EYE EXPOSURE!**

## INBUILT QUALITY ASSURANCE

### Measurement Mode



### Span check with diffuser performs QAL3



The PCME STACK 181 has automatic zero and upscale checks that fully challenge the forward-scatter measurement technique. Additionally, internal diagnostic checks running in the background ensure a high level of confidence in the quality of the measurement and permit early diagnosis of any deterioration in system performance.

The automatic upscale check employs a reference scattering body that is periodically positioned into the measurement path, providing a full check of the instrument's capability to measure forward-scattered light, unlike other systems, which use ratios of laser intensity as the upscale check or do not challenge the optical path of the measurement mode.

Figure 3 (left): Sensor self-checks

# PRODUCT FEATURES

## QUALITY ASSURANCE/AUDITING

The PCME STACK 181 *ProScatter*<sup>®</sup> forward-scatter sensor is supported by filter audit units, which is an approved reference material for conducting quarterly Linearity checks as Absolute Correlation Audit (ACA).

To audit the instrument, the sensor is temporarily removed from the stack and the Filter Audit reference 'scattering bodies' are inserted into the measurement zone (Figure 4). The resulting response is measured to ensure linearity and also to provide a reference check that ensures contamination is not affecting instrument performance.



Figure 4: Audit filters for instrument linearity and reference checks

## NETWORK LAYOUT

The PCME STACK 181 *ProScatter*<sup>®</sup> forward-scatter system is comprised of the sensor probe, which is mounted directly in the stack, and a control unit that provides power and digital communication for the sensor.

The Standard control unit provides configuration, graphical displays and recording of emissions for a single sensor system. The PRO version of the system (with a ProController, Figure 5) extends this to 32 sensor channels.

The control unit can also provide four data loggers:

1. Pulse data logger for instantaneous data, which hold the last two hours of data from a single-sensor system.
2. Short-term data for storing a rolling 24 hours of 1-minute averaged data from a single sensor for process control.
3. Long-term data for storing up to one year of a rolling 15-minute averaged data from a single sensor for emission monitoring.
4. Alarm data logger for a rolling 500 alarm events from a single sensor.

Power and various system signals are connected to the Standard Controller or ProController via the internal terminal blocks.

Onboard normalization can be accomplished by using additional 4–20mA input/output and relay modules from external devices, such as oxygen and temperature transmitters. Flow sensors for calculating Mass emissions can be accommodated along with additional Inputs/outputs to the controllers.



Figure 5: Typical multi-sensor layout

## ADDED VALUE FEATURES AND BENEFITS

The PCME STACK 181 *ProScatter*<sup>®</sup> forward-scatter system's rugged design provides durable long-term measurement. In addition to the reduced cross-sensitivity to changing particulate type and size, increased instrument lifetime and improved measurement reliability are indicated due to:

- No moving parts in the instrument path for increased lifetime and reliable measurement.
- For stacks with flue gas temperatures up to 930°F; using a high quality Quartz rod for transmission of forward-scattered light to the detector. The Quartz rod will not age prematurely and become brittle when used at elevated temperatures, in contrast to other forward-scatter systems that use fiber-optic cables.
- Inbuilt data logging, recording of measured particulate and internal diagnostic value for added confidence and security of the data.
- TCP/IP Ethernet, RS-485, RS232, 4x4 - 20mA outputs, 1x 4-20mA input, 4x Relay outputs, 1x Relay input for increased choice of integration with your DCS or DAHS (controller specific).
- Powerful multilingual, text-driven menu for setup without the use of external equipment, with a large display for an improved user experience.
- Proven rugged and robust mechanical design for harsh environments.



NETWORK CONTROLLERS		STANDARD CONTROLLER	PROCONTROLLER
OVERVIEW	Number of sensors/channels	1	1-32
	Display	Two-tone gray, backlit graphical LCD	High-contrast, anti-glare 7" (viewable) TFT LCD
	Multiple Data Viewing	PC or RS-485	PC/RS-485/Ethernet simultaneously
	Dimensions	W8.7 x H4.8 x D3.2 in.	W15.4 x H8.7 x D4.6 in.
	Power supply voltage	100-240V AC (50/60 Hz)	85-265V AC (50/60 Hz)
	Protection Rating	IP65	IP66
	Ambient Temperature Range	-4°F to 122°F	-4°F to 122°F
FEATURES AND FUNCTIONS	Navigation keys	UP/DOWN/LEFT/RIGHT/ENTER	UP/DOWN/LEFT/RIGHT/ENTER plus 5 function keys: 3x short-cut keys and 2 user-programmable keys
	Icon-driven, multilingual menus	n/a	✓
	Secure password protection	✓	✓
	Sensor system setup and configuration options	✓	✓
	Configurable emission alarm levels	✓	✓
	Sensor calibration screens	✓	✓
	Seamless integration with existing control units and sensors	n/a	✓
DATA LOGGING*	Long-term Log	12 months @ 15 minutes	48 months @ 15 minutes
	Short-term Log	7 days @1 minute	28 days @ 1 minute
	Pulse Log	8 hours @ 1 seconds	32 hours @ 1 second
	Alarm Log	500 entries	500 entries
SYSTEM OUTPUTS	Ethernet (RJ45)	n/a	✓ Connection type: 100Base-T/Tx 100 Mb/s
	USB 2.0	n/a	✓ Suitable for connecting to a local PC or laptop
	Relays	2 off (programmable)	4 off (programmable)
	4-20mA	1 off (programmable)	4 off (programmable)
	RS-485	1	2
SYSTEM INPUTS	Digital User selectable for: PLANT OFF indication, Bag-filter cleaning sequences, multiple calibrations	1	4
	4-20mA	0	2

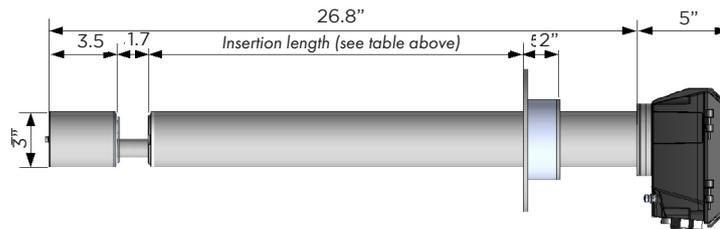
\*Data logging capacity for one sensor. Data stored varies per sensor type. Please consult ENVEA for specific data.

NETWORK ACCESSORIES		STANDARD CONTROLLER	PROCONTROLLER
NETWORK MODULES (can be connected to Controller Network systems to provide additional Inputs and Outputs)	<b>Analogue Output Module (AOM)</b> provides 8 additional 4-20 mA outputs definable to sensors/channels	1	1-8
	<b>Auxiliary Input Module (AIM)</b> provides 4 additional digital inputs, plus 4 additional relay outputs	1	1-8
	<b>Relay Output Module (ROM)</b> provides 8 additional relay outputs	1	1-8
	<b>SPUR</b> provides sensor network connection and local isolation during maintenance	1	1-32
	<b>Power Supply Repeater (PSR)</b> provides voltage and signal boost for extended cable runs and large sensor networks	1	1-8

# SPECIFICATIONS

# PCME STACK 181

181 SENSOR	
Enclosure Temperature Rating	-4°F to + 122°F
Enclosure Rating	IP65 (Ex version IP66)
Enclosure Material	Die-cast aluminium (polyester powder coated)
Connection Required on Duct	Hole pattern to suit DN80 PN10/PN16 or 3" 150lb ANSI (hole ID at least ø3.5")
Power Requirements	24V provided by the control unit
Cable Entries	3x M20 cable entry glands
Air Purge Requirements	Requires continuous air purge at 64-85 cfh, nom.
Hazardous Zone Rating	IECEx 3G/2D



INSERTION LENGTH	NOMINAL	ADJUSTABLE INSERTION	OVERALL LENGTH
181 Standard	max. 22"	3 - 21.7"	26.8"
181 Long	max. 51"	21.7 - 51.2"	56.3"

	IECEx	ATEX
<b>GAS ZONE</b>	<b>ZONE 2</b>	
<b>Certificate number:</b>	IECEx SIR 10.0125X	Sira 10ATEX4260X
<b>Certification code:</b>	Ex ec op is IIC T4 Gc T <sub>a</sub> = -20°C to +55°C	Ex ec op is IIC T4 Gc T <sub>a</sub> = -20°C to +55°C <b>II 3G</b>
<b>DUST ZONE</b>	<b>ZONE 21/22</b>	
<b>Certificate number:</b>	IECEx SIR 10.0125X	Sira 10ATEX9375X
<b>Certification code:</b>	Ex tb IIIC T63°C Db IP66 T <sub>a</sub> = -20°C to +55°C	Ex tb IIIC T63°C Db IP66 T <sub>a</sub> = -20°C to +55°C <b>II 2D</b>

## ABOUT ENVEA

As a progressive environmental Company, ENVEA specialises in particulate measurement for industrial processes. With a worldwide reputation for reliability, innovation and technological excellence, the Company produces under the trademark envea™ equipment for concentration and mass monitoring for regulatory, environmental and process control requirements. A dedicated team of qualified application and sales engineers is always on hand and should be consulted in the selection and usage of the most suitable equipment for any particulate application.



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