

Passionate  
about  
Particulate



# STACKFLØW 400

FLUESØNIC™  
INSIDE

Flue Gas Flow  
Measurement  
System

QALI Approved  
to EN 16911



- Unique extended measurement path (400mm) permits accurate and increased representative measurement
- Robust flow measurement for industrial applications
- Inbuilt automatic reference self-checks for regulatory compliance (QAL3)
- Facilitates stack velocity, volumetric flow and pollutant mass release calculations when linked to gas and dust CEMS
- Angled probe version to fit existing perpendicular ports (patent pending)



## SYSTEM DESCRIPTION

The **STACKFLØW 400** is an advanced flue gas flow measurement system for continuously monitoring releases from industrial sources. This instrument complies with European monitoring standards EN 16911-2 and 15267-3 for QAL1.

The **STACKFLØW 400** satisfies the need for high quality assurance on emission release data, reporting mass emissions (kg/year) as well as concentration monitoring. It uses PCME's unique *FlueSonic™* technology and mathematical measurement algorithm (patent pending) that allows the transit time of the signal to be measured accurately in real stack conditions, hence permitting:

- An extended measurement path of 400mm in a single, stack-mounted probe design
- Capability to deal with flow profiles across the extended measurement path
- Tolerance to contamination and flow eddies



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## PRINCIPLE OF OPERATION

The instrument uses PCME's innovative *FlueSonic™* Ultrasonic Technology measuring the time of flight of ultrasonic signals between two transducers (see Figure 1). Each transducer emits an ultrasonic pulse that is detected by the other. The sensor is mounted in the stack at an angle (typically 45 degrees) such that the transducers lie upstream and downstream of each other.

The time of flight of an ultrasonic pulse travelling between the two transducers depends on the distance it has to travel, the speed of sound in the gas and the velocity of the gas. The time of flight of a pulse travelling in the same direction as the gas (downstream) is shorter than the time of flight of the pulse travelling against the direction of the flow (upstream).

The difference in these flight times is directly proportional to the velocity of the flue gas. The stack flow velocity in the measurement path is calculated from the upstream and downstream transit time in a way that is independent of the speed of sound in the gas, flue gas temperature or pressure of flue gas composition. The flow rate is calculated by multiplication of average flue gas velocity by the stack cross-section area.

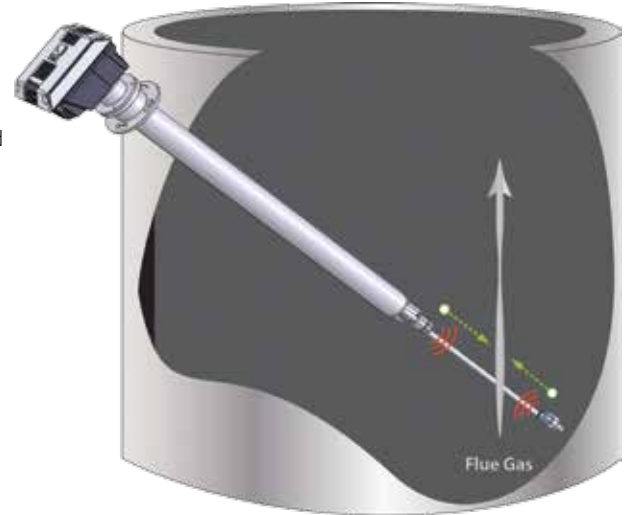


Figure 1: Principle of Operation of the PCME STACKFLØW 400

## CALIBRATION AND INBUILT SELF-CHECKS

The **STACKFLØW 400** measures the average velocity in the stack across a measurement path length of 400mm. It is important to locate this measurement path in a representative location across the stack flow profile and as such the instrument is provided with a 900mm extension tube with movable flange so that the measurement path can be located in the optimum position (probe insertion length 1.4m), see Figure 2. As with all flow measurement devices, the relationship between instrument output and average flow across the full cross-sectional area of the stack is calibrated by comparison to measurements made using a Standard Reference Method (such as Pitot traverses or tracer methods pursuant to EN ISO 16911-2).

### Automated Reference Checks

The **STACKFLØW 400** performs Lower and Upper Reference (Zero and Span) sensor self-checks (a requirement of EN 16911-2), see Figure 3.

These checks assess not only the performance of the electronics and measurement algorithm, but also the performance and correct operation of the transducers, including their ability to transmit, receive and discriminate actual ultrasonic signals from noise and offsets in the stack environment.

These automatic Quality Assurance features provide outputs which can be used for QAL3 reporting requirements (as defined in EN ISO 16911-2) and provide feedback to the user on the correct operation of the instrument.

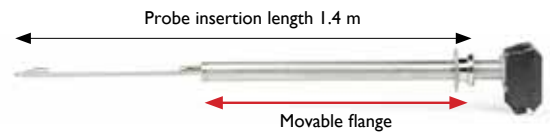


Figure 2: PCME STACKFLØW 400 sensor with movable flange to locate the optimum measurement path



Figure 3: PCME STACKFLØW 400 Lower and Upper Reference Self-Checks

TYPICAL APPLICATIONS

The PCME **STACKFLØW 400** is suitable for measuring the flue gas flow rate after both bag-filter and electrostatic precipitator arrestment plant and satisfies the need for high quality measurement on emission release data. From a regulatory perspective its high quality assurance features make it suitable as a compliance device.

Typical application areas are:

- ✓ Waste-to-Energy and Incineration plants
- ✓ Emissions from Steel, Chemical and Mineral processing applications
- ✓ Gas Turbines and Coal-fired Power plants
- ✓ Industrial stacks (before or after final arrestment plant)
- ✓ Variable speed fans on dust arrestment plant



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ADDED VALUE FEATURES AND BENEFITS

STACKFLØW 400 Sensor	
Certification	QAL 1 Approved to EN 16911-2 and EN 15267-3
Automated QAL3 checks	In-built reference materials (for QAL3) without need for compressed air (unlike Pitot's pressure transducers).
Representative measurement	Extended probe design with measurement path of 400mm and adjustable flange for fine tuning to where flow profile is more representative.
<b>Fluesonic™</b> Higher accuracy	Unique <i>FlueSonic™</i> technology giving higher accuracy over flue gas velocities of 0–50 m/s and flue gas temperatures of -20°C to 200°C.
Tolerant to contamination	No need of air purge to prevent dust contamination with flue gas above dewpoint or dust < 1000mg/m³.
Multi-sensor networked system	The system can be configured as a large multi-sensor networked system (up to 16 sensors) for multi-stack and plant-wide monitoring
Easy integration to existing CEMS	The sensor can be easily fitted to existing gas and dust monitoring systems. Mass emission monitoring and calculation of particulate releases (when combined with PCME MultiController and dust monitor or plant PLC/SCADA) systems (Figure 4).
Easy installation	Single stack mounting flange without the need for additional stack access at different levels or installation of cross-stack ultrasonic instruments. The angled probe version can be supplied to fit existing perpendicular ports without the need to fit a new angled port and standoff (Figure 5).

STACKFLØW 400 Controllers	
Advanced functionality	<ul style="list-style-type: none"> <li>• Graphical display and recording of velocity, temperature, flow rate and QAL3 results and trends</li> <li>• Mass emission calculations</li> <li>• Sensor setup and configuration capability</li> <li>• Easy integration with dust monitors for mass emission calculation and reporting</li> <li>• Industrial communications (Ethernet, Modbus, 4–20mA output/ input, alarm relays output/input)</li> <li>• Multilingual, menu-driven display and inbuilt data logging for recording measured values and internal diagnostic parameters</li> </ul>

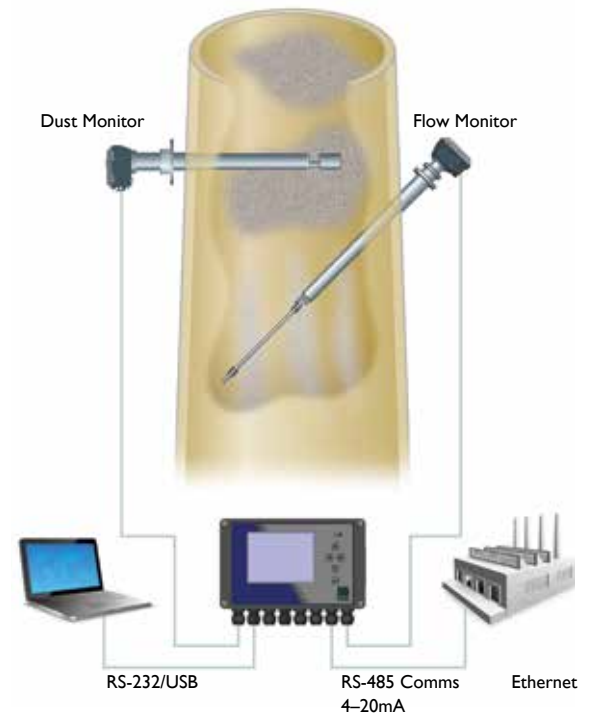


Figure 4: STACKFLØW 400 PLUS combined with PCME dust monitor for integrated concentration and Mass emissions reporting

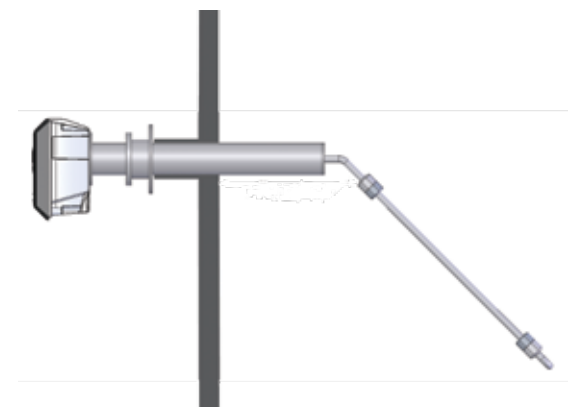


Figure 5: STACKFLØW 400 Angled Sensor using an existing perpendicular standoff

# PRODUCT SPECIFICATIONS

Application Conditions	Specification
Stack Temperature	-20°C to 200°C (-4°F to 392°F)
Stack Diameter	≥0.5 m (1.6 ft)
Stack Pressure	±100 mbar
Ambient Temperature*	-20°C to 50°C (-4°F to 122°F)

\*at monitoring point

Measurement Specifications	
Length of Measurement Path	400 mm (16 in., nominal)
Response Time	40 s
Gas Velocity	±(0–50) m/s ±(0–30) m/s (Certification Range) Resolution: 0.1 m/s
Minimum Detection Velocity	0.0 m/s

Sensor Common Specifications	
Sensor Material	Transducers: Hastelloy Sensor Body: 316 SS
Enclosure Dimensions	W 148 x H 192 x D 106 mm (5.8 x 7.6 x 4.2 in.)
Enclosure Rating	IP65
Power Supply Voltage	24V DC (via Control Unit)
Power Consumption	Average load: 120mA (24V) Maximum load: 140mA (24V)
Outputs	1x RS-485 Modbus 2x Relays 1x 4–20mA
Input	1x Digital input

Straight Sensor	
Installation Angle	45° to stack wall
Flange	3" ANSI or DN80 PN10/PN16 DN40 PN6 (Option)
Sensor Options	Horizontal stack orientation Vertical stack orientation
Maximum Insertion Length into Stack	1350 mm
Weight	8.6 kg (19 lb)

Angled Sensor	
Installation Angle	90° to stack wall
Flange	3" ANSI or DN80 PN10/PN16 DN40 PN6 (Option) 4" BSP Adaptor (Option)
Sensor Options	Horizontal stack orientation Vertical stack orientation
Maximum Insertion Length into Stack	800 mm
Weight	6.2 kg (14 lb)

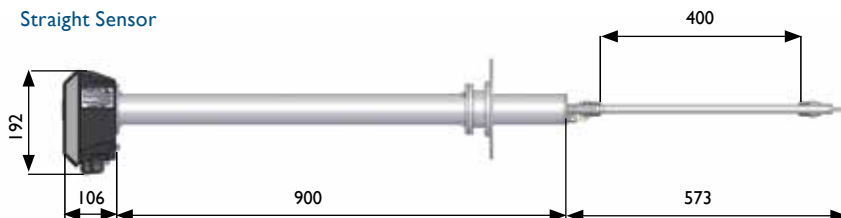
Control Units	Specification	
Type	MULTICONTROLLER	INTERFACE MODULE
No. of Sensors	16	1
Enclosure Dimensions	W 263 x H 162 x D 91 mm (10.4 x 6.4 x 3.6 in.)	W 220 x H 124 x D 80 mm (8.7 x 4.8 x 3.2 in.)
Enclosure Temperature Range	Up to 280 mA (≤2 sensors): -20°C to 46°C (-4°F to 115°F) Up to 840 mA (≤6 sensors): -20°C to 40°C (-4°F to 104°F)	-20°C to 50°C (-4°F to 122°F)
Power Supply	100–240V AC, 50/60Hz, 1A	
Mains Fuse	20x5 mm 1A, type T1AH250V (approved to IEC 60127, UL recognised)	
Data Logs	Long: 2 months @ 15 min Short: 7 days @ 1 min Pulse: 2 hours @ 1 s Alarms: 500 entries	Long: 2 months @ 15 min Short: 7 days @ 1 min Pulse: 2 hours @ 1 s Alarms: 500 entries
Ethernet	Modbus TCP	None
Outputs	1x RS-485 (Modbus RTU) 4x 4–20mA (500Ω) 4x Relays (2A @250V, user selectable)	1x RS-485 (Modbus RTU) 1x 4–20mA (500Ω) 2x Relays (2A @250V, user selectable)
Inputs	4x digital inputs	1x digital input



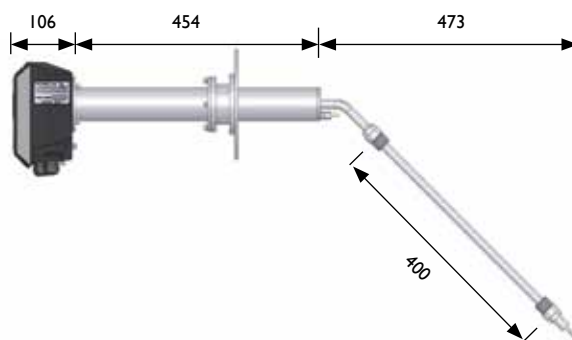
### Stack Connections

3" ANSI // DN80 PN10/PN16 (Standard)  
DN40 PN6 or 4" BSP adaptor (Options)

### Straight Sensor



### Angled Sensor



**Note:** For more information related to the product specification and options, refer to the STACKFLOW 400 Specification Guide (available on request from PCME).

## ABOUT PCME LTD

As a progressive environmental Company, PCME specialises in particulate and flow measurement for industrial processes. With a worldwide reputation for reliability, innovation and technological excellence, the Company produces 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 for consultation regarding the selection and usage of the most suitable equipment for any particulate monitoring application.



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