GREENBANK
Enhancing Performance

Greenbank Terotech Ltd | Systems Division

PfMaster-PFMS®

Pulverised Fuel Monitoring System

Online Velocity and Mass Flow Analysis of PF Systems

GREENBANK PF FLOW MONITORING SYSTEM

"Enhancing the performance of our customers plant & equipment"

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PfMaster-PFMS®

Pulverised Fuel Monitoring System

Reliable, repeatable, pulversized fuel monitoring.

Greenbank's PfMaster® pulverised fuel (PF) monitoring system is designed for use on pulverised feed systems. The PfMaster® system analyses and detects the flow of PF within the piping sys-tem and provides a relative analysis of mass flow and an absolute velocity of particu-late flow across a set of burner pipelines.

Coupled with the total mass flow from a gravimetric feed system, the PfMaster® system can provide an absolute mass flow signal from the sensors on each bank or mill set of burner pipelines.

Poor fuel distribution causes combustion inefficiency. If the fuel-to-air ratio is too rich, the result is unburned carbon-in-ash. If the fuel-to-air ratio is too lean, the result is higher NOx levels.

Analysing the distribution of PF to each burner will help the operator improve stoichiometric conditions, in turn, increase efficiency and reduce greenhouse gases.

The measurement of PF flow has often been reliant on manual sampling, which is both time consuming and expensive. Manual sampling provides one snapshot in time of a set of flow conditions. It is also subjective to load conditions and is not repeatable within +/-10% at any one time.

The dynamics of the PF flows are also dependent on factors such as par-ticle size, roping and the physical plant configuration, in particular the layout of the PF pipe-work from individual mills to the burners.

The utilisation of the PfMaster® PF monitoring system, which can be used on coal and biomass, enables velocity and distribution of PF to be accurately and repeatedly monitored online providing the ability to adjust the PF or air flows to meet the ideal stoichiometric conditions to improve efficiency and reduce emissions.

After the sample is measured the next probe is blasted with the old ash in a continual self cleaning process, or blown into a sample jar for lab analysis. No G-CAM system has ever blocked while operational.

Benefits of the Greenbank PfMaster® System

- Real-time analysis of the distribution and flow of pul-verised fuel provides the ability to improve stoichio-metric conditions.
- Optimising PF distribution will reduce unburned carbon-in-ash and greenhouse gases.
- Real-time analysis of particulate velocity provides the ability to trim and optimise primary transport air.
- Optimising the velocity of primary transport air for a given load will improve both classification and distribution of PF particulate.
- Real-time feedback of distribution and velocity pro-vides the plant operator the ability to control the sec-ondary air to further balance combustion at the burners.

PfMaster PFMS® - Better by Design

- Real-time velocity and PF distribution information.
- Non-intrusive, passive flow-monitoring system.
- Low-maintenance, high-quality, robust long life system.
- An essential system for modern practices in power generation.
- Factory-calibrated and interchangeable sensors and sensor electronics.
- Eradicates the need for manual sampling.
- ATEX and CE approval for safety and reliability.
- Provides ability to trim velocities and finely balance PF flows with manual or automated PF flow control sys-tems such as Greenbank VARB®, Control-Gate® and CoalFlo® technologies.
- Suitable for pulverised coal, biomass and other fine-particulate lean-phase conveying systems.

"It is our vision to excel and lead the world in our area of expertise"

Advanced PF flow and velocity monitoring

The PfMaster® system monitors both distribution and velocity of air-borne pulverized fuel (PF) particulates passing through its electrostatic sensors en route to the burners.

The processor analyses the signals and provides a relative distribution of PF for each bank or mill set of sensors together with the absolute velocity for each sensor sited within the PF pipelines.

Within the circumference of each sensor, two non-intrusive electro-static detection rings instantaneously detect the magnitude of elec-trostatic energy, or charge, which is naturally present in airborne PF particulates.

These signals are amplified and relayed to the PfMaster® processor via sensor electronics for analysis. For each sensor, the PfMaster® processor rapidly analyses the magnitude and correlates the charge detected by each sensor ring. The magnitude is proportional to the amount of electrostatic charge within the sensor, and time of correla-tion between the two signals over a given distance provides an abso-lute velocity of the particulates being conveyed.

The proportion of the total charge inherent in each sensor provides the relative distribution across a given number, bank or mill set of sensors. Coupled with the total mass flow delivered to any bank of sensors, for example, the gravimetric feed input for a mill set of sen-sors, the PfMaster processor can convert relative distribution into an absolute mass flow over a given number of sensors.

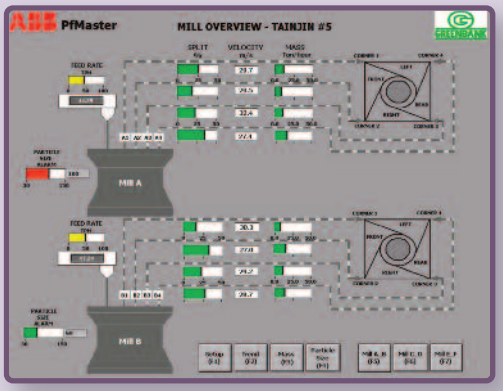
Robust, Low-maintenance, repeatable & Reliable

The sensor rings are set flush with the inside diameter of the sensor and as such there are no intrusive parts. This means the sensor rings are protected from both erosion and damage from mill pops or boiler flashbacks.

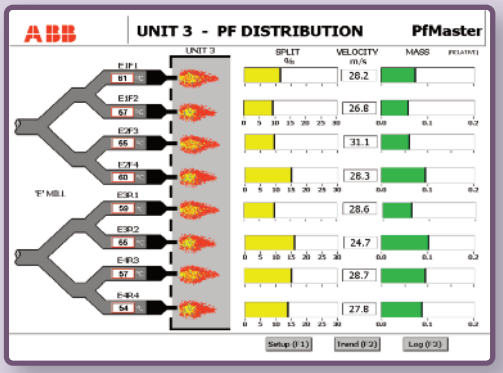
Each sensor, when sited in a position recommended by Greenbank, will provide a repeatable signal under normal working condition at a full range of load conditions. The life expectancy without maintenance is well in excess of that of a general major boiler overhaul.

The sensors are of a 'wafer' design similar to that of a butterfly valve and sit bolted between two flanges each hav-ing a small recess machined in the face to locate the sensor body centrally and accurately. A gasket on the face of the sensor body seals against the adjoining flanges.

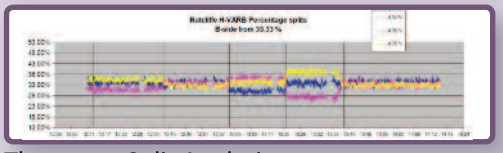
Operating Philosophy



Multi outlet Mill Analysis



Primary and Secondary Split Analysis


Three way Split Analysis

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Pulverised Fuel Monitoring System

General Specification

PfMaster® PFMS Sensors

Size Range:
DN50mm to 660NB

Sensor Body:
Carbon steel super compact design
Epoxy powder coated body
Stainless steel internal sensor and spacer rings

Mounting:
Wafer design between two recessed flanges
Greenbank to advise and approve all mounting positions

Permissible Operating Temperature:
-20 to 180°C (-4 to 356°F)
Pressure Rating:
16barg (NFPA85 compliant)

Environmental:
IP65 / NEMA4X

Measurements:
Absolute PF particulate velocity (averaged)
Relative PF mass loading (concentration) per bank or mill set of sensors
Individual sensor mass flow-rate with external input from gravimetric feeder

PfMaster® PFMS Sensors Electronics

Power Supply:
5v powered from signal processor

Permissible Operating Temperature:
-20 to 70°C (-4 to 158°F)

Environmental:
IP65 / NEMA4X

Cabling (each sensor to signal processor):
Single core 5 pair 0.75 (20/0.2) multi-screen cable max distance 100m

Approvals:
Incorporated zener barriers
CE / ATEX20

PfMaster® PFMS Signal Processor

Display:
Local flat colour 15" screen

Sensor Input Channels:
Options: up to 8, <16, <24, <32, <40, <48 or <56

Velocity Range:
0.3m/s to 60m/s

Inputs (Optional):
Mass (feeder input) via 4-20mA, digital OPC client, Modbus or DH+

Outputs (optional):
OPC server client using Ethernet, Modbus via RS485 or RS432 or DH+

Alarms:
Programmable high/low points for velocity and mass

System response time:
<1.5s and suitable for online PF-flow control

Logging:
Velocity, Split (concentration) having programmable logging intervals, file format *.csv

Permissible Operating Temperature:
-10 to 60°C (50 to 140°F)

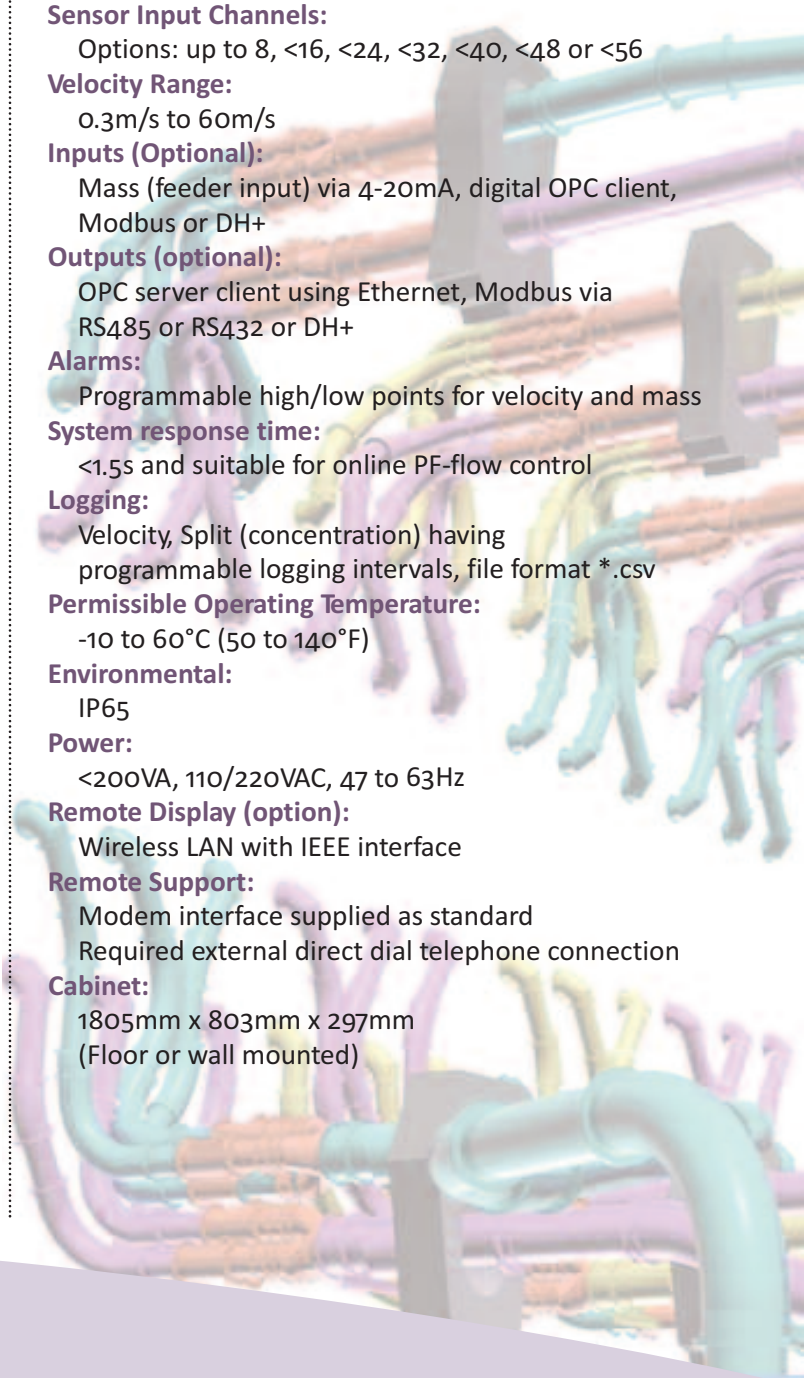
Environmental:
IP65

Power:
<200VA, 110/220VAC, 47 to 63Hz

Remote Display (option):
Wireless LAN with IEEE interface

Remote Support:
Modem interface supplied as standard
Required external direct dial telephone connection

Cabinet:
1805mm x 803mm x 297mm
(Floor or wall mounted)



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