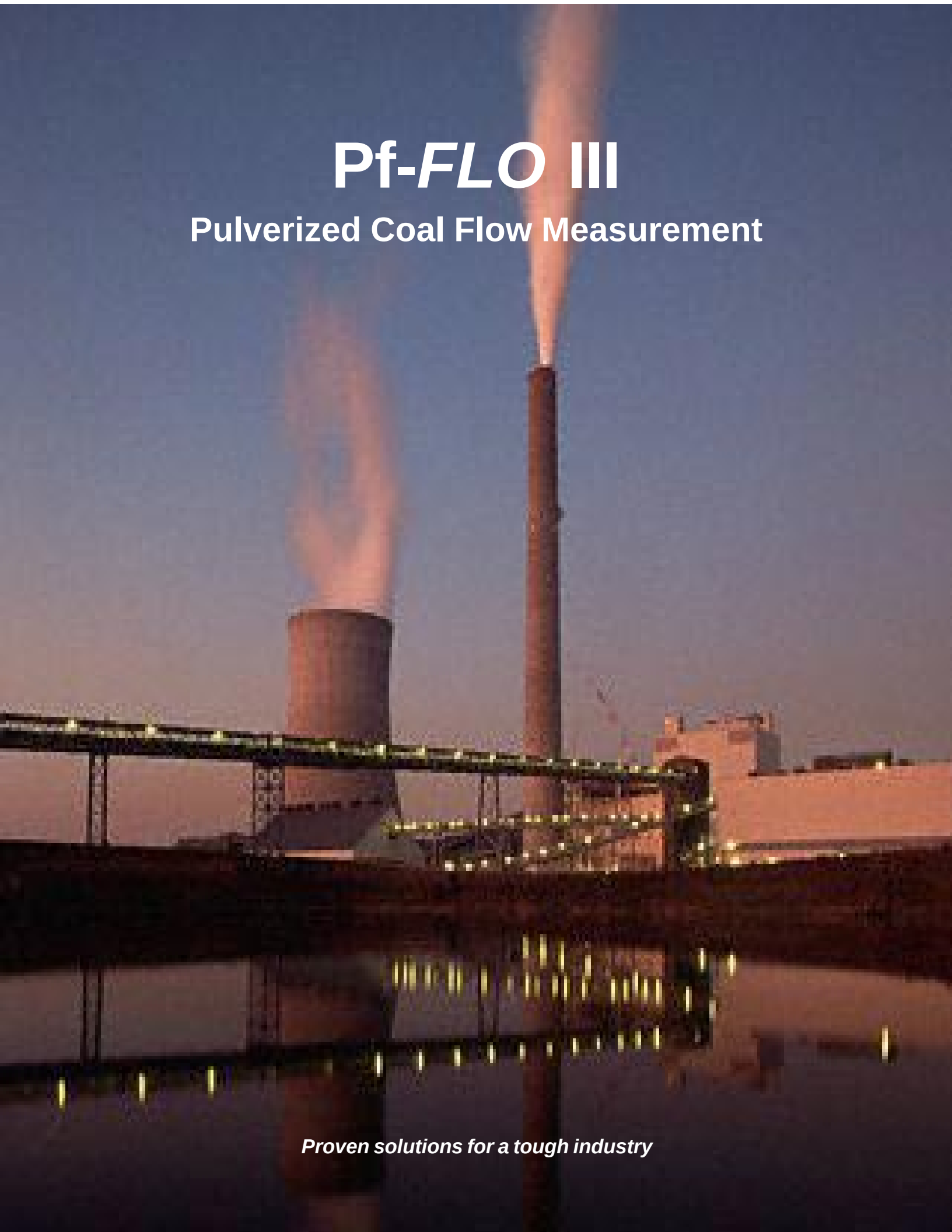
Pf-*FLO* III

Pulverized Coal Flow Measurement



Proven solutions for a tough industry

Pf-*FLO* III ™

Product Description

The Pf-*FLO* III pulverized coal flow measurement system, introduced in 1999, provides reliable and accurate mass flow measurement in pulverized coal flow applications. The system provides boiler operators with real time data of the amount of coal to each burner. Analogous to the automotive industry, the Pf-*FLO* III system enables coal fired power plants to advance beyond carburetion to fuel injection.

Coal fired boilers require accurate pulverized fuel flow measurement to balance coal mass distribution between burners. Balancing the coal mass improves the burner-to-burner stoichiometry, resulting in better plant performance and operating efficiency. Equal coal mass distribution also reduces fuel delivery issues, such as in-furnace slagging, coal layout, fuel slugging, and coal pipe fires.

When Pf-*FLO* III is coupled with individual burner airflow measurement, a boiler operator can use the system to fine tune air-to-fuel ratios on a per burner basis. This makes the Pf-*FLO* III system a very capable NOx reduction and boiler performance optimization tool.

Performance Features

- Real time on-line pulverized coal flow measurement
- 5% accuracy, independently tested, and proven
- System measures full pipe cross-section
- Simple Commissioning. No need for extractive sampling or field testing to calibrate
- Ensures safe boiler operation by detecting fuel delivery problems
- Assists in minimizing primary air while maintaining minimum transport velocity, to reduce CO emissions
- Industrial construction for long term durability
- Combustion optimization tool proven to increase efficiency and reduce emissions
- Replaces manual methods of coal flow measurement

Pulverized Coal Flow Measurement

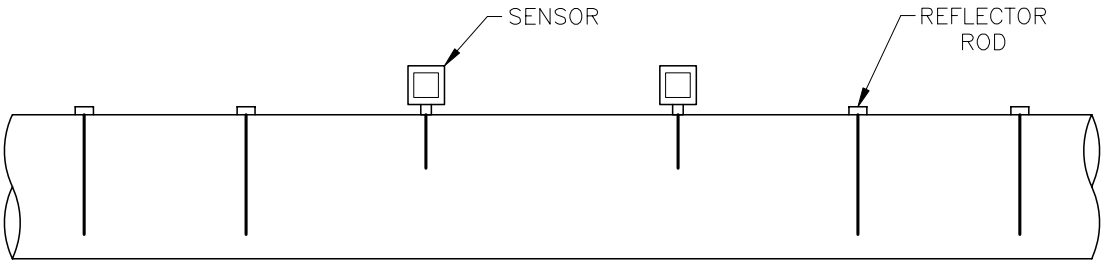
How It Works

The Pf-*FLO* III system determines the mass flow of pulverized coal being transported in a pipe by independently measuring the components of coal velocity and density. The system uses a passive method to determine coal particle velocity, while the coal density measurement uses a microwave based technology.

The Pf-*FLO* III system is comprised of a transmitter, sensors, reflector rods, and sensor cabling. The transmitter mounts near the measurement zone on the coal pipe and performs all processing required to calculate the coal density, velocity, and mass flow. The pipe mounted density, velocity, and temperature sensors are connected to the transmitter with provided factory prepared cabling. The reflector rods are installed upstream and downstream of the sensors. The section of pipe within the sensors functions as a wave guide, along which the microwave signal can propagate. The reflector rods are installed to prevent reflected microwaves from entering back into the measurement zone between sensors. Reflected microwaves can interfere with the density measurement in the form of microwave “noise”.

The Pf-*FLO* III transmitter provides direct coal velocity and mass flow outputs to the DCS via 4-20mA signals, plus an Ethernet connection to the PC which is used for data acquisition, data historian, system commissioning, and configuration.

The drawing below illustrates the typical configuration for pipe mounted components. There are four reflector rods and two sensors per pipe.



Velocity Measurement

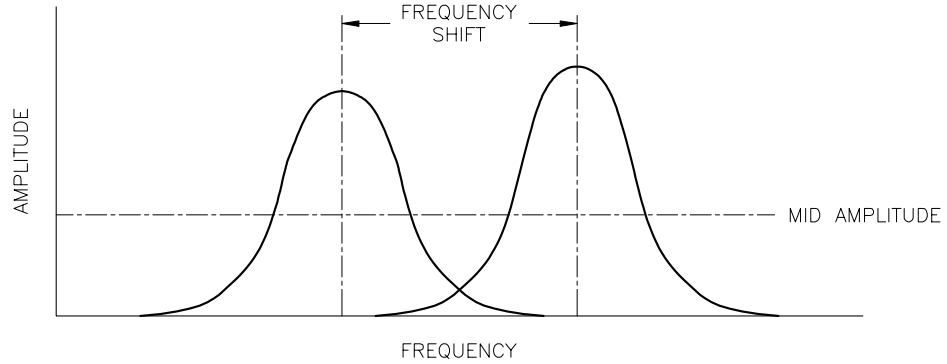
The Pf-*FLO* III system utilizes a passive, cross-correlation method to measure coal particle velocity in the pipe. The coal particles travelling in the coal pipe produce a unique "signature" detected by both the upstream and downstream Pf-*FLO* sensors.

These "signatures" are subjected to cross correlation processing to determine the time of flight (Δt) required for the signature to pass from the upstream sensor to the downstream sensor. The time of flight combined with the known distance between sensors produces the coal particle velocity.

Density Measurement

The Pf-*FLO* III system measures coal density via the relationship between signal frequency shift and the amount of pulverized coal present in the pipe. An increase in coal density produces a measured shift of the microwave resonant signal to a lower frequency.

This shift in resonant frequency is calculated with a patented (U.S. Patent Nos. 6,109,097 and 6,771,080) dual slope measurement algorithm and correlated to coal density.



Pf-*FLO* III ™

Pf-*FLO* Features

Stand-Alone Measurement. Each Pf-*FLO* III coal flow transmitter determines the mass flow rate and particle velocity of pulverized coal, independent of a central processor and/or external inputs such as mill feeder rate. The onboard microprocessor manages the transmitter functionality and performs all data processing, providing reliability with real-time performance.

Data Acquisition. The Pf-*Vu* data acquisition and archival software provides the system operator with both dynamic and historic graphical presentations of all measured parameters (particle velocity, density, mass flow rate, and pipe temperature), logically arranged by mill. Data can be selectively exported numerically into spreadsheet software [in a delimited format] and/or continuously communicated via an OPC or Modbus interface directly to a DCS or PI platform.

Long Term Durability. All in-pipe mounted components are constructed of abrasion resistant Tungsten Carbide to ensure long life, and are backed with a three year warranty.

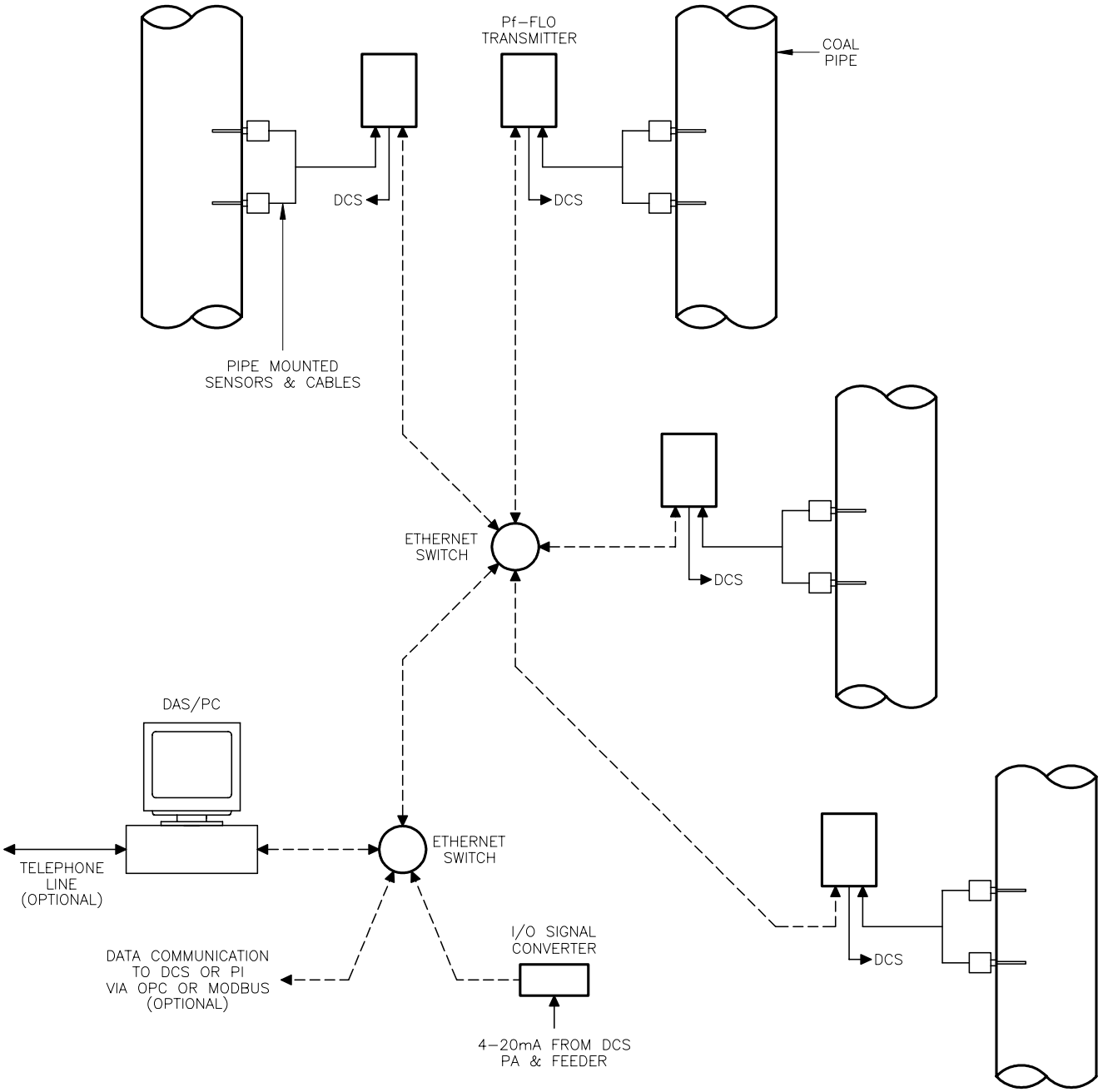
Analog Communication. The Pf-*FLO* III transmitter provides dual 4-20mADC analog outputs for mass flow rate and particle velocity measurements, user configurable for isolated or non-isolated operation.

Local, Central & Remote Configuration. Utilizing the Pf-*PRO* software utility, parameterization and calibration of each Pf-*FLO* III transmitter can be performed from a central PC over industry standard Ethernet wiring, or locally at each transmitter utilizing a laptop computer and a direct connect cable. With the addition of a phone connection to the central PC, each transmitter can be monitored and configured remotely.

Simplified Installation. Included weld-in threaded inserts for pipe mounted components, plus Factory prepared and labeled cables provide for fast and error free installation of the Pf-*FLO* III coal flow system. Cable lengths of up to 50' allow for flexibility in the mounting location of each transmitter's NEMA 4 enclosure.

Pulverized Coal Flow Measurement

System Architecture

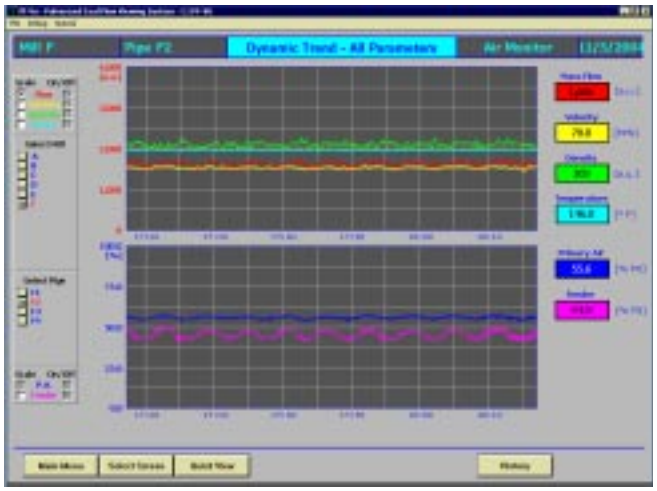


Pf-*Vu* Features

Pf-*Vu* software provides access to all system parameters (mass flow, velocity, density, and temperature) for each mill.

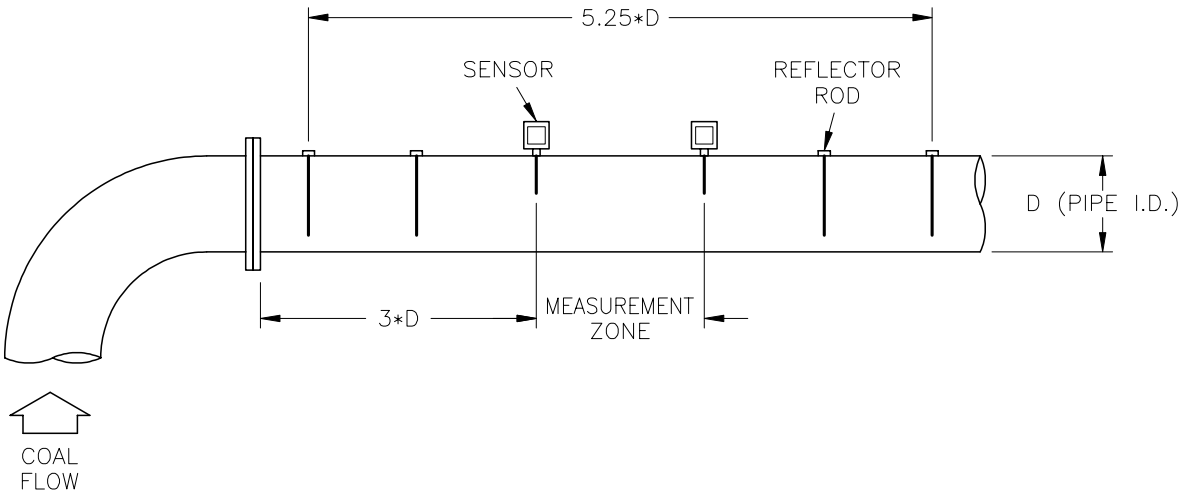
Dynamic and historical data trending can be viewed through the Pf-*Vu* interface.

Screen Selection



Dynamic Trend

Minimum Installation Requirements



- Suitable for installation in vertical, inclined or horizontal pipe.
- Recommended installation in vertical section of pipe right out of mill discharge or first horizontal section of pipe within three to five diameters of the upstream elbow.
- Pipe must not have any flanges in the measurement zone.
- Test ports can be located anywhere except in the measurement zone between the two sensors.
- Fixed or variable orifices and coal valves must be located outside the reflector rods.
- Orifices and coal valves should be installed downstream of the last reflector rod.
- Pipe must not have ceramic lining within the reflector rods.
- Vertical down flow is not a suitable installation for the Pf-*FLO* III system.

Pf-*FLO* III ™

Pf-*FLO* III™ Performance Specification

Accuracy
±5% of mass flow (absolute units), combining velocity and density accuracies.

Power Consumption
42 VA at 120 VAC
24 VA at 24 VAC/DC

Measurement Update Rate
Single Pipe System. Mass Flow: 2 to 3 seconds
Dual Pipe System. Mass Flow: 4 to 6 seconds

Pf-*FLO* III™ Functional Specification

Microprocessor Based Functionality
All functions and operations are performed by the Pf-*FLO* III™ system on-board microprocessor.

Pf-*FLO* III™ to PC / DAS Connectivity
ModBus / TCPIP via Ethernet

Analog Outputs
Dual 4-20mADC isolated or non-isolated outputs
Output 1: Mass Flow
Output 2: Velocity

Analog Inputs
Isolated or non-isolated 4-20mADC inputs for mill feed rate and mill primary airflow. Inputs are for data analysis only and are not required for mass flow measurement.

Rolling Average Filter
Adjustable from 1 to 10 values

Velocity Measurement Range
20 to 200 ft/s

Pipe Temperature Measurement Range
0 to 300ºF

Density Measurement Range
0 to 200 absolute units (approximately 0 to 0.08 lb/ft^3, dependent upon coal type)

Power Supply Requirement
120 VAC, 24 VAC or 24 VDC

Circuit Protection
Power input is fused and reverse polarity protected

Temperature Limits.
–20ºF to 180ºF Storage
0ºF to 140ºF Operating

Enclosure
NEMA 4

Sensor Antenna and In-Pipe Components
Tungsten carbide construction

Threaded Inserts
Weld-in 5/8-18

Pf-*FLO* III™ PC/DAS Functional Specification

Pf-*Vu*
Wonderware™ based software for data display and extraction to Excel™. [Optional] Pf-*Vu/Plus* to include Burner Secondary Airflow Measurement.

Pf-*PRO*
System management software for local or central system parameterization and commissioning.

Data Storage
Receive and archive data for all pipes: Density, Velocity, Temperature, Mass Flow, Feeder, and PA.

Data Extraction
[Optional] OPC or Modbus communication of data to plant DCS or PI system.

Remote Connectivity
PCAnywhere™ for remote operator access. Requires phone connection.

Password Protection
Owner, Administrator, and Operator / User.

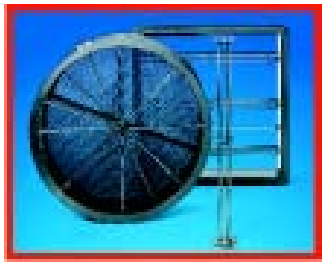
Air Monitor Power's Product Families of Airflow Measurement & Services

IBAM™ – Individual Burner Airflow Measurement

The IBAM™ – Individual Burner Airflow Measurement probe is ideally suited for new or retrofit applications where a reduction in plant emissions and improvement in efficiency can be obtained through accurate measurement of burner secondary airflow. The IBAM™ probe has been designed to accurately measure in the particulate laden, high operating temperature conditions found in burner air passages.

CAMS™ – Combustion Airflow Management System

The CAMS™ – Combustion Airflow Management System has been designed to reliably and accurately measure airflow in combustion airflow applications. The CAMS™ contains the microprocessor based instrumentation to measure the airflow and manage the AUTO-purge. The AUTO-purge is a high pressure air blowback system that protects the duct mounted flow measurement device from any degradation in performance due to the presence of airborne particulate (flyash).



Combustion Airflow Measuring Station & VOLU-probe/SS™ Traverse Probes

Air Monitor Power's duct mounted airflow measurement devices have been designed to accurately and repeatedly measure air mass flow in power plants. The Combustion Air (CA) Station™ includes honeycomb air straightener to accurately measure in shorter straight duct runs than any other flow measurement device. The VOLU-probe/SS™ delivers accurate airflow measurement performance in the form of an insertion probe. Both devices feature Type 316 stainless steel flow sensing arrays.

CEMS™ – Continuous Emissions Monitoring System

Air Monitor Power's CEMS™ – Continuous Emissions Monitoring Systems assist in complying with the Clean Air Act's stringent emission measurement standards and the requirements of 40 CFR 75. Air Monitor Power has assembled a cost effective integrated system consisting of in-stack flow measurement equipment and companion instrumentation to provide continuous, accurate, and reliable volumetric airflow monitoring of stacks and ducts of any size and configuration.

AIR MONITOR
POWER DIVISION

Engineering & Testing Services. Air Monitor Power offers complete engineering and testing to analyze air and coal delivery systems. Air Monitor Power's field testing services use 3D airflow traversing and Pf-*FLO* coal flow measurement systems for the highest possible accuracy. To ensure cost effective and accurate solutions, Air Monitor Power has full scale physical flow modeling capability and in house Computational Fluid Dynamics (CFD). CFD analysis is used to analyze flow profiles and design/redesign ductwork to improve overall performance. Full scale model fabrication and certified wind tunnel testing is used to develop application specific products that will measure accurately where no standard flow measurement can.

P.O. Box 6358 • Santa Rosa, CA 95406 • P: 800-AIRFLOW • F: 707-526-9970 • www.airmonitor.com • amcsales@airmonitor.com

Coal Flow Technology Licensed From:

PROMECON
www.promecon.com

125-196 (7/07)