Pulverized Fuel Meter for coal-fired power stations improves combustion efficiency and reduces emissions.
General Applications

The ABB PfMaster system is for use on pulverized-coal feeds into boilers. A single system can measure up to sixteen pulverized-fuel (pf) burner feeds from a single mill, and up to 24 PF coal pipes by removing the temperature measurement.

Poor distribution of pf causes combustion inefficiency and also environmental issues.

Continuous on-line measurement enables performance monitoring and the possible application of a control system to maintain optimum furnace performance, such as:

♦ Individual secondary air control for burners to match coal flow to each burner, a reactive control measure.
♦ Mills that have multiple coal pipes exiting the classifier can use control valves to balance the fuel distribution.
♦ Application data has shown that reducing the Mill Primary Air for a given load can improve both classification and distribution. The PfMaster velocity information can be used for real-time trimming of mill air.

Greenbank Terotech and ABB Instrumentation can offer advice on the benefits given your mill plant and burner configuration.

Introduction—On-line vs. Sampling

Coal-flow transport behavior and distribution to boiler burners has, up until now, proved difficult to meter. The dynamics of the coal flow are very dependent on factors such as particle size, roping and the physical plant layout.

The common way of checking the condition of the fuel distribution has been to use probe sampling devices. Whilst these do provide a reasonable indication of the flow in a given pipe at a given moment, the time taken to sample up to eight pf feeds across one mill can take several hours, during which the mill conditions have changed and hence the volume of fuel in previously sampled pipes has varied.

The ABB PfMaster is capable of making continuous Rapid measurements of pf flow in all the burner pf feed pipes effectively simultaneously.

Any instabilities in the Mill performance and pf pipework are instantly evident. Measurements are continuously updated and hence the output signals respond accordingly. The PfMaster is ideal for use within pf flow-control systems.
Sensor Electronics

Sensor connection to the signal-processing computer is by a single low-voltage multi-core cable, the design of which has been optimized to provide the highest rejection of possible interference signals generated on the plant.

Another feature of the sensor electronics is the incorporation, as standard, of barrier circuits to prevent any possibility, under fault conditions, of hazardous voltages igniting the explosive atmosphere present in the pipe-bore.

Signal-sensing utilizes the detection of electrostatic energy, which is naturally present on the pf particles. This passive sensing therefore eliminates any dangers which might be present with systems based on ionizing radiation that put energy into the pipe, such as microwave techniques.

The sensor electronics enclosure is rated to IP65/NEMA 4, –20 to 70C and designed to EEx ib e (CENELEC & FM) hazardous environment safety standards.

However, the main benefit to the user of sensor electronics other than safety are:

♦ The low strength static signal is amplified and allows low loss transmission over longer distances.

♦ The differential amplifier virtually eliminates noise pick-up which is necessary for rapid measurement and control.

♦ Competitor systems without such processing have to use rolling averages for measurement data and are not good at reactive control. PF master has a unique non-smoothed instantly reactive measurement of only a few seconds, ideal for any control purpose. (see trend bottom of page).

PfMaster – Signal Processor and Display

At the heart of the system is the signal processor which can handle up to 24 sensors and is shown on the front cover. The standard cabinet is IP65 in design.

Output options are either 4-20 mA current outputs, or rapid serial communications such as DH+ or Fast Ethernet OPC.

A number of ‘Function’ keys at the foot of the display allow the user to switch between other facilities which include:

Setup in which the ranging and output control is set
Trend shows the system’s measured value over the past 60 minutes
Log sets the file and logging interval for the internal data-logging facility
Cal contains system calibration parameters which are accessible only through password controlled entry.

On-Line Velocity Meters

The Latest Low NOx burner designs have been designed for very low PF velocities, some as low as 16 m/s for optimum combustion. It is also well understood that mill classification is improved both on Dynamic and Static Classifiers with reduced PF velocity through the mill.

The On-Line Velocity Meter works on the same principle as the PFmaster, non-intrusive with the same quality sensor electronics & cabinet. The design fits via 4 inch BSP, and it determines velocity from the time of flight of material past its 2 electrodes via cross-correlation techniques of the two signals.

Use the cost effective On-Line Velocity Meter on mill outlet pipes in a control system to minimize primary air through the mill for better classification, distribution and burner combustion.

Instant reaction to forced distribution changes
Typical Specification

**PfMaster Sensor Spool**

- **Size:**
  - Up to 700 NB

- **Spool Piece:**
  - Carbon steel – Compact, un-flanged

- **Mounting:**
  - VJFA or sandwiched between flanges

- **Process Temperature:**
  - -20°C to 180°C

- **Pressure Rating:**
  - 16 bar

- **Environmental:**
  - IP65 / NEMA 4X

- **Measurements:**
  - Absolute PF velocity
  - Burner PF split
  - Relative PF loading (concentration)
  - Mass flowrate – computed for each line from split and external total mass input (mill feed rate or similar)

**Pfmaster velocity sensor**

- **As spool piece except :**

- **Size:**
  - 100 mm / 4 inch

- **Mounting:**
  - BSP thread

- **Measurements**
  - Absolute PF velocity

**Sensor Electronics**

- **Supply:**
  - 5V, powered from signal processor

- **Ambient:**
  - -20°C to 70°C

- **Environmental:**
  - IP65 / NEMA 4X

**Cabling:**

- Single multi-core screened cable
  - Standard sensor distance up to 200m, up-rated amplifier for longer distances.

**Approvals:**

- Designed to EEx ia e (CENELEC & FM)
  - Zone 0 inside pipe
  - Zone 1 outside pipe (Approval pending)
  - EU Pressure Equipment Regulations

**Signal Processor**

- **Display:**
  - VDU – 15” SVGA integral monitor

- **Sensor Input Channels:**
  - Up to 24 channel processor per cabinet system

- **Velocity range:**
  - 0.3 to 60 m/s

- **Optional Analogue Outputs 4-20 mA:**
  - Fully programmable for velocity, split & concentration
  - Alarms programmable high/low points for velocity & split.

- **Optional Serial Data Communications**
  - OPC Fast Ethernet
  - Data Highway plus

- **System Response Time:**
  - <5.0s – suitable for continuous on-line PF flow control

- **Logging:**
  - Velocity, split, concentration & optional temperature

  - File format – Comma delimited (*.csv)

- **Temperature:**
  - 10°C to 60°C

- **Control Cabinet Environmental:**
  - IP65

- **Power:**
  - <400VA