SFM

- On-line measurement of dual-phase flow distribution and velocity. Mass Flow Rate with Feeder Input
- Total Cross-Section Measurement
- Non-Intrusive, Passive Sensors
- Superior Wear Performance with No Probes
- Unaffected by Changes in Moisture or Blend Ratios
- Requires No Field Calibration
- Low Maintenance Visual Inspection Only
- Designed to EExia Intrinsic Safety Standards
- EC Approved to 232 PSIG
- Modular, Scalable
General Applications

The Greenbank SFM system is for use on dilute phase transported solid particles. A single processor can measure up to 16 splits in a single line, up to 32 total. Multi processors can be stacked to monitor the entire process.

Where poor distribution may cause process problems, continuous on-line measurement enables effective process control strategies to be implemented for optimum outcomes.

Introduction—On-line vs. Sampling

Dilute phase transport flow behavior and distribution has, up until now, proved difficult to meter. The dynamics of the flow are very dependent on factors such as particle size, roping and the physical plant layout. The common way of checking the condition of distribution has been to use probe sampling devices. While these do provide a reasonable indication of the flow in a given pipe at a given moment, the time taken to sample distribution lines across a system can take several hours, during which the flow conditions have changed and hence the volume of material in previously sampled pipes has varied.

The Greenbank SFM is capable of making continuous, rapid measurements of flow in all the feed pipes effectively and simultaneously. Any instabilities in performance and pipe work are instantly evident. Measurements are continuously updated and hence the output signals respond accordingly. The SFM is ideal for use within flow-control systems.

Sensor Spool Piece

The sensor, being a spool-piece, provides the highest performance in the presence of roping / mal-distribution of material. The technology works by sensing the charge conveyed by particles, and the distribution is calculated by comparing sensors from each line. Velocity is calculated as the time of flight between two sensor rings using cross-correlation. Having a spool piece allows the measurement to be integrated around the whole circumference so that the effect of variable material location in the pipe is overcome.

The sensor body is constructed from carbon steel and the sensor electrodes from stainless steel. The sensor is available in sizes DN15 to DN600 and in Victualic, Viking Johnson (VJ), Flange or Wafer mounting configurations.

The benefits of spool piece vs. probe type sensors:

- Wear of any intrusion into a transit pipe is a function of the material type and its velocity. The SFM is non-intrusive, and the oldest installation has shown no measurable signs of wear over more than 8 years of operation.
- Greenbank can guarantee a minimum life of sensor spool pieces. All sensors are factory calibrated before shipping with certificate of conformity (no site calibration required).
- Excellent availability—no SFM system has ever failed or suffered down-time and required maintenance.
- The SFM meets the new EU pressure equipment regulations required for pulverized fuel systems.
- The non-intrusive design is such that the instrument is unaffected by pressure excursions.
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 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.

SFM – Signal Processor and Display

At the heart of the system is the signal processor which can handle up to 32 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.

Flow Graphic of Pulverized Coal Flow Balance

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

Set-up 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

Typical Applications

The SFM System is capable of measuring any dilute phase transported powdered or granular material that triboelectrically charges during flow.

Some Examples:
Pulverized Coal
Pulverized Limestone
Activated Carbon
Trona
Biofuels
Glass
PVC
Polypropylene
Teflon
## Technical Specifications

### SMF Spool

**Size**
Up to 28 inch nominal bore

**Spool Material**
Carbon Steel

**Sensor Material**
Stainless Steel

**End Connection**
Flangeless or Victaulic Clamp

**Temperature**
-4 DegF to 350 DegF

**Pressure Rating**
232 PSIG

**Environmental**
IP65 / Nema 4X

**Measurements**
Absolute Velocity
Relative Mass Flow / Concentration
Mass Flow computed via external total mass input measurement

### Sensor Electronics

**Supply**
5V Processor Supplied

**Temperature**
-4 DegF to 158 DegF

**Environmental**
IP 65/ Nema 4X

**Cabling**
Single multi - core screened cable
Standard sensor distance up to 656 feet

### Approvals

- Designed to EE x ia e (CENELEC & FM)
- Zone 0 Inside Pipe
- Zone 1 Outside Pipe
- EU Pressure Equipment Regulations

### Signal Processor

**Display**
SVGA Integral Monitor

**Input Channels**
Up to 32 per cabinet

**Velocity Range**
60 to 11,800 ft/min

**System Response Time**
< 3.0 seconds

**Temperature**
50 DegF to 140 DegF

**Environmental**
IP 54

**Power**
110 / 230 VAC  47 to 63 Hz
<400 VA

**Logging**
Velocity, Split, and Concentration

**File Format**
Comma Delimited (*.csv)

**Options**
**Analog Outputs**
4 to 20 mA Programmable for Velocity, Split, Concentration, Alarms Hi/Low Velocity and Split

**Serial Data Communications**
OPC Fast Ethernet or DH+

---

Greenbank Energy Solutions 185 Plumpton Ave., Washington, PA 15301 PH: 800 468-1180
Email: mail@greenbankenergy.com    Website: www.greenbankenergy.com