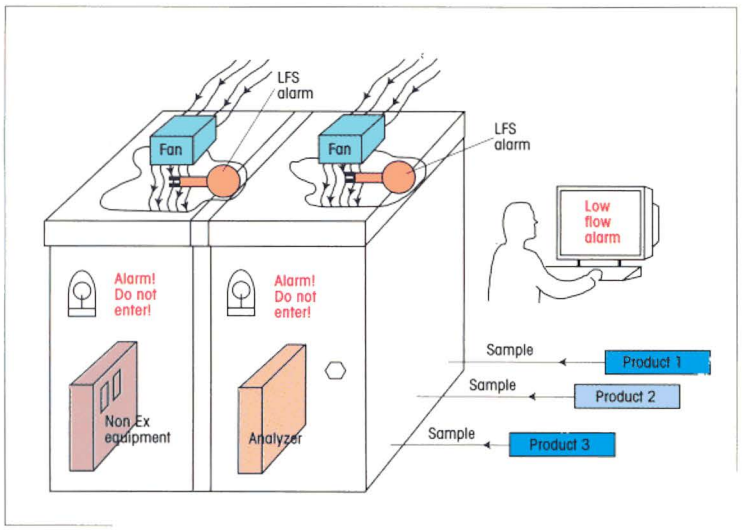


*FIG. 2: If the air inlet flow drops below a preset value in an analyzer house, alarm lights at the entrance door are activated to warn people of an unsafe situation. A remote operator also receives the signal so equipment can be shut down.*

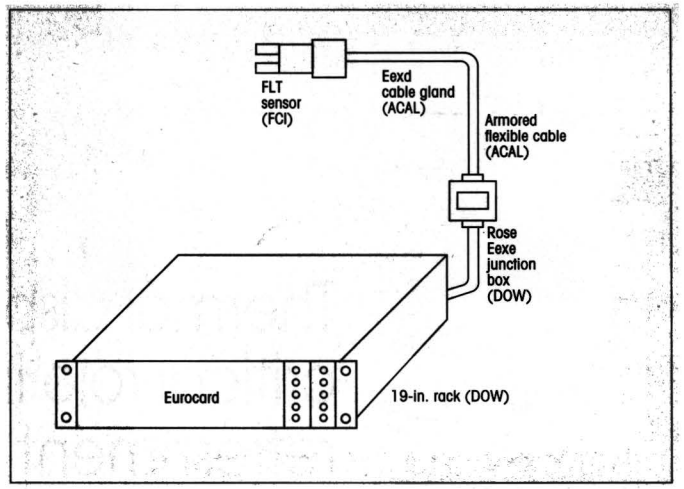


*FIG. 3: ACAL designed the calibration system for FLT sensors.*

*FIG. 4: The switch's control circuit is a fail-safe, dual-relay circuit board that is user friendly. Sensing elements are constructed of stainless steel, Hastelloy C276, Monel, or Titanium.*

drawbacks. Delta-P sensors require a special low-signal transmitter that's highly sensitive and often expensive. Turbine-type flowmeters feature a delicate sensor that easily fouls and outputs weak pulses that are subject to electrical disturbances.

Because of these drawbacks, the Dow engineers decided to search for a more robust sensor. With our help, their search eventually led to thermal dispersion sensing technology. We suggested that they test the FLT™ Series switch, developed by Fluid Components Intl (San Marcos, CA). The FLT is designed with an all-welded thermal dispersion sensing element that monitors gas flow up to 1cc per second in ¾-inch lines.

The Dow engineers liked the switch's rugged sensor, high reliability, no-moving-parts design, low maintenance requirements, and high resistance to signal disturbances. In addition, the technology had been field proven over a wide variety of applications, and was available at a moderate cost.

The FLT has a control circuit that provides simultaneous flow/level/temperature monitoring/switching. For Dow, this functional integration eliminated the need for discrete flow, level, and temperature sensors or switches. It also allowed the device to be transferred easily from one application to another in plant retrofit activities, extending the switch's useful life cycle.

## Dow's requirements were met

For Dow's analyzer house application, gas flow needed to be monitored at 1.2 to 2.4 meters per second over a pressure range of 0.05 to 0.1 Barg under temperatures of –10 to 35°C. The switch met these requirements and provided Dow with reliable flow monitoring with an accuracy to within ±2% of the setpoint velocity over a ±50°F (±27°C) operating temperature range. Repeatability proved to be within ±0.5% of reading.

To meet Dow's requirement that the sensor electronics be installed in a centralized location, the switch was modified. Its electronics were placed on a 19-in. dual channel Eurocard, and the sensor was potted with a flexible shielded cable to meet mounting space limitations. We then calibrated the device and established initial setpoints *(Fig. 3)*.

The switch's control circuit is a fail-safe, dual-relay (SPDT) circuit board *(Fig. 4)* that is flexible and user friendly. Field selected configurations include dual SPDT relays that can be set to operate simultaneously as:

- One DPDT relay for single alarming of flow rate, liquid level or temperature, and
- Dual relays configured to alarm as independent single-pole, double-throw relays.

In setting alarms with the FLT switch, field calibration can be performed without the need for auxiliary calibration equipment. All setpoint adjustments can be made by accessing a card-mounted calibration switch that isolates the sensing element signal from the variable voltage signal on the control circuit. This makes quick adjustments possible with accurate reference voltage readings. Logging of reference voltage readings at critical setpoint values can be done with a multimeter.

The switches have rugged, all-welded sensing elements that are constructed of either stainless steel, Hastelloy C276, Monel or Titanium. The FLT sensing element is mounted in an explosionproof local enclosure designed to withstand rigorous environmental conditions and hazardous areas.

## Dow finds second application

With its analyzer house application operating successfully in numerous plant locations, the Dow engineers identified a second flow application for a thermal device. This application involves gas or liquid level detection in production flow sampling lines. In the sample lines, problems typically occur because of extreme low flows, which are often as little as several cc/minute.

The Dow engineers once again looked at conventional flowmeters and thermal dispersion technology. The requirements were to measure liquids or gasses at temperatures from 0 to 100°C, with pressures of 1-2 Bar and at rates of 0.5 to 2 cc/s.

The engineers determined that thermal dispersion technology offered the advantages of a more rugged, more reliable sensor, and selected the Model FR70 low-flow switch monitor from the same vendor. Depending on the pipeline size, the FR70 detects fractions of a cc/s. This switch was also connected with a 19-in. Eurocard via a flexible shielded cable. After several additional months of operation, both thermal dispersion flow applications at Dow were meeting most performance requirements.