drawbacks. Delta-P sensors require a special low-signal transmitter that's highly sensitive feature a delicate sensor that easily fouls and often expensive. Turbine-type flowmeters 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 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 explosion-proof 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 the sample

![Diagram of air inlet flow and alarm](image1)

**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.

![Diagram of calibration system](image2)

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

![Diagram of control circuit](image3)

**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.