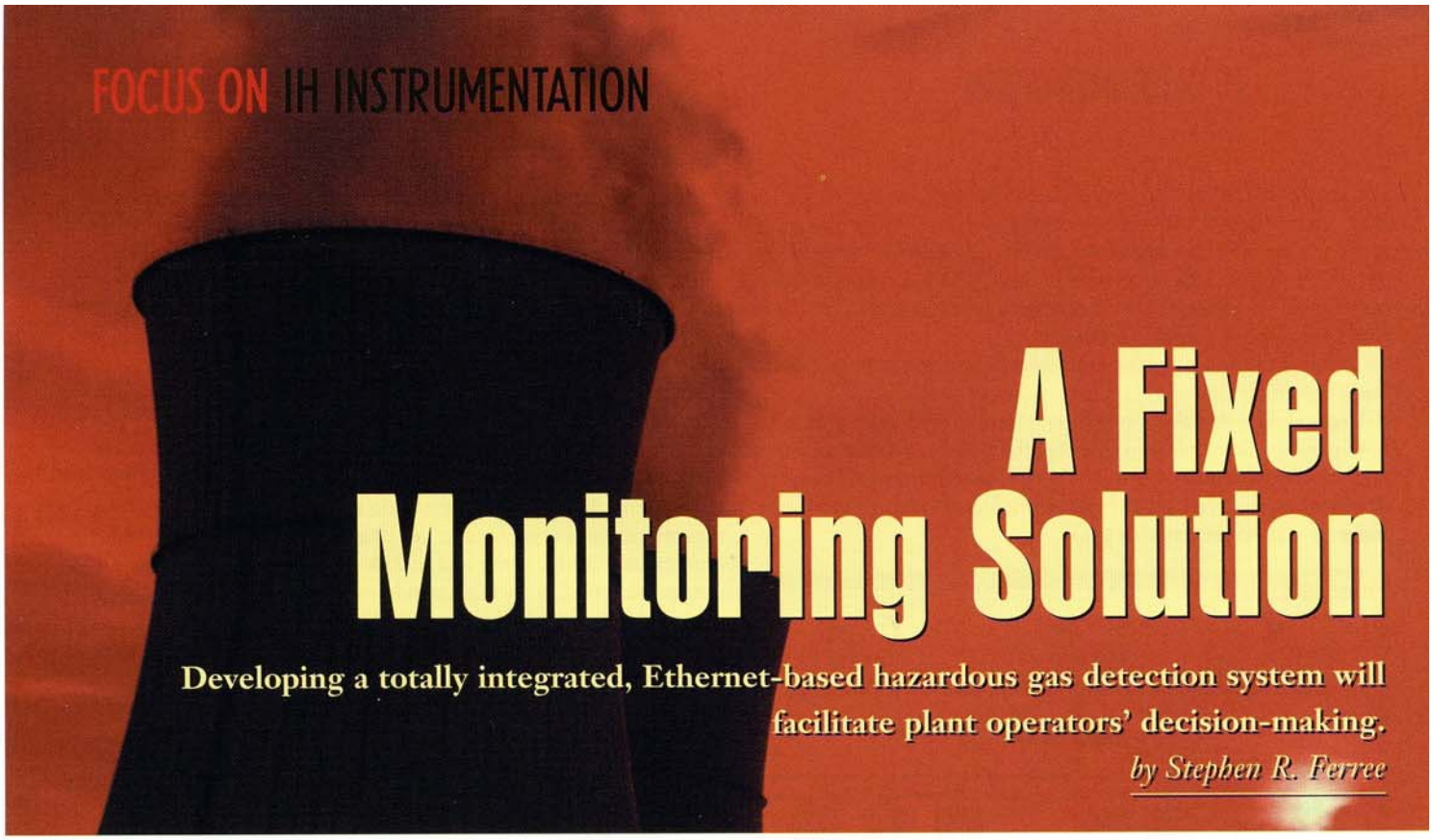

A Fixed Monitoring Solution

Developing a totally integrated, Ethernet-based hazardous gas detection system will facilitate plant operators' decision-making.

by Stephen R. Ferree

A hazardous gas detection system must be able to provide the necessary warning to enable the operator to take the necessary steps to protect both personnel and the facility. Many gas detection systems are simply local alarms that warn those in the room of the problem, just as your smoke detector at home will warn your family of a dangerous smoke or potential fire problem in the room where it is located.

More sophisticated home security systems have smoke alarms connected via a phone dialer to an alarm management company, which can dispatch the fire department and notify the homeowner should a smoke detector alarm. The same monitoring company can remotely monitor your security alarm, sump pump alarm, and a power outage alarm to achieve a full homeowner's security system.

The same levels of hazardous gas detection management exist in industrial plants. You can use a basic gas detection system consisting of a remote gas sensor/transmitter and a single channel controller, which is adequate for providing a local alarm indication but provides only minimal information. An intelligent hazardous gas detection system adds remote indication, data handling, comprehensive alarm strategies, and information processing. A full plant-wide integration adds a much more comprehensive information layer, plus it uses Ethernet to provide hazardous gas monitor information throughout the plant.

A basic gas monitoring system consists of two key elements, the gas sensor module and the controller. Most systems utilize a remote gas sensor/transmitter module with a 4-20 mA signal of gas concentration fed back to a central controller/receiver. There are several deficiencies with such a system.

How the Systems Differ

The remote sensor modules are not intelligent, they provide no relay contacts for alarm and no decision-making capability to activate alarms, and there is no information available at the sensor. Calibration is difficult and often requires opening the enclosure, which might not be acceptable in many locations. Often, the controllers have no data retention to prove due diligence, minor or no diagnostic features, and no zoning functions. The use of 4-20 mA wiring means high installation costs because of the requirement to run shielded wires from each remote sensor to a central control point. Such systems also tend to be stand-alone, with no interface to other plant-wide monitoring systems or serial output to other devices.

An intelligent system utilizes intelligent gas sensor modules in the field that are connected to the controller with a two-way digital communications link. This two-way communications link makes true, one-person calibration possible because the intelligent controller automatically manages all adjustments during the calibration process. The operator starts the calibration process from the controller, exposes the sensors to the proper calibration gas, and the controller completes the calibration and prints out a calibration report. An intelligent system also has the ability to include devices along the bus that can provide control relays and information display in the field, such as outside a room containing the gas sensors. The digital communications link also provides the significant advantage of low installation costs through multiplexing.

The intelligent system has not only smart sensors, but also a smart controller. The user-friendly, microprocessor-based controller lets the operator easily set up system parameters, alarm setpoints, calibration schedule, and sensor information; he can even password-protect these parameters. The intelligent controller can retain key data and calibration details. Zone alarms are no longer a complex task of wiring and relays, but rather a simple software configuration at the controller. In addition, the intelligent controller can provide a serial communications link to other devices, such as a PC-based man-machine-interface program, including Wonderware or Intellution FIX.

For a fully integrated plant-wide hazardous gas monitoring system, you need to bring together all of the information relating to plant gas hazards and make it available to all appropriate points of the plant. The key to any hazardous gas detection system is easily and effectively providing the operator with all information necessary to make quick decisions that protect the plant and personnel.

Like modern process or factory control systems, there are two

key sectors of any facility-wide gas detection system (see figure 1). The essential sector is the control layer, including the sensors, controller, relays, displays, and alarm panels. The second, increasingly important sector is the information layer, which incorporates the handling of data from the control layer and its use in man-machine interface and datalogging functions.

First, let's look at some key *control layer* needs for a plant-wide system.

■ **Expandable scalable systems.** With ever-changing factory configuration demands, it is essential the system have the ability to add additional sensors easily and adapt to other requirements as needs change. The smart sensor/intelligent controller design makes it easy to achieve this goal.

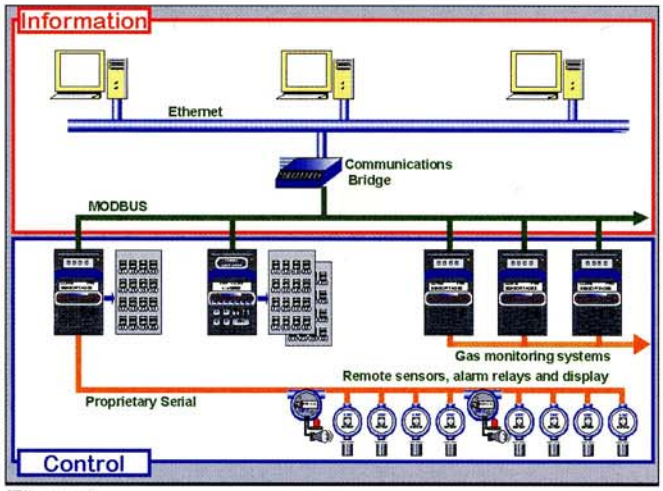

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Figure 1

■ **Data transferable between system elements.** As the hazardous gas detection system grows, the need for a more comprehensive alarm strategy grows. More complex zone alarm patterns emerge, sometimes making it necessary to combine alarms from different controllers. The system's design should avoid making host monitoring computers integral to alarm logic processes so a central alarm control unit interfaces to multiple intelligent controllers, enabling you to meet any alarm strategy needed for the growing plant. Each central alarm control unit could access information from hundreds of different sensors of any gas type and provide any combination of alarm indication, as either a soft alarm (indication only) or hard alarm (relay activation).

■ **Menu prompting at the operator level.** An intelligent system needs to be user-friendly so the operator can configure additional sensors as needed, adjust alarm configuration, run calibration checks, and perform system maintenance. Critical front panel functions can be password-protected so that once the operator has the configuration properly set, it cannot be changed by unauthorized access.

■ **Reliable sensor operation.** Extensive diagnostic functions in both the smart sensors and the intelligent controller are essential to maintain reliable monitoring without the need for unnecessary extensive maintenance. In this case, the self-checking feature of the smart sensors, regularly scheduled calibration maintenance, and self-diagnostics of the intelligent controller meet the goal. Diagnostic information is accessible via the serial communications output of the controller to the MMI system if needed.

Now, let's look at the *information layer* needs.

■ **Transparent data integration.** Gas monitoring system controllers require serial communications interface that provides a full range of detailed information about the operation and status of the intelligent controller and the smart sensors. This data can be provided to PC-based man-machine-interface packages or through the Communications Bridge, and the data can move via Ethernet to any point in the plant.

■ **Enterprise-wide access.** A plant-wide monitoring system allows information to be accessible by various operations of the plant. That means utilizing the pre-existing plant-wide Ethernet backbone to transfer data from the controllers to the central control system. Most future plant-wide monitoring systems will be required to be accessible over the Ethernet backbone. The Communications Bridge is the link to Ethernet. It accepts the Modbus output from the Sentry Commander or controllers and converts it seamlessly to an Ethernet protocol. With the device, the hazardous gas detection system and all its associated data appear as another node on the Ethernet bus.

■ **Interoperable applications.** Hazardous gas conditions cannot remain independent of other operations in a plant. Dangerous levels of combustible or toxic gases affect the safety of the people and the facility and must be tied in with other fire and safety management systems. Various plant operations might affect the generation or need for these gases, so it's also important this information is available to the plant operators. With the information from the hazardous gas monitoring system accessible throughout the facility via Ethernet, plant operators can integrate hazardous gas information with other systems, such as fire and safety monitoring, and plant operations.

■ **Anticipating emerging protocols.** The Communications Bridge in this system can bring information from different devices that might utilize different protocols. As new PLCs, sensor systems, or distributed control systems are added to the plant, software drivers can be installed in the bridge to enable it to support new or legacy protocols.

■ **Meeting increasing information demands and facilitating decision-making.** The key to any hazardous gas detection system is information. Individual sensor elements are designed for monitoring specific gases but vary little from one manufacturer to another. But the key in any hazardous gas detection system is to make sure the data from each of those individual sensor elements is available to the decision-makers quickly and efficiently and in an easy-to-understand format.

Summary

A comprehensive, plant-wide hazardous gas risk management system needs to be capable of bringing together all of the necessary information that allows the operator to make decisions correctly and quickly that protect plant and personnel. Such a system incorporates digital communication links from each sensor to the controller and links the gas detection control system to Ethernet for plant-wide access.

The digital communications link between sensors and controller allows the use of modules for alarm relays and displays to be easily added wherever they are needed. Digital communications from the controller allow this valuable information to be used with MMI programs or DCS. ■

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