multisensor detection for healthcare settings

a life safety white paper
Some hospitals keep their most important life saving equipment on the ceiling.

Dual sensor smoke and CO detection for true life safety in one cost-saving package.

Some day all detectors will be like this.
Until then, there’s only Signature Series.
It was a typical busy day in the large urban medical center when the life safety system went into alarm. The private mode presignal froze staff in their tracks for a moment, then all at once they sprung into action, their evacuation training kicking in.

Some took accounting of the patients that could not safely be moved. Others did a discrete headcount of visitors. Oxygen supplies were quietly shut off. Gurneys readied. Wheelchairs glided into position. Tension rose as the minutes passed — each nurse and orderly awaiting the final coded signal, fully aware that evacuating the hospital would be a dangerous and potentially deadly undertaking. Time crept.

The fire started in a vacant testing lab in the teaching wing. Because the initial flames were fed by alcohol, there was little smoke. In fact the smoke detector in the lab didn’t go into alarm until the fire had spread into the walls. Even then, hospital staff, harassed by a series of false alarms in the weeks leading up to the incident, were slow to react.

It wasn’t until emergency response personnel arrived on the scene that the fire was discovered. But by then the adjacent hallway had already filled with smoke. Local evacuation rushed a few surprised medical students to the exits. The fire was quickly extinguished by firefighters. Luckily, the general evacuation signal never came. Patient floors weren’t affected. Staff everywhere breathed audible sighs of relief when the All-Clear signal finally registered at their stations.

This story, though hypothetical, illustrates just how fragile the integrity of a fire alarm system can be and just how serious the outcome can get — especially in healthcare settings. False alarms and the unpredictable nature of fires make a dangerous combination. But advances in technology have cleared the way for new products and approaches that would make it virtually impossible for this hospital’s system to fail.

**Sharing the processing burden**

In recent years, designers and manufacturers of fire alarm systems have pushed beyond conventional technologies into the realm of distributed intelligence. Like most revolutionary ideas, distributed intelligence rests on a deceptively simple premise: spread the computing power of a life safety system among its devices, free the control panel from intensive yet mundane processing tasks; and, decentralize the system’s core processing functions.

In itself, distributed intelligence is nothing new. The Internet was originally conceived of, decades ago, as a means of providing a kind of command and control system that would support military communications in the event of war. On a smaller scale, modern fire alarm systems provide much the same fail-safe backup that
enable them to continue to provide basic life safety functions, even if a control panel or network node is knocked out of action.

What is new is the capacity of today’s intelligent life safety devices to do much more than simply send information to the control panel. As a result, the burden of processing data and making decisions has shifted from the control panel to its connected devices. This means there is less data required to make the journey back and forth. By being economical with data, control panels today are more efficient and quicker to respond than ever before. And because there is less data traffic, the need for costly high-capacity communications wiring has become a thing of the past. In fact, Signature Series life safety devices from Edwards can be installed on existing wiring. This cuts retrofit costs by about a third, while at the same time delivering all the advantages of multisensor technology and distributed intelligence.

The need for reliability
Intelligent detection systems monitor their surroundings and adjust themselves to compensate for naturally-occurring environmental conditions. In other words, they know the difference between smoke and something that may look like smoke.

The driving force behind this development has been the need for a design that is more reliable and less susceptible to nuisance alarms. This has been accomplished through modifications to the way information is processed, rather than to the way it is gathered. Even though tremendous gains in detector reliability have been made over the past few years, the basic principles of detection have remained virtually unchanged. Photo and heat sensors – the mainstays of any fire alarm system – each have their own specific applications for which they are best suited.

Because of the unpredictable nature of fire, manufacturers have found it necessary to modify detectors so they perform reasonably well under a wide range of conditions. For example, a photoelectric detector must also be able to respond to a fast flaming fire. The result is a device that operates reasonably well, but not optimally.

The trade-off has come at a price: nuisance alarms, which used to be an expected inconvenience. The problem stems from the fact that detectors that are sensitive to smoke are also sensitive to dust; those sensitive to heat can also be affected by normal fluctuations in ambient temperature.

Devices compensate for changes
Edwards pioneered the means of overcoming this problem. With the introduction of the Signature Series family of analog fire detectors, sliding alarm thresh-
olds became possible for the first time. This enabled the device to monitor its own sensitivity and “understand” its environment. If dust or humidity levels increase the chance of a false alarm, the device itself is able to compensate automatically by raising its own alarm threshold. There is no danger, however, that the threshold will be pushed so far as to compromise the device’s ability to detect fire; before that point is reached, the device sends out a message indicating that it’s time for a cleaning.

Signature Series on-board microprocessors provide a means of addressing another concern: the perennial problem of choosing the best type of detector for a particular application. Signature Series multisensor detectors incorporate photo, heat, and carbon monoxide sensors into a single unit. Independently, these different types of sensors can come up with conflicting conclusions concerning the same environmental conditions. But when they are combined in a single smart detector they can be monitored over time, thus reducing the chance of the device reacting to the wrong set of circumstances.

And that’s where the sophistication of the Signature Series detectors comes into play. These advanced devices actually compare values received from the on-board independent sensors to a pre-set algorithm that profiles environmental conditions. The device’s microprocessor can then determine whether there is an actual danger, or whether one of the sensors is reacting to a non-threatening environmental condition such as dust or humidity. This data filtering process means the detector will only initiate an alarm when conditions exactly match the characteristics of a fire.

If conditions exceed these benchmarks, an alarm condition results. Meanwhile, false alarms are virtually eliminated because the microprocessor considers several environmental conditions before an alarm is generated. This, however, is generally true only of Signature Series intelligent detectors, which assess the data from smoke, as well as heat sensing elements. Multisensor detectors that don’t do this are really nothing more than separate sensors that share the same housing.

**Device mapping heads off problems**

Signature Series detectors also adjust their alarm thresholds to compensate for environmental conditions that could generate a false alarm. They don’t simply see things in black and white. As true analog devices, they adjust for subtle changes in humidity, air pressure, temperature, and even dirt. They even perform their own sensitivity tests and track important details such as alarm history, number and types of internal troubles, date of manufacture, and the date it was last cleaned. These detectors also indicate where the device is connected in the building wiring rela-
True multisensor detectors offer a clear advantage over single-application detectors. But since this type of system essentially comprises different types of detector, is the cost prohibitive? It would be if we were still in the early stages of this technology, but fortunately, the field has moved on. What once would have been a cumbersome, expensive proposition, has emerged as an efficient, versatile, and cost-effective solution to healthcare facility life-safety needs.

More than fire threatens life safety
But fire isn’t always the only focus of the latest generation of life safety detectors. Carbon monoxide detection adds yet another vital dimension to hospital safety. A waiting ambulance or idling delivery truck can quickly elevate CO to deadly levels. Hospital boiler rooms, kitchens, laundries, generator facilities — even operating theatres and patient wards all have equipment that generates CO. A blocked exhaust vent or faulty burner could have deadly consequences.

The fact is that carbon monoxide poisoning is such a serious threat to life safety that most states now have laws on the books that mandate their use in hospitals and health care facilities. Combination fire and CO detectors, like Signature Series, offer the best protection for a fraction of the cost of separate devices.

And thanks to the modular design of Signature Series detectors, CO elements can be added only to devices in locations where this kind of detection is needed. This strategy saves money while ensuring the best level of life safety protection.

Putting it all together
Putting all these elements together – the microprocessor plus the latest photoelectric, thermal, and CO detection – results in multi-sensing capacity that represents technology at its best: reliable, cost-efficient and completely unobtrusive.

Had an intelligent system supporting multisensor detectors been installed in the hospital described earlier, the building probably wouldn’t have had to be evacuated. The detector would have caught the situation before the fire spread. And because the system would have virtually eliminated false alarms, hospital staff would have been more attentive and quicker to react. The fire would have been put out with all but a few building occupants even being aware that there was a problem at all.
Life safety briefing:
**Carbon Monoxide Detection**

A vital part of life safety for hospitals, nursing homes, and assisted living facilities.

**What...**
Carbon monoxide is the leading cause of accidental poisoning deaths in America. Known as the “Silent Killer,” CO is odorless, tasteless, and colorless.

**Why...**
More than half of the U.S. population lives in states requiring the installation of CO detectors in commercial occupancies such as hospitals, assisted living facilities, and nursing homes. It may not be the law in your jurisdiction yet, but CO detection should be a part of every new installation and retrofit. It's a responsibility no hospital board should ignore.

**Carbon Monoxide Detection Laws**

![Map showing states with CO detection laws](image)

**Where...**
A recent surge in legislation passed at both the state and local levels across the country emphasizes the importance of CO detection. In fact, The Centers for Disease Control and Prevention estimates that almost 500 deaths a year and over 15,000 people seeking medical attention are a result of carbon monoxide poisoning. Most, if not all of these poisonings could be prevented if carbon monoxide detection was in use.
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U.S.
T 888-378-2329
F 866-503-3996

Canada
Chubb Edwards
T 519 376 2430
F 519 376 7258

Southeast Asia
T : +65 6391 9300
F : +65 6391 9306

India
T : +91 80 4344 2000
F : +91 80 4344 2050

Australia
T +61 3 9239 1200
F +61 3 9239 1299

Europe
T +32 2 725 11 20
F +32 2 721 86 13

Latin America
T 305 593 4301
F 305 593 4300

utcfireandsecurity.com

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