

October 2008

Performance Comparison Overview:

Advanced Multi-Criteria Fire Detector

Executive Summary

Fire detection has always been a balancing act. Detector technology must be sensitive enough to detect fire at its earliest stage, yet not so sensitive as to cause nuisance alarms. As a result, the development of fire detection technology has always been constrained by the need to balance sensitivity and detection speed against nuisance alarm resistance.

For most applications, traditional fire detection technologies, such as ion and photoelectric, have performed admirably, meeting and exceeding baseline standards set by Underwriter's Laboratories (UL) and other agencies. However, for applications in challenging environments with persistent nuisance conditions or in applications where nuisance alarms cannot be tolerated, maintaining this balance between sensitivity and nuisance immunity has proved to be far more challenging.

With the development of the Advanced Multi-Criteria Fire Detector, System Sensor is pushing further against these counterbalancing constraints than any fire detector to date. By combining four distinct sensor technologies guided by intelligent algorithms within a single housing, the Advanced Multi-Criteria Fire Detector is able to deliver an unmatched combination of fire detection speed and accuracy.

To highlight the Advanced Multi-Criteria Fire Detector's ability to quickly detect fires while maintaining the highest immunity to nuisance alarms, System Sensor conducted an extensive comparison study. The study measured the performance of the Advanced Multi-Criteria Fire Detector against an ion detector and another multi-criteria (photoelectric and thermal) fire detector in a wide-ranging series of actual fire tests and challenging non-fire nuisance scenarios.

In both series of tests, the Advanced Multi-Criteria Fire Detector outperformed competing products by providing on par or better reaction times to real fire and near perfect immunity to nuisance scenarios. With these unique performance advantages, the Advanced Multi-Criteria Fire Detector can provide three key benefits that will make you more competitive:

- Enhanced performance of the fire detection system
- Extended system application into challenging areas where short-lived smoke-like phenomena are frequently produced
- Greater functionality in system monitoring and control

The remainder of this report provides background on the development of the Advanced Multi-Criteria Fire Detector, an in-depth description of how it works, an overview of the performance comparison results and information on the detector's current standards approval status.

Background

Every fire is different in the way it develops once a material is ignited. At one extreme, a slow, smoldering fire may never generate much heat, but it will produce large amounts of smoke. At the other extreme, a pure alcohol fire generates very high temperatures very quickly without any evidence of smoke. This variability is recognized by the different Standards bodies throughout the world, all of whom define a series of standard test fires designed to ensure that any detector will respond within the defined parameters under laboratory conditions.

However variable the fire and the characteristics of the materials involved, in a real fire situation, all fires produce carbon monoxide (CO), heat, and particulate matter in varying proportions. In most cases, fires will also produce a changing light signature, usually as the result of flame generation.

This was the starting point for the development of the Advanced Multi-Criteria Fire Detector. It combines independent CO, photoelectric smoke, thermal and infrared detectors in one low-profile housing. All four sensors are managed by an embedded microprocessor. By measuring and processing the individual sensor outputs with sophisticated, responsive and intelligent algorithms, the detector is ultra-immune to non fires, yet very sensitive to actual fires.

Advanced Multi-Criteria Fire Detector Overview

The Advanced Multi-Criteria Fire Detector is the result of extensive research and development carried out in our U.S. laboratories and Trieste European operation. One of the benefits of being the largest detector manufacturer in the world is that System Sensor has the resources to undertake fundamental research and development work aimed at improving the effectiveness of existing technologies—a significant advantage over our competitors.

Specifically, the Advanced Multi-Criteria Fire Detector's alarm decision, except at the most sensitive level, is based on enhancement of the smoke detector element. Of all the products of a fire, smoke is widely recognized as the most important for detection systems aimed at providing the earliest warning possible. While this principle of operation has proved very effective in most situations, when installed in unsuitable or challenging environments, most smoke detectors can be prone to false alarms.

What sets the Advanced Multi-Criteria Fire Detector apart in these more challenging environments is its continual monitoring of all four major elements of a fire. This has enabled the Advanced Multi-Criteria Fire Detector to respond far more quickly to an actual fire, while still maintaining high immunity to nuisances. Specifically, the detector's onboard intelligence dynamically adjusts the detection profile of the device in response to the inputs from the sensors, enabling it to be re-characterized as the ambient conditions change. Based on sensor signals, the program dynamically changes:

- Sensor thresholds
- Sensor gain
- Time delays
- Combinations
- Sampling rates
- Averaging rates

If any sensor fails, the Advanced Multi-Criteria Fire Detector changes the sensitivity of the remaining sensors and indicates a fault condition.

The operating philosophy behind the Advanced Multi-Criteria Fire Detector is for it to normally operate at a high immunity level, changing to become very sensitive to fires when fire characteristics are sensed. In this way, transient nuisances are monitored and ignored. For example, the IR light sensor might recognize a specific situation such as welding and the detector will rapidly adjust itself to take this input into account. Finally, the detector is highly configurable from the panel, allowing it to adapt to changes in the use of the protected building or application.

In the Advanced Multi-Criteria Fire Detector, you as our partner have access to the most advanced, responsive and accurate fire detector yet invented, giving you a significant competitive edge. Your users will benefit from enhanced protection of their staffs and physical assets, as well as reduced costs associated with nuisance alarms.

This unique combination of sensors and intelligence has enabled the Advanced Multi-Criteria Fire Detector to significantly outperform all competitive products against which it has been tested, which is critically important in challenging environments or in applications where a false alarm cannot be tolerated.

Fire Test Comparison

The Advanced Multi-Criteria Fire Detector was tested in a standard fire test room as well as in a special small room constructed within the fire test room. This smaller room represented more typical “real-world” applications where toxic particles and gases can build up much more quickly than in a large fire test room.

It is this real-world performance that sets the Advanced Multi-Criteria Fire Detector apart from any other detector currently available. By definition, any detector will conform to the requirements of performance defined in the appropriate UL and EN54 standards; otherwise, it could not be sold. Therefore, approval to the relevant UL and EN54 standards defines the performance baseline. The Advanced Multi-Criteria Fire Detector far exceeds the requirements of the standard, giving it a significant competitive advantage in challenging environments and in applications where nuisance alarms can be particularly damaging to life safety and assets. Proof of this was ascertained by running greatly reduced (in size) “standard” UL and EN standard fire tests.

UL268 Fire Test Room

The fire tests are to be conducted in a 36 by 22 by 10 foot high (10.9 by 6.7 by 3.1 m) room having a smooth ceiling with no physical obstructions. Air movement in the test room is to be minimal. The distance from the base of the combustible to the ceiling shall be 7 feet (2.1 m). The room is to be provided with a means for the removal of smoke. Heating, humidity, and air conditioning are to be provided for maintaining the room ambient, when required. Specified dimensions are for reference only and are variable as long as the correct smoke build up rates are achieved.

In a very extensive program, System Sensor compared the performance of the Advanced Multi-Criteria Fire Detector against an ion detector and another multi-criteria (photo-thermal) device in 21 different nuisance (false) alarm tests and 29 different fire alarm tests—one of the most comprehensive series of tests we have ever run when developing a new device. The following table lists several of the tests.

Nuisance Alarm Tests	Fire Alarm Tests	
	Small Room	EN54/UL Fire Tests
<ul style="list-style-type: none"> • Watermist condensation plunge • Ramping aerosol in smokebox • Spray aerosol in small room • Propane buffing of flooring in small room • Dust and fan in small room • Diesel exhaust • Disco fog in small room • Toast — dried white bread • Deep fat frying french fries • Watermist with fan on inside • Steam 	<ul style="list-style-type: none"> • Smoldering to flaming wastebasket • Flaming wastebasket • Flaming heptane • Smoldering wood • Smoldering cardboard • Flaming underdesk wastebasket • Electric starter smoldering carpet • Wastebasket flaming • Flaming shredded paper • Flaming heptane • Vegetable oil in flaming rag • Wires on a hot plate 	<ul style="list-style-type: none"> • EN 54 heptane (reduced fuel) • EN54 heptane (reduced fuel with bright halogen lights on (IR test)) • EN54 cotton (reduced fuel) • EN54 smoldering wood (reduced fuel) • UL268 smoldering wood • UL268 flaming wood • UL268 paper • UL268 heptane

Table 1 – Alarm Tests

Comparison Results

The following graph illustrates how the Advanced Multi-Criteria Fire Detector performed against the other products. Note that while all three devices in the graph meet or exceed UL standards, it is in highly challenging applications where the performance advantages of the Advanced Multi-Criteria Fire Detector will be most relevant.

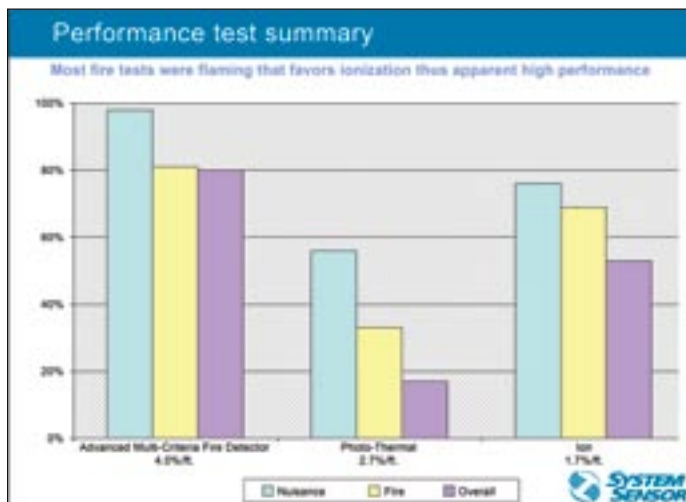


Figure 1 – Performance Test Summary

The blue bars on the graph represent results from the nuisance alarm tests, the yellow represent the fire alarm tests and the purple represent an overall score. The nuisance alarm figure was calculated from the time to alarm of the detector during each of the 21 different false alarm tests. Similarly, the fire test results are the time to respond to the 29 fire tests, measured by the delay to alarm from when the first device responds. The overall score was calculated by multiplying the performance figures for false alarms and the fire tests together (on the basis that in the real world there is no point in having extremely fast fire detection with a huge number of false alarms, or conversely, having no false alarms but very slow or non-existent detection).

In the nuisance alarm tests, the Advanced Multi-Criteria Fire Detector had a near-perfect score, indicating that it either did not go into alarm at all, or it was the last device to respond. In the fire alarm tests, the Advanced Multi-Criteria Fire Detector was either the first to respond or responded within a few seconds of another detector type.

It is interesting to note from the graph how much the presence of the IR detector increases both the false alarm and fire performance; it is also interesting to see how effectively the ion detector performs. This is not intended to indicate how superior the ionization detector's technology was in comparison to the photoelectric sensor, but to show how well the Advanced Multi-Criteria Fire Detector responds.

The fire tests selected were biased toward the flaming end of the scale, because it is known that these are less favorable to the photoelectric smoke detection technology—the primary sensor of the Advanced Multi-Criteria Fire Detector. In light of this fact, the performance of the Advanced Multi-Criteria Fire Detector indicates clearly how well the integration of the four sensing elements works.

Approvals

The Advanced Multi-Criteria Fire Detector is the first multi-criteria detector (with four different sensing elements) ever listed to UL268. It is also the first listed to FM 3230-3250. Both these agencies adopted product-specific tests related to the detector's different sensors in order to approve these listings. Furthermore, ULC, CSFM and MSFM approvals are currently in process.

Conclusions

The introduction of the Advanced Multi-Criteria Fire Detector raises the bar in fire detection system performance by setting new highs for false alarm immunity in conjunction with increased speed of detection—making it an ideal choice for applications in which persistent nuisance alarm conditions exist or false alarms cannot be tolerated.

The benefits of the Advanced Multi-Criteria Fire Detector will have a broad appeal across the decision-maker spectrum. Insurers will like the speed of detection that will reduce the size of claims; users will benefit from the lower fire premiums that should result and the reduction in disruptive false alarms and associated costs, including those related to lost productivity, lost opportunities and reimbursement fees for fire services. System integrators will appreciate the additional coverage and greater functionality that can be achieved, while installers and contractors will like the fact that the Advanced Multi-Criteria Fire Detector is compatible with existing standard 4 and 6 inch bases as well as relay and isolator bases.

Finally, specifying the Advanced Multi-Criteria Fire Detector can make you more competitive by providing the following benefits:

- Enhanced performance of the fire detection system
- Extended system application into challenging areas where short-lived smoke-like phenomena are frequently produced
- Greater functionality in system monitoring and control

To learn more about System Sensor's
Advanced Multi-Criteria Fire Detector,
visit systemsensor.com/multi or contact:



advanced ideas. advanced solutions.™

8 0 0 / 7 3 6 - 7 6 7 2
www.systemsensor.com