

Varying Factors Complicate Smoke Detector Selection

Consider environmental characteristics, such as building or room type, facility use and possible contaminants, when selecting and installing smoke detectors.

Smoke detectors are based on simple concepts, but certain design considerations need to be observed. They should produce an alarm signal when smoke is detected, but should minimize the impact of an unwanted signal, which can arise from a variety of causes.

There are two basic types of smoke detectors: ionization and photoelectric. The sensing chambers of these detectors use different principles of operation to sense the visible or invisible particles of combustion given off in developing fires.

In an ionization detector, dust and dirt can accumulate on the radioactive source and cause it to become more sensitive. In a photoelectric detector, light from the light source may be reflected off the walls of the sensing chamber and be seen by the photosensitive device when no smoke is present. The entrance of insects, dirt, drywall dust and other forms of contamination into the sensing chamber can also reflect light from the light source onto the photosensitive device.

Electrical transients and some kinds of radiated energy can affect the circuitry of both ionization and photoelectric smoke detectors and be

interpreted by the electronic circuitry to be smoke, resulting in nuisance alarms. Underwriters Laboratories establishes the allowable sensitivity ranges for both types of detectors, and all are verified by their performance in fire tests. Regardless of their principle of operation, all smoke detectors are required to respond to the same test fires.

Selecting a Smoke Detector

An ionization detector is more suitable for detection of fast-flaming fires with combustion particles from 0.01 to 0.4 microns. Photoelectric smoke detectors are better suited to detect slow, smoldering fires that are characterized by particulates from 0.4 to 10.0 microns. Each type of detector can detect both types of fires, but their respective response times will vary.

Because the protected buildings normally contain a variety of combustibles, it is often very difficult to predict what size particulate matter will be produced by a developing fire. The fact that different ignition sources can have different effects on a given combustible further complicates the selection.

A lighted cigarette, for example, will usually produce a slow, smoldering fire if it is

dropped on a sofa or bed. However, if the cigarette happens to fall upon a newspaper on top of a sofa or bed, the resulting fire may be characterized more by flames than by smoldering smoke. The innumerable combustion profiles that are possible with various fire loads and ignition sources make it difficult to select the type of detector best suited for a particular application.

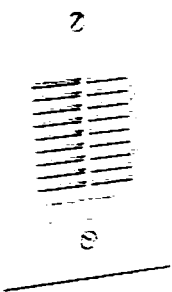
Placement Issues

Smoke detectors offer the earliest possible warning of fire. They have saved thousands of lives in the past and will save more in the future. Nevertheless, smoke detectors do have limitations. They may not provide early warning of a fire developing on another level of a building. A first floor detector, for example, may not detect a second floor fire. For this reason, detectors should be located on every level of a building.

Additionally, detectors may not sense a fire developing on the other side of a closed door. In areas where doors are usually closed, detectors should be located on both sides of the door.

Detector placement is critical to early warning functions. To provide effective early warning of

Audible/Visible Notification Sounder	
PA400B: The PA400B is a beige 12/24 volt sounder.	
Color:	Beige
Voltage:	12/24 V
DC Max. Operating Current - Strobe:	12/15 mA
Wiring Gauge:	12 to 18 AWG
Mounting:	Single gang back box (surface); 4" x 4" x 2-3/4" BBD back box (flush)
Dimensions:	4-1/2" x 2-3/4" x 1-1/8"
Weight:	2.4 oz. (159 g)



a developing fire situation, smoke detectors should be installed in all areas of the protected premises.

Total coverage as defined by NFPA 72 should include all rooms, halls, storage areas, basements, attics, lofts and spaces above suspended ceilings, including plenum areas utilized as part of the HVAC system. In addition, this should include all closets, elevator shafts, enclosed stairways, dumbwaiter shafts, chutes and other subdivisions and accessible spaces.

In general, when only one smoke detector is required in a room or space, the detector should be placed as close to the center of the ceiling as possible. Central location of the detector is best for sensing fires in any part of the room. If a center location is not possible, it may be placed no closer than 4 inches from the wall, or if listed for wall mounting, it may be mounted on the wall.

Wall-mounted detectors should be located between 4 and 12 inches from the ceiling to the top of the detector and at least 4 inches from any corner wall junction. When air supply and/or air return ducts are present in a room or space, the detector(s) should not be placed in the path of the airflow supply or return duct (NFPA 72, 19-99 Edition).

Fire Safety Functions

Smoke detectors are often utilized to control ancillary equipment. Most detectors used in releasing service have auxiliary relay contacts, which are directly connected to the system or device to be controlled. Care should be taken to ensure that detectors utilized in such a manner are approved for releasing service.

A few typical applications include:


- Controlling the flow of smoke in air handling and air conditioning systems.
- Releasing doors to contain smoke in a fire situation.
- Releasing locks to allow exit in a fire situation.
- Capturing and recalling elevators in a fire situation.
- Activating a suppression system.

Spacing and placement requirements for detectors used in releasing service may be different from detectors used in conventional open area applications. It is recommended that 4-wire detectors be used in these situations because depending on the control panel and detectors used, more than one detector relay on a circuit may not receive enough power from the 2-wire circuit to operate during alarm.

Testing, Maintenance and Service

Smoke detectors are designed to be as maintenance-free as possible. However, dust, dirt and other foreign matter can accumulate inside a detector's sensing element and change its sensitivity. They can become either more sensitive, which may cause unwanted alarms, or less sensitive, which could reduce the amount of warning time given in case of a fire. Both are undesirable.

Therefore, detectors should be tested periodically and maintained at regular intervals. Follow the manufacturer's specific recommended practices for maintenance and testing closely. Also refer to Appendix B of NFPA 90A and NFPA 72, Chapter 7.

Smoke tests are helpful in determining proper placement. Special attention should be given to smoke travel directions and velocity because either can affect detector performance. Placement of detectors near air conditioning or incoming air vents can also cause excessive accumulation of dust and dirt on the detectors. Dirt can cause detectors to malfunction and cause unwanted alarms. Detectors should not be located closer than 3 feet from an air supply diffuser or an air return vent. 

Need, Application and the Location of Detectors

This section answers standard and submitted questions about System Sensor's products, applications and installations. Your questions are invited at info@systemsensor.com.

Q: What detector can be used in difficult environments that expose the unit to dust, dirt, insects and occasional water spray?

A: Filtrex™ is a specially designed smoke detector that filters airborne particulates so it can concentrate on sensing smoke. It provides early detection before slower-responding thermal detectors.

Filtrex is an enclosed intelligent photoelectric smoke detector. Filtrex draws air through high-density filters. One filter is field-cleanable; the other is permanent to protect the sensing chamber. A fan cycle to increase life expectancy and reduce current draw pulls the air through the fine filters, past the sensing chamber and back out the cover. Gaskets provide additional dust protection.

Q: What are some of the causes of nuisance alarms?

- A:** Nuisance alarms could result from a wide variety of causes:
- Locations where detectors will not operate properly because of temperatures outside of the detectors' range, excessive dust, dirt or humidity, excessive air flow rates or the presence of combustion particles in the air streams surrounding the detectors.
 - When intelligent detectors' wiring is not protected from interference from induced current and noise in adjacent wiring systems, radio-frequency transmissions and other electromagnetic effects.
 - Lack of annual maintenance can result in accumulation of dust and dirt on the detectors' sensing chambers. Maintenance checks should be scheduled as needed.
 - Seasonal effects such as the reactivation of a building's heating system after summer shutdown can cause nuisance alarms in HVAC applications.
 - Induced current from lightning storms, although rare, could cause nuisance alarms in HVAC systems.
 - Infestation from insects small enough to enter the detector's sensing chamber screen or through openings in the back of the detector.
 - Vandalism or mischievous acts.

Q: What are some specific placement issues?

A: The best way to avoid nuisance alarms is to install the proper detector for its environment. Read System Sensor's installation instructions for proper placement and location of different types of detectors.

Outdoors: Avoid using detectors in open storage sheds or other open structures affected by dust, air currents or excessive humidity and temperature extremes.

Wet or humid areas: Avoid damp, wet or excessively humid areas, such as next to restrooms with showers.

Extreme cold or hot environments: At temperatures below 0°C/32°F, ice crystals or condensation can appear in the sensing chamber. At temperatures above the operating range (49°C/ 120°F), internal components may not function properly.

Areas with combustion particles: Avoid using detectors in commercial kitchens or other areas with ovens and burners and in parking garages where particles of combustion are present.

Fluorescent light fixtures: Do not place detectors too close to fluorescent light fixtures. Electrical noise may cause nuisance alarms.

Areas exposed to exterior drafts: Avoid areas near external doorways in corridors or within 3 feet of either a supply or return vent.

Please refer to www.systemsensor.com and your local codes for more information.

Intelligent Smoke Detector	
FTX-P1: Filtrex™ aspirated smoke detector for dusty and dirty environments.	
Operating Temperature Range:	32°F to 120°F (0°C to 49°C)
Operating Humidity Range:	10% to 93% RH noncondensing
Air Velocity:	0-4000 fpm (0 to 20.3 m/s)
Dimensions:	4" Dia., 3.5" High
Shipping Weight:	7.3 oz. (207 g)
Voltage Range:	15 - 32 VDC
Standby Ratings:	250 µA @ 24 VDC (w/o communication); 360 µA @ 24 VDC (w/o communication)
Power Supply Current:	Max.: 123 mA; Avg: 27 mA
LED Current:	6.5 mA @ 24 VDC (on)
Air Intake Fan:	On for 5 sec. every 30 sec.
Filter:	Airflow checked every 4 hrs.