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Open-Area Smoke Imaging Detection

Open-area Smoke Imaging Detection (OSID) technology was unveiled in October 2009. Following successful Beta trials during 2010 and UL approval in December 2010, the product was launched in the US. EU approval to EN54-12 is imminent.

Challenges to detection in open areas, such as stadiums, large atria, airports, stations, lobbies and warehouses have to date been addressed using line detectors using an optical light beam (known colloquially as "beams") or using aspirating smoke detectors (ASD). While specific risks can be detected using other technologies such as flame detection or video smoke detection, it remains the case that generic fire detection in large open area is most often provided by either beam or ASD technology.

This is principally because both technologies derive their smoke measurement over an area, not at a single location. Such integrated measurement is inherently better for detecting smoke, which is distributed and consequently diluted as it rises to high level or fills large volumes. Moreover both technologies have well established product standards (EN54-12 and EN54-20 respectively) and are included and recognised in most installation codes (such as BS 5839-1 and NFPA72). Thus they can be used with confidence and installed according to an established set of rules to provide "code compliant" smoke detection.

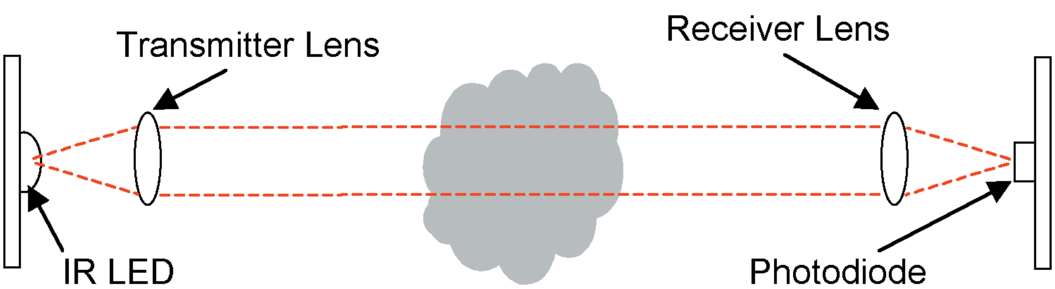
OSID is being approved as a beam detector to EN54-12, but it is not a simple beam detector.

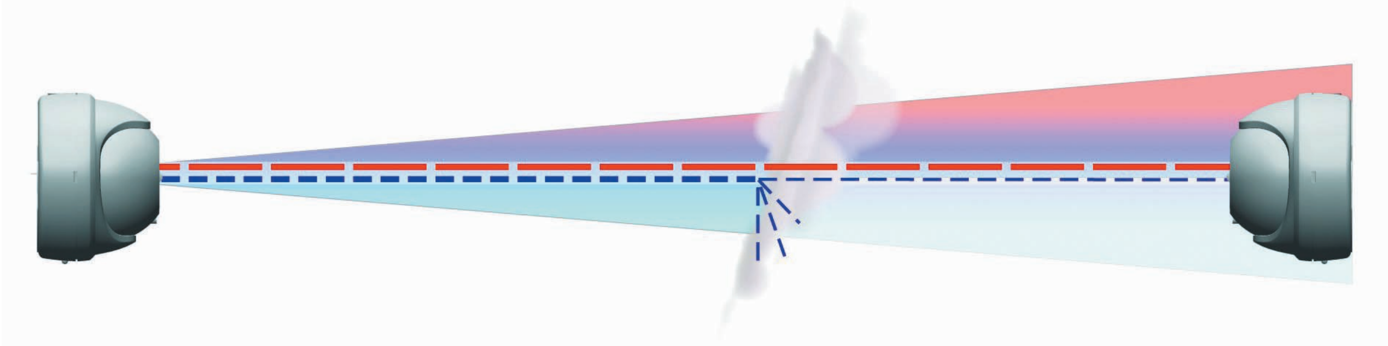
Beam detectors can be surprisingly effective and can often signal an alarm earlier than point-type smoke detectors. However, they do have some fundamental issues that have given them a poor reputation for reliability. OSID uses dual wavelength technology that overcomes the susceptibility to false alarms.

Simple beam detectors

Relating well to the human observation that a light gets dimmer when smoke obscures the view, the simple beam detector is arguably the easiest to understand of all the smoke sensors available. However, by measuring light attenuation (also known as extinction or obscuration) a beam detector cannot reach the level of stability and hence sensitivity of a light scattering detector, particularly over short distances. Thus beam detectors are not considered to be as capable of very early warning performance as technologies based on light scattering (such as most ASD systems). Put simply, this is because a scattering detector is measuring a large increase in a near-zero signal, whereas an extinction detector needs to resolve a small decrease in a big signal. This gives beams an inherently lower stability, higher noise reading and thus low sensitivity.

Nevertheless beam detectors, when applied correctly, can be surprisingly effective in many circumstances and can often signal an alarm earlier than point-type smoke detectors because of the integrating behaviour already mentioned. However, they do have some fundamental issues that have given them a poor reputation for





reliability. Consequently they are often used only when nothing else can be made to fit.

The perception of poor reliability for beam detectors is rooted in their proneness to false alarms and the challenges of achieving and maintaining alignment.

Propensity to false alarms

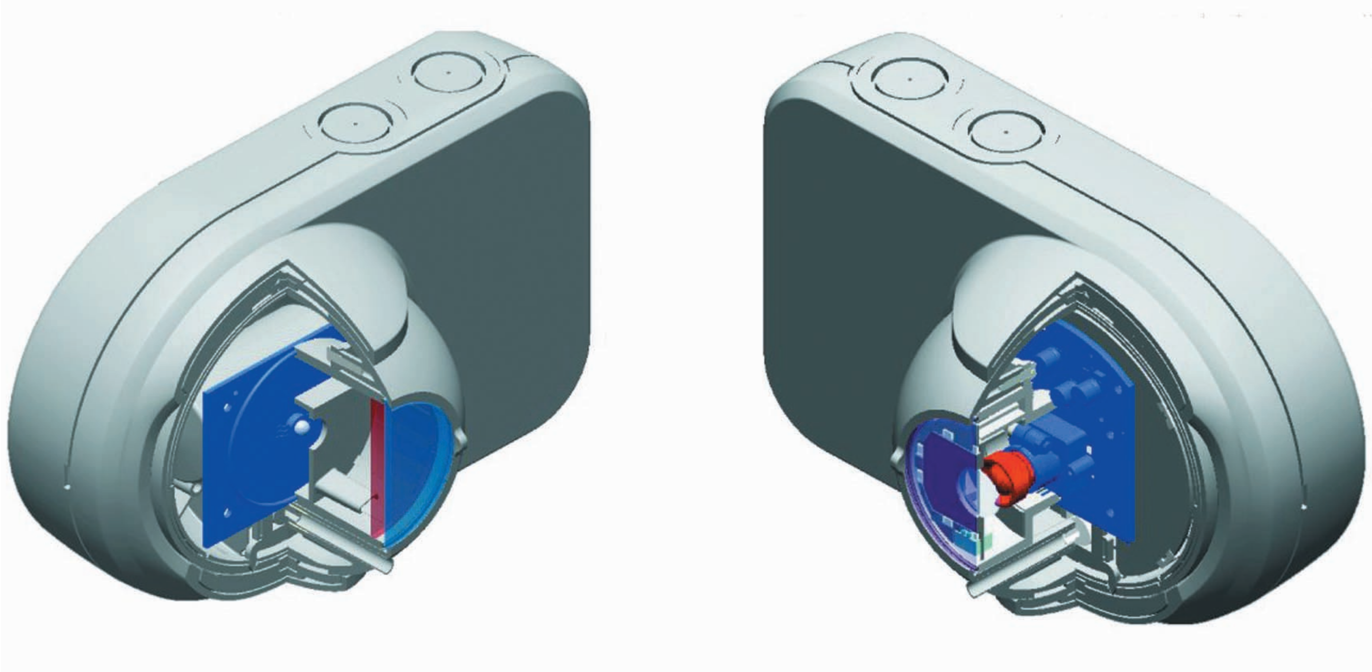
Because the beam detector is responding to attenuation of light between two points, anything that partially obscures the beam is potentially a trigger for a false alarm. For example, if an alarm is signalled when the attenuation is greater than 35% (that is, the light seen at the photodiode drops to 65% of what was observed with nothing in the beam), anything that causes an attenuation of 38% will result in an alarm. So, false alarms may be triggered by objects such as waving banners, balloons or even birds entering the beam path, or by dust in the air, or insects such as moths crawling on the optical surfaces of the transmitter, receiver or reflector. Consequently, beam detectors and false alarms are synonymous for many practitioners of fire detection.

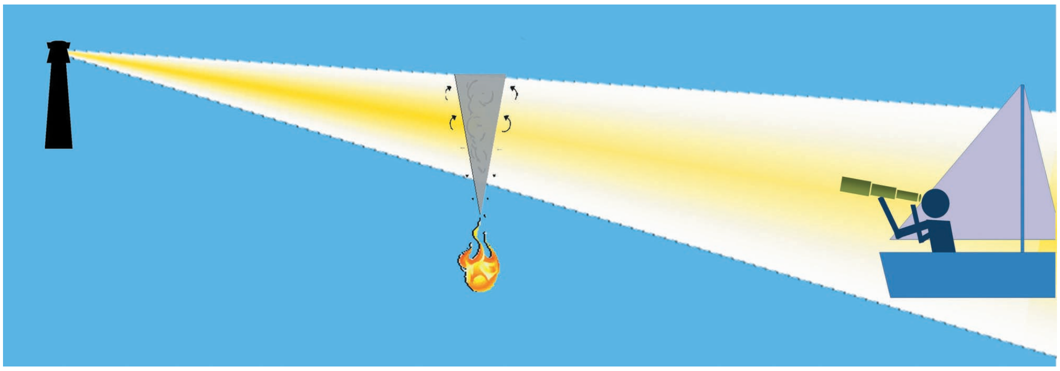
To overcome this susceptibility to false alarms, OSID uses dual wavelength technology. This technique is not new to those who keep up with developments in detector technology, but it has never before been applied to a beam detector. Fundamentally, while the attenuation of light by smoke or other particles is complex, there is a distinct difference between the attenuation of infrared (IR) light and ultra-violet (UV) light when particles are small, but this difference is not present for large particles or solid objects. By measuring the attenuation of these two wavelengths over time, OSID can differentiate between partial attenuation resulting from large dust particles (or intermittent intrusion by solid objects) and partial attenuation caused by smoke. This is what makes OSID so much less susceptible to the false alarm triggers commonly associated with beam detectors.

External influences

Measuring the light received from a distance light source sounds easy and would be if there were no other light sources. Unfortunately this is not the case, and so most beam detectors (including OSID) carefully arrange for the receiver to respond to a narrow band of light (typically IR because it is cheaper) that is matched to wavelength of their light source (or transmitter).

More sophisticated beams (including OSID) also modulate (flash) the light so that even if there are external influences in the frequency band of interest, they can be eliminated because they are not flashing at the expected rate and pattern.





A third effective technique used to ignore light from external influences is to focus the receiver to observe only the transmitter – rather like a sailor who uses a telescope to observe the flashing of a distant lighthouse. The disadvantage of this approach is that the telescope must be carefully and consistently aligned. Hence OSID does not use this technique.

Misalignment of the source

Before explaining how OSID overcomes the challenges associated with aligning the receiver of a traditional beam detector it is worth considering the consequences of misalignment of the transmitter. One can appreciate that the beam from a lighthouse is not consistent, being brightest at the centre of the beam and tailing off at the edges. If the beam was static and aligned to a distant ship, a sailor on that ship with his telescope observing the intensity of light received would find that the alignment of the beam to his ship has a significant effect on the intensity observed. In fact, the sailor would find it hard to be sure that a small fall off in intensity was due to smoke in the beam or movement of the distant lighthouse. However, if the lighthouse flashed alternately blue and red, and if the blue beam diminished more than the red, he could be more confident that it was smoke causing the reduced intensity.

Achieving and maintaining alignment

To avoid the challenges associated with accurate alignment of the receiver, OSID uses imager technology. Essentially a wide-angle camera is used and the position of a red/blue flashing spot within the picture can be monitored. If the camera shifts, the spot can be tracked in much the same way as image stabilisation is achieved on modern digital cameras. What is particularly advantageous about this approach is that accurate alignment of the imager during commissioning is not necessary and subsequent shift in alignment can be tolerated and tracked. Thus OSID largely avoids the importance and challenges normally associated with aligning beam detectors.

Having made this point, it is important to note that alignment is still necessary during commissioning. After all, the lighthouse (Emitter) needs to shine towards the ship and the sailor (Imager) needs to be looking in the right direction too. To make this task as easy as possible, OSID is provided as a locking eye-ball. Using a simple laser screwdriver alignment tool, each eyeball is simply aimed and locked into position with a convenient one-handed operation; essential simplicity when working at height.

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Multi-dimensional detection

To supplement its technological innovations, OSID takes advantage of the wide viewing angle achieved by the Imager to allow for monitoring of multiple Emitters. As such, a single Imager can watch for smoke between itself and up to seven Emitters positioned in multiple planes. To complete the package, the Emitters can be battery-powered so smoke detection over a huge area can be achieved by wiring to a single location.

Acceptable innovation

Never before has the potential and convenience of a beam detector been provided in such a reliable and innovative package. Innovations on this scale typically struggle to gain acceptance in the conservative and safety conscious fire industry but, as OSID is being approved to existing beam detector standards (such as EN54-12 in Europe), it can be used in full compliance with the installation rules for standard beam detectors. IFP

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