

Minimising false alarms

Jonathan Saint, *Marketing Manager, Emerson Process Management, Net Safety Monitoring*, outlines some of the common causes of false alarms in flame detector applications.

Flame monitoring is one of several detection techniques that should assist the protection of life and property in industrial applications. Implementing an effective flame detection installation is not straightforward though. The key is to match the technology with the application and hazard; this greatly increases the overall performance and can reduce costly downtime.

Optical systems such as ultraviolet (UV) and infrared (IR) spectroscopy are the methods that most flame detectors use to perform their function. Almost all flames produce heat, carbon dioxide, carbon monoxide, water, carbon and other products of combustion, which emit visible and measurable UV and IR radiation. These spectral emission 'by-products' are what flame detectors sense in order to quickly and accurately determine the presence of a fire. However, these same emissions from non-flame sources can cause nuisance false alarms and plant shutdowns.

Flame detector selection

Today's optical flame detector options include single wavelengths of UV and IR, integrated UV/IR sensors, and more advanced units that offer triple wavelength IR sensors. The performance and advantages of each of these systems varies, so each must be examined in light of various criteria and requirements.

Outdoor applications must contend with the visible range of sunlight, which covers 0.3 to 0.8 microns. A detector that reacts to direct or reflected sunlight is clearly not appropriate for these applications. UV detectors generally detect energy below solar emissions (0.185 to 0.260 microns) and can be a suitable choice for outdoor applications because of their extremely fast response and wide field of view; but UV/IR and triple IR options offer higher immunity to potential false alarms from high-energy bursts from reflective surfaces.

Safety engineers must also consider the source of the fire when selecting a detector. If the fuel could potentially be hydrogen-based, for example, a specially tuned detector is required. For hydrocarbon-based fires from fuels such as methane and gasoline, multi-spec-

trum IR detectors are typically the best choice.

Overcoming false alarms

A huge consideration in the selection of a flame detector is the potential for false alarms. False alarms are generally not the result of an issue with an instrument, but rather its response to non-flame radiation sources that fall within the field of view. There are two basic types – natural and man-made. Natural sources include rain, lightning and sunlight, while man-made source examples are artificial light sources, welding, and radiation from heaters, flare stacks and machinery. Falling into these two primary sources are four primary types – solar-blind UV, window contaminates, non-modulated IR and modulated IR sources.

With non-modulated sources of radiation, the energy is constant over time or varies at an extremely slow rate. Examples of these are IR energy emitted from heaters, lamps and heat from the sun. Additionally, there's a small amount of IR radiation emitted from all objects which is constantly present in any detector's field of view. To overcome this, the majority of flame detectors available on the market today are designed to only detect modulated IR radiation sources – a key characteristic of flames. With modulated sources, characterised by varied and sporadic energy or as a combination of non-modulated sources, identification can be very chal-

lenging. Examples of these false sources are heated emissions, moving lights, signals or combinations of non-modulating sources being altered by objects moving back and forth in front of them in between the source and the sensor (vehicles, personnel, or fan blades, for example). This is overcome by the use of multi-bands which can distinguish the IR spectrum between flames and other sources of radiation.

While UV detectors work well in sunlight, other factors in outdoor applications may negatively affect them. UV sensors are designed to monitor solar-blind UV, the band of UV energy that is blocked by the ozone layer in the upper atmosphere. Powerful sources of this energy wavelength are commonly produced in industrial settings by halogen lamps, arc welding and even lightning. Additional bands can be employed, or combined UV/IR detectors will overcome almost all of these sources of interference.

Finally, window contamination will negatively affect the detector's performance and can cause the instrument to go into fault mode. Attenuating energy sources will hit or deposit on the window face of the detector as well as accumulate on external reflectors used for automated visual integrity testing. Water droplets, condensation, snow and ice are powerful absorbers of IR energy that can be delivered in random scales and intensity, and are a well-known source to trigger false alarms or faults when combined with modulated energy sources like direct sunlight. UV radiation is also easily absorbed by a range of oils, smoke, carbon and specific gases. Engineers need to be aware of the presence of vapours such as hydrogen sulphide, benzene, ammonia, ethanol, acetone and others when selecting a flame detector for their application.

Flexible in the field

There's no perfect flame detection system for every application – all have challenges. But understanding the type of fire to be detected, the environmental conditions surrounding the installation, and the required performance makes the choice of flame detection technology a much more manageable decision.

A detection solution that allows for field sensitivity and time delay settings will help mitigate the more challenging false alarm sources by allowing users to fine-tune their instruments in-situ for optimal performance. ●



Triple infrared (IR) flame detectors offer the highest level of immunity and maintain a very fast response with wide area coverage

Source: Net Safety Monitoring