Video Image Detection
No Longer a Supplemental System

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INTRODUCTION

While Video Image Detection systems can often provide smoke and fire detection capabilities that exceed traditional detection methods, the acceptance or use of these systems is often limited to that of a "Supplemental" type of service and not that of a "Primary Protection" type of system. This should lead us to ask, why and when will this change?

This paper and accompanying presentation will step through what I have observed as the four major stages in the development of Video Image Detection (VID) as well as the current state of commercially available "Approved" or "Listed" systems.

This paper, adds to the paper and presentation on Performance Based Testing of VID's that I made at the 2008 SUPDET [1] and just as before, I do not debate how this type of technology may or may not be appropriate for any particular application or protection scenario. That remains a separate issue, but the obvious applications to date have included large open areas, not well suited for conventional detection. It has never been considered as a candidate or replacement for small areas normally associated with sleep areas or dwelling units.

I need to point out that the information contained in this paper is based on what is nearly a decade of practical use and the testing of numerous Video Image Detectors from various manufacturers. In addition, I'll point out that the majority of this discussion or controversy centers on the use of a VID for the recognition of a "smoke" signature and not that of a "flame" signature. While the flame detection application is popular, for many reasons, there appears to be simply less confusion or credibility issues when a VID is configured as a flame detector.

STAGE 1 VID – (Flame Only - 2000)

To this author anyway, the first commercial use of a VID searching for a product certification just happened to be that of a flame detector. At the time, a manufacturer submitted a modification to an existing "radiant energy" type of flame detector that was similar in construction and appearance to a typical radiant energy-flame detector of the day.

In that case the modification was the use of a black and white capacitive coupled device (CCD) to observe the fire signature instead of the UV or IR spectrum sensors common at the time.

At the time, with the video imaging sensor (camera), all electronics and processing or decision making done internally in a single housing. It made for a very recognizable

detector package. In fact, there was very little performance differences between the VID flame detection techniques when compared to traditional Radiant Energy flame detectors and this product had great market acceptance.

I will try not to over simplify the process, but traditional radiant energy flame sensors do their best to measure a pre-defined amount of energy of a particular wavelength, or multiple wavelengths in order to make the determination as to whether a measured signal is a real fire, or false signature or stimuli.

The VID decision making process changes the algorithms to measure the intensity of the light, the color (in later versions), the shape, the movement, the flicker frequency and the changes of each frame image over time to make the determination if a flame signal is real or not.

Utilizing a traditional commercial flame detector housing with separate DC power inputs (24Vdc) and providing separate dry contacts for alarm signaling and supervision, for all practical purposes a pretty typical 4-wire device.

All together, the new VID versions of flame detection technique met the performance requirements as prescribed in the applicable ANSI standard (ANSI/FM-3260[3]) and the related NFPA 72 [2] - The National Fire Alarm Code requirements as well.

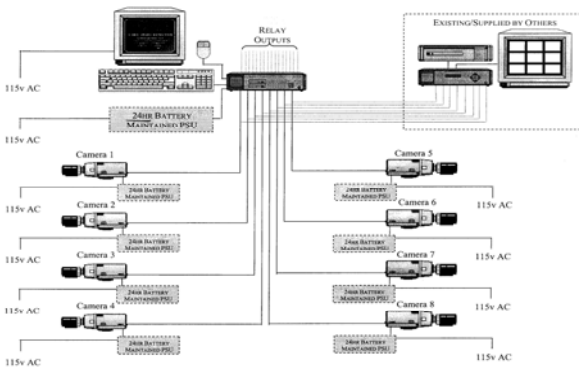
As a result, the first VID flame detectors were readily Approvable or certifiable to the existing NFPA and applicable product standards. The fact that they had similar line of sight issues just as their radiant energy predecessors made the transition almost transparent to end users.

In addition, it did not hurt that similar to previous radiant energy flame detectors, the sensitivity of the detector is actually improved in low or no light conditions; an issue that plagues VID's intended to detect smoke only.

There was very little resistance to the use of a VID as a flame detector. It is seldom considered as a primary means of life safety, although it obviously could be considered a primary means of detection for risks that are more likely to be flaming in nature.

STAGE 2 VID – (Smoke Only - 2002)

This is the point where the first application of a VID system using a smoke detection principle started to appear for testing and product certification. Please note that I stated VID "systems", this is what I see as being part of the confusion over a VID's use as supplemental or primary protection.



The manufacturers often would promote the product as a simple "software" add-on that would work with existing security cameras and possibly run on the customer's existing personal computers.

The idea or principle of a software add-on that would work with existing equipment raises many issues with respect to product certification and installation standards, for example NFPA 72 [(2)] – The National Fire Alarm Code.

These issues include compatibility, environmental suitability, primary and secondary power supply requirements, overall equipment reliability and supervision of the sensors (cameras) and circuits related to the functioning of the "detection or protection system".

Software that would work with any camera meeting some minimum lines of resolution, or any minimum specification personal computer or operating system, has failed on to many instances. In fact as cameras improved with increased resolution, it provided too much additional data that has confused existing software. And there are way too many variables with one software application impacting other software and processing speed to be dealt with here.

The only Approvable or Listed VID's at this point in time are complete "systems" or packages that include dedicated computers and software with specific cameras with separate but well defined primary and secondary power sources.

Performance testing of these line-of-sight smoke detectors with their capability of monitoring large areas simply demanded something more than the small scale prescriptive room test associated with traditional spot type smoke detector test standard (ANSI/UL 268[(4)]).

The test outline developed by FM Approvals for testing the new VID smoke principle combined the typical smoke room tests [(6)], long used for conventional smoke detectors provides a comparison with existing smoke detector technology that was combined or added with the performance based sensitivity testing approach found in the flame detector test standard (ANSI/FM 3260[(3)])

The sensitivity or capability of the smoke principle VID is now defined through specification of the fuel source, its size, the viewing or monitoring range, the field of view, as well as any minimum lighting requirements. In the end, this is a visual detection system ***and if the smoke is not visible, it can not be detected***.

This combined test protocol has evolved into a product Standard FM 3232[(3)] with the potential that a future version will be considered for ANSI adoption.

There is one particular problem area that continues to plague the VID smoke detector, and that is the low ambient light issue. Low light cameras are available, as well as specialized cameras that include built in IR lighting, and there are applications that can

operate 24/7 under controlled or specified lighting conditions. But as you can imagine, this drawback has limited the overall acceptance of these VID installations.

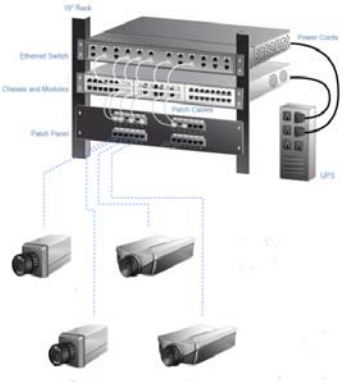
If all of the sighting parameters are met, and all areas are being monitored and the system is installed as Approved or Listed and in accordance with the manufactures guidelines. This system is probably still considered supplemental, but why?

STAGE 3 VID – (Combination Flame and Smoke - 2005)

The introduction of a combination flame and smoke detection package came with the same independent components or bundled hardware packages as the smoke only versions described in Stage 2 above. This time, with new and improved, although somewhat far more complicated, software capabilities.

It's obvious that the combined detection capability (smoke and flame) offers improved detection capabilities to a broader range of fire scenarios over either single signature VID in previous generations. And, it would provide a level of detection capability in complete or total darkness as long as, or once, the fire has transitioned to a flaming stage. Then, if the system was provided with a low level lighting smoke detection capability, traditional or very early warning levels can be achieved and reliably detected.

While this dual signature detection capability should be a clear advantage, there have been a few other concerns that have limited its acceptance. The many discrete pieces of hardware required to make up an Approved or Listed system remain a clear drawback.



While issues like compatibility, environmental suitability, primary and secondary power requirements, equipment reliability and camera supervision are all considered in the testing of an Approved or listed system, it is not clear how often compliant systems are actually sold and installed.

When a system can be sold, installed and made operational but might not include all of the required equipment to be NFPA 72 compliant, this still raised a level of uncertainty and probably contributes to the supplemental signaling label.

STAGE 4 VID – (Single Package Combined Flame and Smoke - 2008)

One of the last stages of development has been the combined flame and smoke VID offered in a common enclosure; the totally integrated package. It can be powered by traditional 24Vdc and provides separate dry contacts for alarm signaling and supervision.

In its simplest form of interface, it's a typical 4-wire detector. The video image can still be viewed for additional interpretation or can be sent to a separate location for interpretation and of course, many various forms of digital communications options exist in today's technology.

At this point, the combined Video Image Detector has developed into a single, recognizable package that should eliminate much of the bulk and questions associated with the earlier versions. Does it still have this supplemental stigma associated with it? Is it deserved, or should it change?

There are a still a couple of things that will assist in the overall market acceptance of Video Image Detectors. The balancing act of improving the VID's response to false signals and the capability to monitor or supervise the image of the area being protected, but that is being worked on as we speak.

THE CURRENT STATE OF APPROVED OR LISTED PRODUCTS

Today you can find VID's for flame or smoke detection and combination detectors listed in the FM Approval Guide web site at www.approvalguide.com .

Video Image Detectors are currently listed under the category(s) of: *Initiating Devices – Flame Activated* or *Initiating Devices – Smoke Activated*. Combination types are listed under both categories. VID's that operate on a flame detection principle comply with Standard FM 3260[3] and those that operate on smoke detection principle comply with Standard FM 3232[5]. To date, all of the Video Image Smoke Detectors listed by FM Approvals have included a supplemental limitation in the listing of the product.

In addition, I've been able to locate a Video Image Smoke Detector listed on the Underwriters Laboratories on line Certification Directory available at; www.ul.com .In this case, Video Image Detectors have been listed under category; (URXG) *Smoke Detectors for Special Applications* and described as tested to Standard 268B. I believe that 268B is a sub-set of the routine 268 program, possibly with the performance based, line of sight criteria from FM 3260. This "special application" listing category is considered supplemental to many parties also.

SUMMARY

As an evolving technology, video image detection offers great potential to learn and improve the present state of the art. To date, the certification process has involved a total "systems" approach integrating performance based testing along with past prescriptive type of tests. This has included the cameras, processing equipment, primary and secondary power supplies as well as the software that drives them.

From a purely code compliance and certification standpoint, the idea that a VID system is a "software only" application that can be run with any processor or any camera or hardware is simply not possible at this time. In all honesty, there are bundled systems as well as single package VID's available, that are code compliant, Approved and/or Listed.

Our direction has always been to investigate new technology and apply it when we find a good fit to a protection need as long as it meets NPFA 72 and other applicable standards. Given the current wording that exists in the NFPA standard, we believe that this has been accomplished in the testing associated with VID's by FM Approvals and other test agencies.

I believe that the ultimate acceptance as to whether VID equipment remains as supplemental or in fact finds acceptance as a primary means of protection will be determined by the specifier's, end users and AHJ's responsible for the properties they are protecting.

ACKNOWLEDGEMENTS & REFERENCES

- (1) *Performance Based Testing of Video Image Detection Devices* – Bob Elliott – SUPDET 2008
- (2) NFPA 72, National Fire Protection Association, *The National Fire Alarm Code* (2007 ed.)
- (3) ANSI/FM 3260, American National Standards Institute, *Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signaling*, (2004 ed.)
- (4) ANSI/UL 268, American National Standards Institute, Underwriters Laboratories, *Smoke Detectors for Fire Protective Signaling*
- (5) FM 3232, *Video Image Smoke Detector for Automatic Fire Alarm Signaling*, (2010 Draft)
- (6) Sections 39 & 40, *Fire Test & Smoke Test* only of ANSI/UL 268