OSID in Challenging Environments

Application Note

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OSID by xtralis

Contents

1 Scope

This Application Note describes the deployment and performance expectations for Xtralis OSID detectors installed in a variety of challenging environments.

While OSID outperforms all traditional beam detectors in both detection and resistance to foreign particles there are, as with all detection devices limitations to where OSID can be reliably deployed.

Reliably means appropriate rejection of nuisance (false) alarms without compromising accurate smoke detection.

This application note illustrates environments where OSID is a good and/or acceptable choice or where ASD (**A**spirated **S**moke **D**etection) should be deployed for reliable detection.

The scope of the application note is to provide guidance in the deployment of OSID in:

- Dusty/dirty environments
- Areas with high humidity; i.e. water mist, steam, condensation, fog, etc.
- Environments with lots of glass and hence much direct or indirect sunlight

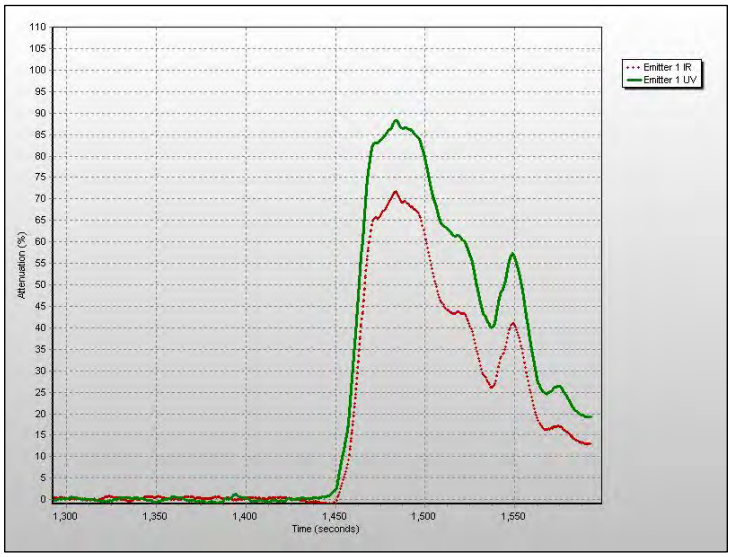
2 Dual Wavelength Operation

This document assumes that the reader has a good understanding of OSID operating principle. Further information can be found in document 15204_Bx_OSID_Product_Guide_A4_IE_lores at www.xtralis.com.

By using two wavelengths of light to detect particles, the system is able to distinguish between particle sizes.

The shorter UV wavelength interacts strongly with both small and large particles while the longer IR wavelength is affected predominantly by larger particles.

Dual wavelength path loss measurements therefore enable the detector to provide repeatable smoke obscuration measurements, while rejecting the presence of transient large(r) dust/foreign particles and/or solid intruding objects.



3 Terminology

In this document we will refer on occasions to (re-) commissioning, (re-) initialising and or (re-) start. It is important that the following terminology is understood.

Full (re-) commissioning

- At very first power-up and initialisation (out of the box).or
- DIP switches 3, 4 and 5 set to 0 for a period exceeding 10 seconds, while the Imager is powered.or
- Using the 'Recommissioning detector' button in OSID Diagnostic SW.

During this action the (new) Emitter locations and the reference levels are being stored.

Partial re-commissioning

- Power cycle already commissioned detectors.or
- Continue operation after PPL loss (+60 sec.; blockage, saturation, vibration etc.).

During this action stored Emitter locations are used and existing reference levels (from full commissioning) are maintained.

4 Possible Faults

Faults can be triggered if the obscuration level is greater than 50% (or 65% in Industrial Mode) or when the Imager is subjected to frequent short blockages or heavy vibration. These faults are:

Object Intrusion

Occurs when a large blockage of 90% attenuation and more occurs quickly i.e. in under 5 seconds and that is not caused by smoke. The blockage has to remain for around 60 seconds before a fault is signalled and the fault relay tripped.

These faults are typically obstruction by ladders, forklifts, banners, etc.

Emitter Obscured

Occurs when there are blockage(s) of the light beam between the Emitter and the Imager of a moderate attenuation (+ 50% or 65% in Industrial mode), sustained for a period of several minutes. There is no defined time limit of how quick or slow the attenuation has to increase. The fault is tripped after 10 minutes. If the attenuation drops below 50% or respectively 65% in IM, the timer is reset).

These faults are typically bursts of dust clouds from operating machinery, unintended escape of airborne particulates from production, water mist, condensation, steam, vapour, etc.

Image Blocked or Unstable

This occurs when the Imager cannot discern the signal from the Emitter beam. This is typical for intermittent blockages and/or excessive vibration when the Imager misses frames. In certain installations, extreme hot air in the beam path between Imager and Emitter(s) can cause this fault as well.

5 Safely Deploying OSID

Experiences from the past in challenging environments have brought Xtralis to offer a SW that is more tolerant in those specific areas. Hence the latest SW V5 provides the option to select an Industrial Mode. Particularly the features below will assist in making OSID more robust system in environmentally challenging environments.

Sensitivity Settings

The Industrial Mode, that can be selected in Imagers with V5 software, is a for the time being unapproved mode that allows more flexibility in sites that turn out more challenging than when initially visited prior to offering OSID. Reasons can be a bad judgement of the assessor or a change in the operating environment.

The Industrial functionality can also be obtained by upgrading the Imager to software version V5 and selecting the Industrial Operation by dip switch 8. When setting dipswitch 8 to Industrial Mode the sensitivity of both the A1 (flaming) and A2 (smouldering) alarm channels can be set to a 65% obscuration level.

Sensitivity	**A1 -Small particle smoke**		**A2 - Large particle smoke**	
	Normal	Industrial	Normal	Industrial
High	20%	20%	45%	65%
Medium	35%	35%	45%	65%
Low	50%	65%	45%	65%

When the industrial mode is selected with dipswitch 8, it can be set permanently or toggled by the Reset switch if dipswitch 10 is set to 1. It is preferred that the Industrial Mode is used through the Reset input and only for the time the high level event is anticipated. The input can be triggered by a key switch, timer, intrusion panel Day/Night setting.

The permanent setting, should only be used if a manual reset of the alarm is mandatory and hence the toggle function is not available. The reduced sensitivity in the Imager will run for as long as the input is activated, meaning as long as a voltage of 5 to 32 VDC is applied to the input contact.

When the voltage is removed, the sensitivity will return to the approved mode threshold values set by Fire Alarm Thresholds (Switch no. 1 & 2).

Reference Levels

The Reference Level is no longer re-established when the unit is powered down or with a partial recommissioning. This implies that if the unit was initially commissioned at the best possible environment, the reference levels will remain as such. The Reference Level will no longer be re-established at the end of a software upgrade.

Reference level issues are reduced as unexpected/unwanted/unforseen loss of power does not cause the system to commission a reference level with particulates in the beam path and hence experience a Reference Level Drift High Fault when the particulates evacuate the area.

A new The Reference Level can now only be set after restart when Dipswitches were set to zero, see product guide.

5.1 OSID in Dusty Environments

5.1.1 Areas with Occasional Dust

OSID may operate reliably in areas where temporary or transient dust clouds and foreign particulates occur. For OSID to operate reliably in dirty environments the dust rejection has to be selected, DIP switch no. 7 ON. Use Industrial Mode if required.

Xtralis recommends using ASD in environments operating above these limits. The recommendation is to ensure reliable detection of genuine smoke. VESDA VLI is specifically designed to operate in dusty environments and uses fully monitored inboard filtration to measure only the true smoke from such environments.

Setting up a quick test/beta site is always recommended. Although beta site test data might make an installer confident to use OSID; the end-user should be made aware that using OSID in an area where the obscuration hits the 20% and higher for a longer period can still result in an occasional fault and/or alarm.

To avoid the Reference Level Drift High fault, the systems has to be initialised in the cleanest possible circumstances (evenings, Weekends, holidays, etc.).

When operating V5 (V5.00.06), recommissioning the unit must be avoided when the air is still dirty as a new low reference level will be set and the Reference Level Drift High fault will be tripped as soon as the signal rises 20%. Reference Level Drifted High cleared as soon as initial value is reached again. The Reference Level Drift Low fault indicates that lenses are contaminated and need cleaning.

OSID compensates for lens contamination over time. In 24/7 operations where there is a permanent obscuration of 20% and above, the Reference Level Drift Low fault cannot be avoided.

In SW version V5.01.00 compensation times are increased and the delays are reset when the attenuation drops below the 20% threshold). The V5.01.00 is non-approved and can be obtained from PLM on special demand.

After cleaning the lenses, when the reference level gets tracked upwards, the fault signal will disappear in 1-10 minutes, The duration is depending on how far down the level was.

Other risks associated with using OSID on such sites is the possibility of alarms caused by diesel fumes from loading and unloading equipment, trucks etc. Diesel exhaust is true smoke, so even if the amount is not enough to trigger an alarm on its own, when added to high levels of obscuration caused by background dust it can result in an alarm if the selected alarm threshold is breached.

Another considerable risk associated with extended 100% obscuration levels is that these blind the system for true smoke alarms and only generate a fault. Reducing the beam length makes the OSID less sensitive as with all beams, a good practice in dusty environments if the dust is uniformly distributed.

Obscuration is not linear but is logarithmic. Example: 60% obscuration at 100m (328 ft.) equals 37% obscuration at 50m (164 ft.) path length.

5.1.2 Areas with Continuous High Dust Levels

OSID must be avoided in production and manufacturing facilities that operate 24/7 and exhibit a continuous high level (+20%) haze of dust and/or airborne particulates.

It is likely that the semi-permanent obscuration is in the range 20% or higher versus a clean environment.

Whilst OSID could operate here and detect true smoke, Reference Level Drift faults cannot be avoided. The possible daily faults will eventually upset the end-user and the system will become useless.

5.2 OSID in Humid Environments

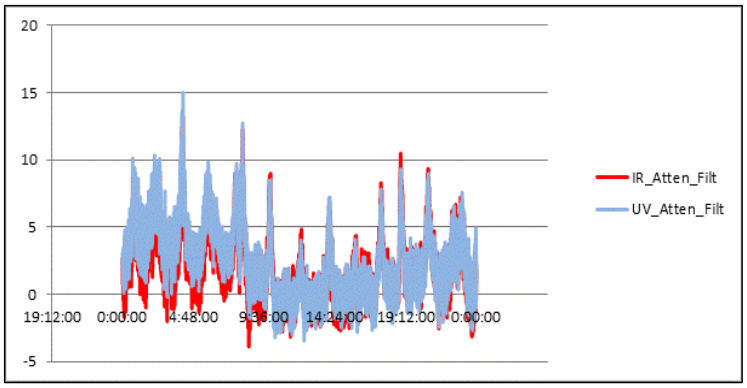
All advice offered in

OSID in Dusty Environments also applies to steam, water mist, fog, condensation etc.

Let's look at some particular applications below.

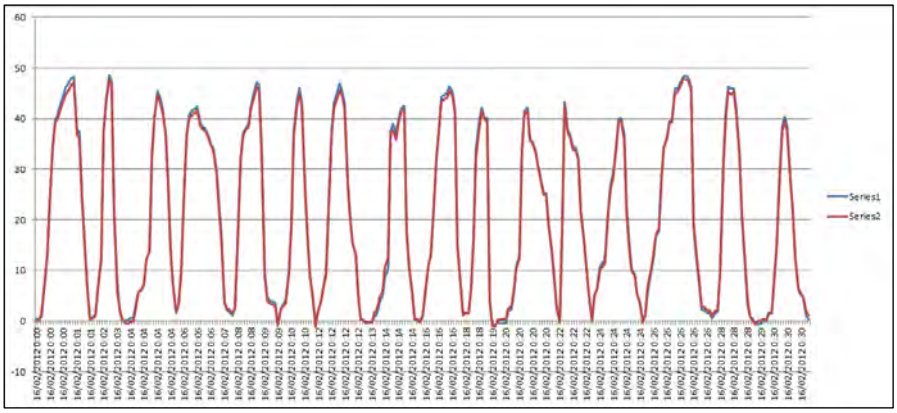
5.2.1 Water Mist

Some facilities use water mist spray systems to reduce dust levels or to maintain humidity at a certain level The example below is from a chicken farm where water mist is sprayed every 2 hours to reduce dust levels. There is little to no differentiation between UV and IR which in this case indicates there is no potential risk of false alarm.



The example below is from a site where water mist is sprayed every few minutes, 24/7 to maintain a humid environment. In a trial using OSID (Imager 10°) over a distance of ca. 40-50m, no water droplets or condensation occurred on the Imager or Emitter lenses. The graph below shows a 30 min period. There is little differentiation between UV and IR, hence the site operated without false alarm or faults.

However, the peak obscuration measured when the mist is sprayed is over 40% so this site is borderline acceptable. The installed traditional Infrared beams continuously reported false alarm at this site.

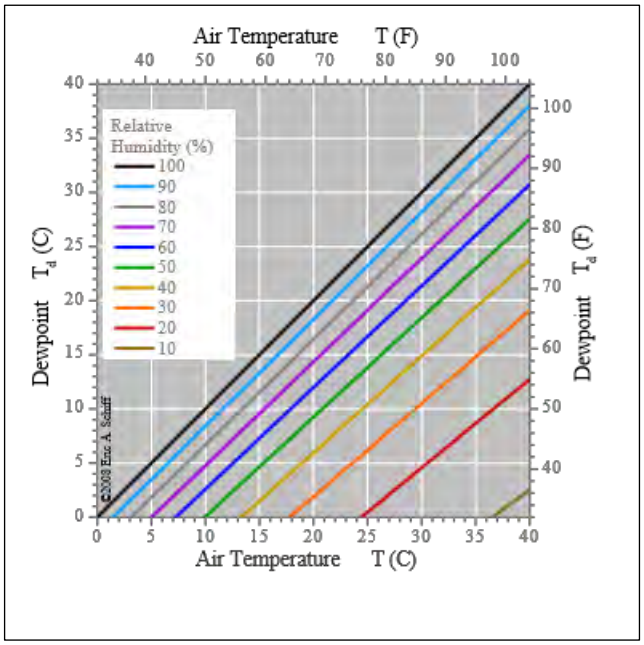


5.2.2 Condensation

Condensation is the change of water from its gaseous form (water vapour) into liquid water when in contact with any surface. Condensation generally occurs in the atmosphere when warm air raises, cools and loses its capacity to hold water vapour. As a result, excess water vapour condenses to form cloud droplets.

Water condensing on an Imager or Emitter is the result of their surfaces' temperature cooling below the dewpoint of the air which is in contact with them.

As one can notice from the diagram to the left, the dewpoint is dependant of the air temperature and relative humidity in the air. Hence condensation can occur at various temperatures.



On sites that have large temperature fluctuations, the heater in the Imager must be powered to minimise condensation on the lens.

Whilst the Emitter lenses are acrylic and less prone to condensation it may in certain extreme circumstances occur that ambient moisture levels are so high that the Emitter lenses accumulate condensation.

OSID will cope with a mild condensation on the Emitter but when it comes to the level where reliable detection is compromised a mechanical solution is required.

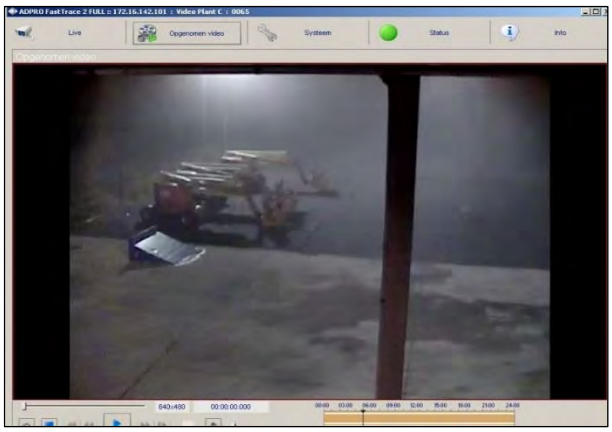
In such cases, Emitters must be placed in environmental housing OSID-EHE that are equipped with a heating element to keep the glass condensation free.

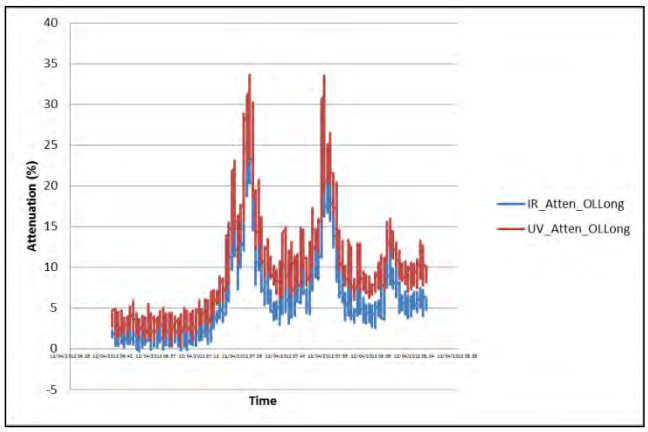
Be particularly careful with cold storage areas. Most cold stores are inherently dry. It is not the low temperatures that is or can be an issue but the environment.

If the room is heavily moisture laden, clouds of vapour can act in a similar way to dust. When the environment is too wet, an IP66 enclosure/housing that is equipped with a heating element, to keep the glass condensation free, must be used for both Imagers and Emitters.

5.2.3 Fog

Buildings (e.g. warehouses) with large entry doors which open in the morning can experience fog rolling in. In this example fog is captured by a security camera to illustrate how thick and uniformly spread along the area fog can be. Fog generates little separation between UV and IR like shown in the graph below fog. Depending on the amount of fog that gets between the Imager and the Emitter and its rate of build-up, there is a risk of A2 alarms. In semi-open areas this risk is quite significant.





6 Protective Accessories

6.1 IP66 Housing

Earlier references have been made to the need to using protective IP66 housing. The reason can be excessive dust, moisture or simply that the units are regularly hosed with water when i.e. cleaning the production area. This typically happens in meat and vegetable processing plants.

Xtralis offers specific custom-made IP66, NEMA 4-4X housings for both Emitter and Imager.

OSID-EHI: IP66 housing for Imager

OSID-EHE: IP66 housing for Emitter

The OSID-EHI also provides openings to connect the FTDI cable and allows for viewing of the Fault and Alarm led through a window on the underside of the housing.

Recommended distances for the OSID-EH series:

	Min	Max (m)
OSI-10	25 m (82 ft)	125 m (410 ft)
OSI-90	5m (16.4 ft)	28 m (91.8 ft)

If there is a risk of condensation inside the housing, the housing must be equipped with a suitable thermo-controlled heating element, minimum 10 W. Internal temperature recommendation is between 10° C (50° F) and 20° C (68°F).

The OSID-EH housings are also convenient in those installations where it is difficult to reach the Imager and/or Emitter after installation. If cleaning the lenses can only be performed from a distance with a tool, than using the OSID-EH will be much more robust for cleaning than cleaning directly the Imager and Emitter. This is particularly the case if the units are fixed with the supplied mounting bracket. In areas with much vibration is recommended to NOT use the mounting bracket but install the OSID units directly to the surface.

6.2 Wire Cage

OSID detection is very convenient for detection in sports arenas, etc. To protect Imagers and Emitters from vandalism and accidental damage a steel cage, OSID-WG, should be used.

6.3 Sun Shield

Beam detectors are susceptible to saturation from direct sunlight most often when installed in an East-West direction and when the sun is low on the horizon.

Background subtraction techniques and IR and UV filters make OSID far less susceptible to saturation than standard IR beams. OSID will never false alarm due to bright sunlight. However, severe saturation may in some cases affect the Emitter IR and UV signal and cause a fault to be reported.

OSI-LS light shield is available for Imagers to prevent saturation from direct or reflected light. The light shield can only be used in end-to-end/one-on-one configurations. Do not use the light shield in Multi-Emitter applications. The shield is easy to apply and protects against light outside of a 30° viewing angle.

The light shield cannot be used in combination with an environmental housing. For EN territory the Emitter saturation fault is only signalled if the Emitter is blinded for more than 2 hours continuously and/or if the temperature changes by more than 10 degrees Celsius from the last measurement point. The OSID system can still detect smoke when the emitter is saturated.

The 2 hour timer is restarted if during these 2 hour period the saturation temporarily disappears. If saturation issues are expected, make sure customers use the OSI-LS light shield on the Imager and put the Emitter in the least favourable location.

6.4 Bird Spikes

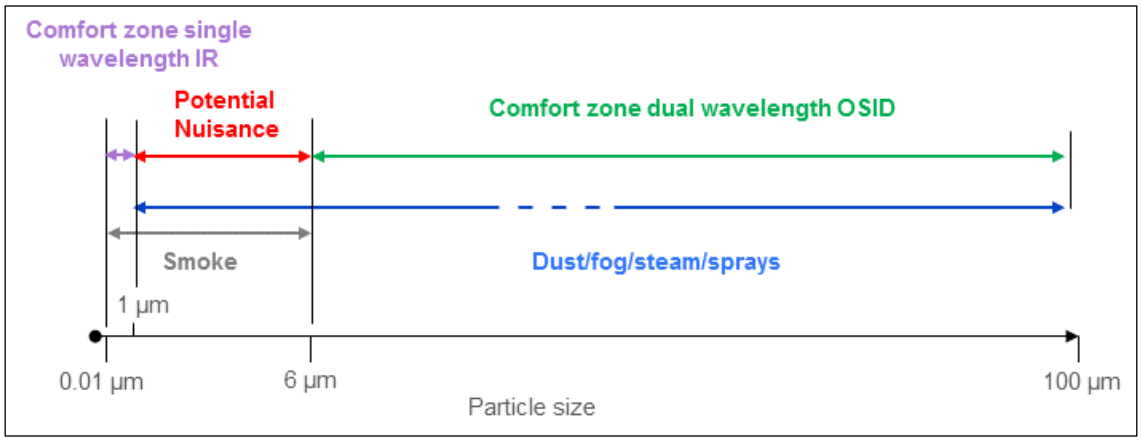
Certain areas like depots, warehouses etc. can house flocks of birds and pigeons. In these environments, it is advised that bird spikes be used to prevent birds from sitting on or above the units. Bird's excreta can contaminate and block the lenses and lead to faults or even prevent alarm detection.

7 Exceptional False Alarm

On rare occasions, certain environmental conditions might trigger an alarm. This can happen when airborne particles are generated which are the same sizes as smoke and in sufficient quantities to breach the selected alarm threshold. Dust particles are typically up to 100 µm in size; smoke is typically between 0.01 µm and 6 µm depending on the type of fire, flaming or smouldering.

Traditional Infra-Red beam detectors will alarm if their sensitivity level is reached **regardless** of the nature of the obscuration. Due to OSIDs dual wavelength technology it will only alarm to particles with a size of approximately 1µm to 6 µm and if the alarm threshold is breached.

OSID therefore has a 'comfort' zone of >90% for nuisance rejection compared to traditional beams which have a very small 'comfort' zone of < 1%.



8 Summary

For reliable smoke detection make the correct choice between OSID and ASD. VESDA or ICAM ASD is a better choice for protecting challenging, large open spaces, but in many instances economic circumstances may favour OSID.

If in doubt about OSIDs capability in any environment, a simple test will provide better insight. OSID's on-board memory records data which can help to establish OSIDs suitability in the environment.

No other beam detector offers the same level of diagnosis. If possible, leave a PC with OSID Diagnostics software running connected to the Imager as it provides continuous and richer data opposite to event driven data in the Imager's log.

Using a PC is typical for data gathering over a week or beta trials but not recommended for permanent installations over long periods.

Using battery powered Emitters and an Imager powered from a PC's USB port allows for a quick and inexpensive test installation.

While the data logged to the PC provides excellent indication of site characteristics and OSIDs behaviour, environments can change over the medium to long term (for example between winter and summer) so the test results do not provide a guarantee that alarms or faults won't occur in the longer term.

When installing OSID, adhere to the followings rules of thumb:

- Do not deploy OSID if background obscuration routinely hoovers between 20% and 40%. (Best measured with an OSID!)
- If the obscuration is uniform, reduce beam distance if obscuration is over 40%. Be aware that in certain cases, beams even at minimum range may still have issues.
- Use protective housings in challenging environments
- In dusty environments be aware that a quick wipe of the OSID housing may frequently be needed
- Be aware that the sufficient amounts of diesel exhaust smoke can cause alarms
- Watch out for moisture clouds in cold stores and freezers
- Use anti-condensation film on the Emitter and power the Imagers heater whenever there is a risk of condensation

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