BS 5839:2017

POCKET GUIDE TO FIRE ALARM SYSTEM DESIGN

eurotech®
FIRE SYSTEMS LIMITED

This booklet is designed to provide essential information on key points from newest edition of the BS5839 Part 1. specifically identified as being important for the installer of fire detection products. It should never be utilised as any form of substitute for the standard itself.

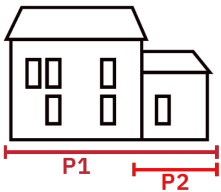
Remember, the correct positioning of detection devices and call points is essential to avoid unwanted alarm activations.
(Note: The phrase "detection device" has been used throughout to represent both analogue sensors and conventional detectors.)

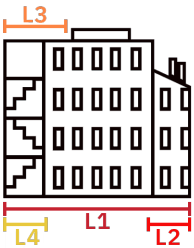
Fully detailed information can be acquired from the standard. Contact BSI directly for your copy, or visit their website at www.bsi-global.com.

Our Technical Team will be pleased to help clarify any questions regarding the standard. Please call 0203 141 0982 or email the team at technical@eurotechfire.com

CONTENTS

FIRE ALARM & DETECTION CATEGORIES





P Automatic Fire Detection (AFD) designed to primarily protect property

P1 AFD installed throughout all areas (usually with remote monitoring)

P2 AFD installed only in specific areas (usually with remote monitoring)

L AFD designed to primarily protect Human Life

L1 AFD installed throughout all areas

L2 AFD installed in defined areas in addition to L3

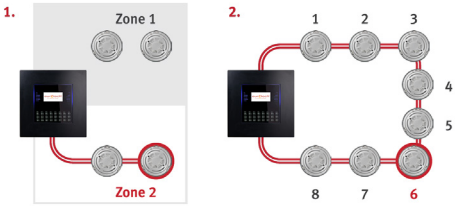
L3 AFD installed in escape routes (as L4) and in rooms opening onto those routes this may include voids

L4 AFD installed in escape routes comprising circulation areas and spaces such as corridors and stairways

L5 A non-prescriptive system in which the protected area(s) is designed and specified to satisfy a specific fire risk objective (other than that of L1 to L4)

M System designed to be operated manually (no AFD) Categories L1, L2, L3 and L4 all include Manual Call Points. To add Manual Call Points to P1, P2 or L5, add /M e.g. P1/M

CONVENTIONAL vs. ADDRESSABLE



1. CONVENTIONAL - A conventional fire detection system employs 'spurs' of detectors grouped into Zones. When a detector is in alarm/fault only the Zone is reported at the CIE.

2. ADDRESSABLE - An addressable (intelligent) fire detection employs a loop of sensors and other devices which are all individually addressed numerically. When a sensor is in alarm/fault the address of that device (and in most cases, a text description) is reported at the CIE.

NON-ADDRESSABLE
Up to 10 beds

ADDRESSABLE
10 beds or more

Where occupants of a building are going to need assistance from staff to evacuate the building (e.g. in residential care premises and hospitals), the fire detection and fire alarm system should be ADDRESSABLE if the building has facilities for MORE THAN 10 PEOPLE to sleep.

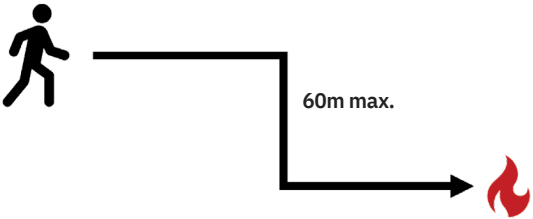
ZONE PLANS/SEARCH DISTANCE

Required adjacent to all CIE

Minimum 15 Lux required

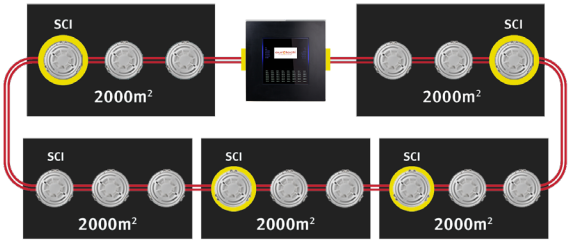
It is important to ensure that a suitable, correctly orientated zone plan is provided adjacent to all CIE (including any repeat control and/or indicating equipment), unless the CIE incorporates a suitable display (e.g an illuminated mimic diagram).

Whether the mimic is illuminated or not, BS5266 requires the control panel and repeater to be illuminated to 15 lux.



A person searching a Conventional Zone for a fire should not have to travel more than 60m from the point of entry into the Zone to identify evidence of a fire.

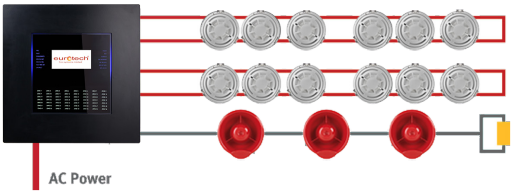
SCIs and ZONES / CRITICAL SIGNAL PATH



Short Circuit Isolators (either on the loop or within the CIE) should be installed to limit the loss of fire cover caused by a single fault to **2000m2**.

The loss of fire cover caused by two simultaneous faults should be limited to **10,000m2 maximum**.

This will therefore restrict the cover provided by any analogue loop to **10,000m2 maximum.**



Cables used for the Critical Signal Path and the final LV (low voltage) mains supply to any fire detection equipment are now required to be fire resistant and coloured externally in a single, common colour (red is preferred).

The LV supply to all parts of the system should be provided with a double pole, lockable isolation device for the safety of the maintainer and be labelled accordingly.

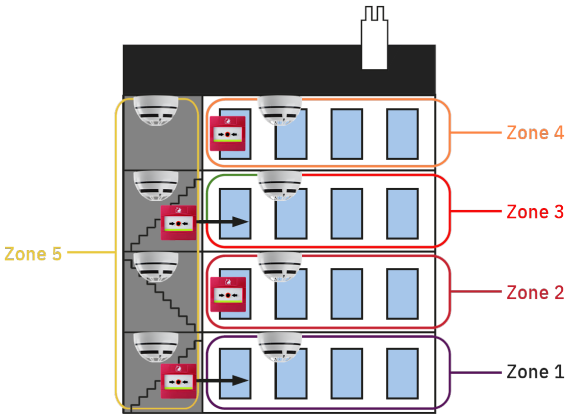
Non-critical cabling may still be non-fire resistant, for example door retainer circuitry which may fail to safe.

DETECTION ZONES

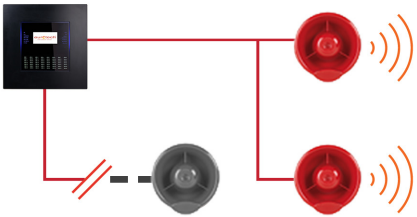
A detection zone should cover no more than 1 storey, unless total floor area is less than 300m2. Voids in the same fire compartment should be included in the same floor zone. The maximum floor area of a zone should not be greater than 2,000m2, except for some large open plan areas that incorporate manual call points only, which can be extended to 10,000m2.

The maximum search distance for the fire fighters to see the seat of the fire within a zone should not exceed 60m assuming the route taken is the worst possible option. Vertical structures like stairwells, lift shafts etc., should be considered as separate zones.

A manual call point within a staircase should be connected to the zone associated with that floor and ideally be mounted on the accommodation side of the corridor exit. Automatic sensors on the stairwell remain as part of the stairwell detection zone.



ALARM DEVICE CIRCUITS



Alarm Device Circuits should be arranged so that, in the event of a single fault, at least one sounder, sited within the vicinity of the CIE, will continue to operate.

65 dB(A) @
500 Hz to 1000 Hz

+5 dB(A) @
500 Hz to 1000 Hz

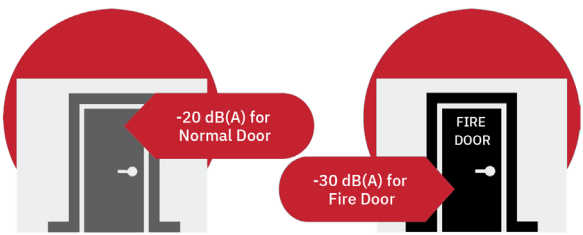
Sufficient sounders, operating within the frequency range of 500 Hz to 1000 Hz, should be installed to ensure that a sound pressure of 65 dB(A) is achieved.

Add 5 dB(A) above a background noise (if lasting more than 30 seconds) at all accessible points with all doors closed.

This may be reduced to 60 dB(A) in stairways or enclosures less than 60m2 excluding corridors.

SOUNDERS & SOUND PRESSURE

For areas where people are sleeping, sounder devices should produce a minimum of 75 dB(A) at the bed-head with all doors closed. This will probably require a sounder within the room.



A reduction in sound pressure of approximately 20 dB(A) may be expected through a normal door, and approximately 30 dB(A) through a fire door.

The standard also details the use of Visual Alarm Devices, and since the beginning of 2014 the design and manufacture of these types of devices has been regulated by EN54 Part 23.

VISUAL ALARM DEVICES

EN54 Part 23 specifies the Light Output required for VADs should be:

- 0.4 lux (0.4 lumens/m2)
- Not designed to wake sleeping people
- The flash colour can be red or white light

Note: The use of one colour throughout a building is best practise, unless specific colours are needed for a specific event type, such as evacuation for example.

The standard also defines three VAD categories:

- C - Ceiling Mounted VADs
- W - Wall Mounted VADs
- O - Open Category devices

Wall Mounted Device Rating:

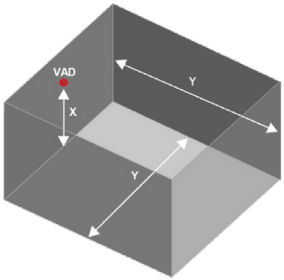
- W - X - Y
- W = Wall
- X = Mounting Height
- Y = Length & Width

Example:
- W - 2.4 - 5

A wall mounted VAD might be rated W-2.4-5, where “W” stands for wall.

The numbers represent the coverage volume, in the shape of a cube where the first number is the maximum height on the wall the VAD can be mounted, and the second number is the length and width of the coverage.

So in this example, we can see that this device is wall-mounted VAD, which can be fitted up to 2.4 metres and provides a 5 metre square coverage base.

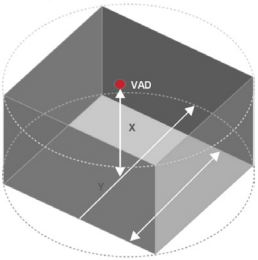


VISUAL ALARM DEVICES

Ceiling Mounted Device Rating:

- W - X - Y
- W = Wall
- X = Mounting Height
- Y = Length & Width

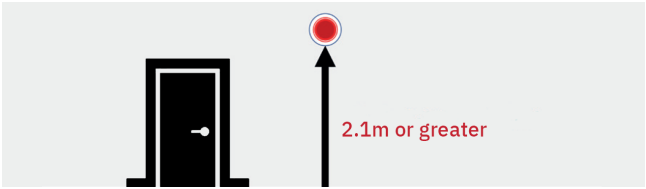
Example:
- C - 3 - 7.5



A ceiling mounted VAD uses a similar rating formula, with two numbers representing the coverage volume, this time in the shape of a cylinder, where the first number is the maximum ceiling height to which the VAD can be mounted, and the second number is the diameter of the coverage.

Note: That ceiling heights can only be classified as 3, 6 or 9 metres.

So in this example, a VAD rated as **C-3-7.5** shows us that it is designed to be fitted at a **3 metre** ceiling height and that the light volume will be a circle of **7.5 metres** wide.



Visual Alarm Devices (VADs) such as strobes and beacons may be ceiling or wall mounted, but for wall mounting the minimum of 2.1m from finished floor levels applies.
It is advisable to fit synchronised VADs, otherwise unsynchronised VADs may be perceived as an increased flash rate and may induce a photosensitive epileptic seizure.

ALARM DEVICE CABLING

All fire alarm cables, below the height of 2m from the finished floor level should be mechanically protected, unless enhanced cable is used.

If a cable passes through a floor, sleeving up to 300mm minimum should be provided.

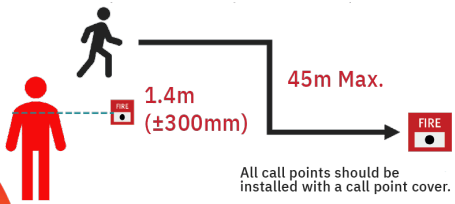
Metal fixings should be used throughout.

No one should have to travel more than 45m to reach the nearest Manual Call Point, or 25m in areas where a higher fire hazard is recognised, for example kitchens, paint booths etc.

The 25m travel distance would also apply where a person in a wheelchair would be expected to operate a Manual Call Point.

Manual Call Points should be positioned 1.4m (+/- 300mm) from finished floor level and if sited below 1.1m a variation will be required.

They may be semi-recessed if readily visible but if required to be seen from the side (for example, in a corridor) they should be 15mm proud of the wall.



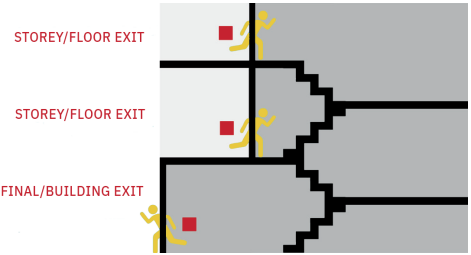
All call points should be installed with a call point cover.

MANUAL CALL POINTS / DEVICE SPACING

Manual Call Points should be positioned at:

• All storey exits from stairways but programmed to display, at the CIE, as being within the storey zone or accommodation zone, not the stairway zone.

• All final exits to open air and arranged to display, at the CIE, as being within the stairway zone.



"Fires not close enough to a detector or in area not covered by a smoke alarm system, accounted for 47% of false alarm incidents." - ONS, 2017

Detection device spacing is crucial, not only to comply with the standard but to provide complete protection.

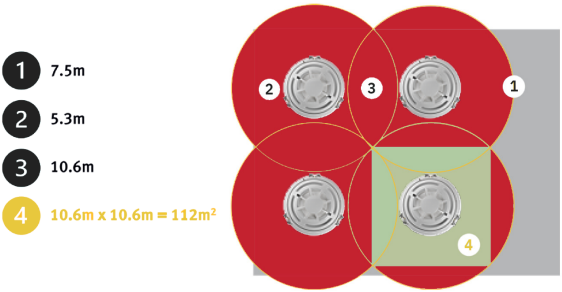
The standard is very specific about spacing devices across ceiling, within voids and in roof spaces.

Let's look at some of the key points worth knowing.
Positioning detectors in the wrong place could either:
• Create false alarms, or
• Stop them responding properly.

DETECTOR POSITIONING

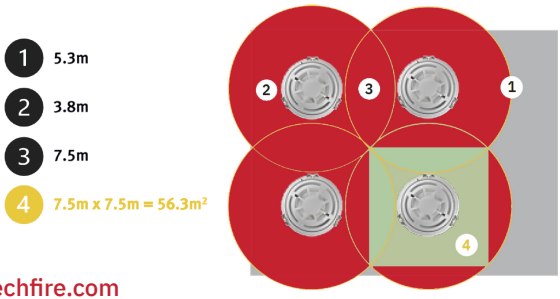
For smoke detectors, individual detector coverage is 7.5m radius, but because these radii must overlap, the actual distance between the detector and the walls must be 5.3m and between detectors must be **10.6m.**

Therefore individual smoke detector can be measured in abutting squares of **112 square metres** (this is regularly approximated to **100 square metres**).



For heat detectors, individual detector coverage is 5.3m radius, but again, because these radii must overlap, the actual distance between the detector and the wall must be 3.8m and between detectors must be 7.5m.

Therefore individual heat detector coverage can be measured in abutting squares of **56.3 square metres** (this is regularly approximated to **50 square metres**).

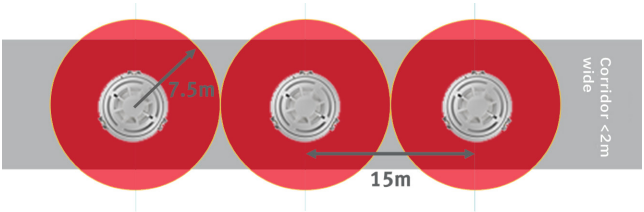


DETECTOR POSITIONING - CORRIDORS

An important note on multi-sensors that can operate as either smoke or heat.

According to BS5839-1 these have to be spaced as per the heat spacings previously, even if they are installed as smoke-only. This is to future-proof the installation against possible change of use or new/updated risk assessments.

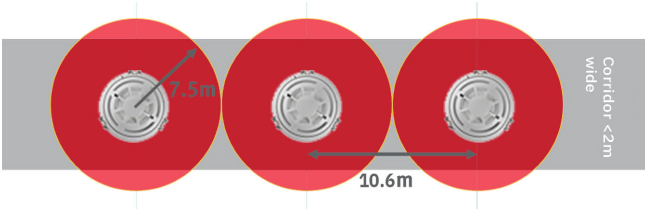
In corridors less than **2m wide** the horizontal spacing of smoke detectors may be increased, the areas of coverage need not overlap as in the case of a room.
Note: In corridors CO sensors can only be used in-conjunction with smoke sensors.



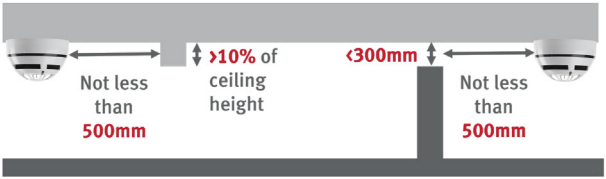
The standard does not recommend using heat sensors in escape routes, unless covered by a variation.

In corridors less than **2m wide** the horizontal spacing of heat detectors may be increased, the areas of coverage need not overlap as in the case of a room.

If a corridor is deemed part of an escape route heat detectors should not be installed due to the possibility of smoke hazard.

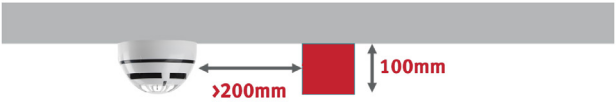


CEILING OBSTRUCTIONS / AIR INLETS



Ceiling obstructions, if deeper than 10% of the ceiling height, or floor-mounted obstructions (e.g partitions) where the top is less than 300mm from ceiling should be treated as walls.

No detection device should be mounted within 500mm of any wall or obstruction treated as a wall.

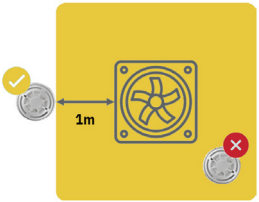


If a ceiling obstruction is less than 250mm, or less than 10% of the ceiling height, such as a strip light fitting, then detection devices should not be mounted closer than twice the depth of that obstruction.

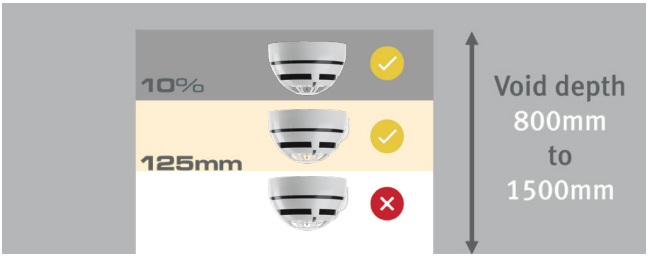
In this example, with a 100mm deep light fitting, the detector should not be closer than 200mm.

Detection devices should not be sited within 1m from air inlets or forced ventilation systems (such as air-conditioning units).

This also applies to wall-mounted air conditioning units where air-flow would affect the build-up smoke.



DETECTION WITH VOIDS



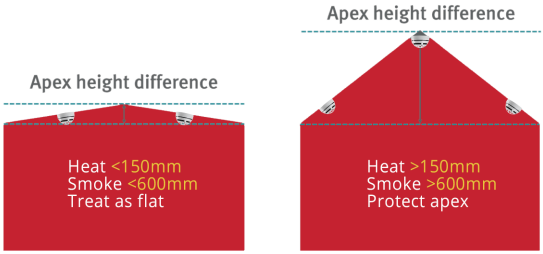
If the system category requires detection in any area, which has a void deeper than 800mm but less than 1500mm depth, detection should be provided in the void.

All such detection should be sited in the top 10% or 125mm of void depth (whichever is greater).

There will be no requirement for void detection if the void is constructed from fire-rated partition.

Voids deeper than 1500mm may be treated as a room when siting detectors below the ceiling - 150mm for heat and 600mm for smoke.

APEX CEILINGS / CEILING HEIGHTS



For ceilings that feature an apex: as long as the height difference between the apex and the height of the eaves is less than 150mm for Heat detectors or less than 600mm for Smoke detectors then these can be treated the same as flat ceilings.

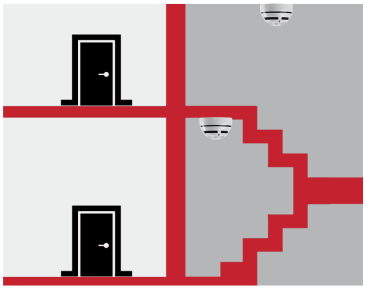
For higher apexes, a device should be installed at or near the apex.

The distance to adjacent devices can be increased by 1% per degree of angle of the roof up to a maximum of 25%.

DETECTION TYPE	GENERAL MAX HEIGHT	10% OF AREA MAX HEIGHT
Heat, Fixed	7.5m	10.5m
Heat, ROR	9.0m	10.5m
Smoke, Co	10.5m	12.5m
Beam Detector, normal	25.0m	28.0m*
Beam Detector, enhanced	40.0m*	43.0m*
ASD, normal	10.5m	12.5m
ASD, enhanced	12.0m	14.0m
ASD, very high	15.0m	18.0m
**seek advice from the manufacturer/supplier*		

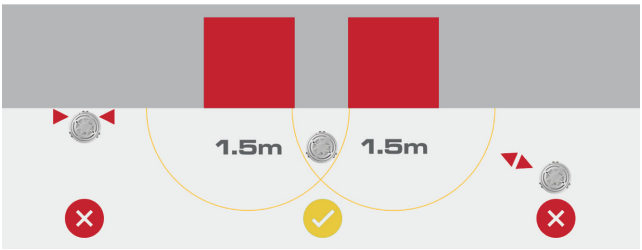
These are the recommended limits for ceiling heights for various detection technologies.
For special ceiling height circumstances always refer to the complete standard.

STAIRWELLS / LIFT SHAFTS



Enclosed stairways should have a detector at the top and at each main landing. Other than in Categories L4, L5 and P2, any vertical flue-like structure (lift shafts, open risers etc.) which penetrates one or more ceilings should have a detection device mounted at the top in the vertical structure and at each level (including the top floor) within 1.5m of any access hatch or door opening to the vertical structure.

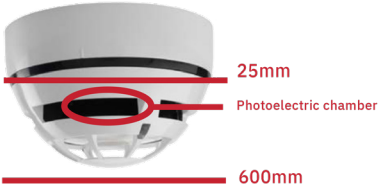
This example shows two lift shafts, side by side - the correctly positioned detector sits within 1.5m of both openings.



DETECTOR CHARACTERISTICS

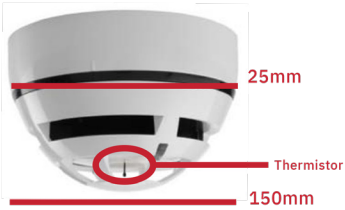
The sensing element of a smoke detection device (the photoelectric smoke chamber) should not be less than 25mm below ceiling, and not greater than 600mm below ceiling.

Smoke Device



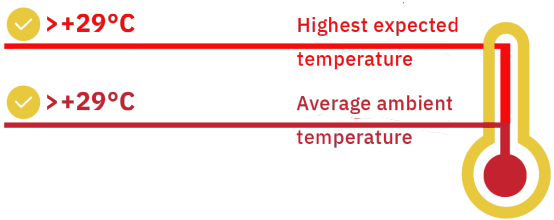
The sensing element of a heat detection device (the thermistor) should not be less than 25mm below ceiling, and not greater than 150mm below ceiling.

Heat Device



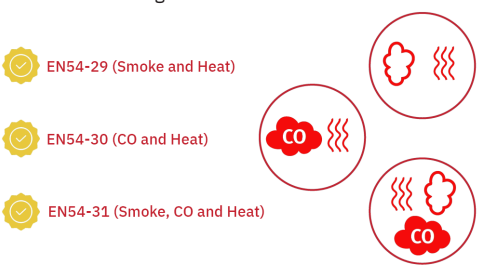
HEAT DETECTION SETTINGS/ MULTI-SENSOR

The minimum static response of heat devices should not be less than 29°C above the average ambient temperature, or less than 4°C above the highest temperature the device can be expected to experience.



In the BS 5839-1 2017 update, the definition of a multi-sensor was clarified. Clause 3.40 defines a multi-sensor as, “fire detector that monitors more than one physical and/or chemical phenomenon associated with fire”.

BS 5839-1 2017 acknowledges that a multi-sensor could be:



The standard does however accept that a multi-sensor can also be used in a single sensor state. Whichever state the multi-sensor is being used in, the detector should meet the performance requirements of the appropriate part of BS EN 54.

VIDEO DETECTION / ANNEX ‘E’

Video fire detection is now a recognised specialised fire detection technique, specifically for L5 and P2 consultant specified categories.

Annexe ‘E’ in the British Standard for the selection, spacing and siting of detectors, BS 5839 Part 1, details the correct procedure for the selection of detector type, to reduce false alarms.

And to reduce false alarms, every system designer or installer needs to ask themselves these questions when specifying a detector based on position, environment and building use, such as:

- What is the risk of a fire developing in this area?
- Is a fire likely to be a rapidly-developing, high energy type fire or a slowly developing, smouldering fire?
- Under normal conditions, will there be high ambient levels of smoke or steam present?
- Is the area a clean, dry environment or are there high levels of dust, dirt or moisture?
- Is there likely to be a high concentration of cigarette smoke?
- Are there any special risks?
- Is there a high ambient temperature or significant variations in temperature?

The Annexe also explains linking fire alarm systems to security systems to instantly notify the responsible person when an incident occurs and the deactivation of remote monitoring during routine maintenance, both again to help reduce false alarm generation.

EUROTECH PRODUCT RANGES

sygno-fi®
by Eurotech

SECURITY & FIRE EXCELLENCE AWARDS
2022 WINNER
HARDWARE PRODUCT INNOVATION OF THE YEAR

This new range of high-performance open protocol EN54-25 wireless detection, control and alarm devices offer exceptional capabilities, quality and reliability. Combined with user-friendly survey, install, commissioning and maintenance software, Sygno-fi revolutionises the wireless fire systems market.

eurotech®
FIRE SYSTEMS LIMITED

The Eurotech intelligent field device series consists of detection, control and alarm devices to build a comprehensive, robust fire alarm system.

toccare
by Eurotech

The Toccare® Intelligent Touch Screen Panel demonstrates the latest in fire alarm technology - the world's first fully touch screen, EN54-certified fire alarm panel. Toccare® by Eurotech is the first range of truly aesthetically designed panels developed to slip seamlessly into high-end, exclusive surroundings.

eurotech®
FIRE SYSTEMS LIMITED

enquiry@eurotechfire.com
+44 (0) 203 141 0999

eurotechfire.com

Eurotech Fire Systems Limited

18-20 Stratfield Park
Elettra Avenue
Waterlooville
Hampshire
PO7 7XN
United Kingdom

Fire Industry Association
Leading Excellence in Fire Since 1916

Assessed to ISO 9001
Cert/LPCB ref. 1213

BAFE FIRE SAFETY REGISTER
REGISTERED ORGANISATION
ID: 302829