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POCKET GUIDE TO BS 5839-1

Fire detection and fire alarm systems for buildings

Hyfire

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Hyfire Wireless is the UK's leading wireless fire detection and alarm system manufacturer. Our wireless systems allow for rapid and reliable installation in the most challenging environments. We continue to invest in technology and talent to develop leading-edge products that are quick to install, simple to use and never compromise on safety.

CONTENTS

About this guide...

BS5839-1 is a BSI Standards Publication outlining the code of practice for design, installation, commissioning and maintenance of fire detection and fire alarm systems in non-domestic premises.

As part of our commitment to keeping people and property safe using the power of wireless technology, we have developed this guide to summarise and illustrate some of the key design considerations for system designers and installers. Where appropriate, we've given reference codes to help identify relevant sections in BS5839-1.

This guide is not intended to be a substitute for BS5839-1 which should be read in full.

If you would like to find out more about how Hyfire Wireless products can protect your people and your premises or enhance your fire alarm system, please contact **info@hyfirewireless.co.uk.**

Types of fire alarm systems

The British Standard covers guidance for fire alarm systems that might comprise only one or two manual call points and sounders to more complex networks. It also includes systems that provide signals to initiate the operation of other equipment or safety measures, i.e. fire extinguishing systems, or grounding of lifts.

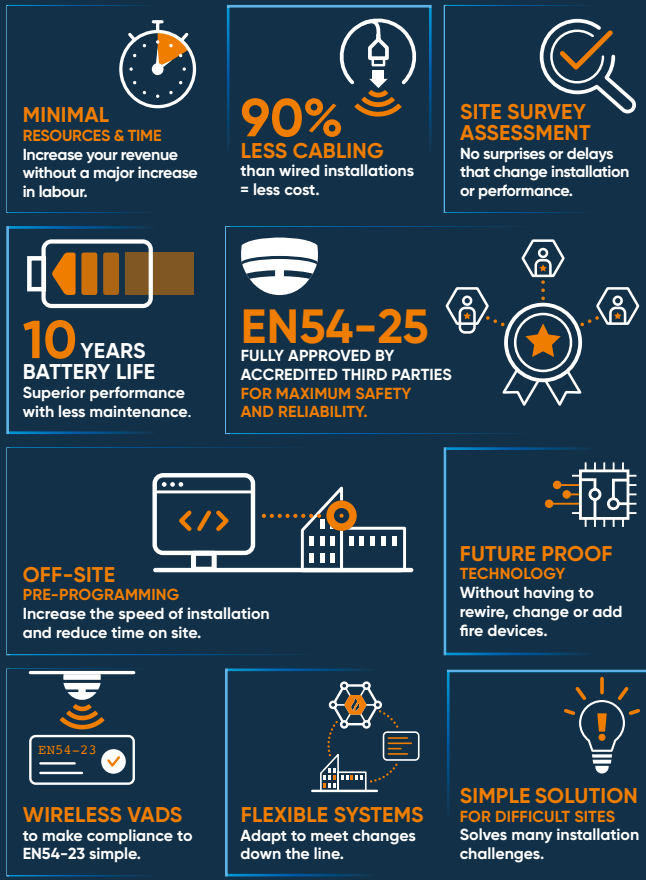
Fire alarm systems are broadly categorised as **conventional** fire alarm systems and analogue **addressable** systems, each suited to different types of premises. **Wireless systems** are now a common alternative to wired systems, providing fast and effective fire protection with minimal disruption and reduced installation time. They are commonly used when wired installations are not suitable or wiring may be prohibited, such as building extensions and grade-listed buildings, but are now becoming mainstream across applications such as residential buildings and commercial premises.

Conventional systems are simpler than addressable systems, ideal for small offices or retail shops. They typically employ 'spurs' of detectors or sounder circuits grouped into zones, each wired on a single cable from the fire alarm panel. When a detector is activated, its zone is indicated on the panel.

Addressable systems are more intelligent systems, suited to larger buildings or more complex projects. They use a loop configuration holding all devices. Each device communicates with the fire panel using a system protocol. When a detector is activated, its exact location is registered.

Wireless systems use a radio signal instead of wires to communicate between the devices and the fire panel. Installation is quick and relatively easy with minimal cabling, causing less disruption for residents and less need for redecoration post installation.

The benefits of Hyfire Wireless



Categories of system

Fire detection and fire alarm systems can be installed in buildings to satisfy one, or both, of two principal objectives: protection of life and protection of property. Systems are divided into a number of different categories depending on the extent of cover.

5.1.2 Category M systems

Manual systems that incorporate no automatic fire detectors and in which an alarm can only be initiated manually. Only suited to buildings in which no one sleeps and fire is likely to be detected before smoke reduces visibility in escape routes.

5.1.3 Category L systems

Category L systems are automatic fire detection and alarm systems intended for the **protection of life.**

L1: systems are installed throughout the building.

L2: systems are only installed in defined parts of the building.

L3: systems are installed in escape routes and areas opening onto these routes to enable occupants to exit safely before the escape routes are impassable.

L4: systems are installed in escape routes comprising circulation areas such as corridors and stairways.

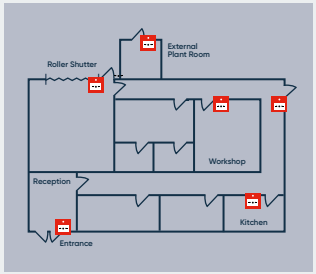
L5: where the location of detectors is designed to satisfy a specific fire safety objective other than that of categories L1 to L4.

5.1.3 Category P systems

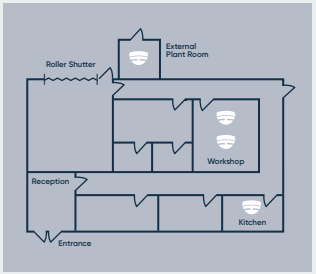
Category P systems are automatic fire detection and alarm systems intended for the **protection of property.**

P1: systems are installed throughout the building to offer the earliest possible warning of fire to minimise damage.

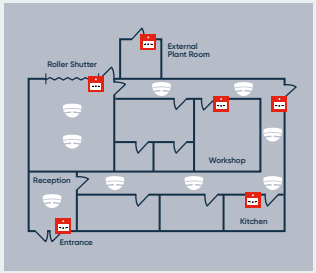
P2: systems are only installed in defined parts of the building where the risk to property or business continuity from fire is high.



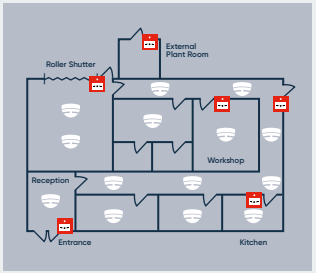
Category M



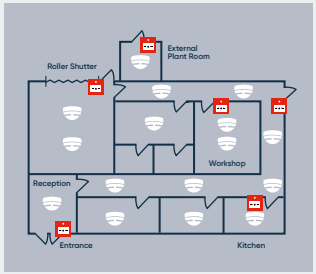
Category L5



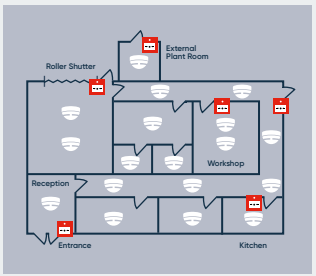
Category L4



Category L3



Category L2



Category L1

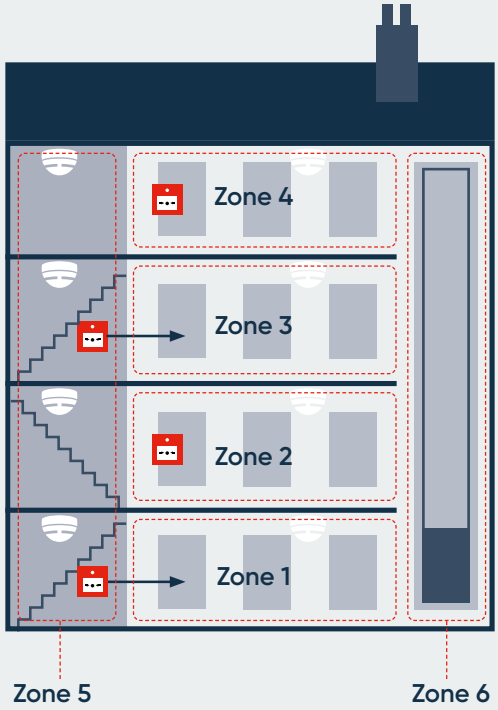
Detection zones

In order to direct the fire and rescue service responding to a fire alarm signal to the area of fire quickly, all buildings, other than very small buildings, need to be divided into detection zones.

Manual call points in a stairwell should be connected to the zone associated with that floor. A manual call point in a stairwell at a final exit to open air may be incorporated with the detection zone serving the stairwell. Automatic sensors on the stairwell remain as part of the stairwell detection zone.

For buildings with a floor area greater than 300m^2, each detection zone should be limited to one storey. The floor area of a zone should not exceed 2,000m^2, except for large open plan areas such as uncompartmented warehouses, which can be extended to 10,000m^2. Vertical structures like stairwells, lift shafts etc. should be considered as separate zones.

The maximum search distance for the fire fighters to see the seat of the fire within a zone should not exceed 60m.



If the total floor area of the building is greater than 300m^2, each detection zone should be restricted to a single storey. Vertical structures like stairwells, lift shafts etc. should be considered as separate zones.

Alarm zones

In smaller buildings, evacuation in the event of a fire may be signalled by the operation of a manual call point or automatic fire detector to operate all fire alarm sounders to evacuate the entire building.

In larger buildings, evacuation may be restricted in extent, e.g. to a single floor or limited area of the building. In this case it is necessary to divide the building into individual alarm zones to help phased evacuation and avoid disruption should false alarms occur.

14.2 Recommendations

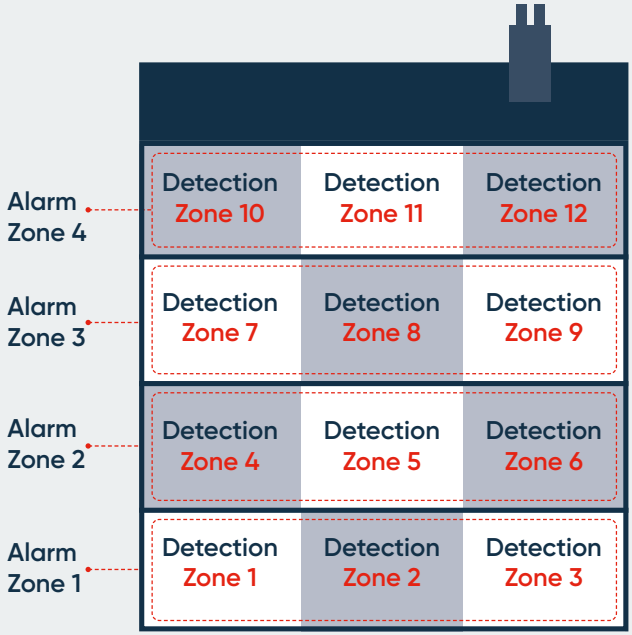
a/ The boundaries of every alarm zone, other than external walls, should comprise fire-resisting construction.

b/ The extent of overlap of signals between alarm zones should not confuse occupants in any area of the building.

c/ A common signal should be used throughout all alarm zones to signal evacuation.

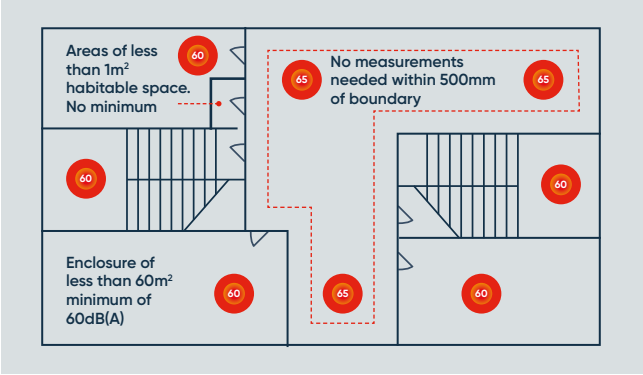
d/ An alarm zone may incorporate more than one detection zone, but not vice versa.

e/ The configuration of alarm zones should be approved by the relevant enforcing authority as appropriate.



Larger buildings are divided into different alarm zones to assist with phased evacuation and minimise disruption should false alarms occur.

Sound levels



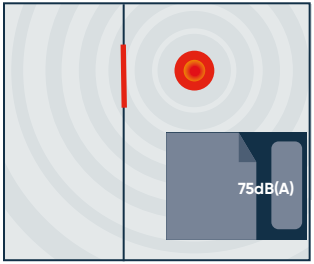
Alarm signals need to be loud enough with the reach necessary to effectively alert all the people that need protecting.

Fire alarm sounders should be distinctive from other alarm systems in the building. The minimum sound level should be 65dB(A) or 5dB(A) above a background noise which is louder than 60dB(A) (if lasting more than 30 seconds) and at a frequency of between 500Hz and 1000Hz. This may be reduced to 60dB(A) in stairways, enclosures up to 60m² and specific points of limited extent. The maximum sound level should not be greater than 120dB(A) at any normally accessible point.

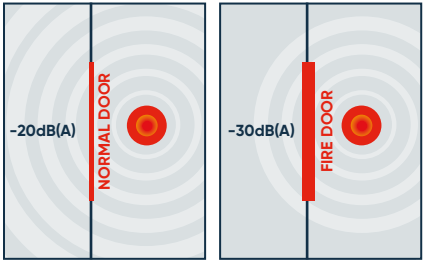
In retail or leisure premises that play music, where the level of music is likely to be greater than 80dB(A) the music should be muted automatically when a fire alarm signal is given.

See **16.2.3** for recommendations applicable to hospitals and residential care homes.

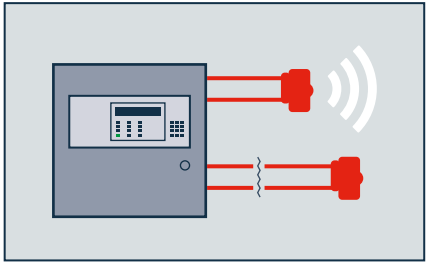
HYFIRE DELIVERS...
The Hyfire Wireless sounder base provides 90dBA @ 1m.



For areas where people are sleeping, sounder devices should produce a minimum 75dB(A) at the bed-head with all doors shut. In buildings providing sleeping accommodation for deaf or people with impaired hearing, bedrooms should have both audible and visual alarms.



Decibel loss occurs through doors: approximately –20dB(A) through a normal door, and approximately –30dB(A) through a fire door. Unless a sounder is installed in a bedroom, it is unlikely that 75dB(A) will be achieved.

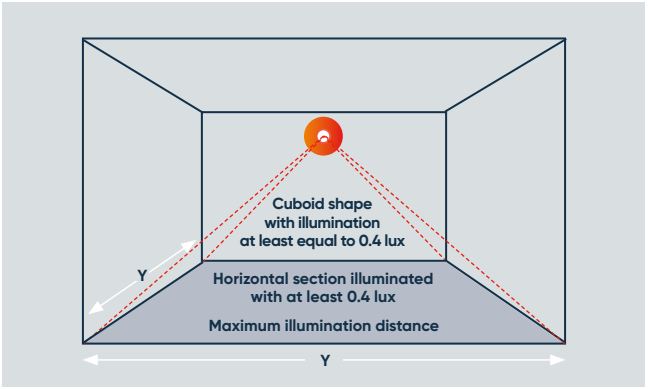


The system should incorporate at least two fire alarm sounders. Sounder device cabling should be arranged so that in the event of a fault at least one sounder will remain operational during a fire condition.

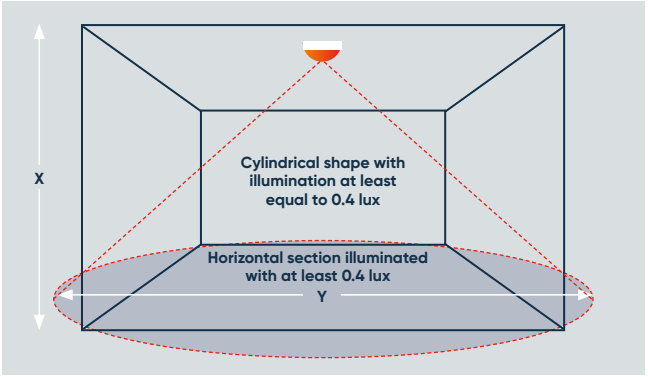
Visual alarm signals

Visual alarm signals can supplement audible alarm signals where necessary, but they should not be used on their own. They should be used in areas where ambient noise levels exceed 90dB(A), where hearing protection is likely to be worn. They may also be used in environments where an audible warning is undesirable, e.g. television and radio studios, cinemas, theatres and hospital operating theatres.

Visual alarm devices should be easily visible from all normally accessible locations throughout the area in which they are provided. The visual alarm signal should flash at a rate within the range of 30 to 120 flashes per minute and be sufficient to attract attention.



Above: Example of illumination pattern from a wall-mounted VAD.
Below: Example of illumination pattern from a ceiling-mounted VAD.



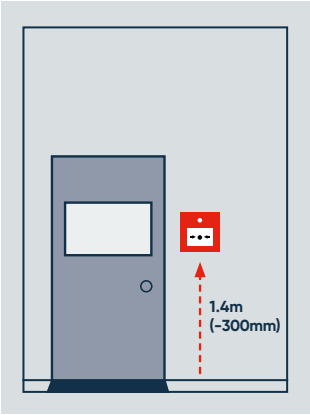
HYFIRE DELIVERS...
The Hyfire VAD base (white flash) has a coverage of 15m (C-3-15). This means you don't have to compromise your detector spacing to comply.

Manual call points

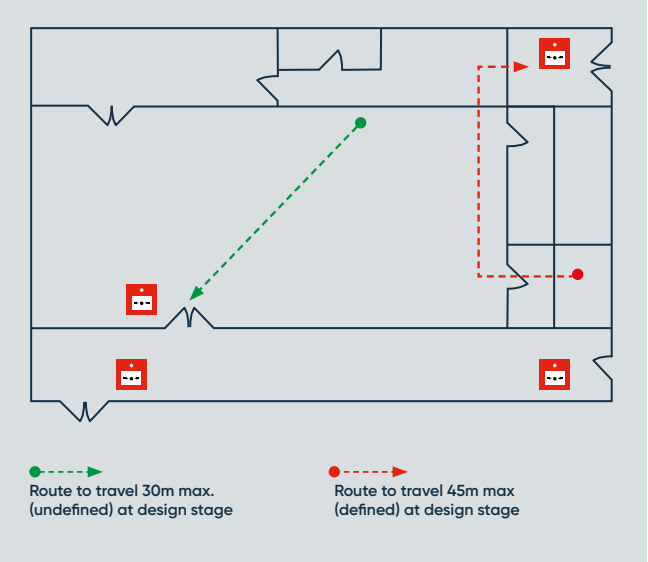
Manual call points (MCPs) enable the sounding of a fire alarm. They need to be sited prominently and be easily distinguished from non-fire alarm call points to minimise any delay between the discovery of a fire and the sounding of the alarm.

In the event of an evacuation signal, people leave the building via an exit that leads to a place where there is no immediate or future danger from fire. MCPs are sited adjacent to all storey exits and exits to open air that lead to a place of ultimate safety. No individual should be able to leave a storey or the building without passing an MCP.

All call points should be identical and fitted with a protective cover, which is moved to gain access to the frangible element.



MCPs should be fixed at a height of 1.4m (-300mm) from floor level. A lower mounting height is acceptable if the first person to raise an alarm is likely to be a wheelchair user.



A person should not have to travel more than 45m to reach an MCP measured along the route they would follow taking into account the interior layout. This should be reduced to 25m if a significant proportion of occupants have limited mobility or rapid fire development is likely.

If the final layout of the building is unknown, the maximum straight line distance between any point in the building and the nearest MCP should not exceed 30m – reduced to 16m if a significant proportion of occupants have limited mobility or rapid fire development is likely.

Types of fire detector & their selection

Fire detectors are designed to detect one or more of the four characteristics of fire:
- heat
- smoke
- combustion gas
- infrared or ultraviolet radiation.

Heat detectors are generally less sensitive to most fires than other types of fire detector but can detect clean burning fires involving certain flammable liquids before a smoke or combustion gas detector.

The choice of detector depends primarily on:
- the speed of response required
- the need to minimise false alarms
- the nature of the fire hazard.

Cost, suitability for the environment and maintenance might also need to be considered.

Key recommendations

a/ The selected fire detector should provide adequate protection of occupants, property or both, while minimising the risk of false alarms.

b/ Heat detectors may not be used in Category P systems in which a small fire has the potential to cause unacceptable damage, escape routes in Category L systems, areas where smoke could prevent the occupant's escape before fire is likely to be detected, or areas in which they may cause false alarms.

c/ Smoke detectors may not be used in areas where the principle hazard is flammable liquids or gases that produce little smoke from fire, or in areas where they have a high potential for false alarms.

d/ In Category L systems, smoke detectors installed in corridors and stairways that form escape routes should be optical detectors.

* See Section 2:21.2 for full recommendations

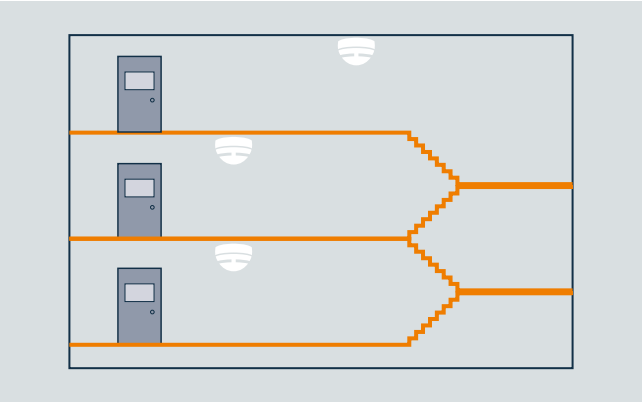
Spacing & siting of automatic fire detectors

The spacing and siting of detectors is based on minimising the time taken for the hot gases and smoke to reach the detector from the fire.

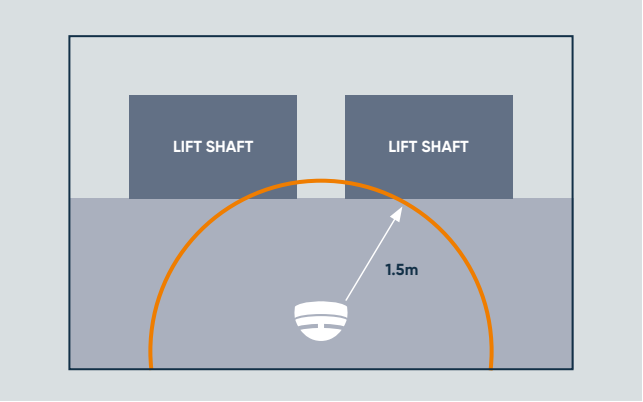
As smoke and hot gases from a fire rise, they are diluted with clean cool air. Therefore the height of the ceiling above the fire affects the speed of detection and the use of more sensitive detectors might be required. Stratification might also occur, creating an 'invisible ceiling' in which case the smoke and hot gases will not immediately trigger ceiling mounted detectors, regardless of their sensitivity.

BS5839-1 outlines extensive recommendations for siting detectors to provide multi-level detection depending on ceiling height and other environmental conditions. The effectiveness of an automatic fire detection system is affected by obstructions between heat or smoke detectors and the products of combustion so additional guidance is provided for clear space principles.

The following pages illustrate key recommendations for spacing and siting detectors to maximise protection and minimise the potential for false alarms. Please refer to the full Section 2:22 in BS5839-1 for further information.

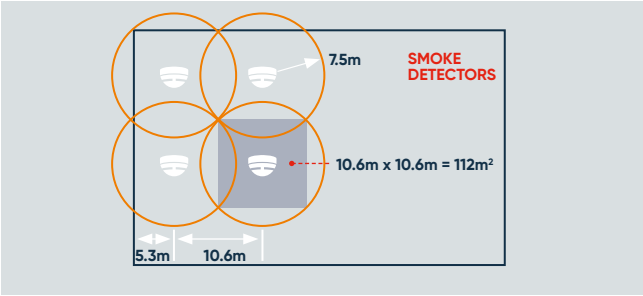


22.2b Enclosed stairways should have a detector at the top of the stairway and on each main landing.

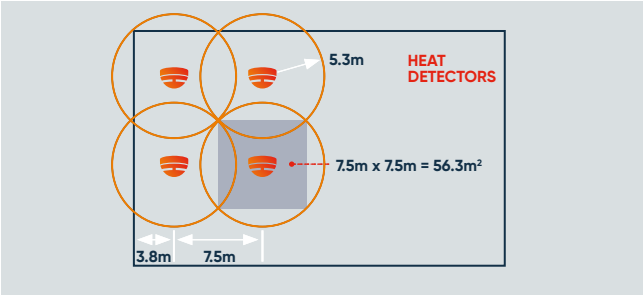


22.2c Vertical shafts like lifts, escalators and enclosed chutes should have a device mounted within 1.5m of any opening (unless a Category L4, L5 or P2 system).

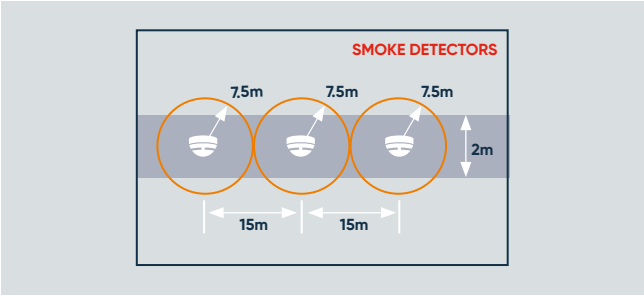
Spacing & siting of automatic fire detectors



22.3 SMOKE DETECTORS: When mounted on a flat ceiling, smoke detection devices cover a 7.5m radius. The radii must overlap to avoid 'blind spots'. Therefore individual coverage can be represented by a square measuring 10.6m x 10.6m giving an actual area coverage of 112m² per device.

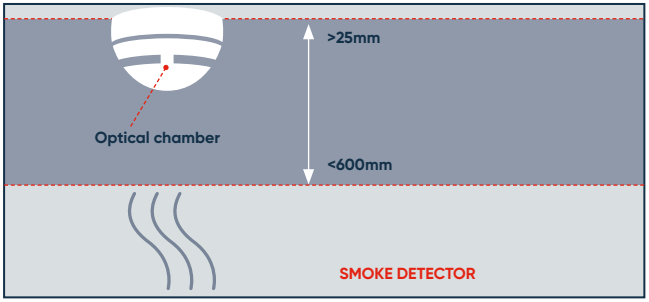


22.3 HEAT DETECTORS : When mounted on a flat ceiling, heat detection devices have an individual coverage of 5.3m radius. The radii must overlap to avoid 'blind spots'. Therefore individual coverage can be represented by a square measuring 7.5m x 7.5m giving an actual area coverage of 56.3m² per device.

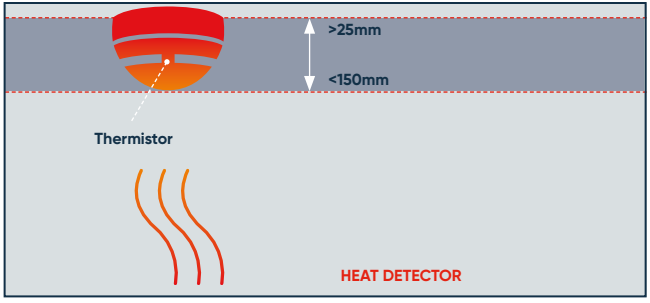


22.3 In corridors less than 2m wide the radial coverage doesn't need to overlap meaning the horizontal spacing of detectors can be increased. In corridors over 2m wide, spacing should follow the standard for rooms.

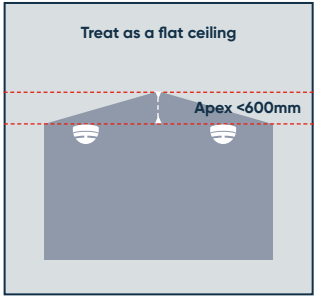
Spacing & siting of automatic fire detectors

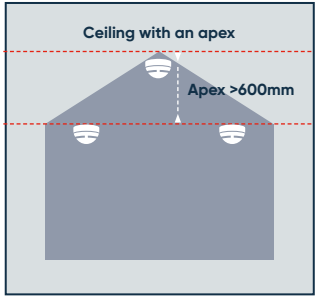


22.3 SMOKE DETECTORS: The sensing element of a smoke detector (optical smoke or ionisation chamber) should be at least 25mm from the ceiling and not greater than 600mm below the ceiling.



22.3 HEAT DETECTORS: The sensing element of a heat detector should be at least 25mm from the ceiling and not greater than 150mm below the ceiling.



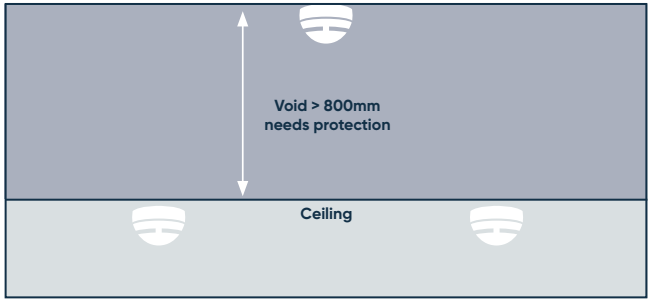


22.3 For ceilings that feature an apex: if the height of the apex from the rest of the ceiling is less than 150mm for heat detectors or less than 600mm for smoke detectors, then these can be treated the same as flat ceilings. For higher apexes, a device should be installed at the highest point. The distances to adjacent devices (as illustrated on page 20) can be increased by 1% per degree of angle of the roof up to a maximum of 25%.

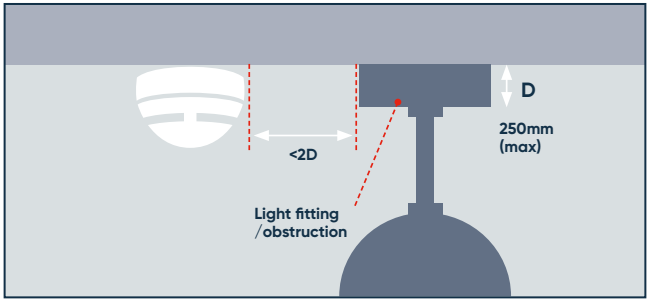
Limits of ceiling height for detector type	Maximum ceiling height (m)	Maximum ceiling height for 10% area (m)
Heat class A1	9m	10.5m
Heat other classes	7.5m	10.5m
Smoke/CO point	10.5m	12.5m
Optical beam (normal sensitivity)	25m	28m
Optical beam (enhanced sensitivity)	40m*	43m*
ASD general limit	10.5m	12.5m
ASD class C with at least 5 holes	15m	18m
ASD class C with at least 15 holes	25m	28m
ASD class B with at least 15 holes	40m**	43m**

*Supplemented detection recommended unless risk of stratification is minimal.
**Multilevel detection recommended unless risk of stratification is minimal.

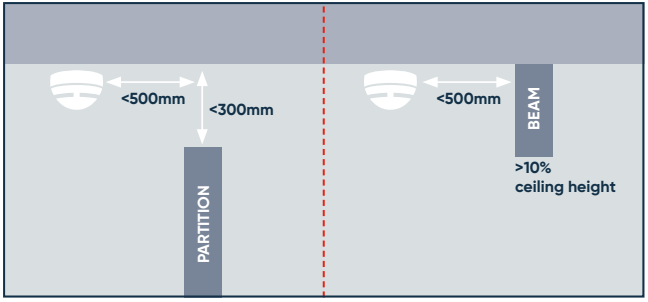
Spacing & siting of automatic fire detectors



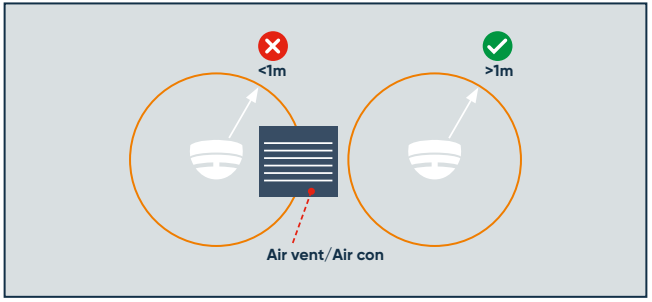
22.2 Voids more than 800mm in height need to have independent coverage. Voids less than 800mm in height don't need independent coverage unless fire or smoke is able to spread from one area to another through the void or risk assessment shows AFD (Automatic Fire Detection) to be necessary.



22.3 If there are light fittings or other ceiling attachments with a depth of up to 250mm, ensure devices are mounted at a distance equal to or more than twice the depth of the light fitting/attachment.



22.3 A device should not be mounted within 500mm of any obstruction. If the top of a solid partition is less than 300mm from ceiling then treat it as a wall. Similarly, ceiling obstructions such as beams should be treated as walls if deeper than 10% of the ceiling height.



22.3 Do not site detectors less than 1m from air supply points or air circulating units.

Section 26

Cables, wiring and other interconnections

The components of most fire detection and fire alarm systems are connected by cables and wiring, but it is possible to connect them by other means, such as radio or fibre optics. Recommendations for radio-linked systems are given in Clause 27. Where fibre optic connections are used, they need to provide at least equivalent integrity and reliability to other cables that are recommended for the same purpose.

BS5839-1 makes recommendations for two levels of fire resistance in cable systems, termed "**standard**" and "**enhanced**".

In general, cables of **standard** fire resistance are suitable for most applications. However, for certain critical applications, in which prolonged circuit integrity is necessary in the event of fire, cables of **enhanced** fire resistance are recommended.

Examples are unsprinklered high-rise buildings with phased evacuation arrangements and premises of such a nature or size that areas remote from the fire could continue to be occupied for a prolonged duration during a fire that might then damage cables serving parts of the fire alarm system in occupied areas.

Section 27

Radio-linked systems

Some of the recommendations of BS5839-1, applicable to wired systems, are unsuitable for, or cannot be applied to, radio-linked systems. These include, in particular, those relating to power supplies and fault monitoring. Additional recommendations apply to radio-linked systems in order to address the integrity and performance of the radio communications link between components and the CIE.

Recommendations

- Components of a radio-linked system should conform to BS EN 54-25.
- Although BS EN 54-25 permits the use of a single battery in each device, radio-linked systems should also conform to the following:
  - all radio-linked components should be supplied from at least two independent power supplies. These can be either:
    - the normal mains supply plus a reserve battery (primary or continuously charged secondary); or
    - a primary battery plus a second primary battery; **or**
    - a primary battery plus a secondary battery.
- Installation of a radio-linked system should only take place after a comprehensive radio survey has been undertaken to ascertain the following:
  - there are no other sources of radio transmission that could interfere with, or block, radio communication between the CIE and other components of the system;
  - there is adequate signal strength for communication both to and from components as appropriate in all areas of the building(s) in which radio-linked components are to be located. This should take into account the minimum

Radio linked systems

acceptable signal level defined by the manufacturer in respect of the level of background radio "noise" at the time of the survey;

– where the system is networked it should be established that the communication conditions described in item 2 are achieved throughout the network;

– records of signal strength readings for each radio device taken at the time of the survey and of the background noise level, should be kept for future reference.

NOTE 3 The record of signal strength and background radio noise may be combined into a single record of signal-to-noise ratio.

NOTE 4 The survey capability may be incorporated within the installed system.

- At the time of commissioning and after the installation of all equipment, including remote antenna(e), the following records relating to the radio data should be recorded where applicable:

  – the system coding (i.e. system address) which should, where possible, be unique to avoid the possibility of interference;

  – the system's channel/ frequency.

- Details of the signal levels received at, or from, each of the receiver units. This data should include signal levels relating to all the radio devices and the background noise level and confirmation that these signal levels are in compliance with the manufacturer's recommendations. In the case of a networked system (i.e. multiple panel system), this should also include the signal levels for the radio-links between panels. In addition to other servicing recommendations in other parts of this standard, this should be undertaken at each routine service visit.

- The signal levels recorded should be within the specifications set by the manufacturer of the radio system. If not within the specification, appropriate remedial action should be undertaken.

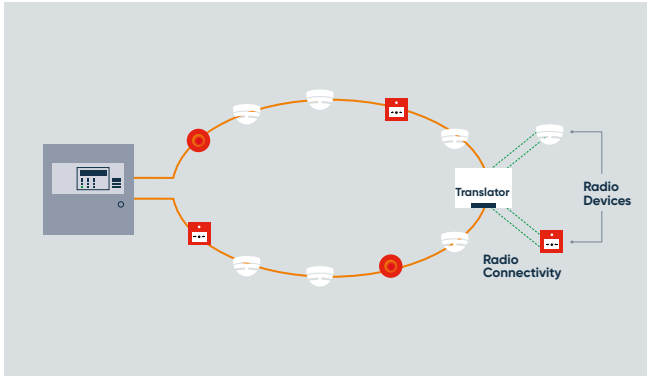
- A copy of the signal levels should be kept on site with the system logbook.

HYFIRE DELIVERS...

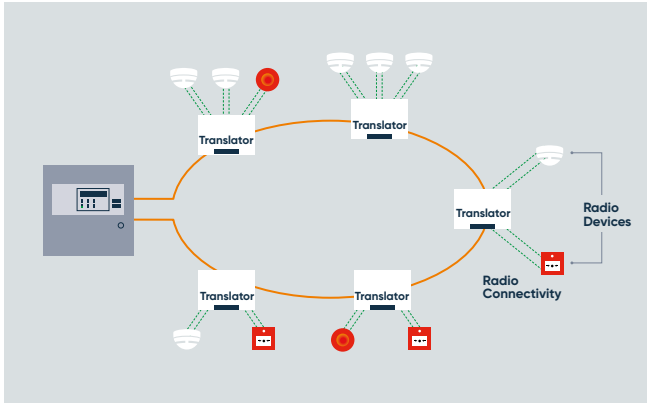
The Hyfire survey tool is driven by a mobile app that automatically delivers and saves detailed reports to help with compliance and design. Site details, device locations, notes and pictures, link quality, channels selected and more, all is on hand on your mobile device.

Installation notes

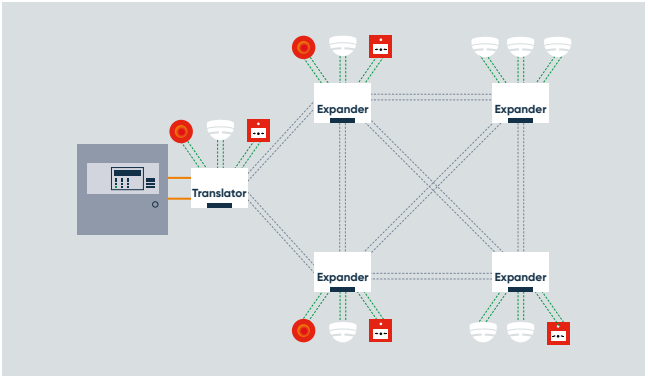
Taurus Wireless Technology : Mostly wired



Taurus Wireless Technology : Hybrid solution



Taurus Wireless Technology



Key features

- Up to 6 translators per loop
- Up to 15 expanders per translator
- 8 expanders hops in a linear arrangement
- Up to 32 devices per expander
- Up to 128 devices controlled by 1 translator
- Up to 240 devices controlled by 1 loop card
- 8 pairs of network channels
- 22 pairs of field channels
- Seamless combination with the Hyfire control panel (Advanced MX5)
- TauREX, new user-friendly software
- Network optimiser technology: 60 communications channels (infrastructure & field devices)
- SafePath mesh expander technology: redundant communication paths between expanders
- SafeSwitch technology: dual channel redundancy
- Pathfinder technology: optimised infrastructure range
- Optimised power management: fully synchronised outputs with rapid reaction time and superior energy management using standard CR123A lithium batteries across the range

Annex A

Choice of appropriate category of fire detection & alarm system

Annex A describes the category of system that is typically installed in different types of premises. We have edited highlights in the following table - please revert to the full standard for more information.

Type of premises	Category	Comments
Common place of work: offices, shops, factories, warehouse, restaurant	**M or P2/ M A or P1/M**	Category M normally satisfies legislation – can be combined with Category P to satisfy insurance requirements.
Hotels, hostels, public houses & student accommodation	**L1 or L2**	In buildings where fire in any area could pose a threat to sleeping occupants, the system category is at least L2.
Non-residential public houses	**M**	
Schools	**M or M/P2 or M/P2/L4 or M/P2/L5**	Category is normally based on fire risk assessment. Category P system may be installed to combat arson.
Hospitals	**L1**	Detailed guidance given in HTM 05-03 Part B [N1] (England and Wales) or SHTM 82 [N2] in Scotland.
Places of assembly /small premises	**M**	E.g. cinemas, theatres, exhibition halls, nightclubs, galleries.
Large buildings	**L1 to L4**	
Transportation terminals	**M/L5**	
Covered shopping centres	**L1 to L3**	Tailor made design and often part of fire engineering solution.
Residential care homes	**L1 to L3**	L1 appropriate for larger premises.
Prisons	**M/L5**	
Phased evacuation buildings	**L3**	
Buildings with 'inner rooms' that have poor visibility to access rooms	**M/L5**	When rooms can only be accessed by other rooms, smoke detectors are sited in access rooms.
When AFD is required to operate other systems, e.g. magnetic doors.	**M/L5**	AFDs are sited to ensure they can signal release of magnetic door holders.
Buildings where fire can spread from unoccupied areas & compromise escape	**M/L4 or M/L5**	Custom and practice does not involve siting AFDs in all unoccupied areas, such as plant and storage rooms.
Buildings requiring AFD for insurance purposes	**M/P1 or M/P2**	

Annex B

Typical noise levels in buildings

Annex B gives typical expected background noise levels for a range of building types. We have edited highlights in the following table – please revert to the full standard for more information.

Type of premises	Area description	L_p dB(A)
Airport terminals	Check-in, arrivals, departures Gate rooms, walkways Customs/baggage reclaim Channels Departure lounge	**59 to 72** **54 to 64** **63 to 71** **59 to 70** **49 to 64**
Arenas/auditoriums	Concert halls, cinemas, theatres	**60 to 75**
Banks, building societies	Public areas	**50 to 64**
Bus stations	Quiet to noisy	**58 to 73**
Cafeterias	Quiet to noisy	**55 to 78**
Classrooms	Quiet to noisy	**56 to 72**
Conference rooms		**40 to 45**
Corridors	Uncarpeted : quiet to noisy Carpeted	**45 to 76** **28 to 32**
Courtrooms		**40 to 50**
Dealing rooms	Computerised to traditional	**60 to 90**
Exhibition halls		**63 to 73**
Factories	Control rooms Light assemblies Heavy engineering	**70 to 105** **80 to 85** **95 to 105**
Hospitals	See guidance in HTM 05-03 Part B [N1] (England and Wales) or SHTM 82 [N2] in Scotland.	
Hotel bedrooms	TV off TV on	**28 to 35** **60 to 70**
Kitchens (commercial)		**65 to 75**
Leisure centres/ sports halls		**60 to 93**
Libraries	Quiet areas Reception/air conditioned	**35 to 45** **50 to 60**
Museums/galleries	Quiet to noisy	**48 to 73**
Offices	Cellular Open plan	**40 to 50** **50 to 85**
Plant rooms	Quiet to noisy	**66 to 93**
Railway stations	Waiting rooms to platforms	**54 to 85**
Restaurants		**72 to 75**
Shopping malls		**70 to 75**
Warehouses	Quiet to noisy	**47 to 80**

Support services

We're here to help you for the entire life cycle of your Hyfire Wireless fire solution, from the initial consultancy and planning through to its installation, commissioning and maintenance. We offer phone support, site visits and initial project support tailored to your requirements.

Phone support & remote monitoring

Call our experts during normal business hours to answer your product questions and solve technical problems. Our engineers can also connect to your phone camera to offer remote visual assistance.

Team site visits

If a technical problem cannot be managed by phone support, our team can travel to your location. We can verify that your products have been properly configured and work with you to identify the steps required to resolve the problem.

Project support

Hyfire technical expertise is available from the project outset to ensure you'll achieve optimal system performance, including the verification of software and firmware versions, device pre-programming, network configuration and product commissioning.

Useful contacts

Sales
T: 01926 485282
E: sales@hyfirewireless.co.uk

Technical support
T: 01926 485935
E: technical@hyfirewireless.co.uk

hyfirewireless.com