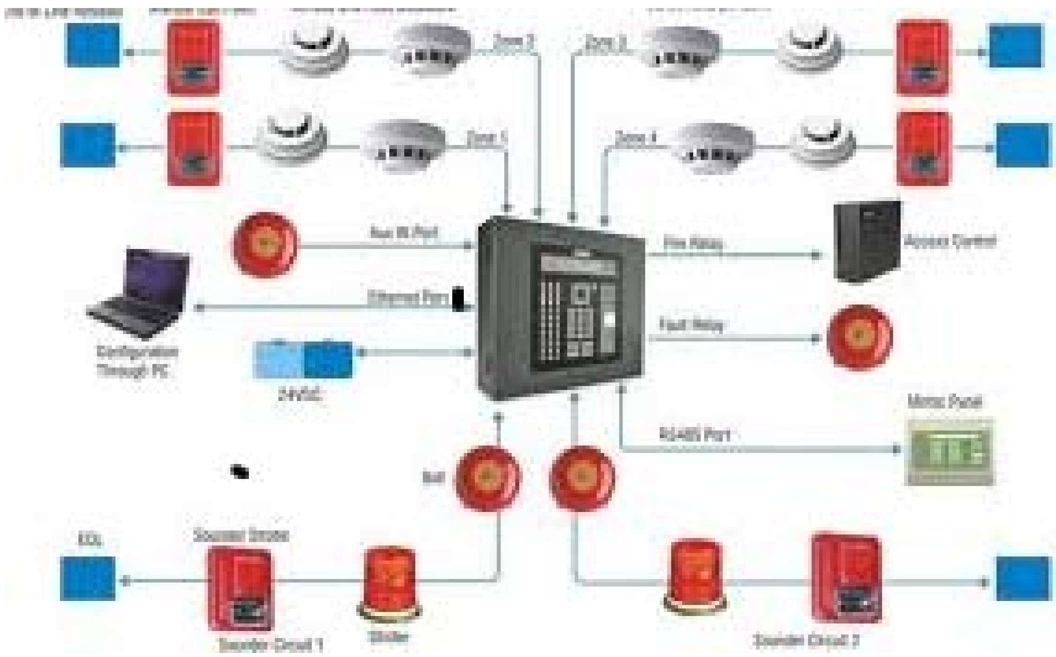
Kurdistan Engineering Union

Guide to
Fire alarm system



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Guide to Fire Alarm Systems

Introduction

The following Guide is based on BS٥٨٣٩ Part ١ on the design and installation of Fire Alarm
Systems for general applications. It is intended as a reference only, and not a replacement for
BS٥٨٣٩ part ١.

When is a Fire Alarm System Required ?

There are various statutory documents covering the need for fire protection in various types of
premises. The principle documents are:
_ Health and Safety at Work Act ١٩٧٤
_ Fire Certificates (Special Premises) regulations ١٩٧٦
_ Factories Act ١٩٧١
_ Offices, Shops and Railway Premises Act ١٩٦٣
_ Private Places of Entertainment Act ١٩٦٧
_ Fire Precautions (Workplace) Regulations ١٩٩٧

The Fire Precautions Act ١٩٧١

Under this Act, all shops irrespective of staff numbers and contents must have:
_ Adequate means of escape while an employee is in the premises (unlocked doors and unobstructed access to them)
_ Appropriate means for fighting fire provided and maintained
A Fire Certificate must be obtained from the Fire Authority for premises in which:
_ More than ٢٠ persons are employed at any one time
_ More than ١٠ persons are employed at any one time other than on the ground floor
_ The shop employees are working in the same building as others and the total in all the premises exceeds ٢٠ or ١٠ elsewhere other than on the ground floor
_ Highly flammable or explosive materials are stored or used
_ Sleeping Accommodation is provided
_ A Hotel or Boarding House contains sleeping accommodation for ٦ or more people, which includes staff and guests, or a Hotel or Boarding House that sleeps a member of staff or any guests above the first floor or below the ground floor.
The majority of Industrial and Commercial premises therefore require a Fire Alarm System with
legislation both nationally and locally covering a large proportion of the various types of buildings and their requirements.
Automatic Fire Detection will normally be required in premises with:
_ Flammable or Explosive materials are used or stored
_ Where people are sleeping as part of the premises business activity eg: Hotels, Nursing Homes, Hospitals etc
_ When the premises has special evacuation problems eg: disabled and elderly persons, cellars and high buildings
All of the above will probably need some degree of Automatic Fire Detection to obtain a Fire

Certificate, however with the new Fire Precautions (Workplace) Regulations ١٩٩٧ it is not
always necessary to apply for a certificate. CAUTION - You almost certainly must have a Fire
certificate OR must comply to the regulations.

The Fire Precautions (Workplace) Regulations ١٩٩٧

-٤-

These new regulations came into force on ١st December ١٩٩٧ and have an important message for
those responsible for ownership/management of a property where persons are employed.
Unfortunately there are numerous interpretations placed on the regulations and some places are
exempted because they are already covered by other legislation or already hold a Fire Certificate.١
To understand the detailed application to your own requirements please contact the following:
١) For advice on Fire Detection and Fire Alarm System Requirements, contact Photain Controls plc
٢) For copies of the regulations contact: The Stationary Office Fax:٠١٧١ ٨٧٣ ٨٢٠٠ Tel:٠١٧١ ٨٧٣ ٩٠٩٠

The important points to note are as follows:

١-It is now the LEGAL RESPONSIBILITY of EMPLOYERS, PERSONALLY, TO COMPLY WITH THE LEGISLATION, and it will no longer be the responsibility of others, eg: the Fire Service to proscribe to employers the measures to be taken to minimise risk. The Fire Service will, however, continue to provide advice and guidance relating to Fire Precautions.
٢ The risk assessment requirements of the ١٩٩٢ Health and Safety Regulations are extended to include fire risk. Fire precautions are to be based upon the risk assessment.
٢a Employers must inform their employees of the results of the risk assessment
٣ Employers must provide appropriate means for detecting a fire, raising a fire alarm and for fire fighting. What is considered appropriate will depend upon the size and the nature of the premises, the number of people present and activities undertaken. Current British Standards such as BS٥٨٣٩ Part ١ ١٩٨٨ provide guidance to system design requirements.
٤ Employers must provide emergency routes and exits for use in case of fire. These must be kept clear, be available in an emergency and be provided with emergency lighting if requiring illumination.
٥ Equipment provided to warn of fire, fight fire and to aid escape from fire must be suitably maintained in good working order.
٦ Where fire fighting measures are necessary, employees must be adequately trained and equipped.
٧ If employers fail to meet their obligations, the Fire Service has the responsibility for enforcement by means of a series of procedures dependant upon the seriousness of the situation.

Consultation

It is always advisable to consult the Local Fire Prevention Officer at an early stage, regarding the

legislation covering a particular premises. The Fire Officer will interpret the Fire Precautions Act
or any other act covering a particular premises and advise on the particular type of Fire Alarm
System that may be required.
It must be remembered that the Fire Prevention Officer is concerned with LIFE, his concern for
property is secondary.
We would advise that you only consult with a Fire Prevention Officer with the client=s consent.
When designing a Fire Alarm System, it is important to consult with all other interested parties,
for example:
The Local Fire Authority
The System Installer
The Health and Safety Officer
Any Consultant or Architect
The Insurance Company
During early discussions it is important to establish the purpose of the Fire Alarm System, ie:
A) To enhance the safety of the occupants
B) To minimise damage to the property
Whilst Insurance Companies give good discounts to clients who fit sprinkler systems the fitting
of complex Fire Detection Systems seldom lead to a reduction in premiums sufficient to encourage a client to fit a Fire Alarm System for property protection. The vast bulk of Fire
Alarm Systems fitted are normally for the protection of Life.

Types of Fire Alarm Systems

All Fire Alarm Systems essentially operate on the same principle. If a detector detects smoke or
heat, or someone operates a break glass unit, then alarm sounders operate to warn others in the
building that there may be a fire and to evacuate. For the system protecting property, it is additionally likely that the Fire Alarm will incorporate remote signalling equipment which would
alert the fire brigade via a central station.
Wired Fire Alarm Systems can be broken down into three categories, Conventional, Addressable
and Analogue Addressable.

Conventional Fire Alarm System

In a Conventional Fire Alarm System, a number of call points or a number of call points and
detectors are wired to the Fire Alarm Control Panel in Zones. A Zone is a circuit and typically

one would wire a circuit per floor or fire compartment. The Fire Alarm Control Panel would
have a number of Zone Lamps. The reason for having Zones is to give a rough idea as to where a
fire has occurred. The accuracy of knowing where a fire has started is controlled by the number
of Zones a Control Panel has, and consequently, the number of circuits that have been wired
within the building. The Control Panel would then be wired to a minimum of two sounder circuits which could contain bells, electronic sounders or other audible devices. Sounder Circuits and Detection Zones are wired in a star configuration. Each circuit would have an end
of line device which is used for monitoring purposes.
Photain Controls currently use ٢٠K resistors for use on the end of all sounder circuits and HRMODULES for use on the end of the Detection Circuits for all of their Conventional Control
Panels except the PCS٨٠٠HR Panel and PCS١٢٠٠HR range which uses a ٤K٧ resistor.

Removal of Detectors while maintaining the Break Glass Operation

BS٥٩٣٩ part ١ ١٩٨٨ (٦.٦.٢) - amendment ٦٣١٧ January ١٩٩١, requires that :
*AWhere Detectors are designed to be removed from the circuit, removal of any detector from the
circuit should not affect the operation of any manual call point.@*
On Conventional Fire Alarm Systems one of the following three methods of wiring could be
used to meet the Head Removal requirements:
TYPE ١ All Manual Call Points could be wired to one Zone or Zones and all Smoke or Heat Detectors could be wired to a separate Zone or Zones
TYPE ٢ All Manual Call Points and Smoke Detectors could be wired to the same Zone providing all manual Call Points are wired in front of all the automatic detectors.٢
TYPE ٣ An active end of line module (HRMODULE) could be wired to the end of the Zone/s in place of the normal end of line unit. This would allow for the wiring of Call Points and Automatic Detectors in any combination on a circuit zone. If any Detector head is removed from its base then all call points will continue to be operative
It should be noted that with Addressable and Analogue Addressable Fire Alarm Systems the
method of wiring to a detector base is different to the method of wiring to a Conventional Base.
In addition the method of operation of Addressable and Analogue Addressable Systems means
that the requirements of the amendment ٦٣١٧ (as detailed on the previous page) are always
complied with, irrespective of the sequence in which the devices are connected.
REF: &MARKET٠١٨

Addressable Systems

The detection principle of an Addressable System is similar to a Conventional System except

that the Control Panel can determine exactly which detector or call point has initiated the alarm.
The detection circuit is wired as a loop and up to ٩٩ devices may be connected to each loop. The
detectors are essentially Conventional Detectors, with an address built in. The address in each
detector, is set by dil switches and the Control Panel is programmed to display the information
required when that particular detector is operated. Additional Field Devices are available which
may be wired to the loop for detection only ie: it is possible to detect a normally open contact
closing such as sprinkler flow switch, or a normally closed contact opening.
Sounders are wired in a minimum of two sounder circuits exactly as a Conventional System.
Loop Isolation Modules are available for fitting on to the detection loop/loops such that the loop
is Asectioned@ in order to ensure that a short circuit, or one fault will only cause the loss of a
minimal part of the system.٣

Analogue Fire Alarm Systems

Analogue Fire Alarm Systems are often known as Intelligent Fire Alarm Systems.
There are several different types of Analogue Systems available which are determined by the
type of protocol which they use. The bulk of Analogue Detectors available are Afairly stupid@
as the Detectors can only give output signals representing the value of sensed phenomena. It is
left up to the Control Unit to decide whether there is a fire, fault, pre alarm or whatever. With
the Photain True Intelligent Analogue System each detector effectively incorporates it=s own
computer which evaluates the environment around it, and communicates to the Control Panel
whether there is a fire, fault or the detector head needs cleaning.
Essentially however, Analogue Systems are far more complex and incorporate far more facilities
than Conventional or Addressable Systems. Their primary purpose is to help prevent the occurrence of false alarms.
With the Photain Analogue Addressable System up to ١٢٧ input devices ie: Smoke Detectors,
Call Points, Heat Detectors, Contact Monitors and other interface devices may be wired to each
detection loop. In addition to the ١٢٧ Input Devices, up to ٣٢ Output Devices such as Loop
Sounders, Relay Modules and Sounder Modules may also be connected.

Photain Analogue Systems are available in ٢,٤ and ٨ loop versions which means large premises
can be monitored from one single panel. Isolator units should be connected between Asections@
of detectors as described for Addressable Systems.

ife or Property

BS٥٨٣٩ Part ١, classifies systems and divides them into six different types:
L١ Intended for life safety and covering the whole building
L٢ Intended for life safety and covering escape routes and other areas of high risk
L٣ Protecting only the escape routes
P١ Intended for property protection and covering the entire building
P٢ Intended for property protection covering any potentially high risk areas
M Intended for giving the alarm in response to operation of a manual call point and having no means of automatic detection

System Design

Before staring the design you will need to ensure that certain information is available. This may
be given in the specification or it may have to be obtained by consultation. As well as the purchaser, there may be a requirement to consult with other interested parties. The most important of which will probably be the Fire Prevention Officer of the local Fire Brigade. The information which should be available includes:
A The type of system required ie: L١, L٢, L٣ etc and where appropriate, parts of the premises to be covered.
B The action to be taken in the event of fire
C Whether other occupants of a multi occupancy building will be affected
D Whether other work is to be done at the same time. If so then consultation with other contractors may be required.
E A Method of calling the Fire Brigade
F Whether the type of occupants or activity in the building will require a greater provision of Manual Call Points than normal
G A likely attendance time of the Fire Brigade

Coverage L١ Systems

In an L١ System, all areas of the building should be covered. It is normal not to cover the following areas:
_ Lavatories and Water Closets unless they contain electric hand dryers
_ Voids less than ٨٠٠mm in height

Coverage L٢ Systems

Coverage of L٢ systems depends on the vulnerability of the likely occupants and the probability
of ignition of fires, ie:
_ Sleeping Areas without supervision
_ Areas having a high probability of ignition ie: day accommodation, store rooms, kitchens and plant rooms
_ Where occupants are especially vulnerable due to illness, age or are unfamiliar with the building. It should be noted that L٢ systems always include L٣ coverage.

Coverage L٣ Systems
In L٣ systems, coverage should be provided for escape routes and any areas in which the occurrence of a fire would directly threaten escape routes. The following areas should therefore
be covered:
_ Corridors, passages and circulation areas
_ Stairwells
_ The top of vertical risers
_ At each level within ١.٥m of an access point to a lift shaft or other vertical riser
_ In all rooms opening onto an escape route

Coverage P١ Systems
In a P١ system all areas of the building should be covered with the exception of:
_ Lavatories and Water Closets
_ Voids less than ٨٠٠mm in height and such that extensive spread of fire or fire products cannot take place in them prior to detection by detectors outside the void

Coverage P٢ Systems
P٢ systems give coverage of only part of the building. The areas covered would normally have a
high fire risk and unprotected areas should be separated by fire resisting construction.
Both P١ and P٢ systems would invariably be connected to the Fire Brigade via a central station.
It would be on an extremely irregular basis that you would ever be requested to fit a P type of
system.

Manual only Systems
An AM@ system provides for Manual only alarm and systems intended for multi occupancy
buildings are given the suffix AX@.

The Survey
If you are surveying a building we would suggest you start at the top of the building and work
down. Two basic reasons for this are as follows:
A If you are as athletic as the writer of this guide then you can ride the elevator to the top floor and the rest of the survey is downhill!
B If you start at the top of the building then you can be sure to check the top of each stairwell. This will need a detector (except a Manual only System) even on an L٣ System. As you work your way down the building you can then check how often detectors are required vertically down the stairwell. On Type L Systems, BS٥٨٣٩ states that this shall be at vertical intervals not exceeding ١٠.٥ metres which normally works out to be every third floor. On Type P Systems, there should be detectors on every main landing.

The Design
If you are designing onto a set of drawings then we would recommend that you adopt the following procedure.
١ Identify and plan out where all break glass points are required.
٢ Note where all the Sounders are required. Indicate where the Control Panel will be. You

now have an >M= System.
٣ Consider fitting door holders/closers onto doors which might otherwise get propped open.
Doors leading onto stairwells should not be fitted with Door Holders. There was an old GLC regulation which requires a Smoke Detector to be fitted within ٢m either side of the door or pair of doors fitted with a Door Holder/s - Closer/s and many authorities ie: West Sussex still require this.
٤ Mark down where all detectors are required in escape routes, top of stairs, landings, ceilings at vertical intervals not exceeding ١٠.٥m, top of vertical risers, within ١.٥m of access to lift shafts and within rooms opening onto escape routes.
٥ You should now effectively have the design of an L٣ System and can now go on to add detectors to bring the system up to L٢ or L١ as required.
٦ Indicate the number of Zones that will be required.

Siting of Manual Call Points

A Break Glass Call Point is a device which enables personnel to raise the alarm by breaking the
frangible element on the facia. They should be mounted ١.٤m from the floor and sited where they
can be easily seen.
Manual Call Points should be sited on the floor landings٤ of stairways and at exits to open air. It
should be noted that many Fire Officers prefer Call Points to be fitted on the floor side of an
access door to a staircase so the floor of origin is indicated at the Control Panel. Where necessary, extra points should be sited٥ so that the greatest travel distance from any point in the
building to the nearest call point does not exceed ٣٠m. A greater number of Call Points may be
needed in high risk areas or if the occupants are likely to be slow in movement.

Siting of Sounders

An Alarm Sounder may be a bell or electronic sounder and it must be audible throughout the
building.
A minimum sound level of either ٦٥db(A) or ٥db(A) above any background noise likely to persist
for longer than ٣٠ seconds, which ever is the greater, should be produced by the sounders at any
point in the building. It is unlikely that more than ٦٥DB will be available if the sound has to
carry through more than one door.
If the alarm system is used in premises such as hotels, boarding houses etc where the alarm is
intended to wake sleeping persons then the sound level at the bedhead should be at least ٧٥db(A)
with all doors closed. We would strongly recommend that you allow one sounder per bedroom.

A few bells sprinkled down the corridor in hotel will not produce ٧٥db(A) at all the bedheads.
It is important to note that the above audibility levels must be produced with all doors shut, after the works on site have been completed. If a Fire Officer even expects that there is a lack of audible sounders, then he is sure to check each area with a db metre and prove it. It can be costly and very inconvenient to have to return to site and fit additional sounders.
A minimum of two sounder circuits should be wired and a larger number of quieter sounders are preferable to a small number of very loud sounders.
At least one sounder should be installed in each fire compartment and all sounders throughout an installation must produce a similar sound, ie: you cannot mix an electronic sounder and bells.

Choice of Detectors

Smoke Detectors will generally detect a fire far sooner than heat detectors. It is therefore preferable to fit Smoke Detectors unless there is any possibility of false or unwanted alarms. It is not advisable for example to fit a Smoke Detector in a kitchen as anybody burning toast would cause an unwanted alarm. Heat Detectors should be fitted in boiler rooms, generator rooms, garages and dusty areas. The products of combustion produced by a boiler, a leaky exhaust on a generator or exhaust fumes from a vehicle could all cause a smoke detector to operate and produce an unwanted alarm.
Fixed Temperature Heat Detectors should be installed in areas where one would normally expect a sudden rise in temperature for instance kitchens and boiler rooms.
Rate of Rise Heat Detectors should be installed where Smoke Detectors would be unsuitable but one would not expect a sudden rise in temperature for instance, garages, car parks, dusty workshops etc.
There are two basic types of Point Smoke Detectors:
١ Ionisation chamber Smoke Detectors which are very sensitive to smoke with small particles ie: fresh cellulosic smoke and the source of almost invisible smoke one gets with burning paper and spirit. They are relatively insensitive to smoke with large particles for example, smoke produced by burning plastics or stale smoke.
٢ Optical Smoke Detectors are sensitive to optically dense smoke ie: smoke with large particles and they are relatively insensitive to optically thin smoke.
Some countries ie: Italy, Japan, Qatar only use Optical Smoke Detectors and within parts of the

Middle and Far East, only Ionisation Detectors are used. Within the UK systems can comprise of a mixture of the two. The demise of most people is caused by thick dense choking smoke which is normally a greater problem than getting burnt. For this reason Optical Detectors are normally used on escape routes such as corridors and stairwells. Ionisation Smoke Detectors are normally fitted within office and other general areas.

Siting of Detectors

In a building the greatest concentration of Smoke and Heat will generally collect at the highest parts of the enclosed areas and it is here therefore, that the detectors should normally be sited.

Smoke Detectors

Smoke Detectors should be sited so that the sensing element is not less than ٢٥mm, nor more than ٦٠٠mm below the ceiling or roof. If a protected space has a pitched or northern light roof, then Smoke Detectors should be installed in each apex.

The maximum horizontal distance between any point in the area being protected and the nearest detector should be as follows:

Under flat horizontal ceilings and corridors more than ٥m wide, then the maximum distance for Point Type Smoke Detectors should not exceed ٧.٥m. The maximum area of coverage of a Point Smoke Detector is ١٠٠ square metres. On the rear of all Photain Smoke Detector Data Sheets, a diagram showing the relevant coverage they provide is shown.

In corridors the number of detectors required depends on the corridor width. When installing Smoke Detectors the following data can be used:

Corridor Width (m)	**Allowable Radius of Cover (m)**	**Maximum Spacing between Detectors (m)**
١.٢	٩.٤	١٨.٧٦
١.٦	٩.٢	١٨.٣٣
٢.٠	٩.٠	١٧.٨٩
٢.٤	٨.٨	١٧.٤٤
٢.٨	٨.٦	١٦.٩٧
٣.٢	٨.٤	١٦.٤٩
٣.٦	٨.٢	١٦.٠٠
٤.٠	٨.٠	١٥.٤٩

٤.٤ ٧.٨ ١٤.٩٧
٤.٨ ٧.٦ ١٤.٤٢
٥.٠ or more ٧.٥
The maximum height that smoke detectors should be installed at is as follows:
Point Smoke Detectors ١٠.٥m
Optical Beam Smoke Detectors ٢٥m
REF: &MARKET٠١٨
If detectors are to be fitted in the apex of a pitched or north light roof then a row of detectors
should be sited within the apex. One row of detectors should be sited at the highest point a
minimum distance of ٠.٥m from the vertical wall. Add to the maximum horizontal distance ١%
for each degree of the slope up to a maximum of ٢٥%. For instance a point type detector at the
apex of a ٢٠ degree slope would work out as follows: ٢٠% of ٧.٥m = ١.٥m. Therefore the
maximum distance between detectors = ٧.٥ + ١.٥ = ٩m. The maximum area of coverage may
also be increased proportionally.
Where the passage of Smoke or Hot Gases from a position to a detector is likely to be disturbed
by a ceiling obstruction such as a beam having a depth greater than ١٥٠mm but less than ١٠% of
the height of the ceiling, then the horizontal distance should be decreased by twice the depth of
the obstruction. For instance for a Point Type Smoke Detector obstructed by a ٢٠٠mm depth
beam then the maximum distance between detectors = ٠.٢m x ٢ = ٠.٤m.
٧.٥m - ٠.٤m = ٧.١m.
Where a ceiling obstruction, such as a beam is greater than ١٠% of the height of the ceiling then
the area either side of the obstruction should be considered as separate rooms.
Ceiling beams less then ١٥٠mm in depth can be ignored.
Optical beam smoke detectors are useful for covering large unobstructed roof areas such as those
found in most warehouses. They can be quite cost effective as one smoke beam can provide the
coverage of many individual point detectors. A smoke beam typically comprises of a Projector, a
Receiver, a Remote Manual Reset Unit and a Local Power Supply with battery standby. Optical
Beam Smoke Detectors should be mounted as follows: (m = Metres)
 The minimum height above floor level = ٢.٧m
 Maximum height above floor level = ٢٥m
 Minimum Optical Beam length = ١٠m
 Maximum Optical Beam length = ١٠٠m

 Minimum distance of Optical Beam = ٠.٣m
From a flat ceiling or apex
 Maximum horizontal distance between Optical = ١٤m
Beams measured at right angles to a Beam
 The Maximum horizontal distance between = ٧m
Optical Beam and an adjacent wall or partition

Heat Detectors

Heat Detectors should be sited so that the heat sensitive element is not less than ٢٥mm, nor more than ١٥٠mm below the ceiling or the roof.
The maximum horizontal distance between any point in the area being protected and the nearest detector should be as follows:
Under flat horizontal ceilings and corridors more than ٥m wide then the maximum distance between any heat detector and any wall or partition should be ٥.٣m.
The maximum area of coverage per heat detector is ٥٠ square metres.
On the rear of all Photain Heat Detector Data Sheets, a diagram showing the relevant coverage they provide is shown.
There is also information regarding detector coverage in corridors using Heat Detectors. As Heat Detectors are very seldom used in corridors then please consult British Standard BS٥٨٣٩ Part ١, should you require this information.
The maximum height that Heat Detectors should be installed at are as follows:
Grade ١ Heat Detector ٩m
Grade ٢ Heat Detector ٧.٥m
Grade ٣ Heat Detector ٦m
High Temperature Heat Detectors ٦m

Control Equipment

The Fire Alarm Control Equipment should normally be sited in an area as follows:
Preferably in an area of low fire risk and on the ground floor by the entrance used by the Fire Brigade and preferably viewable from outside of the building. It should be located in an area common to all building users and where automatic detection is in use, the Control Panel should be in a protected area. An alarm sounder should be sited next to the Control Unit, but not too near the telephone position.
A suitable zone chart of the building should normally be installed adjacent to the Control Panel.

Power Supplies

Two power supplies are required ie: mains and battery and these are normally built into the Fire

Alarm Control Panel. Standby batteries must allow the system to operate without mains for ٢٤ hours longer than the building is likely to be unoccupied and then support the sounders for an additional half hour. If the mains supply is supported by an emergency generator then six hours standby plus half an hour alarm load is sufficient. All modern Fire Alarm Systems are ٢٤ volts.
On the medium and larger sized Fire Alarm Systems, the standby batteries will often not fit within the Control Panel. Where standby batteries are contained within a separate housing, then this housing must be as close as possible to the main Fire Alarm Control Panel. If the power supply or battery housing is located more than ١٠ metres from the main Fire Alarm Control Panel then serious volt drop problems can arise. Standby batteries are invariably of the sealed lead acid variety. Use of nickel Cadmium Batteries is not cost effective and automotive batteries must not

Fire Compartments

Buildings are normally split into fire compartments with each compartment so constructed as to prevent the spread of fire from one compartment to another.
Each floor and each stairwell within a building is normally a separate fire compartment. Within a small factory, the factory unit will normally be separated from the offices by >firewalls= to prevent the spread of smoke and fire from one to the other. The factory and offices will therefore be in separate fire compartments. A zone should normally only cover a single fire compartment.

Zoning

If the total floor area (ie: the total of the floor areas of each floor of the building) is not greater than ٣٠٠ square metres then the building need only be one zone, no matter how many floors it has.
In general, if the total floor area is greater than ٣٠٠ square metres, then each floor should be a separate zone (or set of zones, if the floor is big enough).
There are two exceptions:
A If the building is sub divided into fire compartments, then any compartment communicating with other compartments only at the lowest level of the building can be treated as if it were a separate building ie: if a floor area is not greater than ٣٠٠ square metres then it can all be one zone, irrespective of the number of storeys.

B Where stairwells or similar structures extend beyond one floor, but are in one fire compartment, the stairwell should be a separate zone.
There are two restrictions on the maximum size of a zone, irrespective of the size of the building
A Its total Floor area should not exceed ٢٠٠٠ square metres
B The search distance should not exceed ٣٠ metres. This means that a searcher entering the
zone by the normal route should not have to travel more than ٣٠ metres after entering the zone in order to see a fire big enough to operate a detector, even if the fire is only visible from the extreme end of his search path. Remote indicators show an alarm in a closed area and their fitting can enable larger areas to comply to the search distance requirements.
There are two restrictions on the configuration of a zone, irrespective of its size.
A If the zone covers more than one fire compartment, then the zone boundaries should follow compartment boundaries
B If the building is spilt into several occupancies, then each occupancy should lie within a
separate zone (or set of zones), no zone should be split between two occupancies
For the zoning of special risks or complex areas please consult BS٥٨٣٩ Part ١

Recommended Cable Types

All cables used in Fire Alarms must have a minimum conductor size of ١.٠mm squared.
BS٥٨٣٩ Part ١, recommends ١١ types of cable which may be used on a Fire Alarm System where
prolonged operation in a fire is not required. Therefore ١.٠mm twin and earth cable for instance,
may be used on detection circuits of Conventional Fire Alarm Systems and the detection loops of
Addressable and Analogue Systems providing sounders are not connected to them.
Only two types of cable may be used on Fire Alarm Circuits where prolonged operation in a fire is
required.
١ Mineral - insulated copper - sheath cables (MICC) complying with BS٦٢٠٧
AND
٢ Cables complying with BS٦٣٨٧, and meeting at least the requirements of categories AWX
or SWX
In other words, on sounder circuits and for wiring between a power supply and or battery housing
and the main fire alarm control panel you must use one of the following types of cable.
MICC, Flamsil, Firetuff or similar
On Addressable and Analogue Addressable Fire Alarm Systems we would recommend the use of
a screened cable such as BICC Flamsil or Firetuff or MICC for all wiring so as to minimise the
possibility of interference being picked up by or being transmitted by the data loops.

In the larger buildings within the London area (old section ٢٠ buildings) only bare MICC cable is
often specified.
In summary therefore MICC cable used for all your fire alarm wiring would be acceptable
anywhere. However, ordinary twin and earth ١.٠mm cable may be used on detection circuits of
Conventional Systems in certain circumstances.
As far as possible, joints should be avoided except where a joint is inside one of the systems
components ie: Control Panel, detector, Call Point, Sounder etc. Where joints are required
elsewhere they should be enclosed in a suitable junction box marked fire alarm to ensure that the
fire alarm systems is not accidentally interfered with.
Fire Alarm Cables, should always be segregated from cables for other systems. The segregation
of MICC cables with a plastic sheath is of course not so critical as the segregation of ordinary
twin and earth cable.
Installation of cables should be in accordance with good practices recommended in the latest
edition of the IEE wiring regulations
Connection to the mains supply should be via an isolating switch fuse reserved solely for the
purpose. Its cover must be painted red and labelled AFire Alarm - do not switch off@.
Conductor size should take voltage drop into account. In any case conductors should have a cross
sectional area of not less than ١ square millimetre.
Where possible cables should be routed through areas of low fire risk. Cables installed in damp,
corrosive or underground locations should be PVC sheathed and where there is a risk of
mechanical damage should be protected accordingly. If Cables are installed less than ٢.٢٥m
above the floor should they normally be protected.

Volt Drop in Cables

Unless a detection circuit or detector loop exceeds ١ kilometre in length, it is unlikely to give rise
to a concern about volt drop.
If there are fairly long sounder circuits or a sounder circuit has a large number of Sounders,
Buzzers, Voice Alarms or Flashing Beacons etc on it, then voltage drops can cause problems.
Providing the overall volt drop does not exceed ٤ volts on sounder circuits then the system should
operate satisfactorily.

The calculation of the precise voltage drop at each point in the system is a long and tedious
calculation and way beyond the scope of this guide. However, to get a rough idea as to whether a
system will operate satisfactorily one can use the following calculations.
To start with we need to know approximate volt drop characteristic of different sizes of cable
١.٠mm cable = ٤٢mV per amp per metre
١.٥mm cable = ٢٨mV per amp per metre
٢.٥mm cable = ١٧mV per amp per metre
٤.٠mm cable = ١٠mV per amp per metre
٦.٠mm cable = ٧mV per amp per metre
If one is using ١.٠mm cable:
_ Multiply ٤٢ by the length of the cable in metres
_ Multiply this by the current of all the devices on the length of the cable
_ Divide the entire figure by ١٠٠٠
This gives a rough idea of the voltage drop.
Lets take an example where you have ٣٠ Sounders, each with a current consumption of ٢٠mA on
٢٠٠ metres of ١.٠mm cable.
If you were to wire in ١.٠mm cable then the calculations would look something like this:
٤٢ x ٢٠٠ metres x ٣٠ sounders x ٠.٠٢ amps
١٠٠٠
The answer is ٥.٠٤ volts. This is more than the ٤ volts previously discussed and therefore we
would suggest that ١.٠mm cable would be unsuitable in this instance.
Lets now try the calculation using ٢.٥mm cable. In this instance we have the following:
١٧ x ٢٠٠ metres x ٣٠ sounders x ٠.٠٢amps
١٠٠٠
The answer is ٢.٠٤ volts. A two volt drop is of course acceptable.
Should you be on a budget and be considering using ١.٥mm cable, the answer after making the
calculation would be ٣.٣٦ volts and this is indeed acceptable. However do not disclaim the
possibility that at a later date you may wish to add extra sounders, and therefore you would be
pushing the system to its full limitations by utilising the ١.٥mm cable.
You may encounter examples where even ٢.٥mm cable is not sufficient. Rather than use a larger
cable which would be extremely difficult to terminate in the rear of most sounders, it is usually
better to run additional sounder circuits and spread the load.
Should you be using a remote power supply or battery housing to power the control panel, then
the voltage drop becomes very significant. As well as the consumption of the Control Panel, one

must consider the operating load of the sounders. It is particularly important to keep voltage drop
as low as possible and preferably below ١ volt or power levels will decrease even before you have
commenced consideration regarding the calculation of the volt drop to the sounders from the
control panel.
An example of this now follows.
We have a control panel which consumes ٢٦٠ma and has a number of sounders connected, which
in total use ٣amps in the alarm condition. If you wired between the remote power supply and the
control panel which was only ٢٠ metres away in ١.٠mm cable then the calculation would be as
follows:
٤٢ x ٢٠ metres x ٣.٢٦ amps = ٢.٧ volt drop
١٠٠٠
This would clearly be unacceptable.
Should we be able to locate the remote power supply within ١٠ metres of the control panel and
wire it in ٢.٥mm cable the calculations should look as so:
١٧ x ١٠ metres x ٣.٢٦ amps = just over half a volt
١٠٠٠
The above example should be acceptable. However when calculating the volt drop on your
sounder circuits it would be advisable not to allow any volt drop to exceed ٣.٥ volts.
A word of warning however, the writer of this guide has seen several examples where electricians
have installed cable that is too thin on sounder circuits and consequently the system has
encountered substantial volt drops ie: in excess of ١٢. A way around this has then been sought
and the ٢٤ volt bells have been substituted with ١٢ volt bells. This does not work, as if you lower
the voltage the current increases and so the problem gets worse.

Routine Testing of the System

The system should be regularly tested and serviced and BS٥٨٣٩ Part ١ makes the following
recommendations:
DAILY Check that the panel indicates normal operation. If not record any fault indicated
in the event log and report the fault to a responsible person. Check that any fault
recorded from the previous day has received attention.
WEEKLY Operate a manual call point or smoke detector to ensure the system operates
properly. Each week a different detector or call point should be checked. Check
that the sounders have operated and then reset the system. Check the battery
connection. Any defect should be recorded in the log book and reported. Action
should be taken to correct the defect.

QUARTERLY Check entries in the log book and take any necessary action. Examine the batteries and their connections. Operate a manual call point and smoke detector in each zone to ensure that the system operates properly. Check that all sounders are operating. Check that all functions of the alarm control panel operate by simulating fault conditions. Visually check that structural alterations have not been made that could have an effect on the siting of detectors and other trigger devices. Complete the event log with details of the date, time, trigger device tested and >Quarterly Test= in the event section. Any defects or alterations to the equipment should also be entered

ANNUALLY Carry out an inspection as detailed for this quarterly inspection. Every detector should be tested in site. All cable fitting and equipment should be checked to ensure that they are secure and undamaged.

A qualified engineer should carry out the quarterly and annual inspections and issue a certificate after each annual inspection. It is normal practice for ١/٤ of all detection systems to be cleaned and checked on each quarterly visit so that the entire system has been properly maintained after the fourth visit.

Whilst the end user of the fire alarm system may be expected to carry out the daily and weekly functions very few would be adequately equipped or trained to carry out the quarterly and annual tests.

Photain Controls plc would be please to submit a price for the maintenance of any Fire Alarm System which has been installed using Photain Fire Alarm Equipment.

The intention of this guide is to keep the information given as simple as possible. This necessitates the omission of much information contained within the various British Standards and the requirement of the various fire acts. Photain Controls can therefore not take any responsibility for the way in which any information contained in this guide is used.