A GUIDE TO FIRE DETECTION AND ALARM SYSTEMS

A Fire detection and alarm (FD+a) system is what most workplaces and public accessed buildings have in place. The FD+a system has two primary functions and depending on how it is designed, Protect the life within the building, giving the occupants sufficient warning of an outbreak of fire, so they can evacuate safely and Protect the building and its contents by summoning the Fire Brigade at the earliest opportunity.

Systems designed to protect life are know as Category L.

Systems designed to protect the Building are known as Category P systems.

Some smaller buildings may not have or need an FD+a system, for example a small open plan area where someone shouting “fire” can be heard all around.

The decision on what Category is required for any building is done on the basis of a Fire Risk assessment which identifies hazards, who might be in danger and what would happen as a result of the hazard. This involves consultation with the local Fire authorities, building control, Insurers and consultants.

There are many factors in the decision of the Category required. A building may have sensitive equipment, documents or valuable contents which if damaged or lost by fire would be a severe disruption to that business/building. In this case a P system would be asked for.

The building may have elderly occupants in which case a Category L system would be asked for, to protect the life of everyone in the building.

Another important factor now with the planning of a system is to consider the Disability Discrimination Act (DDA).
This requires for a system to give the same level of warning to a Deaf Person, as it would for a person with normal hearing. It is down the building’s owner to decide if Deaf people will work or stay in his property.

Buildings such as hotels should have visual alarms throughout and tactile alarms (a small vibrating unit that goes under a pillow) in rooms of sleep. This can be very costly to install visual alarms in every area of as building, so a specialist pager system is another option.

The Fd+a systems are based on two technologies and will basically feature automatic fire detectors (AFD) such as a smoke detector and manual call points (MCP) commonly known as a break glass unit. Where a system has no AFD but MCP's only this is known as a category M.

FD+A systems should be installed and maintained in accordance with British Standard 5839 part 1.

Non–Addressable

The basic technology is Non–Addressable which is found more often in smaller buildings due to it being more cost effective. A non-addressable system is simply comprised of Fire zones. These are represented by red l.e.d.s on the control panel. Faults use amber l.e.d.s.

A zone is how a building is split up to speed the location of a fire. For example if a building was not zoned then in the case of a fire, the whole building would have to be searched instead of being directed to the exact zone area by the control panel. This would dramatically slow up the location process and would result in more damage and possibly loss of life.

Each zone is made up of a grouping of AFD and MCP's and in the event of a fire being detected either automatically by AFD of manually by a person discovering a fire and operating the MCP, will cause the control panel to enter fire condition which will then operate the alarm sounders thus alerting the occupants.

The Zone in fire condition would then have to be checked to establish the exact detector that caused the alarm. If an AFD was the cause a red l.e.d would be illuminated on the detector itself.

The zone wiring is in a redial circuit and terminated with an end of line device or resistor which enables the panel to monitor the wiring for short and open circuit

faults.
When a smoke detector enters fire condition it draws much more current than normal which is sensed by the alarm panel and it turn enters fire condition. A MCP is a simple switch between positive and negative which under normal condition is open circuit but when a glass is broke goes closed. A resistor in series with the positive prevents this being a complete short circuit but again causes a surge in power as with the smoke detector.

The panel will typically have two on board alarm sounder circuits which in normal operation send a reversed voltage down each circuit to monitor for faults. The voltage is reversed otherwise the sounders would be on constantly but is changed to normal polarity in a fire condition.

The panel requires a dedicated 240v ac supply and where it is then reduced down through a transformer and then changed to its operating voltage of 24 volts DC via a bridge rectifier.

As the system operates on DC it can now be battery backed up so in the event of a power failure it will continue to provide cover from 24 hours up to 72 depending on it’s Category.

The batteries in the fire panel should be replaced at least every 4 years or when testing dictates.

In this system the physical wiring dictates the zoning and the detector decides if it’s a fire condition or not.

Analogue Addressable:

The second technology is far more advanced and is normally found in the larger premises. This is called Analogue Addressable and will pin point the exact location of a fire through zoning and also the detector in fire having it's own number (address) and text allocated to it.

This system is wired in a loop and unlike the non addressable the zoning is done through programming, so the same cable can pass through the whole building. A typical loop can have up to 126 devices which are constantly tested by the control panel. On this system should a part of the loop wiring become damaged short circuit isolators (SCI) either side of the fault will shut down that particular section of wiring and continue to operate with the reminder of the wiring and devices. Again unlike the non addressable which would loose the zone in fault.

When a detector on the loop senses a fire, information is passed back to the control panel which is then processed and a decision is made by the panel not the detector whether it is a fire or not. Unlike the non addressable system each detector or MCP reports it analogue value back to the control panels front end processor (FEP). The device reports back whether it's in a pre-alarm, alarm or fault state by differing analogue values. Under normal conditions the levels are low but if smoke enters the detector chamber the level will rise until it reaches a predetermined threshold and enters fire condition.

Individual detectors can have their threshold levels altered so for example can be less sensitive during the day and more at night if required. Another advantage it has over non addressable technology is that individual detectors can be isolated instead or an entire zone. This system can dramatically reduce unwanted alarms and unlike non addressable will let the user aware if a detector has become faulty.
In the event of a fire or fault the control panel offers text description of the condition, unlike the non addressable which will only illuminate relevant led's. This make the location of fire and faults much quicker.

The panel operates on the same voltage as the non addressable and also has battery back up.

As with both non addressable and addressable all wiring must be in fire resistant cable.

There is also wire free radio based analogue addressable fire systems which have all the benefits of a hard wire system but with the obvious advantage of no cabling required to all the devices. This is an ideal option for listed buildings such as Churches, where cable runs would look unsightly. There is also no damage to the building or mess from drilling. Installation is far quicker and far less labour intensive but has the drawback of having to replace every battery in each device approximately every 5 years. The equipment is more expensive than hard wired but on the larger installations the reduction in labour costs can be balanced against the cost of hardwired.

Both addressable and non addressable use devices which are designed to detect fires and give audible warning.

These are:

Smoke detectors:

The smoke detector has a few variations such as Optical, ionization, aspirating smoke detector (ASD) and modern combined smoke and heat. Optical is the most widely used and is more suited to detecting a slow burning fire which gives off larger smoke particles. Ionisation which are beginning to be phased out detect a quick burning fire which generates more heat and thinner smoke particles. The Aspirating smoke detector draws air from an area via a network of pipes which have sampling holes. The ASD can detect very small amounts of smoke and has a high sensitivity. The smoke is drawn through the holes in the pipes and back to a central aspirating detector. This is a common choice for areas such as computer suites, telecommunication room's etc where the earliest possible warning of a fire is crucial to protect such sensitive equipment.

The combined detector looks for both heat and smoke, this is seen as a replacement for the ionization detector. Some panels can be programmed to make a combined detector a heat during the day and smoke at night time.

Manual Call Points:

The red box on the wall that everyone is familiar with. In the event of a fire a person would break the glass in the unit which in turn activates the fire alarm. Most commonly found at all exits to the outside of a building.

Heat Detector:

Comes in two variants and are most commonly found in kitchens, boiler rooms or un clean environments. They come as Rate of Rise which detects a rapid increase in temperature or fixed temperature which will only activate after the room temperature exceeds a pre determined temperature set into the detector.

Sounder:

Normally red and alerts occupants audibly to a fire. These can be supplemented by visual alarms (flashing beacons) where areas can be normally noisy i.e. factories or DDA compliance. General sound level required is 65 DBa or 75 DBa in a room of sleep at bed head level. The sounder can also be integrated with a smoke or heat detector making it an ideal option for bedrooms where the owner might not want to see a red sounder on the wall.

Beam Detector:

Normally used in large areas such as warehouses. The beam detector can emit a beam reaching up to 100m in length from one end of a building to the other and can cover 1500m2 with a single unit. The beam is optical and when obscured by smoke (obscuration) will activate the fire alarm.
A wall mounted transmitter can be mounted up to 25m high (or 40m in P systems with Fire Brigade response time is within 5 minutes). This emits a beam to another wall mounted receiver at the other end of the building or a reflective plate which bounces the beam back to the other unit.

All fire systems must be regularly tested and maintenance is essential as it will prolong the life of a system and discover any faults that may occur. A system that is not maintained cannot be guaranteed to protect life and property