System understanding document

Fire alarm panels

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Document created by : Kamaksh G , Mediashala

mediashala

National Design Business Incubator, National Institute of Design ,
Paldi, Ahmedabad, 380007, info@mediashala.com

Scope of the document

This document covers our understanding from the training we underwent during Nov 5 to 28, 2012 with Honeywell Life safety team. It includes overview of fire alarm systems, their architecture, processes and functions. We have kept EN – 54 standards in mind while explaining the document. The examples and graphics shown in the document do not follow any particular fire panel brand. Please consider these illustrations as a part of any general fire panel brand.

- Team Mediashala

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Fire Alarm system

Fire Alarm System

“An automatic fire alarm system is designed to detect the unwanted presence of fire by monitoring environmental changes associated with combustion. In general, a fire alarm system is classified as either automatically actuated, manually actuated, or both. Automatic fire alarm systems are intended to notify the building occupants to evacuate in the event of a fire or other emergency, report the event to an off-premises location in order to summon emergency services, and to prepare the structure and associated systems to control the spread of fire and smoke.” – Wikipedia.

Three main purposes of fire alarm system

Detect
Detect a fire caused by heat, smoke etc.

Alert
Send alerts about fire with its locations to help people take security and safety measures.

Evacuate
Help people evacuate safely and save lives.

There are 2 types of fire alarm panels:

1. Conventional:
These are old fashioned panels with single ended loops. With conventional system, it’s not possible to identify the location of the device which detected fire.

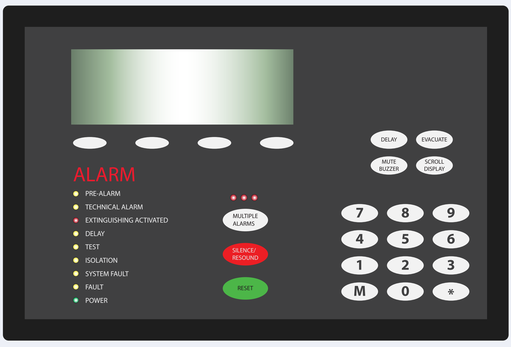
2. Addressable:
These panels have double ended loops. With addressable panels, you can know the exact location of fire. Also, if one device has a fault, it doesn’t affect other devices in the loop.

More about fire alarm panels will be explained in other parts of the document.

Components of fire alarm system

There are 3 main components of a fire alarm system:

1. C.I.E (Control and Indication Equipment)
This is the main part of the fire alarm system. All alarms and events are reported on this panel. This can also communicate with fire alarm devices and control their outputs. It can also communicate with safety and security equipments which are not part of this system. e.g., evacuation systems, fire routing equipment, access systems etc.



2. Power supply
The fire alarm panel runs on 2 types of power supply units, 1. Main power (through DC) 2. Secondary power (through battery back up). If the main power fails due to a fire, it will take power from the battery.

240 v DC
Main power

Battery
Secondary power

3. Input/Output
This includes all devices that can detect fire, alert, and help control the fire.

Input devices

Heat detectors
Smoke detectors
Optical detectors
Ionization detectors

Manual call point

ⓘ In addition to these, there are other types of detectors also available. In most of the cases, customers use only heat and smoke detectors.

ⓘ In some sites, multi-sensors are also used. These devices are combination of more than one detectors.

Output devices

Strobes/Flashers

Sounders

Speakers

Evacuation systems

Routing equipments

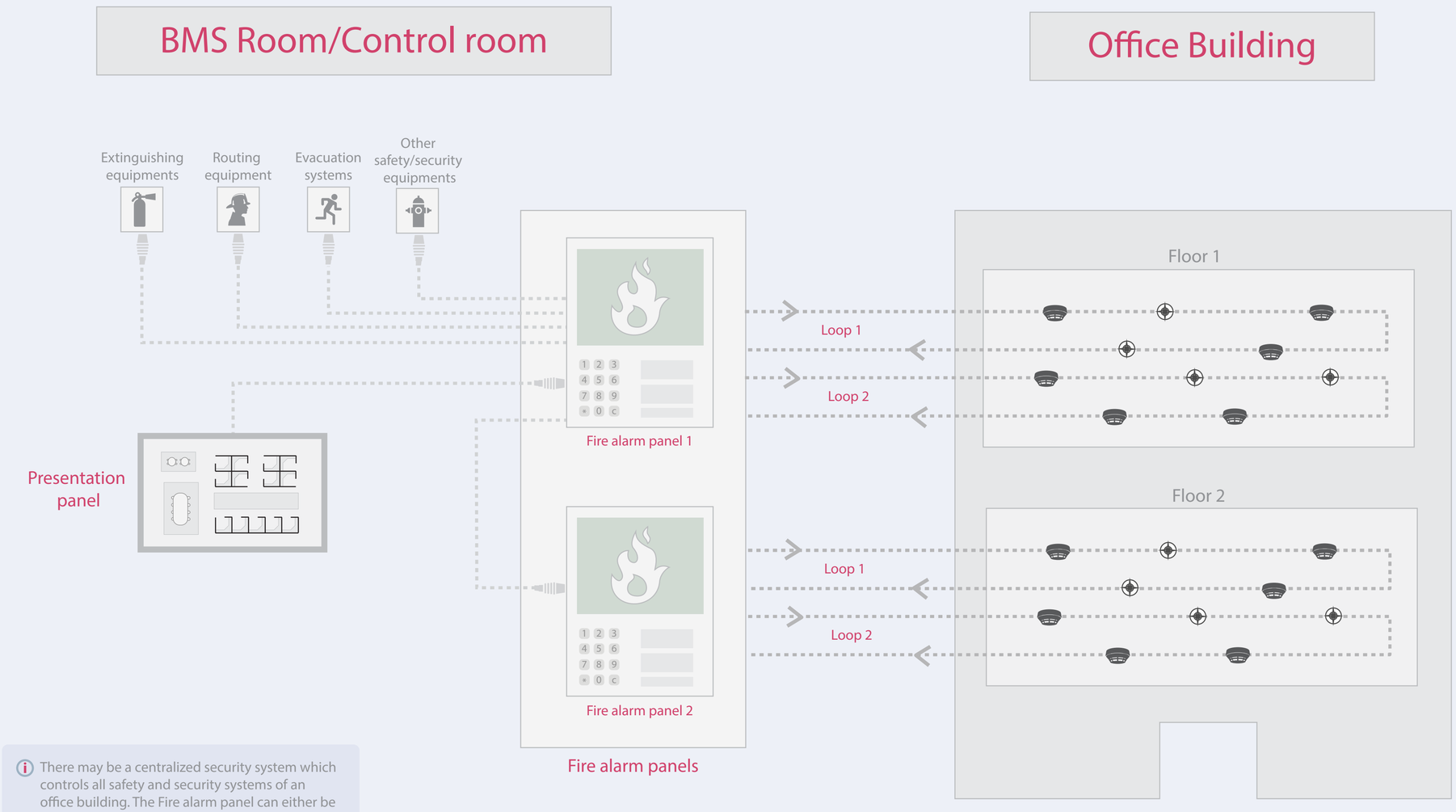
Extinguishing equipments

Other safety and security equipments

Input/Output devices

ⓘ Nowadays, some customers also use devices which are input & output enabled. These kind of devices will have more than one sensors and also outputs like flashers and sounders.

Level 1: Understanding how a fire alarm panel is connected to other systems in control room and how fire alarm devices are connected to it.

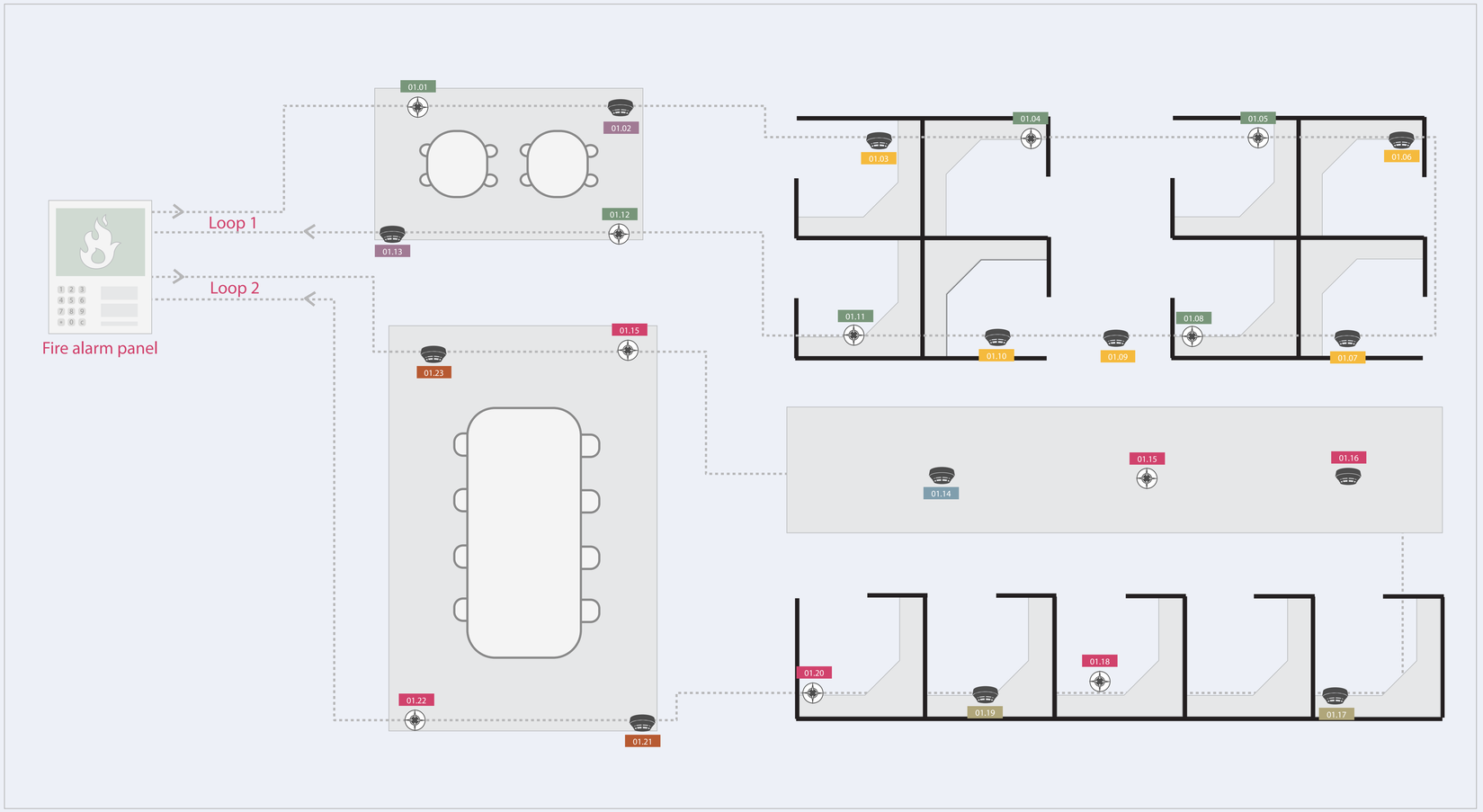


- There may be a centralized security system which controls all safety and security systems of an office building. The Fire alarm panel can either be a part of this system or can be a standalone one.
- The fire alarm panel would also be able to control other equipments in the control room.
- The presentation panel will have a floor plan which will indicate where the fire is.
  It can also control the panel.

- There can be more than one fire alarm panels in an office building. These panel can be connected to each other in a network, and sometimes can also follow the master/slave concept.

- The fire alarm panel can have more than one loops in which several devices can be connected. These devices can be Detectors, Controllers or both. The limit of loops and devices can vary for different brands of panels.

A building floor



In this office floor, there are total 23 devices in 2 loops. The labels are logical addresses for these devices. The label above a device means it's an output device. The label below it means that's an input device. Some panels do not allow in put and output devices in one zone. In that case, one device will have multiple addresses.

Addressing example: the first 2 digit in the addressing mean the loop number, and the last 2 digits indicate the device number.

Below is the zone classification for all devices. Depending up on the panel brand, it will allow or not allow naming of zones. In that case the zone will be given a number. While some brands might also allow further logical classification for better organization. e.g., groups, sectors etc.

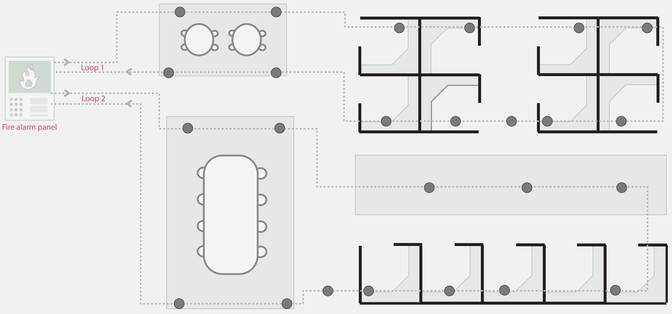
Applying zone address is very crucial. Because, the end user will address the fire by looking at the zone name/address.

Logical addressing

Color	Zone address	Zone name
	01	Output 1
	02	Zone name
	03	Management
	04	Output 2
	05	Corridor
	06	Call center
	07	Conference

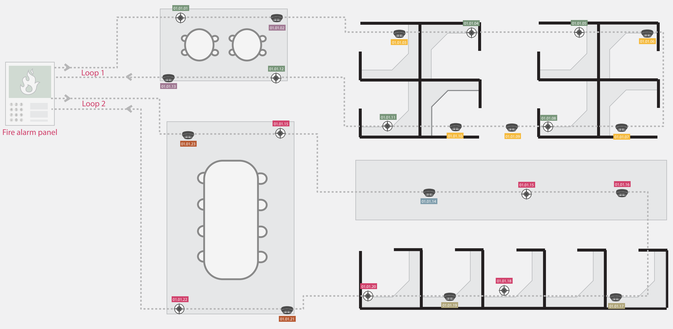
1. Hard wiring/looping

Hard wires are laid in loops and they are conduted. The no. of loops are depended upon the requirement and panel capacity.



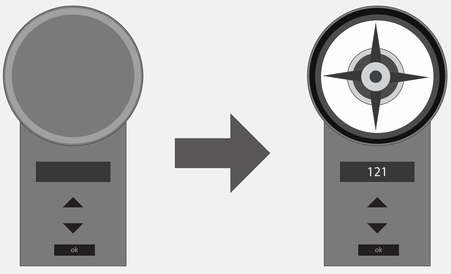
3. Installing devices

After giving addresses to devices, they are installed in the loops. Read more about 'addressing' in Level 2.



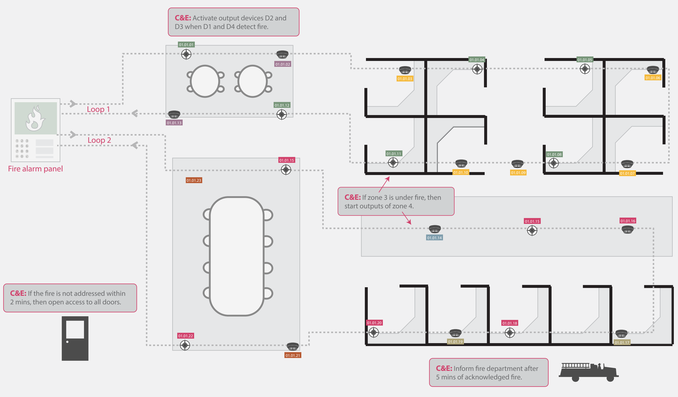
2. Addressing

Devices are given addresses through a hand-held device. This pattern is followed by Eltek systems. In other fire panel systems, the addressing is done either through auto learn or through configuration tool.

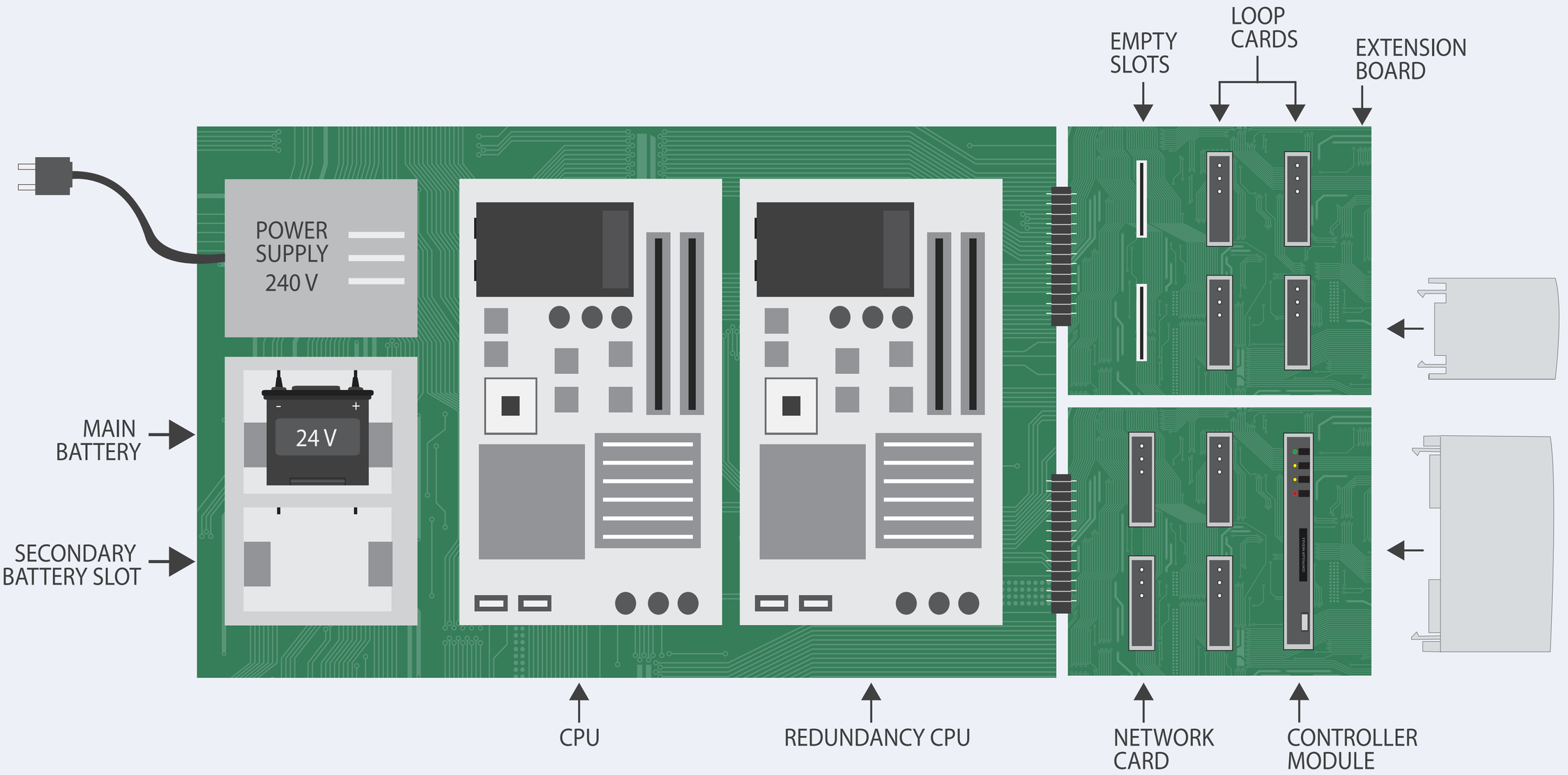


4. Programming

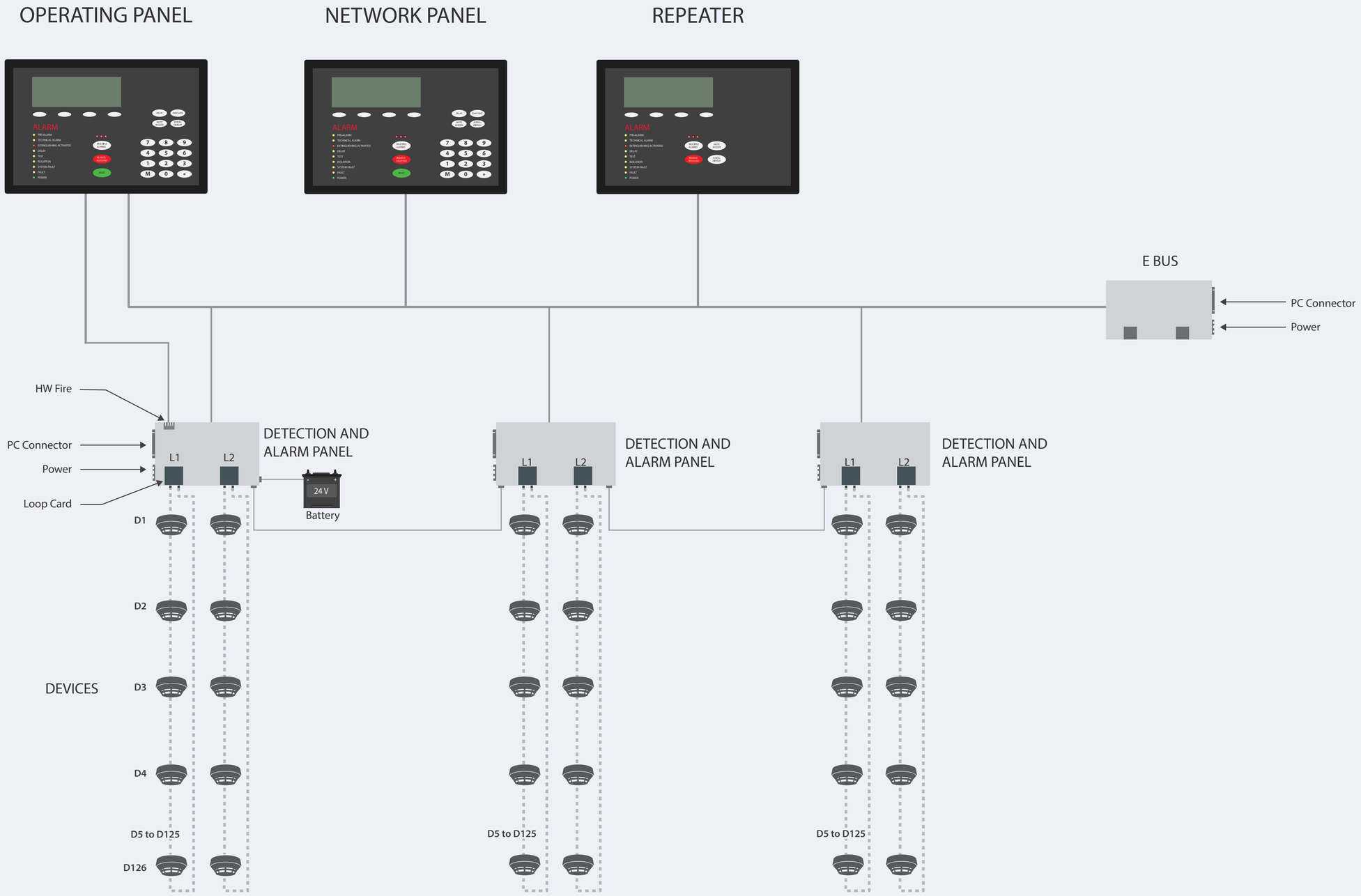
At programming stage, all logics are written. It includes cause & effects, delays, informing fire department and activating evacuation etc. Here are some use cases:



Inside the fire alarm panel

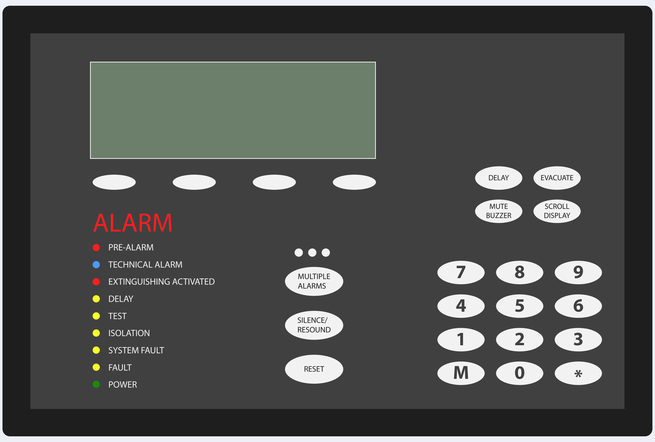


Some fire panels like Flexes will have this kind of architecture. While in Eltek Systems, all components will be separate. Units like DA, Battery will be connected to an operating panel. Read more about such topology in Part 2 of Level 4.



ⓘ In Eltek fire alarm panels, the operating panel is separate from DA in a network topology. In this topology, up to 160 units can be connected, and up to 225 loops are allowed. 1 DA supports 2 loops and each loop can support up to 126 fire alarm devices.

ⓘ The network topology shown here might be complete. It includes important units to make fire alarm system. This is just to explain how Eltek fire alarm panel and it's devices are connected in a network.



Example of a Fire Alarm Panel

ⓘ The C.I.E (Control and indicating equipment) has to follow Standards for Fire Detection and Fire Alarm Systems, depending upon the market/region. Fire panels like Flexes and Eltek follow European Standards, EN-54. The C.I.E. for these panels has to follow Part 2 of EN-54.

Indications

Indications of events on the c.i.e. and alpha numeric display (screen).

ⓘ The examples of indications shown here do not follow and particular panel.

Power supply

A visible indication shall be given by means of a separate light emitting indicator while the c.i.e. is supplied with power.

Power

C.I.E. indication

Fire Alarm condition

Fire alarm indications are Red in color are given 1st priority. It appears without prior manual intervention. The indication of fire is displayed by a separate LED, indication of zones in alarm and an audible indication. These indications are required in all access Levels.

ALARM

C.I.E. indication

Audible indication

Fire

```
First zone in Alarm - 02  12:30 12/12
Latest zone in alarm - 03 12:35 12/12
No. of zones in alarm - 2
```

Output of Fire Alarm

At least one output which signals the fire alarm condition shall be provided. Unless delay and/or co-incidence detection apply, the c.i.e shall action all mandatory outputs within 3 s of the indication of a fire alarm condition.

Unless delay apply, the c.i.e. shall action all mandatory outputs within 10 s of the activation of any manual call point.

Pre-alarm

Pre-alarm is a condition when a detector senses a potential fire. This alarm is to take possible decisions to prevent fire. It is given second priority if the Fire alarm is indicated.

Pre-alarm

C.I.E. indication

Delay

The indication for delay shows whether there's a delay configured. The delay can be configured for output devices like fire alarm routing equipment.

Delay

Fault

The fault indication is used to indicate faults in the fire alarm system. A fault can be indicated without prior manual intervention. It's 4th in the priority list.

Fault

C.I.E. indication

System fault

C.I.E. indication

Audible indication

```
Device not found. Connection lost.
2nd floor, zone 4,
Device no.23
12:55 3/12
```

Display screen indication

Fault output

The c.i.e. should also have provision to inform Fault warning routing equipment in order to send fault indication, so necessary measures can be taken.

ⓘ Some fire panels will also indicate specific faults. e.g. Battery fault, Earth fault etc. At least one indication is mandatory by the standards.

Disablement

This indication is shown when any output device or equipment is disabled. e.g., flashers, fire routing equipments etc. This indication is given 5th priority.

Disablement

```
zone 04 disabled 12:30 12/2
zone 01 enabled  11:20 21/1
zone 05 disabled 10:00 31/12
zone 03 disabled 09:17 20/12
```

Display screen indication

Test

When zones are under test, the c.i.e. will show indications for them. You can not put individual devices to test, you can do that only with zones.

Test

C.I.E. indication

```
Zones in test
zone 04   12:30 12/2
zone 01   11:20 21/1
zone 05   10:00 31/12
zone 03   09:17 20/12
```

Display screen indication

ⓘ Devices under test will show a test LED and will report test fire if they detect any.

Device under test

Device under test reporting test alarm

Technical alarm

When there's a technical fault. it is indicated by a separate light on the c.i.e. This alarm is important and is given 3rd priority.

Technical Alarm

C.I.E. indication

Functions

Functions with respect to access levels.

Access 1

This access level is open for all. It doesn't require any authentication to perform functions at this level.

Silence/Enable audible indications

The person at this level can Silence alarm fire and fault indications and enable them again.

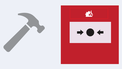
View events

In case of an alarm, the person at Access 1 can view events of the alarm, read alarm counters, but can't take any actions.
He can also read information about disablements.

Disablement of protection equipments

The Access 1 person can also disable protection equipments like fire alarm routing.

Report fire from manual call points



Access 1 person can report fire from manual call points.

Access 2

To enter access level 2, the user will need to use a physical key or a password. The Access level 2 user can perform all actions that an access 1 user can.
Here are some additional functions that the user at Access 2 can perform.

Reset fire & fault alarms

The person at this level can Silence alarm fire and fault indications and enable them again.

Silence/resound fire alarm devices

Disable/enable output devices

These output devices include output to fire alarm devices, fire protection equipment, fire routing equipment, and entire zones.

Put zones to test and cancel test

These output devices include output to fire alarm devices, fire protection equipment, fire routing equipment, and entire zones.

Access 3

To enter access level 3, the user will need to use a password. The Access level 3 user can perform all actions that an access 2 user can.
Here are some additional functions that the user at Access 3 can perform.

Delay

This user can set delays to outputs to fire alarm devices and routing equipment. He can even configure delay timings.

Simulate fire

Level 3 user can also simulate fire in order to check whether fire alarm devices are reporting alarms.

ⓘ Apart from these, there are a lot of functions that level 3 user can perform. e.g. changing system timings, passwords, testing LEDs, screens etc. These function vary from panel to panel. Some fire panels also allow changing zone texts at level 3.

Access 4

Access for is for configuration mode. This level is not accessible from the panel. It requires a computer and a software to enter this level. From the software, operations of all access levels can be performed. In addition, it is specially used to program devices and writing logics. Read more about programming in level 3 of this document.

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