A Comparison Study Between Conventional and Adressable Fire Alarm System

Miran Hama Rahim Saeed*

Electrical Enginnering / Electronic and Communication (Bsc)

Communication Network Planning and Management (MSc)

* Corresponding author E-mail address: Miran.Saeed@live.com

Eng ID : 8426

1. Introduction to Fire Alarm Systems

Fire alarm systems are designed to detect and alert individuals of fire or smoke in a building. They consist of several components, including detectors, control panels, and alarms, which work together to provide early warning and facilitate a safe evacuation. The main objective of fire alarm systems is to save lives, protect property, and minimize fire-related losses.

2. Conventional Fire Alarm Systems

2.1 Overview

Conventional fire alarm systems, also known as traditional fire alarm systems, have been in use for several decades. These systems divide the protected area into multiple zones, with each zone having a dedicated circuit. When a detector or manual call point (MCP) is activated, the control panel identifies the zone where the alarm was triggered, but not the exact location within the zone.

2.2 Components

The main components of a conventional fire alarm system include:

- **Control Panel**: The central unit that monitors the status of the connected devices and provides information about the zones.
- **Detectors**: Devices that detect smoke, heat, or fire. Common types include smoke detectors, heat detectors, and flame detectors.
- **Manual Call Points (MCPs)**: Devices that allow occupants to manually trigger the alarm by breaking a glass element.
- **Sounders and Bells**: Audible alarms that alert occupants of a fire.
- **Zone Wiring**: Electrical wiring that connects the detectors and MCPs within a specific zone to the control panel.

2.3 Working Principle

In a conventional fire alarm system, detectors and MCPs are connected in parallel within a zone. Each zone has a dedicated circuit that terminates at the control panel. When a detector or MCP is activated, it causes a change in the electrical resistance of the circuit, which is detected by the control panel. The panel then indicates the activated zone through visual and audible signals.

2.4 Advantages

- **Simplicity**: Conventional fire alarm systems are straightforward to install and maintain.
- **Cost-Effective**: These systems are generally less expensive than addressable systems, making them suitable for smaller buildings with fewer zones.

- **Reliability**: Conventional systems are reliable and have been tested over time, ensuring dependable performance.

2.5 Disadvantages

- **Limited Information**: The control panel can only indicate the zone of activation, not the exact location of the fire within the zone.
- **Complex Wiring**: As the number of zones increases, the wiring becomes more complex and harder to manage.
- **Less Flexibility**: Adding new devices or reconfiguring the system can be challenging and may require significant rewiring.

2.6 Applications

Conventional fire alarm systems are commonly used in small to medium-sized buildings, such as:

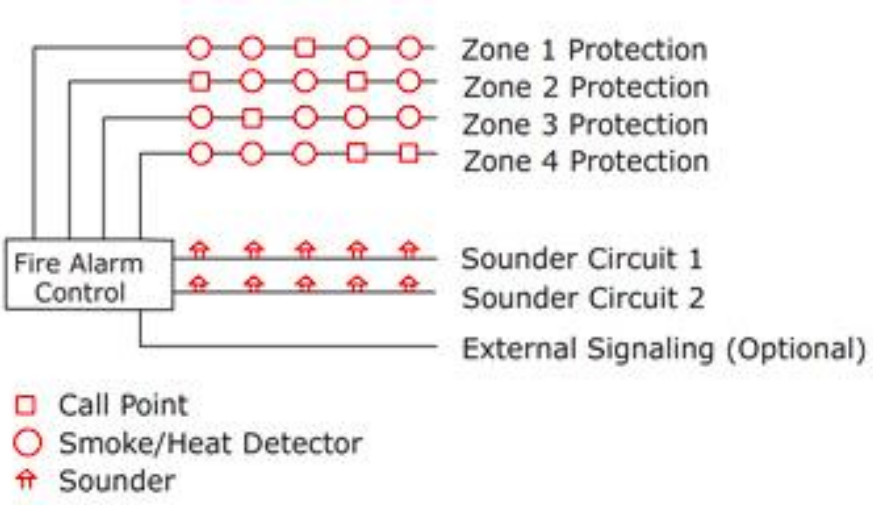
- Residential buildings
- Small offices
- Retail stores
- Schools

2.7 Vendor Examples

Several vendors provide conventional fire alarm systems. Some prominent examples include:

- **Honeywell**: Offers a range of conventional fire alarm systems known for their reliability and ease of installation. Products include the Honeywell Secutron MR-2100.
- **Siemens**: Provides conventional fire alarm systems like the Cerberus FIT, which are suitable for smaller buildings and provide robust fire detection capabilities.
- **Bosch**: Bosch offers conventional fire alarm systems such as the FCP-500 series, which are known for their high performance and dependability.
- **Makim**: A Turkish vendor offering conventional fire alarm systems, Makim provides solutions such as the MA-100 series, which are known for their robustness and reliability.

2.8 Wiring Diagram of a Conventional Fire Alarm System



3. Addressable Fire Alarm Systems

3.1 Overview

Addressable fire alarm systems, also known as intelligent fire alarm systems, provide more advanced features and greater flexibility compared to conventional systems. In addressable systems, each device (detector, MCP, etc.) has a unique address, allowing the control panel to identify the exact location of the activated device.

3.2 Components

The main components of an addressable fire alarm system include:

- **Control Panel**: The central unit that monitors and controls the connected devices, displaying detailed information about the status and location of each device.
- **Addressable Detectors**: Devices with unique addresses that detect smoke, heat, or fire. Types include smoke detectors, heat detectors, and multi-sensor detectors.
- **Addressable Manual Call Points (MCPs)**: Devices with unique addresses that allow occupants to manually trigger the alarm.
- **Sounders and Beacons**: Audible and visual alarms that alert occupants of a fire.
- **Loop Wiring**: A single loop or series of loops that connect all devices to the control panel.

3.3 Working Principle

In an addressable fire alarm system, all devices are connected in a loop configuration. Each device has a unique address, and the control panel continuously communicates with each device,

monitoring its status. When a device is activated, it sends a signal to the control panel with its specific address. The panel then displays the exact location of the activated device, enabling a quicker and more precise response.

3.4 Advantages

- **Precise Location**: The control panel can pinpoint the exact location of the activated device, improving response times and reducing potential damage.
- **Simplified Wiring**: Addressable systems use loop wiring, which is simpler and more flexible than the complex wiring required for conventional systems.
- **Scalability**: Adding new devices or reconfiguring the system is easier, as new devices can be added to the loop without extensive rewiring.
- **Advanced Features**: Addressable systems can include advanced features such as system diagnostics, remote monitoring, and programmable logic.

3.5 Disadvantages

- **Higher Cost**: Addressable systems are generally more expensive than conventional systems, both in terms of initial installation and maintenance.
- **Complexity**: These systems require more sophisticated programming and skilled technicians for installation and maintenance.
- **Potential for Single Point of Failure**: If the loop is broken, communication with all devices on that loop may be lost unless the system is designed with redundancy.

3.6 Applications

Addressable fire alarm systems are typically used in larger and more complex buildings, such as:

- Commercial buildings
- Industrial facilities
- Hospitals
- Large office buildings
- Hotels

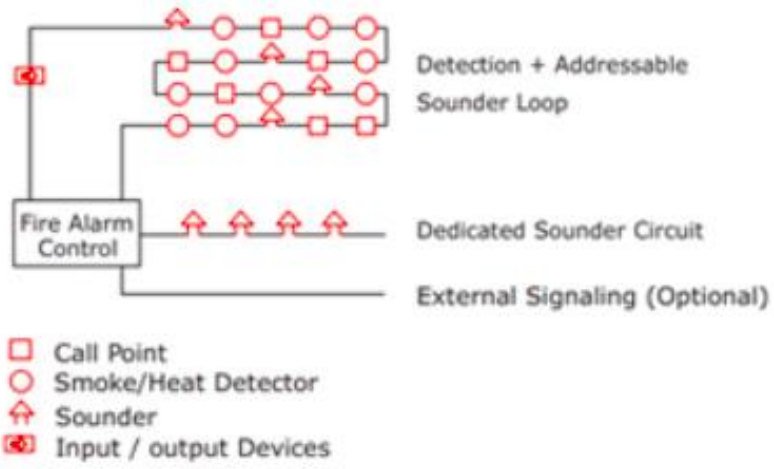
3.7 Vendor Examples

Several vendors provide addressable fire alarm systems. Some prominent examples include:

- **Honeywell**: Offers advanced addressable fire alarm systems such as the Notifier series, which are widely used in large and complex buildings.
- **Siemens**: Provides addressable fire alarm systems like the Cerberus PRO, known for their advanced features and integration capabilities.
- **Bosch**: Bosch offers addressable fire alarm systems such as the Fire Panel 5000 Series, which are renowned for their high performance and reliability.

- **Mavili**: A leading Turkish vendor providing addressable fire alarm systems, Mavili offers solutions such as the Maxlogic Intelligent Addressable Fire Alarm System, which is known for its advanced features and reliability.

3.7 Wiring Diagram of an Addressable Fire Alarm System



4. Detailed Comparison

4.1 Detection and Location Identification

One of the most significant differences between addressable and conventional fire alarm systems is how they detect and identify the location of a fire.

- **Conventional Systems**: Indicate the zone where the fire is detected but do not provide the exact location within the zone. This can delay the response time as the exact source of the fire needs to be identified manually.
- **Addressable Systems**: Provide the precise location of the activated device, allowing for a quicker and more accurate response. This is especially important in large buildings where finding the source of the fire can be time-consuming.

4.2 Wiring and Installation

The wiring and installation processes differ significantly between the two systems.

- **Conventional Systems**: Require a separate circuit for each zone, leading to complex wiring, especially in larger buildings with multiple zones. Adding new devices often requires additional wiring.
- **Addressable Systems**: Use loop wiring, which is more straightforward and flexible. All devices are connected on a single loop or series of loops, making it easier to add new devices without extensive rewiring.

4.3 Cost

Cost considerations include both initial installation and long-term maintenance.

- **Conventional Systems**: Generally have lower initial installation costs, making them suitable for smaller buildings with limited budgets. However, as the building size and complexity increase, the cost of wiring and maintenance can rise significantly.
- **Addressable Systems**: Typically have higher initial costs due to advanced technology and more complex installation. However, they offer cost savings in the long term through simplified wiring, easier maintenance, and enhanced features.

4.4 Flexibility and Scalability

Flexibility and scalability are important factors, especially for buildings that may undergo changes or expansions.

- **Conventional Systems**: Less flexible and scalable. Adding new devices or reconfiguring the system can be challenging and often requires significant rewiring.
- **Addressable Systems**: Highly flexible and scalable. New devices can be easily added to the loop, and system reconfiguration is straightforward. This makes them ideal for buildings that may require future expansions or modifications.

4.5 Advanced Features and Functionality

The level of advanced features and functionality varies between the two systems.

- **Conventional Systems**: Provide basic fire detection and alarm functions. Advanced features are limited, and system diagnostics are minimal.
- **Addressable Systems**: Offer a range of advanced features, including system diagnostics, remote monitoring, programmable logic, and integration with other building management systems. These features enhance the overall effectiveness and usability of the fire alarm system.

4.6 Reliability and Redundancy

Reliability and redundancy are critical for ensuring continuous operation and minimizing the risk of system failure.

- **Conventional Systems**: Generally reliable but lack built-in redundancy. A fault in one zone can affect the entire system.
- **Addressable Systems**: Can be designed with redundancy, such as dual loops or alternate communication paths, to ensure continuous operation even if a fault occurs. This enhances overall system reliability.

4.7 Summarizes The Key Differences

The below tables provide a concise overview of the key differences between addressable and conventional fire alarm systems, making it easier to compare their features and choose the appropriate system based on specific requirements.

Features

Feature	Conventional Fire Alarm Systems	Addressable Fire Alarm Systems
Detection and Location Identification	Identifies the zone of activation but not the exact location within the zone.	Pinpoints the exact location of the activated device.
Wiring and Installation	Requires separate circuits for each zone, leading to complex wiring.	Uses loop wiring, which is simpler and more flexible.
Cost	Generally lower initial installation costs.	Higher initial costs due to advanced technology and complex installation.
Flexibility and Scalability	Less flexible and scalable; adding new devices requires significant rewiring.	Highly flexible and scalable; new devices can be easily added to the loop.
Advanced Features	Basic fire detection and alarm functions with limited advanced features.	Offers advanced features such as system diagnostics, remote monitoring, and programmable logic.
Reliability and Redundancy	Generally reliable but lacks built-in redundancy.	Can be designed with redundancy to ensure continuous operation.
Building Size and Complexity	Suitable for smaller buildings with fewer zones.	Ideal for larger and more complex buildings.
Budget Constraints	More suitable for buildings with limited budgets.	Suitable for buildings where long-term benefits justify the investment.
Future Expansion	Less suitable for buildings that may undergo changes or expansions.	Ideal for buildings that may require future expansions or modifications.
Regulatory Requirements	May comply with local codes for smaller buildings.	Often required for larger buildings with stringent regulatory standards.
Integration with Other Systems	Limited integration capabilities.	Better compatibility and integration with other building management systems.

Vendores

Type	Vendors
Conventional Systems	Honeywell (Secutron MR-2100), Siemens (Cerberus FIT), Bosch (FCP-500 series), Makim (MA-100 series, Turkey)
Addressable Systems	Honeywell (Notifier series), Siemens (Cerberus PRO), Bosch (Fire Panel 5000 Series), Mavili (Maxlogic Intelligent Addressable Fire Alarm System, Turkey)

5. Practical Considerations for Choosing a Fire Alarm System

When choosing between addressable and conventional fire alarm systems, several practical considerations should be taken into account:

5.1 Building Size and Complexity

- **Small Buildings**: For smaller buildings with fewer zones, conventional systems may be more cost-effective and easier to install.
- **Large Buildings**: For larger and more complex buildings, addressable systems offer significant advantages in terms of location identification, scalability, and advanced features.

5.2 Budget Constraints

- **Limited Budget**: Conventional systems are generally less expensive and may be suitable for buildings with limited budgets.
- **Investment in Safety**: If budget allows, investing in an addressable system can provide long-term benefits through simplified maintenance, advanced features, and greater flexibility.

5.3 Future Expansion

- **Static Layout**: For buildings with a static layout and no plans for future expansion, conventional systems may be sufficient.
- **Dynamic Layout**: For buildings that may undergo changes or expansions, addressable systems offer greater flexibility and scalability.

5.4 Regulatory Requirements

- **Local Codes and Standards**: Ensure compliance with local fire safety codes and standards, which may dictate the type of system required for specific building types and sizes.

5.5 Integration with Other Systems

- **Building Management Systems**: If integration with other building management systems (e.g., HVAC, security) is required, addressable systems are typically more compatible and offer greater integration capabilities.

6. Conclusion

Both addressable and conventional fire alarm systems have their own unique advantages and disadvantages. Conventional systems are cost-effective and straightforward, making them suitable for smaller buildings with fewer zones. However, they lack the advanced features and precise location identification offered by addressable systems. Addressable systems, while more expensive and complex, provide greater flexibility, scalability, and detailed information about the location of the fire, making them ideal for larger and more complex buildings.

When choosing a fire alarm system, it is essential to consider the specific needs and requirements of the building, including size, complexity, budget constraints, future expansion plans, regulatory requirements, and integration capabilities. By carefully evaluating these factors, building owners and facility managers can select the most appropriate fire alarm system to ensure the safety and protection of occupants and property.

References

1. "Fire Alarm Systems," National Fire Protection Association (NFPA). Accessed June 12, 2024. NFPA.
2. "Addressable vs. Conventional Fire Alarms," Safe and Sound Security. Accessed June 12, 2024. Safe and Sound Security.
3. "Conventional vs. Addressable Fire Alarm Systems," Fire Protection Online. Accessed June 12, 2024. Fire Protection Online.
4. "Fire Alarm Systems: Addressable vs Conventional," Fire Systems, Inc. Accessed June 12, 2024. Fire Systems.
5. "Understanding Fire Alarm Systems: Addressable vs Conventional," Potter Electric Signal Company, LLC. Accessed June 12, 2024. Potter Electric Signal Company.
6. "Fire Alarm System Basics: Addressable vs. Conventional," ADT Fire & Security. Accessed June 12, 2024. ADT.
7. "The Difference Between Addressable and Conventional Fire Alarm Systems," Security Sales & Integration. Accessed June 12, 2024. Security Sales.
8. "Conventional vs. Addressable Fire Alarm Systems," Fike Corporation. Accessed June 12, 2024. Fike.
9. "Choosing the Right Fire Alarm System: Addressable vs. Conventional," Building Services Engineering. Accessed June 12, 2024. Building Services Engineering.
10. "Fire Alarm Systems: A Comparative Overview," Fire Safety Matters. Accessed June 12, 2024. Fire Safety Matters.