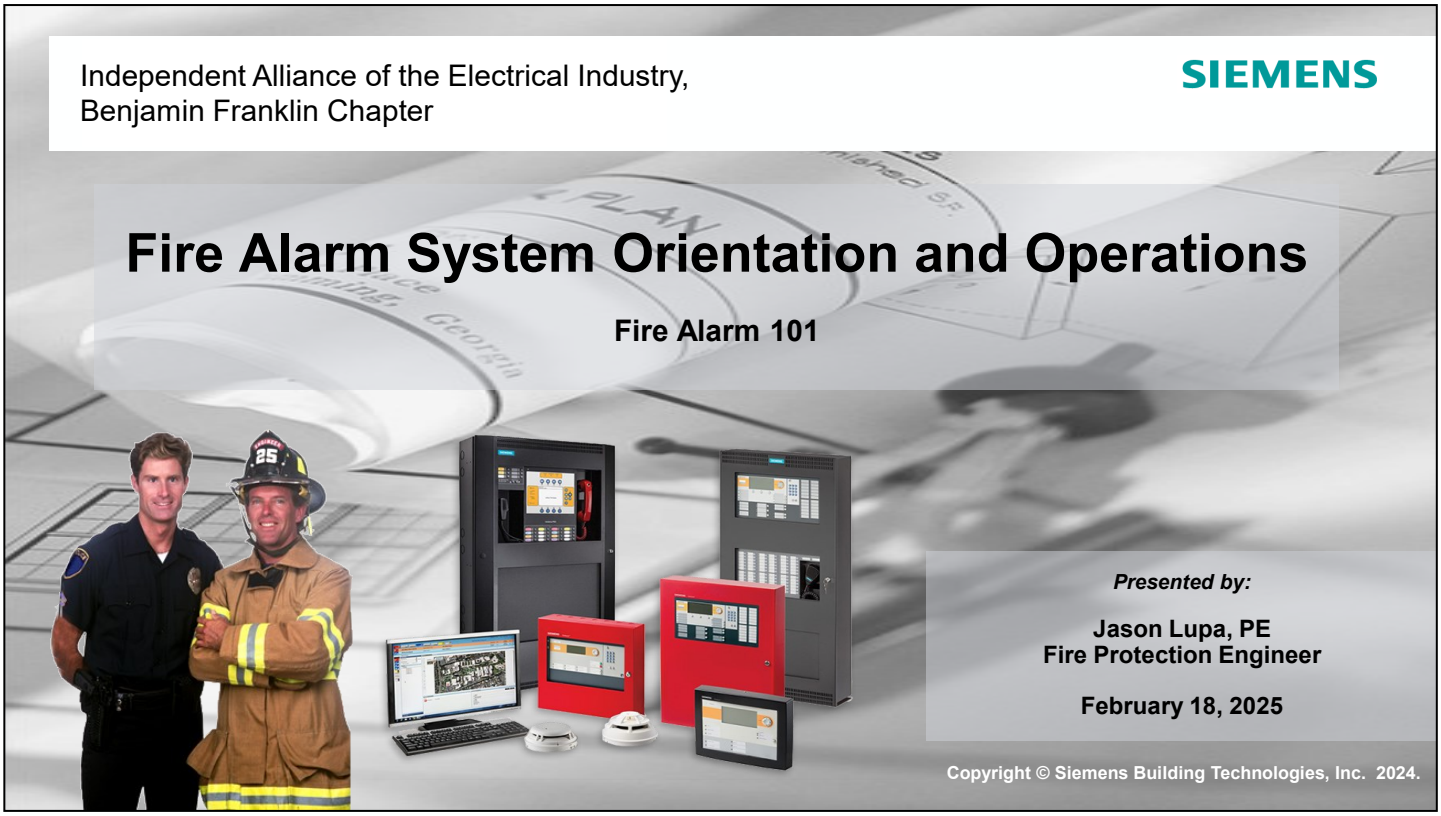

Fire Alarm & Detection Systems for First Responders (Fire Alarm 101) synopsis
This course is an overview for firefighters of the code-required electronic building systems they will encounter during an emergency event. There is an overview of fire alarm components, how they function and procedures the fire department will use to retore them after an activation. New fire alarm technologies will be discussed along with manual voice paging, Emergency Responder Radio Coverage Systems (ERRCS) and firefighter telephones operations. Firefighter control panels for both smoke control and post-incident smoke venting will be discussed. Finally emergency occupant communication systems will be reviewed.

The fire department does not specify, design or purchase these electronic systems; yet they are the primary operators during a crisis. Siemens Industry is committed to the education and professional growth of life safety professionals. This presentation is sponsored by Siemens, but it is not manufacture specific and the terminology is based on industry terms.

Presentation Material:
The material will be presented in a PowerPoint format and available digitally afterwards.

Presentation by:
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This presentation attempts to familiarize users with the fire alarm and life safety concepts, technology and systems. The information provided may have inaccuracies and cannot encompass all aspects of the subject. Therefore first responders need to consult the codes for other changes that may impact a specific design and equipment within their response area prior to an emergency response.

Code Corner:
Painting Fire Alarm Wire in Exposed Ceilings

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With the popularity of exposed ceilings, free-air fire alarm circuits may be visible from the ground. For open ceiling designs, clients often request the exposed deck, joists and equipment be a single color to blend into the background. Certain life safety equipment such as fire sprinkler heads, manual pull stations, fire alarm detectors and notification appliances are specifically code-prohibited from being painted.

Code Corner:
Painting Fire Alarm Wire in Exposed Ceilings

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Should you paint red-jacketed fire alarm cable???

Code Corner:
Painting Fire Alarm Wire in Exposed Ceilings

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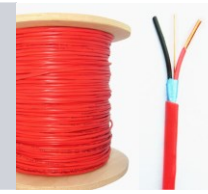
NEC power-limited fire alarm circuits use copper conductors (stranded or solid) with PVC, Polypropylene, or Fluropolymer insulation around the copper conductors. They are inside a Low Smoke Zero Halogen (LSZH) protective jacket. This LSZH special jacket produces minimal smoke and no harmful halogen gases or toxic fumes when exposed to fire. The jacket is also resistant to abrasions, flames, chemicals, acids, oils and sunlight. The flexible FP-series cables are typically red with UL identifying marks and referred to as free-air, red-jacketed, or open fire wire. There are three types of FP-series fire alarm cables, listed in increasing fire resistance characteristics:

Type FPL: General purpose usage, excluding installation environments below.

Type FPLR: Riser cable for use in a vertical run in a shaft floor to floor.

Type FPLP: Plenum cable for use in air-shafts, above ceiling HVAC plenums and similar environmental air circulation spaces.



Code Corner:
Painting Fire Alarm Wire in Exposed Ceilings

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The National Electrical Code - NEC [2020, & 2023] article 110.12 *Mechanical Execution of Work*, Item B prohibits all internal electrical components and connections from being painted, but the section on fire alarm systems only cautions against painting external power-limited fire alarm (PLFA) cable in NEC Article 760.24:

> Informational Note: Paint, plaster, cleaners, abrasives, corrosive residues, or other contaminants might result in an undetermined alteration of PLFA and NPLFA cable properties.

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Red-jacketed FPL cable and red-banded metal-clad cable (MC) are help distinguish fire alarm circuits from other building systems. But the IBC, IFC, NFPA 72 and UL do not require any specific color for fire alarm circuits. The most common FPL color sheath is red, but some manufacturers (Genesis, Belden, Southwire, etc.) offer different colors such as black, white, green and blue. The only time fire alarm wirepaths must be identified by color or signage is if the local jurisdictions adopt that practice or if required in the project specifications. Finally the NEC section 760.30 requires that the fire alarm circuits be identified at terminal and junction locations. Most installers just paint the junction box covers red or apply a label to comply. For federal DoD projects, the 2013 UFC 3-600-01, section 5-7.8, which reads "Identification. Paint all fire alarm junction boxes and covers red in unfinished areas (i.e., above ceilings, mechanical rooms, etc). In finished areas, conduit and junction boxes can be painted to match the room finish, the inside cover of the junction box must be identified as “Fire Alarm” and the conduit must have painted red bands ¾ - inch (20 mm) wide at 20 foot (6.0 m) intervals and on both sides of a floor, wall, or ceiling penetration."

Code Corner:
Painting Fire Alarm Wire in Exposed Ceilings

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While the NEC cautions against painting fire alarm cable, there are no direct prohibitions. Painting does alter the physical condition which the listed cable was tested. As a result, it is impossible to guarantee the positive or negative consequence for the LSZH sheath – short or long term. Always consult the wire manufacturer prior to applying any paint application will void the warranty.

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Painted cable can flake with movement and the outer jacket is resistant to chemicals, so certain paint may not stick. It is critical to select a stable paint which will both bond and not cause damage. Paint a sample portion of the project's fire alarm cable since paint and cable manufacturers will vary between projects.

Code Corner:
Painting Fire Alarm Wire in Exposed Ceilings

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Water-based paints are typically acceptable for use on LSZH jacketed cables. The chemical properties will not degrade the integrity of a sheathed cable. If solvents are part of the composition of a water-based paint, they tend to evaporate rapidly, leading to very brief contact with the cable. Select a paint which includes a primer that is compatible with the installed outer jacket for maximum adhesion.

Oil-based paints are not recommended since they tend to expedite the leaching of plasticisers within the LSZH cable sheath. They might be likely to cause a swelling and softening to the cable following short term exposure, with potentially more serious impact on the cable integrity by way of degradation such as cracking in the long term. Furthermore, a significant concern associated with painting LSZH sheathed cables is the potential impact on their low smoke and/or zero halogen attributes during a fire incident. Any paint containing chlorine compounds will augment the production of halogen gas emitted by the cable in a fire scenario.

Code Corner:
Painting Fire Alarm Wire in Exposed Ceilings

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Before painting fire alarm cable:

1. Verify the project's specifications for fire alarm circuit color.
2. Verify that painting is permitted by the AHJ.
3. Verify the cable manufacture approves the application of paint and will not void the warranty.
4. Obtain paint manufacture's recommendations for the project's application.

Painting suggestions:

1. Document the type of paint and who is applying it for traceability purposes.
2. Ensure that pools of paint do not collect where they are in contact with the cable.
3. Ventilate the space thoroughly so that the paint may dry as quickly as possible.
4. Since the paint will cover the wire's pre-printed legend, ensure these identifiers are visible at junction boxes and panel locations.

During the initial NFPA 72 acceptance testing, it should be document when fire alarm circuits are painted and the exact type of paint noted in the report or on the shop drawings. A portion of the original UL cable markings showing the manufacturer, cable type, conductor size, and voltage rating should always be left exposed.

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Agenda:

Fire Alarm 101

Fire Alarm System Operations

1. When & why fire alarms are installed
2. Fire alarm control panels
3. Detection devices
4. Notification appliances
5. In-building fire department communications systems
6. Smoke control and smoke purge systems
7. Emergency occupant communications systems
8. Fire alarm response resources

About the speaker

Jason Lupa, PE is a Business Development Engineer with Siemens Industry where he supports fire safety professions from pre-con to post construction. For over 35 years he has provided code and performance-based solutions to a wide variety of building sectors. Jason holds a B.S. in Fire Protection Engineering from U of MD, is a Licensed Engineer and certified Firefighter. Active member of the SFPE, NFPA, SAME, GBCA, BOMA, and AFAA.

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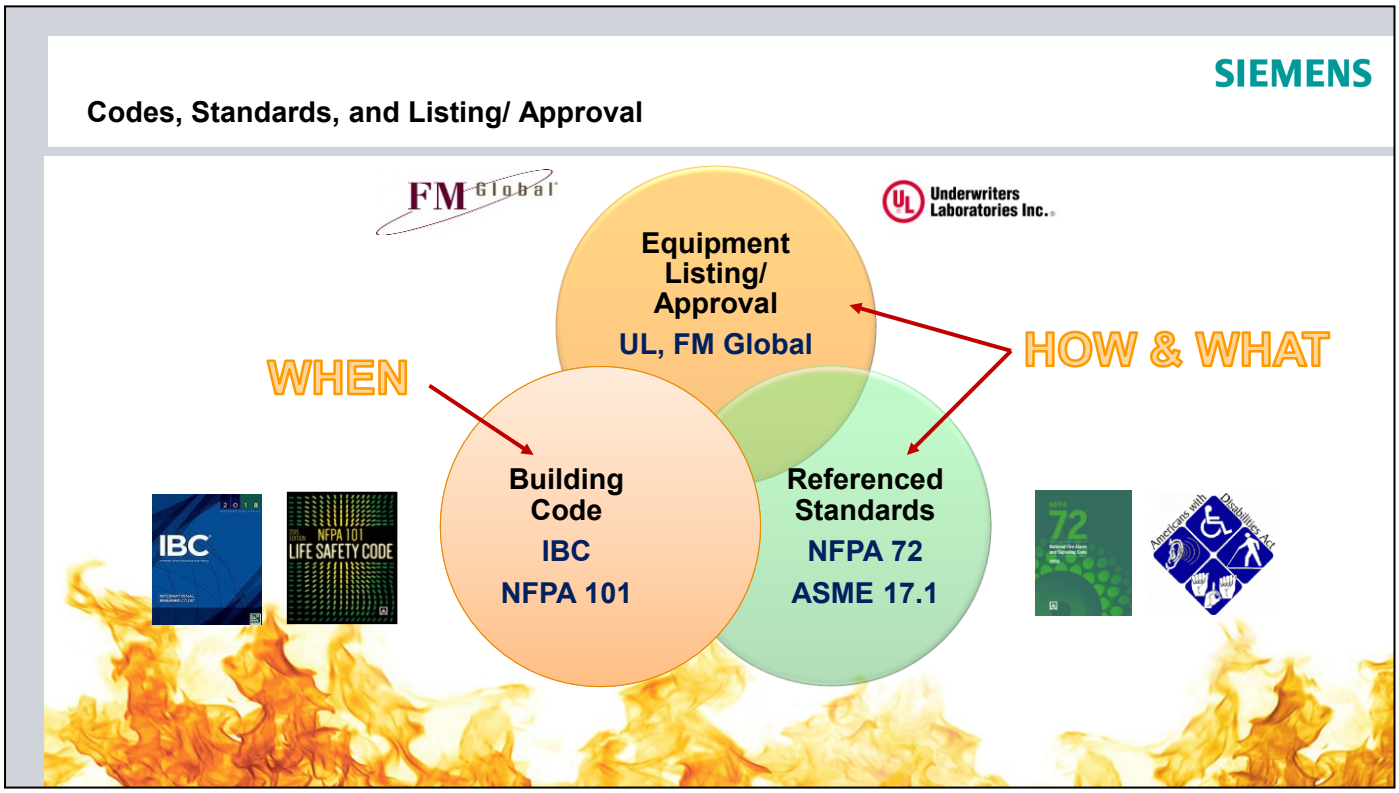

The terms "code" and "standards" are commonly used to represent the same thing. However, the two terms stand for completely different meanings. Fire alarm codes are written rules and regulations that are then adopted as law for enforcement by an AHJ or Authority Having Jurisdiction. Fire alarm codes once put in place, are the minimum requirements that must be complied with to provide a reasonable degree of life safety. Codes are written based on standards. Fire alarm standards are generally produced by a consensus or technically committee to represent a minimum level of how to install certain types of protection. Standards are focused on one particular system component and give guidelines on the proper installation, maintenance and inspecting.

Keep in mind that NFPA 72 tells us how to install fire alarm systems. It doesn't explain what type of equipment (pull stations, smoke detectors, duct detectors, waterflows, tampers) should be used. This information can be found in the specific jurisdiction's adopted building code.

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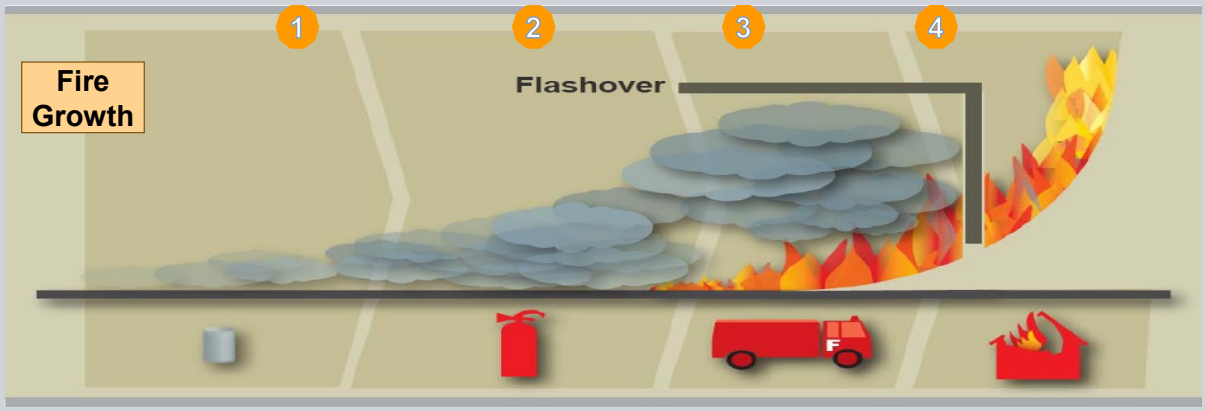
Fire Principles – Stages of Fire Development



1. **Incipient stage:** Little visible smoke occurs
2. **Smoldering stage:** Smoke, but no flame and little heat.
3. **Flaming stage:** Visible flame, more heat, much less smoke.
4. **Fully Developed or Flashover:** Large amounts of heat, flame, smoke and toxic gases

Fire Alarm 101 – Jason Lupa, PE

 Page 17

The incipient stage is first. It begins when heat, oxygen and a fuel source combine and have a chemical reaction resulting in fire. This is also known as “ignition.” The incipient stage is the easiest stage to suppress but also the most difficult to detect.

Smoldering is a slow, low temperature, flameless form of combustion, sustained by the heat evolved when oxygen directly attacks the surface of a condensed phase fuel. It occurs on the surface of the solid rather than in the gas phase.

Once a fire reaches the flaming stage, it becomes harder to control. If a fire detector recognizes a fire at this point, you have little time to put it out before it reaches flashover.

A fully developed fire is the hardest to suppress because, at this point, the fire is at maximum temperatures and causing the most heat damage. If you’ve failed to suppress it before this point, then your odds of stopping the fire are much smaller.

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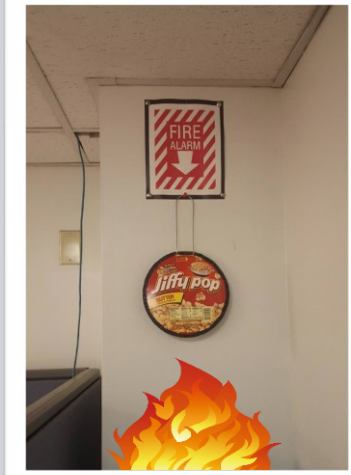
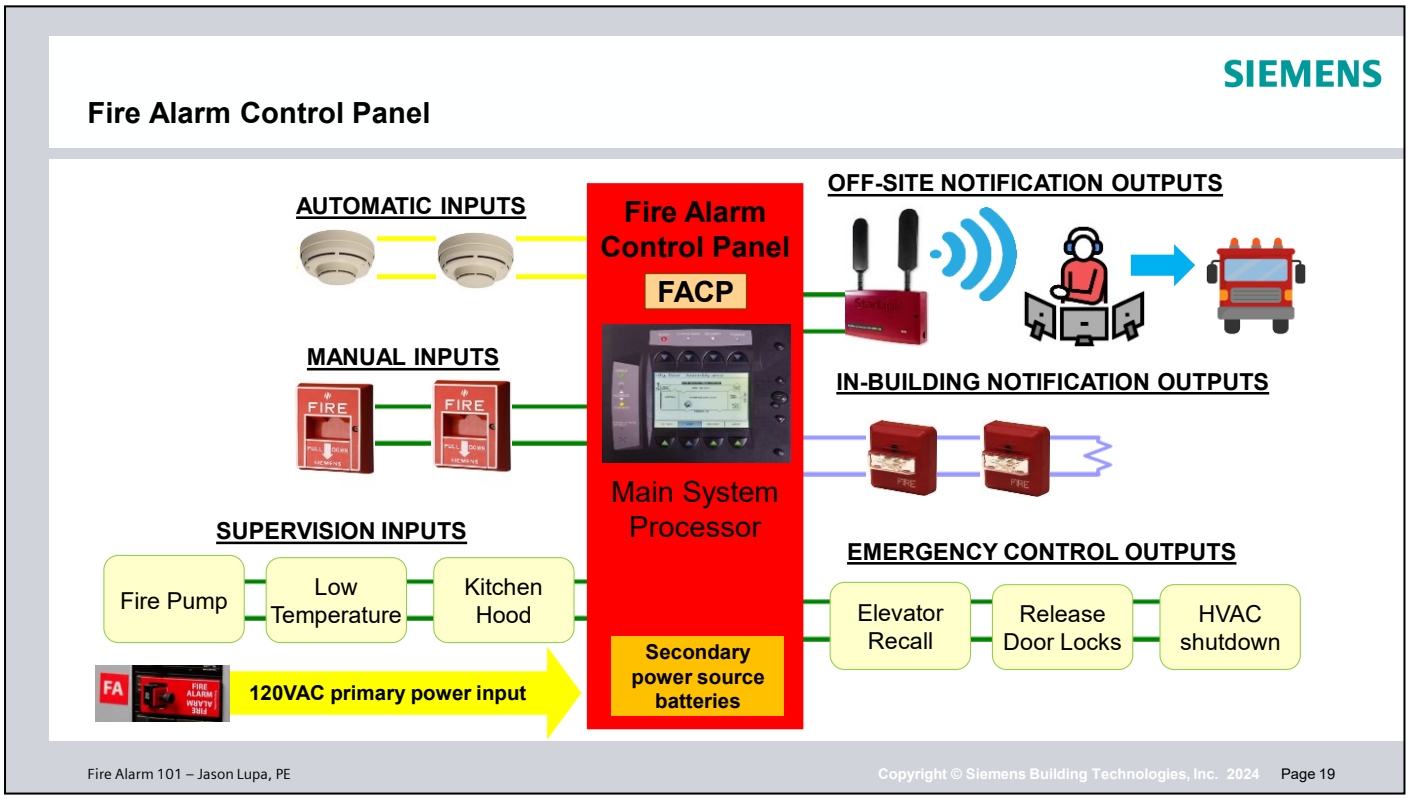
This is NOT a Fire Alarm System



When you hear da poppin' better get to runnin'

There's got to be a better way…

Don't do this!



A fire alarm system is a crucial part of the fire and life safety of a building and its occupants. Most fire alarm systems consist of the following components:

Fire alarm control panel – the system hub monitors inputs and system integrity, controls outputs and relays information.

Primary power supply – primary power for your fire alarm system is usually supplied in the form of 124V or 240V AC from the power company.

Secondary (backup) power supply – backup power supplies usually consist of lead-acid batteries used to power the system in case the primary power source fails.

Initiating devices – these are your activation stations, and can be manual (pull stations) or automatic (smoke detectors).

Notification appliances – notification appliances are things like flashing lights, strobe lights, horns, speakers, etc. that actually let people know of the danger in your building.

Building safety interfaces – these are things like exit lighting, ventilation systems, etc. that make it easier for people to get out of the building once a fire has started.

Since FACPs are used for life safety and property protection, the listing standards are more stringent than those used for electrical safety only. Listed panels are published in the current Underwriters Laboratories (UL) Fire Protection Equipment Directory in the subcategory “Control Units, System” of “Signal and Fire Alarm Equipment and Services.” Panels are tested for performance against UL Standard 864, Control Units for Fire-Protective Signaling Systems. There are over 100 manufacturers of FACPs listed in the UL Fire Protection Equipment Directory.

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Fire Alarm Control Panel: Two sources of power

Primary Power Supply

- 120 VAC power on a dedicated electrical circuit.
- Identified as “FIRE ALARM CIRCUIT” breaker lock or in a locked electrical room
- May require Emergency Power feed.

Secondary Power

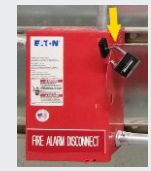
Standby batteries are sized with sufficient capacity to operate the system in both non-alarm (standby) and alarm (activation). NFPA 72 provides battery sizing values based on voice/ non-voice and E-power availability.

Panel power-down Sequence

1. Remove battery connection
2. Remove 120 VAC power

To restore power, reverse order

NYC requires a dedicated fire alarm service disconnect means in a red metallic cabinet and labeled. It must be secured in the ON position and use cartridge fuses.



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 Page 20

It is important that a fire alarm system be provided with reliable power so it can operate during any emergency.

Primary Power Supply

Commonly the non-switched 120 or 240-volt alternating current source supplied from a commercial power utility. In non-residential applications, a branch circuit is dedicated to the fire alarm system and its constituents. "Dedicated branch circuits" should not be confused with "Individual branch circuits" which supply energy to a single appliance.

Backup Power Supply

Secondary power to the fire alarm system can be provided via properly sized batteries, batteries and a standby generator, or an Energy Storage System. Typically UL Listed sealed batteries are used in commercial applications. Two 12V batteries are wired in series to provide 24VDC. These may be located within the control panel itself or in a separate enclosure mounted adjacent to the main control panel. They usually are connected to the FACP to charge and monitor them.

Battery calculations shall include a 20 percent safety margin to the calculated amp-hour rating. The secondary power requirements vary for voice and non-voice.

To power down a fire alarm panel, you should first disconnect the AC power source at the electrical panel board, then open the panel and carefully disconnect the battery wires, ensuring to follow the manufacturer's instructions and safety procedures; always consult the specific manual for your fire alarm panel as the exact sequence may vary depending on the model.

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Fire Alarm Control Panel: Annunciation & Control

Fire Alarm Control Panel (FACP) – The headend panel for the fire alarm system. Requires 120VAC.

Remote Annunciator (RA) – A duplicate display with optional control capability. Powered by the fire alarm control panel.

Graphic Annunciator (GA) – A map of the building with status LED's guiding responding firefighters to the general area.

Workstation – A PC-based desktop computer with advanced command & control features. They can be text-only or text/ graphics.

Fire Alarm 101 – Jason Lupa, PE

 Page 21

Firefighters have just a few seconds to pinpoint a fire's location and identify the whereabouts of occupants. This critical time frame makes all the difference between safety and tragedy. To get the information they need, firefighters must read the operator interface screen on your fire detection system panel. But the same information may also be displayed on a remote annunicator, graphic annunicator or PC workstation.

The fire alarm control panel is the brains of a fire alarm system, which monitors all the system's inputs. The control panel is also responsible for controlling the actions of the system's output actions, and relays information to the notification appliances.

Workstations are typically reserved for larger systems installed in high-rise buildings and campuses where there is a large amount of data which must be managed.

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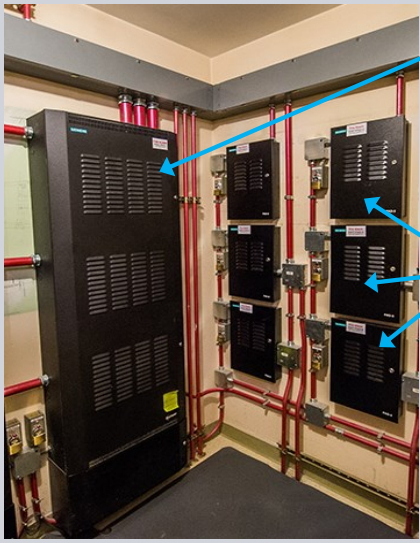
Fire Alarm Control Panel: Support Equipment



Remote Transponder Panel (RTP) – a subpanel which is dependent on the main fire alarm control panel. It does not have controls or a display, but can support addressable and notification circuits. Requires 120VAC.

Notification Appliance Circuit (NAC) Booster Panel – a device used in fire alarm systems to extend the power capacity of a standard NAC from the FACP, allowing for more notification appliances (like horns, strobes, or speakers), often needed to meet accessibility requirements like ADA compliance by providing increased sound levels in large areas; essentially, it acts as a power booster for the NAC circuit coming from the main fire alarm control panel. Requires 120VAC.

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Fire Alarm Control Panel: Remote Off-site Notification

Dialer – Off-site communications to Central Station Monitoring Company, most common is the dual path cellular communicator. This is required for all fire alarm panels unless 24/7 onsite staff supervises the system.

Digital Services – Optional supplementary notifications services (apps, emails, text) and remote access for diagnostics services by fire alarm technicians. IP connection is via the Cloud and the building codes to not permit this to be the primary means of off-site monitoring.

Supervising stations monitor the premises and include Central Station Service, Proprietary Supervising Stations, and Remote Supervising Stations. The communication method to those supervising stations is done with the communication methods shown below. Based on the types of signals received from the fire alarm control unit and the type of supervision station, the supervising station may alert the emergency forces or dispatch a runner service to fix a trouble to supervisory condition.

Codes and new technologies are expanding fire alarm digital services. Remote system status, diagnosis and even services can be delivered on-site and above-site with new portals. With digital services for fire safety we can go beyond simply meeting fire system regulations, by using data and intelligently applied analytics to fully protect people and assets. Developing smarter protection systems through cloud connectivity reduces the burden on people, eliminates unnecessary interruptions and gives businesses much-needed transparency over their processes, for smoother operation and system availability.

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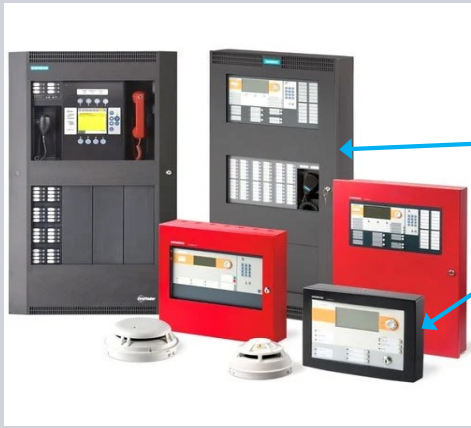
Fire Alarm Control Panel: Dedicated vs. Combination

Dedicated Fire Alarm Control Panel



CONTROL PANEL

REMOTE ANNUNCIATOR

Combination Fire & Intrusion Alarm Control Panel

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 Page 24

Combination fire & intrusion alarm control panels are typically for smaller deployments. With everything combined into one box, the total number of sensors is often capped and the management capabilities are limited to simple commands. Until the 2007 update to NFPA 72, combo panel-based systems were subject to local approval by AHJ. Use of Combo Panels in some municipalities may be a point of contention.

Because operating combination fire & intrusion alarm control panel can be difficult and their fire alarm features are limited, some local jurisdiction ban them for commercial properties.

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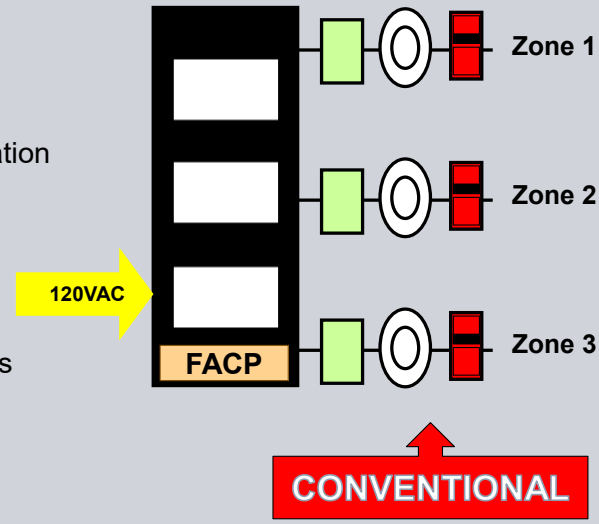
Fire Alarm Control Panel: Conventional Fire Alarm Panel

- AKA: dumb systems
- Report by general area - no device identification
- Limited information on device health
- No history log
- Less common, but still used in small buildings



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 Page 25

There are two main control panel arrangements, conventional and addressable.

In a conventional system, the fire alarm control panel does not have a list of every distinct smoke detector and pull station. Instead, the panel displays zones or areas. These zones then are often displayed on a key near the control panel. For example, the panel may show that there was a fire detected in zone B. After looking at the key, you will see that it is on the third floor. The system will not show which exact detector detected the fire. The zone in question is typically indicated by a light on the control panel.

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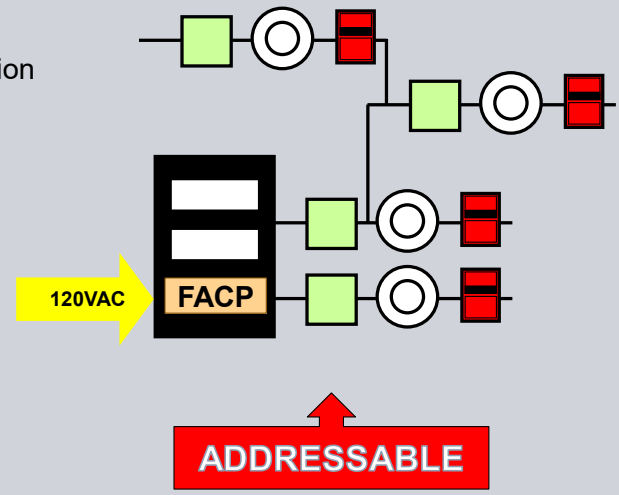
Fire Alarm Control Panel: Addressable Fire Alarm Panel

- AKA: smart or intelligent systems
- All activity report by device for quick identification
- Each Device has a Unique Address
- Detector sensitivity changes from FACP
- History log
- Most common type of fire alarm panel in commercial buildings



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 Page 26

In an addressable system, the fire alarm control panel will show exactly which detector or pull station detected the fire. This is typically indicated by text that will display on the screen on the control panel. Unsurprisingly, this can make responding to a fire much more efficient. You will find addressable fire alarm control panels in most newer buildings.

An addressable fire alarm system gives a unique address to each device that is on the system. This allows you to identify the precise location of the activated device and relay that information to the fire department. In this system, all the devices are connected on one wire that is looped into the control panel. As a result, even if one section is damaged, the system is still able to relay information to the control panel utilizing the other end of the loop. Addressable fire alarm systems provide a lot of flexibility and are often used for large facilities.

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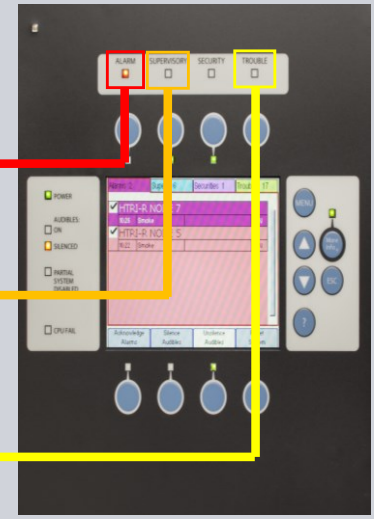
Fire Alarm Control Panel: General FACP Signals

Fire alarm signals are classified into three categories:

ALARM – A signal indicating a fire event

SUPERVISORY – A signal indicating an abnormal condition with another building life safety system

TROUBLE – A signal indicating a fire alarm system component fault which may impair the FACP's performance.



ALARMS
Dispatch the fire department and activate the notification appliances

SUPERVISORIES
Dispatch the facility maintenance staff

TROUBLES
Dispatch the fire alarm service technician

Fire Alarm 101 – Jason Lupa, PE

 Page 27

Fire alarm system responses are classified into general categories to increase response time:

Fire Alarm Signals. An alarm condition means there is an immediate threat to life, property, or mission. An example of this would be a smoke detector sending a signal to the fire alarm control unit that there is a presence of smoke, which would initiate notification to the occupants to evacuate. Actuation of alarm notification appliances shall occur within 10 seconds after the activation of an initiating device.

Supervisory Signal Indication. A supervisory condition means there is an issue with a system, process, or equipment that is monitored by the fire alarm control unit (see supervision section). An example of this would be a sprinkler system valve being closed, this would show up as a supervisory signal on the control unit. Visible and audible indication of supervisory signals shall be indicated within 90 seconds at the local fire alarm control unit.

Trouble Signal Indication. A trouble condition means there is an issue or fault with the fire alarm system. An example would be a break in an initiating device circuit. Trouble signals shall be indicated within 200 seconds at the local fire alarm control unit.

All activations of a fire system must be immediately investigated to determine whether or not there is an imminent threat to life or property. Because fire has the potential to injure or kill on a large scale, fire alerts take priority over all other service calls and field activity that is not related to an immediate threat to life.

DEMO: https://www.youtube.com/watch?v=9S3tqjBtJUY

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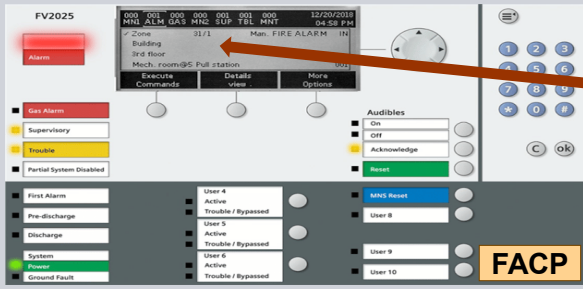
Fire Alarm Control Panel: Device Descriptions



Fire alarm panels provide a description of the device in alarm along with its location.

A map with the major building features and room names which match the fire alarm panel descriptions can be very useful for responding firefighters.

Fire Alarm 101 – Jason Lupa, PE

 Page 28

Most fire alarm panels provide some information, but the description may be difficult to understand to someone unfamiliar with the building and operating during an emergency response. The small screen on most systems can only display a limited amount of text, which often appears as vague abbreviations that can confuse and delay firefighters. Maps aid rapid orientation and that help firefighters to quickly identify the origin of the alarm. It's important for first responders to quickly identify the general area of the building. If it is a rapidly growing fire, there will be obvious smoke when they arrive in the area. If it is still a small-scale event or false alarm, they can then search for the device in alarm.

Floorplan maps are not required by code, but a common request by AHJ's to be displayed next to the fire alarm control panel and remote annunciators.

Demo: https://www.youtube.com/watch?v=fY0yZmIKYao

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Fire Command Center

A fire command center (FCC) is a room dedicated for the fire department. The FCC consolidates the building's life safety system components and information to allow responders to efficiently evaluate and manage an emergency incident.

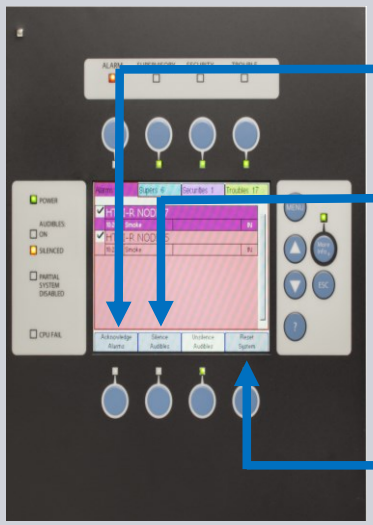
A FCC complying with IBC Section 911 is required in all high-rise buildings. It is also typically found in large low-rise buildings or in a central campus Security Operation Command Center.

Fire command centers are communication centers are dedicated rooms containing fire alarm and related fire protection and utility control equipment. The FCC consolidates life safety system components and information to allow responders to efficiently evaluate and manage an emergency in the building. They are designed for the fire department to run their Incident Command Centers. They allow the first responders to locate the fire origination, control life safety systems and transmission of information/ instructions pertaining to a fire emergency to the occupants (including fire department personnel).

The prescriptive code requirements for a FCC are itemized in IBC Section 911.1.5.

SIEMENS

Fire Alarm Control Panel: Resetting a FACP



1. **ACKNOWLEDGE – Tells the system you know it has been triggered and you are aware of the alarm condition(s).**
2. **SILENCE – Tells the system to turn off the notification signals, the system is still in alarm.**
3. **Locate and restore the fire alarm device(s) which initiated the alarm condition. All must be cleared before resetting the panel.**
4. **RESET – Restores the system to normal standby mode, if all the alarm events are not cleared, the system will return to the original alarm condition.**

Fire Alarm 101 – Jason Lupa, PE

 Page 30

Refer to the operating instructions for your building's fire alarm system to understand how to use the control panel. They should be posted inside the FACP on the door or next to the panel. Many of the buttons on the control panel are straightforward. Some buttons might have different meanings on different control panels, but UL has standardized fire alarm panel operations for first responders. All panels should provide positive confirmation when a button is pressed.

The fire alarm control panel is in a Standby state when the green LED is on and the LCD display has a system normal message. To access the panel's controls, unlock and open the panel door. Some remote annunciators may also have system control buttons.

The first step in managing an alarm condition is to acknowledge the alarm event. This does two important things:

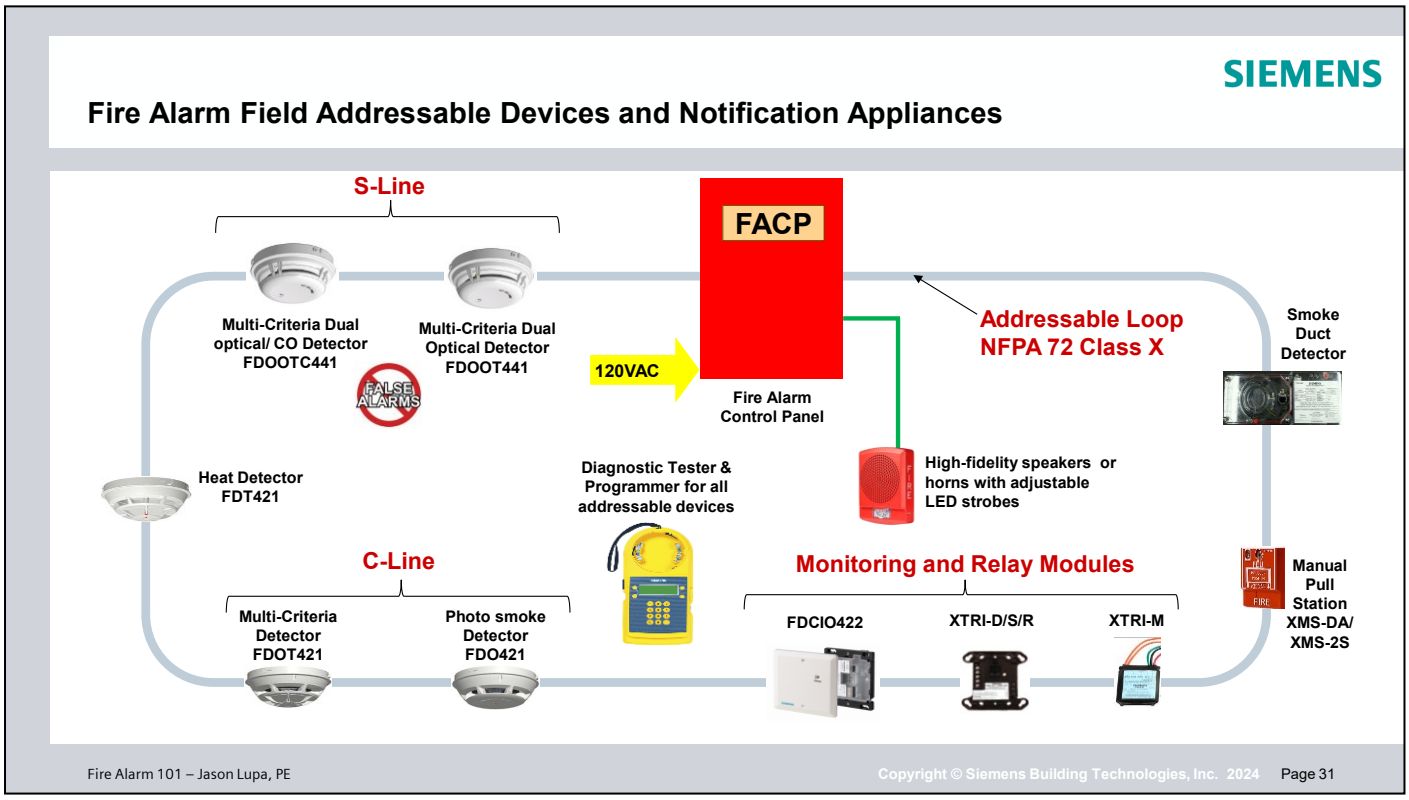
1. It records the time and date at which you observed the presence of the alarm condition and stores that information in the system's historical log.
2. If multiple alarms are present, the system displays specific information for each device when you press the ACKNOWLEDGE (ACK) button. Some systems require you to press the button for each device in alarm.

Next press the SILENCE button to turn off all audible notification appliances. Strobes may continue or may also stop, depending on programing.

1. Alarms should NOT be silenced until there is confirmation the occupants have evacuated.
2. Press the SILENCE button again to reactivate the notification appliances.
3. Any new alarm events will turn the notification appliances back on.
4. Panel programming may delay the alarm silence feature or may prevent alarm silencing when water flows through the sprinkler system.

The third step is to investigate the scene(s) and carry out the necessary actions to determined there is no fire threat. Always assume that a fire exists until proven otherwise. Make sure all smoke detectors are free from smoke and all manual pull stations are reset.

Finally, after the condition that caused the alarm has been identified and corrected, the system may be reset to the Normal state pressing the RESET button. If the device has not been properly restored, the fire alarm panel will return to an alarm state.



We have a comprehensive portfolio that allows us to cost effectively meet the requirements of small jobs, like retail space, all the way up to complex applications such as hospitals and high-rises. This picture will show the devices that can be connected to the SLC. All devices on the loop are addressable.

The automatic detectors are subdivided into C- and S-Lines. The C-LINE detector family contains a Multi-Criteria (combined Photoelectric & Heat sensors) detector, Photoelectric (smoke only) detector, and a thermal (heat) detector. The C-LINE detectors are best suited for standard applications and offer a very competitive economical solution. The S-LINE detector family contains two advanced multi-criteria dual optical detectors; the model OOHC941 contains a CO sensor as well.

The S-LINE detector series differs from the C-LINE primarily in the areas of the advanced signal analysis, redundant sensors, optional CO sensor and the inclusion of innovative forward and backward light scattering detection technology. Additionally, the S-LINE provides more user friendly, field selectable application profiles. The S-LINE is ideal for difficult detection applications where the maximum false alarm prevention is required or sophisticated high value areas where the earliest possible detection is required to prevent downtime and maintain business continuity.

We have a variety of manual pull stations, remote annunciators and addressable duct detectors that can be used on the C-Net. Existing H series detectors can be used with the Cerberus PRO Fire Safety control panels, and can be mixed and matched on the same SLC addressable loop. There is a new 4 input, 4 output intelligent interface module that provides class A wiring capability, FDCIO422.

SIEMENS

Device Programming Unit (DPU)

A totally clear loop before the Fire Panel!

No waiting for the Fire Panel to be installed

WHAT CAN THE DPU DO?

- Pre-test field devices
- Program the address of field devices
- Send the device address to the label printer for placement on the base, detector and/or as built drawing
- Replace devices with on-site staff
- Electrical circuit diagnostics including:
  - Communications
  - Ground faults
  - Shorts
  - Opens

Fire Alarm 101 – Jason Lupa, PE

 Page 32

Another example of time saving technology is the Siemens Device Programming/Test Unit (DPU). It not only programs the addressable device, but tests it to verify functional prior to installation. This versatile tool is used to aid the installation, commissioning, maintenance and servicing of all Siemens's current and legacy of addressable devices.

With competitors you may find out a device is bad after you have climbed up a 30 foot ladder and connected it to the system.

Another benefit of the DPU, is that it is not only a device programmer, but also allows the entire device loop to be tested for communication issues, wiring faults and addressing issues before the fire alarm control gets installed which gives you a head start on the job which saves time.

SIEMENS

Local Status Indicators

Siemens addressable detectors and monitoring modules have an onboard multi-colored LED that indicates the device's status. For devices obstructed from view, a remote lamp will provide the same status information and help responders locate the hidden device.

The status LED will flash green, amber, or red.

- **Green** – the device is operating normally, 10 second flash interval
- **Amber** – the device is in trouble (fault) condition, 4 second flash interval
- **Red** – the device is in alarm mode, 1 second flash interval.

The green status may be disabled via programming, which is sometimes requested for sleeping areas or if it is visually distracting.

The device or remote fire alarm status LED" is a small light that visually indicates the current status of the equipment. It typically uses different colors and flashing patterns to provide local status, inadtion to the display on the panel and remote annunciatrors.

The green light indicates the panel has power and is working normally. The red light comes on when there is a Fire Alarm. The Amber lights come on when the device is in trouble.

SIEMENS

Manual Inputs

DEVICE TYPE	DESCRIPTION	RESTORATION
 Normal  Active	A manual pull station is a wall mounted device meant to be pulled by a building occupant. It locks in alarm and requires a key to reset.	1. FACP: press the ACK button 2. FACP: press the SIL button 3. Locate the pull station which initiated the alarm event. 4. Open the pull station with a key or allen wrench. 5. Move the switch back to normal, if required, some self-reset. 6. Close the manual pull station 7. FACP: press the RESET button
	In areas where false calls are a problem, pull stations may be covered with a clear plastic cover that sounds a loud tamper alarm when opened.	

Fire Alarm 101 – Jason Lupa, PE Page 34

Manual pull stations are activated by the building occupants.

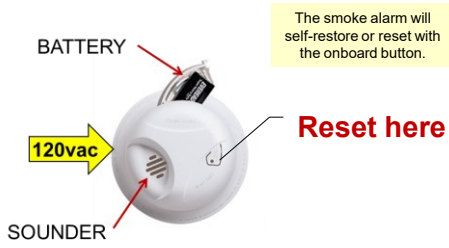
Location: Typically within five feet of the exit doorway opening, at each floor. Additional manual fire alarm boxes may be located next to the FACP, in Security Offices, or on the sides of large stages.

T45-KEYS are used for all Siemens Desigo fire panels, strobe and audio booster panels. They may also be used to reset used to reset models XMS-series manual pull stations. Insert the Siemens T45 key provided into the key lock and turn the key counter-clockwise as the arrow shows and the cover will move upward to the to the Normal position. Rotate the key back clockwise and remove key from the lock.

Indicating the activation: Pull stations will typically have the activation member pulled down or out to indicate activation. Those pull station devices that have glass rods, will have the broken rod lying on the floor beneath the pull station. Furthermore, resetting the unit is required prior to resetting the fire alarm panel. This is performed using a designated key. Wrench or small flat-head screwdriver.

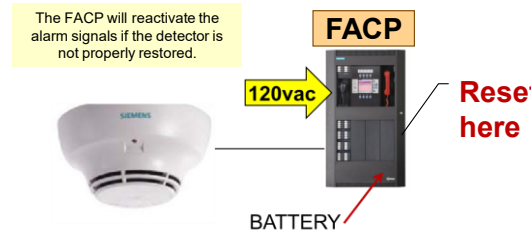
SIEMENS

Automatic Inputs: smoke



UL217
SMOKE ALARM
Single or multiple station

120VAC smoke alarms are only permitted in residential applications.
Their life span is 10 years.
Smoke alarms do not report to a FACP



UL268
SMOKE DETECTOR

System smoke detectors are permitted in commercial and residential applications. Their life span is based on performance testing.
Detectors do report to a FACP.

Fire Alarm 101 – Jason Lupa, PE

 Page 35

A smooth bore nozzle is very different than a fog nozzle. Both are nozzles, but they have very different operational purposes. In fire protection and code language, a smoke alarm is different than a smoke detector.

Although they look alike, a smoke alarm is a stand-alone device with a built-in audible sounder, they are powered by 120VAC with onboard battery backup. They utilize simple smoke detection technology and must be replaced after 10 years in service. A smoke alarm is may be stand alone (single station) or connected to several other smoke alarms (multi-station) within the building. After an activation, they can be reset using an onboard button. Smoke alarms are not UL listed for commercial applications.

On the other hand, a smoke detector is part of a fire alarm system. They are 24VDC powered and supervised by a fire alarm control panel. Smoke detectors can be paired with an optional sounder base, but typically activate the building audible and visual notification appliances. Their replacement schedule is based on the results of annual NFPA 72 sensitivity testing. After an activation, they can be reset at the fire alarm control panel. Smoke alarms are UL listed for commercial applications and residential applications with the correct sequence of operation programming.

IBC 907.2.11.7 permits the use of UL268 system smoke detectors in place of UL 217 120VAC smoke alarms, but they must be programmed so for activation of a smoke detector in a dwelling unit only initiates alarm notification in the dwelling unit. Activation of a dwelling smoke detector shall not activate alarm notification appliances outside of the dwelling unit, provided that a supervisory signal is generated at the FACP.

SIEMENS

Automatic Inputs: Detection Technology

The new editions of UL 217 for 120VAC smoke alarms and UL 268 for system smoke detectors include more than 250 technical changes to the previous edition and about 50 lab tests to verify the effectiveness of smoke alarm and smoke detectors.

FASTER RESPONSE – Modern homes tend to be built and furnished with lighter, synthetic materials that burn hotter and faster - and feature layouts with higher ceilings and open floor plans - that may result in less time for a safe evacuation if a fire breaks out. Escape times have reduced from 10-15 minutes in the 1970's to 1-2 minutes today (NFPA).

REDUCE NUISANCE ALARMS – Three cooking events were identified: toasting bread; pan-frying hamburgers; and broiling hamburgers. UL developed tests to replicate real cooking smoke and ensure new smoke alarms and smoke detectors have better immunity from cooking nuisance alarms.

Who likes false alarms??? Standards are always evolving to address innovations in safety science and technology.

UL announced that their new editions address differing smoke characteristics between fast moving and smoldering polyurethane foam fires. They also include criteria to reduce nuisance alarms.

Research shows that smoke characteristics have changed, and escape times have reduced. Several decades ago, escape times averaged around fifteen minutes, now the critical exit time is reduced down to three or four minutes, largely due to changes in materials used in furnishings and construction[1]. The new UL standards require a detector to more accurately identify a fire signature an activate an alarm quicker.

A major update implemented in the eighth edition of UL 217, the Standard for Safety for Smoke Alarms, includes new requirements for a Cooking Nuisance Smoke Test to help prevent cooking nuisance alarms. During the test, smoke alarms are mounted 10 feet away from an electric range, which is turned to full power with frozen hamburger patties cooking inside on a broiler tray underneath electric broiler coils. In order to pass the test, the alarms must not go off while the patties are cooking prior to the smoke reaching a certain obscuration (OBS) level.

The updates to UL 268 and 217 are intended to better address these changes, compared to the previous 2015 edition.

REFERENCES 1 Underwriters Laboratories. 2021. "Close Before You Doze." Close Your Door. Last modified November 21, 2021. https://closeyourdoor.org/#facts

SIEMENS

Automatic Inputs

DEVICE TYPE	DESCRIPTION	RESTORATION
	A photoelectric smoke detector optically detects the presence of smoke. It projects a beam of light inside a chamber. If the beam of light becomes obscured, the detector will sound an alarm. New technology makes ionization detectors obsolete.	1. FACP: press the ACK button 2. FACP: press the SIL button 3. Locate the detector which initiated the alarm event, find the red LED. 4. Clear the fire condition. 5. Clear the detector, use compressed air to clean the detector. 6. FACP: press the RESET button 7. The FACP will reactivate the alarm signals if the detector is not properly restored.
	A thermal detector senses heat, there are two varieties. Rate-of-rise detects a change in temperature of 15° degrees within one minute. Fixed temperature are calibrated to alarm at a specific temperature, Some mechanical (conventional) heat detectors are non-restorable.	

Fire Alarm 101 – Jason Lupa, PE

Page 37

A smoke detector is a device that detects visible or invisible particles of combustion. They may be located for protection of equipment, such as above the fire alarm control panel, located to initiate a particular function, such as in an elevator lobby to signal cab recall, or spaced for area coverage. When installed for area detection, NFPA 72 and UL limit their design coverage to 900 sq ft for typically spacing of 15 ft from walls and 30 ft between detectors.

The Heat Detector is a ceiling-mounted initiating device good for places where smoke detectors are inappropriate.

Heat Detectors are available in a variety of models that are generally grouped into the following types:

Fixed temperature technology uses a spring-loaded plug fastened to the detector with a solder. The solder is engineered to melt at the detector's designated temperature value.

Rate of Rise technology uses a bag of air that is designed to release at a particular rate per second. When the surrounding temperature heats the air in the heat detector, the air expands, causing pressure that closes contacts that trigger an alarm. If the air expands faster than it is released from the bag, the detector triggers an alarm.

Combined Technology: heat detectors use both Fixed Temperature and/or Rate of Rise technologies to detect the sudden presence of heat.

Heat detectors are available in a variety of temperature alarm points and are available in weatherproof models.

Indicating the activation: Smoke detector activation is typically indicated by a red LED located on the smoke detector that remains constantly illuminated or flashes rapidly. Detectors in high locations or concealed locations may have a remote indicator LED. Compare all smoke detector devices to assist in determining if the detector is activated or

not. Heat detectors may have an LED a metal ‘button’ which pops-off or no visible means of determining if they are activated.

SIEMENS

Automatic Inputs

DEVICE TYPE	DESCRIPTION	RESTORATION
	Carbon monoxide (CO) detectors sense the, colorless, odorless, poisonous gas produced by the incomplete combustion of various fuels, including coal, wood, charcoal, oil, kerosene, propane, and natural gas.	1. FACP: press the ACK button 2. FACP: press the SIL button 3. Locate the detector which initiated the alarm event, find the red LED. 4. Clear the fire condition. 5. Clear the detector, use compressed air to clean the detector. 6. FACP: press the RESET button. 7. The FACP will reactivate the alarm signals if the detector is not properly restored.
	A multi-sensor or multi-criteria detector senses smoke, heat and gas. Their sensors are capable of generating different outputs based on the activation. Their algorithms provide the highest resistance to false alarms.	

Fire Alarm 101 – Jason Lupa, PE

Page 38

A multi-sensor or multi-criteria detector is a device that contains multiple sensors that separately respond to physical stimuli such as heat, smoke, or gas. This device is capable of generating multiple alarm signals from any one of

the sensors employed in the design, independently or in combination. The sensor output signals are mathematically evaluated to determine when an alarm signal is warranted. The evaluation can be performed either at the detector or at the control unit. This device has listings for each sensing method employed.

If some sensors are disabled, the detector should be labeled to avoid confusion during the annual NFPA 72 inspection. For example, a multi-criteria smoke/ thermal/ CO detector may be installed 2 ft above the floor near a fire place and have a sounder base programed for Temporal-4 signals. CO detection is required due to the product of combustion, but the location is only valid for CO monitoring. A label will ensure the design intent is maintained and the detector is not relocated away from the designated hazard.

Indicating the activation: Smoke detector activation is typically indicated by a red LED located on the smoke detector that remains constantly illuminated or flashes rapidly. Detectors in high locations or concealed locations may have a remote indicator LED. Compare all smoke detector devices to assist in determining if the detector is activated or not. Heat detectors may have an LED a metal ‘button’ which pops-off or no visible means of determining if they are activated.

SIEMENS

Typical CO activation response SOP

Carbon monoxide (CO) is a colorless, odorless, and tasteless gas that can be fatal. It's also known as the "silent killer" because it's difficult to detect. Carbon monoxide detectors are time-weighted. While high levels will initiate an immediate alarms conditions, it also can be triggered due to a low-level buildup of CO as time passes. The primary source of carbon monoxide (CO) is the incomplete combustion of carbon-containing fuels like gasoline, oil, natural gas, coal, and wood. Common sources of carbon monoxide:

- Leaking/ blocked chimneys and flues.
- Back-drafting or improper venting from furnaces, gas water heaters, wood stoves, and fireplaces.
- Worn or poorly adjusted combustion devices (e.g., cracked heat exchanger allows flue gasses to enter the building when the unit is operating).

Upon any CO detector activation, the immediately area should be evacuated. When responding to a CO alarm activation, a portable CO meter is the only way to determine the hazard level. CO levels are measured in parts per million (ppm). The meter will display the gas levels, in real-time. Here are some basic procedures, always consult the meter's specific operating instruction prior to use. Multiple meters are recommended for high frequency rapid responses. Do not enter the area to locate potential carbon monoxide sources without a functioning gas detector and proper PPE.

- **Calibrate the meter:** Before use, always check that your CO meter is properly calibrated according to manufacturer instructions. This is also called a bump test.
- **Zero the meter:** Place the meter in fresh air and zero it out to ensure accurate readings. Normal readings should be zero (0).
- **Select location:** Position the meter in the area you want to test, typically near potential CO sources with the appliance operating.
- **Isolation:** Reduce fresh air dilution by stopping exhaust fans and closing doors and windows.
- **Allow stabilization:** Let the meter stabilize and display a steady reading before recording the value.
- **Create a Worst-Case Scenario:** Turn on all fuel burning appliances simultaneously and close up the area.
- **Take multiple readings:** If necessary, take readings in different areas or at different times to get a comprehensive picture.

If the reading are high, ventilate the area as necessary and repair technicians must investigate the potential source(s). Interview the occupants, look for symptoms of carbon monoxide exposure and ask about possible sources of combustion. An HVAC technician may also be required to verify proper air flow. If the room builds up negative pressure, a backflow condition may occur. To check for this condition, turn on all exhaust devices (attic fan, kitchen vent hood, bathroom fans, etc.) and use a smoke generator or air flow meter to test backflow from the fireplace, hot water tank, and furnace. Inspect all chimneys and all other appliance venting systems for leaks, cracks, holes, and blockages. Finally check CO detector locations that within at least 15 feet of a fuel-burning appliance and within the operational period. Verify that they are installed according to the manufacturer's recommendations and that they are not located in hot or humid areas.

Normal readings should be zero (0). Levels upto 9 ppm pose no health risk, but may be a sign of equipment failure which could become progressively worse. While high levels can cause immediate health effects, low levels over long periods of time can also have adverse effects. Long-term exposure to levels 10–29 ppm may cause headaches and nausea, 30–35 ppm flu-like symptoms may develop, especially for the elderly and young. Compare your readings with the levels below:

1. 50 PPM: Permissible Exposure Level (PEL) for 8 hours (OSHA)
2. 200 PPM: Possible mild frontal headache in 2 to 3 hours.
3. 400 PPM: Short-Term Exposure Limit (STEL) for 15 minutes (ACGIH)
4. 800 PPM: Headache, dizziness, and nausea in 45 minutes; collapse and possible death in 2 hours
5. 1,500 PPM: Immediately Dangerous to Life and Health (IDLH) in 30 minutes (OSHA)

SIEMENS

Automatic Inputs: suppression

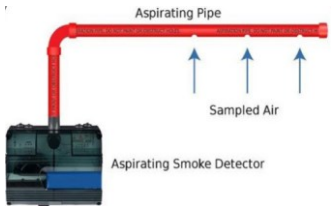
DEVICE TYPE	DESCRIPTION	RESTORATION
	Fire suppression system activation such as a fire sprinkler waterflow switch, clean agent release (FM-200) or kitchen hood system. This equipment is supervised by an addressable monitoring module reporting to the FACP. The monitoring module will have a status LED light on the faceplate. It should be labeled and be accessible.	1. FACP: press the ACK button 2. FACP: press the SIL button 3. Locate the equipment which initiated the alarm event. 4. Clear the fire condition. 5. The monitoring module will only restore once the equipment is returned to normal operations 6. FACP: press the RESET button

A carbon monoxide detector or CO detector is a device that detects the presence of the carbon monoxide (CO) gas in order to prevent carbon monoxide poisoning. CO is a colorless, tasteless and odorless compound produced by incomplete combustion of carbon containing materials. It is often referred to as the "silent killer" because it is virtually undetectable without using detection technology and most do not realize they are being poisoned. Elevated levels of CO can be dangerous to humans depending on the amount present and length of exposure. Smaller concentrations can be harmful over longer periods of time while increasing concentrations require diminishing exposure times to be harmful.

Indicating the activation: Suppression activation will be reported at the fire alarm control panel and remote annunciators/ graphic annciators is applicable. CO detector activation is typically indicated by a red LED located on the detector that remains constantly illuminated or flashes rapidly. Some CO detectors will display the CP PPM on the device itself or remotely on the FACP.

SIEMENS

Automatic Inputs: specialize detection

DEVICE TYPE	DESCRIPTION	RESTORATION
 HVAC device	A duct smoke detector is a smoke detector in a housing mounted on a HVAC air handling duct. It uses probes to sample the air. New codes now require activation to initiate a SUPERVISORY condition.	1. FACP: press the ACK button 2. FACP: press the SIL button 3. Locate the device which initiated the alarm event. 4. Clear the fire condition. 5. Take-off the duct housing cover, use compressed air to clean the detector. The ASD will self-clear once the smoke condition has been removed. 6. The detector may require a local reset with a button or keyswitch. 7. FACP: press the RESET button
	An aspirating smoke detector (ASD) is a central detection unit that draws air in through a network of sample pipes to sense smoke and other toxic gases.	

Fire Alarm 101 – Jason Lupa, PE

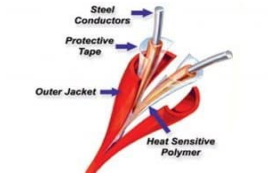
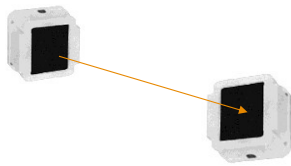
 Page 41

The duct smoke detector is a duct-mounted sensor that is used in the Fire Alarm system. It detects smoke within the protected duct. When the smoke detector senses smoke, it sends a data message to the system control panel for processing. When there is no smoke in the protected duct, the smoke detector sends a data message to the panel, indicating that the duct is in a normal. Duct detectors in high locations or concealed locations may have a remote indicator LED.

An aspirating smoke detector (ASD) is a system used in active fire protection, consisting of a central detection unit which draws air through a network of pipes to detect smoke. ASDs can typically detect smoke before it is visible to the naked eye. They continuously sample air to provide the earliest possible warning of an impending fire hazard. ASD's typically have multi-level warnings. They are typically used in high-value areas and challenging detection scenarios.

SIEMENS

Automatic Inputs: specialize detection

DEVICE TYPE	DESCRIPTION	RESTORATION
	Linear Heat Detection (LHD) is a continuous sensor cable. A fire will melt the cable, the steel conductors make contact and initiate an electrical short for an alarm. They are common in attics, rooftop solar panels, and industrial settings.	1. FACP: press the ACK button 2. FACP: press the SIL button 3. Locate the device which initiated the alarm event. 4. A LHD can not be restored by the FD after an activation. A beam detector may require a local reset panel, front cover Test/Reset button, or remote accessory keyswitch. 5. FACP: press the RESET button
 **Line-of-sight device**	A beam smoke detector projects a light beam across an open area to detect smoke. When the light is blocked, they will cause a trouble condition. They are used in large spaces, such as atriums theaters and gyms.	

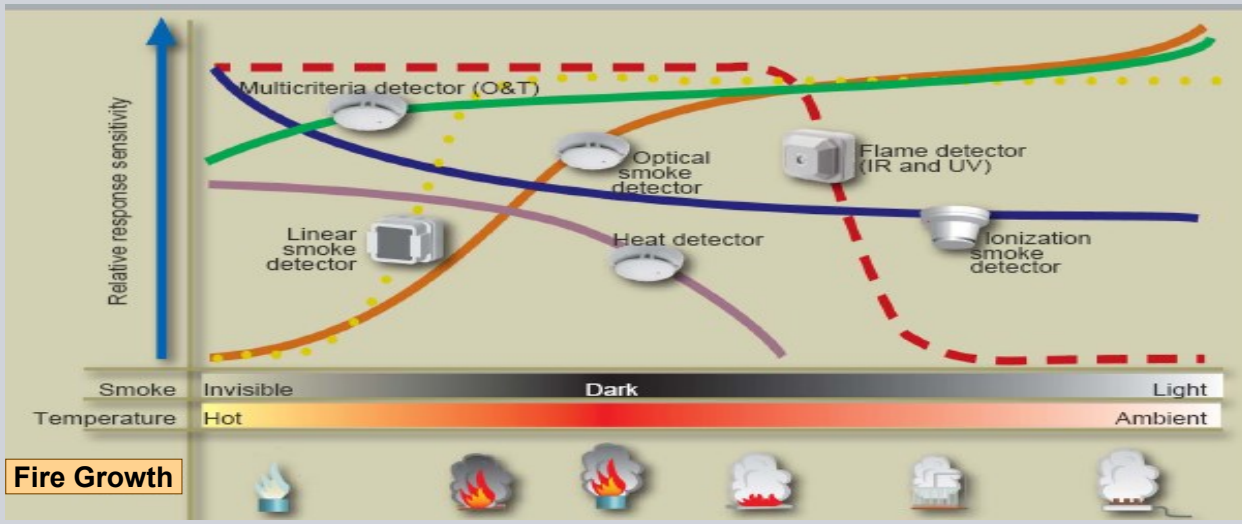
Linear Heat Detection (LHD) is a continuous heat detector designed to detect heat along the length of a sensor cable. This sensor cable is made up of two conductors, both insulated by heat sensitive polymers. The heat sensitive polymer is protected by an outer jacket. Beneath this jacket and heat sensitive polymer coating is a pair of steel conductors. When the ambient temperature meets or exceeds the detector's fixed temperature, the polymer melts. As it melts, the steel conductors make contact and initiate an electrical short that then sends a signal to the fire alarm panel of an alarm condition.

Smoke beam detectors are good choices for large rooms, such as a gymnasium or an auditorium. They are devices that projected beam of light, similar to a spot smoke detector. A wall-mounted unit sends out a beam, which is either received by a separate monitoring device or reflected back via a mirror. When the beam becomes less visible to the "eye" of the sensor, it sends an alarm signal to the fire alarm control panel.

Modern fire alarm systems can integrate highly refined beam detection systems that use multiple beam transmitter sources and only one receiver that requires being hard-wired. Beam detection is one solution for large volume and architecturally sensitive spaces. Many manufacturers now offer beam detection systems that only require a transmitter/receiver installed in one location with a reflector on the opposite end of the detection space, reducing installation complexity. Additionally, newer beam detectors are far less prone to false alarms caused by obstructions, sunlight, building movement and misalignment.

SIEMENS

Fire Principles – Automatic Detector Response



To reliably detect all expected incipient fires, it may be necessary to combine different types of detection

As you can see it takes different technologies to detect different types of fires. The right choice is up to the designer based on the expected fire type for the area to be protected.

Fire can develop over a long period of time.

Different detection technologies may be used to sense fire at different stages.

Heat is the last stage of fire development therefore smoke and poisonous gases can exist before a heat detector could detect the fire. Therefore heat detectors are typically not used for life safety designs, unless the environment is not suitable for smoke detection.

SIEMENS

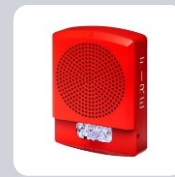
Notification Output Appliances

Fire alarm systems utilize a variety of audible and visual appliances to alert building occupants and fire authorities within the protected area as well as outside that an event or fault has occurred.

These appliances include:

1. Audible alarms (horns, voice speakers, bells, buzzers, chimes, etc.)
2. Visual alarms (strobes, flashing lights, etc.)
3. Scrolling signs, video display, emails, text messages, etc. provides auxiliary notification






The audible types are most common, with a variety of types being available from bells to all kinds of different electronic sounders including those containing pre-recorded spoken messages. Many types of alarm sounders are available and the choice of device is dependant on local preference, code requirements and the need to have a distinct signal from all other building audible alarms.

1. Bells were common in the 1950's and 60's and often coded.
2. Horns are the most common fire alarm signals. The typical pattern used is Temporal, Code 3.
3. Chimes may be used where a soft alarm tone is preferred, such as health care facilities and theaters.
4. Electronic solid state sounders (AKA mechanical horns) with mono or multi tone output normally in the range of 800 - 1000 Hz.
5. Small sirens operating in the range of 1,200 - 1,700 Hz. Sirens ranging widely in size from 0.17kw to 11kW generally operating in the frequency range of 400 - 800 Hz. Outdoor sirens should be fitted with heaters and thermostats to protect against low temperature conditions.
6. Audio speakers are becoming more common option, which sound a reproducible signal such as a recorded voice message. Voice communication capabilities can be integrated into a fire alarm system by connecting loudspeakers or public address (PA) systems located throughout the building to a central control. These systems enable fire department personnel to instruct the building occupants on procedures to follow during the fire. They are often ideally suited for large, multistory or other similar buildings where phased evacuation is preferred.

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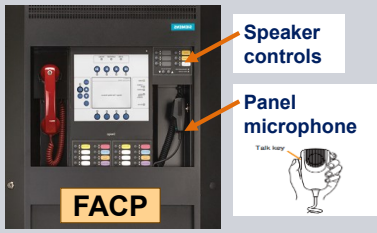
Operating Voice Notification Systems

Instead of horns or bells, a fire alarm system with voice notification uses speakers. When the panel has an alarm event, an alert tone and a pre-recorded message automatically play. Firefighters can override this automatic message with the panel microphone. The manual paging feature can also be used to broadcast a live message when the panel is in the normal (non-alarm) state.



Microphone Manners

Hold the microphone 1-2" from your mouth and talk past the mic instead of directly into the it. This is the same operation as apparatus or portable radios.

Manual Paging Instructions

Step 1 – Unlock and open the FACP door.

Step 2 – Using the speaker controls, select 'ALL CALL' to page the entire building or press individual areas. Multiple paging areas can be selected at the same time. Each paging area LED will stay lit as confirmation.

Step 3 – Using the panel microphone, press the Talk Key. There will be a brief pre-announce alert tone, then you can speak. The green microphone indicator LED will confirm your activity. Live voice messages always have priority over automatic messages.

Step 4 – When done speaking, release the Talk Key and return the microphone to the holder. Then deselect the paging zone(s) by pressing the button(s) again. The paging area LED will turn off.

Fire Alarm 101 – Jason Lupa, PE

 Page 45

A voice evacuation system functions similarly to a fire alarm system, with a few notable exceptions. It utilizes similar field equipment, smoke and heat detectors, but instead of horns and strobes to alert occupants, it broadcast a combination of tones and voice instructions through speakers. The manual paging function may be used while the fire panel in in standby (non alarm) or active (alarm) mode. They have priority over pre-recorded messages.

Manual Voice Paging to the Entire Building – All Call

To broadcast a live voice message throughout the building:

1. Pick up the microphone on the fire panel.
2. Press the ALL CALL or PAGE TO ALL button.
   - The LED illuminates speaker groups.
3. Key (press and hold) the panel's microphone button.
   - A brief preannouncement tone sounds and the preannounce tone LED is illuminated steady. Wait to speak.
   - The Ready to Page LED illuminates. Begin speaking.
4. Hold the microphone a couple of inches from the mouth. Angle it so that you speak across it, not directly into it. Use a clear and controlled voice when speaking.
   - During the call, the operator can briefly (for up to five seconds) unkey and then re-key the microphone (for example, to cough) without re-initiating the preannounce tone.
5. To end the call, the operator un-keys and replaces the microphone.
   - The Ready to Page LED turns off.
6. To return the system to normal, the operator presses the ALL CALL switch again.

Broadcast to individual areas using the above steps, but instead of pressing the ALL CALL button, select the broadcast area(s).

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Fire Alarm Response Resources

The apparatus should carry a small Fire Alarm Response Kit with the following:

Reset Key – A collection of 42 keys common fire alarm keys are available to purchase on Amazon. Vendors also have extra keys from previous installations. Panel and reset keys should also be kept next to the FACP and inside the Knox Box. Screw drives can also be used to reset some manual pull stations.

Compressed Canned Air – Once the room is cleared of any smoke, simply direct the nozzle of the compressed air duster at the smoke sensing chamber and press to discharge. This usually will be able to remove any fine particles that are causing the alarm. A small fan or a piece of cardboard may also be used to stir up the air.

Smoke Canned Spray – Safe to test the functional ability of a smoke detector. Puts both photoelectric and ionization smoke detectors through their paces to ensure that they are functioning and that they are actively sampling the air. Never use real smoke.

Smoke Alarm – Spare battery-operated smoke alarms and fresh 9-volt batteries. These can temporally replace defective residential units or replace low/ missing batteries.

Always follow your departments SoP's when responding to a fire alarm activation.

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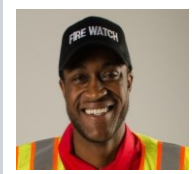
Fire Watch



When a portion of a fire alarm or fire sprinkler system is disabled, the Authority Having Jurisdiction (AHJ) may require a fire watch.

During a fire watch, a designated person would be responsible for:

- Preventing a fire from occurring.
- Patrolling the building for a fire condition.
- Extinguishing small fires.
- Notifying the fire department and building occupants in the event of an emergency.

All areas of a building, including unoccupied and hidden areas, must be continuously patrolled for smoke, fire, and other hazardous situations.

The building code requires that facilities provide protection for occupants of the building during the time the of any fire protection systems are out of service, including during maintenance or construction. During these times, the fire department must be notified, and a fire watch initiated.

A fire watch is a period of time when a group of dedicated staff continually circulate through the affected area of the building looking for signs of fire. Part of the watch includes notifying the fire department or other emergency response group and documenting when that notification occurs, as well as noting the times the rounds are conducted by the fire watch staff.

The staff should have no other responsibilities than circulating through the affected area and looking for signs of fire and checking to make sure that fire escapes, exits, alarm systems, and other elements of the building's fire safety system remain unobstructed, functioning, and available if needed.

Cameras can be used to supplement the fire watch, but cannot be used in place of human staff. Camera equipment lacks the senses of smell, hearing, and perception for what conditions may produce a fire.

Fire Department Communications: wired
Firefighter Phone System (FPS)

SIEMENS

The Firefighter Phone System provides dedicated two-way, hard-wired communications for high-rise facilities where radio communications may be unreliable. Buildings will either have dedicated phone stations or portable handsets which plug-in to telephone jacks. When a firefighter activates a phone, it causes a buzzer to sound and lights a "Common Call" indicator on the panel telephone panel in the FCC. The Incident Commander can 'answer' incoming calls using the panel telephone handset and the panel control switches. Once a phone circuit is connected to a talk line, all remote phones on that circuit are also connected. Additional lines can also be added or deleted.

Fire Alarm 101 – Jason Lupa, PE

 Page 48

The Firefighter Phone System provides dedicated two-way communications for facilities where radio communications may not be available or are unreliable. They are typically used during active firefighting conditions, fire alarm investigation, or during fire alarm system inspections. They operate similarly to a Plain Old Telephone System (POTS). The main difference is the firefighter's phone uses no bell ringing voltage, no dial-tone, and you can't dial-up any other buildings. Unlike a traditional copper phone service, the firefighter's phone wires are supervised for opens, shorts, or ground faults. The panel phone in the Fire Command Center can connect to the emergency telephones or telephone jacks located throughout a building.

All phones on the Firefighter Phone System use a common communication system called a talk line. The portable handsets plug-in to the Fire Fighters' telephone jacks which are located throughout the building. Plugging in a portable telephone handset causes a buzzer to sound and lights a "Common Call" indicator on the panel telephone panel in the FCC. The Incident Commander can 'answer' incoming calls using the panel telephone handset and the control switches. Once a phone circuit is connected to a talk line, all remote phones on that circuit are also connected. All active phones on the talk line can talk together, as on a party line. Additional lines can also be added or deleted

In lieu of a wireless emergency responder radio coverage system, a wired fire department communication system utilizing 2-way telephone jacks will be installed at the following locations per IBC [2015] 907.2.13.2 and NFPA 72 6.10:

- Inside each elevator car
- Elevator lobbies
- Entry inside the stair enclosure, at each floor level
- Each Fire Pump Room
- Each Elevator Machine Room

Fire Department Communications: wireless
Emergency Responder Radio Coverage System (ERRCS)

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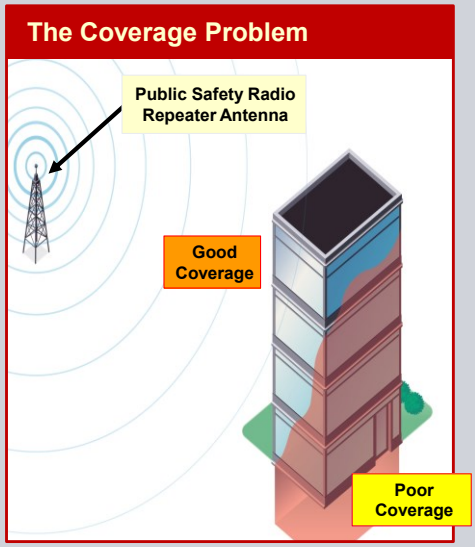
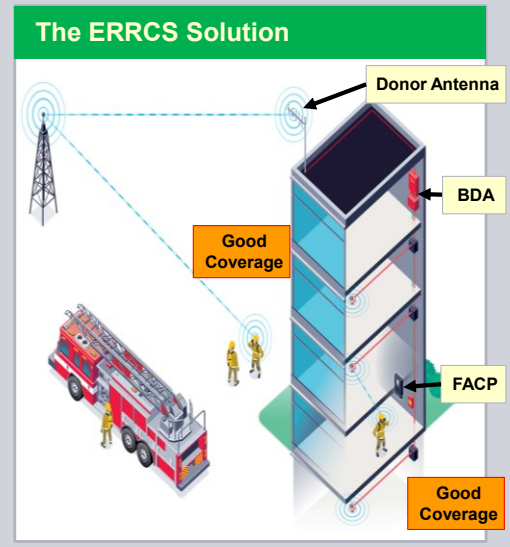


A ERRCS is a dedicated system in a building that receives external Public Safety radio signals and retransmits them within the building ensure penetration in all areas including stairwells, elevators, basements, and other heavily shielded areas.

It is required by the building code!



Fire Alarm 101 – Jason Lupa, PE

 Page 49

The ERRCS is made up of a donor antenna that receives external radio signals from the local emergency responder radio tower, a bi-directional amplifier/repeater that boost the radio signal, a coaxial cable or fiber medium that distributes the radio signal throughout the building, and coverage antennas that transmit and receive radio signals within the building for reception by Land Mobile (handheld) radios used by emergency responders.

IBC [2015, 2018, & 2021] - Section 918 *Emergency Responder Radio Coverage*

- Refers to IFC section 510 or the state recognized fire code

IFC [2015, 2018, & 2021] Section 510 *Emergency Responder Radio Coverage*

New building coverage requirements: IFC 510.1

Existing building coverage requirements: IFC 510.2

New & existing design requirements: IFC 510.4.2 and NFPA 1221.

NOTE: Previously NFPA 72 contained ERRCS design and installation requirements. The 2016 edition of NFPA 72 relocated these requirements to NFPA 1221 in Section 9.6.

- The 2018 edition of the building code references the 2016 edition of NFPA 1221.
- The 2021 edition of the building code references the 2019 edition of NFPA 1221.

Fire Department Communications: wireless
Emergency Responder Radio Coverage System (ERRCS)

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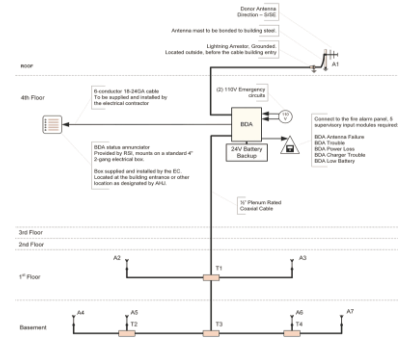
Distributed Antenna System (DAS)
The in-building passive network of coax cables, splitters, and antennas

Bi-Directional Amplifier (BDA)
Head-end active electronics. Amplifies signals for distribution via the DAS

Emergency Responder Radio Coverage System (ERRCS)
Engineered system of antennas & repeaters designed to amplify the exterior public safety radio signal inside



Fire Alarm 101 – Jason Lupa, PE

 Page 50

How ERRCS work:

- Ground command signals are transmitted through the public safety radio repeater to a donor antenna. The donor antenna receives the signal and passes it to a Bi-Directional Amplifier (BDA) that boosts the signal and transmits it throughout the building via the Distributed Antenna System (DAS).
- Via this method, messages can also be sent / received by land mobile radios to people outside of the building and other emergency responders inside the building.

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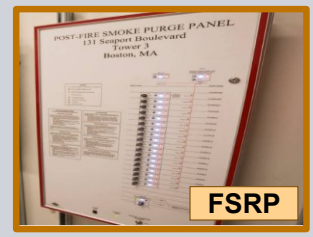
Post-fire Smoke Purge System



In large buildings, breaking windows or cutting roofs for ventilation is not always an options. A post-incident smoke purge system is comprised of a Firefighter Smoke Removal Panel (FSRP) which helps to remove smoke after a fire. They repurpose the HVAC fans or may have dedicated fans. The FSRP has a graphical depiction of the building and controls for the first responders to operate.

Typically, a 3-position on–off–auto switch is provided for each zone. In the “auto” position, the building fans operate normally. In “manual purge”, the switch will activate fans and dampers that are required to achieve the smoke removal. In the “off” position, all fans and dampers shut down.

Firefighter ventilation of a fire incident is a critical step to restoring the building operations. It removes toxic products of combustion, residual heat and replaces them with fresh air. This initial environmental restoration assists the first responders with their suppression efforts and helps limit further property damage.

In smaller buildings, firefighters can break windows or cut holes in roofs as ventilation technique to remove smoke, heat and other combustion products from a structure. They can then utilize hydraulic or portable mechanical positive pressure ventilation fans. In larger occupancies, such as high-rise buildings, manually creating ventilation points is not practical due the size of the structure. When pre-planning a response to a fire event, most fire departments will not allow the removal of glass panes/ glazing or the use of special windows designed to break upon impact (often identified with a maltese cross). This can be a time-consuming process, cause debris to fall on emergency crews, and complicate the building restoration process.

If manually operable windows or reversable stair fan systems are not available, some occupancies require fixed post-incident smoke removal systems to safely remove smoke after a minor fire event. The goal is to help resume normal activities as quickly as possible once a fire has been controlled of remove smoke from interior spaces and making it suitable for occupancy as fast as possible. This type of post-incident system used exclusively by the fire department. It does not have the same code or design requirements as a smoke control system. These post-fire salvage or smoke purge systems use mechanical ventilation sized to remove smoke from indoor areas once a fire has been extinguished during firefighter overhaul operations.

Standard environmental HVAC fans can be used for post-fire salvage duty (smoke removal) providing the BAS is programmed with the correct sequence of operations. The IBC lists the base requirements for post-fire salvage systems in Section 403.4.7. Since this type of system is NOT classified as smoke control, UUKL listing, elevated operational temperature requirements, supervised circuits, etc., are not required.

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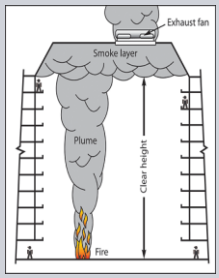
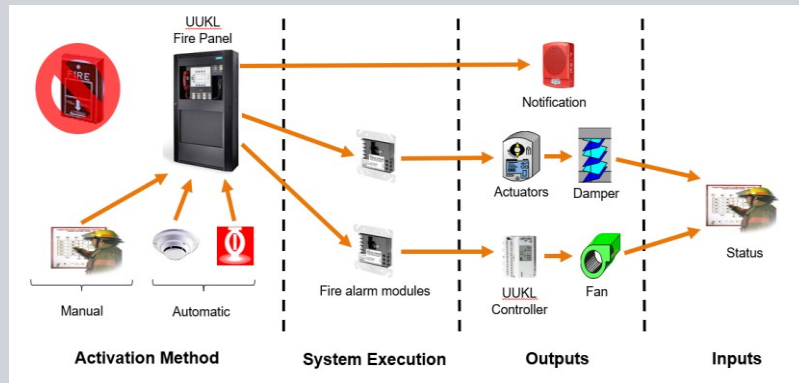
Smoke Control System



Smoke control systems must maintain a tenable environment for the time necessary to allow occupants to exit the building or keep smoke from entering a space in which occupant can not evacuate.



Typical Applications

- Atriums
- Large theaters
- Stair pressurization
- Elevator hoistway pressurization
- Zoned smoke control

Fire Alarm 101 – Jason Lupa, PE

 Page 52

A smoke control system is intended to prevent smoke from spreading throughout the building or partially remove it allowing occupants a clear evacuation route. They are typically required in high-rise buildings, large assembly occupancies, atria, deep underground buildings and occupancies with restricted egress access. These custom engineered systems must be designed by a team with the necessary expert knowledge to ensure optimum performance during a live fire event. Since a smoke control system must operate under active fire conditions, all of the components must be UL 864 UUKL listed and have a graphical firefighter smoke panel.

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Firefighter Smoke Operations

Firefighter Smoke Control Panel Operations

Per IBC 909.16

Fire fighters smoke control panel

Status lights.

Panel override switches

On-Auto-Off
Open-Auto-Close

FANS
DAMPERS

General Light Annunciation Sequence:

WHITE/NORMAL - illuminated when the system is idle (switch is in AUTO)

GREEN/OPEN/ON - illuminated when that specific component/s is confirmed to be Open or On when either an automatic or manual command has occurred for that specific component.

AMBER/FAULT - illuminated when the specific component fails to complete the action it has been commanded to complete.

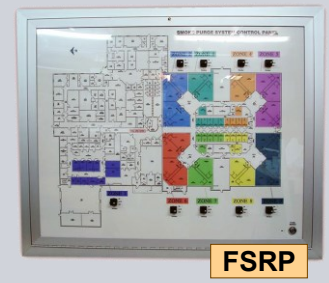
RED/CLOSED/OFF - illuminated when that specific component is verified to be Closed or Off.

FSCP

- Operates during a fire event
- Automatic operations with manual overrides
- Full status feedback of system operations

Firefighter Smoke Removal Panel Operations

Per IBC 403.4.7



FSRP

- Operates after a fire event
- Manual operations
- Limited status feedback of system operations

Every smoke control system requires a custom-built firefighter's smoke control panel (FSCS) which annunciates equipment status, provides firefighters manual control of system components. It is required to be in the fire command center in high-rises or at a location approved by the AHJ; often adjacent to the building fire alarm panel or near the smokie control area. The panel is an integral component which must meet Underwriters Laboratories Inc.(UL) requirements for the UL 864 UUKL Smoke Control Listing. Each building that has the smoke control listing requires an FSCS panel. The graphic contains major building features with positive feedback to the operator to quickly show what is happening in the space. This panel can be provided by either the fire alarm contractor or the mechanical contractor.

Emergency Occupant Communications
Rescue Assistance Systems

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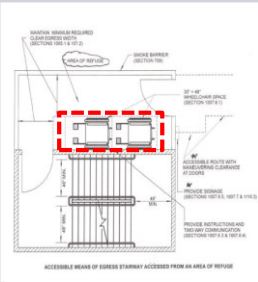
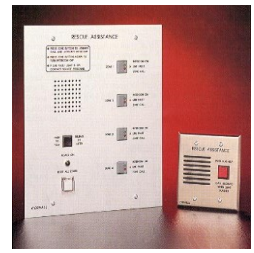
Area of Refuge	A dedicated fire-rated space in a building designed to hold occupants during an emergency, when evacuation down the stairs may not be safe or possible. They are sized to include one wheelchair space for every 200 occupants served.	
Rescue Assistance System	An electronic two-way communication system which provides live voice communications for occupants in need of assistance that are unable to egress during an emergency due to a physical limitation.	

Fire Alarm 101 – Jason Lupa, PE

Page 54

An Area of Refuge (AoR) is a dedicated space where persons unable to use the stairways can remain temporarily while they request help. The wheelchair spaces are provided at stairways and accessible means of egress elevators and should not obstruct the path of egress. Additionally, areas of refuge are separated from adjacent spaces by smoke barriers or horizontal exits but can also be in the fire-rated enclosure of an interior exit stairway.

Areas of refuge must include an electronic two-way communication system. Rescue Assistance Systems (RAS) are occupant two-way communication systems which provide ADA-complaint emergency communications between civilians who need assistance and emergency responders. They are separate platforms from the fire alarm control panel. RAS call stations are provided at areas of refuge or elevator lobbies

Basically if an occupant has a mobility issue and can't get out of a building during a fire, power outage, elevator failure, etc, the code requires a communication system to call for assistance if trapped on a non-ground level floor.

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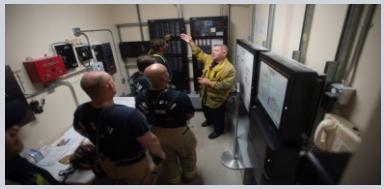
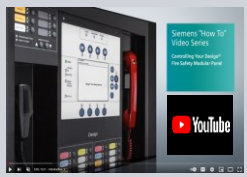
Building Life Safety System Training





Fire alarm systems must be inspected once a year. A NFPA 72 annual inspection is an excellent opportunity for firefighters to experience hands-on operations for fire alarm systems in their first due local.

Training opportunities are available from several trade organizations:

- NIST, IAFC, OSHA, NFPA, SFPE, AFAA, NEMA, NECA, etc.

Fire alarm manufactures also provide product data, educational material and virtual system demos. Siemens has a fire alarm 'How to' series on YouTube and additional resources at:

www.siemens.com/us/en/products/buildingtechnologies/fire.html

Firefighter put their turnout gear on BEFORE they enter a burning building, NOT once they're inside! The same is true for fire alarm training.

There are several virtual and in-person training opportunities. Many building life safety systems are engineered and custom designed. It is important to learn about the specific type of systems installed in your first due area. Learn their features, benefits and operation PRIOR to an emergency call.

The more you know about your fire alarm system, the better decisions you can make about keeping your building's fire protection up-to-date. If you have any additional questions about your fire alarms, or if you need inspection or testing of your life safety system, pls contact Siemens Industry!

Jason A. Lupa, P.E., *Mid-Atlantic Business Development Manager*

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