FIRE ALARM SYSTEMS

Part 1: Foundational Basics

1 VIRTUAL TRAINING

FED®

LEARNING CENTER

ICC PREFERRED EDUCATION PROVIDER

Table of Contents

What We Believe 2

The Student Experience 3

Instructional Design Variety 4

Course Objectives 5

Standards, Codes, Testing, & Enforcement 6

History, Types, & Components 15

Functionality of Panel & Input/Output Devices 25

Glossary of Terms 35

#NFPA96
#NFPA17A #NFPA10
#GenerationTrained

What is the FED Learning Center?

The FED Learning Center is an educational platform supporting training and developmental needs of the Fire and Life Safety industry.

In late 2017, Fire and Life Safety industry leaders came together to address challenges in employee hiring, retention, and training. Specific focus was given to the need for technical training, as it relates to the field technician responsible for maintenance, inspection, and repair in fire suppression applications. Continued research and planning, by BHC, resulted in the development of the FED Learning Center. The plan was officially announced in the spring of 2018, with courses held later that summer.

The FED Learning Center was created to fulfill the need for educational opportunities on a variety of topics affecting the Fire and Life Safety industry. To strengthen the educational value the program provides, several industry experts have participated in developing the facilities and content, including many Engineers, Product Specialists, Code Professionals, and Facility Experts. Additionally, great care has been given to Instructional Design so that learners of all types benefit from the courses offered within the program.

Our Work Saves Lives

What We Believe?

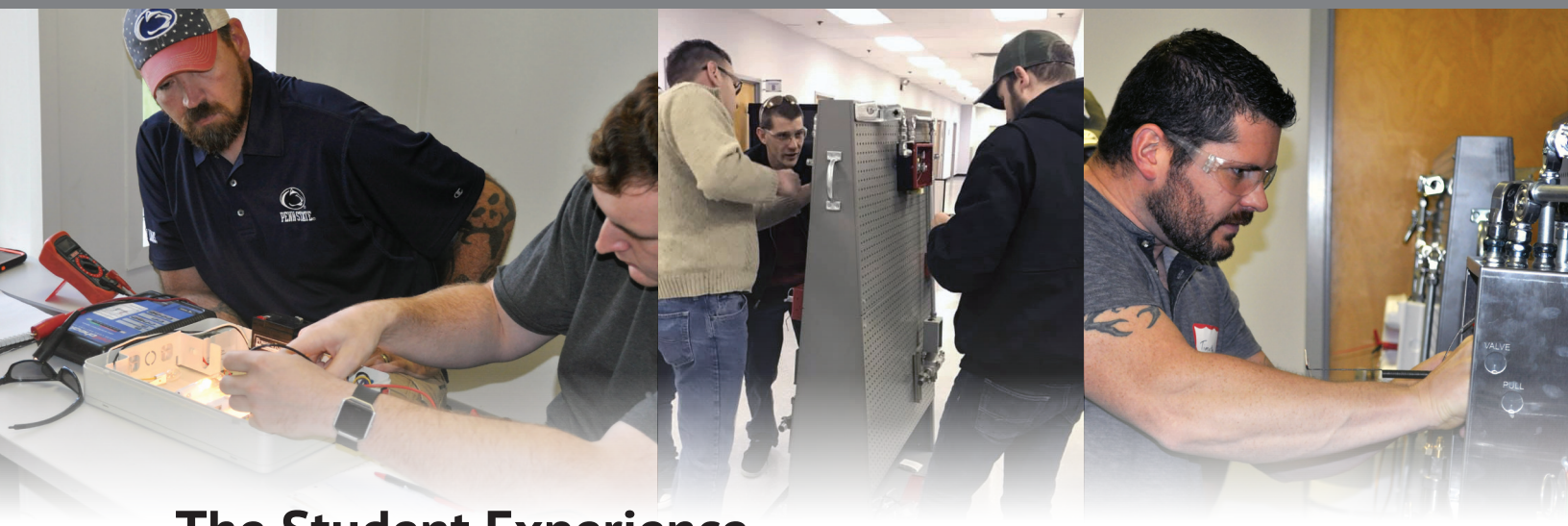
Our **POSITION** is simple. We believe that the better educated we are as a community of fire and life safety professionals, the safer we all are. Understanding safety is a **CHALLENGE** and keeping others safe is a **CALLING**. So the team at the FED Learning Center is committed to doing everything within our reach to promote and provide educational opportunities that support the needs of those who hear the calling and have accepted the challenge.

Our **VISION** is to provide an industry-specific, educational platform for all members of the Fire and Life Safety community, because we are on a **MISSION** to educate as many people as possible on what it takes to protect the world from safety hazards, in accordance with codes and NFPA standards.

We accept the **CORPORATE RESPONSIBILITY** necessary to provide a professional, non-political environment, where the" business" of fire protection is put aside, allowing 100% of the focus to be on gaining knowledge and developing skills. And we proudly wear the **SOCIAL IMPACT** we are making like a badge of honor, as we do our part in increasing the number of properly trained professionals in the field.

We all share the **GOAL** of protecting people and property, but every-day hazards change, technology develops, and the way we interact in the world evolves. The work we do saves lives, so we must all make the **COMMITMENT** to develop and evolve too.

Hear the Calling
Take the Challenge
Get Trained
Stay Trained



The Student Experience

Feel Your Vibe: You're in charge of the vibe you want to experience during training. Do you want to send one person to a general session course? How about sending a small group to create comradery amongst the team? On the other hand, what about a private session to combine technical training and teamwork? You are in charge, so you choose! Luckily, the more you send, the greater the discount!

Find Your Venue: If being at an FED Learning Center campus is important to you, select from one of our four campuses spanning the East Coast and the Midwest. Alternatively, off-site sessions may be better for your travel time.

Select Your Course: Our course catalog is always growing. Determine what your instructional needs are now and select from the courses available. Every effort is made to offer multiple product disciplines within a course week, so those who want to stay for multiple courses can do so.

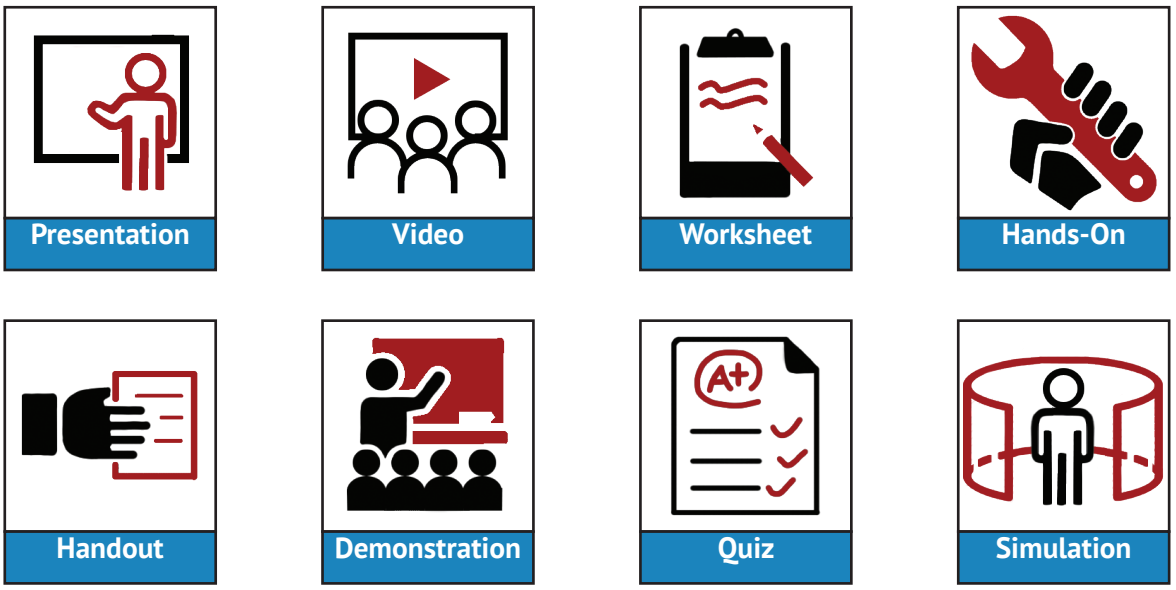
Secure Your Seats: When you're ready, log on to www.FEDLearningCenter.com and secure your seats through our super-simple registration process. Once registered, you will receive a confirmation email, receipt, calendar reminders, and course details for later reference. Don't worry if the venue you are looking for is full, put yourself on the wait list, and we'll do our best to get you in the course or create another course that matches your needs.

"Tell me and I forget,
teach me and I remember,
involve me and I learn."

~ Benjamin Franklin

Instructional Design Variety

No two students learn the exact same way, so at the FED Learning Center, great care is given to ensure the instructional design offers something for everyone. It's our intent to offer a variety of styles and methods in course instruction, ensuring that all students have the opportunity to learn.



Course Objectives

Upon completion of this course, you will have learned:

- The role technicians play in the Fire and Life Safety industry.
- The main reference book required in the Fire Alarm industry.
- How to read NFPA codes.
- Key NFPA definitions.
- Fire Alarm Industry reference books.
- Who is an AHJ.
- The history of Fire Alarm Systems.
- Basic Fire Alarm System Components and their functionality.
- A deep dive into NFPA 72, Chapter 14, Inspection, Testing & Maintenance.
- Emergency control functions.
- The importance of Emergency Communication Systems.
- Circuits and Pathways System wiring.
- Understanding the design and placement for Input and Output Devices.
- The different type of Fire Alarm Circuits.
- The way Fire Alarm Systems communicate to a Central Station.
- The dangers of Carbon Monoxide poisoning.

COMMERCIAL FIRE SAFETY ECOSYSTEM:

STANDARDS, CODES, TESTING, & ENFORCEMENT

Frequency of Fires

Every 23 seconds, a U.S. Fire department responds to a fire!

$15.9 Billion on in US property was damaged by fire in 2021![1]

#WeSaveLives

[1]NFPA, News and Research: Fire loss in the United States, retrieved from https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem/Fire-loss-in-the-United-States#:~:text=A%20fire%20occurs%20in%20a,were%20caused%20by%20home%20fires.on December 7, 2022.

Fire Safety Ecosystem

COMPONENTS OF THE ECOSYSTEM

Government Responsibility:
Maintaining an effective policy and regulatory environment supporting fire, electrical, building, and life safety.

Development and Use of Current Codes:
Using the latest codes and standards developed by experts from across the world.

Reference Standards:
Applying all standards referenced within the primary fire, life safety, building, and electrical codes and standards.

Investment in Safety:
Prioritizing safety across the board.

Skilled Workforce:
Promoting the development of skilled professionals to apply the codes and standards.

Code Compliance:
Supporting effective code enforcement.

Preparedness and Emergency Response:
Providing effective preparedness and response capabilities to deal with fire, electrical, and related hazards.

Informed Public:
Educating the public about the dangers of fire, electrical, and related hazards.

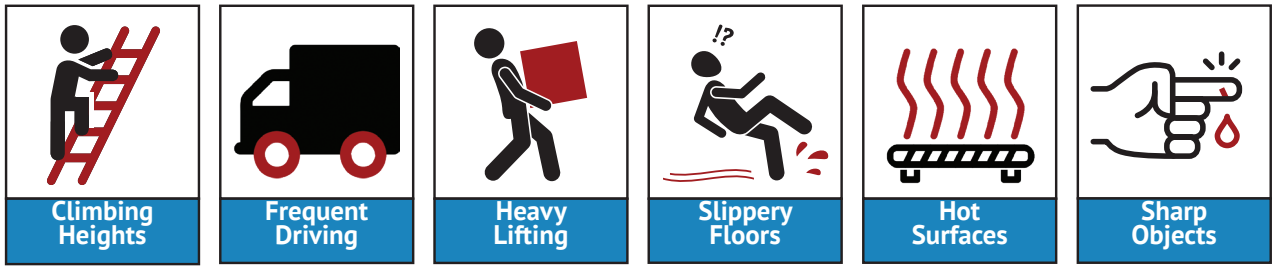
NFPA, *https://www.nfpa.org/About-NFPA/The-NFPA-Fire-and-Life-Safety-Ecosystem*, 2023.

Value of a Well Trained Technician

- Fire and Life safety equipment is proven to work when properly installed, inspected, and maintained.
- **When properly trained**, fire safety technicians support preservation of human life and protection of property.

The First Response before First Responders!

Technician Work Environment



General Safety Tips

- ✔ You are responsible for your own safety.
- ✔ Be aware of your surroundings.
- ✔ Wear personal protective equipment necessary for the job.
- ✔ Always use the equipment/tools/machinery safely and properly.
- ✔ Lift properly using your legs and not your back.
- ✔ Keep your work area clean.
- ✔ Wear appropriate and safe work clothing and footwear.

✔
Think Safe...
Work Safe...
Be Safe...

What is NFPA?[1]

The **National Fire Protection Association (NFPA)** is a global, self-funded nonprofit organization, established in 1896, devoted to eliminating death, injury, property, and economic loss due to fire, electrical, and related hazards.

- Recommend minimum standards for adoption consideration.
- Training.
- Research.
- Public education.

Standards – NFPA 72

What is NFPA 72 2022 Handbook?

NFPA 72 is one of the main reference books required in the fire alarm industry that is used quite often.

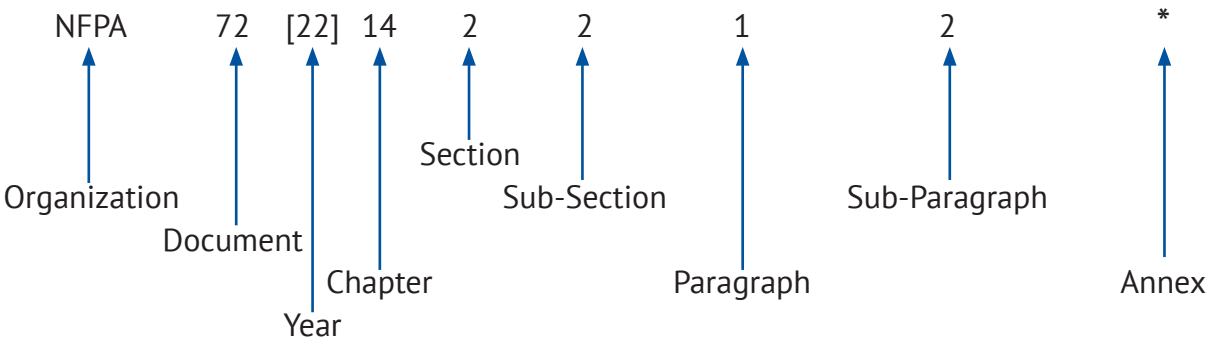
- National Fire Alarm and Signaling Code NFPA 72.
- Installation Requirements.
- Performance.
- Testing and Maintenance.
- Shaded text explains the reasoning behind the code requirement.

[1]NFPA, *https://www.nfpa.org/About-NFPA*, 2023.

How to Read Code

NFPA 72 2022 14.2.2.1.2* – Inspection, testing and maintenance programs shall verify correct operation of the system.

If there is an asterisk (*) next to the code, this means to refer to the Annex for further details.



NFPA Definitions[1]

- **Shall** – Indicates a mandatory MINIMUM requirement.
- **Should** – Indicates a recommendation, or that which is MINIMALLY advised but not required.
- **Standard** – A document, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and which is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Non-mandatory provisions shall be located in an appendix or annex, footnote, or fine-print note and are not to be considered a part of the requirements of a standard.

[1]NFPA, *https://www.nfpa.org/-/media/Files/Codes-and-standards/Glossary-of-terms/glossary_of_terms_2022.ashx?la=en*, 2022.

Fire Alarm Industry References NFPA 70 (NEC)

- NFPA 70 (NEC).
- Fire alarm system wiring and equipment, including all circuits controlled and powered by the fire alarm system, shall be installed in accordance with the requirements of this Code and of *NFPA 70, Article 760.*

Fire Alarm System Wiring

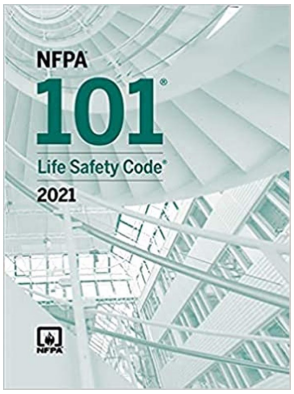
- NFPA 70 (NEC), Article 760:
  - Article 760 its scope of rules for fire alarm and other systems.
- Types of Fire Wire:
  - FPL – Power-Limited Fire Alarm Cable:
    - Suitable for general fire alarm use.
  - FPLR – Power-Limited Fire Alarm Riser Cable:
    - Suitable for vertical runs in shafts or penetrating more than one floor.
  - FPLP – Power-Limited Fire Alarm Plenum Cable:
    - Suitable for use in ducts used for environmental air.
    - Has low smoke producing properties.

International Building Code

- Which buildings require Fire Alarm Systems.
- Type of Fire Equipment required.
- Chapter 9 - Fire Protection & Life Safety Systems
- Chapter 903 - Automatic Sprinkler Systems
- Chapter 907 - Fire Alarm and Detection Systems

NFPA 101

- Life Safety Code NFPA 101:
  - Regulates where smoke alarms are required.
  - Provides safety from fire, smoke and panic.
  - Required Fire Alarm Systems by occupancy type.



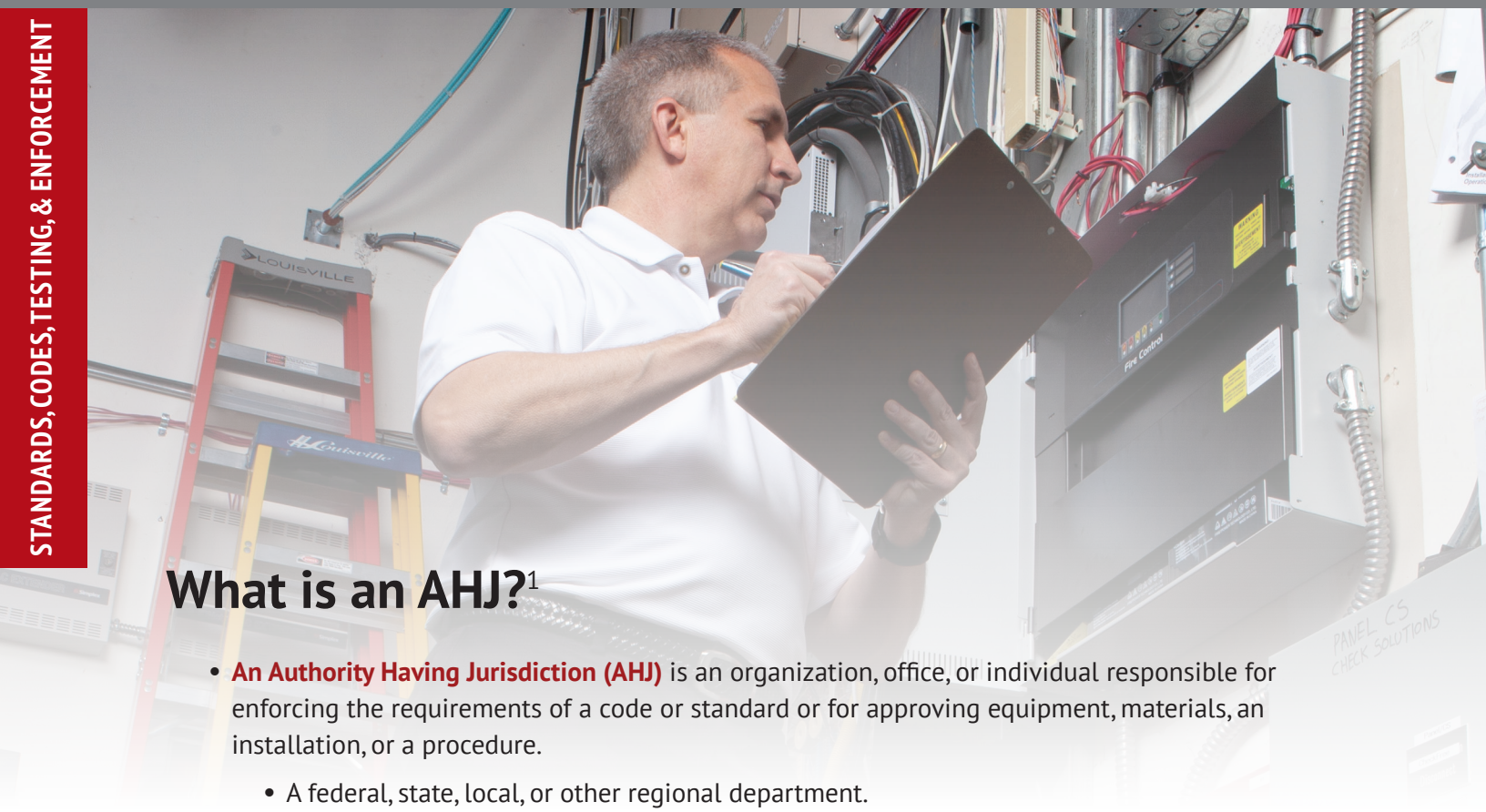
American Disabilities Act

- The American Disabilities Act (ADA) was enacted by US Congress on July 26, 1990. The purpose was to ensure that all disable Americans had access to facilities and services with physical challenges.

- The intent, related to fire alarm systems, was to provide visual notification devices for the hearing impaired.

- Sleeping areas posed a challenge as the visual strobe had to be intense enough to wake the hearing impaired.

- Pull Stations are required to be accessible by mounting at the appropriate height.



What is an AHJ?[1]

- **An Authority Having Jurisdiction (AHJ)** is an organization, office, or individual responsible for enforcing the requirements of a code or standard or for approving equipment, materials, an installation, or a procedure.
  - A federal, state, local, or other regional department.
  - An individual:
    - Fire Chief, Fire Marshal, Building Official, Electrical Inspector, Insurance Inspection Department or other Insurance Agent.
- The AHJ enforces the standards, which have been locally adopted into code within their jurisdiction.
- Not all jurisdictions have adopted the most current edition of any given NFPA standard:
  - Example: Charlotte could adopt the NFPA 72 2010, even though there is an NFPA 72 2019.
- Always check with the local AHJ to understand the codes adopted in that particular locale.

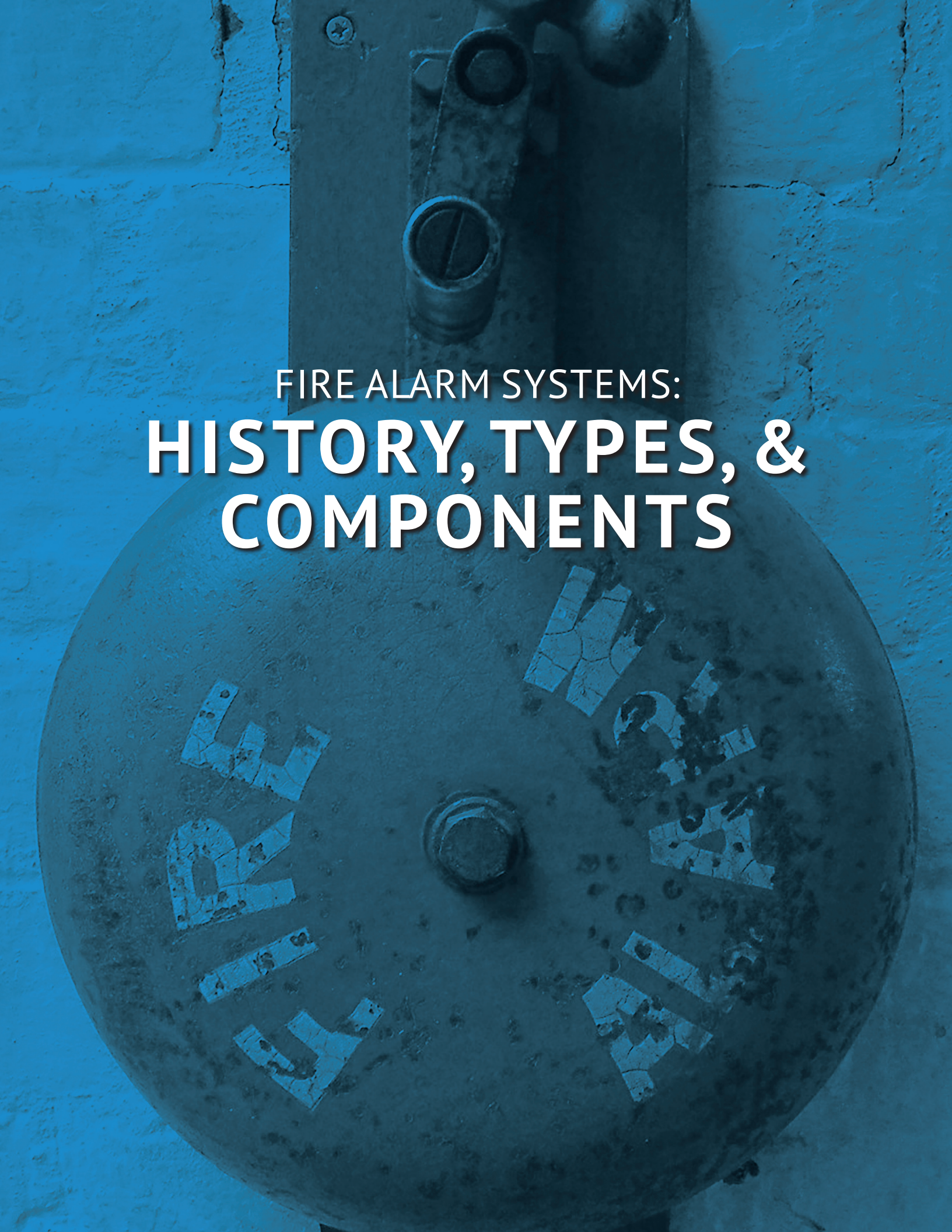
Q: Which reference book would be required for fire alarm wiring?
A: NEC

Q: What reference book would you use to know if a fire alarm is required in the building?.
A: IBC

Q: What does AHJ stand for?
A: Authority Having Jurisdiction

KNOWLEDGE CHECK

[1]NFPA, NFPA 1, Chapter 3 - Definitions, retrieved from https://link.nfpa.org/free-access/publications/1/2021 on December 7, 2022.



FIRE ALARM SYSTEMS:

HISTORY, TYPES, & COMPONENTS

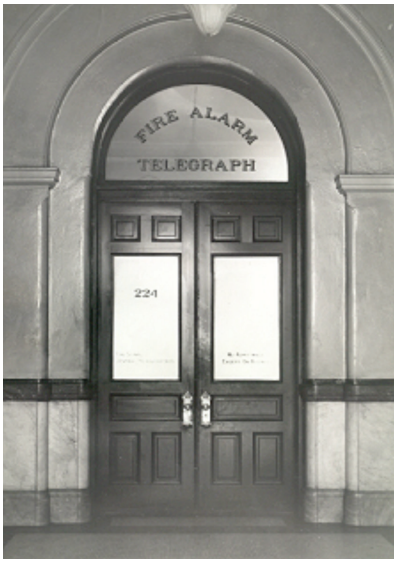
History of Fire Alarms

- Benjamin Franklin (on December 7, 1736) co-formed the Union Fire Company, also known as the "Bucket Brigade", in America, as a non-profit unit using volunteers. In 1752 Ben Franklin introduced fire insurance to the country too.[1]

History of Fire Alarm Systems

- The first Fire Alarm Telegraph System went into service on April 28, 1852 (invented by Dr. William F. Channing and Moses Farmer in Boston, Massachusetts).[2]

- The first electric Fire Alarm System was patented in 1890 by Francis Robbins Upton (assisted by Mr. Fernando J Dibble, who is often overlooked).[3]



[1]BUMPERCHUTE, *http://bumperchute.com/blog/a-brief-history-of-the-us-fire-department/*, 2022.
[2]DISPATCH, *http://www.cfdhistory.com/htmls/company.php?name=68.*
[3] SocialTechTV, Francis Robbins Upton Fire Alarm Pioneer retrieved from https://www.youtube.com/watch?v=ddR7EVxIuac on December 9, 2022.

What is a Fire Alarm System?

- A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate appropriate response to those signals NFPA 72, Chapter 3.

Combination System (Burglar and Fire)

- Provides fire and security protection:
  - Not rated as a commercial fire panel.
  - Mostly used in homes.
  - Smoke detectors are supervised by the control panel.
  - Adds extra protection as the system can be monitored.

Household Fire Alarm System

- Smoke detectors throughout the home:
  - No FACP in most cases.
  - Newer homes have sprinklers installed.
  - Photo detectors are best protection.

Municipal Fire Alarm System (Public Emergency Alarm Reporting System)

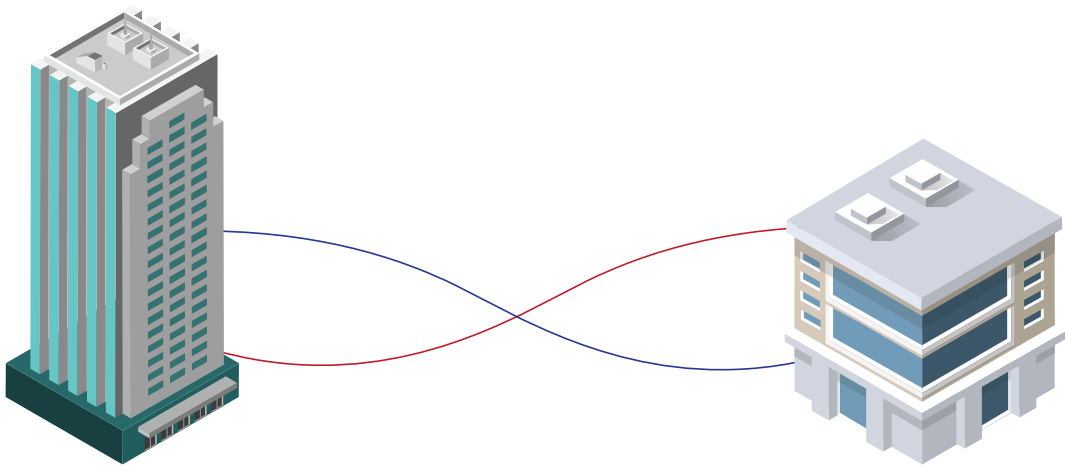
- Auxiliary.
- Local energy.
- Shunt-type auxiliary.

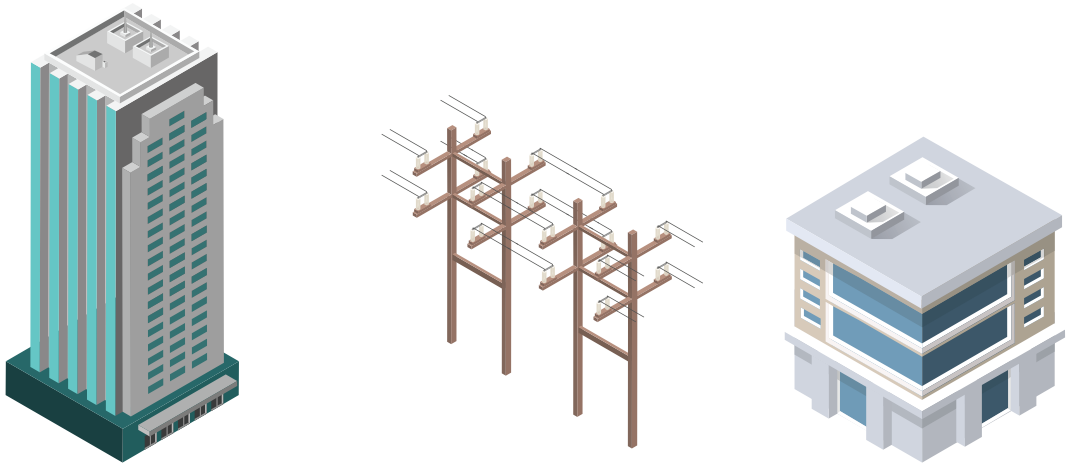
Protected Premises Fire Alarm System

- Building Protection.
- Dedicated Function:
  - Performs emergency control functions.
- Releasing:
  - Activation of fire suppression.

Types of Fire Alarm Service

- Supervising Station Alarm System:
  - Central station.
    - UL listed.
- Proprietary:
  - All buildings under one owner.
  - Attended 24/7.





Fire Alarm Control Panel

- A component of the fire alarm system, provided with primary and secondary power sources, which receives signals from initiating devices or other fire alarm control units, and processes these signals to determine part or all of the required fire alarm system output function(s) 3.3.115.

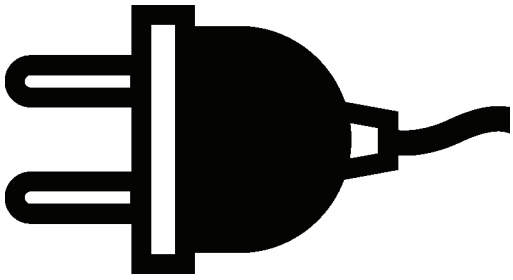
2 Types:

- Conventional.
- Addressable.

Fire Alarm Control Panel/Unit (FACP/FACU)

Power Sources

Fire Panels require an AC and DC power source.



Primary (AC)

Secondary (DC)

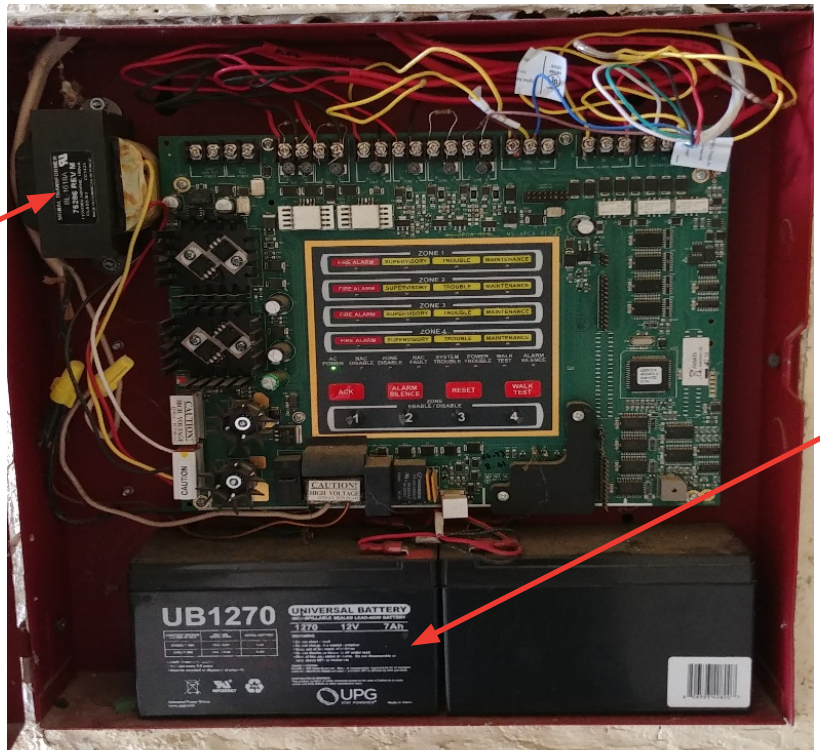
Primary Power

- Typically, electric utility (AC).
- Dedicated circuit.
- Permanent red marking.
- Lock-out device:
  - Where a circuit breaker is the disconnecting means, a listed breaker locking device shall be installed 10.6.5.4.

Secondary Power

- Typically, batteries (DC).
- Capacity:
  - Must provide a minimum of 24 hours of standby if only **batteries** are used as secondary power.
  - Must provide a minimum of 4 hours of standby if a **generator** is used as secondary power.
  - Must provide a minimum of 5 minutes of alarm.
- Battery calculations are required:
  - 20% minimum safety margin.

Example Power Sources

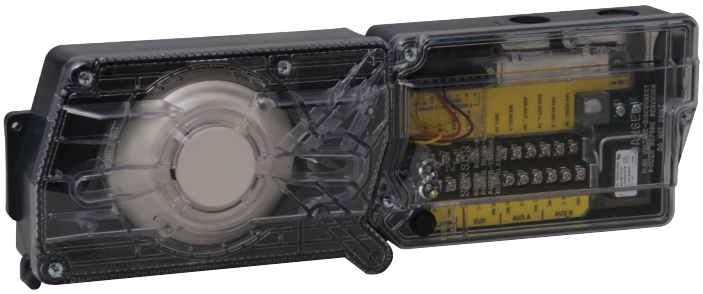


Initiating Devices

- Initiating devices are also known as “Inputs”.

Inputs

- A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch 3.3.148.



Notification Devices

- Notification devices are also known as “Outputs”.

Outputs

- Notification appliance:
  - A fire alarm system component, such as a bell, horn, loudspeaker, visual notification appliance, or text display that provides audible, tactile, or visual outputs, or any combination thereof 3.3.189.

NAC = Notification Appliance Circuit NFPA 72. Note: L-Series is the new System Sensor product that draws less current so you can add more on a NAC circuit.

Q: What does FACP Stand for?
A: Fire Alarm Control Panel

Q: The two sources of power required on a Fire Alarm panel are:
A: AC/DC

Q: A horn strobe is known as a “_____” device?
A: Output

KNOWLEDGE CHECK

FIRE ALARM SYSTEMS:

FUNCTIONALITY OF PANEL & INPUT/ OUTPUT DEVICES

Fire Alarm Panels Pros & Cons

Addressable Control Panel	Conventional Control Panel
Requires AC and batteries	Still requires AC and batteries
Has a SLC – Signaling Line Circuit	Has an IDC – Initiating Device Circuit
Requires more programming	Requires less programming
More involved to install	Quicker to install
Requires software programming	Little programming
More options in programming	Less options
Unique ID location	No input address
Panel is expandable	Limited expansion

Remote Annunciator

- Mimics the information just like the fire panel does
- Installed when the fire panel is in a secured location
- Has a Liquid Crystal Display (LCD)
- Alarm, Supervisory, Trouble, AC Failure, and Battery
- Can be red or white

Fire Panel Conditions

NFPA 72 2022. There are three basic types of signals a fire panel will generate. These conditions will display and sound at the panel and if monitored will send the appropriate signal to the central station. Alarm conditions hold a higher priority than supervisory or trouble conditions.

- Alarm Condition 3.3.65.1.1*:
  - An abnormal condition that poses an immediate threat to life, property, or mission.
- Supervisory Condition 3.3.65.1.3*:
  - An abnormal condition in connection with the supervision of other systems, processes, or equipment.
- Trouble Condition 3.3.65.1.4*:
  - An abnormal condition in a system due to a fault.

Any alarm condition will take priority over supervisory or trouble conditions.

Input Devices: Manual Pull Station

NFPA 72 2022, Chapter 17.15, calls a pull station "Manually Actuated Alarm-Initiating Devices". Also noted in NFPA 72 as Manual Fire Alarm Boxes. In the fire industry, they are just called pull stations.

- Terminology:
  - NFPA 72.
  - Chapter 17.15 - Manually Actuated Alarm-Initiating Devices.
  - Chapter 17.15.9 - Manual Fire Alarm Boxes.
- Fire Industry:
  - Pull stations.

Regardless of the name, the functionality is the same!

Types of Manual Pull Stations

- Single Action:
  - Require only one operation to activate.

- Dual Action:
  - Require two distinct operations, a set-up and an activating action.

- Break-glass stations:
  - Has an inhibit device that must be damaged to activate the station.

Activating Input Devices: Manual Pull Stations

- Single Pull Down:
  - One Activation.
- Double Pull:
  - Two Step Activation.

Manual Fire Alarm Boxes

- Metal or plastic.
- Key or no key.
- Weatherproof.
- Conventional or addressable.

Pull Station Cover

This is the STI-Stopper, made from polycarbonate. They are installed in stores, schools, and high-risk areas that are accessible to the public who may case damage or false alarms.
NFPA 72 2022, A.17.1.15.8.

- Protects the pull station from damage and false alarms.
- Features a 95 dB horn.
- Used in commercial areas.
- High-risk areas:
  - Schools
  - Public buildings
  - Weather conditions
- Fits over the pull station.

Input Devices: Waterflow

As fire technicians, we monitor only the waterflow or supervisory switches. The sprinkler system itself is designed and installed by a sprinkler company.

- Primarily used to monitor sprinkler systems.
- Flow switch:
  - Each riser requires one.
- Delays activation for up to 90 seconds of continuous flow to prevent false alarms caused by fluctuations in city water pressure 17.13.2.

Input Devices: Waterflow

- Types of Waterflow switches:
  - OS&Y – Outside Stem and Yoke.
  - PIV – Post Indicator Valve.

Input Devices: Supervisory

Supervisory/Tamper switches

- Prevents cut-off of water supply.
- Must generate signal within 2 turns of cutting off the water supply.
- Displays on panel as supervisory alarm.

Input Devices: Smoke Detectors (Spot Detector)

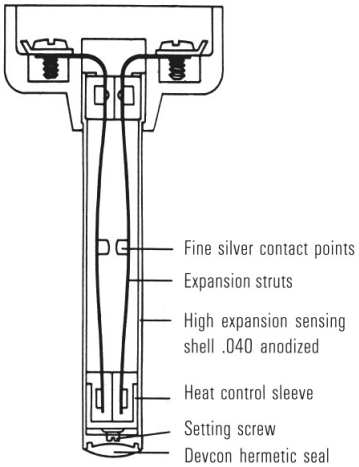
- 2 Types:
  - Photoelectric.
  - Ionization.
- Provides detection concentration in a particular location.
- Used in both residential (smoke alarm) and commercial buildings (smoke detector).

Input Devices: Heat Detectors

Thermal lag is the delay that results in response time due to the heating of initiating device.

Rate Compensation Type

- Detector responds when the temperature of the surrounding air reaches a predetermined level, regardless of the rate of temperature rise, the system compensates for thermal lag.
- During a slow rate of temperature rise, there is more time for heat to penetrate the inner element, which inhibits contact closure until the total device reaches the rated temperature level.
- During fast rate of increase, there is less time for heat to penetrate the inner element, which exerts less inhibiting effect, so contact closure is still obtained at the rated temperature.

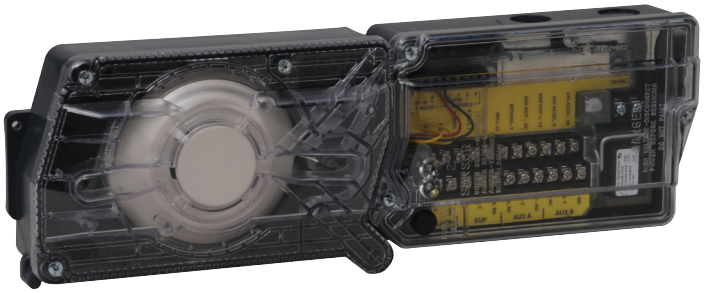


2

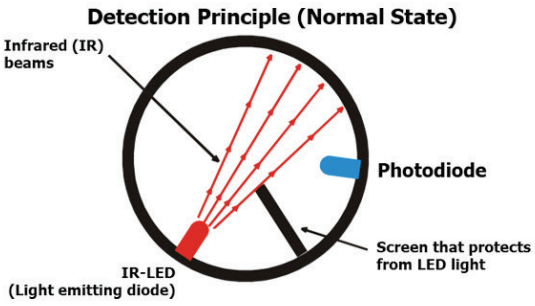
Input Devices: Duct Detectors

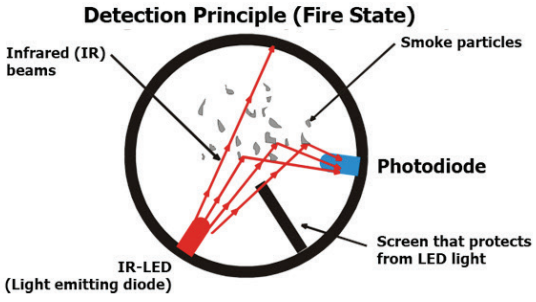
Duct detectors are used to shut down HVAC systems, in order to stop smoke from spreading in the building. It also helps from feeding the fire by providing oxygen.

- Devices used to shut down HVAC system:.
  - Installed in duct work.
    (Uses sampling tubes.)
  - Requires a Photo-R:
    (R = Resettable.)
  - Housing for a relay:
    (Relay interrupts power.)



Photoelectric Sensing Chamber[1]

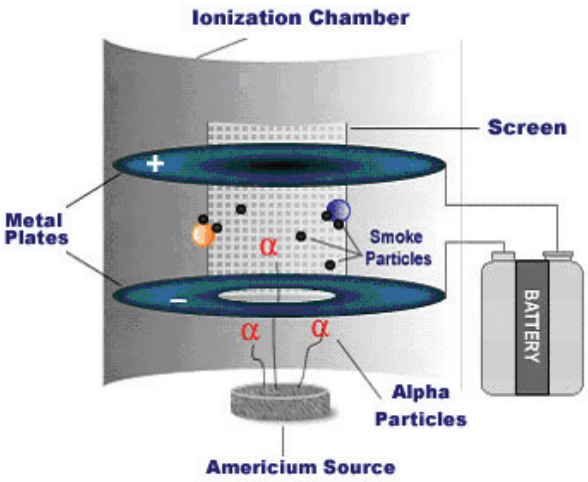




[1]Mavili, *https://www.mavili.com.tr/en/databank-3.html*
[2]Hiller Systems, Thermotech Heat Detector, *https://sep.yimg.com/ca/l/yhst-84151632480785_2272_21331948*, 2019

Ionization Smoke Detectors

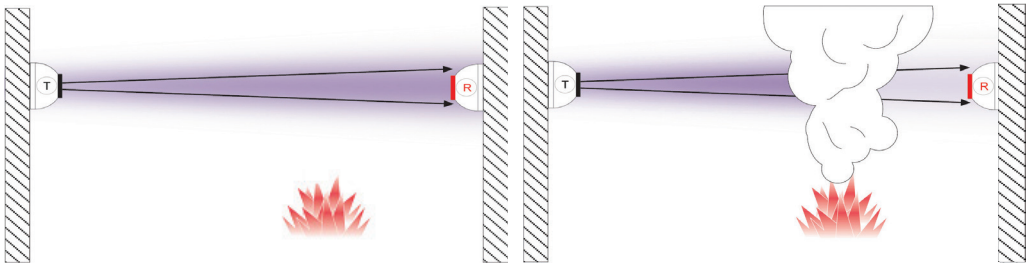
Smoke particles entering the chamber attach to the ions and return them to their neutral energy state. As fewer ions reach plates, the disrupted current triggers an alarm.



Beam Detector

- Generally installed with the beam parallel to the ceiling.
- Spacing as per manufacturer's recommendations.
- Installed below the ceiling level to overcome the stratification.
- May be installed in place of smoke detectors.
- Consists of a transmitter and a receiver.

Projected Beam Principle[1]



[1]FIRERA,Y Optical Beam Smoke Detectors, *fireray-prehled-produktu.pdf*

Activating Input Devices

Spark or Flame Detectors

Spark/Ember detectors are visual-sensing devices that look for a Ultraviolet (UV) or Infrared (IR) emitting source in a normally darkened environment. Flame detectors are visual-sensing devices that look for a Ultraviolet (UV) or Infrared (IR) emitting source in a normally lighted environment.

- Flame:
  - Rapid combustion produces radiant energy.
  - Visible in IR & UV spectrums.
  - Heat begins to buildup at this stage.

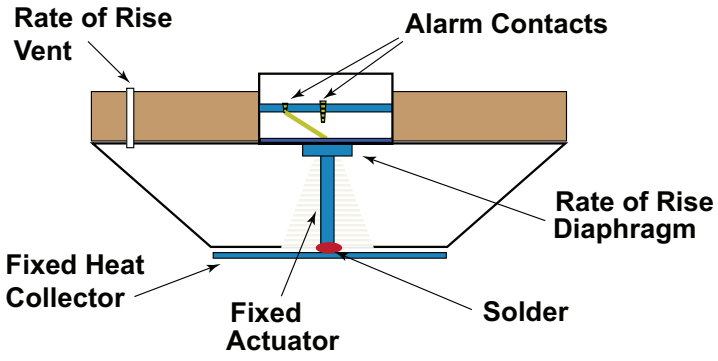
Heat Detectors

Heat detectors are also used in areas where there a lot of dust or in environments where smoke detectors would not function, due to dust, dirt, etc. Like warehouses, is a good example. Uncontrolled combustion is caused by the heating of nearby combustibles to their ignition point.

- Thermal (Heat) detectors are the oldest type of automatic fire detection device.
- Not considered direct Life Safety devices.
- Slowest-responding fire detection devices.
- Exhibit the lowest false alarm rate.
- Best used in applications where:
  - Fast-developing, large fires are expected.
  - Environment won't allow the use of other fire detection devices.
  - The speed of detection is not a prime consideration.

IMPORTANT: Never Paint Heat Detectors!

Fixed Temperature and Rate-of-Rise



Q: What do the Addressable and Conventional Panels have in common?
A: 2 Different Power Sources

Q: What are the two types of Manual Fire Alarm Boxes?
A: Single & Dual Action

Q: Select the two types of Smoke Detectors?
A: Photo & Ion

KNOWLEDGE CHECK

Output Devices: Notification Appliances

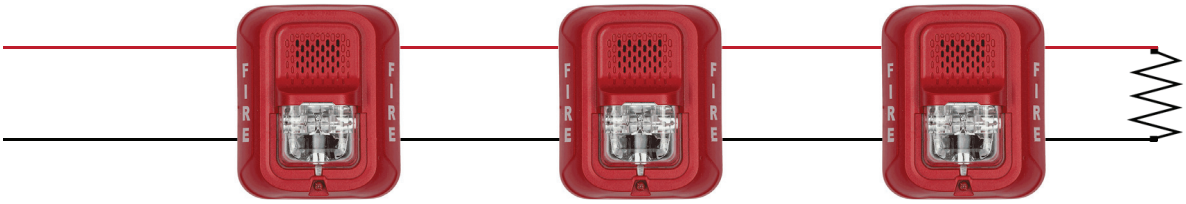
Notification devices are designed to notify occupants of a building to leave immediately upon an alarm situation.

- Used to alert occupants and fire safety personnel of a threat condition
- Distinctive Evacuation Signal:
  - Temporal 3 Code.
  - Other coded signals are permitted.
- Visual signaling appliances:
  - When the average ambient sound level is greater than 105 dbA, visual signaling appliances are required.

Notification Appliance Circuit

NACs on addressable panels can be programmed for other things, depending on the manufacture. Always follow the manufacture instructions for wiring, distance, and number of devices on a circuit.

- Horn/Strobes are connected and powered by the panel or an auxiliary power supply.



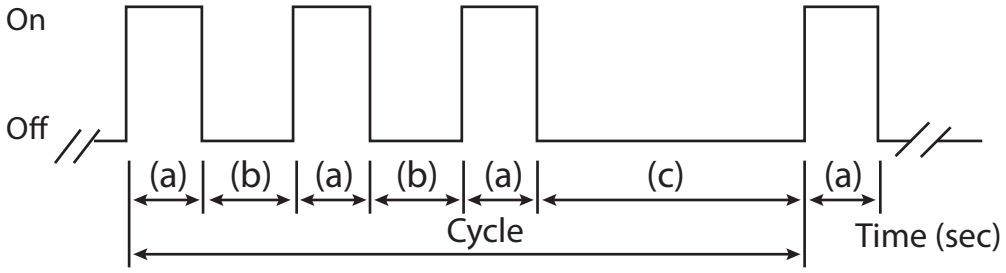
Notification Appliances

- Horn/Strobes:
  - Must be loud enough to alert building occupants.
    - 15 dB above ambient sound levels. (Offices = 55 dBA)
  - ADA requires enough light intensity to alert the hearing impaired.

Horn/Strobes Synchronization

- Visual Synchronization reduces the effect on those who are prone to suffer seizures from Epilepsy.
- Required when more than two appliances are in the same field of view.
- Audible Synchronization permits the proper sounding of evacuation coding.

The standard evacuation signal shall be synchronized within a notification zone 18.4.2.3*.



Key:
Phase (a) signal is on for 0.5 sec ±10%
Phase (b) signal is off for 0.5 sec ±10%
Phase (c) signal is off for 1.5 sec ±10% [(c) = (a) + 2(b)]
Total cycle lasts for 4 sec ±10%

Q: True/False: When two or more strobes are visible, synchronization is required.
A: True

KNOWLEDGE CHECK

Glossary of Terms

- **Condition** – A situation, environmental state or equipment state of a fire alarm or signaling system.
- **Signal** – An indication of a condition communicated by electrical, visible, audible… or other means.
- **Response** – Action performed upon the receipt of a signal.
- **PoC** – Products of Combustion
- **PIV** – Post Indicator Valve
- **OS&Y** – Outside Stem and Yoke Valves
- **Cd – Candela** – Unit of luminous intensity
- **dB – Decibels** – Unit of sound intensity
- **EOLR** – End of Line Resistor
- **UL** – Underwriters Laboratories, Inc.
- **NFPA** – National Fire Protection Association.
- **NEC** – National Electrical Code (NFPA 70).
- **ANSI** – American National Standards Institute
- **ADA** – Americans with Disabilities Act

FED®

LEARNING CENTER

#FEDLC #FireFam
#GenerationTrained
#NFPA10 #FireSafety #NFPA
#OurWorkSavesLives #NFPA72
#NAFED #NFPA17A #FireExtinguisher
#HandsOnTraining #FlameGame #NFPA101
#NFPA96 #KitchenSuppression #FireProtection

www.FEDLearningCenter.com

@FEDLearningCenter

261002