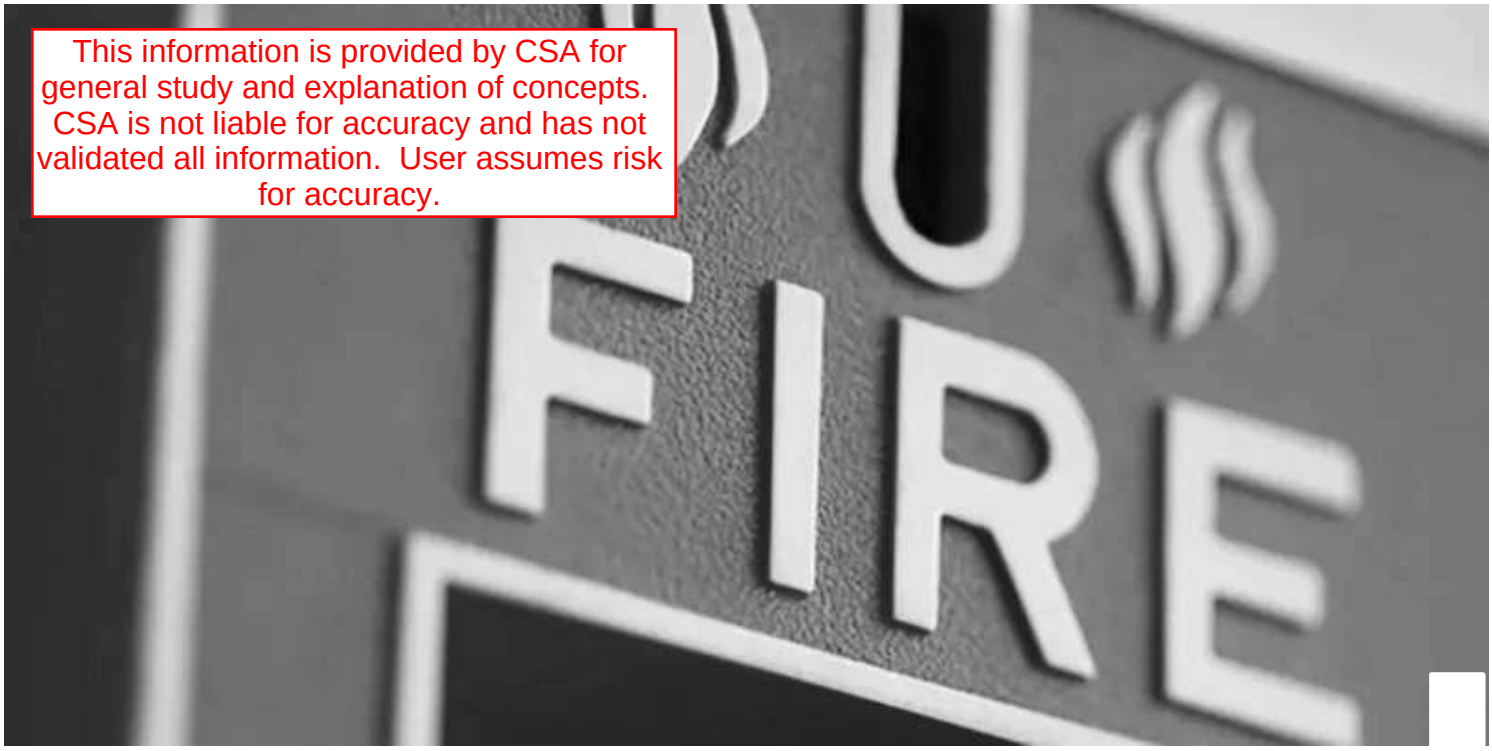
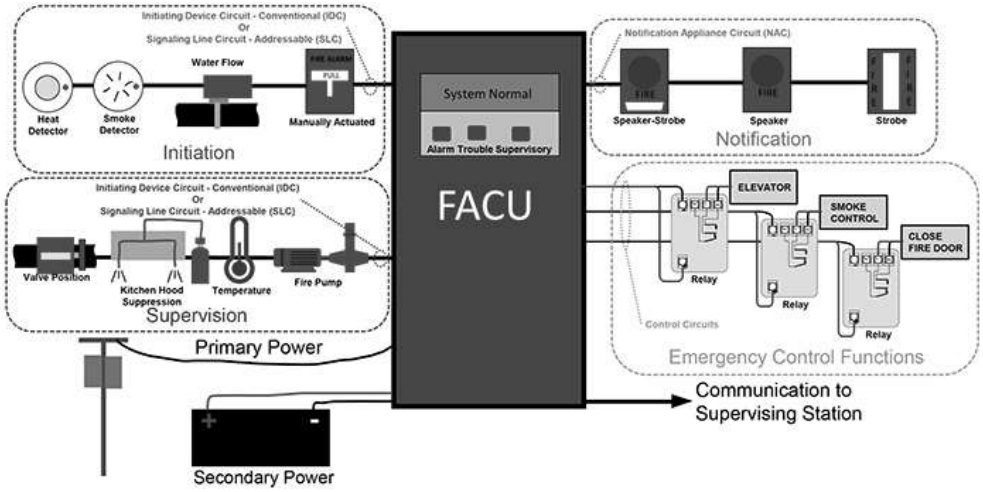
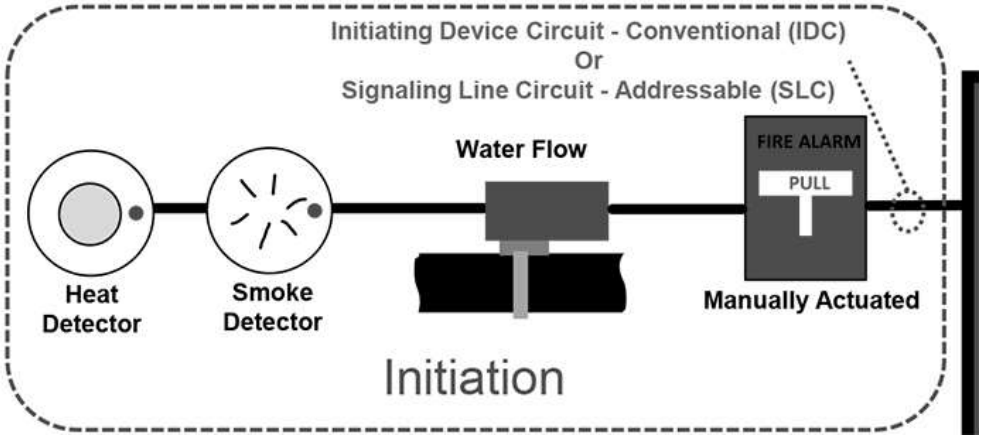


A Guide to Fire Alarm Basics: Initiation

By Shawn Mahoney
14-Apr-2021

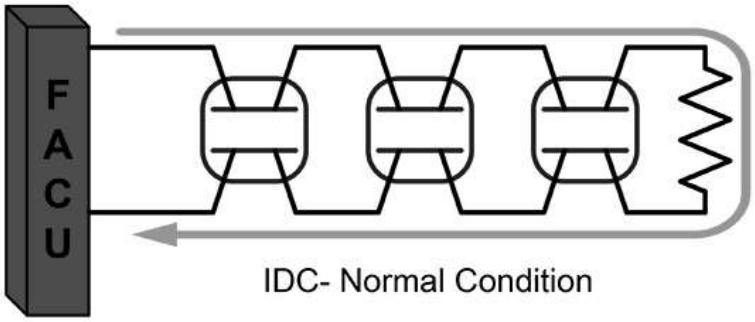
A fire alarm system is a crucial part of the overall fire protection and life safety strategy of a building . A fire alarm system serves many functions and the differences between the functions can be a bit confusing, so I created a visual guide to fire alarm basics. The objective of this blog series is to discuss some of the major components and functions of a fire alarm system. For an overview of the entire system take a look at my Guide to Fire Alarm Basics Blog. This blog will take a deeper dive into the initiation portion of a fire alarm system.





The main function of the initiation portion of a fire alarm system is to report the status of a protected space or the existence of a fire. The components include all devices and circuits that send a signal to a fire alarm control unit (FACU) such as heat detectors, smoke detectors, carbon monoxide detectors, water flow switches, manually actuated devices, and pressure switches. Depending on the system, the signal from an initiating device can create an alarm condition or a supervisory condition. Based on the type of detectors and FACU, the signals can be sent over an initiating device circuit (IDC) for conventional systems, or a signaling line circuit (SLC) for addressable systems.

Initiating Device Circuit

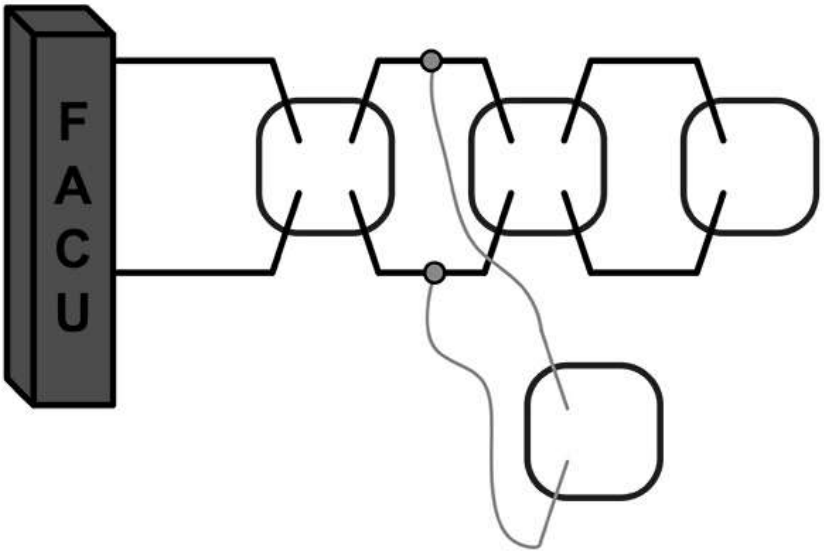


IDC- Normal Condition

IDC- Alarm Condition

Conventional initiating devices are typically detectors that use a switch contact to short both sides of the initiating device circuit together. By doing so, the initiating device causes an increase in current flowing through the circuit, which the FACU interprets an alarm signal. Once one device shorts the circuit, no other device on that circuit or "zone" can send a signal. Because of this any device on the circuit or "zone" will put the entire zone into an alarm state. Zones are typically designed to enable someone to easily identify an area where the alarm is located, for example, in a school you may have a gymnasium zone circuit and an auditorium zone circuit that each contain multiple devices.

Signaling Line Circuit

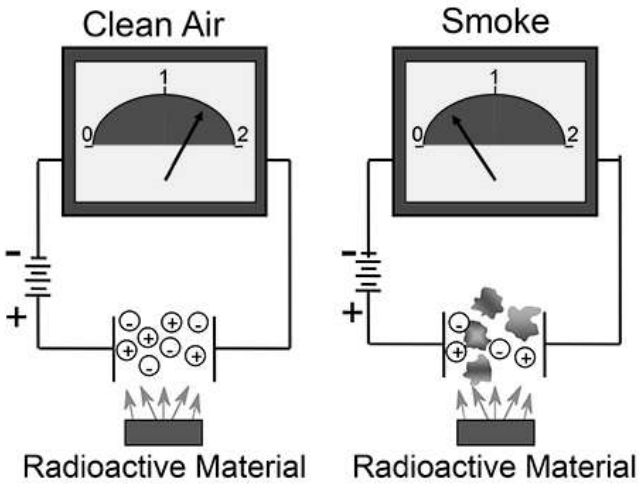


Addressable devices are either initiating devices or control/notification appliances that are capable of communicating a unique identification number or address to a control unit via a signaling line circuit. This identification consists of a binary string of 1s and 0s that indicate the address or location of that device on the circuit. When the FACU polls an initiating device, the initiating

device responds with its status (Normal, Alarm, ect.) and address. The device address allows for the location of the detector to be identified at the FACU. When one initiating device is activated on a signaling line circuit, the FACU is still able to poll the other devices unlike a conventional initiating device circuit.

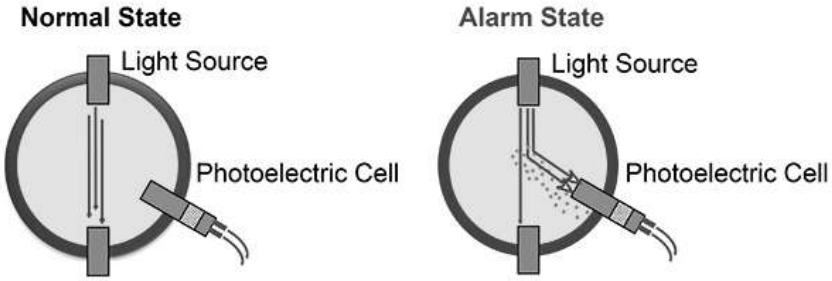
Additionally, some addressable initiating devices are able to also transmit to the FACU a range of values of smoke density, temperature variation, water level, water pressure changes, and other variables. And then the control unit software determines the set points for initiation of an alarm, supervisory, or trouble signal. These types of initiating device circuits are known as analog addressable as they are able to tell the FACU their address and their value.

Ionization Smoke Detector

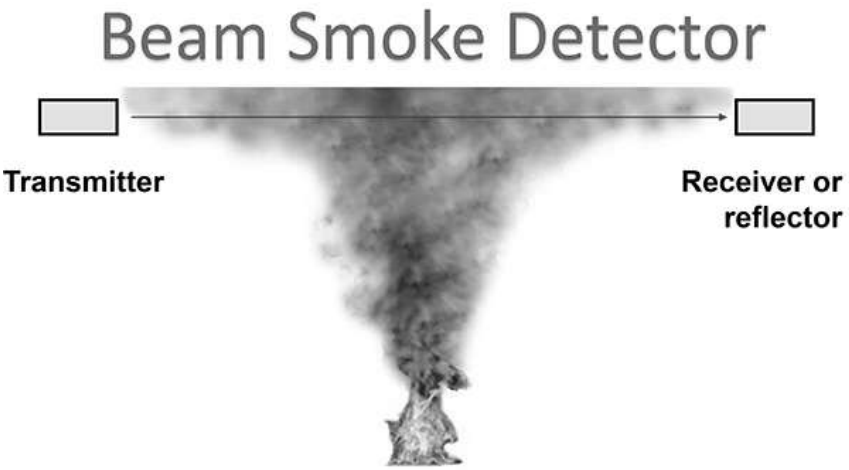


Ionization smoke detectors utilize a small amount of radioactive material to ionize air molecules into positively and negatively charged molecules that create a small electric current. The introduction of smoke into that ionized air will reduce the amount current and cause an alarm signal.

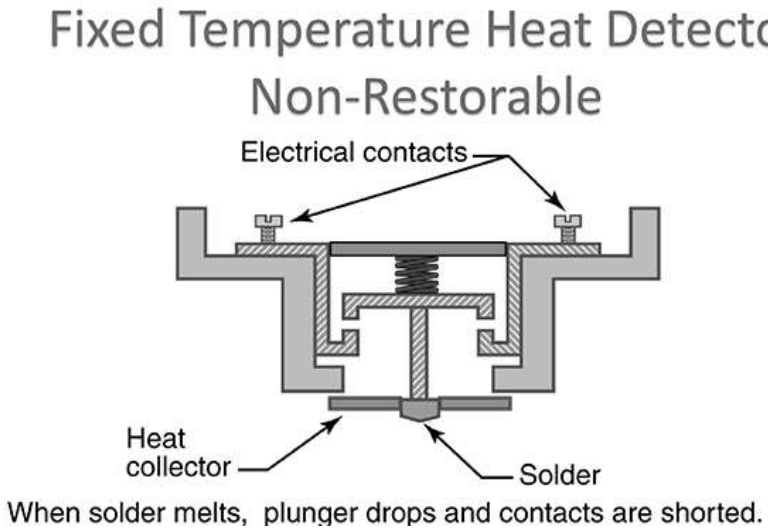
Photoelectric Smoke Detector



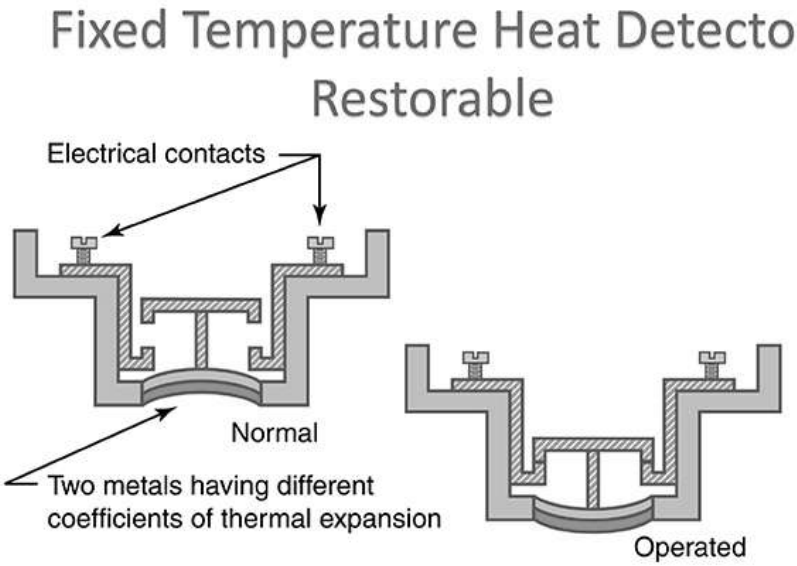
Photoelectric smoke detectors utilize a light source and a photosensitive cell. When smoke enters the chamber, light scatters and is picked up by the photosensitive cell, causing an alarm signal.



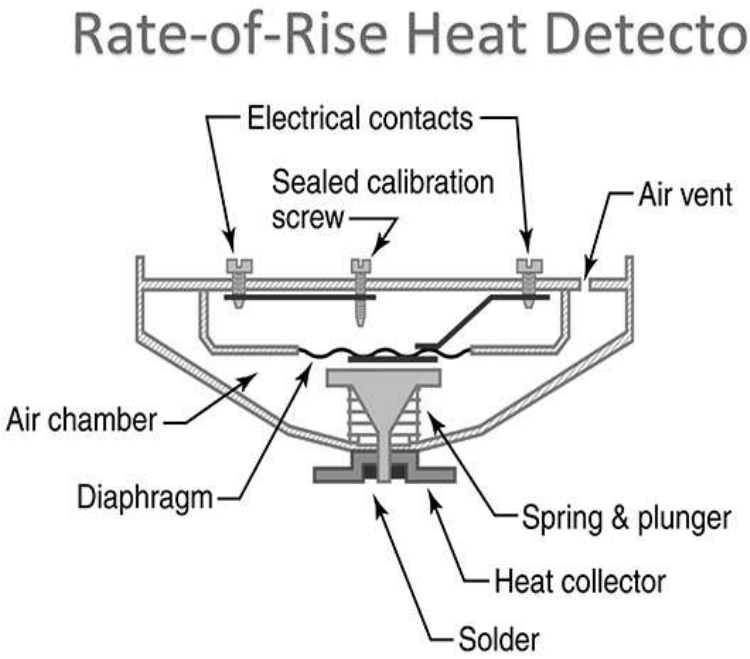
A beam smoke detector is like a photoelectric detector, except it is designed to cover a large area. A transmitter and receiver or reflector are placed to create a light beam across a space, when the amount of light being received by the receiver or reflected to the transmitter falls below a certain percentage, an alarm signal is sent.



A non-restorable fixed temperature heat detector utilizes solder that holds up a plunger. The solder melts at a specific temperature and causes the plunger to drop, which shorts the contacts and causes an alarm signal.

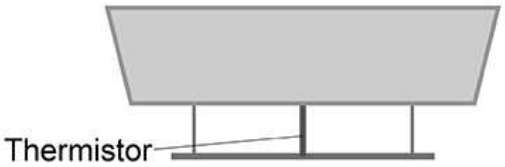


A restorable fixed temperature heat detector utilizes two metals that have different thermal expansion coefficients. At a specific temperature, these metals will bend and cause the plunger to short the contacts, which causes an alarm condition. When the metal cools it will bend back in the other direction and restore itself.



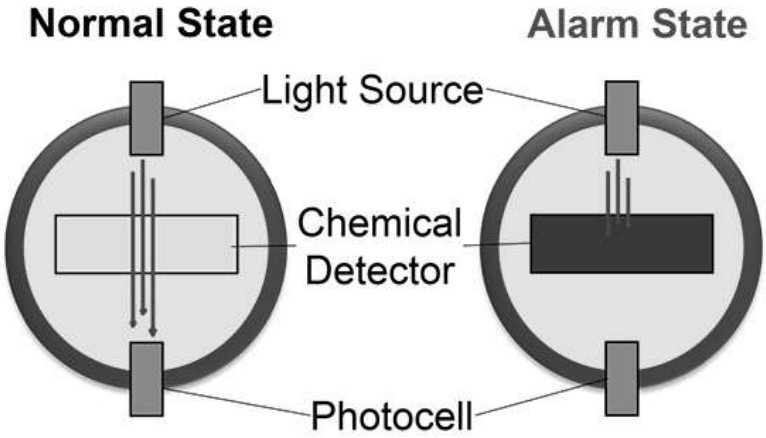
A rate-of-rise detector utilizes an air chamber and a diaphragm. When a fire causes the air in the chamber to expand faster than it can escape out the vent, the increased pressure forces the diaphragm to close the contacts and initiate an alarm signal. This rate-of-rise detector also contains a fixed temperature plunger that will operate if the temperature exceeds the determined temperature.

Analog Addressable Heat Detector



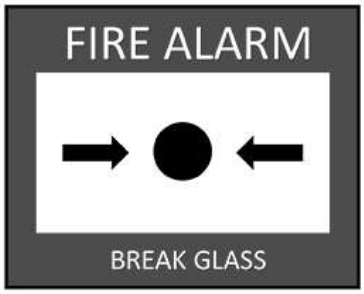
An analog addressable heat detector utilizes a thermistor element to constantly monitor the temperature. The response criteria, which can be a temperature above a specified level, or a specific rate of rise in the temperature, is programmed at the FACU.

Carbon Monoxide Detector

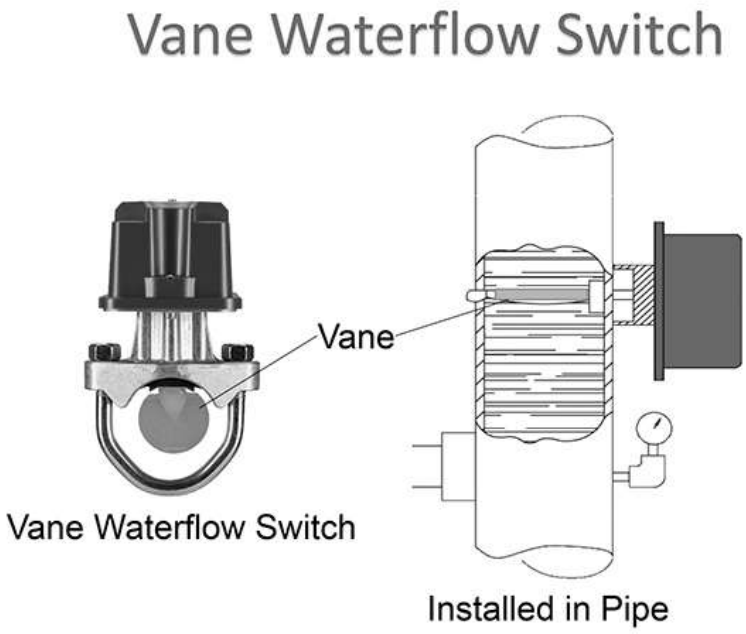


There are many different types of carbon monoxide (CO) detectors. One example of a CO detector is a Colorimetric detector. Like a photoelectric smoke detector, this detector contains a light source and a photocell that are constantly measuring for light being reflected from a chemical detector. In the presence of carbon monoxide, the chemical detector will change to a black color and light will no longer be reflected to the photocell, which will result in an alarm signal.

Manually Actuated Initiating Device

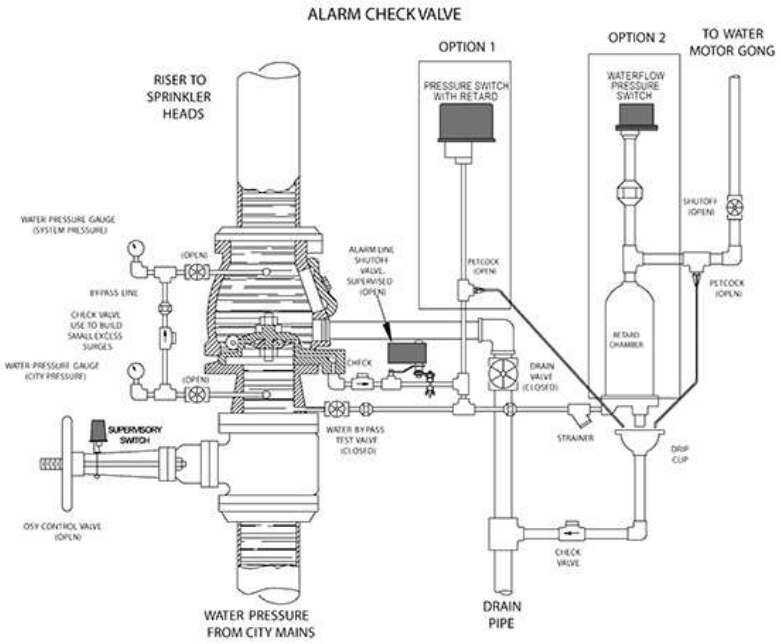


Sometimes called manual fire boxes, pull stations, or call points, manually actuated initiating devices initiate an alarm signal when there is an input from a person, such as pulling a lever or pushing a button. These can require multiple actions to initiate such as lifting a cover or breaking glass prior to actuating the device.



Flow switches are installed inside the piping of a sprinkler system and have a vane that moves with the flow of water. When water begins to flow within the pipe, the vane operates a switch that initiates an alarm.

Water Pressure Switch



Pressure switches are installed on sprinkler systems to monitor for a change in water pressure. A signal will be sent to the FA when there is an increase in water pressure, which means that water is flowing though the sprinkler alarm valve.

Want to Learn More?

Like I noted in the beginning of this blog, if you are interested in learning more about fire alarm basics, take a look at my Fire Alarm Basics Blog. I will be updating this series over the next few months to add a deeper dive into different portions of the fire alarm system. If you found this article helpful, subscribe to the NFPA Network Newsletter for monthly, personalized content related to the world of fire, electrical, and building & life safety.

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NFPA Technical Services Engineer

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