

Fire Alarm Cables

Initiating Device, SLC Lines, and NAC Cables



STANDARDS

Fire Alarm Systems

A fire alarm system is number of devices working together to detect and warn people through visual and audio appliances when smoke, fire, carbon monoxide or other emergencies are present. These alarms may be activated automatically from smoke detectors, and heat detectors. They may also be activated via manual fire alarm activation devices such as manual call points or pull stations. Alarms can be either motorized bells or wall-mountable sounders or horns.

Fire Alarm System Design

After the fire protection goals are established, the fire alarm designer undertakes to detail specific components, arrangements and interfaces necessary to accomplish these goals. These are usually determined by referencing the minimum levels of protection mandated by the appropriate model building code, insurance agencies, and other authorities. Equipment specifically manufactured for these purposes selected and standardized installation methods are anticipated during the design. In the United States, NFPA 72, The National Fire Alarm Code is an established and widely used installation standard. In Canada, the ULC is the standard for the fire system.

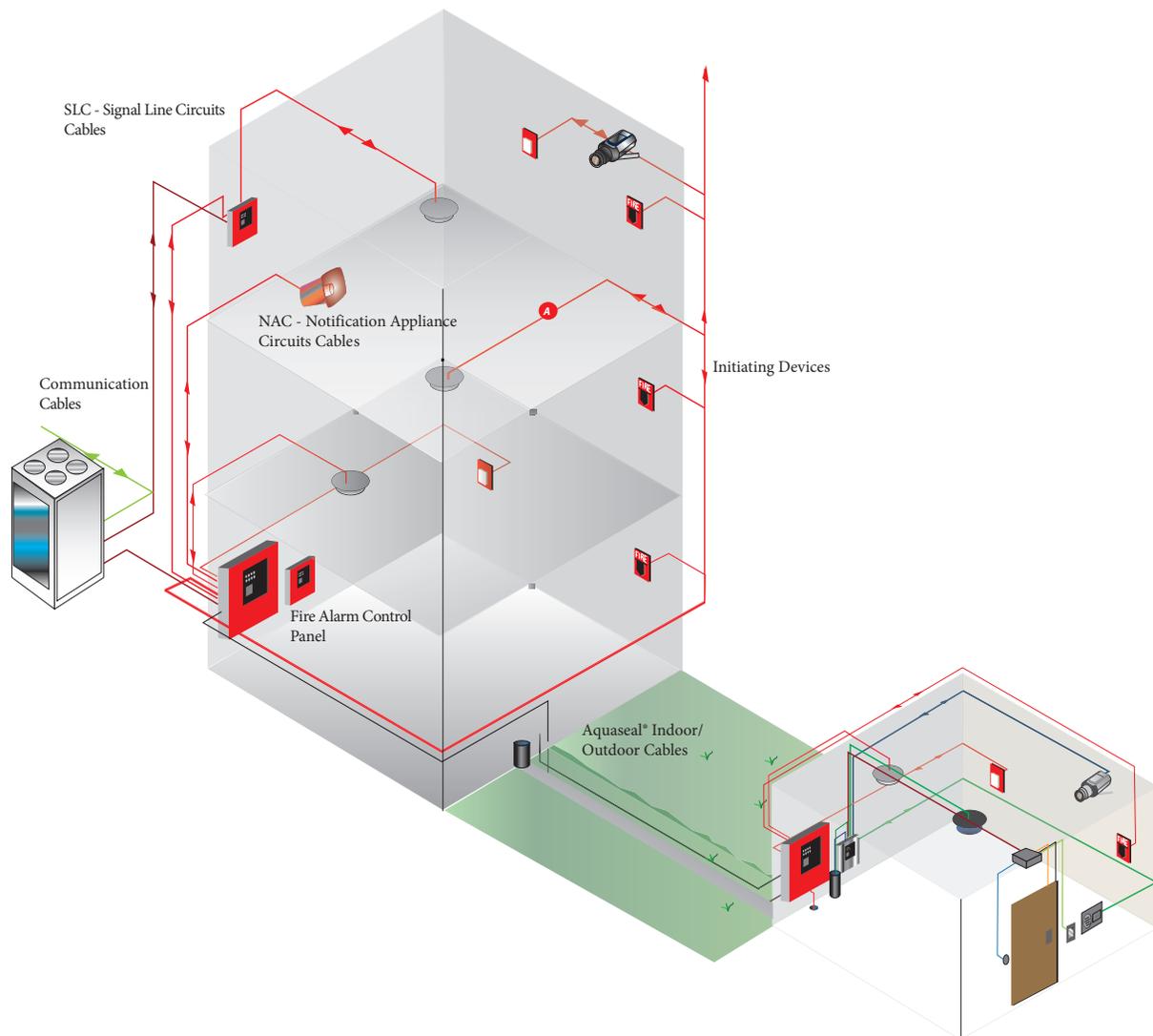
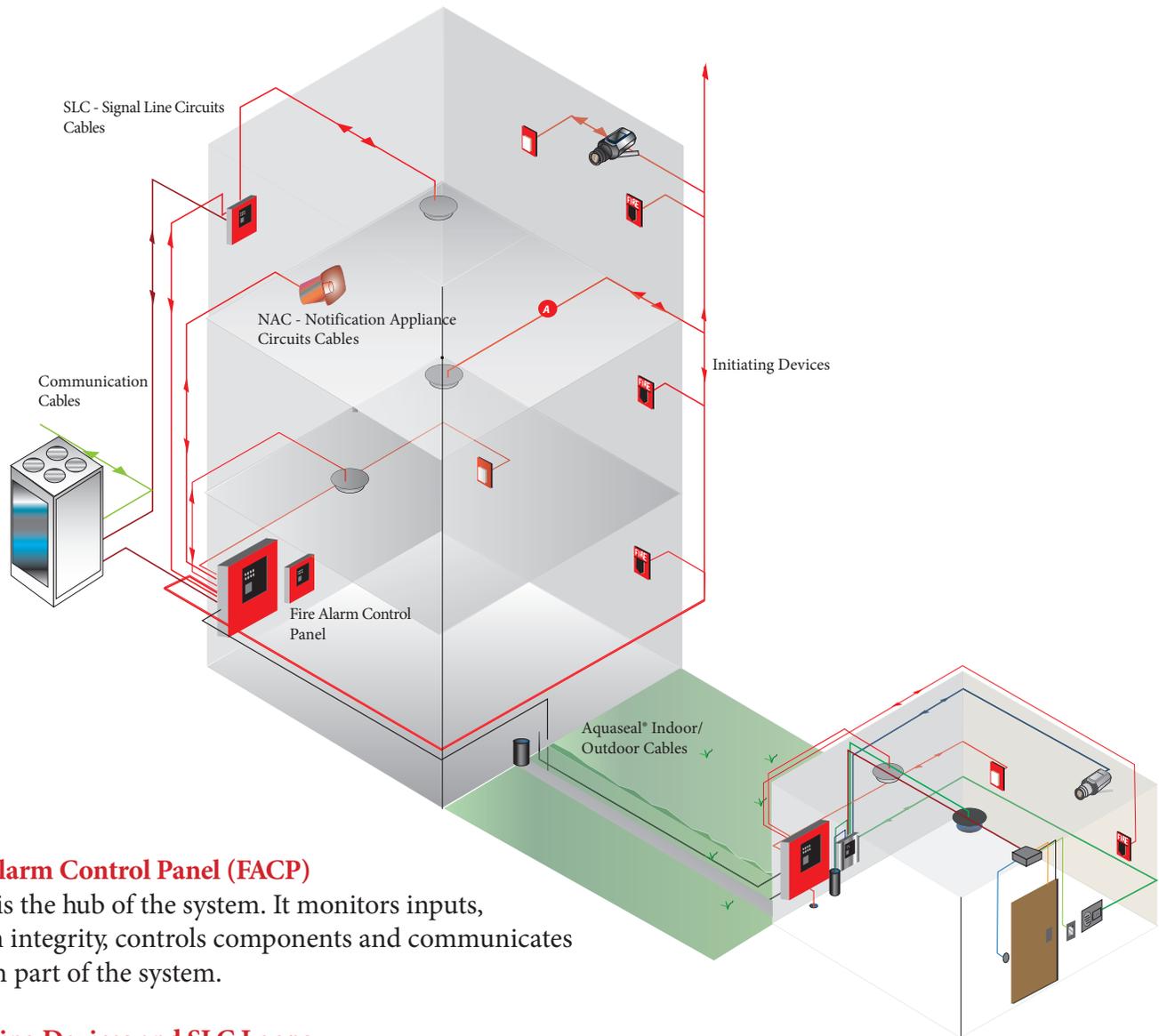


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Fire Alarm Systems



Fire Alarm Control Panel (FACP)

FACP is the hub of the system. It monitors inputs, system integrity, controls components and communicates to each part of the system.

Initiating Devices and SLC Loops

Initiating devices consist of pull stations, call points, automatic heat, smoke flame detectors and other devices that initiate a communication back to the FACP.

SLC - Signal line circuits are initiating devices in an addressable fire alarm system.

Notification Appliance NAC Devices

Notification devices notify in-building occupants about a problem. This is done by audible, visible, tactile, and textual devices.

Fire Alarm Systems

Fire alarm systems can be put into three system designs. Conventional (analog), addressable (digital) and multiplex systems (analog/addressable).

Conventional Systems (Analog)

Conventional fire alarm systems, in their various forms, solely been around for many of years and have changed little in that time in terms of technology, although design and reliability have improved significantly. However, conventional systems are a well-proven technology protecting many hundreds of thousands of properties worldwide. A conventional fire alarm system is often the natural choice for smaller systems or where budget constraints exist.

In a conventional fire alarm system the “intelligence” resides solely within the fire alarm control panel. The panel receives a trigger signal from conventional detectors or initiating devices circuits (smoke, heat, flame detectors) which, in turn, signals the condition to the notification device circuits such as alarm sounders, horns, strobes and other remote signalling equipment.

Conventional detectors are normally connected to the fire control panel via dedicated circuits. Each circuit protects a designated “zone” or area of the building. The system has different modes: normal, alarm, trouble, and others, depending on the fire alarm manufacturer.



Conventional Fire Alarm Design

The designer must be sure that the last device on the circuit has sufficient voltage to operate the device within its rated voltage. When calculating the voltage available to the last device, it is necessary to consider the voltage drop due to the resistance of the wire: the larger the wire, the less the voltage will drop. Generally, for purposes of determining the wire size necessary for the system, it is best to consider all of the devices on the end of the supply circuit.

Typical wire size resistance: loop resistance

18 AWG solid: Approximately 6.5 ohms/1000 ft. 13 ohms/1000 ft.

16 AWG solid: Approximately 4.1 ohms/1000 ft. 8.2 ohms/1000 ft.

14 AWG solid: Approximately 2.6 ohms/1000 ft. 5.2 ohms/1000 ft.

12 AWG solid: Approximately 1.8 ohms/1000 ft. 3.6 ohms/1000 ft.

Power Limited and Non-Power Limited Systems

Conventional fire alarm cables are designed based upon the AWG of the cable. Conventional systems can be broken into two categories: power limited and non-power limited. Power limited is the dominant designed system.

1.Type FPL- FPL power-limited fire alarm cable is listed by the NEC as being suitable for general purpose fire alarm use. This listing excludes installation in riser, ducts, plenums and other space used for environmental air unless the cable is installed in conduit. All FPL cables are listed as being resistant to the spread of fire and must pass both UL test 1424 and the vertical flame test UL 1581.

2.Type FPLR- FPLR power-limited fire alarm riser cable is listed as being suitable for use in a vertical run in a shaft or from floor to floor. All FPLR cables are listed as having fire-resistant characteristics capable of preventing fire from traveling from floor to floor. Riser cables must pass both UL test 1424 and the Vertical riser test UL 1666.

3.Type FPLP- FPLP power-limited fire alarm cable is listed by the NEC as being suitable for use in ducts, plenums and other space used for environmental air. All FPLP cable are listed as having adequate fire resistant and low-smokeproducing characteristics and must pass both UL test 1424 and UL Stiener tunnel test 910. (NFPA262)

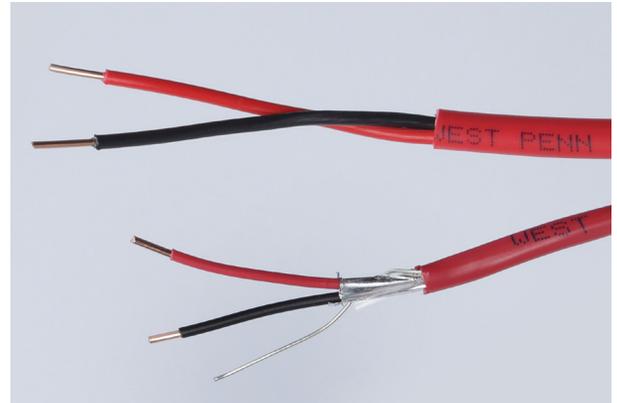
- No voltage rating markings on PLFA cables
- CL3 and CM rated cables, which have a voltage rating of 300V, are permitted to be used as PLFA cables.
- Inherently limited by the power supply
- Transformer
- Other power supply devices

Non-Power Limited

1.Type NPLF- NPLF non power-limited fire alarm cable is listed by the NEC as being suitable for general purpose fire alarm use. This listing excludes installation in riser, ducts, plenums and other space used for environmental air unless the cable is installed in conduit. All NFPL cables are listed as being resistant to the spread of fire and must pass both UL test 1424 and the vertical flame test UL 1581.

2.Type NPLFP- NPLFP Non power-limited fire alarm cable is listed by the NEC as being suitable for use in ducts, plenums and other space used for environmental air. All NPLFP cable are listed as having adequate fire resistant and low-smoke producing characteristics and must pass both UL test 1424 and UL Stiener tunnel test 910.(NFPA262)

- Power source of NPLFA circuits output voltage shall not exceed 150 volts.
- Class 1 cables can be installed and used as NPLFA, but must be placed in a tray or conduit.
- Overcurrent devices shall be located at the point where the device to be protected receives its supply.



Conventional FA Cables

Conductor:

- Shall not be smaller than a 26 AWG
- Single conductor are smaller than 16 AWG
- Solid or stranded conductor

Insulation:

- FPLR: PVC or polypropylene insulation
- FPLP Fire/flame retardant PVC for plenum rated
- Conductors are either cabled or twisted pair. West Penn Wire 2 conductor cables are twisted.

Shield:

- Dependent on the system requirements and environmental conditions
 - unshielded or shielded
- Shield is used to protect the cable against interference created from other cables or outside electronic/electrical or mechanical devices.
- Shield is normally 100% aluminum foil wrap.

Jacket:

- PVC for Non-Plenum FPLR
- Flexible Fire Retardant PVC for FPLP
- Jacket Color: Normally red, but can be any color. West Penn Wire has the capability to strip the cable jacket.

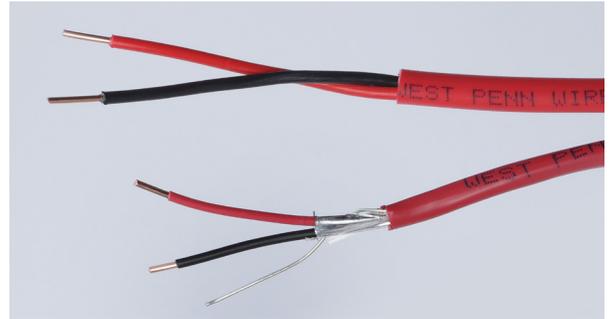
Electrical Characteristics:

- Nom. DCR (AWG size) is the most important electrical property in conventional systems.
- Capacitance: The capacitance is not an important electrical property in conventional systems.

Notes:

Initiating devices and the associated cables communicate back to the FACP. The cable's gauge size is the important factor to deliver the analog signals to the FACP. You will find that normally 18-16 AWG cables.

Notification devices and associated cables send power to the devices. You will find that normally 16-12 AWG cables are utilized.



Addressable (Multiplex) FA Systems

Addressable fire alarm systems differ from conventional systems in a number of ways and certainly add more flexibility, intelligence and speed of identification, and scope of control. For this reason, addressable fire alarm systems are the natural choice for larger premises and buildings, with more complex system requirements.

In an addressable system, detectors are wired in a loop around the building with each detector having its own unique address. The system may contain one or more loops depending upon the size of the system and design requirements. The fire control panel communicates with each detector individually and receives a status report, such as normal, alarm or trouble. As each detector has an individual address the fire alarm control panel is able to display or indicate the precise location of the device in question. This helps the speed of an incident and, for this reason, zoning of the system is not necessary.

Addressable detectors are, in themselves, intelligent devices which are capable of reporting far more than just fire or fault conditions. Most analog addressable detectors are able to signal if contamination in the device reaches a preset level enabling maintenance to take place prior to problems being experienced.

In most earlier styles of addressable systems, the notification appliances were not intelligent. Today, many manufacturers are providing addressable notification technology. There are many advantages of providing such technology, such as lower costs of products and overall installation time.



Addressable Cable Selection

The designer must be aware of not only the DC resistance of the cable, but the capacitance and the velocity of propagation of the cable. The designer must assure that the overall loop capacitance is not compromised, and error rates are kept to a minimum.

Nominal Capacitance for wire sizes:

- 18 AWG solid unshielded: 16 pf/ft
- 18 AWG solid shielded: 25 pf/ft 45 pf/ft **
- 16 AWG solid unshielded: 17 pf/ft
- 16 AWG solid shielded: 30 pf/ft 54 pf/ft **
- 14 AWG solid shielded: 30 pf/ft. 54 pf/ft **
- 12 AWG solid shielded: 35 pf/ft. 63 pf/ft **

**capacitance between one conductor and the other connected to the shield

Addressable FA Cables

Conductor:

- Can not be smaller than a 26 AWG
- Single conductor no smaller than 18 AWG
- Solid or stranded conductor, bare copper for low DCR

Insulation:

- Polypropylene insulation FPLR
- Fluoropolymer insulation Teflon FPLP
- Conductors are twisted.

Shield:

- Dependent on the system requirements and environmental conditions
 - unshielded or Shielded
- Shield is used to protect against interference created from other cables or outside electronic/ electrical or mechanical devices.
- Shield is normally 100% aluminum foil wrap.

Jacket:

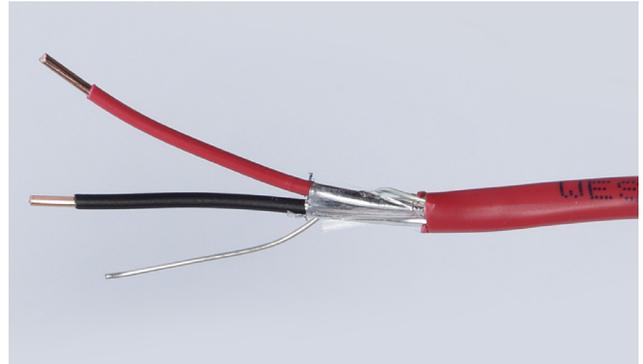
- PVC for non-plenum FPLR
- Flexible fire retardant PVC for FPLP
- Jacket Color: Normally red, but can be any color. West Penn Wire has the capability to strip the cable jacket.

Electrical Characteristics:

- Nom. DCR (AWG size) is an important electrical property in addressable systems.
- Capacitance: The capacitance has a bigger influence on cable distance. The lower the capacitance the better the digital signals can be transmitted and received.

Notes:

Initiating devices in an addressable systems are referred to as SLC - signal line circuits or, signal line circuits. Normally 16-18 AWG low capacitance higher velocity of propagation.



For Digital Audio Loops: a 100Ω +/-5% is needed. West Penn Wire D980 and D990 are the best choice.

Notification devices and associated cables send power to the devices. You will find that normally 16-12 AWG cables are utilized.

West Penn Wire Cables Guide

Unshielded Fire Alarm Cables

AWG Size	# of Cond.	FPL				FPLR	FPLP Plenum	
		Aquaseal Direct Burial	Aquaseal In-Conduit	Low Cap	Parallel			Low Cap
12 Solid	2				974	998	60995B	
14 Solid	2				972	994	60993B	
14 Solid	4					700	60700B	
16 Solid	2			D990	971	990	60991B	D60991
16 Solid	4					992	60164B	
18 Solid	2			D980	970	980	60980B	D60980
18 Solid	4					982	60992B	
12 Strnd	2	AQ227						
14 Strnd	2	AQ226	AQC226					
14 Strnd	4	AQ246						
16 Strnd	2	AQ225	AQC225					
16 Strnd	4	AQ245						
18 Strnd	2	AQ224	AQC224					
18 Strnd	4	AQ244						

Shielded Fire Alarm Cables

AWG Size	# of Cond.	FPL			FPLR	FPLP Plenum	
		Aquaseal Direct Burial	Aquaseal In-Conduit	Low Cap			Low Cap
12 Solid	2				999	60994B	
14 Solid	2						
14 Solid	4				995	60992B	
16 Solid	2			D991	991	60990B	D60990
16 Solid	4				993	603164B	
18 Solid	2			D975	975	60975B	D60975
18 Solid	4				977	60977B	
12 Strnd	2	AQ296					
14 Strnd	2	AQ295	AQC295				
14 Strnd	4						
16 Strnd	2	AQ294	AQC294				
16 Strnd	4	AQ2345					
18 Strnd	2	AQ293	AQC293				
18 Strnd	4	AQ3244					

AQUASEAL® - Indoor/Outdoor Cables



Aquaseal® power-limited water-resistant cables are designed to be used for indoor/outdoor fire alarm systems. The Aquaseal products are manufactured using a premium-grade jacket compound. These cables are flame retardant, sunlight and water resistant, and employ an abrasion and crush-resistant construction. This durability allows the Aquaseal power-limited water-resistant cables to be direct burial.

The internal cable construction employs a dry water-blocking barrier instead of a messy gel. Unlike many other outdoor cables which can not be placed indoors due to their inability to pass flame tests, Aquaseal water-resistant cables carry both indoor and outdoor ratings.

Aquaseal cable retains consistent electrical characteristics compared to standard cable when immersed in water. The moisture-blocking barrier used in this cable has proven itself in various tests where standard outdoor cable has failed. This can be verified by monitoring the capacitance levels of both cables. Aquaseal water-resistant cables will consistently have lower capacitance values and remain stable over the long haul enabling the lowest signal loss.

Aquaseal is UL listed, NEC type FPL or PLTC rated and utilizing 18 AWG to 12 AWG makes this cable excellent for low-voltage conventional and addressable systems.



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