

Fire alarm cables

Conventional system cables

Addressable system cables

Indoor/outdoor cables

Product Bulletin

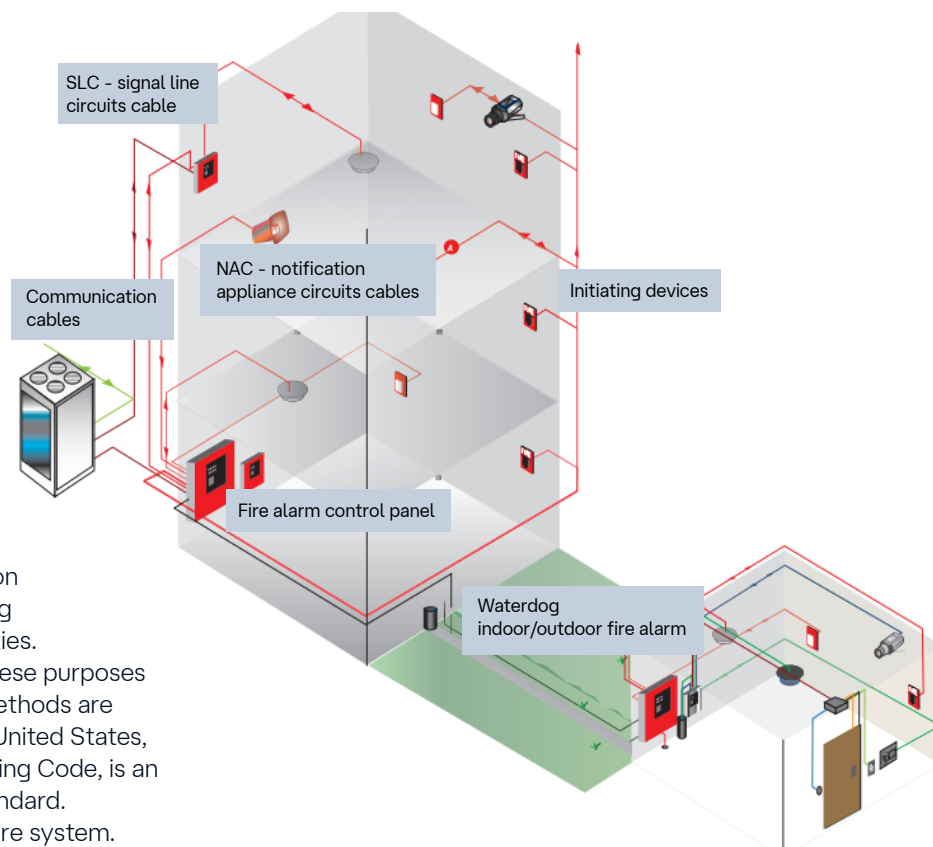


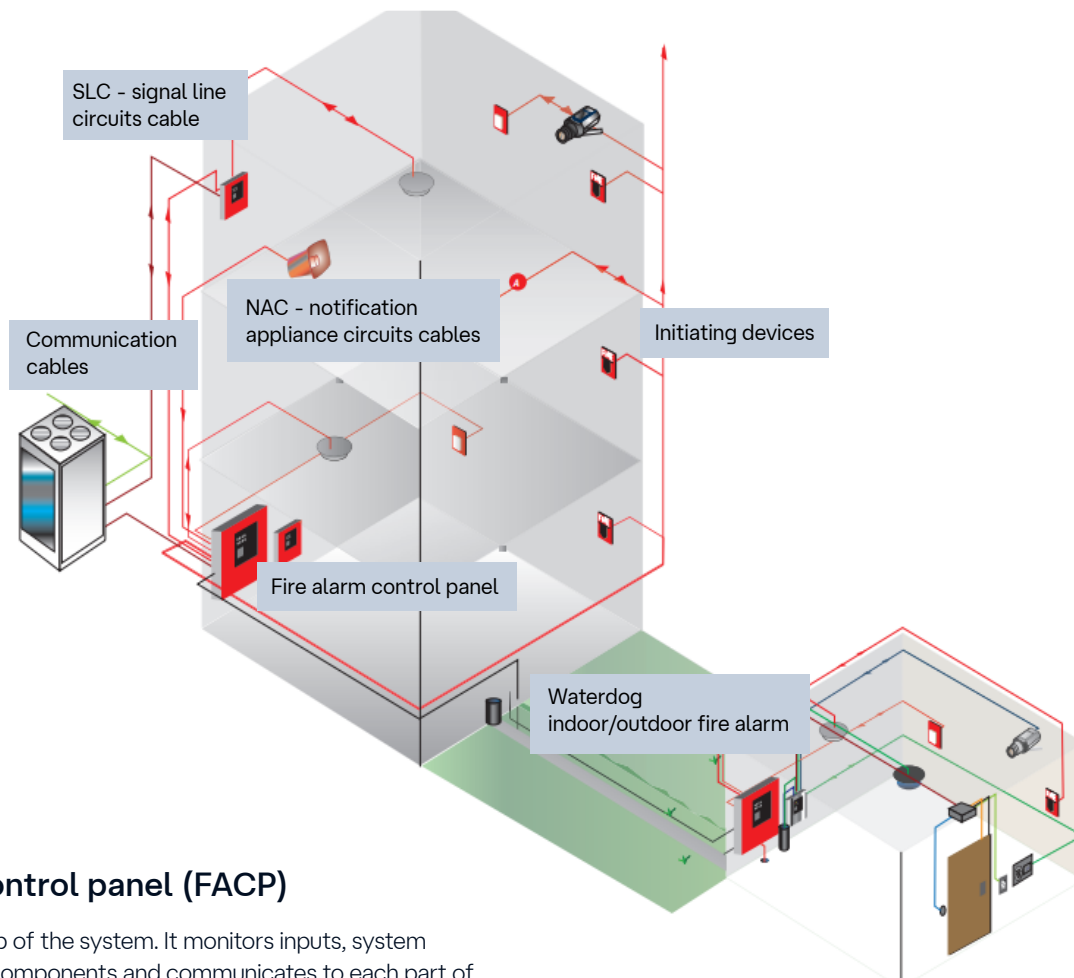
Fire alarm systems

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 details 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 is selected, and standardized installation methods are anticipated during the design phase. In the United States, NFPA 72, the National Fire Alarm and Signaling Code, is an established and widely used installation standard. In Canada, the ULC is the standard for the fire system.





Fire alarm control panel (FACP)

The 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, or 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

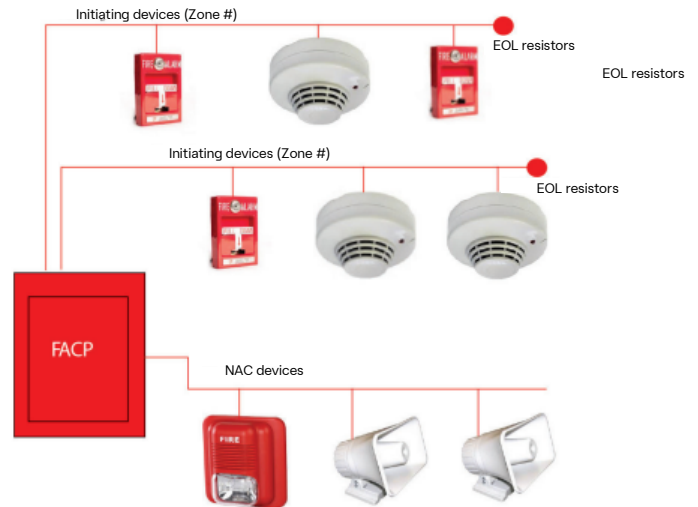
Fire alarm systems can be put into three system designs: conventional (analog), addressable (digital) and multiplex systems (analog/addressable).

Conventional systems (analog)

Conventional fire alarm systems, in their various forms, have 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” reside solely within the fire alarm control panel. The panel receive 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 signaling 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 risers, ducts, plenums and other spaces 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 spaces used for environmental air. All FPLP cable are listed as having adequate fire-resistant and low-smoke-producing characteristics and must pass both UL test 1424 and UL Steiner 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

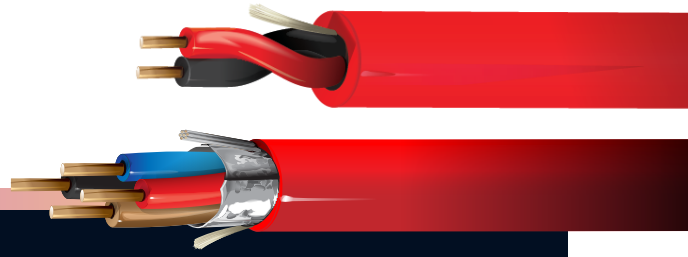


Non-power limited

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 risers, ducts, plenums and other spaces 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 spaces used for environmental air. All NPLFP cables are listed as having adequate fire-resistant and low-smoke-producing characteristics and must pass both UL test 1424 and UL Steiner 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 26 AWG
- Single conductor is 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. Belden 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

»» Jacket

- PVC for non-plenum FPLR
- Flexible fire-retardant PVC for FPLP
- Jacket color: Normally red, but can be any color. Belden 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 used.

Addressable (multiplex) FA systems

Addressable fire alarm systems differ from conventional systems in a number of ways and certainly add more flexibility, intelligence, 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 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 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. Belden 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 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 system are referred to as SLC - signal line circuits.
Normally 16-18 AWG low capacitance indicates higher velocity of propagation.

For digital audio loops: A 100 ohm cable is required. Belden 5320UV or 5220UV are the best non-plenum choices. 6320UJ or 6220FK would be the best plenum choices.



Belden Fire Alarm Cable Guide

Unshielded version

AWG size	No. of cond.	FPL rated			FPLR rated	FPLP Rated	
		Legacy	Waterdog	Low capacitance			Low capacitance
12 Solid	2				5020UL	6020UL	
14 Solid	2				5120UL	6120UL	6120UJ
14 Solid	4				5122UL		
16 Solid	2	9572		5220UJ 5220UV	5220UL	6220UL	6220UJ
16 Solid	4				5222UL	6222UL	
18 Solid	2	9571		5320UJ 5320UV	5320UL	6320UL	6320UJ
18 Solid	4						
12 Strd	2		5001U1 5000U2		5000UL	6000UL	
14 Strd	2		5100U1 5140U1 5100U2		5100UL	6100UL	
14 Strd	4		5102U1				
16 Strd	2		5240U1 5200U2		5200UL	6200UL	
16 Strd	4		5202U1 5202U2		5202UL		
18 Strd	2		5300U1 5340U1 5300U2		5300UL	6300UL	
18 Strd	4		5302U1 5302U2		5302UL	6302UL	6302UL

Notes:

Belden offers many other types of conductor count constructions as well as other AWG sizes. For more information on Belden's complete offering, please contact a Belden representative.

Special constructions are available upon request. Special construction is considered a non-standard jacket color, non-standard insulation colors, packaging, labeling, cable imprint and others.

New Direct Burial Waterdog - U2 versions are available

Armored versions are available upon request



Belden Fire Alarm Cable Guide

Shielded version

AWG size	No. of cond.	FPL rated				FPLR rated	FPLP Rated		NPLF
		Legacy	Waterdog	Low capacitance	Shipboard			Low capacitance	
12 Solid	2	9583		5120FJ		5020FL	6020FL		5020FN
14 Solid	2					5120FL	6120FL	5120FJ	5120FN
14 Solid	4					5122FL			5122FN
16 Solid	2	9575		5220FJ	1321SB FPLR	5220FL	6220FL	6220FK	5220FN
16 Solid	4	9579				5222FL	6222FL		5222FN
18 Solid	2	9574		5320FJ	1302SB FPLR	5320FL	6320FL	6320FK	5320FN
18 Solid	4	9578		5322FJ		5322FL	6322FL		5322FN
12 Strd	2			5020FJ		5000FL	6000FL		
14 Strd	2		5140F1 5100F2			5100FL	6100FL		
14 Strd	4					5102FL			
16 Strd	2		5240F1 5200F2			5200FL	6200FL		
16 Strd	4		5202F1 5202F2			5202FL			
18 Strd	2		5300F1 5340F1 5300F2			5300FL			
18 Strd	4		5302F1 5302F2			5302FL			

Notes:

Belden offers many other types of conductor count constructions as well as other AWG sizes. For more information on Belden's complete offering, please contact a Belden representative.

Special constructions are available upon request. Special construction is considered a non-standard jacket color, non-standard insulation colors, packaging, labeling, cable imprint and others.

New Direct Burial Waterdog - F2 versions are available

Armored versions are available upon request



Belden Fire Alarm Cable Guide

Waterdog - Indoor/Outdoor

A ruggedized cable capable of resisting temperature and humidity variability

Security and building management systems often involve devices located outside the building or in adjacent buildings. In those situations, off-the-shelf security cabling isn't up to the task due to harsh environments with temperature and moisture fluctuations.

Belden New Generation (New Gen) Waterdog Cables are a complete line of ruggedized, water-resistant/direct-burial cables that support security and building management systems. They meet UL water-resistance standards and TIA water-filtration tests and are available as paired, multi-conductor or coaxial cables with numerous conductor and shielding options



AWG size	No. of cond.	FPL - PLTC				
		Direct Burial Waterdog FPL Unshielded	In-Conduit Waterdog FPL Unshielded	Direct Burial Waterdog FPL Shielded	In-Conduit Waterdog FPL Shielded	Shipboard
12 Solid	2	5000U2			5020FJ	
14 Solid	2	5100U2	5140U1	5100UF2	5140F1	
14 Solid	4					
16 Solid	2	5200U2	5240U1	5200F2	5240F1	1321SB
16 Solid	4	5202U2	5202U1	5202F2	5202F1	
18 Solid	2	5300U2	5300U1 5340U1	5300F2	5300F1 5340F1	1320SB
18 Solid	4	5302U2	5302U1		5302F1	

Notes:
U2 and F2 items are new to Belden. Indoor/outdoor direct burial.



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