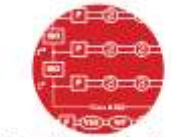
Fire Alarm Wiring

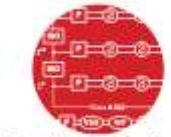
Circuit types, styles and limitations

What we will cover



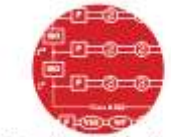
- Types
  - Notification Appliance Circuits (NAC)
  - Initiating Device Circuits (IDC)
  - Signaling Line Circuits (SLC)
- Classes
  - Class A, B, C, D, E, & X
  - Survivability
- Limitations Attendee Discussion
  - Questions and Answers
  - What to watch out for in the real world
    - Capacitance
    - Voltage Drops
    - Power Limited vs Non-Power Limited

Types



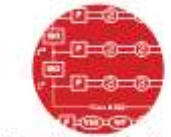
- Notification Appliance Circuits/Control Circuits (NAC)
  - Supervised polarity reversing power circuits for Horns, Strobes, Bells, Chimes
  - Any NAC that does not have a Notification Appliance attached shall be considered a Control Circuit
  - Performance shall be based upon wiring Class (Note the old Class & Style has been replaced with Class only)
  - Troubles (Opens, Shorts or Grounds) must be reported within 200 seconds
  - Alarms must activate NACs and Control circuits within 10 seconds
  - Survivability, an Open, Short or Ground cannot affect any other NAC for more than 200 seconds
  - Faults on Addressable Notification Devices that are in different “notification Zones” but on the same SLC can not interfere with those in other notification zones.

Types Continued



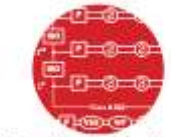
- Initiating Device Circuits (IDC)
  - A circuit where Automatic or Manual Initiating Devices are connected and the signal does NOT identify the individual device operated.
  - Performance shall be based upon wiring Class (Note the old Class & Style has been replaced with Class only)
  - Alarms must activate NACs and Control circuits within 10 seconds
  - Troubles (Opens, Grounds) must be reported within 200 seconds
  - No more than 5 Waterflow devices and no more than 20 Supervisory devices per IDC

Types Continued



- Signaling Line Circuits (SLC)
  - A circuit where any combination of addressable devices connect to system interface containing both input and/or output signals
  - Performance shall be based upon wiring Class (Note the old Class & Style has been replaced with Class only)
  - Troubles (Opens, Shorts or Grounds) must be reported within 200 seconds
  - Alarms must activate NACs and Control circuits within 10 seconds
  - Survivability, an Open, Short or Ground cannot affect any other SLC Controlled NAC for more than 200 seconds
  - Faults on Addressable Notification Devices that are in different “notification Zones” but on the same SLC can not interfere with those in other notification zones.

Types Continued



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Class A

- Class A has the benefit of a redundant pathway back to the control panel.
- That pathway assures that any signal is received at the control panel.
- This wiring Class applies to NAC, IDC and SLC (except the SLC with Short Circuit Isolation)
- The NFPA 72 2013 recognizes the use of Fiber Optic cable and is not affected by shorts of grounds.

TYPE OF FAULT	OLD NFPA 72 2007 CLASS A STYLE 6	NEW NFPA 72 2013 CLASS A
SINGLE OPEN	ALARM, TROUBLE	ALARM, TROUBLE
SINGLE GROUND	ALARM, TROUBLE	NOT APPLICABLE
SHORT	TROUBLE	TROUBLE
SHORT & OPEN	TROUBLE	TROUBLE
SHORT & GROUND	TROUBLE	NOT APPLICABLE
OPEN & GROUND	ALARM, TROUBLE	NOT APPLICABLE
COMMUNICATION LOSS	TROUBLE	TROUBLE
APPLICATION EXAMPLE	initiating device circuit & notification appliance circuit	Fiber Optic Pathways GROUND & SHORT N/A

Class B

- Class B has no redundant pathway back to the control and as such is more susceptible to wiring faults.
- This wiring Class applies to NAC, IDC and SLC

TYPE OF FAULT	OLD NFPA 72 2007 SLC STYLE 4	NEW NFPA 72 2013 "CLASS B"
SINGLE OPEN	TROUBLE	TROUBLE
SINGLE GROUND	ALARM, TROUBLE	ALARM, TROUBLE
SHORT	TROUBLE	TROUBLE
SHORT & OPEN	TROUBLE	TROUBLE
SHORT & GROUND	TROUBLE	TROUBLE
OPEN & GROUND	TROUBLE	TROUBLE
COMMUNICATION LOSS	TROUBLE	TROUBLE
APPLICATION EXAMPLE	Initiating device circuit, signal line circuit, & notification appliance circuit	No redundant path: Alarm receipt with a single ground signal line circuit & notification appliance circuit

Class C, D & E

- System integration is addressed in Classes C, D & E.
- Class C is for wired Ethernet devices where the pathway is not as important as the communication between both ends of the pathway. (NFPA 72 2016 introduces Class N which is a 4 wire [Class A like] wiring method)
- Class D is for FailSafe operating circuits
- Class E is for ancillary “Non-Supervised” circuits

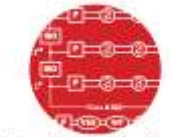
TYPE OF FAULT	NEW NFPA 72 2013 "CLASS C" LAN/WAN/INTERNET	NEW NFPA 72 2013 "CLASS D" FAIL-SAFE	NEW NFPA 72 2013 "CLASS E" NOT SUPERVISED
SINGLE OPEN	TROUBLE	NO ANNUNCIATION	NOT SUPERVISED
SINGLE GROUND	TROUBLE	NO ANNUNCIATION	NOT SUPERVISED
SHORT	TROUBLE	NO ANNUNCIATION	NOT SUPERVISED
SHORT & OPEN	TROUBLE	NO ANNUNCIATION	NOT SUPERVISED
SHORT & GROUND	TROUBLE	NO ANNUNCIATION	NOT SUPERVISED
OPEN & GROUND	TROUBLE	NO ANNUNCIATION	NOT SUPERVISED
COMMUNICATION LOSS	TROUBLE	NO ANNUNCIATION	NOT SUPERVISED
APPLICATION EXAMPLE	Fire control unit digital alarm communication transmitter	Power to door holders where interruption of the power results in the door closing	Circuits that do not require supervision eg. Jockey pump

Class X

- Class X is the new designation for SLC Style 7 wiring
- Includes a Class A like redundant pathway
- It is supposed to allow the circuit to remain functional even with a wire-to-wire short

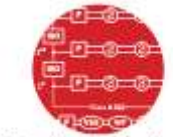
TYPE OF FAULT	OLD NFPA 72 2007 CLASS A STYLE 7	NEW NFPA 72 2013 "CLASS X"
SINGLE OPEN	ALARM, TROUBLE	ALARM, TROUBLE
SINGLE GROUND	ALARM, TROUBLE	ALARM, TROUBLE
SHORT	ALARM, TROUBLE	ALARM, TROUBLE
SHORT & OPEN	TROUBLE	TROUBLE
SHORT & GROUND	ALARM, TROUBLE	ALARM, TROUBLE
OPEN & GROUND	ALARM, TROUBLE	ALARM, TROUBLE
COMMUNICATION LOSS	TROUBLE	TROUBLE
APPLICATION EXAMPLE	Fire alarm network communication cabling	Fire alarm network communication cabling

Survivability



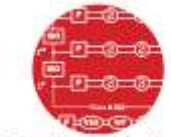
- The level of survivability required is dependent on the type of fire alarm system being installed. A higher level of survivability applies to systems used for relocation or partial evacuation of occupants
- Levels of Survivability are 1 - 3, depending on if the wiring is within an Evacuation Signaling Zone (ESZ) or not
- An ESZ is a discrete area of a building, bounded by smoke or fire barriers in which occupants are intended to relocate or evacuate.
- Level 0 means no survivability is required (wiring within the ESZ)
- Level 1 - 3 indicate that attack by fire shall not impair the control and operation of Notification Appliances outside the ESZ

Survivability Continued



- The Key Concept behind Levels 1 -3 is the Fact that Metal Raceway only protects wiring against Mechanical Damage, NOT Damage by Fire.
- Level 1, In buildings that are protected by an Automatic Sprinkler System and who's wiring is installed in Metal Raceways
- Level 2 can be accomplished by,
  - A, 2-hour rated CI Wire OR
  - B, 2-hour fire rated cable system OR
  - C, 2-hour fire rated enclosure OR
  - D, 2-hour performance alternative approved by the AHJ
- Level 3, a combination of Levels 1 & 2.

Survivability Continued



- When attack by fire will affect signaling and control outside of the ESZ, then pathway survivability Levels 2 - 3 are used (at the discretion of the AHJ)
- When the wiring outside of the ESZ is necessary for the operation and control of Notification Appliances until it enters the ESZ, Level 2 - 3 must be used
- CI rated Cables may be used where pathway survivability Level 2 - 3 is required.
- CI Cables are not required for Levels 0 - 1.
- Follow NEC 760 and the AHJ’s guidance

Let’s talk

Circuit Classifications

Questions?
Field issues?
What’s next in this series of Fire Alarm Tech Presentations