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.
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.
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
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.
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
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
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

<table>
<thead>
<tr>
<th>TYPE OF FAULT</th>
<th>OLD NFPA 72 2007 CLASS A STYLE 7</th>
<th>NEW NFPA 72 2013 &quot;CLASS X&quot;</th>
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<tr>
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<td>ALARM, TROUBLE</td>
<td>ALARM, TROUBLE</td>
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<tr>
<td>SINGLE GROUND</td>
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<tr>
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<tr>
<td>COMMUNICATION LOSS</td>
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<tr>
<td>APPLICATION EXAMPLE</td>
<td>Fire alarm network communication cabling</td>
<td>Fire alarm network communication cabling</td>
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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

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