AFX 2025.ai

Fire Alarm Transmission Technologies

Art Black
Richard Roberts

Automatic Fire Alarm Association

1

Learning Objectives

- Review of Model Code Requirements
- Development of Communications Methods
- Benefits and Pitfalls of Current Communication Options
- NFPA 72 Performance Based Requirements

Automatic Fire Alarm Association

2

Disclaimer

Comments and opinions during the presentation are exclusively the presenter and do not reflect an official position of the International Code Council (ICC), National Fire Protection Association (NFPA), its employees, or any of the Technical Committees.

This presentation will not cover all the revisions, editorial changes, details, requirements or exceptions.

Highly recommend purchasing a copy of the ICC or NFPA Code or the Handbook for all the changes, requirements and details:

www.nfpa.org

www.iccsafe.org

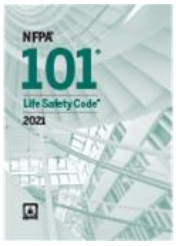
Model Code Requirements

International Fire Code (IFC):

907.6.6 Monitoring. Fire alarm systems shall be monitored by an approved supervising station in accordance with NFPA 72.

NFPA 101, *Life Safety Code*:

9.6.4.1 Where required by another section of this Code, emergency forces notification shall be provided to alert the municipal fire department and fire brigade (if provided) of fire or other emergency.



Development of Communications Methods

NFPA 71-D (1899)

First NFPA document relating to fire alarm and detection systems.

"GENERAL RULES AND REQUIREMENTS FOR THE INSTALLATION OF WIRING AND APPARATUS FOR AUTOMATIC FIRE ALARMS, HATCH CLOSERS, SPRINKLER ALARMS, AND OTHER AUTOMATIC ALARM SYSTEMS AND THEIR MANUAL AUXILIARIES"


NATIONAL
FIRE PROTECTION
ASSOCIATION.

A PARTIAL RECORD OF THE

TRANSACTIONS

AT

THIRD ANNUAL MEETING

HELD IN BOSTON

June 13th, 14th and 15th, 1899.

Boston:
Standard Publishing Company
1899

Outside connections must have two outside connections from every risk equipped. These connections should be chosen from the following, choice being made in the order given:

First: Fire department house within 2,500 feet, having permanent men and hoses stationed therein.

NFPA 71-D (1899)

Outside Connections (continued)

Second: Fire department house within 2,500 feet having "bunkers" and horses at night.

Third: House of engineer or foreman of risk when same is within 1,200 feet.

Fourth: House of owner or superintendent of risk when same is within 1,200 feet.

Fifth: House of chief engineer or foreman of local fire department when either is within 1,200 feet.

Sixth: House or regular employee , other than those above mentioned, when same is within 12,00 feet.

When it is impossible to obtain any of the above, special instructions shall be obtained from the inspection department having jurisdiction.

Connection to city or town fire alarm box is not allowable.

Fire Alarm Standards Timeline

1899 General Signaling Standard

1911 Municipal Standard

1931 Central Station Standard

1960 Remote Station Standard

1964 Local System Standard

Fire Alarm Standards

1965 Auxiliary Standard
1965 Proprietary System Standard
1967 Household Standard
1983 Emergency Voice Alarm
1985 Guide to Testing and Maintenance
1985 Guide to Notification Appliances

Recombination Efforts

1985 Partial Recombination

72A, 72B, 72C, 72D, and 72F
Issued 1990 as NFPA 72-1990

1988 Total Recombination

All Signaling Standards
Issued 1993 as NFPA 72-1993

Communications Methods

- 1993-2007 Communications Methods
  - Active Multiplex
  - DACS
  - McCulloh
  - 2-Way Radio
  - 1-Way Radio
  - Direct Connect
  - Private Microwave
  - Other Technologies
- 2010-2025 Communications Methods
  - Active Multiplex
  - DACS
  - McCulloh
  - 2-Way Radio
  - 1-Way Radio
  - Direct Connect
  - Private Microwave
  - Other Technologies
    - "Performance Based"

11

11

McCulloh

- McCulloh coded telegraph wheels.
- They required to be rewound or reset after an alarm.
- Copper connection did not transmit very far and needed repeater stations.

12

Active Multiplex

- "Derived Local Channel"
- Telephone companies provided "modem" equipment to allow single phone line to carry voice and alarm signals.
- Use depended on the extent of participation of the local phone company.
- First use in the US was in January 1983 by Wisconsin Bell.
- Analogous to DSL.

13

Direct Connect Non-Coded

Technology from the early 1960s.

Leased sub-voice grade lines (Series 1000 circuits) provided on-off signal to the local fire department.

"Non-Coded" means that annunciated signals are either "FIRE" or "NOTHING".

DACTs

- **D**igital **A**larm **C**ommunicator **T**ransmitter (DACT)
- Uses regular telephone lines
- But – what are regular telephone lines?

15

DACTs

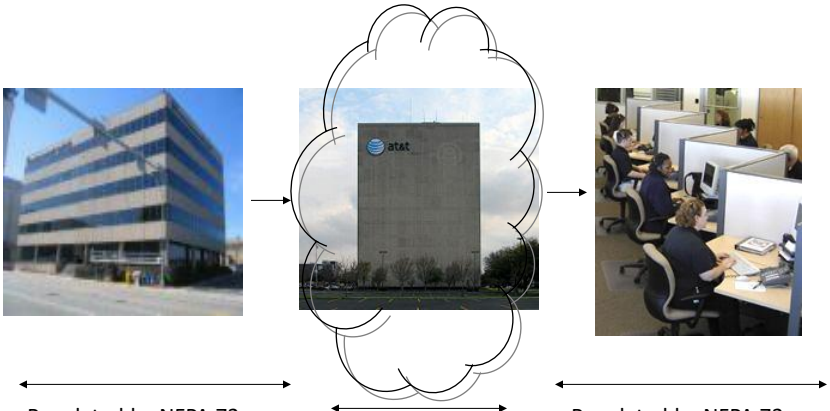
First introduced to the committee in the 1980s.

Determined (twice!) by NFPA 71 committee to be unreliable.

DACT proponents successful on third attempt to get into the standard, but with precautions for redundancy.

16

Digital Alarm Communications Systems



17

DACTs

DACTs are to be connected to the public switched telephone network (PSTN) upstream of any customer owned equipment.

Connection needs to be on a loop start POTS telephone line.

POTS = Plain Old Telephone Service, an end-to-end copper line from the protected premises to the central office.

18

DACTs

- DACTs need to do the following when sending a signal:
  - Seize the line
  - Disconnect any other use of the phone line.

19

DACTs

- DACTs ***cannot*** be connected to party lines.
- DACTs ***cannot*** be connected to public telephone lines.
- DACTS ***can*** be used with DSL with appropriate filters

20

FUTURE OF DACS

- "With each passing day, more and more communications services migrate to broadband and IP-based services, leaving the public switched telephone network ('PSTN') and plain-old telephone service ('POTS') as relics of a by-gone era."
- Federal Communications Commission (FCC): In 2019 the FCC issued Forbearance Order 19-72A1, which officially granted telecommunications carriers permission to abandon outdated, degraded copper POTS lines
  - This FCC order effectively severed the ties that forced carriers to maintain a specific standard of traditional POTS connectivity
  - At present, the legacy carries have not announced an official date when they will no longer support this technology

Mesh Radio

- Listed as one-way radio.
- Sole path technology.
- Dependent on robust local network ("mesh")
- **AES Intellinet** is primary manufacturer

Performance-Based

- Originally identified in NFPA 72 as “Other”
- No specific “recipes”; this section has specific ***performance*** requirements
- Allows new technologies to be listed instead of having specific ***prescriptive*** requirements in NFPA 72

23

Cellular Radio

- Listed under Performance-Based Technologies
- Listed as sole-path
- Many manufacturers, perform essentially the same

24

IP (Internet Protocol)

- Listed as performance-based technology.
- Transmits over internet pathways using customer routers and servers (in most cases…)

25

IP vs VOIP

IP = internet protocol

VOIP = voice over internet protocol.

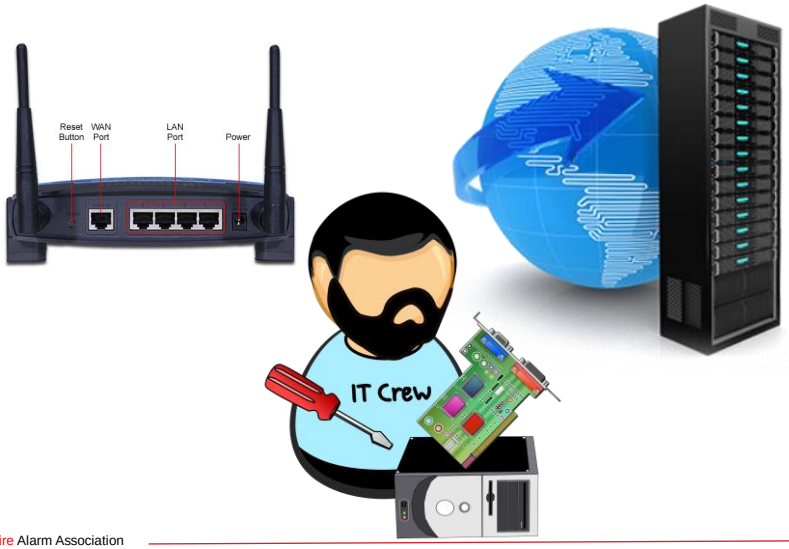
IP is not associated with voice transmission.

VOIP can be either utility VOIP or consumer VOIP.

Consumer VOIP cannot be used for fire alarm signal transmission.

26

IP Communications Issues



NFPA 72 Performed-Based Requirements

NFPA 72 Performance Based Requirements

- Telecommunications technology has and continues changing at a ***rapid*** pace
- To keep up with technology advancements, a ***new*** Performance-Based Technology section was added to the 2013 edition of NFPA 72®
- The goal is ***not*** to specify ***prescriptive*** requirements of a specific technology, rather provide basic operating parameters (***performance based***), such as transmission supervision rates of technologies
- Performance Based Technologies are required to monitor the integrity (**supervise**) of the transmission technology and its communications pathway

NFPA 72 Performance Based Requirements

- **Communications Failure:** All communications failures due to latency or jitter conditions shall result in a trouble signal annunciated at the protected premises FACU
- **Single Communications Pathway:** Where approved by the AHJ, a single communications pathway is permitted, provided a failure of the pathway communications is annunciated at the supervising station and the protected premises FACU within 60 minutes
- **Multiple Communications Pathways:** Are permitted provided:
  - A communications failure for each pathway shall be annunciated at the supervising station and the protected premises FACU within 60 minutes
  - The pathways be arranged to prevent a single point of failure for the two pathways

NFPA 72 Performance Based Requirements

- **Single Technology:** A single technology is permitted to create the multiple communications pathways requirement provided
  - A communications failure for each pathway shall be annunciated at the supervising station and the protected premises FACU within 60 minutes
  - The pathways be arranged to prevent a single point of failure for the two pathways

✓ **Examples:**
  - One cellular carrier that produce two pathways with two or more cell towers of the carrier
  - Two different cellular carriers that produce two pathways

NFPA 72 Performance Based Requirements

- **Spare Equipment:** The supervising station is required to maintain spare communications equipment, and the supervising station operators must be able to place the spare equipment into service within 30 minutes of unit failure

- **End-to-End Communication Time:** The maximum duration between the initiation of an alarm signal at the protected premises, the transmission of the signal, and the display/recording of the alarm signal at the supervising station shall not exceed 90 seconds

- **Recording and Display Rate of Subsequent Alarms:** All alarm signals received at the supervising station are required to recorded and displayed within 10 seconds

NFPA 72 Performance Based Requirements

Listing of Sharing Communications Equipment:

- Premises equipment that initiate signal transmission at the control unit shall be listed independently of the communications technology and be part of the fire alarm system

- If the fire alarm transmitter is sharing communications equipment at the protected premises, the shared equipment shall be listed as
  - Communications equipment
  - Information technology equipment, or
  - Telecommunications equipment

Automatic Fire Alarm Association

33

NFPA 72 Performance Based Requirements

- **Secondary Power:** The secondary power capacity for all transmitters and shared communications equipment located at the protected premises have a minimum of 24 hours

  Exception: Secondary power capacity for shared equipment is permitted to have a capacity of 8 hours where acceptable to the authority having jurisdiction and where a risk analysis is performed to ensure acceptable availability is provided

Automatic Fire Alarm Association

34

Questions

ART BLACK
CARMEL FIRE PROTECTION ASSOCIATES
ART@CARMELFIRE.COM

RICHARD ROBERTS
SENIOR INDUSTRY AFFAIRS MANAGER
HONEYWELL FIRE SAFETY
RICHARD.ROBERTS@SYSTEMSENSOR.COM
630.338.7025