

Auxiliary Functions and Fire Alarm Matrix

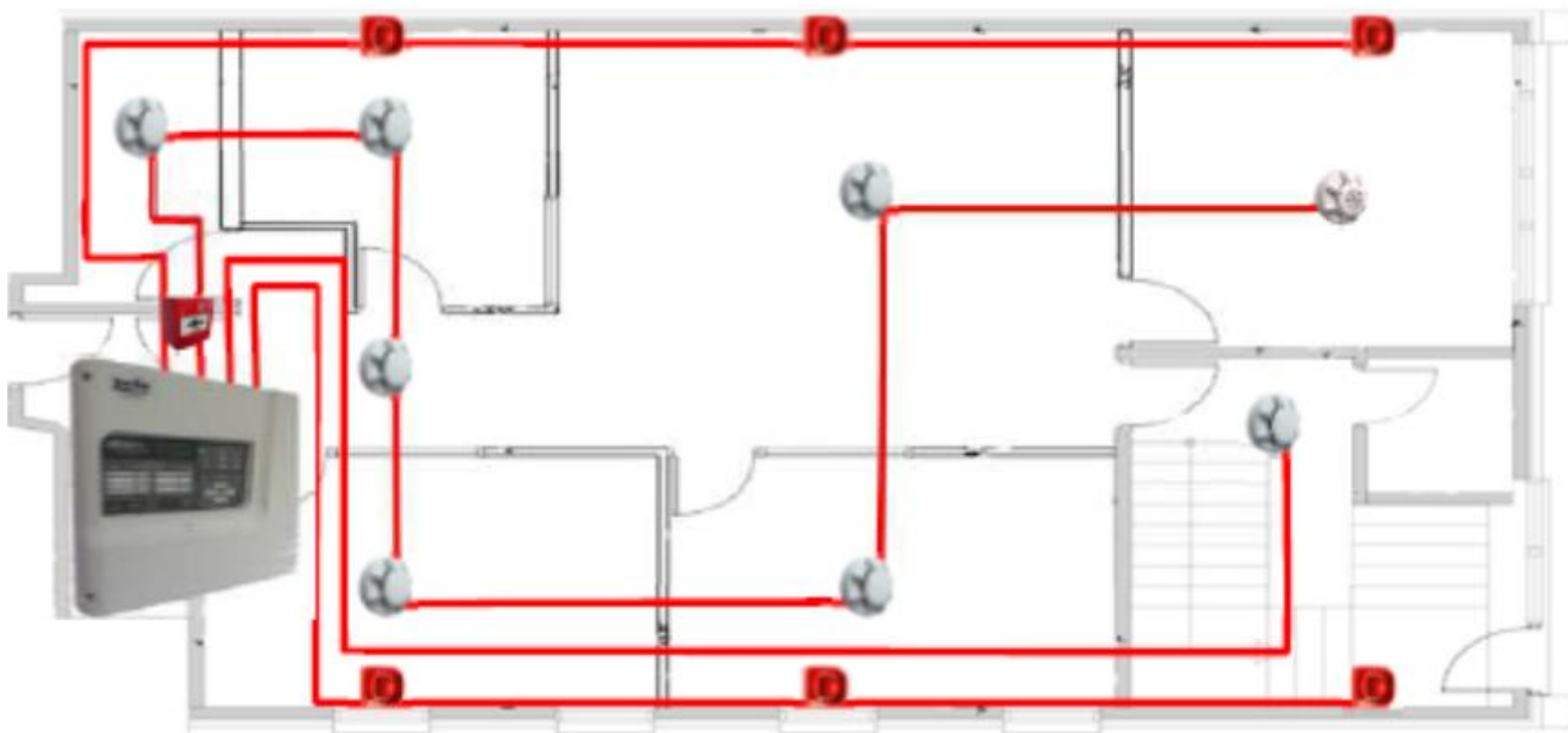
- Identify the different functions a FACU can perform in addition to interpreting detection signals and initiating notification signals.
- Determine the response from a FACU for a given input from a fire alarm matrix.
- Explain system integration.



Conventional Alarm System

- Used in small locations
- Activate individually upon detection
- Help in quick and safe escape
- Use radial circuits
- Can set up in zones
- Devices are simple two-state (on/off) devices that use different levels of resistance (load) to signal to the control panel
- Less expensive due to less installation labor

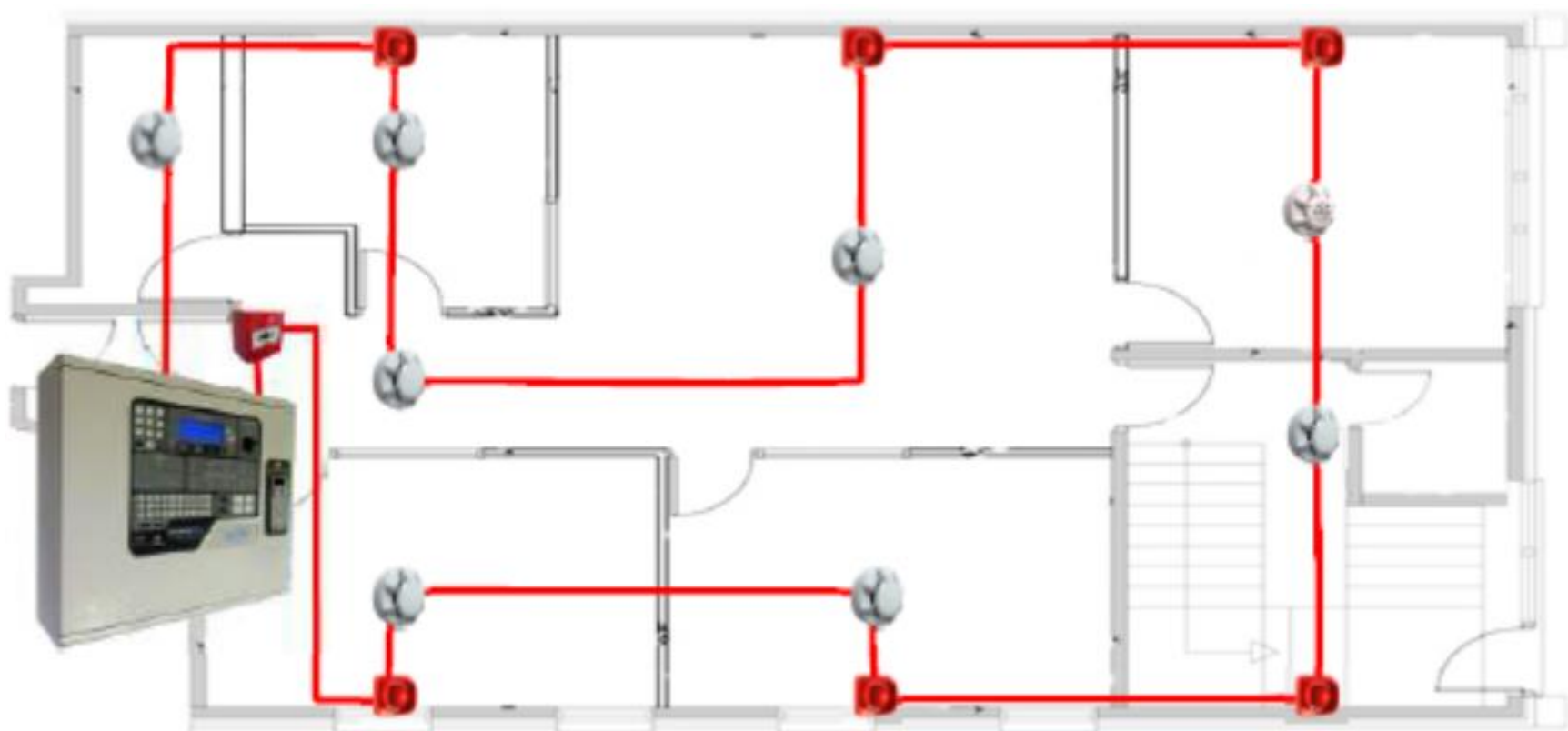




Addressable Alarm System

- Use in large buildings or complexes
- Customizable
 - Different devices with different alarm thresholds
 - Data communications technology
 - Contains FACU that show exact location of alarming device
 - Each device is given a unique identification number (address)
- More programming may mean more expense





Addressable System Advantages

- In the late 1990s it was generally not considered cost-effective to switch to an addressable system until more than 8 zones were required, but with today's products it can sometimes be worthwhile for a system as small as 2 or 4 zones
- Advantages
 - Reduced cable requirements
 - Simple loop based wiring. Able to add devices and expand easily
 - Notification devices may be more easily integrated with detection
 - Displayed location identification in the event of alarm rather than just a zone number
 - Event log for locating faults



Signal Transmission

- Link between devices and the control panel
 - Three basic circuits
 - Initiating device
 - Notification appliance
 - Signaling lines
 - Two-way data communication
 - Addressable device to panel
 - Communication of alarm off-site
 - Remote
 - Central station



System Outputs

System Inputs

System Inputs		Control Unit Annunciation																Notification				Required Fire Safety Control										Supplementary				
		Actuate common alarm signal indicator	Actuate audible alarm signal	Actuate common supervisory signal	Actuate audible supervisory signal	Actuate common trouble signal indicator	Actuate audible common trouble signal	Actuate 1st floor (zone 1) alarm indicator	Actuate 1st floor (zone 2) alarm indicator	Actuate 1st floor (zone 3) alarm indicator	Actuate 2nd floor evacuation signals	Actuate 3rd floor evacuation signals	Display/print evacuation signals	Transmit fire alarm signals	Transmit trouble change of status	Transmit supervisory signal to supervising station	Release trouble signal to supervising station	Recall magnetically held smoke doors	Recall elevators to primary recall floor	Recall elevators to alternate recall floor	Actuate 1st floor smoke exhaust	Actuate 2nd floor smoke exhaust	Actuate 3rd floor smoke exhaust	Unlock exits	Actuate suppression system pre-discharge alarms	Energize suppression system releasing sequence	Actuate graphics system - display floor map	Pressurize stairwells	Shutdown process #1	Shutdown process #2	Actuate exterior visual notification appliance at f.d. response point					
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG		
1	Manual fire alarm boxes – 1st floor	●	●					●			●			●	●			●							●				●		●			●	1	
2	Manual fire alarm boxes – 2nd floor	●	●						●			●		●	●			●							●				●					●	2	
3	Manual fire alarm boxes – 3rd floor	●	●							●			●	●	●			●							●				●			●			●	3
4	Smoke detectors – 1st floor	●	●					●			●			●	●			●	●			●			●				●					●	4	
5	Smoke detectors – 3rd floor	●	●						●			●		●	●			●	●			●	●		●				●					●	5	
6	Smoke detectors – 1st floor	●	●							●			●	●	●			●	●					●				●						●	6	
7	Smoke detectors – 1st floor elev. lobby	●	●					●			●			●	●			●		●				●				●						●	7	
8	2nd floor computer rm. smoke det.-zone 1	●	●						●			●		●	●			●	●					●	●			●						●	8	
9	2nd floor computer rm. smoke det.-zone 2	●	●						●			●		●	●			●	●					●	●			●						●	9	
10	In-duct smoke detector – supply fan 1	●	●					●						●	●			●						●				●						●	10	
11	In-duct smoke detector – supply fan 2	●	●					●						●	●			●						●				●						●	11	
12	In-duct smoke detector – 1st floor return	●	●					●						●	●			●						●				●						●	12	
13	In-duct smoke detector – 2nd floor return	●	●						●					●	●			●						●				●						●	13	
14	In-duct smoke detector – 3rd floor return	●	●							●				●	●			●						●				●						●	14	
15	Heat detectors – 1st floor mech. rm.	●	●					●						●	●			●	●					●				●						●	15	
16	Heat detectors – 2nd floor storage room	●	●						●					●	●			●	●					●				●						●	16	
17	Heat detectors – 3rd floor janitor's closet	●	●							●				●	●			●	●					●				●						●	17	
18	Waterflow – 1st floor	●	●					●						●	●			●	●		●	●		●				●	●	●				●	18	
19	Waterflow – 2nd floor	●	●						●					●	●			●	●		●		●		●			●	●		●			●	19	
20	Waterflow – 3rd floor	●	●							●				●	●			●	●		●		●		●			●	●			●		●	20	
21	Sprinkler control valve – 1st floor			●	●								●			●												●							21	
22	Sprinkler control valve – 2nd floor			●	●								●			●												●							22	
23	Sprinkler control valve – 3rd floor			●	●								●			●												●							23	
24	Fire pump running	●	●										●	●			●							●				●					●		24	
25	Fire pump power failure/phase reversal			●	●								●			●												●							25	
26	Fire alarm ac power failure					●	●										●																		26	
27	Fire alarm system low battery					●	●										●																		27	
28	Open circuit					●	●										●																		28	
29	Ground fault					●	●										●																		29	
30	Notification appliance circuit short					●	●										●																		30	

△ FIGURE A.14.6.2.4 Typical Input/Output Matrix.

Detector Installation

- Special applications
 - Duct smoke detectors
 - Initiate closure of smoke doors
 - Fire suppression control
 - Clean agent
 - Pre-action systems
 - Deluge systems



Auxiliary Services

- Shut down HVAC system
- Close smoke and/or fire doors and dampers
- Stairwell pressurization
- Override control of elevators
- Automatically return the elevator to designated evacuation floor
- Operate heat and smoke vents
- Activate special fire extinguishing systems
 - Pre-alarm and release
- Monitor aspect of fire pump
- Process shutdown



Other Automatic Fire Suppression Systems

- There are NFPA standards describing the respective fire suppression systems and the standards provide information as to interfacing requirements with the fire alarm system



Fire Safety Function Interfaces

- Elevator control
 - Recall
 - Shut down
- Door control
 - Circuit should be arranged to provide fail safe operation
 - Release a door normally held open
 - NFPA 72 does not require a door hold-open device to be connected to standby power
 - Units are required to operate in a failsafe mode
 - Unlock a door that is normally locked
 - Conflict arises when security systems attempt to control occupied movement in buildings in contradiction to freedom of movement for self-preservation
 - Security systems cannot override code requirements established for life safety









System Integration

- All systems through one panel
 - Fire
 - Nonfire
 - Reduced costs
 - Ease of use



Interfaced Equipment

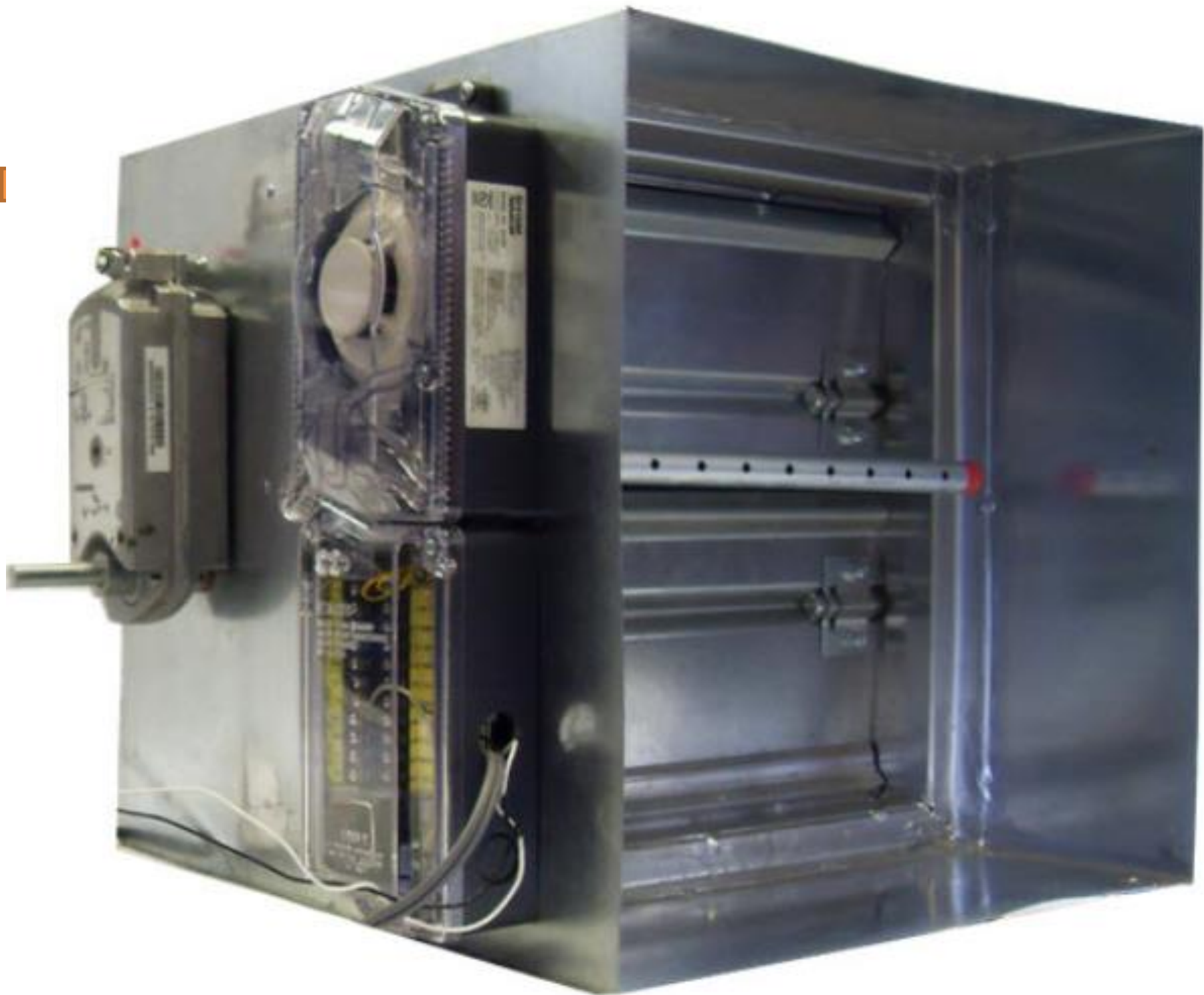
- Relay to initiate control must be within 3 ft of device
 - Why?
- Must be listed method
- Must be compatible with FACU
- Wiring must monitored for integrity
 - Or fail in correct operation
- Interface must not interfere with other functions



Building Automation Systems

- Non-computer control systems
 - Power is generally switched on or off
 - Wiring for these controls must be monitored for integrity
- Computer controlled building systems
 - Examples are fans and dampers
 - Network interconnections must be monitored for integrity
- Interconnected fire alarm control units
 - May occur during in addition to a building
 - Involves two different manufacturers' control units to be interconnected
 - Possibility of error in the system. Example:
 - First alarm system controls exhaust fan in a smoke vent shaft
 - Second alarm system controls the dampers in the vent shaft
 - If connected to different alarm systems and the interface is compromised, the fan can be told to start and the damper not be told to open resulting in collapse of the vent shaft





Non-Fire Alarm Interfaced Equipment

- AHJ should be consulted
 - If the interfaced system is monitoring conditions affecting life safety of the occupants, it may be required to have that system initiate an alarm condition on the fire alarm system



Key Point

- Address interface requirements early in the design stage to ensure the operational reliability of the fire alarm systems being interfaced with other building systems

