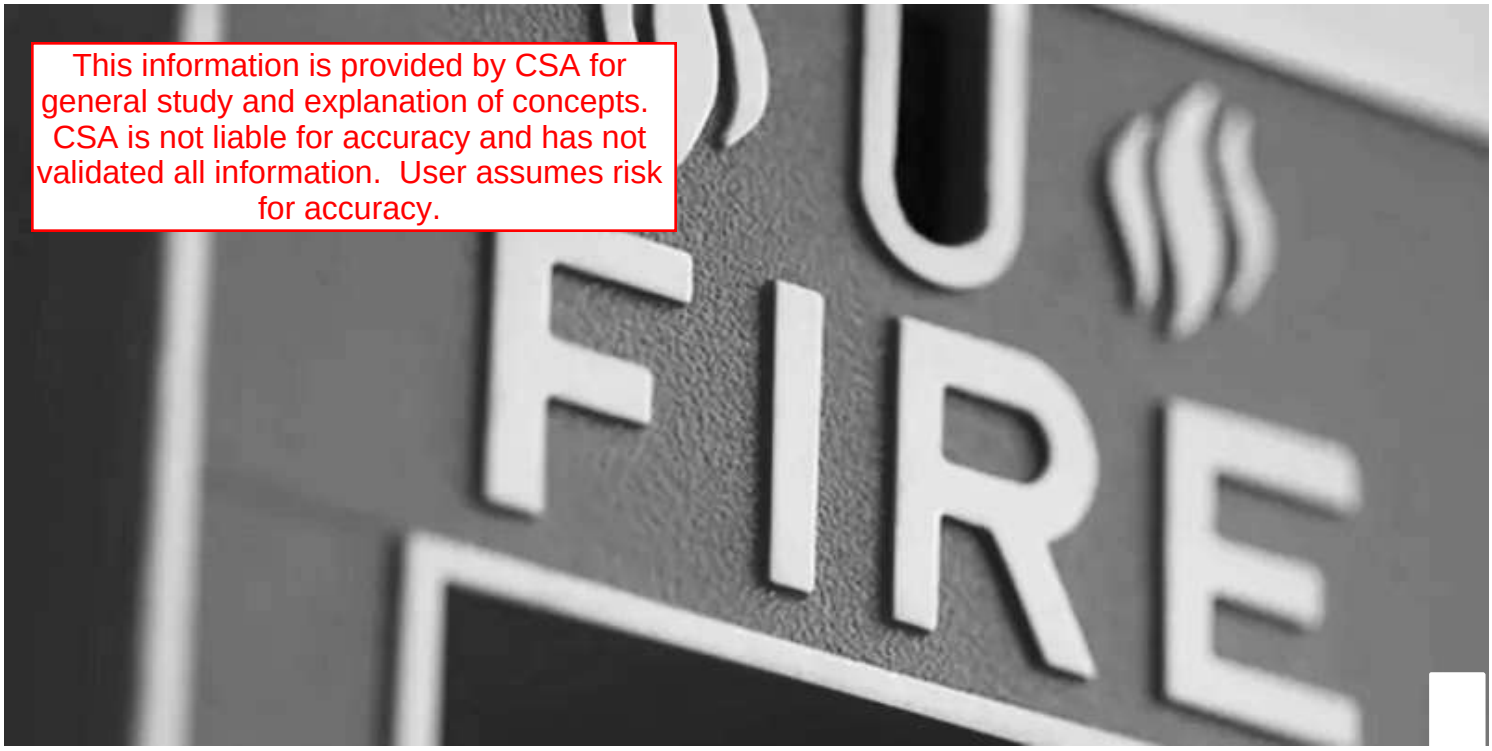
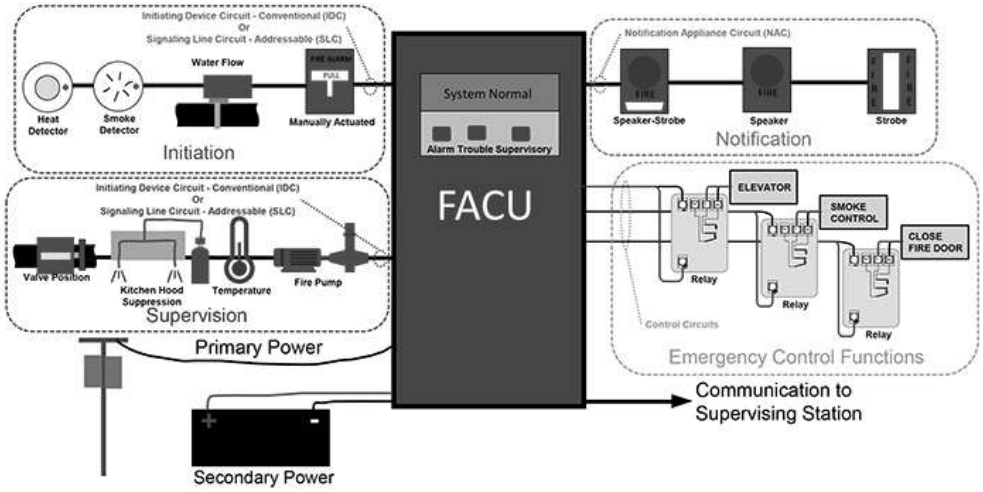
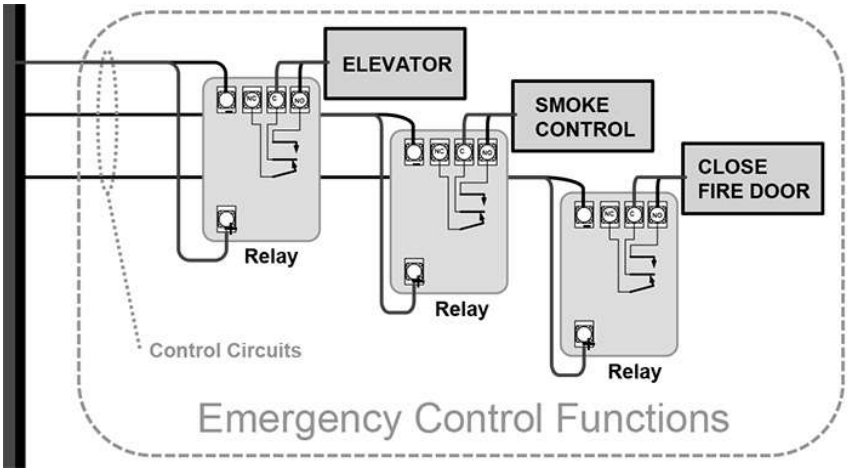


A Guide to Fire Alarm Basics: Emergency Control Functions

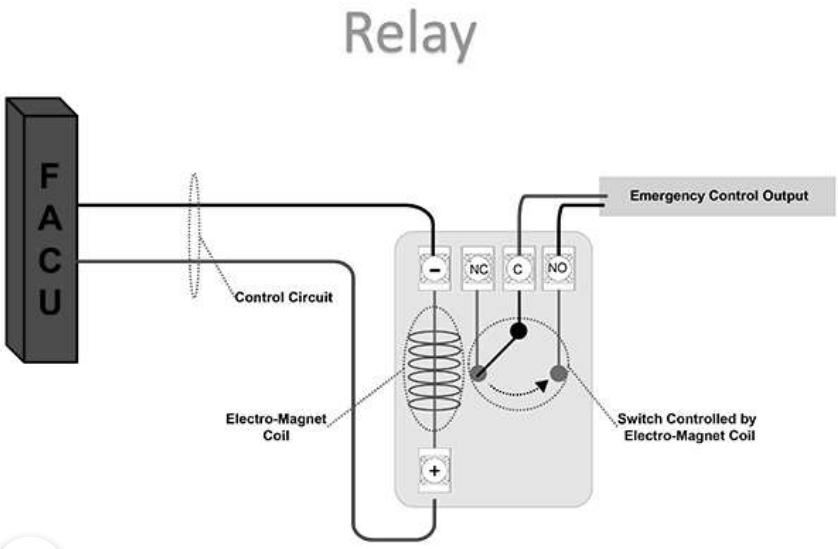
By Shawn Mahoney
20-Aug-2021

A fire alarm system is a crucial part of the overall fire protection and life safety strategy of a building. A fire alarm system serves many functions and the differences between the functions can be a bit confusing, so I created a visual guide to fire alarm basics. The objective of this blog series is to discuss some of the major components and functions of a fire alarm system. For an overview of the entire system take a look at my Guide to Fire Alarm Basics blog. This blog will take a deeper dive into the emergency controls of a fire alarm system.

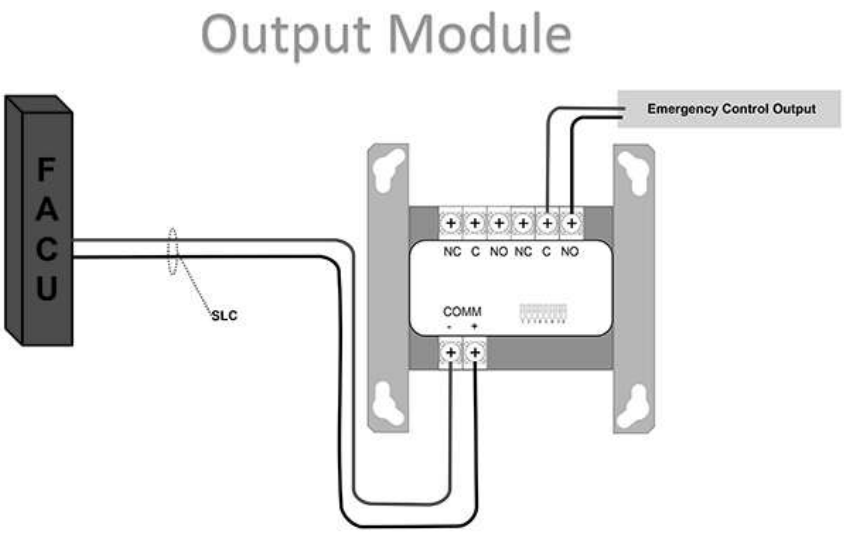




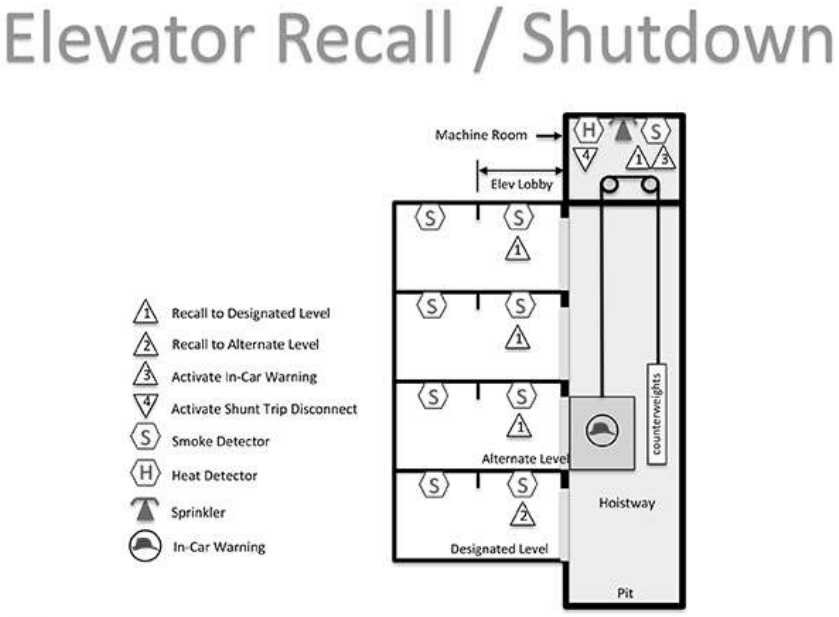
The fire alarm control unit can be used to control the function of other systems such as elevator recall, automatic door closers, smoke control systems, and so on. The most common way that the fire alarm can do this is through the use of a control circuit and a relay.



A control circuit is essentially a notification appliance circuit (NAC) that is used to send power to a relay instead of notification appliances. A relay is a switch that is open and closed electromechanically and allows the fire alarm control unit to operate emergency control functions. As seen above, power sent from the fire alarm control unit will energize an electro-magnet coil, which will cause the switch, which is controlling power coming into the common terminal (C) to move from the normally closed (NC) position to the normally open (NO) position. This switch can then be used to control other systems.

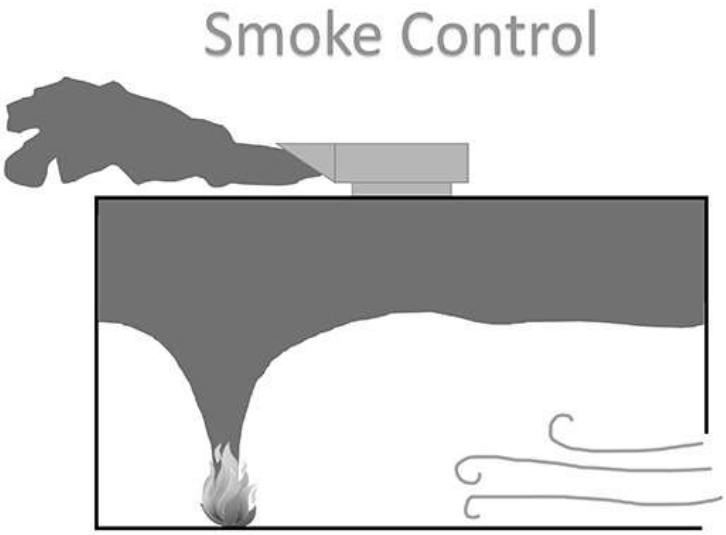


The control outputs from a fire alarm control unit can also be sent out on a signaling line circuit (SLC) to an addressable outp module, which can open or close a contact based on information sent from the fire alarm control unit on the SLC to the COM terminals. This is beneficial because multiple output modules can be controlled by the same SLC, which can control each module separately. For example, all output modules controlling all of the door hold opens in a building could be on the same SLC, but based on the specific input to the control unit, only specific doors can be closed. If all of these modules were on the same control circuit, the control unit would only be able to close all the doors.

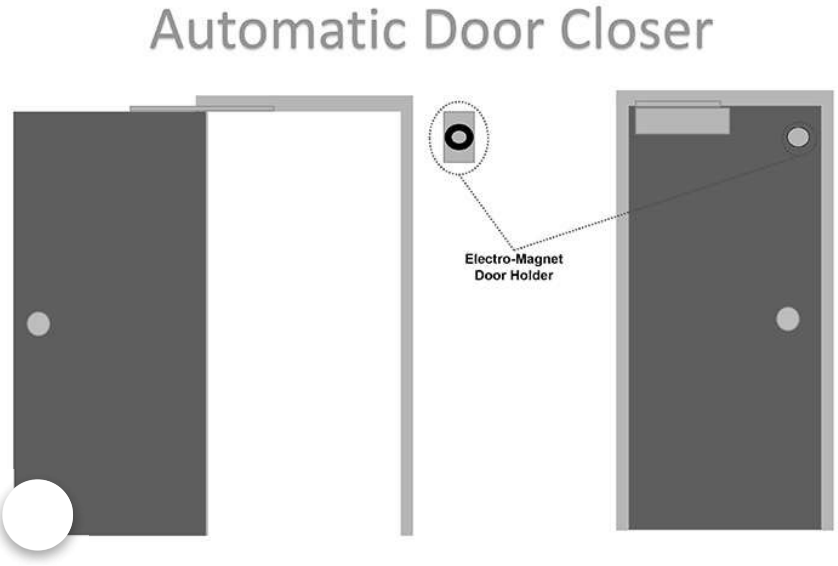


The fire alarm control unit can also be used to send a signal to the elevator controller to initiate elevator recall or shutdown. The fire alarm control unit will send a signal to send the elevator to the designated level (typically street level) when a smoke detector on any floor lobby or in the elevator machine room detects smoke, if smoke is detected in the designated level lobby the elevator will be sent to the alternate level (typically the level above the designated level). This is done to protect any of the occupants in the elevator by ensuring that they exit the building and do not go to a floor that has a fire on it.

If the elevator hoist way, pit, or machine room is required to have sprinklers, the fire alarm control unit is used to cut power to the elevator via a shunt trip prior to sprinkler activation to protect occupants. This is done by either placing a heat detector with a lower response time index (RTI) next to the sprinkler or by using a waterflow switch next to the sprinkler. The lower RTI means the heat detector would activate before the sprinkler, if a waterflow switch is used, it would need to have a 0 second time delay.



Many building designs include the use of large open spaces such as atriums that connect multiple floors of a building. To keep occupants safe in the event of a fire, a smoke control system may be needed to maintain the level of smoke above the occupants as they are exiting the building. These systems may be composed of exhaust fans and makeup air openings that are all controlled by a separate smoke control panel. The fire alarm control unit is responsible for sending a signal to the smoke control panel to initiate smoke removal when specific smoke detectors, pull stations, and waterflow alarms within the protected space are actuated. Additionally, the fire alarm control unit may be responsible for closing specific fire doors and dampers to enclose the smoke control zone. Want to learn more about smoke control systems? Check out this blog.



If a fire were to start within a building, an important objective is to contain the fire and products of combustion within an enclosed space for as long as possible. This is accomplished through construction that can resist the passage of fire. In most buildings these fire-resistant barriers can be found in corridor walls, and shafts (including stairwells). Openings within the fire-resistant construction need to be protected with fire doors. For these doors to be effective they need to be closed, so they are equipped with automatic closers. In some cases, the fire alarm can be used to hold these doors open with an electro-magnet door holder. Upon alarm, the fire alarm control unit will send a signal to cut power to the electro-magnets allowing the door to close.

Input Output Matrix

		System Outputs				
		NAC Ckt 1	NAC Ckt 2	Elev. Recall to Designated Level	Elev. Recall to Alternate Level	Machine or Control Space
	Input	A	B	C	D	E
1	Basement	●	●			
2	1st	●	●			
3	2nd	●	●			
4	3rd	●	●			
5	Basement Elev. Lobby SD	●	●		●	
6	1st Elev. Lobby SD	●	●		●	
7	2nd Elev. Lobby SD	●	●	●		
8	3rd Elev. Lobby SD	●	●	●		
9	Elevator Pent. SD	●	●	●		●
10	Elev. Hoist. SD (if used)	●	●	●		●
11	Atrium Beam Det.	●	●			

A key piece of documentation for the fire alarm system is known as the input/output matrix. This table outlines all the outputs from the fire alarm control unit when a given input is received. Above is a portion of the input/output matrix outlining elevator recall. An example shown on this chart would be when the fire alarm control unit receives an input from the 1st floor elevator lobby smoke detector (row 6) it will activate the NAC circuit 1 and NAC circuit 2 as well as send a signal to the elevator controller to recall the elevator to the alternate level. This document is key to the proper design of a fire alarm system and is also a crucial when performing testing to ensure that all of these systems are working as intended.

When a fire alarm control unit controls another system, it is known as system integration. It is crucial that the fire alarm system along with all integrated systems are tested properly.

Want to learn more?

Like I noted in the beginning of this blog, if you are interested in learning more about fire alarm basics, take a look at my Fire Alarm Basics blog. I will be updating this series over the next few months to add a deeper dive into different portions of the fire alarm system. If you found this article helpful, subscribe to the NFPA Network Newsletter for monthly, personalized content related to the world of fire, electrical, and building & life safety.

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Fire Alarm Basics Fact Sheet

Download Now!

Shawn Mahoney

NFPA Technical Services Engineer

y **yangkis284@gmail.com** 1 year ago

Sorry spilling mistakes fire alarm control panel installation

0 0 Reply

S **Stanislav Suslin** 2 years ago

Dear Shawn,
Is it permissible to control the components of the smoke exhaust system without using the smoke control panel? Open dampers directly from the fire alarm relay module, start fans, display statuses on FACP? would it be against the standards?
Thanks!

0 0 Reply

S **Shawn Mahoney** 2 years ago

I recommend that you take a look at chapter 6 of NFPA 92, you are required to have a firefighters smoke control station.

0 0 Reply

S **Stanislav Suslin** 2 years ago

Just one more question please. If I install a FSCS, but it will be connected to the FACP, and the smoke exhaust dampers and fans startup, will be controlled by the FACP over SLC devices (relay and monitor modules), but the status information will be on the FSCS (as well as HOA switches), can we consider that the requirement is satisfied? That is, the FSCS itself will not have a separate signal line and input/output modules to control smoke exhaust equipment. Thank you.

0 0 Reply

S **Shawn Mahoney** S Stanislav Suslin 2 years ago

I am sorry, but a question like that would need to go through our Technical Questions Service, which is free for NFPA members, you can ask your question online here https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=92&tab=questions.

0 0 Reply

S **Stanislav Suslin** 2 years ago

Thank you!

0 0 Reply

R **Rubina** 2 years ago

my fire alarm relay is making a clicking noise . what could be the reason

0 0 Reply

S **Shawn Mahoney** 2 years ago

Unfortunately I am unable to assist with a question like that, I recommend getting a qualified fire alarm technician to take a look.

1 0 Reply

w **weston chandler** 3 years ago

thanks for the info. do you know where I can find required fan shutdown down time upon duct detector activation? many thnx.

0 0 Reply

S **Shawn Mahoney** 3 years ago

Weston, I am not aware of a required time.

0 0 Reply