FASST

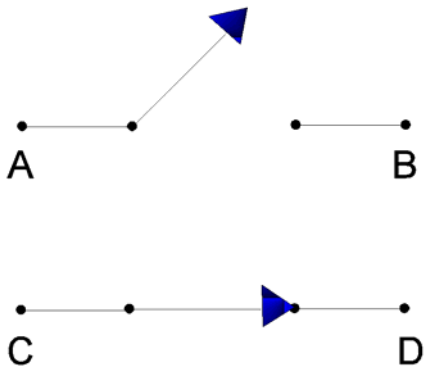
Field Associate Sound System Training

Relays & Switches

Relays and switches are extremely valuable for sound system application. Most often, they are used to turn devices such as speakers, microphones, and source players off and on.

The concept of a contact closure is important for this discussion. A contact closure is very much like a short in that it occurs when there is a connection between two conductors that permit unimpeded flow of current.

In the diagram to the right, a contact closure exists between points C & D, but not between points A & B.



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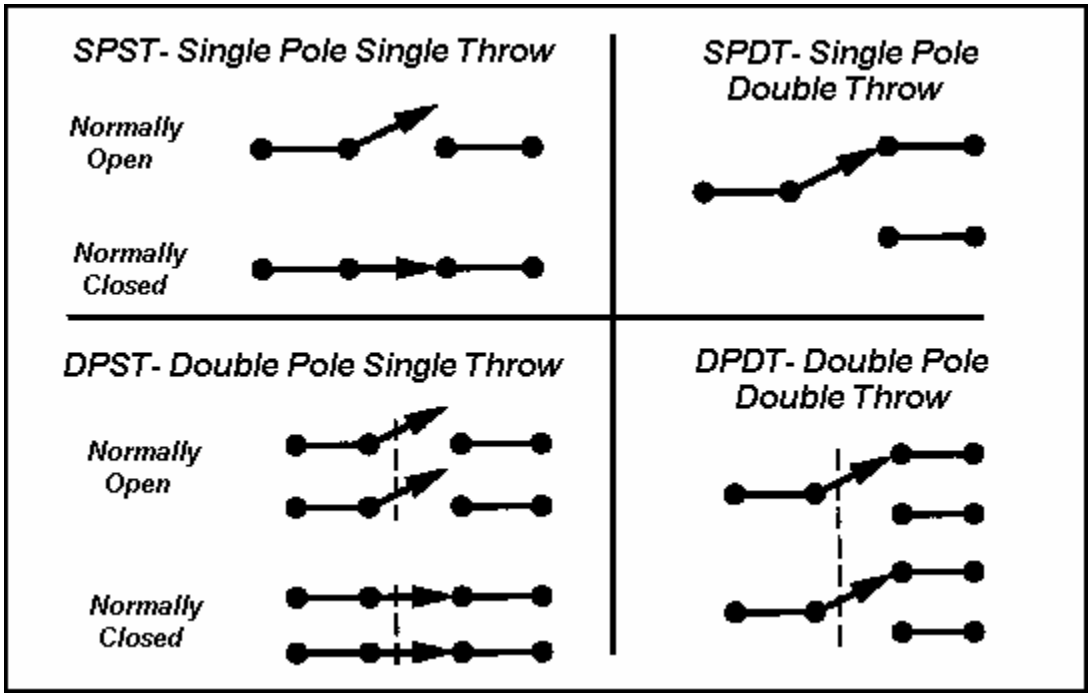
Switches

There are a few different types of switches that are used most frequently in our industry. The toggle switch is probably the most common, but push button and rotary switches also have certain applications.

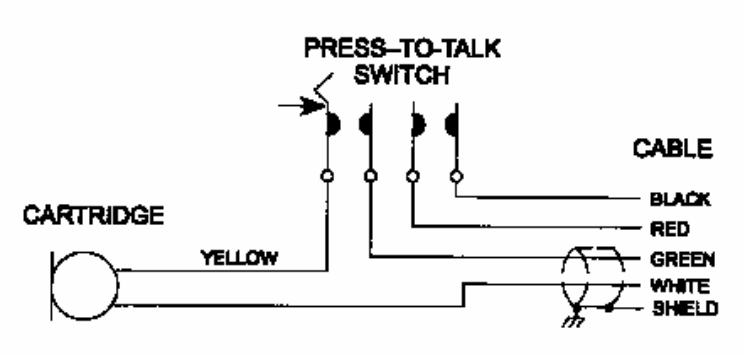
As shown in the figure below, toggle switches come in different configurations. Typically, a single pole single throw (SPST) is sufficient for most applications, but a DPDT switch could be used to simultaneously turn one device on and the other off. It is possible to have more than 2 Poles if needed.



Some audio companies use toggle or rotary switches to select the audio source by sending the audio signal through the switch. While it is a cheap way to route audio signals, it also tends to add a significant amount of noise into the system. We highly recommend avoiding this application.

Switches can have momentary or fixed contacts. A doorbell button is a good example of a momentary closure. When the button is pushed, a connection is made allowing the flow of current between two points in the electronics of the doorbell. When the button is released, the contacts are broken. An example of a fixed contact is a light switch. Flip the switch up and current flows until the switch is flipped back down. These are both examples of a SPST switch.

Push to talk buttons on microphones are push button type switches. They can come in a normally open or normally closed configuration. Most microphones are normally open and create a contact closure when the button is depressed. The switch in the Shure 514B schematic below is an example of a DPST switch that is performing two functions. One is to create a contact closure that could be used to mute the music that is playing and the second closes the audio circuit when the button is engaged. When the button is released, the microphone is effectively disabled and the music is allowed to return.

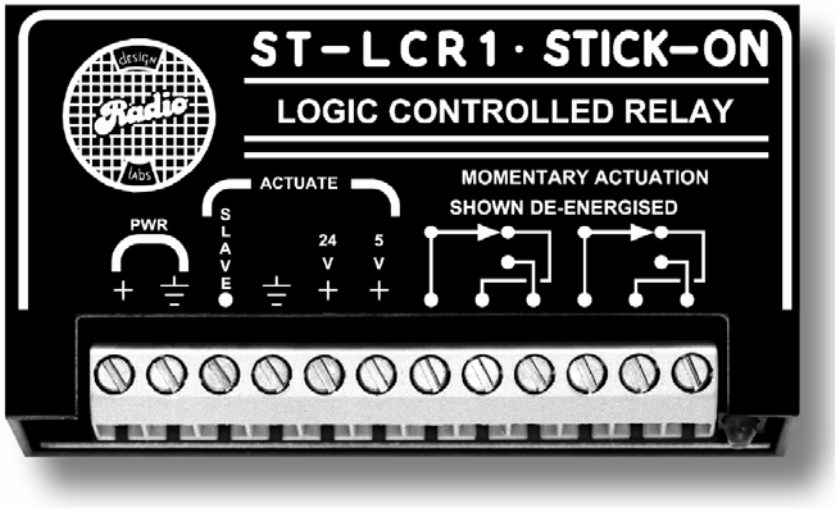


Switches are rated for certain load limits, so make sure you are using the proper switch especially if the switch is being used on an amplified level circuit.

Troubleshooting & Tips

Toggle switches are rarely labeled to indicate how they operate, so it is normally up to the installer to determine which contacts are engaged in each of the switches positions. This is easy enough to do with a continuity tester, multi-meter, or some other meter that is capable of measuring resistance. Continuity testers and multi-meters typically have a light or tone that they emit when a short is detected, however you can also measure the resistance between the contacts. An open circuit is going to have infinite resistance and a closed circuit or short will have zero or minimal resistance.

Relays



Relays are a form of switch that can be actuated without any human intervention. They most often are active devices that must be plugged in to operate.

The relay shown to the right is essentially a DPDT switch that can be wired normally open or normally closed depending upon the contacts that are used. Once the relay is actuated, the wiper will move down to the other contact breaking the opening the existing circuit while closing the other. This can be used to create multiple contact closures or it could be used to break an audio path to mute any music during a fire alarm.

Logic Controlled relays are actuated either by receiving voltage or sensing a contact closure created by another device. Some relays react to momentary signals, while others actuate on fixed signals. Like switches they also have current limitations, so make sure you refer to the spec sheets of the device before using them in high power applications.

Audio Sensing relays are very similar in operation to their logic controlled brothers. The only difference is in the actuating circuitry. Instead of looking for a contact closure, they sense a line level or mic level signal. Make sure you have the proper device depending upon the actuating signal. This type of relay is useful for a customer who has a juke box that he wants to automatically override his programmed foreground music when it begins to play and then return after the juke box stops.

Setting the sensitivity and delay on this device is crucial for making it work properly. With

the actuating source stopped, the sensitivity level should be turned down all the way and then brought back up until the noise on the line no longer triggers the relay. Hopefully, the signal from the actuating source will be significantly stronger than the noise level. Also, beware that problems can arise if the power circuit for the sound system is shared with other devices.

We have had limited success with these devices when the actuating signal has a large dynamic range. Classical music with extremely soft passages can sometimes get below the sensitivity level of the relay and it will go back to its normal state. Increasing the delay can help in these situations, but that can also lead to significant dead space after the program material ends. If you have a customer that has significant problems getting a audio controlled relay adjusted to their satisfaction, it may be best to move them to a logic controlled relay that is manually controlled. Logic Controlled relays have proven to be very reliable.

TOA Electronics incorporates many of these logic and audio controlled features into their 900 series mixer/amplifiers and modules.