THINGS YOU CAN DO WITH SWITCHES

Say what? Everybody knows that switches turn things on and off. What's the big deal? I'd agree that most of the switches we operate every day are simply a handy means of opening and closing a gap in a wire. I'll add that switches come in a variety of flavors. Aside from the simple on/off control of, say a light bulb, variations on a theme give us handy tools to simplify a variety of switching tasks.

Table 11-1. AeroElectric Connection
S700-Series Toggle Switches

Dash No.	# of Poles	# of Positions	Action Keyway - Center-Opposite
1-1	1	3	ON-OFF-ON
1-2	1	2	OFF-none-ON
1-3	1	2	ON-none-ON
1-5	1	3	(ON)-OFF-ON
1-7	1	3	(ON)-OFF-(ON)
1-8	1	2	(ON)-none-ON
2-1	2	3	ON-OFF-ON
2-2	2	2	OFF-none-ON
2-3	2	2	ON-none-ON
2-5	2	3	(ON)-OFF-ON
2-7	2	3	(ON)-OFF-(ON)
2-8	2	2	(ON)-none-ON
2-10	2	3	ON-ON-ON
2-50	2	3	(ON)-ON-ON
2-70	2	3	(ON)-ON-(ON)

First, I'd like to introduce you to our numbering convention. As we update schematics and power distribution diagrams, we'll try to add more detail to a switch's description. Adjacent to the reference designator number (S1, S2, S3, etc.) we'll include in parentheses the dash number out of Table 11-1 which describes the switch's number of poles, number of positions and its action.

The left column of Table 11-1 is the suffix to add to the basic switch specification number. To fully describe a switch you would precede it with the standards number followed by the dash number appropriate to the action you want. For example, an S700-2-7 switch is a two pole, three position toggle switch spring loaded to center from both extremes and having an (ON)-OFF-(ON) action. The parentheses ( ) around an action label means the switch is spring loaded to leave that position when released. Other styles of switches (like rockers) will replace the "S700" with another number but the dash number to describe the number of poles: number of positions and action will remain the same.

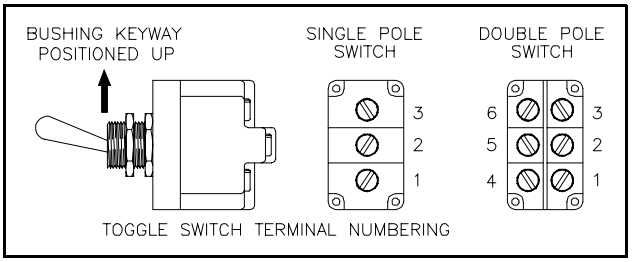

Figure 11-11. Toggle Switch Terminal Numbering.

We'll standardize all our drawings to conform to the above terminal numbering convention for switches. The mounting for a toggle switch is a 15/32" threaded bushing with a keyway cut on one side. Switch actions described in the last column have keyway side positioning of the toggle first, followed by center positioning (3-position switches only) and opposite side positioning on the right. For most applications, switches are mounted with bushing keyway oriented UP in the panel.

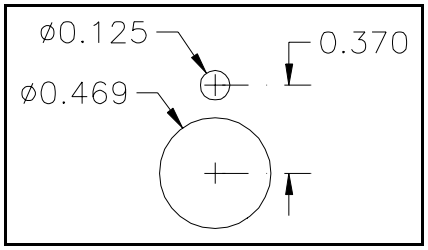

Figure 11-12. Hole Layout for S700 Series Toggle Switches.

It is appropriate to mention here that toggle switches can be difficult to keep tightly mounted in the panel. This is because it's attached with threaded fasteners and you're always yanking on its handle. You could use thread-locker to make the nuts difficult to move after the switch is installed but this makes the switch difficult to replace later.

The best solution is to take advantage of the anti-rotation keyway washer and internal tooth lockwasher that is supplied with all switches from our catalog. The keyway washer has two tabs, one to engage the keyway in the switch bushing, the other to engage a 0.125"hole that you need to drill in the

panel, 0.37" above the 15/32" mounting hole. The anti-rotation keyway washer installs from the back and will not protrude through a panel of .062" thickness or more. Most panels have a placard to label the switches that will cover a 0.125" hole. Inclusion of this hardware in your installation will keep the switches right where you installed them. Leaving thread-lockers out of the installation will make them easy to replace should it become necessary.

By the way, you'll find a 9/16" "Spin-Tite" or nut driver very useful when installing or replacing toggle switches. I have several that have been polished with crocus cloth to a very shiny surface where it touches the panel. This little modification to the stock tool assures you that it cannot scratch your panel placard . . . even if it's plastic.

SINGLE POLE SWITCHES

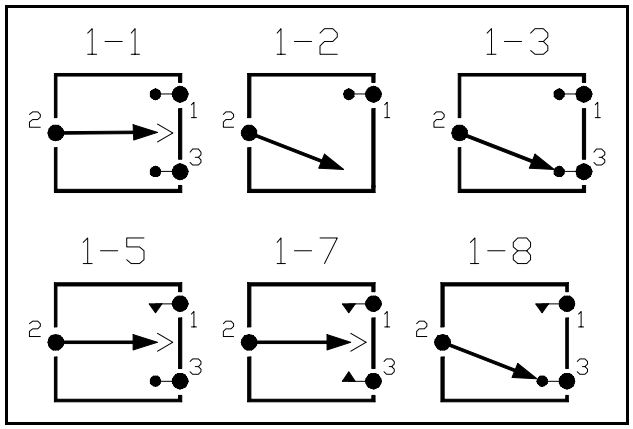

Figure 11-13. Family of Single Pole Switches.

Here's how the single-pole switches look in our schematics. The symbols have a great deal in common but there are differences that give you clues as to what kind of switch is being called out . . . and how it works.

First, I'd like to point out the ">" symbol between terminals 1 and 3 of three switches illustrated in Figure 11-13. This tells you that there is a center position that makes it a 3-position device. Switches without this symbol are 2-position devices. Note also that the moveable "arm" of the switch can be swung to make contact with either a solid dot (●) or a solid triangle (▼). The dot represents a sustained position for the switch while the triangle represents a momentary or spring loaded position.

Okay, 6 kinds of toggle switches . . . why would we want so many and what would we do with them?

1 dash 1, ON-OFF-ON switches are useful for selecting either of two devices with a both off position. How about having a landing and taxi light fixture share a single fuse or breaker? Terminal 2 connects to the bus, terminal 1 might power the landing light fixture while terminal 3 connects to the taxi light.

1 dash 2, OFF-none-ON switches are useful for any simple task of controlling nav lights, landing light, fuel pump, pitot heat, etc. We don't stock this kind of switch because a 1-3 switch has the same functionality. If you want a **1 dash 2**, we can supply it to you. Note that the only "ON" condition is with the toggle placed opposite the keyway. To use this style switch for a landing light, you would have to mount it keyway down in order to have the switch close when the toggle is moved up. On the other hand, a **1 dash 2** switch would serve nicely as a magneto switch. Unlike landing lights, magnetos are "ON"when the switch is open. I've included them in the family tree of switches because they do exist.

1 dash 3, On-none-ON switches select either of two circuits but doesn't permit both to be off. Obviously, terminal 3 of the **1 dash 3** switch can be ignored when the switch takes on simple tasks of the **1 dash 2** style switch described above. Since connection is made at both extremes, you could use a **1 dash 3** switch to use a single fuel gage to monitor either right or left-hand fuel tanks. Or how about switching a single dimmer between to lighting loads, say a map light and an overhead flood?

1 dash 5, (ON)-OFF-ON switch has one position spring loaded to center, the other is a sustained position. One application that comes to mind would be an ignition-start combination switch for an engine like a Rotax. Terminal 2 would be connected to ground. Terminal 3 would ground the ignition in the down position (kill the e engine), leave the ignition free to function in the mid position, and operate a ground-to-energize starter contactor in the up position. Here's a first example of getting a single switch to do two separate but related functions. I've had some builders use the **1 dash 5** switch for electric flaps where a single action selects fully "extended" flaps but the spring loaded "retract" operation is conducive to milking the flaps up during a go-around.

1 dash 7, (ON)-OFF-(ON) switches have momentary throws both sides of center. This action might be used for electric trim operations where momentary blips to either direction of trim are desired. On of my Defiant builders plans to use a **1 dash 7** switch to control front and rear starter contactors from a single switch.

1 dash 8, (ON)-none-OFF switches have a sustained and momentary contact at either extreme of two positions. The **1 dash 8** action could be used to replace a push-button where

terminals 2 and 1 are used to momentarily operate some device (like the starter contactor).

TWO POLE SWITCHES

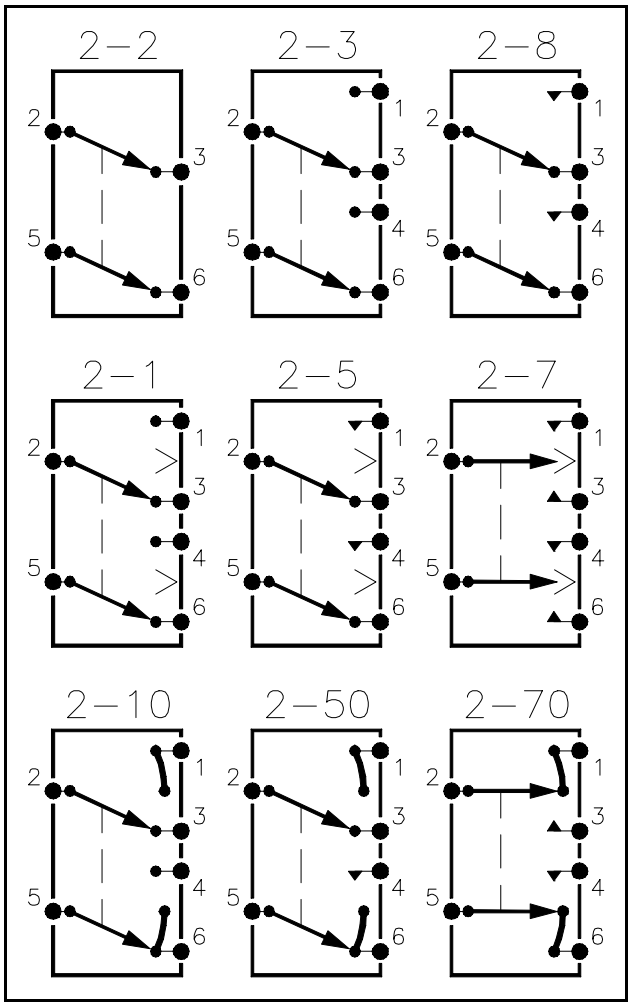

Figure 11-14. Family of 2-Pole Switches.

Wow! wouldja look at all those two-pole devices! You'll recognize the first 6 as close cousins to the single pole devices shown earlier. We've simply doubled up the mechanism so that two switches side by side share the same behavior. When a 3-position switch has more than one pole, small changes in the transfer mechanisms can yield some unique functions.

I don't have applications for all of the switching actions depicted but here are a few that I've used in the past. Some of these are also shown on our power distribution diagrams and wire-book examples.

2 dash 3, On-none-ON is a common part number we stock. This device is recommended for combination battery-master/alternator-field switching. MUCH less expensive than the popular but unnecessary "split rocker" found on many certified ships, the **1 dash 3** works quite nicely in this position. The **1 dash 3** also serves nicely as a magneto switch. You can use terminals 2 and 3 to kill the magneto in the down or OFF position. The other pole is used in series with the second magneto switch. Properly wired, you can disable the starter except when the impulse coupled magneto is ON and the non-impulse coupled magneto is OFF. Use of toggle switches with a starter lockout feature eliminates the kickback hazard inherent with the key-type OFF-L-R-BOTH-START switches found on most certified single engine ships. Furthermore, toggles are easier to mount and much less expensive than the key-switch. The big bonus of using toggles comes when and if you replace either or both magnetos with electronic ignition. The existing toggle is "electronic ignition ready."

2 dash 7, (ON)-OFF-(ON) is commonly found in trim or flap systems that use permanent magnet motors. When wired as shown below, the **2 dash 7** reverses polarity of power applied to the motor to reverse its direction.

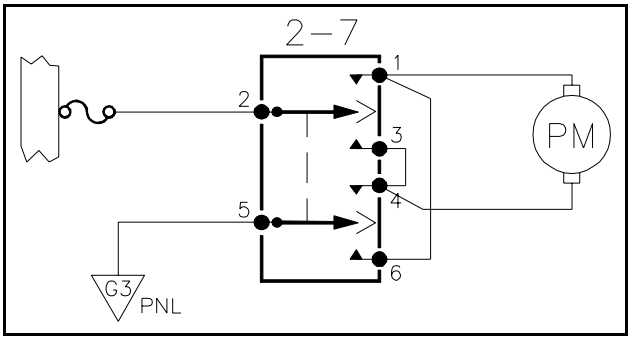

Figure 11-15. example of a **2 dash 7** Switch Application.

The spring loading to center from both extremes makes it easy to "bump" the switch for small trim changes.

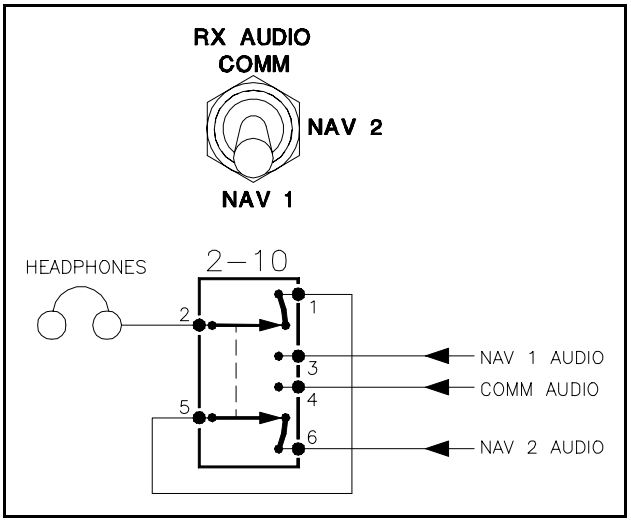

Figure 11-16. Example of a **2 dash 10** Switch Application.

2 dash 10, ON-ON-ON. Here's an interesting example of how you can wire a **2 dash 10** switch to implement a single-pole, three-position action. In the drawing above, I show how a headset can be switched individually to any of three audio sources. Incidentally, four pole switches are available in the **dash 10** configuration so that you can implement a 2-pole, three-position configuration.

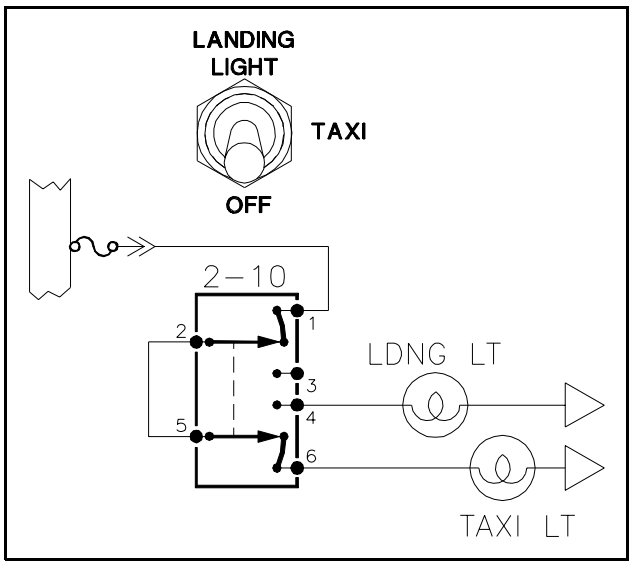

Figure 11-17. Example of a **2 dash 10** Switch Application.

Shuffle the wires a little bit on a **2 dash 10** and you can control landing and taxi lights from a single switch powered from single source.

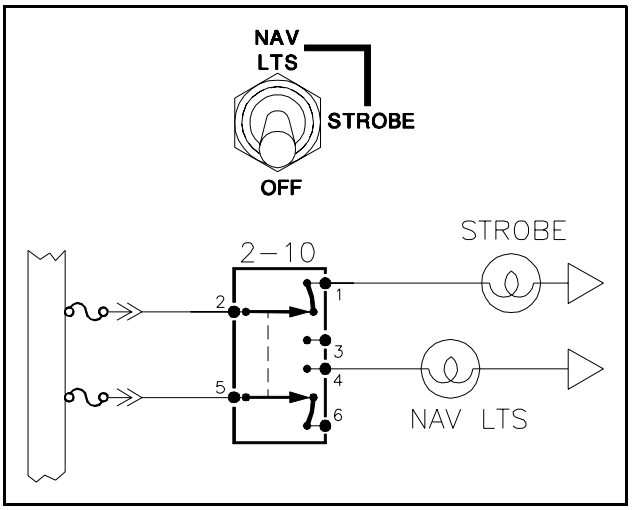

Figure 11-18. Example of a **2 dash 10** Switch Application.

Another space saver for switch panels uses a **2 dash 10** switch to control both strobe and nav lights. The first position brings up the strobe lights while the second adds nav lights. Each lighting circuit has its own power supply and circuit protection.

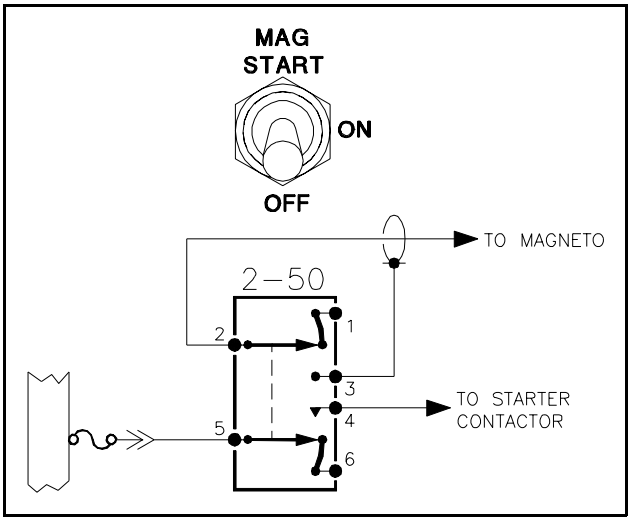

Figure 11-19. Example of a **2 dash 50** Switch Application.

Here's a way to combine magneto switching with starter control. Using the **2 dash 50** in this configuration makes it easy to change out magnetos for electronic ignition at a later date. Just use terminals 1 and 2 to control DC power to the ignition system.

4-pole versions of these switches follow the same numbering conventions. The need for a 4-pole device is pretty rare but a **4 dash 10** switch could be wired as a 2-pole, 3-position transmitter select switch or perhaps to use a single instrument for monitoring volts, main alternator load and aux alternator load.

Virtually all applications I've had for 4-pole switches were some small signal application where a miniature toggle was called for. We may not stock these soon but if you need one and have trouble procuring it, we'll be pleased to assist.