Servicescope

Neil Martin

Repairing pushbutton switches

Some call the time we're living in, "the pushbutton age". And rightly so. If you don't agree, just take a look at the front panel of a typical modern oscilloscope. You can count at least a dozen pushbuttons, and probably more.

Pushbutton switches are very reliable devices. And it's a good thing they are, considering the number in use. But you will encounter an occasional failure even in reliable devices, and pushbutton switches are no exception. Let's take a look at the types of pushbutton switches used in Tektronix instruments, what kind of troubles you may experience, and how to go about correcting them.

Most pushbutton switches used in our instruments are manufactured by Tektronix, Centralab, or Grigsby. Those built by Tektronix are sealed and it is not feasible to repair them, so we'll concern ourselves with those manufactured by Centralab and Grigsby. It is easy to tell them apart—the Centralabs have black or blue housings, while the Grigsbys are red. The basic switch action is the same for both kinds, with minor differences in the latching mechanisms and contact shape. The movable contacts are mounted on a plastic plunger, and make contact with fixed silver-plated pins that pass through the switch body and extend on both sides. These pins are often soldered directly into a circuit board, serving as the switch mounting as well as the fixed contacts.

Types of switches

There are three basic types of pushbutton switches used in Tektronix instruments: a momentary contact switch used for such functions as beam finder and single sweep reset; the push-push switch used for functions such as + or — slope, and ac or dc coupling; and a series of interlocking, or self-cancelling, switches used for such functions as vertical and horizontal display switching. All three types of Centralab switch are shown in Fig. 1. Switches (a), (b), and (c) are interlocking switches. Note the latching notches in the plunger near the front of the switch body. Switch (d) is a push-push switch. Note the absence of latching notches in the plunger, and the flat spring at the top front of the switch. Under this flat spring is a pin that fits into a channel in the plunger (see Fig. 3). It is this pin, spring, and channel that provide the push-push action. Switch (e) is a momentary contact switch and lacks the latching notches, the pin, and the flat spring. The black ring at the front of the switch body limits the plunger travel.

Typical problems

Before taking the switches apart and examining how they work in detail, let's discuss some of the operating problems you may experience. The most common is intermittent operation. This can often be cured by spraying No Noise in the back end of the switch, while working the switch. This should remove any foreign material from the contacts.

Bent or badly worn contacts are the next most likely cause of intermittent operation. It will be necessary to disassemble the switch to examine the con-

tacts, and we'll discuss how to do that shortly. Another condition that can occur is an interlocking switch may fail to latch in. This could be caused by a weak latch bar spring or a sticking latch bar. A push-push switch can fail to latch in if the spring holding the pin in position becomes weak or bent. The remedy for these problems is to bend the spring so it supplies sufficient tension, or replace it. Rough operation may be caused by bent contacts, lack of lubrication on the plunger, or a small burr on one of the parts.

To cure most of these problems, you will have to take the switch apart. A small screwdriver and a short pair of long nose pliers are all the tools you need. Small hands, a degree of manual dexterity, and patience are also helpful. We suggest you have a good switch on hand to use for replacement parts. You may wonder, "why take parts from a good switch and put them in an old switch?" That's a logical question, and the reasons are that it's much quicker to replace the parts, and you eliminate the possibility of damaging the printed circuit board when removing and soldering in the new switch.

Taking them apart

Now let's take a look inside the switches. If you have a spare switch, it will be helpful to examine it and practice taking it apart and reassembling it. You will find it to be a relatively simple operation, and also learn to hold onto the springs while removing and installing the keepers as the springs have a tendency to suddenly take off into space and roll out of sight.

To disassemble the push-push switch refer to Figure 2. Use the small screwdriver to remove keeper (a); remove spring (b); and remove pin (d). The plunger (f) can now be slid out the rear of the switch body (e). As you push the plunger slowly to the rear you will see the contacts start to appear. You should hold them in place with the thumb and middle finger so you can examine how they are mounted in the plunger. The contacts are item (g) in Figure 2.

Figure 3 is a close-up of the plunger showing the channel the pin traverses. The pin travels the path shown by the dashed arrow when the button is pressed and remains in. The solid arrow shows the path when the button is pressed and releases.

The Grigsby version of the push-push switch has essentially the same action as the Centralab. The only difference between a push-push and an interlocking contact switch in the Grigsby is the length of the pin. The shorter pin is used in the push-push contact switch. The long pin could be left out of the interlocking switch and it would function properly unless it were

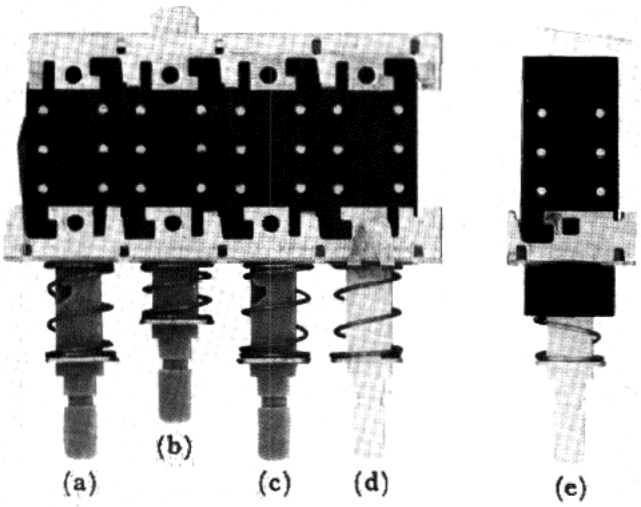


Fig. 1. Three types of Centralab switches are shown above. (a), (b), (c) are interlocking, (d) is push-push, and (e) is momentary contact.

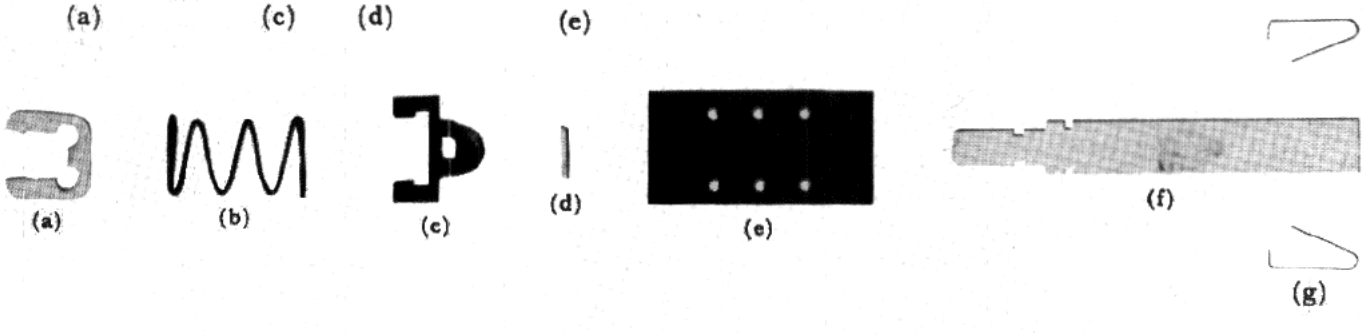


Fig. 2. A Centralab push-push switch disassembled. Components are: (a) keeper, (b) plunger spring, (c) pin spring, (d) pin, (e) body, (f) plunger, and (g) contacts.

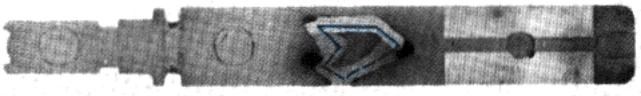


Fig. 3. Plunger from Grigsby switch. Pins travel path shown by dashed line when button is pushed and remains in. Solid arrow shows the path when the button is pressed and releases.

mounted upside down.

A Centralab interlocking switch is shown in Figure 5. Note the latching bar spring in the end view. The additional steps in disassembling this type of switch involve removing the latching bar spring, carefully unbending the tabs on the front and rear keeper frames, and sliding the frames slightly to the side. Carefully remove the keeper frames and note the orientation of the latch bar, and the spacers in the rear keeper.

The interlocking switch works as follows: When the pushbutton is depressed, the first plunger notch pushes against the latch bar (d) in Figure 5, and the latch bar pushes against the latch bar spring (e). When the latch bar reaches the peak of the notch, the latch bar releases the other switches. As you depress the switch further, the latch bar spring forces the latch bar into the second slot, which holds the switch into position. Spacers (b) located in the rear keeper frame (a) prevent two switches from being pressed in at the same time. This is called lockout.

The Grigsby interlocking switch operates in the same manner as the Centralab but uses a different shaped latch bar spring, and the latch bar is located in the bottom of keeper (a) in Figure 6 instead of behind keeper (f) as in Figure 5.

It is relatively easy to replace a single Grigsby interlocking switch as all you have to do is remove the keeper, spring, and pin spring, unsolder the switch, and lift it out of the assembly. The remaining switches can be left in place.

Conclusion

It is much easier to repair pushbutton switches than it is to replace them. Many can be repaired without removing the printed circuit board on which they're mounted. Often the task of removing and installing the circuit board takes more time than repairing the switch. If you find it necessary to replace the switch, it is usually easier to cut the mounting pins and remove them one at a time from the circuit boards.

You may have been hesitant in the past to attempt to repair pushbutton switches. It's not really as difficult a task as it may appear.

We trust these brief service hints will help make your life in this "pushbutton age" more enjoyable, and productive.

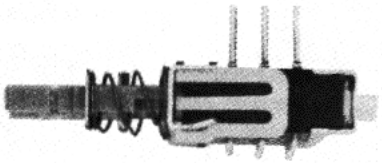


Fig. 4. End view of Centralab interlocking switch showing latch bar spring.

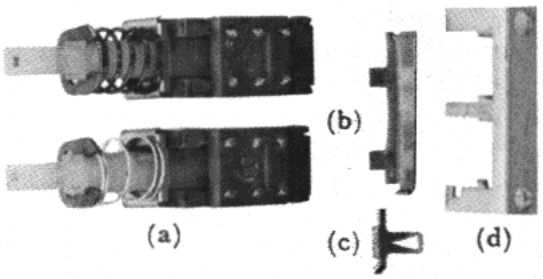
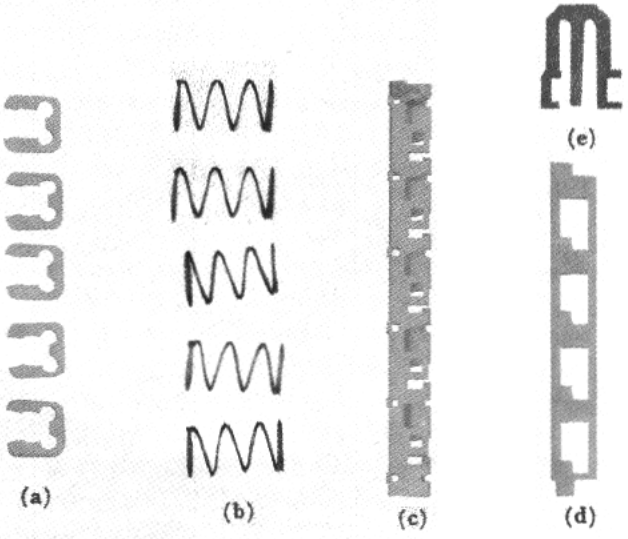


Fig. 6. A Grigsby interlocking switch partially disassembled. Items (b) and (c) are the latch bar and latch bar spring.



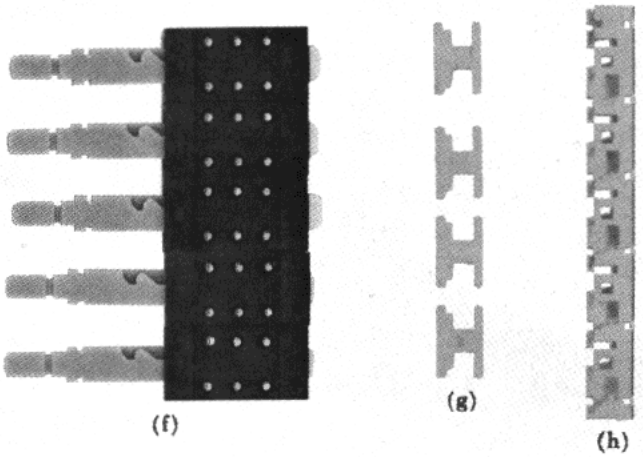


Fig. 5. A Centralab interlocking switch partially disassembled. Items (d) and (e) are the latch bar and latch bar spring. Item (g) prevents two switches from latching in simultaneously.