

# **cam switch repair manual**

## **1. INTRODUCTION**

This manual has been prepared to assist field personnel in troubleshooting and repairing cam switches. Use it as a supplement to service manuals for instruments that have cam switches.

The information herein is presented in the most logical inspection/repair order normally followed by technicians, starting with knob/shaft misalignment and progressing through contact contamination and cleaning, contact pressure and alignment problems, contact and actuator replacement.

Causes of failure are also presented in the most probable sequence of occurrence based upon service record reports and failure analysis of parts returned to Beaverton.

## **2. FRONT PANEL PROBLEMS KNOB/SHAFT MISALIGNMENT**

Only knob/shaft misalignment can be checked from the front panel.

1. First check tightness of knob set screws. If after tightening, the misalignment problem still exists, remove the set screws and examine for damaged threads. If threads are damaged, replace the entire knob.
2. Two basic knob configurations are used for mating with the shaft. One is a metal insert molded into the plastic knob. If the inner diameter of this insert is scored, replace the entire knob.  
The second configuration uses a split bushing that can be pushed out with a pencil. If this bushing is fractured or scored, install a new bushing.
3. Check the knurl of the shaft for wear and damage. Its surface should feel rough when rotated between thumb and forefinger. If the knurl is damaged, replace the entire actuator assembly (see section 5).

## **3. SWITCH/CIRCUIT BOARD PROBLEMS**

Some switch/ECB assemblies can be inspected while in the instrument by simply removing the switch cam cover; others require removal of the actuator assembly. If this is the case, leave the cam cover in place to keep the switch intact during removal.

For removal instructions, consult the service manual for that instrument.

Also, do not restrict your inspection to the cam switch alone. Board problems such as component drift, damaged runs and defective solder joints can underlie what is thought to be strictly a switch problem.

## CONTACT CONTAMINATION/CLEANING

Contacts require cleaning: (1) when visual inspection shows contamination on the contacts or pads; (2) after solder work has been done on the ECB [flux fumes may leave a thin film deposit on contact surfaces] (3) after board wash, which can trap contaminants around closed contacts.

Two cleaning procedures are recommended. Procedure A is preferred. Use procedure B only if A proves inadequate.

**WARNING:** Do not use No-Noise or other contact lubricants on cam switches. They are designed to operate dry, and lubricants tend to trap dust particles.

### Cleaning procedure A

1. Remove the cam cover.
2. Clean contact pads and fingers with isopropanol (isopropyl alcohol) or fotocol (ethyl alcohol) using a soft brush and alcohol on cotton swabs. Be very gentle around the contact fingers. Rotate the switch shaft during cleaning and drying to prevent dissolved contaminants from collecting around closed contacts.
3. Allow switch to air dry for 60 seconds.
4. Blow out remaining residue with an air hose while rotating the shaft to prevent trapping of particles.
5. If contacts are clean, proceed with checking for contact pressure and damage. If contamination persists and cannot be removed with this procedure, use procedure B.

### Cleaning procedure B — Removing hard films

This procedure is to be used only on films not removeable by procedure A.

**CAUTION:** There is only about 0.0001 inch of gold on the contact pad surface. Any abrasive material will remove some of this gold, thus increasing risk of corrosion and decreasing the life of the switch.

1. Rotate the switch shaft to open contacts to be cleaned.
2. Cut an Eberhard Faber 'Pink Pearl' eraser into the shape of a screwdriver tip small enough so that it can be inserted between the contact fingers and pad. Note: do not use typewriter- or fiberglass-type erasers because they are too abrasive.
3. Use light strokes to remove contamination. Use only enough pressure and strokes to change the gold pads to a more satiny, yellow finish.
4. Follow up with the alcohol cleaning procedure A to remove residue.

## CONTACT PRESSURE

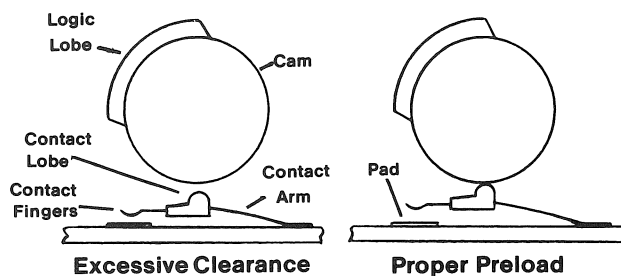
Improper contact pressure on a pad can either cause or contribute to switch failure. Contact pressure is determined by visually inspecting cam-to-contact arm height and contact arm shape.

Sometimes a "defective" switch will operate satisfactorily after being installed on either a new or freshly cleaned circuit board.

Make your visual checks with the cam cover removed. Rotate the switch shaft to check all contacts in both open and closed positions.

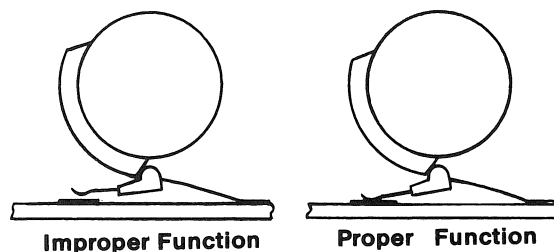
### With contacts open:

1. Lobe on contact arm should ride on the cam. A gap means either a defective contact arm or excessive cam clearance.
2. Contact-to-board gap should be even. Variations may indicate defective contacts, actuator problems, or cam cover problems



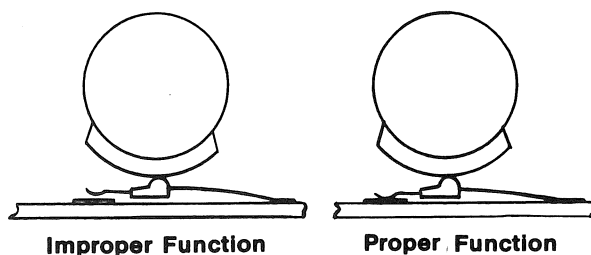
### As contacts close:

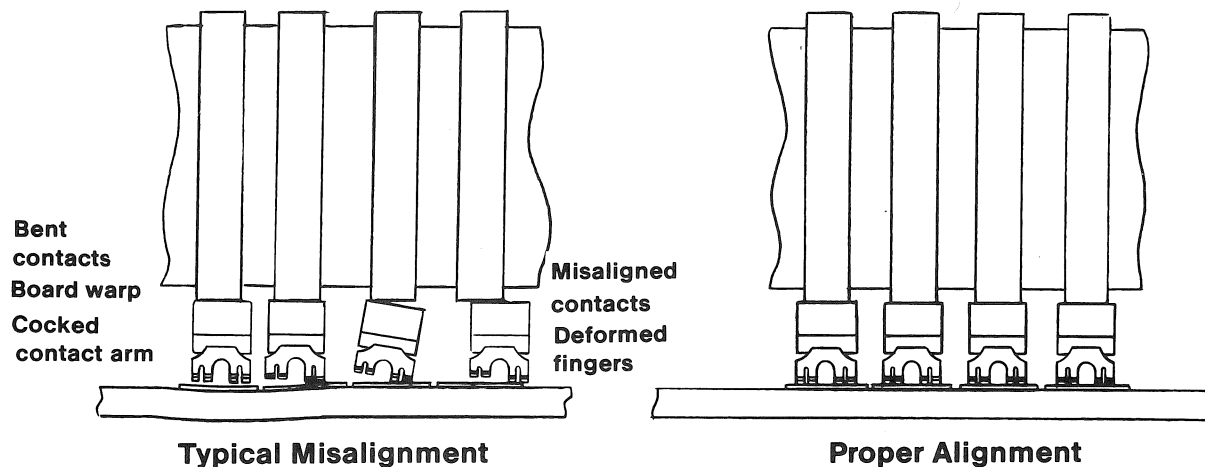
1. Contact should be made while the contact lobe is still on the cam ramp (before logic lobe is over the contact lobe). Failure means excessive cam clearance or defective contact arm.
2. All fingers on any arm should touch the pad at the same time. Failure means defective contact arm or fingers.



### With contacts closed:

1. Contact fingers should be centered squarely on the pad. Failure means defective contact arm or fingers.
2. Contact arm should be deflected toward ECB. Failure of contact arm to deflect means that inadequate pressure is being exerted on the pad. This may mean either a defective contact arm or actuator problems.





**For normally closed attenuator contacts:** Sight along board. All contacts should be in line and set squarely on their pads. Failure means defective contacts, which must be replaced.

#### 4. CONTACT REPLACEMENT

All defective contacts should be replaced. Do not attempt to adjust or repair defective contacts because optimum realignment is not possible.

For standard contacts use replacement kit 040-0541-00. For high-frequency (attenuator) contacts use kit 003-0708-00, and for T900 Series instruments install a whole new contact strip.

Other factors can also affect contact pressure although they rarely occur, and are found primarily on long, single-cam switches. These include:

1. Board warpage, which causes uneven height variations between cam and board. Check for this condition by visual inspection.
2. Repeated switch failures with no indication of physical damage may mean a tolerance buildup somewhere. Installing a new actuator assembly and cam cover may help.

#### 5. ACTUATOR REPLACEMENT

Mechanical failure of the actuator is usually easy to identify. The cam won't turn, it may be scored, etc.

To remove an actuator, first reinstall its cam cover. This will hold the actuator in alignment. Removal must be done carefully to avoid risk of damaging the contacts.

When installing a new actuator, include a new cam cover as well.

#### 6. DEFECTIVE PARTS/SPECIAL PROBLEMS

The Switch Design Group does failure analysis on all returned parts. If actuators are returned with covers on, it is easier to identify the cause of failure. Any helpful additional information should be sent along with the part.

If questions arise about a specific instrument, write or phone Irv Sherbeck, manager, Electromechanical Design Support, or Virgil Hanes, switch and relay reliability engineer, at delivery station 58-021, ext. 7909 (Beaverton GTE).

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