



P2309N Model 7B Switch Circuit Controller



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Installation • Operation • Maintenance

General Railway Signal Corporation

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TABLE OF CONTENTS

SECTION 1 - GENERAL DESCRIPTION

INTRODUCTION	1-1
PHYSICAL DESCRIPTION	1-1
Case	1-2
Operating Mechanisms	1-2
Cams	1-4
Camshaft	1-4
Crank Arm	1-5
Mounting	1-6

SECTION 2 - FUNCTIONAL DESCRIPTION

GENERAL	2-1
MODEL 7B OPERATION	2-1

SECTION 3 - SCHEDULED MAINTENANCE

GENERAL	3-1
PREVENTIVE MAINTENANCE INDEX	3-1
PREVENTIVE MAINTENANCE PROCEDURES	3-1
Inspection Procedure	3-1
Operational Test	3-3
Lubrication Procedure	3-4

SECTION 4 - TROUBLESHOOTING

GENERAL	4-1
LIKELY TROUBLESHOOTING CHECK POINTS	4-1

SECTION 5 - CORRECTIVE MAINTENANCE

GENERAL	5-1
SPECIAL TOOLS	5-1
SPARE PARTS	5-1
REPLACEMENT PROCEDURES	5-2
Front Contact	5-2
Back Contact	5-3
Contact Finger	5-4
Circuit Controller	5-5
CAM ADJUSTMENT	5-7
CONTACT ADJUSTMENT	5-9
CRANK ARM ADJUSTMENT	5-10

SECTION 6 - PARTS CATALOG

GENERAL	6-1
PARTS LIST	6-1

LIST OF ILLUSTRATIONS

<u>Figure No.</u>	<u>Description</u>	
1-1	Model 7B Switch Circuit Controller.....	1-1
1-2	Operating Mechanism Side View	1-2
1-3	Contact Arrangement	1-3
1-4	Contact Numbers on Terminal Board	1-3
1-5	Cams and Camshaft	1-4
1-6	Crank Arm Mechanical Linkage.....	1-5
1-7	Typical Mounting of Circuit Controller With Mounting Plate.....	1-6
2-1	Switch Position Operation	2-1
3-1	Crank Arm Movement	3-3
3-2	Lubrication Points	3-4
4-1	Layout of Model 5 Switch Machine and Model 7B Circuit Controller.....	4-2
5-1	Front Contact.....	5-2
5-2	Back Contact	5-3
5-3	Contact Finger Bar	5-4
5-4	Terminal Block and Post Nuts	5-6
5-5	Cam Adjustment Screw	5-8
5-6	Normal Contact Operation	5-8
5-7	Contact Dimensional Adjustments.....	5-9
5-8	Centering of Crank Arm	5-10
6-1	Model 7B Switch Circuit Controller.....	6-2

LIST OF TABLES

<u>Table No.</u>	<u>Description</u>	
3-1	Preventive Maintenance Index.....	3-1
3-2	Inspection Procedure	3-2
3-3	Operational Test Procedure	3-3
3-4	Lubrication Table.....	3-4
5-1	Spare Parts.....	5-1

SECTION 1

GENERAL DESCRIPTION

INTRODUCTION

The Model 7B Switch Circuit Controller is used in switch layouts for point position detection of the Model 5 Switch Machine and in other applications, when a "circuit open" or "circuit closed" indication for any two-position device is required. The circuit controller is affixed to a wooden tie by using three 6-inch lag screws, or three approved bolts and a mounting plate that is affixed to the wooden tie.

This manual describes the usage and features of the controller, how it operates, how to service it in the field or at the shop, the necessary spare parts and contains a parts catalog section.

PHYSICAL DESCRIPTION

The switch circuit controller, as shown in Figure 1-1, consists of four sets of front-back contacts housed in a cast-iron case with a cast-iron cover. A mechanical linkage from the connecting rod to crank arm of controller rotates the camshaft which positions two adjustable cams that actuate the moveable portion of four dependent contacts. The controller may be used to integrate positions of various devices with suitable control circuits. If the switch points should fail to reach their full normal or full reverse position, the indicating circuits will not be completed and the out-of-correspondence indication for the switch will be established. Average weight of a controller, complete with crank arm, is about 50 pounds.

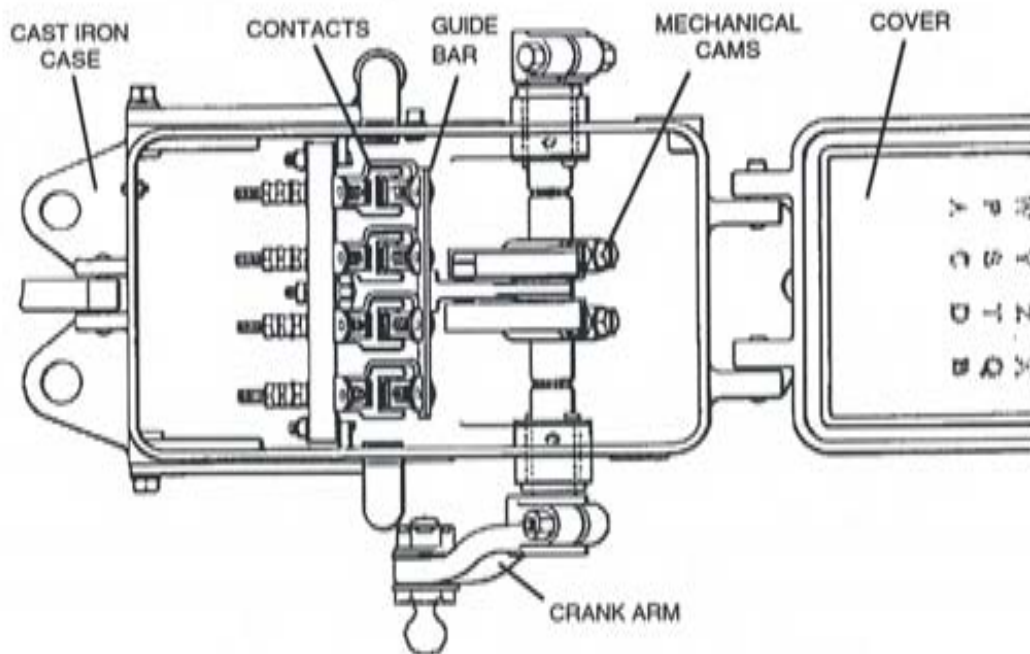


Figure 1-1. Model 7B Switch Circuit Controller

Case

The Model 7B case is cast-iron with an arched construction which provides great mechanical strength, eliminates projecting corners, and offers full access to all internal parts. Across the inside of the cast-iron cover are two reinforcing bridges. With the cover closed, a bridge gasket bears against the terminal board, sealing the terminal compartment from the mechanism compartment. The outside rim of the cover is also gasketed, and a spring-type padlock hasp keeps the cover tightly closed. The cover is hinged low on the case allowing the cover to swing out of way for performing maintenance. Ventilators with screens are mounted on the sides of the case which equalize internal and external temperatures, thus minimizing internal condensation. Dimensions of the case are about 7 1/8" high by 18 1/2" long by 13 1/4" wide with the crank arm installed.

Operating Mechanisms

The operating mechanism, as shown in Figure 1-2, can detect rail movement as little as 1/8 inch, yet isolate contacts from vibration. Cam faces and camshaft are concentric (they rotate parallel to each other). Thus, crank movements due to vibration can only affect contact fingers when the cam is positioned with the rollers on the guide at the transition section or throat end of the cam. Contacts do not chatter during normal use, because vibrations do not reach a level high enough to overcome the force exerted by the contact spring.

Rollers are made of heat-treated chrome silicon steel. These rollers revolve on pins made of tool steel.

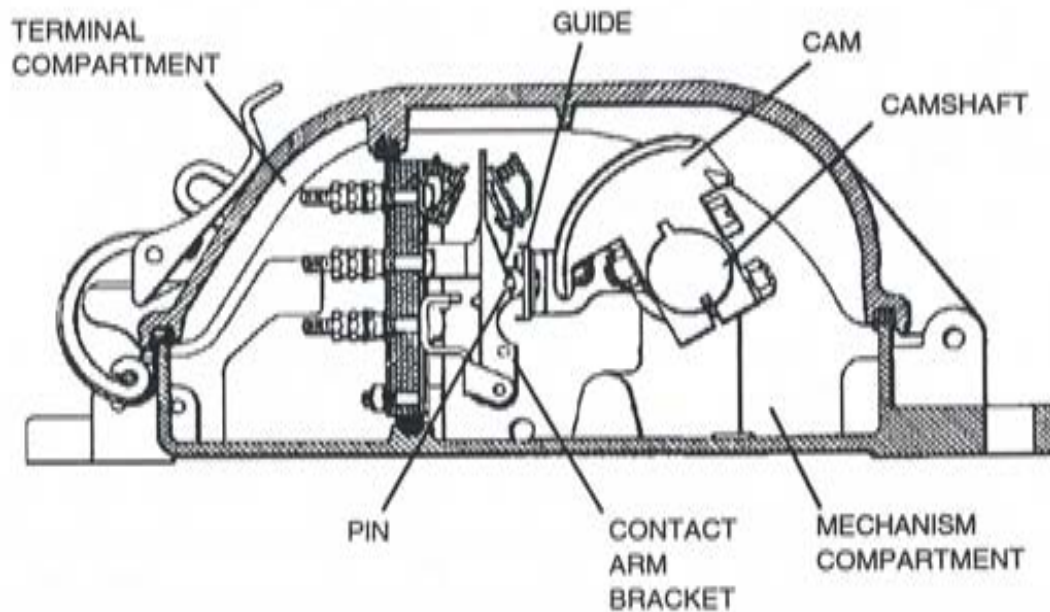


Figure 1-2. Operating Mechanism Side View

Contact arrangement details are shown in Figure 1-3. Both front and back contacts develop their contact force and wipe by spring loading. (Contact wipe is a scrubbing action, which cleans the contact surfaces as they operate). Contact supports are seated in a locking groove in the terminal board which keeps contacts properly aligned. Contact wipe is assured by angles of contacts and presence of springs. Contacts are electrically bonded to contact supports by flexible copper braid. The contact numbering scheme is shown in Figure 1-4, as viewed from the terminal post side of the board.

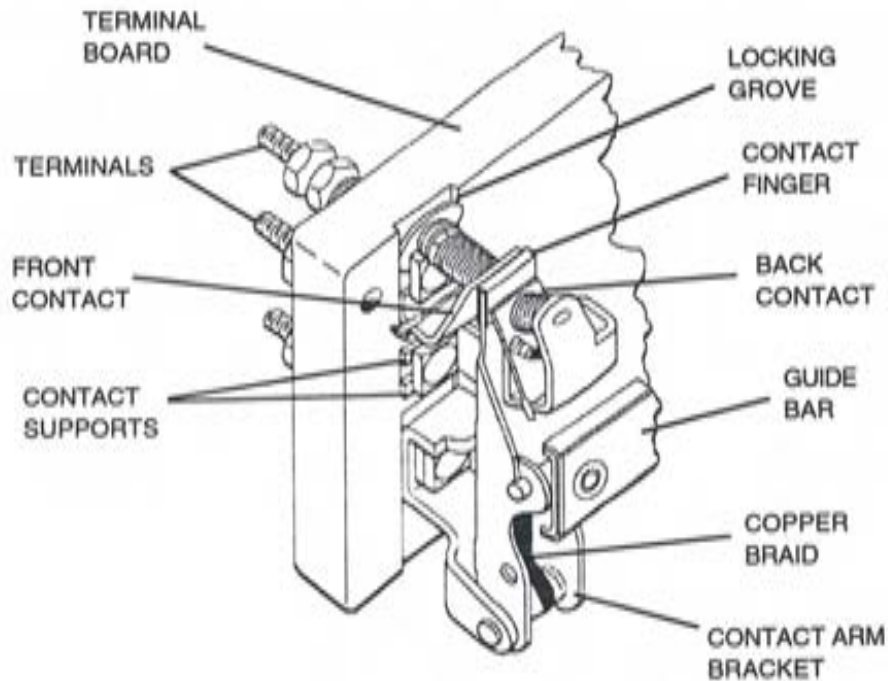


Figure 1-3. Contact Arrangement

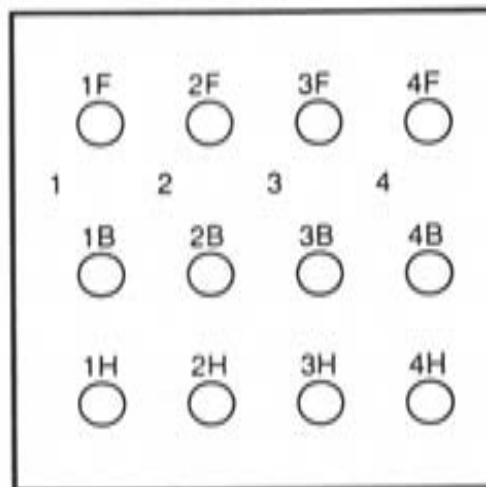


Figure 1-4. Contact Numbers on Terminal Board

Cams

Cams, as shown in Figure 1-5, are made of forging quality, hot rolled steel. Both cams are adjusted by loosening a clamping screw and turning an adjusting screw. Threads on the adjusting screw mesh with threads hobbled into the shaft, thus producing cam rotation about the shaft as the adjusting screw is turned. After adjusting cam, the clamping screw is tightened to hold the cam in the adjusted position.

Camshaft

The camshaft is one inch in diameter, made of cold-drawn steel and cadmium plated with zinc electroplate iridescent yellow chromate finish. It is mounted in replaceable bronze bearings with annular grease grooves. The camshaft ends are square, three quarters of an inch across, to provide firm mounting for the crank arm, right-or-left-hand application.

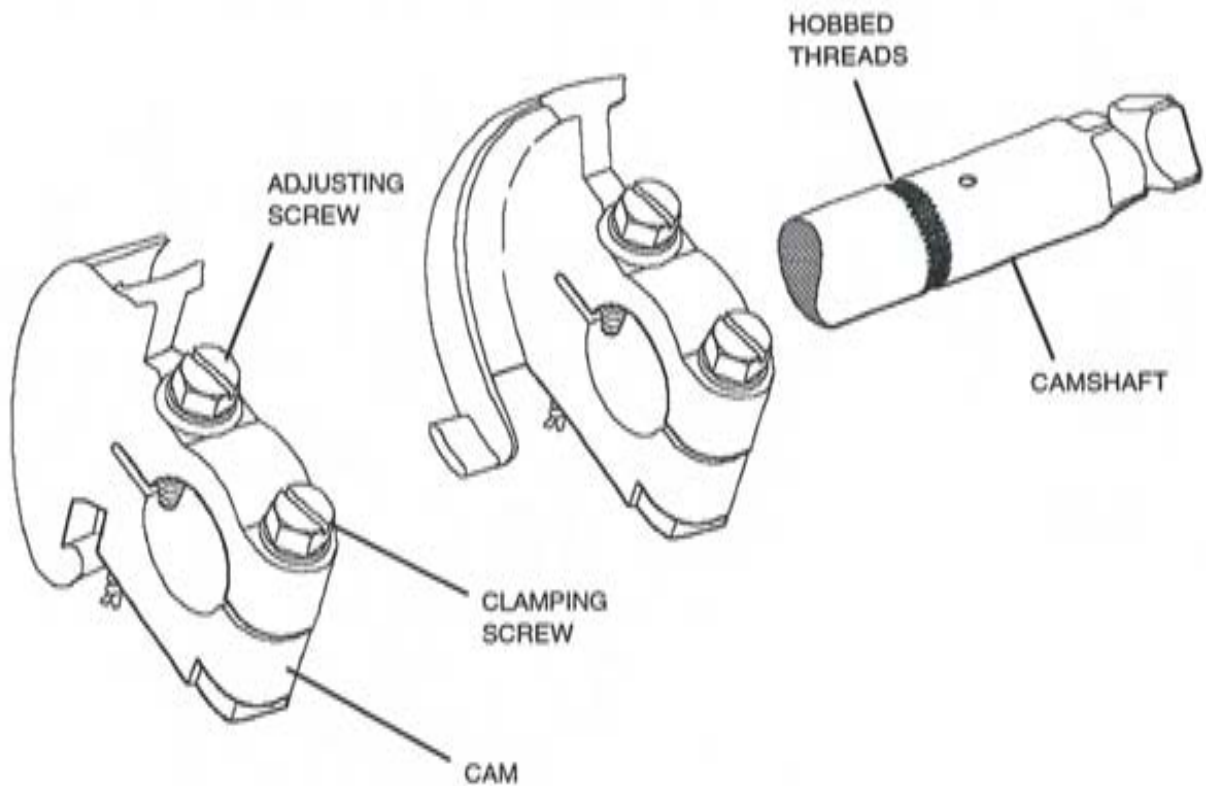


Figure 1-5. Cams and Camshaft

Crank Arm

The crank arm, as shown in Figure 1-6, is the mechanical linkage between the controller and the connecting rod at the switch points. The crank arm has an insulated ball for making connection to the connecting rod. The insulated ball allows the crank arm to swing through its angular motion while electrically isolating the controller from the rail. The ball is fitted with a grease fitting for lubrication.

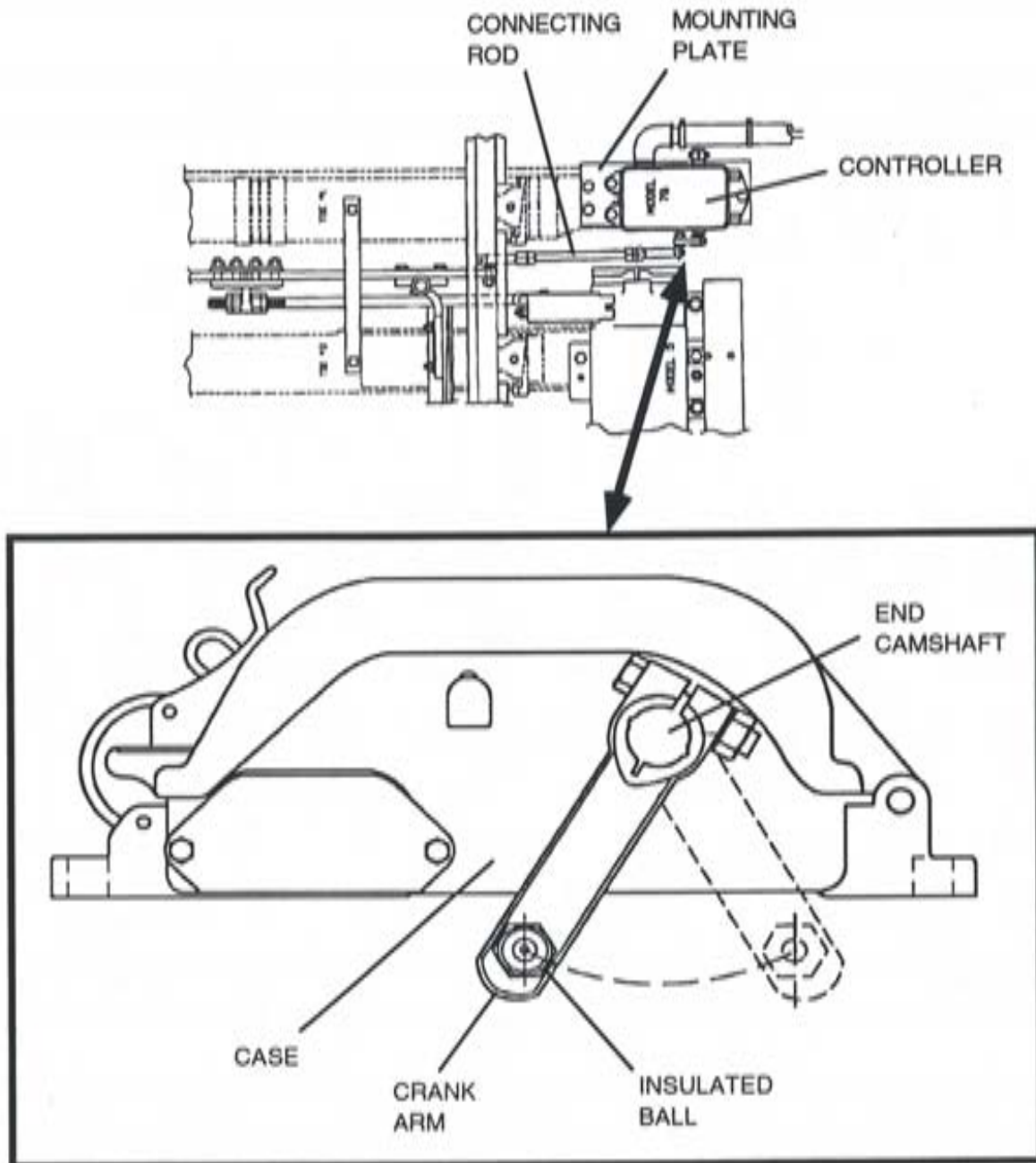


Figure 1-6. Crank Arm Mechanical Linkage

Mounting

A mounting plate, as shown in Figure 1-7, is used in conjunction with the Model 7B Switch Circuit Controller. The mounting plate (Stock Number 03-14-0790) is reversible for a right or left hand switch layout.

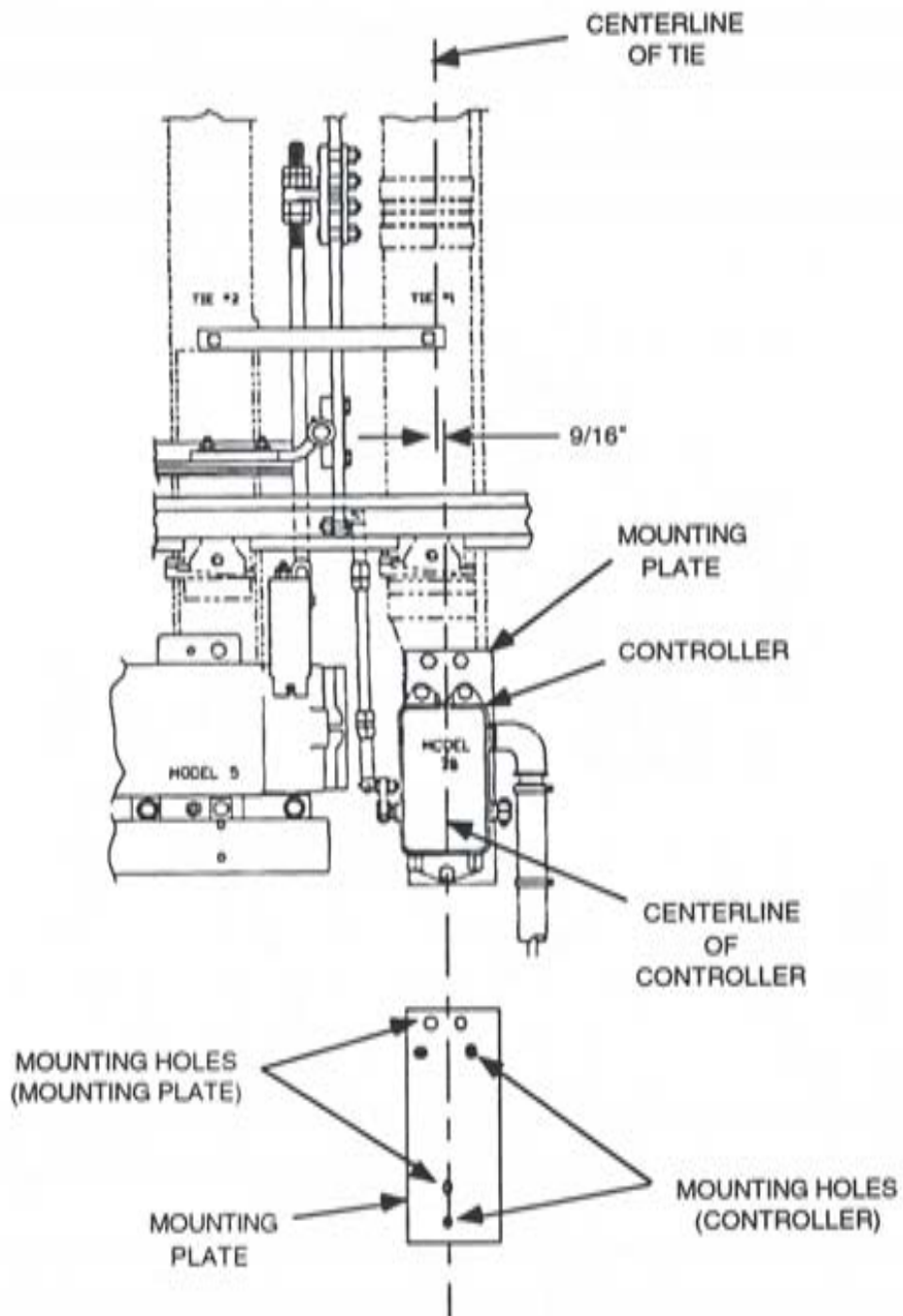


Figure 1-7. Typical Mounting of Circuit Controller With Mounting Plate

SECTION 2

FUNCTIONAL DESCRIPTION

GENERAL

The Model 7B Switch Circuit Controller is used in conjunction with a Model 5 switch machine to detect the position of the switch point in either the normal or reverse position.

MODEL 7B OPERATION

The following description assumes a right-hand layout and the right-hand switch point is normally closed. With the switch in the normal position, as shown in Figure 2-1, the pressure of the contact spring holds the contact finger firmly against the front contact. When the switch points are moved toward reverse position, the hardened steel rollers on the guide are driven by the cams on the shaft. The guide rollers move up on the cam face, and the contact finger moves against the pressure of the contact spring, to open the front contact and close the back contact.

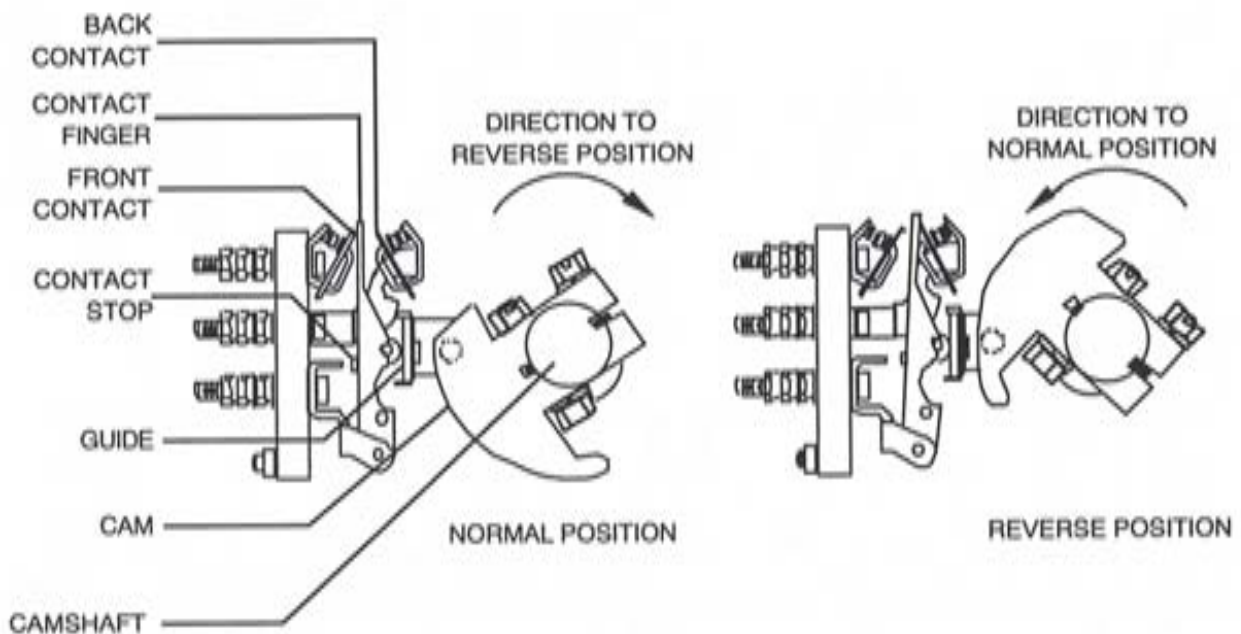


Figure 2-1. Switch Position Operation

SECTION 3

SCHEDULED MAINTENANCE

GENERAL

This section covers scheduled line maintenance for the Model 7B switch circuit controller. Included are preventive maintenance procedures which deal with inspection and lubrication procedures.

PREVENTIVE MAINTENANCE INDEX

Table 3-1 prescribes the recommended interval for maintenance action. The Maintenance Action column lists the preventive maintenance procedure to be performed at the prescribed interval. In rapid transit application, the interval may be done monthly to allow for more use based on increased traffic or as the Authority's policies dictate.

Table 3-1. Preventive Maintenance Index

Interval	Maintenance Action
Monthly	Inspection Procedure
Monthly	Operational Test
Monthly	Lubrication Procedure

PREVENTIVE MAINTENANCE PROCEDURES

The following preventive maintenance procedures are to be done monthly.

Inspection Procedure

The periodic Inspection Procedure should be performed in conjunction with its associated switch machine. Table 3-2 lists the inspection procedures for the switch circuit controller.

CAUTION

When opening cover, keep fingers away from hasp. The hasp spring stores considerable energy and will snap open once it passes the toggle point.

Table 3-2. Inspection Procedure

Step	Procedure	Action Taken
1	Inspect case for scratches, large dents, cracks or other obvious mechanical damage.	Paint scratches and replace excessively damaged parts.
2	Open cover and inspect for loose connections.	Tighten as necessary.
3	Inspect parts for breakage or excessive wear.	Replace worn or broken parts or unit.
4	Inspect for excessive dirt, dust, or foreign objects.	Remove foreign objects. Clean case with damp lint-free cloth.
5	Inspect wiring and cabling for broken wires, brittle or cracked insulation.	Replace wire/cable.
6	Inspect ventilator screens for blockage.	Clean ventilator with brush. Replace ventilator if it cannot be cleaned
7	Inspect for dirty or pitted contacts.	Clean and polish using approved method. Replace if excessively pitted. See Section 5.
8.	Operate mechanism to which switch circuit controller is attached and observe operation of the contacts. Verify smooth operation occurs.	Troubleshoot according to Section 4.
9	Check for proper crank arm movement. Verify crank arm moves equally between the perpendicular (x) and normal and reverse positions. See Figure 3-1.	For Crank/Arm adjustment procedure, see Section 5.
10	Verify contact fingers clear the back stops at each end of stroke. At mid-stroke, verify that the contact fingers are fully open.	For Contact adjustment procedure, see Section 5.

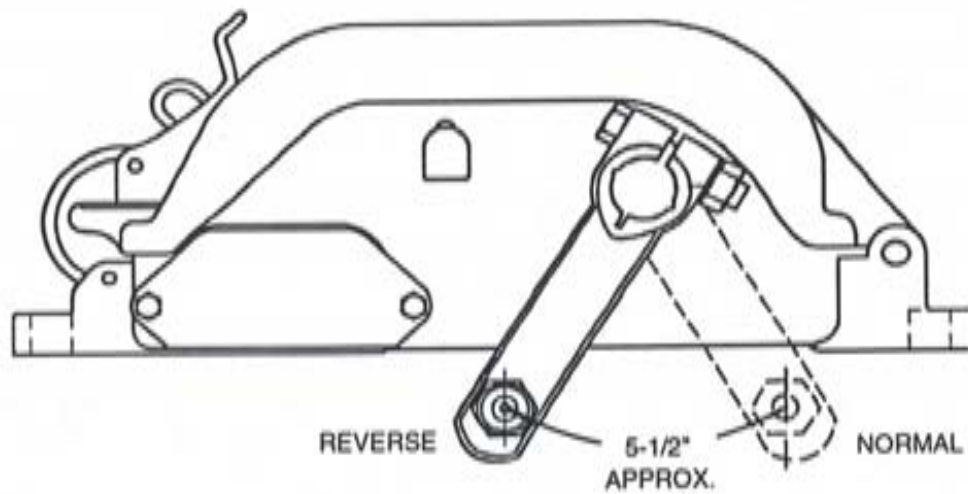


Figure 3-1. Crank Arm Movement

Operational Test

The following Operational Test should be performed in conjunction with its associated switch machine and when there are no trains approaching the switch as this test would flash signals on adjacent tracks. This test is performed to ensure that the switch circuit controller is adjusted and operating properly.

CAUTION

When opening cover, keep fingers away from hasp. The hasp spring stores considerable energy and will snap open once it passes the toggle point.

Table 3-3. Operational Test Procedure

Step	Procedure
1	Insert standard 1/4-inch obstruction gauge between the switch point and the stock rail 6 inches back from the tip of the switch point.
2	Hand crank switch machine so that point is firmly up against obstruction gauge.
3	Check that the switch circuit controller contacts are open and that switch repeater relays are in the de-energized position.
4	This test is to be made for both the normal and reverse positions

Note: Switch circuit controller rod connections with excessive lost motion, must be replaced.

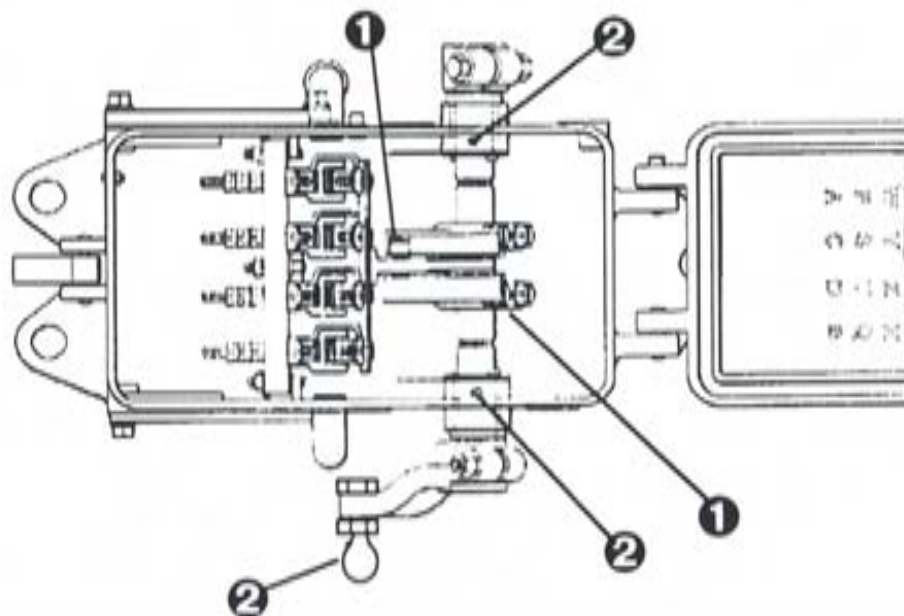
Lubrication Procedure

It is best to always lubricate the controller before placing it into service. During normal operation, the controller should be lubricated monthly, or whenever it has been flooded, in accordance with the following information. Lubrication of controller parts prevents galling and excessive wear, reduces internal forces, excludes contaminants, and prevents corrosion.

The following steps describe how to lubricate the switch circuit controller. Figure 3-2 indicates lubrication points with designators describing lubricant to use.

Table 3-4. Lubrication Table

Step	Procedure
1	Oil Cam and Rollers. Remove excess oil.
2	Lubricate main bearings (both sides), and ball stud on crank with grease.



Recommended Lubrication

1	GRS 91A0007 or Semaphore Oil (2A)
2	GRS 91A0012 or Lithium-Based Grease

Figure 3-2. Lubrication Points

SECTION 4

TROUBLESHOOTING

GENERAL

Troubleshooting of the switch circuit controller installation is done by making a thorough visual inspection of the device and the layout. Two areas of importance are the security of mounting and cleanliness of the layout, that is, no unnecessary debris, dirt, mud or other matter in or around the movable linkage connections between the controller and the switch machine. If the controller is presently or has been flooded, then follow the procedures in Section 3 to properly service the controller before operating it again. A completely lubricated controller and switch machine should operate quickly and with minimal problems.

Internally, the most important check of the controller consists of verifying the cams are positioned properly on the camshaft so that the four contacts open or close as necessary when the switch machine is in the full normal or reverse position. Details of the adjustment for the cams are found in Section 5.

The following description assumes a right-hand layout and the right-hand point is normally closed. When the switch points are moved to the reverse position, the cam faces press against the rollers attached to the guide bracket. The rollers move along the cam faces and the contact finger moves against the pressure of the contact spring to open the front contact and close the back contact. When the controller is in the normal position, the front contact is closed while the back contact is open.

LIKELY TROUBLESHOOTING CHECK POINTS

The following is a checklist of points that could be the cause of abnormal controller operation.

1. Check layout to verify controller is securely fastened to the tie. See Figure 4-1, a typical switch and controller mounted to ties.
2. Inspect mechanical linkage from controller crank arm to connecting rod.
3. Lift cover and verify front or back contact makes with contact finger for the selected thrown switch position.
4. Check contacts for electrical continuity. If no continuity, clean and polish or replace contacts as necessary.
5. Check terminal board wiring for opens or shorts. Repair if necessary.
6. Confirm both cams are positioned properly and are not loose on the camshaft. Also that the rollers are located properly on the cam faces. Cams clamping screws should be torqued to 15 foot-pounds.
7. If there is no indication on the local control panel of switch machine operation, check that the switch points are not obstructed and the control circuit for the switch machine is operating. If any further problems with the switch machine, then check the maintenance manual and the circuit drawings.

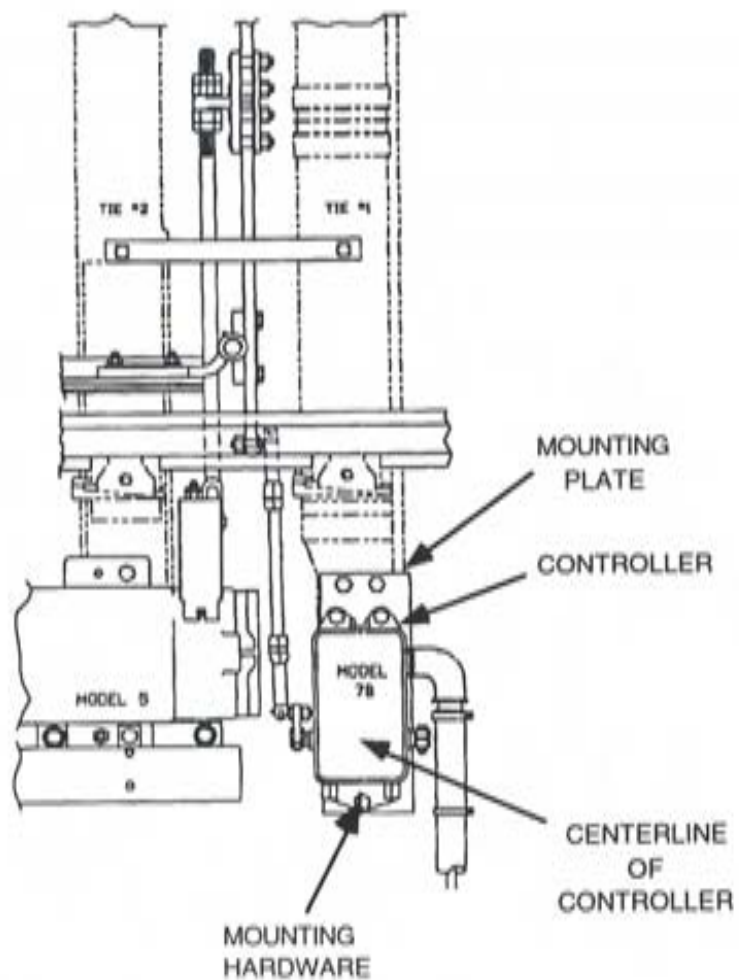


Figure 4-1. Layout of Model 5 Switch Machine and Model 7B Circuit Controller

SECTION 5

CORRECTIVE MAINTENANCE

GENERAL

Corrective maintenance at the field service level is intended to restore malfunctioning equipment to an operable condition as quickly as possible. Replacement procedures include replacement of contacts (front, back and finger) and circuit controller as a unit. Adjustment procedures are provided for the cams, contacts and crank arm. The maintainer can make these adjustments at the location.

SPECIAL TOOLS

The only special tools needed for maintenance are feeler gauges and a 0-30 ft/lb torque wrench.

SPARE PARTS

The parts listed in Table 5-1 are recommended spares for this model controller.

Table 5-1. Spare Parts

Description	Drawing Number
Arm Complete Contact (Front)	35467-009-02
Arm Complete Contact (Back)	35466-009-02
Operating Arm Complete (Contact Finger Bracket)	35490-009-02
Crank Arm	38660 -013-01
Grease Fitting	34232-024-00
Ventilator	52981-003-00
Shaft, for 3/4" dia. cams	38651-003-00
Terminal Board, for contacts	35460-011-00
Shield, for shaft	39996-002-01
Case Complete	38638-008-05

REPLACEMENT PROCEDURES

Front Contact

This procedure describes the replacement of front contacts in the controller. After replacing front contact(s), it is necessary to do the "Cam Adjustment Procedure."

1. Open cut-out contact for switch machine and hand crank switch to put switch points in mid stroke to release pressure on contacts in controller.
2. Loosen terminal post nuts (top row), holding front contact to terminal block (see Figure 5-1).
3. Looking from contact side of terminal block, push terminal post slightly toward mechanism compartment and slide front contact to right until disengaged from terminal post.
4. Install new front contact by sliding to left under head of terminal post screw and align into locking groove.
5. Tighten terminal post nuts.
6. Adjust cams and contacts by following procedures in this section.

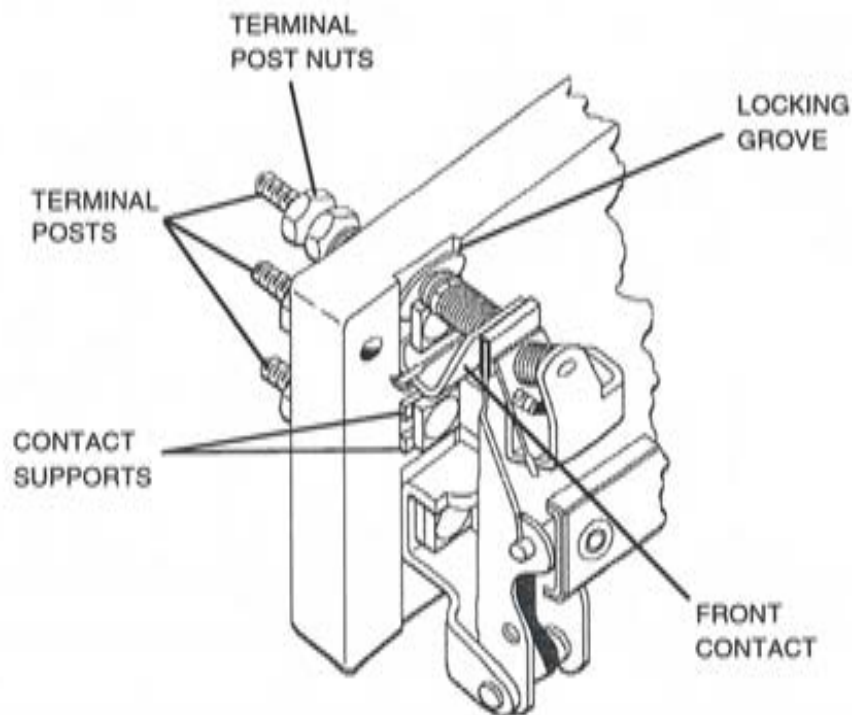


Figure 5-1. Front Contact

Back Contact

This procedure describes the replacement of back contacts in the controller. After replacing back contact(s), it is necessary to do the "Cam Adjustment Procedure."

1. Open cut-out contact for switch machine and hand crank switch to put switch points in mid stroke to release pressure on contacts in controller.
2. Loosen terminal post nuts (middle row), holding back contact to terminal block (Figure 5-2).
3. Loosen terminal post nuts (bottom row), holding back contact to terminal block.
4. Looking from contact side of terminal block, push terminal post slightly toward mechanism compartment and slide back contact to right until disengaged from terminal post.
5. Install new back contact by sliding to left under head of terminal post screw and align into locking groove.
6. Tighten terminal post nuts on both back contact and contact finger bracket terminals.
7. Adjust cams and contacts by following procedures in this section.

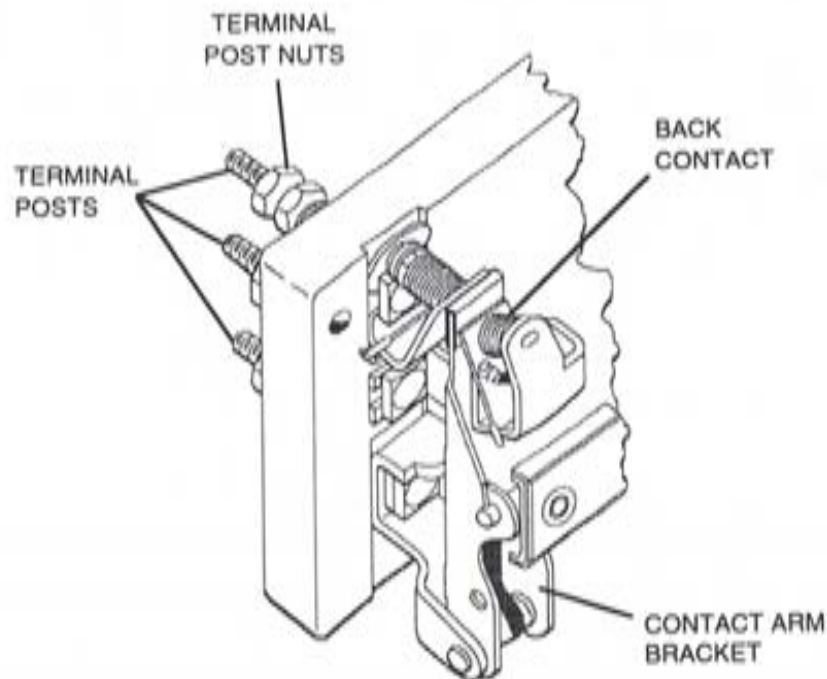


Figure 5-2. Back Contact

Contact Finger

This procedure describes the replacement of contact fingers in the controller. After replacing contact finger(s), it is necessary to do the "Cam Adjustment Procedure."

1. Open cut-out contact for switch machine and hand crank switch to put switch points in mid stroke to release pressure on contacts in controller.
2. Remove all back contacts by following preceding procedure. Disconnect all heel contacts. Disconnect bar of guide.
3. Remove pin holding contact finger to guide bar. Now remove guide bar. (Figure 5-3).
4. Install new contact finger by inserting pin through contact finger and guide bar.
5. Reconnect bar of guide and all heel contacts. Install all back contacts.
6. Tighten terminal post nuts on both back contact and contact finger terminals.
7. Adjust cams and contacts by following procedures in this section.

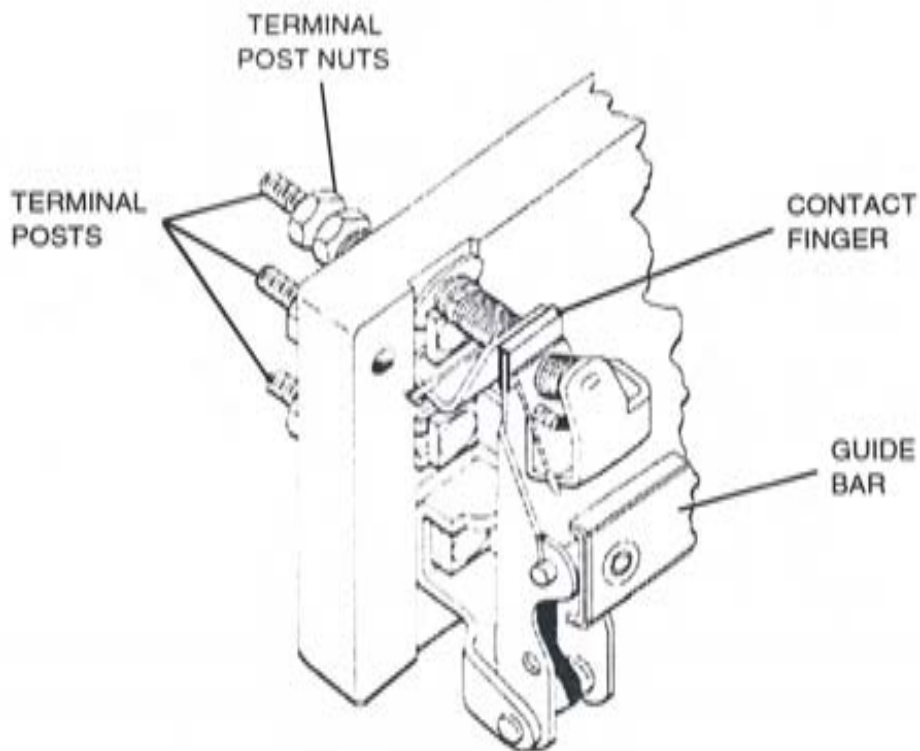


Figure 5-3. Contact Finger Bar

Circuit Controller

This procedure describes replacement of the complete circuit controller. After replacing circuit controller, perform the Cam Adjustment Procedure, Crank Arm Adjustment Procedure, and Contact Adjustment Procedure.

1. Open cut-out contact for switch machine and hand crank switch machine to mid-stroke position, this will release pressure on contact and mechanical linkage.
2. Remove mechanical linkage from ball stud on crank arm.
3. Remove cover.
4. Tag and remove circuit wires from terminals on terminal block. (See Figure 5-4 for terminal designation.)
5. Remove wire entrance coupling, wires and jumpers from case while being careful not to damage wires or tags.
6. Remove three mounting lag screws and any other hardware from case mounting holes.
7. Remove unit from tie and place new unit onto tie matching mounting holes in case to holes in tie.
8. Secure unit case to tie using three lag screws and supplementary hardware.
9. Install wires, jumpers, and coupling into unit. Attach wires to appropriate contact terminals. See Figure 5-4.
10. Attach mechanical linkage to ball stud of crank arm.
11. Adjust crank arm according to procedures in this section.
12. Adjust cams according to procedures in this section.
13. Adjust contacts according to procedures in this section. Make sure hardware is tightened and locked.
14. Operate switch machine electrically in each direction of throw and check that circuits are functioning properly.

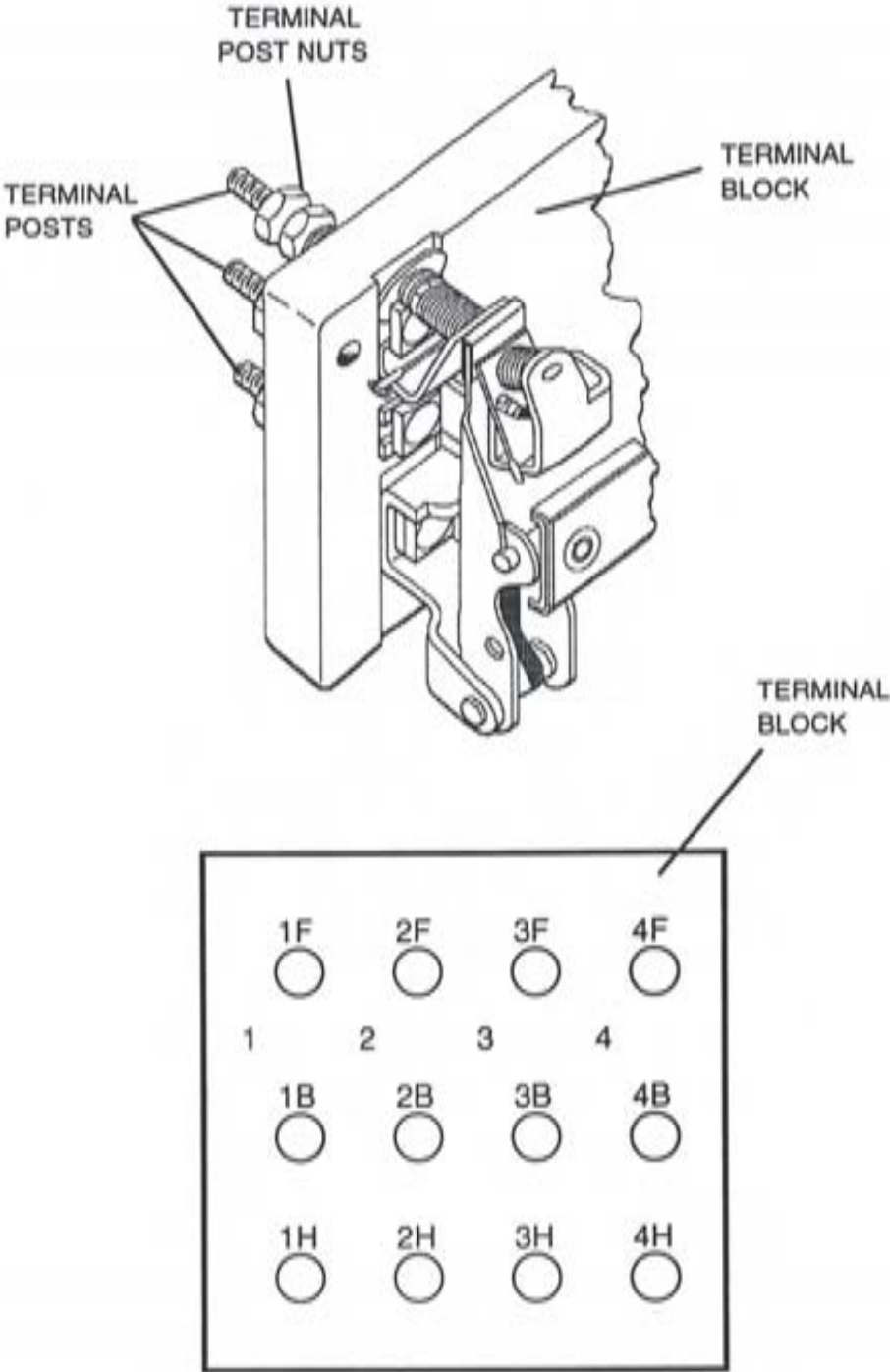


Figure 5-4. Terminal Block and Post Nuts

CAM ADJUSTMENT

The following is the procedure for adjusting the contact closure cams in the controller. This procedure assumes a right-hand layout and the right-hand switch point is normally closed.

CAUTION

When opening cover, keep fingers away from hasp. The hasp spring stores considerable energy and will snap open once it passes the toggle point.

1. With the switch controller cover removed and the cut-out contact for the switch machine open, observe the adjusting and clamping screws on top of cam. Refer to Figure 5-5. When in the adjusting position, the screws are easily accessible.
2. Hand crank the switch and insert a 3/16-inch obstruction gauge six inches back from the point of the switch, between the stock rail and the switch point.
3. Crank the switch point back to the stock rail so that the gauge is snug between the switch point and stock rail.
4. Front stationary contacts and finger contacts should be touching. Refer to Figure 5-6. To adjust cam for contact touching, insert the screwdriver blade in the slot of the clamping screw.
5. Turn the screwdriver counterclockwise only enough to unlock the cam from the shaft.
6. Remove the screwdriver and insert blade into the slot of the adjusting screw on the same cam. Turn screw and bring up the moveable contact fingers so that they just touch the front stationary contacts. Refer to Figure 5-6.
7. Remove the screwdriver and insert blade into the slot of the clamping screw on the same cam. Turn screw clockwise to tighten and lock the clamp on the shaft.
8. Crank the switch to mid-stroke, remove the 3/16-inch gauge, insert the 1/4-inch gauge and close the switch points so that the gauge is snug between the switch point and the stock rail.
9. All contacts touching (front and finger) must be fully open with the 1/4-inch obstruction in place.
10. Crank the switch to mid-stroke position and remove the 1/4-inch obstruction gauge.
11. Crank the switch back to the fully locked position to check the adjustment.
12. The adjusted contacts must be closed and have at least 1/16-inch wiper between the front stationary and moveable finger contacts.
13. Proceed in the same manner to adjust the contacts and cam for the opposite switch position.

14. Crank the switch to mid-position, insert the 1/4-inch obstruction gauge as before, close the cut-out contact and allow gauge to obstruct the switch point for both normal and reverse positions under power.
15. Contacts for that switch position must be fully open.
16. Readjust as necessary.

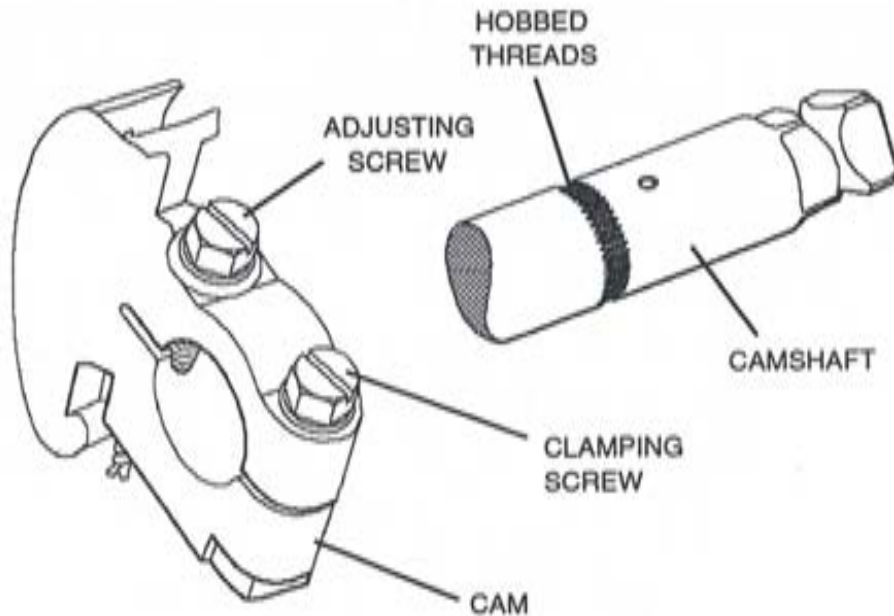


Figure 5-5. Cam Adjustment Screw

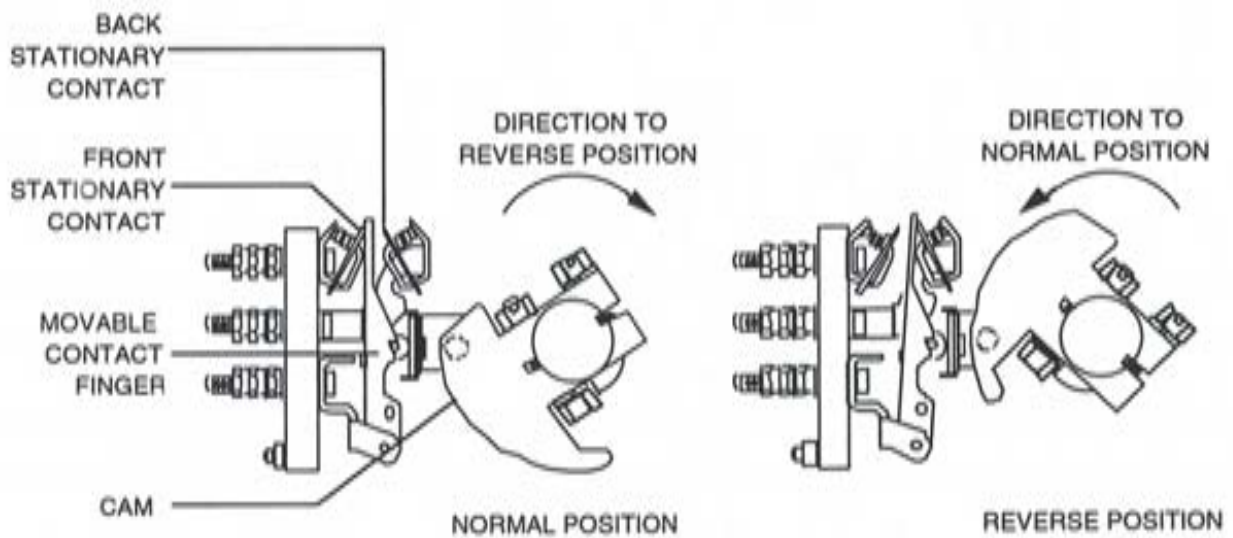


Figure 5-6. Normal Contact Operation

CONTACT ADJUSTMENT

The following procedure is for adjusting contacts in the controller.

CAUTION

When opening cover, keep fingers away from hasp. The hasp spring stores considerable energy and will snap open once it passes the toggle point.

1. Open cut-out contact for switch machine.
2. Open controller cover.
3. Hand crank switch to mid stroke position
4. Align front and back contact to $1\text{-}1/16$ inch from face of silver contacts where they fit in recess of terminal board. See Figure 5-7, Detail A.
5. Adjust back stops of front and back contacts to give $.060$ to $.070$ inch travel at top of finger after the contact is just made. See Detail B. This adjustment is done with light contact pressure spring (part no. 586-25).
6. Except at either end of stroke, be sure movable contacts clear front and back contacts a minimum of $1/16$ inch. See Detail C.
7. After all contacts are adjusted, verify fingers clear the back stops at each end of stroke.
8. Close controller cover and close cut-out contact for switch machine.

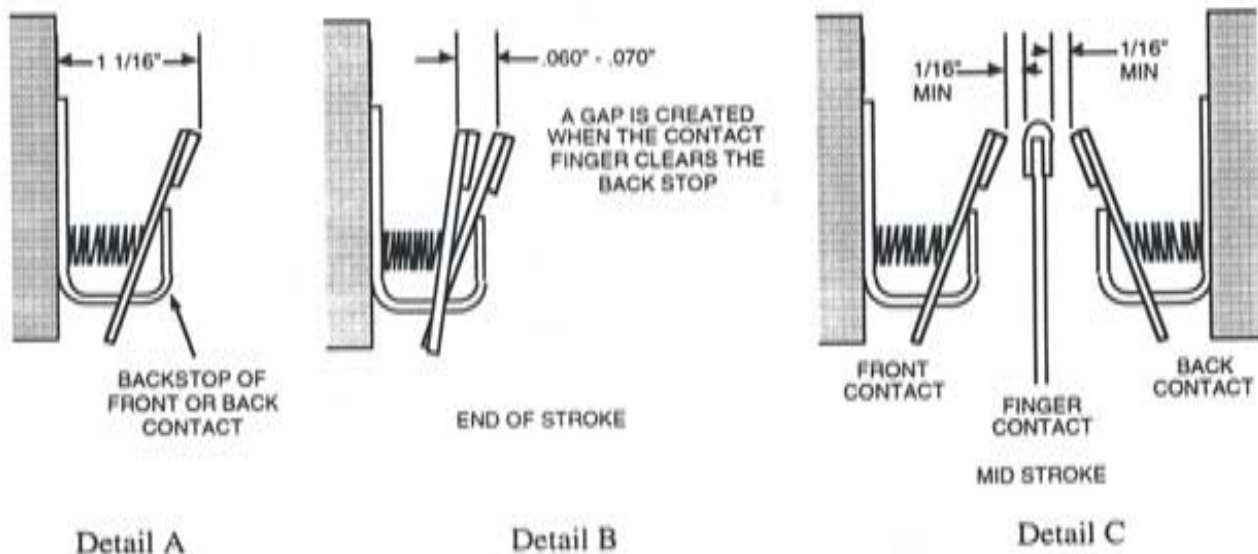


Figure 5-7. Contact Dimensional Adjustments

CRANK ARM ADJUSTMENT

Following is the procedure for adjusting the crank arm on a 7B switch circuit controller. Refer to Figure 5-8 while performing this procedure.

CAUTION

When opening cover, keep fingers away from hasp. The hasp spring stores considerable energy and will snap open once it passes the toggle point.

1. Open cut-out contact for switch machine.
2. Open controller cover.
3. Manually throw the switch to mid-stroke, observe that the crank arm is in a vertical position. Observe crank arm placement in relation to controller placement. If crank arm movement is not equally positioned between the perpendicular and reverse and perpendicular and normal, go to step 4.
4. Loosen jam nut on each end of connecting rod and rotate rod until the crank arm is vertical.
5. Tighten jam nuts and throw the switch full reverse and normal and observe crank arm movement. Confirm equal movement from the vertical position to normal and reverse.
6. If the cam and guide roller positioning is incorrect, redo the Cam Adjustment Procedure.

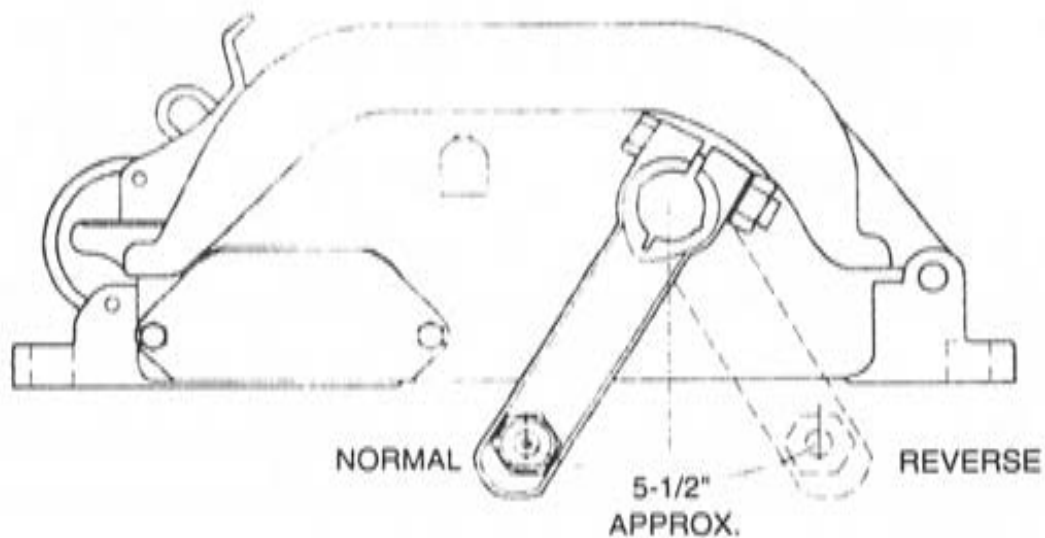


Figure 5-8. Centering of Crank Arm

SECTION 6

PARTS CATALOG

GENERAL

This section lists parts that may be ordered to repair or replace the Model 7B Switch Circuit Controller at the field or shop level and identifies where each part is located.

PARTS LIST

The Model 7B switch circuit controller, as shown in Figure 6-1, is followed by a parts list which gives drawing numbers and descriptions for replaceable parts. Index numbers are given to help locate and identify the replaceable parts.

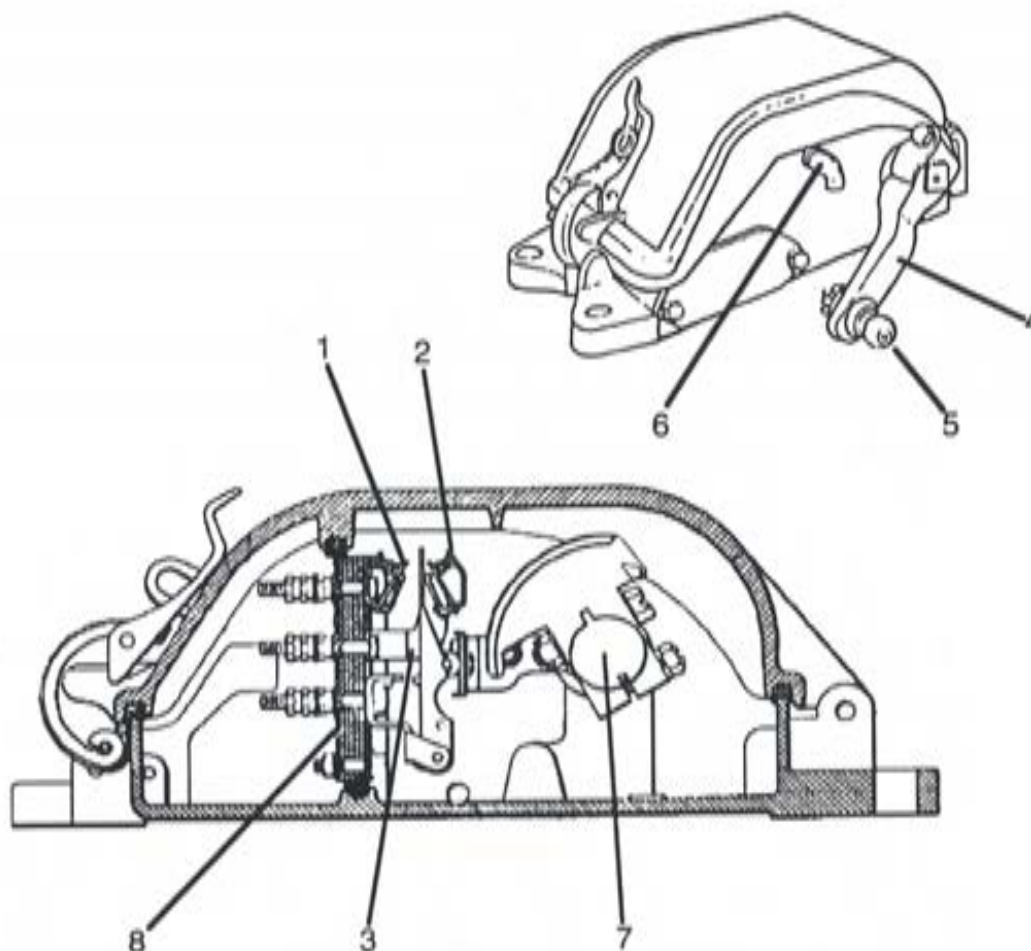


Figure 6-1. Model 7B Switch Circuit Controller (Sheet 1 of 2)

Model 7B Switch Circuit Controller (P/N 53530-033-01)

Index No.	Description	Drawing Number	Qty/ Assy
1	Arm Complete Contact (Front)	35467-009-02	4
2	Arm Complete Contact (Back)	35466-009-02	4
3	Operating Arm Complete (Contact Finger Bracket)	35490-009-02	4
4	Crank Arm	38660-013-01	1
5	Grease Fitting	34232-024-00	1
6	Ventilator	52981-003-00	2
7	Shaft, for 3/4" dia. cams	38651-003-00	1
8	Terminal Board, for contacts	35460-011-00	1
9	Shield, for shaft	39996-002-01	1
10	Case Complete	38638-008-05	1

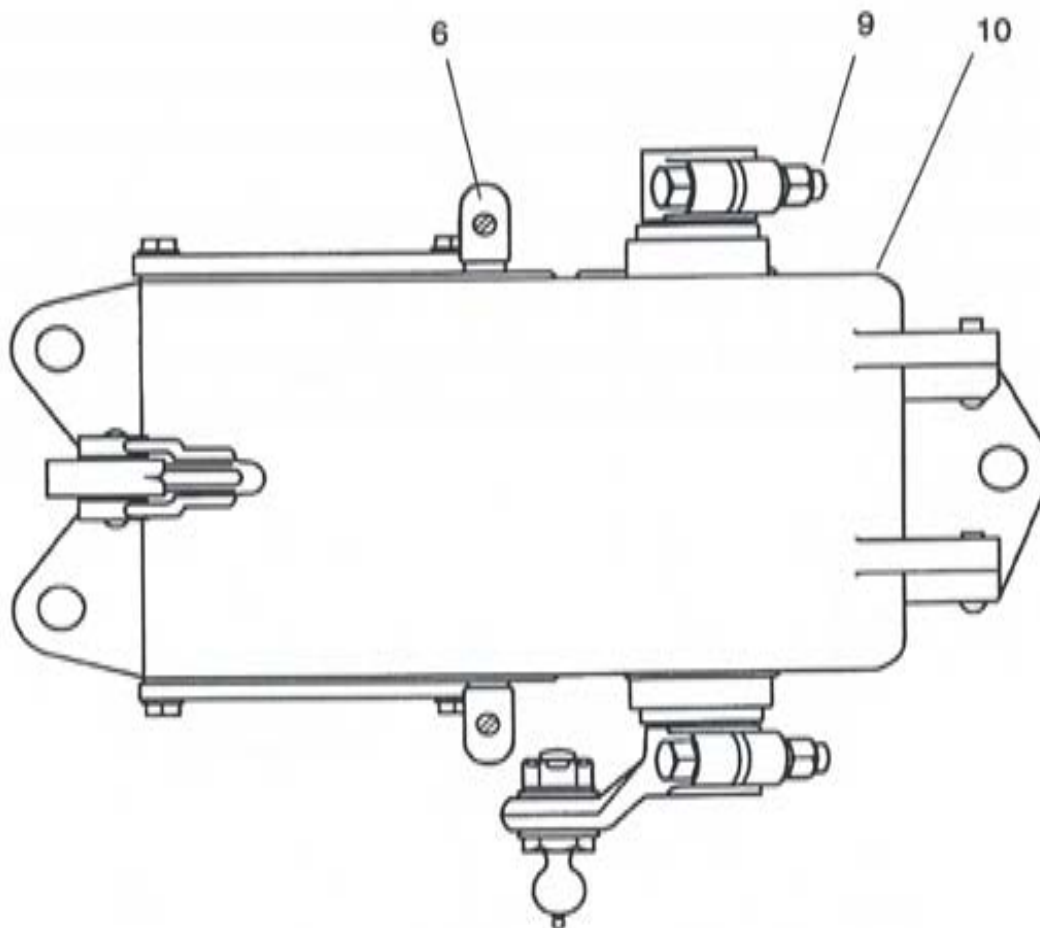


Figure 6-1. Model 7B Switch Circuit Controller (Sheet 2 of 2)

Model 7B Switch Circuit Controller (P/N 53530-033-01)

Index No.	Description	Drawing Number	Qty/ Assy
1	Arm Complete Contact (Front)	35467-009-02	4
2	Arm Complete Contact (Back)	35466-009-02	4
3	Operating Arm Complete (Contact Finger Bracket)	35490-009-02	4
4	Crank Arm	38660-013-01	1
5	Grease Fitting	34232-024-00	1
6	Ventilator	52981-003-00	2
7	Shaft, for 3/4" dia. cams	38651-003-00	1
8	Terminal Board, for contacts	35460-011-00	1
9	Shield, for shaft	39996-002-01	1
10	Case Complete	38638-008-05	1

