



# AUTO-LITE

## *Service Manual Bulletin*

THE ELECTRIC AUTO-LITE COMPANY  
PARTS AND SERVICE DIVISION  
TOLEDO, OHIO

PAGES 1 PAGE NO. 1 DATE 7-19-56 SERIAL NO. X-4  
SUPERSEDES \_\_\_\_\_ DATED \_\_\_\_\_ SUBJECT 1956 Packard Transmission Control

The 1956 Packard and Clipper Cars use electric controls of the push button transmission. Auto-Lite units used in the control system are the actuator unit which consists of a motor and a switching device, the control panel assembly, the motor reversing relay and a pressure switch. Two other relays (three on early production) and a thermal circuit breaker are also used in the circuit but are not furnished by Auto-Lite.

The accompanying instructions together with this bulletin should be filed in the miscellaneous section of the Service Manual. These instructions explain the operation and servicing of the controls. It is anticipated that these instructions will be revised within a short time in order to include additional illustrations and any further information developed as we gain experience on this device.

**POLICY:** Auto-Lite standard warranty will apply to detached units manufactured by Auto-Lite. Since removal of the units from the car requires transmission tools and experience this portion will be handled by Packard dealers. The actuator unit should be adjusted on the bench by Auto-Lite accounts while Packard will make the installation and final adjustment.

The instructions cover the removal and installation of the control panel and actuator even though this part is normally performed by Packard dealers. This is included to complete the information and to make it available for emergencies.

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# **ELECTRIC AUTO-LITE SERVICE MANUAL**

GENERAL NOTES ON TRANSMISSION CONTROL DEVICES

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## **PACKARD "PUSH BUTTON" TRANSMISSION CONTROL**

The electro-mechanical transmission shifter includes the actuator or power unit, the push button control panel, four relays and a pressure switch.

The power unit actuates the driving range selector valve of the transmission into the various ratios. It consists of a shunt wound, reversible motor with a worm gear on the armature shaft. This worm gear drives a sector which in turn actuates the transmission shifter shaft. An arrangement of contacts is mounted on the sector to drive the shifter shaft to the position selected by the push button control.

The control panel consists of six buttons, three of which close a single circuit when depressed. The other three each close two circuits when depressed. Through a series of cams and linkages, the buttons are arranged so that only one can be in the closed position. Any of the buttons will automatically snap out when another is pressed in.

The reversing relay completes the ground circuit for the actuator motor. It includes two relay units, one for each direction. Each of these relays is energized by the push button and shifter contacts, which one (or direction of motor travel) depends upon the button selected and the position of the shifter sector.

The battery relay used on early production is energized when the ignition is turned on and controls the circuit from the battery to the shifter units. This unit keeps power from the controls except when the ignition is on. The battery relay was eliminated on late production cars.

The parking relay is a single pole, double throw relay, which is connected in the circuit to the parking contact of the actuator. When the ignition is turned on, this relay closes one set of contacts and connects the push button in the circuit so that the operator can select any button desired. When the ignition is turned off, the other set of contacts closes. This feeds power to the park circuit and the transmission shaft is rotated to the park position.

The starter relay is energized only when the park or neutral push button is depressed. It is connected in the control circuit of the starter solenoid and prevents operation of the starting motor unless the transmission is in the "park" or "neutral" position.

A governor oil pressure switch is mounted on the transmission. This switch is open when the fluid pressure is high (above 8 MPH approx.) and closed at lower pressures. It is connected in the feed circuit for the "Neutral", "Park" and "Reverse" controls and prevents shifting the transmission into these positions when traveling at higher speeds. If one of these buttons is depressed when traveling at high speeds it will have no effect on the transmission until the car slows. This switch is overridden by the parking relay when the ignition is turned off and the transmission shifts to park even though the car is traveling faster than 8 MPH.

## **OPERATION**

Operation of the push button transmission shifter by the driver requires no special precautions. He is free to shift into "Low", "High" or "Drive" at any time simply by depressing the proper button. As with other transmission controls it is best to bring the car to a stop before reversing the direction of travel or putting the transmission in the "Park" position. The control units will not be damaged by shifting into reverse for instance, when the car is going forward, but there will be a strain on the transmission when the valve is rotated.

The wiring diagrams (Figures 1 & 2) show the hookup and internal connections of the units in the transmission control circuit. Battery voltage is fed through a relay to the "H" "L" "D" buss bar of the push button. It is also fed to the "N" "R" "P" buss bar thru the pressure switch which is closed when the car is stopped or traveling slowly. If the neutral or park button is depressed battery voltage is carried from the buss bar to the starter circuit relay so that the engine can be started by closing the starting contacts of the ignition switch.

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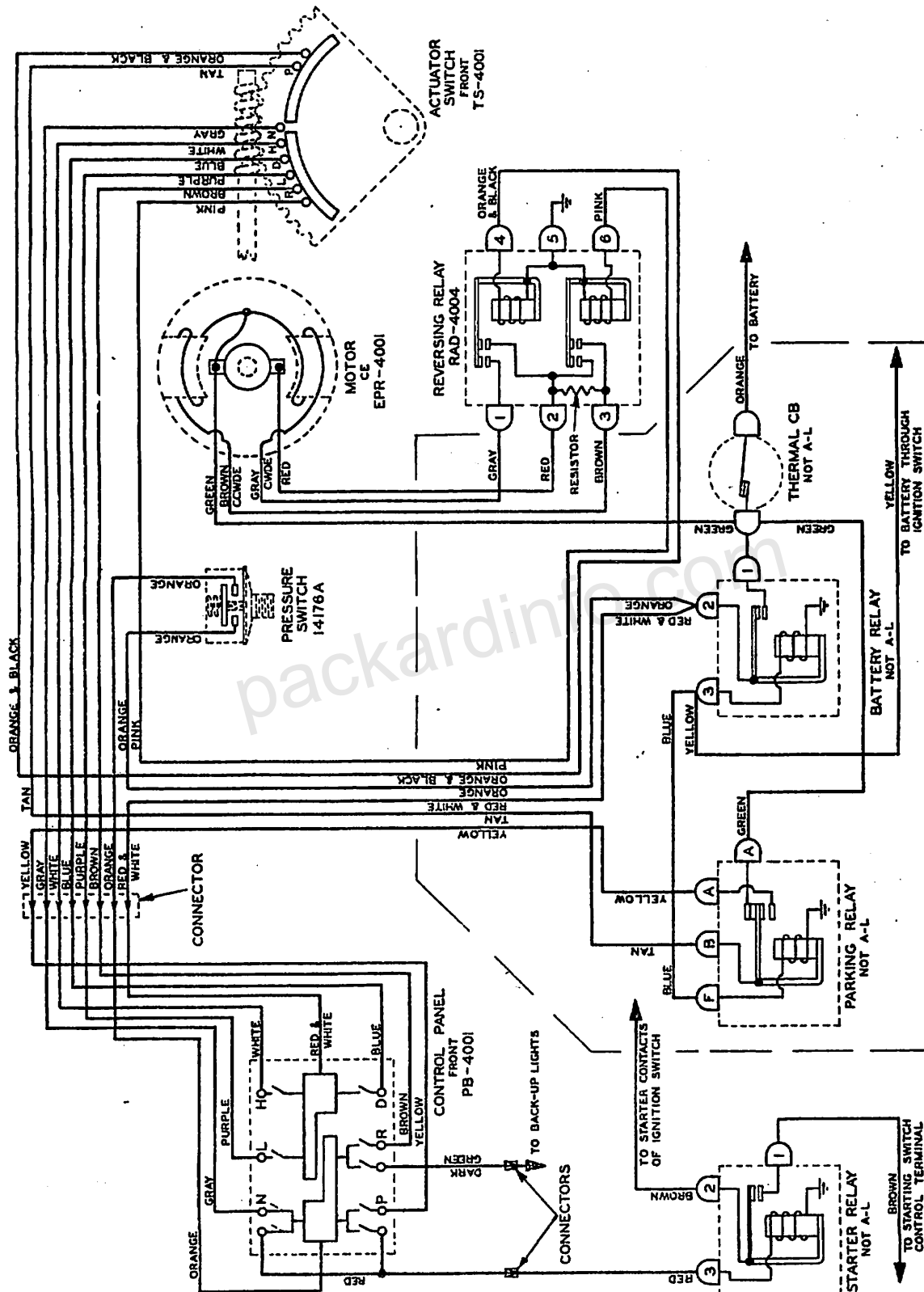


Fig. 1 COMPLETE WIRING DIAGRAM

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The diagram shows the actuator and switching mechanism in neutral. Since the neutral contact on the actuator switch is over the opening in the contact plates, no current flows from the buss bar thru the "neutral" push button and switch to the reversing relay.

If the "drive" button is depressed its contacts are closed and the "neutral" button is opened. Battery current is now fed from the buss bar thru the "drive" button to the "D" contact on the actuator. The "D" contact is connected by the switch plate to the outer contact so current flows thru the pink lead to the #6 terminal on the reversing relay. This closes the relay and connects both the #2 and #3 terminals to ground. This completes the motor armature circuit and one of the motor field circuits so that motor runs. Operation of the motor turns the sector thus shifting the transmission. When the sector turns to the point where the transmission valve is in the "drive" position, the opening in the contact plates has reached the "D" contact. This opens the relay circuit and the motor stops.

If the "Low" button is now depressed the "drive" button opens. Current now reaches the "Pink" lead thru the "L" contact and the same contact plate. The relay closes and the motor rotates further in the same directions until the transmission is in the low position and the opening reaches the "L" contact.

If the "Drive" button is now depressed the "Low" button opens. Current now flows to the "D" contact then thru the other contact plate and the orange and black lead to the reversing relay. The second relay unit is now energized and the #1 and #2 terminals are grounded. The motor armature and the second field coil are now energized so that the motor operates in the reverse direction and shifts back to the drive position. The motor stops when the "D" contact reaches the opening in the contact plates.

The motor and actuator thus select a position which depends upon the button selected. This holds true except when the "N" "R" or "P" button is depressed while traveling more than a few miles per hour. If one of these buttons is depressed at high speeds the motor does not operate and the transmission is not shifted until the car slows and the pressure switch closes.

Due to the sensitivity and the rapidity in which the motor positions the transmission shifter shaft there is a tendency to turn too far. This closes the circuit thru the other contact plate and reverses the direction of the motor. The motor tends to turn in one direction then reverse and continue to "hunt" in this manner. To counteract this tendency a damping resistor is connected in the relay and a friction brake is built into the actuator. Spring tension keeps pressure on the brake. This pressure is increased or decreased by the thrust due to the worm, gear, depending upon

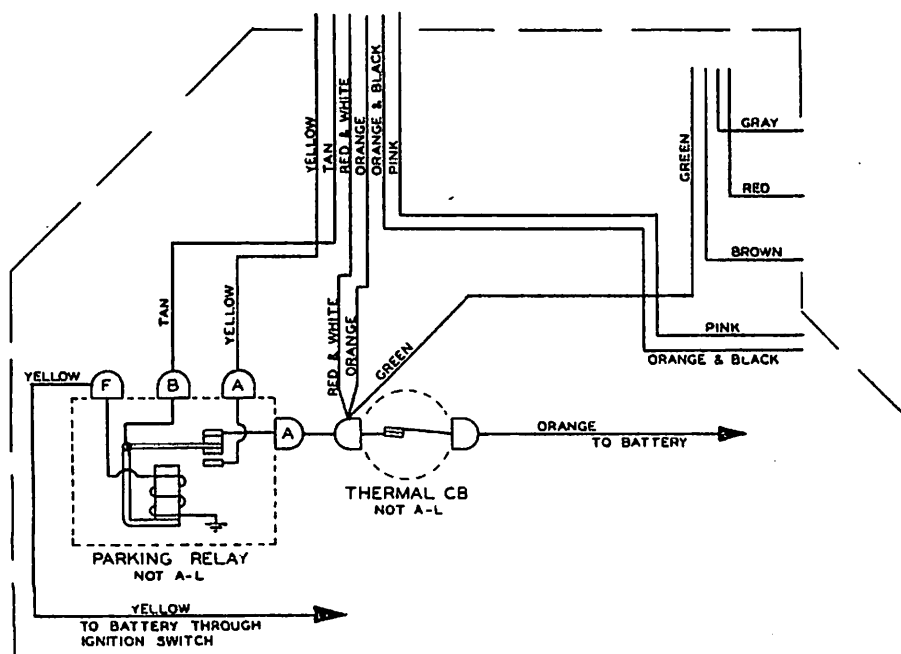


Fig. 2 CHANGES IN WIRING FOR LATE PRODUCTION

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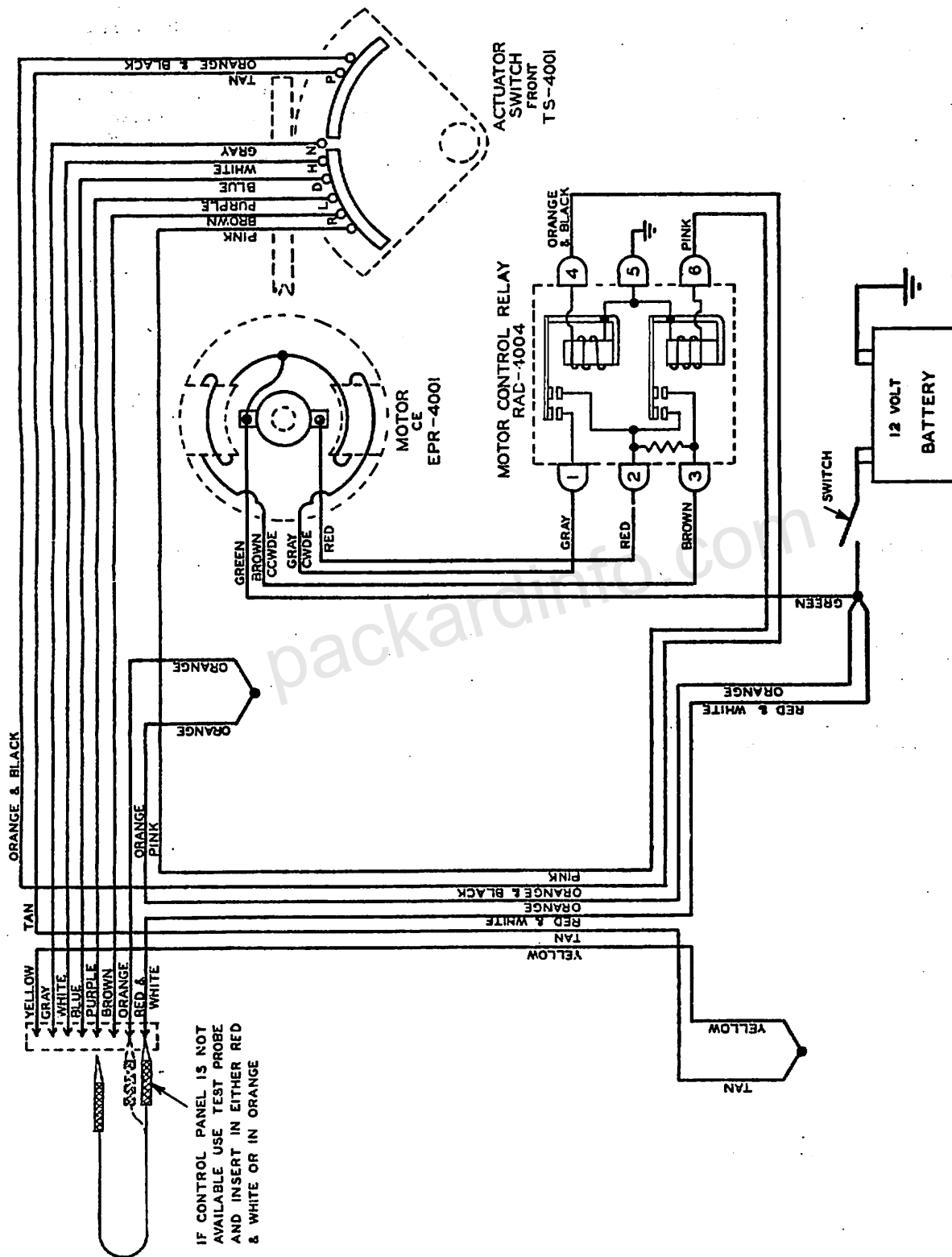


Fig. 3 TEST WIRING DIAGRAM

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the direction of armature rotation. When turning toward the "park" position the armature thrust increases the pressure on the brake so that coasting of the motor past the proper position is reduced. When turning toward the "reverse" position the pressure is reduced by the thrust.

To offset the reduction in braking when turning toward "reverse" the damping resistor in the reversing relay energizes the second field coil slightly. This reduces the motor torque when turning in that direction so that it does not coast as easily past the proper position.

## ADJUSTMENT

The only adjustment which may be periodically required is the anti-hunt feature. Hunting will make itself known by a rapid series of relay clicks as the unit completes a shift. Hunting due to normal wear or change of adjustment usually begins as a mild, short lived hunt of a few cycles which soon stops of its own accord. This in itself will not cause serious damage. Adjustment should be made, however, before the condition worsens to the point of causing a continuous oscillation.

While the anti-hunt system can be adjusted on the bench, it should be remembered that the transmission itself adds considerable damping to the system and therefore adjustment should be made light on the bench. Tightening of the adjustment until the hunt is limited to a few quick cycles is usually sufficient to ensure non-hunting when installed. Avoid overly tight adjustment as this increases the load on the motor.

## MAINTENANCE

**HUNTING** Normal maintenance requires only the periodic check and adjustment of the anti-hunt system. Hunting will make itself known by a rapid series of relay clicks as the unit completes a shift. Hunting due to normal wear should begin as a mild, short-lived hunt of a few cycles which soon stops of its own accord. This in itself should not cause serious damage. Adjustment should be made, however, before the condition becomes worse to the point of causing a continuous oscillation.

If hunting occurs refer to the trouble shooting chart to eliminate the other possible causes then adjust according to the instructions below. These same instructions apply whether the unit is mounted on the bench or on the transmission. If tested on the bench it should be connected to a control panel and reversing relay. The other relays can be eliminated from the bench test circuit by connecting the yellow and tan leads together (park relay), the two orange leads together (pressure switch) and connecting the red & white, orange, and green leads to the battery (battery relay). Ground the motor frame and the reversing relay base. The correct reversing relay must be used in the test circuit as shown in figure 3 but the control panel can be eliminated by the use of a test probe as shown.

- ANTI-HUNT ADJUSTMENT**
1. Back off the armature thrust screw (center screw) ("A" Fig. 4) on the right end of the casting several full turns.
  2. Operate the various push buttons in random order. The unit should hunt in any one or several position.
  3. If hunting does not occur back off the outer adjustment screw ("B" Fig. 4) slightly and tap the side of the motor sharply with a soft hammer while moving from "R" to "P" and "P" to "R". Continue to back out the adjustment screw until hunting occurs.

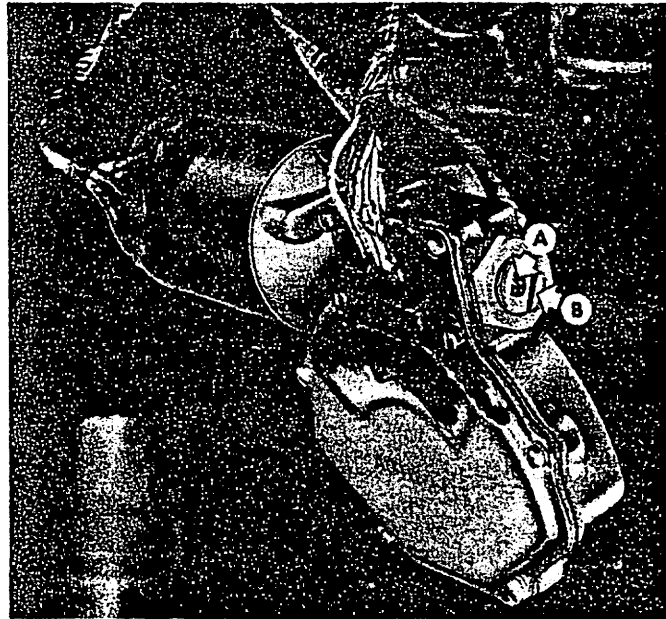


Fig. 4 ANTI-HUNT ADJUSTMENT

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4. Gradually tighten the outer adjustment screw  $1/4$  turn at a time until the device no longer hunts. Do not allow the motor to hunt for long periods as it will become hot enough to affect the adjustment. It will be noted that as proper adjustment is neared it will no longer hunt continuously but will make several oscillations at one or more positions. This is the proper adjustment on the bench. If the unit is on the transmission, the proper adjustment is  $1/4$  turn beyond the point at which the unit does not oscillate. **DO NOT OVER ADJUST AS THIS WILL CREATE AN UNNECESSARY LOAD ON THE MOTOR.**

**NOTE:** When turning in the direction from Park toward Reverse, the actuator will, when functioning properly, stop at the selected position immediately. In the opposite direction the actuator will often over-travel slightly causing a short reversal for positioning. This is normal and this single oscillation should not be confused with hunting which consists of more than one oscillation.

5. Lock the jam nut firmly.
6. Adjust the armature end play by screwing the center screw in firmly against the shaft then backing the screw out one full turn.

**NOTE:** If motor becomes abnormally hot (over  $200^{\circ}$  F.) allow to cool before completing the above adjustment.

7. Stop the actuator in the "R" position to place the unit in the proper position for installation on the transmission.

## TROUBLE SHOOTING

There are several possible partial failures which are easily isolated.

1. Failure to start
  - a. With ignition on, connect test light between terminal #3 (red lead) of the starter relay and ground. If light remains dark, the lead from the push button, or the push button contact is open.
  - b. Connect the test lamp to the #2 terminal (brown lead) and operate starter switch. If the lamp does not turn on, the ignition switch or the lead from the ignition switch to the relay is open.
  - c. Connect the test lamp to the #1 terminal (brown lead) and operate starter switch. If the lamp does not turn on the relay is defective. If the lamp turns on the starter switch or its lead is defective.
2. Failure of back-up light
  - a. Check lamps and line fuse.
  - b. Connect test light from dark green lead to ground and press "R" button. If lamp fails to light the dark green lead has an open circuit, loose connection or a poor contact in the push button. If lamp lights the wiring to the back-up lights or their sockets are at fault.
3. Failure to shift R, N, and P
  - a. Pressure switch open. Pull the orange wires with Douglas terminals from the pressure switch mounted on the side of the transmission near the actuator. Connect these together (protect from ground). If the actuator performs normally, replace the pressure switch.
  - b. Open circuit in the orange lead. Inspect for open or broken lead. This is most likely to occur at the cable connector near the drivers side of the firewall. Be certain that all of the terminals are pushed fully into the connector. Use a small screwdriver to force any exposed brass terminal ends into the case.
4. Failure to shift H, L, and D
  - a. Open circuit in the red with white tracer lead. Inspect as in (b) above.

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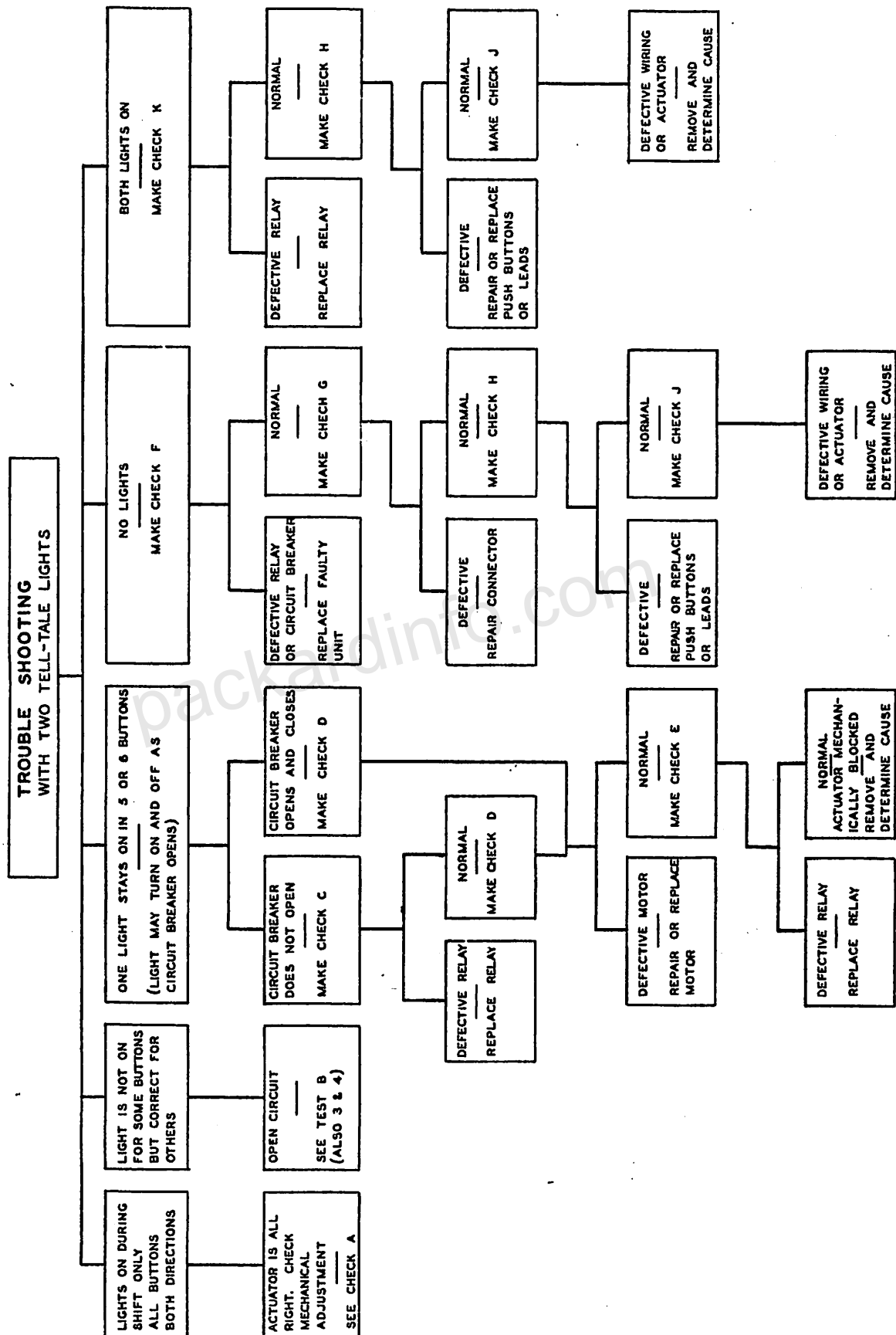


Fig. 5 TROUBLE SHOOTING CHART



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## FAULT ANALYSIS

Less readily detected faults may be located with the aid of a set of tell-tale lights by following the outlined procedure.

The tell-tale lights should have their sockets soldered together and attached to a large battery clip. They may then be conveniently clipped to a body bolt near the windshield for easy viewing from the drivers seat.

**Inspection Procedure** Connect the tell-tale lights with one clip to the #4 terminal of the motor control relay and the other to the #6 terminal. One or the other of these two terminals becomes energized as a signal for a desired shift. Thus, one light or the other (depending upon the direction of shift) will light upon a request to shift and go off upon completion of the shift. Malfunctioning of these lights will provide clues for locating faults.

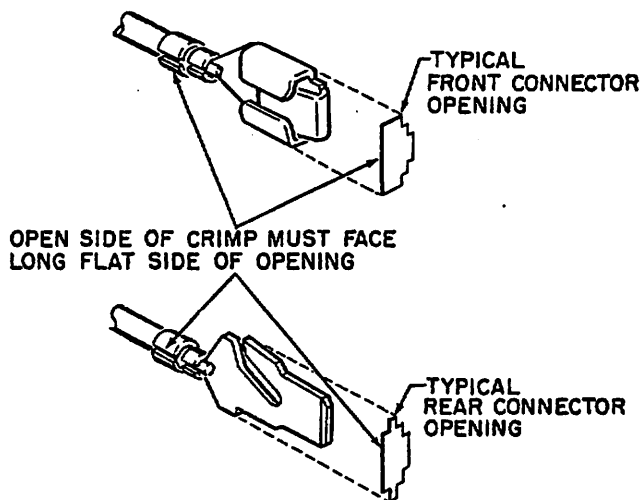


Fig. 6 TERMINAL INSTALLATION

With the tell-tale lights connected as above press the various buttons and note the operation of the lights. Refer to the chart for the results and follow the tests indicated.

**Check A - Mechanical Adjustment** It is possible for the actuator to be so adjusted angularly on the transmission that one or more positions of the shifter valve is not in the correct position with the detent centered.

After the unit has been shifted to the affected position loosen the actuator adjusting nuts. Carefully rotate the actuator so that the detent is centered then lock in place. (Refer to installation procedure on page 28.)

To check for proper adjustment, hold the brake, advance the throttle to fast idle and shift L, H, D, H, L. A distinct change of torque should occur on each shift. Similarly, R and N may be detected.

**Check B - Electrical Fault** If the lights fail to operate upon depressing the button in question, the actuator is not receiving a signal.

Check for an open circuit in the affected lead. This is most likely to occur in the cable connector. Make certain that all of the terminals are pushed fully into the connectors. Use a small screw driver to force any exposed brass terminal ends into the case.

**NOTE:** If the terminals are not properly installed with the opening where the wire is clamped by the terminal toward the flat side of the opening in the case there will be a tendency for the terminals to work loose. See figure 6.

If a loose connection in the connector is not the cause, disconnect the connector and check the actuator for continuity with test probes between the affected lead and either the pink lead or the orange with black tracer lead. If neither lead shows a complete circuit, the fault is either in the lead itself, or more likely, in the contact spring within the actuator.

Check the push button circuit for continuity in the same way by checking between the affected lead and the orange lead or the red with white tracer lead.

If the affected lead is for Park, check the automatic park relay. This may readily be done by removing the yellow and tan leads from the relay, and connecting them together.

**Check C - Motor Control Relay** The fact that the circuit breaker does not open indicates there is no current flow to the motor.

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With the ignition off, disconnect the four motor leads (green, red, brown, and gray). Connect the common clip of the tell-tale lights to the hot terminal of the battery and one lead to terminal #1, the other to terminal #3. Turn ignition on and depress the various buttons.

If neither light turns on, check for a good ground at terminal #5. If this is not at fault, replace relay.

**Check D - Motor** With the ignition off, disconnect the four motor leads (green, red, brown, and gray).

If the circuit breaker has not been opening and closing and the relay passes Check C, there may be an open circuit in the motor. A quick check may be made by attaching the common clip of the tell-tale lights to the hot battery terminal, one lead to the green motor lead and then touching each of the other motor leads to ground in turn. The light must come on in all cases.

If the circuit breaker has been opening and closing, there may be:

1. A grounded condition in the motor. An ohmmeter (or tell-tale light) check should show very high resistance (or no light) between any of the four motor leads and ground. If grounded replace motor.
2. A faulty field or armature winding. An ohmmeter check of the fields (brown and gray to green) of .26 to .29 ohms and of the armature (red to green) of .42 to .46 ohms. If beyond these limits, replace the motor.

**Check E - Motor Control Relay** A faulty relay. Disconnect the orange with black tracer and the pink leads from terminals. Clip a jumper wire to the hot battery terminal and:

1. Touch terminal #4 with the jumper. Using a good ohmmeter check the resistance to ground of terminals #1 and #2. If these are not zero one contact is open and the relay should be replaced.
2. Touch terminal #6 with the jumper. The resistance from terminals #2 and #3 to ground should also be zero. In this later case, BE CAREFUL to look for a small resistance as an open contact at either #2 or #3 will cause the circuit to ground to pass through a 1/2 ohm resistor which is a very small reading on most ohmmeters.

**Check F - Input Voltage** In the case of neither tell-tale light turning on, there is no signal voltage available. This check is to assure presence of input voltage.

Connect the common clip of the tell-tale light to a body bolt. With the clip of one of the light leads:

1. Touch large orange lead terminal on the input side of the circuit breaker. If no light, circuit is open between the hot side of the starter solenoid and the breaker.
2. Touch the output terminal of the circuit breaker (point of attachment green motor lead). If no light, replace circuit breaker.
3. With ignition switch on, touch terminal #3 of the battery relay (yellow lead). If no light, there is an open circuit between here and the ignition switch.
4. Touch terminal #2 of battery relay (orange and red with white tracer). If no light, replace relay.

**Check G - Cable Connector** If a voltage supply is available as shown in Check F, there is an open circuit in the position selecting and detecting system. This is most apt to occur in the cable connector on the driver's side of the firewall. Visually inspect to be certain all prongs are pressed firmly in place paying particular attention to the orange and the red with white tracer leads. Use a small bladed screwdriver to force the prongs home.

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**Check H - Push Buttons** Should the connector be correct, the open circuit is either in the supply to the push button or collector leads to the actuator.

Disconnect the cable connector. Connect the common clip of the tell-tale lights to the battery and with a needle probe:

1. Connect one light lead to the orange terminal on the push button plug. Run a ground lead to the yellow terminal. Depress all buttons in turn. Only the P should illuminate the lamp. Move the ground lead to the gray terminal. Only the N should light. Similarly when the ground is connected to the brown terminal, only the R should light.
2. Connect the light lead to the red with white tracer terminal. Grounding the blue, white, and purple terminals in turn should light only on D, H, and L respectively. In the event the lights are on at any incorrect time, investigate cable for pinched wires and the push button assembly for shorted conditions. In the event lights do not come on as they should, investigate for broken connections or open contacts in the push button assembly.

### Check J - Actuator Position Sensing Circuit

1. Disconnect the pink and the orange with black tracer from the motor control relay. Connect a test light between the hot battery terminal and the pink lead. Ground the orange with black tracer lead. If lamp lights, remove actuator and determine cause for short between these leads.
2. With the test light connected as above, ground the brown terminal at the cable connector. The lamp should light. If not, remove actuator and determine cause for open circuit.
3. Disconnect tan lead from automatic park relay. Connect test lamp between hot battery terminal and the orange with black tracer. Ground the tan lead. The lamp should light. If not, remove actuator and determine cause for the open circuit.

**Check K - Motor Control Relay** Connect the common clip of the tell-tale lights to the hot battery terminal. Connect the leads to terminals #1 and #3 of the motor control relay and operate buttons. If both lights are on at any time, replace relay.

## OVERHAUL

### Removal of the Actuator Unit

The actuator unit is mounted on the left side of the transmission with the outer end of the valve lever shaft secured in the sector gear with a tapered set screw and lock nut. The gear housing and motor is attached to the transmission case with one stud and nut. The shift actuator can be removed from the transmission as follows:

1. Disconnect the tan and yellow leads from the parking relay. This will prevent automatic shifting to "Park" when the ignition is turned off.
2. Turn on the ignition and press the "R" button. This positions the sector with the set screw pointing downward. Turn off the ignition.
3. Remove the wiring harness connector from the forward side of the firewall.
4. Disconnect the leads from the motor reversing relay.
5. Disconnect the green lead, orange lead and red with white tracer lead from the battery relay.
6. Disconnect the two wires from the pressure switch on the side of the transmission.

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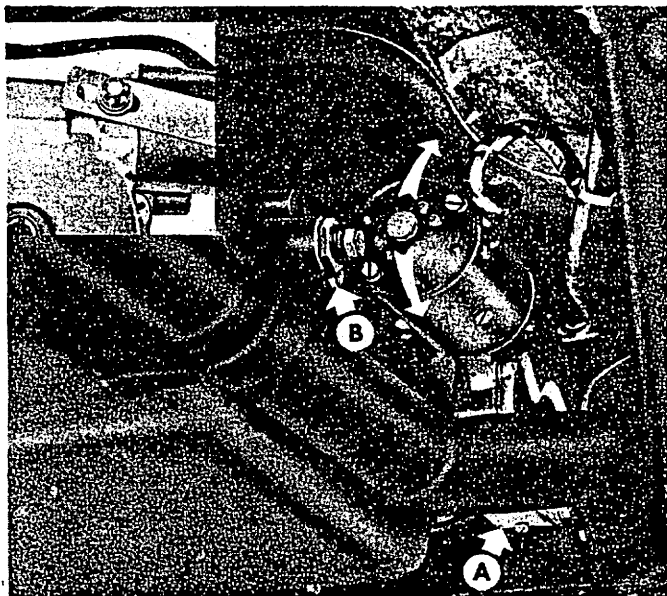


Fig. 7 REMOVING ACTUATOR

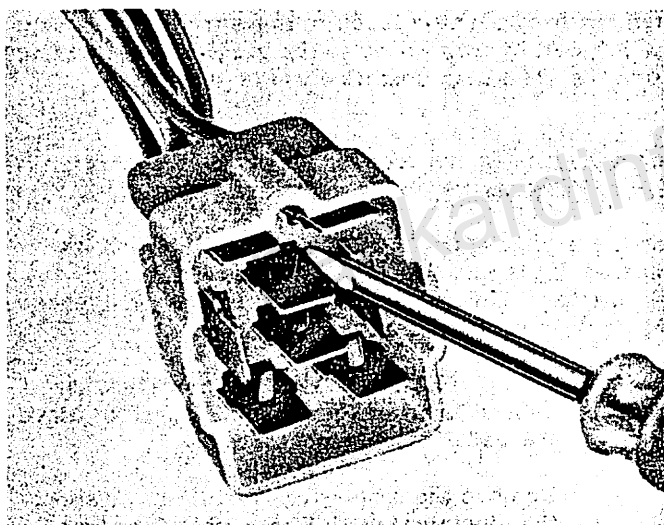


Fig. 8 REMOVING TERMINALS FROM CONNECTOR

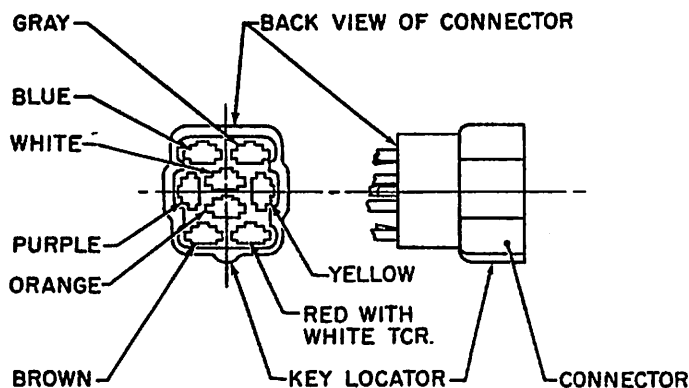


Fig. 9 WIRE LOCATIONS FOR PUSH BUTTON CONNECTOR

7. Remove the screws and plate "A" figure 7 from the lower side of the actuator gear housing.

8. Loosen the set screw lock nut and remove the set screw.

**NOTE:** If the sector gear set screw can not be positioned downward because of faulty wiring, motor failure etc, it will be necessary to remove the two shift motor thru bolts and take off the motor. Turn the worm gear shaft with a suitable tool to position the sector.

**Warning:** When removing the motor, be careful and not allow the worm shaft to come out with the motor as the brake plates and the thrust ball bearing will fall out of place.

9. Disconnect the front universal joint.

10. Jack up the rear of the engine and remove the transmission tail shaft and housing. Disconnect speedometer cable.

11. Using a pry bar or jack move the rear of the engine to the right as far as possible.

12. Remove the cap screw ("B" fig. 7) that holds the actuator unit to the transmission and slide the assembly outward off the valve lever shaft.

### Removal of Push Button Control Unit

1. Disconnect the connector at rear side of firewall.

2. Remove the wires and terminals from the connector by pressing in on the lip of the terminal, figure 8, with a small thin screwdriver and then pulling the wire and terminal out of the connector. Remove all of the wires from the connector.

3. Disconnect the dark green wire, red wire and black wire from their individual connectors.

4. Remove the four bolts that clamp the two halves of the push button switch housing to the steering column and remove the two housings.

5. While guiding the wires into the lower opening in the steering column, carefully pull the wires one at a time up through the steering column.

**NOTE:** Do not remove the push button control panel unless it is known to be faulty. It can be inspected and tested while mounted.

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6. When installing the push button be sure the terminals are installed as shown in figure 6 and in the position noted in figure 9.

### ACTUATOR UNIT

#### Disassembly and Inspection

1. Motor. Remove the two through bolts. Tap the motor housing to free it from the casting. Withdraw the motor housing with care to prevent the slip joint coupling at the end of the motor shaft from sliding the worm gear shaft out of the gear box. (Figure 10)

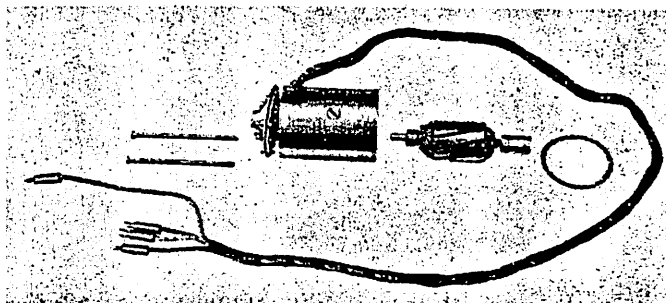


Fig. 10 ACTUATOR MOTOR

Inspect the inside of the motor for signs of overheating such as excessive discoloration of the insulation or heavy deposits of varnish on the metallic parts. Inspect the brushes and commutator for wear and discoloration. Clean the commutator and replace the brushes if necessary.

Connect an ammeter and voltmeter to the green and brown motor leads to measure the amperage draw of the right field coil. Repeat to test the left coil by connecting to the green and gray motor leads. Replace the field coils if the current draw is not within specification or if they test grounded.

Inspect the armature for signs of open coils or damage. Do not test for shorts on the growler as the connections in the armature will cause it to show shorts on the usual growler test.

2. Gear Box Assembly. Remove the external cover plate. (Figure 11) Fit the armature and its coupling on the worm gear shaft and rotate the shaft by hand. The shaft should turn freely and smoothly except at each end of the segment stroke. Torques in excess of two pound-inches or a feeling of stickiness are abnormal and the cause must be determined.

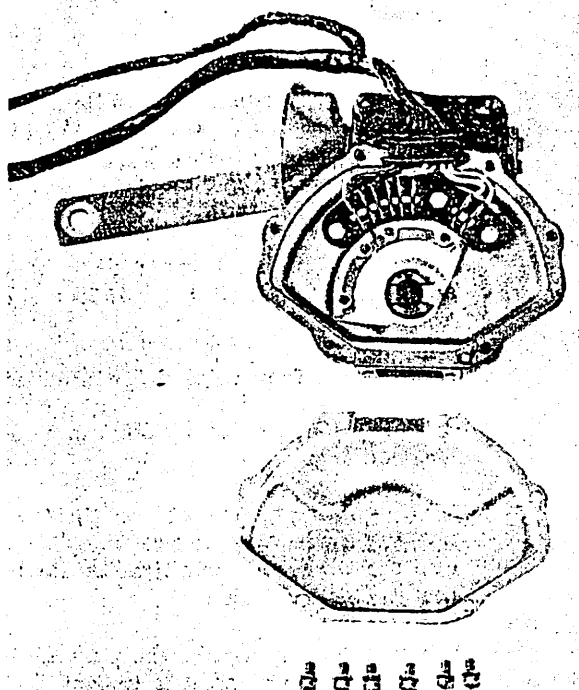


Fig. 11 ACTUATOR WITH COVER REMOVED

**CAUTION:** Do not turn the armature far enough to allow the contact fingers to leave the end of the contact segment.

Remove the external cover plate. Inspect the electrical switch assembly for signs of excessive wear or damage to the contact fingers. Check for looseness of the contact fingers and make sure the insulation on the wires is in good condition.

**NOTE:** If the switch assembly does not require minute inspection it is unnecessary to disassemble it from the base plate.

To disassemble the switch remove the screws which retain the contact finger assembly (Figure 12). The fingers should be smooth and clean and all have the same shape. All fingers should be properly aligned in their slots.

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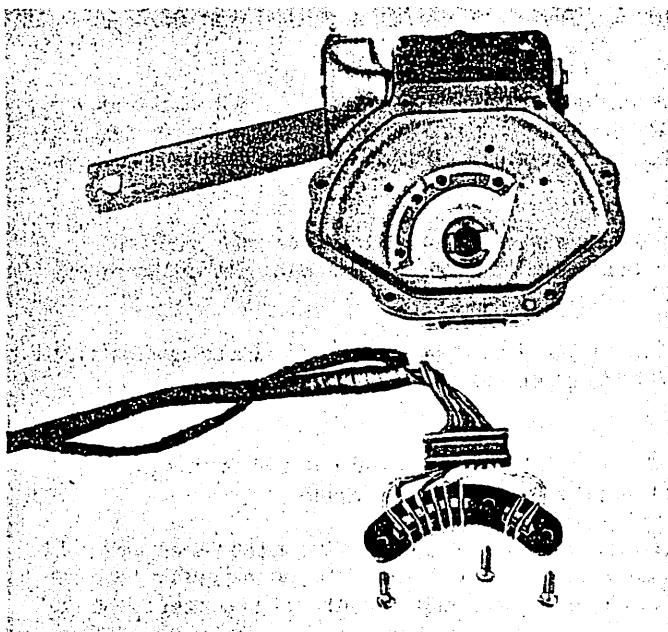


Fig. 12 ACTUATOR WITH SWITCH PLATE REMOVED

This will allow the various components of the anti-hunt brake system and the worm to be removed. Wash in clean solvent.

Inspect the fibre brake plate for abnormal wear or scuffing. Examine the notch for broken ears or edges. Check for a free sliding fit on the worm shaft. Place the fibre in a cup of clean SAE #20 oil and allow to soak until ready for assembly.

Inspect the steel brake washers. These should have a smooth polished surface. The internal lug should be free of burrs and the whole unit should slide freely on the worm shaft.

Inspect the worm for abnormal wear or roughness and for free sliding action on the shaft and key.

Inspect the ball thrust bearing for damaged balls or thrust plates.

Inspect the spring for damage.

### Assembly and Test

#### Brake Assembly

Loosen the jam nut and back out the outer adjustment screw at the end of the worm shaft until the end is about even with the inside of the housing. Insert the worm shaft partly into the left bearing of the casting. As the end is gradually moved into place, install the various components in the following order.

Place the spacer on the shaft with its narrow diameter next to the casting wall. Remove the brake plate from the oil and shake off the excess oil. Place the plate on the shaft with the notched end engaged on the boss in the casting. Install one 1/16" thick steel brake disc or two 1/32" thick steel brake discs on the worm shaft so that the lug engages the keyway. In-

To remove the contact segment, remove the snap ring and slide the segment from the shaft. (Figure 13) The surface of the outer rim of the contact should be smooth and clean. The gap between the segments should not exceed .078" and the radius on the segment corners should not exceed .040".

Remove the base plate, with or without the switch installed, by lifting the plate. If the contact plate has been removed the sector gear will be left in the housing and can be inspected in the assembled condition.

The worm and sector gear should be coated with lubricant. There should be at least .010" backlash at the worm. Turn the sector gear to the right which should cause free motion of the worm against the spring. Rotation of the worm shaft should cause a limited motion of the fibre brake plate.

Remove the sector gear. Wash in solvent and inspect for abnormal wear and rough surfaces.

Remove the worm shaft slowly being careful not to create any damage to the coupling end.

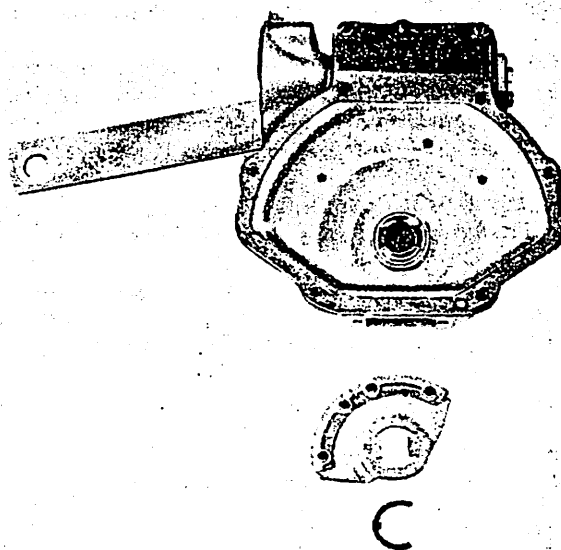


Fig. 13 ACTUATOR WITH CONTACT SEGMENT REMOVED

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Service Manual



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## GENERAL NOTES ON TRANSMISSION CONTROL DEVICES

stall the worm and its key. Slide the thrust ball bearing, consisting of the ball assembly between two thrust plates, in position on the shaft. Place the spring and its thrust washer on the shaft and slide the shaft into position.

**Motor Assembly** Place the gasket in position on the commutator end head. Install the brushes in their holders and insert the armature into the commutator end bearing. Release the brushes and inspect to see that they seat properly on the commutator. Place the commutator end head in position on the frame.

With the gasket in place on the shoulder of the gear housing, move the motor into position engaging first the armature coupling with the worm shaft and then the locating pin in the motor frame with the slot in the casting.

Install the thru bolts and tighten thoroughly. As the bolts are tightened, strike the motor frame several sharp blows with a soft hammer to align the motor and bearings.

### Motor Test

Screw the armature thrust screw firmly against the shaft then back out one full turn. Do not screw the outer adjustment screw in as this will place tension on the brake.

Connect the motor for a no load test with an ammeter in series between the green lead and a 12 volt battery, and ground the brown and red leads. Connect a voltmeter from the green lead to ground. The motor should operate clockwise at the drive end and its current and speed should be within specifications.

Change the hookup so that the gray and red leads are grounded. The motor should now turn counter clockwise and the current and speed should again be within specifications.

If the motor does not operate according to the specified figures it indicates faulty fields, armature, brushes, hookup or a drag on the armature. This drag may be due to tension on the brake mechanism or to worn or improperly aligned bearings. Check to see that the armature turns easily without binding or restrictions.

### Switch Assembly

Install the sector gear with the notched end of the hub up and with the approximate center of the gear engaged with the worm. Rotate the worm shaft to check for freedom of movement. Lubricate the worm and sector gears with 1 1/2 to 2 ounces of ST-350 grease.

Install the base plate and its gasket, holding it in place with the two top most screws. Check for proper engagement with the locating dowel pin. Use care to ensure a good gasket seal.

Mount the contact segment on the hub and lock in place with the snap ring.

Carefully install the contact finger assembly by inserting three screws through the assembly. Slide the assembly toward the contact sector until the contact fingers touch the sector. Cautiously align the screws with the holes and hold firmly while the screws are tightened. Inspect carefully that the contact fingers are all lying across the contact rim and that none has slipped out of place.

Carefully tuck each wire under the contact assembly so that none will rub against the back of the contact finger or be pinched by the cover.

Mount the cover plate and gasket and tighten all screws evenly and thoroughly. Make sure the grommet fits into the cover plate properly, and that the base plate is correctly located on the dowel pins and that the gasket is securely in place.

Connect the wires to the connector as shown in figure 6 and in the positions shown in figure 14.

### Adjustment

Adjust the anti-hunt brake system as previously described.

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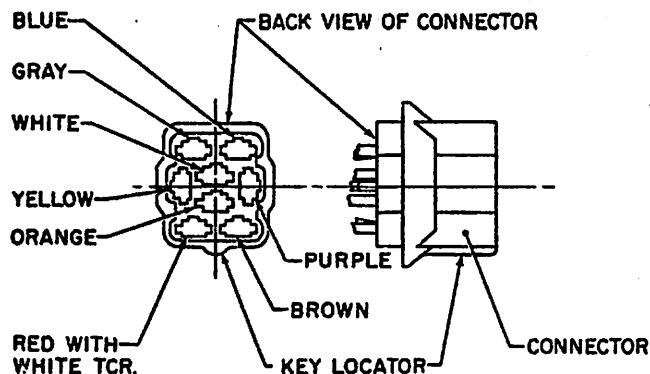


Fig. 14 WIRE LOCATIONS FOR ACTUATOR CONNECTOR

## Installation

Be sure actuator is in the reverse position. Connect the leads as indicated in the wiring diagram (Fig. 1) except leave the tan lead disconnected from the parking relay. Turn on the ignition and press the "R" button. Turn off the ignition.

Manually turn the transmission shifter valve to the reverse position. Slide the actuator unit into position and tighten the dog point screw. Be careful to set this screw as tightly as possible. Remove the jam nut if necessary to secure full purchase on the screw slot. When tight, lock securely with the jam nut.

Fasten the inspection plate and gasket ("A" Fig. 7) firmly in place. Engage the mounting stud with the actuator and install the mounting nuts ("B" fig. 7).

Before tightening the nuts turn on the ignition and press the "D" button. Rotate the actuator by hand until the center of the "D" detent is felt then tighten and lock the mounting nuts.

Connect the tan lead to the "B" terminal of the parking relay.

Check the operation of the actuator by pressing the various buttons at random paying particular attention to any signs of laboring or hunting.

Check the angular adjustment of the actuator by starting the engine and operating at a fast idle, with the brake on press the various buttons and feel for the correct shift. Shift L, H, D, H, L. A distinct shift should be felt when the actuator is correctly located with respect to the detent.

## SPECIFICATIONS

### TS-4001 Transmission Control

VOLTS	12
MOTOR	Part No. EPR-4001
ROTATION	Reversible CWDE Rotation - Connect Green to battery and ground Gray and Red leads. CCWDE Rotation - Connect Green to battery and ground Brown and Red leads.
BRUSHES	2
BRUSH SPRING TENSION	9 1/2 to 11 ounces with new brushes.
FIELD COIL DRAW	70°F. 3.5 to 3.8 amperes at 10 volts (each coil)
NO LOAD DRAW	12.0 volts, 45 Max. Amps., 1020 Min. RPM Note: Test with Sector gear removed and with brake adjustment backed off to relieve tension. Test in both directions.
STALL TEST	12.0 volts, 66 Max. Amps., 23 Min. Oz. Ft. Torque
POLE SHOES	Install pole shoes with identification mark toward commutator end.
BEARINGS	Bronze



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## **GENERAL NOTES ON TRANSMISSION CONTROL DEVICES**

### **LUBRICATION**

At overhaul. Soak armature shaft bearings and felts in SAE #10 oil and drain off excess oil. Clean oil from re-tainer and heads. Pack gear chamber with 1 1/2 ounces clutch lubricant (ST-350). Coat sector shaft and bearing with clutch lubricant.

### **RAD-4004 Relay**

Resistor	.5 to .6 ohms.
Resistance of windings	
Contacts close	3.0 to 6.0 volts
	Seals at 8.0 volts max.
Contacts open	1.0 volts min.

### **14176A Pressure Switch**

Contacts open at  $10 \pm 2$  pounds per sq. in.

packardinfo.com

# ELECTRIC AUTO-LITE SERVICE MANUAL

EPR TYPE MOTORS

**EPR**  
(Issued 7-5-56)

These shunt type motors are reversible and are designed for electrical transmission shifts. They have two field coils only one of which is used for each rotation.

VOLTS 12

ROTATION Reversible

POLES 2

BRUSHES 2

LUBRICATION Bearings are lubricated at assembly and do not need periodic lubrication. At overhaul lubricate bearings and felts with light engine oil. Drain off excess oil. Do not soak bearings in grease solvent as it will wash all lubrication from bearings and felts.

END PLAY See Transmission Shift Manual Page.

ARMATURE TEST Due to the internal connections and low resistance of the windings the armature cannot be checked on a growler as all coils will check shorted. These armatures can be tested by using an AC milliammeter (5 ampere with 100 scale divisions) and making a test between bars.

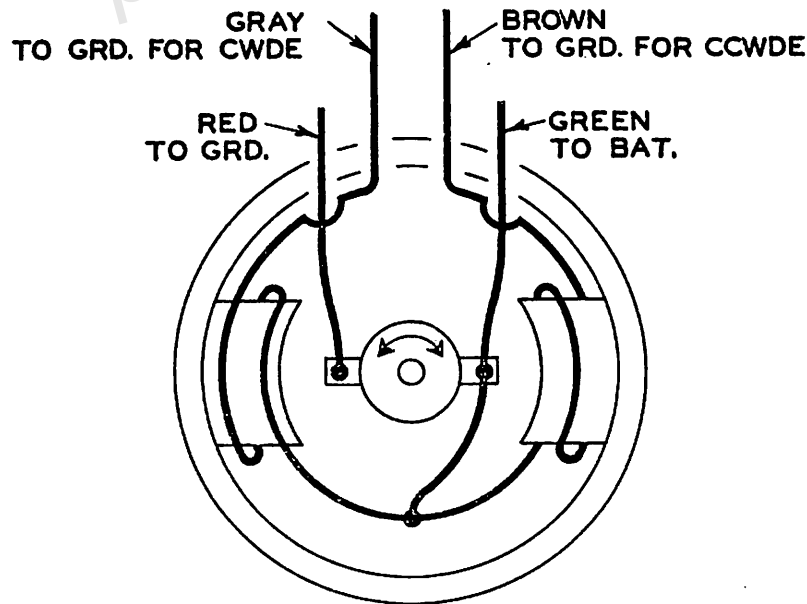
NO LOAD 12 Volts, 45 Maximum Amperes, 1020 Minimum R. P. M.  
Test in both directions of rotation.

STALL TEST 12 Volts, 66 Maximum Amperes, 23.3 Minimum Oz. Ft.  
Test in both directions of rotation.

WITH LOAD 12 Volts, 47 Maximum Amperes, 4 Oz. Ft., 860-920 R. P. M.  
Test in both directions of rotation.

Unit	Internal Wiring	Connections
EPR-4001	Fig. 1	Note #1

NOTE #1 - Connect green lead to battery. Ground red and brown leads for CCWDE rotation or ground red and gray leads for CWDE rotation.



VIEWED FROM COMMUTATOR END

Fig. 1