Protecting MGB Circuits with Relays

The Challenges

Switches are Crude - The combination of available engineering in the 60's with the price point envisioned for our cars when they were first designed, means that the rocker switches used to control various MGB circuits after 1968 are rather crude mechanical devices. This causes two problems: 1. When you *do* use them, switches eventually wear out and fail, and 2. When you *don't* use them, switches internal contacts corrode over and fail.

Reproductions are Questionable - Aftermarket switches have been available from a variety of vendors and unfortunately, none seem to have risen to the top as being able to meet or exceed the OEM switches in quality. Stories abound about switches that came apart during installation or that eventually stopped working.

Headlamp Switch Issues Cause Dim Lights (or worse) - The eventual degradation of switches that control headlamps leads (at best) to a dimming of the lamps. Some owners will upgrade their headlamps to halogen units in an attempt to squeeze a few more lumens out. These bulbs draw more amperage than stock and (while brighter) will actually accelerate the degradation of the switch. At worst, this can lead to a harness meltdown and perhaps a fire. As you may know, the headlamp circuit in an MGB is unfused. If enough heat is generated by the switch to begin to melt the insulation off wires supplying it, a resulting short will not blow a fuse. It will continue to melt the harness until the wires separate or something combusts.

Switch Anatomy

Early "Blade" style

Early "Blade" style rocker switches can be identified from the back by the clip at the top and bottom protruding outside the bezel (see photo 1 below).

The rocker action is transmitted through a spring to a ball bearing that rocks a plastic actuator against two metal blades. In the headlamp switch in this case, the shape of the actuator first closes one circuit to complete the parking light circuit, then closes the other to complete the headlamp circuit (see photo 2 below).

The metal blades are forced down on contact points to complete and break the circuits. Each time the rocker is thrown a tiny arc between blade and contact deposits a small amount of carbon on the face of the connection. (Note: seen as a small sooty black circle on photo 3 below) This carbon eventually builds up until the connection is no longer clean between the faces. This results in some of your amperage being lost to the effort required for power to jump across the carbon. We see this as heat and dim headlamps.

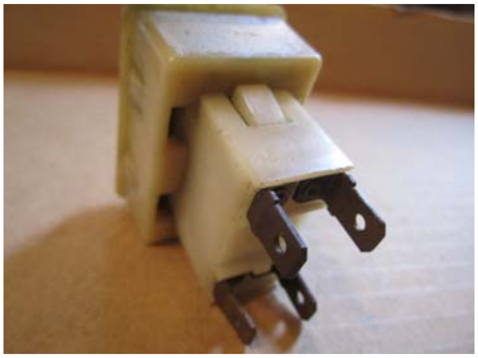


Photo 1

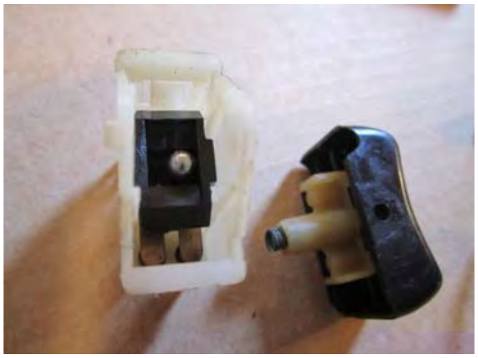


Photo 2

Photo 3

Later (and reproduction) "Shuttle" style

Later switches can be identified from the back by the clip on the top of the switch body being inside the bezel at the top and bottom. You can see in the photo of a cheap repro (see photo 4) that the silver bar of the bezel appears bowed upwards where the clip is pressing. This is an indicator that this particular switch is poorly made. Moderate pressure on the rocker on the front is enough to "unclip" the switch from the bezel. Essentially, switching on the headlamps could cause the guts of the switch to fly forward into your dash.

These later rocker switches, and the switches supplied in the aftermarket rely on a similar design. The rocker is connected to an arm that forces a copper backed shuttle up and down in the body of the switch…where it rides against various terminals to establish and break connections (photos 5 and 6).


Photo 4

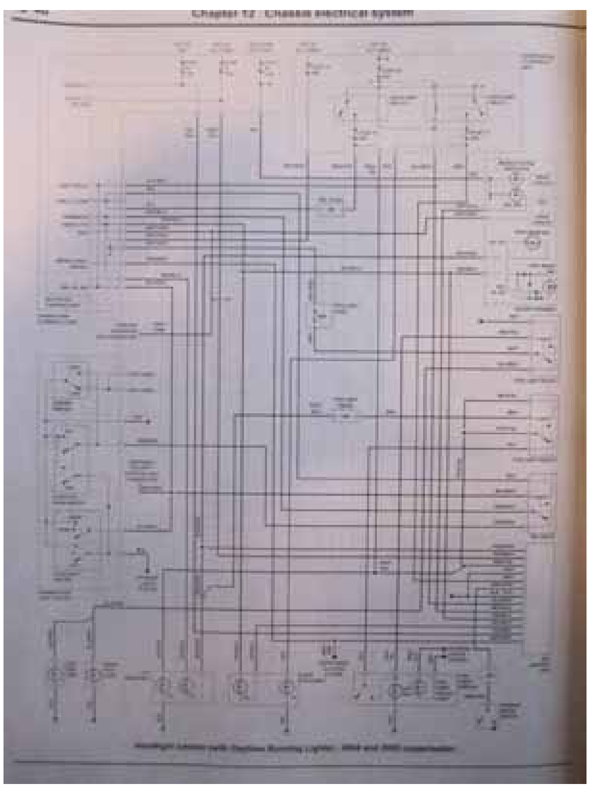

Photo 5

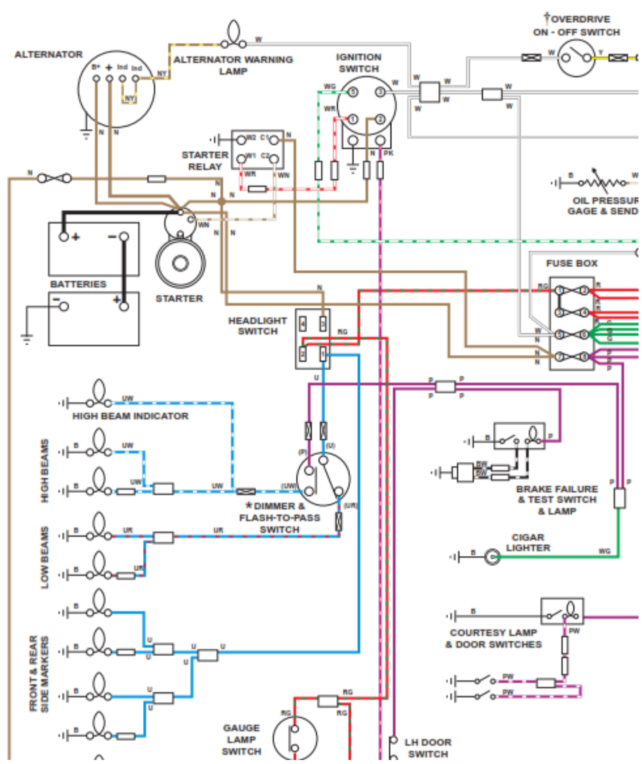

Photo 6

In this photo (left), a new (aftermarket) switch was disassembled after it failed to operate correctly. In position one, the parking lights would illuminate, but in position two the headlamps would illuminate but the parking lights would go out! Some investigation reveals a manufacturing flaw with the top right contact slightly raised above the two below. The shuttle would ride up this contact, closing the headlamp circuit but opening the parking light circuit. The moral: New is not always better.

MGB Wiring

Although an understanding of the wiring in our cars can seem like a daunting task, things really are relatively straightforward, especially if you consider similar work on modern cars. For example, looking at the drawing on the left, this is the schematic for just the headlight circuits of my Honda Civic. Contrast this to the relevant part of the MGB wiring schematic on the right.





(Illustration from www.advanceautowire.com)

Brown wires come from the starter and connect to the headlamp switch and blue wires come from the switch and head to the parking lights and headlamps. The important thing to note in this (other than the absence of a relay) is the lack of a fuse - a common design principle at the time but unheard of today.

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This photo is from behind the dash on my 1970 MGB when I first bought it. You can see the brown wire on the lower left where it attaches to the back of the headlamp switch looks deformed from some excessive heat. Top center you can see the effect of a dead short on an unfused circuit on the harness. A conductor has melted right through the insulation and blue vinyl tape. The sketchy heater fan switch addition bottom center is certainly poorly executed but in this case was likely added when the original circuit died in the meltdown.

Options:

There are a number of approaches we can take to address the risk and shortcomings. The worst case scenario of course is a fire and total loss of your car. Even a small meltdown can mean replacement of your harness however and that is going to be at least $550 plus someone's labour. Alternatively:

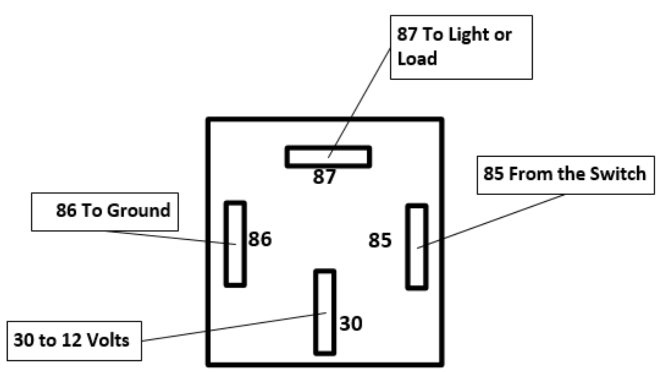
- Disassemble and clean switches periodically
- Replace bullet sleeve (Luclar) connectors when necessary
- Replace switches - $20 (perhaps quality replacements will be available someday)
- And/or install relays at a cost of approximately $8 per unit.

Relays

The automotive relay is used on all modern cars to protect circuits and controls. Commonly called the "Bosch" relay as it was popularized and standardized by the German parts company, but has now become so much of a commodity that actually Bosch no longer manufactures them.

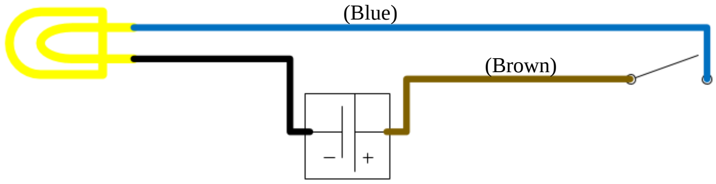
The benefit of a relay is that it isolates the switch from the load. The relay is essentially an electromagnetic switch that uses a low current to activate a higher current. The small current travels through the coil windings on the left, causing the electromagnet to pull the armature plate on the right towards it. This closes the contacts at the bottom right and allows the large current to flow.

Standard Terminal Layout



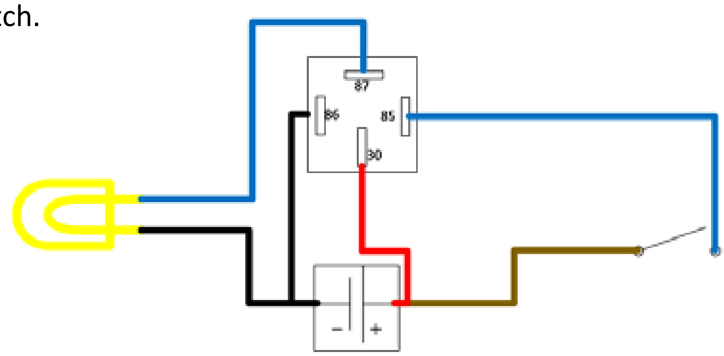
We also have Bosch to thank for the strange standard terminal numbering system on the bottom of relays. These numbers corresponded to standard numbered points on the wiring harnesses of German car manufacturers. Relays commonly have 5 terminals, but for the sake of the type of applications we only need to make use of these 4. (We'll ignore 87a that usually appears in the center)

Basic Headlamp Circuit



In our basic headlamp circuit (diagram above), the power comes from the battery, travels along a brown wire to the switch and a blue wire from the switch to the headlamp. The other side of the headlamp completes the circuit via black ground to the chassis (and back to the battery). When a halogen bulb is used, this simple arrangement can draw up to 9 amps through the switch.

Adding a Relay



A relay is attached as suggested in the standard terminal layout (diagram to the right).

- We find a convenient spot to "break" the blue wire.
- Attach 85 to the blue wire headed to the switch.
- Attach 87 to the blue wire headed to the lamp.
- Attach 30 to a fresh source of 12 volts.
- Attach 86 to chassis ground.

Using the relay, the amperage flowing through the switch now drops to somewhere around 0.5 amps.

Practical Installation

Although you can cut the blue wire anywhere between the switch and the headlamps to install a relay, it is preferable to disconnect an existing bullet connector to achieve this. By adding the relay at an existing connection, you reduce the number of connectors you're adding and, for the preservationists; you're making a modification that is entirely reversible.

The most natural point for this is the group of connectors under the right hand horn (see above left). At this point the high beam and low beam circuits each split in a four way bullet connector to supply both lamps. To add a low beam relay:

- Locate the four way bullet connector with three Blue-with-Red wires entering it.
- Pull out the one Blue-with-Red wire from the connector that runs back to the switch.
- Test by turning on your headlamp switch. If one headlamp comes on, you pulled the wrong wire. Try again. If neither lamp comes on, you chose correctly.
- Short leads can now be run between the relay (85) and the one wire that was pulled, and the relay (87) and the bullet connector that still has the remaining two wires.
- Run a wire from relay (86) to a good ground. One is available in the same location under the horn.
- Run a wire from a good 12 volt source to relay (30). I recommend adding a 20 amp fuse to this wire either by adding an inline glass or ATO fuse or by adding an entire auxiliary fuse panel if you're feeling ambitious.
- Select a place to mount your relay. Some use Velcro to fasten to the underside of the slam panel, some use a simple bracket to attach to the radiator stay. I mounted mine to a panel against the body.
- Repeat for the High Beams' Blue-with-White Tracer wire.

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Adding Relays to Horns

The general instructions for adding relays to the headlight circuit can be adapted to apply to nearly every other circuit on the MGB: brake lights, stereo, heater fan, even adding a second switched power socket for your GPS and cell phone… **BUT! It does not apply to all horns**.

Horns need special consideration in our cars. If your MGB has horns with a single wire (1978 -1980) disregard this warning. You can add a relay as above. But for most of the MGB's up to 1977, the horns are always powered. These earlier horn circuits have two wires leading to each horn: Purple (12v) and Purple with black (ground)

The horn switch works by completing the circuit to ground, not to positive. To add a relay:

- Disconnect purple with black at harness under the right horn.
- Connect Relay (86) to the Purple with Black that leads to the switch
- Connect Relay (87) to the Purple w/Black that leads to the horns
- Connect Relay (85) to 12v (The existing Purple is fine)
- Connect Relay (30) to Ground

Final Thoughts

There are of course thousands upon thousands of MGB's out there without relays that are ticking along just fine. I'm not suggesting that every MGB without these modifications is about to burst into flames. However, in the spectrum of changes we make to our cars, this is a worthwhile and low cost addition that adds both safety and usability through brighter headlights and louder horns with very little downside. The next owners of your car will either appreciate the addition, replace it with whatever future technology replaces relays or remove it without a trace to prepare the car for its concours judging.

Supplies and Sources

- "Bosch" Automotive 12v 30 amp relay
  - Princess Auto pn 8080376 (relay with socket) $5.99
  - Canadian Tire pn 20-3760-4 $4.99
- Wire
  - 2 meters 14 gauge 28 strand color coded PVC $2.60
  - http://www.britishwiring.com/28-Strand-PVC-Wire-14-ga-AWG-p/c128.htm
  - Or 25' spools of 14 gauge at Princess Auto $8
- 6 Position Automotive Fuse Panel
  - Princess Auto PN 8138224 $14.99
- Bullet Connector tools and supplies
  - Moss wiring harness repair kit pn 161-751 $177 (crimper, closing tool, bullets, sleeves)
  - British Wiring Crimper $60 Closer $30 Bullet Assortment pack $19
- Other Kits:
  - Limey's 3 relay kit: http://www.bits4brits.net/Relays.html $60
  - Moss 2 relay kit 117-515 http://www.mossmotors.com/Shop/ViewProducts.aspx?PlateIndexID=104070 $43
  - Advance Auto Wire 2 relay 4 fuse kit http://www.advanceautowire.com/ $95
- Ceramic Headlamp Harness Extension (to guard against overheat conditions caused by upgraded halogen bulbs)
  - http://www.amazon.ca/Vehicle-Ceramic-Female-Pre-wired-Socket/dp/B00JR5BCNI/ref=sr_1_9?ie=UTF8&qid=1418760185&sr=8-9&keywords=h4+ceramic
  - $6.35 per pair

MOORS GARAGES

Editors Note: Greg Moors is the current MGB Marque Co-ordinator for the MG Car Club of Toronto