

This essay is written for people who have never attempted anything like this before. Over the last several years I think I've made every mistake and lost or broken every part that possibly could be so. Outside a specialist workshop and in an industry geared towards the replacement module, the obvious things unfortunately are not always passed on. Hence the detail.

Enjoy.

*Jeff M<sup>c</sup>Carthy.*

## **Maintaining and Repairing the Lucas 16W Wiper Motor**

Unless the wiper motor on your car had been scrupulously maintained (and even then things wear out over 30 odd years) sooner or later the wipers won't park quite right or one or more of your speeds won't work. The units are robust and can easily be repaired and adjusted.

The first and most likely causes of failure (and the easiest things to fix) are the two plugs that go into the side and end of the wiper motor. The connectors are probably loose or corroded and/or the loom is pulling them away from the plug or the plug itself away from the motor. The next thing in importance is replacing old grease.

After that the parking switch probably needs adjusting. Beyond that is testing and replacement of the motor switches and/or the motor brushes if necessary. If after each stage problems persist at least the more minor causes have been eliminated and prevented from escalating. Next is testing the dashboard switch and then, and only then, the more expensive and complex control units located under the dashboard cover. For the 6W motor on early Shadows read this article in conjunction with a previous article by John Kilkenny in [Tee One #36](#)

### **BEFORE YOU START**

- 1- Turn off the wiper motor at the dash, turn off the ignition and remove the wiper fuse from the fuse box. Lift the wipers off the screen
- 2- Peg old pillow cases or cloths around underneath the motor. Every time you drop something it takes half an hour to find it down there - if you ever do. Own one or more magnetic pick up tools and a set of those long pliers with the bent angle ends you get cheaply at the 2-dollar shop. Have plenty of rags and small brushes.
- 3- Buy a spray can of [Electrical Clean and Grease](#). Jaycar sell it and it is marvellous not only for cleaning & protecting all the wiring plugs on the car but it makes re-inserting them and later removal very much easier. Also some cans of [compressed air](#) (Officeworks, it's used for cleaning keyboards).
- 4- Have on hand as well some small screwdrivers and sockets the following depending on the job:

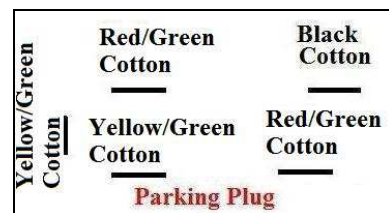
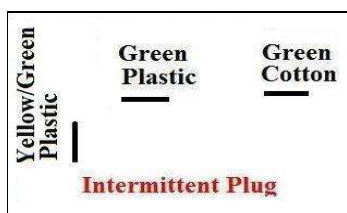
Grease	Small Allen keys	Electrical Spray/ WD40	Silicone
Masking Tape	Can of Compressed Air	7/16" circlip(s)	
Small cleaning Brushes	Tiny &/or 2BA – 4BA washers	3/4" & 7/16" spanners	

### **TO CHECK AND FIX THE PLUGS AND CONNECTORS**

- Spray a bit of the electrical contact spray straight into the plugs without removing them. Leave for a minute and then *gently* jiggle the wires to see if the connectors move.
- Turn on the wipers and then jiggle both plugs a bit more – if things stop and start there are loose or corroded connections. Turn the wipers off again.
- Remove the loom plugs, clean the plug on the motor (male) connectors, if they're really dirty *lightly* sand the pins. On the outer (loom) plug you can remove the female connectors using a very small jeweller's screwdriver or a special tool – be careful not to distort them. If they're corroded or bent replace them.

- Thoroughly clean the plug housings using degreaser if necessary. Dry & spray with Electrical grease.
- If the plug is loose put a small amount of silicone on the top outside of the loom plug. Use your judgement - you don't want to get it on the contacts &/or glue it permanently.
- If the loom is pulling on the plug use masking tape to hold the loom steady while the silicon sets and then re-position the loom securely. There are usually a couple of P-clips nearby. The important thing is that the connectors and the plugs don't move and that the loom doesn't pull on the plugs

**WATCHPOINT:** *When removing wires from plugs do it one at a time & make a note of each wire by colour & position. The Practical Wiring Diagrams in the Workshop Manual cannot help you. There were several motors & wiring colour schemes over a fairly long development towards the series II and/or the wiring may already have been tinkered with by a previous owner. Keep a record in several handy places. Think of the next time. Below are the colours and positions on SRH20280, my late 1974 Shadow series1 which appear to be original.*



- There is an adjusting screw for general speed. Labelled in the photo, it's a grub screw with either an Allen key or a slot-screw end. The larger nut is a retaining nut. It needs a 7/16 inch spanner. Loosen it and tighten the grub-screw all the way then back it off in 1/8<sup>th</sup> (*maximum*) turns.
- Tighten the retaining nut. The grub-screw touches the worm-gear end-on. It also keeps things in the motor from moving so don't over-loosen it. It can be removed for cleaning while the motor isn't turned on.
- If your wipers are parking just a little short of where they should be, an inch or so, undo the rack-nut with a 3/4" spanner and loosen the motor in the bracket. Move your wipers to where they should be and then tighten the motor in the bracket and tighten the 3/4" nut. Don't overdo this procedure as it's robbing distance from the other end of the travel arc.



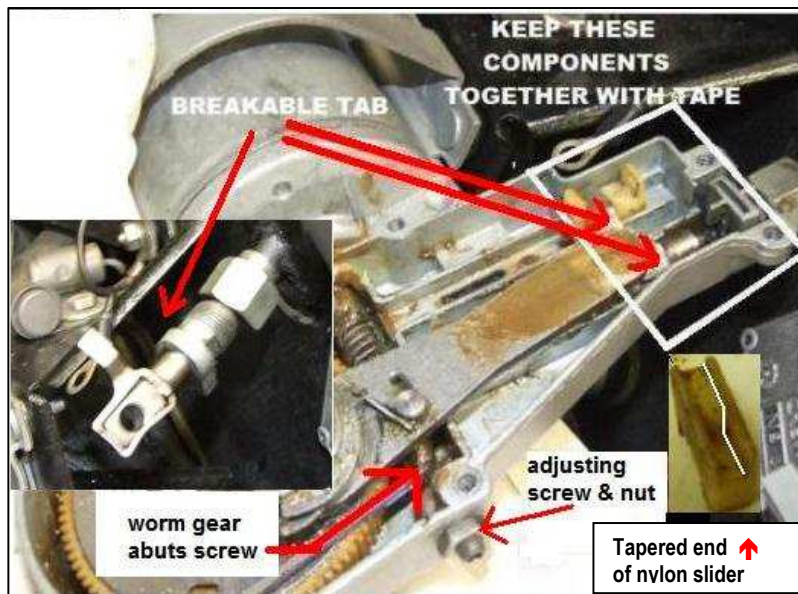
**Use the correct connectors.**  
**Lucar type 4.8mm with the locking tab. The tab is necessary or the connectors won't stay in the plug.**  
 Available [here](#) on eBay and elsewhere

### TO CHANGE THE GREASE

*The following is an easy regular maintenance method if you're not going to adjust the parking switch, change the brushes, or generally venture further. Otherwise read 'Replacing the Brushes' below.*

- Remove the 6 screws and 6 washers holding on the metal and plastic covers. When replacing use the washers and don't over tighten. The plastic might be brittle and crack.
- Without loosening the big (rack) nut at the windscreen end yet, tape around the pointy end with masking tape to keep these bits in position and to avoid having to replace the slide arm into the rack-end (under the end of the arm is a pin which descends into the rack end-joint). 'Rack' is the name of the cable connecting to the wiper arms.

- The little nylon slider may fall out. Look underneath. It has a blunt end and a tapered end. The tapered end goes toward the pin & the blunt towards the cogwheel. **This is important or the nylon switch-pin underneath it will snap!** Gently lift the rack & arm just enough to angle it back under. Don't lift by the tab & don't bend the tab. *See photo inset on lower right below*
- N.B. the earth connection wire at the top of the triangular metal lid – don't forget to screw it back. I wrap a piece of red electrical tape there to remind me when I'm finished.
- Without disturbing anything much use small non-shedding rag strips to clean under the cog and slider arm and around the worm gear. Skewers, tooth picks, old toothbrushes all come in handy but don't leave any bits of them behind!
- Use a toothbrush soaked in electrical spray grease or WD40 on the cog-wheel gears. Blast it out with compressed air. Repeat till clean.
- Be aware that there are two switches underneath so use a little bit of electrical spray grease or WD40 to loosen the old grease but don't drown it unless really necessary for rock-hard grease.
- Replace with fresh grease especially in the corners near the worm drive and be careful to get it in and around the slide pin under the slide arm. Use a piece of flexible plastic to get under and right up to the centre of the cog as well.



**WATCHPOINT:** The weakest point in this otherwise robust mechanism is the linkage between the slide arm and the rack. The end of the rack has a small stainless tab, spot-welded to the end, which in turn slides a small nylon slider beside it. The tab and its joining ring very easily break at all points. **DO NOT PUT ANY PRESSURE ON OR TWIST ANY PART OF THIS TAB OR THE SMALL FRAME WHICH ATTACHES IT TO THE RACK!** Tape the section in the photo to prevent it all coming loose. For simple regreasing it isn't necessary to disassemble this section.

- Put a dab on *top* of the end of the slider-arm – there's a depression groove in the metal cover it rides against. Don't over tighten the cover when replacing but it shouldn't flex loosely either.
- Grease the cog gear assembly. I used lithium grease on this pile of cams/gears/springs on top of the gear cog. Bike chain grease is probably also good. Use a small bit of general purpose grease as well. Depends how often you're likely to take the lid off and check it's well lubricated.

**WATCHPOINT:** DON'T REMOVE THE CIRCLIP ON TOP OF THE COGWHEEL ASSEMBLY !! It's almost impossible to re-assemble correctly and is the *least* likely part to be out of whack or broken. The manual has drawings of the assembly. They are of academic interest only unless you're a 3-D chessmaster. If the cogwheel is broken you'll need a new one and it must then be absolutely the correct one.

- Remove the tape and replace the metal lid. Reconnect the earth strap. Finger tighten the 3/4" nut and firm up (just!) with the spanner. Lastly put a dab of grease under the housing where the cog-wheel downward shaft is held on with a washer and a circlip. It can't be seen from above but they spin around. Reconnect power, check all the bits are in place and the whole motor is secure and test.
- This is a good time to also oil the wheel box spindles as outlined in [Tee One #43](#)
- If it all works note the current date on the lid with a 'permanent' marker or a paper label as a reminder to re-grease and re-check connectors every year or two. Don't wait till it fails.

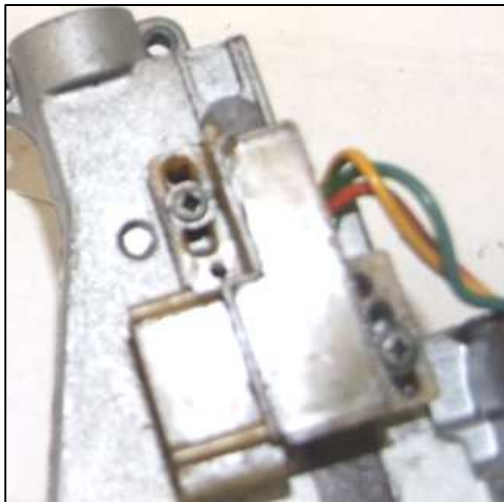
### TO ADJUST THE PARKING SWITCH

- Lift the wipers off the windscreen. Place a cloth under and around the motor
- The motor housing comes out of the bracket by undoing the screw on the bracket. The nut underneath is the bastard nut on this job. The bracket is sprung and this square nut will fly away without some care. My way of dealing with it is shown at right:



With about 8 inches of fencing (or coathanger) wire. Wrap loosely once around a piece of about 1 inch pipe. Put the loop in a vice and twist the ends together with pliers. It should slip over the end of the bolt underneath the bracket and over the 2 arms but hang just low enough to be above the bottom end of the bolt. Re-adjust the twist in the vice till you get it right. Snip off the ends of the twist. This arrangement will stop the arms springing apart and should be removed after you've finished the job. Putting the bolt back is also easier, without it you need three hands, one each to hold the bracket, the nut & the screwdriver

- Fully undo the large 3/4" nut on the rack. Don't remove the metal or plastic covers.



- Slide the motor out of the bracket – which can be pulled somewhat further apart without damage - and turn the whole housing away from you so the Park Switch is visible. Mark the Switch's position (at the cogwheel end) with masking tape.

- Hold the switch tight against the housing. Loosen but don't remove the 2 screws holding the switch. There are 2 pieces of metal behind it; one about 2 inches long with a hole for the pin and a small spacer underneath that one towards the windscreen end. Easy enough to re-fit (but fiddly) if they slip out.

- If the wipers are parking too high (the usual case) slide the switch about 1/8th inch towards the windscreen. Tighten the screws. Remember they are threaded into the

soft housing so don't strip the thread! If they have no washers on them the screws should be removed and the washers replaced to prevent the switch wandering.

- Re-assemble and test for Park. It will either have improved or you'll have lost the parking sequence altogether. In the latter case the switch has been moved too far and needs to come back a bit. There are no shortcuts here - it's trial and error.

- When it's all parking satisfactorily remove the position tape and scribe a small line marking the new position for future reference. Replace the motor in the bracket and tighten the 3/4" nut to finger tight then *just* firm with the spanner. Replace the bracket screw and remove the fencing wire. Test with wipers off the screen and then put them onto the screen to see their position.

## FIXING ONE OR MORE SPEEDS WHICH DON'T WORK

### -Testing and replacing the two motor switches

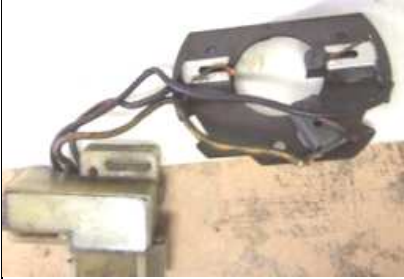
- After turning off the wipers, lifting them from the screen and placing drop cloths around the motor remove it from the bracket and turn so the base is visible.
- At the base of the cog-wheel is the shaft on which it spins. There is a 7/16" circlip and a washer holding it there. Remove the circlip with very fine pointed electrical or circlip pliers. I put a dab of grease on it so it sticks to the cloth if it jumps off.
- Put the circlip and the washer together in a small plastic baggie or similar - the washer is very specific to here. If you lose the circlip it can be replaced with a 7/16" new one.
- Turn the motor over and undo the 3/4" nut on the rack. Undo the covers.
- Push the cog upwards by the spindle. It's probably stuck in the rack terminal by dried old grease.
- Use a screwdriver to lever it out. BUT - the point of the screwdriver must **not** pivot on any part of the tab or its frame! Use a gentle rocking motion to separate them
- Remove the cog-wheel from the unit and keep the thin domed washer from under the cog-wheel in the bag with the circlip and first washer. This washer is *really* difficult to replace if lost.
- You can now remove the switches to test if they're working. On the Park switch the black cotton brings power and transfers it to either the red/green or yellow/green set of wires depending on whether the button is depressed or not. I use a cheap little continuity tester because it's simple and fast.
- On the Intermittent switch the yellow/green has power and sends it to either/or the other two wires. Notice this one is mounted from above i.e. underneath the cog-wheel. Remember this *before* replacing the cog-wheel. Under the cog wheel is a small cam bump; this presses the button once each turn sending a pulse to the control units under the dash. Read below if you do need a new wheel (unlikely).
- New switches/parts are available from the UK & USA. Specify exact parts before ordering as there are variations - earlier motors having only two wires. Suppliers and Repairers listed below. Spare cog-wheels require buying a second-hand or new wheel with the **exact** specs: *the same degree and with the cam bump underneath!*

Steve Hunt restores motors and sells parts. BCP USA restores motors. Replacement Parts & Stafford UK sell parts	
<b>Steve Hunt</b> UK	<a href="http://stores.ebay.com.au/tankard03/Wiper-Motors-/i.html?_fsub=1529364016">http://stores.ebay.com.au/tankard03/Wiper-Motors-/i.html?_fsub=1529364016</a>
<b>Stafford Vehicle Components</b> UK	<a href="http://www.s-v-c.co.uk/category/wiper-systems-and-parts/">http://www.s-v-c.co.uk/category/wiper-systems-and-parts/</a>
<b>Replacement Parts</b> USA	<a href="http://www.replacementpartsinc.com/servlet/StoreFront">http://www.replacementpartsinc.com/servlet/StoreFront</a>
<b>British Car Parts</b> USA	<a href="http://www.british-car-part-restoration.com/lucas_wiper_motors.html">http://www.british-car-part-restoration.com/lucas_wiper_motors.html</a>

### -Replacing the brushes

- Prepare a part of the bench with a white cloth on it to lay out the parts in order. Ensure there are no small metal washers, screws, Allen-keys, scrap bits and *especially* no metal filings or dust within several meters of the workspace. *One small piece of misplaced metal in the housing or armature will destroy the motor* The magnets are very strong.
- Don't remove the armature from the magnetised housing until just before you're ready to clean it.
- If you prefer not to do this job yourself, every city has businesses which restore small electric motors or perhaps ask an auto-electrician. It's safer & cheaper though to source your own parts for them. Except for brushes, which they can often cut to size, they're unlikely to have the parts on hand.

Replacing the original brushes requires quite fine soldering skills. However, with a nominal rating of 14W (a more common motor) Stafford UK have assured me (by telephone) that their standard replacement unit is for all 14W, 15W and 16W motors and has been successfully used by both Shadow and Jaguar owners. Note that the new wire colours might not match exactly. So use the original...



...as a template to connect the correct switch wire to the correct brush. Either solder or use connectors - the one positive of the latter being it gives a test point in the circuit without disassembling the motor to check the brushes. The downside, of course, is more joins to break or corrode.

- Having first removed the cogwheel, undo the 2 bolts at the rear of the round motor housing. And remove them. The housing with the armature and worm drive should slide out together. Place aside in a clean metal-free place. **Take care when it is removed that the 3 springs behind the small carbon brushes don't fly away.**
- The brush holder is held in place by 3 screws. Note the way the wires are tucked around it and remove. There is a star shaped flat washer left in the body which holds in an olive shaped washer. It is not necessary to remove these even to clean them.
- Clean up the body and if you're so inclined paint it with POR15 Brilliant Aluminium and bake in a 180C degree oven or else use a heat gun.
- Either replace the brushes or the unit and connect to the parking switch under the body. Take care to keep and use the small rubber grommet and switch cover (*see photo below*).
- Have ready some rags, grease, WD40 or Electrical grease and compressed air and remove the armature from the housing. It is extremely important not to lose the tiny ball bearing in the end of the armature pin.
- Inspect the housing and remove any loose rust and detritus. Give it a generous spray with WD40 etc. and then wipe out all the excess leaving only the thinnest coating on the steel parts and as little as possible on the actual magnets.
- Use the compressed air to clean the armature.
- Put a small dab of grease on the ball bearing – enough to make it stick but not enough to fly off and get into the housing or armature. Replace the armature in the housing for now and check that the ball bearing isn't loose – The housing will grab the armature with some force.
- If you paint the outside of the motor housing the original colour is Hammertone grey metal finish. Hammerite is too light if you're a *concoours* purist. I used it and then misted it with black from a distance on the final coat. Basically it's a charcoal colour. Wrap some masking tape around a couple of cotton-buds (Q-tips) and insert to block off the bolt holes and a Glad bag to protect the armature. Notice the small scribe mark on the outside of the housing and make a similar mark on the inside of the housing so you don't lose its position when you paint !
- To reassemble get a couple of bamboo skewers. Remove the armature from the housing, check the tiny ball-bearing is firmly in place with grease then re-insert the worm-drive through the brush-holder.

Use the skewers to gently push back the brushes so you can get the commutator centred in them. This is a bit fiddly and usually takes a few tries.

□ Once the brushes are seated, place the skewers across the commutator so that when you put the motor housing back on there will be a small gap. .



□ Grab the worm gear very firmly and replace the housing – it will jump on to the armature and if you're not holding the gear tightly the commutator will pull out of the brushes.

□ Replace the housing using the scribe mark to locate the top of the motor housing with the top of the gear housing and re-insert the long bolts using the small gap under the skewers to locate them into their threads. When tight remove the skewers and screw home. Reassemble the entire unit ensuring that all the washers on the gear-wheel are correctly placed, the top domed washer on the cogwheel points downward.

□ Replace the motor to test.

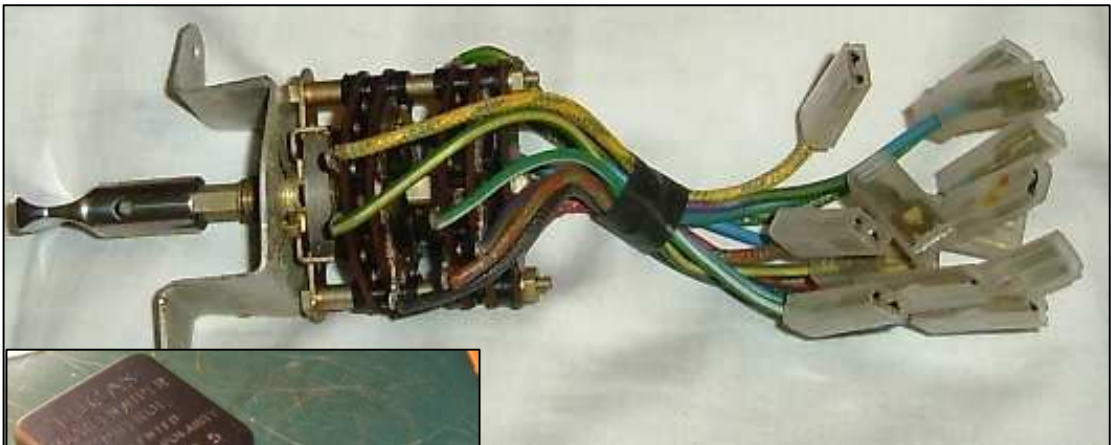
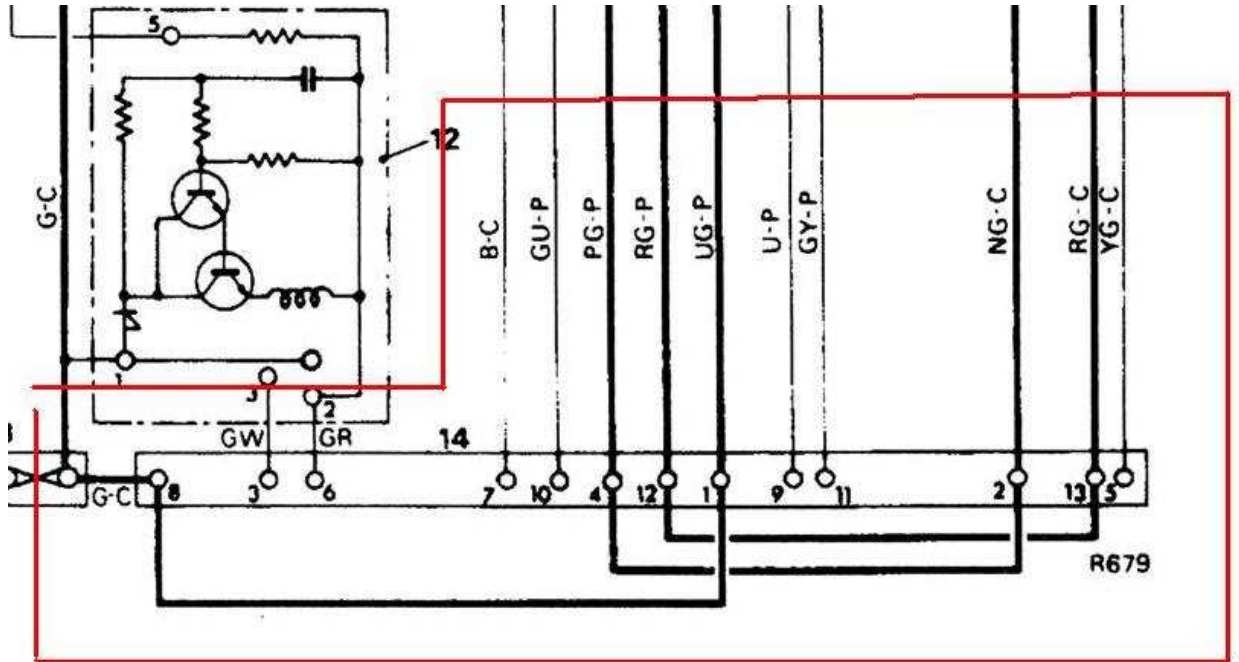
### FURTHER PROBLEMS

□ If the wipers continue to be slow and the wiper spindles have already been oiled it might be necessary to clean and grease the wiper boxes. These are difficult to access but there is a [useful discussion on the RROCA forum](#). Hopefully someone who has done this will outline the entire procedure there soon. If you're reading this could I make an appeal now: Please?

□ The next thing to do is to test the continuity of the wires from the motor to the switch and the control boxes. The loom wires are unlikely to be broken but, after removing the top roll, check and clean the connections to the switch then test the contacts on the switch for continuity. The procedures for testing for various faults are on [page M71 of the Workshop Manual](#). While reading the diagrams in this section takes a bit of learning, doing so pays a substantial dividend. The fault diagnosis instructions number the positions on the switch to test – unfortunately there are no numbers on the switch itself so go by wire colours and the diagram below.

□ The important thing for now is the wiring colour notation. GY-P for example is Green/Yellow Plastic and BC is Black Cotton. Except for N=Brown and U=Blue they use the initial letter of the colour name. GW is Green/White and GR is Green/Red. There are 13 of them.

**WIRING SWITCH** – outlined in red



*Dashboard Switch- above. Control Box- left*

- Finally, to access the 2 control boxes involves removing the relay board in the centre of the dashboard. It is held on by 2 bolts and nuts at the rear top. If you do this it is imperative to mark the position of each box (left/right) and to label and/or photograph which wire goes on which pin. My camera is on holidays at the moment so I'll post on the forum if anyone asks – it's really quite straightforward though.
- These boxes can be repaired by people who do radio type electronics or replaced from places like Flying Spares and Introcar. If there are any further questions or corrections to anything above please contact me via the forum. *Jeff*