Gearbox and Overdrive

Last updated 04-Jan-2012

NEW NEW NEW **The sectioned MGB at the Heritage Motor Centre Museum, Gaydon** NEW NEW NEW

Auto Kickdown Cable *Added December 2008*

André Wilding contacted me to ask if I could offer any advice in changing the kick-down cable, as the gearbox end seems to be concealed inside the gearbox, and where it goes in is concealed by the tunnel! I have no personal experience of changing one of these cables, but from the diagrams and descriptions in the workshop manual it appeared that the pan might have to be removed, which would mean draining the fluid first of course. Using that bit of information André took the plunge, and subsequently wrote back to me with the following:

> "You have to drop the pan because the cable end fixes into a cam in the gearbox and there is no other way to get to it.
>
> "The 'cut-out' modification in the transmission tunnel is essential for getting to the screw in part of the cable where it goes into the gear box. Without it I think you would have to take out the gearbox etc. Even with it, it is a pig to get at and takes ages to screw in tight! Also, the hole is handy for getting at the reverse switch if something happens to it.
>
> "Apart from that - it's an easy job!"

D and LH Type Differences

There are both ratio and electrical differences between the early and later ODs fitted to the MGB. The earlier D type has an OD 3rd ratio that is closer to 4th than the LH type - 73% as opposed to 65%. Thus the LH type has closer to a '3rd and a half' ratio than the D type, but both offer a useful mid-way point between 3rd and 4th for spirited twisty bits or a long steepish climb. The LH also has a higher OD 4th ratio that the engine is well capable of pulling, giving even more relaxed touring.

The D type is not as strong as the LH and has vacuum switch and relay to prevent the driver from disengaging OD under certain conditions - high revs and no throttle - which could overstress the unit. The wiring and a description of this circuit can be found here.

Updated August 2010: There were two types of LH OD - chrome bumper cars had a black Laycock label, and rubber bumper cars a blue. The main significant difference is in the speedo drive, the black label give 1240 turns per mile and the blue 1000, which will give a very significant difference in speedo readings with the wrong combination (speedo dials have the tpm stencilled on them).

Electrical Diagnosis For the location of the lockout switches click here.

UK 4-cylinder cars always had OD on 3rd and 4th. North American spec cars originally had OD on 3rd and 4th, changing to 4th gear only in Feb 1977 (possibly because of unreliability of one of the gearbox switches). V8s originally had OD on 3rd and 4th, changing to 4th gear only (to prevent damage to the OD unit) at car number 1404 around Feb 1974. However it seems that many cars were retrospectively modified by dealers as examples of 3rd gear OD are virtually unknown.

Schematics:

- D type
- LH type without ignition relay
- LH type with ignition relay - UK
- LH type with ignition relay - North America

As the overdrive solenoid contains moving parts you might be tempted to connect 12v to it and see if you can hear it clicking, like you might a relay.

D-type:

The earlier D-type unit has a relay and vacuum switch as well as the manual and gearbox switches. The manual switch and vacuum switch just operate the relay and it is the relay that operates the solenoid, so you will have to check both circuits if the OD isn't working. On the D-type you **should** be able to hear both the relay and the solenoid clicking as you connect and disconnect power with the car stationary, so you will have to differentiate between them. The D-type solenoid has a two-part winding and contact - a low resistance/high current (0.7 ohms/17 amps) 'pull in' winding, which when the solenoid has moved so far opens a contact which leaves just a high resistance/low current (6 ohms/2 amps) 'hold in' winding energised. There is an adjustment provided to make sure this contact opens when it should, if it doesn't the solenoid will almost certainly overheat and could burn out. To check this, remove the cover plate by the solenoid (three bolts). With the ignition on, 4th gear selected, and OD switched on, the solenoid should move a lever. This lever has a hole near the solenoid spindle, and another hole in the casting behind it. With the solenoid correctly adjusted a 3/16" bar should pass through the hole in the lever into the hole in the casting. If it does not, adjust the self-locking nut on the end of the solenoid spindle (holding the spindle by the two flats machined in its shank) so that it does.

To measure the current through the **solenoid**, as opposed to the relay, you will have to insert the ammeter either in the single white where it joins the one relay contact, or in the two yellow/reds where they leave the other relay contact. Be aware that there is no fusing in this circuit, so anything shorting to earth/ground may well damage the harnesses.

LH-type:

On the later LH-type you probably **won't** hear anything operating at a standstill. When applying power to the solenoid the moving part tries to moves towards the middle of the coil, pressing a ball-bearing against the end of a nozzle to block oil flow. This causes the pressure in the system to rise which engages OD. When power is disconnected with the car running the moving part only moves very slightly away from the ball-bearing and nozzle under oil pressure. With the car stationary there will be no oil pressure, and whilst you may hear a faint click the first time the solenoid is energised, on being de-energised it won't move back (no oil pressure) and so when energised again it won't move at all and so won't make a noise. However you can use an ammeter, test-lamp or voltmeter to test the circuit and prove its continuity. An ammeter is best as it will show the actual current flowing in the circuit and indicate any bad connections (causing a lower than expected current and possible non-operation) as well as a complete disconnection. A voltmeter and maybe a test-lamp will only indicate a disconnection, they can't differentiate between good and bad (unless very bad) connections, and they won't reveal at all an electrical fault inside the solenoid.

If you have the manual switch on the dash or column then find the bullet connector where the yellow in the main loom joins the yellow/red in the gearbox loom at the back of the right-hand inner wing. For a car with the manual switch on the gear lever look for white/browns in that position. Part the connector and insert the ammeter in the circuit. With the ignition on and manual switches on and the gearbox in an overdrive gear you should see a current of about 800 milliamps, equating to a solenoid resistance of about 15 ohms. If using a test-lamp or meter then with the ignition off and the manual switch off poke the probe of the test-lamp or meter in the connector and the other connection to a 12v supply e.g. the purple (which is fused and hence safer than the brown) at the fusebox. By putting the gear lever into an overdrive gear the test-lamp should glow/meter register 12v which indicates electrical continuity through the gearbox loom, gearbox switch (and manual switch when on the gear-lever) and solenoid. Now connect the flying lead of the test-lamp or meter to ground instead of 12v, and with the manual switch and ignition both on it should glow/register with the gearbox both in and out of an overdrive gear. If it only glows/registers when the gearbox is **out** of an overdrive gear then a bad connection back towards the ignition is indicated, including the manual switch where this is on the dash or column.

Updated September 2010: If the problem is intermittent, i.e. the OD drops out only after driving for a while, and the static tests indicate a normal current of 800mA, then you can either do the tests indicated above hoping that it doesn't 'repair' itself whilst doing them, or do something a bit more reliable. That is to wire the ammeter into the circuit semi-permanently, have the instrument in the cabin, then go for a drive. At a normal running voltage of about 14v the current should be closer to 1 amp. When OD drops out glance at the ammeter, and if that has dropped significantly then you do at least know the problem is electrical.

Note that if the static tests show significantly **less** than 800mA, then even though OD may work when cold, there may be insufficient current flowing when things get warmer for the solenoid to do its job. However in this case I'd expect OD to go from being engaged, to drifting in and out of engagement, before it disengages altogether.

In either of the above cases at this point you will need to start working through the circuit with a **volt**meter. If you have a break or a high-resistance connection somewhere in the circuit, then on the 12v supply side of that fault you will see 12v, but on the solenoid side you will see significantly lower than that or no voltage at all. Start at the main harness to gearbox harness connection as that is in the middle of the chain on most cars. Ideally you need the ammeter still in the circuit so you can confirm the fault is still present while doing your voltage tests, but that will need a second instrument, although you should be able get away with a test-lamp. With your voltmeter or test-lamp test between the connector and a known good earth i.e. the engine, if you see a full 12v, and the ammeter is still indicating low or no current, then the fault lies closer to the gearbox. If the voltmeter or test-lamp shows no or low voltage, then the fault lies back towards the 12v supply.

In the former case the next point in the chain is the gearbox switch, which is going to be awkward to get to, especially as the fault may 'repair' itself while you are getting at the switch. In that case I would run a wire up from the gearbox switch to a voltmeter sitting in the cabin, and again go for a drive. If that shows a dropping voltage when OD drops out, then the problem lies back towards the connector by the fusebox, if it doesn't then then it lies closer to the solenoid. Depending on what year and market your car is there could be the gearbox and manual switch connections down there, several bullet connections, as well as the final connection to the wire going into the solenoid (see the schematics). If this last shows no drop in voltage when the OD drops out, but the current test still shows a drop, then the problem is either inside the solenoid, or its connection to earth. You may find a dry joint where the wire connects to the winding, but I think the earth connection is simply a pressure connection between two bits of metal, probably from the end cover that retains it.

If the fault lies back towards the supply then it could be the manual switch itself, its spade (dash switch) or multi-plug (column switch) connections, test each of these in turn. Remember to test the back of each bullet as well as the metal sleeve of bullet connectors, both sides of the multi-plug connector, and the wiring connectors as well the spades on both sides of the switches. If you find you have voltage on one spade of the switch, but not the other, then the switch itself is faulty. If you find you have voltage on a spade but not the wiring connector that is on that spade, then the connection between the two is faulty, however this is likely to be disturbed by prodding it and may 'repair' itself there and then.

Remember, all connections must be made (via an ammeter if appropriate), ignition on, manual switch operated, gearbox in an OD gear

for voltage tests to be valid. If you have an ammeter in circuit that must also be showing reduced or zero current for the voltage tests to be valid. If the ammeter shows a normal current i.e. 800mA then there is no point doing voltage tests, as **ELECTRICALLY** the circuit is working as it should. Finally, if the ammeter is still showing about an amp when the OD drops out, then the problem isn't electrical, but is mechanical or hydraulic, which is a whole different ball-game.

Resistance measurements through switched circuits can be unreliable. Most ohm-meters only pass a microscopic current through the circuit, and where switches are involved this can sometimes not be enough to 'burn' through the oxide film that can develop on the switch contacts if they have not been used for a while, and instead of showing zero resistance as you would expect you will see a resistance possibly in the tens of ohms indicated. This may lead you to think the switch is faulty and go through the cost and aggro of changing it whereas passing the real-world current through the circuit will show no or negligible volt-drop across the switch which is the only valid test. Resistance measurements of **components** though, like the solenoid itself, are valid.

If all that is OK any problems are likely to be hydraulic or mechanical. The first step in diagnosing **that** should be a pressure gauge on the OD, which should show 400 to 420psi with OD engaged, zero when disengaged. This will obviously need the engine and gearbox to be run with the rear wheels off the ground, handbrake off, **and the car very safely supported**. Remember to switch OD in and out when doing a pressure test as you will need to note from the spinning of the wheels whether OD is actually engaged when the pressure shows it should be, this will be easier with just one wheel raised and the other on the ground. If the problem is that OD drops out after driving for a while then it will need to be run like this for an equivalent time to allow the fault to develop. Insufficient pressure indicates pump or relief valve problems, or dirt in the passageways, correct pressure but OD not engaging indicates problems with the actuator pistons, again dirt in hydraulic passageways feeding them, or the sliding member (list not exhaustive, only indicative).

Interlocking Arm Assembly *Added July 2010*

Stephen Stringer wrote to me while changing his 3-synch non-OD to OD. He had to obtain parts to build the OD gearbox up but couldn't find an Interlocking Arm Assembly. The 3-synch non-OD item is very different, the 4-synch looks similar and although it drops in the gears wouldn't select. As they selected with it **not** fitted Stephen was wondering whether he could leave it out, or if I could point him at a source for one. I don't know exactly what this part does but the word 'interlock' makes me think it is something to do with preventing two gears being engaged at once under certain conditions, which would be catastrophic. The part also seems to be NLA. Unusually the 'official' Workshop Manual and Parts Catalogues weren't that helpful as they didn't show both 3-synch and 4-synch for comparison (and in any case are only drawings i.e. only representative) and Haynes was the best source with a couple of

photos that showed the part. From these I reckoned that a 4-synch could be made to fit, and Stephen subsequently reported that this was indeed the case. He says: "It's a simple mod, cut the mounting flange along the bend, move the cut off part back 4mm and reweld, that's it."

Mounts and Cross-member *Added January 2011*

Michael Beswick tackles replacement of the gearbox mounts on his 69/70 and has documented in great detail the trials and tribulations at getting at all the nuts and bolts, and making the oft-discussed moddification to the crossmember to make the job easier. I've appended information on what mounting arrangements were used when, and the importance of the **front** mount control brackets on Mk2 chrome bumper cars.

Oil Change

The most important thing to be aware of is the oil to use. Whilst the minimum performance level quoted by BL is the same for both gearbox and rear axle of the V8, when it names individual manufacturers products there is a difference. Whilst both V8 gearbox and rear axle oils are typically based on 90wt, the V8 gearbox contains EP whilst the rear axles contain a higher pressure hypoid variant. For example and quoting just two, the Workshop Manual specifies Castrol Hypoy or Esso GP 90/140 for the gearbox, but for the rear axle it specifies Castrol Hypoy B90 or Esso GX 90/140. None of the recommended products seem to be available still, unsurprisingly, and in fact I could only find Castrol products. These are labelled a bit more clearly these days, as 'EP-90 Manual Transmission Fluid' for the V8 gearbox and 'EPX 80W-90 Differential Oil' for the rear axle in both V8 and 4-cylinder cars. Note that the 4-cylinder gearbox and overdrive takes engine oil of the same grade as for the engine e.g. 20W/50. The 3-synch gearbox takes 4.5 Imperial pints, 2.56 litres, 5.6 US pints and the 3-synch gearbox plus OD takes 5.33 Imperial pints, 3.36 litres, 6 US pints. The 4-synch gearbox takes 5.25 Imperial pints, 3 litres, 7 US pints and the 4-synch gearbox and OD takes 6 Imperial pints, 3.4 litres, 7 US pints. Note these are for clean and dry gearboxes, a drain and refill can be expected to take a little less than that as some oil is bound to be left behind.

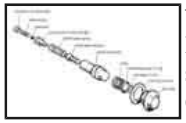
Take the car for a run of 10 miles or so to warm things up and allow the old oil to run out a little easier, especially the gear oil in the V8. **Make sure** you can remove the filler/level plug or dipstick before draining the oil. You can live with not changing the oil for a bit while you ponder how to shift it, but not if you have already drained the oil and can't refill it. I had the front of the car up on ramps and the rear on axle stands so I could do both gearbox and rear axle together, and the car was relatively level making refilling with the correct quantity easier.

The drain plugs (I did both cars) came undone easy enough, although I found a 3/4" spanner and socket were just a bit too big for the roadster (fine for the V8) so used an 18mm socket instead, and left that to drain while I got on with refilling the diff. The

drain plug on the roadster (didn't notice on the V8) is hollowed out and although at first it didn't look like there were any bits in the hollow when I stuck a screwdriver in there I did get some bits out. The largest was about 1mm in size, the rest much less than that, I suppose it is inevitable in a manual gearbox but I'd rather not have seen it.

When the dripping had slowed I replaced the drain plug and started on the OD sump/filter. The bolts came undone easily, slackening each bit by bit like head bolts/nuts to avoid the chance of warping. Free the sump with at least two of the bolts on opposite sides or ends still loosely fitted so it doesn't fall away all at once. I had to use a bit of gentle leverage to get the sump parted from the OD body, there is a handy tab on the sump adjacent to the large hex plug for the relief valve expressly for this purpose, it seems. Be ready for more oil to drain out once you have broken the sump seal, quite a bit more comes out here, I left that to drain rather than try getting the sump completely off at that point and fill my sleeves with oil. With the sump off the V8 there was a slight tear in the gasket/filter across the middle bar so I decided to replace it, I had bought one at Stoneleigh last month. The old one took quite a bit of scraping to get off the sump, in hindsight it would probably have been OK to put back as the outer ring was fine. The filter and sump were as clean as a whistle, but got a wash in petrol anyway. The roadster sump came off without any tearing of the gasket, and I decided to leave it stuck to the sump and not clean underneath as any bits should have been on top of the screen. The little specks in this photo are globules of oil or petrol, not bits as I first thought. Touching the screen made some vanish and other appear. I did pour some petrol into the sump through the screen, gave it a good swill and poured it out again, hopefully that should have washed out any fine sludge, it looked clean enough in there from peering through the screen.

The hex plug for the relief valves also came free easily, a little more oil draining out. Be careful not to lose the little O-ring between it and the valve or any of the other bits inside. Whereas on the roadster it was in a groove in the end of the hex plug and didn't come free in washing, on the V8 as I recall it was loose on top of the hex plug i.e. there was no groove. Careful teasing with a pair of long-nosed pliers got the cylindrical filter out together with the valve assembly. Quite a few bits involved here (13 on the roadster!) so be careful to note what order you find them in and not to lose any.



Whereas the V8 was similar to the drawing in the Workshop Manual the roadster seemed a bit different having a very coarse screen round the upper part of the valve which isn't shown in the drawing, and a large spring above the valve plunger which is shown much smaller in the drawing. I didn't find any of the 'valve ball, valve spring or low pressure valve plug' on either car. The larger O-ring should be in the groove in the relief valve body so shouldn't come free. The roadster had three shims between the valve plunger and the spring (not shown in the manuals), presumably to set the hydraulic pressure, I didn't find any on the V8.

While you are away from the car put a clean empty container under the OD to catch any bits (e.g. the 'valve ball, valve spring or low pressure valve plug' which I didn't find) as they might be there and fall out as the OD cools. If you don't they might roll away or not be noticed on a driveway until too late. Again the filter and valve components were as clean as a whistle, but got rinsed in petrol before replacement in the correct order. On the V8 the new OD sump gasket got a smear of Hermetite Red (non-setting) on both sides, I tightened the sump bolts bit by bit in a logical sequence to avoid warping. I haven't seen a specific torque figure for these bolts, but the standard figure for 1/4" UNC/UNF is 6-7 ft.lb. (8-10 NM) so I wouldn't go above that or you could strip the threads or warp the sump. On the roadster I just put the sump and gasket/filter back as it came off, no Hermetite this time, we shall see if it leaks or not.

There have been two questions recently about where to find the chrome bumper dipstick and filler, so here they are. Note the access hole and rubber bung were still fitted to rubber bumper cars, and I found that the easiest way to refill the V8, with the tubing down through the access hole and into the side-fill hole.

Whilst side-fill is easy to clean around the filler hole and get the end of the tubing into it without picking up any dirt, top-fill needs a bit more care. I loosely inserted the dip-stick to stop any dirt falling in, then from underneath wiped round the dipstick and the top of the casing. I'd seen recommendations to use a long length of plastic tubing up from the filler hole (top or side) into the engine compartment so one can refill in relative comfort, but opted to do the V8 from the right-hand footwell instead. I used a short length of tubing just smaller than the filler hole via the grommet hole in the transmission tunnel (although originally for the dipstick/filler hole on chrome bumper cars it is present on all cars) even though it is a side-fill gearbox. The gear oil for the V8 gearbox comes in 1 litre squeezy bottles and the nozzle of these fitted neatly into the end of the plastic tubing, and I had enough room to empty each bottle in turn even with the steering column on that side of RHD cars. The 4-cylinder uses engine oil in the gearbox and OD, the 1-litre bottles of this don't have the nozzle like the gear and diff oil bottle do, so you will need a funnel in the end of the tubing for either 1-litre bottle or 5-litre can. I also did the roadster from the footwell and rather than try to wield a 5-litre can in the limited space decanted 1 litre at a time into an empty diff oil bottle so I could use the same method as for the V8. Squeeze for a few moments then release and wait a couple of seconds, and the oil in the tube will drain down and air come back up to replace it and expand the bottle again. Much easier than trying to squeeze a litre in all in one go.

It will take time for the oil to flow everywhere so don't pour in the whole of the recommended amount in one go or it will probably overflow. Even though a dry-fill takes 3.4 litres in the roadster I found that even after 2 litres I was having to pull the tube up a little bit to get any air back up the tube into the bottle. Testing with the dip-stick showed it was just above the MIN mark even through there wasn't much more than half the quantity in yet. With the V8 I was able to get about 2.5 litres in

without the same effect, for some reason. At this point I ran the engine on both cars in 3rd and 4th (I had the rear of the car raised to do the rear axles as well, remember) switching OD in and out to distribute the oil. While the V8 was fine OD on the roadster wouldn't engage, which concerned me a bit. However when I removed the tube and checked again with the dipstick it was now off the bottom. I put another litre in (making 3 litres so far) and tried again, this time it was OK - phew! **MAKE SURE** it is supported safely, don't be underneath the car with the engine running, and make sure there is some run-off room in front of the car. Recheck the level and top-off as required, then replace the filler plug/dipstick and check the drain plug is tight before taking it for a run of a few miles. On your return check the level again on a flat and level surface, and check it again when cold after leaving it overnight, rechecking the drain and level/filler plugs are tight. After the next decent run check the level and the plugs again to give you confidence there are no leaks, then you should be fine to leave it the normal service intervals.

Overdrive Fusing

As with the Fuel Pump it is a good idea to fuse the overdrive circuit to avoid loom damage or total loss of the car to a fire if the wire or overdrive should short out. Later models with the manual overdrive switch on the gearlever are particularly vulnerable because the continual flexing of the wires at the lever due to gearchanging.

For cars with the manual switch on the dashboard it is best to make up an in-line fuse with a male spade on one end and a female on the other, then simply pull one spade off the switch and put the male end of the new fuse in that, and the female end of the new fuse back on the switch. Either wire will do, but logic dictates the earlier in the circuit the better, i.e. in the white.

For cars with the manual switch on the column you will would have to cut one of the wires and crimp/solder male and female spades or bullets onto the cut ends if you want the fuse to be as early in the circuit as possible. Note that some years have **two** white wires coming out of the main harness and going to the plug that feeds the overdrive switch, so unless you put the fuse in the yellow wire you would have to cut and connect **both** whites. If you put the fuse on the switch-side of the multi-way plug there is only one white (and yellow) in all cases, but you would have to redo the mod if replacing the column switch assembly. However I don't like cutting into wiring so on my V8 I have inserted the fuse at the bullets where the gearbox harness joins the main harness near the fusebox.

For UK cars with the gearlever manual switch you have to insert the fuse in the **brown/white** wire by the bullet connectors between the main loom and gearbox loom as above.

For North American cars with the gearlever manual switch there is a double-connector with one white wire from the inertia switch, a white to the fuel pump, and a white/brown to the overdrive switch. I suspect this double-connector is with the

others where the firewall and RH inner wing join, but I am not certain. To just fuse the overdrive insert it in the white/brown wire. But while you are at it you could fuse both the fuel pump **and** the overdrive it you insert it in the white from the inertia switch. If the inertia switch has spade connectors you could insert it here (using male and female spades on the in-line fuse instead of bullets).

Personally I would use a standard 17amp rated/35 amp blow fuse in the circuit simply because there are (or should be!) a couple of spares of that rating in the main fusebox. That rating may seem higher than required for the overdrive (and pump where applicable) but the purpose of the fuse in nearly all cases in the MGB is to protect the wiring and that is the correct rating of fuse for the grade of wire used.

The above relates to cars with the later LH-type overdrive. Cars with the earlier D-type overdrive have a vacuum switch and relay as well as the manual switch. On these cars the manual switch operates the relay and it is the relay that operates the overdrive. The relay has its own white (unfused ignition) feed which should be fused as well as that to the manual switch, see the schematic.

Overdrive Sequencer Relay

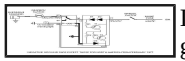
These are the details of the MkII version. For the MkI version click here.

It may be my age but from time to time I find that I move from 3rd or 4th with overdrive engaged to 1st or 2nd and forget to switch overdrive off. All is well until I change up from 2nd to 3rd, then all of a sudden the overdrive engages again, usually under conditions where it is inappropriate. This means not only do I get the mild and unexpected jolt as it engages but another one when I manually switch it off until I need it again. This has bugged me for some time and I felt sure I could knock up (i.e. build!) a circuit to prevent it.

The intention of the circuit is to allow overdrive to be engaged if the manual switch is operated whilst in 3rd or 4th but to lock it out when I change to any other gear even when I change back to 3rd or 4th until the manual switch is turned off and on again. Originally I achieved this with just one relay with a single normally-closed contact, but its disadvantage is that it requires a connection to the solenoid side of the gearbox lockout switch and there is the faint possibility that a fault could leave overdrive engaged in reverse which would destroy it. This version uses some simple electronics as well as the normally-closed relay and completely eliminates that possibility.

What happens is that the normally-closed contact of the relay is wired **in series** with the gearbox and manual switches. This means that if **any** of the manual switch, the gearbox switch, or the relay contact are open overdrive is disengaged, and they all have to be closed before overdrive will engage. **Thus it is fully fail-safe - any fault in the additional circuitry can only cause the OD to either operate exactly as the factory intended, or not at all, it can never cause it to operate when it shouldn't be i.e. when reverse gear is selected.** So as long as the relay remains released the overdrive operates completely normally, but when the relay operates it prevents the overdrive engaging regardless of the state of the gearbox and manual

switches. The circuit is such that if the manual switch is closed and the gearbox switch is open then the relay will operate, and will remain so until either the manual switch is opened or the ignition is switched off. Remember that whenever the relay is operated its normally closed contact is open, and this prevents the overdrive from engaging.



If you look at the diagram you will see that with the manual and gearbox switches closed and the relay released the solenoid operates in series with the two diodes, D1 and D2. Semi-conductor diodes exhibit a small volt-drop when forward-biased, and though this is not enough to affect the solenoid the voltage developed across the two in series is used to forward-bias transistor T1 via resistor R1 and so switch it on. T1 switched on ensures that transistor T2 is switched off by connecting emitter potential to its base via R2. T2 switched off means that the relay is released, so maintaining the status quo, and overdrive engaged.

If the gearbox is taken out of an overdrive gear the gearbox switch opens, the solenoid is disconnected and overdrive switches out. At the same time the current ceases to flow through diodes D1 and D2 so there is no longer any volt-drop across them. This causes transistor T1 to switch off, which allows transistor T2 to switch on via resistors R2 and R3. Transistor T2 operates the relay which also breaks the circuit to the solenoid. D3 acts as a 'spark quench' diode to prevent high-voltage back-emfs from the relay from damaging transistor T2 when it switches off and releases the relay. Even if an overdrive gear is selected again and the gearbox switch closes, the relay contact ensures that the solenoid is not energised, there is still no current flow through diodes D1 and D2, so again the status quo is maintained and overdrive remains switched out.

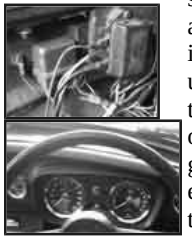
It is not until the manual switch is turned off, or the ignition is turned off, that the sequencer relay releases, because there is no longer the 12v supply via transistor T2 to keep it operated. But this also means that even when the relay releases there is no voltage supplied to the solenoid so overdrive remains switched out.

It is not until the manual switch is turned on again in an overdrive gear that current flows through diodes D1 and D2 the sequencer relay (released), the gearbox switch (closed) and the solenoid to operate and switch overdrive in again.

There has been some discussion about having a warning light glowing when overdrive is engaged, but with the dash and gear lever switches there doesn't seem much point as it is easy to see and feel whether it is on or off. Less easy with the column switch, and in fact my V8 (column switch) came with a warning light courtesy of a PO. But on the roadster with the sequencer relay there have been a couple of occasions I wasn't sure if overdrive was engaged or not, even though the manual switch was on, i.e. I can't tell if the sequencer relay has operated and locked it out without turning the manual switch off and on again. So an enhancement is to have a warning light that glows only when the sequencer relay has operated i.e. overdrive is manually selected but locked out.

Electronic components: I used some 100v 1A diodes (from Lucas, believe it or

not) and 50v switching PNP transistors I happened to have lying around from my Telecom days 25 years ago. The resistors used will depend on which transistors you use, but they are not critical. I think I used 1k ohms in each case selected to give minimum current but reliable operation of the circuit. I mounted the components on a small circuit board such that it could be fitted inside an old Lucas metal can 6RA relay, utilising the spades on the insulated base plate (winding and contacts removed) for its connections to the outside world. The warning light is a red (red being significantly brighter than the green and yellow examples I had in my box of bits) LED in series with a 470 ohm resistor, the pair being connected in parallel with the relay winding, so that whenever the relay is operated the LED glows. *Updated September 2010:* The relay is a 12v automotive 'changeover', 'single-pole double-throw' or 'SPDT' type (try Googling '12v SPDT auto relay') with five spade terminals - a normally open (87), a normally closed (87a) and a common (30) as well as the two winding terminals (85 and 86), check the diagram on the relay matches up with type S4 here. Note that the circuit includes a protection diode (D3), if using relay type S6 you won't need D3 but must get the relay winding terminals 85 and 86 the right way round or you will blow the transistor. Relay type S5 includes a protection **resistor**, on its own that may not be enough to protect the transistor, and may alter the parameters of the circuit so is best avoided.



Installing to the car. The electronic module together with an aftermarket relay (with 87 and 87a connections) were mounted side-by-side close to the fusebox using a handy tapped hole that already existed on my 1973 roadster. Once the two units are interconnected they just need a ground connection from a tag under the fixing screw, and two wires - one to the yellow from the main loom - via an in-line fuse if you haven't already fitted one by the manual switch - and one to the yellow/red in the gearbox loom. I've never liked drilling holes in the dash for extras so positioned the led at the top of the cut-out in the dash that accommodates the steering column. With my combination of height, seat and steering wheel I can just see the LED from my normal driving position, and being recessed slightly into the cut-out it is clearly visible even in bright sunlight.

Update October 2010:

After realigning the steering and rack columns I find the warning light has moved from being just visible to just invisible, unless I keep leaning forward which is a pain, so a new position has to be found. I settle on the small gap between the end of the crash rail and the door seal, as shown here.

Differences in other years and markets:

- The electronics are obviously polarity sensitive and so cannot be used as-is on a positive-ground car. However it should not be beyond anyone capable of building such a circuit to come up with a suitable variant, i.e. reversing the diodes and using NPN transistors.
- MkI models use the D-type overdrive and I have not tested the circuit with

this unit only the later LH-type. But because the forward-bias voltage of the diodes is constant, even if the D-type solenoid takes a lower current than the LH-type the circuit should still operate satisfactorily.

- From the 1977 model year all markets had the manual switch on the gear lever, and from Feb 77 North America had overdrive on 4th gear only. Cars other than 'Feb 77-on' cars for North America are wired as before but the yellow and yellow/red wires have to be picked up by the gearbox owing to the physical position of the manual switch. However North America '4th gear only' cars were wired differently because the gearbox switch also controlled vacuum advance through the TCSA switch. In these cars current flows from the ignition, through the gearbox switch, then through the manual switch to the solenoid. With this switch configuration the circuit will not work properly - overdrive will be locked out by the manual switch and not the gearbox switch as it should be. It would be possible to come up with an alternative circuit like for the MkI version, but you must be aware that it will involve connections to the solenoid side of the gearbox switch, so if a fault develops it might be possible for overdrive to remain operated in reverse so destroying it. **You have been warned**.

Testing:

- With the ignition on but engine stopped and the gearlever in 1st, 2nd or reverse turn the manual switch on and off a few times. You should hear the relay click as it operates and releases with the manual switch.
- With the manual switch off, select 4th gear, then operate the manual switch. You should not hear the relay click at any time.
- Move the gear lever into 1st and you should hear the relay click once as it operates.
- Move the gear lever into and out of 4th a couple of times and you should not hear the relay clicking.
- Switch the manual switch off and you should hear the relay click once as it releases.
- On the road, get into top gear and the overdrive should engage and disengage as normal as the manual switch is turned on and off.
- With the switch on and overdrive engaged move into 2nd and note the revs (which will be higher than in 4th of course). Move the manual switch to off and there should be no change in engine revs.
- Go back into 4th and move the manual switch to off and back to on again. If the sequencer relay is doing its job there will be no increase in revs as you switch it off but there will be a decrease in revs as you turn it on again and overdrive engages.

I've used the MkII version over several hundred miles now and it works well, just a glance at the LED tells me if the sequencer relay has locked out the OD, and sometimes the LED catches my eye anyway.

Overdrive - How many were there? *Added January 2008*

An oft discussed question, opinion being it was 'not many' in North America for some reason on new cars, although it is considered a very desirable addition today. Why there weren't many originally I can't imagine - it is eminently suitable for the long distances common in North America, and similar technology to automatics which were very common so that shouldn't have put people off (it didn't in the UK where automatics were rare, and are still uncommon today). Maybe buyers just didn't understand what 'Overdrive' was'. Living quite close to Gaydon and the BMIHT archive I considered spending some time there counting. Thinking further, I realised I didn't need to go through all the individual build records as 18V engines from August 1971 (North American spec) and November 1973 (all other markets) had different engine types according to whether OD was fitted or not. So if there were documents showing how many engines of each type were ordered by Abingdon I could just look at those. It was only subsequently I realised that Clausager already contains this information, as the engine number types and quantities are listed in 'Original MGB'! So here they are:

Period	Market	No OD	OD	Total	Percent OD
Nov73-Sep74	Home and non-North American export	434	7123	7557	94
Sep74-Oct80 (OD standard for Home market from June 1975)	Home and non-North American export	813	40087	40900	98
Total Home and non-North American export		**1247**	**47210**	**48457**	**97**
Aug71-Aug72	North America	19390	2650	22040	12
Aug72-Sep74	North America	37993	6449	44442	15
Sep74-Dec74	North America	5300	1403	6703	21
Dec74-Aug75	North America	9260	1593	10853	15
Aug75-Jun76	Canada	996	313	1309	24
Jun75-Jun76	USA	14700	3408	18108	19
Jun76-Oct80	USA (not California)	50883	10324	61207	17
Jun76-Dec79	California	11958	4483	16441	27
Jun80-Oct80	Japan	0	805	805	100
Aug76-Oct80	Canada	3458	1176	4634	25
Total North American spec		**153938**	**32604**	**186542**	**17**

Note: Whilst the Home and non-North American total tallies very closely with Clausagers production figures (just 17 cars more) the North American total is some 5200 cars higher, at the moment I can't see why. However this does represent a disparity of less than 3%.

At 97% with overdrive for the Home and non-North American export market and only 17% for North American spec there is indeed a huge disparity. And why should Japan get 100% with OD (admittedly on a very small number) when they got the North American spec towards the end of production? Even California and

Canada got a significantly higher proportion than the rest of the USA.

Update April 2008 I've just come across the following passage in MG by McComb (p197): "Another special problem on the US market concerned the MGB overdrive, which had been available from early 1963 but for some time was withheld from America - where it was most needed - because it might adversely affect the already dwindling sales of the big Austin-Healey. Eventually commonsense prevailed ...". There is no indication of how long this withholding lasted or when overdrives started to be supplied. However that doesn't explain the continuing very low take-up in North America.