Overdrive on 2nd on a BJ8

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Background

I am sort of new to the AH fold but had exposure in my youth to numerous TR2/3/3A cars that had the same Laycock type A overdrive. The Triumphs usually also had overdrive on 2nd and the switching arrangement was different with interlock switches for the top 3 gears and OD dropping out in neutral. No throttle switch (TS) but sensible practice was to disengage the OD with +ve torque to the rear wheels.

Always wondered as to why no overdrive on 2nd on the Healey ? This is further aggravated by the fact that there is a 37% gear change jump from 2nd to third.

From my manual, ratios for AH MkIII are:

AH Gear Shift	AH Ratio Change	Step % no OD on 2nd	Step %with OD on 2nd	Toyota %
1st to 2nd	2.64:1 to 2.07:1	22	22	42
2nd to 2nd OD	2.07:1 to 1.70:1	--	18	
2nd OD to 3rd	1.70: to1.31:1	--	23	
2nd to 3rd	2.07:1 to 1.31:1	37	--	32
(3rd to 3rd OD)	(1.31:1 to 1.07:1)	(18)	(18)	
(3rd OD to 4th) *	(1.07:1 to 1:1)	(7)*	(7) *	
3rd to 4th	1.31:1 to 1:1	23	23	21
4th to 4th OD	1:1 to 0.82	18	18	22 (5th)

The popular Toyota 5 spd (W58) conversion ratios shown here for interest.

From the above, the AH would clearly benefit with a 22% OD on 2nd with much better spacing. I particularly remember how useful it was for accelerating in traffic, and for hill work too. ** Only 7% step from 3rd OD to direct 4th - so really not much use, so better to skip 3rd OD if accelerating to 4th, but could be useful for hill work.

Implementation

So, decided to see how this could be safely accomplished with interlocks, and if it was feasible with the increased torque and weight of the AH. You could of course carefully do a test by bypassing the the 3/4 switch - but beware the dreaded UDC in reverse. I Had to remove my GB this Winter so decided to get into it.

Max torque of an AH compared to a TR is 117/165 ft lbs. TR 2nd ratio is 2:1 compared to 2.07:1 Yes the AH produces more torque but the difference is within normal design safety factors. Some higher HP and heavier and more powerful cars also used the same OD. Weight difference is 2,105/2,550 lbs. and the mechanical stress when engaging may be an issue. You could of course use the clutch when engaging 2nd OD. Just had my flywheel lightened, so this too would improve the jolting . Had several discussions with Overdrive Spares in the UK on this topic. They felt that there should be no issues with this on an AH. Only thing that may or may not be of benefit is to maybe consider upgrading the OD clutch to the competition "grippier" material. Have had my OD out and in pieces in past 2 years so reluctant to tear it apart again. At that time upgraded the hydraulics - now about 510 psi and holds 480 psi for over a week. As an aside, wonder why relieving the OD residual pressure is not normal practice ?

Options to consider

If we ignore the open loop, no interlocks, there are 2 alternatives to consider. Have road tested both options.

(a) No TS (throttle switch)

Still not clear why some cars use the TS and others don't. In AH think function is to ensure pos. torque to rear wheels when coming out of OD.

In this mode the OD would drop out going through neutral when you normally use the clutch so no stress in switching out of OD when accelerating or coasting to a stop with OD in. A maybe issue is when say going down a long hill in 3rd or 4th OD you decide to disengage OD. In the TR, I always blipped throttle at the same time as switching out of OD. No risk of being in OD when you start off.

(b) Using the TS

Logic is a bit more complex and extra relays required. When accelerating, the OD is briefly retained going through neutral until the TS opens as you accelerate - as per the original electrics. No risk of disengaging without pos. torque. Road testing revealed a situation when, if you had been in OD in any gear, and coasted to a stop the OD would be on very briefly (almost unnoticeable) as you started off again in 1st until the TS opened. Rectified with extra logic.

Control

Dash switch ON for OD to operate.
No overdrive engagement is possible in 1st or reverse.

The electrics for this 2nd OD project were to also to incorporate a sort of paddle switching via a gear knob push button (pb). An indicator led someplace is a good idea. I always found the original system difficult to use when accelerating through the gears because of the 3/4 switch not dropping out when going through neutral. The pb/paddle switching works something like this:

Consider OD dash switch ON and driving in 2nd.. Push the the pb switch and 2nd OD engages. Accelerate. Shift to 3rd as normal. OD deactivated going through neutral but retained briefly by throttle switch (option b). As soon as you continue to accelerate (TS opens) you will be in 3rd. Then pb for 3rd OD. Continue for 4th as above. PB to disengage OD in any gear, and throttle switch will ensure pos. torque. Option (a) with no TS is simpler.

Construction

On the centre change box it is just not practical to simply add another interlock switch. So after a lot of trial and error with micro limit switches etc in different positions, added 3 proximity inductive sensors to the tunnel for 2/4; 1/3; and for the reverse inhibit. Two 1 1/4 in dia. 1/2 in wide metal collars were installed onto the selector shaft to trigger the sensors. Reverse inhibit was a challenge and all but stumped me. Eventually carved a notch (pia with no mill !) out of one of the collars so it only operated when the reverse detent was activated. Must have had the top GB cover off in excess of ten x not to mention those bl pegs ! Good trick is to insert a card under the top cover to help prevent having to fish for the detent springs in the oil. I

The sensors (M8) were tapped and locked into the tunnel and a small box for the relays located on drivers side near OD relays, mounted with rare earth magnets to avoid holes. Collar positions relative to sensors adjusted via grub screws on the shaft. All a bit fiddly as experimenting and would be a lot easier next time.

The existing 3/4 switch is used with 4 additional relays and one FF relay. The original OD power relay is retained. All new circuits fused and existing OD cable harness used to drive the solenoid. No cable molestation and is all reversible. New cables, plugs for the sensors, and multi-conductor plugs for all the signals to the relay box. Circus drawing and collar position dimensions available if anyone is interested. Wiring is tedious - particularly the plugs. Could all be done without removing tranny from the car. Did some off car GB spinning tests with an electric vs drive.

A few photos below.

Now to locate or construct a hollow, compatible gear shift lever and knob to hide the single pb wire that goes down the back of the gear shaft .... and maybe a led to confirm OD is engaged.

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