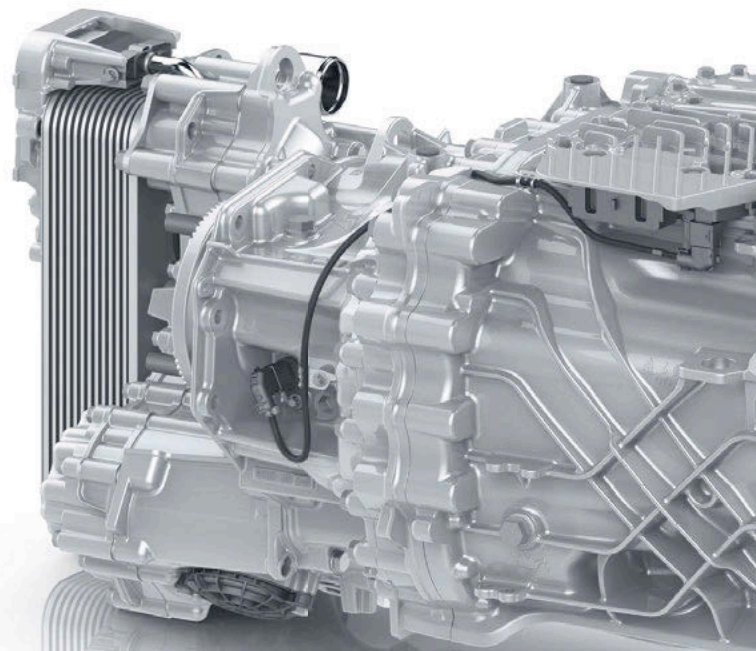


# SHIFTING TRENDS



**The market for coach transmissions is divided between bus-derived automatics and automated manuals developed for trucks. Richard Simpson finds out why**

There can be few around who lament the passing of manual transmissions from coaches. With a 'driver-forward' cockpit, the gear lever exited the floor behind the driver's seat, making the selection of even-number gears a strain-inducing exercise for most.

Now, the UK coach market is largely divided between fully automatic fare-stage bus-style transmissions (autos) and truck-derived automated manual transmissions (AMT), with the latter being favoured by vertically integrated manufacturers including Mercedes-Benz, Scania and Volvo. But, it seems, some operators like a choice. Modern AMTs should offer optimum fuel consumption, but an auto allows drivers to easily jump from one vehicle to another, and there is no mechanical clutch to wear.

We have Mercedes to thank for the AMT, standardised as the electro-pneumatic shift (EPS) in its trucks in the mid-'80s because manual gearboxes of the time could not cope with increasing levels of engine torque without an unduly heavy shift action. EPS (soon renamed electronic power shift) allowed the driver to change gear, one or (if a pre-determined algorithm of engine and road speed allowed) two gears at a time by flicking a small lever once or twice, rather than pushing a heavy lever through an H-gate pattern or handling range-change and splitter controls.

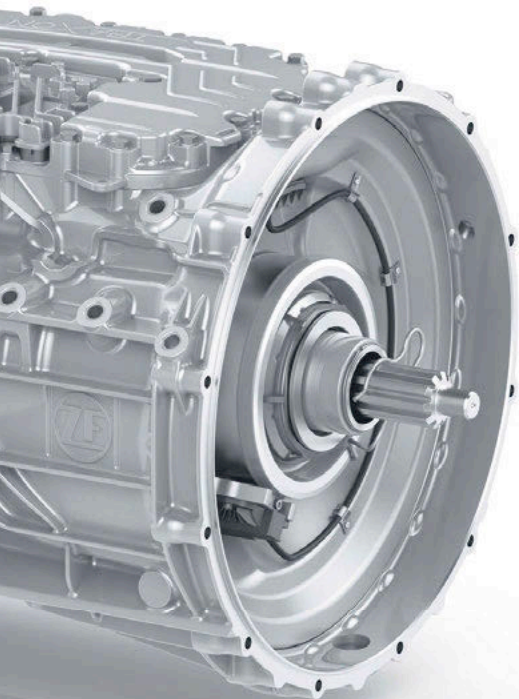
AMT development continued despite the often-disappointing driver experience because they made vehicles cheaper to build. Without mechanical linkages, connecting an AMT was done simply by plugging wires together. This was particularly advantageous in the case of coaches, where the gearbox is at the rear of the vehicle.

But these systems had limitations. EPS still had a clutch pedal, and the system would not change gear without it. A step forward came in 1996, when Mercedes linked major vehicle systems by CAN-Bus network. All electronic units could communicate with each other. The gearbox, now renamed Telligent, could select the appropriate ratio for

conditions including speed, incline and load, with all information harvested via the CAN-Bus. A digital display showed the driver which gear was engaged, but also flashed up the suggested optimum ratio. The driver could flick a lever to change up or down.

The technology improved again with the introduction of Volvo's acclaimed I-Shift. It appeared in 2001 in trucks, and in 2004 in coaches and buses. Genuinely automatic in operation, it lacks a clutch pedal and selects the appropriate ratio for vehicle speed, acceleration, weight, road grade and torque without any driver intervention. I-Shift's own electronics establish the correct ratio for the situation, and the corresponding





gear is engaged by pneumatic actuators. In some applications, the driver can override or anticipate the I-Shift's decision, while in others (more usual in passenger-carrying applications) not. The software can be programmed to adapt to a variety of duties through different strategies, such as softer shifting in passenger applications. So fine is the control it asserts over the rest of the driveline that I-Shift dispenses with the transmission's synchro gears; engine and road speeds always match, without mechanical intervention.

Mercedes fought back with the deletion of the synchros from its 'box, now named the PowerShift, in 2006.

Other vertically integrated manufacturers followed suit, and proprietary manufacturer ZF joined the party with its non-synchro AS-Tronic in 2003, first with IVECO, and, subsequently DAF and MAN.

### NEXT STEPS

The next step was to use predictive information to determine ratio selection. From 2012 Mercedes-Benz introduced Predictive Power Control. This uses 3D mapping and GPS to determine the contours of the road ahead, and select gears accordingly, while taking factors such as vehicle weight into account. Besides choosing the correct gear (and throttle) settings for ascents, the transmission can activate its EcoRoll function when it reaches the summit.

## EITHER/OR ...

### FULLY AUTOMATIC TRANSMISSIONS

*Torque converter uses fluid coupling rather than mechanical clutch*

Contemporary example: ZF EcoLife

- Facilitates driver swap-over
- Requires relatively little maintenance (no clutch wear, for example)
- Smooth shifting
- Limited torque range for heavier vehicles

### AUTOMATED MANUAL TRANSMISSIONS

*Electronics chooses gear and directs actuators to perform the gearchange*

Contemporary examples: Volvo I-Shift, Mercedes-Benz PowerShift, ZF AS-Tronic and TraXon; Continental eHorizon

- Optimum fuel consumption
- Easier vehicle assembly (no mechanical linkages)
- Shifting smoothness has improved
- Predictive gearchange software improves fuel economy
- Mechanically complex

That allows it to coast down a gentle incline to gain momentum for the next climb, or select a lower gear to maximise retardation.

AS-Tronic has now been replaced by ZF's new modular TraXon AMT, pictured above, in coaches, as well as trucks. Predictive shifting, where the transmission reads the road ahead and works out the appropriate gearchanging strategy, can be incorporated as an aid to fuel economy. Irizar showed the first TraXon-equipped Integrals at the Euro Bus Expo 2018. These mate the ZF transmission with DAF Paccar MX-11 and MX-13 engines to replicate the proven DAF trucks' combination.

Where engine output is 2,300Nm or less, operators can still choose the 'coach' version of ZF's fully automatic EcoLife transmission. This has a torque converter rather than a hydraulic clutch, and only six speeds rather than 12. Fitting it requires a radical change in drive-axle ratio: TraXon-equipped Irizar's will typically run a 2.93:1 diff, while the EcoLife ratio is 4.7:1.

In theory, an automated manual should be better on fuel than a full auto, yet EcoLife remains a popular choice.

In explaining the apparent paradox, Irizar (UK)'s head of coach sales, Julie Hartley, cites various factors. "The EcoLife is well suited to fleets where any driver can find themselves in any vehicle. Having a full auto makes for a seamless transition for drivers between vehicles.

"A smoother shift quality was also an EcoLife advantage, but this has rather been eroded by the introduction of the TraXon. Torque limitations on the auto mean that you can't have one behind the 13-litre engine anyway." The EcoLife is only an option on the M-11 (443bhp).

### SERVICE LIFE

But this does not mean that the auto boxes have problems with in-service durability, according to Steve Spiller, director of Somerset's Centurion Travel, who is an advocate for EcoLife.

"The EcoLife transmission just goes on and on. It gives smoother, easier shifting than an AMT and requires very little maintenance. In contrast, the AMT boxes, particularly those from the integrated manufacturers, are much more mechanically complex and difficult to fix if they go wrong. As a coach operator, we maintain our vehicles in-house."

There is more to come from automated manual transmissions. Automotive technology supplier Continental is developing ever more sophisticated predictive drivetrain control. Its current 'static eHorizon' uses topographic data provided by mapping company Here Technologies to decide a shift strategy. The next step is 'dynamic eHorizon', which will harvest real-time information (such as traffic) from other vehicles on the road via the mobile telephone network. That will be combined with route data and sent to vehicles via a wireless network, enabling connected vehicles to have a view of conditions on the route ahead, and adjust their gearshift and coasting strategies accordingly. [TE](#)