HARROP ELOCKER

PROVES ITS WORTH ON TEST

Melbourne-based automotive performance company Harrop Engineering has developed electromagnetically lockable differential kits to suit Toyota LandCruiser, Prado and HiLux, Nissan Patrol GU and GQ, and all Jeeps using Dana 30, 35 and 44 axles. The ELocker range is being distributed nationally by Opposite Lock.

Harrop Engineering is best known for its engine performance equipment, including a wide range of superchargers. The company also manufactures induction systems for many of the world's high-performance vehicles, including some Lotus and Audi models. The Australian-owned company earned the attention of the global Eaton Corporation and the two companies co-operate on many automotive projects. Harrop also distributes some of Eaton's automotive products, including the well-known Detroit Locker self-locking and Truetrac torque-biasing differentials.

The Harrop ELocker functions as a fully-open differential until activated by the driver. Electromagnetic engagement means there's no need for an air compressor to lock and unlock the mechanism. The ELocker is a four-pinion design, built with precision-forged gears that are designed to mesh perfectly, providing improved strength and durability over cut gears.
Prices for the ELocker are around RRP$1700, plus fitting. The kits include dashboard switches, a wiring loom and all necessary parts.

Why traction control may not be enough

Many 4WD buyers think that there's no need for after-market lockable diffs in these days of electronic traction and stability control, but that's not the case for people who want to venture onto severe terrain, as our test clearly showed.

Electronic traction control works by applying selective braking to spinning wheels, thus sending torque to the opposite wheel that isn't spinning.
Check out our explanation of traction control in
http://outbacktravelaustralia.com.au/doc/TractionControl.pdf

Traction control was developed to ensure vehicle movement in conditions where wheelspin would prevent movement; it's intended for short-term, intermittent use, not for consistent control of wheelspin for long periods. There are two major limitations with electronic traction control: the slowing effect of braking in conditions where forward momentum may be lost; and a time limitation on traction control operation.

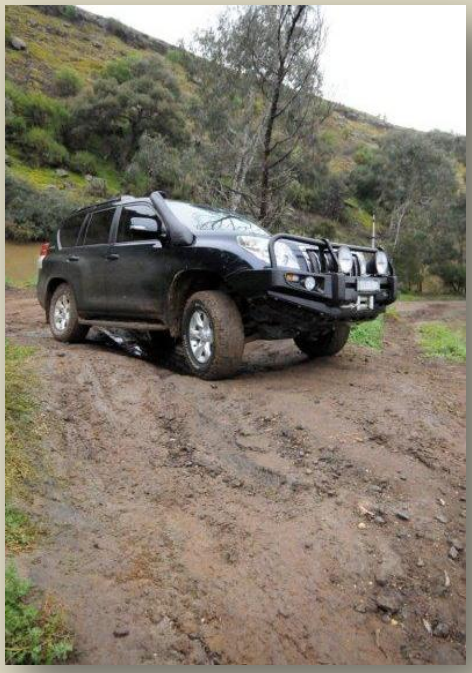
In a several-kilometre, beachfront drive on very soft sand, for example, electronic traction control may not be adequate in ensuring traction. The continuous intervention of wheel braking to control wheelspin reduces momentum precisely when the driver needs it and eventually the TC system will shut down due to overheating of the brakes, or a loss of pressure in the accumulator to apply the brakes – or both.

A long climb up a slippery hill that's a virtual mogul-field of crests and hollows will also over-tax the TC system and it will often 'give up' before the summit is reached. In this situation the only option is to stop the vehicle (if possible) and wait until the TC system catches its breath.

Our testing of all vehicles fitted with electronic traction control has revealed these limitations, so there's still room for the positively-locking differential for severe off-road conditions.

ELocker test

We took a traction-control-equipped 2011 Prado GXL, fitted with front and rear Harrop ELockers, to Rob Emmins' Melbourne 4WD Proving Ground, to check out the relative strengths of its traction control system and locking differentials.



As expected, the electronic traction control system coped quite well with most of the conditions at this cleverly designed venue, but Rob Emmins has some special areas that 'sort the men from the boys', as he puts it: steep, slippery climbs with alternating crests and hollows in the individual wheel tracks soon ensure that any vehicle will have diagonally opposite wheels in the air.

In this situation electronic traction control becomes confused when the vehicle stops moving, despite intermittent braking of the wheels that are in the air. What happens then is that the vehicle starts to bounce around, while the two wheels with some traction try to generate sufficient grip to propel it forward. Sometimes the bouncing is enough to gain better grip, but at other times it sends the vehicle sideways and things can get ugly.

We managed to get the test Prado into exactly this situation a few times and the traction control didn't manage to extricate it. The cure was to press the ELocker switches and the vehicle moved forward without any additional acceleration or bouncing. When we engaged the ELockers before attempting these severe climbs the vehicle simply walked up the slopes without a trace of individual wheelspin. All four wheels rotated at the same speed, for a controlled climb.

We noted that it wasn't necessary to worry about the standard traction control system's ability to operate in conjunction with the diff locks. With only the rear ELocker engaged the TC system controlled front axle wheelspin as normal, but had a lot more reserve power, because the rear axle was under diff lock control. Also, the ELockers could be engaged with or without the Toyota's central differential being locked - handy in high range on very slippery surfaces, such as Rob Emmins' mud paddock, when manoeuvrability is required.

We checked out the Prado's standard hill descent control and diff lock performance on the same slopes, running downhill. Hill descent control employs the same technique as traction control to limit downhill speed on steep slopes and it did so quite well on this test, albeit with a lot of braking noise and jerking as the wheels lost ground contact over the crests and hollows. As with traction control, hill descent control is designed to work for short periods, before losing puff or overheating the brakes.

Hill descent control is not ideal as means of speed control when two wheels lose grip at the same time, because the braking effort required to slow the vehicle locks the two wheels that have grip, forcing the HDC system to let go momentarily, thus letting the vehicle speed up. Hence the jerky HDC action we experienced.

With both ELockers engaged hill descent was much more controlled and jerk-free, relying on gearing and engine braking to control downhill speed, rather than intermittent braking.

We also found that the diff locks worked well in conjunction with the HDC system, taking a great deal of the slowing work load off the HDC controller.

Some across-axle differential locks – notably Toyota's factory units for the LandCruiser 70+ Series – resist engagement and disengagement when there's any toque build-up in the driveline. The electromagnetic engagement system in the ELocker has ramp and pin engagement, so it can't torque-bind in or out. We tried on this test to catch it out, but reaction to the dashboard switch was instant. Harrop also makes the point that there's no need to have an on-board air compressor for diff lock action – it's all electric.

If you plan taking your traction control equipped 4WD into tricky situations one or two ELockers could be the go.

ELocker Operation

The ELocker diff centre is built around a bolted-up central cross, carrying four pinions that mesh with two side gears, into which the axle half shafts are splined. One side gear has a meshed collar with three lugs on its circumference that mount three axial pins that protrude through the opposite end of the diff carrier. A movable collar with fore and aft ramps that centre on the pin ends is moved by a second, electromagnetic collar. Belleville washers absorb end-float movement and depress when the diff locking action is activated.

When the diff is working as a conventional 'open' diff the ramped collar is held clear of the pin ends, allowing the pin-carrying side gear to rotate independently of the opposite side gear, but when the electromagnetic collar is energised it rotates the ramped collar over the pins, with smooth depression ensured by ramping action. This movement across the diff carrier forces the pinned collar to mesh with its side gear and the diff carrier now rotates as a unit, effectively locking all the pinions and the side gears.