



BMW



Mercedes



Mini



Interiors

Limited Slip Differential Conversions

There's something odd going on at BMW.

Although the ZF type LST was available as an option on many pre 1990 model cars, often this inexpensive option was not selected by the buyer or the new car, especially if the car was automatic. LSDs were been the preserve of the fabulous M-Power cars. Those of us who choose a more comfortable but less extravagant and focussed BMW may well find that the standard power of the car easily overcomes the amount of traction available. This is especially true with engines of more than 3.0l, and the E30 cars, with their light rear ends. For the first time, there is a cost-effective option for those who want to enjoy maximum acceleration performance without compromising safety or stability. We now offer the world renowned Quaife automatic torque biasing differential for the entire BMW range. Be prepared to wonder why BMW are not offering this amazing device.....

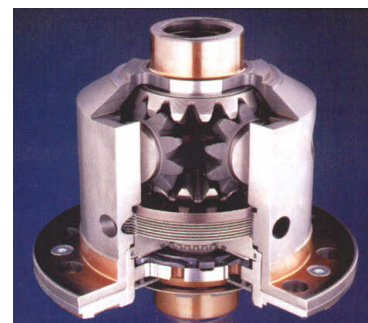
What's that little flashing yellow light....?

Since the early 90's, BMW have added electronic torque limiting systems to every model range. Engines producing over 200hp can often experience loss of traction. In a rear drive chassis, this can lead to the infamous "through the hedge backwards" experience, so prevalent in the days of the E21 323i. BMW have continuously worked to eliminate this unwanted characteristic, but no amount of high tech Z-axis or near perfect weight balance can prevent the unwary or inexperienced driver from exceeding the rear grip available in all road conditions. Add to this the inevitable increases in engine performance and capacity over time, and something had to give.

Enter the traction management system. With BMW, this started as a simple device that would cut power if the management determined that one driven wheel was spinning faster than the other. Fabulous idea, as many people found out while trying to pull away from a wet side street into a gap in fast approaching traffic. Waiting for power to be restored, with a look on their face like they had just bitten into an unripe lemon. Shortly after the introduction of this entertaining device, BMW then decided to omit the LSD from their model line-up. We guess that the thinking was, if the traction control is on the car, there's no need to worry about drivers overpowering the rear end grip, so we can save some cash. Of course if you were lucky enough to have sufficiently deep pockets, all M-Power cars still arrived properly equipped.



Quaife Automatic Torque Biasing LS Differential



BMW M LS Differential

TC, ASC, ASC+T, DSC and whatever else down the line.

True enough, BMW have improved their traction management technology hugely since the first examples. Many of the latest cars are much less intrusive, and have a three stage driver selectable system (definitely on, nearly off, and definitely off). There's no doubt that these latest systems are hugely effective in stopping car/scenery interfaces, and the nearly off setting allows normal drivers to drive very close to the true limit of the car (which is "a good thing"). Moreover, BMW have added all sorts of clever additional facilities, such as brake drying, hill start, and integration with the ABS, to rid the car of all of those nasty results of a misjudged braking, steering or acceleration events. They even try to use the rear brakes to give a "virtual LSD" effect, albeit a very inefficient one.



How can a LSD Improve matters?

Quite simply, it increases the torque presented at the tyre contact patch with the road, which increases the force exerted on the road, and, as Mr Newton states, this increases the rate of acceleration. In the situation where one wheel is spinning, a car with an "open" diff can potentially lose all drive, but this can only happen on very low grip surfaces, like ice and wet grass. The LSD prevents the wheel with the least grip from spinning, traction control is therefore not triggered anywhere near as often, and the car accelerates to its true potential.

The LSD also improves stability. As mentioned before, many incidents on the road are generally caused by loss of stability as a consequence of sudden driver reaction input. The fact that the margin of longitudinal rear grip has been increased moves the limits beyond the torque output at the rear axle, in most conditions. That's one of the causes removed.

What types of LSD are available?

There are three types available for BMW. The BMW M differential, the ZF type and the Torsen type. The BMW M Differential is great, but given BMW own it, it cannot be sourced from anyone but them. It is capable of being installed into non-M models, but costs plenty.

The ZF type diff is what BMW used all the way up to the M3 E36. It works, but has a couple of major downsides. Firstly, it has wearing clutches, which are costly to replace (BMW don't support the rebuilding of these, and would rather charge £1,600 or so for a new one) The second problem occurs during the aforementioned pulling away from a wet junction. The way this diff transfers torque to a spinning wheel can only be described as sudden. In this situation, the sharp transfer of torque is often enough to break traction on both wheels. Entry speed into the desired lane of traffic is somewhat improved, but at a heroic angle of attack, and with plenty of corrective steering angles. This diff can be purchased and modified to fit many BMW open differentials. The torque split varies (instantaneously!) Between approx. 5% -25% or more.

(Tuners like 10-40%)

The Quaife Torsen type differential has to be the favourite. It has no clutches to wear out, and is capable of varying the torque split between 0 to 80%. Perfect! Well, nearly. On extremely slippery surfaces, it can react like an open diff, so it shouldn't be relied on if you want to drive on sheet ice or wet grass. In that somewhat rare example, you're better off with the ZF.

And the result is?

With cars not equipped with traction controls, the car accelerates to its maximum potential, with total stability. The driver now has the option to use all of the power the engine can generate. It's difficult and expensive to tune current BMW engines for more power. It's even harder to convert that power to acceleration. Rest assured, the Quaife ATB Differential is an amazing solution, without compromise.