



## Quaife ATB Differential Conversions

### There's something odd going on at BMW.

The last production BMW to be sold with the option of a limited slip diff was the E36 328i. Since then, LSDs have been the preserve of the fabulous M-Power cars. Unfortunately, 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 late cars, equipped with run-flat tyres, and stiff suspension. 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 ATB (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.

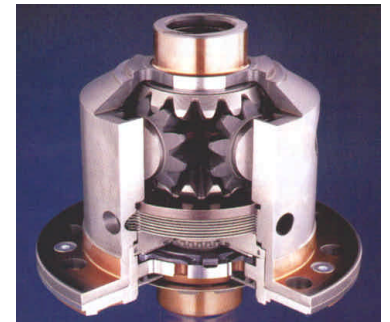
Add to this the inevitable increases in engine performance and capacity over time, and something had to give.

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 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 clever differential improve matters?

First of all, some definition is required. All "clever" differentials are designed to transmit maximum torque presented at the tyre contact patch with the road, which increases the force exerted on the road, and, as Mr Newton recognised, this increases acceleration.

The three examples available for BMW all achieve this, but in different ways. The LSD locks the two output shafts together to a limit that is pre-set in the differential. The load on the clutches inside the differential determines the amount of slip.

The Quaife ATB differential detects which wheel has the most torque being transmitted to the road, and biases it back to the wheel with the lesser torque. It does this mechanically, with no noise, drama, or wearing of clutches.

## What types of trick diffs are available?

The ZF LSD 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. The differential actually locks up, effectively removing all the action of the differential. 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 angle. 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%)



## You can't do this with an open diff!

Photograph courtesy of David Smith

The BMW 'M' LSD, the ZF LSD and the Quaife ATB differential. The BMW M Differential is great, but given BMW own it, it cannot be sourced from anyone but them, and at some substantial cost. It is capable of being installed into non-M models, but is expensive to engineer onto other cars. It uses clutches plus a viscous coupling to generate the reduction of slip. It generates quite a lot of heat while it slips, and is wasteful of power therefore.

The Quaife ATB differential has to be the favourite. It has no clutches to wear out, has a lifetime warranty, and gently massages the torque away from the spinning wheel to the one with more traction and is capable of varying the torque split between 0 to 80%. Perfect! It is genuinely one of the very best tuning products we have ever encountered in our 30+ years in the BMW tuning industry. No wonder Autocar said "As car addicts, we cannot allow the Quaife ATB to be ignored"

## And the result is?

The little yellow flashing light is encouraged not to, and 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.