

If in doubt,
flat out



Following the tried and tested route is fine, but if you can pull off something original, well, that's even better. What you're looking at here is something very special indeed. This is one lesson in Mk2 modding you don't want to miss.

Words: David Kennedy Photos: James Lipman

Picture the scene. You're the proud owner of a nicely worked over Mk2, with perfectly polished paintwork and a well-bolted-in 1.8T BAM motor up front. Nothing too hardcore but a quick daily good enough to hold its own in the show 'n'

shines. But then, one drive home, your new baby throws its toys out the pram in a big way, bending a con rod in the process and leaving you stuck sweating and swearing on the hard shoulder, staring down the barrel of a big repair bill. For most people, that would be the end of it, game over. But then, most

people aren't like Paul Turner, a technician team at VAG specialist, The Phirm. "It's my own fault really," Paul said with a smile. "It was quick enough with the BAM in but I kept turning the boost up and up... till it let go!" I guess we can hardly be surprised really; after all, this is a man who, on more than one



occasion, has said the words "if in doubt, flat out" to us!

But before we get too deep in to what happened next, let's start at the beginning. Paul is a guy who really does live, breathe and sleep VWs. It all started when he did his apprenticeship at VW, back in the day, coupled with living so close to the TRL, when it played host to GTI International. Fast forward to today and Paul is one of the team at The Phirm, a company that should need no introduction to readers of this mag, and during his time has owned a Mk1, a Mk2, a Rallye, an A4, and a B3 Passat amongst others. His last big build was a 'charged VR-powered Mk2 that never saw the road as it got offloaded the moment its Porsche Riveria blue paint dried to fund the purchase of this

car after Paul saw it go through a full top-to-bottom rebuild for customer, Mike Newlands. "It was red, it had the interior done and the Ronals, and it had the BAM lump in on DTA Management," Paul explained. "I knew it had everything done on it mechanically and it was solid so I wouldn't need to do much to it."

And it was, at least till Paul started getting a bit trigger happy with the boost control anyway. After throwing out talk of sourcing another BAM block and either a fresh K04 or even a GT28 and going big on the faithful 20v, Paul had a change of heart. And it's this change of heart that has got him here today. "I'd always talked about putting a 2.0-litre TFSI from a Mk5 GTI in a car; Tim (The Phirm's head honcho) and I kept chatting about doing it one day, after all, the TFSI

lump has got to be the next big thing for conversions," Paul explained. "The next thing I knew Tim had bought me a TFSI lump and six-speed 'box as my Christmas bonus!"

And so, with the project given the green light, and with a figure of 360bhp+ his target, Paul set about sourcing a few parts to work over his Christmas bonus block.

Luckily, Andy, a regular customer of The Phirm, had his TFSI S3 under the knife at the same time to take it up to GT3071 spec, leaving a few choice parts ripe for the picking, namely the bigger K04 blower and the injectors. Of course, before any of that could be bolted on, Paul had a bigger problem. Just how was the 2.0T lump going to fit in the vulnerable Mk2's bay, especially as the car is right-hand drive – which meant

that it couldn't just drop in as the turbo fouled the steering rack universal joint? Fortunately the guys at The Phirm are the masters of getting creative and after trying a few things out Paul decided to graft the original Mk5 engine mounts in to the Mk2's bay to sort the problem. And while that might sound simple, Paul assures us it was anything but, with both the chassis legs needing some fairly serious cutting and strengthening work to not only place and fit the mounts, but to make room for the large six-speed transmission, too. But after a few months of late nights and Sundays spent head-scratching, cutting, welding and fabricating, Paul had the engine in, lined-up and bolted-down perfectly.

And then, almost straight away, Paul took it out again. Because, if he thought getting

the force-induced four-cylinder in the Mk2's bay was difficult enough, the hardest part was yet to come. There is a very good reason Paul has the first-fully operational Mk2 TFSI running the full platform in the UK, and only one of a small handful in the whole world. Are you sitting comfortably? Good, because we're about to get technical...

One of the biggest problems is that the TFSI's injectors need a 65v supply to work, something that certainly isn't found in your usual aftermarket ECU or management systems. It's this injection system that defines the TFSI motor itself and without it, well, it's just not a TFSI. And it's the stratified injection system that is so hard to make work in anything not equipped with a CAN-bus ECU, like a Mk2 for example. In fact,

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Now this is what we're talking about – K04'd Mk5 GTI 2.0-litre TFSI lump put up a fight at first but looks perfectly at home in Mk2 bay now

because it's so in-depth, and frankly, it makes our heads hurt thinking about it, we've teamed up with electronics guru, David Bywater from Haslemere Tuning, for a full-on technical blow-out over on p16 explaining a little of what went in to the wiring and hooking up the clocks.

While 'Diesel Dave' was working his magic with the laptop and the bay was getting a fresh lick of red paint at Phirm FX, Paul set about making sure his new powerplant wouldn't go the same way as his last one. After stripping and checking everything over, he drafted in a set of Integrated Engineering

rods, an Autotech high-pressure fuel pump, a Pelquin diff' and fabricated a pair of custom driveshafts. With the engine given a clean bill of health and bolted back together, Paul then set about constructing one of his favourite parts of the car, the custom front crossmember. Using a section of old Mk1 roll-cage, donated by Jelly – a fellow Phirm employee, Paul fabricated up a crossmember to brace the two chassis legs, mount the engine on and support the bottom of the radiator and the huge intercooler. And not only does it do the job of holding the whole front end together, it looks as hardcore as anything

with the front end unbolted. Because, thanks to some clever thinking and some wiring tricks, Paul can unbolt and remove the entire front end in a matter of seconds – the whole front end electrical system hooking up through two connectors.

"I wanted the engine to look totally factory in the bay," Paul explained, "which meant I wanted to use the OE wiring, connectors and hoses. I didn't want anything to look custom, although virtually everything is." To keep everything looking OEM is difficult enough even when you're doing a swap that's been done countless times before, but to do it so

well on a swap that hasn't been done before is just crazy. As they say, it's all in the details. And Paul's engine bay is full of them. Like the amount of thought that has gone in to stopping the heat from the turbo cooking the brake fluid in the previously relocated master cylinder. Or the way the wiring loom has been hidden under the left-hand engine mount and brought along the chassis leg to keep it out of view. Or how the battery in the boot feeds through and in to the engine bay via a single connector on the chassis leg. It's not a show car-spec smoothed bay, that's not what the car is all about; this is a cleaned

bay from a pure engineering standpoint. "Everything from the B-pillar forward has been rewired," Paul explained. "It has been, without a doubt, the most difficult swap I have ever done. I would say that once I really got in to it, it took about eight months or so to get it wired up and running. That's doing it on Sundays and at night, though; it was all done out of work hours. I need to give a shout to Matt Morgan, too. He was our apprentice at the time and really put the hours in to help out."

And after such a long time spent in the workshop after hours, that first drive was



Dub Details

ENGINE: 2.0 TFSI (BWA engine code) running standard management, Audi S3 K04 turbo and injectors. Integrated Engineering H-section con rods. Autotech high pressure fuel pump spindle, ITG Maxogen induction kit, full custom 3" turbo back exhaust system, Cooling Mist water/meth injection system, Forge re-circ diverter valve, Audi S3 intercooler and radiator, 02Q six-speed gearbox with Pelquin LSD, custom driveshafts. Mk5 Golf customised engine mounts, custom front crossmember, Revo Stage 3 software and Revo Select Plus switch, Lupo GTI engine bay power point
CHASSIS: 7.5x15" Ronal LS, powdercoated black with vinyl decal and Toyo R888 205/50/15 tyres, Koni coilovers, Elbach anti-roll bars, Powerflex bushes throughout, VR6 master cylinder and servo, Wilwood Dynalite four-pot calipers on 280mm discs with Ferodo DS2500 brake pads, Mk4 Golf rear calipers, Goodridge braided hoses

OUTSIDE: Tornado red with black roof and styled bonnet, G60 arches, 16v rear lights, Depo smoked cross-hair headlamps, vinyl front grille and door handles, modified front bumper and custom front number plate

INSIDE: Full black leather retrim with Mitsubishi FTO front seats, Mk3 16v clocks with engine management and shift lights, VDO gauges (oil pressure, oil temp, boost pressure), Mk5 R32 throttle pedal, Mk4 R32 clutch and brake pedals, custom boot release and water/meth switches, Momo Corse steering wheel, battery relocated in boot

SHOUT: Everybody at The Phirm, Tim, Diesel Dave, magical apprentice Matt Morgan, Jelly, Kristian, Wallye (was bad) Walcott, Kev and Carl at Revo Teknik for software (www.revotechnik.com), Ryan Lau at Time to Shine (07769 172708), Koni UK for help with the chassis setup, Adam at Add Signs for vinyl and decal work (add.signs@tiscali.co.uk), Marcus Burnham for required metals and just being Marcus, Big Paul Gormley and his dad for amazing work on the front number plate, Steve Taylor for his helping hand, my girlfriend Holly and you know the rest



“With the 888s on it doesn’t spin up in fourth anymore, only in first and second and a bit in third”

something very special indeed, as Paul’s friend Marcus explained: “It was a lovely summer evening. The sun was just setting and I was following Paul back from the workshop in my own Mk2. To see the grin on his face after all that hard work was awesome.”

This first drive was the Saturday night before the car’s show debut in its new guise at the chilled-out Stonor Park show near Henley-on-Thames. “It was that morning when I realised how bad my traction was,” Paul laughed. “I think the clue was when Marcus beat me off the lights in his 8v as I just sat there spinning right through to the end of fourth gear in a cloud of smoke!”

That tyre-shredding power comes courtesy of a custom Revo Stage 3 map. The story goes that Carl and Kev from Revo had to rework their normal Stage 3 software as Paul’s engine was running so well, it was more capable than most and they could push it further. And with an estimated 365bhp

(Paul hopes to get it on the rollers soon) and an estimated 170mph top end (thanks to the six gears), this is one seriously quick Mk2.

So after debuting the car at Stonor Park, Paul set about trying to sort out his traction issues. Out came the old FK Silverlines and, in their place, Paul bolted up a set of Koni coilovers – courtesy of Koni UK – and mounted up a set of chunky R888s over the now black Ronal LSs. “With the 888s on it doesn’t spin up in fourth anymore, only in first and second and a bit in third,” he smiled. “And that’s with the Mk5 six-speed ‘box too remember.” And although the 888s were up to the job, Paul found the stock S3 clutch wasn’t after a run or two up the strip at this year’s scorching GTI International. The solution came in the form of a custom spec’d Helix clutch with 1400kg of clamping pressure rather than the regular 1200kg to try and keep everything under control.

Paul hasn’t just concentrated on what’s

under the bonnet though. Since getting hold of the car he has added the black paintwork on the bonnet, roof and wheels. But our favourite part of the bodywork, and Paul’s too, is the front plate. Yep, you read that right. Because take a closer look and you will notice it’s not just your average plate. “I needed to get more air-flow through the front bumper because of where the intercooler and radiator sit. I was going to just cut some big holes either side of the plate, but then Tim came up with the idea of making up a custom plate instead,” Paul explained. “Marcus first made me a foam plate, then he made me a stainless steel one, but running it was just ridiculously dangerous. So then Big Paul (another The Phirm regular) and his dad laser cut me one out of an original plate. There’s no mesh added to it, that’s the original plate.” And while it might not look like it would make that much of a difference, Paul reports that with it fitted he was seeing

intake temps of between 16° and 18° degrees during this summer’s heat wave, and that was without the water/meth setup, a drastic reduction on the temps before.

You get the feeling speaking to Paul about his car that, above everything else, he is just incredibly proud of what he has achieved with his Mk2. And rightly so, it really is something special. Because not only has Paul built himself one hell of a road car, he’s managed to do what many people said couldn’t be done, run the TFSI lump without running Mk5 clocks and all off the original sensors. Throw in the full compliment of S3 performance parts too and the straight-out-the-factory OEM quality of the install and, well, it’s no surprise that Paul has found himself, and his car, absolutely surrounded every time he has popped the bonnet at a show. “It’s just got this massive grin factor every time I drive it,” Paul smiled. “And it’s been totally faultless since day one. It was built to be driven and it gets driven hard. I

use it daily after all.” If in doubt, flat out, right? “There is nothing more enjoyable than shoving RS4s and Monaros down the road and seeing their faces,” Paul laughed. “I’ve not had anything go past me yet.” And after seeing the car on the road ourselves, we’re not surprised nothing’s had him yet.

As you would expect, Paul isn’t done with his Mk2. “Diesel Dave says he can program a traction control system in to his box of tricks,” Paul explained. “So that’s next on the list. But other than that, I just want to get out there and enjoy it, I knew it was going to be good, but... just wow!” But what if your numbers came up on a Saturday night, Paul? “I’d turn the Mk2 in to a proper strip car and compete in the WDRCC,” he smiled. “Oh, and I need to build another Rallye too, probably with a TT RS engine in it, and a Type 3 Squareback, too” he continued. The Saturday night numbers might not come up anytime soon but if they do, don’t bet against him pulling it off we say ●



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MAKING THE TFSI TICK: David Bywater from Haslemere Tuning explains how new in to old can go, you just need the magic touch

There is an urban legend that it’s very difficult to make a full TFSI engine work in an early car. Fortunately for me, Paul had already done the difficult part of making it fit – all I needed to do was make it run. Like so many of these things, the hard part is working out how to do it.

It’s well known that the TFSI injectors need a 65v supply to open them, and that’s not something you generally find in an aftermarket ECU. So, if we were going to use the engine properly, there were two choices. We could either use the OEM ECU that came with the engine, or develop a new aftermarket ECU for the TFSI. VAG has spent a lot of time and money developing its ECU and it seemed a shame to waste it, so we decided to install that.

The issue is, modern cars have lots of electronic systems in them, and many of them talk to each other. As a result, if you take a single system out of the environment it was designed to work in, it’s liable to sulk. So how do you make it smile again?

Essentially, when you drop an engine into a vehicle for which it was not intended, the problems generally appear where the joins are. These can be mechanical, for example, will the new gearbox work with the original driveshafts and gear linkage?

The same is true for the electronic systems. When you try and connect a modern OEM ECU to the host car there are going to be lots of electronic joins, even though you can’t necessarily see them. The TFSI ECU has a traction control function as part of the ESP system, so it needs wheel speed information. If it can’t find the ABS computer to read the wheel speed sensor data, it flags up a problem. Some of these problems are more important than others, and some are harder to solve.

There are two obvious pieces of data that we want from the engine ECU: RPM and engine temperature – so that we can show them on the instrument panel. These can be taken from the CAN-bus, but it’s never quite as simple as that! RPM is fairly simple because the CAN data packet with this information is pretty consistent across the VAG range. We chose to develop a CAN reader module that converts the data into a

pulse stream that can run a Mk2 or Mk3 tachometer. As there was now a custom electronic module around the instrument panel, we decided to put a facility in to drive a couple of shift lights, and to run the temperature gauge.

However, that’s where the next problem appeared. One of the development cars for the system used on Paul’s car is an Audi 3.0-litre TDI, which has an ECU of the same vintage as the TFSI. We used this to sniff out what some of the CAN data was on a VAG bus, and found the engine temperature. This was then used to run a slave instrument panel to prove that everything worked and was calibrated.

The problem occurred when the module was connected to the TFSI as rather too much of the data unexpectedly disappeared, and the temperature gauge stopped working. To find out why, we started shredding the Audi systems. Once we knew what was happening it was quite simple to resolve with another custom module. We could have grafted a conventional instrument panel temperature sender into the cooling system and run a wire back to the clocks, but that wasn’t considered to be an elegant solution.

As the engine was being installed into a Mk2, there were not many engine-associated power feeds. The easiest solution was to build a new relay/fuse box for the ECU, which has been fitted into the centre console area. A second new fuse/relay box was also built to run the cooling fans and the water/meth pump, and for convenience, we also put the OBD2 connector here.

While you work your way through the systems, lots more issues come to light. The TFSI engine expects to be able to talk to a steering column module for cruise control information, and the ECU will log a fault code if it can’t communicate with it. You have to decide which of the missing or broken functions matter, which can be ignored, and which you can work with. In some cases, the easiest solution is to buy a module from VAG and wire it in to mollify the ECU. It does feel rather like throwing money at the problem, and we have developed ways to work around some of these issues. One of the advantages of developing your own electronic modules is that they can be uprated items,

which can make installation and future upgrades easier. If your ultimate plan is a 600bhp transplant, you might as well fit some of the better parts now! For some of the anomalies, it’s easier to modify the program in the ECU and ignore the difference. Several chip-tuning companies can remove the immobiliser function from your ECU, and also delete a lot of the more obscure fault codes. If the immobiliser challenge is ignored, the engine will start and run for about a second before cutting out. But is there a better solution?

This conversion also had a slightly unusual problem in that the car is fitted with the six-speed manual gearbox that came with the engine. This does not have a location to fit a speedometer cable or sender unit. One possible solution was to fit a GPS or Doppler speedometer, but that’s not pretty enough! Back to the custom electronic modules again, this time to do something similar to the newest cars – we developed a module to read ABS sensors, and use that to generate a pulse stream. As Paul’s car is fitted with Mk3 instruments, it has an electric speedometer head that the pulse stream could be scaled to. Now there was road speed available on the data bus, we could do a little more with it. The main instrument panel custom module is also responsible for switching on two radiator cooling fans, which are switched at different temperatures so that the engine is not over-cooled. There is now a firmware function that turns off the cooling fans when the road speed is sufficient for air-flow to keep the car cool. It’s only a little thing, but why not? All the technology was in place, we simply had to join up the dots.

The first transplant with a new type of engine is always the hardest, and we now have solutions to the problems. The next one will be both easier to do, and a more elegant engineering solution. Utopia is to be able to start and run the engine, to have a management fault light (MIL) that only comes on when a genuine problem happens, and to be able to read the DTCs and see ‘no faults’ reported. That’s a pretty colourful dream for a modern transplant, but at least you know what we aim for.