

## **CHAPTER TWO**

# **Oilhead Throttle Body Synching for Dummies**

**Where Our Ham Fisted Hero Pursues Mechanical Nirvana, One More Time, with  
FEELING.**

**- Or -**

**But Officer, I'm Just Tweaking The Fuel Injection System, Really !!!**

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The author(s) have done their best to provide accurate information. However, they/we assume no liability for any damage or injury caused by any errors or omissions in this manual. Use at your own risk. Verify all values with your BMW shop manual.

## Are Ya Skeered Yet?

OK, right off the bat we are going to be dealing with a few procedures and circumstances that range from being potentially destructive to plain old dangerous of men and machine and device. For this reason (and a few others) it is **STRONGLY** recommended that you read this entire chapter **AT LEAST ONCE, BEFORE** you proceed.

If normal common sense is ignored and/or these instructions aren't followed with an eye on safety and proper situational awareness, any number of 'bad things' could happen. We could make an extensive list of possible dire consequences ranging from breaking (or at least severely hurting) your TwinMax to turning your bike into a flaming (and potentially explosive) very expensive signal fire for your fire department to add yet another data point to their vast collection.

We **ARE NOT** responsible for your actions, lack of same, nor the consequences (unless they're all good, in which case we will all bask in the limelight). We are providing you with a set of our experiences and procedures with the aim of helping **YOU** adjust the throttle bodies on **YOUR** bike. As such **YOU** are the one performing this adjustment and it's **YOUR** job to make sure that the procedures are performed properly. We are only providing the basic details of how we perform this maintenance function.

This chapter does not and can not be complete in every detail nor does it try to be. It assumes that you are familiar with many things concerning your bike and your ability to operate it and maintain it correctly.

If you have questions regarding, or are confused by, **ANY** of the material presented here, get them answered **BEFORE** you begin.

In short **KNOW** what you will be doing **BEFORE** you make the attempt. It is **YOUR RESPONSIBILITY** to get all of this right.

Ok, enough of that shit, on with the procedure.

### ***Hand tools you'll need are***

A large flat blade screwdriver for the **B**ig **B**rass **A**ir **S**crew (**BBAS**) on the **T**hrottle **B**odies (**TB**'s)

A 10mm open ended wrench (for the lock nut on the cable adjuster).

And of course a TwinMax (or a manometer will suffice for all but the advanced tune up procedure).



### ***Where Are We Coming From***

Near the very end of the preceding chapter (OVAD) we recommend synching your Throttle Bodies (TB's) because they will need it after the valves are adjusted. That this is so, is due to the intrinsic nature of engine breathing and how small tweaks to optimize the breathing will make changes to the left to right balance of the TB's.

This also implies to a certain extent that the TB's can (and do) compensate for the degree of in-accuracy of the valve adjustment. Put another way, for any specific setup of the gaps for all 8 valves, the TB's will show a different degree of balance between the two cylinders...

That this situation is so 'touchy' and sensitive is a double edged sword, good in that compensation can be applied to bring the breathing of the engine somewhat back into balance and a pain in that it really needs to be done to minimize the vibration and buzz.

### ***WTFAWTAH***      What The F\*\*k Are We Talking About Here

Just what ARE we trying to accomplish here (you might, or should be asking your self)? Well, the answer is synching the throttle bodies of course, but what does that really mean.

This procedure is about matching the volume of air that gets delivered to each cylinder, under all conditions that we can control.

Since air pressure (either positive or negative) is really all a TwinMax can indicate, not air volume, were not actually directly adjusting the volume of air but rather the negative air pressure (vacuum) at any (and all) given moment(s) in time.

Despite this little discrepancy, this procedure rewards our efforts with matched power delivery from each cylinder and thus less vibration. Why? If we match the amount of vacuum generated by each cylinder, over time (the intake stroke), in a fixed environment (the fuel/air supply manifold) this will yield matched air volume to each cylinder and thus matched power from each cylinder.

The factors we can control here are valve timing and throttle body butterfly position. What this means is, this portion of an engines state of tune is dependant upon how close the valves are matched AND how close the 2 TB butterfly's are matched as well. Each of these 2 primary adjustments WILL interact and will tend to compensate for deviations for the other set of adjustments.

What we will be matching during this procedure are the butterflies (the assumption being that you just matched the valves so they are 'perfect').

### ***TwinMax BAH, It's Just Another Pretty Face***

What, you might ask, is a TwinMax, and where can I get one, and are there alternatives, and how much do they cost, and which model should I get, and, and, and.

The TwinMax is a tool that can be used to tune both Carburetor and Fuel Injection systems to equalize each cylinders power output. This results in less vibration (WOW, I can see out my mirrors again!), more useable power, less ware and tear on the engine and a bigger smile on your face...

To find out more about it, you can do an internet search (one word, twinmax) or call around and see if any of your local dealers has one in stock. They are imported from France into the US by <http://www.adventuremotogear.com/> and sometimes the importer runs out so there can be a wait.

They cost about \$80 +/- and ARE more expensive than a mercury manometer, which is a sorta equivalent device that can also be used, although not during the advanced tune up phase (see below).

The reason we really like the TwinMax for this job over any other tool is 3 fold.

Probably the most significant reason is you can run the bike on the street in the real world and observe the degree of TB balance (the advanced tune up phase).

And the second reason is the TwinMax is a differential instrument, which is very different than a magnitude instrument (like a manometer).

And third, since the TwinMax is an electronic gadget, it has no mercury to spill, which means that your one on one, up close and personal interaction with your local HazMat team can be kept to a bare minimum...

### **Geez, Now We Gotta Get All Geeky?**

Without delving deeply into an explanation of instrumentation types, let me say that each of these 2 types (magnitude and differential) has unique strengths and weaknesses.

Most of us are very familiar with magnitude instruments, we use them all the time and differential types much less so (unless you're a technoid). Examples of common magnitude gauges are speedometers, volt meters, clocks, calculators etc...

Examples of differential devices are... ahh... well the TwinMax, certain types of scientific instrumentation, and that's about it.

Magnitude devices tell us amounts of things and they usually need to be calibrated in some way, like our GS speedometers (i.e. is 60mph really 60mph?). They are usually stable and repeatable, otherwise we wouldn't trust the info they tell us.

Differential devices show us ONLY the difference between 2 (or sometimes more) inputs. Rarely is an amount or quantity displayed except as the difference between the inputs. Indeed, in using the TwinMax there is no way to show an amount, due to the sensitivity control which makes calibration of the quantity pointless.

Establishing a true zero is the only real adjustment that will make a reading either meaningful or meaningless (assuming the meter is functioning properly). Verification of a true zero referent is easy and essential (just disconnect or equalize the 2 inputs and re-zero). As is verification of input sensitivity (just reverse the inputs) and see if the indicated difference mirrors the reversal. Differential gauges are very sensitive to power supply variations however, and to even the slightest differences in the way the inputs are delivered to the instrument, these must be matched. Since the goal of synching our TB's is based on MATCHING the 2 vacuum pulses, a differential gauge is the ideal instrument to use. We really don't care about what (or how much) difference there is, only that we can minimize it to as close to zero as possible.

In addition a differential device will automatically cancel out ALL changes in signal that are common to both inputs. In our case this means that the normal and constantly changing amounts of vacuum present in the intake manifolds is not seen EXCEPT where the 2 inputs are different from each other. This is exactly what we want to pay attention to, and since a differential device eliminates all common background activity (or noise), we ONLY see what is significant and relevant without any extraneous distractions.

An example would be trying to visually match the constant rising and falling of 2 columns of mercury so that they are matched. It can be done but the amount of averaging that your eyes and brain must perform is completely unnecessary using a TwinMax.

So how do we make sure that we reduce the weaknesses of a differential instrument and then take advantage of its strengths?

In our case, when using a TwinMax, stabilizing the power supply is VERY important as is matching the hoses that hook up to the intake ports. The latter is quite easy, just make sure you use 2 pieces of IDENTICLE hose that are the SAME length. If in doubt about this, just reverse the hoses and see if the meter indication reverses exactly, small leaks in the hoses or couplers etc. WILL show up because that is precisely what a differential device is meant to show. In some cases you might need to add some additional length to the hoses as supplied with the TwinMax. Just be sure that they are the same length, come from the same source and don't leak.

As for the power supply, since the TwinMax uses a standard 9 volt battery, the most effective thing we can do is to minimize the drain on the battery. This calls for a little surgery but fortunately if we cut the wrong wire it won't blow up and us along with it... (Just kidding.)

The TwinMax has a backlight that always comes on when powered up. We can (and should) disable this extra drain on the battery. We really don't need the backlight anyway since trying to adjust the TB synch in the dark would be an exercise in futility, AND disabling the backlight gives us much more accurate and stable readings.

***Will The REAL Dr. Geek Please Report To Surgery IMMEDIATELY***

There are at least 2 different case designs and the detailed procedure below is for the older long and narrow case design that uses a single screw on the back. The newer case design (much more square in shape), has 4 screws buried under the 4 rubber feet, and requires much more involved surgery and should be left to someone who is comfortable taking delicate electronic gadgets apart. I will high-light the procedure but it would be far too easy to damage the internal components if you don't have some previous experience at diving into these kind of electronic gadgets...



Front of Old TwinMax



Inside Shot of Old TwinMax with wire cut

**Here's how to tweak your OLDER, LONG AND NARROW TwinMax for maximum sensitivity with more repeatable and consistent results.**

To open the unit up use a #1 phillips screwdriver and remove the screw in the center of the back of the unit (it would be best to remove the battery first, just because). Then gently pull the back of the unit off. Next peer into the guts of the unit and locate the 4 wires that run from the circuit board up to the meter body. These wires are paired, a red/black pair for the meter movement itself and a red/black pair for the backlight. Cutting one of the backlight wires is our goal. You only need to cut one wire which means you have a 50% chance of cutting the wrong wire, good luck.... (just kidding) The pair you DON'T want to cut goes to the meter movement in the middle of the meter itself. This means you can cut either of the other 2 wires which disappear into the left side of the head of the meter itself. I cut the black wire as you can see in the picture.

Once you cut the wire, verify that the unit still works by attaching the battery and turning the unit on and adjusting the zero knob and watch the needle move. If it doesn't, no matter how much you fiddle with the knobs, you cut the wrong wire... DON'T PANIC... Now all you need to do is solder 2 ends back together again. It's not brain surgery.. Then cut the OTHER wire of the same color and you're done... Now reassemble the unit.



Front of New TwinMax

**The procedure for the newer more square TwinMax.**

Pull the 2 front panel knobs off, then pull the 4 feet off, then remove the Phillips screws. GENTLY pull the 2 halves apart making sure the knob shafts and circuit board move with the

bottom half. Locate the 4 wires that run from the circuit board to the meter and then find the pair the drives the meter (see photo above). Cut one of the wires from the OTHER pair. Reassemble.

What you've just accomplished is to maximize your run time and the device's repeatability (2 very good things).

### ***The Full Meal Deal***

So we will be matching the vacuum at each intake manifold to be the same ALL THE TIME. This means under all throttle positions rpm's and loads. This is a different approach than matching the TB's at 3K rpm or some other arbitrary rpm while sitting on the center stand. What we want is matched vacuum ALL THE TIME and at all throttle openings. That is exactly what we will be seeing on the TwinMax dial, differences in vacuum ALL THE TIME. When we twist the throttle what we are changing is the TB's resistance to air flow expressed as a vacuum in that moment (regardless of rpm). What we can match up is how much air is delivered to each cylinder as we open and close the throttle. AND we can and should, do this while we ride the bike ON THE ROAD, not just in the garage or in the shop. This is an advanced tune up procedure, where we have the ability to match up the TB synch ON THE ROAD. This is a HUGE advantage for the TwinMax and is why we recommend it over any other device. **Now, be aware that what we are sharing here is the method WE USE. We pay attention to the traffic around us so that we and that Chevy Suburban (with the soccer Mom and the entire team) barreling down on us don't get too close and share that special something, like oh, say, body paint or other body parts.**

### ***When You're Hot You're Hot***

Another important factor we must address is engine temperature. The only really significant temperature that matters (as far as this procedure goes) is full operating temp. Which means the bike HAS to be fully warmed up FIRST, to get a really good final synch. The initial adjustments we make can get us close but it will be the adjustments we make on the road, when fully warmed up, that will really deliver the goods.

### ***TECH NOTE***

Make sure you have a fresh battery in the TwinMax, if you are uncertain replace it with a known new battery. If you are a tweaker at heart, haul out your DVM and measure the battery. If you measure a voltage lower than about 8.5 volts replace it. Yes, the power supply is that important.

### ***Practice, Practice, Practice,***

This next section is mostly to help you become familiar with the procedures and techniques, any adjustments made are preliminary. Becoming familiar with the methods and means before getting out on the road is very helpful for several reasons. #1, since the engine will be Fully warmed up we want to make the adjustments fairly quickly so as to not over heat the engine. And by making initial adjustments now, will (hopefully) reduce the amount of the adjustment we will need to make during the On The Road Tests™<sup>©</sup>™<sup>®</sup>™<sup>QD</sup> which helps with reason #1.

Ok first, start the engine and let it warm up a bit so that you see 1 or 2 bars on the RID. Shut the engine down and let it sit for a minute while you hook up the TwinMax to the intake manifolds

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(you can let the 2 hoses that were connected just dangle, or pocket the rubber caps if so equipped). When you first try and pull the existing hose or plug off the air nipples, it might be necessary to twist the hose in order to let it come loose. They sometimes can be rather difficult to get off the first couple of times, you may even have to use a small screwdriver and pry the hose down (be careful to not scratch the brass nipple itself). Now be sure and keep the TwinMax hoses away from the really hot stuff so you don't burn them and be sure that you don't kink the hoses which will screw with the reading. I usually put the TwinMax on the seat or tank bag and let the hoses dangle down and make a gradual turn back up to the intake air nipples.



TM in Shop Position



This works well during the initial setup but not during the On The Road Tests™©®QD. Why? Because you don't want the hoses interfering with your boots or the controls etc. During the On The Road Tests™©®QD I run the hoses down the tank, then slide the hose between the seat and the tank to help hold it in place then toward the TB's. Then I run it between the TB's, and the engine block, away from the throttle assembly, then a gentle bend back up to the intake air nipples.



TwinMax in Traveling Position



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Now for a step sideways... Use your screwdriver and turn your BBAS clockwise and count the number of turns each is out from being LIGHTLY seated. Do this for both sides and write the numbers down or memorize them if you can do so. What is important here are 2 details, #1 what are the number of turns out from being lightly seated BEFORE we change anything and #2 how much difference is there between them. Ideally they should be the same. A large variation (say ½ turn difference or more, which is very uncommon) means one (or both) intake(s) may have an air leak which will make this job more difficult until the leak is fixed. Be sure and return both BBAS's to their original position



Right Side BBAS



Left Side BBAS

Next turn the TwinMax's sensitivity to MIN and turn the power on and then adjust the zero so that the needle stays at zero at both MIN and MAX sensitivity (and everywhere in between). Make sure and return the sensitivity to MIN when done.

### **Functional Note**

If the needle will not stay within the zero line from MIN to MAX you have a defective TwinMax and it needs to be repaired/replaced.

### **Operational Note**

DO NOT leave the TwinMax ON and at MAX sensitivity and then start the engine... The needle WILL swing from HARD left to HARD right... This could damage the meter movement permanently.

### **Now, Lets Get Serious**

Next, with the zero set properly and the sensitivity turned to MIN, start the engine and watch the needle AFTER the idle settles down. By now the fast idle lever should be off and the engine idle at spec (1100rpm +/- 50). If the idle speed is outside the acceptable range we can adjust it during this procedure (assuming it's not WAY out of range). If initially, at idle, the needle is pulling to one side or the other (remember we are still at MIN sensitivity) then we adjust the BBAS to correct this. First blip the throttle lightly and see if it returns to the same place as before. If so, great. If not, then blip again and again, and notice where the needle wants to stay.

Wait for the idle to completely stabilize between blips. Don't pay any attention to what happens to the needle during the blip just yet, we'll get to that in a bit. Once you determine where the needle wants to stay at idle, then we can make changes to the BBAS to bring it back to center (if needed).

Which BBAS do we fuss with one, you ask? Well that depends on if you want the idle speed to go up or down or stay the same, AND where the BBAS's are to start with. Now I know what you're thinking about now. WTF, why is he bringing up a whole new dimension of adjustment without even mentioning it before hand... Well ya see it's like this, if the amount of adjustment is only slight (like about a 1/4 of a turn of the BBAS, then it won't really matter if you turn one BBAS up or the other down or split the difference. Your idle won't change all that much, BUT if the needed adjustment is more than 1/4 of a turn, your idle can be moved in the desired direction by adding more air flow to the weak side (which increases idle speed) and visa versa.

Which side of the needle is the weak side? Well, say the needle moves to the right side, the right side is pulling more vacuum than the left side (the weak side). And say you want to increase the idle rpm and balance the needle reading, you would turn the left side BBAS counterclockwise (open it up, to add more air flow). If you want to slow the idle down, close the right side BBAS (clockwise, to restrict air flow), until the needle is centered over zero. As you watch the needle move when you make changes to the BBAS's you will begin to see the pattern emerge...

NOW turn up the sensitivity and continue to adjust the appropriate BBAS until you MAX out the sensitivity knob and the idle pulses are centered over zero. Did you see how the needle started to wiggle in a fatter and fatter arc as you increased the sensitivity? Why, you might ask is this

happening? Well, because we are running the engine at idle, and the 2 vacuum pulses arrive at slightly different times and the TwinMax is showing the difference between the 2 cylinders. First the needle gets pulled one way then the other, back and forth. As the rpm's increase the time difference between the arrival of the two vacuum pulses decreases and so the width of the needle wiggle reduces. This is a good thing because as the engine rpm's go up we gain resolution in our readings which works in our favor.

Now if you need to move your idle engine speed up or down, just start cranking on both BBAS's until the needle shows a zero balance AND you have the correct engine idle speed. Unscrew (counterclockwise) the BBAS's for faster idle (more air) and screw them in (clockwise) for slower idle (less air)...

### ***Operational Note***

This adjustment will most likely need to be further dialed in after the engine is fully warmed up.

### ***Technical Note***

The BBAS has a maximum adjustment range of about 4 turns of which the first 3 is the suggested useable maximum. This isn't a hard and fast rule but only a guideline. For the GS, the 'normal range' runs from about  $\frac{3}{4}$  to  $2-\frac{3}{4}$  turns. Adjusting the BBAS outside of this 'normal range' indicates compensation for other 'abnormal' settings. Ideally both BBAS's should be within  $\frac{1}{4}$  turn (or less) of each other. Also note that as the BBAS continues to open up it's accuracy and the degree of precision of air control decreases. This isn't a huge concern but just something to be aware of.

Now blip the throttle and watch to see if the 'fat needle' stays centered in the zero zone or wanders off then meanders back or pulls one way then pulls in the opposite direction when the throttle is closed... Each of these behaviors will be addressed later. For now just make sure that at idle the 'fat needle' is centered over zero.

### ***RE-CAP #1***

Ok what have we learned and where are we in the greater scope of things.

1. We have run the engine and observed how the TwinMax shows us using varying degrees of sensitivity how the vacuum for each cylinder can be adjusted at idle.
2. We now know how we can adjust the idle rpm up or down and keep it balanced left and right.
3. We have observed when we open and then close the throttle what the vacuum difference between the 2 cylinders looks like.

### ***Are You Sure You Want To Screw With This Some More?***

The next step is to observe what the TwinMax needle does when we open the throttle and run the rpm's up a ways hold it there then let it fall back to idle. This is where things start to get very interesting...

Watch the needle as you slowly raise the rpm's up to say 3K rpm then hold it there for a few seconds then let the rpm's slowly fall back to idle. Do it again and notice the pattern as the

needle moves off zero. Try to make the opening and closing of the throttle take the same amount of time, with a pause in the middle.

Next test, open the throttle more quickly up to say 4k rpm (like a Big Blip) hold and then let it fall quickly back to idle. Again notice the pattern of the needle. Repeat once the idle stabilizes. Again make the run up and run down take the same amount of time.

### ***Technoid Note***

Thus far I have seen 3 somewhat different types of needle behavior when you open and close the throttle. Most of the time these behaviors are only really noticeable when the sensitivity is cranked to MAX (or very close to it). Ideally, the needle shouldn't move off zero regardless of where the throttle is, or what the engine rpm or load is. For those who have the simpler behavior (#1 below), you'll be done much sooner. The rest of us will need to make a determination on just how far we want to pursue that wiggling little needle.

The first behavior is the easiest to deal with, the other two require more fiddling if your goal is to completely eliminate the extra needle excursions and have the TB's behave 'perfectly'. It is NOT necessary to achieve perfection, but for some who just HAVE to make this as perfect as possible, I'll explain later what you have to do. You can ALWAYS change your mind! ! !

#1 The first type of response; after you open the throttle, the needle pulls in one direction and then stays there until the throttle is closed at which time the needle returns to zero, every time.

#2 The second type of response; the needle pulls in one direction while opening and then pulls in the opposite direction when closing the throttle and usually returns to zero. This indicates compounding influences in your throttle cable assembly.

#3 The third type of throttle response; has the needle pulling in one direction and then moves back to zero when you stop moving the throttle but then shoots over to the opposite side of zero when the throttle is closing, then eases back to zero, sort of, after the throttle is closed and the rpm's settle down. This is a slightly different set of the same compounding influences as #2.

One common characteristic of both the 2nd and 3rd type of needle behavior is that zero at idle doesn't stay at zero but shifts around to varying degrees. This wandering of the zero at idle is indicative of a small problem that while not of major importance certainly frustrates all attempts to 'make it right'. These needle fluctuations result in VERY minor performance differences, so the 'need to make it right' is more psychological than anything else. Remember, you can usually only see these behaviors while the sensitivity is at MAX.

### ***How To Make A Throttle Cable Length Adjustment, THE RIGHT WAY.***

For those of you who would like to make an initial adjustment, just to get used to the procedure, here's what to do. The idea is to change the length of the outer cable sheath which effectively changes when the inner cable (the one that actually moves) begins to pull on the throttle shaft cam and thus changes when the butterfly starts to move with respect to the other side. Put another way we are changing the initial timing of the 2 butterflies with respect to each other. The desired end result is to make both butterflies move as one.



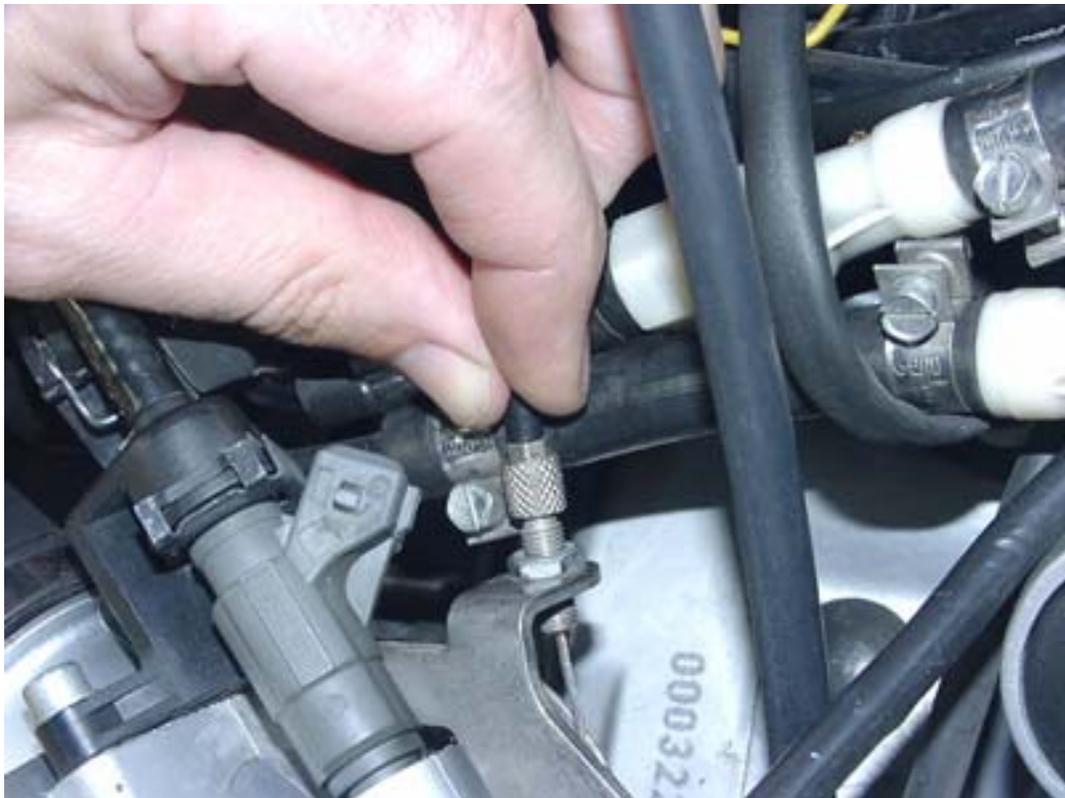
Left Side Adjuster Location



Right Side Adjuster Location

Now, which way should we twist the adjuster? Think of it this way. As you lengthen the outer sheath (twist the adjuster to the right, counterclockwise as viewed from the top) you will make that throttle shaft begin moving sooner, this will pull the TwinMax needle more to the side that you are adjusting. Shorten the sheath (clockwise rotation) and the needle will pull more to the other side. As a general rule I only twist the adjuster 1/8 of a turn at a time MAX, usually it's 1/2 that amount. Then I check the results on the TwinMax by opening the throttle and watching the needle to make sure I actually did make a change and it moved the needle in the correct direction. It is also a good idea to open the throttle several times and watch for the new needle movement pattern to emerge. BE SURE and lock the adjuster back down with the lock nut (1/2 sneerk will do) after every change, since it WILL effect the needle reading.

One factor that WILL screw with your head big time, is if the outer sheath twists when the adjuster is changed. If you let this happen, then your life immediately gets much more complicated. DO NOT let this happen. How? Well, I hold the outer sheath steady while I twist the knurled adjuster just a little bit at a time and then tighten the lock nut back down. THEN, I make sure that the outer sheath is pushed fully into the adjuster just to make sure it's fully seated. This last step is absolutely essential, especially for the newer bikes with updated cables that fit very snugly in the adjusters.



Fingers Holding the Sheath

So which adjuster should you mess with and which way do you turn it? Well, you have a choice here. You really only want to make changes to the adjuster on one side, the other needs to remain fixed as a reference. Either side can be adjusted so the decision is yours. If you look at

both cable adjusters you'll notice that at least one side has a dab of paint on the threads and lock nut. If only one side is 'marked' then adjust the other side. If both sides are marked then you get to choose one to make your changes on. I'd choose the side that is easiest to get to.

### **Operational/Responsibility Note**

Your dealer will most likely notice that the paint blob has been 'violated'. This tells them that someone (you) has changed the setting. This is a normal part of maintenance and they (if approached correctly) shouldn't have a problem with you learning how to maintain your own bike. If they do, just explain to them you are learning basic procedures on using a TwinMax to synch your TB's and want to keep your bike running as best it can. It does not violate your warranty to make routine maintenance adjustments. Also be aware that there are other related functions and aspects of the throttle cable system that are being changed beyond just the TB synch. As long as the changes are small these other factors will not be a problem. On the flip side, if the amount of change required to bring the TB's into synch are majorly large, then there is something else going on and your dealer SHOULD be made aware of this 'abnormal' situation.

This initial adjustment procedure only really applies for making very small amounts of adjustment, if larger amounts of change are needed other details need to be brought into the picture. But normally this initial adjustment, and after the engine is fully warmed up perhaps an additional tweak, should do the trick.

If small adjustments don't make a noticeable change in the meter, 1 and/or 2 things are happening. Either, 1) the cable has not been fully seated in the adjuster after an adjustment has been made and/or 2) the amount of adjustment needed is larger. For this later situation pull the outer cable sheath up and away from the adjuster and observe the meter indication. Either the needle moves closer to zero (or shoots on past to the other side) or it will bury itself even deeper on the same side. This tells you that the adjuster needs to move a bunch, either up or down based on what happens when you pull the cable sheath up. Just follow the needle, if when you pull the cable up and the needle swings towards zero then that will tell you about how much you need to lengthen the adjuster. Conversely if the needle doesn't head to zero then you need to shorten the adjuster...

### **RE-CAP #2**

Ok where are we in the bigger picture here...

1. We have balanced the TB's at idle and adjusted the idle rpm
2. We have opened and closed the throttle and matched the throttle cables (at least well enough for now)
3. We are familiar with how to make all the adjustments we need to deal with, in order to do the advanced final adjustment, the On The Road Test™©®QD.
4. We are familiar with how the TB's react to opening and closing the throttle (albeit the engine isn't fully warmed up and under no load conditions).

### **On The Road Again**

Ok, next step, the advanced final adjustment, On The Road Test™©®QD is where we separate us from the rest of the pack. This is where we can achieve that extra little bit of tweak since we are

now going to finish tuning the TB's under the same conditions where we normally use the bike. Not in the shop or garage but on the road and fully warmed up.

Is it really that important to take this extra step?

We believe so, not because it alone will make a huge night and day difference, but in conjunction with the other tweaks (valve matching, for example) they all tend to reinforce each other and the results will speak for themselves.

We want the TwinMax connected up but in the traveling configuration (make sure the TwinMax is turned OFF) and then go for a ride to fully warm up the engine.

You want to leave it off as much as possible to conserve your battery. This means only turn it on when you are using it, not during the warm up, nor when you are waiting for traffic to clear etc. You need to secure it to your tank or tank bag with a bungee cord or... make sure that you can read the meter while riding, and that the bungee does not interfere with either of the adjustment knobs or the power switch.

Most likely during all of this fussing, the zero knob has been moved and the unit will need to be re-zeroed, but don't worry about that right now.

### **Operational Note:**

The number one priority is to SAFELY ride the bike, looking at the needle is of secondary importance, do not get caught by needle fixation, pay attention to what is going on around you.

### **Operational Note Again:**

DO NOT leave the TwinMax ON and at MAX sensitivity and then start the engine... The needle WILL swing from HARD left to HARD right... This could damage the meter movement permanently...

Ride the bike and find a nice long (relatively) straight stretch of road with light traffic and plenty of places to pull over and fiddle with the adjustments without being in any ones way. You will be opening the throttle and closing it many times in 2<sup>nd</sup> or 3<sup>rd</sup> gear so your speed will reach higher than safe residential speeds so plan accordingly. If you can find a suitable empty parking lot all the better.

Once fully warmed up, turn off the engine and re-zero the TwinMax as described above, then leave the sensitivity at MIN and start the engine and check your idle balance.

Adjust the BBAS's as necessary as you turn the sensitivity knob to MAX.

Next move on down the road and watch the needle move as you open and close the throttle.

Pull over and make an adjustment to the cable adjuster, then blip the throttle and watch for the change you just made. Then pull back onto the road and verify the change your adjustment has made under load.

The idea is to adjust then check, then adjust again etc and minimize the needles deflection from zero under all conditions.

If you let the outer sheath twist, the changes you make will take far more time to settle down and be repeatable. This is due to the sheath untwisting itself as you open and close the throttle repeatedly... This can really add much confusion to the point of being frustrating...

If your bike is behaving as described by type #1 you should be able to dial in the adjustment with repeatable and consistent results very quickly.

Once balance is achieved, remove the TwinMax (turn it off), hook up the crossover hoses again (or plug the caps back on) and be amazed at how much improvement you notice. You're done.

### ***And Now To Separate The Men From The Boys***

For those of you who are chasing that little needle around like you've got a fly swatter and your hunting that damned little fly.... (Needle behavior #2 or #3), you have a choice. For now get the needle as close to zero as much of the time as you can and then decide how much work you want to put into the next stages...

The second type AND the third type of throttle responses have a similar problem at their source. We have found that these problems are due to the outer cables inner teflon sheath (that runs right next to the stainless steel moveable inner cable) has shifted. It can usually be found scrunched up against the inside of the adjuster and is effectively pushing the sheath away from the adjuster body OR pulling the inner cable tighter.

Since this is not a good nor consistent thing, your TwinMax needle will tend to jump all over the dial when on MAX sensitivity...

The solution is to either replace the throttle cables (a major PITA) or cut the extra bit of inner sheathing that is sticking out from the cable ends, off, as I did (which is why I know about this in the first place).

Be careful not to cut or nick the inner cable as this will add further complications later in life. Usually (hopefully) the inner teflon sheath hangs out at the TB adjuster end. This is a much easier place to get to than the Bowden cable assembly where all 4 of the throttle cables merge. It is located under the ABS controller and battery box area.

If the cable ends at the TB's don't show signs of that inner sheath messing with the adjuster then your next step is to gain access to the Bowden assembly.

At this point (which is WAY beyond the scope of this chapter) you can pay the bucks for the dealership to run it down OR live with the small deflections showing up on your TwinMax. Functionally and realistically the performance differences are minor. Where it will become most evident is if you have replaced your cat afterburner with a 'Y' pipe and your exhaust system likes to imitate a howitzer.

With these small cable problems your howitzer will have more authority and head turning power. This is especially gratifying for that Manly Man inside us all or for those Hardly Ableson wana-be's.

I found it especially gratifying inside tunnels.

At this point, you have 3 choices, go after the cables, forget about it and call it good, or if you still are on warranty, have BMW replace the cables... You will probably have to convince the

service department that there is a defect by showing them the inner sheath has slipped out of it's intended home and is messing with your TB synch tweak.

This will entail yanking one (or both) cables off of the TB's and then re-synching them again but by that time you're probably an old hand at chasing that little needle around anyway...

Ok lets close up shop and head for the hills to enjoy your new found smoothness and discover any other changes in the way your engine responds...

Turn off your TwinMax, and replace the hoses or caps over the intake port nipples. Take the battery out of the TwinMax (just a safety precaution) and seal the 2 hoses so little critters don't nest inside your nifty electro-tool.

And be sure and stay tuned for the next few exciting chapters in our continuing saga... OBFD  
And then we will unleash OSSSST.

Yes, we can hear those gasps of anticipation even now!!!

### ***About the Authors***

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