Smart Tuner

SMT6

INSTALLATION GUIDE

Digital TECHNOLOGY (pty) ltd

Perfect Power

TABLE OF CONTENTS

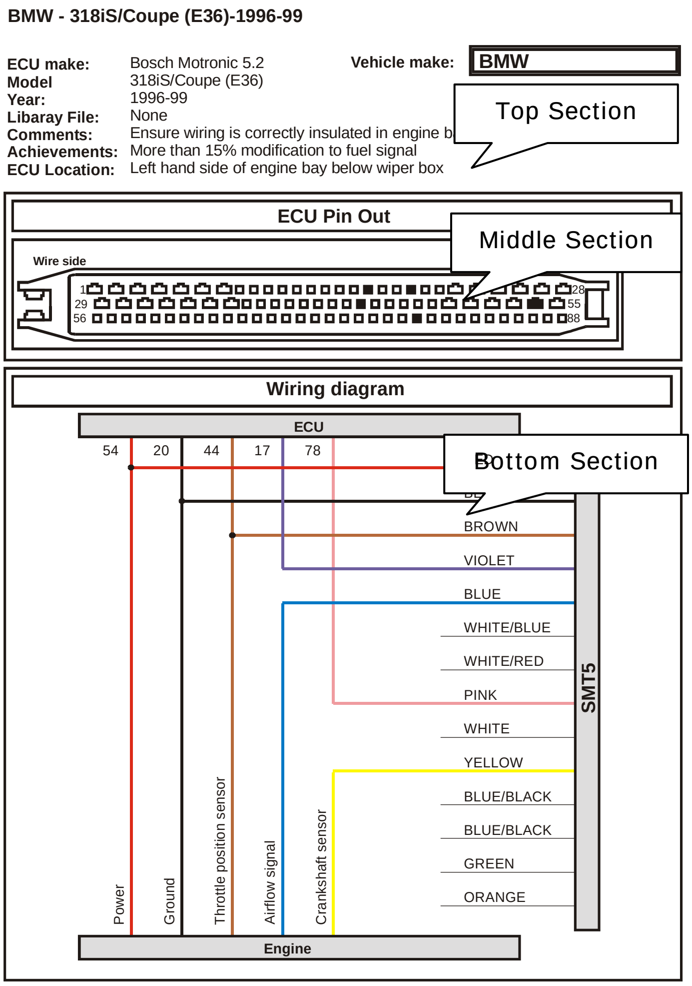
1 INTRODUCTION

This guide focuses on the standard installation of an SMT6 unit. For help with non-standard tuning applications, such as the turbo nitrous control, please refer to the Application Notes. Application Notes can be found under the "Downloads" section on our website www.perfectpower.com.

Please send any comments or suggestions to info@perfectpower.com.

It is not recommended to complete an installation by wiring everything at once. The reason is that should a problem occur, it could be difficult to isolate it. It is best to divide the installation into its separate components, and complete each component successfully, step by step. It will be useful if you are familiar with wiring diagrams as a wiring diagram can help you save time. However, wiring diagrams should only be used as a reference, as it may be possible that the diagram is not compatible with your particular car. By following the installation step by step, you can confirm that you have the correct signals with an oscilloscope. If you don't have an oscilloscope (scope) when doing an installation, this step by step installation guide will at least help isolate any problems, should one occur.

The following is a typical wiring diagram of an installation. If you need assistance with wiring diagrams, please send the ECU pinout schematics for it and send them to info@perfectpower.com. This guide will also explain some of the wiring principles, signals and how to make your own wiring diagrams. If you have no information on the car then the correct wires and signals will need to be traced. This process will be explained in the guide.



Wiring Diagram Explanation:
The wiring diagram is split up into three sections: top, middle and bottom.

The top section has information on the type of car, type of ECU, and year. General information on previous installations is also included.

The middle section is the ECU pinout. This part of the diagram is useful and it is the most obvious way of telling if you have the correct diagram. If the harness in the diagram does not look the same as the one in your car, this means you don't have the correct diagram. The blacked out pins indicate the pins used by the SMT6 unit.

The bottom section of the diagram shows the actual wiring. The top portion of the diagram shows the wires coming from the ECU, the right hand side is the SMT unit and the bottom shows the wires coming from the engine.

2 STEP BY STEP PROCEDURE

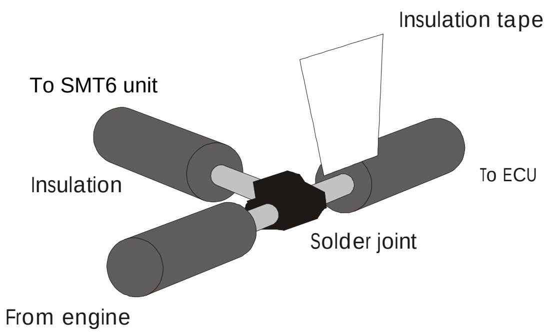
2.1 STEP 1 – GETTING STARTED

When working with any electronic device you need to ensure that it is plugged in to a stable and clean power source. Any “noise” present through the power source, will filter through the entire SMT6’s circuitry and could be the cause of possible problems.

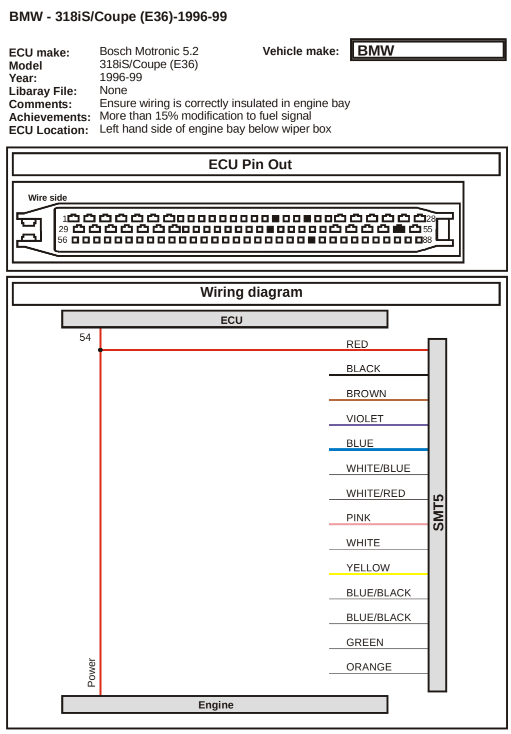
If you don’t have a wiring diagram you can look for a power source on the ECU either with a multimeter or a scope. It is recommended that you use a scope so that you find a source that does not switch. It may be possible that you get power from the injector supply, and although it may look fine on a multimeter you will be able to see that it is incorrect on a scope.

Attach the ground of the scope probe to the chassis of the car (you can connect it to the earth strap loop on the vehicle’s door). Test all the pins of the ECU until you find a supply of +12V DC. This supply needs to be flat, stable and free of noise. Switch on the engine and make sure it remains flat and stable. Ensure that this supply switches off when ignition is turned off. This is very important as it forms the foundation of your installation, so please do spend some time to ensure that you have established the best power supply for your SMT6.

If you are making a diagram, it should look something like the diagram at the end of this step. You will notice that power is just connected to the power connection of the ECU - this is known as “teeing” into a wire. The following diagram shows a method of doing this:



Teeing to ECU



Example of a Wiring Diagram

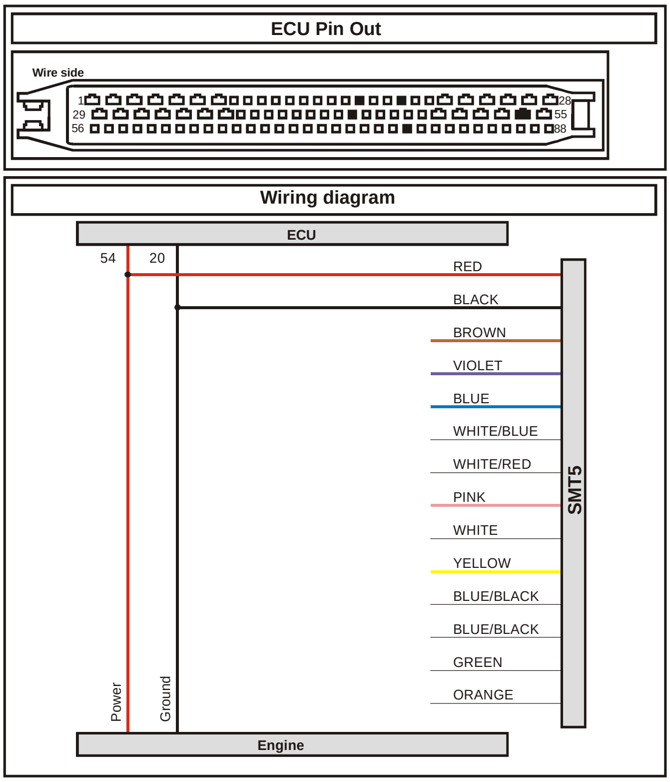
2.2 STEP 2 - CONNECTION

The next connection is ground (-12VDC). This can also be checked with a multimeter but preferably use a scope. Once you have found a ground pin on the ECU harness or elsewhere, make sure there is very little noise on it. The entire SMT6's circuit uses this point as a reference, so excessive noise on the ground terminal of the SMT6 will be reflected on the output signals of the SMT6. Please note however that you won't find a point with no noise, but the least amount of noise will be best! The closer the ground point is to the negative terminal of the battery, the less noise you will have.

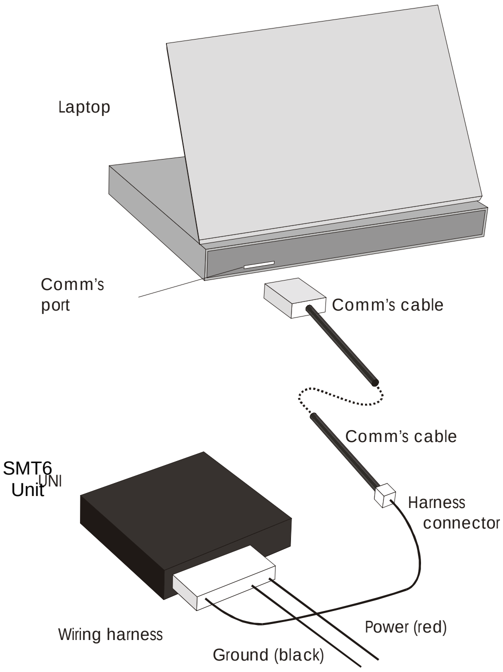
The diagram should now look like the one below:

BMW - 318iS/Coupe (E36)-1996-99

ECU make:	Bosch Motronic 5.2	**Vehicle make:**	BMW
Model	318iS/Coupe (E36)		
Year:	1996-99		
Libaray File:	None		
Comments:	Ensure wiring is correctly insulated in engine bay		
Achievements:	More than 15% modification to fuel signal		
ECU Location:	Left hand side of engine bay below wiper box		



2.2.1 CONNECTING THE SMT6



Once the +12VDC and the –12VDC are connected as shown in the above wiring diagram, can you now start the communications on the SMT6 using your personilised Windows tuning software.

Connect the SMT6 to the wiring harness. Connect the one end of the comms cable, supplied with the Start-Up Package, to the harness and the other end of the comms cable to a serial port of a laptop/PC.

WARNING:
If the laptop or computer is connected to a mains wall socket or on charge for the above communications, it is possible that the computer port will "BLOW" the communication port on the SMT6. To be safe, connect the comms cable first, switch the PC ON and <u>then</u> turn ON the car's ignition. Avoid disconnecting and reconnecting comms cable while Ignition is ON as this could damage the SMT6.

Start the Windows software on the PC and then turn the ignition on without cranking the engine. You should get communications with your SMT6 by seeing numbers changing on the screen. Don't worry if you error messages for now, as you have no sensors connected. The comms port selection can be found under "Tools" on the Menu Bar.

If the SMT6 is not communicating with the PC, check these common problems:

CAUTION:
ALWAYS turn the ignition OFF before removing and inserting the comm's cable. Leaving the ignition ON, could damage the PC and or the SMT6.

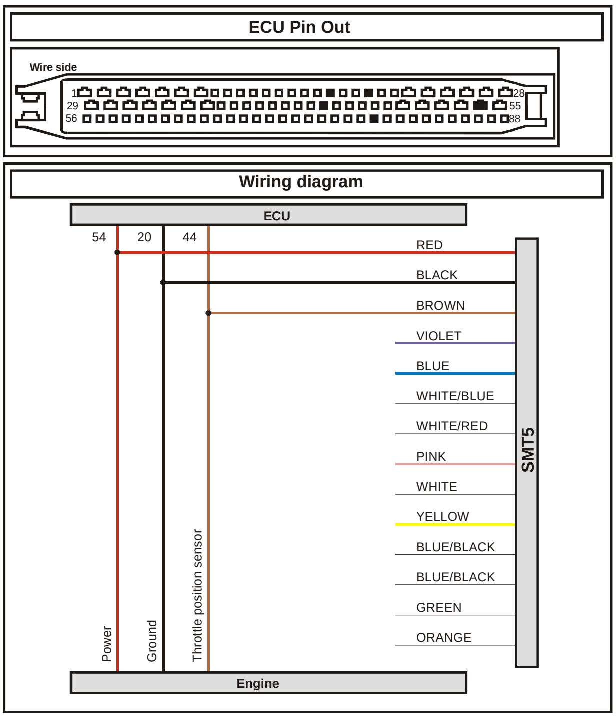
1) **Re-check the power connection**. Make sure there is no noise and that it is a stable voltage i.e. non-switching.
2) **Make sure that the power stays ON constantly**. You may be connected to an alternate supply that only stays on for a few minutes and then switches off.
3) **Check the comms cable for continuity**. The cable could be damaged or disconnected during the installation
4) **Make sure the laptop's comms port is working**. Try another laptop or PC that you know has an operational comms port.
5) **Connect to the correct comms port.** In the Windows tuning software, check to see if the correct comms port is being used. This can be found under "Tools" on the Menu Bar.
6) **Contact Perfect Power Technical Support if the above checks have not solved the problem**. When contacting Perfect Power at info@perfectpower,com, please provide as much information on the installation as possible.

You should only continue with the rest of the installation, if there is communication with the SMT6. Communication is essential for the rest of the installation and tuning. A communication problem becomes complex to solve, if all the other wires of the SMT6 are already connected.

2.3 STEP 3 – THROTTLE POSITION SENSOR (TPS)

BMW - 318iS/Coupe (E36)-1996-99

ECU make: Bosch Motronic 5.2 **Vehicle make:** BMW
Model 318iS/Coupe (E36)
Year: 1996-99
Libaray File: None
Comments: Ensure wiring is correctly insulated in engine bay
Achievements: More than 15% modification to fuel signal
ECU Location: Left hand side of engine bay below wiper box



Once communication has been established, the next step is the connection of the throttle position sensor (TPS).

The throttle position sensor should put out a voltage between 0-5V DC. If you don't have a diagram, there are three methods to identify the TPS. The throttle position sensor normally has more then one wire coming out of it. With a multimeter, establish which wire is the signal wire.

1. One method is to remember the signal wire colour that comes the from the TPS. Then find the same colour wire in the ECU harness. There could be a few wires of the same colour in the ECU harness, but at least your search is narrowed down . If this is the case, use the method below, to establish which wire it is.

2. Another method is to put a multimeter in continuity mode and connect one end to the TPS signal wire. With the other end of the multimeter, test all the pins of the ECU harness with the ECU disconnected from the harness until the multimeter shows continuity.

3. The last method is to look for the signal with a scope. Turn the car's ignition ON <u>without</u> starting the engine. Test each of the pins until you find a DC signal that fluctuates when you press the accelerator. The reason you don't want to start the engine is because the airflow sensor has a similar signal and you could get confused between the two. (There is no airflow when the engine is not running so the airflow sensor is just a flat DC voltage).

Once you have found the wire, mark it and amend your diagram. T-Connect the brown wire of the SMT6's harness to the TPS signal wire. Your diagram should now look like the one on this page.

2.3.1 ANALOG DEFLECTION SCALE

You will now need to set-up the analog deflection scale in the Windows software. To do this, turn the ignition ON without starting the engine.

In the above picture, the "99%" is your present throttle deflection value. Remember this value. Put your foot flat on the accelerator and remember the flat foot throttle value. Click on "Scale Settings" from the Menu Bar and select "Deflection"

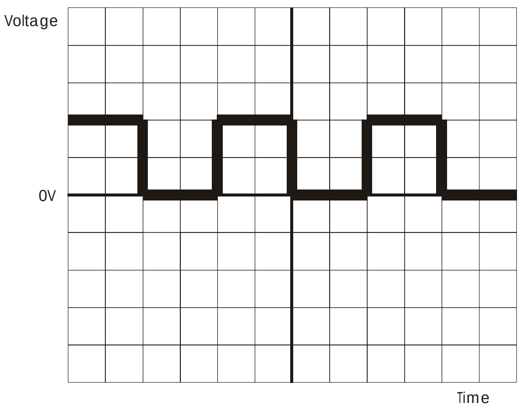
On the "Deflection Scale" screen you will see a bar graph of your present throttle deflection. Tick the "Activate Function" check box. In the "% Minimum" box, insert your lower throttle position plus 5%. In the "% Maximum" box, insert the flat foot reading minus 5%. Click on the "Apply" button and then on the "OK" button to exit the screen.

When you now press and de-press the accelerator pedal, the cursor on the map screen should move smoothly from the left most column to the right most column. For more information on how to setup the throttle or load deflection, refer to the Windows manual.

2.4 STEP 4 – ID IGNITION SIGNALS AND WAVE FORMS

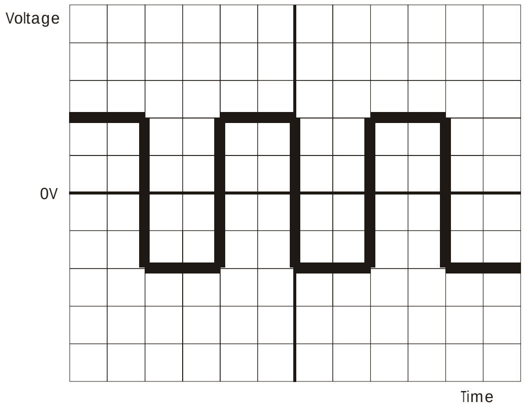
Here, you will need to confirm that you can read an ignition signal, but not modify it for now. The SMT6 needs to understand the ignition signal first, before any modifications are done to it. Ignition modifications are therefore left until last. Before continuing, it is best to understand some of the different types of ignition signals you could find. This is when having an oscilloscope is really important.

2.4.1 STANDARD SQUARE WAVE UNIPOLAR SIGNAL



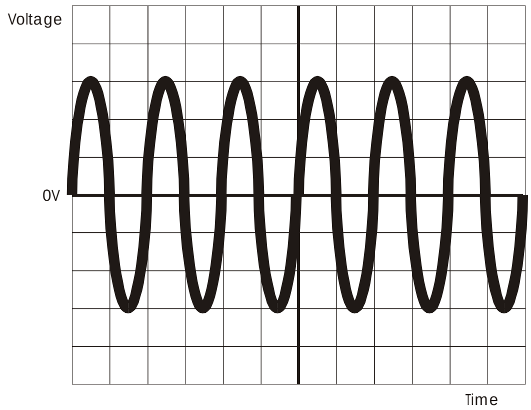
A basic voltage swing from zero volts to a positive voltage, commonly 5V or 12V DC is shown in the diagram below. This signal is simple and your SMT6 will be able to advance and retard this signal.

2.4.2 STANDARD BIPOLAR SIGNAL



The bipolar signal similar to the unipolar signal, except that this signal swings to a negative voltage, or more accurately, crosses the 0V mark. Your SMT6 can also advance and retard this signal.

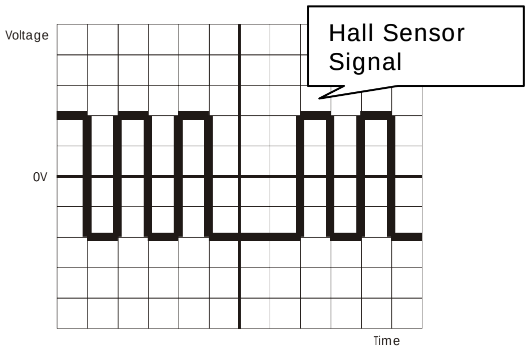
The above two signals, (the square wave type), are common with hall sensors. The hall sensor is a type of switch that switches on and off, resulting in the nice square waves. Another form of bipolar signal is taken from a magnetic sensor, which creates a sinusoidal waveform shown in the diagram to the right.

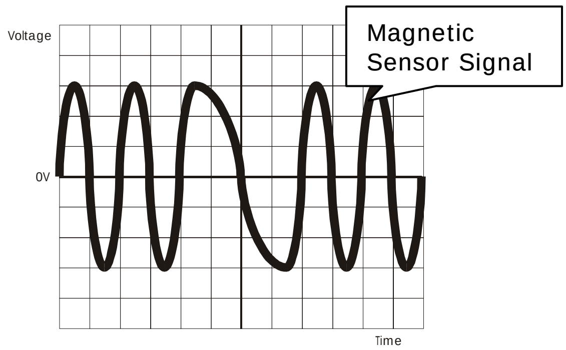


2.4.3 MISSING TOOTH SIGNAL

For missing tooth signals, the pickup reads a wheel with a number of teeth on it - similar to a gear found on a bicycle. The most common numbers of teeth on the “gear” tends to be either 60 (which is normally found on Bosch systems) or 36 (commonly used in Fords). The 60 minus 2 or the 36 minus 1, are the most common in the cars found today.

What makes the missing tooth signal, is that either one or two teeth are taken off the gear resulting in a gap in the signal where the teeth are missing. The missing tooth normally depicts Top Dead Centre (TDC). There are also two types of pickups or sensors used with missing tooth signals. Either a hall sensor or a magnetic sensor is used. The hall sensor signal, is easy to see since it is just missing one of its square waves (see below). The magnetic sensor signal, results in a bit of a strange crossing when encountering the missing tooth (see below).

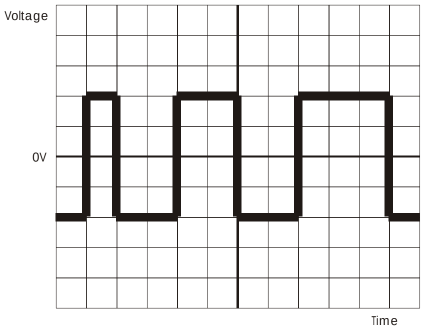




When defining the type of missing tooth wheel you have, you need to include the missing teeth. An example would be to physically count 58 teeth on the wheel and physically count two missing teeth. Adding all the teeth together, this would be a 60 tooth wheel. In this example, the missing tooth wheel is referred to as a 60 minus 2 or 60 – 2.

2.4.4 ODD SIGNALS

All the above ignition type signals can be advanced and retarded. The "ODD" ignition signal can only be retarded.



When advancing the ignition signal, the SMT6 needs to predict a future signal revolution ahead so as to fire the spark plug earlier. This means that the SMT6 has to be programmed to know what the signal looks like. Since the above ignition type signals are uniform in pattern, the SMT6 can easily advance these signals. With the "ODD" ignition signal, the pattern is non-uniform and therefore not possible to advance. Retarding the signal is a lot simpler, since the SMT6 is delaying the ignition signal. It is therefore safe to presume that almost all ignition signals can be retarded, but only ¾ can be advanced.

Odd signals are normally found in Nissans, many American cars like the Chevrolets and cars with the LS1 engine. An example of such a signal is shown in the next diagram:

2.5 STEP 5 – SIGNAL READING

As mentioned in the previous section, we first need to read the signal before modifying it. This is to ensure that the SMT6 is understanding the ignition signal with the correct global settings.

2.5.1 SIGNAL READING & DIFFERENT SETTINGS

Using a scope, place it on the crank sensor signal. Firstly establish at the sensor, what type of signal is coming from it while the engine is running. You will need to take these readings while the ECU is still connected. Either remove the harness cover as shown in the picture below, and take the readings from behind the connector or puncture each wire with a pin and take the readings.

Once you have found the ignition signal at the ECU, you will be able to change the global settings. To do this, tee the yellow wire of the SMT6 into the ignition signal and start the engine. You should get some sort of RPM reading in the tuning software. It won't be 100% correct but it does give you the indication that this it is working. If you don't get a reading at all, set the SMT6 to low level input. Click on "Global Settings", "System Config" and click the "ON" radio button for "Low level input". This should give you a reading on the tuning software. If it still does not show a reading, it could be out of range and you'll need to know how to set this up in the Windows tuning software.

For standard square wave and bipolar ignition signals, the typical way of setting up the "Global Settings" is as follows:

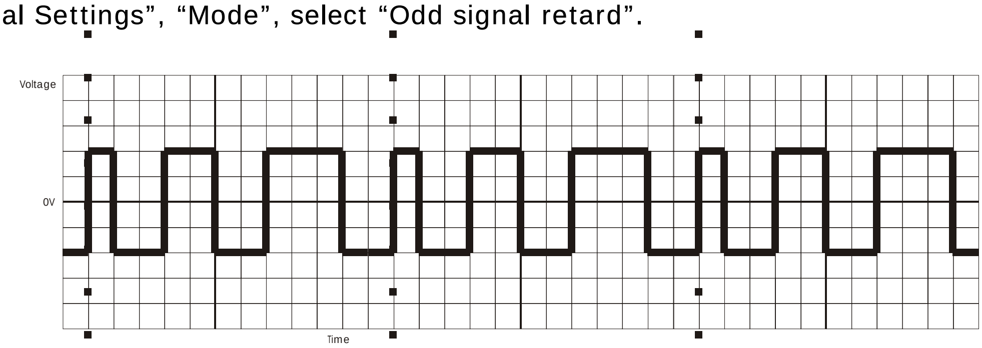
- Take the number of cylinders and divide this number by 2. This will become your teeth per turn. Teeth per firing should be 1, so for a 6-cylinder engine you will have 3 teeth per turn and 1 per firing. The above example has been set for a 4 cylinder engine.
- Use these settings and start the engine again. The RPM reading should match the reading on the odometer. (This will occur 90% of the time, but in the event that it does not occur, please contact Perfect Power Technical Support). Standard ignition signals are selected in the "Mode" tab of the "Global Settings" in the software.

For missing tooth settings, the setting up of global settings is slightly different:

- Teeth per turn is equal to the number of teeth. Teeth per firing is equal to teeth per turn divided by the number of cylinders and then multiplied by 2. An example would be a 60 tooth wheel set-up on an 8-cylinder engine. Teeth per firing is equal to 60, divided by 8, which gives 7.5, multiplied by 2 results in 15.
- Start the engine Once again and the RPM readings in the tuning software should match the car's RPM readings. In the Windows software, under "Global Settings", "Mode", select "Missing Tooth Operation".

For odd signals, the "Global Settings" will need to be set up as follows:

Using a scope, look at the signal. You should see that eventually the signal will repeat itself. Count the number of low dips in one cycle and multiply this number by two. This value will be your "teeth per turns". You can put any value in "teeth per firing". In the Windows software under "Global Settings", "Mode", select "Odd signal retard".

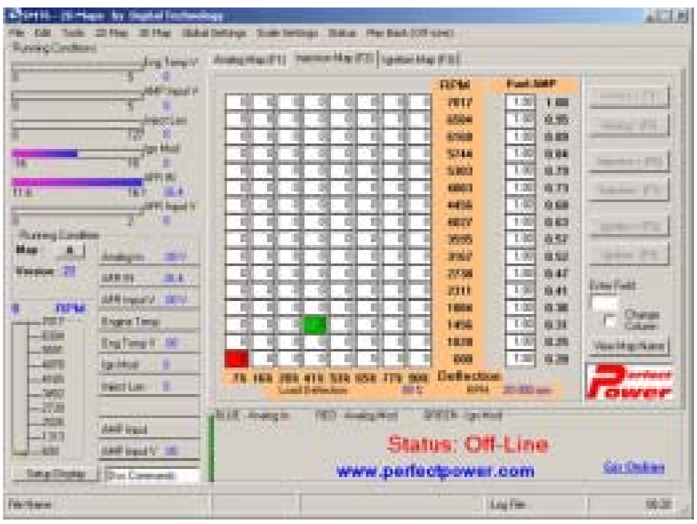


An Example of an ODD Ignition Signal

The dotted lines in the above diagram indicates the repetition. The signal drops low, 3 times in one cycle. Your set-up here, would be 6 teeth per turn and any value in teeth per firing. Select "Odd signal retard" from "Mode" in the "Global Settings".

One clear indication of an incorrect set-up of the ignition is if your RPM display on the tuning software does not match the RPM dashboard display. This applies to all of the above ignition signal types. Sometimes you may need to "play" with the teeth per firing and teeth per turns to get a correct value. In this case, it also helps to know what the crank wheel physically looks like.

2.5.2 SETTING UP MAP SCALES



Once you have a correct RPM reading, you will need to set-up the RPM map scales. The RPM Scale is set-up in the same way as the "Deflection" scale settings. Click on "Scale Settings" on the Menu Bar and then select "RPM Scale". The bottom most row on any of the tuning maps has no effect. You can put any value in the cells on the bottom row and you see that nothing will happen. Modifications only begin in from the bottom second row moving upwards. When you set the lower RPM Scale point, you need to aim for a value that will get the cursor to sit in the second row of the tune map, and not on the bottom row. Notice where the green dot on the below tune map is located.

Take the idle RPM and calibrate the lower scale, so that the green cursor that runs along the map sits in the second row at idle. For the upper RPM point, set it at the maximum RPM of the car, or the maximum RPM that you want to modify to.

2.6 STEP 6 - FUEL

Fuel, is the first connection where you will need to cut wires. If you have been following the installation guide to this point, all your wiring should be intact or just “Tee” joined only.

The most typical way to modify fuel is to modify the load sensor signal (airflow sensors). It is also possible to modify fuel, using a lambda sensor. For further details on Closed Loop Lambda Operation, please refer to the Application Note.

2.6.1 LOAD SENSOR SIGNAL

The load sensor uses one of two signals. It can either be an analog signal similar to the TPS signal or it can be a frequency-based signal. The frequency-based signal is similar to the uni-polar signal.

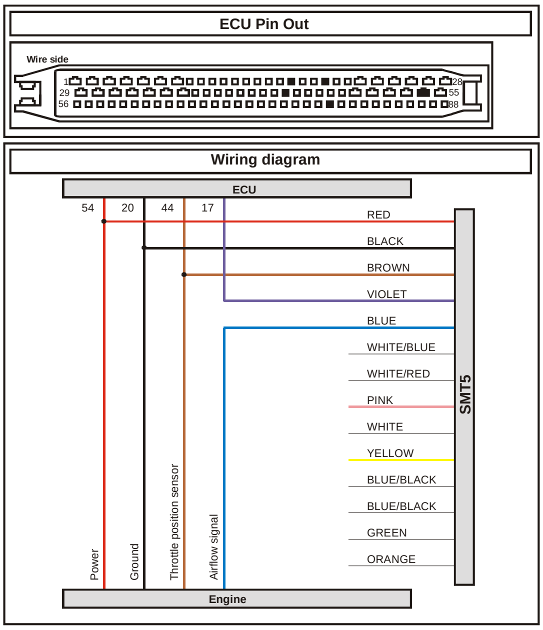
For an analog signal setting, the signal goes into the SMT6 via the blue wire and out of the SMT6 to the car’s ECU through the purple wire. In “Global Settings”, “Modes” all the modes support analog fuel tuning. The only setting you need to look out for is the lambda tuning option. If you enable this option, the fuel modification may not work correctly. Ensure that this option is not enabled at this point, even if you wish to tune Lambda.

For frequency-based tuning, the SMT6 needs to run in standard ignition frequency fuel mode in the Windows software. This can be set in the “Global Settings”, “Modes”. Select “10-Single ignition advance and retard + frequency fuel”. You will also need to know the lowest and highest frequency the sensor uses. This can be measured on a scope. The SMT6 can be set to recognise two different ranges of frequencies in the “Global Settings”, “System Config”. When “High frequency” is enabled (“ON”), the frequency range is changed from 10-3,3kHz to 80-18kHz. It may take a bit of “trial and error” to establish the range you do have. An incorrect setting will result in either flat fuel at low loads, if the mode is high when it should be low or flat fuel at high loads, if the mode is low when it should be high.

BMW - 318iS/Coupe (E36)-1996-99

Vehicle make: BMW

ECU make:	Bosch Motronic 5.2
Model	318iS/Coupe (E36)
Year:	1996-99
Libaray File:	None
Comments:	Ensure wiring is correctly insulated in engine bay
Achievements:	More than 15% modification to fuel signal
ECU Location:	Left hand side of engine bay below wiper box



Wiring is fairly easy. Connect the white/red wire along with a pull-up (black/blue) to the sensor wire and the white/blue wire to the ECU.

Check that the set-up works by increasing and decreasing fuel values on the fuel map on the Windows tuning software.

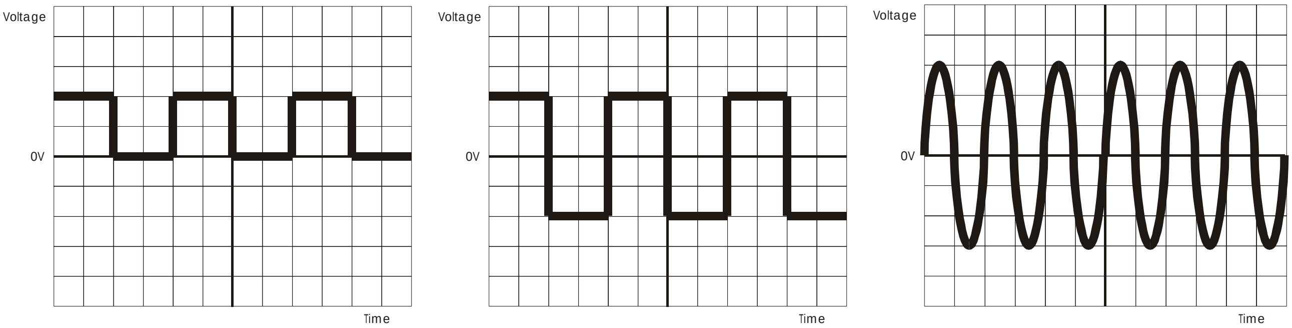
The diagram on the left shows what a typical analog installation should look like.

2.7 STEP 7 – THE FINAL STEP

Following the step by step procedure above, you should have the following results:

- power on the SMT6
- the throttle position sensor moving a cursor on the fuel and ignition maps
- a correct RPM reading when the engine runs
- the ability to adjust fuel

It is important that the basic waveforms have been understood from the previous sections above. Before referring to the installation again, we will explain the different types of signals used, and how they affect the SMT6.

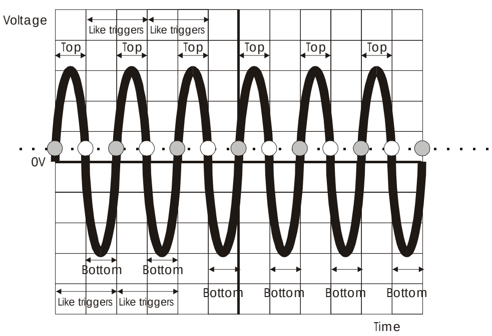


In Step 4 above, we only "teed" into the signal. This means that we did not affect the ignition to the ECU in any way. By doing this, it was not necessary to be absolutely accurate as the engine would still run. Tuning the ignition signal does require the ignition settings to be accurate. Remember the modified signal does not need to look like the ones depicted above. The shape of a waveform is usually not critical, but what is important is the trigger level of the SMT6 and where the signal voltage crosses this level.

Think of the trigger level of the SMT6 as a single line. On the above ignition signal types this could be the 0V line, referred to as the trigger voltage. The SMT6 reads or triggers when a signal rises above or drops below the trigger voltage. The distances or time between these cross over points is also measured. A signal that moves from below trigger voltage to above trigger voltage, is the positive edge trigger. From above the trigger voltage to below, is the negative edge trigger.

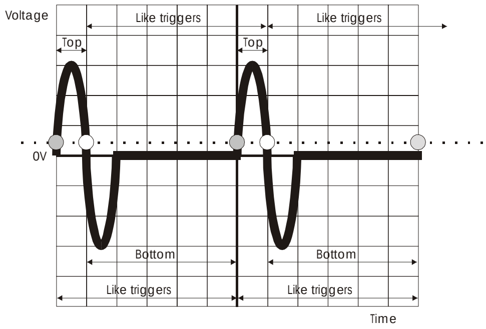
The SMT6 can be used to select the positive edge or negative edge as a reference point under "Global Settings", "System Config". By clicking on the "ON" radio button "Positive input pol" it is positive, by clicking "OFF" makes it negative. The same applies to "Positive output pol". By using a scope, the way to choose the correct edge is to look at the wave and select the side that does not wiggle or wiggles the least. This would be the correct edge to use on the ignition signal. Once the correct edge has been established, select the correct (ON or OFF) "Positive input pol" and do the same for the "Positive output pol". It is important that both input and output are both set to positive or negative (ON or OFF). The correct edge will also give a more stable RPM reading on the Windows tuning software.

2.7.1 MAGNETIC WAVE SIGNAL



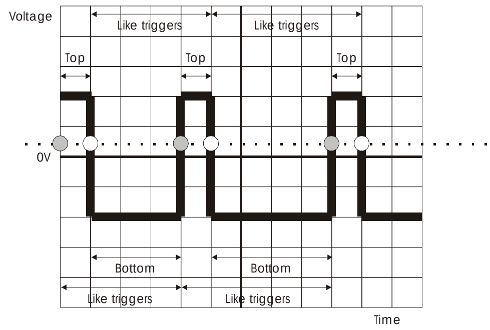
This diagram shows a typical magnetic wave. The dots represent a trigger point detected by the SMT6 and the level is marked by the dotted line. The signal can either trigger on a low to high rising edge or a high to low falling edge.. The grey is rising, while the white is falling. In order for it to be a balanced signal, the distance from the rising edge to the next rising edge must be the same as the distance to the next rising edge.

2.7.2 BALANCED MAGNETIC WAVE SIGNAL



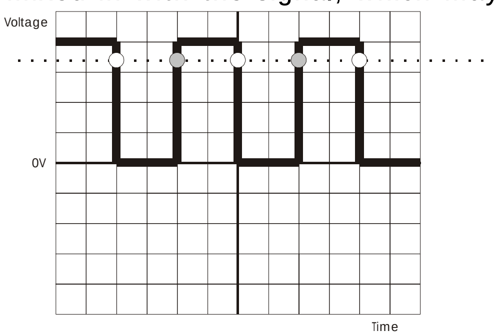
If you compare the diagram in the Magnetic Wave Signal with the Balanced Magnetic Wave Signal, you will see that the distances between the top part of the dots and the bottom parts may not be the same, the distance between the like edges are. This makes it a balanced signal.

The diagram to the right, shows an unbalanced signal. Although it has identical lengths on the top portion, the bottom portions are not equal. The like edges are not the same distance away from each other, thus resulting in an unbalanced signal. You would have to use the "Unbalanced Signal Mode" of the SMT6, in order for it to work with this signal. You would also only be able to retard the signal. This could be useful in turbo and related installations.



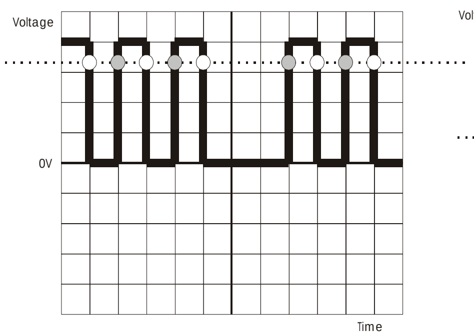
Another signal to identify is the physical trigger level of the SMT6. At this point, the aim is to get the SMT6 to read and identify the sensor signal. You need the trigger level to be at a known point so that the signal voltage will cross a bipolar signal. This is when a signal crosses the zero volt mark on a scope, which means that the trigger level should be zero volts, in theory. In practice however, the trigger level is close to zero volts (0.1V to be precise). You can enable this level, by selecting "Low level input" in the "System Config" tab under "Global Settings".

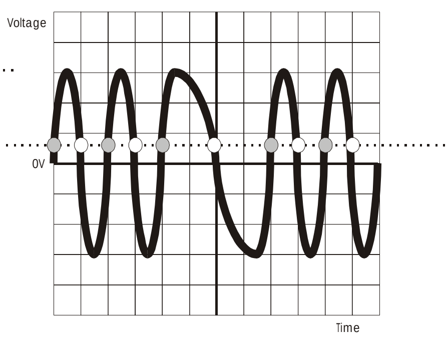
This trigger level may not work for a uni-polar signal. The signal may have a small DC signal mixed in with the signal, which may not allow it to reach below 0.1V. You can raise the trigger level to approximately 4V (disable low level trigger) and then use the SMT6 pull-up output (blue/black wire) to ensure that the signal goes above this point. This is shown in the balanced signal diagram below. This pull-up connection should also be used with the white\red wire with frequency based airflow meters.



We have not mentioned the pull-up resistor when working with uni-polar signals in Step 4. This is because the car's ECU has one already built-in and pulls the signals to a level recognised by the SMT6. Although the signal is read by the SMT6, this does not always guarantee that it will be read in this step.

The final types of signals are the missing tooth signals shown below:





From the two diagrams to the, you should notice that the trigger level rules do not depend on the mode of the signal but rather on its voltage swing. Triggering is done the same as with standard ignition signals. Also, you may notice why these are not unbalanced signals. This is because that although they are actually unbalanced, the SMT6 has been programmed to look for this signal. It knows what it is supposed to look like and can then predict what it should do, and therefore it is possible to advance and retard the unbalanced missing tooth signal.

3 SUMMARY

When looking at ignition signals first look at the distance between trigger points. This determines the mode that the SMT6 will run in. Balanced signals are standard ignition and can be advanced or retarded. Unbalanced signals cannot be predicted so you will need to select the unbalanced mode of the SMT6. The missing tooth signal while unbalanced, is recognised by the SMT6 and therefore can be advanced and retarded in “Missing tooth operation”, under “Global Settings”, “Mode”.

Trigger levels are independent from the mode. Place this level where you know that the signal will definitely pass. Most of the time, bipolar forms run in low trigger mode and uni-polar (hall) have high trigger modes coupled with a pull-up resistor.

There are another two types of signals you need to look out for: twin ignition and balanced signals.

Twin ignition signals are not commonly found for crank signals. They are also difficult to identify without an ECU pinout description. The best way to identify twin crank signals is to go through the entire ECU pinout with a scope. If there is another signal identical to the one you used in Step 4, then you may need to modify this one as well. This is further explained in the Technical Manual.

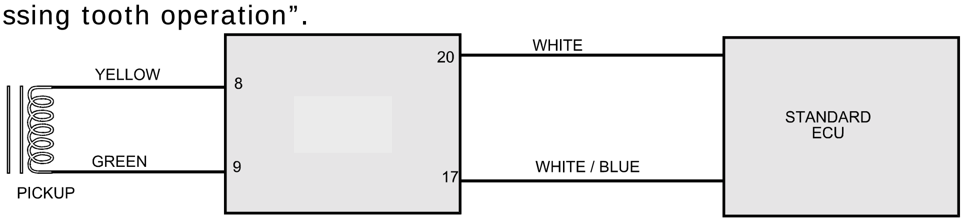
The most common use for the twin ignition mode is when you cannot modify the crank signal, but the vehicle has a wasted spark application (4 cylinder) on the output. Here you can modify the signal coming out the ECU to the coils. It is important to check where the ignition amplifier is. The SMT6 cannot drive a coil on its own. If there is no amplifier between the SMT6 and the coil, you will need to install one between them (one for each coil).

Balanced signals are easier to identify. Check the ECU pinouts and you will find that you have two missing tooth signals. Another method of identifying balanced signals, is if you install the SMT6 correctly and as soon as you try to advance and retard ignition on the ignition map, the engine stalls. Balanced signals are very common in cars with missing tooth signals, so be sure to check all ECU pinouts for a second signal.

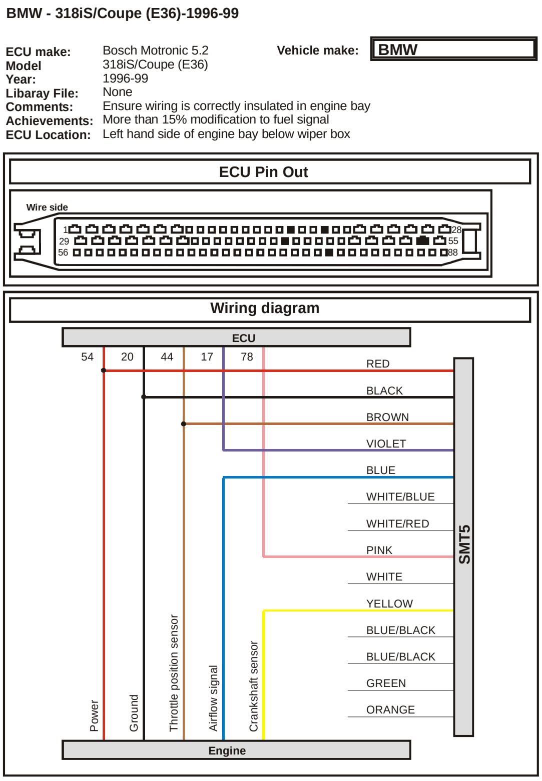
Once you have gone through the signal checking, you will be ready to cut wires. Take the ignition line and cut it. The sensor side will always go to the yellow wire. Use the information in this document to decide whether or not to use a pull-up resistor.

The ECU side depends on the signal. Remember like the SMT6, the vehicle’s original ECU also has its own trigger levels. The SMT6 caters for this by having two crank signal outputs. Uni-polar which is generated by the white wire and the bi-polar generated by the pink wire. The one you choose should be the same as the incoming sensor signal. It shouldn’t be necessary to use a pull-up resistor with a uni-polar signal as the ECU has one built in. We don’t need to generate magnetic waveforms because like the SMT6, the ECU is only interested in trigger points and not the physical shape of the wave.

For balanced signals, you need to look at both signals on a scope. Take the weaker of the signals, cut its wire and connect the sensor side of the wire to the green wire of the SMT6. Take the ECU side of the wire and connect it to the blue/white wire of the SMT6. Cut the stronger signal wire and connect the sensor side to the yellow wire of the SMT6, and the ECU side to the white wire of the SMT6. In the Windows Software, “Global Settings” the SMT6 will run balanced signals in “Missing tooth operation”.



The following picture, is what your diagram could look like at this point:



You should now be able to start the engine. Should you have any problems try the following:

1) Check the power.
2) Using a scope, read the crank signal going into and coming out of the SMT6. Make sure the rising and falling trigger points line up with one another i.e. rising with rising falling with falling. If they don't, try selecting different input and output polarities in the system bit configuration - these settings must be the same.
3) Check the tuning software. If you are getting a valid RPM reading while cranking, the problem could be on the output side of the ECU. Try switching to the pink or the white wire of the SMT6.
4) A common fault with magnetic sensors, is if the crank signal on startup is too weak. The ignition advances heavily and has trouble starting every time. Once it does start however, it works fine. The SMT6 has a lower trigger level to compensate for this, but if the problem persists you may need to find a way to strengthen the crank signal.
5) Check for any noise on the crank signal. Spikes that make it past the trigger point will be seen as a trigger. You may need to filter the crank line (this problem is more common in stand-alone applications).