Here is a detailed guide of how to build your megasquirt II kit specifically for the Mazda FSDE engine used on the 3rd gen Protégé, P5 and the MSP. Before getting started I strongly recommend reading the following :

1. http://www.megamanual.com/index.html : Read the FAQ so that you understand what the Megasquirt can and cannot do.
2. Read the section on how Megasquirt works. The index will appear on the left hand side of the screen, the more you read the better prepared you will be to deal with your settings and tuning.
3. http://www.msextra.com/doc/ms1extra/MS_Extra_Ignition_Hardware_Manual.htm#wheeldecr : This article helps you understand how the Megasquirt (or your stock ECU) understands at what point in the cycle your engine is. The FSDE uses a 36-1 wheel with a VR sensor, pay particular attention to that setup.

You will be running the MS extra firmware, but more on that later. To begin with, these are the things you will need to build your megasquirt:

Megasquirt-II kit with V3.0 PCB
JimStim MegaSquirt Stimulator with Wheel Simulator – (I recommend Unassembled to make sure you can solder well enough before beginning the MS)
12' wiring harness
If you have a turbo car or are planning to go turbo in the future, you will need a threaded Intake Air Temperature Sensor, I guess the MSP guys can use the stock one, but I suggest using a GM type IAT with a welded in 38NPT-Bung (available in stainless steel/aluminum)
TuneCable 6' DB9 tuning cable
USB to DB9 convertor(Only needed if your laptop doesn't have a true DB9 port)
You can get all this from any MS approved tuning store, I recommend DIYautotune, they are very helpful with everything.

You should also consider getting a wideband since tuning it right without one is a nightmare.

I suggest starting the assembly with the jimstim (if you have no soldering experience) which is a test bench for your megasquirt, You can check each stage of progress as you go along with it, and be sure you are doing things right. I had never really soldered anything before I began this but I can do good a job as anyone now, so there is no need to really worry about skill here.

The Jimstim assembly instructions are here:

http://www.jbperf.com/JimStim/JimStim_assembly.html

When you are done with this, move on to the main board assembly process, there are detailed instructions in the link below, and this guide will tell you which route to take whenever there is a choice to be made.

Assembly instructions: http://www.megamanual.com/ms2/V3assemble.htm

Read everything there and follow the comprehensive instructions given carefully, specially making sure you orient the components correctly. Make sure you understand exactly which way each component has to be placed (+,-) , if you have a doubt, read the instructions again.

Choice 1: Step 22: I am personally happy with the stock ECU controlling my idling, so I don't need to jumper any of the IAC functions, but for those of you who want to control idle with your MS ECU, you should figure out what kind of idle control you have and add the correct jumpers.

Leave the IGN and IGBT jumpers out for now, we will come to those later.

We will not be using CAN communications so no need to jumper anything to CANH or CANL.

Choice 2: step 26-b: Set your baud rate to 115200 since you'll be using the MS II

Choice 3: step 50: Install the VR input circuit, since the FSDE has a 36-1 crank wheel with a VR sensor.

Note: When you hook up the stim to check the tach input, you may not get an RPM reading immediately, twiddle with the RPM coarse and RPM fine pots on the stim a bit and you should be able to get some sort of RPM reading in to check the circuit, although this will not be available throughout the rev range. This is normal with the VR circuit and as long as you get a reading, it is fine.

Note: you can install both circuits and select the input with jumpers as shown in step 52.

Choice 4: step 54: Install the recommended bias resistors, you can always calibrate the values in MS II as I will explain later.

Choice 5: step 65: Install the VB921/BIP373 , install R43 and **do not** install R57. Do not make any of the jumper connections, these will be made at the end.

Note: there are several "Pull up circuit" options right after this, ignore all these.

Choice6: step 69: Install both the PWM flyback damping circuit and the standard flyback circuit.

Choice 7: step 71: Install the current limit protect circuit.

Step 80: Before you install the LED's and the jumpers, I suggest you wash the PCB with isopropyl alcohol and then warm water. **Make sure the board is completely dry** before you go any further, otherwise you will fry your MS!

Pullup circuit to run the stock coils: Once you are done with the basic circuit and the washing as instructed in the megamanual, and once the board is fully dry, build the pullup circuit as shown in the diagram below.
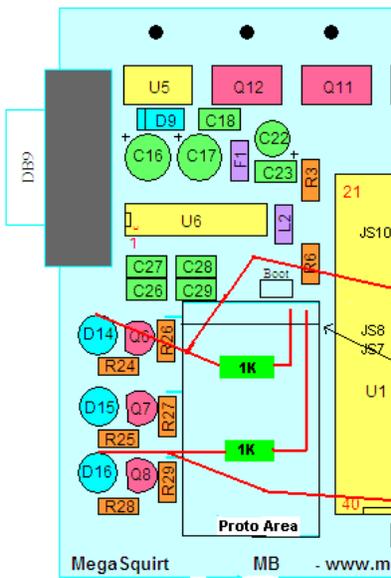
Add 1K resistor from the -ve side of D14 to the +5V on the proto area. Run a wire from the neg of D14 to IGNOUT

Add another 1K resistor from the -ve side of D16 to the +5V on the proto area Run a wire from the neg of D16 to SPR4

Connect to IGN pin

This side of both 1K resistors goes to 5V on Proto Area

Connect to SPR4
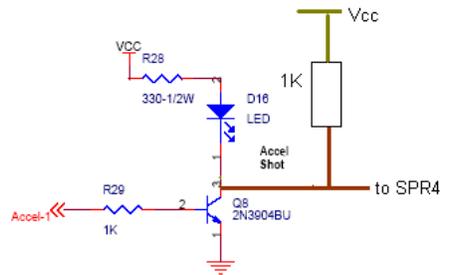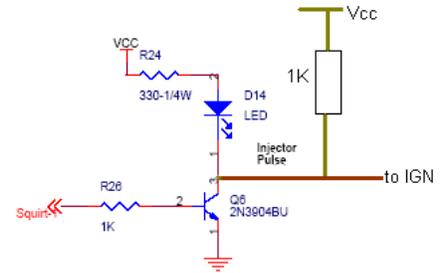
V3 PCB ONLY

When finished, the back of your MS II mainboard should look something like this:
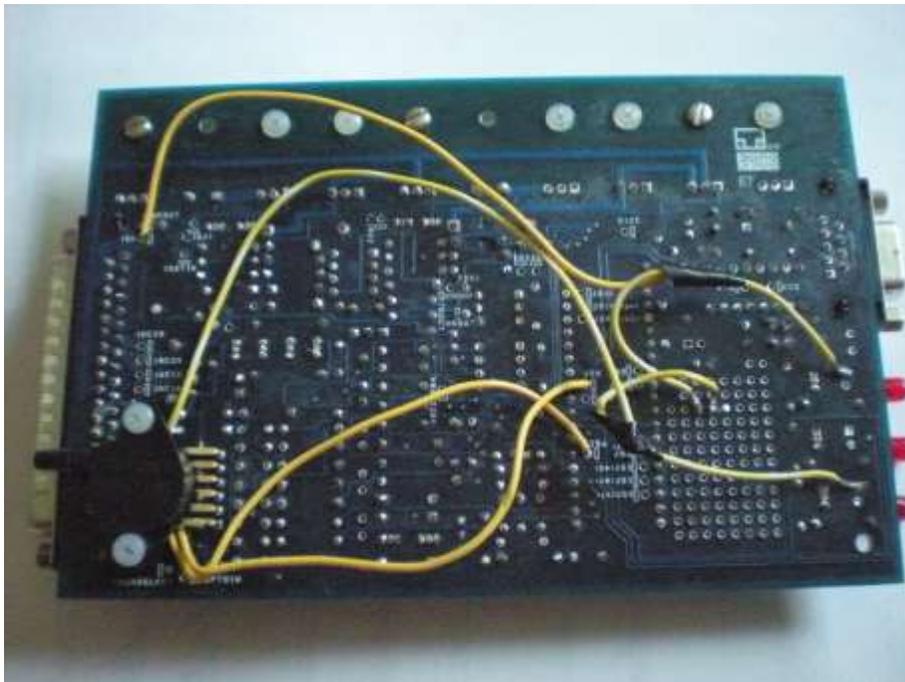
Note: I have jumpered the CAN hi and CAN low, you can choose to ignore that. It does no harm either way.

External wiring: To do your external wiring, all you have to do is hack into the stock ECU, taking away fuel and spark control from it and giving it over to the MS. This way, you get to control what you really need to and leave the stock ECU to do its job with the A/C, lights, instrument cluster, OBD etc. You don't have to make all the connections shown here, just the ones listed below.

MegaSquirt V3.0 Main Board External Wiring Diagram

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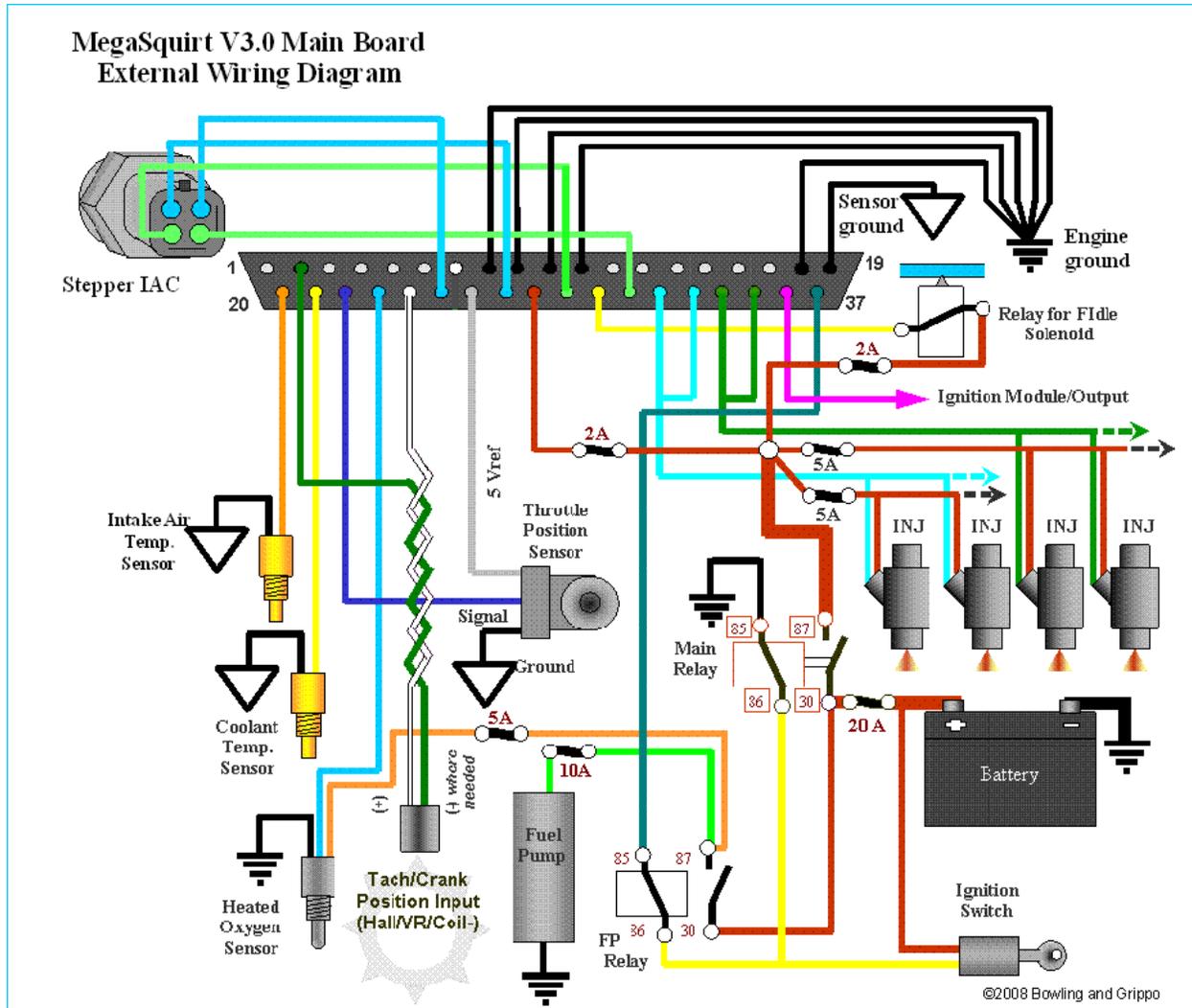
What you need to do:

The stock ECU lies behind the passenger side kick panel in the footwell, and is mounted on the reverse side of the plate. You will have to take of three interior pieces holding the carpet down, peel back the carpet and take off the 4 10 mm (I think) bolts holding this plate down, then remove the two clamps that are holding the ECU to the back of the plate and free the ECU from the plate. Be very careful doing this, the edges of the plates are really sharp and will cut the careless hand! The connector is bolted onto the head of the ECU and needs to be unscrewed out. Make sure your battery –ve terminal is disconnected before you disconnect the ECU!

The stock ECU connector has pin numbers on it at both ends of every row, what you need to do is count from there to find the right pin number, and thereby the right wire. On the MS side, if you buy your kit from DIYautotune, you will get labeled wires on the wiring harness, or else you can count from the DB 37 connector as shown in the wiring diagram.

1. Power supply (12V): The power supply is very important and must maintain power even during cranking. I chose to take input power for the MS from the stock ECU power supply, but with a 5 amp inline fuse attached. This will have to be spliced and soldered (Strip about ½ an inch of the wire coming out of pin 97 a few inches from the connector, making sure not to cut any of the strands of the stock wire in the process. Split the strands in half and pass the MS wire through the gap, twist it all together firmly and solder. Use good quality electrical insulation tape over the entire joint.)
   Power supply: Pin 97 on the stock ECU (5 amp fuse inline)
2. Temperature sensors:

Sharing CLT and IAT sensors: I like to keep the car looking as stock as possible, therefore I share the stock sensors. To do this I hack into the sensor inputs at the stock ECU. I use the radio shack splicing clips for this, that way there is no mess with soldering and what not, and both the ECU's get the required input. I give about 3" to 4" of wire away from the stock connector and splice into the respective wires.

The required pin numbers are:

CLT (Coolant line temp): pin 38 in the stock ecu

IAT(Intake air temperature): pin 39 in the stock ECU

3. VR Inputs (+,-): It is highly recommended, even essential I would say to use a shielded wire for this to prevent noise in your VR input. This is the most important input that the MS needs!! Again if you are ordering from DIY, they will have this set up for you. With a shielded wire, one of the sides (either + or – I can't remember) is the shielding, you need to bunch these strands together and solder it to the respective wire in the stock harness. This again is a splice, follow the method used for the 12V supply (without the fuse inline of course). You will also need to put a resistance inline on the negative side or else you will lose your in dash tach. Speedy Gonzales on the forum uses a 6.8Kohm resistance and I use a 10Kohm one, either seems to work fine.

   VR+ : Pin 21 on the stock ECU
   VR- : Pin 22 on the stock ECU (With 6.8 to 10Kohm resistance inline)

4. TPS (Throttle position sensor): The TPS again is shared with the stock ECU, it needs a signal input and a reference voltage input (Vref). I spliced these using the radio shack splice clips again, you can splice and solder it too.
TPS signal: Pin 89 on the stock ECU
TPS Vref: Pin 90 on the stock ECU

5. O2 signal: I recommend using a wideband O2 sensor, but for those of you who don't want to do this for some reason, you can splice (And share) into the stock O2 sensor signal.
O2 sensor signal: Pin 60 on the stock ECU

6. Grounding: There are 6 pins on the MS that you need to ground (Black in the wiring diagram, pins 8,9,10,11,18,19), each one must be run from the MS to a point on the engine block with proper electrical contact being made. DO NOT use one fat wire, this will introduce noise in the system, use 6 wires and ground them at the same point. I ran the wires through an available hole in the passenger side door frame that leads to the fender and then to the engine bay:


You may also choose to drill a hole in the firewall and get the wires through, it's your choice.

7. MAP: The final input the MS needs is a Manifold air pressure (MAP) reading, since the MS comes inbuilt with a MAP sensor, you need to figure out how to get a tube/hose from some point in the line going from your intake manifold to your brake booster, to the MS. The MAP sensor has a barbed end sticking out of the MS case, it's about 1/8th of an inch in diameter, so get the right size of tube and hook it up. This I leave to you because there are a million easy ways to do it. I personally have a vac block and use one of the outputs from that to connect.

8. Input testing: I strongly recommend testing all you inputs at this time, if you have hooked up your MS correctly you should get perfect readings. You will have to put in a few settings in your megatune/ tuner studio ms at this point. Refer to http://www.mazdas247.com/forum/showthread.php?t=123780542 for the complete settings, once you have set them correctly, you need to calibrate your TPS and your CLT, IAT sensors. This can be found under "tools"-> "calibrate TPS" and "tools" -> "calibrate thermistors" in tuner studio MS.

   The bias resistor values are 2490 and you can enter any three values from the curve given below, obviously keep the points far apart. The temperature values are in Celsius {Fahrenheit} format, and the curve is same for both CLT and IAT.
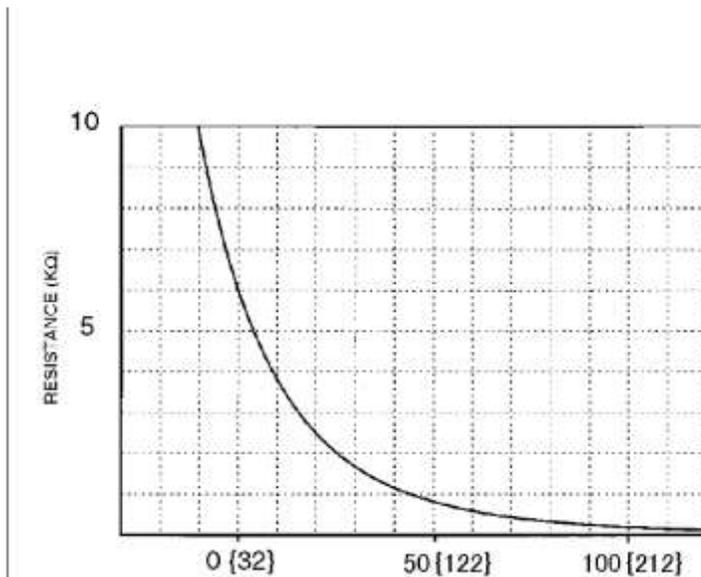
   For the TPS, when you open the calibration window with the MS hooked into the car and into your laptop, play with the throttle and make sure the ADC count increases as you increase throttle. If you have wired it wrong it will decrease and you need to flip the wires around. With your foot fully off the throttle, hit the "get current" button next to the 0% box, then fully open the throttle and hit get current on the 100% box. Your TPS is then calibrated.

   Now, hook up your MS both to your car and to your laptop, turn ignition on and start tuner studio MS, you should get reasonable readings of MAP (close to 100 KPa) and temperatures (Around ambient if the engine is cold). Start the car and see that you are getting a good RPM reading, the pulse width and ignition advance will do something, but they are not hooked up right now. Your MAP reading should fall to between 20 and 30 at idling. Your CLT reading should increase as the car warms up. If you are not getting all the readings right, **DO NOT** proceed further. Work out the faults in the inputs before attempting the outputs.

9. Outputs: Now that you have all the inputs working, all you have to make are 4 connections for the outputs for fuel control. For these, you will have to completely cut the wires coming out of the stock ECU and connect them to the MS.

   The MS is a batch injection system, so two injectors will be connected to one injector driver, that is:
   Injector driver 1 From MS: inj.1 pin 75 On the stock ECU
   injector driver 1 From MS: inj.4 pin 100 On the stock ECU
   and
   injector driver 2 From MS: inj.2 pin 101 On the stock ECU
   injector driver 2 From MS: inj.3 pin 74 On the stock ECU

   for the ignition coils, in wasted spark format, connect the following:
   Coil A (pin 36 on DB 37 from MS) : pin 26 on stock ECU
   Coil B (pin 6 on DB 37 from MS)   : pin 52 on stock ECU

   Make sure you have your fuel and spark tables loaded and burned into the MS before you attempt to start.

   WARNING: this is only meant as a guide and I do not take any responsibility for anything that goes wrong with your vehicle because you followed the instructions here.

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   This was written by Dushyant Karthikeyan on 07/27/2010