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Troubleshooting Your MegaSquirt® V3 Main Board

If you have put your MegaSquirt® together, but it does not work, this section will help you sort out the problems. Often there is something simple wrong, and a few simple checks can identify what needs correcting.

Follow the instructions below. Before checking anything else, make sure your stimulator has a fresh battery - many problems are traced to a low battery voltage, but only after a long, frustrating troubleshooting effort! Also, make sure the CPU is in the correct way. On an MS-I, the notch should be closest the edge of the PCB. On an MS-II, the 6 pin header should be nearest the edge of the PCB. Before starting, have a look at the schematics and PCB layout PDF files - you may want to print some sections to help you troubleshoot. Read ALL of the troubleshooting tips first, then go through the steps:

Note: With 2.88+ code, the first thing you must do is set the ECU Type (under '*Fuel Set-Up/General*') to match your hardware (MS-II = 1 or MicroSquirt = 2), MegaTune will not let you change anything else until you do this. The rpm will cycle from 0 to 8000 rpm, and most of the menus will be inaccessible. Do not change settings, expect the stim to work, load an MSQ, etc., until you have set the ECU Type (MS-II = 1, MicroSquirt = 2, the MS-II Sequencer will be 3). This setting applies to MS-II derivatives with code 2.88 or higher code only.

0) Is your stim battery powered? The battery might be dead, as they only last a few minutes while powering MegaSquirt. So replace the battery with a fresh one. If that doesn't help, remove the processor, and check the voltage at the voltage regulator (U5). You should get:

- stim voltage (~9 Volts), on the pin nearest the DB9,
- the middle one should have less than 1 Ohm to ground (use the heat sink, or the center pin of the voltage regulator, as a ground), and
- 5.0 Volts on the pin furthest from the DB9.

If you don't get 5.0 Volts, there's a short somewhere. The most common cause is the pins of the voltage regulator itself having a 'solder bridge' but it could be a bridge on almost anything you've installed so far, a diode backwards, or a polarized capacitor backwards (C22 is a likely candidate). Also check that C15 and C16 are the right way around (if they aren't, discard them and get new ones, they will be toasted!).

It's also possible that one of the diodes is backwards, I would check them all, but especially D9, D10, D11, D12, D13 and D19. But check ALL the diodes again (even if you have checked them already, you sometimes have to look several times before seeing something like this) - this is most likely the cause.

If you installed components on the heat sink that required mica insulators (Q12 and Q9), make sure you are getting around 60K Ohms resistance to ground between the heat sink and the tab of the component. Make sure the FETs (Q1 & Q5), if you used a metal screw to secure them, have not have there insulation cut through by the screw. Also, if you haven't yet, wash the board in 99% isopropyl alcohol as recommended in the assembly guide.

Other possibilities are for low voltage are shorts (most likely caused by solder bridges. Check very carefully to make sure there's no solder bridges on the installed components, including the 40-pin CPU socket and the DB37 connector.

If those are OK, then the next thing to do is pull up one leg of each component (diodes and caps) at a time (by melting the solder of one leg with a soldering iron and pulling the leg out of the PCB with needle nose pliers) until you do get 5 Volts on the regulator pin (and CPU socket). See the schematic here to find the applicable components: [url]http://www.megamanual.com/ms2/pcb.htm[/url]

1) Hall sensor input issues:

a. If you have **no rpm signal to MegaSquirt** and you are using the Hall/Optical/Points input circuit, verify that you have a **XG1 to XG2** jumper in place on the MegaSquirt® main board. MegaSquirt® will not receive ignition pulses if this jumper is not there. See assembly step #52 for more details. Check the other ignition circuit jumpers as well:

For the VR sensor:

- Jumper **VRIN** to **TACHSELECT** on the bottom side of the PCB (near the DB37, opposite the heat sink.)
- Jumper **TSEL** to **VROUT** (Or **VROUTINV** if you want the VR input to be inverted) on the bottom side of the PCB, near the center.

OR (Do NOT install both sets of jumpers, chose one set or the other!)

For the Hall sensor, optical sensor, coil negative terminal or points:

- Jumper **XG1** to **XG2** on the bottom side of the PCB, near the 40 pin socket,
- Jumper **OPTOIN** to **TACHSELECT** on the bottom side of the PCB, near the DB37 connector, opposite the heat sink.
- Jumper **TSEL** to **OPTOOUT** on the bottom side of the PCB, near the center.

b. **If the Hall sensor input is noisy**, run the ground from the Hall sensor to one of the jumper slots on the DB-37 connector (like DB37 pin #6 for SPR4), then connect SPR4 to XG1. Remove the jumper from XG1 to XG2. Twist the signal wire (DB37 pin #24) and ground wire (DB37 pin #6) together all the way to the ignition module, this will further reduce noise in the signal. *(Note that you will have to ground XG1 with a jumper wire to run on the stim.)*

c. If you have **an intermittent signal**, but it doesn't work at all speeds or all temperatures in the car, check the Hall circuit modifications here: Hall input circuit mods

2) If you have no rpm, it may be because the stimulator may not have the voltage to 'overpower' the **D2** diode, which must be 'jumpered' to test MegaSquirt® on the stimulator. This diode (D2) is needed if:

- Your ignition system has a large offset bias - most systems do not have such a bias.
- You are triggering directly off the coil negative terminal.

So, to start, you can either solder in a jumper wire in this location, or, you can install the diode D2, and then install a jumper around the two leads of the diode - in effect shorting it out. The latter will allow you to snip the jumper later on if needed, putting the diode back in circuit. (Note that D2 should not be installed for a Hall or optical sensor, it should only be installed if triggering off the coil negative terminal.)

3) If your oxygen sensor feedback doesn't seem to work, recall that the O2 voltage (top bar on the MegaTune Runtime dialog) is the raw data coming in (and it should respond to stimulator input). On the other hand, the EGO correction bar (or equivalent gauge on the tuning screen) WILL NOT move away from

100% unless you have the EGO correction parameters set properly and MegaSquirt® senses the proper inputs to activate EGO correction. Don't confuse EGO and O2 voltage. EGO is a kind of integrator function that acts on the O2 voltage. So, O2 should respond, EGO will only respond if MegaSquirt® has:

- been on for more than 30 sec,
- the current rpm (adjusted on the stimulator) above the EGO 'active above' rpm threshold,
- EGO step and limit do not equal 0, and
- the coolant temperature above the 'coolant temp. activation'.

These are set on the enrichments window of MegaTune.

4) If nothing else seems wrong, but your MegaSquirt® doesn't work as expected, check your soldering. Check **all** the solder joints visually for solder bridging and excess flux.

- Solder bridging is when the solder from one lead has a tail that touches another lead, shorting the two components together - it indicates that too much solder was used. If you have a solder bridge, use a piece of fine braided copper wire and a hot soldering iron to soak up some of the excess solder.
- Excess flux generally shows as a shiny transparent scale on the surface of the PCB. You can wash it off with acetone or 99% isopropyl alcohol and a toothbrush, then rinse the PCB in hot water and let it dry completely (generally overnight is sufficient).
- Also look carefully for any solder joints that may not be perfect. '**Cold solder joints**' are joints that look okay, but have not bonded properly to the solder pad on the PCB. Cold solder joints often look grey or powdery after a while. These will often work okay at room temperatures, but not when hotter or colder. If you have any doubt, reflow the solder joints with a hot soldering iron (hold the hot soldering iron against the joint until the solder melts again and flows out over the solder pad.)

5) Next, if the soldering is perfect, but MegaSquirt® still doesn't work as expected, review the assembly guide. Check each step to make sure that you have not missed any components. Verify that all components that have a particular orientation (polarized) are installed correctly - this includes all ICs, all polarized capacitors, all diodes and LEDs, the MAP sensor, the voltage regulator, and the transistors.

- Verify that each component is the correct item for each location. Pay particular attention to make sure the correct diodes are in the correct locations. Their markings are very small and they are easily mistaken.
- Be sure you have not swapped some of the 0.1 µF capacitors at C1, C3, C13, C18, C19, C23, and C26 to C29 (marked 104) with the 0.01 µF capacitors at C11,C21, and C32 (marked 103). They are very similar looking and the markings are very small.

In particular, check:

<u>Capacitors</u>:

- **C14**: The positive lead (it will be marked with a small “**+**” on the right side of the label) is closest to R19.
- **C16**: The positive lead (it will be marked with a small “**+**” on the right side of the label) is closest the heat sink.
- **C17**: The positive lead is nearest the heat sink.
- **C22**: The positive lead is furthest from the heat sink.

<u>Diodes</u>:

- **D2, D3, D5, D7, D8, D11, and D17** : have their banded end closer to the DB37 connector.
- **D1, D6, D9, D10, D12, D13, D18, D19, D20, D21, D22, D23**: have their banded end closer to the DB9 connector.
- **D4,** : has its banded end closer to the heat sink.

<u>LEDs</u>:

- **D14, D15, D16**: There is a small flat spot on the plastic base of the LED. In all cases, this flat is nearest the DB9 connector.

<u>Transistors</u>:

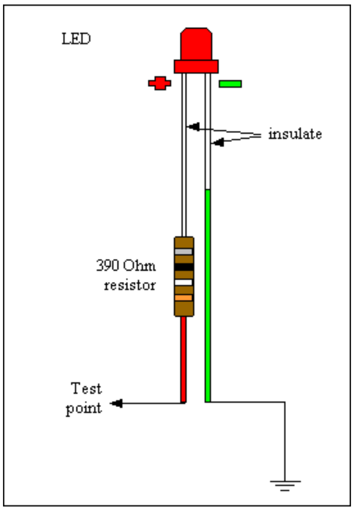
- **Q2, Q4, Q6, Q7, Q8, Q19, Q20**: The flat side should face away from towards the DB9 end of the PCB.
- **Q10, Q13, Q14, Q15, Q22, Q23**: The flat side should face towards the heat sink.

<u>ICs</u>:

- **U1**: The notch in the chip should be closest to the “**www.megamanual.com**” in the copyright label.
- **U2**: The notch in the pin #1 should be in the square pad furthest from the heat sink.
- **U3**: The notch in the pin #1 should be in the square pad closest to the heat sink.
- **U4**: The notch should be towards the heat sink. If you have a “dot” instead of a notch, the dot should be closest to Q9 on the heat sink.
- **U6**: The notch/dot should be closest to the DB9 connector.
- **U7**: The notch should face the heat sink connector.

If you find some that are incorrectly installed, de-solder them and turn them the right way around - it is likely that they are not damaged - EXCEPT for the tantalum capacitors (C16 & C17) that should be replaced if installed incorrectly.

6) You can use an LED in series with a 330 ohm (or 270 ohm) resistor and probe the input and output of various circuits, like the injector driver, to make sure that these are working. Solder the resistor to either leg of the diode, then solder a lead (20-22 gauge wire) to other end of the resistor, and another to the other end of the diode. Use heat shrink tubing or electrical tape to ensure that the leads cannot contact each other. Strip a bit off each end of the wires to use as probes, or solder on a bit of the leads you have cut off other components while assembling MegaSquirt® EFI Controller, etc.



Test the probe by connecting it across your power supply. It should light connected one way, but not light when connected the other way around.

Now you can use the ends of the wires to probe the circuits for signals - the led will light (or flash) if it gets a signal (positive voltage). The longer lead of the diode goes to the circuit you want to probe (for a positive signal) the other lead (from the side of the LED case with the flat on it) goes to a good ground (such as the heat sink).

7) Check to see what (if any) functions work. Try the loopback test, the serial communications test, the clock count-up of the processor, and check for power and ground to the pins of the MC68HC908GP32 processor (see the assembly guide steps for details). Verify that no components are touching the crystal (Y1), which might prevent it from working properly.

8) Note which (if any) of the LEDs light on the Stimulator, and under what conditions. If your are able to isolate the problem to a particular area of the MegaSquirt® EFI Controller, check the schematics for that function, and double check all the related components for correct value, orientation, and proper soldering,

9) The most common cause of a MegaSquirt® failing after it has been working for a while is excessive flux residue. The flux residue can absorb water from the air and short MegaSquirt® internally. The solution is to clean the PCB with:

- 99% isopropyl alcohol (rubbing alcohol)

and a soft toothbrush. Remove the entire PCB from the case first, and remove the CPU. Clean it gently, being sure to get the alcohol around each of the components on both sides. Then allow it to dry completely before reassembling and testing it again.

Also look carefully for any solder joints that may not be perfect. '**Cold solder joints**' are joints that look okay, but have not bonded properly to the solder pad on the PCB. Cold solder joints often look grey or powdery after a while. These will often work okay at room temperatures, but not when hotter or colder. If you have any doubt, reflow the solder joints with a hot soldering iron (hold the hot soldering iron against the joint until the solder melts again and flows out over the solder pad.

10) The LEDs flash briefly when MegaSquirt® is powered up with the bootloader jumper in place. However, they also flash and go out if no rpm signal is received. The Warm-Up and Accel LEDs do **not** light coninuously, even if the conditions for them are appropriate, until an rpm signal is received. So this will make it look like no code has been loaded. If you suspect problems with the stimulator (for example, everything seems to work, but there is no RPM indication in MegaTune) follow these steps:

a. Do you have RPMC installed? Some people have had trouble finding a supplier for one, and assumed the stim would work without it. It doesn't.
b. Check that you have installed D1, and put a jumper across D2 (or jumpered both of these positions, if directed to do so in the instructions). If either D1 or D2 are 'open', the rpm signal will NOT reach the processor.
c. Check that you have installed the correct jumpers for either the VR or Hall input circuits (step #52 of the V3 assembly manual):

For the VR sensor:		For the Hall sensor, optical sensor, or points:
• Jumper **VRIN** to **TACHSELECT** on the bottom side of the PCB (near the DB37, opposite the heat sink.) • Jumper **TSEL** to **VROUT** (Or **VROUTINV** if you want the VR input to be inverted) on the bottom side of the PCB, near the center.	**OR** (Do NOT install both sets of jumpers, chose one set or the other!)	• Jumper **XG1** to **XG2** on the bottom side of the PCB, near the 40 pin socket, • Jumper **OPTOIN** to **TACHSELECT** on the bottom side of the PCB, near the DB37 connector, opposite the heat sink. • Jumper **TSEL** to **OPTOOUT** on the bottom side of the PCB, near the center.

d. If you have installed the jumpers for the VR input circuit (instead of the Hall circuit), you may have to make some very careful adjustments to the VR circuits pots (R52 and R56) to get an rpm signal to MegaSquirt.

   With a VR sensor on the VR input circuit: Start with the R56 pot all the way counter-clockwise, and R52 about 6 to 8 turns clockwise from the fully counter clockwise position. The fully counter clockwise position is reached when the pot clicks (you can feel and might be able to hear this). The pots are 25 turns from the fully clockwise position to fully counter-clockwise position.

   With a Hall sensor (or other square wave input, like an EDIS or HEI, or on the stim) on the VR input circuit: Start with the R56 pot about 6 to 8 turns clockwise from the fully counter clockwise position, and R52 about 6 to 8 turns clockwise from the fully counter clockwise position.

   - R52 (in the middle of the board) is the hysteresis pot,
   - R56 (near the edge of the board) is the threshold pot.

   Also see: www.megamanual.com/ms2/vradjust.htm

e. Are you are absolutely sure you have the battery wired in correctly? Use your LED tester (see step 6 to make one) to verify.
f. Check the orientation of the transistor (T1) - the flat side should face the TPS pot. See step #62 in the MegaSquirt® assembly guide for some notes on transistor orientation. If it is in correctly, plug the battery into the stimulator, and connect the stimulator to MegaSquirt.
g. Using the LED tester, you should be able to get a signal on the LED tester (step #6) from jumper from "**TachSelect**" (which goes to either VRIN or OPTOIN, depending on which input circuit you are using), *Note that the LED tester will appear to stay light continuously if the rpm is above about 400 rpm. Try to turn the rpm pots down so that the rpm is 100 or so - then you should see distinct flashing.* If the LED tester doesn't flash (it stays on, or doesn't come on at all), then you need to check you soldering of the DB37 very, very carefully to make sure there are no bridges and no solder flux left in the pins. Use the schematics and PCB layout to help you.
h. If that checks out, connect the + lead of the tester to the very small via hole near the backside of the stim connector (- lead in the boot header hole nearest H1, furthest from the CPU), in line with the "Pump" label, adjacent the resistor R1. The LED should flash. If it doesn't, you need to check that the 555 timer on the stim is operating. If it does flash, check the soldering of the pins on the stim's DB37 connector.
i. The stim is not actually powered directly by the battery. Instead, the 12 volt supply powers the MegaSquirt® EFI Controller, which then powers the stim via the +5Vref lead. So check that you have 5.00 ± 0.07 volts at the MegaSquirt® regulator (assuming your multimeter is accurate). This is installed on the under side of the MegaSquirt® PCB. The outer pins are +12 Volts (actually 9V) from the stim and +5 Volts to the stim. The middle one is ground. So check the out two ones against the center (or the boot header hole nearest H1, furthest from the CPU), with the LED, or preferably with a meter. You should get ~9 volts and 5.00 ± 0.07 volts.
j. If you don't get 5.00 ± 0.07 volts on the regulator (U5) pin furthest from the DB9 connector next to it, the stim (and most of MegaSquirt) isn't getting any power. Check the soldering of the regulator, as well as the soldering, flux, etc. of pins 26 and 28. If you do have 5.00 ± 0.07 volts, then check that it makes it to the 555 on the stim.
k. **Pin 8** on the 555 chip on the stim is its power supply. Without 5 volts on pin 8, the 555 will not operate, even if it is in working condition. Pin 8 is closest the **CLT** pot. Check the voltage on pin 8 (light the LED or 5 volts), using the boot header hole nearest H1, furthest from the CPU, for a ground. If you don't have 5 volts (after checking all the previous items), check for inadequate soldering and excess flux around pins 26 and 28 of the stim's DB37.
l. If there is 5 volts at the 555, then it is likely that the 555 or the T1 transistor (2N2222 or ZTX450) is fried (if you don't have 5 volts, see the previous step). You can get these at low cost at virtually any electronics shop, like Radio Shack, etc. (5 for ~$3) Cut the legs off the old one while it's still on the board, and de-solder the pins (a braided copper "wick" or a vacuum "sucker"), also available at Radio Shack, etc. Then put a new 555 in and you ought to be functional! (*You might want to solder in an 8-pin socket, then insert the 555 into that - it makes later repairs easier.*)

11) If everything seems to work in MegaTune, including the RPM, but the injector LEDs don't light, the most likely problems people have is either the LEDs are in backwards, or the PWM% is set to near zero.

Note: If you have a MS-II™ controller with version 2.88+ code, and on the stim the INJ1 LED is always on, but the INJ2 LED is flashing normally, and you are running V2.88 firmware, make sure you have ECU type set to MegaSquirt-II (=1) instead of MicroSquirt (=2). Then cycle the power to MegaSquirt (i.e., turn the power off, then on). This should fix that particular issue.

If these are okay, then you need to check that the FET driver (U4) is receiving signals from the CPU. Then you need to check that the FET driver is sending the proper signals to the FETs. Then you need to check that the FETs ground the pins properly, so that the LEDs are getting the correct signal.

To do this, build an LED tester as shown above (step #6). Set the stimulator's RPM pots to indicate about 1500 RPM on MegaTune. Put the ground end of the tester in the boot header hole nearest H1, furthest from the CPU.

a. The CPU sends out signal to the FET driver on pins #21 (INJ1) and pin #22 (INJ2), near the L2 inductor. Recall that the pins are numbered starting with #1 at the corner with the dot, an are numbered counterclockwise from there. Check these on the LED tester, by putting the positive end of the tester against the pin, and be sure they flash.
b. The FET driver receives the CPU signals on Pin#2 (INJ1) and Pin#4 (INJ2), on the side of U4 closest to the CPU. Check these on the LED tester and be sure they flash.
c. The FET drivers sends out signals on Pin #5 (INJ2) and #7 (INJ1), on the side of U4 closest to the DB37 connector. Check these on the LED tester and be sure they flash. Note that the driver inverts the signal, so the flashing may look a bit different, but it should still flash at the same frequency.
d. The signals arrive at Pin #1 of the FETs (Q1 & Q5) on the heat sink, and are fed out to the stim LEDs through pin #2. Both of these should flash with the LED tester.

If the output pins are flashing, then you have a problem with either the DB37, or the stimulator itself. Recheck the LED orientation, and the soldering of the DB37 connectors, and the stim LEDs (D2, D3) and stim resistors (R5, R6).

12) If you have trouble with the Throttle Position Sensor reading in MegaTune, the problem is most likely with the wiring at the TPS. Refer to the TPS section of the wiring guide for more information.

However, if it also gives problems on the stim, you need to look at the following components to make sure they are correct: **C8** (0.001), **C9** (0.22), and **R9** (1K Ohm). Check all the solder joints as well. Also, make sure there is no excess flux around the affected components. If all of these are okay, you need to look a bit deeper.

Disconnect the stimulator and remove the 68HC908 processor. The TPS signal connects to pin 26 of the CPU, so you might check that this pins is soldered properly. You can measure the resistance of **R9** directly on the board (it should be about 1K Ohm ± 50 ohms). **R9** is above the "&" in the copyright notice. You can also check the resistance from the CPU pin #26 (near the H1 boot header) to **R9** - on the side of R9 nearest the DB37 you should have less than 1.0 ohm (0.1 is better), - on the side of R9 nearest the DB9 you should have ~1K Ohm.

13) If you are having trouble getting values to 'stick' in your MegaSquirt® EFI Controller, check your power supply. Typically, a bad power supply will allow you to set values, but they will revert to the previous values after powering down. PC power supplies are especially notorious for this, and should be avoided.

14) a. If your MegaSquirt® starts up fine, then fades and dies, the issue may be C22. On the stim, MegaSquirt® might die after a few seconds, in the car the engine might start and run for several minutes (or seconds, or not at all). Using a wall-wart adapter instead of a 9 Volt battery might help on the stim, but possibly not completely.

By far the most likely cause of C22 giving problems is it being in backwards. C22 is a polarized cap, meaning it has to go is a certain way (the positive lead should be furthest from the heat sink). It is a small cap, with an even smaller "+" symbol imprinted on it, and it is easy to get it in the wrong way. C22 is used on the Vref output circuit. If C22 is failing, it might not conduct when cold, but when warmed up it could short the 5 Volt supply to ground, and MegaSquirt® will not run. *(Note that on the stim a dying 9 Volt battery can give similar symptoms, so check that first. Also, if you do not find the problem in the step above, check your soldering as described in step #4.)*

14) b. One the other hand, if the MegaSquirt® won't respond at first (when cold), or won't start with a serial cable and laptop attached, but works normally after a few seconds of powering up (or a few cranking tries), then suspect D19. On a V3 board D19 protects the 5 Vref from voltage spikes. The supply is 5 Volts, so the Zener diode rating must be higher than that, otherwise the diode will conduct all the time and fail quickly from excessive heat/current. In theory, 5.1 Volts is okay. However, in practice, these diodes typically have a tolerance of ~10%, meaning that a 5.1V Zener diode may conduct at 4.6V, and thus conduct all the time, heat up, and fail. A 5.6V can be as low a 5.1 Volts, which is fine. Also, these diodes have a temperature dependence - their rating when cold is lower than when hot (*actually Zener diodes greater than 5.00 volts act this way, diodes rated less than 5.00 volts have a higher rating when cold*). So you should replace D19, and moving up to a 6.2 Volt Zener diode, such as DigiKey 1N4735ADICT-ND would be a good idea (it provides slightly less protection, but potentially much better reliability).

15) If you serial connection doesn't work (or has stopped working), and you have tried the tips here: connection troubleshooting guide, you need to do some hardware troubleshooting. On a V3 main board, the following should be connected:

- DB9 pin 2 to MAX232 pin 14
- DB9 pin 3 to MAX232 pin 13
- MAX232 pin 11 to CPU socket pin 12 (TxD)
- MAX232 pin 12 to CPU socket pin 13 (RxD)

Each of those should have less than 1 Ohms resistance between the two test points. If they don't, resolder the appropriate connections.

You should check that you have 5.0 Volts (±0.10) on the MAX232 pin 16, and ground on pin 15. Use the middle pin of the voltage regulator as a ground for measuring the voltage, and check that you have less than 1 Ohms resistance between pin 15 and the center lead of the voltage regulator.

If you have your MAX232 in a socket, make sure the MAX232 is well seated in the socket.

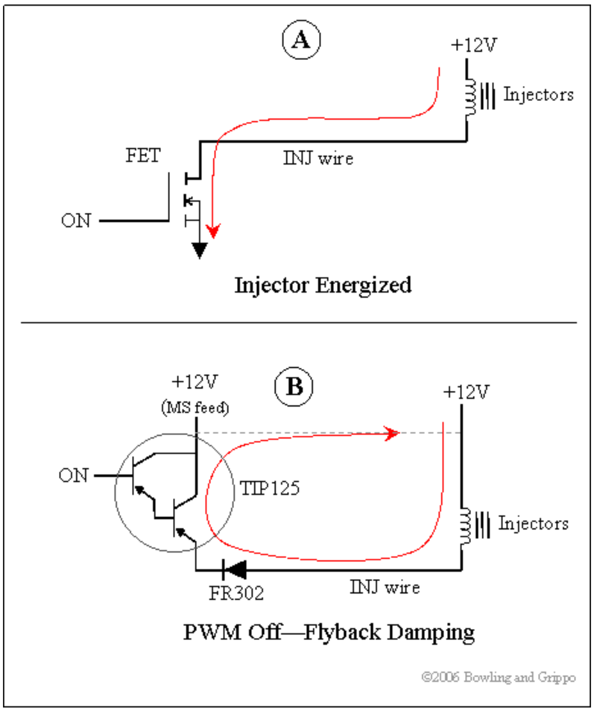
The associated components for the MAX 232 are (on a V3 main board): C26, C27, C28, C29. Make sure they are the right components, and are well soldered and not bridged.

If all of the above are okay, replace the MAX232 (cut the legs, then remove the body of the IC, and unsolder the legs one at a time to avoid damaging the PCB). The MAX232 does not tend not to 'wear out', so the amount of use isn't important, but they can fail after a few hours if they have seen a static shock at any point.

16) If you have MAP sensor spikes that aren't traceable to back-fires, etc, and you are using PWM to limit the current to low impedance injectors, you might have to modify flyback circuit. The fix for this specific problem (noise in the sensor signals, and a noisy +12v battery signal, spikes to 17v, dips to 7v) was to decouple the flyback +12v lines (both TIP125's) from the MS +12v input pin, and run them back to *before* a noise filter on the +12v input of the MegaSquirt.

To do this, lift the +12v pin of each of the TIP125's in the flyback circuit. The TIP125 are Q9 and Q12 (the ones with the mica insulators). The 12V pin on the TIP 125 is the pin in the middle - melt the solder and pull the pin up with needle nose pliers. Then run a wire from each of the pins you pulled up independently back to the raw +12v supply (outside of the box), and before the noise filter. You can ran the wires through the spares (SPR3 and SPR4, which go to DB37 #5 and #6). 20ga is just fine.

Here is a little explanation on the flyback during PWM.



The top drawing A shows the current when the injector driver is on, during the high-time of the PWM waveform. Basically the FET is turned on, energizing the injector. This is the PWM high time, and it depends on the setting of the PWM duty cycle.

The second drawing B is the path when the driver is turned off during PWM flyback damping, or recirculation mode. This occurs during the off time of the PWM current limit. During this time the injector is trying to maintain the current that was there during the PWM on time (see Lenz law). So the injector will generate a current (from the collapsing magnetic field) that flows thru the FR302 diode, the TIP125 transistor, thru the +12V feed and back to the injector. The +12V feed to the MS is used as a path. Note that this is the closed loop path, this is not ground-referenced - the +12V is used as a return path, not as the potential source.

Now if the +12V line has resistance, then this current path will cause a voltage drop across the line - Ohm's law. If you have ever used one of those portable lights on the long extension cord with the built-in socket (trouble-light) and ever ran a tool from this outlet, you may notice that the light bulb dims down whenever the tool is active. This is due to the resistance in the extension cord wiring, and by drawing more current the wire drops some of the available voltage, and this is seen in the light. More current means more voltage drop for a given resistance. Now if the extension cord is a large-gauge wire then the voltage drop is less.

Same thing applies here in the +12V line. Depending on the path of the current thru the +12V wiring from the raw +12V MS feed back to the injector +12V feed there are many places where could be potential voltage drops. Things like small-gauge wire, resistance in contacts like relays and MS connector, etc. can all add up.

You can also use the separate +12V lead just for the flyback. The flyback damp +12V is on the bottom of the PCB. This trace could be cut and ran thru a spare connector output. Best bet would be to run this wire direct to the injector +12V source in order to complete the damping circuit and to separate this from the MS +12V source.

17) Finally, if none of this helps to discover and solve your problem, send a message (including any information you found from doing any of the above) to the MegaSquirt Forums. Feel free to ask for help, that is why the MegaSquirt forums are there - just realize that you may be sent back for more information. You will solve your problem much faster if you provide as much detail as possible when asking questions the first time around. And, following the assembly steps, you will discover problems and correct them as you go along.

If all else fails, you can have someone else troubleshoot and repair your MegaSquirt. **Peter Florance**, who runs an electronics repair business, and who is a very active and informed member of the MegaSquirt® community, has offered to troubleshoot and repair MegaSquirts for those in need. The fee is based on standard shop rates, with a ½ hour minimum.

You can contact Peter at: peter@firstfives.org.

Various MegaSquirt® schematics and other info for troubleshooting.

- MegaSquirt V3 Main Board Information and Schematics
- MegaSquirt V3 External Wiring Diagram
- MegaSquirt V3 Main Board BOM
- V3 Troubleshooting

- MegaSquirt-II Daughter Card

- MegaSquirt V2.2 Main Board Schematics
- MegaSquirt V2.2 External Wiring Diagram
- MegaSquirt V2.2 Main Board BOM
- V2.2 Troubleshooting

- MegaSquirt Stimulator Assembly Instructions and Schematic
- MegaStim BOM

- Relay Board Assembly Instructions
- Relay Board Schematic
- Relay Board BOM

- MegaView Assembly Instructions and Troubleshooting
- MegaView Schematic
- MegaView BOM

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