The vast majority of DSMs that come in for a tune, either remote or in person, have issues that need to be addressed first in order to get a good end result. When remote tuning, it is up to you to sort these things out. For tunes at the shop or at the track, you can do these things yourself, or we can take care of them in the shop for you. In any case, these things MUST be addressed before starting the tuning process.

1) **Initial ECMlink setup**

Update your ECMlink software to the latest revision first. Even if you just bought it.
http://www.ecmtuning.com/downloads.php

Connect to the ECU and check the firmware revision on the lower right corner of the ECU Info tab. If that's not the latest version on the firmware changelog page (https://www.ecmtuning.com/wiki/v3firmwarechangelog), update that as well. Follow the instructions available from this page: http://www.ecmtuning.com/apps/firmwareupgrade

While you're in there, verify all of your sensor inputs. With the key on engine off, connect and start stream.

- If you have a MAP sensor, it should be very close to 0 psi.
- IAT (or intake temp for MAS cars) and Coolant Temp should read reasonable values. If the car has been off for a while (overnight) they should match within a few degrees, giving some confidence in their reading. Note however that as temps rise during the day the IAT will reflect that before the coolant temp does.
- Baro (MAS cars) should read a reasonable value for your current altitude and atmospheric conditions.
- Battery voltage should be good, usually 12.0+.
- If there are any unexplained discrepancies, fix them.

Make sure the basic setup is correct. There are online tutorials on basic setup, feel free to use those. As a minimum, for the car to run, the following should be set up correctly:

- On the Fuel tab, Global and dead time set to the basic recommended settings for your injectors, base fuel pressure, and fuel type. Use the "Calculate" feature to help you with Global Fuel.
- On the MAF Comp tab, set your Base MAF Type to whatever MAF is installed in the car, or

Speed Density.

- If you no longer use a stock type narrow band O2 sensor, you'll want to set up the NB Sim tab. Set the switching voltage to the correct value for your particular wideband. See the chart at https://www.ecmtuning.com/wiki/v3narrowbandsim I recommend keeping a stock type front O2 sensor whenever possible.
- On the Misc tab, check the box for Use non-95-96 CAS if that applies to you.
- On the ECU Inputs tab, set up both portions. The top portion applies to your laptop only, but also sets sensor up to be seen by others in your logs. Change "factory/none" to your installed sensors for each input that applies. Then hit Save Pin Assignments to make it permanent, and be sure each one is added to the list in Captured Values so it will be logged. The lower half is stored in the ECU. The ECU needs those sensors set in order to run properly. Set up any sensors you have installed. The top half and bottom half should match of course for MAP and WB (IAT is not included on the bottom half, it's assumed to be on the intake temp input only).
- Save all of these changes to the ECU.

2) Throttle cable

The throttle cable must be adjusted correctly for proper operation. It needs to register exactly 0% at idle and it should read 100% at WOT. A throttle cable that is set too tight can break throttle bodies and cause high idle conditions (sometimes only when warm, which is frustrating to troubleshoot). A throttle cable that is set too loose can prevent full throttle opening at WOT. The following procedure will provide only enough travel to achieve 100% throttle opening, with all remaining available travel going into slack at idle, where it's needed.

1. Loosen the two throttle cable bracket bolts on the intake manifold.
2. Have a friend floor the gas pedal. Make sure there are no floormats or other obstructions under the pedal.
3. Pull the throttle cable jacket/bracket back until the throttle is wide open against the WOT stop and hold it in that position.
4. Tighten the two bolts to lock it down.
5. The TPS may not yet read 0-100%, that will be addressed at a later step.

3) Idle Switch

This is often ignored with 1Gs and simulated with ECMlink, but it still needs to be set properly. It holds the throttle open slightly and is a coarse adjustment for idle speed/ISC position. The correct starting position is found by backing it out until it's off the throttle cable cam, then thread it in until it JUST moves the cam. Thread it in another 15/16ths of a turn from there and lock it down.

Other throttle bodies may not have an idle switch, but most will still have some mechanical screw that holds the throttle open slightly. Use your best judgement in setting this. It should hold the throttle plate slightly open. Without it, the throttle plate can bind in the closed position and wear out the plate/bore. Too much and idle will be too high for the ISC to control.

4) TPS

With the throttle cable adjusted and the Idle Switch (or idle screw) set, Run the TPS Adjust tool in

ECMlink to account for any change in throttle position or range.

1. Key on engine off, Start Stream.
2. Gradually floor the throttle pedal and release.
3. Stop Stream.
4. Right click on the log and select TPS Adjust.
5. Save the suggested changes to the ECU.
6. Start another stream and verify proper operation (0-100% , IdleSw changes from 1-0 around 1-2% throttle).
7. Re-run the TPS Adjust as needed until the tool stops suggesting changes.
8. Verify the IdleSw parameter reads 1 at idle and switches to 0 at 1-2% throttle.

In rare cases, if you find that you can't get the correct range out of the TPS sensor, for example, it reaches 100% before you are all the way WOT even after running the TPS adjust, you need to physically adjust the TPS sensor slightly to get it back into its range. It's worth taking the time to get this right.

5) FIAV

The FIAV has no servicable parts, but it's important to know its failure modes and how they will affect operation. If the FIAV has failed closed, you will get no fast idle operation when cold. This is the same as blocking it off. If the FIAV fails open, you will always have a high idle, even when warm. In this case the only options are to replace the FIAV with a known good one, or block it off. Without a working FIAV the car will still idle fine, but will likely need some throttle input while it's warming up to keep it from stalling. In many cases the ISC provides enough range to allow it to stay running in most weather.

6) ISC

Check your ISC for proper operation. These can fail in two ways. Electrically, and mechanically. Electrical failure can be diagnosed with a multimeter. In some cases, with a short, the ISC can fry the ISC drviers in the ECU. See ECMlink's page on bad ISC drivers for more info. Ocasionally, an ISC that tests good electrically still doesn't move correctly due to mechanical issues. There are how-tos online showing how to check your ISC for proper functionality.

In all cases it's important to keep in mind that the ECU does not do closed cloop control of the ISC. In other words, it tells the ISC to move, but has no way to know if it actually did or not. When the ECU is reset (power removed for ~10 seconds), it "homes" the ISC by driving it hard against it's travel limit. It can then assume it knows where it is, and starts counting "steps" from there. Any time the ECU and ISC get out of sync, you can have idle control problems. Something as simple as disconnecting the ISC connector while the engine is running can cause this out of sync condition. The ECU needs to be reset to get them back in sync.

Reset the ECU any time you:

- Unplug the ISC while the ECU is powered up
- Remove and reinstall the ISC
- Change the ISC

The first time you turn the key to the "on" position after reconnecting the battery, you will hear the ISC chatter for several seconds while it homes, if it is working correctly.

7) BISS

The BISS is a manually adjustable air bleed around the throttle plate that allows for fine tuning ISC position. This should be adusted until LearnedIdleAdj is ~144 and ISCposition is ~25-30. This gives maximum range in the up and down direction for the ECU to control high or low idle speeds. Any time target idle speed is changed in the ECU, this will need to be adjusted again. If you run out of range with the BISS, you can adjust the throttle closed position to get back in range (if you change the physical throttle position, re-run the TPS Adjust tool, naturally).

8) Cam Timing

Rotate the motor to TDC on #1 power stroke. Verify that the cam marks and crank pulley marks are all lined up. If not, look into this and correct it now. Note that some crank pulleys, even "new" ones, have the mark in the wrong place. The best way to be sure the pulley mark is correct is to check it when you build the motor. With the trigger plate mark lined up with the pointer on the oil pump, install the timing cover and crank pulley and verify the mark is alinged to the T (0 degrees) on the cover. Any shift in this mark will affect your base timing setting in the next step!

9) Base Timing

Before setting base timing, ensure the CAS is installed in phase. It is possible for it to be 180 degrees out of phase. The engine will still run, but not as well, especially at idle and cruise, and the more extreme the setup the worse it can be. If you're not sure it was installed correctly, pull the CAS and verify that the notch in the driven part is aligned to the dot on the case when the motor is at #1 TDC (all timing marks lined up). Correct it if necessary. It obviously makes sense to do this before setting base timing, since removing and reinstalling the CAS always requires base ignition timing to be reset.

Base ignition timing MUST be set correctly for proper engine operation, good power, and maximum safety. With the engine idling, on the Misc tab in ECMlink check the box to ground timing. This will force the ECU to hold a steady 5 degrees so you can set it (start a stream and watch timing to verify, but you'll hear the idle drop). Use a timing light on the plug wire for cylinder 1 or 4, and adjust the CAS until it also reads 5 degrees, so the ECU's idea of timing and the actual physical timing match. This is whole point of setting base timing. Any number degrees at the ECU MUST be the same number of degrees at the crank. 5 degrees BTDC is the mark on the timing belt cover that is between the T (0) and the 10.

Some things to keep in mind:

- The crank pulley and timing cover must be right, or your base setting will be wrong. Some aftermarket pulleys, and stock pulleys that have spun, will not have the timing notch in the right place. The best way to verify this is when you build the motor. With the timing marks all lined up correctly, make sure the "T" mark on the timing cover lines up with the notch in the crank pulley. If it doesn't, correct the problem (file a new notch at the T and highlight it with a dab of white paint).

- For cars with crank position sensors (7 bolt 2Gs, EVOs, Kiggly crank triggers), base timing will not be adjustable. But it should still be verified! Most of the time it is 5 degrees. If it is off a degree in either direction, that's ok, just make note of it and let me know at the start of the tuning process.
- For cars without lower timing covers, a pointer will need to be made to adjust/verify base ignition timing. Note that a pointer that points at the pulley notch with all of the marks lined up is set to 0 degrees! We need a mark at 5 degrees BTDC. I like to do the math on the pulley diameter and make a new notch 5 degrees BTDC. When setting base timing, this is the notch you line up with the pointer. You have to be dilligent and ensure the pointer is always set right before checking base timing, they can be hit by things and moved!

10) Base fuel pressure

Base fuel pressure needs to be set correctly, and FPR/pump/return line functionality verified before tuning any car. Most people will simply start at 42-43 psi and be good to go. Others will run more or less base pressure, but you have to be sure you understand the implications of doing this. Always run it by your tuner. The following is the procedure I use to verify operation of the fuel system.

1. Turn the FPR set screw in all the way, or until you achieve ~80 psi (different FPRs have different maximums). This verifies FPR spring pressure, and that the pump assembly has no leaks. Blown out pump hat o-rings often won't let you get over ~50 psi.
2. Back the FPR screw all the way out. This verifies return line functionality. Ideally you will be able to get down to 20-25 psi. This doesn't guarantee you aren't over running the return line, but it's a start.
3. Set base pressure to 42-43 psi.
4. Apply 40 psi shop air to the FPR reference port. You should see 82 psi. If not, check for boost leaks in the FPR.
5. If possible, apply 20"hg vacuum to the reference port with a mightyvac. You should see pressure drop 10 psi, to 32. If not, check for leaks, or over running the return line (a larger line or regulator orifice may be required).
6. Reattach the reference line and start the car. Note idle vacuum and subtract it from your set base pressure (2"hg = 1 psi). This should be the pressure you see at idle. If not, check for leaks or return line over run.
7. If all of this passes, you can be reasonably sure that the fuel pressure control system will function as expected. It's still always a good idea to log fuel pressure, since it will show any of a large number of possible problems easily, with no guessing.

11) Wideband

Make sure what your ECU logs from the wideband matches what you see on the display, at all AFRs. The easiest to check is idle. If you're using a stock type front O2 sensor, or have set up your narrowband simulation correctly (be sure the switching voltage is correct for your WB), it should cycle around 14.7 at idle. Make sure the ECU and WB display match. If it moves around too much to be sure they match, you can try locking the ECU in open loop to steady the reading temporarily. If you're able to make WOT pulls, be sure it also matches at WOT. Tuning is done based on that AFR number, so it has to be right for the tune to be right.

Some widebands will have more issues than others. Please see the tech page on O2 sensors at Sixsigmatuning.com.

12) Cooling System

Make sure the car can idle and drive and go WOT without overheating. Lots of tunes are stopped in their tracks by overheating issues. On a 2g it's best to let the ECU control both fans like stock. On a 1g, the main fan relay is controlled by a temp switch in the radiator. It works OK, but can be improved upon if you want to run a little cooler or are having issues with it. An aftermarket temp switch in the t-stat housing will control coolant temps much better, and it's a very simple project. Just install the new switch, and extend the wiring to it (polarity does not matter). Another option is to use an ECU output instead of the temp switch. Then ECMlink's nitrous controls will control the fans. The advantage here is ease of adjustability. You can turn the fans on and off at any temp that is above the thermostat temp.

13) General condition.

The car should be in good general running condition. Safe to drive. No leaks. Brakes operational. Lug nuts tight. Boost leaks fixed. Etc. It might sound silly, but I've seen it all.

14) Do all of these things!

Most people will tell me they did all of this, when in fact they didn't. I will always find out!

At this point, the car should be ready to tune. The tuning process may uncover additional issues that need to be addressed, but at least of the most common issues should be avoided. As always, this is all done at your own risk. I can't possibly know the condition of every part of your car. Tuning will stress many parts, things can go wrong, etc. You are liable for any and all damages.