

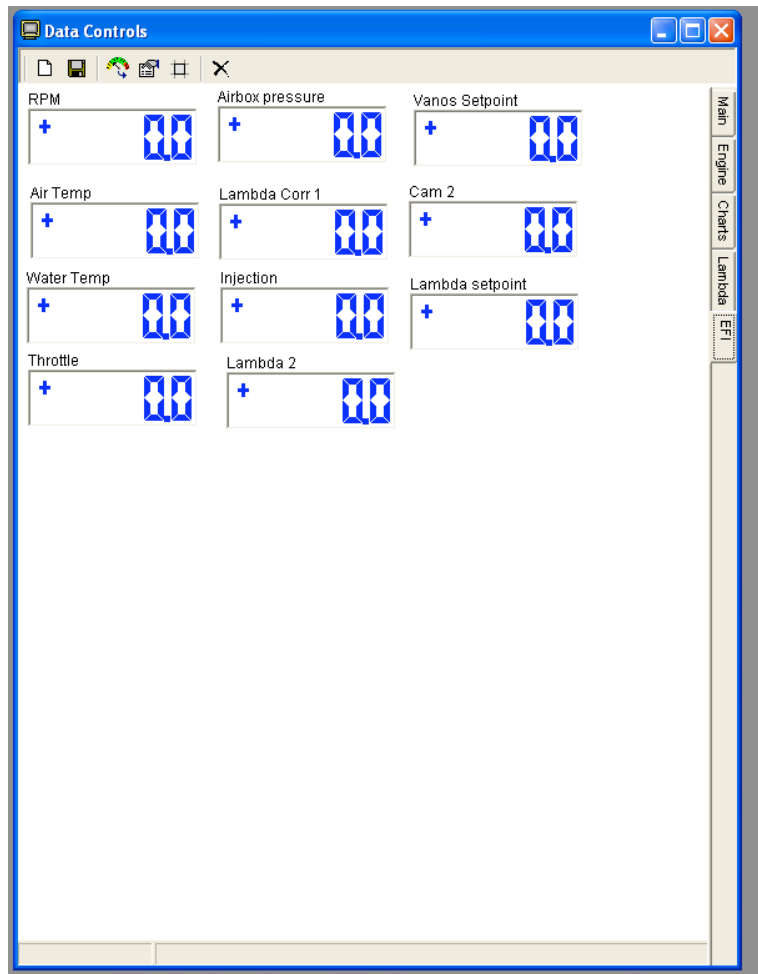
BOE

Getting Started with EFI

I. Setup

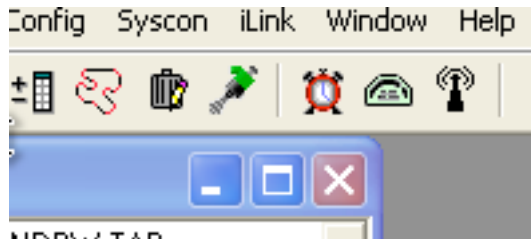
a. Basics

- i. Install EFI software on your laptop and configure your USB to serial port controller if needed.
- ii. **Open Editor.** You **MUST -MUST** be running an Editor version 7.1.11 or newer . If you're not, you need to DL a more recent version from our website or get it from DRS.
- iii. Configure the data control screen as follows:
 - 1.

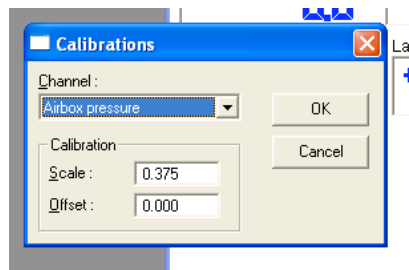


- iv. Configure your ECU calibrations. This will ensure that your ECU is setup to give you temps in degrees C and read your 3 bar MAP correctly.

1. Laptop does NOT need to be connected to the car for this step.
2. Locate the icon with the pencil on it next to the race track:

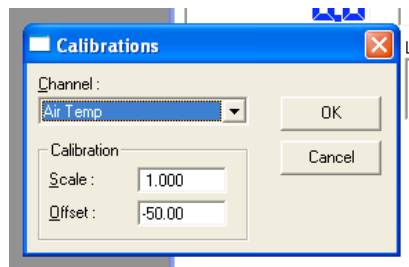


3. **MODIFY TAB**
4. Configure your airbox pressure as so (must be a GM style 3bar maps sensor, as supplied with the kit):



a.

5. Configure BOTH your air temp and water temp channels as so:



a.

- v. You should have a map emailed to you unless otherwise arranged. You must save your maps in the "maps" folder within power to win. The EFI will not import maps not saved to this folder.
 1. If you make sub folders within the "maps" folder to stay organized and store maps in them, you need to copy paste the "control file" into each sub folder that you keep your maps in.

vi.

- b. Hook your laptop up to the EFI

- c. Cycle key on and be sure things look good- DO NOT START YET. The engine may click uncontrollably until you have a working map loaded into the EFI.
 - i. Your fuel pump should run. If not, is your 20amp fuse in?
 - ii. Ensure that you're "working on line" per the icon near the top of the screen.
 1. Click "replace file" and select the map you just saved and click OK.
 - a. You will hear a series of clicks as the map uploads. Flip your map switch and do the same. You'll be placing the same map in both locations for now. You can change this later if you like with different maps.
 - iii. NGK should count down and read "cal" once warmed up.
 1. You may need to calibrate the NGK as per instructions it came with
 - iv. Airbox pressure should read about 30, +/- 2
 - v. Temps should look reasonable in degrees C.
 - vi. Lambda 2 should read about 1.1 (see definitions below)
 - vii. The checksum should read 364FH
 1. Located in "Filer Folder" in the main window.
 2. If it doesn't you need to upload new firmware.
 3. Call for assistance.
 - viii. Your check engine light on the stock dash will always be on and your shift light will shine around 6,000 rpms. Those two lights no longer serve a purpose.
 - ix. If all looks good, then proceed.
 - x. If you have questions about how to install a tune/map or anything else you're stuck on, PLEASE CALL or email someone that can help you.
 1. Kris at DRS, 562-694-2226, kris@racesolutions.com
 2. Phil at BOE, 913-244-6999, phil@boefabrication.com
 3. There are several threads on Lotus Talk that talk about the EFI and I recommend reviewing them as well.

- d. Start the engine and look down at your bypass valve (may need to cycle the key to prime your fuel system if it has been a while since you initially turned the key on). You should be able to tip the throttle in quickly and watch the bypass valve operate on the supercharger. Be sure that it does.
- e. Warm the car up and just keep an eye on controls.
 - i. You will almost certainly have to tweak your idle to be just right. There's a lot of information on Lotustalk about this in the EFI tuning tips thread.
- f. **Go for a test drive and pay close attention to your AFRs. This blower puts out a LOT OF AIR. Don't assume your tune is okay until it has shown you that it's good to go through watching your AFRs. You should be in the mid to low 12's at WOT passed 6,000 RPMs. If not, you need more fuel.**
- g. This blower is VERY quiet. Therefore, you may wonder if it's working at all since it doesn't give off the loud whistle you're used to with the old MP62... Don't worry, it's working just fine...
- h. The EFI editor does NOT care if you shut it down when the car is running or not.
- i. Be sure to click the save icon to save any changes that you make.
 - i. You should typically "save as" any significant changes to the car so that you can revert back to a previous map if need be...

II. EFI Tips and Glossary

- a. **Lambda:** This is simply the term for AFR (air fuel ratio). A lambda reading of 1 is an AFR of 14.7. Your EFI only displays AFR in terms of Lambda. To equate Lambda to AFR, you simply multiply the Lambda value by 14.7. Ex: $0.80 \text{ Lambda} = .80 \times 14.7 = 11.76 \text{ AFR}$. Or say you're shooting for 12:1 AFR. Simply take $12 / 14.7 = .816 \text{ Lambda}$. Easy, huh?
- b. **Lambda Corr 1:** Also known as short term fuel trims. Most maps have the window for fuel trims set to +/- 15%. In other words, if you set your target AFR for a particular load/rpm site (known as Lambda Setpoint) to .85 Lambda and your fuel map is overly rich in the area you're telling the car to run .85L, then

the ECU will pull fuel. You can tell what percentage of fuel it's pulling to achieve the setpoint of .85 by observing the Lambda Corr 1.

- c. **VANOS**: This is a BMW term for variable valve timing. In the VANOS tab, you'll find all the setting for our cam timing.
- d. **VVT**: Variable Valve Timing. Our engines have single VVT. Meaning that we can control the timing or phase of just one cam, and that is the intake cam.
- e. **VVL**: Variable Valve Lift. The 2ZZ has the ability to change the lift of both the exh and intake cam. Good or bad, this action of increasing or decreasing the lift is an on/off occurrence. It is not variable as to how much left change you get and both cam change their lift parameters at the same time. You do have control of what RPM and what load this shifts takes place. Depending on the age of your EFI control file, the VVL adjustments will either be titled Exh cam or VVL. However, both titles are found in the same place within the VANOS chapter and in Constants subchapter.
- f. **LAMBDA 2**: This is the output of your Wideband O2 Sensor. Anytime you're monitoring or see something pertaining to Lamba 2, you'll know that's the actual AFR in terms of Lambda. The channel labeled "Labmda 1" is not used for the wideband systems.
- g. **Airbox (Also Airbox Pressure, and MAP)**: This is the channel your MAP input comes in on. Airbox, Airbox Pressure, and MAP are all synonymous for this ECU. This will always be displayed in units of inches of hg (mercury). See MAP below for more details
- h. **MAP**: MAP is Manifold Air Pressure. It is expressed in inches of hg. This is the same thing as barometric pressure. You probably have one of these gauges in your kitchen. Typical barometric pressure is about 30, which is also known as 1 bar or 1 atmosphere. To turn in/hg into something you can relate to like boost psi, there is a conversion. You always can take the "x" in/hg and subtract 30 and then divide by 2 and you'll have psi. For instance, let's say your airbox pressure or MAP reading was displaying 48. That's 48 in/hg. Take $(48-30)=18$, then divide by 2 and you have 9. So 48in/hg equals about 9 psi boost.

Intuitively, when you see 30, you know that's essentially just atmosphere, i.e. no boost and no vacuum. With your key on and the engine not running, your MAP should be about 30 +/- 2. While this seems like a lot to remember, you'll get quite used to thinking about MAP in terms of in/hg rather than PSI...

- i. **Cranking Pulse:** Found in the Fuel Injection tab and then fuel constants. This is the injection time that your ECU uses while you're cranking the engine over. You typically will have to fine-tune this for your car for the best starting possible. It's typical to see your injection time about 3X greater than your injection time at idle. For most cars, cranking pulse will be about 3-3500uSec which is 3-3.5m/s. Most cars will idle around 1m/s injection pulse width, as you'll see in your fuel map. Cranking injection IS manipulated by the temperature injection corrections. So if you find that your car starts perfectly on a 80degree F day, but not on a 30F day, you may need to steepen the inj vs coolant temperature curve.
- j. **Cam Timing Setpoint or Intake Cam Degree or Vanos Setpoint:** There's a lot of work that goes into building a good cam timing table (recall this is for intake cam timing only). You have a good all around cam timing table with the map you were supplied with. Feel free to play with this setting, but best if done with the help of someone familiar with it and only on a dyno. NOTE, that playing with the cam timing will impact that amount spark the engine needs and the required fuel as well. So tread lightly here. The range for the cam setpoints are from 55 to 15. 55 is the most retarded and 15 is the most advanced. Those numbers don't really mean anything. They're just numbers. They are linear in the way that they adjust the cam timing. So 35 is in the middle of the available cam timing/phasing adjustment...
- k. **Cam 2:** Cam2 shows where the intake cam actually is. So let's say you have your Vanos setpoint (referenced above) set to 30 at x load and y rpm, and you drive the engine that point. The Vanos setpoint will say 30 and Cam2 will show just how close to the desired 30 the cam actually is. It's typically within 2 or 3 degrees of the set point.

- l. **Air Temp:** The air temp shown is not outside air. It's represented in degrees C and is the IAT or intake air temp.
- m. **Water Temp:** Represented in degrees C as well. Piggy backs off the stock sensor
- n. **Injection:** This is the actually m/s that the injectors are firing. This is helpful for diagnosing problems with startup. All the numbers in your fuel map are actual injections pulses.
- o. **Active Cursor:** If the Active Cursor button is illuminated, then the closest cell in your fuel or spark or intake cam map will be highlighted in some fashion that is being referenced by the ECU. This is particularly helpful when tuning. Be sure to turn the cursor off when you don't need it as you cannot work on cell that are not highlighted.
- p. **Closed Loop:** This is when the ECU is controlling the fuel. As long as the Lambda Corr 1s are within +/- 15%, then the ECU is in charge. If you see that the L Corr 1 is pegging out at 15+/-, then you really need to make fuel map changes where the occurrence takes place. Make note that the ECU does not trim fuel unless the throttle is still. If the throttle is transient, it will not trim fuel. It will wait until the throttle has stopped moving.
- q. **Check Sum:** If you're ever uploading new firmware or are suspicious of a corrupt file, check your checksum. It is specific to the firmware and will only show if the firmware is Okay.