Digifant-1: DIY custom mapping using Tunerpro.

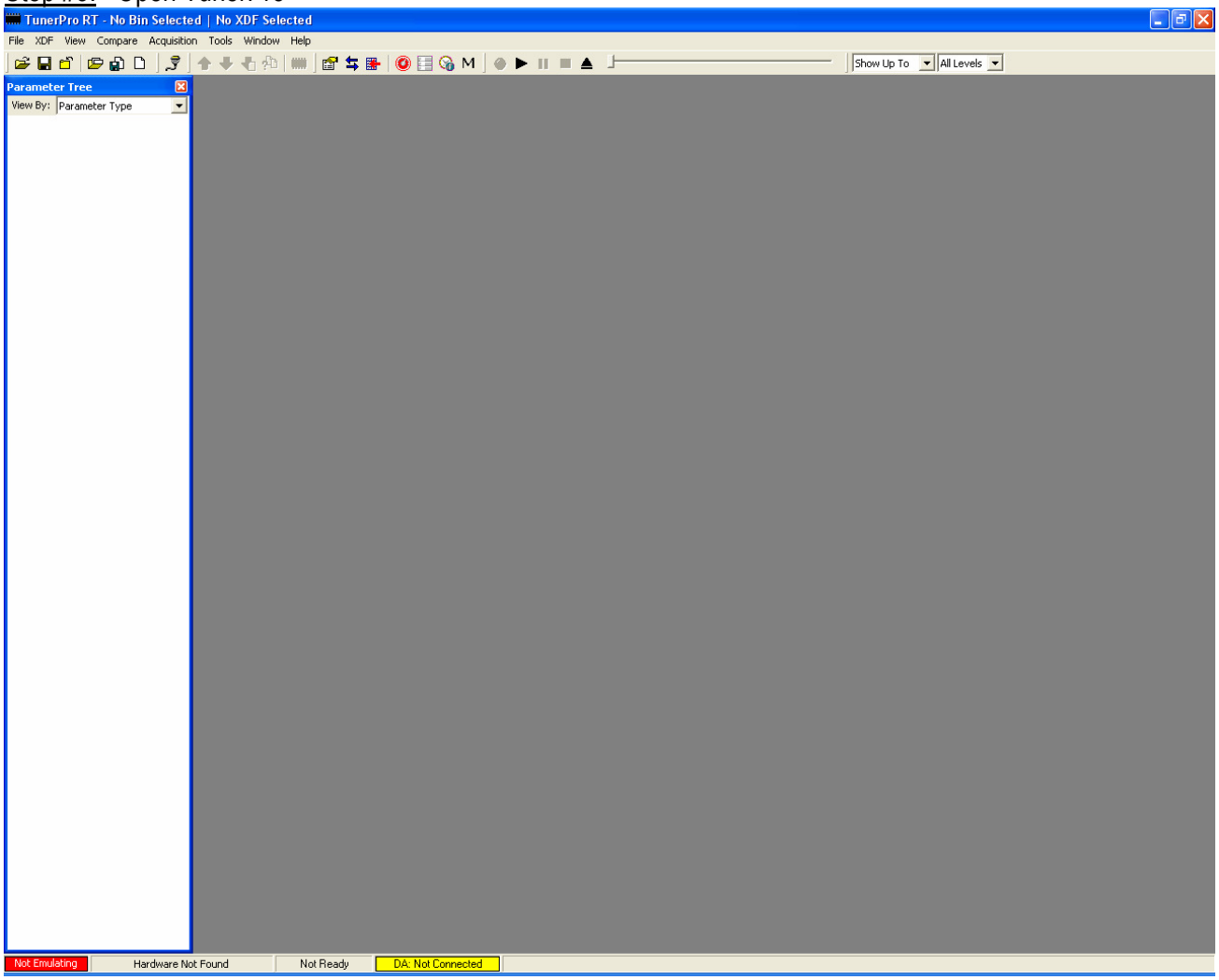
**DISCLAIMER:* This is by no means a definitive tuning guide, and specific equipment is required to do any tuning. The level of commitment is up to the end user. Many of the maps listed in the XDF file are 'unknown' elements, and there is very little need to play with them in order to do any custom mapping. Do so at your own risk, I assume no responsibility for accidents incurred while 'tuning'.

SECTION 1: Getting Started

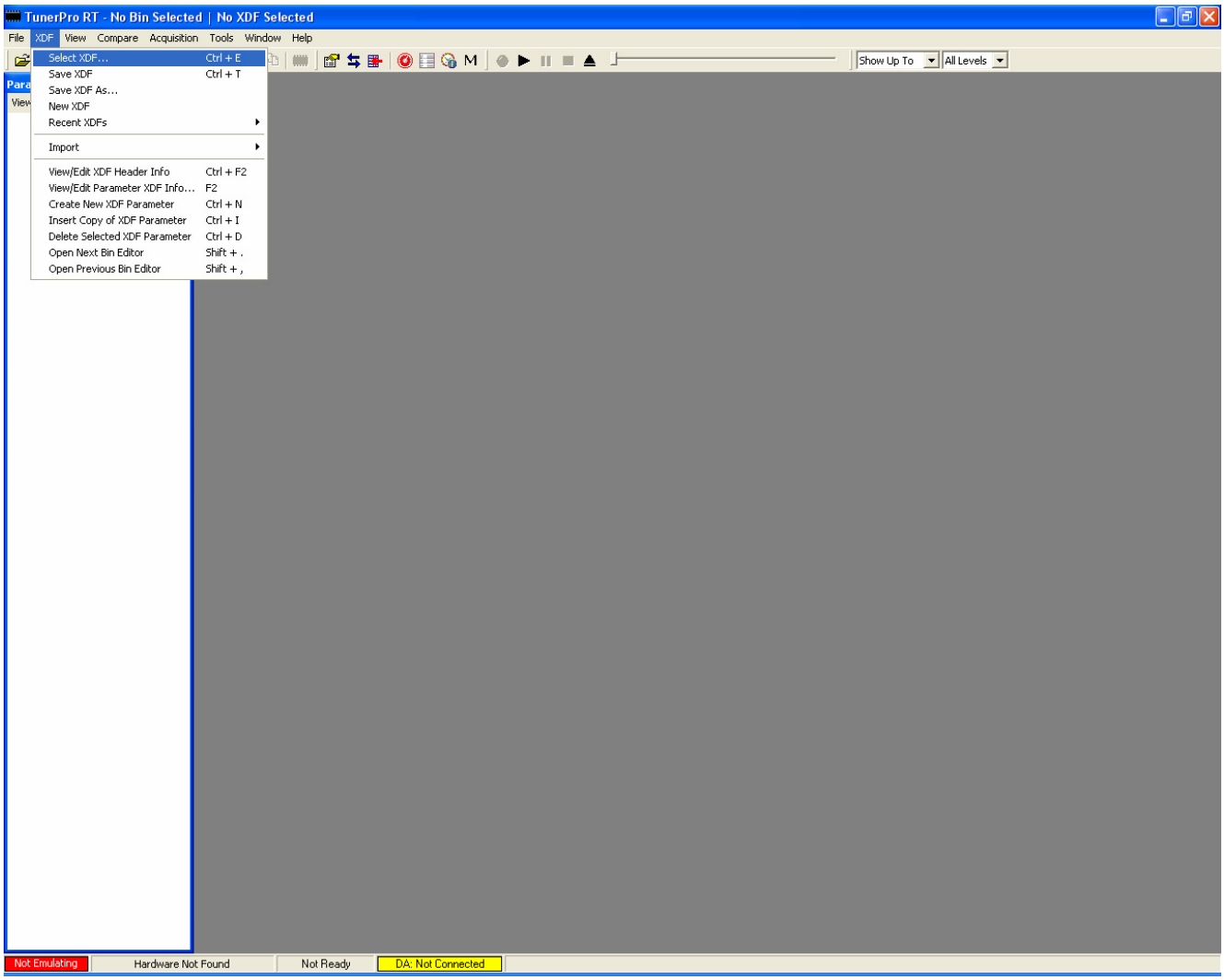
Step #1: Download TunerPro v.5 from http://www.tunerpro.net/beta/Builds/SetupTunerProRT_v500.exe. The XDF (template) file that is used is only workable in V.5 due to the majority of the development having taken place with that version of the software. There are many different ways of working with Digi-1, but I prefer to tune with TunerPro and do any hex editing with the demo version of WinOLS. Hex editing is rarely required though, since the XDF file allows you to tune many of the available maps hidden in the Digi-1 hex code.

Step #2: This assumes you have downloaded and installed the above software package. Download the XDF file required to make sense of the Digifant-1 hex code. It is contained here: http://www.ecuconnections.com/forum/viewtopic.php?f=25&t=49 . Also download the stock Digifant-1 hex code (referred to as a 'bin' file from this point on) from here: http://www.ecuconnections.com/forum/viewtopic.php?f=41&t=45
There are multiple types of digifant-1 bin file to choose from, but the one with the most development is the one posted above, hereafter referred to as the 'single-map' bin file. All bin files will work in all ECUs, since the differences between ECUs are purely code-based, not hardware.

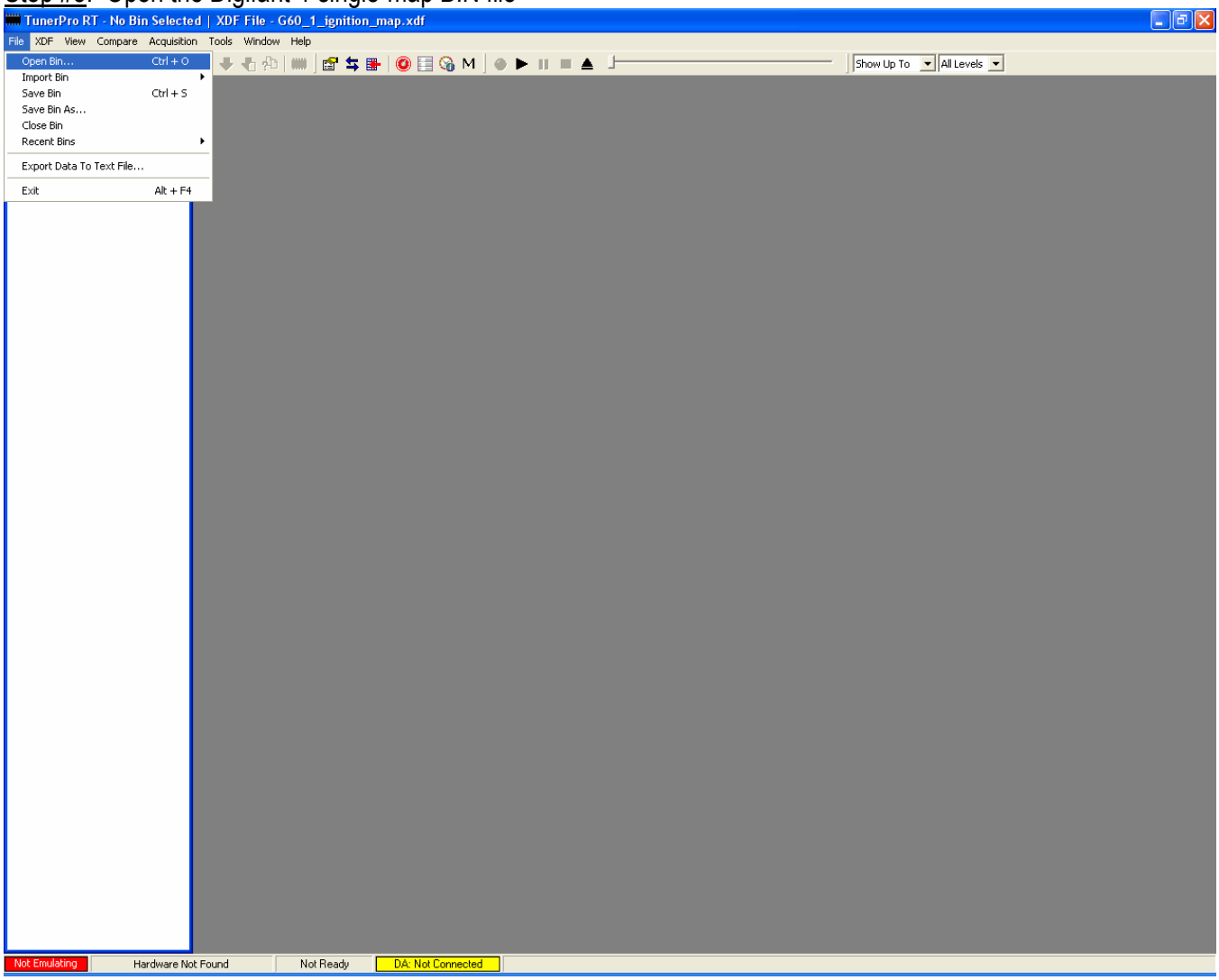
Step #3: Open TunerPro



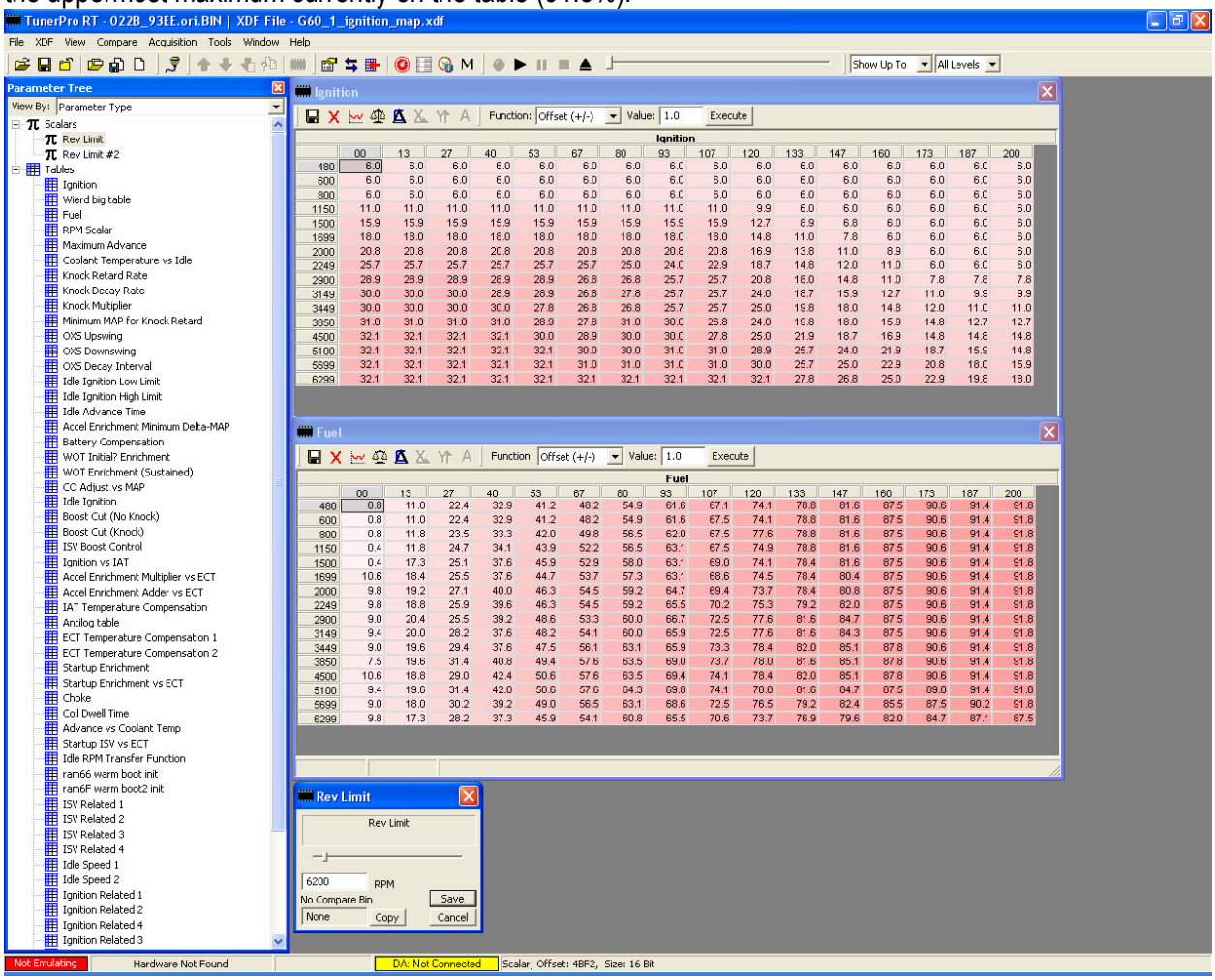
Step #4: Open the Digifant-1 single-map XDF file



Step #5: Open the Digifant-1 single-map BIN file



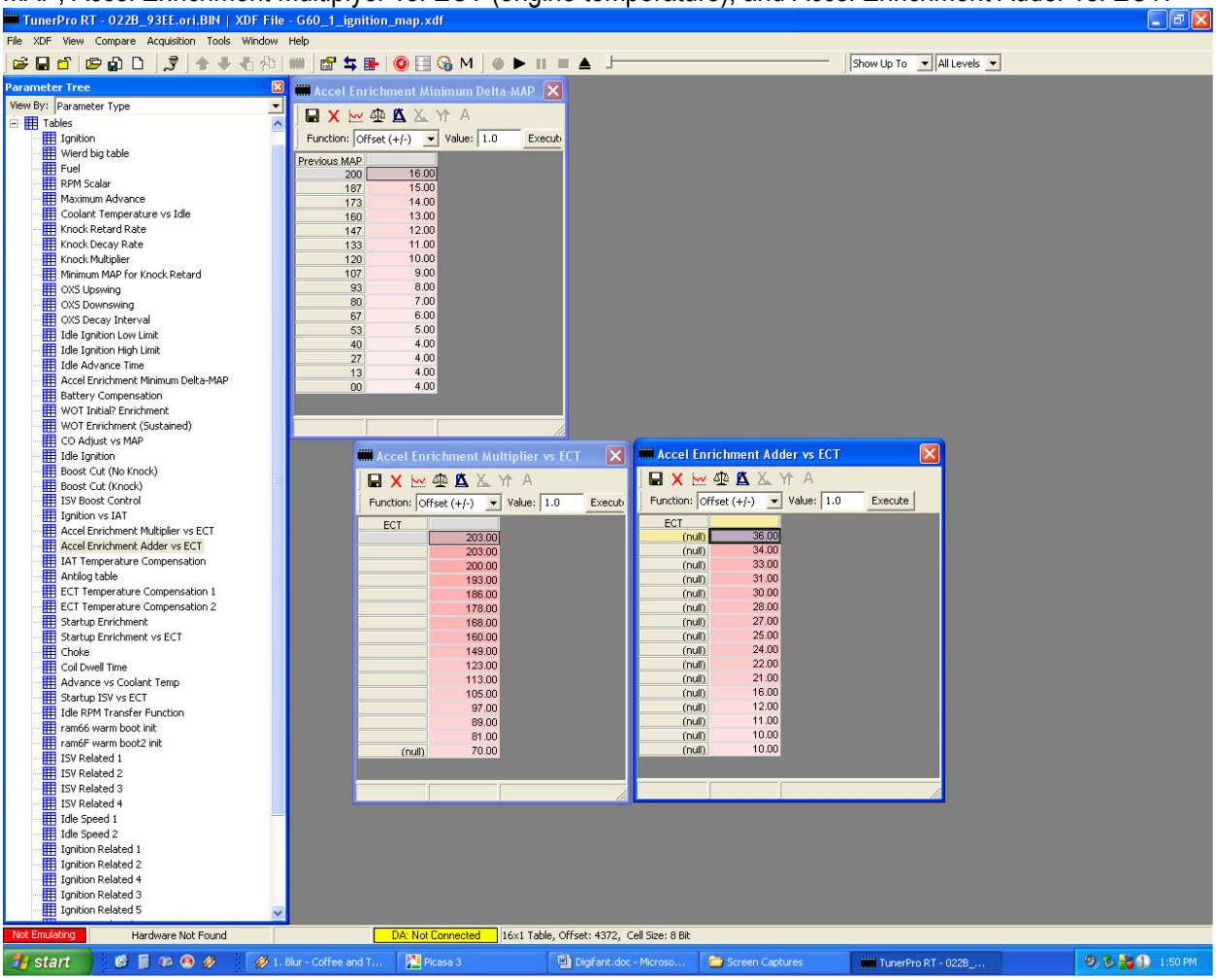
Step #6: Once you have done both steps 5 and 6, you'll see that in the left-hand frame there are two selections: "Scalars" and "Tables". Click on the plus sign beside each item and it will expand to reveal the tuning tools available. The rev limiter, fuel map, and ignition map are the important ones, and the easiest to start with. For the time being, ignore 'rev limit #2', as it is for the triple-map BIN files, which are not well known (nor needed, in the author's opinion). The main fuel map is populated in 'duty cycle' of the injectors, so changes to the map should NEVER exceed 95%, and it is a very good idea to never go any higher than the uppermost maximum currently on the table (91.8%).



SECTION 2: How Digifant-1 works (the basics)

It is important to know how Digifant-1 works before making changes to the maps, so this is a basic overview. Hopefully this will provide enough insight into how it operates, and what maps need to be changed in order to effect proper changes that will fit the user's needs. The main fuel/ignition maps have already been covered, so the next topic will be acceleration enrichment.

There are three components to the acceleration enrichment 'equation': Accel Enrichment Minimum Delta-MAP, Accel Enrichment Multiplyer vs. ECT (engine temperature), and Accel Enrichment Adder vs. ECT.

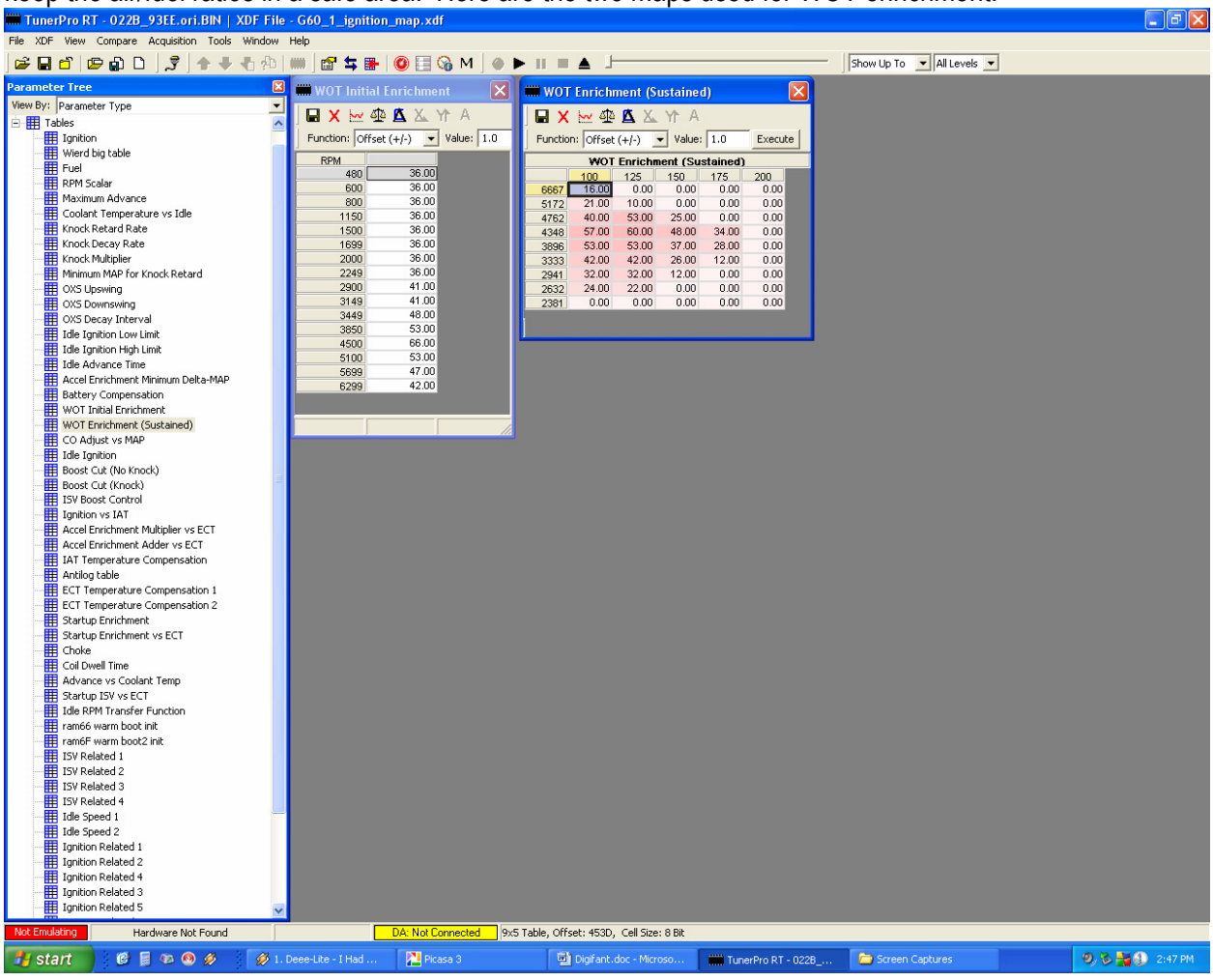


-Accel Enrichment Minimum Delta-MAP: This is the table that determines how sensitive the accel enrichment is at any given point. The previous MAP range is compared to the current MAP range (going from low throttle to high throttle for example), and the variable that it arrives at is the sensitivity. It is set quite low, due to the stock programming being for 1990's emissions standards. There is a great benefit to be found by increasing the entire table by 4-6 (which also helps combat digi-lag). Making it too sensitive will result in poor driveability however, so experiment first.

-Accel Enrichment Multiplyer/Adder vs. ECT: These are maps that have not been fully fleshed out yet, and are lacking the temperature scale. Their basic function is to control the amount of fuel

injected based on the Delta-MAP trigger and engine temperature. Adjustments will probably not have to be made to these tables, unless radical modifications have been made to the engine, such as wild camshafts, 16v/20v heads, larger displacement, etc. The rule of thumb is to change these last, and always save the BIN before making changes, so it will be possible to return to stock if need be.

WOT (Wide-Open-Throttle) enrichment: Digifant-1 does NOT use the above tables for WOT enrichment, it is primarily for the throttle range between idle and WOT. Once the WOT switch on the throttle body is depressed, a different system takes over. The switchover to this enrichment system is where Digi-lag comes from, as the ecu tries to switch from closed-loop (explained later) to WOT enrichment in order to keep the air/fuel ratios in a safe area. Here are the two maps used for WOT enrichment:



WOT Initial Enrichment: This is the initial 'shot' of fuel that the injectors fire upon depression of the WOT switch.

WOT Enrichment (Sustained): Think of this as the fuel table that the ECU defaults to once the WOT switch has been activated, although it is purely a multiplier/adder that works off of the main fuel table. Both the main and WOT Sustained tables work together at this point. Make changes to the WOT Sustained table for WOT fueling, not to the main fuel table.

SECTION 3: How to get the modified file into the ECU.

Ok, now that the basics of modifying the digifant-1 BIN file have been covered, here's how to transfer/install that file into the ECU. This can be accomplished quite simply, all the equipment needed is an EEPROM (chip) burner that can handle a 28 pin DIP chip. The BURN2 from Moates.net is an inexpensive and user-friendly choice, although any burner that can program the 28 pin EEPROM will work: http://www.moates.net/product_info.php?cPath=73_69&products_id=197

EEPROMs (chips) will be needed, and a commonly used product is the 27SF512, which is a 64kb chip (the digifant-1 BIN file is 32kb). These can be found on eBay and many other places on the internet, or even at higher-end electronics stores.

Once the file has been burned to the chip, it's ready for use. This is the simplest way to tune digifant-1, although there are other methods available if more complex tuning is needed. An emulator (such as the Ostrich2.0 from Moates.net) can be installed in place of the chip, and 'real-time' tuning can be done, which is quicker than constantly changing chips. Once the file is exactly to spec, then it can be burned to a chip and inserted into the ECU. This is a more involved process, so this is up to the end-user to investigate, as this is not intended to be a road map to every Digifant-1 tuning method available.

SECTION 4: Disclaimers and miscellaneous information.

The XDF file used to custom map the Digifant-1 ECU is far from complete, and absolute care should be taken when using it. Many maps are still undefined and their function is not understood. The basics are there though, and can be used to make radical enough changes to compensate for many aftermarket modifications. There is still much to discover, such as the correct modifications to convert to turbo, the correct way to alter the file for naturally aspirated engines, and how to correctly fight digi-lag (which many aftermarket digifant-1 tuners have defeated, but their work is well outside the scope of this document). With the age of Digifant-1, and the lack of people still interested in making custom chips, hopefully this document helps keep Digifant-1 a viable option for people interested in an OEM solution to their tuning needs. The ultimate end result would be complete control over the ECU functions, but that could be a long time off, if it ever happens.

Written by: BrendanSmall on the www.ecuconnections.com forums
Huge thanks to the open source community found there, who believe in FREELY sharing information for the betterment of the knowledge pool. Open source tuning should be the domain of many, not the secret of a few.