VORTEX ECU INSTALLATION and TUNING TIPS

INSTRUCTIONS: It is strongly recommended to read the Vortex Instructions packaged with all ECU's . If you do not have them they can be accessed on the Duncan Racing Website; www.duncanracing.com -TECH CENTER-INSTRUCTIONS-VORTEX

Failure to read and properly understand the manufactures operating instructions will hamper your ability to have optimal success with the Vortex ECU (Engine Control Unit). The following Tech Tips are to be used in conjunction with the manufactures instructions

COMPUTER REQUIREMENTS: No computer is required. The Vortex X10 ECU is preprogrammed with 10 High Performance ignition/fuel maps. All of the programming has been done for you.
The only thing the user may want to change is the fuel trim switches in order to fine tune the air fuel ratio. The VORTEX X10 ECU replaces the standard ECU and this allows it to have complete control over the Fuel Injection and ignition system. This ECU is far superior to the many Piggy Back systems available. The Piggyback system is only able to adjust some of the parameters of the standard ECU and therefore is not able to achieve the same performance gains of a replacement ECU System like the VORTEX X10 ECU. In addition a piggyback system is inherently less reliable as there is more electrical connections and wiring which are prone to added faults.

WHAT IS A MAP: A map is a table of data programmed into the ECU. This table of data tells the ignition when to fire the spark plug and the injectors when and how long to let in the fuel. Maps are inside the Engine Control Unit (ECU). The ECU is a mini computer that runs your ATV. It is a bit more complicated than this, but hopefully this will give you a basic idea.

1-ECU Map = 1- Ignition map + 1- Fuel Map

All of the preprogrammed maps installed in your VORTEX ECU have a specific Ignition Curve (also referred to as Ignition Maps with each having different ignition timing to increase or change the power delivery)
For Example: By changing the ignition timing, the engines power delivery can be increased at the lower RPM's and Smoothed out in the middle RPM's or softened at low RPM's and Strengthened in the middle RPM's. There are a multitude of possibilities.

Why do we need so many options?
Because different terrains, riding applications, engine modifications and riders all react differently to different ignition timing.
Riding Terrains; Sand, Hard Pack, Loamy Dirt, Mud, etc. all respond differently to different ignition timing.
Engine mods- compression, cam timing, intake system etc. also respond differently to different Ignition Curves
Riders….Sizes, Abilities, Riding Styles
Type Use… MX, XC, Desert, Drag Racing

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During the R&D process of this ECU- countless ignition Maps with multiple applications in mind were created and tested. After Ignition Map was written by Vortex Engineers

A custom Fuel Map was built for each ignition Curve. The Fuel Map is designed optimize the air-fuel ration with Vortex ECU Fuel Trim switches set at LO: 5 MID: 5 Hi: 5. This allows for the fuel trim to be fine-tuned by adjusting the switches *(see FUEL TRIM Section below for more details)*

STARTING PROCEDURE: Start your machine using no throttle. Do Not compress starter switch for more than 2-3 seconds, If machine fails to start after 2-3 seconds stop and repeat the starting process. Once machine has started you MUST ALLOW engine to warm up- at idle-

This warm up process can take 2-3 minutes under normal weather conditions. (Longer in colder temps). Do NOT use the throttle until the engine is warm.
During this warm up phase the ECU is calibrating the ISCV (Idle Speed Control Valve). *NOTE: The machine may not sound great and idle may be off slightly during the initial warm up faze- THIS IS NORMAL.
After the machine is warmed up you will want to Rev the Machine up a few times and then let it settle back to idle.
It is not uncommon for the machine to sound and act differently after it is warmed up and has been revved up. Have patience- The process is very similar to starting your PC Computer- It takes a few minutes for the engine to warm up completely and the ISCV (Idle Speed Control Valve) to set correctly.

X10 SWITCH: The X10 switch is located on the ECU. It is numbered 1 to 0 (With "0" is equivalent to the number "10"). By selecting a different number on the X10 dial- An alternate map is selected.
*This switch is built in to the ECU- See Vortex instructions for more details

WHAT MAP SHOULD I USE: Included with the Vortex Instructions is a document with a brief overview of what each map was designed to do. Some Maps have a higher REV LIMIT and therefore should only be run with on engines with a modified Valve Train. For the other maps there is no Right or Wrong choice. The absolute best option is to test all the maps. Click the X10 dial to any number and go ride for a while. Test them back to back.
For general reference regarding Vortex maps:
TRACTION Maps: Have a more ride able, predictable power band. Less wheel spin in dry slippery conditions.
POWER Maps: Have a more aggressive power delivery- Work well when traction is at a premium
* Different engine tuners have different maps that they prefer for their engine mods.

IGNITION: The Hi Performance Ignition Maps designed by the Vortex Engineers are the key to the overall success of the Vortex ECU. The design of these Maps are a proprietary product of Vortex. The Hardware features of the ECU are *State of the Art*.
But don't discount the importance of the maps inside.

IDLE: Idle adjustments vary from machine to machine- Consult the Factory Service Manual
Regarding the Yamaha YFZ 450R (ATV) The idle on both the stock factory OEM ECU and the Vortex X10 ECU is preset. It can only be changed in the Vortex software. With thousands in use today, the standard set in the Vortex ECU works for 99% of users

FUEL TRIM:LO: 2.5%-25%   MID 33%-66%   HI 75%-100%
Adjusting the 3 Fuel Trim switches is how you fine tune the engine.
BASELINE FUEL TRIM SETTINGS ARE: 5-5-5
Each dial increment richens or leans the fuel by 2.5% per increment.
Dials 1-4 are LEANER (Position 1 is the leanest setting)
Dials 6-0 are RICHER (Position 0 is the richest setting)

Adjusting the Fuel Trim Switches is VERY similar to tuning a carb.

FUEL

TRIM DIAL   CARBURETOR

LO: Pilot Jet/Needle Diameter

MID: Needle Jet-Clip Positions

HI: Main Jet

NOTE: The "LO", "MID" and "HI" switches are fuel trim based on throttle opening and NOT RPM

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DYNO TUNING vs TRACK TUNING: Adjusting the air fuel ratio on your machine via dyno tuning can help you establish a baseline. But-Be Aware in the vast majority of applications the tune will need to be adjusted once it is put on the track. The Fuel Trim settings will need to be adjusted and fine-tuned for maximum performance on the track.

CHARGING THE BATTERY: Unhook the battery +POS whenever charging the battery.

WELDING ON YOUR MACHINE: The ECU and the Battery (+ POS) Terminals should always be disconnected before any welding is done on the chassis or the engine of your YFZ 450R.

OPTIONAL VORTEX PROGRAMMING SOFTWARE: The 10 preprogrammed ignition/fuel maps installed in your X10 ECU are designed to cover the vast majority of riding/engine mod applications.
For engines with special needs; extremely hi-compression, turbo charging,
Vortex offers programming software for engine tuners that require special ignition and fuel settings different from Vortex's Factory Installed programs. This software should only be used by technicians skilled and trained in programming Electronic Fuel Injection
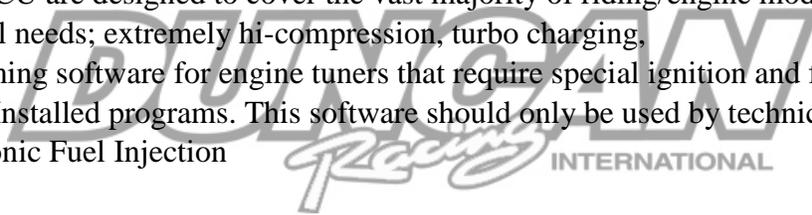
TROUBLE SHOOTING: Vortex as do most OEM's have a built in Flash Code System to alert you of any issues with the system. The Vortex Instructions include a Chart with some of the most common problems that can occur with your EFI system. The ECU will relay these problems to you by Flash various times on the OEM Dash. *See Vortex Chart for more information*.
NOTE: It is highly recommended to retain the stock Yamaha YFZ 450R dash-without it access to important information can be lost.

TUNING TIPS: When attempting to tune any motorcycle/atv it is imperative that the engine and its associated components are in proper working order. If anything is off with the engine you could work for hours and get know where but frustrated.
Tuning and engine requires a common sense approach- It is not some mysterious process. When logical adjustments to the tuning of an engine are made- logical results will be had. When this is not the case- Usually something is wrong.
Before attempting to tune your engine it would be wise to make sure the following systems/components are in proper working order;

-All EFI sensors are working properly- No codes are flashing

-Valve clearance is with-in proper specification- tight/lose valves will hamper engine function

-Cam Timing- Whenever checking valve clearance- confirm cam timing is set correctly.

-Engine Leak; It is always a good idea to do a Leak Down test on your engine to establish a solid baseline for tuning the engine.

-Fuel; If you want your machine to run properly- Use quality fuel. Good Quality name brand Race Gas is hard to beat. Steer away from any fuel using Ethynol

-Air Cleaner: It can be a big waste of time, attempting to tune a machine with a dirty or improperly maintained air cleaner

-Muffler Packing; Proper exhaust muffler packing is necessary to get maximum performance from your machine. Worn or blow out packing will cause inconsistencies in performance. An over packed muffler can suppress performance substantially.