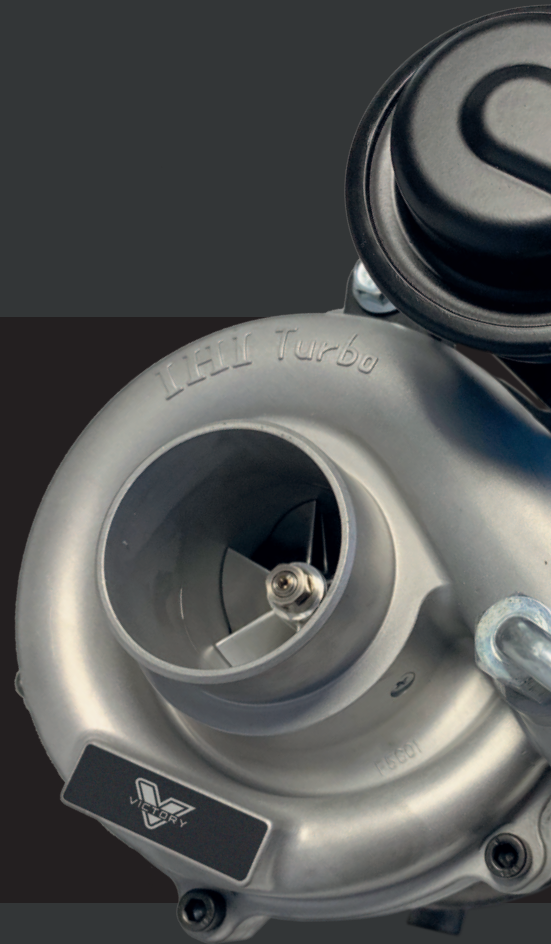


THE STORY BEHIND HORSEPOWER

THE PHYSICS, THE CRAFT AND THE NUMBERS



Map Tun[®]
performance

THE PHYSICS

HOW HORSEPOWER IS ACHIEVED

There are a lot of ways to modify a stock engine to achieve higher performance. By modifying the engine you can increase the displacement, change valve timing, compression ratio etc. All these things involve removing the engine and taking it apart, a complicated and often too costly venture for the average customer.

The majority of customers instead look for modifications outside and around the engine. This boils down to five key factors:

- Pressure or "boost" (applies to supercharged engines only)
- Fuel supply
- Ignition timing
- Air flow and temperature
- Exhaust flow and temperature

The capacity of each factor is different for each different vehicle and engine but all factors affect each other. Reprogramming the Engine Control Unit (ECU) to increase the pressure from the turbocharger will, for example, result in higher air intake temperatures. This reduces engine efficiency and increases the risk of engine knock if done incorrectly or without necessary hardware changes. This increase in pressure is carried over to the exhaust side as well. An increase in exhaust volume may increase exhaust backpressure, reducing power and generating unnecessary heat that shortens components life span. This is what's commonly referred to as a bottleneck, the one factor that is currently limiting higher power output.

The way these factors interact with each other also means that you can't expect a noticeable increase in power from altering just one of them. The engine will not benefit from a high flow exhaust system if other parameters are not changed to take advantage of it.

In a modern engine the air pressure, fuel and ignition are all controlled by the ECU. Just reprogramming the ECU will likely result in an increase in power even for an otherwise stock engine. Adding upgraded hardware such as a sport exhaust system, cold air intake and fuel injectors - removing bottlenecks - may allow the ECU to increase the power even further.

There is no silver bullet. You cannot reprogram the ECU to circumvent a limiting factor if the maximum capacity of the hardware has been reached. Not without damaging the engine, that is.





THE CRAFT

HOW WE WORK TO ACHIEVE THE BEST PERFORMANCE

Before we begin tuning a vehicle we get familiar with the vehicle and the engine construction, and perform thorough tests on the stock configuration in our dyno. Already at this stage we install a variety of sensors to accurately measure pressures, temperatures, fuel, flow and power.

After these tests we analyze the numbers and identify components or other factors that may be limiting for higher power output. These are the previously mentioned bottlenecks.

With full access to the ECU and all its different maps we can begin localizing the necessary parameters that will need to be adjusted. By adjusting in small increments and performing lots and lots of test runs in the dyno, we can closely monitor the process and record how the engine responds to the changes. For each combination of rpm and load, there are numerous parameters that will need to be individually adjusted for each specific tune. We stress test the engine by running it hard over extended periods of time, at both full and partial load, to make sure temperatures and other parameters don't reach harmful levels over time. No one wants a ticking time bomb!

Once we have achieved the power figures we desire, field testing begins. Driving the vehicles in the same environments as our customers is crucial to getting the best possible driveability. All the sensors are still installed on the vehicle and we get copious amounts of data for review. Thanks to the MaptunerX, we can also test, adjust and refine the tune on location during field testing.

After field testing the software we hand it over to our ambassadors and racers. This is the key to test the tunes in real-world situations and with many different driving/riding styles. Using the MaptunerX Data Logger we get feedback and even more data to analyze. We can then adjust the tune individually and let different drivers try out different tunes to see what works best. Driveability and a wide power band means more usable power, and to us that is more important than peak power - This is a noticeable performance advantage when driving a Maptun tuned vehicle.

If we release a new tuning stage or make adjustments to an existing one, the customer gets all of these updates for free. The updates are easily downloaded to the MaptunerX using PC and the MyMaptuner software. The MaptunerX is capable of storing thousands of different vehicles at the same time, making sure that you can use it for your current as well as future vehicles for many years to come.

Maintaining margins and reliability is very important to us. Using the MaptunerX and getting access to the entire ECU makes it possible to increase performance while still maintaining all the built-in safety features of the ECU. We like to call it; performance under control.

THE NUMBERS

HOW HORSEPOWER IS MEASURED AND PRESENTED

We always measure power on the crankshaft or wheel hubs of the vehicle for the most accurate and repeatable results. We don't use estimated power figures or "rolling road" type dynos for our testing. Our facility has a dedicated testing room with our dyno setups, including fan system producing 26,000 liters of air every second, and other cooling systems for different vehicle and engine types. We always try to mimic the conditions of the vehicle - for example keeping it cool for snowmobiles.

The most important thing when measuring power and torque is to maintain the same environment and conditions consistently to detect changes and get trustworthy results. The ambient air pressure and temperature, naturally, can't be controlled but will nevertheless affect the power the engine can produce under the given conditions. As these conditions are varying they need to be compensated for in the computer processing the dyno data. This is called a compensation factor. To get this data correct the air temperature, humidity and pressure needs to be measured using a weather station.

However, this weather data can also be manually fed into the computer. Feeding the computer incorrect weather data, deliberately or by accident, alters the power and torque figures presented.

You can have the most accurate dyno in the world, but if the compensation factor is set manually and incorrectly, you will receive false power and torque figures. Depending on the environment, these false figures may be a couple of percent to sometimes close to double the real figures.

