

# Understanding HP & TQ Measurements

Sometimes Gtech users are surprised or confused when the results of a HP/TQ measurement seem to be off.

This document is intended to help explain where some of the misunderstandings come from, and also to help identify places where problems creep in when measuring HP & TQ.

If you are getting very consistent results, but not the results you expected, this is usually easy to address & resolve.

If you are getting wildly-varying results, some troubleshooting is in order.

A word of note: when we talk about HP & TQ, we are referring to the graph & results under the "HP & TQ vs RPM" section after you do a run. We are not referring to HP vs time, nor are we referring to HP readings from PASS on the PC.

One other note: we always recommend that you use the latest/newest firmware available. The latest firmware will always be the most accurate firmware we have. So if you are not using the latest firmware that is available on our website, please upgrade your unit and repeat your horsepower runs -- you may get much better results.

## **Consistent, but unexpected, results**

If your results are consistent, it usually indicates the following good things:

- Accelerometers are providing consistent acceleration information
- Driving style is repeatable and not a factor
- Road & environmental conditions are not a factor
- RPMs are probably working well on your vehicle (necessary for torque, i.e. if your RPMs weren't working properly, your torque values would be off)
- 1/4 mile results are probably working well on your vehicle

If the 1/4 mile results are **not** close to what you'd expect, the problem may be one of the following:

- **Accelerometer calibration:** make sure (via the XYZ Gs screen) that your accelerometers are well-calibrated
- **Road surface:** make sure that the road surface is smooth and flat. A dragstrip is a perfect example.

## Understanding HP & TQ Measurements

- **Vehicle pitch / wheelspin / wheelhop / etc:** The Gtech cannot make accurate measurements if the vehicle is incapable of accelerating smoothly down a straight line
- **Mounting:** Make sure your Gtech is mounted very rigidly so that it doesn't flop/bounce around. Make sure everything is tight and that nothing in the mounting system is cracked or damaged.

If the 1/4 mile results are good, but the HP/TQ readings are off, usually the issue is one of the following:

- There is a specific recommended driving style to get the best results. This driving style is different than the style you would use when doing a fast 1/4 mile. There is a tech note about doing HP runs with the Gtech on the Tesla web site which explains how you should accelerate & shift.
- RPMs -- are your RPMs "clean", i.e. if you view RPMs vs time, do the RPMs have a "sawtooth" effect with an obvious & smooth RPM climb in the gear you chose for measuring HP. If not, the Gtech could get confused as it scans for a good clean consistent RPM range to use for the HP & TQ measurement. **Good clean working RPMs are necessary for viewing HP & TQ measurements as of firmware version 3.0.**
- Remember that the Gtech measures net horsepower, and the net horsepower will be lower than published (crank) numbers and lower than almost any chassis dyno (which measure at the wheel) due to rolling resistance, aero drag, etc. There is an example at the end of this document which explains how engine (crank) horsepower is lost through different parts of the vehicle.
- A vehicle weight that is incorrect will affect your measurement (a low weight will lower the measured HP, and vice versa). Double check and make sure your vehicle weight is entered properly, including driver & passengers, fuel, etc....
- When doing HP & TQ measurements, you should always do a half-dozen runs and throw out the lowest & highest runs, and then average the results of the remaining runs.
- A HP run in 2nd gear will read higher than a HP run in 3rd gear due to the fact that the effects of aero drag (negative HP) is more significant in 3rd gear. So always do all your HP runs in the same gear, and use 2nd gear when possible. Some very powerful cars might need to do their HP runs in 3rd gear if they experience a lot of wheel slip in 2nd gear.

## Understanding HP & TQ Measurements

- Try to spend at least 2-3 seconds in the gear where you choose to measure RPMs. Most vehicles will need at least this much time to cover the full range of RPMs in 2nd gear, and even more so in 3rd gear. If you spend very little time in a gear, the Gtech may not consider that to be a valid range for a HP measurement.
- Lastly, you can always download the data from the Gtech into PASS, and then export the data (File->Export Main Run), and graph/view it in a program like Excel. If you plot HP vs Time, be sure to visually filter out any "spikes" in HP that are due to shifts or bumps.

**Here is an example with some numbers, i.e. suppose the manufacturer of a rear-wheel drive vehicle lists it as 320 HP.**

This is just an example. Bear in mind that these figures vary between vehicles and even within a family of vehicles... they are just provided for the sake of this example.

- First of all, there is a variance as to the horsepower ratings within a set of engines from the factory. Your engine may have been delivered at **310 HP** instead of **320 HP**
- This **310 HP** figure would be as measured in a lab, out of the vehicle, with no major accessories attached, and perhaps a very low impedance exhaust (if any exhaust at all.) You can lose about 10% with the engine actually in the car:  $310 * 0.90 = \mathbf{295\ HP}$  left over
- The gearbox may sap a few percent:  $295 * 0.98 = \mathbf{288\ HP}$  left over
- The driveshaft may sap a few percent:  $288 * 0.98 = \mathbf{282\ HP}$  left over
- The differential may sap 4 percent:  $282 * 0.96 = \mathbf{271\ HP}$  left over (this would be higher in an AWD vehicle)
- At 65 mph or more, we may lose another 30 or 40 HP to rolling resistance and aerodynamic drag, which drops us into the **230 HP** territory

This 230 HP value is the net HP which is left to accelerate the vehicle after all losses have been accounted for.