

Understanding Your Gtech Results

We are often contacted by Gtech owners who expect one set of results, but get another.

For example:

- "Is my Gtech damaged?"
- "Am I doing something wrong?"
- "Why doesn't the Gtech's 0-60 MPH or 1/4 mile time match the published stats for my vehicle?"
- "Why are the results on my track timeslip different than the Gtech?"
- "Why does the Gtech measure such a low horsepower for my vehicle?"
- "Why aren't all of my times close to one another?"
- "I think my Gtech isn't working properly. Can I send it back to Tesla for inspection?"

This document is intended to help you obtain more consistent and repeatable results with your Gtech Pro Competition performance meter.

Since we cannot fly out and supervise every acceleration run performed by every user, the best we can do is to reinforce proper usage of the Gtech, as well as point out things to check / look out for as you use the product.

An undamaged Gtech used properly under the same conditions will yield very consistent results.

In an extremely small percentage of situations, there may be something wrong with the Gtech unit. Almost always, however, the discrepancy is due to another factor.

In testing under controlled laboratory conditions, the Gtech Pro Competition's accuracy/repeatability running firmware version 3.0 has been measured at better than 0.01 seconds for a "1g" run. Ideal conditions include:

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- the vehicle experiences an instantaneous surge of 1g acceleration, i.e. on a plot of acceleration vs. time, the measured acceleration instantaneously goes from 0.000g to 1.000g
- the road is perfectly flat (level) and smooth, i.e. no bumps/potholes, and absolutely no uphill/downhill
- the accelerometers are perfectly calibrated across a wide temperature range
- the Gtech's orientation does not change relative to the direction of acceleration throughout the run (no pitching, crabbing, etc....)
- the Gtech is "hard mounted", thereby eliminating any possibility of improper mounting of the Gtech in the articulating mounting system
- there are no environmental variables such as wind, humidity, temperature, etc.

The extent to which any of these factors are NOT true will impact your results. There are other factors too, but these are some of the primary sources of problems.

Many of these aspects are technical and detailed. Our wish is to keep you insulated from these details by providing you with a fun and accurate product that measures your vehicle's performance using principles of physics and math, without requiring you to understand them. However, if you really want to understand why your Gtech may not always match up with your expectations, you will need to understand some of these details.

Quantifying the effects of any of these factors without a vast amount of technical data and scientific research is impossible. In other words, we simply cannot answer questions such as:

- "If I upgrade to a stiffer suspension on my vehicle, how much better will my results be?"
- "How much is my mounting system contributing to the offset in my results?"
- "How much will my results be affected if the road isn't perfectly flat?"

As with any piece of measuring equipment, the quality of the results you will get with the Gtech is largely dependent on the time and effort that are put into setting it up and using it properly.

Performance measuring equipment costing 10 or even 100 times as much requires a lot of set up and testing time. That is a reality of precision

measuring equipment. It would be nice if the Gtech cost less AND required less set up time and attention... but that isn't the reality!

Some factors are more under the control of the user than others. Influencing factors are discussed below, along with some ideas and notes.

Firmware version

The latest available firmware version will always be our most accurate and consistent Gtech firmware. Anyone running firmware that is older than the latest firmware on the website should upgrade their Gtech by downloading the new firmware from our website & installing it.

Acceleration Profile

No vehicle experiences acceleration that instantaneously goes from 0.000g to something like 1.000g in under a millisecond. When launching from the starting line, acceleration gradually ramps up from 0.000g to a value usually over 0.5g (even more for a high-powered vehicle that is not traction-limited.) Since the Gtech's race clock is triggered by sustained acceleration above a certain threshold for a certain amount of time, the more quickly and suddenly the vehicle accelerates, the less time the vehicle spends moving without the clock running.

Road Surface

The extent to which the road surface is not flat affects your measurements. Even roads which *appear* to be flat may not be. If the road is not perfectly flat, acceleration due to earth's gravity will impact the measured vehicle acceleration. Also, even small bumps and potholes/dips can have a surprising effect on your results.

Accelerometer Calibration

The Gtech Pro Competition has 3 high-precision sensors called accelerometers. These sensors need to be calibrated in order to make their readings meaningful. The quality of the accelerometers' calibration affects the results. In turn, the quality of the calibration depends on:

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- how steady the unit was during the calibration procedure (steady is good)
- how quickly the calibration procedure is performed (quick is good)
- how far apart the 2 temperatures are for the 2 calibration points (far apart is good)

Units shipped before August 2003 required the user to perform 2 calibrations, one at a cooler temperature and one at a warmer temperature. The reality is that the same Gtech hardware will perform better for a user who performed a very quick calibration with a steady hand at 2 very different temperatures, than for a user who is not very steady and who took longer to complete the calibration procedure.

Accelerometer Orientation

The fastest drag vehicles don't "crab" (sideways acceleration) and pitch / bounce as they go down the track. They go in a very straight, flat line very quickly. The extent to which your vehicle doesn't match this will negatively impact your results.

A car that "stands" at launch, or pitches & dives during shifts, etc. will perturb the accelerometers orientation. If the front end of your car veers left or right at all during the run, or worse, goes up (pitch) or down (dive), the accelerometers are being deprived of the opportunity to measure true straight-line acceleration. Pitch / dive of only 1 or 2 degrees can impact the results in a measurable way. (Check out how small 1 degree is on a protractor - it isn't very much!)

Rollout

The extent to which you can set the rollout distance in the Gtech to match the rollout distance on the track will help. However, this is an impractical and almost impossible task. Unless you stage the same way every time on the track to within a fraction of an inch, most likely with the help of spotters on either side of your vehicle, this will certainly affect your numbers.

Our website has a tech note that explains just how much of an impact the first 12 inches or so of a race affects your results. It is very significant, and surprising to many, how much time is spent moving the first few inches from a stop.

The effects of rollout mean that it is a pointless exercise to compare track timeslips to the Gtech results -- the track and the Gtech start timing at

different points in a race (the Gtech being acceleration-triggered, the track being beam-triggered.)

For example, if your vehicle is 3 inches from the start beam on a track, but your Gtech rollout is set to 12 inches, the track will start timing when you have moved 3 inches, but the Gtech won't start timing until you have moved 12 inches. ***This can amount to several tenths of a second!***

Mounting

If the Gtech is not rigidly mounted, results will be erratic and inaccurate. The 2 most common sources of problems pertaining to the mounting system are:

- improper assembly and use of the mounting system. The 3.1 User's Guide has detailed instructions on proper use of the mounting system. Also our website has a tech note on the mounting system (it is a subset of the pages from the manual.)
- damaged components in the mounting system, usually either a deformed rubber ball on the small end of the mounting clip, or a crack at the narrow end of the conical "A frame" piece. The A-frame may crack if the large tensioning nut is overtightened. If your A-frame is cracked, it may not be visible to the naked eye unless you try to gently separate the 2 legs (they should not separate, it is molded as one piece.) If the mounting system is damaged, the Gtech will "bob around" as your vehicle is moving and measure inaccurately (imaging trying to draw a straight line on a pad of paper while someone is moving it.) The Gtech's sensors are incredibly sensitive and pick up vibrations that are due to a loose mounting clip.

Environment

Environmental conditions like wind, humidity, etc. can affect your results. If you did a set of runs on a very cold, still day, and then compare them to runs you did on a warm, windy day, the times will not be similar. This isn't the Gtech's fault -- the car will move more slowly on a warm day into a head wind.

In fact, even runs on the same day can be affected by your vehicle warming up, changing winds, etc. so there are a LOT of variables involved.

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Regarding published times & stats

One of the first things a new Gtech owner usually wants to do is use the Gtech and verify that his/her vehicle really does do 0-60MPH, in say, 5.5 seconds as published. Or that it really runs the quarter mile in 13.9 seconds, or that it really has 255 HP.

Unfortunately this user is headed for disappointment due to unrealistic expectations. Driving style, test conditions, track conditions, measurement conditions, vehicle variances, etc. can account for large variability in measurements. Add to that the fact even amongst publications, there is a range of performance numbers for any given vehicle.

Also, for 0-60 MPH measurements (as late as firmware 3.0), the Gtech starts timing as soon as the vehicle starts moving... most publications use equipment that starts timing after the first 12 inches of movement, which can take several tenths of a second. Thus, you will usually see faster 0-60 MPH times in publications as compared to the Gtech.

Another point to keep in mind is that the Gtech measures net horsepower instead of crank horsepower, and these are VERY different values (see the technote on the Gtech & horsepower runs). So comparing the Gtech's measured HP to a publication doesn't make sense.

Thus you will see that trying to match the Gtech results to the published results for the vehicle just doesn't make sense.

Summary

In summary, the GTech Pro Competition has high-precision accelerometers that measure acceleration very accurately. Through the magic of physics and math, the Gtech uses this information to calculate vehicle performance.

Since the results are only as good as the acceleration measurements, you can see how important it is to use the Gtech in the prescribed manner (good mounting, good calibration, flat, level road, no vehicle pitch, etc....) The extent to which this advice is heeded will have a huge impact on the quality of your results.

If your results are very repeatable with the Gtech but not what you expect, you are probably in one of the situations described above where an "apples to oranges" comparison is causing the trouble:

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- comparing 2 different kinds of horsepower measurements (e.g. net HP vs. crank HP)
- comparing the Gtech to a track timeslip or a publication which use different measurements
- comparing your results to a friend's, with a different driving style, vehicle setup, Gtech configuration, etc.

The most important thing is that you get very repeatable results with the Gtech that you can trust. This way, when you make a modification to your vehicle and measure a repeatable improvement, you'll know the difference is real.

And if your results aren't repeatable, chances are very high the answer is in this document.