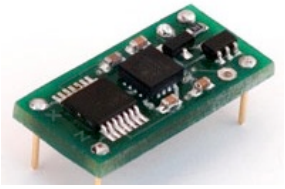
# How to use the G-force Sensor in the SD4, SD8 & FHD4 DVRs

The G-force sensor is built into our Driver Safety Mobile DVRs.
The 3-axis of the sensor measure and document the inertia of the forces applied to the DVR from driving, impacts bumps and crashes.
The data range of the G-force sensor deflections is from -2G to +2G. This is primarily designed to document dangerous driving behaviors, as well as trigger Events from possible impacts or crashes that may go unreported.

In order to setup and operate the G-Force data, the user is required to access the menu in the DVR via an analog LCD display.

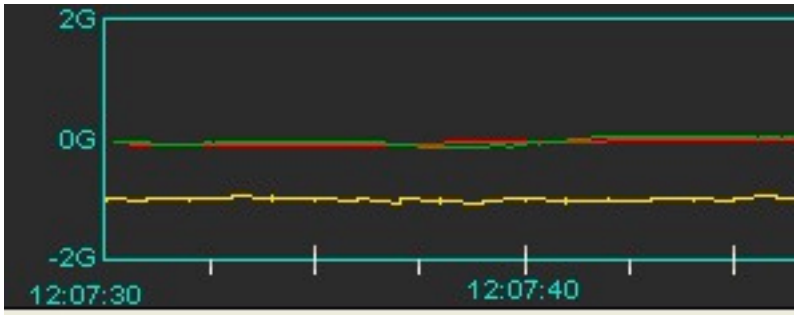
## What is an Accelerometer?

An accelerometer is an electromechanical device that will measure acceleration & gravity forces. These forces may be static, like the constant force of gravity, or they could be dynamic - caused by moving the accelerometer. By measuring the amount of dynamic acceleration, you can analyze the way the device is moving, as well as inertia experienced in 3 different axes.



## Accelerometer Charting for "X", "Y" & "Z"

Accelerometers for vehicles are typically set-up with 3 different inertia measurements:
"X" for acceleration & deceleration inertia fluctuations (Forward & Reverse)
"Y" for lateral inertia fluctuations, (Left & Right)
"Z" for gravity inertia fluctuations (Up & Down)
The orientation of the DVR will dictate which axis is which, with the preferred mounting configuration being the DVR in a horizontal position with one of the sides facing forward and one rear, or an alternate configuration would be face of DVR facing rear of vehicle and rear of DVR facing front of vehicle.




*When then vehicle is static or "at rest" the lines will be nearly horizontal or charted in a straight line, with no deflection or charted deviation. Note the Z-axis charting is not at "0" as the vehicle is subject to gravity so there is a built in baseline at "1G" as long as the vehicle remains on planet Earth, caused by the forces of Earths gravity thus a permanent deflection baseline.*

## Understanding G-Sensor Charting

Wide chart deflections can indicate dangerous driving behaviors that may indicate a need for additional

fleet driver risk management oversight by supervisors or in some cases management intervention in order to prevent those recorded and identified as dangerous driving behaviors from creating a potential threat to life and limb, risk of capital investment in assets or liability lawsuits.
Distracted fleet drivers, for example, often display hard braking as they are often not paying attention to the vehicle in front of them until they are about to hit it, hence the cause for the hard braking.

## Basic Charting terminology:

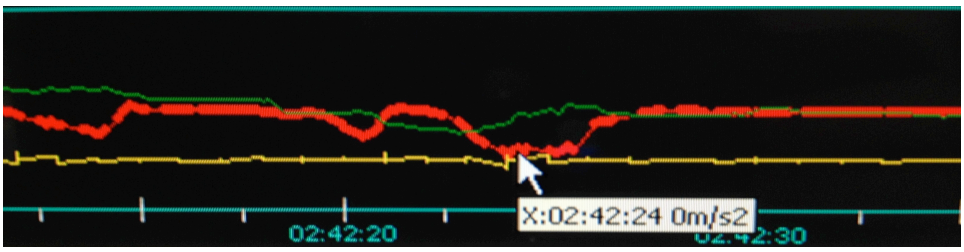
G- is a unit of acceleration equal to Earth's gravity at sea level
X- axis is the acceleration forces on vehicle (Forward & Backward depending on mount orientation)
Y- axis is the lateral forces upon the vehicle (Left & Right depending on mount orientation)
Z- axis is the force of Gravity upon the vehicle (Up & Down depending on mount orientation)
Deflections- are the variance or deviation from a straight line as displayed on the chart
Baseline- is the axis chart line when the vehicle is at rest, displayed as a straight line on the chart
Spike- is the maximum chart deflection possible on the 2 "G" deflection chart
Acceleration- is the slope of velocity versus time on a linear chart
Inertia- is the resistance of any physical object to a change in its state of motion

## Fleet Driver Safety & Fleet Driver Risk Management

G-Sensor charting with wide deflections (increases or decreases in inertia) may indicate dangerous driving behaviors, and a pattern of these behaviors if left unchecked, greatly increases the risk of vehicle related fatalities, accidents and liability.
Fleet driver risk management is enhanced when clear indications of dangerous driving behaviors can be identified prior to the accident scene reconstruction when it is already too late.

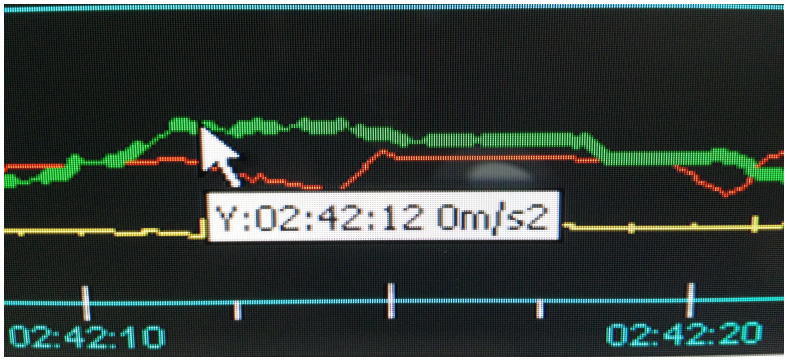
Fleet Driver Risk Management as well as Driver Safety Training of specialty vehicles like buses, trucks, concrete transports, fuel trucks addressees the fact many not them are top heavy, lateral inertia of even .6G can be dangerous, and incidents of this may be cause for concern and immediate attention to prevent loss of control, or possible rollover beyond the .6G threshold. Safe Driver Training Systems like our mobile DVRs can alert the drivers of their potentially dangerous vehicle operations w/o any need for supervisor or management review of discussion. Active alerts when they exceed safety thresholds of vehicle operation can immediately let a distracted driver know they are not in control of their vehicle before any review is performed on any documented events.

In general under normal operating conditions, driving G-sensor charting should be represented by 3 different color charted lines near level or straight, with gradual slight deflections as the vehicle is accelerated, navigates turns and slowly applies the brakes. Any large potholes or speed bumps should be encountered at lower speeds so as to not adversely affect the vehicle or provide extreme forces that might cause the driver to lose control. When charting axis deflections are far from straight lines it is an indication that something is wrong, and driving behaviors or other influence may have caused a potentially dangerous operation of the vehicle during normal driving navigation.



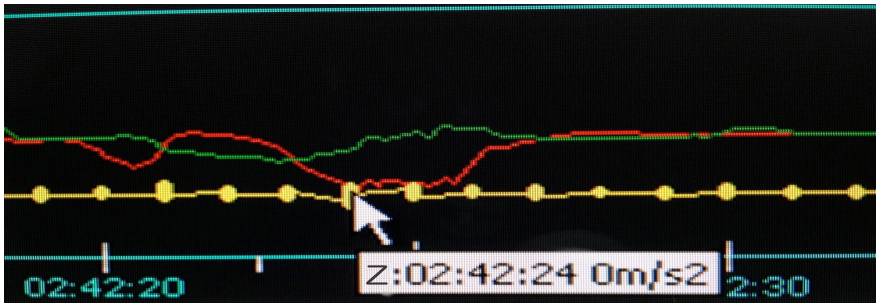

*"X" axis chart deflections can indicate rapid acceleration and hard braking*

*Hard Braking is an indication that the driver may be distracted and possible "Texting While Driving" as their attention is diverted from their primary function of safe vehicle navigation. Tailgating can be an indication of aggressive driving behaviors where a driver intentionally follows too closely increasing the chance of inability to stop should the followed vehicle suddenly hit the brakes. Racing & Rapid Accelerations may indicate aggressive driving behaviors as well as employees with anger issues intent on taking it out on the company vehicles. Impact to Vehicle, Object or Crash*




*"Y" axis chart deflections can indicate high-speed hard turns, erratic lane changes and failure to maintain lane that cause vehicles to lean hard to their sides. High Speed Turns can cause vehicles with a high center of gravity to flip or roll over endangering driver /passenger lives and damaging property.*

*Distracted Driving & Texting While Driving can cause frequent erratic lane changes as well as hard braking when they realize they are about to run into the vehicle in front of them. "Texting while driving" lawsuit settlements have been as high as $49,000,000, so it is imperative drivers activities are documented and if caught "texting while driving" they are penalized to insure this dangerous driving behavior is not permitted to cause loss of life, damage to property or expose the company to liability lawsuits. Erratic Lane Changes or Inability to Maintain Lane may be indications of driver fatigue, where they are having problems staying awake and focused.*




*"Z" axis deflections can indicate sudden changes in up or down inertia, that can be caused by hitting large potholes, running over curbs or running over speed bumps at a high rate of speed. Anything that will cause the vehicle to drop down or bounce up will be reflected on the "Z" axis charting. Common problems include; school bus drivers who do not slow down for the speed bumps at schools and hit them at unsafe speeds, tractor trailer drivers who routinely run over curbs and storm drains causing damage to trailer tires as well as often crushing storm drains and property involved.*

## Calibration of the 3-Axis Accelerometer

Every vehicle type and configuration will require different G-sensor settings for “X, Y & Z” axis. Even the exact same vehicle with a different application or loading may be different as the weight, height of center of gravity may shift between the exact same vehicles that are loaded for different applications or carrying different equipment in them.

For liability reasons, companies do not provide a recommended threshold setting to use as if used and a driver has an accident that setting may come under scrutiny and could end up exposing the device provider unnecessary exposure to liability risk as well as the user.

There is no set chart, nor specific setting we can recommend for your vehicle as each vehicle will have subtle difference, but in general we can describe how we arrive at the “X, Y & Z” axis threshold settings to establish a workable baseline we use in those vehicles we install the systems in, in case others would like to follow the methodology we incorporate.

Please Note; The orientation of the DVR will dictate which axis is which, with the preferred mounting configuration being the DVR in a horizontal position with one of the sides facing forward and one rear, or an alternate configuration would be face of DVR facing rear of vehicle and rear of DVR facing front of vehicle.

**Step 1-**

We ask the fleet director or manager to recommend to us the most experienced driver with the best safety record they have for a particular vehicle type. Using the standard default settings of the “X, Y & Z” axis as they come from the factory. We then setup a sample trip to create a baseline asking the driver to drive the trip in a manor that would be typical and within safety guidelines for that vehicle.

**Step 2-**

When the driver has completed the trip, we ask if there were any atypical or unusual events that may have affected the driving of the vehicle, so we cam consider or disqualify those incidents from establishing a baseline norm. We the review the G-sensor logs and “X, Y & Z” axis charting for the trip, paying special attention to the maximum deflections of the “X, Y & Z” axis on the chart.

When we have actual indications of maximum deflection so the “X, Y & Z” axis, we then ask the director or manager what percentage of the baseline peak charted deflection, of additional inertia or G-Force do they want built into the settings. The device will create a Alarm each time the G threshold is exceeded, so if the setting is too low the result will be a plethora of Alarms for often insignificant reasons.

For example if they have a maximum charting deflection of X axis for forward and reverse inertia of “0.5” and the director or manager tells us to built in 10% additional inertia, we will set the X threshold at “0.55”

**Step 3-**

Set the “X, Y & Z” axis thresholds along with the Audio Alert for the driver awareness if this is a separate function and the vehicle is ready to test.

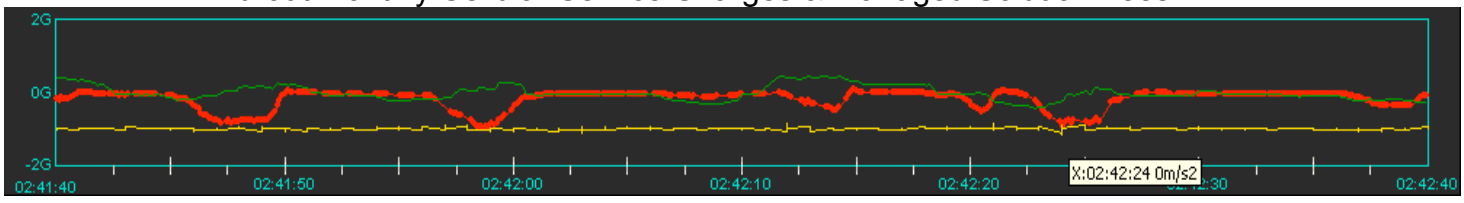
Using the same driver have them drive the same route to see if the unit triggers too low or is too sensitive, causing annoying beeps and driver alerts. If the settings are too low you can slightly increase them and record what settings they were set at in order tot provide this documentation to the director or manager of the fleets so they will have this information if they ever need to edit or duplicate it.

After the test if the audio alerts were NOT triggered, just to insure they are functional, in a safe location we ask the driver to have the vehicle move about 15 MPH and brake hard to cause a higher than normal X inertia deflection that should trigger the audio driver warning.

**G-Force chart deflections can indicate some of the following Dangerous Driving Behaviors:**
Erratic Lane Changes may indicate Distracted Drivers with cell phones, drinks, or other distractions
Hard Braking “X” force, often demonstrates Sleepy or fatigued drivers who may cause accidents
Rapid Acceleration “X” force, may indicate Aggressive Driving and wasted fuel
Hard Turns “Y” force, indicates turns at high speed or sharp angle potentially rolling a vehicle over
Hard “Z” force indicates large potholes, high curbs or running over speed bumps at a high speed


# Stop Dangerous Driving Behavior Now

Without Monthly Cellular Service Charges & Managed Solution Fees

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