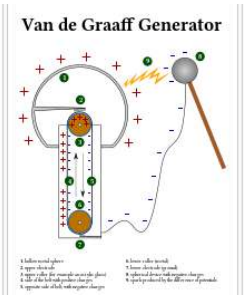
Focus Applied Technologies

Technical Information

Electro-Static Charge Control on Chassis Dynamometers

ELECTROSTATIC CHARGING OF CHASSIS DYNAMOMETERS



You may recall seeing a “Van De Graaff” generator as a child. This is a high-voltage producing device usually consisting of a rubber belt spinning over rollers, with perhaps an arm rubbing it to pick up the charge. It can develop thousands of volts, but very low current, and is used in demonstrations of electrostatics, such as having one’s hair “stand on end”, as each strand is repelled from the others by the high, common charge.

When running a vehicle on a chassis dynamometer (as shown at right), the shearing of the rubber compound in the tires can create a similarly high voltage on the vehicles chassis. As the chassis dynamometer is instrumented with various sensors, this high voltage can cause a problem with the electronics. If either the dynamometer controller, or a connected computer (or other piece of equipment) receives an electro static voltage, it may cause unwanted signals, or even “seize up” communications, and potentially damage sensitive equipment.

While generally the dynamometer controller continues to function normally, the controller to computer link may be subject to intermittent data “holdups”. While the controller sends out data at a constant rate, if the communications lines to the computer have a high charge on them, the data will not “get through” until the voltage drops back down. This can result in several data points (which were spaced out in time) arriving at the computer nearly simultaneously.

There are a few basic ways of preventing this problem, including elimination at the source, and remediation between the chassis dynamometer, controller and computer.

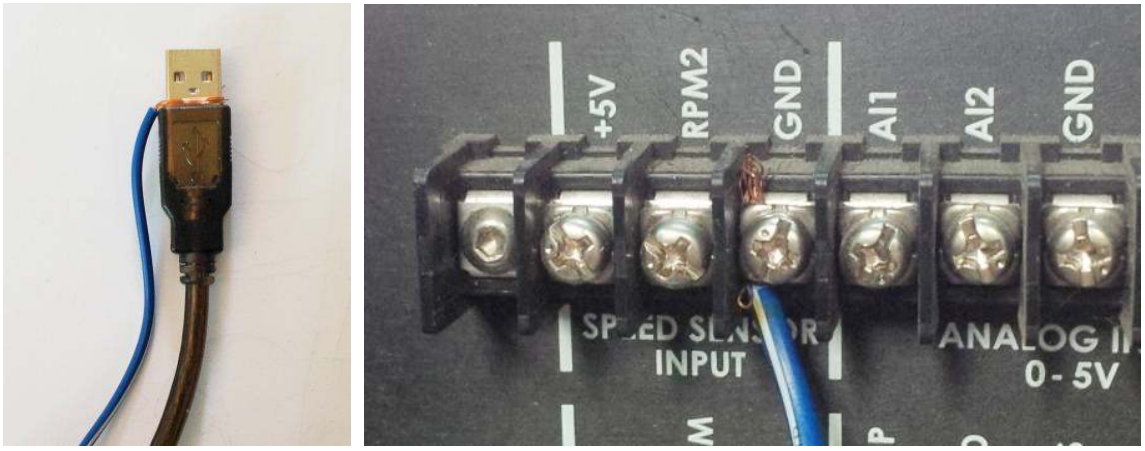
ELIMINATION AT SOURCE

The simplest way to avoid chassis dyno electro static voltage buildup is to apply a grounding strap between the frame of the vehicle (the chassis) and the frame of the dynamometer. As the vehicle is mounted on tires which are electrically insulating, any charge developed on the tires can charge up the body of the vehicle with respect to the frame. A driver in the vehicle will similarly become charged, as does anything they touch (eg. a computer, part of a dynamometer controller or remote control). Common practice is to include a grounding strap between the dynamometer frame and the body of the vehicle. Obviously you will want to clamp on to a conductive part of the frame which is directly connected to the vehicles “ground”.

This chassis grounding strap will dissipate the charge from the body of the vehicle before it becomes a problem, thereby protecting all associated equipment. You will notice this is also standard practice with refueling vehicles (for example at airports, and fuel stations when the tanker trucks come to refill the underground fuel storage tanks).

REMEDIATION OF ELECTROSTATIC CHARGE

Another way to reduce the effects of Electrostatic Charge on instrumentation systems is to eliminate potential voltage differences between the various components. While most equipment will be grounded to a good earth ground sometimes either the earth ground is not properly connected, or other times, a component, such as a lap top computer, may not be connected to ground. In cases like this USB-Serial communications are especially subject to disturbances. You might think that because a USB-Serial communications cable appears to have metal shielding in it (often the outer insulator is semi-transparent, and you can see the metal fibers of a shielding line wrapping the wire bundle) it connects the USB ground to the RS-232 ground on the other end, but you'd be wrong. A quick check with a volt meter shows that the two "shield ground" ends of the cable are actually "isolated" (ie. not connected). In this case any stray voltage effecting one end of the system (eg. the lap top becoming charged by touching the operator of a vehicle on a chassis dynamometer) will strain or dissipate via the ***internal*** wiring of the connection. Obviously this will be a problem for the information trying to make it through the cable! One common "remedy" is to ground the shield ground of the USB end to the opposite end (ie. the dynamometer controller). This can be done by placing a grounding wire looped around the USB shield end, and connect the other end of the grounding wire to a ground (labeled GND) on the controller as shown below.



This grounding strap then dissipates any relative voltage between the two devices.

An alternative, but equivalent, way to do this is to connect each item in the system to a common earth ground. This is generally already done with the dynamometer controllers and dyno frames as well as most desk-top computers. This is, however, subject to the buildings wiring, and in some countries the grounding can be poor or even non-existent, and some components, like lap top computers, may not be connected to ground at all. In these cases it is best to inter-connect all components frames to a good earth ground.

REFERENCES:

Wikipedia Van De Graaff Generator