



TIME-BASED vs PROPORTIONAL BRAKE CONTROLS

Over the years there have been several approaches to applying the brakes of trailers. This mostly shows that there is no absolute method, but rather, a mix of options that all have their pros and cons.

There are two styles of Brake Controls generally available on the market – Time-Based and Proportional. Proportional can also be sub-divided into those using pendulum or accelerometer technology, but both Proportional controllers function in the same conceptual manner.

In fact, both the Time-Based and the Proportional brake controllers have proponents and detractors. Those favoring the Time-Based units point to simplicity and trailer braking that leads the vehicle braking, as the reason to use such units. Proportional controller proponents cite proportional braking between the trailer and vehicle brakes as the strength of these units.

The detractors of Time-Based controllers say that they respond too slowly in panic stops, and they need to be adjusted to match speed conditions. Proportional detractors point to the lagging nature of the Proportional controller and to the difficulty the operator has in getting them correctly adjusted.

And as with most discussions, there is a mixture of fact and fiction in these assumptions.

First, there is no question that the Time-Based controller provides leading trailer braking while the Proportional provides lagging trailer braking.

In more detail, the Time-Based control starts applying the trailer brakes as soon as the vehicle brake pedal is slightly depressed. It is not uncommon, in light braking situations, to apply only the trailer brakes and never significantly apply the vehicle brakes. (Note that the initial movement of the brake pedal in most vehicles only prepares the brakes to be applied. It takes more pedal movement to actually apply the brake.) This allows the trailer to pull the vehicle to a stop, keeping the trailer and vehicle in line during the stop. Conversely the Proportional controller does not apply the trailer brakes until the vehicle has created sufficient deceleration to pass the threshold setting in the controller. So the trailer will need to push the vehicle in order to keep the trailer brakes applied. And if the trailer and the vehicle are not in line, the trailer can push the vehicle to one side or the other.

Regarding the speed of application, the common assumption is that Proportional controllers are faster in panic stops and slower in routine stops. There is little debate about the routine stops. The Time-Based controller starts applying the trailer brakes as soon as the vehicle brake pedal is slightly depressed and applies the brakes to the operator determined maximum setting.

More often than not, a complaint about Time-Based controllers is that they are willing to apply too much trailer brake in "soft" stops. On the other hand, the Proportional controller usually ignores "soft" stops because they do not generate enough inertia.

The case of the panic stop is different – and widely misunderstood. Everyone knows that the Time-Based unit immediately starts to apply the trailer brakes and continues to apply them until the brake pedal is released. There are variations between controllers, but in general the Time-Based controller applies the trailer brakes at a fixed rate. To apply 100% of the trailer braking capability would usually take about 3 seconds. However 100% of the trailer braking would likely lock the wheels and put the trailer into a skid. So the brake controller is usually set to provide less than 100% of power to the trailer brakes based on conditions (trailer brake size, trailer weight, trailer load, road conditions, etc). A common setting for many circumstances is 50%, which only takes 1.5 seconds to achieve the desired braking.

The common assumption is that Proportional controllers activate immediately. However this is normally not the case. First the vehicle must create sufficient deceleration. Further, in a Proportional system, the inertia sensor is usually a very sensitive device. It can detect very small changes in incline and vibrations in the vehicle. In order to make the controller work properly, the inertia sensor output must be filtered to effectively ignore these small signals. If not, the trailer brakes would be constantly turning off and on. There are several methods of achieving this filtering, but all have one thing in common. They do not apply the trailer brakes immediately, but rather take some time to process the information from the sensor and determine whether to apply the brakes. And while the Proportional controller is "thinking", the Time-Based controller is applying the trailer brakes. The amount of "think" time is not consistent, but 0.8 second is not unreasonable. At that point, a Time-Based controller can have the trailer brakes providing significant braking.

So in a hard stop, the Proportional controller will apply the trailer brakes to the maximum setting sooner. But the Time-Based trailer brakes were applied earlier. So which controller will stop the vehicle and trailer in less distance?

The honest truth is that it depends. The biggest factor is usually how the operator has adjusted the controller settings to conditions. The best system is the one that the operator understands and does the best job of setting to the conditions and that drivers preferred method of driving. I know many people who have no understanding of brake controllers and no interest in them. The simplicity of the Time-Based controller is what works best for them. Likewise, the involved driver that wants leading trailer braking will prefer the Time-Based controller. The driver that accepts lagging trailer braking and is willing to develop a feel for achieving the proper inertia setting will favor the Proportional unit.

Both have their place in the market based on operator preference.

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