The Trend Setter

Part 2 **ONE-WIRE**

compared to

THREE-WIRE

ALTERNATORS

In recent years it seems that the term ONE-WIRE has become a much-used buzzword, and ONE-WIRE is often used by people who do not understand it. Among the GM SI series alternators, there is both the ONE-WIRE type and the THREE-WIRE type. Many people who have called did not know that ***not all alternators with a built-in voltage regulator are "ONE-WIRE" types***. Many people simply refer to *all* alternators with built-in voltage as ONE-WIRE. (Lumping the THREE-WIRE and the ONE-WIRE, both with built-in voltage regulator, into the same classification; is incorrect and results from lack of being informed.)

With this technical feature we will attempt to discuss, compare, and provide the information needed to decide which system is the best for particular applications. (ONE-WIRE, or THREE-WIRE, both with a built-in voltage regulator.) And we will discuss the advantages and disadvantages of each type when used in different applications.

Shown above is the first-generation GM Delco-Remy alternator with built-in voltage regulator. The "ONE-WIRE" alternator shown above only has a heavy gauge wire connected from the output terminal to the battery. The obvious advantage is that not much knowledge is needed to wire it! (The ONE-WIRE alternator shown above is the 10SI model.)

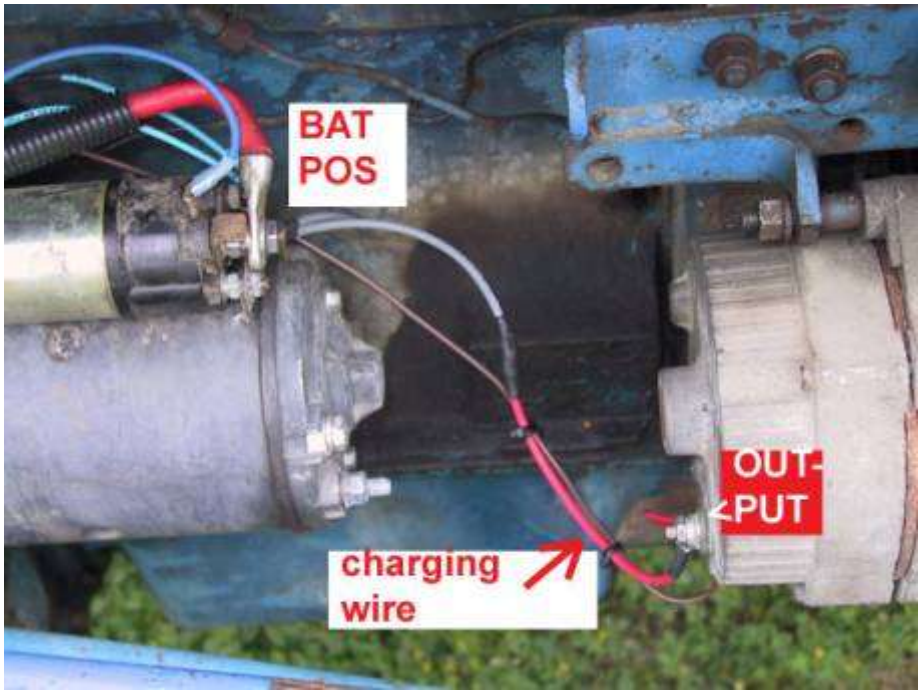
It's logical that Delco-Remy Division of GM would have originally designed the "ONE-WIRE" version of their 10SI alternator. These alternators have been widely used on agricultural and industrial machinery. Considering the number of companies building tractors, forklifts, engines for irrigation pumps, air compressors, and the many other examples of machinery requiring an alternator, it would have been simple to furnish the ONE-WIRE. There's not much to teach about wiring the "ONE-WIRE." And so the "ONE-WIRE" alternator would have avoided a lot of "how-to-wire-it" teaching sessions, which can occur when supplying the THREE-WIRE system. (Trust us, the tech calls can drive a person MAD! And the need for knowledge of proper wiring is why we made the part#ALT-1 kit, which comes with good instructions and all the proper wiring parts.)

If the "ONE-WIRE" would have worked well with the complicated wiring involved for support of all the many accessories on cars, then over the years GM could have saved a

fortune in wiring. But GM did not compromise electrical system performance in this area. They did spend more money for engineering and wiring to install the THREE-WIRE alternators, which will deliver best performance. And as we shall see, there really is value to the little extra work required to install the THREE-WIRE system.

The "ONE-WIRE" alternator is best suited for applications that need the alternator only for a battery charger. Okay, so it's a little radical to use an old farm tractor as a model in a site for High Performance cars. Ha! But the tractor example makes a strong point about the ONE-WIRE alternator system.

This tractor is an application that only needs the alternator for battery charging purpose. This simple tractor has **no lights, no electrical accessories, and not even an ignition system** (The engine is a diesel model.)



And the **wire harness** on tractors and most other machinery **is short in length**, with fairly heavy gauge size wire. The ONE-WIRE alternator could satisfy the battery charging needs on this simple old tractor.

It's important to notice the short-in-length charging wire on the tractor. Significant voltage drop will not occur with the battery charging wire only a few inches in length. And there are no accessories to hook-up downstream from the alternator. The "remote voltage sensing" option available with the THREE-WIRE is not needed with this tractor application.

However… Even the most simple of applications, like **the old tractor, can use the THREE-WIRE type alternator with built-in voltage regulator** (the two wire plug-in plus the "charging wire). Although it must be properly wired, the THREE-WIRE type does work equally well for the tractor application. The added benefit of wiring the tractor for the THREE-WIRE alternator is that replacements will be less expensive and more easily found. (Since the "THREE-WIRE" type was used on many years of all GM cars and trucks, it can be found at about any place where auto parts are sold, and usually for far less money than the special "ONE-WIRE" type.) And a Warning Light on the dash in addition to a gauge will be an option when the THREE-WIRE is installed.

TIPS Notice the debris at the air-intake for cooling, which probably resulted from operating in a dusty, dirty environment. (see arrows) This needs attention, as alternators require adequate cooling. What we should see through those air-intake openings is the rectifier heat sink with aluminum cooling fins. Sometimes plugged air-intake is also a problem when fiberglass hood insulators deteriorate on cars and trucks. That debris will have to be cleaned out of there. The cooling fan at the front of these alternators is an exhaust fan, and it pulls air in through the back of the alternator where the rectifier heat sink is mounted. (That's why the debris is stuck in the back-of the alternator.)

Cooling is very important to an alternator. Machinery built by man is never 100% efficient. But energy is never lost or destroyed (only converted). Briefly speaking, if an alternator design was only 50% efficient, and 4 horsepower was required to operate the alternator; then we would get 2 horsepower worth of electrical energy from the alternator and 2 horsepower worth of heat energy from the alternator. And of course, as with

engines, increasing the output potential will increase the heat output. (Heat is the by-product of efficiency loss.)

When alternator output rating is increased, the cooling capacity of the alternator should also be increased. ***Beware of budget 100 amp alternators built upon the 63 AMP rated, 10SI model case design***, and with only original design rectifiers and fans. The output potential is nearly doubled, and the cooling capacity is reduced since the case will be filled with more windings. And be thankful for good companies like POWERMASTER, who improve the cooling capacity when they increase output potential. (POWERMASTER also gives us the options of both "THREE-WIRE" and "ONE-WIRE" alternators.)

The difference between the ONE-WIRE and THREE-WIRE alternator is the **voltage regulator**. The Delco part # D680 voltage regulator shown above is used in both the 10SI and 12SI THREE-WIRE models. The same model of alternator can be assembled with different types of voltage regulators (for ONE-WIRE or for the THREE-WIRE system). We do have options, and the choice is ours to make.

The voltage regulator for the "ONE-WIRE" alternator is often referred to as "SELF-EXCITING." The "self-exciting" terminology probably comes from the old generator days,

when testing the generator output required "exciting" the field winding (which involved powering-up the field winding so that it would make a maximum strength "magnetic field"). And the "self" part of the term comes from the voltage regulator turn ON function without the assistance of a dedicated wire circuit.

How the ONE-WIRE Voltage Regulator Works

The iron core material next to the field winding in the alternator will retain some magnetism after once being magnetized with field winding power-up (during assembly). After the engine has been started, and the alternator is spinning, the existing weak magnetic field from the iron core material will cause the alternator to produce a small amount of current. This small amount of current is used to turn the voltage regulator electronics ON (rather than wiring a special wiring circuit to turn the voltage regulator ON). And of course the faster we spin the alternator, the greater the potential for output. That is why sometimes we have to rev the engine once to kick in the "ONE-WIRE" alternator. (We have to spin the field in the alternator fast enough to make sufficient current to turn ON the "self-exciting" voltage regulator.)

How the THREE-WIRE Voltage Regulator Works

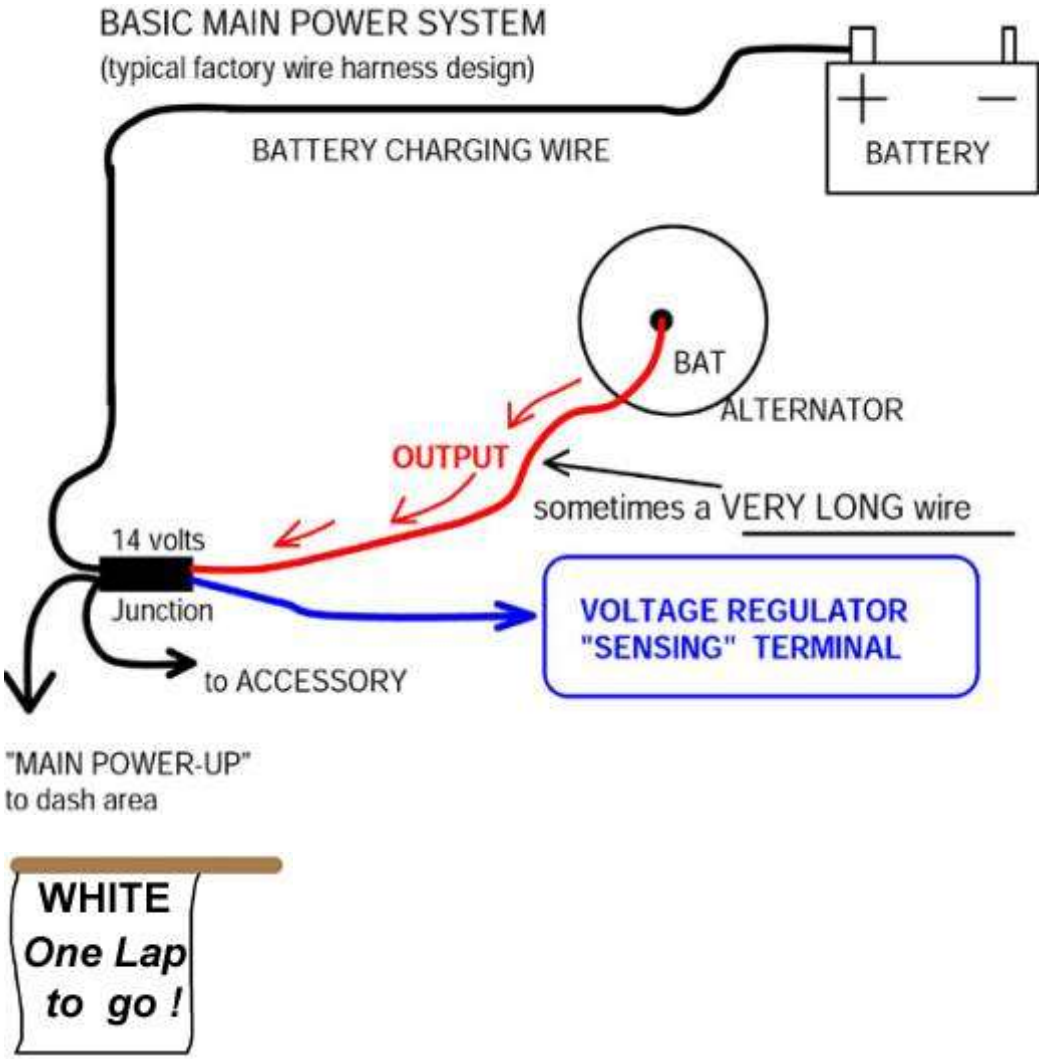
(the Turn ON & Warning Light circuit)

With the "THREE-WIRE" alternator model built for cars and trucks, one of the voltage regulator terminals is wired to an ignition switched OFF/ON source. And the OFF/ON circuit may also be used to operate a warning light at the dash. (The THREE-WIRE type can be wired with or without a warning light at the dash. The warning light is an option–not a requirement.)

REMOTE VOLTAGE SENSING, a THREE-WIRE *advantage*

The other of the two plug-in wires at the SI series alternator is the "voltage-sensing" terminal for the voltage regulator. Through the sensing-wire, the voltage regulator monitors electrical system voltage and makes adjustments to alternator output. The regulator will adjust alternator output as needed to maintain the place where the sensing-wire is routed (at about 14.2 volts). And the sensing-wire can be routed to a place remote from the alternator (downstream).

This "remote voltage-sensing" feature is often a big advantage when running with a factory type wire harness from the Muscle car period (60's and early 70's period cars and trucks). Then the alternator output will be adjusted according to what goes on far downstream from the alternator–at the main power distribution junction, which operates the whole car plus charges the battery!



click here to continue

to the last part of this ONE-WIRE compared to THREE-WIRE feature

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