

How to Convert Any 6-Volt Vehicle to 12-Volt

With Step-by-Step Installation Instructions

Vintage Auto Garage

*Best in Class Products
for American Classics*



Written by Jay Johnson

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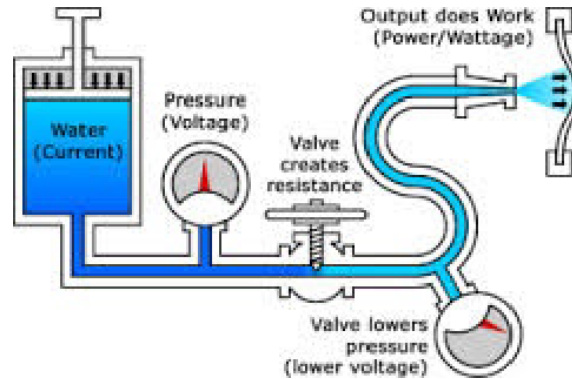
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NOTE: Use caution when working around your vehicle; rotating belts and pulleys are hazardous and can catch clothing and take off fingers. Always disconnect the battery when doing any electrical work, which will avoid shock hazard and burns. Use jack stands when working under vehicle. Follow instructions and use common sense

Brief review of electricity

The following is to help you better understand what is involved in converting any vehicle from 6 to 12 volts. First, however, let's review how electricity works.



Think of electricity as water. Think of the battery as the reservoir of water that provides pressure and volume. Electrical wiring is the same as a hose. Electrical resistors are the same as a water valve. And, the output power/wattage is the nozzle at the end of the hose. Needing more power to drive a device is similar to increasing the amount of water inside a hose.

Thus, when you increase the capacity or volume of the water, pressure needed to drive a device is reduced.

When changing from 6 to 12 volts in your vehicle, the voltage is doubling. Therefore, you would decrease needed amperage by one half. *Example:* if a heater motor requires 20 amps to operate on 6 volts, at 12 volts that same motor will need only 10 amps. The same approach is true for wiring: because 6-volt systems require higher amperage to operate, wiring within such a system essentially is two times larger than that required for 12-volt systems. This is why you are able to use the same wiring and mechanical switches in a 12-volt system as in a 6-volt system. This comparison, of course, presumes your wiring and switches are in good condition and not a hazard.

Electrical terms to serve as a guide

AC	Alternating current
Amps:	Volume of electricity
Capacitor:	Device that stores electricity for short periods of time (not voltage sensitive)
DC	Direct current
Diode:	Allows current to flow in one direction only.

- Parallel: Wired similar to your home lighting system, with each light powered individually.
- Polarity: Defines the direction current flows
- Resistor: Device that controls the volume of electricity, acts like a hose nozzle
- Series Wiring: Like a string of old Christmas tree lights, i.e., if one bulb goes out, they all go out.
- Volts: Pressure of electricity
- Watts: Amount of electricity used or needed to power a device

A word about safety

You can become injured working around electricity. You may not think 6 or 12 volts can hurt you, and you are wrong. A battery can pull lots of current. If you get between the positive and negative, and the situation is right, you can get badly burned. Any time you work around your vehicle's electrical system **always disconnect the negative battery terminal** and be careful when removing the terminals, too.

Also, always be careful when working around **belts and pulleys**, these can catch clothing, fingers, and hair.

Positive versus negative-grounded electrical systems:

Ford, Dodge, Chrysler, Plymouth, DeSoto, Studebaker, Cadillac, Kaiser, and some other brands wired their early automobiles with the positive terminal of the battery to ground, or the frame, and the negative to the starter and electrical system. Chevrolet and most other GM vehicles (except Cadillac) wired their vehicles with negative grounds.

After the late 50s early 60s, most every manufacture went to negative-grounded electric systems and this is the standard today. All modern solid-state electronics, radios, phone chargers, GPS, and solid-state voltage reducers are based on negative ground systems and will become damaged on positive ground systems.

When performing your conversion to 12 volts, if your vehicle is positive ground, you will want to switch your systems to negative ground by simply changing the terminals on the battery: negative pole of the battery to the chassis and engine and the positive going directly to the starter or starter solenoid and electrical system.

When switching to negative ground, everything in your vehicle will work as it did before. This should remove the myth about starters and heater motors turning backwards when changing from positive to negative polarity. *They will all turn in the correct direction.*

The reason why is that starter and heater motors in your vehicle do not use permanent magnets. Instead, they use field coils to energize and create the magnetic force and these types of motors are designed to turn in one direction only, regardless of polarity.

Generator versus alternator

You have the option either to convert your generator to 12 volts or install a modern alternator with built-in voltage regulator.

Staying with a generator and converting it to 12 volts has limitations on output amperage. The most a 12-volt generator will produce is 40-42 amps, and this greatly depends on the condition of the armature. Perhaps the bigger disadvantage of a generator is the inability for the generator to produce current at low engine speeds. You may need to be driving at 20 MPH or so before it starts to produce any current. This means at idle speed the electrical system is running off the battery and maybe is why the engine is hard to start after driving short distances.

Alternators were designed in the late 1960s, early 1970s, to meet the higher electrical demands of the automobile. Alternators work by spinning the field coils inside stationary wiring called stators, which is opposite from the way a generator works. By changing the design, the alternator can turn much faster, up to 10,000 RPM, before there is any internal damage. Therefore, most alternators are driven at 1.5 to 2 times engine speed. This higher speed ensures a strong output current. Most modern engines have an idle speed of 1000 to 1100 RPM and the alternator RPM is 1500 to 2200. However, older engines typically have lower idle RPM and pulleys that were meant for generators, which means the alternator is turning slower than the typical 1500 to 2200 RPM. We will cover the solution to this in the next few sections.

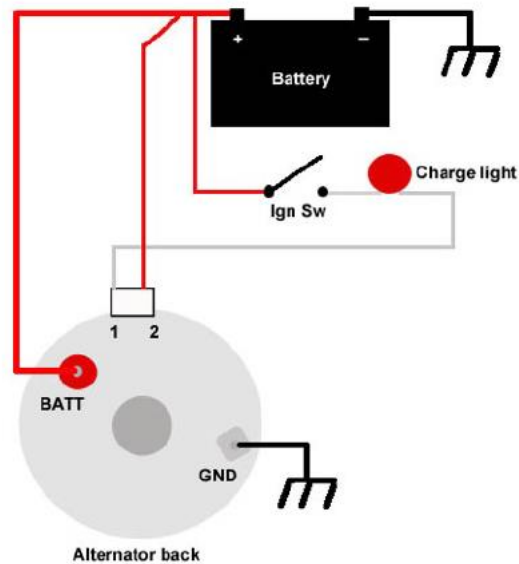
1-wire vs. 2-wire alternators

The 1-wire alternator was built primarily for modern high-idle RPM engines with pulley ratios that will turn the alternator at high RPMs. One-wire alternators utilize residual magnetism stored inside the rotor to excite the field coils and allows the alternator to start charging when it reaches about 1200 RPM. These are simple to connect with just 1 wire from the output to the battery, thus called 1-wire alternators. These are fine for modern engine applications; however, 1-wire alternators are not always the best solution for older, slower-idle engines that can't turn the alternator fast enough to charge the battery. You will sometimes see this in older cars when, at a stop sign at night, the headlights will dim because the generator or maybe the 1-wire alternator stopped

charging and the vehicle is running strictly off the battery. Also remember that newer vehicles that were designed with an alternator use the proper crank-to-alternator pulley size to spin the alternator to stay on all the time.

The 2-wire alternator utilizes an extra connection called an excite wire that delivers a small amount of 12-volt current into the alternator that starts the alternator charging at low RPM and will remain charging through the entire RPM range, and does not rely on residual magnetism like the 1-wire does. The other advantage of a 2-wire alternator is the ability to operate a dash charge-no charge light. See wire diagram with dash light wired below

Wiring diagram for Delco Series 10-SI and Series 12-SI alternators







To connect the 2-wire alternator, there is an excite plug that snaps into the rear of the alternator, which is sometimes located under a black dust cover. Remove this dust cover and insert the excite plug. The plug comes with a long white wire that connects to switched 12 volts. Connect this white wire to the ignition switch or connect to the plus side of the coil, (which is the same electrical connection as the key switch). On Delco 10 and 12SI alternators, there is short red wire that connects to the output of the alternator to sense the output voltage. This short red wire does not exist on the later model CS130 alternators. (see the 2 types below)

The white excite wire should have a diode (one-way electrical check valve) to allow current to flow *into* the alternator. Without this diode, and particularly on early vehicles, ignition switches without a neutral will prevent engine shutdown and possible drain the battery overnight. The other second connection in the 2-wire is the output wire that goes directly to the positive side of the battery in a negative ground system.

Below are the two different alternators with the connection wire and plug.

Click images to see more about the product

	<p>10 and 12 SI alternators show 2-wire alternator connection. The white wire is the one with the diode and connects to switched 12 volts. Short red wire connects to alt output and the Long Red 10 AWG wire goes directly to the battery positive side.</p>	
	<p>CS130 Shows 2-wire alternator connection shows the white wire with the diode and connects to switched 12 volts. Long Red 10 AWG wire connects directly to the battery positive side. Note there is no short red sense wire needed; it is internal to the alternator.</p>	

Click these links to see connection plugs

[Delco 10Si & 12 Si Plug](#)

[Delco CS121 & CS130](#)

[10 AWG Red connection wire](#)

[8 AWG Red connection wire](#)

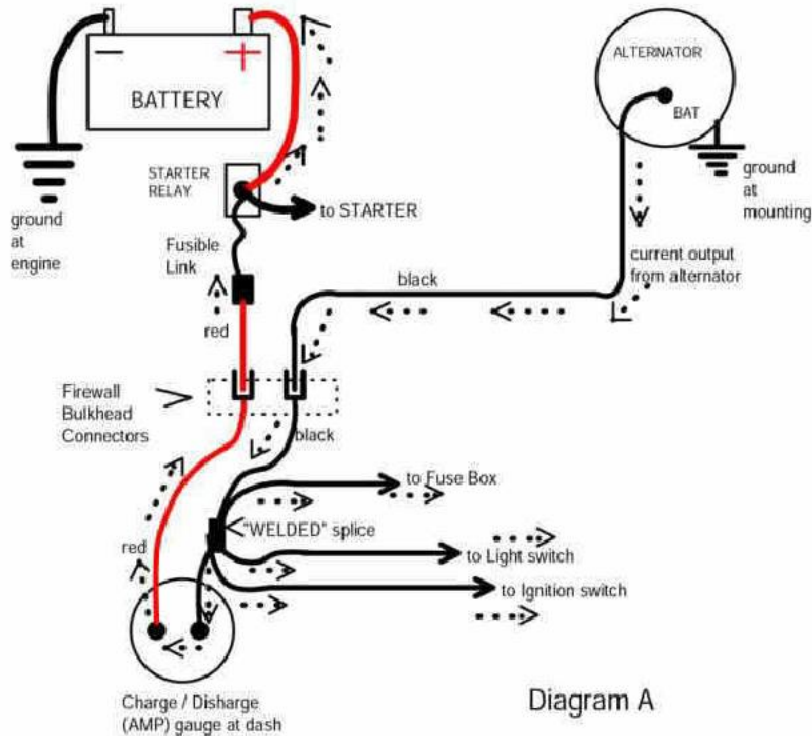


Diagram A will help you connect the alternator to the battery via a dash ammeter. Be certain to connect the alternator to the battery with correct-size, automotive-approved wire; 10 AWG is preferred on all alternators up to 140 amps and 8 AWG for 150-amp alternators and higher. Note this diagram only shows 1 wire connection and does not show the excite wire.

Fuses and circuit breakers

Most older vehicles only have a few circuit breakers under the dash; these will work on 12 volts. We recommend installing an in-line fuse in the alternator output wire, close to the battery connection. The fuse value should be 25% greater in value than the alternator output. *Example:* a 63-amp alternator would use an [80-amp fuse](#), 100-amp would use a [125-amp fuse](#), and a 140-177 amp would use a [200-amp fuse](#).

Ammeters / battery gauges.

If you plan to keep your original ammeter in place, there is no need to install a reducer. Ammeters read current flow and not voltage. If you have a volt meter rather than ammeter, you may need to add a resistor, or we recommend adding an aftermarket 12-volt meter. Ammeters read current back and forth between the battery and the alternator, even if you install 100-amp alternator does not mean that 100 amps is being used; the demand on the alternator is dictated by the demand of the electrical system.

In other words, if the electrical system demand is 40 amps with everything turned on, then that is all the alternator output will be.

How to figure the correct alternator output for your vehicle. An important aspect in selecting alternator output is the demand your vehicle will have at low RPM and when cruising down road. Most vehicles with running lights, a heater, and maybe a radio will work fine on a 63-amp alternator; add a radiator fan, AC, and stereo and now you must have a minimum of 100- to 140-amp alternator. The following is the output level of alternators at speed and idle. 63 / 30 amps at idle, 100 / 50 amps at idle, 140 / 70 amps at idle, and 177 / 100 amps at idle. As you can see, the larger the output alternator, the higher idle output. If the vehicle is running a radiator fan or AC, you must have a 100 to 140-amp alternator to keep the battery charging. Those accessories have high current demands and you want the AC operational at idle and low speed without draining the battery. If the vehicle has a much higher electrical demand, it may require 177 / 100-amp hair-pin-style alternator. [Click to see alternators](#)

Alternator pulleys come in different belt widths and diameters. Choose the pulley that will fit your belt size by measuring the top of the belt. Typical belt sizes are 3/8", 1/2", 5/8", and 3/4". The diameter of these pulleys is between 2.5" and 3". You want to avoid using the pulley from your old generator because it is too large in diameter and will not turn the alternator fast enough at low idle speeds. Ideally, the alternator should turn 2.5 to 3 times faster than the crank pulley; this is not always possible with order engines, which could be 2 to 1. The faster the alternator turns at idle, the better output current the alternator will produce. With older engines that idle in the 500-800 RPM range, the alternator will be turning at around 1200-1800 RPM. [Click to see pulleys](#)

Alternator brackets attach the alternator to the engine and come in several types. Make sure to select the correct alternator bracket that will fit your engine application and mounts the alternator so the pulleys line up. [Click to see brackets](#)

Ignition coils: There are 2 types of ignition coils, one with internal ballast resistors and one with external resistors. Chances are you have an older 6-volt coil with external ballast resistor. When changing to a new 12-volt coil, we recommend an internally resisted coil, which eliminates the need for the external resistor and has one less part with which to deal. [Click to see coil](#)

Keep in mind that coils are polarity sensitive, meaning the negative post goes to the distributor and positive post to the key switch. This is opposite from the way a positive ground electrical system is wired.

Distributor points and condensers will work fine on 6 or 12 volts. There is no need to change them when converting. However, it is always a good idea to replace the

condenser often because these electrical devices can dry out and cause a dead short that will cause the engine ignition system not to operate correctly.

If you want to eliminate the points and condenser in your distributor and keep the original look, you can install an electronic ignition. These systems are available for most make and model engine distributors and will make a big difference in engine performance; and the engine will never need to be re-time again, which is a huge plus. When selecting an electronic ignition, choose the correct part-number ignitor for your distributor. Sometimes distributors were changed out through the years and may not match the original engine, so having the correct distributor part number is helpful.

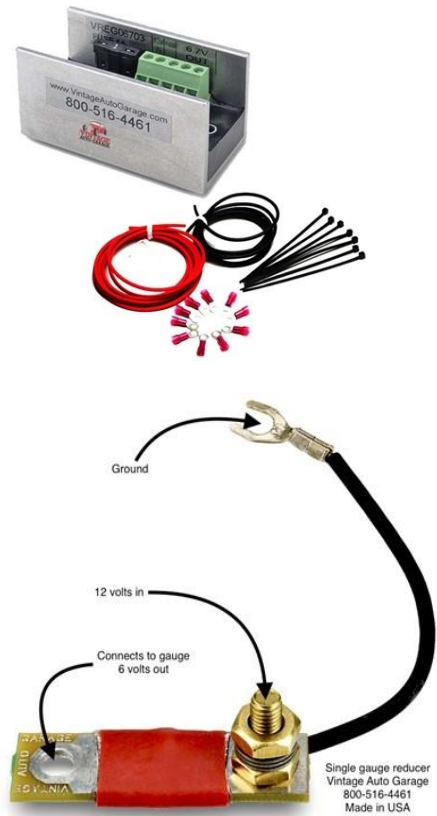
[Click to see electronic ignition](#)

Six-volt electric Oil, Gas, and Temp gauges are meant to work only on 6-8 volts maximum. If you apply 12 volts to any 6-volt gauge, it will burn up quickly. We recommend the use of a solid-state voltage reducer/regulator rather than any type of resistor because the solid-state devices work the best and protect your gauges. The problem with resistors is that when they heat up, the values change and the gauge will not read correctly. Keep in mind that some auto manufactures used a combination of electric and mechanical gauges while others used all-electric gauges. You will need to select the correct gauge reducer for your vehicle. It is best to use the part number VREG0703 for multi-gauge applications and V12872 for single electric gauges.

[Click to see](#)

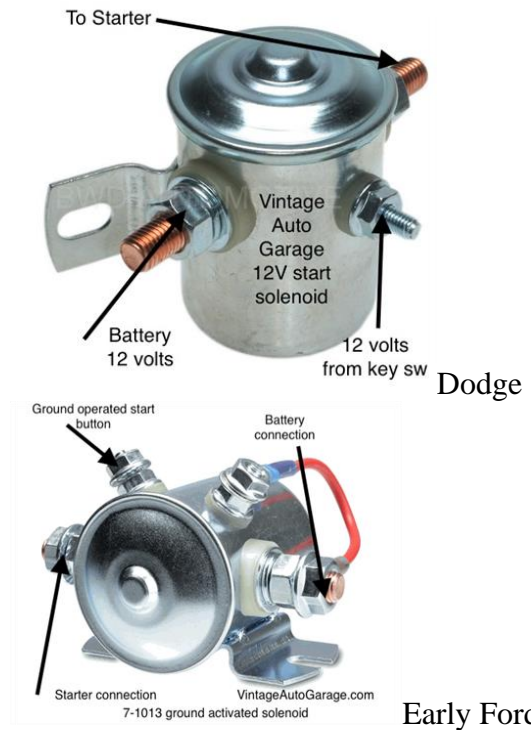
In most cases, when installing the correct type of 12-to-6-volt gauge reducer/regulator, you do not need to change the sending units because the gauge and sending units will continue to operate on 6 volts. This will save you time and expense by keeping your original sending units and gauges. If the polarity is being changed from positive to negative ground, you need to switch the wires on the back of the gauges. If you don't, the gauge will read backwards; nothing bad will happen, just simply reverse the polarity on the back of the gauge. There is no need to put any reducer on the ammeter or battery gauge as these meters read current flow and are not voltage sensitive.

[Click to see](#)



Starter solenoids are essentially relays that take high current loads for starters. If your vehicle has a starter solenoid mounted to either the firewall or starter itself, we recommend replacing it with a 12-volt solenoid. On early and even later model Fords, the solenoid is located on the firewall and is activated via a ground circuit from the start button, while others require 12 volts to activate. You will need to make sure you select the correct solenoid for your vehicle application. Chevrolet, GM, Chryslers, and some others use a solenoid mounted to the starter. These are large cylinders with a plunger that activates the starter gear.

[Click to see](#)

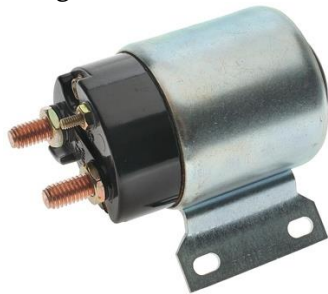


Dodge

Early Ford



Plunger



GM1202



Later Ford

You may have a mechanical foot-type starter that is found in early Chevy and Dodge cars and trucks and some others. There is no need to make any changes to this mechanical system, it will work fine on 12 volts.

Heater and defroster 6-volt motors require a resistor when converting to 12 volts. Electric wiper motors will also need resistors. Each motor or device will require a different and unique resistance value. Be certain you select the correct resistor for the application. When installing resistors, it is best to install in a well-ventilated area under the dash and away from anything flammable or otherwise could be touched because the resistors get warm-to-hot and that is perfectly normal. When checking a resistor, there needs to be a load applied to it for the resistor to reduce the current. After connecting,

turn the motor or radio on and then check the output side of the resistor for lower voltage. [Click to see](#)

Horns will work on 12 volts because the windings in 6-volt horns are heavy gauge wire and appear to hold up with the short duty cycle. The horn will sound a bit different on 12 volts versus 6. There is typically a horn relay installed in the circuit that needs to be changed to 12 volts.

Tube radios

If your vehicle has an existing 6-volt tube radio that you want to use, there are 12-to-6-volt reducers that you can use, or have the radio itself converted to 12 volts. If you elect to use a voltage reducer, make sure to use one that designed for radios and that has correct-size resistors and heat sink attached.



[Click to see](#)

Power seats, window, and convertible-top motors will run too fast on 12 volts and will burn up over time. There are two solutions when converting your vehicle, with these options: (1) Rewind the motors, there are several companies that will do this work, or (2) There is a reducer solution for windows and seats. Unfortunately, there is not a reducer currently made to handle the current needed to work on convertible top motors. The problem is top motors take a very high current draw when raising the top and exceed most reducers on the market. [Click to see](#)

Light bulbs will need to be replaced because 6-volt bulbs will not last on 12 volts beyond one nano second. Recommend taking the original 6-volt light bulbs to the local parts store and match up with 12-volt bulbs.

Headlight switches in older vehicles are a common cause for dim or flickering headlights because all the current from the lights is running through the switch. Installing a headlight relay in the light electrical system will eliminate this problem and also take all the 12-volt current off the switch itself. [Click to see](#)

Electric clock will need to have the clock converted to 12 volts; there are no 12-to-6-volt reducers that will work on electric clocks.

Light bulbs will need to be replaced to 12-volt bulbs. Following is a list of bulbs:

Bulb Location	6-Volt Number	12-Volt Replacement
Headlamp	6006 (Sealed beam)	6014 or 6015
Park w/ turn	1154	1157 or 198
Park lamp	63	67 or 1155 or 97
Tail and stop	1154	1157 or 198
Tail and turn	1154	1157 or 198
Tail lamp	63	67 or 1155 or 97
Stop lamp	1129	1141 or 1159
Tag light	63	67 or 1155 or 97
Ignition	51	53 or 53x or 1445 or 182
High beam (ind)	51	53 or 53x or 1445 or 182
T/S unit	51	53 or 53x or 1445 or 182
Dash	55	57 or 57x or 1895 or 293
Speedo	55	57 or 57x or 1895 or 293
Clock	63	67 (3 candlepower)
Glove box	55	57 or 57x or 1895 or 293
Dome lamp	88	90 or 94 (6 candlepower)
Courtesy lights	82	90 (6 candlepower)
T/S flasher	535 HD 6 volt	550 HD 12 volt

The Battery Is one of the most important components in your vehicle's electrical system. Sometimes we take for granted that the battery will always start the engine. This is generally the case, provided the battery has been properly maintained and charged. We think of the 12-volt battery to be fully charged at 12 volts, right? ... Wrong. At 12 volts, the battery is only 25% charged. In fact, most starters and starter solenoids will not work if the battery is below 12.4 volts (75% charged). Also, a low battery can destroy a starter and, in many cases, fuse the contacts in the starter solenoid. A fully charged battery should be 12.6 volts or higher. [Click to see battery brain](#)

Battery voltage state of charge:

12.6 + volts 100% charged

12.4 volts 75% charged

12.2 volts 50% charged

12.0 volts 25% charged

11.6 volts Discharged

Batteries should always be charged with an external battery charger. Do not use the alternator to charge a low or dead battery. This will overheat and damage the alternator's rectifiers and regulator and they will need to be replaced.

Internal alternator regulators are set at 14.1 to 14.4 volts, the correct voltage to keep the battery fully charged

Battery cables' condition and size are very important to ensure the starter receives adequate current. It is always best to replace the cables when converting to 12 volts. Order cables with copper connectors and shrink-wrapped ends for long trouble-free service. [Click to see](#)

Grounds Older vehicles use the chassis as a means to ground and complete the electrical circuit. Make sure all the grounds are tight and there is a good ground between the engine and the chassis. This by far is the most common electrical problem found in all older vehicles.

Many vehicles built between 1940-1964 had Borg Warner R10 or R11 electro mechanical overdrives. If you are lucky enough to have one of these overdrives installed, both the solenoid and the relay will need to be replaced with 12-volt devices. The wiring and switches will work on 12 volts just fine. [See complete list of overdrive parts](#)

Enjoy your newly converted vehicle, have fun and be safe!

[Click this link to request conversion parts list](#)

Following are step-by-step instructions for converting most every vehicle to 12 volts. You may need to have a wiring diagram available for your vehicle.

Before starting the conversion, read all these instructions. We also recommend taking a few pictures of the engine compartment so you can see how the vehicle is wired. This will help when re-installing the parts.

Start by disconnecting the battery; remove it and place it in a safe place.

Step 1: Locate the voltage regulator, usually found on the firewall. Remove the GEN and FLD wires that go to the generator. They are not needed. We recommend leaving the regulator on the firewall, which will be easier than removing it and will keep the electrical system intact. Regulator will be inoperative once generator wires are removed. The new alternator has a built-in regulator and the external regulator is not needed.



The regulator terminals are marked.

Step 2: Remove the old generator. In some cases, you are removing the existing generator mount; in other applications you will be using the existing mount and installing a new bracket. This depends on your specific engine application.

Step 3: Install the new bracket with the hardware provided and mount the alternator to the bracket. The alternator case needs to be grounded all the way back to the negative side of the battery. Make sure the alternator hardware connections are free from grease and dirt to ensure the alternator is properly grounded. If not grounded, the alternator will not charge and damage to the internal regulator may occur. If needed, install a separate 10-8 AWG ground wire from the alternator to the engine and ensure the engine is grounded to the battery.

Step 4: Reinstall the belt and tighten. There should be some belt slack, about 1/2". There is no need to over-tighten the belt, or it will put extra stress on the water pump and alternator bearings. You may need to obtain a new longer or shorter belt, as the alternator set-up maybe different on some engines.

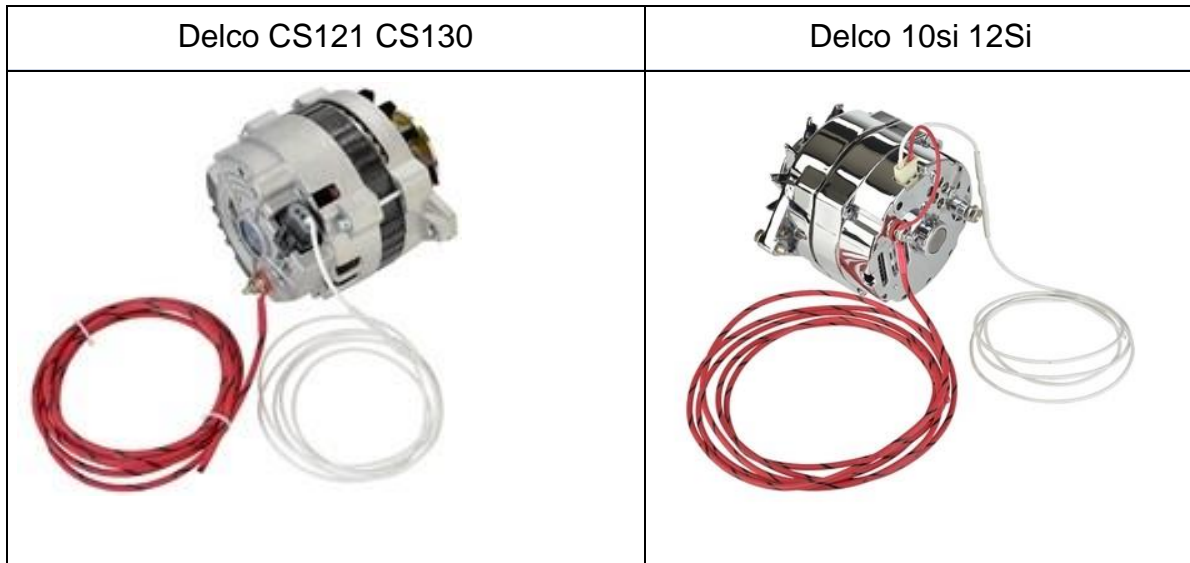
Step 5: The alternator requires two electrical connections. Locate the 10AWG RED wire and connect using the provided ring connectors: one end to the alternator output stud, and connect the other end in one of two ways

- Connect directly to the BATT terminal on the old voltage regulator IF the terminal has direct connection to the positive battery terminal. Or,
- Fish the wire through the firewall; cut and install to the ammeter; then back out of the ammeter to the positive battery terminal or anyplace that has direct connection to the positive battery terminal.

Install the inline fuse on the alternator output wire close to the battery connection. This will protect the alternator and electrical system in case of a short. The fuse should be 25% larger than the rated output of the alternator. *Example:* for 63-amp alternator, use 80-amp fuse; for 100-amp alternator, use 125-amp fuse; and for 140-170-amp alternator, use 200-amp fuse.

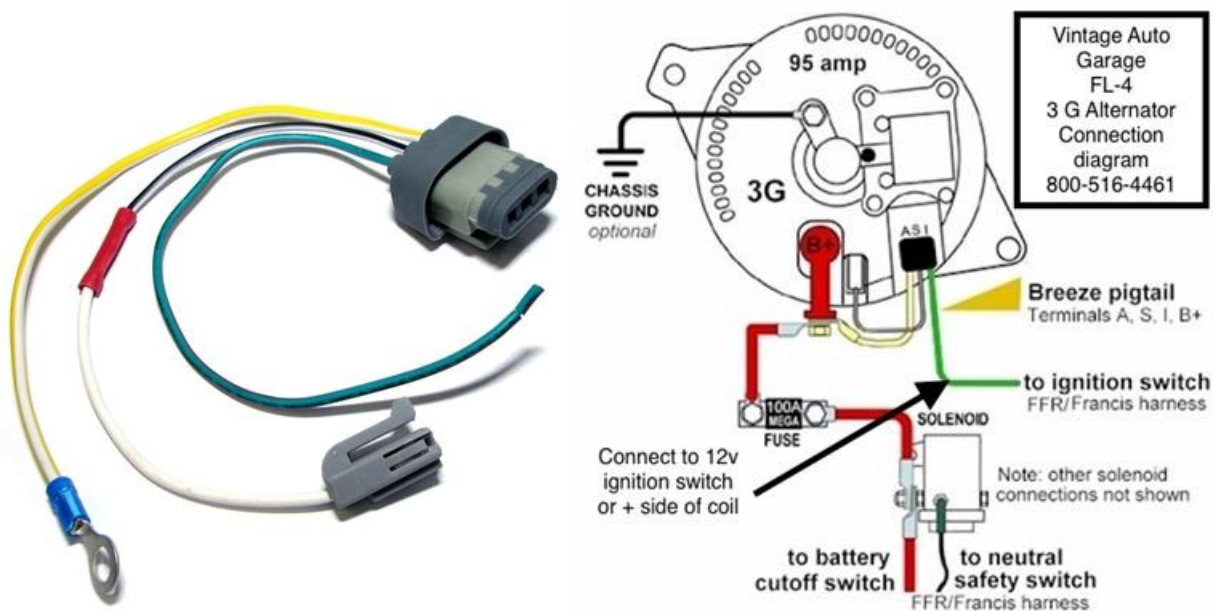
Ammeters read current going to and from the battery. These meters are not voltage sensitive and do not need reducers. Some ammeters have two terminal connections and others have a small metal loop on the back through which you feed the 10AWG wire. This is known as an induction meter and reads current going through the wire. If you are going from positive to negative ground, you may need to feed the wire the opposite way to get the meter to read correctly. Ammeters read current flow going to and from the battery.

Step 6: Install the alternator excite plug. The 10Si alternators use a plug with a long white wire that connects to any switched 12-volt power. The easiest connection is the plus side of the coil or it can be installed directly to the key switch at the same place the coil wire is connected. There is a short red wire coming from the plug. Connect this wire to the output of the alternator. CS130 and CS121 alternators only have one long white wire and no red wire. The white wire connects to the plus side of the ignition coil or to the key switch at same place the coil wire is connected. See images of each alternator.



If installing an electronic ignition, we recommend connecting the white excite wire directly to the key switch itself. Sometimes connecting to the plus side of the coil can cause a voltage drop to the electronic ignitor.

Ford 3G alternators commonly found in the Thunderbird conversion kits use a different plug, see wire diagram below and the 3G excite plug



The generator charge light in the dash, if there is one, can be enabled by connecting the white wire on the Delco 10Si alternator; the green wire on the 3G to one side of the dash light, the other side of the light is connected to the ignition switch (switched

power). When the alternator starts to charge, the light will turn off. Installing CS130 or 121 will require a different excite plug. DSC130L. because the lamp circuit is located on a different pin in the excite plug.

Installing Power Master alternators have their own set of instructions and should be followed. These are one-wire connection alternators. Some models have the generator light terminal to make it simple to power the dash light. Power Master alternators are designed to deliver current at low RPM and do not require an excite wire. It is very important that these alternators, like the others, are well grounded or the internal regulator will become damaged if started and not grounded.

Step 7: Install the new ignition coil; wire positive side to the key switch and the negative to the distributor. Coils are polarity sensitive. Ensure these connections are correct to obtain maximum ignition performance. The coils provided in the Vintage Auto Garage conversion kits are internally ballast, there is no need to add ballast resistors. If the vehicle has a ballast resistor, remove and wire straight from the key switch to the positive side of the coil.

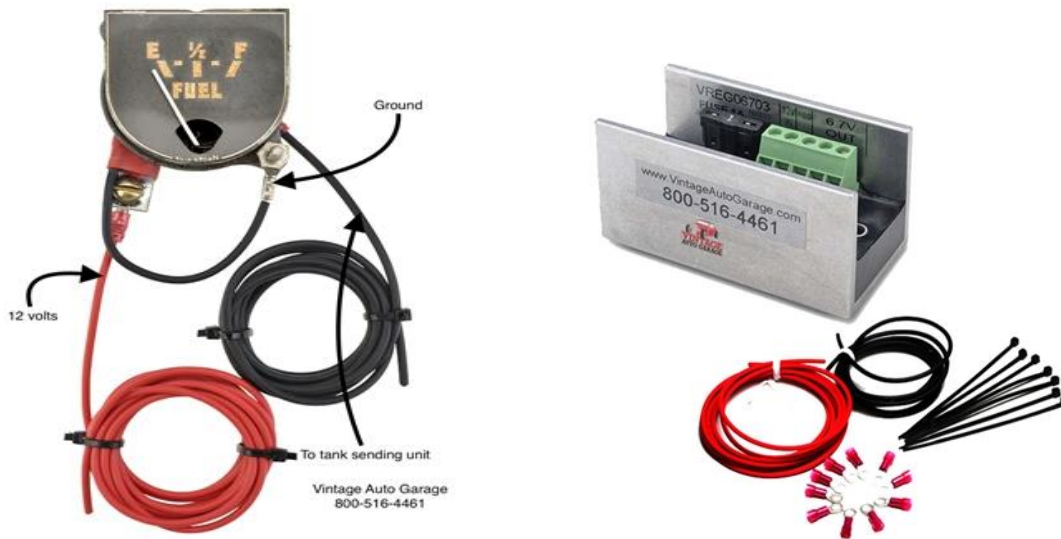
Step 8: Connect the headlight relay. This may require a specific wire diagram for the vehicle to find the correct wires. This relay removes the high voltage from the headlight switch. The switch itself will work fine on 12 volts once this relay is installed.

Step 9: Replace the horn relay. This can be found generally close to the steering column where the horn button wire extends from the horn button. Connect H= horn, S=horn button, and B=battery voltage.

Step 10: Install the start solenoid. Depending on the make and model vehicle, this could be on the firewall or on the starter itself. If the vehicle has a foot pedal starter, no solenoid is present. Early Fords used start buttons that have 1 wire and the button goes to ground. The solenoid that is provided, [PN 7-1013](#), is able to connect the same as the original, without the need to rewire the start button. On vehicles with solenoids mounted on the starter, remove the 6-volt solenoid and install the new 12-volt solenoid. In some cases, the plunger that activates the linkage needs to be changed to one that has a bullet end to engage the switch at the end of the solenoid.

Step 10a: 6-volt starters will work fine on 12 volts and will turn in the correct direction when changing polarity to negative ground. Or change the starter to a new modern gear reduction starter available for most make/model year engines.

Step 11: Install the appropriate gauge reducer provided in the kit. Vehicles like Ford and others came with three electric gauges. Chevrolet, GM, and Dodge vehicles came



with electric gas gauges and the oil and temp gauge are mechanically operated via a line directly from the engine. Install the gauge-specific reducer/regulator per the instructions provided with these devices. If converting from positive to negative ground, the wires on the back of the gauges will need to be swapped. If not, the gauges will read backward. The sending units do not need to be replaced because the voltage is reduced to the sending units in addition to the gauges.

Step 12: voltage reducers for the heater, defroster, and wiper motors are installed in the wire from the switch to the motor and can be installed and wired on either end of the reducer. Resistors require mounting to a hard metal surface in a well-ventilated area under the dash for best dispersion of heat. Resistors will get warm-to-hot depending on demand. Resistors work by giving off heat while they reduce voltage. When checking voltage after installing the reducer, the motor needs to be turned on to provide a load, then check voltage on the output side of resistor. If you attempt to check voltage without the motor running, voltage will be the same, at 12 volts, at both ends. Refer to instructions provided.

Step 13: Installation of the radio reducer is similar to motor reducers as they also give off heat when reducing voltage. Mount in well-ventilated area under the dash and connect per instructions provided. The radio will work fine when converting from positive to negative ground. The exception would be if the radio has an electronic vibrator, which is polarity sensitive, then the vibrator would need to be changed.

Step 14: If the vehicle is equipped with a Borg Warner electrically operated R10 or R11 overdrive, the 6-volt solenoid and relay will need to be replaced or a solenoid reduced relay installed. [See Part number VRODS1](#) for the reducer relay and part number

ODKIT12 for new 12-volt solenoid and relay. The kick throttle switch, governor, and lock-out switch do not need to be replaced; they will work fine on 12 volts.

Step 15: The light bulbs will all need to be changed to 12-volt bulbs; 6-volt bulbs will not work at 12 volts. Most local auto parts store will carry the correct 12-volt bulbs.

Changing your vehicle's polarity from positive to negative ground.

If the vehicle is positive ground, meaning the positive pole of the battery is connected to the chassis and engine, the battery will need to be connected with the negative terminal to ground and positive terminal to starter or starter solenoid. It is very important that, when doing this conversion, the battery is connected with negative ground. Damage will occur to the alternator and solid-state devices if installed with positive ground.

Step 16: Install a new 12-volt high cranking amp battery that will fit the vehicle battery tray. Install new battery cables as needed, positive side to the starter or starter solenoid, negative to the chassis and engine.

Step 17: Before starting the engine, check that the battery is fully charged by an external battery charger. A battery with low voltage will cause problems with the alternator, starter, and starter solenoid. Use the chart below to check your battery. We recommend using a digital volt meter when possible. ***Never try to charge a low or dead battery with the alternator or it will cause damage to the alternator internal regulator.***

Fully charged battery	12.6 volts
75%	12.4 volts
50%	12.2 volts
25%	12.0 volts
Discharged	11.6 volts

Step 18: Starting engine and testing

Be careful to keep fingers, clothing, and hair away from the rotating pulleys ... they can take off fingers!

Start the engine and allow it to warm up a few minutes. Raise the engine to 1200-1500 RPM and measure the output of the alternator with a digital volt meter; it should measure 14.1 + / - volts. This is the correct voltage to keep the battery charged at the

desired 12.6 volts. Let the engine return to idle and then measure the output voltage to see if it is still 14.1 volts +/- . Alternator output will depend on pulley diameters and engine RPM. If the alternator output voltage is not 14.1 volts +/- , stop the engine and check all connections, there could be a bad ground. If not grounded, connect a separate 10- or 8-gauge wire from the alternator to the negative side of the battery.

A quick way to check if the alternator is working is to take a pocket knife or screw driver and carefully place it on the back of the rear alternator bearing. You should feel a slight magnetic pull, which shows alternator is working and charging and feel a stronger pull when more electrical load is applied.

Finally, the wire harness in the vehicle does not need to be changed unless it is not safe. If needed select an aftermarket wire harness that will fit the vehicle.

Trouble shooting guide:

1 Question: The alternator output voltage is the same as the battery voltage when the engine is running.

Answer: This means the alternator is not charging. This can be caused by a bad ground from the alternator case to the negative side of the battery, or the output of the alternator is not connected securely to the + side of the battery or the excite wire is not connected to switched 12 volts. Alternator output voltage, when running, should read 14.1 to 14.6 volts.

2 Question: Gas gauge is not reading correctly.

Answer: The most common cause of fuel gauge trouble is a poor ground, especially at the tank sender. Make sure all wiring connections are tight and free of dirt and corrosion. A poor ground or loose connection to a fuel gauge system is just like loose or dirty battery cables to your starting system.

3 Question: Going from positive to negative ground and the gauges are reading backward.

Answer: the wires on the back of the gauges need to be reversed.

4 Question: Installed voltage reducer for the heater and it gets very hot.

Answer: The resistors must be mounted on metal / aluminum to dissipate the heat. Some motors will draw more current if they are dirty. Clean the motor commutator and look for worn brushes. This is generally the situation for these reducers to get hot or fail. Remember, to reduce voltage, the byproduct is heat.

5 Question: Ford starter solenoid 7-1013 sticks in the on position,

Answer: This can be caused by a low battery and the starter having a very high amperage demand that puts an undue current load on the solenoid. Charge battery and the solenoid may need to be replaced.

6 Question: Does the ammeter need to have a voltage reducer?

Answer: No, the ammeter reads current flow between the battery and the electrical system and these gauges are not polarity sensitive.

7 Question: Problems with lights flickering or stop lights not working correctly

Answer: Check all the grounds. Older vehicles use the chassis to run the grounds and the connections can develop rust and corrosion. Trace the ground wiring clean and replace as needed.

8 Question: How to service Vacuum Wiper Motors

Answer: Remove the vacuum wiper hose from the engine manifold and hold it above the height of the dash and squirt brake fluid into the hose. The brake fluid will run down inside of the hose to the inside of the vacuum motor. Reconnect the hose. Turning on the wiper motor with the engine running will circulate the brake fluid inside the vacuum motor and soften the leathers inside of the vacuum motor. Finally, be sure the brass intake screen on top of the vacuum motor is free of dirt and dust. The cause of most vacuum wiper motor failures is lack of use. To revive an old vacuum wiper motor, remove from the car and soak in brake fluid. This may soften the leather bellows inside the motor. Depending on their condition, it might bring them back to life. If the leathers have been dried out for too long and are cracked and separated, you will have to send the vacuum motor to be rebuilt or change to a 12-volt motor.

9 Question: how to solve moisture in distributor caps

Answer: Many vehicles have a problem with moisture collecting inside the distributor cap. The solution is to drill a small, 1/16-inch, hole on the back side of the distributor cap. This will allow air to clear out the moisture. Some of the early distributor caps already came with the hole drilled in the cap.

10 Question: The coil is not producing any spark

Answer: Check that the coil is connected properly, negative side of coil to the distributor and the positive side to the ignition switch 12 volts. It is common that this is missed when removing and re-installing the new coil.

11 Question: do the turn signal switch and flasher need changing?

Answer: the turn signals switch will work on 12 volts. The 6-volt signal bulb and the flasher will both need to be changed,

If you need assistance with your installation, call 800-516-4461 during normal business hours.

Enjoy your new 12-volt electrical system.