Solenoid Wiring Instructions

Since you've bought yourself a "constant-duty" solenoid (also called a "100% Duty Cycle" or "100% DC" solenoid) to use as an isolator, you're probably wondering how to wire it up...

First, let's identify the thing - although that's probably the easiest part. It looks like a small can on a flat mounting bracket with some screwposts sticking out - here's a "self-grounding" solenoid (the trigger signal goes into the small screwpost on the front, the supply and load go to the two large posts sticking out the sides, and the solenoid coil grounds through the mounting bracket:

This picture isn't actual size, but I've held it in my hand and pictured it over a keyboard so you get some idea of the size of the thing. It's smaller than my fist, which makes it a good deal smaller than most solid-state isolators! The solenoid itself fits into a box about 3" on a side with some room to spare, and the actual size is rather smaller - about 3.25" wide, 2.5" high, and about 2.5" deep, including terminals. You'll need to allow about an extra half-inch to the sides and front so you don't short out. The small terminal on the front (on this version) is the one that you're going to use to trigger the thing, while the power source will connect to one of the large terminals (doesn't matter which,) and the auxiliary battery will connect to the other.

The 200A version has four posts - the two large ones, and two of the small ones (one for the trigger lead, and the other for a ground. You can run the ground to either a mounting screw or to a convenient ground, but you'll have to clear a spot down to bare metal around a mounting screw for the "three-wire" version.)

I ran across these while working as an industrial mechanic, they were used to switch power to electric motors used as prime power suppliers for hydraulic systems on trucks. They're rated for the given current (I offer them in 85A and 200A versions) to run 100% of the time - day in and day out. A typical solenoid (rated for rather less than 100% duty cycle) will either overheat and fail, or just experience a contact failure (they usually end up welding shut) after a while. This is why old-style Ford starter solenoids don't work as battery isolators - but I've used these for a number of years without any trouble.

Now, these solenoids may be mounted in *any* orientation - but the usual is a simple "upright" or "inverted" orientation - when mounted on a vertical surface. But, I've seen them mounted every which-way, so I know it can be done. The only real concern is to make sure that there is some airflow over the thing, and that the wiring is clear. For reference, here are the common orientations...

Upright Orientation

Inverted Orientation

The main difference is how much of the solenoid bulk ends up between the large-gage cables. "Upright" and "inverted" are little more than terms of convenience - and why I pictured the meaning of each. You do need less vertical clearance with an "inverted" mount (since more of the rigid section of the cable is alongside the solenoid,) but you'll still need about ½" additional room around the terminals.

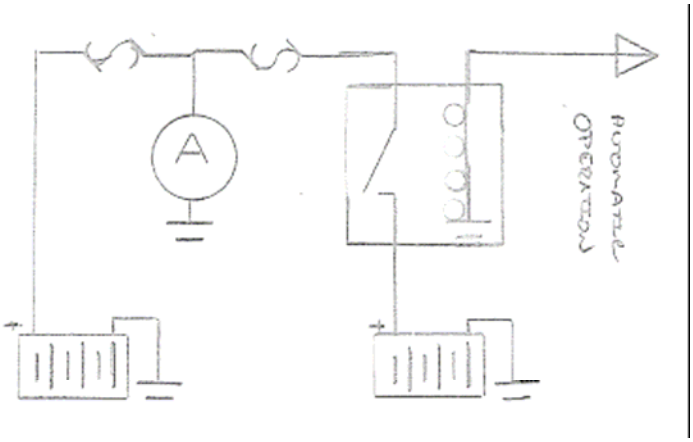
The mounting tabs (you can see them behind the heavy lugs in the "upright" picture above) are formed for flat surfaces. They will accept most sheetmetal screws (#10 or #12 preferred) with washers, and form the ground path for the solenoid coil - so they need to have a patch of clean metal in contact with them when mounted. The screw threads may be enough, but I don't trust them. Clean a small patch down to bare metal around one of the mounting screws (say, ½" square, about the size of a postage stamp,) apply Ox-Gard, and screw the solenoid down to the bulkhead. If you're using sheetmetal screws, two holes about 1½" to 2½" apart will serve neatly. Make sure to use washers or washer-head screws.

The two large terminals are the "high-current" terminals for the load you're switching. They're not polarized - doesn't matter which lead you connect to which - but you'll want to run one lead to your vehicle distribution (like the PDC post or battery + terminal) and the other will go to your secondary battery. You'll then select a "Hot in RUN" lead to tap for triggering the solenoid - if you have trouble selecting one, drop WiP a line (Jeep16Power@yahoo.com) and I'll see if we have wiring diagrams for your rig so we can help you. The "trigger" signal is fairly small - less than ¼ ampere - so you can use a relatively small wire (14AWG will usually serve.) The "trigger" signal will go to the small screwpost (use a #10 ring lug, the two large ones will take a $^{5}/_{16}$" ring) on the front. If there are two small screwposts, then pick one for the "trigger" signal, and the other will need a small jumper lead to a convenient ground, or just to a mounting screw (the "bare patch" is still a good idea for that one.)

Note that these instructions (and the accompanying pictures) will be revised once I can dummy up a mounting so I can take pictures of the process...

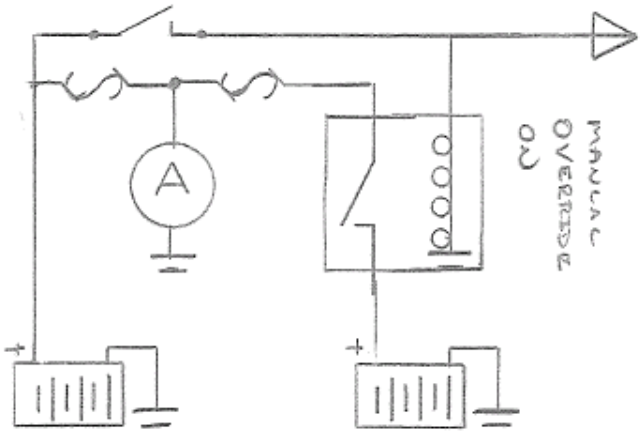
As far as wiring goes, there are three (actually, four - if you combine two) ways to wire the thing...

Direct Operation - This allows for fully-automatic operation, where the solenoid "follows" the key. It will be CLOSED when the key is ON (putting both batteries in the circuit) and OPEN when the key is OFF (isolating the auxiliary battery from the main system.) Wiring follows the schematic immediately below:



Note that I have shown fuses between the alternator and *both* batteries - this may not be strictly necessary, but won't cause any trouble. Select an 80A fuse for the secondary battery, so current is limited through the solenoid (if using the 85A solenoid. If you are using the 200A solenoid, use a 200A fuse. Both are available from WiP, along with mounting blocks.) The lead with the arrow goes to a "Hot in RUN" lead to trigger the solenoid - as mentioned, let WiP know if you need help identifying one. The primary battery is to the left, and is wired directly to the alternator by way of a fuse. The secondary battery is to the right, through the fuse and solenoid. It is possible to have more than one secondary battery - but if you're going to "gang" secondaries, make sure they're identical, and make sure you run the 200A solenoid - you're probably going to need it... All leads, save the one represented by the arrow pointing to the right, are to be large-gage leads - the one to the primary battery will be OEM (8AWG) or larger, and the one to the solenoid, and from the solenoid to the secondary battery, should be 1AWG (but can be 4AWG if a fuse is installed, as 4AWG is suitable for up to 100A in short runs. If using a 200A solenoid and fuse, just make them 1AWG all around.)

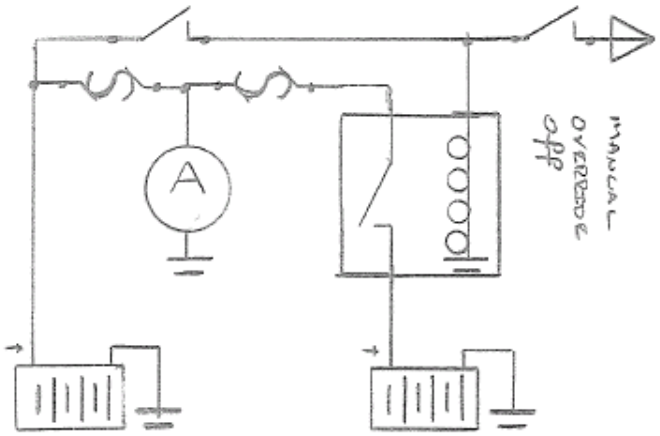
The following solenoid shows wiring the solenoid to allow a manual override switch to turn the solenoid ON at will - with or without the key:



Note the addition of the switch in the "trigger" circuit. This switch is wired to an "always HOT" lead (as shown,) and need not be closed for normal operation. If the switch is closed, the solenoid will be closed and both batteries will be in circuit.

Why would you want this? Assume for a moment that you've managed to drain your starting battery somehow. This allows you to "cut in" the secondary battery, allowing you to crank your starter, allowing you to drive home *without* a tow truck! That's really the only use I can think of, but it's a big one...

With this variation, you have the option of having a manual override turning the solenoid either ON or OFF:



As you have probably noticed, the switch shown in the previous schematic is still there (Override ON,) but another switch has been added between the solenoid and the source for the "trigger" signal. This switch is actually CLOSED ("ON") in normal operation - turning it OFF will disable the solenoid "trigger" signal, forcing the solenoid OFF - provided the other switch is OFF as well. This is the option you'd want in case you've managed to drain your secondary battery fully - force them OFF to save strain on your alternator and get home, then put the secondary battery on a charger overnight. (Note that the switch is shown on the OPEN or OFF position for clarity in the schematic.)

It is entirely possible to add one, both, or neither switch and have useful operation of the solenoid - the overrides just give you more options. They aren't strictly necessary - but they can come in handy! If you decide to install one or both override switches, be sure to put the switches in a fairly convenient location. Also, be sure to select switches that can handle at least one-half ampere at 12VDC. Relays may be used if desired, but they unnecessarily complicate things (given the current levels involved.)

Kelley's Works in Progress