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ALTERNATOR UPGRADES

WHY UPGRADE?

The alternators that came stock with the TR250 and the TR6 are fully adequate for their intended purpose. Add a few electrical accessories such as driving lights, moderately powered stereo, etc, and do a lot of stop and go night time driving in the winter, with all the lights on, heater fan on high, and stereo blasting, and you will soon run the battery down. The stock alternator just isn't up to the task, particularly the units supplied with the earlier models. Upgrading to a mid-80s GM alternator (model #7127) is a very simple task, at least from an electrical standpoint, and doesn't compromise originality all that much. I have a 55 amp unit in my '71 TR6, and I can sit at idle with everything in the car on, and still not see that dreaded alternator warning light glow!

Because of the variations in physical mounting details from year to year, depending on whether or not the car has pollution controls, an A/C unit, etc, no mechanical mounting details will be provided. Normally, the mounting of the GM unit is well within the capability of the average home mechanic. If not, most good repair shops can do the mounting for you at a reasonable cost. It's usually the wiring that creates the real hassles, and this chapter will attempt to supply the necessary details to make that as painless as possible.

WIRING METHODS

Two methods of wiring will be described - one utilizing the existing wiring, and a second method using upgraded wiring. Why two methods?

The factory alternator output ranged from 28 amps on the early cars, to 45 amps on the later cars. The GM units can produce 55 or more amps (they can be bought with over 100 amp capacity if you want to spend the $$$). The wiring in the cars is only designed for the lower rating of the stock alternator. If you add heavy loads, driving lights, high power stereo, etc, you can exceed the capacity of the wires. Also, If you let the battery discharge completely, the alternator can possibly recharge with enough current to overload the wires.

If you use the stock wiring method, and you let your battery completely discharge, you should recharge it with a charger rather than push starting the car and letting the alternator recharge it. If you must do this, and you have an early model with an ammeter, keep a close watch on the ammeter, checking for overcharging. If you have a later model with a voltmeter, feel the wiring harness occasionally to check for signs of overheating.

If you use the upgraded wiring method, you can add loads and recharge a dead battery without any problems, but there is a penalty to pay for this on the early ammeter equipped models. You will either need to replace the ammeter with a higher range unit, add a shunt to it, or bypass the ammeter with the new wiring, in which case you will get an erroneous reading (see chapter 15, Gauges, for details on this). With a later voltmeter equipped model, there is no problem with using the upgrade method, as the voltmeter will work as before.

Unless you add large loads, or wish to be able to recharge a dead battery with the alternator, the stock wiring should not present a problem. The main advantage of the higher output is the ability to provide a higher charge rate at low RPM and idle. The standard loads on the TR6 do not require a higher charge current at normal engine speeds, so the alternator will not be called on to provide enough current to overload the wires.

PHYSICAL MOUNTING DETAILS

Although mounting details are beyond the scope of this manual, **figure 1**, below, may be valuable as you figure out the physical mounting details. All GM alternators have what is known as a "clock" position, that is, the terminals can be located at 3:00, 6:00. 9:00, or 12:00, as shown here. Often, the wiring can be greatly simplified with one clock position versus another. Regardless of the clock your unit comes with, any GM unit can be changed by the owner. Just remove the screws holding the case halves together, separate the case just slightly, and rotate to the preferred clock position.

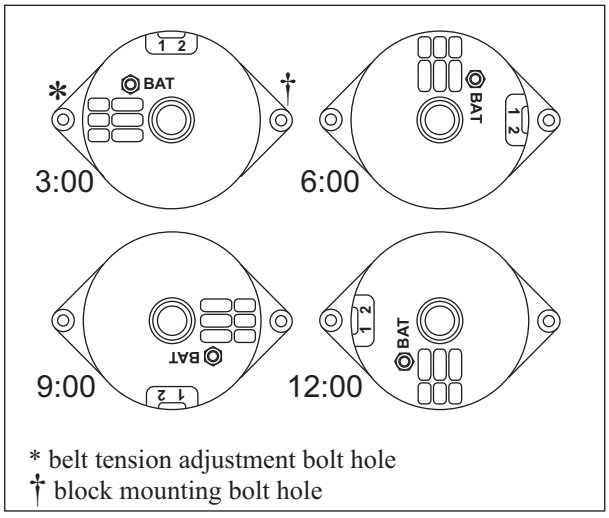

FIGURE 1

GENERAL PROCEDURES

Disconnect the ground lead from the battery before proceeding with any electrical work, and, of course, follow all the rules of proper wiring practices. I recommend using solder connections, and covering them with heat shrink tubing, but crimp type connectors will work quite well also. You will need butt connectors, suitable for the size of wires you are connecting, and a large ring connector for the screw terminal. For more details on wiring procedures, refer to chapter 10, Wiring Harness Repair.

ALTERNATOR CONNECTIONS

The Triumph factory wiring will differ a bit from one model to another, as will the connections at the alternator. The instructions below are all for using a GM alternator as a replacement, so the alternator connections will be the same for all models covered, and these connections will be described here, rather than repeated for each model.

On the side of the case of the new alternator, there are two spade lugs recessed into the body. The lugs are identified on the body of the alternator as either 1 & 2, R & F, or with no markings at all, depending on the particular unit you have. Regardless of the markings, the terminals will be the same, and will be located as shown in the following diagrams. You will need a plug (connector) for these. These plugs are readily available at an auto supply store, usually in a package hanging on the pegboard display rack in the electrical section, and usually identified as an alternator extension connector, or something similar. If not, the counter man will know what you are looking for. There will be two short wires already connected to the plug - one black wire, which goes to terminal #1, and one red wire, which goes to terminal # 2. Your existing wiring will be spliced to these leads. The plug is keyed, so it will only go into the alternator one way.

If you would prefer not to have splices, you can remove the terminals, and the wire, from the plug. Using new terminals of the proper type, connect directly to the existing Triumph wiring, and insert the terminals into the plug. New terminals (and new plug assemblies complete with terminals) can be purchased from, among others:

British Wiring
20449 Ithaca,
Olympia Fields, IL 60461
708-481-9050

The Wire Works
167 Keystone Road
Chester, PA 19013
800-292-1940

On the back of the case, you will find an insulated screw terminal, usually, but not always, labeled BAT. This is the main charging connection.

WIRING CHANGES

METHOD ONE (Utilizing existing wiring)

TR 250

At the alternator regulator (control box), you will find the following wires, as shown in **figure 2** below.

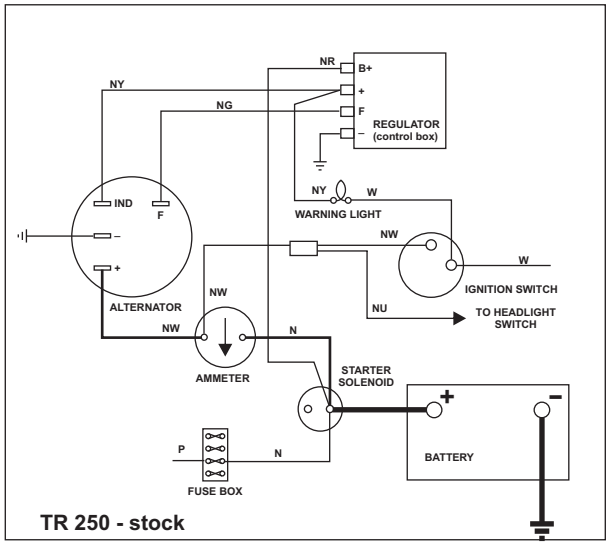

FIGURE 2

One black wire: Remove and discard.

Two brown/yellow wires: Remove and connect together.

One brown/green and one brown/red wire: Remove and connect together. **Figure 3** below shows the wiring changes after the conversion.

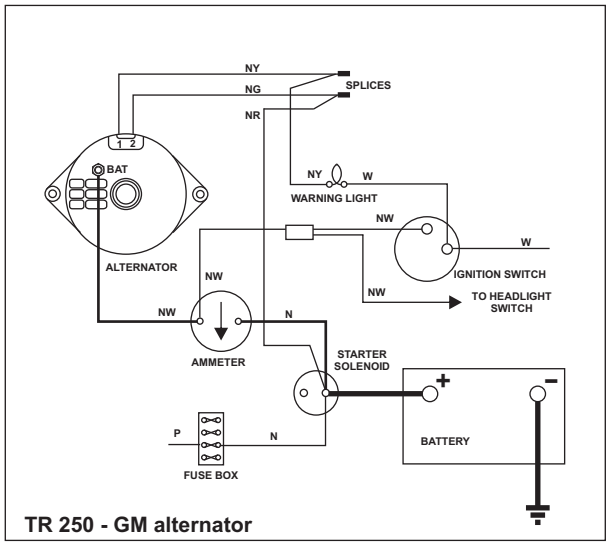

FIGURE 3

At this point, you have two options: you can either remove the control box or gut it and use it as a termination point for the revised wiring. If you gut the box and leave it

in places, you can make the wiring changes at the control box by terminating the wiring on the control box terminals, rather than using splices. If you wish to remove the box, you will need to use insulated connectors or solder and insulating tape to make the connections. Either way is satisfactory, but using the control box might be just a bit tidier, assuming you don't prefer to remove the box all together to reduce the overall clutter under the hood. If you leave the box there, and paint the GM alternator black, a concours judge might not even notice the change, if that's of concern to you.

At the old alternator, you will find three wires, one brown/green, one brown/white, and one brown/yellow: disconnect them from the generator, cut off the terminals, and leave in place. Remove the alternator.

At the new alternator, connect the Brown/Yellow wire to the plug wire going to the # 1 terminal, and connect the Brown/Green wire to the other lead from the plug (#2). Connect the Brown/White wire to the screw terminal, using a ring terminal. When you are finished, your wiring should be as shown above in **figure 3**.

TR6

At the stock alternator, you will find either a five, or a three, wire connector. If you have the five wire connector (See **figures 4**, and **5** below for wiring details), you will find a large Brown/White wire, a smaller Brown/Red wire (except for '72, which uses a Brown wire), and what appears to be three Brown/Yellow wires.

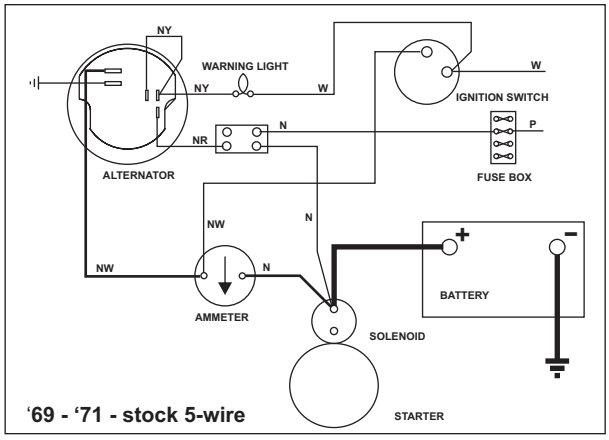

FIGURE 4

What appears to be three Brown/Yellow wires are actually only two. At one terminal, you will find two Brown/Yellow wires, and at another, you will find one. The single Brown/Yellow wire actually goes into the harness for a very short distance, and then turns around and comes back out, where it connects to the terminal with another Brown/Yellow wire. If you pull on the single Brown/Yellow wire, it will pull out of the harness, and you will see what I mean. You may have to loosen the harness a little bit to get it to pull out. That short piece of Brown/Yellow wire is to be discarded.

If you have a three wire connector (see **figure 6**, below), the short piece of Brown/Yellow wire has already been removed - either by the factory, on '73 and later models, or by a previous owner when he replaced the alternator with a later model. For '69 - '72, with an owner modification, the wire colors will be as above. For '73 and later, there will be a large Brown wire, a smaller Brown wire, and a small Brown/Yellow wire.

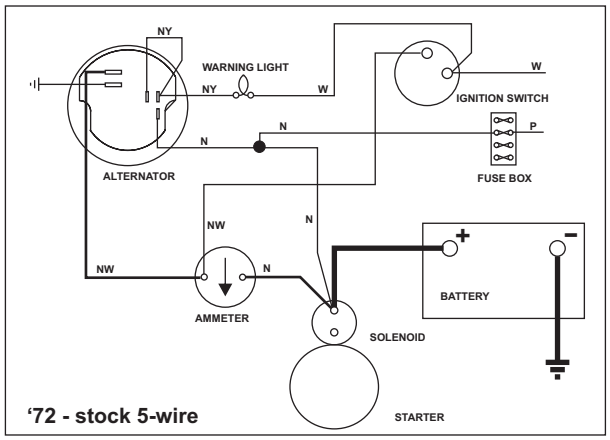

FIGURE 5

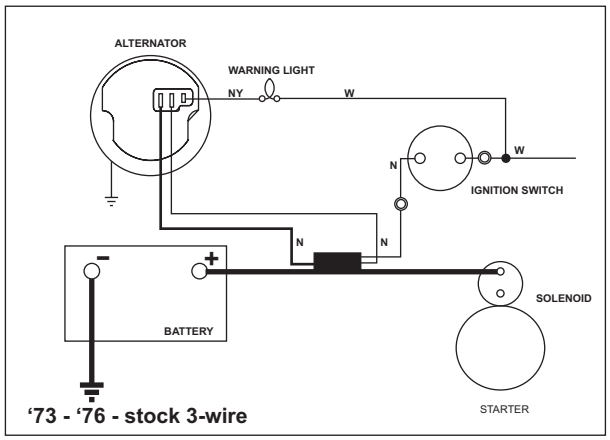

FIGURE 6

The large Brown/White (Brown) wire is the main charging lead. The small Brown/Red (Brown) wire measures the system voltage to tell the alternator how much to charge. The Brown/Yellow wire(s) operates the alternator warning light, and provides the initial voltage to the alternator to start it charging when the engine first starts. Refer to the chapter 4, Alternator Operation for more details on this.

FIVE WIRE MODIFICATIONS: Refer to **figures 7** and **8,** next page, Discard the short Brown/Yellow wire, as above. Cut off the terminals from the remaining Brown/Yellow wire, and from both the Brown/White, and the Brown/Red (Brown for '72) wires. Connect the Brown/Yellow wire to the lead coming from position (1) of the plug and Connect the small Brown/Red (Brown for '72) wire to the other terminal, (2). Connect the large Brown/White wire to the screw terminal. Insert the plug,

and you are finished.

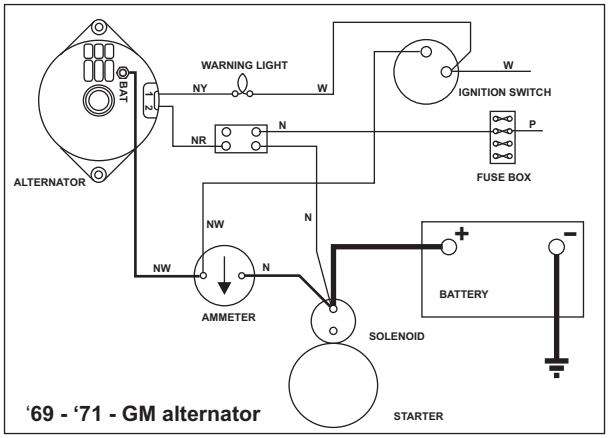

FIGURE 7

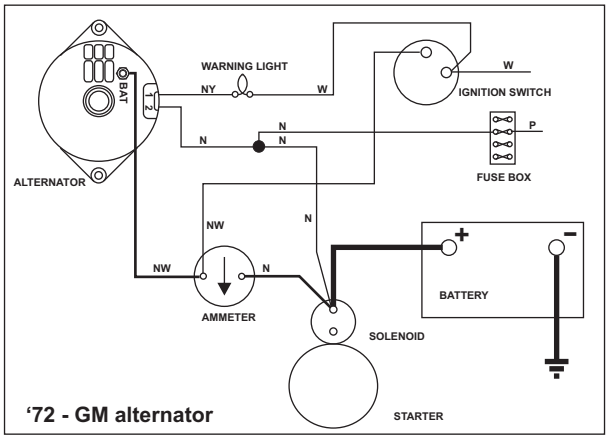

FIGURE 8

THREE WIRE: Refer to **figure 9** below. For '69 - '72, as above, except the short Brown/Yellow wire is not there. For '73 and later, connect the large Brown wire to the screw terminal, the smaller Brown wire to the lead coming from terminal 2 of the plug, and the Brown/Yellow wire to terminal 1. Insert the plug, and you are finished.

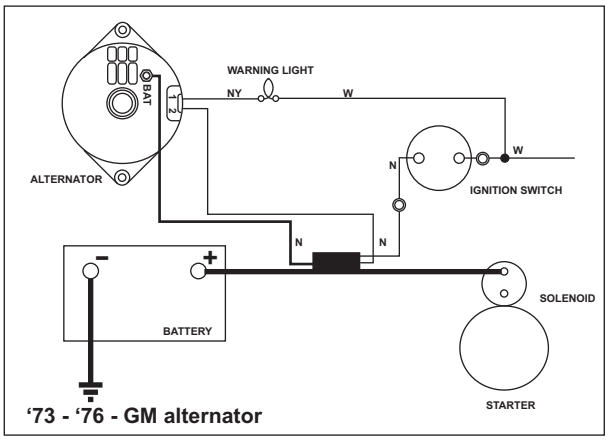

FIGURE 9

METHOD TWO (Upgraded wiring):

TR250/'69 - '72 TR6: For these models, if you wish to upgrade the wiring to take advantage of the higher output, you have two options - replace the existing wiring and replace or shunt the ammeter, or bypass the ammeter with new wiring.

The simplest method is to bypass the ammeter, as shown in **figures 10, 11,** and **12**, below.

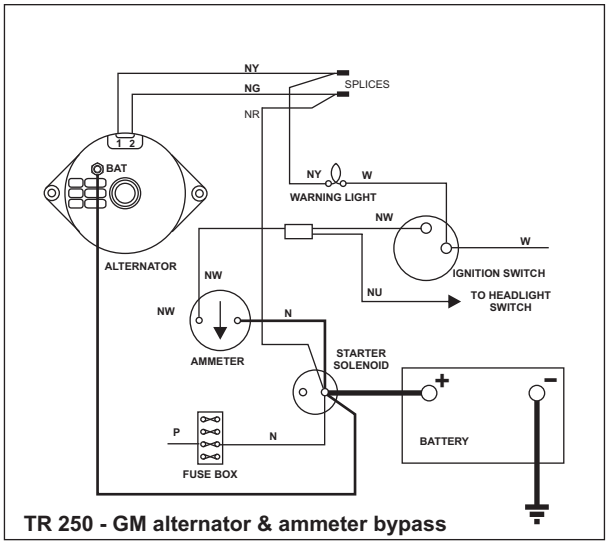

FIGURE 10

To do this, cut off both ends of the Brown/White wire - at the old alternator and at the ammeter - as close to the wire harness wrapping as possible (or, unwrap the harness, and remove the wire all-together). ***NOTE***: there are two Brown/White wires at the ammeter. Use a multi meter, or a continuity checker, to make sure you remove the correct wire. If you remove the wrong one, the car will have no electrical power. The wire you need to remove should be the larger of the two, if there is any size difference. Remove and discard the ends of the wires you just cut.

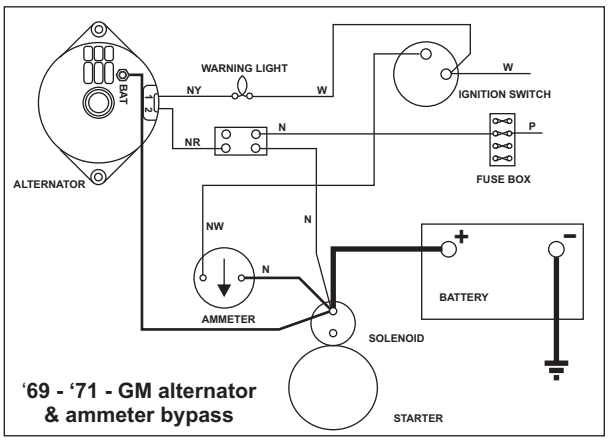

FIGURE 11

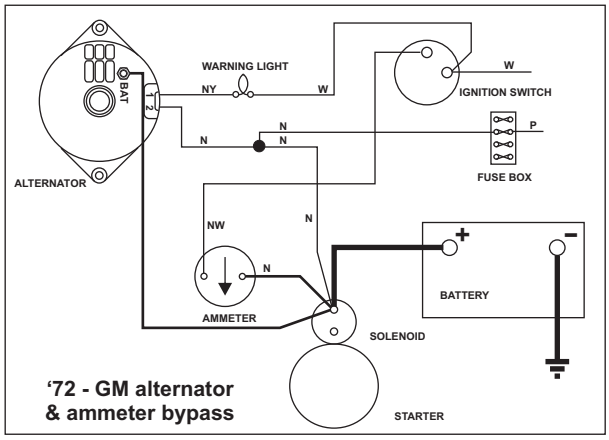

FIGURE 12

Next, instead of connecting the existing brown/white wire to the new alternator, add a new wire of at least 10 Ga (8 Ga preferred). Connect one end to the screw terminal at the alternator, and the other end to the terminal on the starter solenoid where the main cable from the battery is now connected. There are also two brown wires, (and a brown/red wire on the TR250) on this terminal. Leave them in place. Very carefully route the new wire alongside the existing wiring harness, and use cable ties liberally for support. Wired this way, the ammeter will no longer read correctly. See chapter 15, Gauges, for details.

If you wish to add extra loads, such as a high power sound system, connect them directly to the battery, or to the battery connection at the starter solenoid, properly fused, of course. Loads connected directly to the battery will not be indicated on the ammeter either. Again, see chapter 15 for details.

The second approach, although a bit more difficult, is actually a better way of upgrading. For this approach, you will need to replace the Brown wire from the starter solenoid to the ammeter, and replace the Brown/White wire from the ammeter to the alternator. The best way to do this is to open up the wiring harness and remove the wires, replacing them with new wires of at least 10 Ga.(8 Ga. preferred). Alternately, you can just cut and remove the ends of the old wires, as described above, and add new wiring alongside the old.

The next step is to replace or modify your ammeter. There are ammeters available with a 60-0-60 amp rating, but none of them will match your existing gauges. If you can live with the mismatch, this is probably the best way to go. If you want to retain the original gauge, you will need to add a bypass shunt to it. Instructions for doing this are included in at the end of this chapter.

Even if you use this method, it is still recommended that you connect any high power loads to the battery or the battery connection at the solenoid, as the remainder of the Triumph wiring may not be able to handle the load. Any load connected this way will be indicated on the ammeter as a charge current. The reasons for this are also described in chapter 15, Gauges. In this case, when these loads are on you will need to consider the charge indication as your new "zero" point. If the needle drops below this point, you are discharging the battery, while a reading above this point indicates a charging current.

'73 - '76 TR6: For these model years, the upgrade modifications are quite simple, as shown in **figure 13** below. To do this, cut off the ends of the large Brown wire from the alternator to the connector on the main battery lead (or open the harness and replace the wire), run a new wire, 10 Ga or larger, from the large terminal on the alternator to the battery terminal on the solenoid. As the '73 - '76 models did not use an ammeter, there is no drawback to the upgraded wiring method - the voltmeter will still read correctly. As for the other years, and for the same reasons, any high powered loads should be connected directly to the battery, either using the now unused terminal on the battery cable connector, or at the solenoid.

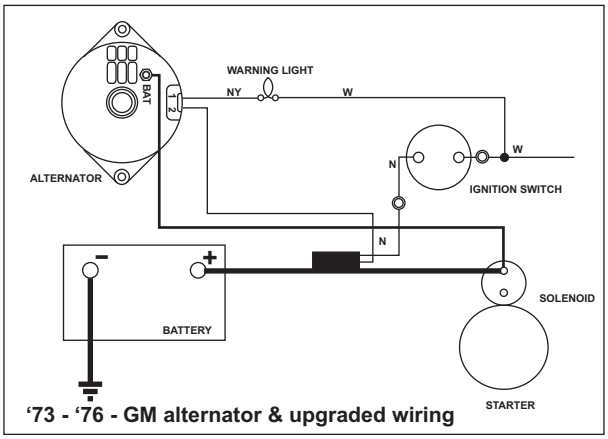

FIGURE 13

OPTIONS:

There are several other ways to do the replacement. For example, you may wish to replace the ammeter with a voltmeter. To do this, just remove the ammeter, and connect all the wires from the ammeter together (excluding, of course, the wires for the illumination lamp). Be very sure that you have a good connection here, as this junction will carry a lot of current. If the connection is not good, a lot of heat can be generated, and a lot of heat is NOT what you want under the dash.

Connect the replacement voltmeter to the wiring, tying one side (the positive post of the VM if your VM is polarity sensitive - most are not. See chapter 15, Gauges, for details) to a convenient green wire, and the other, or minus, side to a good ground. The voltmeter draws very little current, but the wiring used to connect to the green wire should be at least 14 gauge because of the fuse size used in the green wire circuit. The size of the ground wire isn't important, and can be as small as 20 gauge with no

problem. Either reuse the old lamp holder from the ammeter, if it fits, or cut and splice the old wires to the new lamp holder.

You may also choose to use a different alternator, rather than the GM unit. If so, it will be wired very similarly to the above, only the connections at the alternator itself will be different. All internally regulated alternators have the same basic connection requirements. Each requires four connections - ground, main charging, sensing, and warning light. The general arrangements of these connections may differ, and in some cases the connections are made internally, but they are all basically the same. If you want to use another make, go to the public library and get a manual for the car which uses your choice, and determine the connection scheme for it in the manual. Mechanical mounting details may differ significantly from one make of alternator to another, but, in most cases, fabricating mounting brackets is well within the capability of most backyard mechanics.

Once you have identified the proper connections, it's a simple matter then to transfer that data over to correlate with the equivalent GM connections as described here. If you are not sure, take your alternator and this manual to an alternator repair shop and ask the folks there to correlate the data for you. Usually, they will not charge you to do this, but even if they do, the cost will be minimal, and well worth it for the peace of mind it will bring.

Although I have no personal experience with them, it has been reported that a Bosch alternator from a Ford Fiesta is a "bolt-on, plug-in" direct replacement for a Lucas alternator with the three terminal arrangement. The part number for these units has been given as (120 489 346) or (120 489 347). The only modifications reported is the need for a slightly longer belt. The Fiesta has an output of 70 amps, but is a bit more expensive than the GM.

WIRING DIAGRAMS

In this chapter, I have included nine diagrams, one before and two after, for each of the three alternator connections used in the TR250 and TR6. These diagram do not depict all of the connections used by Triumph - only those for which documentation has been provided by official Triumph or Triumph approved publications, or for which I am personally acquainted. These cars have also appeared with other configurations at various times. I did not attempt to include every configuration, because of the uncertainty involved. I have no way of knowing if the different wiring schemes are original factory installations or modifications made by previous owners, and, in many cases, it is not possible to determine the exact wiring scheme without tearing up the wiring harness. As you can imagine, not many owners are willing to let me do that!

With the information supplied in this and the alternator operation chapter, it should not be difficult to arrive at the proper wiring scheme for the other situations.

AMMETER SHUNT

If you wish to upgrade to a larger capacity alternator, yet want to retain your ammeter, all is not lost, as there is a relatively simple modification you can make to allow the ammeter to function with as large a current as you choose. Although the modification is quite simple, a little experimentation will be required to implement it.

Ideally, an ammeter has zero resistance; it's in the main lead supplying power to the whole car, so it carries a lot of current, and any large resistance here would drop an excessive amount of voltage. In reality, though, an ammeter has some resistance, just a few thousands of an ohm. Looking at **photo 1** below, you can see that the current carrying portion of an ammeter is nothing more than a piece of wire, thus the resistance of the ammeter is just the resistance of that piece of wire.

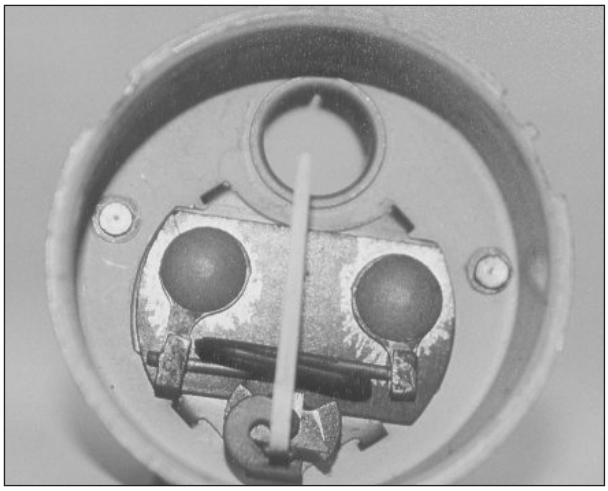

PHOTO 1

The internal ammeter wire may be capable of carrying more than 30 amps, and, although I can't say with any absolute certainty, it appears that no damage would be done to the movement if it were operated well over its range, it would still be nice to have the needle operate within the meter dial range, without banging the sides. One way to bring the ammeter scale into range is to have the excess current shunted around the ammeter. This is shown in **figure 14**, next page.

If you recall from chapter 1, Introduction, the circuit shown is a parallel circuit, and in a parallel circuit, the voltage on each component is the same, while the current is split between the components. If the resistance of the shunt is equal to the resistance of the meter, the current will be evenly split between the two. In this instance, the current capacity of the meter would be doubled to 60 amps. The meter dial would still say 30-0-30, so you would have to mentally double your reading to get the true reading, certainly not a problem.

As the meter is just a piece of wire, another piece of wire

of the same gauge and length would have the same resistance as the meter, and the current would be split 50 - 50. The wire in the ammeter shown in **photo 1**, taken from a '71 TR6, measures to be an approximately 3 inch long piece of 15 gauge copper wire. A 3 inch piece of 15 gauge wire used as a shunt would then give you 50 - 50 split. Unfortunately, 15 gauge wire is not readily available for use, but a slightly longer piece of 14 gauge, or a slightly shorter piece of 16 gauge, would do nicely. The ammeter wire size measurement was not a laboratory precise measurement, so experimentation will be required to arrive at the actual length and gauge of wire needed. You may prefer to split the current in a different ratio, depending on the output capability of your alternator. If, for example, you have a 100 amp alternator, you may wish to split the current 70:30.

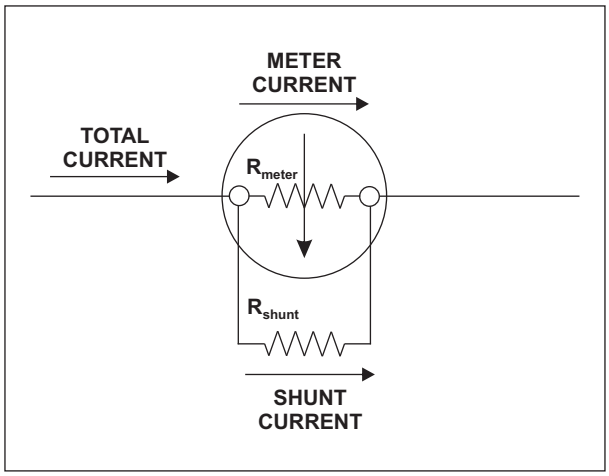

FIGURE 14

Probably the best way to size the shunt would be to set up a load on the ammeter, using a battery or a battery charger as a source of power, and noting the current. The load should be sized to draw near mid-scale current. A few old headlights would do nicely. Starting with a "guesstimated" length of wire as a shunt, adjust the length as needed to arrive at the desired current split. It is not at all necessary that your final reading be very accurate, as the meter dial is not readable with much precision anyway, and a precise value isn't needed.

Even if you use this method, it is still recommended that you connect any high power loads to the battery or the battery connection at the solenoid, as the remainder of the Triumph wiring may not be able to handle the load. Any loads connected this way will be indicated on the ammeter as a charge current. The reasons for this are described in chapter 15, Gauges.