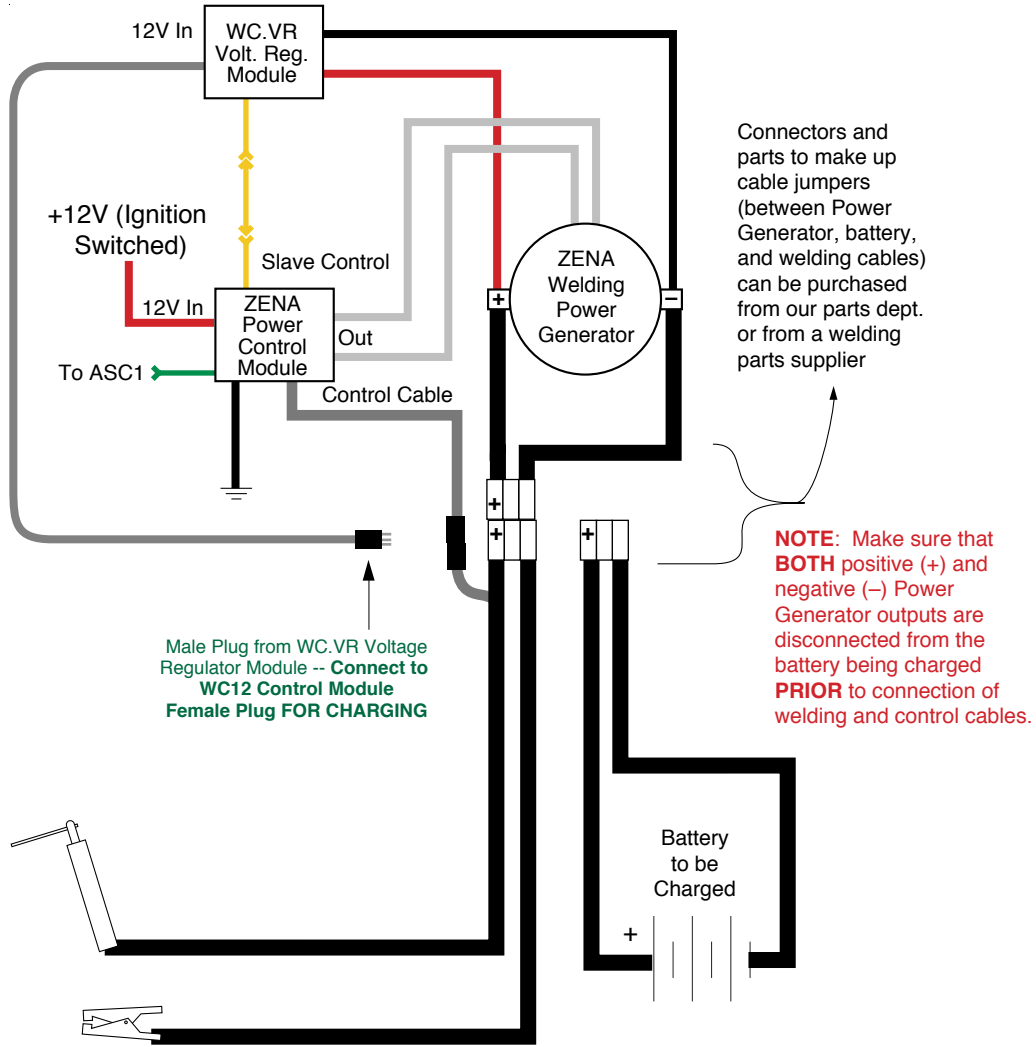
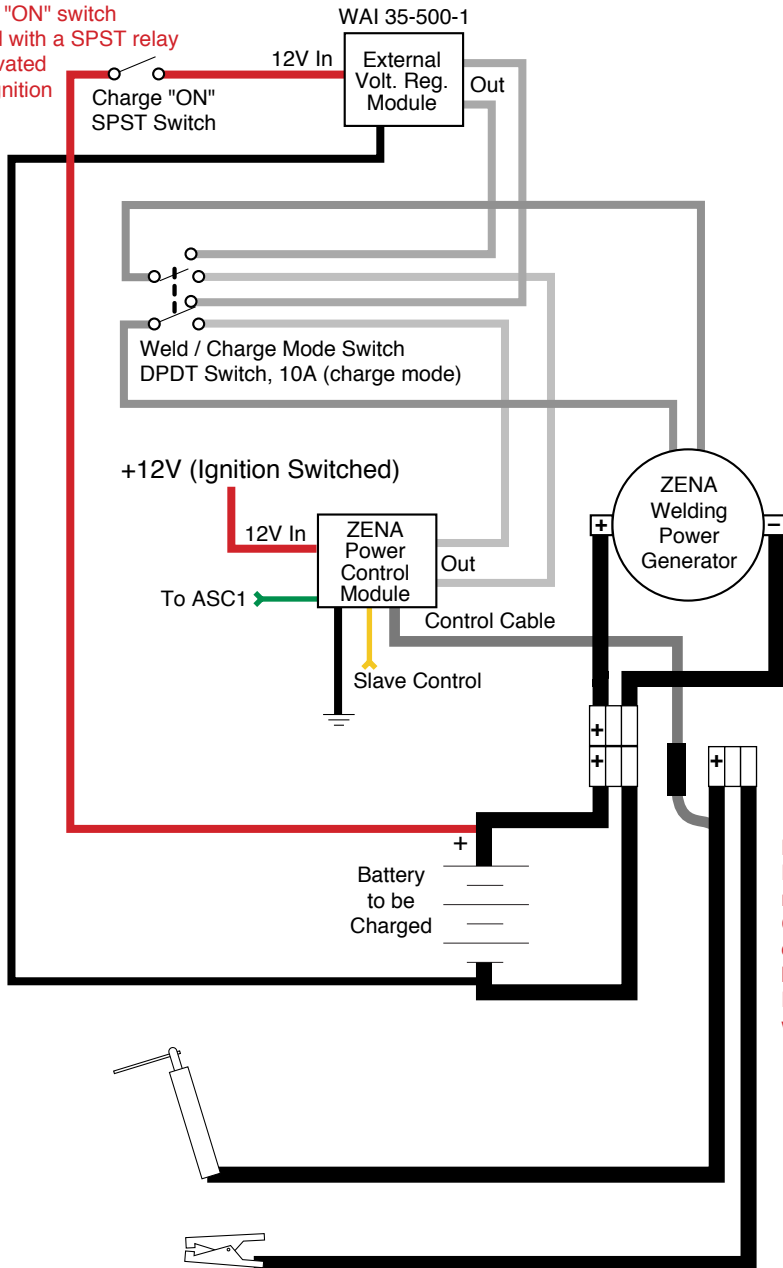


**Appendix C Part 1 -- Schematic -- Using a ZENA mobile welding system with the ZENA WC.VR voltage regulator for battery charging . . . and/or for added system functionality -- i.e., for powering hi-amp inverter, automatic quick charging, vehicle alternator replacement, etc.**



**Appendix C Part 2 -- Schematic -- Using a ZENA mobile welding system with an automotive type voltage regulator (i.e., ZENA Model WAI 35-500-1) for battery charging . . . and/or for added system functionality -- i.e., for powering hi-amp inverter, automatic quick charging, vehicle alternator replacement, etc.**

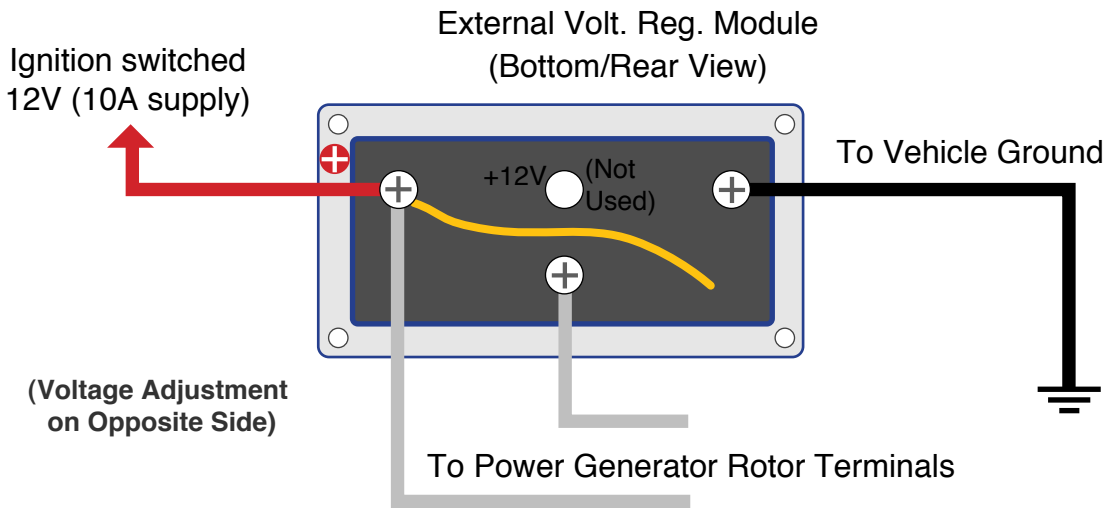
**NOTE:** Charge "ON" switch can be replaced with a SPST relay wired to be activated by the engine ignition circuit



Connectors and parts to make up cable jumpers (between Power Generator, battery, and welding cables) can be purchased from our parts dept. or from a welding parts supplier

**NOTE:** Make sure that **BOTH** positive (+) and negative (-) Power Generator outputs are disconnected from the battery being charged **PRIOR** to connection of welding and control cables.

**Appendix C Part 3 -- Wiring Diagram -- Model WAI 35-500-1 External Voltage Regulator**



**NOTES / INSTRUCTIONS:**

- 1) This external voltage regulator is an A-Circuit type regulator (continuous 12V to one leg of rotor, active ground to the other). As wired, this regulator is ignition excited/triggered. However, It can also be excited by either to a stator terminal or to a diode trio. The Yellow wire is the input to the trigger circuit. If the regulator is to be excited by the stator or a diode trio, the yellow wire is removed from the positive terminal and attached to the appropriate trigger point.
- 2) The diagram above shows how this regulator is attached to the ZENA Power Generator. Gray wires to the rotor terminals -- either wire to either terminal.
- 3) The Power Generator's Rotor can draw as much as 8 amps. Make sure that supply current is sufficient and that the supply is properly fused (10A). Proper voltage regulation requires a good current source.

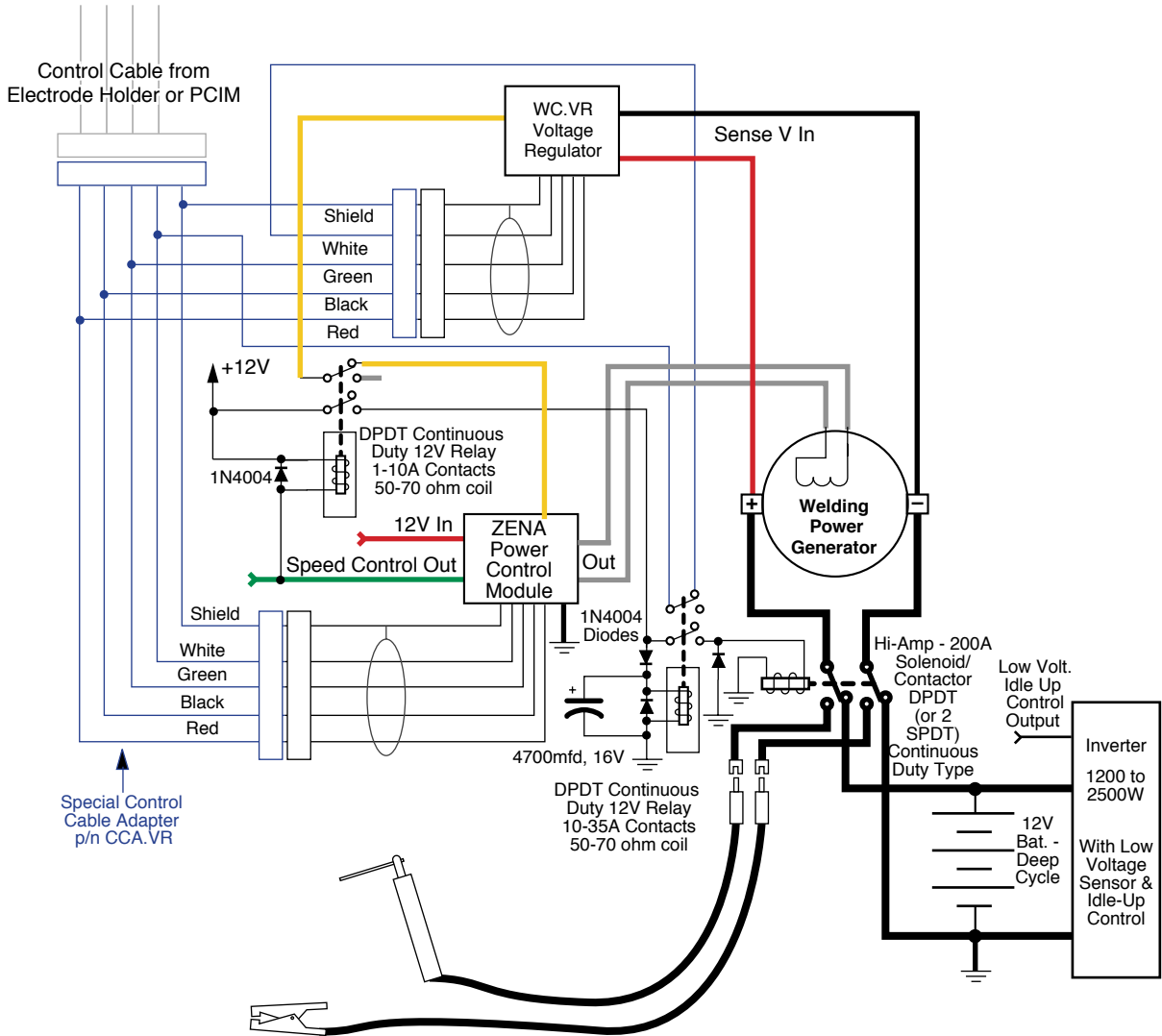
**IF YOU DO NOT HAVE A SWITCHED IGNITION SOURCE THAT CAN SUPPLY SUFFICIENT CURRENT, USE A HIGH CURRENT RELAY TO SUPPLY THE REGULATOR WITH CURRENT DIRECTLY FROM THE BATTERY (VIA A 10A FUSE) -- WITH THE RELAY SWITCHED BY THE IGNITION CIRCUIT.**

- 4) The voltage regulator's heat sink/case is not grounded. Grounding the heat sink/case will not affect operation of regulator and is not necessary for operation.
- 5) This is a 14V regulator with adjustable output voltage. It should be set to the system charging voltage recommended by the vehicle manufacturer. For aggressive charging, set voltage slightly higher than 14V (but no greater than 14.4V, for less aggressive charging set voltage to slightly LESS than 14V (13.8V is a common set point). To reach the adjustor, temporarily remove plastic cap covering the screwdriver adjustment point on heat sink/case.

**BEFORE ADJUSTING, MAKE SURE THAT THE BATTERY IS FULLY CHARGED. MEASURE VOLTAGE AT THE BATTERY AND USE A PRECISION VOLTMETER WHICH HAS BEEN PROPERLY CALIBRATED.**

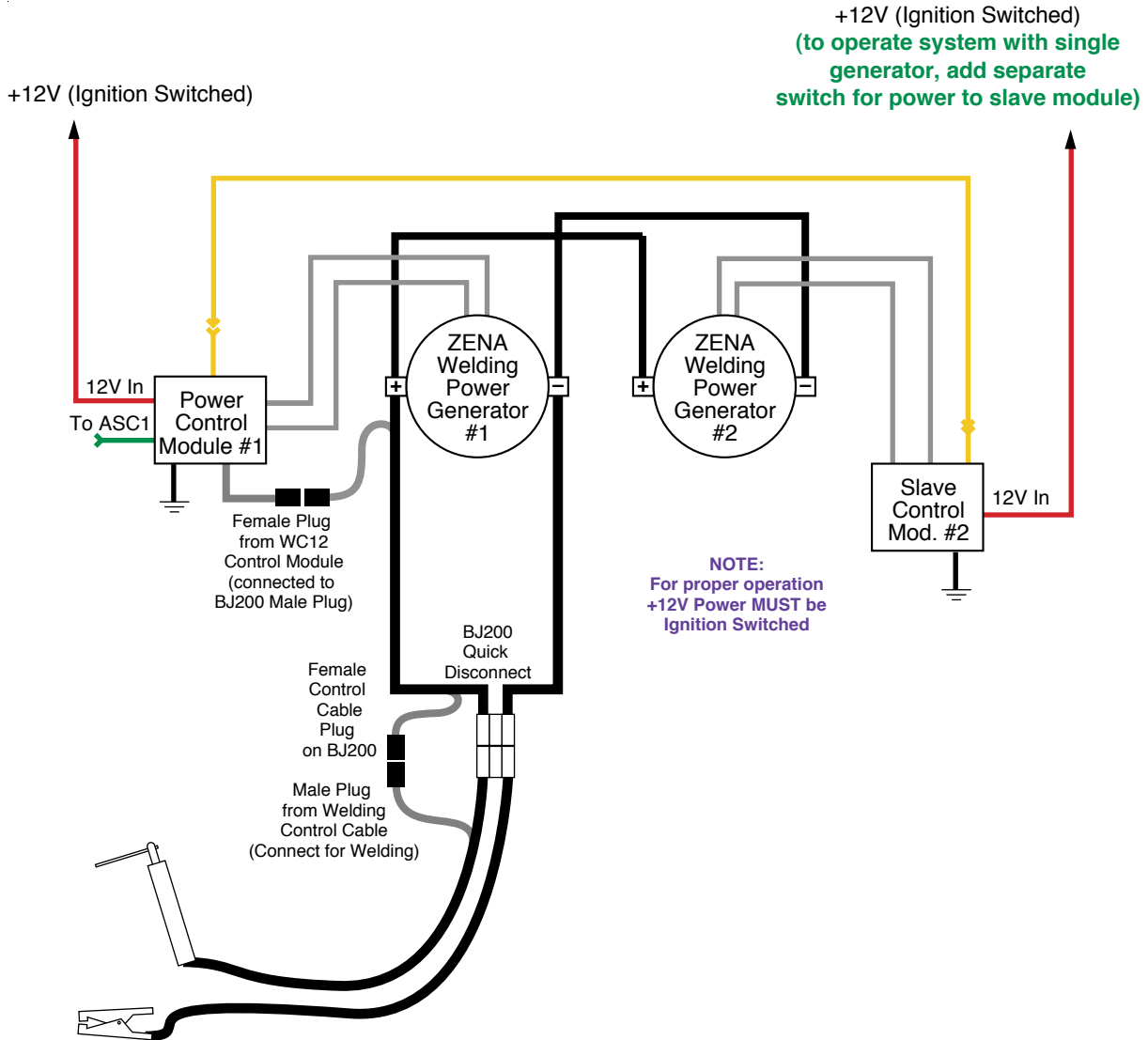
- 6) Maximum power is produced at higher engine speeds. Using an automatic engine speed control or some other means to increase engine speed will insure fastest possible battery charging or maximum extra power for your accessories.

**Appendix C Part 4 -- Schematic -- Method of AUTOMATICALLY switching power generator control between a Model WC.VR voltage regulator and a welding power control module . . . for added system functionality -- i.e., for powering hi-amp inverter, automatic quick charging, vehicle alternator replacement, etc.**

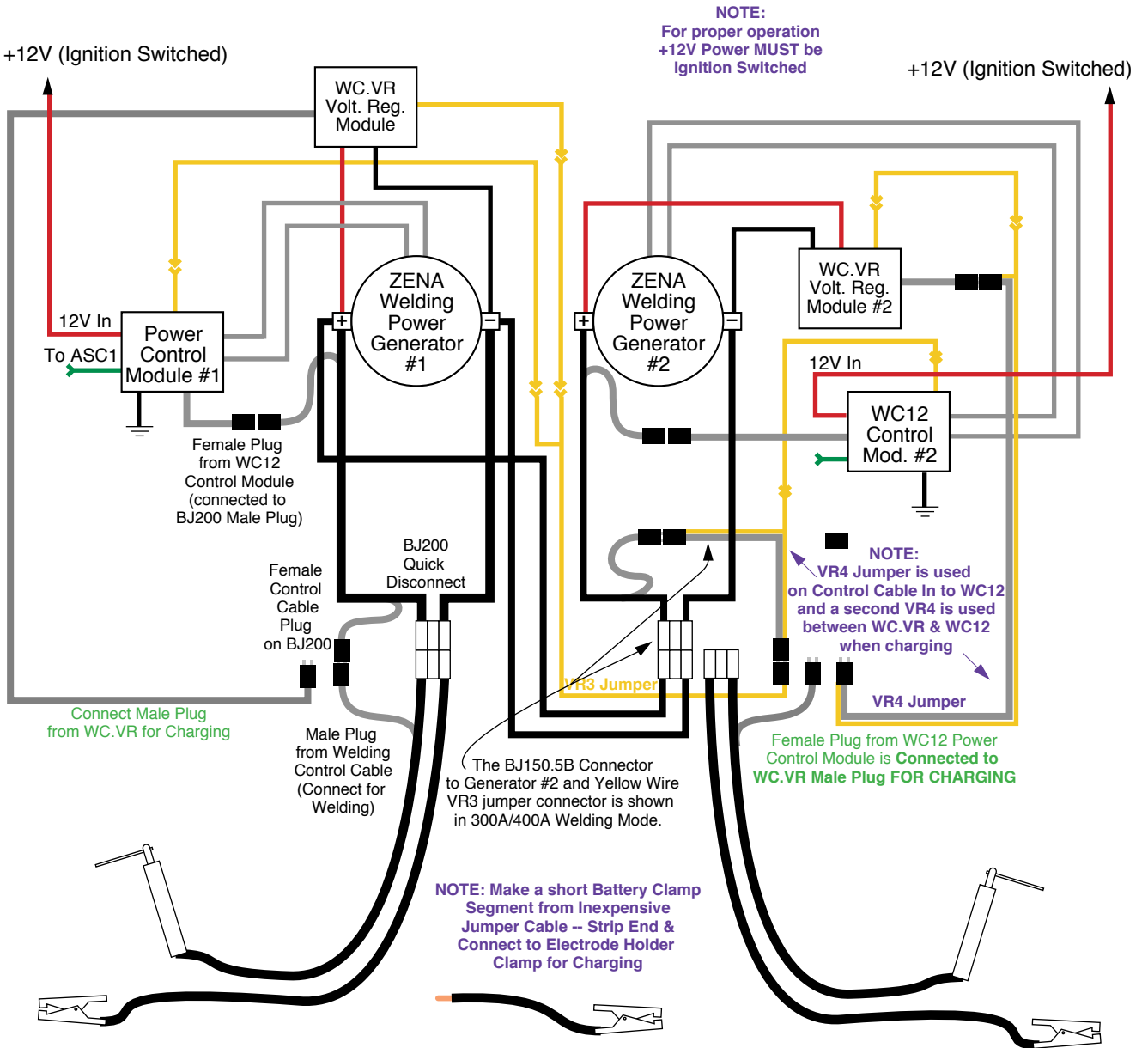


**NOTE:** Depending on desired function of vehicle speed control system, other components may be necessary to insure proper idle up when inverter demand is high and to insure proper operation of relays and/or vehicle engine speed control components.

**Appendix C Part 5 -- Schematic -- A 300A or 400A ZENA mobile welding system**

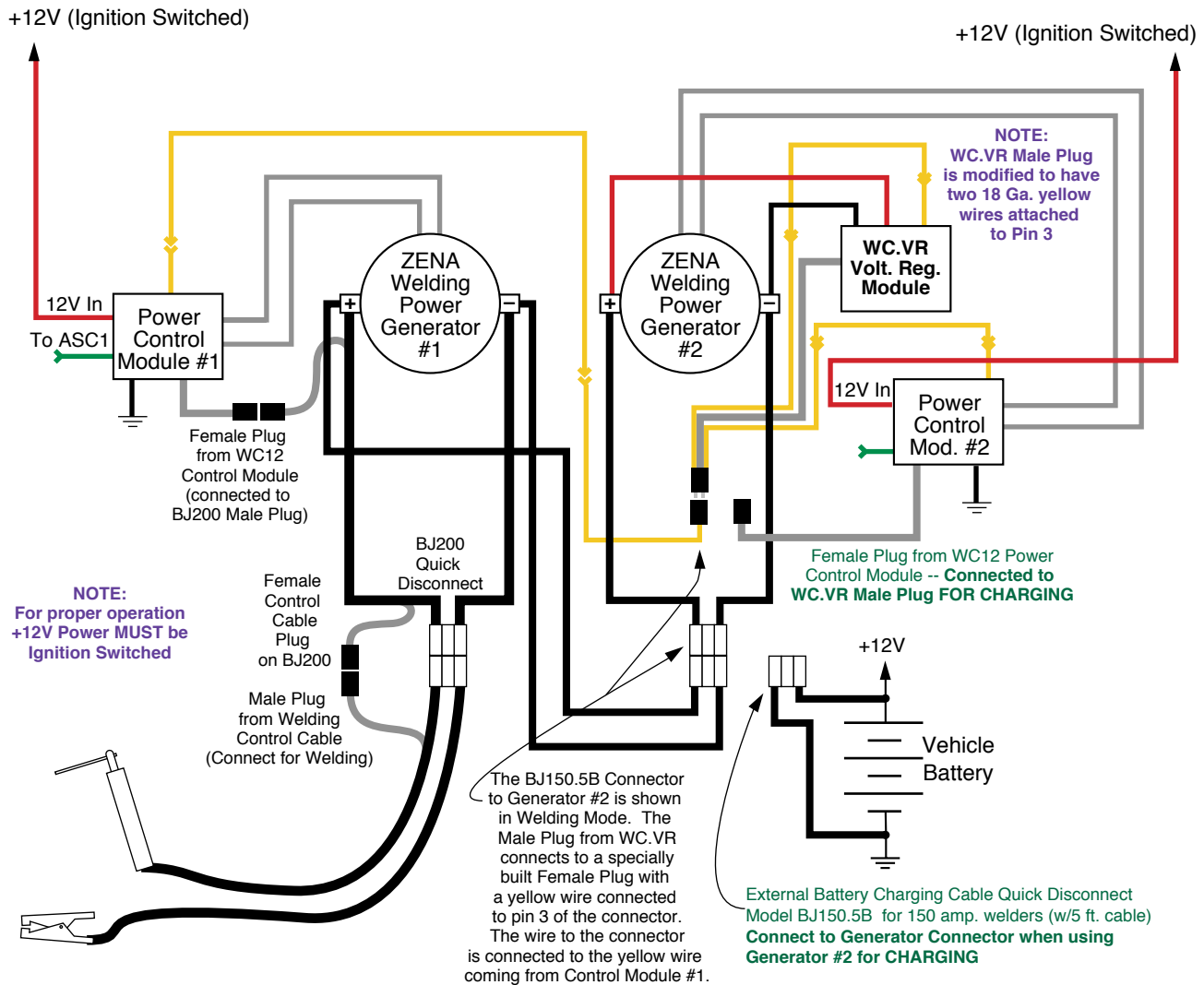


**Appendix C Part 6 -- Schematic -- A 300A or 400A welding system set up for single OR dual operator control/welding**

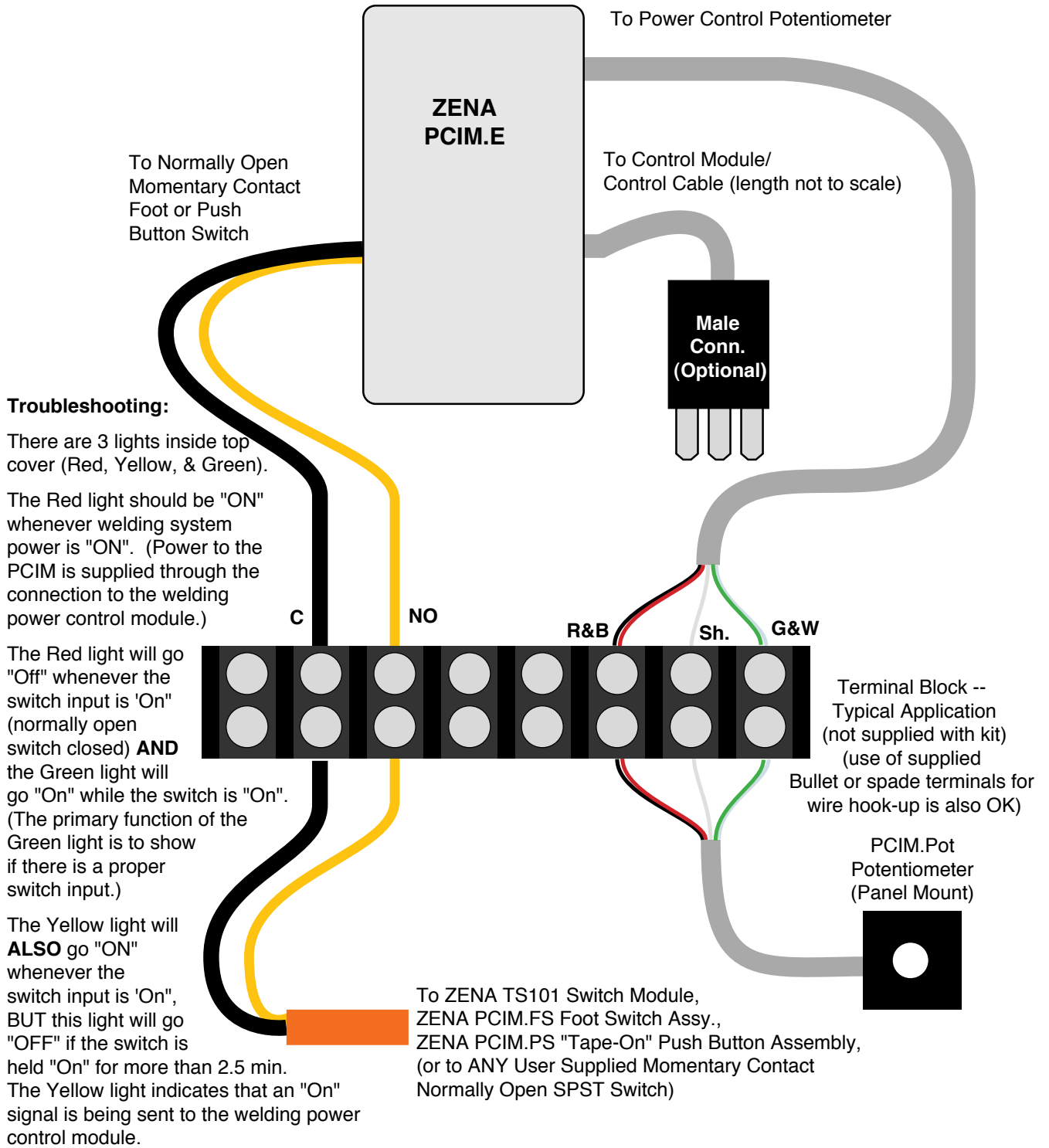


**Appendix C Part 7 -- Schematic -- Using a WC.VR Voltage Regulator in a dual generator welding system so that one power generator may be used for vehicle charging while welding with the second generator (dual generator welding is done with vehicle charging disabled)**

**(Connections shown in welding mode).**



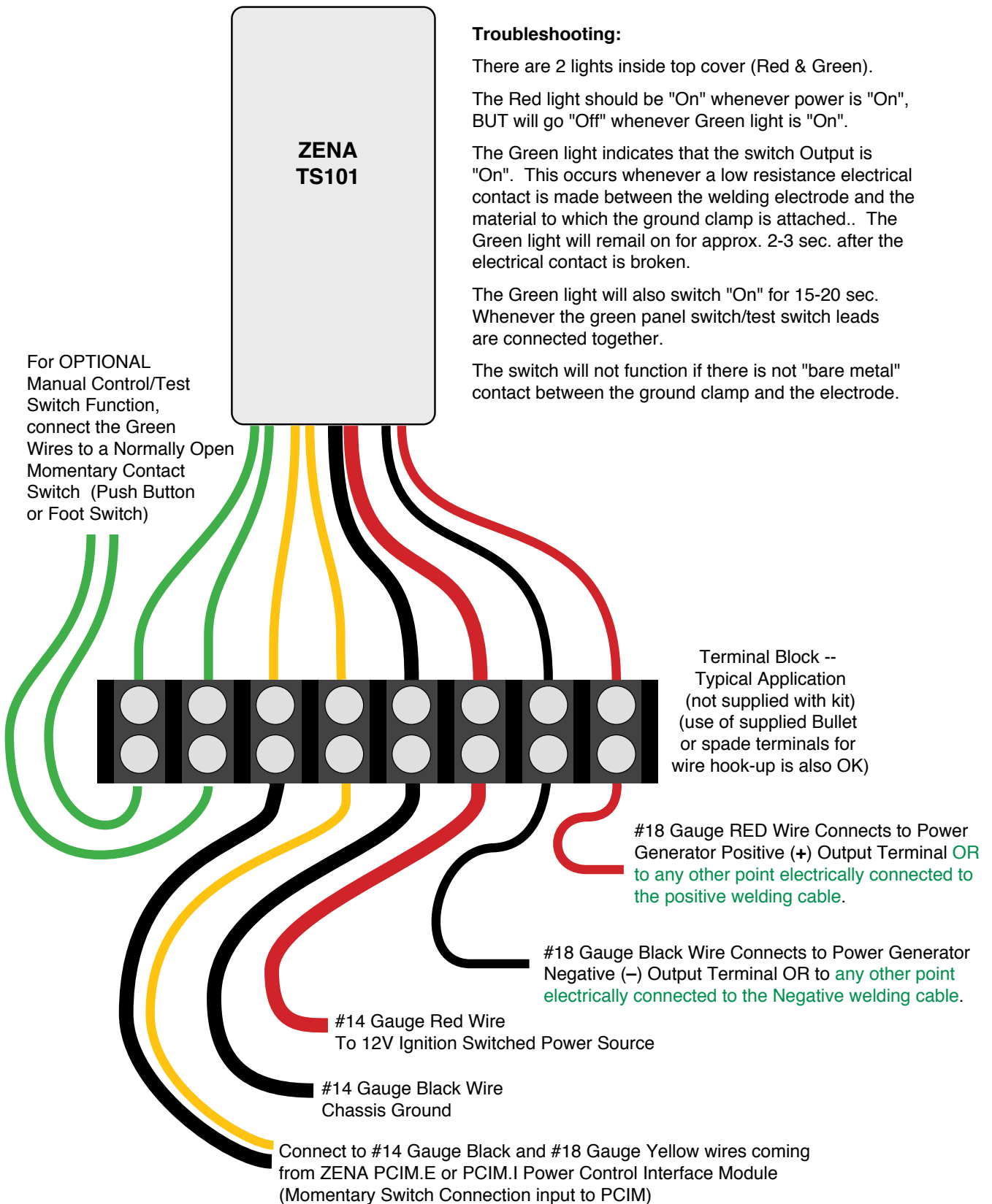
**Appendix D Part 1 -- Wiring Diagram -- ZENA Power Control Interface Module Model PCIM -- Panel Mount Type (Model PCIM.E) -- Typical Hookup**



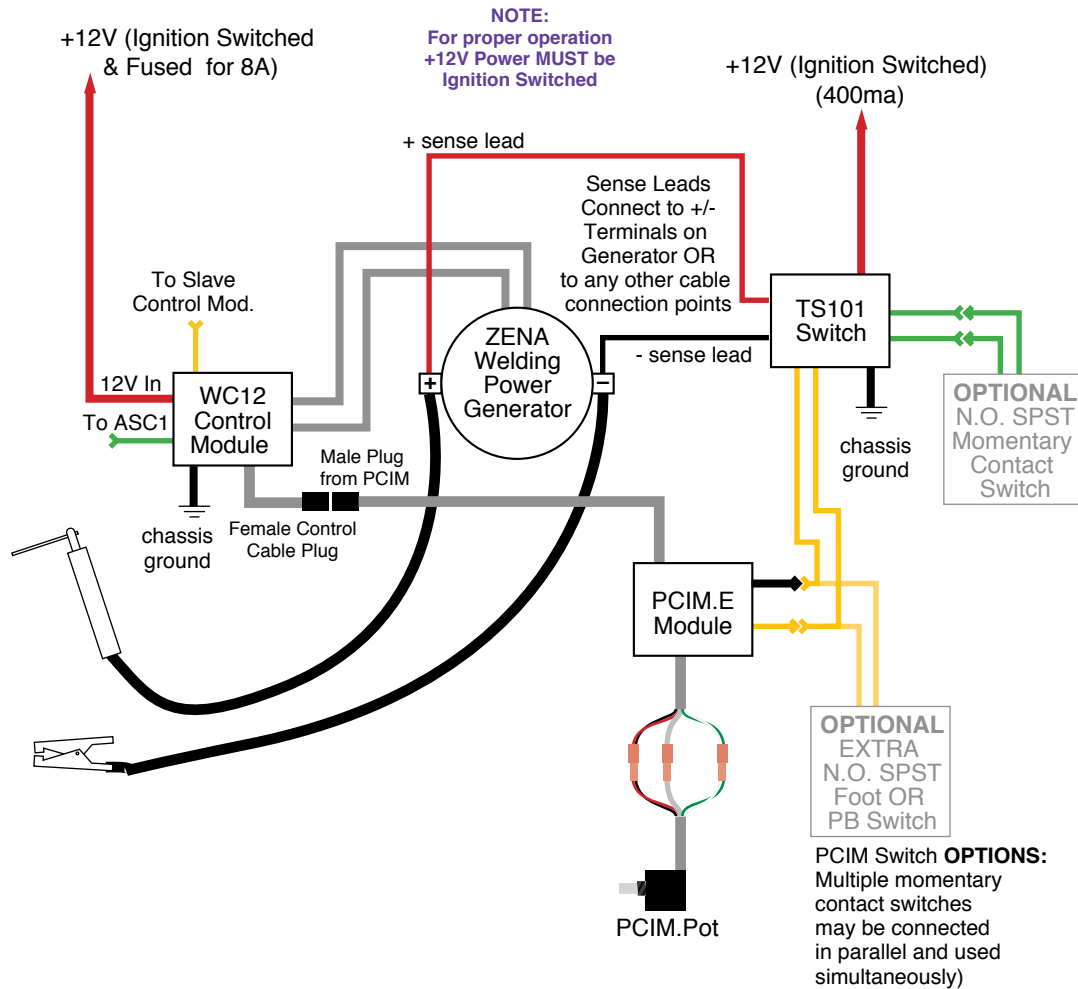
The Yellow light will also show that the safety time-out circuit which is built into the PCIM is working. Should the momentary contact switch is held on for more than 2-1/2 minutes, the PCIM will automatically switch the control signal to the power control module "Off" to prevent possible damage to the welding system. In this case, the Yellow light will be "Off" (no power on to welder), but the Green light will still be "On" (switch held on).



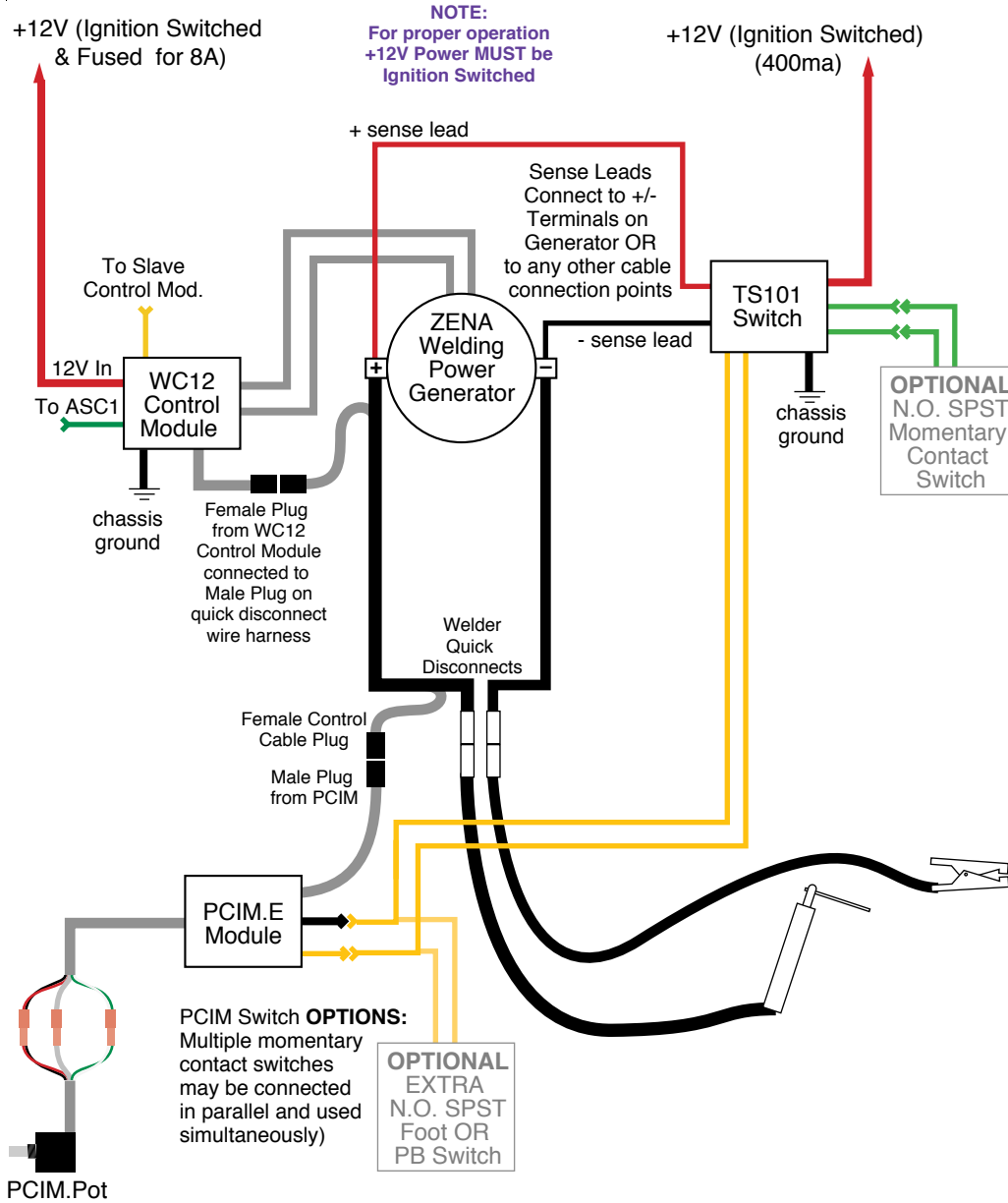
**Appendix D Part 2 -- Wiring Diagram -- ZENA Electrode Contact Sensor/Switch Module Model TS101 -- Typical Hookup**



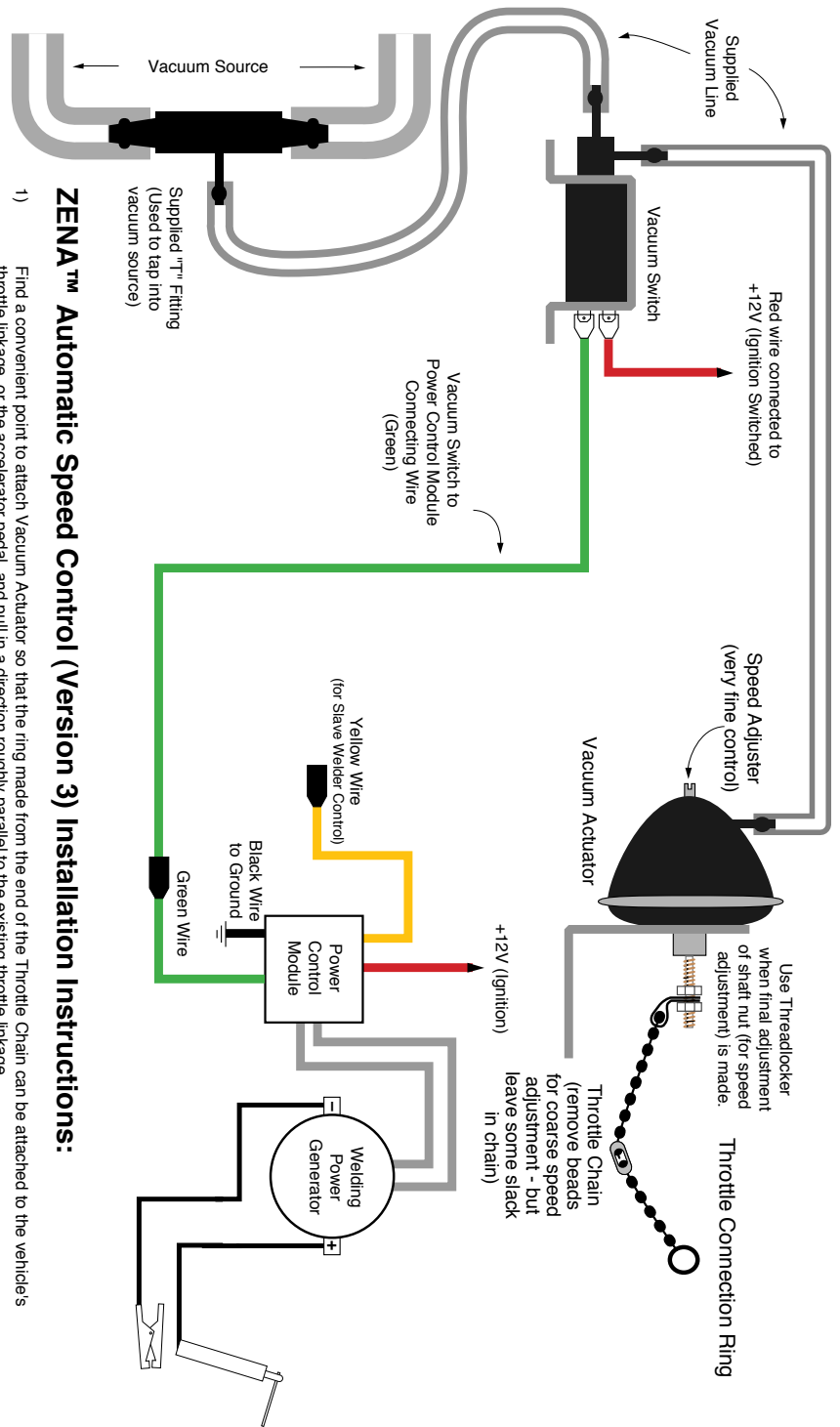
**Appendix D Part 3 -- Schematic -- Using a ZENA TS101 Electrode Contact Sensor Switch with a PCIM.E Power Control Module, and a PCIM.Pot, & OPTIONAL normally open momentary contact switch (i.e., a PCIM.FS or PCIM.PB or other compatible switch)**



**Appendix D Part 4 -- Schematic -- Using a ZENA TS101 Electrode Contact Sensor Switch with a BJ150.4 Quick Disconnect Kit and a PCIM.E Power Control Module, and a PCIM.Pot, & OPTIONAL normally open momentary contact switch (PCIM.FS or PCIM.PB or other compatible switch)**



## Appendix E Automatic Speed Control Version 2 -- Installation Diagram & Instructions

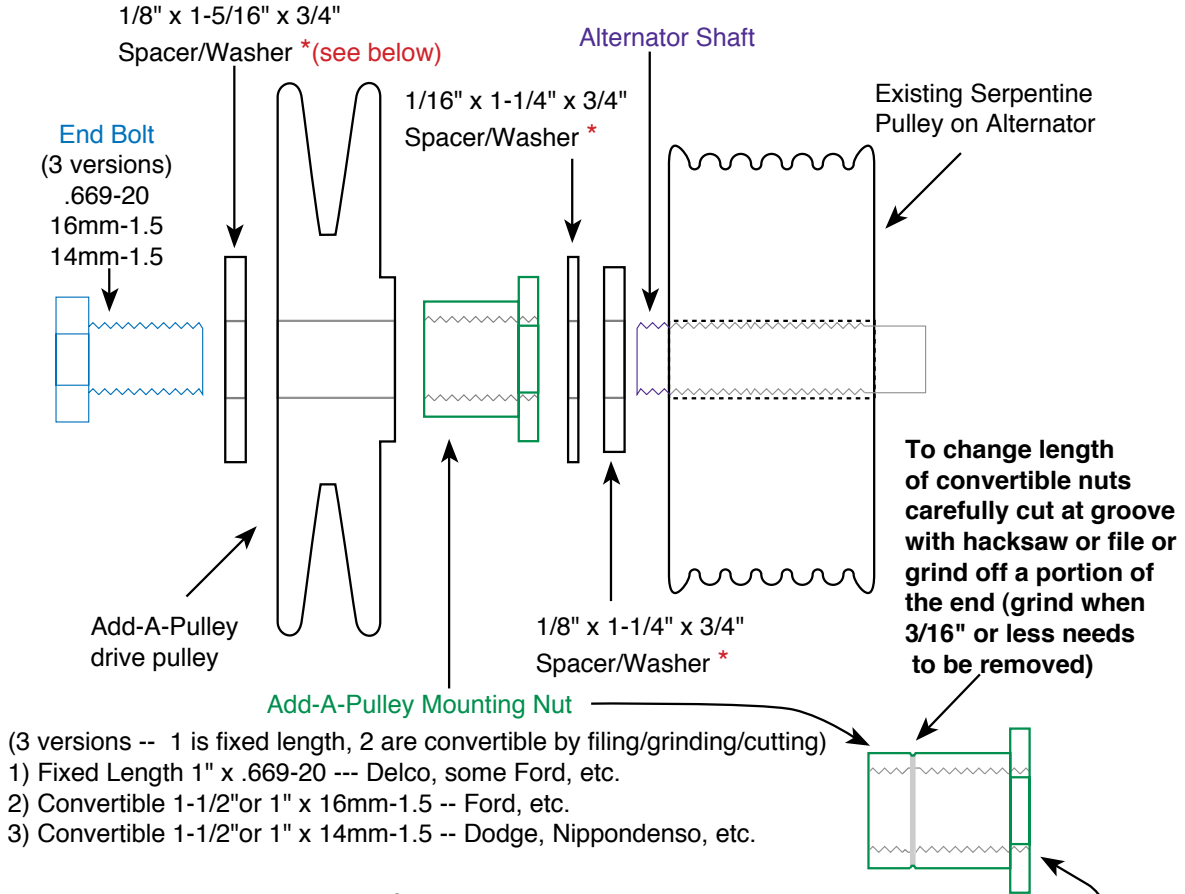


### ZENA™ Automatic Speed Control (Version 3) Installation Instructions:

- 1) Find a convenient point to attach Vacuum Actuator so that the ring made from the end of the Throttle Chain can be attached to the vehicle's throttle linkage, or the accelerator pedal, and pull in a direction roughly parallel to the existing throttle linkage.
  - 2) Attach Throttle Chain to throttle linkage (or pedal) – adjusting length of the chain (by removing beads and/or by adjusting shaft nuts) so that it has just a little slack (it should not pull when at rest).
  - 3) Find a convenient point to attach the Vacuum Switch. **NOTE:** It will be connected to your welder's Power Control Module and to a switched 12 volt source and to a suitable vacuum source.
  - 4) Using the supplied Red wire and connectors, attach the Vacuum Switch to a suitable switched 12 volt power source.
  - 5) Attach the Vacuum Switch to a suitable vacuum source using either the supplied "T" connector to tap into a high volume vacuum line attached to the intake manifold or to a suitable unused vacuum fitting on the intake manifold.
  - 6) Attach the Green Wire which extends from your welder's Power Control Module to the Vacuum Switch using the supplied Green wire and connectors.
  - 7) This completes the installation. With the vehicle running, and with the welding cables attached to the Power Generator, test the Speed Control by pressing the Power Button. The vacuum actuator should pull the throttle and the engine will speed up. Make a "coarse" adjustment by setting the position of the shaft nuts and or the amount of slack in the beaded chain. Then fine adjust the welding speed by using the speed adjuster screw located on the Vacuum Actuator (on the end opposite the Throttle Chain).
- NOTE:** In some cases, a throttle spring may be quite stiff -- preventing the Vacuum Actuator from easily moving the throttle. In this case, a "helper" spring can be used to counteract, partially, the force of the throttle spring and/or a second Vacuum actuator may be used to double available force. (If you need this actuator, call our parts department and order p/n ACT1.)

## Appendix F Using the ZENA universal Add-A-Pulley™ alternator power take off kit

diagram shows a typical assy. after removal of existing alternator pulley end nut)



### Typical Assembly Instructions/Notes:

(\* not all installations use/need all spacers – spacers shown are for a typical Delco):

- 1) It is not necessary to remove tension from serpentine belt
- 2) Remove existing alternator pulley nut (use impact wrench for best results)
- 3) Slip 1/8" and/or a 1/16" Spacer/Washer onto alternator shaft (**IF NEEDED**) (spacers are used **only** in cases of End Bolt to Alternator Shaft interference)
- 5) Thread Add-A-Pulley Mounting Nut onto Alternator Shaft and tighten finger tight
- 6) Slip Add-A-Pulley pulley onto Mounting Nut (if Mounting Nut extends completely through Add-A-Pulley, file/cut/grind Mounting Nut along groove to shorten)
- 7) Slip 3/16" Spacer/Washer (1/8" for 14mm) onto End Bolt
- 8) Thread End Bolt into Add-A-Pulley Mounting Nut and tighten finger tight
- 9) Check for contact between End Bolt and Alternator Shaft (add/remove spacers)
- 10) With parts assembled without interference/contact, disassemble and reassemble tightening Mounting Nut and End Bolt securely

Note: thread locking chemicals may be used -- use stud locking type for contact area between Add-A-Pulley drive pulley and use removable type for all bolt and nut attachments)

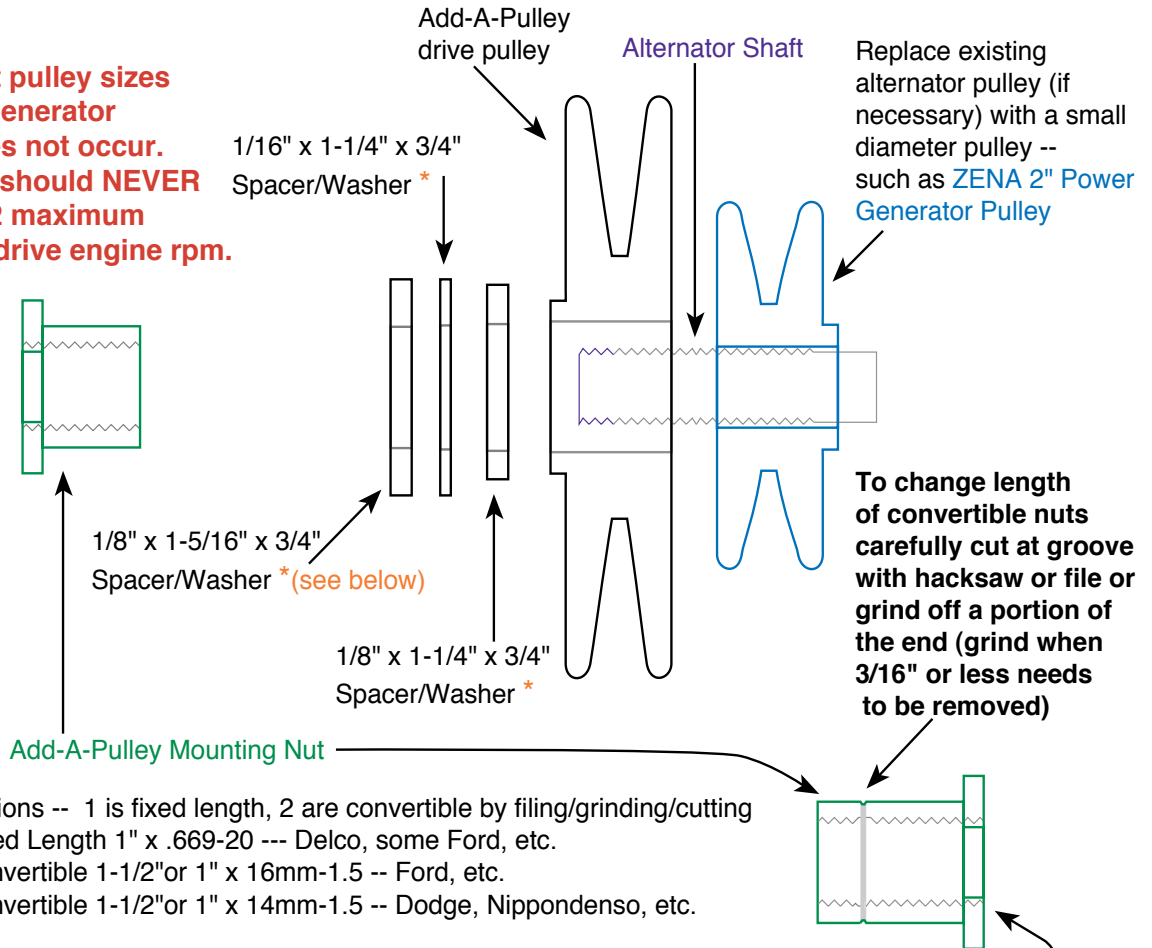
Note: a properly sized/adjusted impact wrench may be used for this operation

## Using the ZENA Add-A-Pulley™ alternator power take off kit to reduce the engine speed needed for welding by up to 57%\* (for tractors, etc.)

(diagram shows a typical assy. after removal of existing alternator pulley)

### CAUTION:

**Carefully select pulley sizes so that power generator over-speed does not occur. Welding speed should NEVER be less than 1/2 maximum recommended drive engine rpm.**



### Typical Assembly Instructions/Notes: (\* not all installations use/need all spacers)

- 1) Remove existing alternator pulley nut (use impact wrench for best results)
- 2) Slip 1/8" and/or a 1/16" Spacer/Washer onto alternator shaft (**IF NEEDED**) (spacers are used **only** in cases of End Bolt to Alternator Shaft interference)
- 5) Thread Add-A-Pulley Mounting Nut onto Alternator Shaft and tighten finger tight
- 6) Slip Add-A-Pulley pulley onto Mounting Nut (if Mounting Nut extends completely through Add-A-Pulley, file/cut/grind Mounting Nut along groove to shorten)
- 7) Slip 3/16" Spacer/Washer (1/8" for 14mm) onto End Bolt
- 8) Thread End Bolt into Add-A-Pulley Mounting Nut and tighten finger tight
- 9) Check for contact between End Bolt and Alternator Shaft (add/remove spacers)
- 10) With parts assembled without interference/contact, disassemble and reassemble tightening Mounting Nut and End Bolt securely

**Note:** Thread locking chemicals may be used -- use stud locking type for contact area between Add-A-Pulley and existing alternator's drive pulley and use removable type for all other bolt and nut attachments).

**Note:** A properly sized/adjusted impact wrench may be used for this operation.

## Appendix G Installing, Using, and Adjusting the model WC.VR ZENA™ universal voltage and charging current regulator

The ZENA universal voltage and charging current regulator is **not a standard automotive voltage regulator**, but rather a sophisticated electronic control device which works with your **existing** ZENA welding power control module to control one, or more, ZENA welding power generators when they are being used for external battery charging, or for automotive or marine alternator replacement. Unlike normal voltage regulators, maximum charging current can also be adjusted -- allowing you to adjust output current to prevent generator over current and/or to best match the needs of the batteries to be charged and/or your specific electrical system.

**NOTE:** The current control is separate from regulator circuits and it can be adjusted independently.

**CAUTION:** When charging AGM type batteries, maximum charging current should be adjusted no higher than 80%.

**CAUTION:** Make sure that charging leads are large enough to handle whatever charging current is utilized. For 150A or 200A power generators, we recommend that charging leads be made from #4 AWG (or larger) welding cable.

The ZENA universal voltage and charging current regulator is powered by the ZENA welding power control module. When properly installed, the resulting power generator charging system should be **ignition excited** (turned on ONLY when engine is running). Unless you specifically requested a regulator for something other than a 12 V electrical system, your regulator has been factory adjusted for operation in a 12V DC electrical system. If you ordered your regulator for another voltage, it will have been factory adjusted to that voltage.

**NOTE:** When using the ZENA power generator for remote charging, batteries in a 24V system can be charged individually without need for re adjustment of the voltage regulator to 24V specifications. And, because the ZENA power generator is an electrically isolated device, without need to remove or disconnect the batteries from the remote vehicle.

**CAUTION:** It is very important that your welding power control module be installed so that it receives power ONLY WHEN THE ENGINE IS RUNNING (i.e., it should receive its power from vehicle's engine "ignition" circuit) -- OR that a small ignition circuit switched relay be used to break the Yellow wire connection between the voltage regulator and the control module . This must be done even if you have chosen to install a separate a ON/OFF switch for your welder. Failure to do this will result in a undesirable continuous current drain (from 2-7A) on the vehicle's battery, overheating of the power generator, and possible power generator failure.

Installation is very easy. The thick gray wire (with square black connector) is attached to the mating connector on the welding cable input on the control module. The yellow wire connects to the yellow wire which comes out of the control module. The red (+) and black (-) wires are sense wires (not power wires) and are usually connected to the positive (red) and negative (black) power output terminals on the power generator. Optionally, the sense wires can be connected directly to the battery which is being charged.

Unless otherwise specified, your regulator has been adjusted to a "turn on" (charge start) voltage setting of:

**13.8 VDC**

and a "turn off" (charge off) voltage setting of:

**14.1 VDC**

The voltage/charging current regulator has also been factory adjusted to limit maximum charging current to approximately 50% of rated current output (approx. 75A for 150A units -- 100A for 200A units).

In most cases, this setting will be proper for most vehicles if charging leads are properly sized, all connections/terminals are properly crimped, and cable to battery connections are not corroded.

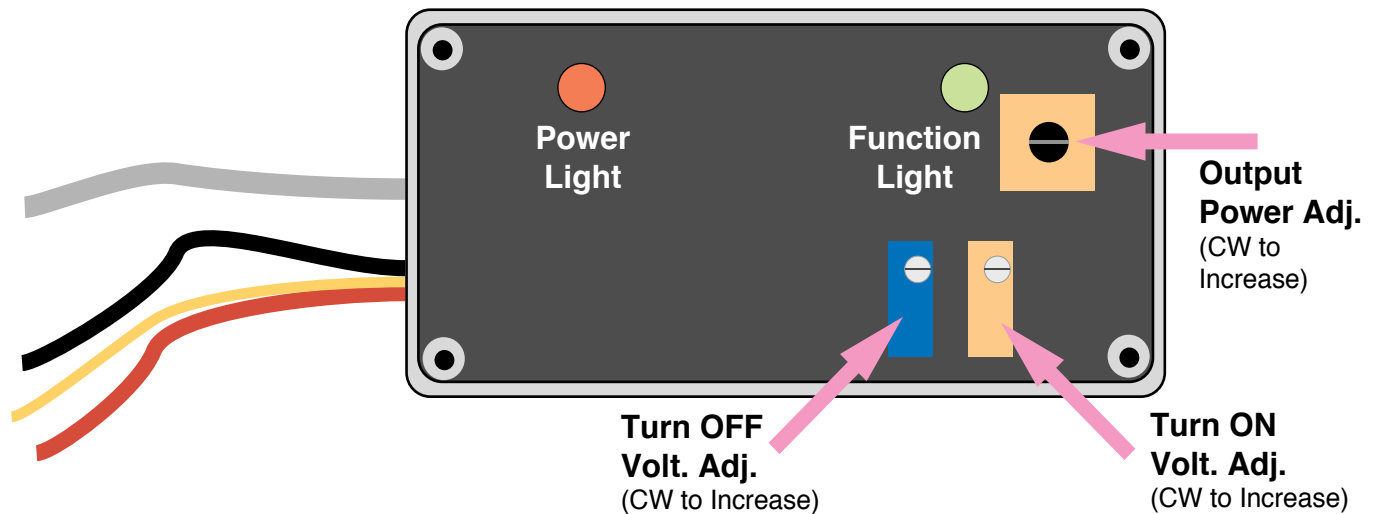
**CAUTION:** It the owner's responsibility to check factory specification for the vehicle in question AND the type of battery (or batteries) to be charged and to insure that the voltage regulator is working properly in the vehicle in which it is to be installed.

To check voltage regulator operation: First, properly connect the voltage regulator to the ZENA power control module and to the battery (or batteries) which is (are) to be charged. Second, insure that the ZENA power generator (or generators) which are being controlled by the voltage regulator are properly connected to the battery (or batteries) to be charged. Third, start the vehicle engine and check the voltage present at the battery terminals (do not check voltage at the power generator) with a sensitive and properly calibrated volt meter.

**If adjustment is determined to be necessary in the field, follow the following steps:**

**CAUTION:** The vehicle's battery should be fully charged, and in good condition, before adjusting. (A charged 12V battery will show between 12.5 to 12.7V DC across its terminals -- 25 to 25.4V DC for a 24V.)

1. Using a small Phillips screwdriver, carefully remove the four screws which hold the voltage regulator's service cover in place. Then remove the cover.
2. The diagram below, identifies the points of adjustment and indicator lights that are present under the service cover of your ZENA voltage regulator.



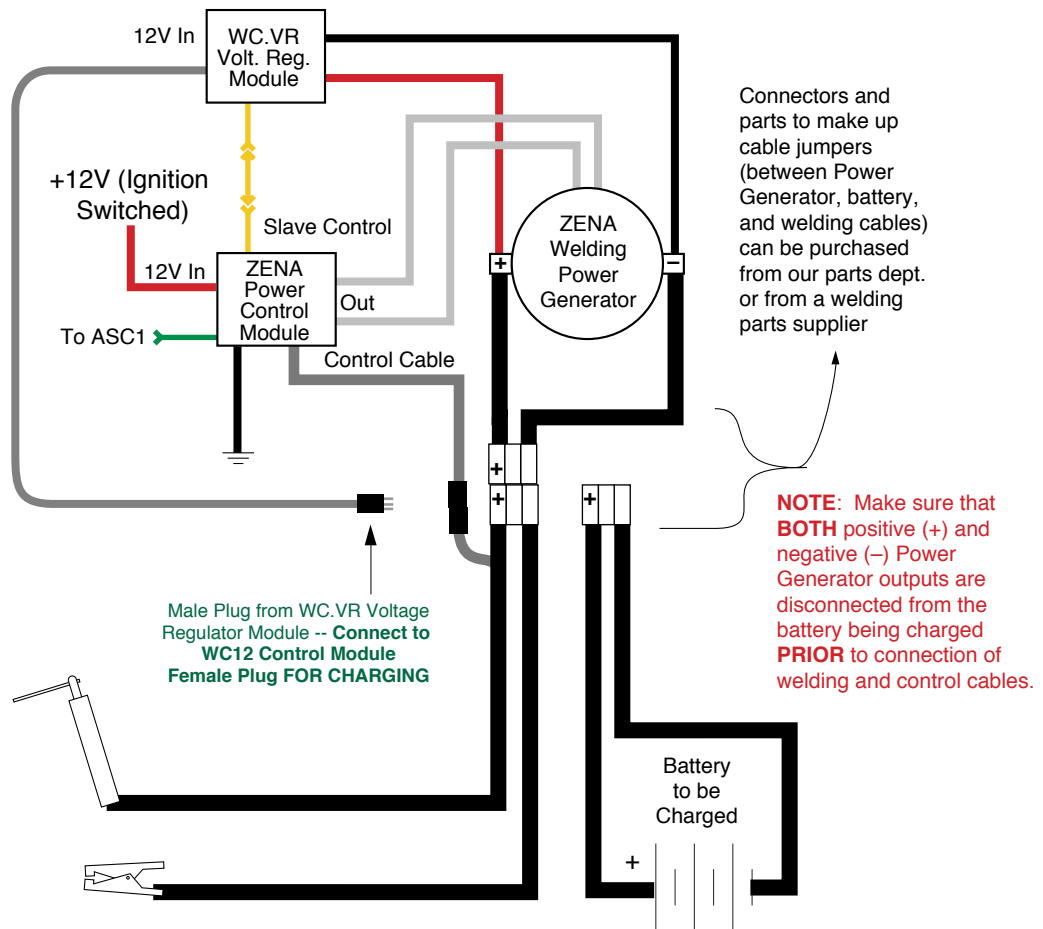
3. With a small straight-slot screwdriver, rotate the screwdriver adjustment points on the multi-turn, high resolution type **turn on** and **turn off** controls fully **counter clock wise** (CCW) (20 full turns). Then rotate the **turn off** control clockwise (CW) three (3) complete turns.
4. Make sure that the power generator output terminal are properly connected to a **fully charged battery**. Attach a sensitive, and properly calibrated volt meter, to the battery terminals, and turn on the vehicle's ignition switch -- but **do not** start the engine at this time.
5. Observe the indicator lights. The red **power** should be illuminated. The **function light** should be dark.
6. While observing battery voltage, adjust the **turn on adjustment** control slowly, and **carefully**, CW until the **function light** illuminates (working the control CCW, to turn the light off, and CW to illuminate it again will help insure that you are at the correct point here -- and indicate correct regulator operation).
7. Start the engine and adjust the **turn on adjustment** control slowly CW (or CCW) until the battery voltage meets the vehicle (and/or battery) manufacturer's charging voltage specification. The **function light** will be illuminated (likely dim, flickering, or pulsating at this point). Check and readjust after following steps.



8. The **turn off** voltage point can now be adjusted. Observe the **function light**. If it is flickering and/or pulsating, slowly and carefully rotate the **turn off** adjustment CW (more than one turn may be required). The **function light** will brighten and/or become more steady as you adjust. **Stop rotating when the light becomes steady and/or if the brightness peaks**. With a steady **function light**, slowly rotate the control CCW, stopping when the light becomes less steady, and/or begins flickering slightly, and/or dims a bit. This is the proper adjustment for most vehicle electrical systems. In other applications, turning the control further CCW to increase the difference between TURN ON and TURN OFF voltages may be desirable.
12. Maximum output power may be adjusted at any time. Turn the **output power control** CW to increase charging current -- CCW to decrease. Maximum output power should be adjusted to suit your individual system configuration. For small batteries (less than 150 AH), or small engines (less than 11 hp), reducing output power can prevent high charging currents and/or reduce severe engine loading. For large battery banks (over 200 AH), reducing maximum output power can prevent alternator overheating.

**CAUTION:** To insure that overcharging of your battery, and/or possible damage to your vehicle's electrical system cannot inadvertently occur, monitor charging voltage at all times. Most vehicles are factory equipped. If you do not have a meter, one can be added easily for little expense.

**NOTE:** If operating in wet or high vibration applications, a small "dab" of automotive grade silicone sealer should be applied on each adjustment point. (The silicone is easily removed for future adjustment.)



## Appendix H General Information -- ZENA UB2 Universal Bracket Kit

The UB2 has been designed to provide a versatile means of accomplishing a piggyback welder installation.

It's such a popular installation method that, with some variation, its used in more than 50% of all vehicle installations. The only major drawback is that a unique set of brackets must be built for each different engine.

This is why we have developed the UB2.

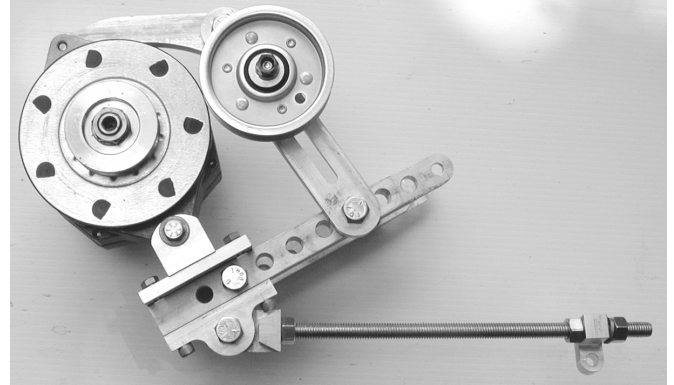
The UB2 is made up of a number of high precision aluminum bracketing components which can be made to fit together in an almost unlimited number of different combinations.

So many factors have been considered in the design of the UB2 that, in many cases, not all of the supplied components will be required to complete a given installation. For example, you may choose not to tighten your belts with an idler pulley. Therefore the components supplied to accommodate this might be used to simply support the generator -- and, in fact they are designed to do this as well as to facilitate other mounting schemes -- including ones that we have not thought of.

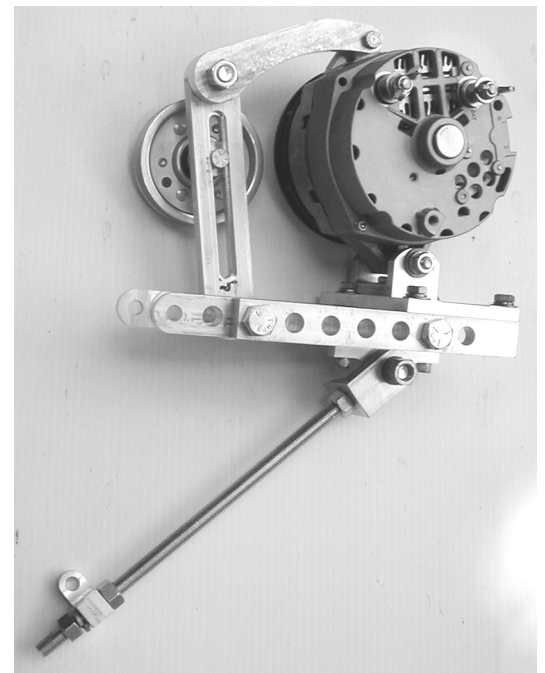
In other cases, since it's not possible to anticipate all factors, additional easy to fabricate parts may be required to work with the supplied UB2 parts. While the UB2 is an accessory designed to work primarily with the 150A welding systems -- with a bit of on site modification, customers are finding that it provides an installation platform for our 200A welders as well.

The UB2 should provide you with a great installation tool -- one which is limited only by your imagination and mechanical skills.

**Let us know how it works for you!**

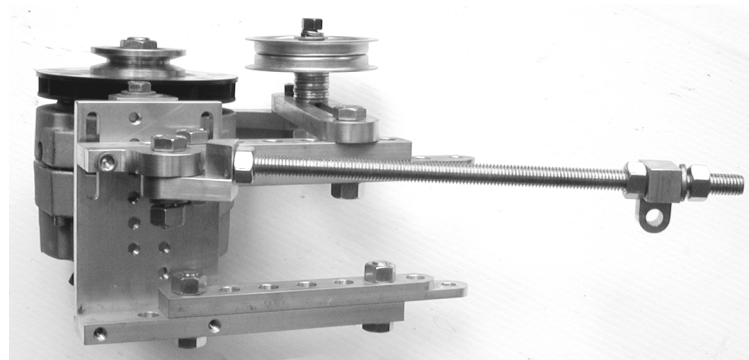


**View of the UB2 configured for use.**



**Bracket components are attached to illustrate a typical configuration.**

**This IS NOT the only way that they can be fitted!**



In this V-8 Dodge truck, the owner installed a MW150KB welding system. He used the UB2 universal power generator mounting bracket so as to mount the power generator UNDER the UB2 frame members using the A300A bracket supplied as part of the MW150KB truck kit.

In this installation, V-belt drive for the power generator is obtained by using a standard model AAPK Add-A-Pulley alternator power take off kit (also part of the MW150KB).

Belt tensioning by means of an idler pulley was determined to be best. The choice of mounting position for the generator facilitates the use of the idler on the inbound (slack) side of the power generator's drive pulley. This insures excellent belt wrap around the power generator pulley and provides a means of tensioning the drive V-belt.



Since, in this application, the generator does not have to be moved for belt tensioning, only a minimum of extra space is required.

Because the generator does not have to be moved for belt tightening, other than providing some strain relief points to hold hoses out of the way, no extra modification to hoses or hose routing was required.

The photo on the left shows the power generator in place on the UB2. This photo also shows the use of "all-thread" rod (supplied with the UB2) in conjunction with the UB2 bracing components which are designed to be used with this type of threaded rod. In this case, these support components are attached to the third mounting bolt on the stock alternator bracketing.

The welding control module was mounted remote from the generator in this application. Welding cable hook-up is by means of the BJ150.4 quick disconnect kit supplied as part of the MW150KB. In this application, thanks to the versatility of the UB2, no welding or extra bracketing components had to be fabricated!

# ZENA, Incorporated Limited Warranty

## TERMS & CONDITIONS

The mobile welding system (Product) that you have purchased from ZENA, Incorporated (ZENA) is warranted to the original purchaser (Purchaser) to be free from defects in materials or workmanship for a period of three (3) years from the date of purchase.

If the welding system, or a welding system component, is found to be defective during the warranty period, ZENA will, at its option, either repair or exchange the defective product with an identical or equivalent replacement product with substantially equivalent or superior specifications.

This is not an unconditional guarantee against all hazards or failures (see Exclusions from Warranty). This warranty is made to the original purchaser, or in the case of a gift, to the original owner, and is not transferable.

The Product that you have purchased has been manufactured to ZENA's current product specifications. It may vary in details of design and construction from descriptions in literature or samples, displays or other models inspected by Purchaser previously.

## WARRANTY PROCEDURES

All claims under this limited warranty shall be deemed waived unless received by ZENA within 10 days of delivery if visibly damaged or defective, and, otherwise, within 30 days after the defect to which each claim relates is discovered.

Immediately upon identifying a problem which you believe to be a failure subject to the product's limited warranty, you must contact ZENA at the address or telephone number listed in your operation manual. Be prepared with the following information:

- Proof of purchase documentation
- Your product's serial number
- A description of the problem or failure

You must work with our technical support staff to help diagnose the problem. This may include performing routine diagnostic procedures. The technician will determine if the problem can be solved over the telephone or if return for repair is required.

Upon determining that the product has failed under the terms of the warranty, and that return to the repair facility is required, ZENA will provide you with the following information:

- A Return Merchandise Authorization (RMA) number
- The address to which your product must be sent

Systems must be shipped, at the purchaser's cost, insured, and in their original shipping containers and packing material or otherwise adequately packed for shipment, and the RMA number must appear clearly on the outside of the package. If the product is damaged during shipment or received in inadequate packaging, this warranty may not apply.

## EXCLUSIONS FROM WARRANTY

This warranty is contingent upon proper use of the Product by Purchaser. This warranty does not apply to Products which have been incorrectly installed or which have been subjected improperly to extreme operating or environmental conditions; to Products subjected to modification, tampering, or repair by any party other than ZENA; or to Products damaged by negligence, casualty, improper service, or maintenance. The warranty also does not apply to Products damaged during shipment, or as a result of the purchaser's failure to comply with any of the procedures specified in the Product's Operators Manual. This warranty does not apply to failure caused by normal wear and tear, or to physical damage to components which may occur during normal use.

## NO RECOVERY OF CONSEQUENTIAL OR SPECIAL DAMAGES

ZENA shall not be liable for any consequential or special damages based on negligence, breach of warranty, strict liability, or any other theory, for failure to perform its obligations under this agreement. Additionally, consequential and special damages shall be not recoverable even if the repair or replacement remedy for ZENA's breach of its limited warranty fails of its essential purpose or for any other reason.

## LIMITATION OF REMEDY

Purchaser's exclusive remedy and the limit of ZENA's liability for breach of the limited warranty set forth above, whether based on negligence, breach of warranty, strict liability, or any other theory, shall be, at ZENA's option, repair or exchange of the defective Product, F.O.B. Elmwood, Tennessee, with an identical or equivalent replacement Product with substantially equivalent or superior specifications.

## DISCLAIMER OF WARRANTIES

Except as expressly provided above, this Product is provided "as is" without warranty of any kind, and ZENA expressly disclaims all warranties, express or implied, including any implied warranties of merchantability and fitness for a particular purpose. If the Product has a manufacturing defect, your sole remedy is the repair or replacement remedy stated in this warranty, and under no circumstances shall ZENA be liable for any other damage or loss, whether direct, incidental, special or consequential, arising out of the use of, or the inability to use, the Product. Some states do not permit the exclusion or modification of these implied warranties or the exclusion of incidental or consequential damages, so this disclaimer may not apply to you.

