

**MANUAL****Model: GS-1AC Generator Starter**

Solar Converters Inc. - Rev. B

**Warning:** To prevent inadvertent operation of the generator, connect the battery only to the unit and set-up the start/stop voltages to the required levels before connecting any of the relay controls.

**1.0 Specification****1.1 Electrical**

Nominal battery voltages	12 - 48V DC
Maximum Input (V)	63
Minimum Voltage	10
Relay:	8 amps @ 12/24V, 2 amp @ 48V, 5 amps @ 120 VAC Basically rating of Potter and Brumfield T72 series relay For more current, use these relays to drive larger relays
Self-Consumption	
Relay Power	0.5W per relay coil when powered, voltage independent
Quiescent less than	<25 mA
Fusing	0.5A, internal electronics only

**1.2 User Controls**

MID Scale Set Voltage: 1.4V  
 Generator Stop Set Voltage: 1.6V  
 Generator Start Voltage: 1.2V  
 Manual start/stop toggle switch overrides remote smart stop control  
 Remote start/stop

**1.3 LED Display**

Generator start/stop  
 Relay position for precrank, crank, load, run, stop, fault

**1.4 Mechanical**

Weight: 8 lb.  
 Size: 10" X 8" X 4" NEMA 3R

Connections:  
 Power: Euro-style Terminal Strip # 14 AWG

Operating Temperature: -40 to 60 deg. C  
 Humidity: 0 - 90% non-condensing,

**2.0 Power Connections**

**Warning:** This unit operates from multiple **Hazardous** energy sources. Ensure that all power sources are inactive before making any connections to this unit. Ensure proper procedures and the appropriate electrical codes are followed. To be serviced and operated only by qualified personnel.

**2.1 Ground**

Using wire of sufficient amperage (min. #12 AWG) connect the ground of unit to appropriate system ground as required by the appropriate electrical code. Note this ground is not internally connected to any of the unit's terminals.

## 2.2 Battery Connection

Output voltage: 10- 63 V

Output current: 0 - .5A max., Standby 25 ma,

**Warning:** Ensure the battery is disconnected and/or safe operating procedures are followed when making battery connections. Extreme care must be taken to ensure the battery is not shorted. BE SAFE. Make sure all strands are inside their respective terminals. The battery must be fused. Qualified personnel only to connect and operate this unit.

Using wire of sufficient amperage for the battery connection #16 AWG or better connect the positive of the battery (through the strain relief) to the positive battery connection of the control unit marked BAT +. Similarly connect the negative of the battery to the negative battery connection of the solar regulator terminal block.

## 2.3 Generator Start Sense Connection

Using wire of sufficient amperage for the connection, #20 AWG or better and an in-line 1/2 amp fuse (AGC 0.5 or similar, connect the LD+ terminal of the unit to the generator Output hot or line connection. The crank relay will disengage and the generator will stop cranking when the unit sees 3 cycles of 60 Hz Over 60 Vac.

## **SETUP the generator start and stop battery voltages** See Section 4.1

**WARNING:** SETUP the generator start/stop voltage BEFORE connecting to the relays to prevent inadvertent or wrong commands sent to the generator via the relays. This unit uses the measured battery voltage compared to the desired start/stop voltage and its logic is setup to act accordingly.

## 2.4 Relay Connections

**WARNING:** SETUP the generator start/stop voltage BEFORE connecting to the relays to prevent inadvertent or wrong commands sent to the generator via the relays. This unit uses the measured battery voltage compared to the desired start/stop voltage and its logic is setup to act accordingly.

This unit has many features and can perform a number of generator care taking functions. Evaluate the basic functions that are required and connect to the appropriate relays to actuate the various functions. See the section of start-up and shutdown sequence for the relay timing.

ALL relays are NO (Normally Open) contacts. If more power is required than the relay rating, these relays may drive the coils of larger relays to actuate the required function.

### **Fault:**

This relay is actuated any time the battery voltage has fallen to .2 V (scaled to 12 V battery) below the low voltage setpoint. It is an indication that the generator start-up sequence was not successful and the batteries have further discharged. It will also be actuated if the start/stop toggle switch is left in the start position.

### **Precrank:**

The precrank relay is actuated for 20 seconds before any generator control relays are actuated. It can be used to signal generator start, heat glow plugs, start air compressors, and fuel pumps etc.

### **Crank:**

This relay is actuated to crank the generator

### **Run:**

This relay is actuated anytime the generator is cranking or expected to run. For many generators or for single wire start generator, this would be the normal connection.

### **Load:**

This relay is actuated and is used to control the timing of loading the generator. It waits a few seconds to allow the generator to get up to speed before applying the battery-charging load on start-up. Conversely it works with the stop relay on generator stop to unload the generator for a few seconds before the generator actually is shutdown. A common use of this function is when chargers are used and it is not desirable to subject the battery charger to low generator voltage conditions.

**Stop:**

The stop relay is used to signal the generator to stop.

2.5 Temperature Compensation

This regulator is designed to use the voltage of a temperature sensitive zener (National Semiconductor # LM335Z or equiv.) attached at the battery location (hence battery temperature). This unit is available from Solar Converters Inc. as Model No. TC-2.

**Warning:** If temperature compensation is not used, a 4.99k precision resistor must be connected between the TC+ and TC- terminals (its default condition). Lack of this resistor will not harm the regulator, but will require re-adjustment of the battery setup voltage.

If temperature compensation is being used, remove the 4.99k resistor across terminals TC+ and TC-. Using a wire of sufficient amperage (#24 AWG or better) connect the TC+ terminal to the anode (the red lead) of the temperature sensitive zener. Similarly connect the TC- terminal to the cathode (the black lead) of the temperature sensitive zener (LM335Z).

**Warning:** This connection is not line isolated. Do not expose to any voltage not reference to the low voltage ground of the regulator.

Note: Shielded twisted pair is recommended if the batteries are a "substantial" distance from the regulator.

2.6 Remote Stop/Start

The generator may be started and stopped remotely by momentarily shorting (for a couple of seconds) the start and stop terminal positions on the start/stop terminal block. Note that the toggle switch overrides this function. **The normal position for this terminal block is to have none of the terminals shorted** or unconnected. If left shorted, this will offset the generator start and stop voltages, making these settings inaccurate.

3.0 LED Indicators

This unit has LEDs to signal to relay position and start/stop sequence.

**Start LED:**

The unit is in its start sequence and is running the generator.

**Stop LED:**

The unit is in its stop sequence, and the generator is stopped.

**Fault, Precrank, Crank, Run, Load, Stop LEDs:**

The unit's relays with the same name are actuated with the corresponding LED. See the section on relay connections, section 2.3.

4.0 User Controls4.1 SETUP the generator start and stop battery voltages

**WARNING:** SETUP the generator start/stop voltage BEFORE connecting to the relays to prevent inadvertent or wrong commands sent to the generator via the relays. This unit uses the measured battery voltage compared to the desired start/stop voltage and its logic is setup to act accordingly.

The unit has 3 adjustment pots for mid scale, Generator start and generator stop setpoints.

The set points have a 1/10-scale factor. To set a setpoint to trip at 12 V for example, set the set point to 1.2V. To set it to trip at 48.5 V, set the setpoint to 4.85 V.

- 1) Power the unit with any source 10 V to 60 V connected to its Bat + and BAT - of the terminal blocks.
- 2) With a voltmeter connected to the test point ground (GND) and the TPM setpoint, adjust the midscale set point pot such that the voltmeter reads 1/10th the voltage that the generator's start and stop. For example start: 12V and stop: 16V, midscale voltage would be 14, which is 1.4V.

- 3) With a voltmeter connected to the test point GND and the TP- setpoint, adjust the Gen Start set point pot such that the voltmeter reads 1/10th the voltage that the generator is to turn start at.
- 4) With a voltmeter connected to the test point GND and the TP+ setpoint, adjust the Gen Stop set point pot such that the voltmeter reads 1/10th the voltage that the generator is to turn off at.

#### 4.2 Generator Stop/Start

**IMPORTANT NOTE:** For normal operation, this switch is left in the middle or “**Normal**” position. If left in the stop position, the generator will never start, never charging the battery. If left in the start position, the generator will never stop, overcharging the battery.

A toggle switch located in the upper left corner may be used to override the setup voltages and force the unit into its start or stop sequence.

**Start:** **NOTE:** DO NOT LEAVE IN THE START POSITION

To start the generator at any time, move the toggle switch to the start position. The Fault light and relay will come on (Warns of this position) and approx. 25 seconds later the generator start light comes on and the unit generator start up sequence begins. Once the start-up sequence is started, move the toggle switch back to its “normal” position.

**Stop:** **NOTE:** DO NOT LEAVE IN THE STOP POSITION

To stop the generator at any time, move the toggle switch to the stop position. Approx. 2 seconds later the generator stoplight comes on and the unit generator stop sequence begins. Once the stop sequence is started, move the toggle switch back to its “normal” position.

**Reset:** By shorting the **RST** pin to battery +, all the logic function are reset to start-up state and the unit goes through its stop sequence.

### **5.0 Generator Function**

#### 5.1 Sequence of operation on start-up

When the battery voltage is detected as too low per user adjustable setpoint, or the toggle switch or the remote start-up is actuated, the generator goes through its start sequence:

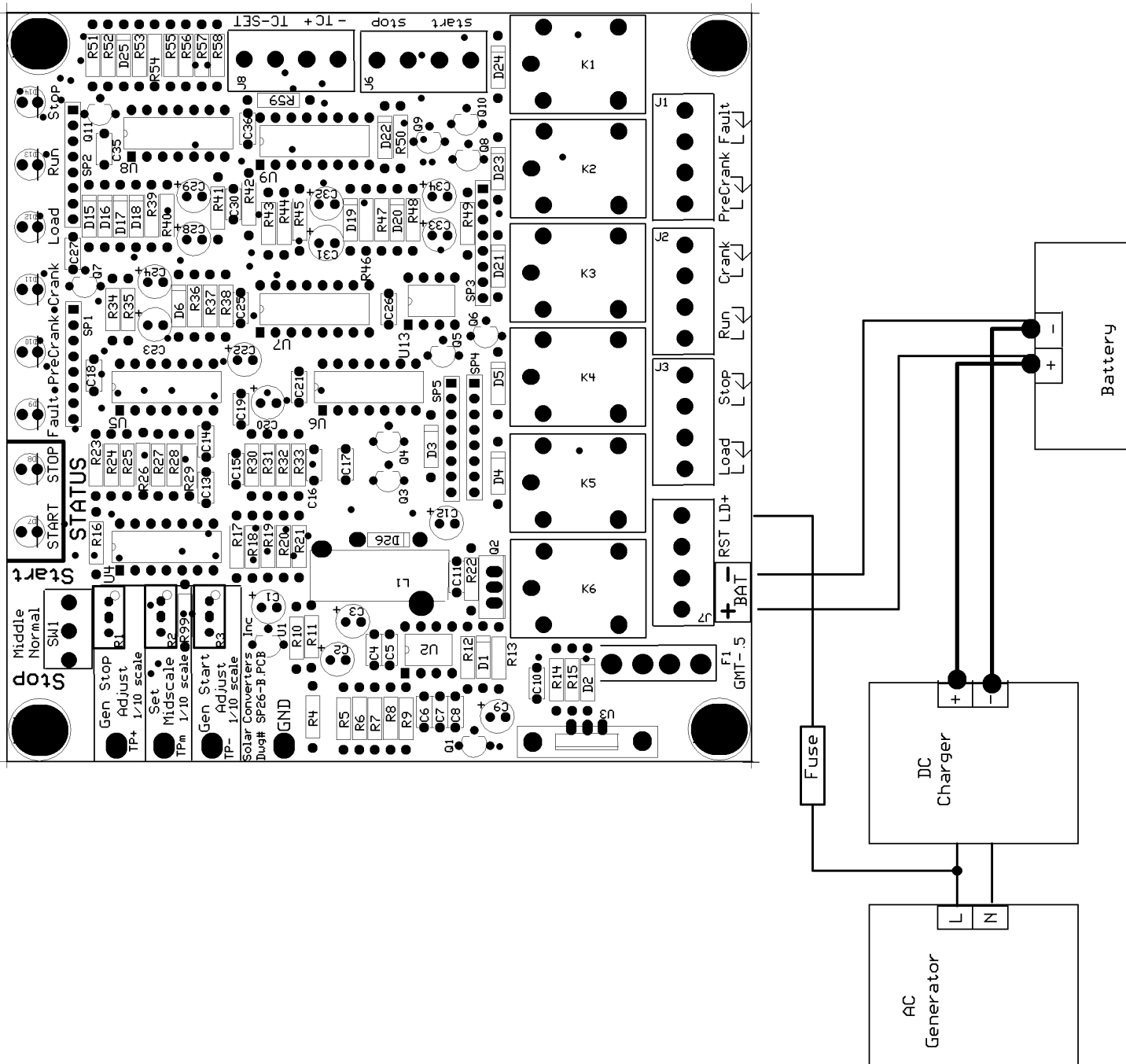
- 1) The Generator start LED comes on.
- 2) Precrank: 20 seconds relay closure (with LED on) prior to generator start/crank.
- 3) Crank: relay closure (with LED on) for 10 seconds or until Genset start detected defined by generator/battery voltage starting to rise.
- 4) Run: Relay closure (with LED on) whenever generator is cranking or running.
- 5) Load: load relay closure (with LED on) 30 seconds after run relay closure.
- 6) If battery voltage falls another .2 V (relative to 12 V battery), fault relay is activated for remote signaling of fault.

#### 5.2 Sequence of operation on shutdown

When the battery has charged to the user adjustable setpoint, or the toggle switch or the remote start-up is actuated, the generator goes through its stop sequence:

- 1) The Generator Stop LED comes on, start light turns off.
- 2) Load: Load Relay opens (with LED off).
- 3) Run: Run relay opens (with LED off) 20 seconds after load relay opens.
- 4) Stop: Relay Closes (with LED on) for 10 seconds after run relay opens.
- 5) All internal logic resets itself upon completion of the stop cycle.

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**WARRANTY**

The product is warranted to be free from defects in material and workmanship for a period of one (1) year from the date of purchase by a retail customer. The purchase date must be evidenced by a valid and original sales receipt. In lieu of sales receipt, factory will use code date on its label. Removal of the Solar Converters Inc. label or serial number will void the warranty.

Product liability, except where mandated by law, is limited to repair or replacement at the manufacturer's discretion. No specific claim of merchantability or use shall be assumed or implied beyond what is printed on the manufacturers printed literature. No liability shall exist from circumstances arising from the inability to use the product, or its inappropriateness for any specific purpose or actual use, or consequences thereof for any purpose. **It is the user's responsibility to determine the suitability of the product for any particular use.** Solar Converters Inc. shall not be liable for any damages or any kind including without limitation, special, incidental or consequential obligations and liabilities of Solar Converters Inc. and the remedies of Buyer set forth herein shall be Solar Converters Inc. sole and exclusive liability.

Failure to provide a safe and correct installation, safe operation, or care for the product will void the warranty. Personal safety, and compatibility with any other equipment is the ultimate responsibility of the end user. Any returned product that shows significant evidence of abuse may not be covered by this warranty. Installation must be preformed by a person with qualification to insure safe and effective operation and the installation thereof certifies that the installer has the technical qualifications to do so.

Solar Converters Inc. cannot guarantee the compatibility of its products with other components used in conjunction with Solar Converters Inc. products, including, but not limited to, solar modules, batteries, and system interconnects, and such loads as inverters, transmitters and other loads which produce "noise" or electromagnetic interference, in excess of the levels to which Solar Converters Inc. products are compatible. Solar Converters Inc. shall not assume responsibility for any damages to any system components used in conjunction with Solar Converters Inc. products nor for claims for personal injury or property damage resulting from the use of Solar Converters Inc. products or the improper operation thereof or consequential damages arising from the products or use of the products.

The warranties set forth herein are Solar Converters Inc. sole and exclusive warranties for or relating to the goods. Seller neither makes nor assumes any warranty or merchantability, any warranty fitness for any particular purpose, or any other warranty of any kind, express, implied or statutory. Solar Converters Inc. neither assumes nor authorizes any person or entity to assume for it any other liability or obligation in connection with the sale or use of the goods, and there are no oral agreements or warranties collateral to or affecting the sale of the goods.

**WARRANTY CLAIM PROCEDURE**

In the event of product failure, follow this warranty claim procedure.

1. Make sure the problem you are having is actually due to the suspected product and not some other part of the system. You may call technical support for advanced troubleshooting assistance.
2. If you determine that a Solar Converters Inc. product is actually defective, describe on paper, in detail the exact nature of the failure.
3. The product must be accompanied by proof of the date of purchase satisfactory to Solar Converters Inc.
4. Return the product and description to the business office address, along with your address and a daytime phone number. Purchasers must prepay all delivery costs or shipping charges as well as any other charges encountered, in shipping any defective Solar Converters Inc. product under this warranty policy. **No shipment will be accepted Freight Collect.**
5. Any return shipment from Solar Converters Inc. will be via Canada Post. Foreign shipments will ship best way. Special shipping arrangements are available at the customer's expense.