MicroGenius® 150

Rugged, High-Performance, Genset Charger

Installation & Operation Manual

12/24V, 6A
12V, 6A
12V, 10A

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PATENT PENDING

Installation or service questions?
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1 IMPORTANT SAFETY INSTRUCTIONS FOR INSTALLER AND OPERATOR

1.1. **SAVE THESE INSTRUCTIONS –** This manual contains important safety and operating instructions for MicroGenius® 150 battery chargers.

1.2. Do not expose charger to rain or snow.

1.3. Use of an attachment not recommended or sold by the battery charger manufacturer may result in a risk of fire, electric shock, or injury to persons.

1.4. **This charger is intended for commercial and industrial use.** ONLY TRAINED AND QUALIFIED PERSONNEL MAY INSTALL AND SERVICE THIS UNIT.

1.5. Do not operate charger if it has received a sharp blow, been dropped, or otherwise damaged in any way; shut off power at the branch circuit protectors and have the unit serviced or replaced by qualified personnel.

1.6. To reduce risk of electric shock, disconnect the branch circuit feeding the charger before attempting any maintenance or cleaning. Turning off controls will not reduce this risk

1.7. **WARNING – RISK OF EXPLOSIVE GASES**

1.7.1. **WORKING IN THE VICINITY OF A LEAD-ACID OR NICKEL-CADMIUM BATTERY IS DANGEROUS. STORAGE BATTERIES GENERATE EXPLOSIVE GASES DURING NORMAL BATTERY OPERATION. FOR THIS REASON, IT IS OF UTMOST IMPORTANCE THAT YOU READ THIS MANUAL AND FOLLOW THE INSTRUCTIONS EACH TIME YOU USE THE CHARGER.**

1.7.2. To reduce the risk battery explosion, follow these instructions and those published by the battery manufacturer and the manufacturer of any equipment you intend to use in the vicinity of a battery. Review cautionary markings on these products and on the engine.

1.8. **WARNING – RISK OF SHOCK**

1.8.1. **ULTRACAPACITORS ACCEPT AND DISCHARGE CURRENT RAPIDLY. NEVER ATTEMPT TO JUMP OR CONNECT A BATTERY TO AN ULTRACAPACITOR.**

1.9. **PERSONAL PRECAUTIONS**

1.9.1. Someone should be within range of your voice or close enough to come to your aid when you work near a storage battery or ultracapacitor.

1.9.2. Have plenty of fresh water and soap nearby in case battery electrolyte contacts skin, clothing, or eyes.

1.9.3. Wear complete eye protection and clothing protection. Avoid touching eyes while working near a storage battery.

1.9.4. If battery electrolyte contacts skin or clothing, wash immediately with soap and water. If electrolyte enters eye, immediately flood the eye with running cold water for at least 10 minutes and get medical attention immediately.

1.9.5. **NEVER** smoke or allow a spark or flame in vicinity of battery/ultracapacitor or engine.

1.9.6. Be extra cautious to reduce risk of dropping a metal tool onto the battery/ultracapacitor. It might spark or short circuit the battery/ultracapacitor or another electrical part that may cause explosion. Using insulated tools reduces this risk, but will not eliminate it.

1.9.7. Remove personal metal items such as rings, bracelets, necklaces, and watches when working with a storage battery/ultracapacitor. A storage battery/ultracapacitor can produce a short circuit current high enough to weld a ring or the like to metal, causing a severe burn.

1.9.8. **When charging batteries, charge 6 and 12 cell LEAD-ACID or 10 and 20 cell LIQUID ELECTROLYTE NICKEL-CADMIUM batteries only, with rated capacity of 30 to 200 Ampere hours.** Do not use this battery charger to supply power to an extra-low voltage electrical system or to charge any type of non-rechargeable, dry cell, alkaline, lithium, nickel-metal-hydride, or sealed nickel-

cadmium batteries that are commonly used with home appliances. These batteries may burst and cause injuries to persons and damage to property.

1.9.9. **NEVER** charge a frozen battery.

1.9.10. The charger contains a DC output fuse for *internal* fault protection, but this will not protect the DC wiring from fault currents available *from the battery/ultracapacitor*. Consult national and local ordinances to determine if additional battery fault protection is necessary in your installation

1.9.11. Study all battery/ultracapacitor manufacturer specific precautions such as removing or not removing cell caps while charging and recommended rate of charge.

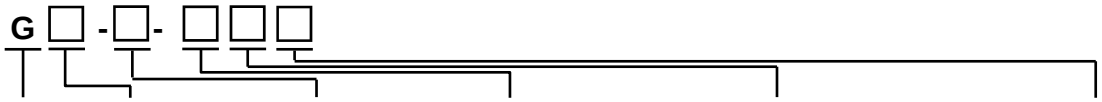
1.9.12. Do not operate charger in a closed-in area or restrict ventilation in any way.

1.9.13. Never place the charger directly above or below the battery being charged; gases from the battery will corrode and damage charger.

1.9.14. Canadian Standards Association warning: "Locate the charger as far away from the battery as DC cables permit."

1.10. WARNING: This equipment is compliant with Class A of CISPR 16. In a residential environment, this equipment may cause radio interference.

2 MODEL NUMBER BREAKOUT



Model	Output Voltage	Output Current	Factory Assigned	Housing Configuration	User Interface
	12: 12 Volts	06: 6 Amps	L: C-UL Listed, CE Marked	W: Enclosed Housing	A: Base Charger
	22: 12/24 Volts	10: 10 Amps (12V only)	R: C-UL Recognized, CE Marked	T: Open-frame, Terminal Blocks	B: J1939 Interface
				P: Open-frame, Plug Connectors (special order)	D: LCD, Form C Alarms, and J1939 Interface

3 PERFORMANCE SPECIFICATIONS

See MicroGenius® 150 Product Data Sheet and Product Specification at www.sens-usa.com for detailed performance specifications. This equipment is guaranteed to meet performance parameters when operated as a battery charger.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

4 INSTALLATION INSTRUCTIONS

INSTALLATION OF THE UNIT MUST COMPLY WITH LOCAL ELECTRICAL CODES AND OTHER APPLICABLE INSTALLATION CODES AND BE MADE ACCORDING TO THE INSTALLATION INSTRUCTIONS AND ALL APPLICABLE SAFETY REGULATIONS.

4.1. Mounting Location

The charger is provided in two different chassis options, fully enclosed or open-frame. See diagram at back of manual for mounting information.

4.1.1. The fully enclosed charger is rated IP22 and can withstand dripping liquid but may require additional protection from spraying, splashing, or blowing liquid. The open-frame chassis charger should be installed

in a customer-provided enclosure, protected from rain, snow and blowing or dripping liquid.

4.1.2. The charger should not be located where temperatures are expected to be colder than -20ºC (-4ºF) or hotter than +40ºC (104ºF) for 12V-10A and 12/24V-6A chargers, or +45°C (113°F) for enclosed 12V-6A, or +50°C (122°F) for open-frame 12V-6A.

4.1.3. Allow sufficient room for routing the fixed wiring to the charger. All wires enter the charger from the bottom. See diagram at back of manual for further information.

4.1.4. Mount charger vertically to ensure adequate ventilation and to prevent the charger from overheating.

4.1.5. Leave clear space for ventilation all around the unit: at least 6 inches (15 cm) at the top; at least 2 inches (5 cm) at the bottom; at least 2 inches (5 cm) on each side. Do not restrict the gap between the wall and the rear surface of the charger.

4.1.6. Do not set anything on top of the charger.

4.1.7. Do not mount the charger above any heat generating equipment.

4.1.8. Never allow battery acid to drip on charger when reading electrolyte specific gravity or filling battery.

4.1.9. Mount to a wall or other vertical support. The mounting surface must safely support the weight of the charger and the fixed wiring. The weight of the charger is 3.4 pounds (1.54 Kg) for the fully enclosed version and 2.5 pounds (1.13 Kg) for the open-frame version.

4.2. Static Discharge Precautions

Printed circuit boards contain static sensitive components. Damage can occur even when static levels are too low to produce a noticeable discharge shock. To avoid static discharge damage:

4.2.1. Handle the charger by the chassis only. Remove the cover only when access is essential for installation and service, and replace it promptly when finished.

4.2.2. Wear an approved static protection strap. If one is not available, touch one hand to the chassis before contacting any other part of the charger.

4.3. Mounting Instructions

The charger is provided in two different chassis options, fully enclosed or open-frame. See diagram at back of manual for mounting, dimensions, and connections information.

4.3.1. Drill four mounting holes using the mounting template provided with the charger.

4.3.2. Mount the charger before connecting AC, DC, communications and alarm wiring to ensure un-obstructed access to mounting holes.

4.3.3. Mount the charger using the appropriate fasteners for the chassis version. All mounting hardware is provided by the installer.

4.3.3.1. Fully enclosed version mounting hardware: four ¼ inch (M6) screws with standard flat washers

4.3.3.2. Open-frame version mounting hardware: four #10 (M5) screws with standard flat washers

4.4. Preparing Battery or Ultracapacitor For Charge

4.4.1. Be sure area around battery is well ventilated while battery is being charged.

4.4.2. Ensure battery/ultracapacitor terminals are clean and properly tightened. Be careful to keep corrosion from coming in contact with eyes.

4.4.3. Add distilled water in each cell until battery acid reaches level specified by battery manufacturer. Do not overfill. For a battery without removable cell caps, such as valve regulated lead acid batteries, carefully follow manufacturer's recharging instructions.

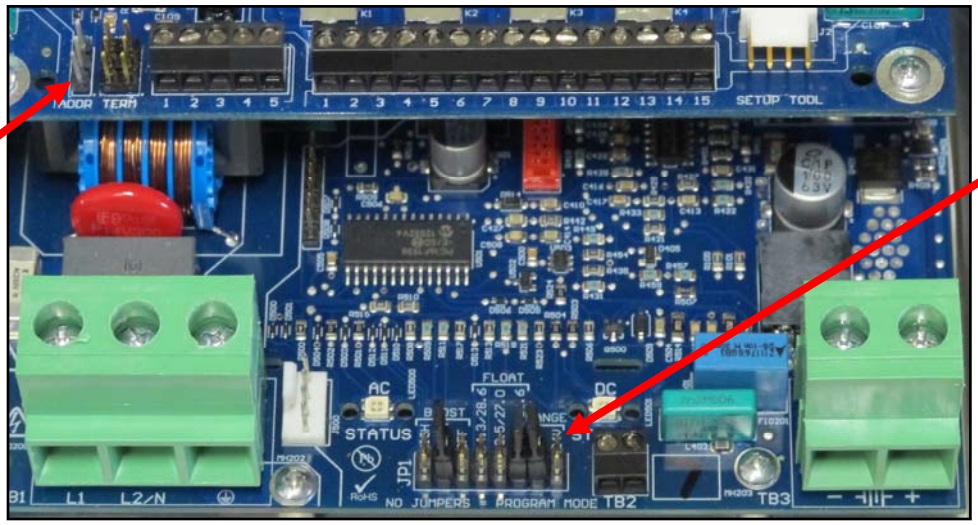
4.4.4. Understand all battery/ultracapacitor manufacturer specific precautions while charging and recommended rates of charge. The recommended charge current range must include the rated output current of this charger, which is 6 or 10 amperes.

4.4.5. Remove shorting wire connecting ultracapacitor positive and negative terminals before installation.

5 CHARGER SETUP

The charger includes a feature called PROGRAM MODE that enables an OEM or specially qualified distributor or packager to set the charger using customized settings. If the charger is supplied without output jumpers installed, it may be using this mode. See Section 5.5 for more information.

Figure 1 – Jumper Settings
(fully enclosed model with optional alarm/communications circuit board shown)



J1939 JUMPERS:
- **Select Charger 1 or 2**
- **Enable J1939 CANbus communications**

OUTPUT JUMPERS:
- **Select 12 or 24V battery/ultracap**
- **Set FLOAT voltage**
- **Enable BOOST**

OR

Jumpers removed when in PROGRAM MODE

5.1. Output Voltage Range Setup

Set the RANGE jumper on JP1 to 12V or 24V depending on appropriate nominal battery/ultracapacitor voltage. 12V only models will not produce any output if set for 24 volts; LEDs and optional LCD will indicate the invalid setting.

5.2. Float Voltage Setup

Float mode is used to maintain a battery in its fully charged state. When the charger is in Float mode the output voltage is maintained at the float voltage setting. Set the FLOAT output voltage jumper on JP1 to the battery manufacturer's recommended 25ºC (77ºF) float charge voltage. Incorrect charge voltage will accelerate generation of explosive gases, increasing the risk of fire or explosion. Jumper options:

- 14.3/28.6 volts for 10 or 20 cell nickel cadmium at 1.43V/cell
- 13.5/27.0 volts for 6 or 12 cell (VRLA, AGM or high capacity) lead-acid at 2.25V/cell and 19 cell nickel cadmium at 1.42V/cell
- 13.3/26.6 volts for 6 or 12 cell (flooded) lead-acid at 2.22V/cell and 19 cell nickel cadmium at 1.40V/cell

The FLOAT output voltage setting is not used for charging ultracapacitors. Place the unused FLOAT output voltage jumper on JP1 in the BOOST NORM position (no FLOAT setting) if charging ultracapacitors rather than batteries (see Section 5.4 for ultracapacitor setup).

5.3. Dynamic Boost™ Mode Setup

Dynamic Boost mode is the standard boost mode for the charger and provides a battery interactive boost voltage cycle that automatically adapts to each application in real time by compensating for depth of discharge, varying load, battery age and other variables. Dynamic Boost mode safely maximizes recharge performance while cutting risk of overcharge that is associated with prolonged fixed charge cycles or excessive boost settings.

Set the BOOST voltage jumper on JP1 appropriate for the battery type used. Table 1 lists the charge voltages corresponding to the jumper selections. Boost charge is typically disabled (OFF jumper setting) for Valve Regulated Lead Acid (VRLA) batteries. Normal boost charge (NORM jumper setting) is recommended for typical wet cell (flooded) battery installations. Normal boost may be used with VRLA batteries only when recommended by the battery manufacturer. HIGH boost charge is recommended for applications where rapid charge recovery is essential or required for strict NFPA-20 fire pump or NFPA-110 emergency power system installations. Charging

at high boost voltage increases water loss, therefore *regular maintenance of battery water level is mandatory* with the high boost setting. Use high boost only with batteries where water can be replenished, *not* with VRLA or other types of non-refillable batteries. Use of the optional remote temperature compensation probe is highly recommended when boost charge is set to HIGH to maximize charging performance and optimize battery life.

Table 1– Boost Voltage Settings

	12V			24V		
Float Setting	**13.3/26.6**	**13.5/27.0**	**14.3/28.6**	**13.3/26.6**	**13.5/27.0**	**14.3/28.6**
Boost OFF (Float)	13.3	13.5	14.3	26.6	27.0	28.6
NORM Boost	14.0	14.2	15.2	28.0	28.4	30.4
HIGH Boost	15.3	15.7	16.0	30.6	31.4	32.0

Set the BOOST output voltage jumper on JP1 in the BOOST HIGH position if charging ultracapacitors rather than batteries. Dynamic Boost mode is disabled for operation with ultracapacitors (see Section 5.4 for ultracapacitor setup).

5.4. Ultracapacitor Mode

Ultracapacitor mode is used to charge ultracapacitors rather than batteries. Place a jumper in the 12V or 24V RANGE position and jumpers in both the BOOST NORM and BOOST HIGH positions (no FLOAT setting jumper) on JP1 to enable operation with ultracapacitors.

WARNING:
ULTRACAPACITORS ACCEPT AND DISCHARGE CURRENT RAPIDLY. NEVER ATTEMPT TO JUMP OR CONNECT A BATTERY TO AN ULTRACAPACITOR.

5.5. Program Mode

Removing all jumpers enables PROGRAM MODE. In PROGRAM MODE the charger output is determined by values programmed in the charger by an OEM or specially qualified distributor or packager. If the charger has not been specially programmed, removing all jumpers will result in an error state and the charger will not produce output.

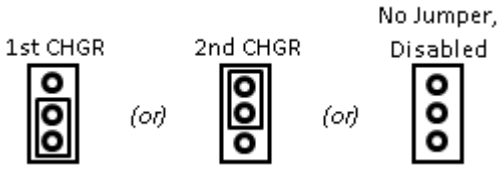
5.6. SAE J1939 Communications Setup (CANbus)—*Optional*

The optional J1939 interface on the charger is intended to provide genset suppliers with a highly reliable, low cost method to present all the information required by NFPA 110 to the genset controller, eliminating the need for a volt/amp display and alarm relays in the charger. To be operational, the genset controller must support the charger's J1939 connection. Contact your genset supplier to determine if your genset supports a J1939-connected charger.

5.6.1. ADDR Jumper

J1939 supports two chargers per network cable. Set the ADDR jumper on JP2 to position 1 for main charger or position 2 for auxiliary charger (see Figure 2). The jumper is set to position 1 by default. Remove the ADDR jumper to disable J1939 communications.

Figure 2 – J1939 ADDR Jumper Position



5.6.2. TERM Jumpers

Enable the TERM jumpers on JP3 if the charger is at the end of the J1939 cable and only if a separate terminator is not already in place (see Figure 3). Cable terminations are applied only at the ends of the bus, and J1939 networks typically provide a separate termination attached to the cabling. The jumpers are set in the disable position by default.

Figure 3 – J1939 TERM Jumper Setting

6 WIRING

All wiring must comply with applicable codes and local ordinances. See diagram at back of manual for wiring and connections information.

WARNING:
ENSURE THAT AC POWER IS DISCONNECTED AT A CIRCUIT BREAKER OR OTHER SAFETY DISCONNECT BEFORE WIRING THE CHARGER

6.1. Wire Ratings

6.1.1. All power conductors should be rated for use at 90º C or higher. Alarm relay conductors and J1939 data cable should be rated for use at 75º C or higher.

6.1.2. All input and output conductor sizes should be coordinated with the fault protection devices: 6.3A on AC input (14 AWG, 2.5 mm^2 typical), 15A on DC output (12 AWG, 4.0 mm^2 typical), 2A on alarm terminal block (20 AWG, 0.5 mm^2 typical).

6.1.3. The charger terminal blocks accept the following wire gauge ranges:

- AC input terminal block (TB1): 14 – 10 AWG (2.5 – 6 mm^2)
- Temperature sensor terminal block (TB2): 28 – 16 AWG (0.08 – 1.5 mm^2)
- DC output terminal block (TB3): 14 – 10 AWG (2.5 – 6 mm^2)
- J1939 terminal block (TB4): 28 – 16 AWG (0.08 – 1.5 mm^2)
- Alarm terminal block (TB5): 28 – 16 AWG (0.08 – 1.5 mm^2)

6.2. Grounding Instructions and Connection

6.2.1. Charger must be grounded to reduce risk of electric shock. The charger must be connected to a grounded, metal, permanent wiring system, or an equipment-grounding conductor (earthing conductor) must be run with the circuit conductors and connected to equipment-grounding terminal on charger.

6.2.2. Connect the equipment grounding conductor to the ground position on terminal block TB1 in the charger (see Figure 4). This position is marked with the ground symbol. This should always be the first wire connected and the last wire disconnected.

6.3. DC Connection

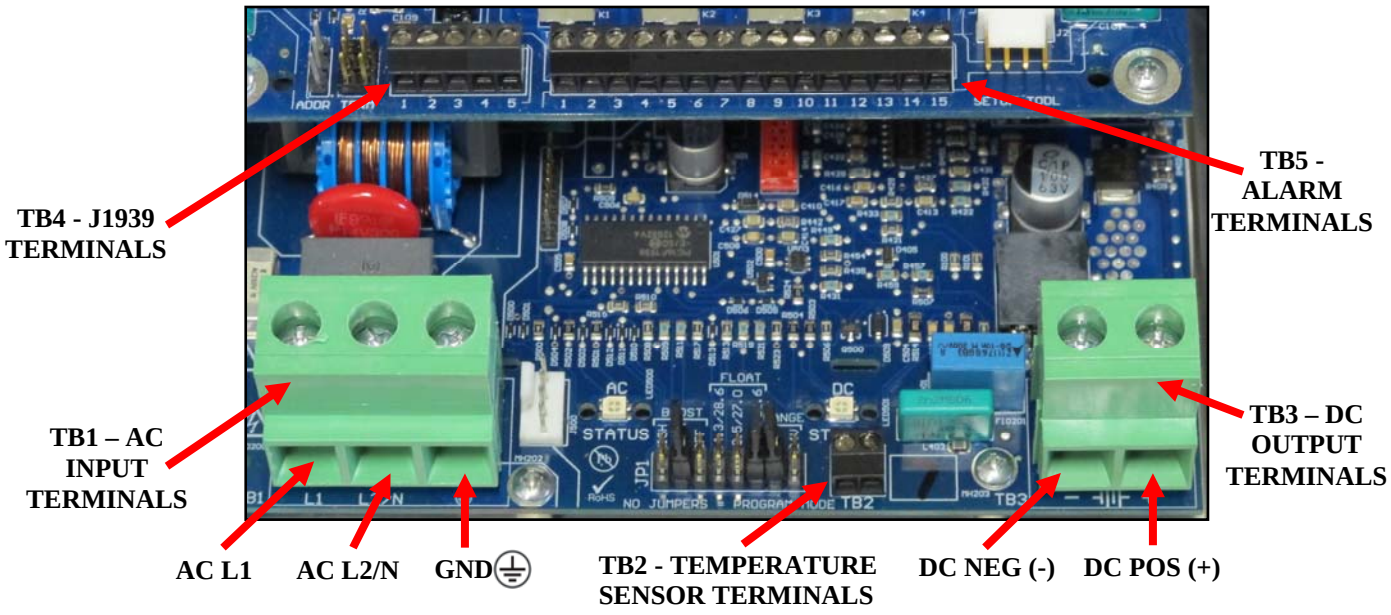
Ensure that any battery/ultracapacitor disconnect device in the system, if used, is opened (batteries/ultracapacitors disconnected from DC bus). **Ensure that ultracapacitors are discharged or not connected to charger until AC is applied.** Connect the DC output conductors to terminal block TB3 in the charger (see Figure 4). Always observe proper polarity of the DC output leads. Make the connections in the following order – charger output to ungrounded battery/ultracapacitor terminal, followed by charger output to grounded battery/ultracapacitor terminal. Always connect the output leads in this order. If the battery/ultracapacitor must be disconnected for service, remove the output wiring in the reverse order. The terminals accept 14 through 10 AWG (2.5 through 6 mm^2) conductors. Tighten connections to 10.5 Lb-In (1.2 Nm) using a Phillips/Slotted #2 driver. Route DC wiring at least ¼ inch (6 mm) away from AC wiring, alarm wiring, and the circuit board.

For North American and European Class B EMC installations, install one cable ferrite core around both DC wires

(positive and negative wires to battery/ultracapacitor) and within 10 cm of the charger. Use ferrite cores that suppress 70MHz to 300MHz frequencies. Suggested part numbers from Fair-Rite Products Corp. (www.fair-rite.com): 0431178281 or 2675665702.

WARNING:
A MAXIMUM OF 40 VOLTS MAY BE APPLIED AT THE OUTPUT TERMINALS. HIGHER VOLTAGE MAY DAMAGE THE CHARGER.

Figure 4 – Wire Connections
(fully enclosed model with optional alarm/communications circuit board shown)



6.4. AC Connection

This unit is permanently connected to the AC circuit and to the battery/ultracapacitor. An external disconnect device with a minimum of 0.12 inches (3 mm) pole separation must be located in the AC input to the charger. The charger automatically accepts AC inputs within the range of 90-265VAC, 47-63Hz.

Ensure that the AC input supply is de-energized. Connect the AC line and neutral conductors to terminal block TB1 in the charger (see Figure 4). If there is an identified grounded circuit conductor (neutral), attach it to the terminal marked "L2/N." The terminals accept 14 through 10 AWG (2.5 through 6 mm^2) conductors. Tighten connections to 10.5 Lb-In (1.2 Nm) using a Phillips/Slotted #2 driver. Route AC wiring at least ¼ inch (6 mm) away from DC wiring, alarm wiring, and the circuit board.

For EN 61000-6-3 Class B installations, install one cable ferrite core around all AC wires (L1, L2/N, GND) and within 10 cm of the charger. Use ferrite cores that suppress 70MHz to 300MHz frequencies. Suggested part numbers from Fair-Rite Products Corp. (www.fair-rite.com): 0431178281 or 2675665702.

6.5. Alarm Connections—*Optional*

If the optional alarms and communications circuit board is included, connect the alarm wiring to the respective terminals on terminal block TB5 in the charger (see Figure 4). Wire from FAIL or OK to COM depending on whether the alarm should be present on an open or closed circuit (see Table 2). Connect alarm terminals only to low voltage, limited energy ("Class 2") circuits. Alarm circuits are rated 2A at 30V AC or DC. The terminals accept 28-16 AWG (0.08-1.5 mm^2) conductors. Tighten connections to 2.0 Lb-In (0.22 Nm) using a small slotted driver. Route alarm wiring at least ¼ inch (6 mm) away from DC wiring, AC wiring, and the circuit board.

Table 2 – Alarm Relay Contact Wiring

Relay Contacts	AC Line Failure Alarm	High Battery Alarm (High DC)	Low Battery Alarm (Low DC)	Charger Fail Alarm	Output Fail Alarm
Close on alarm (normally open)	TB5-1 FAIL Defaults to FAIL with no AC input	TB5-4 FAIL	TB5-7 FAIL Defaults to FAIL with no battery	TB5-10 FAIL	TB5-13 FAIL Defaults to FAIL with no AC input
Common	TB5-2 COM	TB5-5 COM	TB5-8 COM	TB5-11 COM	TB5-14 COM
Open on alarm (normally closed)	TB5-3 OK	TB5-6 OK Defaults to OK with no battery	TB5-9 OK	TB5-12 OK Defaults to OK with no AC input	TB5-15 OK Defaults to OK with no AC input

6.6. Remote Temperature Sensor Connection—*Optional*

The charger includes local temperature compensation when an internal sensor is installed at terminal block TB2 and remote temperature compensation when an optional external sensor is located at the batteries/ultracapacitors. Remote temperature compensation is required for ultracapacitor charging and should be used in applications where battery and charger are located in different ambient conditions. Remote temperature compensation is appropriate for all applications but it is especially important that NFPA-20 fire pump and NFPA-110 emergency power system installations use a remote temperature sensor in order to return 100% of the battery/ultracapacitor's ampere-hour rating within 24 hours without causing damage to the battery. See Section 9.5 for further information regarding temperature compensation.

6.6.1. If the optional remote temperature sensor is used, remove the internal sensor from terminal block TB2 (see Figure 4).

6.6.2. Connect the remote sensor leads to TB2. The sensor is not polarized; it does not matter which lead connects to each terminal.

6.6.3. Route sensor wiring at least ¼ inch (6 mm) away from DC wiring, AC wiring, and the circuit board.

6.6.4. Locate the remote sensor where it will accurately detect the battery/ultracapacitor temperature by connecting it to a *grounded* battery/ultracapacitor terminal or the battery/ultracapacitor case. When securing to the battery/ultracapacitor case, use an adhesive/glue properly rated for the application material and temperature, such as Super Glue®.

6.7. Verify Connections

6.7.1. Verify that all connections are secure and in the proper locations. Tighten all unused screws on the terminal blocks to secure them against vibration.

6.7.2. Ensure all wires are routed in a way that the cover or other objects will not pinch or damage them.

7 POWER ON/POWER OFF PROCEDURE

7.1. Apply AC Input Voltage

Remove any jumper from JP1 on circuit board to disable output voltage (if charger is not in PROGRAM MODE). Verify the AC input is the correct value (90-265 VAC, 47-63 Hz) and apply AC to charger.

7.2. Connect Battery/Ultracapacitor

Ensure wiring is correctly connected between charger and battery/ultracapacitor and that AC is applied. Close any system battery/ultracapacitor disconnect, if used, to connect the battery/ultracapacitor to the charger. Replace jumper removed from JP1 to power on charger.

Depending on the state of charge of the batteries/ultracapacitors and the load on the DC bus, the charger may go into current limit at this time, in which case the output voltage will be reduced as the charger operates in constant

current mode. Eventually as the battery/ultracapacitor is charged, the charging current demand should taper to a value below the current limit set point of the charger, and the charger should revert to constant voltage output.

7.3. Power Off

Power charger off in reverse order or remove any jumper from JP1 (if charger is not in PROGRAM MODE) to disable output voltage.

8 ALARMS, LEDS AND DISPLAY

8.1. LED Indicators

The charger is equipped with two LEDs, one for AC status and one for DC status. See further alarm definitions in Section 8.4.

Table 3 – LED Definitions

AC LED (bicolor RED/GRN)	**DC LED** (bicolor RED/GRN)	**Meaning**
OFF	OFF	AC and DC not applied, or charger failed
*SOLID GREEN	SOLID GREEN	AC good, DC good, in Float Mode
SOLID GREEN	FLASHING GREEN	AC good, in Dynamic Boost Mode
*SOLID GREEN	FLASHING 2X GREEN	AC good, DC in current limit (max charge)
*SOLID GREEN	SOLID RED	AC good, charger fail
*SOLID GREEN	FLASHING RED/YELLOW	AC good, reverse polarity detected on output
*SOLID GREEN	SOLID YELLOW	AC good, high or low battery voltage (above/below setpoint)
*SOLID GREEN	FLASHING RED	AC good, high incompatible battery error or overvoltage shutdown (charger disabled)
*SOLID GREEN	FLASHING YELLOW	AC good, low incompatible battery error (charger disabled)
*SOLID GREEN	FLASHING GREEN/YELLOW	AC good, output limited by high temperature
SOLID RED	SOLID GREEN	AC fail, battery voltage good
SOLID RED	SOLID YELLOW	AC fail, high or low battery voltage (above/below setpoint)
SOLID RED	SOLID RED	AC fail, charger fail
SOLID RED	FLASHING RED	AC fail, high incompatible battery error or overvoltage shutdown (charger disabled)
SOLID RED	FLASHING YELLOW	AC fail, low battery voltage (below setpoint) or low incompatible battery error
ALTERNATING FLASHING YELLOW		Illegal jumper configuration

*AC LED will flash green when charger is in Ultracapacitor mode.

8.2. Individual Alarm Relay Contacts—*Optional*

The optional alarms and communications circuit board offers five alarm discrete Form C contacts. The Form C relay contacts change state when alarms are activated (see Table 2). Except for the AC FAIL relay which activates immediately, the relay contacts change state 30 seconds after the onset of a fault or after an OEM-programmable time period when the charger is in PROGRAM MODE (see Section 5.5). See Section 8.4 for alarm definitions.

8.3. LCD Panel—*Optional*

If the optional alarms and communications circuit board is included, a two line by twenty-character LCD is present and provides precision digital ammeter and voltmeter as well as information about alarms and status. The voltmeter is accurate to $\pm$2% and the ammeter is accurate to $\pm$5%. The display is readable with or without ambient lighting and operates automatically, requiring no operator intervention. During routine operation the ammeter and voltmeter are always present and followed by status. Alarms will replace normal status information when alarm conditions are present.

8.4. Alarm Definitions

See Table 3 for full description of LED indicator activity. Unless noted otherwise, the following alarms are displayed on the optional LCD panel if it is included.

8.4.1. AC Line Failure

Indicates AC input voltage is not applied or is inadequate. Activates solid red AC LED. Optional alarms and communications circuit board AC LINE and OUTPUT relay contacts immediately change to Fail state.

8.4.2. High Battery Voltage

Indicates DC output voltage is above factory alarm setpoint (see Table 4), or the OEM-programmed level if the charger is in PROGRAM MODE. Activates solid yellow DC LED. Optional alarms and communications circuit board HIGH DC relay contacts change to Fail state after delay.

In Ultracapacitor mode (see Section 5.4), alarm activates at 17V for 12V ultracapacitors and 28.4V for 24V ultracapacitors.

Table 4 – High DC Alarm Setpoints

Battery Range	Float	High DC		
		Boost Off	Normal Boost	High Boost
12V	13.3/26.6	14.27	15.01	16.38
	13.5/27.0	14.48	15.22	16.70
	14.3/28.6	15.33	16.28	17.12
24V	13.3/26.6	28.54	30.02	32.76
	13.5/27.0	28.97	30.44	33.40
	14.3/28.6	30.65	32.55	34.24

8.4.3. Low Battery Voltage

Indicates DC output voltage is below factory alarm setpoint (see Table 5), or below the OEM-programmed level if the charger is in PROGRAM MODE. Activates flashing yellow DC LED if AC has failed or solid yellow DC LED if AC input voltage is not applied or is inadequate. Optional alarms and communications circuit board LOW DC relay contacts change to Fail state after delay.

In Ultracapacitor mode (see Section 5.4), alarm activates at 13V for 12V ultracapacitors and 22.4V for 24V ultracapacitors.

Table 5 – Low DC Alarm Setpoints

Battery Range	Float	Low DC
12V	13.3/26.6	11.00
	13.5/27.0	11.00
	14.3/28.6	11.00
24V	13.3/26.6	22.00
	13.5/27.0	22.00
	14.3/28.6	22.00

8.4.4. Charger Failure

Indicates the charger is not able to provide the current demanded by the battery/ultracapacitor and/or load or is providing excess current. This is typically caused by an internal component failure. This alarm does not occur during AC power failures. Activates solid red DC LED. Optional alarms and communications circuit board CHARGER and OUTPUT relay contacts change to Fail state after delay.

8.4.5. Output Fail

Output fail is a relay contact alarm only and is not displayed on the LCD panel. Optional alarms and communications circuit board OUTPUT relay contacts change to Fail state if either AC LINE or CHARGER relay contacts change to Fail state; indicating the charger is not able to output due to either AC power or charger failure.

8.4.6. Overvoltage Shutdown

Indicates that the charger has executed a high voltage shutdown. The charger disables itself whenever excessive output voltage occurs while the charger is delivering current. Overvoltage Shutdown cannot be disabled, but is protected against nuisance trips. If the high voltage condition is caused by an external source the charger will not execute an Over Voltage Shutdown. Activates flashing red DC LED. Optional alarms and communications circuit board CHARGER relay contacts change to Fail state after delay. Reset the charger by removing and replacing any jumper at JP1 on the circuit board to clear the alarm.

8.4.7. Reverse Polarity

Indicates a battery is connected backwards. Charger output is disabled until the condition is corrected. Activates flashing red/yellow DC LED.

8.4.8. Low Cranking Voltage

Alarm available only when the optional alarms and communications board is installed and only on the LCD panel. Indicates the battery/ultracapacitor voltage is inadequate to provide engine-cranking capability and that DC output voltage is below 6V for a 12V system and below 12V for a 24V system. Rather than immediately resetting, the Low Cranking Voltage alarm resets 2 minutes after the voltage rises above the alarm setpoint.

8.4.9. Incompatible Battery

Indicates a 12V battery is connected to a 24V charger or a 24V battery is connected to a 12V charger. Activates flashing red DC LED if battery voltage is high and flashing yellow DC LED if battery voltage is low. The charger will charge for approximately 5 minutes to determine if the battery voltage will begin to rise. If the voltage rises properly the charger will continue to charge the battery normally. If the voltage does not rise appropriately within 5 minutes the charger will shut down. Activates solid red DC LED. Optional alarms and communications circuit board CHARGER and OUTPUT relay contacts change to Fail state after delay. After correcting mismatched condition, remove and replace any jumper at JP1 on the circuit board to reset the charger and begin operation. See Section 9.5 for charging a very low or zero-volt battery.

8.4.10. Invalid Settings

Indicates output voltage JP1 jumpers (see Figure 1) are not valid. Charger output is disabled until the condition is corrected. If the charger is programmed to use custom settings it will enter PROGRAM MODE when all jumpers are removed. The invalid jumper alarm will not be active in this case, but will be active if no jumpers are installed and the charger has not been programmed.

8.4.11. CAN Bus Not Active

Indicates that a charger cannot access the J1939 network. This will occur if the charger is not connected to a J1939 network or if the charger cannot claim an address to use on that network. The charger will not use J1939 communications until it can acquire a network address. Removing the CAN ADDR jumper (JP1) will inhibit this message and disable the J1939 interface.

8.4.12. Thermal Fold Back

Indicates the charger output is reduced to prevent over-heating. The charger will not be able to produce full output until the ambient temperature returns below +40ºC (104ºF) for 12V-10A and 12/24V-6A chargers, or +45°C (113°F) for enclosed 12V-6A, or +50°C (122°F) for open-frame 12V-6A.

8.4.13. No Temperature Probe

Alarm available only when the optional alarms and communications board is installed and only on the LCD panel. Indicates a disconnected or failed temperature sensor.

8.4.14. Current Limiting

Indicates the charger is operating at maximum allowable output, either the maximum current setting or 150 Watts DC output (whichever occurs first).

9 OPERATION

The MicroGenius® 150 charger uses a demand-based automatic dual rate (float and boost) charging algorithm with an output power limit of 150 Watts. Reset the charger at any time by removing and replacing any jumper at JP1 on the circuit board.

9.1. Float Mode

Float mode is used to maintain a battery in its fully charged state. When the charger is in Float mode the output voltage is maintained at the float voltage setting.

9.2. Dynamic Boost™ Mode

Dynamic Boost mode is the standard boost mode for the charger and provides a battery interactive boost voltage cycle that automatically adapts to each application in real time by compensating for depth of discharge, varying load, battery age and other variables. Dynamic Boost mode safely maximizes recharge performance while cutting risk of overcharge that is associated with prolonged fixed charge cycles or excessive boost settings. Dynamic Boost mode should be used only when the battery manufacturer recommends Boost charging and is typically disabled for Valve Regulated Lead Acid (VRLA) batteries. Dynamic Boost mode is disabled for operation with ultracapacitors.

9.3. Ultracapacitor Mode

Ultracapacitor mode is used to charge ultracapacitors rather than batteries. The AC LED will flash green to indicate ultracapacitor mode (see Section 8.1 for LED operation).The charger output voltage in ultracapacitor mode is 15V for 12V ultracapacitors and 25.4V for 24V ultracapacitors. Dynamic Boost mode is disabled for operation with ultracapacitors.

9.4. Recharging Batteries

After a battery has been discharged, the charger will exit Float mode and enter Dynamic Boost mode if this mode is enabled (see Section 5.3). While in Dynamic Boost mode, the output current is limited and the output voltage may be lower than the Float voltage set-point (depending on how deeply the battery has been discharged). Charging will continue until the output voltage rises to the Boost voltage point (see Table 1), output power decreases, and the Boost recharge cycle has timed out. The charger returns to Float mode after the Boost mode time limit has expired and will stay in Float mode until the battery is discharged.

9.5. Charging Low or Zero-volt Batteries

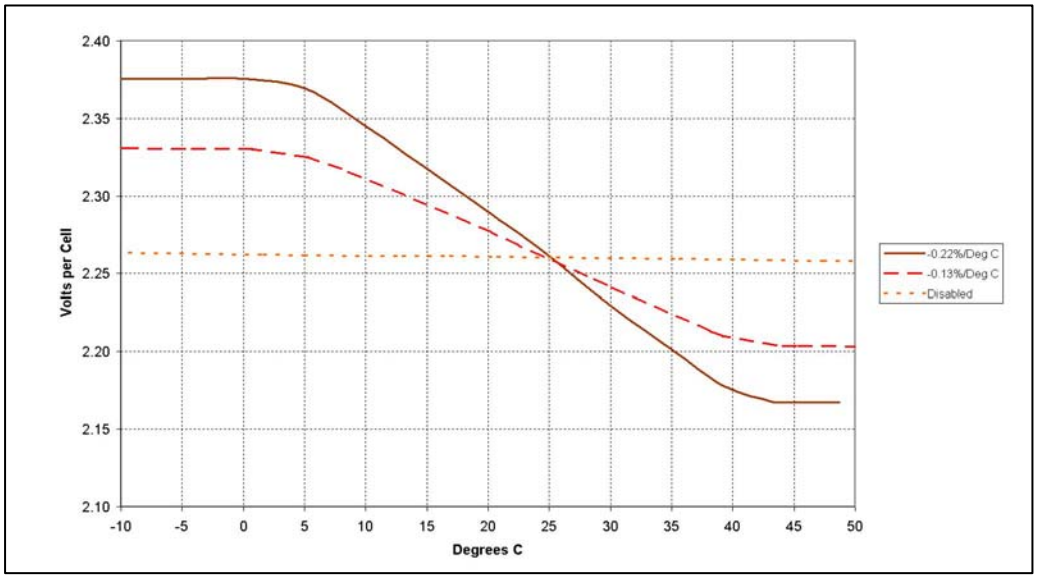
The charger will initially charge/commission zero-volt or fully discharged batteries without special user intervention. The charger will charge for approximately 5 minutes to determine if the battery voltage will begin to rise. If the voltage rises properly the charger will continue to charge the battery normally. If the voltage does not rise appropriately within 5 minutes the charger will shut down. This shut down prevents long-term overcharge of a 12V battery in the event of a mismatched battery (a 12V battery is connected to a 24V system). After correcting mismatched condition, remove and replace any jumper at JP1 on the circuit board to reset the charger and begin operation.

9.6. Temperature Compensation

The charger is temperature compensated to match the negative temperature coefficient of the battery/ultracapacitor. When Temperature Compensation is active, the output voltage will increase slightly as temperature decreases, decrease as temperature increases, and is clamped at 0°C (32°F) and +50°C (122°F) to protect against extremely high or low output voltage (see Figure 5).

The charger automatically includes local temperature compensation when an internal sensor is used and remote temperature compensation when an optional external sensor is located at the batteries/ultracapacitors (see Section 6.6 for connections). Remote temperature compensation is required for ultracapacitor charging and should be used in applications where battery and charger are located in different ambient conditions. Temperature Compensation is set to a slope of -0.18% per °C by default for operation with batteries. The temperature Compensation slope for ultracapacitors is set by the factory and is not adjustable. Temperature compensation is disabled when neither the local nor remote temperature sensor is connected. If the optional LCD is included, the temperature present at a sensor (local or remote) is displayed. Actual battery/ultracapacitor temperature is only displayed if the optional remote temperature sensor is connected to the charger and placed at the batteries/ultracapacitors.

Figure 5 – Example Temperature Compensation Curves



9.6. Parallel Charger Operation

Multiple MicroGenius® 150 chargers may be connected in parallel to provide charger redundancy. Active load sharing is not required; the chargers will automatically operate normally and it is not uncommon for one charger to be more heavily loaded than the other. The chargers must be set for the same voltage range (12V or 24V) and Float voltage. Boost mode should be disabled on one charger to avoid conflicts between chargers. As a result, redundancy of Boost output voltage is not included.

10 TROUBLESHOOTING

Figure 6 – Troubleshooting AC FAIL

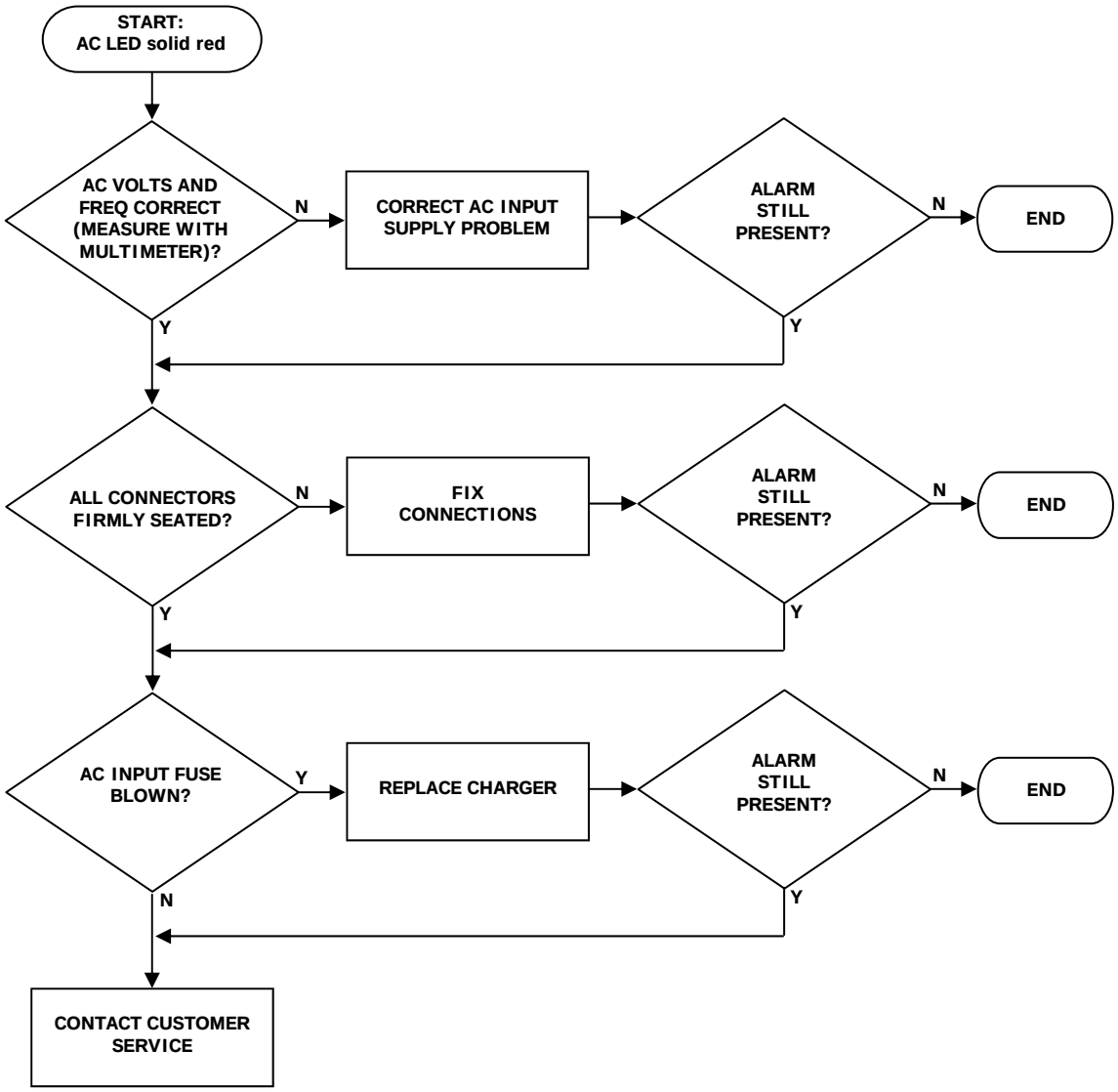


Figure 7 – Troubleshooting CHARGER FAIL

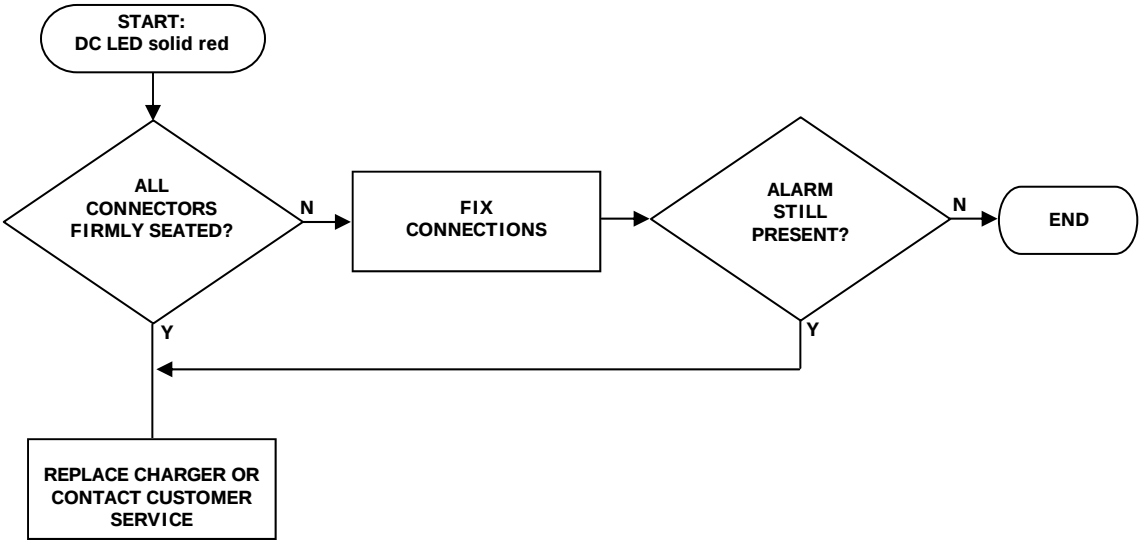


Figure 8 – Troubleshooting HIGH DC

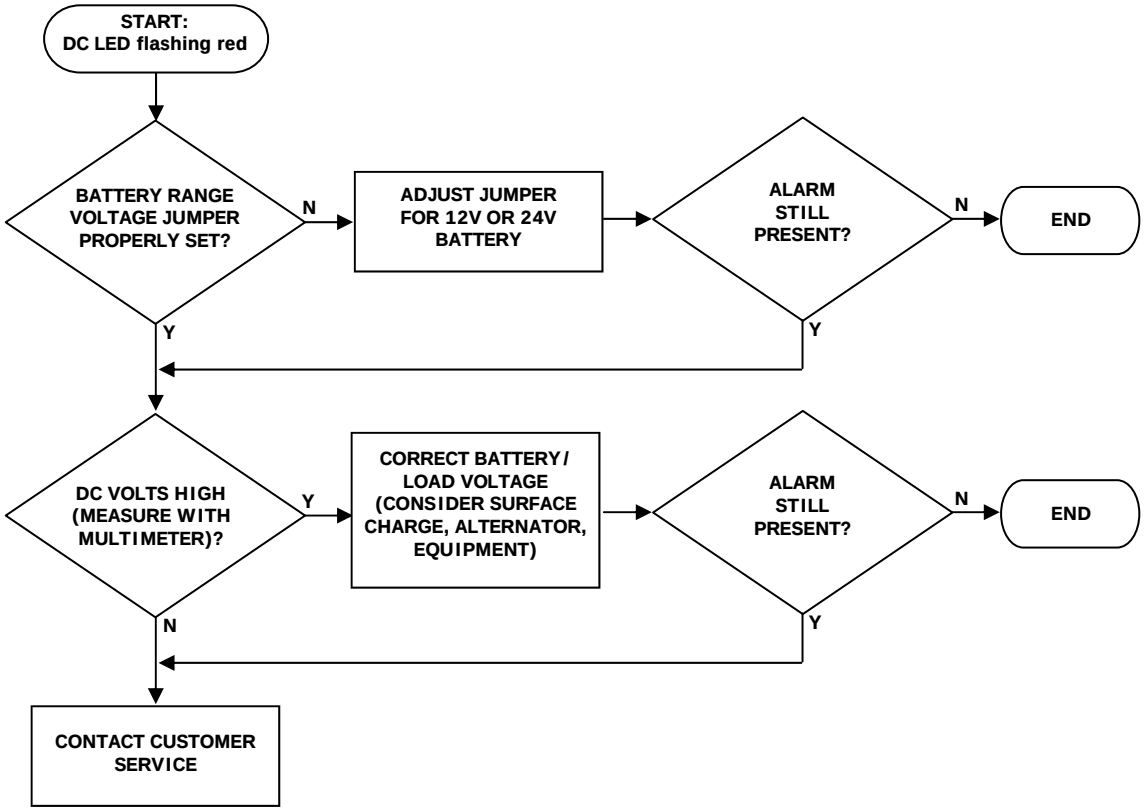


Figure 9 – Troubleshooting LOW DC