# B & C Specialty Products, Inc.

123 East 4th St, P.O. Box "B", Newton KS 67114-0894
Telephone: (316) 283-8000 * Fax: (316) 283-7400 * Online: www.BandC.aero

## BC433-H & PMR3A Troubleshooting Guide

This troubleshooting guide is not intended to be exhaustive of all possible charging system failures. Following this procedure will, however, locate the most common system problems encountered by B&C's technical staff.

The BC433-H is a three-phase alternator incorporating a fixed stator and a permanent magnet (PM) housing that revolves around the stator to generate electrical energy. Since the winding is stationary, there are no brushes required to transfer electrical energy. Continuity of the winding may be checked with a high impedance—preferably digital—volt/ohmmeter (DVM) to detect any broken wires in the leads or winding. If the PM housing rotates and the wiring is continuous, there must be A.C. output. Each phase of the alternator wiring should be fused with circuit protection (typically a 20 amp in-line fuse).

The PMR3A is a solid state, series-type rectifier-regulator incorporating an integral heatsink (case). It is rated for a maximum throughput of 35 amps, and is designed for mounting on an aluminum or steel surface. In operation, the PMR3A changes (or "rectifies") the AC output of the BC433-H into DC, at a non-adjustable set-point of 14.5v (+/- 0.5v). Electrical connections on the PMR3A are made via field-installed terminal plugs incorporating environmental seals.

Please reference wiring diagram 505-500 (Rev. J, 2/5/08, or later) and use a DVM for the following checks. When calling for additional technical support, the information gained from these checks should be readily available to aid B&C's technician to narrow the field of possibilities as quickly as possible. Please use the provided blanks to record the various measurements. Note: the engine should not be running, the mags should be OFF, and there should be no auxiliary or external power applied to the aircraft electrical system.

1. Ground Connections:
    - Turn all switches OFF.
    - Use the lowest resistance scale on the DVM.
    - Measure Ohms between battery negative (-) and PM3A regulator ground

      _____ Ohms

    - Measure Ohms between battery negative (-) and the engine case

      _____ Ohms

A. Measured values should be within 0.5 Ohms; values outside of this would be cause for investigation (check the engine ground strap, battery ground strap, and regulator ground wire for loose or contaminated connections, broken conductors or bad crimp joints in this case).

B. If measurements measured values are less than 0.5 Ohms, any of these three points may be used as reference (-) for the following measurements.

2. Power to Regulator
   - Turn ON the battery master
   - Turn ON the alternator field switches (if the aircraft is so equipped)
   - Measure the voltage on the battery bus

     _____ Volts
   - Measure the voltage on the positive (+) terminal of the PMR3A

     _____ Volts

A. Measured voltages should be equal or within 0.30 volts; a difference greater than 0.30 volts may be caused by poor contacts in the field breaker, the relay module, or the presence of poor/broken crimp joints in the wiring between the battery bus and the positive (+) terminal of the PMR3A.

B. If the positive (+) terminal of the PMR3A has no voltage, it will not operate. In the case of reported intermittent operation, carefully assess the condition of the wire crimp joint at the positive (+) terminal.

3. Alternator Circuit Breaker
   - In the case of an absence of voltage at the positive (+) terminal of the PMR3A, move to the 30A output breaker (recommended)
   - Measure the voltage on the switched side of the 30A breaker:

     _____ Volts
   - Measured values should again be equal or within 0.25 volts of the battery bus voltage; a difference greater than 0.25 volts may be caused by poor contacts in the field breaker. An absence of voltage on the switched side of the breaker indicates a failed breaker.

Note that a marginal breaker may initially test within acceptable values, and later test outside of these values as the flow of current causes an increase in resistance in the breaker contacts – a condition often responsible for intermittent or erratic charging.

4. Control Relay
    - Given the presence of adequate voltage on the switched side of the output breaker, move to the Control Relay.
    - Turn all switches OFF
    - Measure the resistance at the Control Relay ground terminal (85)

      _____ Ohms

A. Compare these values with those measured in Step 1. Measured values should be within 0.5 Ohms; values outside this merit further investigation, as they may indicate a broken wire, bad crimp joint, or faulty ground.

- Turn ON the battery master switch
- Turn ON the alternator field switch
- Measure voltage at the COM (30) terminal

  _____ Volts

- Measure the voltage at the NO (87) terminal

  _____ Volts

B. Measured values should again be equal or within 0.30 volts of the battery bus voltage; a difference greater than 0.30 volts may be caused by a damaged or failed Control Relay.

- Keep battery master and alternator field switches ON
- Measure the voltage coil terminal (86)

  _____ Volts

C. Values should again be equal or within 0.30 volts of the battery bus voltage; a difference greater than 0.30 volts may be caused by a marginal or failed circuit breaker, switch, Control Relay, or a wiring issue. If a significant voltage drop is observed in this circuit, step-by-step voltage checks at each device in the circuit are suggested.

D. To rule-out a wiring issue, inspect the color-coded wire going to the Crowbar OV Module from the Control Relay coil terminal (86) and ensure that the color-coding has been properly observed. Inspect also the 1N4005 diode associated with this same connection to confirm that it has been installed properly, with the silver stripe toward the yellow/orange wire.

5. Filter Capacitor
    - Keep battery master and alternator field switches ON
    - Measure the voltage at filter capacitor's positive (+) terminal

      _____ Volts

      This value should be equal or within 0.5 volts of the battery bus voltage; a difference greater than 0.5 volts may be caused by a bad crimp joint, broken wire or wire terminal, or a marginal or failed Capacitor (rare).

6. Move forward to the BC433-H Alternator, and associated wiring and circuit protective devices.

    A. Locate each of the three (3) in-line fuse holder assemblies connected to the Alternator control wires. With the battery and alternator master switches OFF, make the following checks:

        (1) Perform a visual inspection of each fuse, giving particular attention to indications of a "blown" or open fuse link. Since fuses are not generally subject to wear-and-tear, a closed (or intact) fuse link is expected; an open fuse link merits closer scrutiny of the Alternator windings and associated wiring (see below).

        (2) Confirm the condition of the fuses by checking each for continuity using a DVM (black probe in COM port, red probe in the VΩmA or similar port). Continuity indicates an intact or closed fuse link; no continuity indicates an open fuse link, and should be investigated further (see below).

    B. Evaluate the BC433-H for continuity with the battery master and alternator field switches OFF. Be certain there is no power present during this test.

        (1) Check the three phases of the BC433-H against each other. This may be accomplished by probing the test points of any two in-line fuses at the same time. Repeat until all three phases have been tested. Continuity should be observed between each phase; no continuity indicates a broken wire in the alternator windings.

        (2) Check each of the three phases of the BC433-H against the alternator frame and housing by touching a probe to one in-line fuse test point and the other probe to the alternator frame. No continuity should be observed; continuity indicates an internal short-circuit.

7. If all of the voltage and condition checks in the above steps are close to the values specified, the charging system should be operative.

If the problem seems to be intermittent in nature, consider temporarily bringing small test wires into the cockpit from 2 or 3 points in question to allow monitoring with the DVM during periods of system failure. It may also be helpful to double (or triple) check all screw and crimp terminals for security, and perform a 5 pound pull test on all crimp joints and make sure that the terminal is crimped on the wire, not the insulation (which can occur more frequently than one might expect).

Noise problems are also difficult to find. A few tips to help with curing noise problems follow:

1. A unitized grounding system helps prevent noise problems by preventing voltage differences between different ground points (ground loop).

2. The battery acts as a noise filter in the system. Poor connections to the battery or a battery that is going bad can add to or even cause noise problems.

3. Shielding low level audio leads (especially microphone leads or headset leads) is required. Sometimes the shields in the cables can separate from repeated flexing. Try checking shield continuity with an ohmmeter or substituting another headset, microphone, etc.

4. Wire routing may be important in some installations. Separation of noise carrying conductors such as “P” leads from other wiring may help. Running noisy wiring parallel to other wiring in the same bundle is asking for trouble. Wires at 90 degrees to one another, however, do not couple noise.

5. Running transmitter feed lines close to and in parallel with other wiring can cause a problem. Normally, problems will only be encountered if there is a mismatch and therefore a high SWR in the antenna system. If noise or charging system breaker tripping occurs only during Comm transmit or only when the transponder is on, check the corresponding antenna system carefully or separate the transmission line from other wiring.

6. The best plan is to stop the noise at its source. Once the noise is “loose,” it can be difficult to filter it out of all affected systems. Try to locate the offending item and correct the problem at that point. Switching off the alternator, the mags (first one then the other), or any other electrical equipment that generates noise should help to find the offender.

B&C is always ready to assist our customers with technical problems during construction and thereafter. The safety of our friends and reliability of our products are top priority. If this guide has not solved your problem, call us. If we cannot help you find the problem, we may know someone who can.