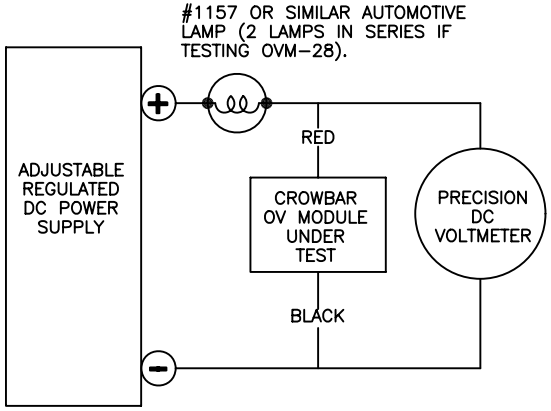
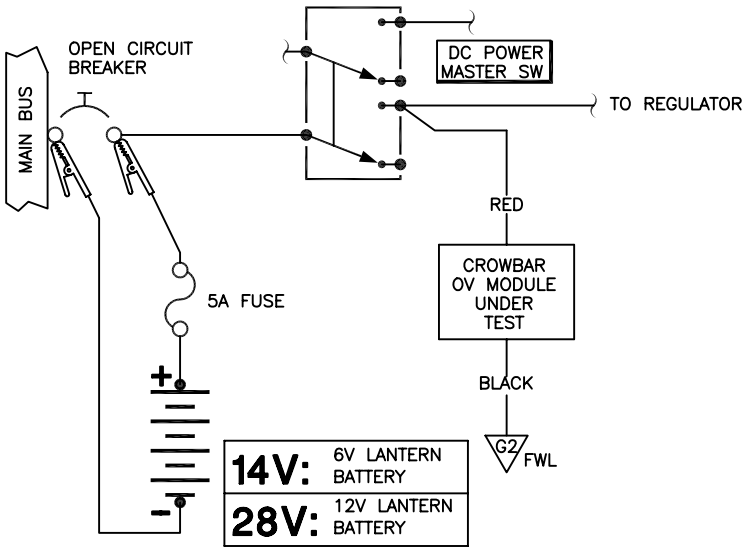
NOTES:

1. INTERCONNECT DEVICE TO BE TESTED AS SHOWN IN BENCH TEST SETUP TO THE LEFT. THE LAMP BULB IN SERIES WITH THE POWER SUPPLY PROTECTS SUPPLY FROM SHORT CIRCUIT DAMAGE WHEN CROWBAR "FIRES." IF POWER SUPPLY IS INTERNALLY PROTECTED FROM OVERCURRENT, THE LAMP MAY BE ELIMINATED.
2. SET THE POWER SUPPLY FOR 16.3 VOLTS. ADJUST POTENTIOMETER ON OVMODULE SLOWLY UNTIL IT TRIPS CAUSING THE LAMP TO ILLUMINATE OR PLACES A DEAD-SHORT ON POWER SUPPLY. DISCONNECT OV MODULE TO RESET IT. SET POWER SUPPLY VOLTAGE BELOW 16 VOLTS AND RECONNECT OV MODULE. ADJUST POWER SUPPLY VOLTAGE SLOWLY UPWARD AND OBSERVE TRIP POINT. ADJUST POT AS NEEDED TO ACHIEVE TRIP POINT OF 16.3 +/- 0.3 VOLTS (32.6 +/- 0.6 VOLTS ON 28V SYSTEM).
3. THE OV PROTECTION MODULE IS SELF RESETTING IN NORMAL SERVICE. AFTER THE MODULE FIRES, THE BREAKER THAT SUPPLIES POWER TO THE CROWBAR MODULE AND ALTERNATOR FIELD WILL POP THUS REMOVING POWER FROM THE FAILED ALTERNATOR SYSTEM. RESETTING THE CIRCUIT BREAKER WILL RESTORE NORMAL SYSTEM OPERATION EXCEPT IN CASES WHERE THE VOLTAGE REGULATOR HAS FAILED WHEREUPON THE OV PROTECTION MODULE WILL TRIP AGAIN AND SHUT DOWN THE FAILED SYSTEM.
4. THE OV MODULE SHOULD BE TESTED EVERY YEAR FOR PROPER OPERATION. SUGGEST REMOVAL AT EVERY ANNUAL INSPECTION TIME FOR BENCH TESTING AS DESCRIBED IN NOTES 1 THRU 3 ABOVE.
5. AN ALTERNATIVE TEST FOR FUNCTIONALITY ONLY MAY BE CONDUCTED IN THE AIRPLANE. USE A 6-VOLT LANTERN BATTERY (12-VOLT FOR 24V AIRCRAFT) WITH ALLIGATOR CLIP LEADS AND A 5A, INLINE FUSE AS SHOWN IN THE FIGURE BELOW.
6. BEGIN WITH MASTER SWITCH OFF, OPEN THE ALTERNATOR FIELD BREAKER, CLIP THE TEST FIXTURE ACROSS THE BREAKER TAKING CARE TO OBSERVE POLARITY, THEN TURN DC POWER MASTER SWITCH TO ON.
7. THIS TEST SETUP ADDS THE LANTERN BATTERY VOLTAGE TO THE SHIP'S BATTERY VOLTAGE. THIS HIGHER THAN NORMAL VOLTAGE SHOULD TRIGGER THE CROWBAR OV MODULE AND POP THE FUSE IN THE TEST FIXTURE. THIS TEST SHOWS GROSS FUNCTIONALITY OF THE OVM BUT DOES NOT TEST CALIBRATION.
5. NUMBERS IN PARENS () ARE DIGIKEY CATALOG NUMBERS. CALL 1-800-344-4539 AND REQUEST A CATALOG.
6. IF YOU PREFER TO PURCHASE RATHER THAN BUILD, ASSEMBLED AND TESTED OVM-14 AND OVM-28 CROWBAR OV MODULES ARE AVAILABLE FROM B&C SPECIALTY PRODUCTS
NEWTON, KS (316) 283-8000



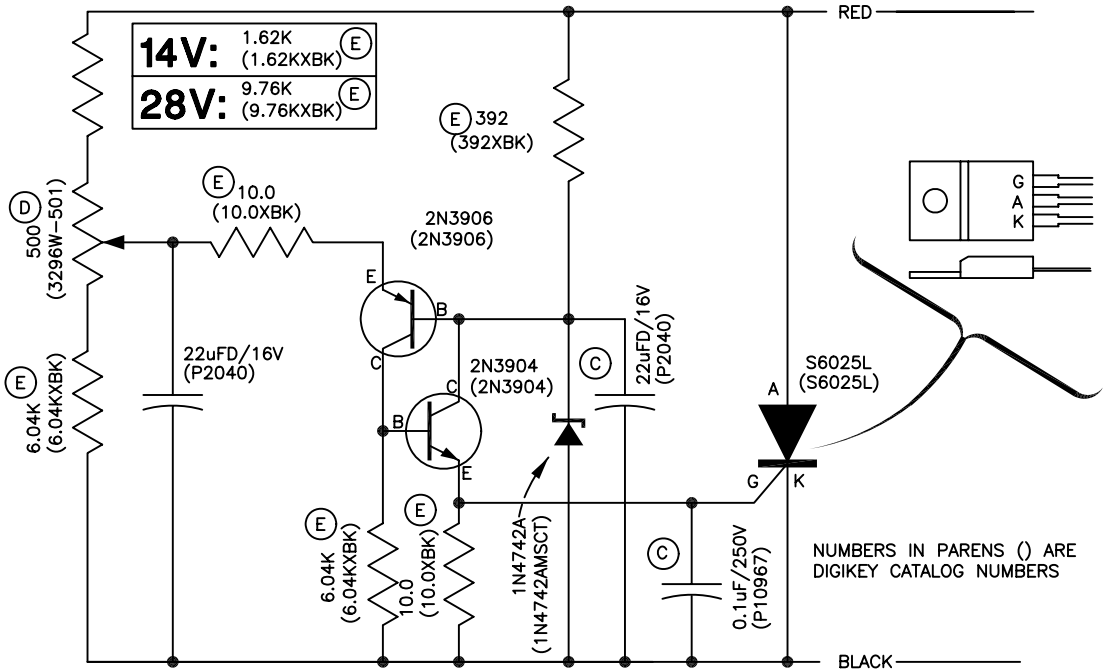
BENCH TEST SETUP



TEST SETUP FOR TESTING ON THE A/C

(See text)

SCHEMATIC AND BILL OF MATERIALS



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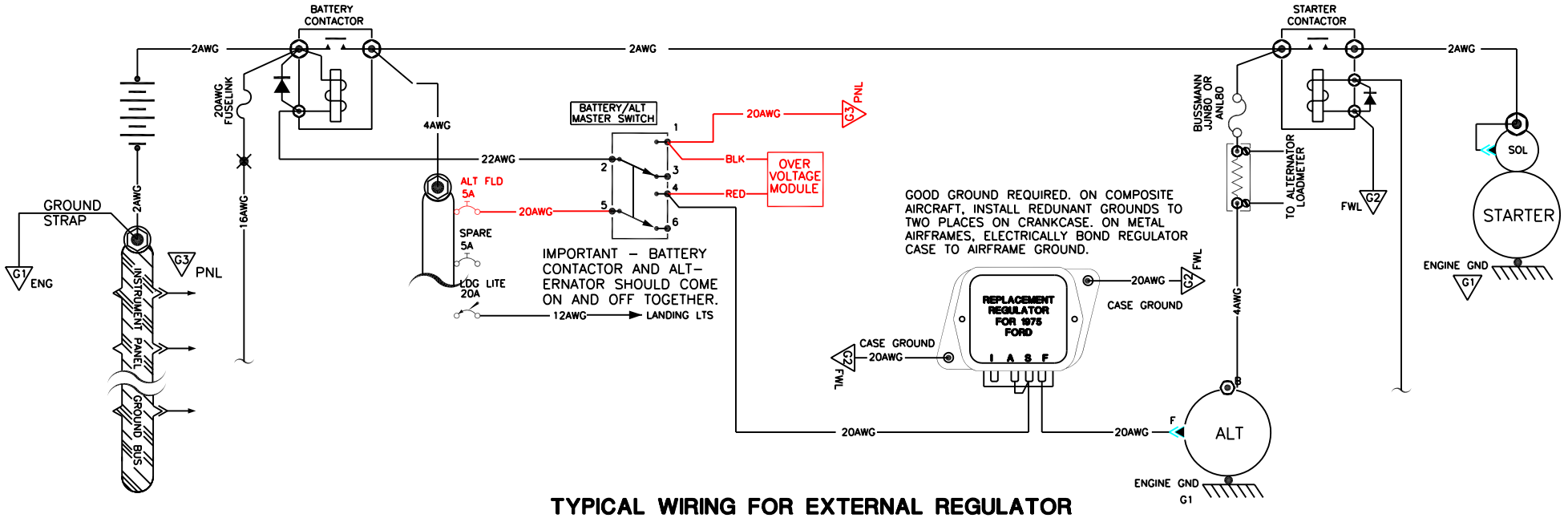

TYPICAL WIRING FOR EXTERNAL REGULATOR

The AeroElectric Connection does not recommend the use of internally regulated alternators on aircraft. Wiring for these alternators has been deleted.

TYPICAL WIRING FOR INTERNAL REGULATOR

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OVM INSTALLATION

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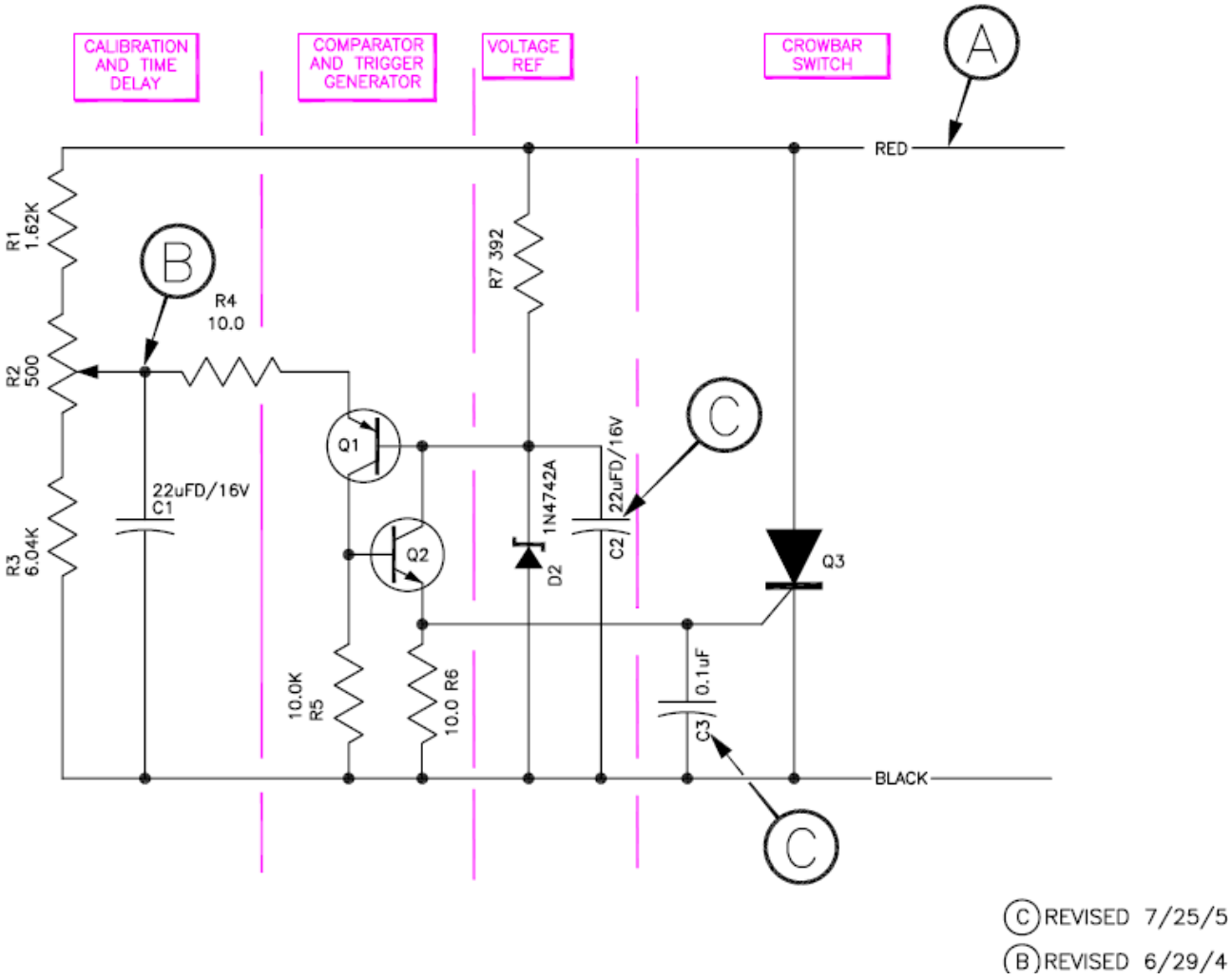
DIY Crowbar OV Protection Module

How it works:

The circuit below can be divided into four functional sections. Calibration and time delay, voltage comparator and trigger generator,



voltage reference and a solid state crowbar switch.

Resistors R1 through R3 provide an adjustable voltage divider.

With the potentiometer R2 centered, the equivalent circuit voltage divider is 1870 ohms from bus (A) to the arm of the potentiometer (B) and 6290 ohms from the arm of the potentiometer (B) to ground yielding a voltage multiplier of 0.77

A normal bus voltage (A) in the range of 13.8 to 14.8 volts will produce a voltage range of 10.6 to 11.4 volts across capacitor C1 at “B”.

The voltage divider has a source impedance of 1440 ohms. Combining this source impedance with the 22 uF capacitor (C1) offers a time constant

on the order of 3 milliseconds. This time constant prevents short duration surges from nuisance tripping the OV protection module.

Resistor R7 and zener diode D2 comprise the voltage reference of 12 volts when measured at (C).

The silicone controlled rectifier (Q3) serves as the crowbar switch. This device is normally an open circuit between the bus connection (A) and ground. When fed with a gate trigger pulse at (D) the device turns ON and remains ON until power is removed. The crowbar OV protection module is designed to deliberately open a circuit breaker so in normal operation, power is removed from a triggered crowbar switch within milliseconds of the triggering event.

Capacitors C2 and C3 were product improvements added ad Revision C when a reader discovered and illuminated a tendency of the circuit to nuisance trip under the influence of very narrow, negative going transients in the system.

The “magic” happens in the comparator/trigger section comprised of Q1, Q2, R5 and R6. In the normal operating state, the voltage at the base of Q1 runs 0.6 to 1.4 volts BELOW the emitter of Q1 which is held at 12 volts by voltage reference zener D2. During an OV condition the voltage at B rises. When it passes 12.5 volts, transistor Q1 goes into conduction and it’s collector PULLS UP on the base of Q2 driving it into conduction. The collector of Q2 is tied to the base of Q1 which pulls it DOWN into still harder conduction. This positive feedback causes a rapid increase in the conduction of Q1/Q2 pair causing the charge on C1 to be dumped into the gate of Q3. This rapid, short duration pulse triggers Q3 and initiating the crowbar OV shutdown.

Troubleshooting:

Step 1. Disconnect gate (trigger lead) of Q3 and the junction of Q2 emitter and R6 (Test Point D). Also if diode D1 is installed, remove it (deleted at revision B).

> *Discussion: This will permit some preliminary adjustment and diagnosis of circuit malfunction without tripping Q3 (main crowbar SCR). This also prevents reference voltage from R7/D2 from affecting examination of voltage divider calibration.*

Step 2. Set bench power supply to 10.0 volts (Test Point A). Monitor voltage at the arm of R2 (Test Point B) with respect to ground and adjust R2 so that the voltmeter reads 7.70 volts.

> *Discussion: If you cannot achieve the target setpoint voltage check to see that R1 and R3 are not transposed in the circuit. Also check that the polarity of C1 is proper. Either condition will cause the voltage at “B” to be too low.*

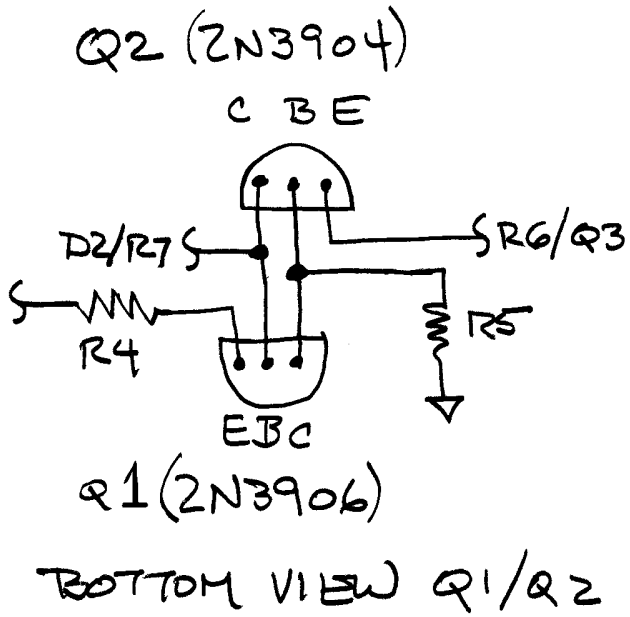
Step 3. Set bench power supply to 14.0 volts. Measure reference voltage at the junction of R7 and D2 (Test Point C). It should be 12.0 ± 0.6 volts. Make note of exact voltage reading.

> *Discussion: If voltage at C is very low but not zero (on the order of 0.6 volts) check for D2 installed backwards*.

Step 4. Confirm voltage at "B", now measures 10.8 ±0.1 volt.

Step 5. Monitor voltage at "B" while you slowly increase supply voltage. At some supply voltage between 16.0 and 16.6 volts, the trigger generator transistors Q1/Q2 should "trip" and voltage at "B" should quickly drop to something on the order of 2 volts.

Discussion: If the trigger generator does not trip, check wiring for the transistors. Wiring of the two transistors is a common wiring error. See adjacent sketch.



Step 6. Momentarily disconnect bench power supply from circuit under test. This will allow the trigger generator to reset.
Repeat Step 5 several times noting supply voltage were the trigger generator trips. Adjust R2 as necessary to achieve a trip voltage of 16.3 volts (32.6 volts for 28 volt system).

Step 7. Reconnect Q3 gate lead disconnected at "D" in Step 1. Set power supply for current limited operation at 1 to 2 amps –OR- conduct the following tests with the #1157 lamp(s) installed in series with the bench test supply.

Step 8. Repeat Step 5 to confirm similar behavior except in this case, the circuit becomes a high-current short across the power supply which causes the power supply to go into a current limited mode –OR- the lamp to illuminate brightly.

Discussion: Failure to trigger and latch the crowbar SCR (Q3) is usually due to wiring errors. Re-check connections to Q3 as depicted in the assembly instructions. If Q3 is wired correctly, try reducing the value of R4 to 10 ohms (reduced from 51.1 ohms in earlier versions).

Other Potential Difficulties:

The occasional crowbar OV protection module will be sensitive to radio transmissions. This difficulty is most often caused by "large" construction techniques. I've rebuilt several owner assembled modules into more compact construction to reduce the antenna effects of long interconnect wires between components. Building the OVM into a metal enclosure grounded to airframe also helps with this case.

On occasion, operating some appliance in the airplane causes the OVM to trip and take the alternator off line. In perhaps 8 years of supplying this product in numbers on the order of 200-300 units, I’ve encountered perhaps 3-5 instances where this problem arose. In all cases, spike suppression techniques normally applied to such devices was left out of the original installation.

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