



# R251DR

## 28V ELECTRONIC ALTERNATOR CONTROLLER /VOLTAGE REGULATOR FOR TWIN ENGINES

### Features:

- Voltage Regulation, IC sense referenced
- Field-to-Ground Fault Protection (GFP)
- Trouble-Shooting Light (TSL)

### Benefits:

- \* Increase Regulator. Not temperature sensitive.
- \* Protects against grounded alternator field.
- \* Helps isolate grounded alternator field in twin engines
- \* Identifies grounded field. Reduce trouble-shooting time

**Voltage Regulation: 27.7V ± 0.4V. Max Field Current (IF): 5A. Field-to-Ground Protection @ IF > 6A**

### VOLTAGE REGULATION

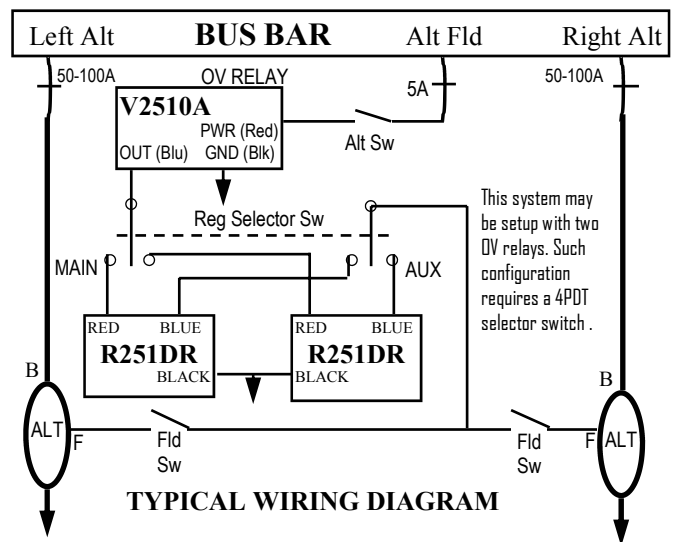
The Voltage Regulator keeps the bus voltage constant by controlling the alternators field current: increasing it when the system load increases and decreasing it when the load drops.

### FIELD TO GROUND SHORT PROTECTION

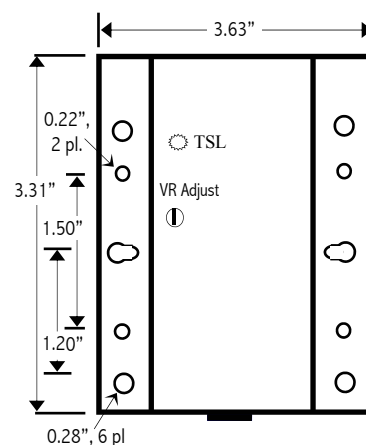
Should either of the alternator's field become shorted to ground (the reason most Voltage Regulators fail), the field-to-ground short protector will deactivate the Voltage Regulator, and switch on the unit's RED field-to-ground short indicator. The defective field may be identified by selectively operating the right or left alternator. The alternator with the faulty field will not come on line, while the good one will allow bus voltage regulation to 27.5V to 28.0V.

**TROUBLESHOOTING LIGHT (TSL).** The troubleshooting light on the unit is designed to alert the user to the condition of the Alternator / ACU system. The light is normally off.

**RED TSL**, with master switch on indicates a ground short in the alternator field or controller to field wiring.



TYPICAL WIRING DIAGRAM



Mounting Diagram

Height: 1.10"

The R251DR replaces

- BEECH & CESSNA: 9000591
- CESSNA: 9000591, 11570010-1
- DELCO-REMY: 9000591
- LYCOMING: 74292
- PIPER: 450-395



# R251DR

## 28V ELECTRONIC ALTERNATOR CONTROLLER /VOLTAGE REGULATOR FOR TWIN ENGINES

### How the system works

In the typical installation, one R251DR controls the field of two alternators and thus the the system's voltage regulation level.

When the Bat switch is closed battery power is applied to the aircraft Bus. The Over-Voltage Relay (OVR) is powered at the same time through the Alt switch and 5 Amp circuit breaker. The OVR supplies the current to the controller. The R251DR controls the alternator's field current to regulate the bus voltage.

**The OV relay.** The OVR, a normally closed switch, monitors the bus voltage for excessive voltage (Over-Voltage) that could damage batteries and other voltage sensitive equipment. If the OVR senses an OV condition, it opens the current path to the controller and thus disables the alternator field.

**The Voltage Regulator.** The controller monitors the bus voltage and compares it to an internal voltage reference. If the bus voltage exceeds the preset level, it reduces the field current to return the bus voltage to preset level. If the voltage falls below the preset level, it increases the field current to return the bus voltage to preset level. Increasing or decreasing the field current regulates the bus voltage.

**Field to Ground Short Protection.** If either alternator's field shorts to ground, the R251DR will turn itself off, removing current from both fields, and switches on its Red TSL to indicate a field-to-ground short. The defective field may be identified by selectively operating the right or left alternator. The alternator with the faulty field will not come on line, while the good one will allow bus voltage regulation to 27.5V to 28.0V.

**Trouble-Shooting Light (TSL).** The TSL on the unit is designed to alert the user to the condition of the Alternator / ACU system. The light is normally off.

**Red TSL,** with master switch on indicates a ground short in the alternator field or controller to field wiring.

### INSTALLATION INSTRUCTION

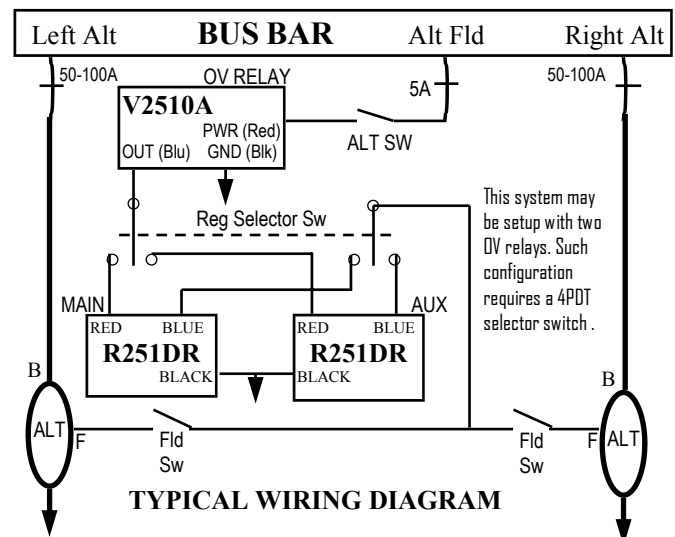
- 1 Disconnect and remove the present ACU/VR.
- 2 From wire on the airframe side of the ACU/VR's blue wire, measure the resistance between the field and the ground. The normal resistance is 10.0 to 18Ω. Resistance outside the specified range require checking the alternator field and the connections/wire from the ACU/Regulator's field wire to the alternator's field. 0Ω indicates a field to ground short. Correct fault.
- 3 Mount and connect the new ACU/VR to the system.
- 4 Perform the Post Installation Test Procedure.

### POST INSTALLATION TEST PROCEDURE

1. For each ACU - Turn on the Master switch and observe: That the ACU's TSL is off. If the TSL is Red, the Field or field wire is shorted to ground. Repair the problem before proceeding.
2. Measure the voltage on Red and Blue wires. The Red should read Battery voltage, while the Blue reads 1-2 volts less than the Red wire.
3. If the steps 1 and 2 are successful, perform step 4.
4. Turn Off all the avionics. Start the engine. At 1500-1600 RPM measure bus voltage: It should read 27.5-28.0V. If the bus voltage exceed these limits, check for voltage drop in the 5A breaker, the Alt switch, and pre-ACU/VR wires.

### TROUBLE-SHOOTING THE SYSTEM

For help on how to solve problems in the system, see the Trouble-Shooting Notes (TSN) page and or TechCards.







## Frequently Asked Questions & TECHCARD Notes

### 28V Type B alternator system on twin Beech, Cessna, Piper etc

### *TROUBLE-SHOOTING THE SYSTEM*

#### TROUBLE-SHOOTING

- With BAT, ALT, REG & FLD switches on and the engine off, the voltage on the Blue wire will be 0.5-2 volts less than the voltage on the Red wire.
- Turn Off all the avionics. Start the engine, and at 1500 RPM measure a bus voltage of 27.5-28.0V. If the bus voltage exceed these limits, check for voltage drop in the input devices (5A breaker, the Alt switch, the OV Relay, Reg selector Sw & pre-VR wires) due to high internal resistances.
- With engine at about 1500 RPM, depending on the system load, the field voltage will increase from 1 to 24V. Loading the alternator beyond its rating (at a given speed) causes it to Current Limit.
- Normal Field resistance is 10 to 18Ω. If the resistance is out of that range, check the alternator field or wires/connections/switches/fuses from controller to the field.
- Verify that the input devices have resistances of 0.1Ω or less.
- With the master switch On, verify that the voltage drop from the bus to the Red wire on the is less than 0.2V. If it is higher, find the source of the problem by checking the voltage drop across the input devices.

#### Both Alternators Drops Off-line

If both alternators drop off-line, check the color of the controller's TSL. A Red TSL indicates an alternator with internally or externally grounded field. Another reason could be that the system experienced an over-voltage fault and the OV relay tripped.

#### One Alternator Drops Off-line

If one alternator drops off-line, check the condition of the wire to and from the controller and the field switch. If the system has separate field fuses, check the condition and connection of the fuses. Also check the resistance of the field. The field could be open or have a high resistance.

#### Fluctuating Charge-meter or Flickering Panel Lights

This problem is usually caused by a resistance build-up in pre-controller input devices like the ALT switch or OV relay, the 5Amp breaker, or bad wires/connections between the Bus and the Red wire on the Regulator.

With the master switch On, verify that the voltage drop across the alternator switch and 5 Amp circuit breaker is less than 0.2V. Another way to do it is to verify that the Alt switch & OV Relay resistance is 0.1Ω or less. If either measurement is higher than indicated, replace the bad part.

#### No voltage regulation

With the master switch on and Battery voltage measured on the ACU input, The ACU output voltage should be 0.5 to 2V less the bus voltage.

- If the ACU input has no Bus voltage, look for a broken wire, bad connection or input device between the ACU and the bus.
- If the input voltage is more than 0.2V lower than the bus voltage, look for and correct or replace the input device that is causing the problem.
- If the output voltage is 0 and the input has battery voltage, look for a grounded alternator field or field wire (as indicated by a Red TSL). If the field resistance is correct as shown in step 5 of the installation tests and the TSL is off, send the ACU in for test/repair.
- If the TSL is Red, repair the field ground fault or replace the alternator.
- If the output and input voltages are the same, look for an open alternator field or field wire. If the field resistance is higher than what step 5 of the installation tests shows, send the alternator in for test/repair. If the field resistance is correct, send the ACU in for test/repair.

**Except for the field to ground-short protection, the trouble-shooting notes are applicable to systems that use the Delco-Remy 9000591.**

**OUR GOAL IS TO HELP YOUR SYSTEM OPERATE BETTER  
AND HELP YOU UNDERSTAND ITS OPERATION.**

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TECHCARDS

**INSTALLATION TESTS.** BEFORE INSTALLING THIS UNIT, PERFORM TESTS:

1. Read pages 1 to 3 and this page.
2. Check for and replace open, frayed, or broken wires. Clean thoroughly or replace corroded, dirty, or oxidized connections, terminals, contact, or poorly soldered wire junction.
3. Check for Open or Ground-shortened alternator field. Most 24V alternators have 10-18Ω field resistance. Ground shorted alternator field will damage most Voltage Regulators/ACU. **If the alternator has a field to ground short, do not connect the ACU/Regulator to it.**
4. With the engine off: Check voltage drops across the field and Alt circuit breakers, and OV relay. High voltage-drop means excessive junction resistance and will lead to many problems like: fluctuation ammeters, charge-meters and panel lights.
6. Perform and record the following tests with the **Master Switch Off:**

	24V Values	Typical Values
A. Field resistance at ALT	____, ____Ω	10 – 18Ω
B. Field resistance at ACU	____, ____Ω	10 – 18Ω
C. Field SW resistance	____, ____Ω	0 – 0.1Ω
D. Field C/BKR resistance	____, ____Ω	0 – 0.05Ω
E. ALT out C/BKR resistance	____, ____Ω	0 – 0.05Ω
6. Perform and record the following tests with the **Master Switch On:**

	24V Values	Typical Values
A. BUS Volt Engine Off	____, ____V	24 – 26V
D. ACU/Reg input Volt	____, ____V	24 – 26V
F. Field Voltage	____, ____V	0.5-2V <VBus
7. **Post Installation.** If all tests are correct to or per steps 5 & 6, run the engine and record:

	24V System	Typical value
J. Bus voltage. R251DR Main.	____V	27.5 – 27.9V
K. Bus voltage. R251DR Aux.	____V	27.5 – 27.9V

Call for tech help & more TechCards:

**903-758-6661**

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