R25101 Rev A, R25102 Rev A

28V ELECTRONIC ALTERNATOR CONTROLLER /VOLTAGE REGULATOR

Features:

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

Benefits:

- **Increase Regulator Life. Not temperature sensitive.**
- **Protects against grounded alternator field.**
- **Identifies grounded field. Reduce trouble-shooting time**

Voltage Regulation: 27.7V ± 0.4V for R25101 Rev A, 28.7V ± 0.4V for R25102 Rev A
Max Field Current: 5A. Field-to-Ground Protection @ Field current > 6A

VOLTAGE REGULATION

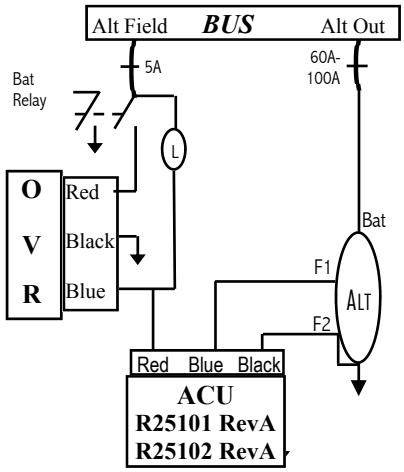
The Voltage Regulator keeps the bus voltage constant by controlling the alternator's field current: increasing it when the system load increases and decreasing it when the load drops.

FIELD TO GROUND SHORT PROTECTION

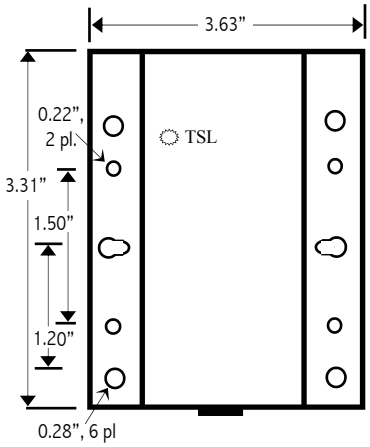
Should the alternator's field become shorted to ground (the reason most Voltage Regulators fail), the field-to-ground short protector will deactivate the Voltage Regulator, and switch on the unit's RED field-to-ground short indicator.

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



Wiring Diagram



Mounting Diagram
Height: 1.10"

The R25101 Rev A replaces
- CESSNA: C611004-0101, C611002-0205
- ELECTRODELTA: VR500-0101
- PFT/LAMAR: DGR
- LYCOMING:

The R25102 Rev A replaces
- CESSNA: C611004-0102
- ELECTRODELTA: VR500-0102
- PFT/LAMAR: DGR
- LYCOMING:

By Femi G. Ibitayo

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ZEFTRONICS
Electrical Charging Systems Solutions

R25101 Rev A, R25102 Rev A

28V ELECTRONIC ALTERNATOR CONTROLLER /VOLTAGE REGULATOR

HOW THE SYSTEM WORKS

When the master switch is turned on, battery voltage is applied to the input of the alternator controller/voltage regulator through the Over-Voltage Relay (OVR).

The current passing through the voltage regulator is applied to the field of the alternator. Without the engine running, the field voltage is typically 0.5-2V less than the bus or battery voltage.

Voltage Regulation

When the engine is running, the voltage regulator keeps the bus voltage constant by controlling the alternator's field current: increasing it when the system load increases and decreasing it when the load drops.The regulated bus voltage is normally about 28V unless the alternator is self-current limiting[1] or if there is voltage drop in the alternator field circuit breaker, alternator switch, OV Relay[2], or wiring and connections between the bus and the red wire on the control unit/voltage regulator. Voltage drops across the different components and connections occur when current, up-to 2 Amps in some instances, passes through the resistance built-up in them. *The resistance build-up often causes flickering ammeter and instrument panel lights.*

Field-to-Ground Short Protection

Should 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.

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.

[1] self-current limiting—Internal characteristics of the alternator that causes it to limit its current and voltage output at a given speed.

[2] OV Relay—OverVoltage Protection Relay opens its normally closed contacts when the bus voltage exceeds 32V or the OV trip point.

INSTALLATION INSTRUCTION

1 Disconnect and remove the present ACU/VR.
2 From pin 2 on the airframe side of the ACU/VR connector, 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.

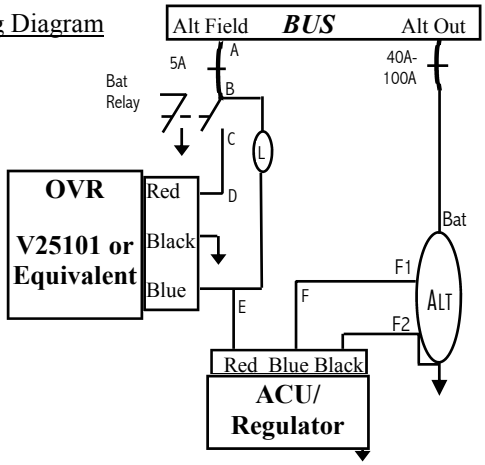
POST INSTALLATION TEST PROCEDURE

1. Turn on the Master switch and observe: On the ACU the 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 (pin 1) and Blue (pin 2) 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 27.5-27.9V (R25101 Rev A) and 28.5-28.9V (R25102 Rev A) . 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.

Wiring Diagram



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TROUBLE-SHOOTING THE SYSTEM

28V Type B alternator system on Cessna, etc

R25101 Rev A, R25102 Rev A

When the master switch (Alt & Bat) is turned on, battery voltage is applied to the Bus & OV Relay input.

Take all voltage measurements at test points (TP) A, B,D, E and F referenced to ground.

A. _____ Volts.		B. _____ Volts	
D _____ Volts.		E. _____ Volts	
F _____ Volts.		Fl. _____ Volts	

The voltages measured at A, B,D, and E should be the same, Bus voltage (around 24V). The voltage on F and F1 (alternator field and the controller output) will be 0.5 to 2V less than the voltage at A, D, or E.

If the voltage at A is 0.2V more than that on E, check the 5 Amp breaker, ALT switch, and connections between the bus and E for high resistance or open circuit. A high resistance between A & E may lead to flickering / oscillating ammeter and panel lights or show a higher than normal Bus voltage. An open circuit between A & E will not allow current to get to the controller/regulator and subsequently no current to the alternator's field and no voltage regulation. When there is no voltage regulation, the Bus voltage remains at battery voltage (about 24V).

If the voltage on F1 is 0.2V or more less than the voltage F, check for poor connection or open circuit between the controller/regulator output and F1 on the alternator. If the resistance between the F and F1 is higher than 0.5Ω, the alternator may not carry its rated load, showing a symptom similar one where there is an open stator wire or open diode in the alternator.

With the master switch on and the controller's pin has battery voltage on it, if the voltage on F1 is 0 or close, check for a ground short on F1 and F or open circuit between F and F1.

If there is a field-to-ground short, the controller turns itself off and turns its Trouble-Shooting Light (TSL) Red.

An open stator wire or open diode in the alternator causes the alternator only able to carry about half its rated output. For example, a 60A 24V alternator has a 28V output with about 30A load on it. When the load is increased to 40A, the bus voltage drops to 26 to 27V, indicating an alternator that is current limiting.

See TechCard for resistance and voltage measurements.

With the engine off, when the master switch (Alt & Bat) is turned on, battery voltage (~24V) is applied to the input of the ACU/regulator through the 5 Amp FLD circuit breaker, Alt switch and the OV Relay. The applied voltage causes current to flow to the alternator's field through the ACU/regulator to excite the alternator's field.

With the engine on and the master switch on, the ACU/regulator controls the excitation of the alternator to produce a Bus voltage of 27.5 –27.9V (R25101 Rev A) or 28.5 –28.9V (R25102 Rev A). This regulated voltage charges the battery and allows the alternator to power all the electrical system loads in the aircraft.

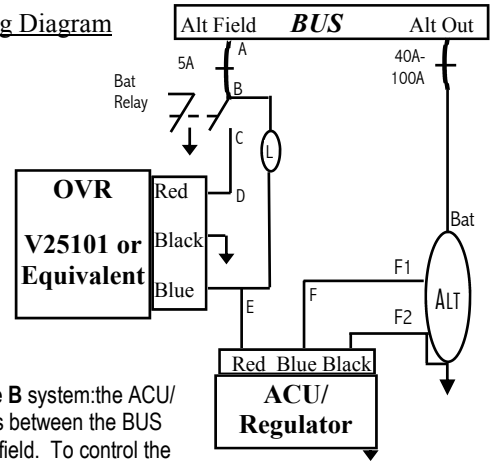
The 5 Amp circuit breaker opens if the current going to the ALT field exceeds 5 amps beyond a preset time lag thus protecting the wire from the Bus to the field. *Some wrongly expect this breaker should protect their non-Zeftronics ACU/regulator if the field shorts to ground.*

If the Bus voltage exceeds the preset over-voltage (OV) limit, the OV Relay, which is normally closed, will open up and disconnect the Bus from the ACU/regulator to remove excitation from the alternator's field.

When power is applied to a static (non-rotating) alternator through the ACU/regulator, the F1 voltage is 0.5-2V less than Bus voltage. When the alternator is rotating, F1 voltage will start low and increase with each load increase until the alternator current limits.

See TechCard for resistance and voltage measurements.

Wiring Diagram



In this **Type B** system:the ACU/Regulator is between the BUS and the Alt field. To control the bus voltage, the unit switches power to one side of the field several times a second.
The OVR opens when OV occurs.

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Frequently Asked Questions & TECHCARD Notes

28V Type B alternator system on Cessna, etc

TROUBLE-SHOOTING THE SYSTEM

Flickering / oscillating ammeter and panel lights.

Check the 5 Amp breaker, ALT switch, OV Relay and connections between the bus and the OV Relay's output for high resistance and or intermittent connection..

No voltage regulation

With the master switch on and Battery voltage measured on the OV Relay output:
Look for Bus voltage on the ACU/Regulator input and out put.

- If the ACU input has no Bus voltage, look for a broken wire between the ACU and the OVR.
- If bus voltage is greater than the input voltage by more than 0.2V, look for & correct the device (5A breaker, Alt switch, OVR or connection or wire) that is causing it.
- If the ACU output voltage is 0V and the input has battery voltage, look for a grounded alternator field or field wire. If the field resistance is correct as shown in step 5 of the installation tests and the ACU's Trouble-Shooting Light (TSL) is off, send the ACU/Regulator in for test/repair.
- If the TSL is Red, repair the field ground fault or replace the alternator.
- If the output voltage is the same as the input voltage, look for an open alternator field or field wire. If the field resistance is higher than what is shown in step 5 of the installation tests, send the alternator in for test/repair. If the field resistance is correct, send the ACU in for test/repair.

Bus voltage remains at battery voltage (about 24V)

To solve this problem, see No voltage regulation.

Alternator carries only about half its rated output.

Look for an open stator wire or open diode in the alternator. Check the shunts and alternator output wires. indicating an alternator that is current limiting.

Bus voltage drops with load increase

An open stator wire or open diode in the alternator causes the alternator only able to carry about half its rated output. For example, a 60A 24V alternator has a 28V output with about 30A load on it. When the load is increased to 40A, the bus voltage drops to 26 to 27V, indicating an alternator that is current limiting.

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

ZEFTRONICS 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-shorted 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**:

	12V 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. R25101 Rev A.	_____V	27.5 – 27.9V
K. Bus voltage. R25102 Rev A.	_____V	28.5 – 28.9V

Call for tech help & more TechCards:
1-903-758-6661

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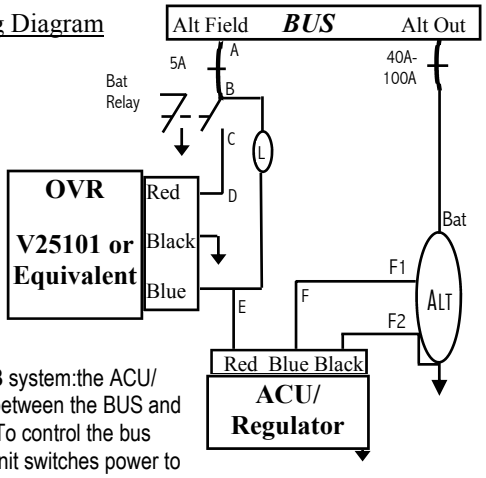
Electrical Charging System Solutions

Wiring Diagram



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