



R2530L

28V ELECTRONIC ALTERNATOR CONTROLLER (ACU)



Features:

- Voltage Regulation, Pulse Width Modulated
- Field-to-Ground Fault Protection (GFP)
- Trouble-Shooting Light (TSL)
- Over-Voltage Protection
- Low & Over Voltage Sensor /Indication

Benefits:

- * Increased Regulator life. Reduced panel lights flicker
- * Protects against grounded alternator field
- * Identifies grounded field. Reduce trouble-shooting time.
- * Protects system loads against overexcited alternator
- * Improves safety—Warns of Low voltage & OV condition

Voltage Regulation: 28.5V ± 0.4V. Max Field Current: 5A. LV: 24.7 ± 0.6V. OV: 32.0 ± 0.8V. GFP @ I_{Field} > 6A

VOLTAGE REGULATION.

The Voltage Regulator with Pulse Width Modulated (PWM) field control 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.

OVER VOLTAGE (OV) PROTECTION.

To protect sensitive avionics equipment and the battery, if the bus voltage exceeds 32V, the OV Protector (OVP) turns off the Voltage Regulator and the alternator.

LOW VOLTAGE (LV) & ALTERNATOR OFF-LINE (AO).

The LV/AOI light will come on if:

- The bus voltage drops below the LV level
- The ALT switch is off while the battery switch is on
- The field-to-ground short protection (GFP) trips
- OV protection turns off the alternator.

FIELD TO GROUND SHORT PROTECTION.

If the alternator's field shorts to ground, the GFP will turn off the Voltage Regulator and switch on the unit's Red field-to-ground short TSL, and the LV/AOI light on the instrument panel.

TROUBLE-SHOOTING LIGHT (TSL)

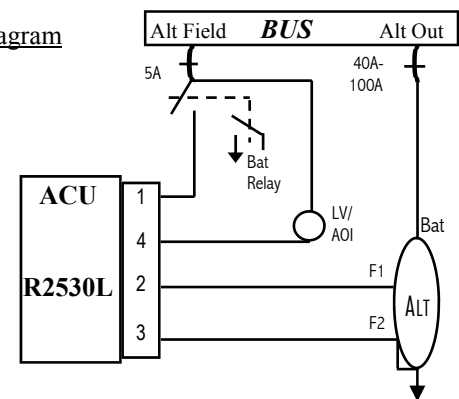
The TSL (on the unit) is designed to alert the user to the condition of the Alternator / ACU system.

Red TSL indicates: An internal or external ground short in the alternator field circuit.

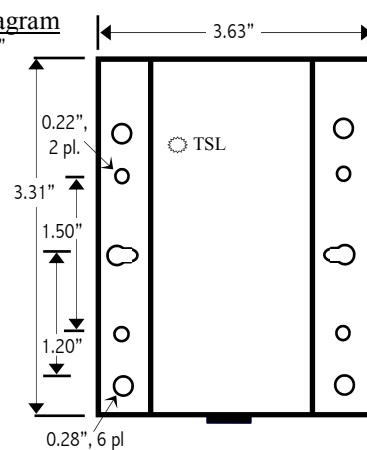
Without the engine running but master switch on, Green TSL indicates that the ACU is supplying current to the alternator's field.

With the engine running, master switch on, and bus voltage @ about 28V, Green TSL indicates correct alternator output voltage.

Wiring Diagram



Mounting Diagram
Height: 1.10"



Trouble-Shooting Light Continued

With the engine running, master switch on, and bus voltage @ about 12V, Green TSL indicates that current is flowing from the ACU but the alternator field or field wire to it is open.

With the master switch on, if the TSL is off, that indicates that one power input device (e.g. switch, circuit breaker, or wiring) is open or the ACU is defective.



R2530L 28V ACU

HOW THE SYSTEM WORKS & INSTALLATION INSTRUCTION

HOW THE SYSTEM WORKS

Turning on the master switch applies battery voltage to the input of the ACU through the input devices and wires from the bus. The ACU passes current 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 limiting¹ or if there is voltage drop in the input devices preceding ACU.

OVER VOLTAGE PROTECTION.

To protect sensitive avionics equipment and other system loads, if the bus voltage exceeds 32V the OV Protector (OVP) deactivates (turns off) the Voltage Regulator to remove the alternator's field current. The ACU stays latched off until the alternator switch is reset.

Field-to-Ground Short Protection

Should the alternator's field short to ground, the field-to-ground short protector turns off the Voltage Regulator, and switches on the ACU's Red field-to-ground short TSL and the instrument panel's LV-AOL light .

TROUBLE-SHOOTING LIGHT (TSL)

The TSL on the unit alerts the user to the condition of the Alternator / ACU system. The TSL has three color/states: Red, Green, and Off.

Red TSL indicates: An internal or external ground short in the alternator field circuit

Without the engine running but master switch on, Green TSL indicates that the ACU is supplying current to the alternator's field. An **Off TSL** indicates that one of the power input devices is open or the ACU is defective.

With the engine running, master switch on:

A bus voltage @ about 28.5V, **Green TSL** indicates correct alternator output voltage.

A bus voltage @ about 24-26V, **Green TSL** indicates that current is flowing from the ACU but the alternator field or field wire to it is open.

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

INSTALLATION INSTRUCTION

1. Disconnect and remove the present ACU.
2. At the ACU, measure the alternator's field resistance: i.e. resistance between the field and ground . A resistance of 10 to 20Ω is normal. If the measured resistance is outside the specified range, check the alternator field and the connections/wire from the field wire of the ACU to ground. 0Ω indicates a field to ground short. Correct the fault.
3. Mount and connect the new ACU to the system.
4. Perform the Post Installation Test Procedure.

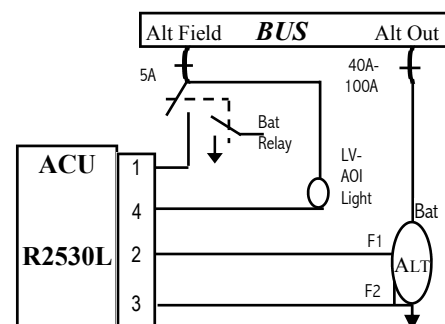
POST INSTALLATION TEST PROCEDURE

1. Turn on the Master switch and observe:
On the ACU the TSL light is on. A Red TSL indicates that the Field or field wire is shorted to ground.
2. Measure the voltage on Red (pin 1) and Blue (pin 2) wires. The pin 1 should read Battery voltage, while pin 2 reads 1-2 volts less than the pin 1.
3. If the steps 1 and 2 are successful, perform step 4.
4. Turn off all the avionics and voltage sensitive loads. Start the engine. At 1500-1600 RPM measure bus voltage: It should read 28.3V - 28.8V. If the bus voltage exceed these limits, check for voltage drop in the 5A breaker, the Alt switch, and pre-ACU wires.

TROUBLE-SHOOTING THE SYSTEM

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

Wiring Diagram





TROUBLE-SHOOTING THE SYSTEM

28V TYPE B ALTERNATOR SYSTEM ON LANCAIR: R2530L

Turning on the master switch (ALT & BAT) applies battery voltage to the Bus and ACU.

Refer to figure TS1. Take all voltage measurements at test points A, B, D, E and F referenced to ground.

A. _____ Volts.	B. _____ Volts
D. _____ Volts.	E. _____ Volts
F. _____ Volts.	F1. _____ Volts

The voltages measured at A, B, and D should be the same, Bus voltage (around 12V). The voltage on F (field or pin 2 on the ACU) will be 0.5-2V less than the voltage at A, B, or D. The voltage at F1 will be the same as F.

If the voltage at A is 0.2V more than that on D, check the 5 Amp breaker, ALT switch, and connections between the bus and D for high resistance or open circuit. A high resistance between A & D may lead to [flickering / oscillating ammeter and panel lights](#). An open circuit between A & D 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.

If the voltage on F1 is 0V or close, check for a ground short on F1 on the alternator or wire from F on the controller/regulator.

If there is a field-to-ground short, the ACU will turn itself off and turn its [built-in Trouble-Shooting Light \(TSL\)](#) Red.

An open stator wire or open diode in the alternator will make the [alternator only able to carry about half its rated output](#). For example, a 70A 24V alternator has a 28.5V output with about 30A load on it. When the load is increased to 40A, the bus voltage drops to 24 to 26V, indicating an alternator that is current limiting.

See page 4 for resistance and voltage measurements.

With the engine off, turning on the master switch (ALT & BAT) applies battery voltage to the input of the ACU through the 5 Amp FLD circuit breaker, and ALT switch. The applied voltage causes the ACU current to flow to the alternator's field excite the alternator's field.

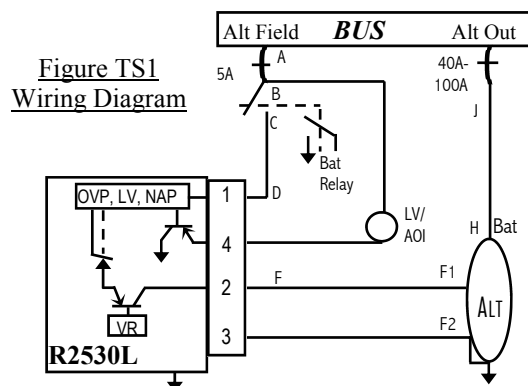
With the engine on and the master switch on, the ACU controls the excitation of the alternator to produce a Bus voltage of 28.3 –28.8V. This regulated voltage charges the battery and allows the alternator to power all the electrical system loads in the aircraft.

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 people wrongly expect this breaker should protect their non-Zeftronics ACU.*

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 to remove excitation from the alternator's field.

When power is applied to a static (non-rotating) alternator through the ACU, 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 page 4 for resistance and voltage measurements.



In this **Type B** system: the ACU 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 OVP opens when OV occurs.



Frequently Asked Questions & TECHCARD Notes

TROUBLE-SHOOTING THE SYSTEM

Flickering / oscillating ammeter and panel lights.

Check the 5 Amp breaker, ALT switch, and connections between the bus and the input to the ACU for high resistance or intermittent connection..

No voltage regulation

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

- If there is no Bus voltage on the ACU input, look for a broken wire, bad connection or input device (5A circuit breaker or Alt switch) 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 0V and the input has battery voltage, look for a grounded alternator field or field wire (as indicated by a Red [Trouble-Shooting Light, TSL](#), of the ACU). If the field resistance is correct as shown in step 5 of the installation tests and the TSL of the ACU 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 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 25V)

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

To solve this problem, see [Alternator carries only about half its rated output](#).

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

INSTALLATION TESTS. BEFORE INSTALLING THIS UNIT, PERFORM TESTS:

1. Read pages all the pages of this document.
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 10-20Ω field resistance. Ground shorted alternator field will damage most Voltage Regulators/ACU. Repair or replace an alternator has a field to ground short, do not connect the ACU to it.
4. With the engine off: Check voltage drops across the Field, Alt switch, Alt field circuit breaker and ACU. High voltage-drop means excessive junction resistance and will lead to many problems like: fluctuation ammeters, charge-meters and panel lights.
5. Perform and record the following tests with the **Master Switch Off**:

24V Values Typical Values

A. Field resistance at ALT	_____ Ω	12– 18Ω
B. Field resistance at ACU	_____ Ω	12– 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:

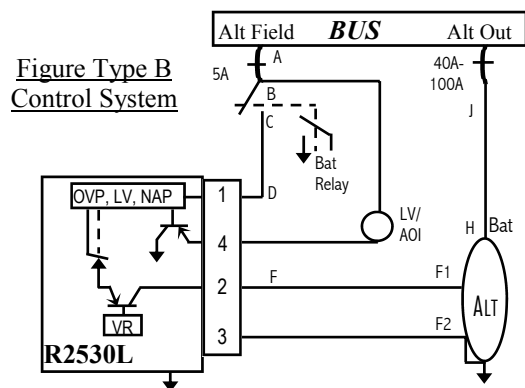
24V System Typical value

A. Bus voltage	_____ V	28.3 – 28.8V
H Bus voltage	_____ V	28.3 – 28.8V
J Bus voltage	_____ V	28.3 – 28.8V

For tech help & other TechCards, call: **903-758-6661**

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Electrical Charging System Solutions



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