



R25400

28V ELECTRONIC ALTERNATOR CONTROLLER

ZEFTRONICS: SOLUTIONS



Features:

- Voltage Regulation, IC voltage reference
- Remote Voltage Sensing
- Low & Over Voltage Sensor /Indication
- Field-to-Ground Fault Protection (GFP)
- Trouble-Shooting Light (TSL)
- Over-Voltage Protection

Benefits:

- * Increased Regulator life. Not temperature sensitive.
- * Improved Voltage Regulation. Reduced panel light flicker
- * Improves safety—Warns of Low voltage & OV condition
- * Protects against grounded alternator field
- * Identifies grounded field. Reduce trouble-shooting time.
- * Protects system loads against overexcited alternator

Voltage Regulation: 28.7V ± 0.4V. Max Field Current: 5A. Field-to-Ground Protection

VOLTAGE REGULATION.

The 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 decreases.

REMOTE VOLTAGE SENSOR

By sensing the alternator's battery terminal voltage, the ACU provides better voltage regulation and eliminates flickering charge-meter and panel lights.

LV / OV SENSOR & INDICATION

The LV warning light connected to pin 4 comes ON when the alternator drops off-line. the bus voltage drops below the LV level, or the OV trips the ACU off-line.

OVER VOLTAGE (OV) PROTECTION.

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

FIELD TO GROUND SHORT PROTECTION (GFP)

If the alternator's field shorts to ground, the field-to-ground short protector deactivates the Voltage Regulator and switches on the unit's Trouble-Shooting Light (TSL) red and the aircraft LV warning light.

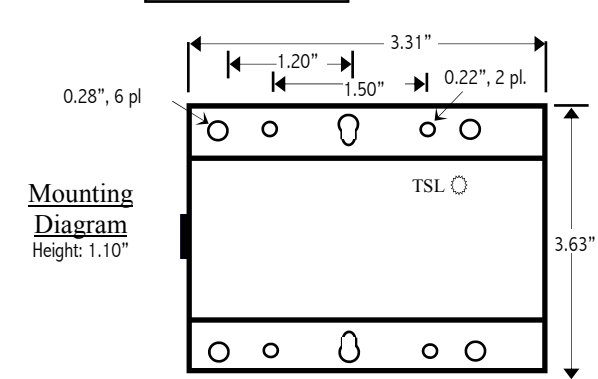
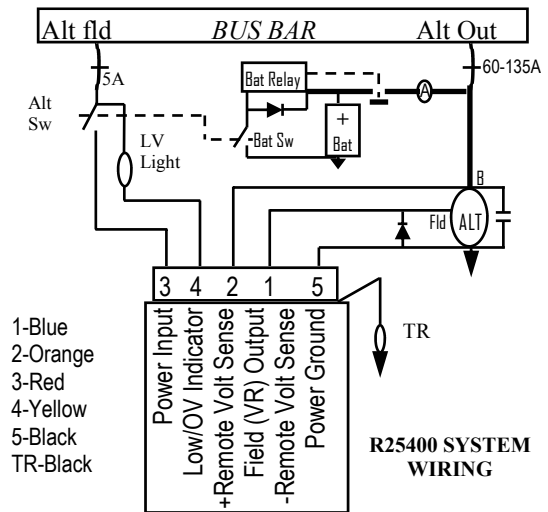
TROUBLE-SHOOTING LIGHT (TSL)

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 @ 28.5 to 28.9V, **Green TSL** indicates correct alternator output voltage.



Trouble-Shooting Light Continued

*With the engine running, master switch on, and bus voltage @ 24V-26V, **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.*



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28V ELECTRONIC ALTERNATOR CONTROLLER

HOW THE SYSTEM WORKS

Turning on the Master switch applies battery voltage to the input of the ACU through the input devices (Alt switch, 5A circuit breaker and wires from the bus). The ACU controlled current passes 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 28.5V-28.9V unless the alternator is self-current limiting¹ or if there is voltage drop in the devices before or after the ACU (excluding the alternator).

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 (GFP)

If the alternator's field shorts to ground, the field-to-ground short protector deactivates the Voltage Regulator and switches on the unit's Trouble-Shooting Light (TSL) red and the aircraft LV warning 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:

At bus voltage of 28.5V-28.9V, **Green TSL** indicates correct alternator output voltage.

At bus voltage of 24V-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

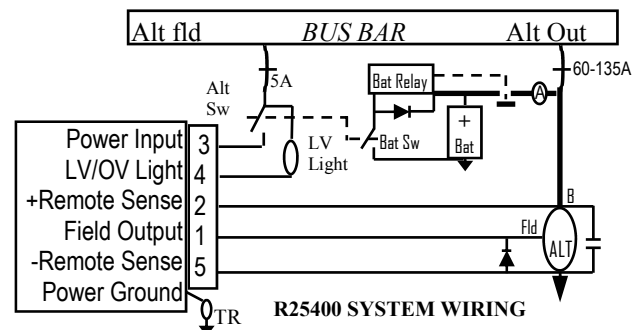
1. Disconnect and remove the present ACU.
2. At the ACU, measure the alternator's field resistance: i.e. resistance between the field (the ACU's pin 1) and the ground wire (the ACU's pin 5). A resistance of 10 to 18Ω is normal. If the measured resistance is outside the specified range, check the alternator field and the connections/wire from the ACU's field wire 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 (BAT only) and observe: On the ACU the TSL light is off and on the instrument panel, the LV light is on. A Red TSL indicates a grounded Field or field wire.
2. Turn on the Master switch (BAT & ALT only) and observe: that the LV light is Off, on the ACU the TSL is Green. A Red TSL indicates a ground shorted Field. An off TSL may indicate an open circuit between the Alt Sw and the ACU airframe connector's pin 3.
3. If the TSL is Green, measure the voltage on pins 3 and 1. Read Battery voltage on pin 3. Pin 1 should read 0.5-2 volts less than what is on pin 3.
4. If the steps 1 to 3 are successful, perform step 5.
5. Turn off all the avionics and voltage sensitive loads. Start the engine. At 1500-1600 RPM measure bus voltage: With 10A load, bus should read 28.3V - 28.9V. If it exceeds these limits, check for voltage drop in the 5A breaker, 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 TechCards.





R25400 28V ELECTRONIC ALTERNATOR CONTROLLER TROUBLE-SHOOTING THE R25400 SYSTEM

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

Refer to figure TS1. Take all voltage measurements at test points A, B, D, E, F1 and H referenced to ground.

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

The voltages measured at A, B, D and H should be equal, Bus voltage (24-26V). The voltage on F1 (field or ACU output) will be 0.5 to 2V less than the voltage at A, B, D or H. 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 ACU and no current to the alternator's field, resulting in [no voltage regulation](#). When there is no voltage regulation, the [Bus voltage remains at battery voltage \(about 24V\)](#).

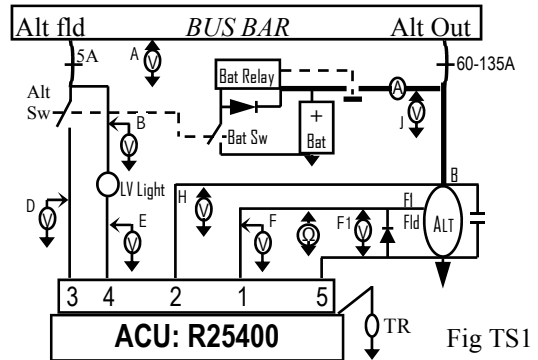
If the voltage on F1 is 0.3V less than the voltage F, check for poor connection or open circuit between the controller/regulator output and F1 on the alternator. If the resistance between the F and F1 is higher than 0.5Ω, the alternator may not carry its rated load, showing a symptom similar one where there is an open stator wire or open diode in the alternator.

If the voltage on F1 is 0 or close, check for a ground short on F1 on the alternator or wire from F on ACU. If there is a field-to-ground short, the ACU will turn itself off & 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 28V output with about 30A load on it. When the load is increased to 40A, the bus voltage drops to 22 to 26V, indicating an alternator that is current limiting.

See [TechCard](#) 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 grounds the field when OV occurs.



Turning the master switch (ALT & BAT) on with the engine off, applies battery voltage to the input of the ACU through the 5 Amp FLD circuit breaker, and ALT switch. To excite the alternator's field, the ACU passes controlled current to 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 28.3-28.9. This regulated voltage charges the battery and allows the alternator to power all the electrical system loads in the aircraft.

Normally, the 5 Amp circuit breaker opens if the Field current exceeds 5 amps beyond a preset time lag thus protecting the wire from the Bus to the field. The built-in electronic circuit breaker of the R25400 turns the ACU off before the circuit breaker opens.

If the Bus voltage exceeds the preset over-voltage (OV) limit, the OV Protector will ground the field to turn off the alternator.

Applying power to a static (non-rotating) alternator through the ACU produces F1 voltage that is 0.5-2V less than Bus voltage. When the alternator is rotating, F1 voltage starts low and increases with each load increase until the alternator current limits.

If [the LV light does not come on](#) with only the Bat side of the Master switch on, with the ACU still connected, verify that the voltage on pin 4 or test point E is 0-2V. If pin 4 has 0-2V, disconnect the ACU and ground pin 4 on the airframe side of the connector. The LV light should illuminate. If it does not, the LV lamp is bad or there is an open circuit on the line from the Bus to pin 4.

See [TechCard](#) for resistance and voltage measurements.



Frequently Asked Questions & TECHCARD Notes

28V Type B alternator system on Beech, Mooney etc

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 or

Bus voltage remains at battery voltage (about 25V)

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 Bus voltage, 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 ACU TSL). 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 in for test/repair.
- If the TSL is Red, repair the field ground fault or replace or repair the defective 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 or repair.

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.](#)

NO LIGHT on the unit, with the Master Switch on. This means that one power input device (Alt switch, 5A circuit breaker, or wiring) or ACU is damaged. To confirm a damaged ACU, remove the field wire from the alternator. The presence of voltage on its input (pin 3) and no voltage on its output (pin 1) confirms that the ACU is defective.

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-shortened alternator field. Most 24V alternators have 10-18Ω 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	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

A. Bus voltage	_____ V	28.3 – 28.9V
H Bus voltage	_____ V	28.3 – 28.9V
J Bus voltage	_____ V	28.3 – 28.9V

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

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ZEFTRONICS
Electrical Charging System Solutions

TROUBLE-SHOOTING THE R25400 SYSTEM

