Before you install this product, please read this document.

INSTRUCTION FOR CONTINUED AIRWORTHINESS (ICA)
For Continuing Airworthiness Maintenance, use the procedures and instructions in this document or return this unit to ZEFTRONICS or its approved Repair Station, HAZOTRONICS. The GCU is not field-adjustable.

DELCO-REMY GENERATOR SYSTEMS

Read the documents that came with this unit before you begin its installation. Incorrect installation procedure may damage the unit. If you are unsure of the condition of your generator or system, call us or an FAA approved generator repair station for help. If your generator or system wiring damages this unit, we will deny your warranty claim.

This Generator Controller (GCU) passed a full operational on a test with a 50 Amp Delco-Remy generator: Generator Build-up, Voltage Regulation, Current Limit, Reverse Current Protection, and on applicable part numbers, Paralleling and other functions. Correctly used, this document should help reduce your down time and prevent any damage to this unit by defective generator and associated system components.

HOW THE PRODUCT WORKS

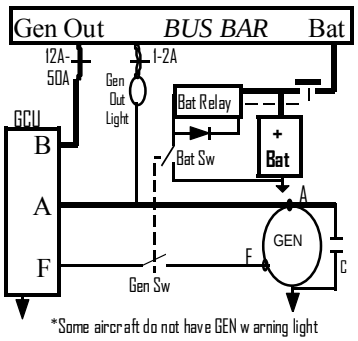
The G1XX0N series electronic Generator Controller Units (GCU) replace the Delco-Remy or Electrodelta vibrating point Voltage Regulators used with 12 to 50 Amps direct current generators in 12 volts applications. The GCU consists of some or all the following functions: Voltage Regulator (VR) and generator build-up, Reverse Current (RC) cutout, Current Regulator or Limiter (CL) and GCU system Trouble-Shooting Lights (TSL). The GCU will cause a generator with >1.6V residual voltage to build-up.

- The **Voltage Regulator (VR)** controls the Generator's field to keep the aircraft electrical system voltage at the specific 14V. This "type A" GCU, with power on one side of the field, electronically switches the other side of the field on/off to ground to keep the Generator output voltage at the VR set point. As long as the Generator output voltage is less than the VR set point, the switch is closed, current flows, and the Generator's output increases. When the Generator's output voltage exceeds the VR set point, the switch opens, current flow stops, and the Generator's output decreases.
  A GREEN light on the unit shows VR. The GCU will cause a generator with >1.6V residual voltage to build-up.
- The **Generator On-line (GO)** circuit, through a low resistance path, builds-up the generator output from residual voltage to over the normal battery voltage. When the Generator's output Voltage exceeds the battery voltage, the GO light and the instrument panel GEN OUT lights turn off, the light turns on if the generator voltage drops below the battery.
- The **Current Limiter (CL)** controls the maximum output current the Generator can produce. It turns off the field excitation when the output current exceeds the CL set point (determined by the generator's current rating). It allows normal field excitation when the generator output is below the GCU CL set point.
- The **Reverse Current (RC) Protection** circuit blocks the battery current from going back to the generator. It allows current to flow only from the generator to the battery and system.
- The on-unit system Trouble-Shooting Lights, TSL, identify how the system is operating and, helps with system testing and trouble-shooting. The lights indicate Generator Off/On-line (GO, GREEN), Voltage Regulation (VR, GREEN), Current Limit (CL, RED), and Parallel (EQ, or Load sharing, GREEN).

CAUTION & REMINDERS

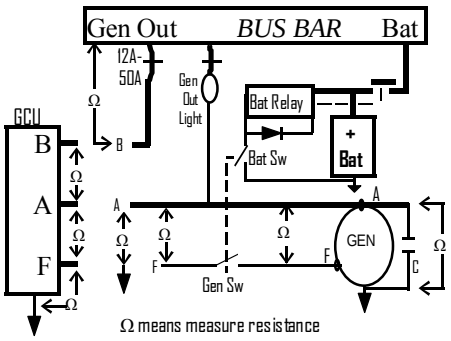
1. *Grounding the field to see if the generator produces current is not a good indication that it is working properly. Doing so can lead to excessive system voltage, which may damage batteries, radios, GCU, etc. This practice will not always identify a defective voltage regulator is because it may hide field or armature defects that can damage a regulator/GCU.*
2. *DO NOT PUT POWER TO THE FIELD OF THE GENERATOR. Doing so will reverse its polarity.*
3. *Some Generator overhaul shops use armature windings with excessively high resistance. A high Armature resistance will cause the generator to come on-line at engine speed above 1400 RPM.*
4. *Remember to charge Gell-Cell or discharged batteries before installing the GCU.*
5. *Field resistance outside the range specified on page 1-11-1b could damage the GCU or reduce the maximum Generator current output*

WIRING DIAGRAM*



*Some aircraft do not have GEN warning light

TROUBLE-SHOOTING DIAGRAM



Ω means measure resistance

With the GCU disconnected, take the resistance measurements shown.

Making these measurements should encourage good trouble-shooting practices and expedite technical support calls.

- **Use a high quality Digital Multi-Meter for the identified measurements.**
- **Confirm the "0Ω" point of the DMM or zero the DMM.**

Before connecting the GCU or with the GCU disconnected, perform the resistance measurements indicated below

Disconnect the GCU/Voltage Regulator, close the FLD (GEN) switch, measure the resistances shown in the table below. At the wires disconnected from the GCU/Regulator, measure the resistances from Field to Ground, Field-to-Armature, Armature-to-Ground. Also, measure the resistance from the BAT wire to the BUS. Then at the Generator, measure the resistances from Field to Ground, Field-to-Armature, Armature-to-Ground. Values measured at the GCU/regulator wires and at the Generator should be the same. If the values are different, you may have a problem in switches, circuit breakers, connections or wiring.

At the Gen*/Bus Check		Typical Value	GCU wires	At Gen	
1	***Field to Ground***	8Ω (6-10Ω)			Field resistance should not cause a current of greater than 2A. Higher Armature-to-Ground resistance will cause Gen to come on line at higher RPM (i.e. over 1400 RPM). Uncharged or depleted Gell Cell batteries will load the Generator down and may cause it to come on-line at higher RPM. So, charge the Battery before installing the GCU.
2	***Field-to-Armature***	8Ω (6-10Ω)			
3	***Armature-to-Ground***	0 - 0.1Ω			
Bus-GCU BAT		0 - 0.1Ω			A higher resistance may cause poor system operation

At the GCU Check		Typical	Measured		At the GCU Check		Typical	Measured	
1	FLD to Case	0 - 1Ω			3	FLD to ARM	2KΩ or more		**GCU tests. Remove the wires from the GCU before performing these tests.**
2	ARM to Case	2KΩ or more			4	ARM to BAT	250Ω or more		

BEFORE CONNECTING THE GCU, CHECK THE GENERATOR'S RESIDUAL VOLTAGE AND POLARITY

Make sure that the generator's polarity is correct by connecting a voltmeter between the generator's armature and ground. At 1200 RPM, the generator output voltage should be positive (greater than +1.5V). A negative voltage reading indicates a generator that has a reverse polarity. **Do not connect the GCU to generator with reversed polarity. TURN OFF THE ENGINE, Polarize the generator by flashing the field.**

POLARIZE THE GENERATOR BY FLASHING THE FIELD

1. With the engine off, **disconnect the Generator Controller (GCU) or Voltage Regulator**
2. Ground the Field and turn on the GEN FLD switch
3. At the Regulator/ GCU: Touch and hold (for 1-3 seconds) the removed BAT wire to the ARM wire three to five times

SEE THE NEXT PAGE FOR INSTRUCTIONS ON INSTALLING THE UNIT, AND POST-INSTALLATION TESTS.

Title	PRODUCT INSTALLATION			Drawn By		Approved By		Released to	
Model No	G1120N, G1200N, G1250N, G1350N, G1500N	Rev		Femi G. Ibitayo		*FPGIbitayo*			
Drawing No	**Z20ID1**	Rev	B	Date	11/19/07	Date	11/19/07	*Page*	***1-11-1b***

Rev			Classification
Rev	B	*Revised to clarify/add trouble-shooting notes & add required ICA Maintenance*	Classification: *Minor*
Rev	A	*Added trouble-shooting notes and clarified test & system operation procedures*	Classification: *Minor*

INSTALLATION INSTRUCTION AND TESTS (BEFORE ENGINE IS STARTED, WITH GCU CONNECTED)

1. Remove the existing Voltage Regulator.
2. In the same manner as the one removed, connect and mount the Generator Controller (GCU). It may require some slight wire repositioning and shorter full threaded bolts. **The Case of the GCU must be well grounded.**
3. Ensure that all connections are clean and tight. A loose connection causes poor conduction of electricity, and is a potential fire hazard.
4. Secure all wiring and ensure their clearance from moving parts and controls. **Ground Unit's case.**
5. Weight and balance change: Negligible.

POST-INSTALLATION CHECK AND TESTS (WITH GCU CONNECTED)

- With the BAT and FLD switches ON and engine OFF, on the GCU the GO (Gen Out*), VR (Voltage Regulator), and CL (Current Limit) lights should be ON. *If the CL light is OFF, remove the GCU & check the generator for correct polarity & wiring.*

On the GCU Check	Typical	Measured	Notes
BAT-Ground (Case)	12V (12.6V)		If less, Battery is discharged or discharging. It may be greater than 13V.
Field to Case	0-2V		If the field and battery voltage are equal, look for open field or FLD Wire

- With the BAT & FLD switches on and engine running, the generator should come on line before 1400 RPM.
  ** On units that have serial numbers starting with M or N, the GO light may be off until the bus voltage exceeds 12.3V-13.3V. On units with serial numbers starting with P, the GO light will come on only when the GEN (Armature) voltage is less than bus voltage.*

- Check the Bus voltage with the engine at 1600 -1800 RPM and about 5 to 10 Amps load on.

Bus Voltage	13.8 to 14.4V	If less or higher check the generator field switch or the main generator circuit breaker resistance

Instructions for Continued Airworthiness Maintenance: The GCU should perform as shown in this document. It is not field repairable or adjustable. It should be returned to ZEFTRONICS or a ZEFTRONICS approved repair station for maintenance or overhaul.

ZEFTRONICS authorizes the installer to use its STC/PMA product whose serial number is identified on the warranty registration form for a one-time installation.

Rev			**Classification**
Rev	*B*	*Revised to clarify/add trouble-shooting notes & add required ICA Maintenance*	**Classification** *Minor*
Rev	*A*	*Added trouble-shooting notes and clarified test & system operation procedures*	**Classification** *Minor*

Throughout the following tests, turn off all NAV/COMM equipment & other voltage sensitive devices

Steps	*Trouble-Shooting Procedure/Steps*		Record		Record
1.00	Touch the two ends of the ohmmeter probes together & record resistance	0 ohm		Ω	
	System check from the Regulator/GCU's point of view				
	These tests measure resistances to find short or open circuits or abnormal Resistances in wiring, switches, circuit breakers, and generator.				
1.10	N/A	Engine Side			
1.11	Disconnect ARM, BAT & FLD from the Regulator or GCU, Gen FLD Switch on				
1.12	Measure the resistance from the ARM to FLD on the removed wires	ARM - FLD		Ω	
1.13	Measure the resistance from the ARM to GND (airframe) on the removed wires	ARM - GND		Ω	
1.14	Measure the resistance from the FLD to GND (airframe) on the removed wires	FLD - GND		Ω	
1.15	Measure the resistance from the from Regulator or GCU BAT wire to aircraft Bus	BAT - BUS		Ω	
	Checking the Generator by itself, *with* ARM & FLD wires disconnected				
	Static tests: checks the condition of an isolated generator, wires excluded				
1.20	Measure the resistance from the ARM to FLD on the Generator	ARM - FLD		Ω	
1.21	Measure the resistance from the ARM to GND (airframe) on the on the Generator	ARM - GND		Ω	
1.22	Measure the resistance from the FLD to GND (airframe) on the Generator	FLD - GND		Ω	
1.23	Measure the resistance from the ARM to FLD on the removed wires	ARM - FLD		Ω	
	Testing the isolated rotating Generator *(not connected to the system or GCU).*				
3.10	Connect the Generator FLD and ARM wires to the Generator				
3.11	Isolate & Insulate the disconnected Reg/GCU BAT wire. **Ground the FLD wire**				
3.12	Connect a voltmeter to the GCU ARM wire through an extended wire*[1]				
3.13	Turn on the Master switch & Start the engine: Record the Arm voltage @ ~ 800RPM	ARM Voltage		V	
3.14	Increase the engine speed to about 1000 RPM and record the ARM voltage	ARM Voltage		V	
3.15	Increase the engine speed to about 1400 RPM and record the ARM voltage	ARM Voltage		V	
3.16	Turn off the engine	*This section tests if the generator comes on-line by itself. It can hide a high resistance armature.*			
	Testing the GCU & Generator working while disconnected from the Bus. Extend meter wires away from props				
4.10	Remove the voltmeter from the ARM wire & connect it to the GCU BAT terminal				
4.11	Connect the ARM & FLD wire to the Regulator/GCU; leave the BAT wire off				
4.12	Turn on the Master switch & Start the engine: Record the BAT voltage @ ~ 800RPM	BAT Voltage		V	
4.13	Increase the speed to ~1000 RPM and record the GCU BAT terminal voltage	BAT Voltage		V	
4.14	Increase the speed to ~1400 RPM and record the GCU BAT terminal voltage	BAT Voltage		V	
4.15	Turn off the engine	*This tests if the Generator comes on-line & works with the GCU without being connected to the Bus*			
	Concluding the Generator & GCU testing part of the trouble-shooting				
5.10	Remove the voltmeter from the GCU BAT post. Connect the BAT wire to GCU				
5.11	Turn on the Master switch & Start the engine: Record the Arm voltage @~1400RPM	BUS Voltage		V	
5.12	Turn off the Master switch & shut off the engine per the normal procedures				
	The voltage at step 5.12 with ≤5A load should be >13.8V for 12V systems and >27.8V for 24V systems.				

*[1] This is to prevent running into a rotating propeller while taking voltage measurement.

Fax, email, or return results ZEFTRONICS Tech Help.

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Title	**PRODUCT INSTALLATION**			**Drawn By**		**Approved By**		**Released to**	
Model No	G1120N, G1200N, G1250N, G1350N, G1500N	**Rev**		Femi G. Ibitayo		*FGIbitayo*			
Drawing No	**Z20ID1**	**Rev**	B	Date	11/19/07	Date	11/19/07	*Page*	***1-11-1d***

Rev			**Classification**	
Rev	*B*	*Revised to clarify/add trouble-shooting notes & add required ICA Maintenance*	**Classification**	*Minor*
Rev	*A*	*Added trouble-shooting notes and clarified test & system operation procedures*	**Classification**	*Minor*