ATA 24

ELECTRICAL POWER

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ELECTRICAL POWER

ELECTRICAL POWER

DESCRIPTION AND OPERATION

Electrical System

The B300 electrical system is a 28-volt dc, single-loop, triple-fed system with a negative ground. During normal operation, two 28-volt, 300-ampere starter-generators and a 24-volt nickel-cadmium battery (FL-1 thru FL-214, FM-1 thru FM-9) or a 24-volt lead acid battery (FL-215 and after, FM-10 and after) supply all of the airplane electrical needs. These power sources are brought on-line by the pilot with three switches, placarded MASTER SWITCH, BATT, ON-OFF, L GEN, R GEN, RESET-ON-OFF, under the master switch gang bar on the pilot's outboard subpanel. An auxiliary power unit (APU) may be connected to the airplane external power receptacle when an external power source is required.

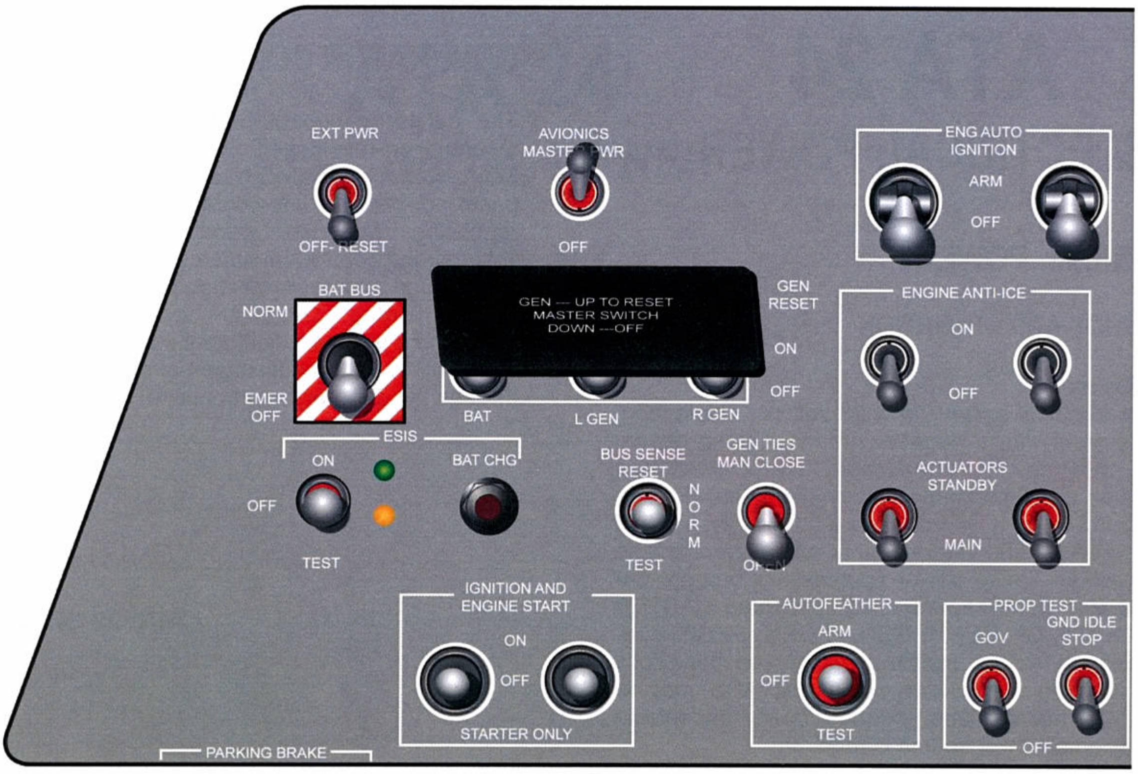
A battery is installed in the RH wing center section between the RH nacelle and fuselage. Battery power is connected to a battery bus, the center bus and the triple-fed bus. Selected equipment is powered from the "hot" battery bus to allow operation without turning on the battery switch.. Control of the two starter/generators is accomplished with two generator control panels, the bus-tie control PCB (A257), current sensors, switches and the bus tie, line contactor and generator control relays. The generator control panels provide line-contactor relay control, voltage regulation, generator paralleling, differential voltage sensing and control, reverse current sensing and control, overvoltage and overexcition protection and cross-start current limiting.

Five primary buses distribute power to all of the sub-buses from the three main power sources. The primary buses consist of a "hot" battery bus, center bus, triple-fed bus, and the left and right generator buses. This system is termed a triple-fed bus system, with each bus receiving power from the three dc power sources. This design minimizes the risk of a complete power loss should a power source become isolated. For example, the triple-fed bus is powered from both generator buses and the battery.

The five primary buses are also individually protected by current sensors, limiters, diodes and relays. The triple-fed bus is protected by a diode and 60-ampere current limiter wired between it and each feeder bus. This configuration provides overcurrent protection and prevents current flow away from the triple-fed bus. Load-shedding is accomplished by isolating a faulty bus from those that are still functional, thereby preventing a failure of the entire electrical system. of avionics power distribution.

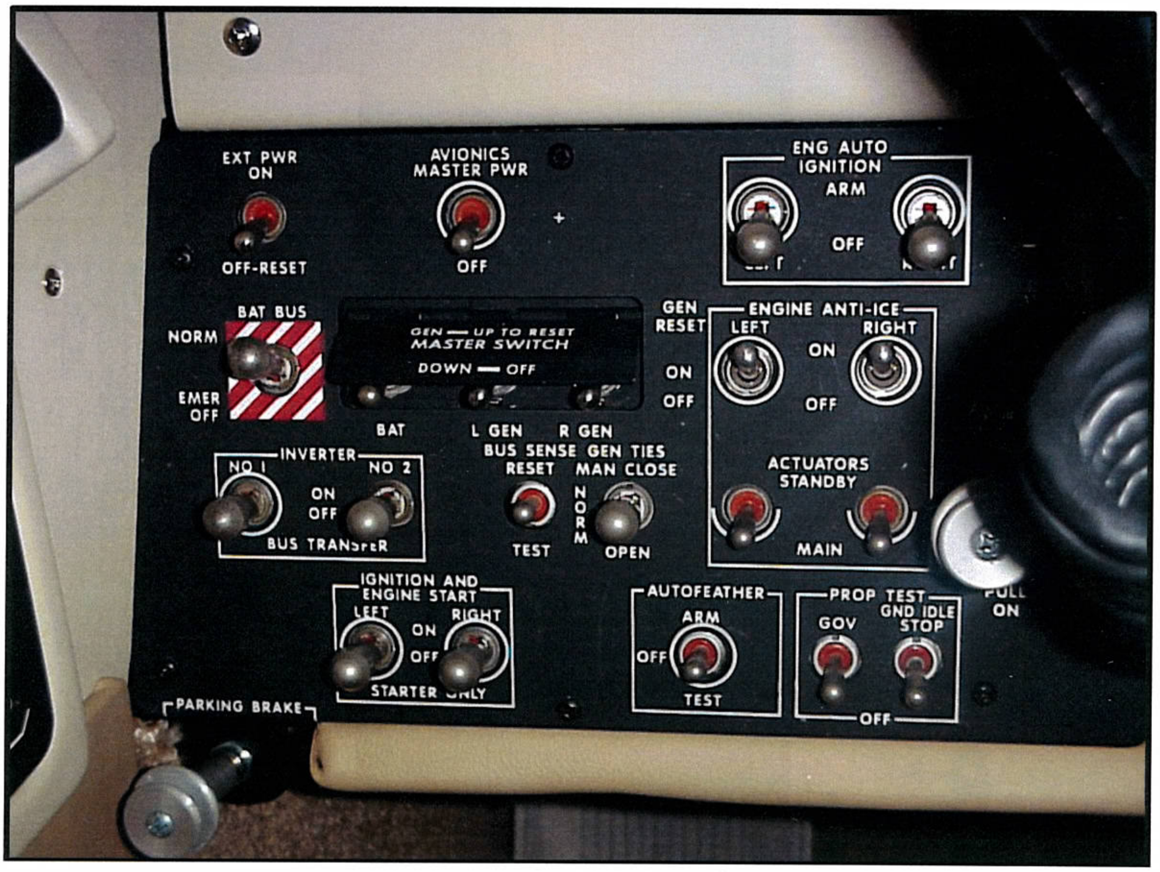
GENERATOR CONTROL PANELS

The generator control panels are self-contained units mounted on the Main Power Distribution Panel (A145). Each starter/generator has its own generator control panel to provide line-contactor relay control, voltage regulation, generator paralleling, differential voltage sensing and control, reverse current sensing and control, overvoltage and overexcitation protection and cross-start current limiting. There are two voltage-measurement jacks and a voltage-adjustment screw on the face of each unit to allow for the adjustment of starter/generator output through the generator control panel regulator circuit.

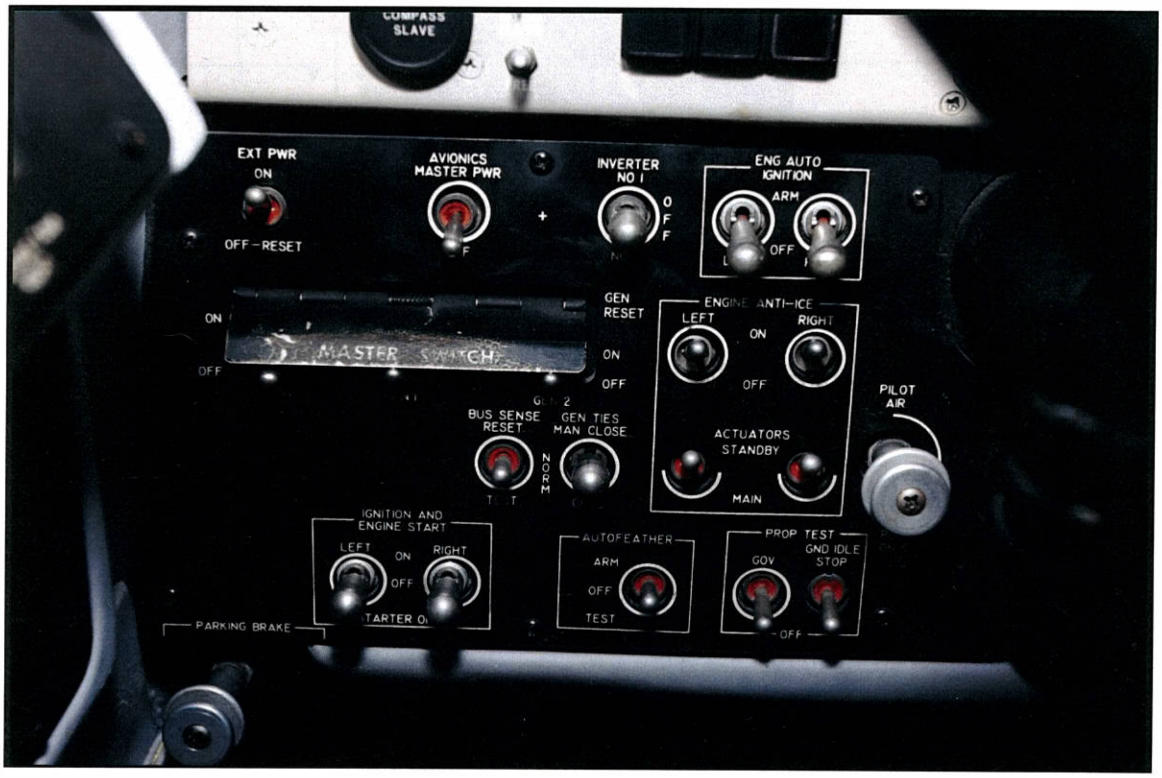


Electrical Controls

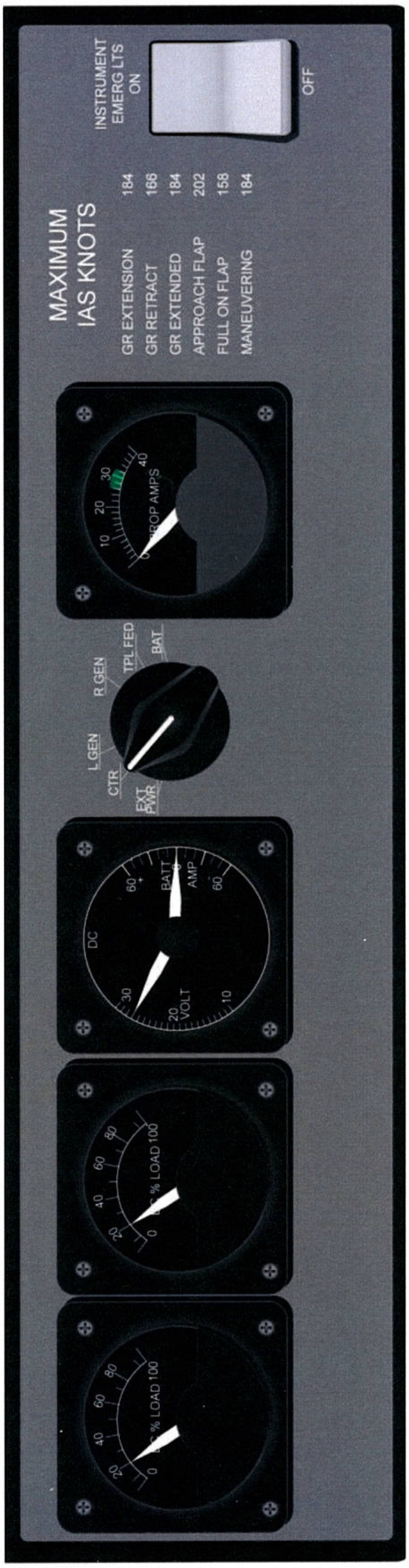
350 Electrical Controls (Proline 21 – No Inverters)



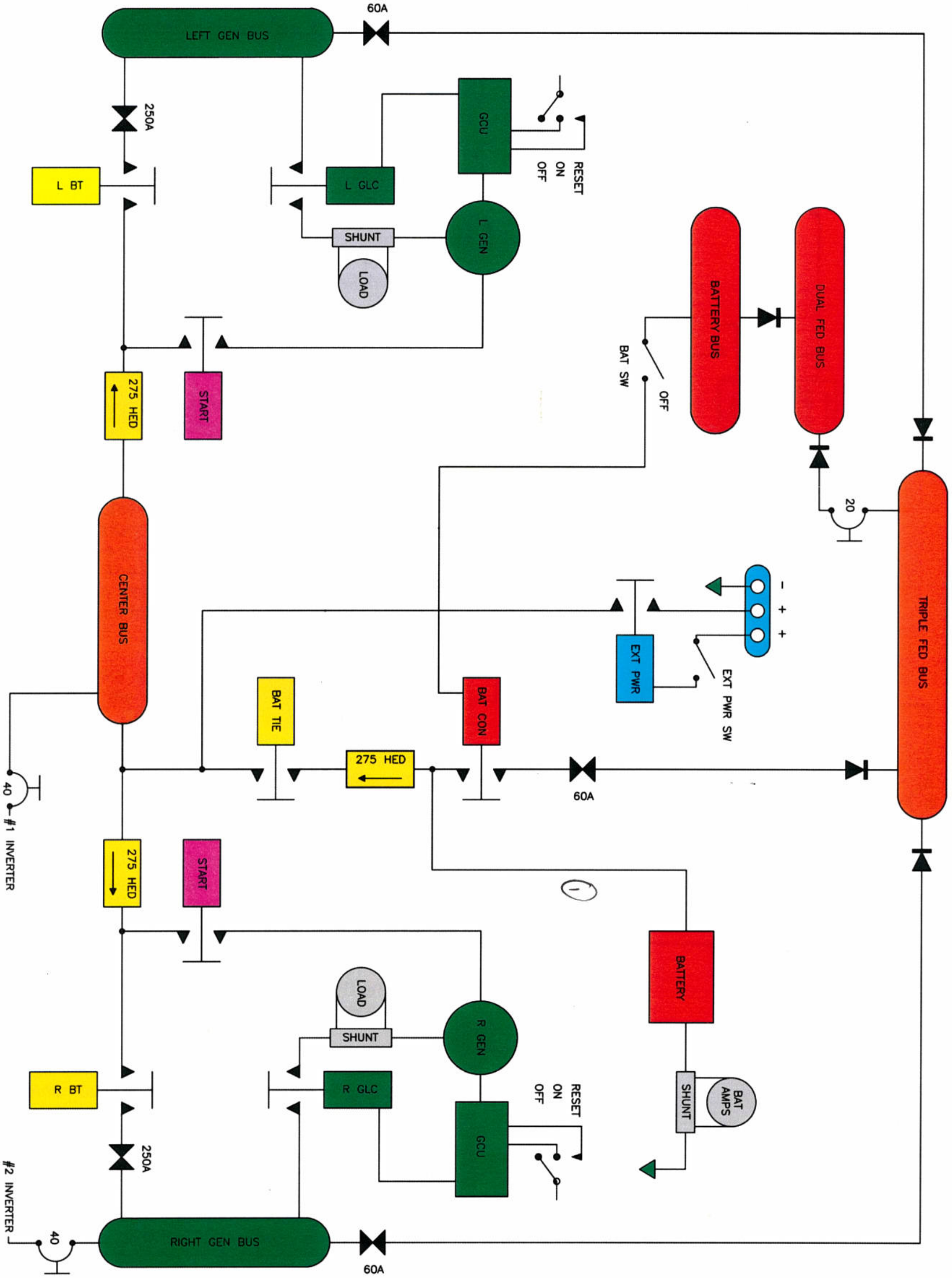
350 Electrical Controls



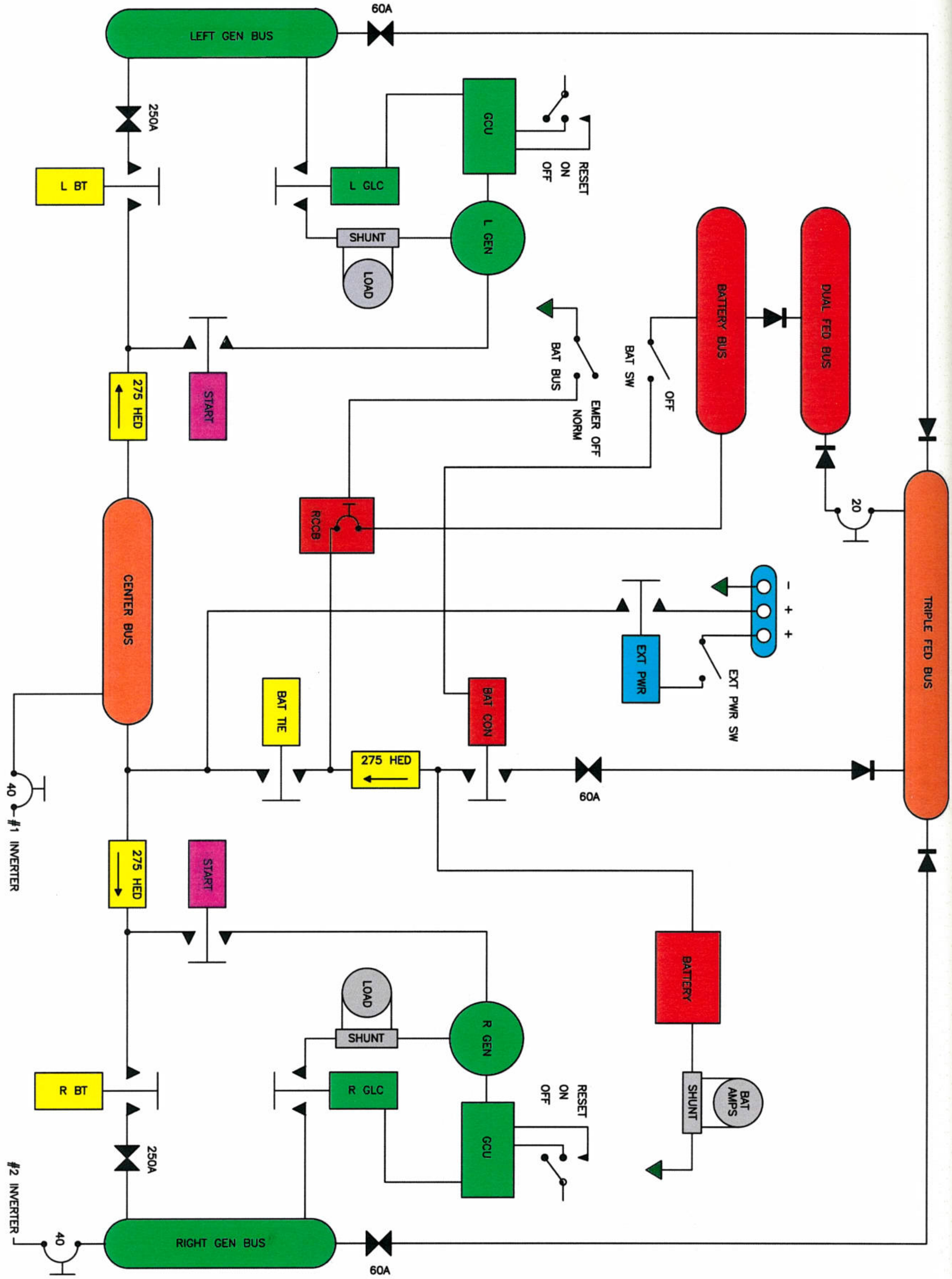
300 Electrical Controls



300/350 Overhead Panel Meters



300 Electrical System Block Diagram



350 Electrical System Block Diagram

BATTERY MONITOR

DESCRIPTION AND OPERATION

(FL-1 THRU FL-214; FM-1 THRU FM-9)

A battery charge current monitor is installed to provide a visual indication of abnormal battery charge current. The system provides an indication when the conditions exist for a thermal runaway of the nickel-cadmium battery. The battery may then be removed from the charging system before further battery damage occurs. The most common cause of the thermal runaway is damage to the gas barrier between the plates, resulting from overcharging the battery at a high rate at high temperatures. Once it has sustained gas barrier damage, the battery is subject to thermal runaway when charged on a constant voltage charging system over a period of time.

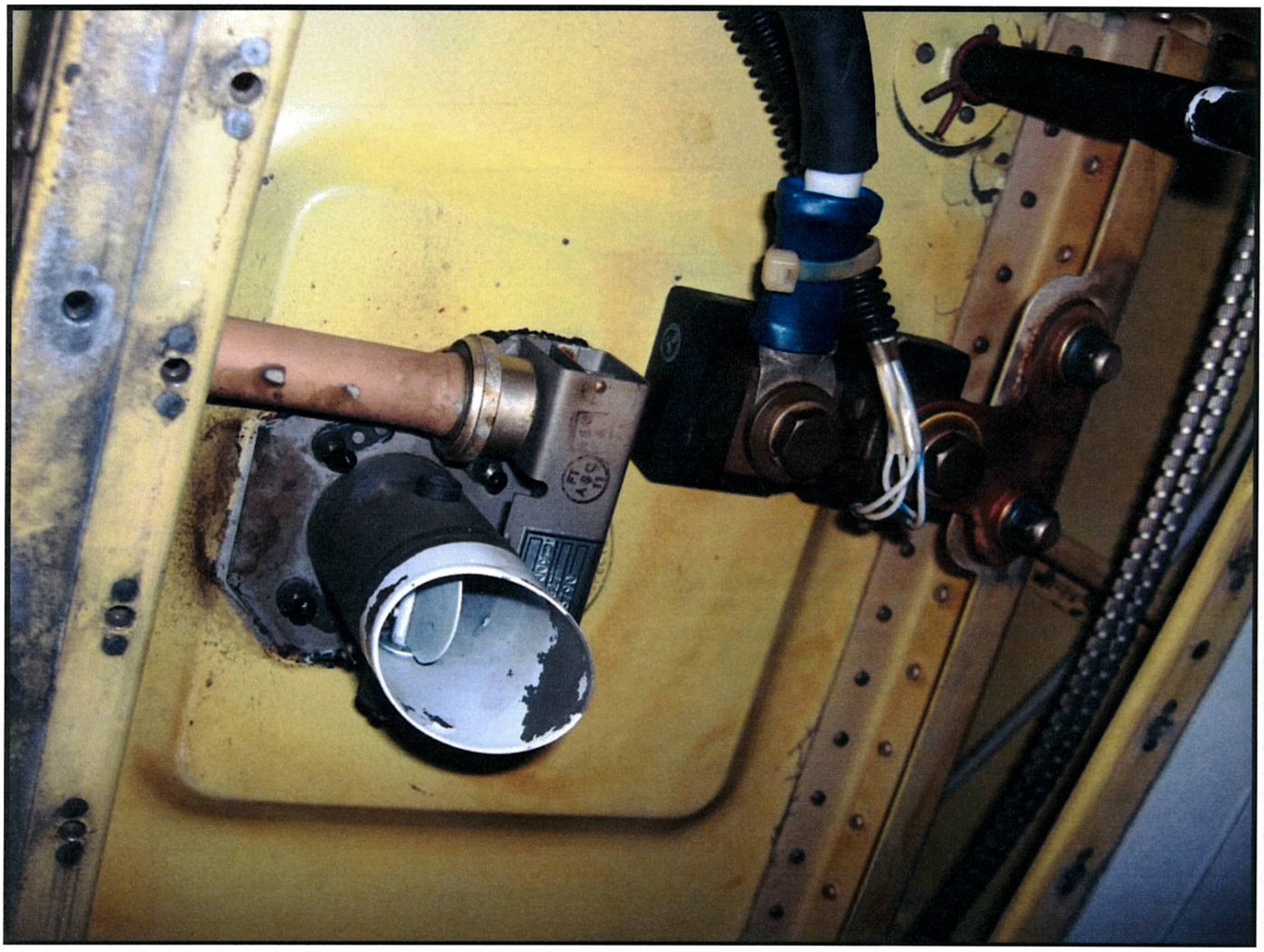
During normal operation, the idle current of the battery is less than one amp. It increases significantly above the normal level when the battery is charged at an elevated temperature or from a high charge voltage. A high idle current increases water consumption and may destroy the gas barrier (cellophane separator) between the plates. Once a battery has sustained damage to the gas barrier, it will have a high idle current and be subject to thermal runaway. The battery monitor system provides an indication of high charge current resulting from high battery temperature, high charging voltage, or gas barrier damage.

The battery monitor system consists of a shunt in the negative lead of the battery, a battery charge current detector, and a BATTERY CHARGE light in the annunciator panel. The shunt is located below the battery box in the right center section, while the detector module is mounted in a printed circuit board box assembly beneath the center aisle floor immediately aft of the partition between the cockpit and cabin.

The charge current detector circuit amplifies the signal from the shunt and provides a 28-volt output for the BATTERY CHARGE light when the signal exceeds the trigger level of 1.5 ±0.2 MV. This trigger level corresponds to 7.5 ±1 amp with the 250-amp shunt. The circuit resets when the signal decreases 0.3 MV below the trigger level to provide 1.5-amp hysteresis. There is a six-second time delay to override momentary recharges when heavy loads are switched on.

The system illuminates the yellow BATTERY CHARGE caution annunciator during battery recharge to provide a self-test of the system. Following an engine start, the BATTERY CHARGE annunciator illuminates and remains on for about five minutes until the charge current decreases to the current detector reset level as the battery approaches full charge. The time the light remains on exceeds five minutes if the trigger level of the current detector is too low or if the battery is in a low state of charge, has been previously discharged at a low rate, has a low charge voltage per cell, has gas barrier damage or is at a low temperature.

After the BATTERY CHARGE light extinguishes, it should remain off unless either a thermal runaway has begun, or the battery idle current increases in response to an increase in electrical system voltage. Such a voltage increase normally results from poor generator paralleling or load switching. The BATTERY CHARGE light may illuminate for short intervals as the battery recharges when the generator speed is increased above cut-in speed.

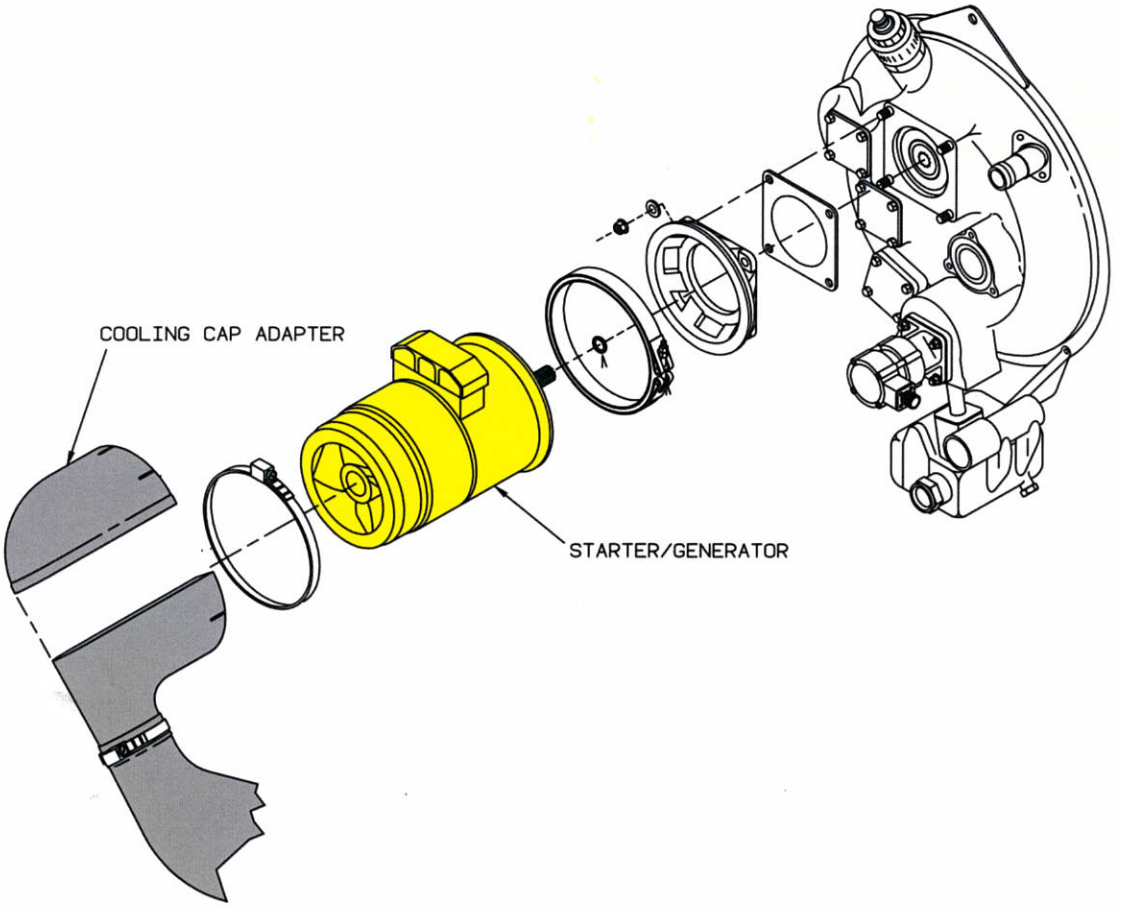


Battery Shunt (Miswired after Lead Acid STC)

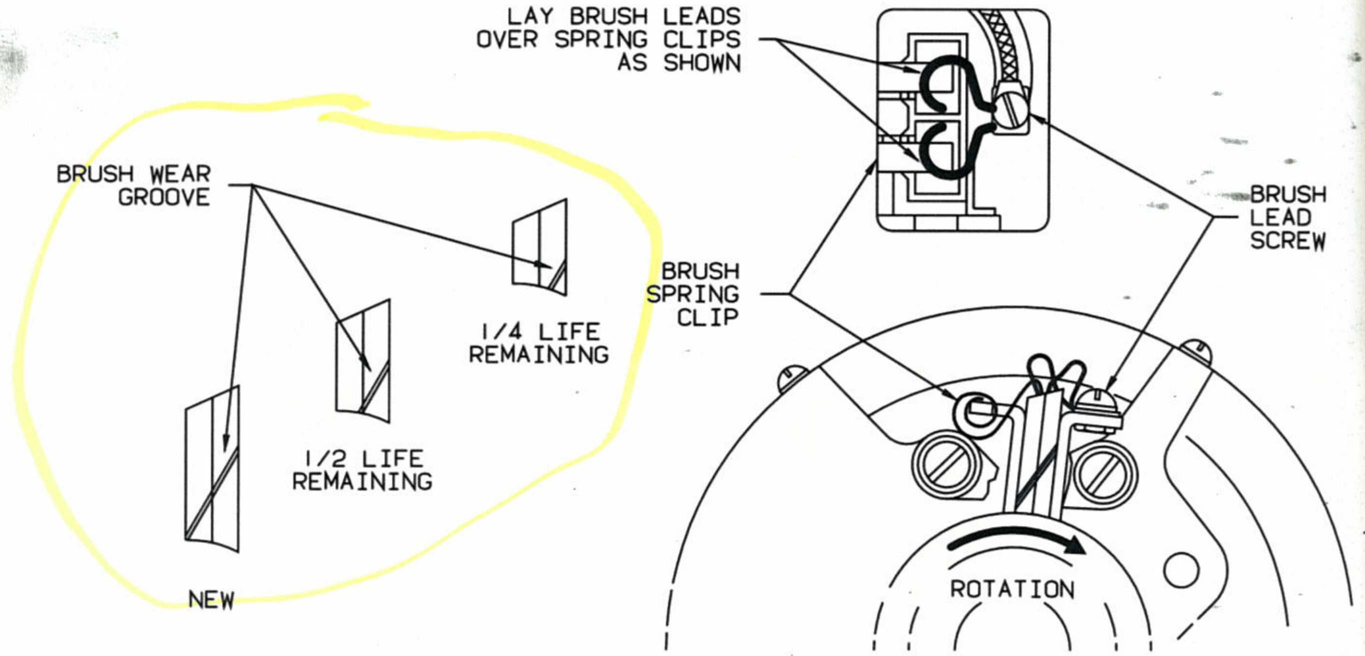
DC STARTER/GENERATORS

The starter/generators are dual-purpose, 28-volt, 300-ampere units which produce torque for engine starts or generate electrical current to meet the airplane electrical loads. A quick-disconnect mounting adapter is bolted to a mounting pad on the engine accessory gearbox, providing the starter/generator with a pin-aligned mount. The unit mates with the engine gearbox by means of a splined drive shaft, providing a direct torque transfer for both generator and starter functions. Should a condition occur causing excessive torque at the starter/generator splined drive-shaft, the shaft will shear, minimizing damage to the starter/generator and engine components. An internal shaft-driven fan draws outside air through the starter/generator to provide ground cooling.

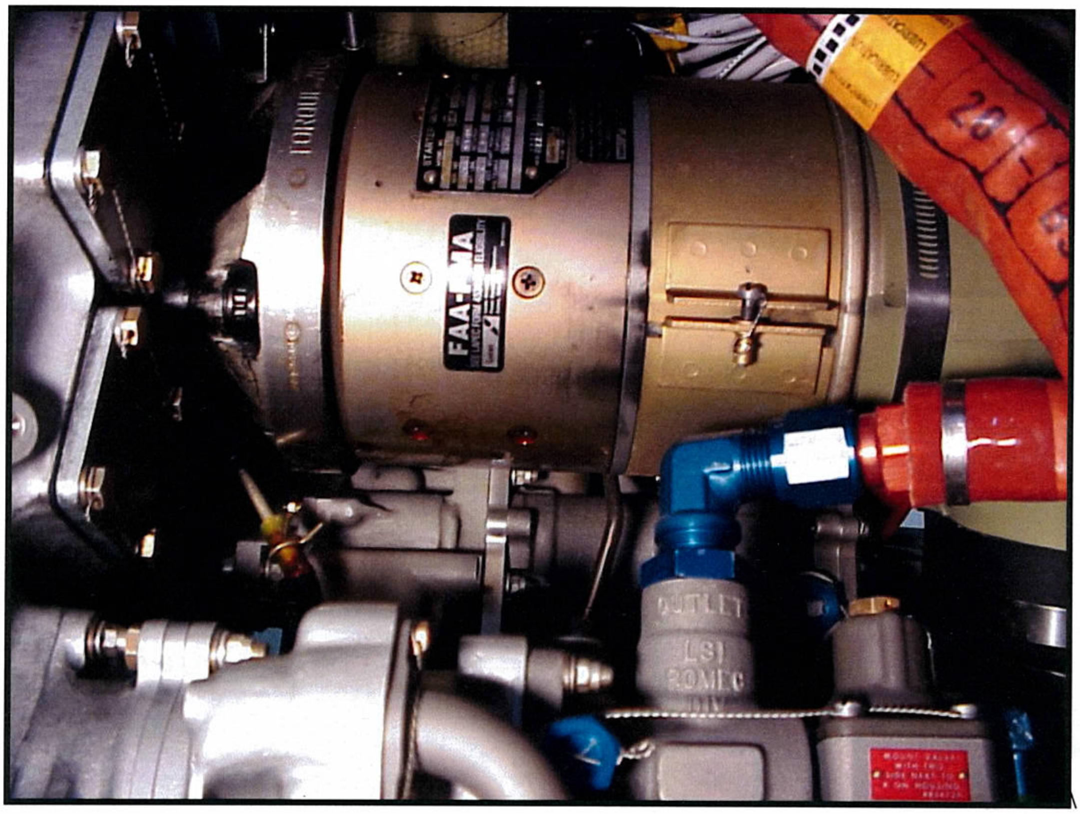
A series starter winding is used for starter operation, and a shunt field winding is used during generator operation.. The starter/generator interpole and compensating windings are in series with the armature and provide a voltage proportional to starter/generator output current. Voltage developed across the interpole and compensating windings is output at terminal D of the starter/generator. The generator control panel senses this voltage at pin D to provide equalization during dual generator operation. Each generator control panel also provides a field excitation voltage from pin M to terminal A on the starter/generator. While monitoring starter/generator output at pin B, the generator control panel adjusts field excitation voltage accordingly, thereby regulating starter/generator output at terminal B within the normal range of 28.25 ± 0.25 vdc.



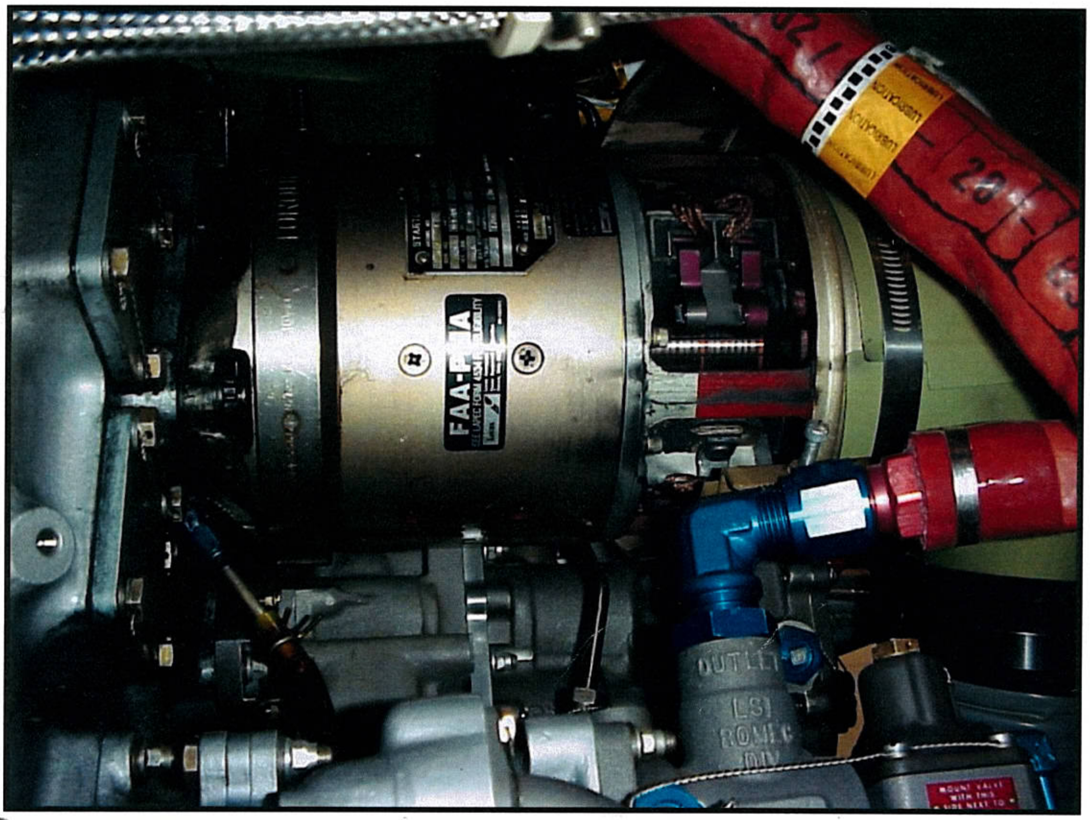
Starter/Generator Installation



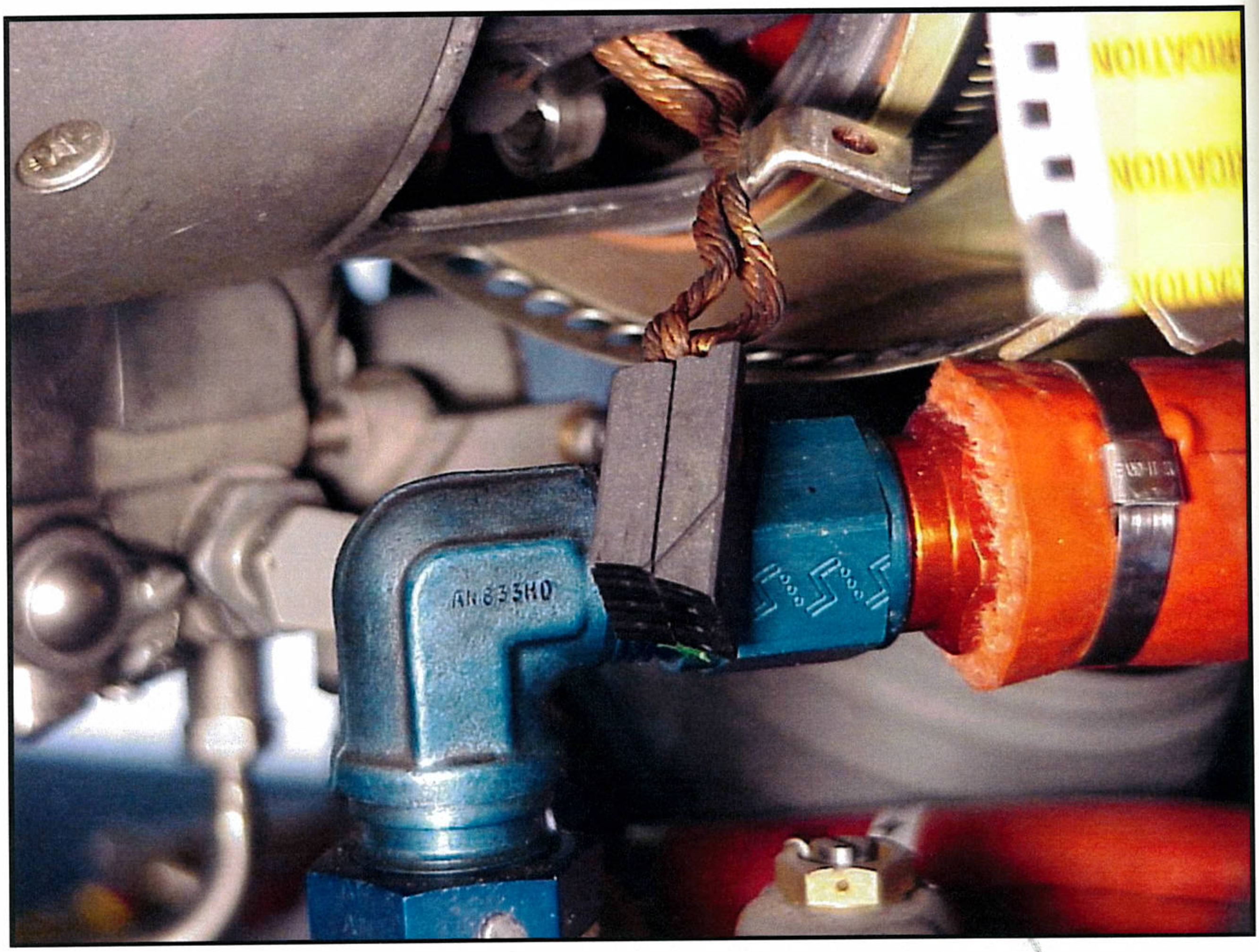
Starter/Generator Brush Installation and Wear Limits



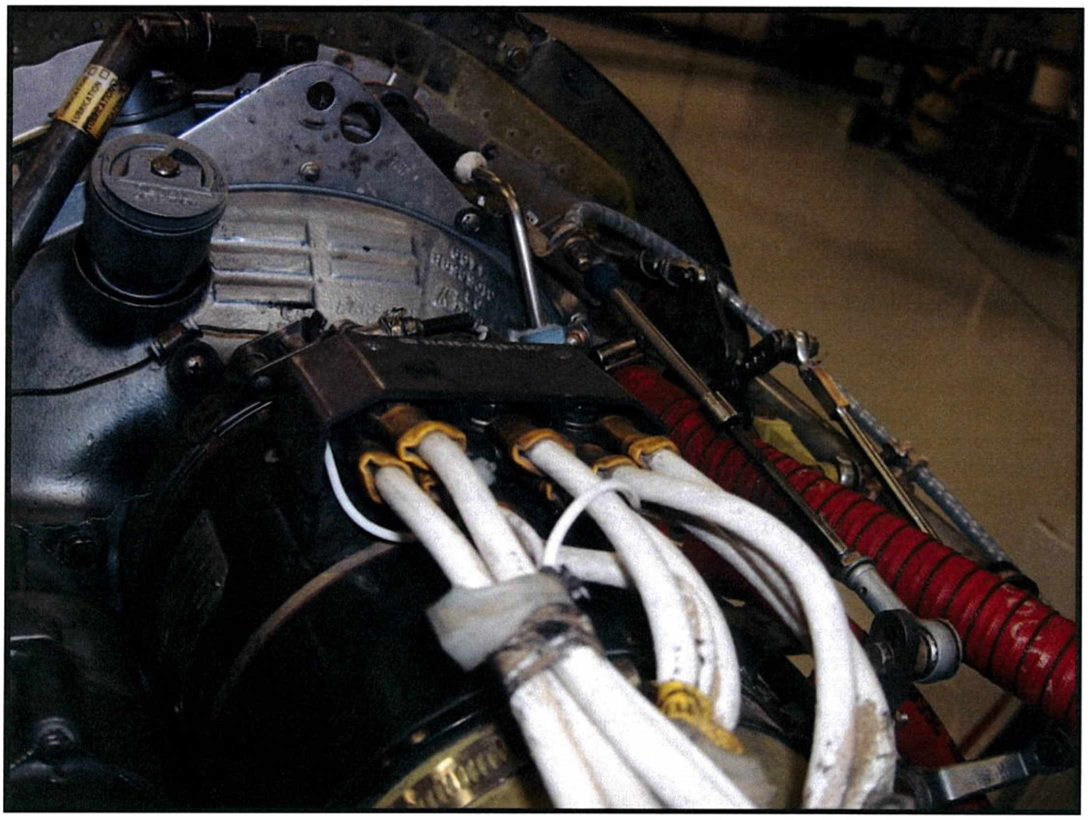
Starter Generator Brush Cover



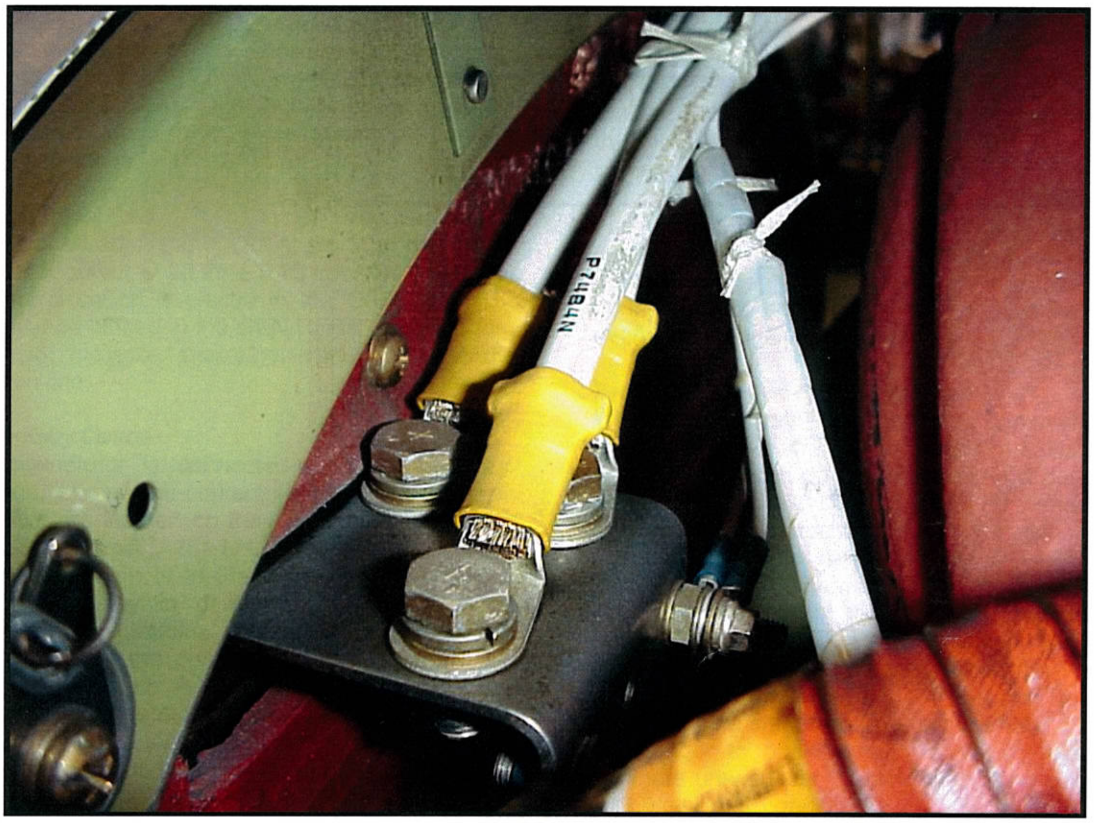
Starter Generator Brush Access



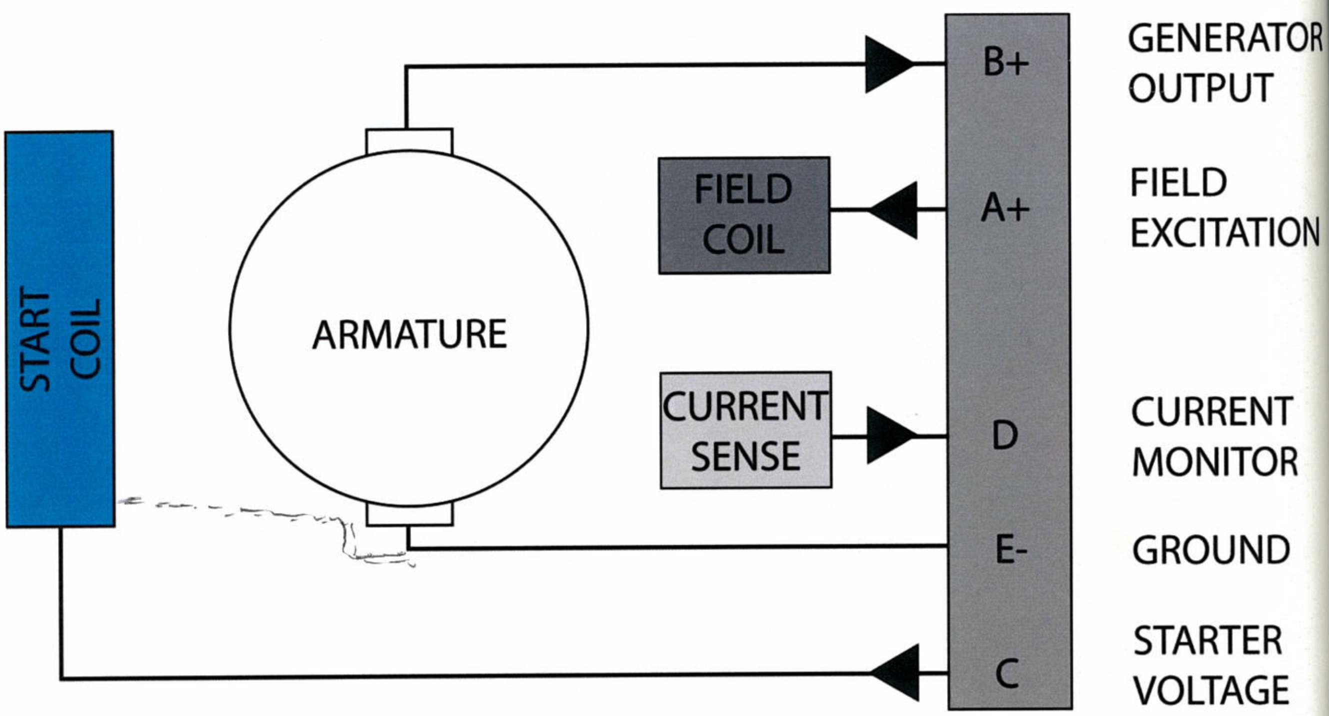
Starter Generator Brushes



Starter Generator Wiring



Starter Generator Wiring



L Gen.
R Gen
EXT PWR
MAIN TIES CLOSE.

Starter Generator Fundamentals

DC GENERATION AND CONTROL

DESCRIPTION AND OPERATION

The dc generation and control system consists of two dc starter/generators, the battery, three current sensors, two generator control panels, two line-contactor relays, three bus-tie relays, two generator control relays, two generator control switches, a bus-tie control switch, bus-sense switch and the bus-tie control pcb. The system also includes load and voltage indication for all three power sources and five annunciators that indicate status of the system.

Field Flash Circuit and Voltage Regulation

The generator control panel monitors starter/generator output voltage and controls the shunt field excitation to maintain a constant voltage under varying operating conditions such as speed, load and temperature. Before the control panel can regulate starter/generator output, it must use residual voltage to build starter/generator output to a level the regulation circuit can control. Residual voltage, normally 0.3 to 2.0 vdc, is present at terminal B of the starter/ generator as long as the unit is spinning and the control panel is not supplying a regulator voltage to the shunt field at terminal A of the starter/generator. When either generator control switch is placed in the GEN RESET position, a low-resistance path is established from terminal B of the starter/generator to pin K on the control panel, through an internal relay, then out pin M and back to the starter/generator at terminal A. Upon reaching terminal A of the starter/ generator, residual voltage excites the shunt field and increases output at terminal B of the starter/generator until the control panel internal relay energizes, breaking the field flash path. At this point, starter/generator output voltage should be sufficient to allow the regulator circuit to take over and continue increasing starter/generator output until 28.25 ± 0.25 vdc is reached.

The control panel will continue to regulate the starter/generator by adjusting output at pin M to maintain starter/generator output at 28.25 ± 0.25 vdc. Anytime the generator control switch is placed in the OFF position, this switch must be placed in the GEN RESET position to excite the field, increase starter/generator output and bring it back on line.

Line-Contactor Relay Control

Each starter/generator is connected to its respective generator bus by a line-contactor relay. The line-contactor relays are located on their respective Forward Power Distribution Panel (A251 LH, A252 RH). When the generator control switch is in the ON position and the generator control relay is de-energized (start signal removed), voltage from terminal B of the starter/generator is applied to pin C of the generator control panel. Bus voltage is sensed at pin A of the control panel and compared to starter/generator output voltage at pin B of the generator control panel. When these voltages are nearly equal, an output from pin H of the generator control panel will close the line-contactor relay. The yellow R DC GEN or L DC GEN caution annunciator will extinguish and generator output is applied to the bus-tie relay contacts for distribution. The generator control panel monitors a number of inhibiting signals and will open the line-contactor relay should a fault occur requiring isolation of the starter/generator from the generator bus.

Starter/Generator Paralleling

The generator control panels incorporate circuitry to maintain the starter/generator electrical loads within 10 percent of each other for their entire operating range. An equalizer relay in each generator control panel is used to connect both starter/generator equalizer channels when the line-contactor relay is closed, enabling the generator control panel equalizer circuit only when load-sharing is possible. The bus-tie control pcb also incorporates an internal relay to provide an interconnect between pin E of each generator control panel. The bus-tie control pcb internal circuitry will not close its internal relays until it receives signals indicating that the line-contactor and bus-tie relays are closed for both sides of the system. Once these conditions for load-sharing are met, each generator control panel will compare the interpole winding voltages from terminal D of both starter/generators to determine the relative amount of load current being supplied by each starter/generator. The generator control panels accomplish this by sensing interpole voltage (of the starter/generator they are regulating) at pin D and the opposite side starter/generator interpole voltage at pin E. The generator control panels then bias their voltage regulation circuits accordingly, adjusting voltage output at pin M to accomplish equal load-sharing. Precise load distribution from the generator control panels is provided without the need for adjustment while the units are in service.

Over-Excitation Protection

When a failure occurs causing excessive field excitation, the affected starter/generator will attempt to carry all of the airplane's electrical load. During parallel operation, this is sensed at the generator control panel by comparing interpole voltages of the starter/generators. The starter/generator will be de-energized if generator bus voltage is greater than 28.25 vdc and the output current differential between starter/generators is greater than 15 percent for 5 seconds. This circuit functions during parallel operation only and does not require an overvoltage condition to function.

Reverse Current And Polarity Protection

When the generator field becomes underexcited for any reason, or when the starter/generator slows down to a point where it can no longer maintain a positive load, it will begin to draw current from the center bus. The reverse-current-protection function senses starter/ generator interpole voltage at pin D of the generator control panel to determine if the starter/generator has become a load rather than a power source. If reverse current is present, indicated by positive voltage at pin D, the generator control panel will open the line-contactor relay and remove the starter/generator from the bus. During engine shutdown, the unit will have a tendency to wait longer to open the line-contactor relay. This will eliminate unnecessary cycling of the line-contactor relay during a normal condition.

NOTE: THE STARTER/GENERATOR DOES NOT REQUIRE A RESET WHEN THE GENERATOR CONTROL PANEL REVERSE-CURRENT-PROTECTION CIRCUIT HAS BEEN TRIPPED. THE GENERATOR CONTROL PANEL WILL AUTOMATICALLY RESET ITS INTERNAL CIRCUITRY.

In the case of starter/generator reverse-polarity buildup, the generator control panel protects the electrical system from damage by tripping an internal-field relay to de-energize the affected starter/generator.

Overvoltage Protection

If a fault occurs where starter/generator output or bus voltage is supplied to the generator field at terminal A of the starter/generator, or should the voltage regulation circuit fail, the affected starter/generator will attempt to assume the full load as its input voltage increases. If bus voltage increases above 28.25 ± 0.25 vdc, reverse current will begin to flow to the regulated starter/generator and the line-contactor relay will be opened, isolating the regulated starter/ generator from the buses. If the affected starter/generator output voltage rises above 32.5 vdc, it will be removed from the bus and the unaffected starter/generator will automatically be reconnected. The resultant voltage depends upon starter/generator speed, electrical load and the nature of the fault.

The generator control panels monitor starter/generator output voltage at pin J for excessive voltage that could potentially damage the airplane electrical system. If starter/generator output exceeds 32.5 vdc, an inverse time delay will trip an internal field relay to de-energize the starter/generator and open the line-contactor relay. Slight voltage surges will normally be associated with a longer time delay to prevent nuisance trips of the internal field relay, whereas a severe increase will cause an immediate trip. This overvoltage protection circuit requires a manual reset of the starter/generator to bring the starter/generator back on-line.

A completely separate circuit is used to open the line-contactor relay if voltage exceeds 40 vdc. This provides extra protection of the electrical system and allows a faster response to a fault because it does not work on a time delay. Manual reset of this individual circuit is not required because there is no time-delay mechanism.

An overvoltage condition arising from a resistive connection in the signal ground wire to the generator control panel can be detected by the generator control panel with an alternate ground-return path. This ground allows the generator control panel to sense an otherwise undetectable overvoltage condition and provide an automatic trip of the internal field relay.

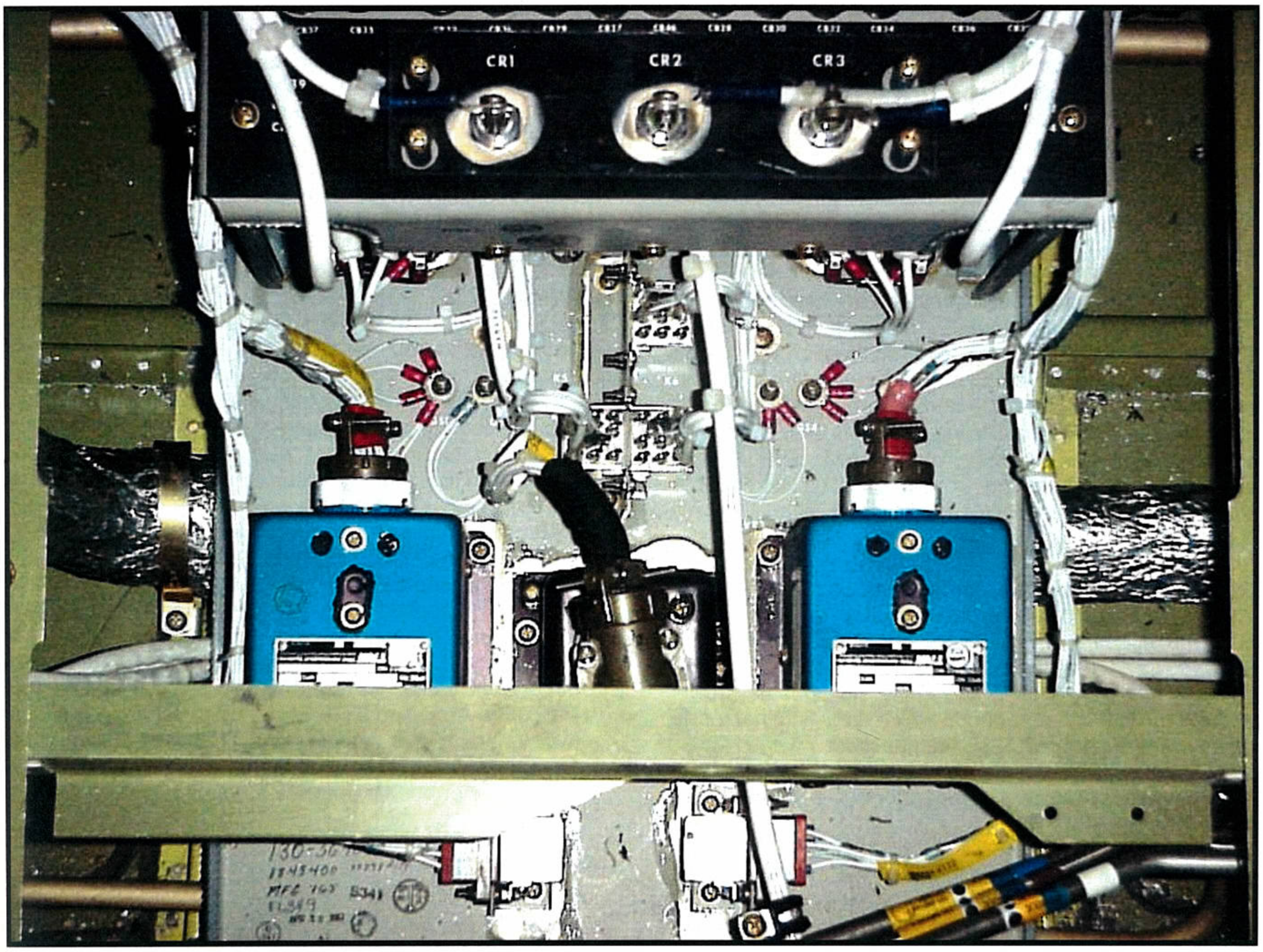
Provisions are made within the generator control panel to exercise the overvoltage-protection circuit. When the generator control switch is moved from ON to OFF, voltage is removed from pin C of the generator control panel (line-contactor in), opening the line-contactor relay. Once in the OFF position, the generator control switch applies starter/ generator output to pin P (overvoltage test) of the generator control panel, tripping the control panel overvoltage circuit and shutting down the starter/generator. This circuit allows the generator control panel to shut down its starter/ generator without creating an actual overvoltage condition. of the overvoltage circuit.

Cross-Start Overload Current Limiting

The generator control panels have a feature that limits the on-line starter/generator output current during engine cross-starts. This circuit prevents the on-line starter/generator from providing excess current to the starter/generator being used as a starter. When either ignition/start switch on the pilot's outboard subpanel is placed in either the ON or STARTER ONLY position, a signal is applied to pin R of the opposite generator control panel, enabling its current limiting circuit. The generator control panel will then limit starter/generator output until the signal is removed from pin R.

Generator Control Relay

The generator control relays are located on the Main Power Distribution Panel (A145) with the generator control panels. Each relay utilizes three sets of contacts and is energized when the respective ignition/start switch is placed in the ON or STARTER ONLY position. One set of contacts supplies starter/generator output to voltage at pin J of the generator control panel, allowing the control panel to sense any overvoltage that may be present when the relay is de-energized. When the generator control relay is energized, the same set of contacts opens and removes power from pin J of the control panel. This inhibits any generator output during starter operation. The two remaining sets are closed only when the relay is energized. One set provides 28 vdc to energize the engine start relay and the other set shorts the shunt field of the starter/generator during engine starts, preventing transients from entering the generator control panel.



DC Distribution Panel and GCU's

BUS-TIE CONTROL PCB

General

The bus-tie control pcb monitors the current sensor signals and other inputs to provide control of the bus-tie relays. When the current sensors are not sensing an overcurrent and at least one line-contactor relay is closed, the bus-tie control pcb will close the generator bus-tie relays, powering the center, battery and opposite generator bus with generator power. Whenever reverse current of 275 amperes or greater flows through one of the current sensors, the affected current sensor will signal the bus-tie control pcb to open the applicable generator bus-tie relay, thereby isolating the overcurrent to that bus. The bus-tie control pcb will close the battery bus-tie relay anytime the battery switch is placed in the ON position and no overcurrent exists. Battery power is then connected to the battery bus, center bus and triple-fed bus.

The bus-tie control pcb also provides an interconnect for the generator control panels during starter/generator parallel operation. It consists of a connection from each generator control unit pin E to the bus-tie control pcb at pins 17 and 18. The bus-tie control pcb uses an internal relay to connect the paralleling channels when the line-contactor and bus-tie relays are closed. This feature ensures that load-sharing is possible only when both starter/generators are on-line with their bus-tie relays closed.

Generator Bus-Tie and Bus-Sense Switches

The generator bus-tie switch, located on the pilot's outboard subpanel, has several functions implemented through three switch positions. The MAN CLOSED position manually closes the generator bus-tie relays through the bus-tie control pcb which also illuminates the green MAN TIES CLOSE annunciator. The NORM position allows the bus-tie pcb to analyze bus voltages and automatically close the generator bus-tie relays when no fault exists.

The bus-sense switch, adjacent to the bus-tie control switch, simulates an overcurrent condition by applying voltage to all three current sensors anytime it is placed in the TEST position. The switch must be moved to RESET anytime the bus-tie relays have been opened by an overcurrent or test. The switch does not influence the system when in the NORM position.

Bus-Tie Relays

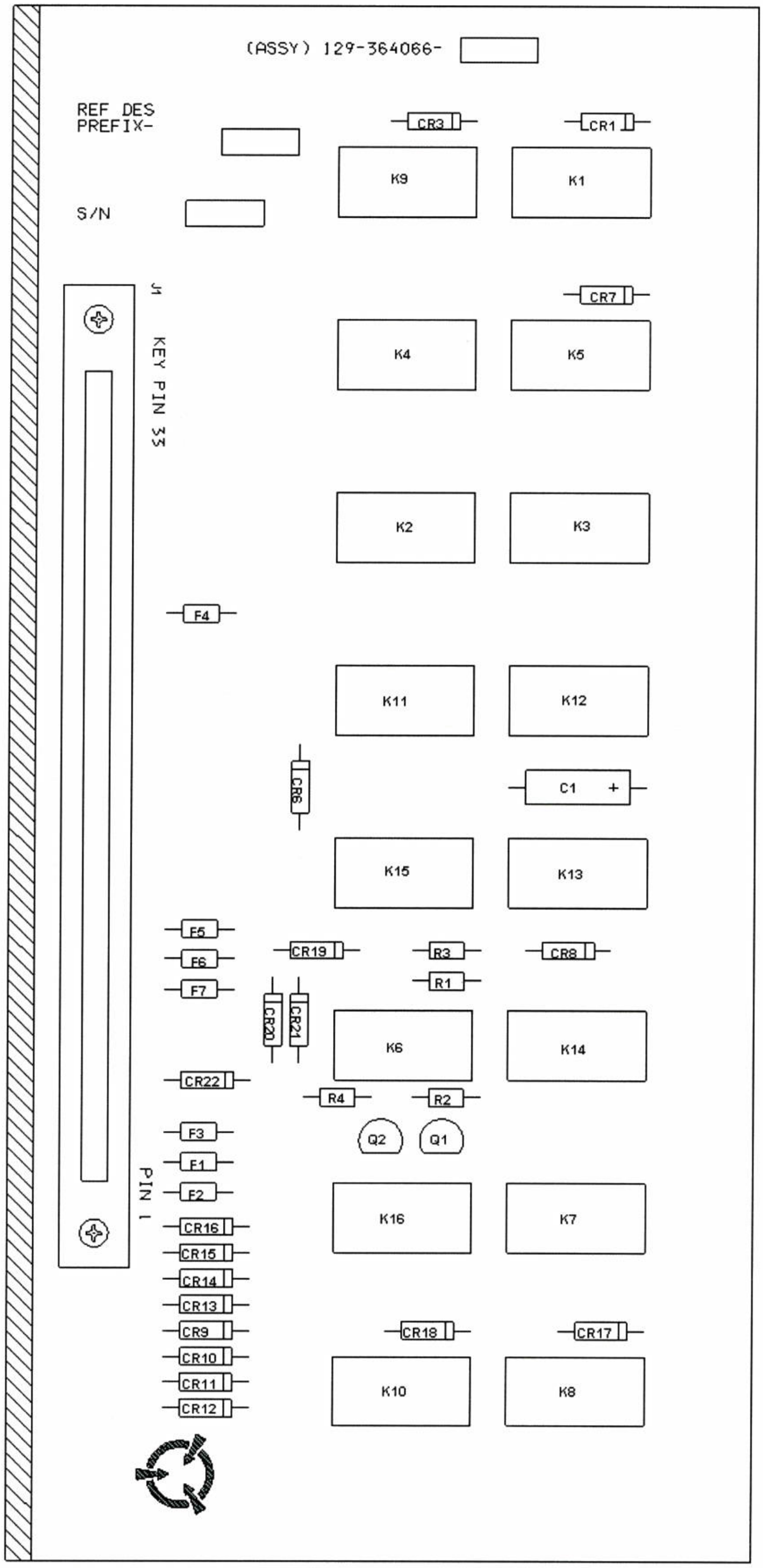
There are three bus-tie relays used to connect the three DC power sources to the main buses. They consist of the battery, LH generator and RH generator bus-ties. The generator bus-tie relays are located on their respective Aft Power Distribution Panel (A253 LH, A254 RH) and the battery bus-tie relay is located on the Battery Power Distribution Panel (A228). Each generator bus-tie relay has two sets of auxiliary contacts. The first set allows the generator control panel to sense center bus voltage when the contacts are open and to sense generator bus voltage when they are closed. The second set provides 28 vdc to illuminate the respective yellow L GEN TIE OPEN or R GEN TIE OPEN caution annunciator when the bus-tie relay is open. The battery bus-tie relay has only one set of auxiliary contacts which provides 28 vdc to illuminate the yellow BAT TIE OPEN caution message when the bus-tie is open.

BUS-TIE CONTROL

General

The GEN TIES and BUS SENSE switches are located on the pilot's outboard subpanel to provide control over the bus-tie system. Placing the BUS SENSE switch in the TEST position applies a control voltage from the buses to each current sensor's test input. This voltage simulates an overcurrent condition to exercise the hall effect device circuitry. The current sensors signal the bus-tie control pcb to open the bus-ties for the test. All three caution annunciators should illuminate. Reaction time of the battery current sensor is 0.1 second and .01 second for the generator current sensors. Because reaction time is so fast, only a momentary actuation of the BUS SENSE switch to TEST is necessary. By momentarily moving the BUS SENSE switch to RESET, the technician will remove power from the bus-tie relay coils and de-energize them. Voltage is then removed from the annunciator outputs and applied to the bus-tie relay coils by the bus-tie control pcb to close the bus-tie relays.

The GEN TIES switch is used to manually open or close the bus-ties without applying voltage to the current-protection circuits. When the GEN TIES switch is placed in the MAN CLOSE position, the bus-tie control pcb manually closes the generator bus-tie relays. This allows power to be applied to the generator buses during ground maintenance or testing without running the engines. The MAN TIES CLOSE annunciator is illuminated anytime the generator bus-tie relays are closed using the MAN TIES CLOSE switch. The GEN TIES switch will manually open the generator bus-tie relays anytime it is placed in the OPEN position. While in the NORM position, control of the generator bus-tie relays is automatic through the bus-tie control pcb.


(ASSY) 129-364066-
REF DES PREFIX-
S/N
J1
KEY PIN 33
PIN 1
CR3
CR1
K9
K1
CR7
K4
K5
K2
K3
F4
K11
K12
CR6
C1 +
K15
K13
F5
F6
F7
CR19
R3
R1
CR8
CR20
CR21
K6
K14
CR22
R4
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Q1
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F1
F2
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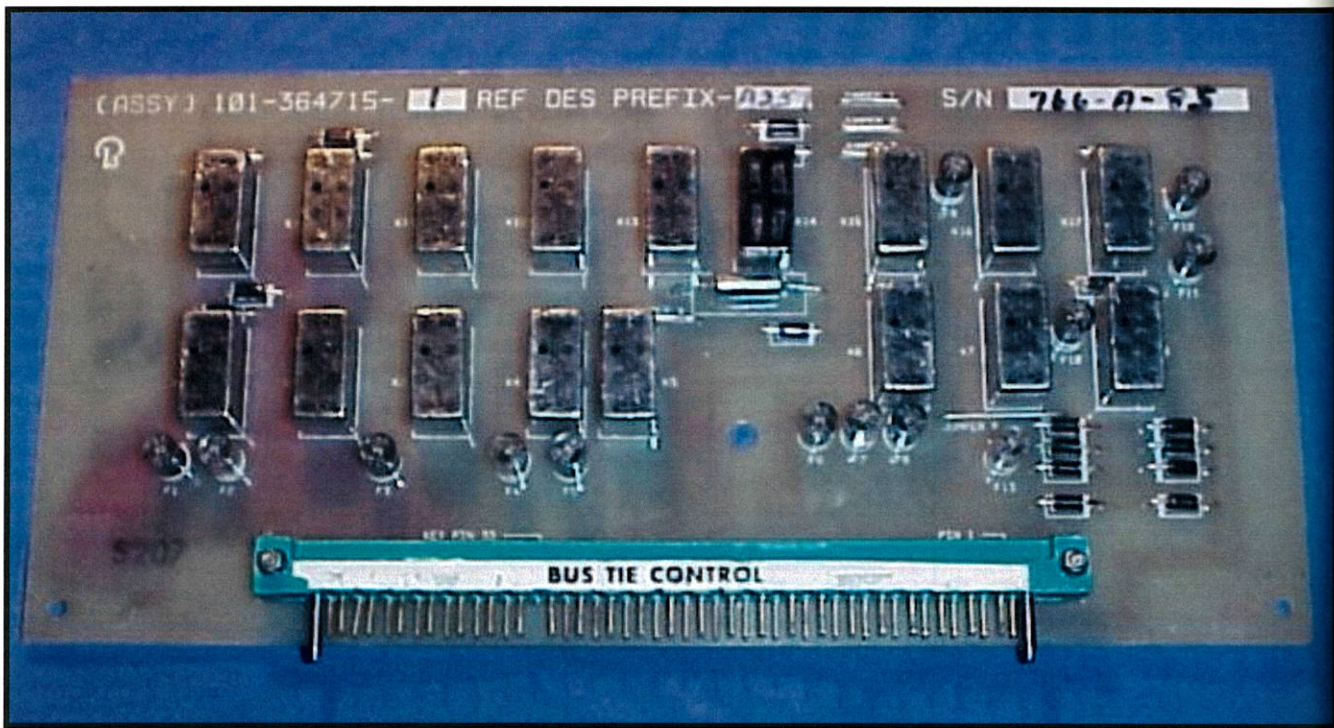
K10
K8

Bus Tie PCB



A257 Bus Tie PCB

EXTERNAL POWER

DESCRIPTION AND OPERATION

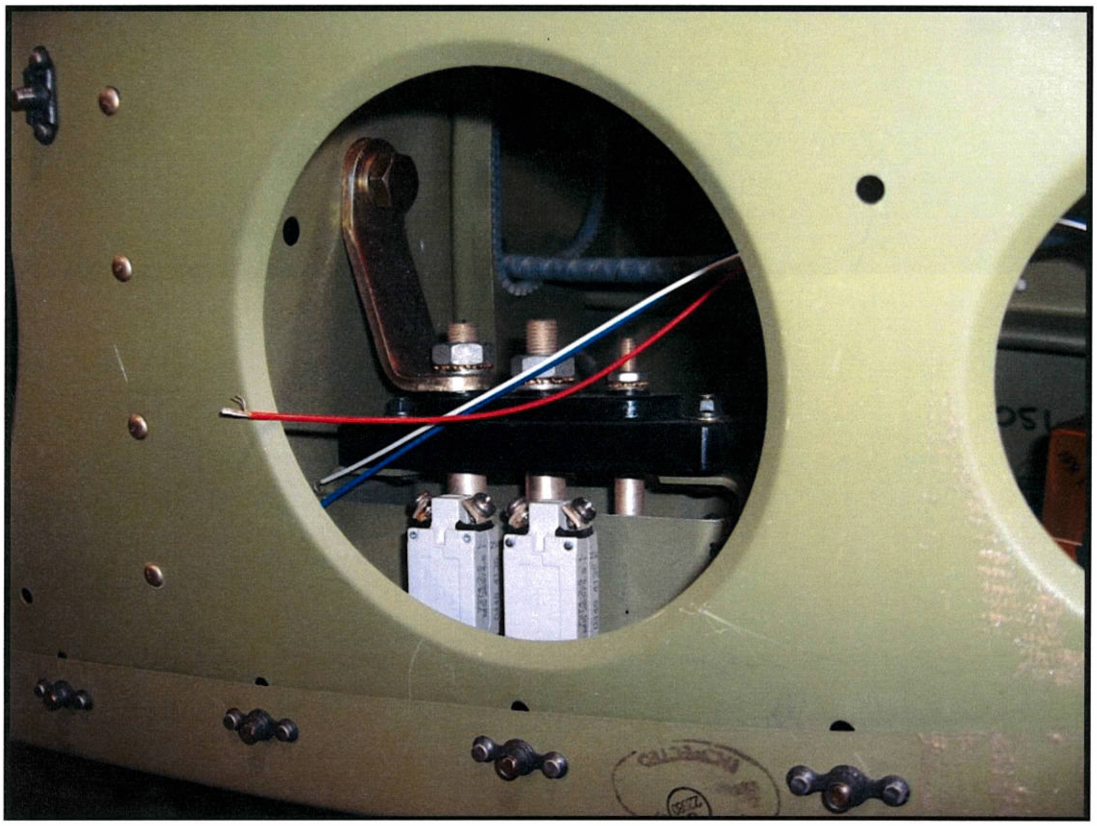
The external power receptacle is located underneath the right wing, outboard of the engine nacelle. The receptacle is designed for use with an auxiliary ground power unit having a standard AN plug. An external power sensor module, installed in a printed circuit board box assembly under the center aisle floorboard, protects the airplane electrical system from an auxiliary ground power unit with reversed polarity or an excessively high output voltage. The sense module utilizes the voltage from the airplane center bus and the continuity of the circuit between the positive terminal and the polarizing terminal of the GPU plug to illuminate the yellow EXT PWR caution annunciator when an GPU is plugged into the receptacle. The unit does not necessarily need to be turned on to illuminate the annunciator.

If the GPU output has the correct polarity, and the external power switch is ON, the external power printed circuit board outputs a voltage to close the external power relay and to close the bus tie relays. The external power unit automatically powers all dc buses. External power is routed through the external power relay to the center bus. A voltage from the small polarizing pin of the external power receptacle is routed through a 5-ampere circuit breaker, mounted in the outboard right center section, to the voltmeter select switch in the overhead instrument panel. This permits monitoring the voltage of the GPU before the external power relay is closed.

CAUTION: VOLTAGE IS REQUIRED TO ENERGIZE THE AVIONIC MASTER POWER RELAYS TO REMOVE THE POWER FROM THE AVIONICS EQUIPMENT. IF EXTERNAL POWER IS USED FOR GROUND MAINTENANCE, SUCH AS LANDING GEAR RIGGING, USE CARE TO ENSURE THAT EACH AND EVERY AVIONICS UNIT IS TURNED OFF.

position.

External Power Connection



Ground Power Connection (Wing Removed)

ELECTRICAL LOAD DISTRIBUTION

DESCRIPTION AND OPERATION

The electrical load distribution system provides the means of supplying direct and alternating current to the various airplane systems. Direct current is provided from three separate power sources, the battery and the LH and RH starter/generators. Alternating current is provided from two dual-output inverters (26 and 115 vac) located in the wing center section outboard of each nacelle.. A ground auxiliary power unit may be connected to the airplane to supply power to all five primary buses during ground operation.

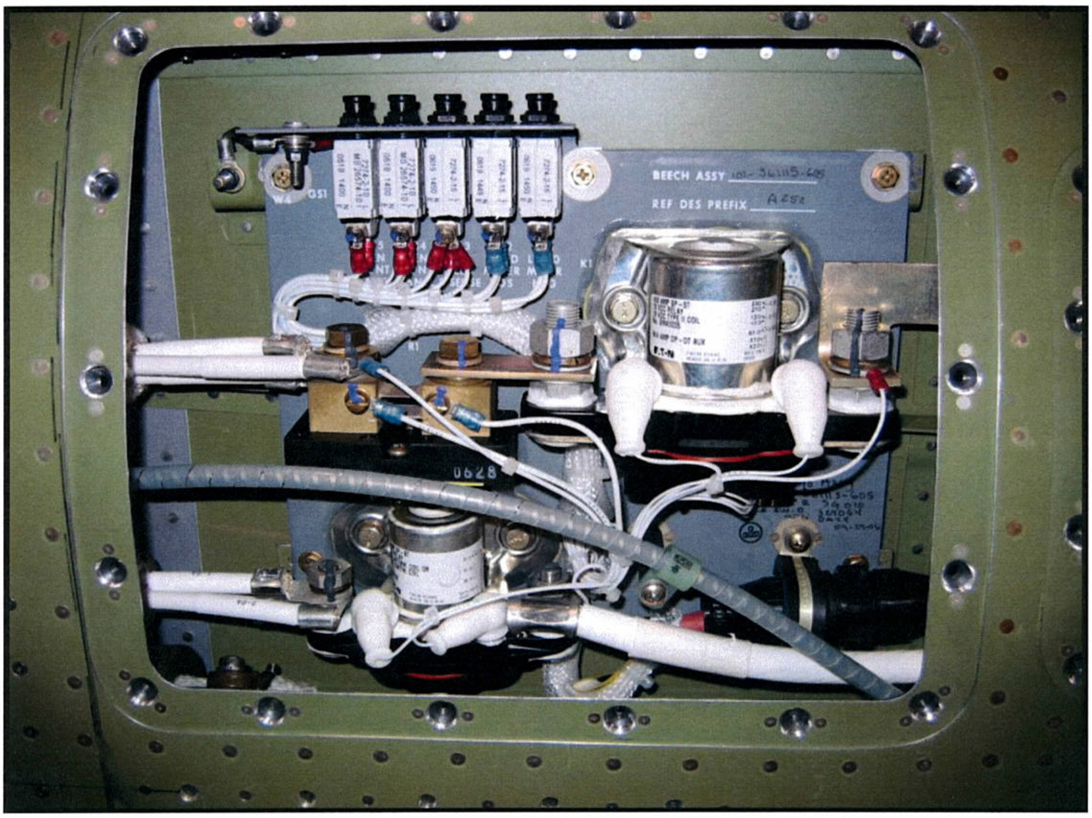
Power Distribution On The Buses

There are five primary buses that distribute power from the dc power sources. They consist of the left and right generator buses, center bus, triple-fed bus and the battery bus. The buses are interconnected to provide a triple-fed, single-loop system that is protected through the use of the limiters and bus-tie relays. The battery bus is connected to the battery through a remote control circuit breaker and is located in the fuel control panel.. The battery switch and the battery bus switch are both located on the pilot's outboard subpanel. The generator buses are located aft of the firewall on the inboard side of their respective nacelle. The center bus (lower forward cabin limiter assembly) is located under the forward center aisle floor and is powered from each generator through a 250-amp limiter and generator bus-tie relay. The generator buses, battery bus and battery are all tied together by the center bus, which in turn supplies power to the environmental system.

AVIONICS POWER DISTRIBUTION

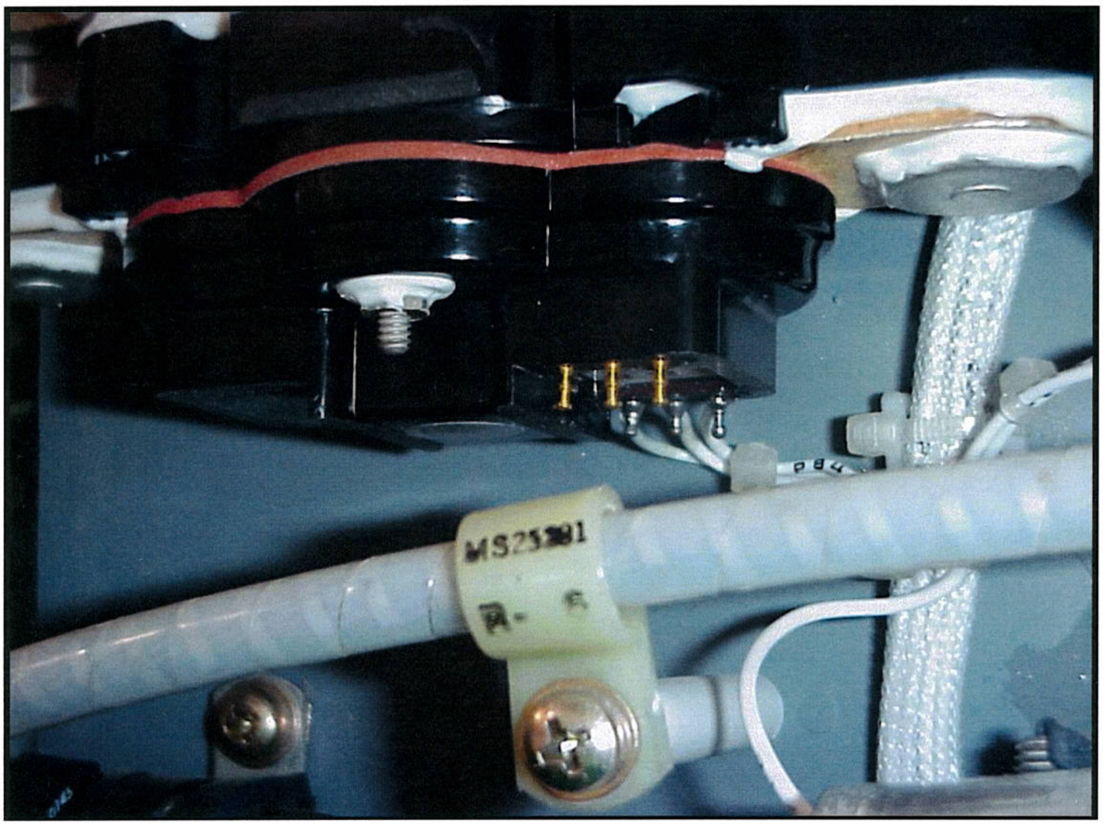
Electrical power is distributed to the avionics equipment from three primary buses through three power relays and three feeder circuit breakers. The avionics bus feeder circuit breakers and power relays are located on the A145 main-power-distribution panel. The avionics master control and avionics-power circuit breakers are located on the RH circuit breaker panel.

The avionics-power relays are energized with triple-fed bus voltage through the avionics master power switch placarded AVIONICS MASTER POWER, OFF on the pilot's outboard subpanel. When the avionics master switch is placed in the ON position, voltage is removed from each avionics relay coil and the contacts are closed to supply power to the avionics power circuit breakers. The circuit is such that the avionics relays are opened by a control voltage when the master switch is OFF. This configuration allows power to be supplied to the relay-controlled avionics buses in the event a switch or relay malfunctions. Memory power for selected avionics equipment is pulled from the "hot" battery bus.

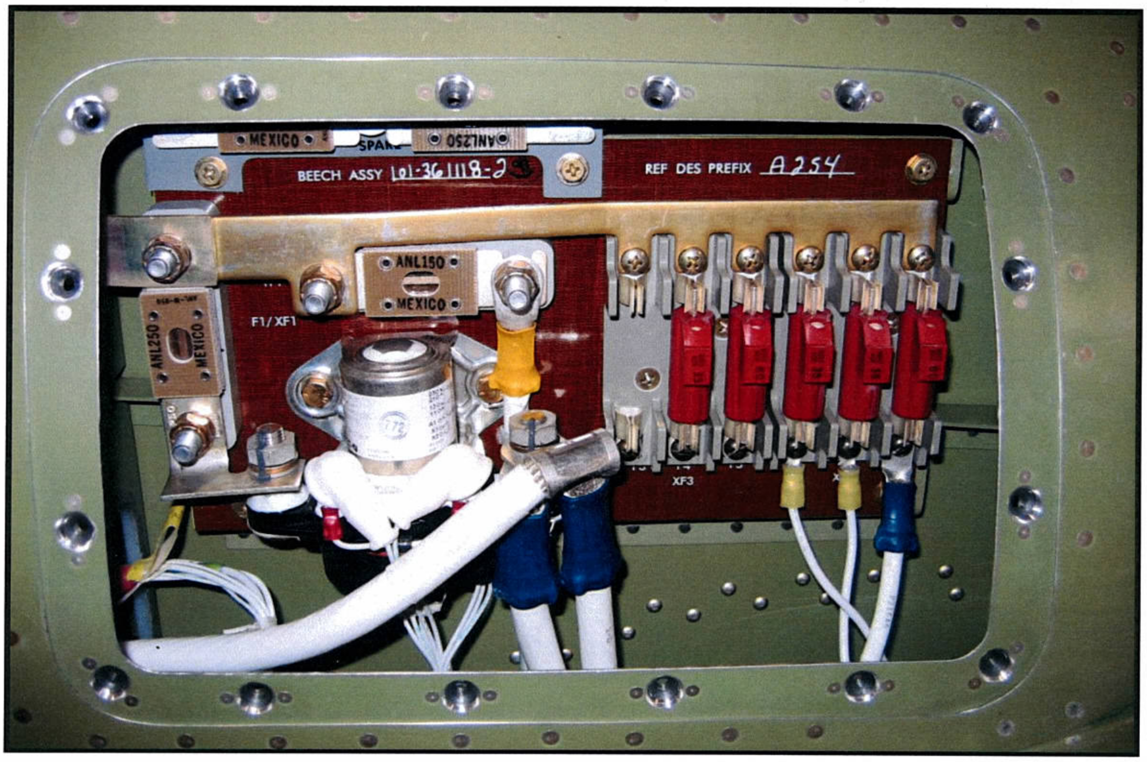


Start Contactor- Generator Line Contactor- Ammeter Shunt

350 yellow DC light in cockpit

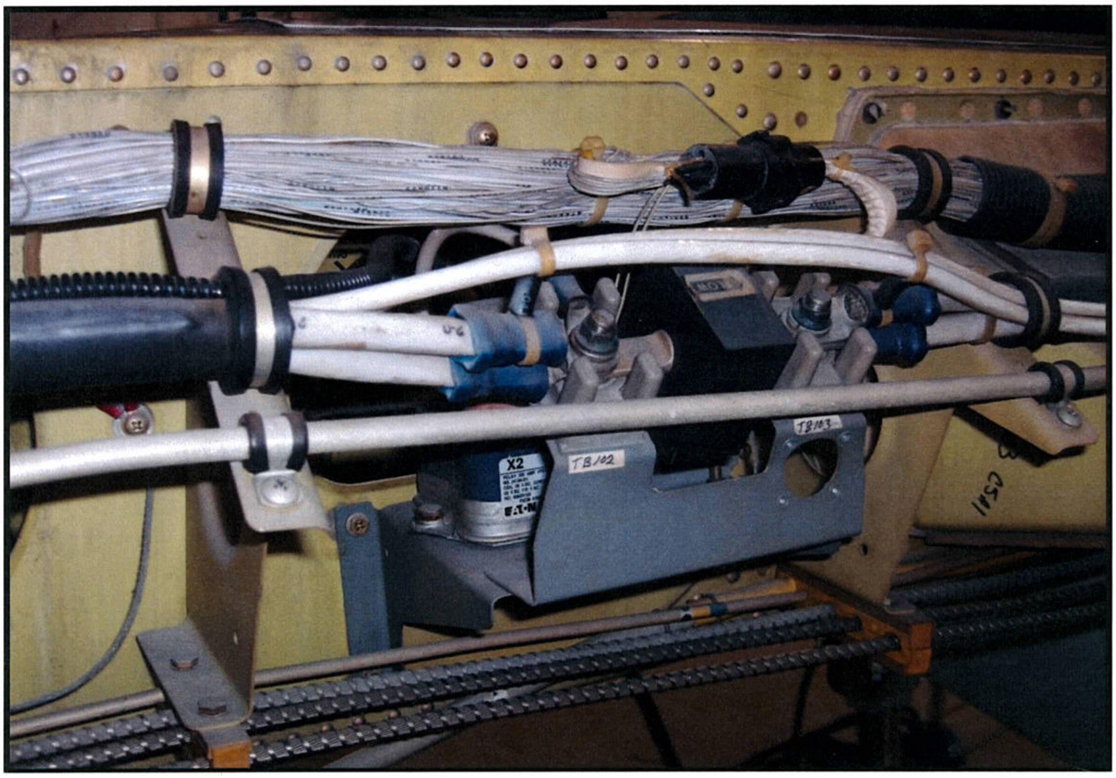


Auxiliary Contacts

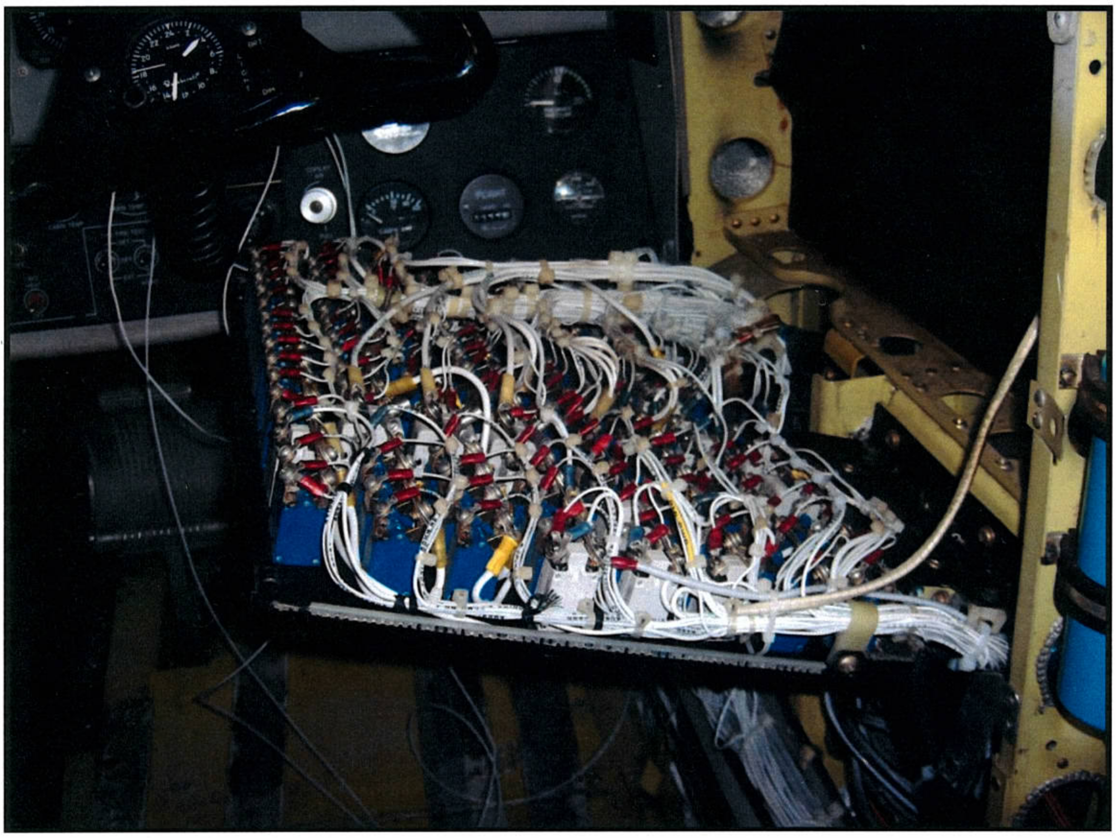


Bus Tie Contactor

RCCB- Battery Contactor- Battery Bus Tie- Right Bus Tie- Hall Effect Sensors- Ground Power Contactor

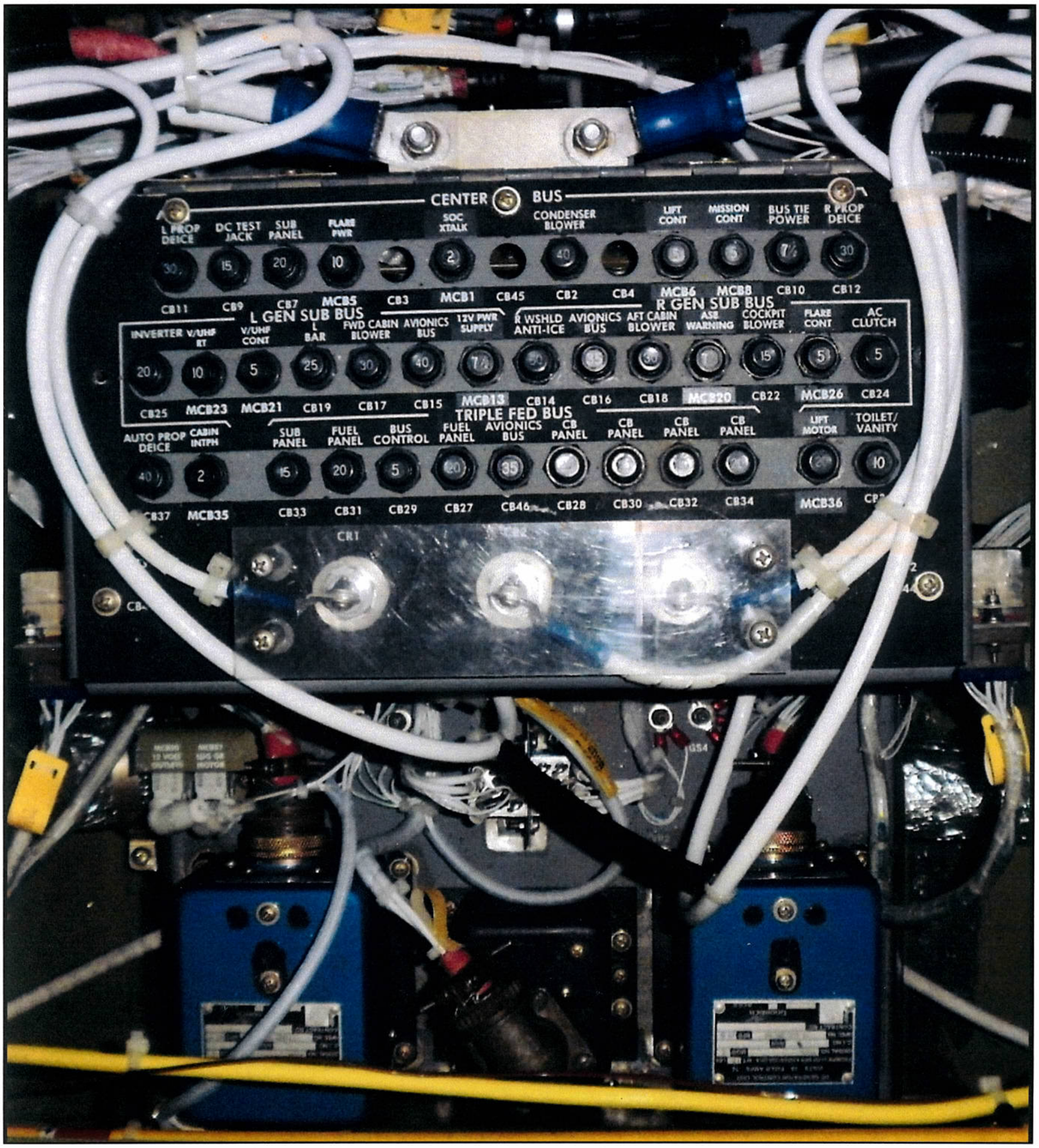


Left Hall Effect Sensor (HED)



Right Circuit Breaker Panel

DC light goes off when GCU close.



GCU – voltage regulator.
– current limiter.
└ close GCU **DC Power Distribution Panel** close gcu line contactor.
{ overvoltage protecting
└ Bus compare

AC ELECTRICAL SYSTEM

DESCRIPTION AND OPERATION

NOTE: THE 400 HZ AC ELECTRICAL SYSTEM IS REMOVED ON AIRPLANES EQUIPPED WITH THE PRO LINE 21 SYSTEM. THE 110 VAC (60 HZ) CABIN POWER IS RETAINED. THE COCKPIT LIGHTED PANELS ARE DRIVEN BY 5 VDC AND 110 VAC.

The AC electrical system is a 115-vac and 26-vac, single phase, 400 Hz system. It operates on 28 vdc and provides ac power to certain avionics and electrical equipment. The system consists of two static inverters, two bus-transfer relays, an ac power monitor circuit card and the associated switches, circuit breakers and annunciators.

Inverters

The two static inverters are located in the wing center section, outboard of each nacelle. Two inverter control switches on the pilot's outboard subpanel provide individual control of the inverters. In the OFF or TRANSFER position, the output of the inverter is zero even though the dc input is not interrupted. In the ON position, the inverters are remotely switched on to provide 115 vac and 26 vac outputs.

The inverters convert a 28 vdc input to single phase 400 Hz ac at 115 vac and 26 vac. Voltage and frequency regulation are accomplished internally. Voltage regulation is + 5% to -7% and frequency is 400 ± 1%. The continuous rated capacity of each inverter is 150 va from the 26-volt output and 750 va total output. The outputs of the inverters are synchronized during simultaneous operation. The No. 1 inverter is powered from the center bus and the No. 2 inverter is powered from the right generator bus.

Bus-Transfer Relays

The bus-transfer relays, located in the fuel control panel, provide the capability to manually transfer ac equipment draw from one inverter to the other should one inverter become inoperative. The inverter switches provide manual control of the bus-transfer relays.

The outputs of the inverters are connected to the normally closed (NC) contacts of their respective bus-transfer relay and to the NO (normally open) contacts of the opposite bus-transfer relay. When the inverter switches are ON, the inverters provide power to their corresponding buses. When one inverter switch is in the TRANSFER position, its inverter is shut down and the corresponding bus-transfer relay transfers its ac buses to the remaining inverter.

During operation in the TRANSFER mode, all ac loads are connected to one inverter. Therefore, the total airplane ac load is limited to the capacity of one inverter to avoid overload when a transfer is necessary.

AC Power Monitor PCB

The ac power monitor printed circuit card (A320) monitors both 115 vac buses, both 26 vac buses and both inverter switches. It provides outputs to the #1 AC BUS or #2 AC BUS annunciator when a voltage or frequency is out of tolerance. It also closes the sync line between the two inverters when both inverters are operating.

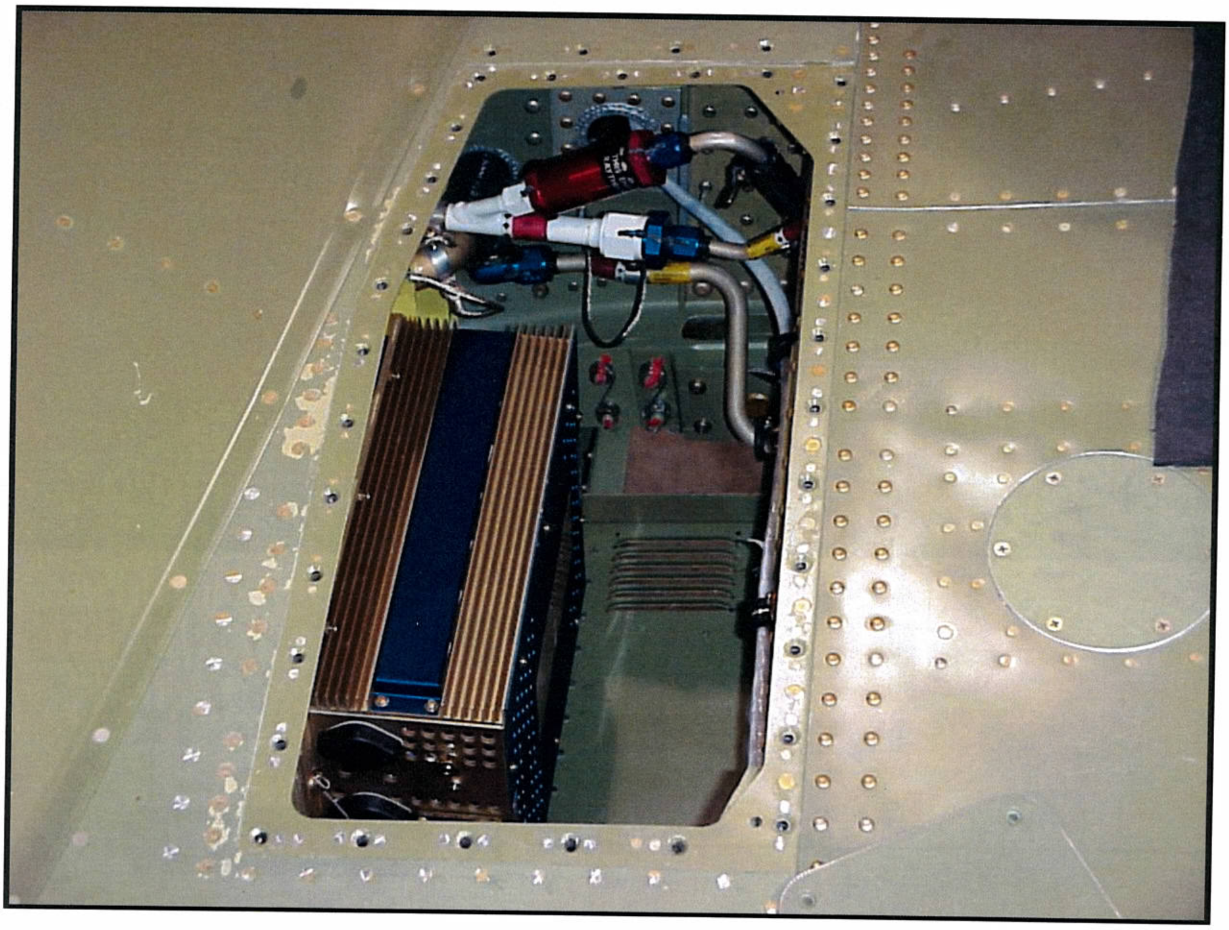
Control of the ac annunciators is provided by two separate circuits that sense each ac bus. If all voltage and frequency inputs are within limits, the ac annunciators are extinguished when the system is brought on line. Acceptable limits for the ac system are as follows:

115 V input	103.5 to 126.5 VAC
26 V input	23.4 to 28.6 VAC
Frequency (115 V input)	380 to 420 Hz

If any of the inputs are outside of the above limits, the ac monitor pcb outputs a signal to the appropriate ac annunciator to identify the failed system. The annunciator remains illuminated as long as the condition exists and extinguishes when the condition is corrected.

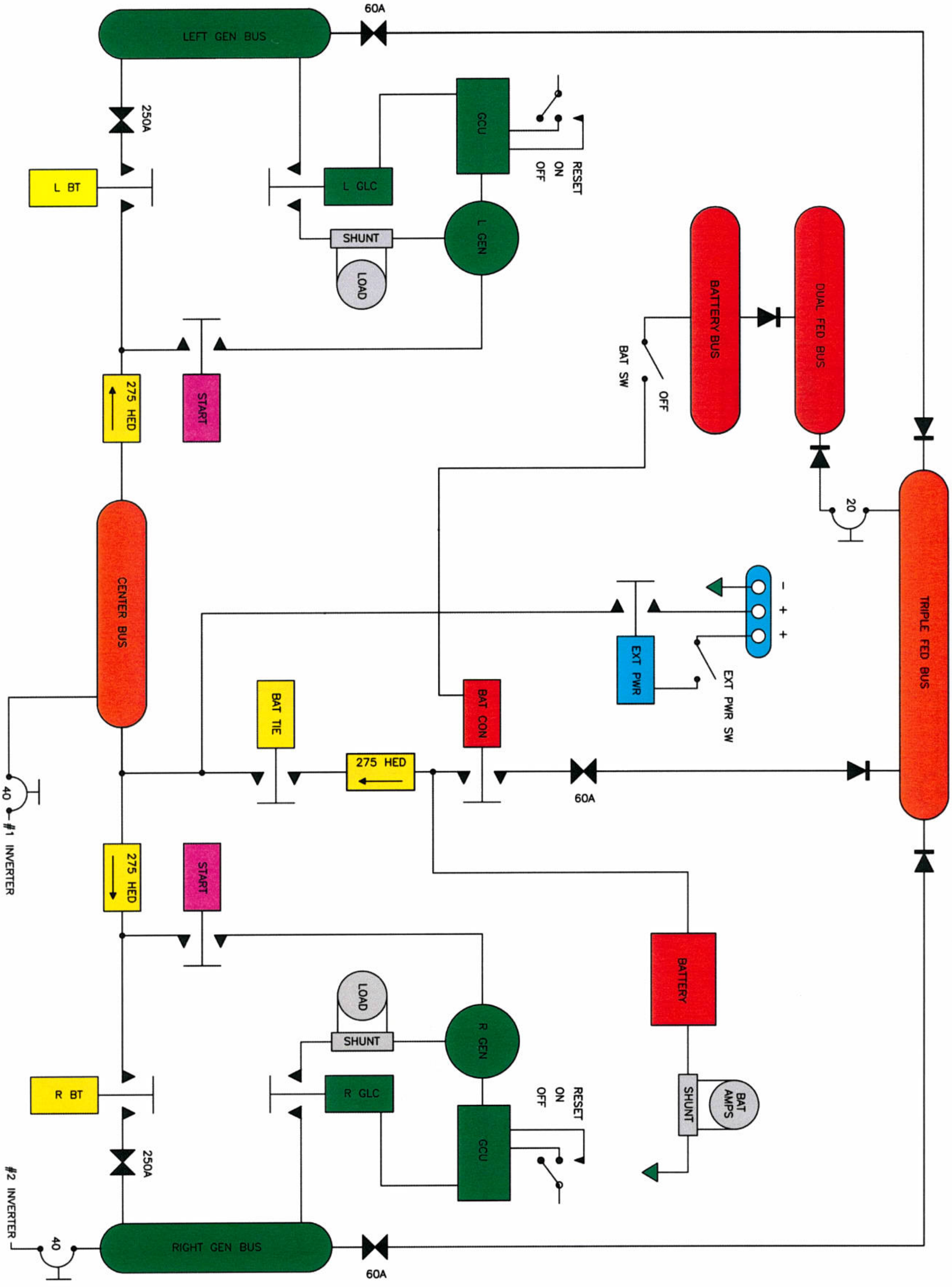
The ac monitor pcb senses the position of both inverter switches and monitors both ac annunciator signals to control synchronization. When both inverter switches are ON and both ac annunciators are extinguished, the ac monitor pcb closes the sync line between both inverters to phase-lock both inverter outputs

Inverter (Removed)

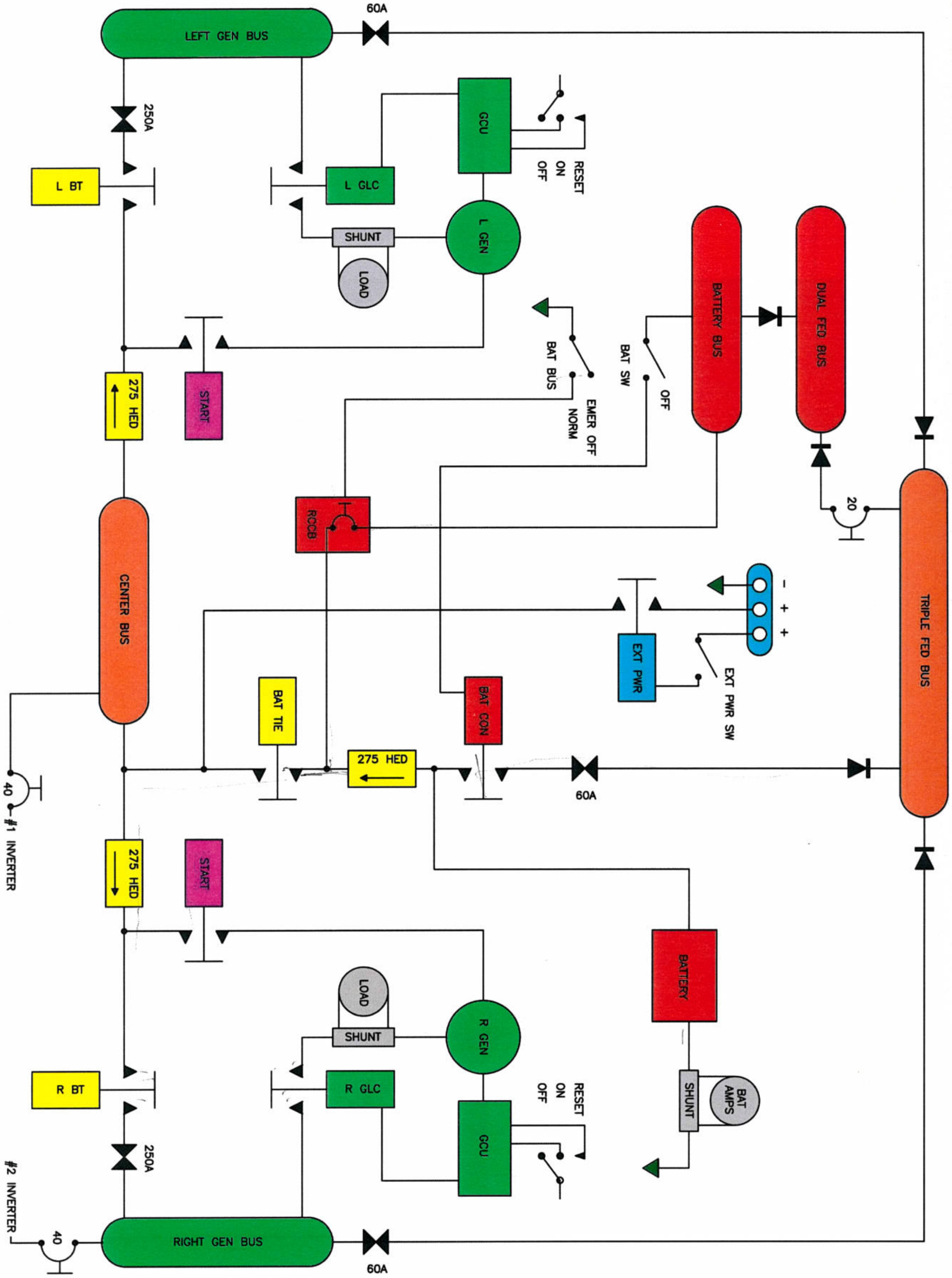


Inverter Bay

Inverter Bay Ram Cooling



300 Electrical System Block Diagram



350 Electrical System Block Diagram