

# CHAPTER 24 - ELECTRICAL POWER

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## GENERAL

The function of the electrical power system is to provide electrical power supply to the aircraft, both in Direct Current (DC) mode, as in Alternating Current (AC) mode.

The electrical power supply is possible by means of:

- **DC Power Generation:** DC power is produced by two generators-starters, two batteries and two Transformer Rectifier Units (TRUs).
- **AC Power Generation:** AC power for the avionics equipments is produced by an inverter (a second inverter remains in standby). In addition, two alternators generate AC power for some auxiliary functions.
- **Exterior Power Sources:** while on ground, the aircraft can be powered in DC or three-phase AC from an exterior Ground Power Unit (GPU), connected to the aircraft through exterior power sockets.
- **Electrical Loads Distribution:** includes all those circuits that link the AC and DC generating devices with their respective electric loads.
- **General Services:** includes the elements that provide electrical power to the sockets located in the cockpit and in the cargo cabin.

# AC POWER GENERATION

The Alternating Current (AC) Power Generation system supplies:

- Constant frequency single phase AC power to the avionics equipment.
- Unregulated AC power to the propeller de-icing systems and to the heaters on the distribution valves of the wing and tail de-icing system.
- Unregulated AC power to the TRUs (TRU 1 and TRU 2), that transform it into DC power to the MISC buses, or for the main DC buses (BAT1, BAT2, GEN1 and GEN 2) in emergency.

## DESCRIPTION

Main components are:

- **Inverters:** two inverters that provide AC power for the avionics equipment. The main inverter is energized from BAT BUS 1 and the standby inverter from BAT BUS 2. Each inverter delivers two output voltages: 115 V AC and 26 V AC at 400 Hz.
- **Alternators:** two alternators, one in each engine pod, driven by the related propeller reduction gearbox. When  $NP \geq 70\%$  the related alternator supplies 26 KVA output, with two three-phase voltages at 115 V AC and 200 V AC. They provide wild frequency AC power for some anti-icing functions and for the TRUs.
- **AC INVERTERS Control Panel:** located in the cockpit overhead panel, enables system management and monitoring.

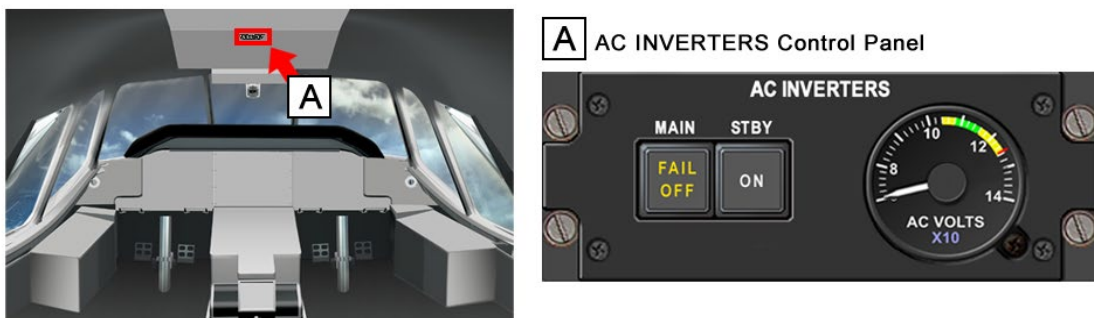


Figure 24-1 AC Power Generation - Components

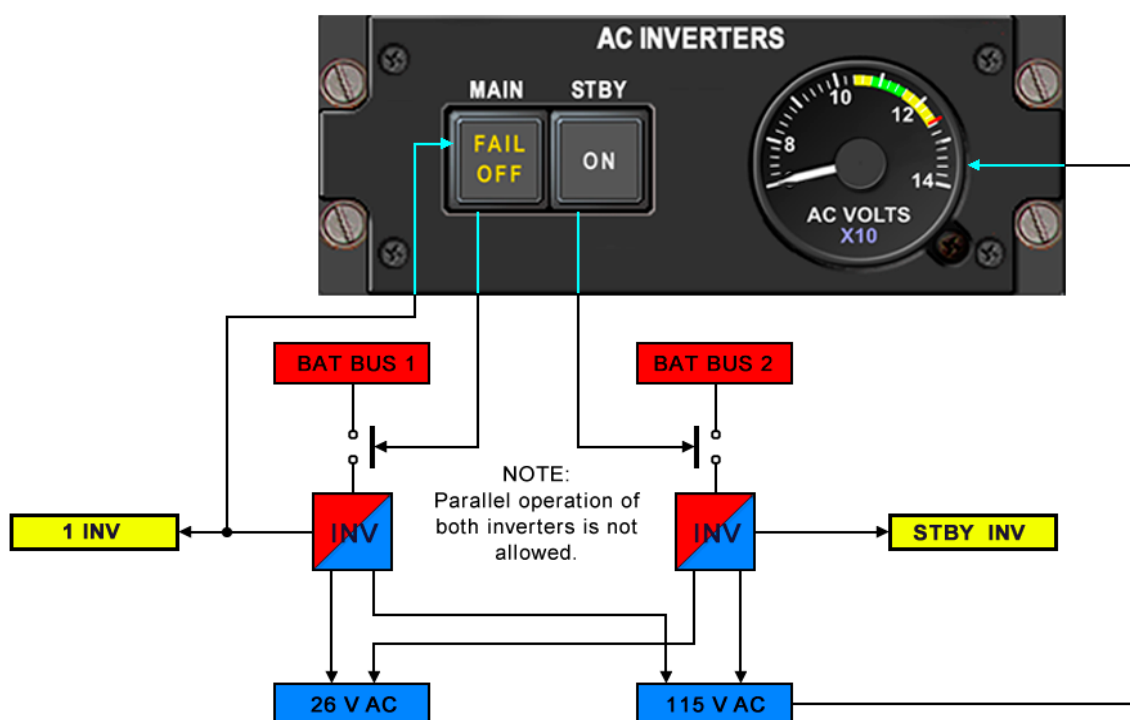


Figure 24-2 AC Power Generation - Architecture

## OPERATION

The inverters are engaged by the MAIN and STBY pushbuttons. For the normal operation, the output from the main inverter (MAIN) is manually connected to the AC bus bars (115 V AC BUS and 26 V AC BUS) and the standby inverter (STBY) is disconnected.

### NOTE

Parallel operation of both inverters is not allowed.

If the main inverter is not working correctly, the FAIL warning on the MAIN pushbutton comes on and the IEDS will display the associated 1 INV caution. The main inverter is turned off by pressing the MAIN pushbutton and the OFF warning on the MAIN pushbutton comes on. The standby inverter is turned on by pressing the STBY pushbutton and the ON legend on the STBY pushbutton comes on. If the standby inverter does not work properly, the IEDS will display the STBY INV caution.

If one of the alternators fails or NP<70%, the IEDS will display the associated 1, 2 AC GEN warning. If both alternators fail, the propeller de-icing system, the heaters on the valves of the wing and tail de-icing system, and the ability to generate DC power through the TRUs, will be lost.

## CONTROLS AND INDICATORS

### (1) MAIN Pushbutton:

- *Pressed (OFF amber light off):* main inverter is fed with DC and supplies 115 V AC and 26 V AC.
- *FAIL (amber) light on:* failure on the main inverter.

### (2) STBY Pushbutton:

- *Pressed (ON light on):* standby inverter is fed with DC and supplies 115 V AC and 26 V AC.

### (3) AC Voltmeter:

it displays the voltage on the 115 V AC bus when the associated inverter is working.

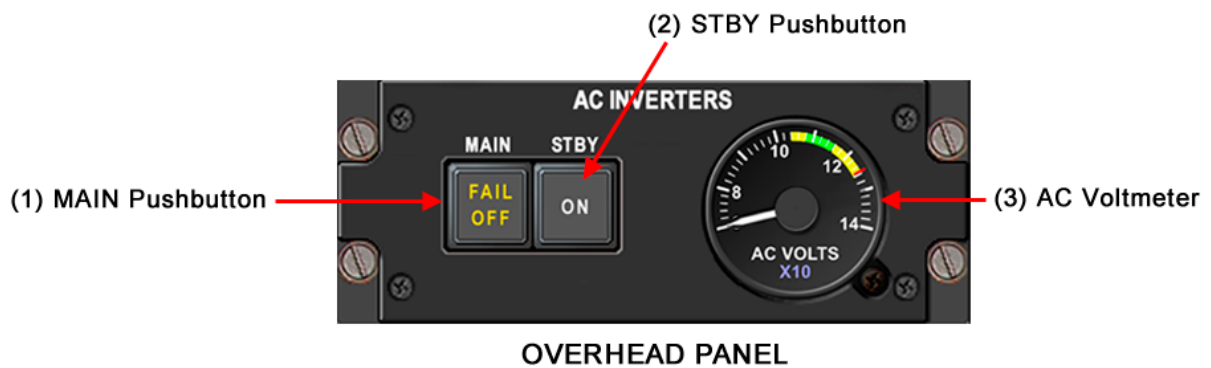


Figure 24-3 AC Power Generation - Controls and Indicators



## DC POWER GENERATION

Direct Current (DC) power generation purpose is to provide electrical power supply at 28V DC to aircraft systems throughout all-time operating conditions, both on ground and airborne.

### DESCRIPTION

Main components are:

- **Batteries:** two 24V/37AH Ni-Cd cells (located in each fairing of the main landing gear) capable to provide up to 15 KW over short periods. When no other power source is available, supply the power needed for both systems requirements and engines start-up. Under normal situations, both batteries are charged by the generators-starters.

Located beneath the cargo cabin, there are also two back-up batteries that provides 24 V DC to the automatic circuit breakers of the back-up bus B B/U (circuit breaker panel: AVIONICS 1 / AVIONICS 2) during engines start-up, to avoid memory losses due to voltage drop in certain FMS (pilot side) devices. Once the engines are running, and the engine MODE SEL selector is back in OFF, the back-up batteries end supplying power and start to be charged from the BAT BUS 1.

- **Generators-Starters:** two generator-starters, one in each engine pod and driven by the engine, provide 28 V DC. Each generator can operate as an electric motor to turn the engine during start-up. Once the engine reaches the self-sustaining rate, every generator changes automatically to power supply generation function. Each generator is connected to the associated bus bar, and managed by a Generator Control Unit (GCU) that completes the following functions: voltage regulation, output current limiter, over/under voltage protection, overheats protection, earthing failure, reverse polarity, engine ignition logic control unit, and control of the connection between generator and bus bar.
- **Transformer Rectifier Units (TRU):** there are two TRUs (TRU 1 and TRU 2). Each TRU transforms AC power, from the related alternator or from the AC GPU, into 28 V DC / 300 A power for the related Miscellaneous Bus (or for the main DC buses in case of emergency, but both MISC buses are missed). If AC GPU is being used, TRU 1 can provide DC power to the main DC buses and TRU 2 to the miscellaneous buses.
- **POWER GENERATION Control Panel:** located in the cockpit overhead panel, enables system management and monitoring.
- **SYSTEM TEST Control Panel:** located in the cockpit overhead panel, enables system management and monitoring.
- **MISC BUS Control Panel:** located in the cockpit overhead panel, enables system management and monitoring.
- **MISC XFR Pushbutton:** located in the instruments central panel, enables system management and monitoring.

The different DC buses are:

- **Main DC buses:** BAT1, BAT2, GEN1 and GEN2 buses.
- **Two HOT buses:** each HOT BUS is always directly battery-powered (and from the generator buses, if current driving). If an overload occurs in a HOT BUS, the associated circuit breaker in the overhead panel will be automatically released.

- **Two MISC buses:** the miscellaneous buses are powered through TRUs (TRU 1, TRU 2), or directly by the DC GPU if connected. The LH MISC BUS is divided in two groups:

- LH MISC Group 1: LH recirculation fan.
- LH MISC Group 3: toilet and general services.

The RH MISC BUS is divided in two groups:

- RH MISC Group 2: RH recirculation fan and RH windshield heater.
- RH MISC Group 4: galley.

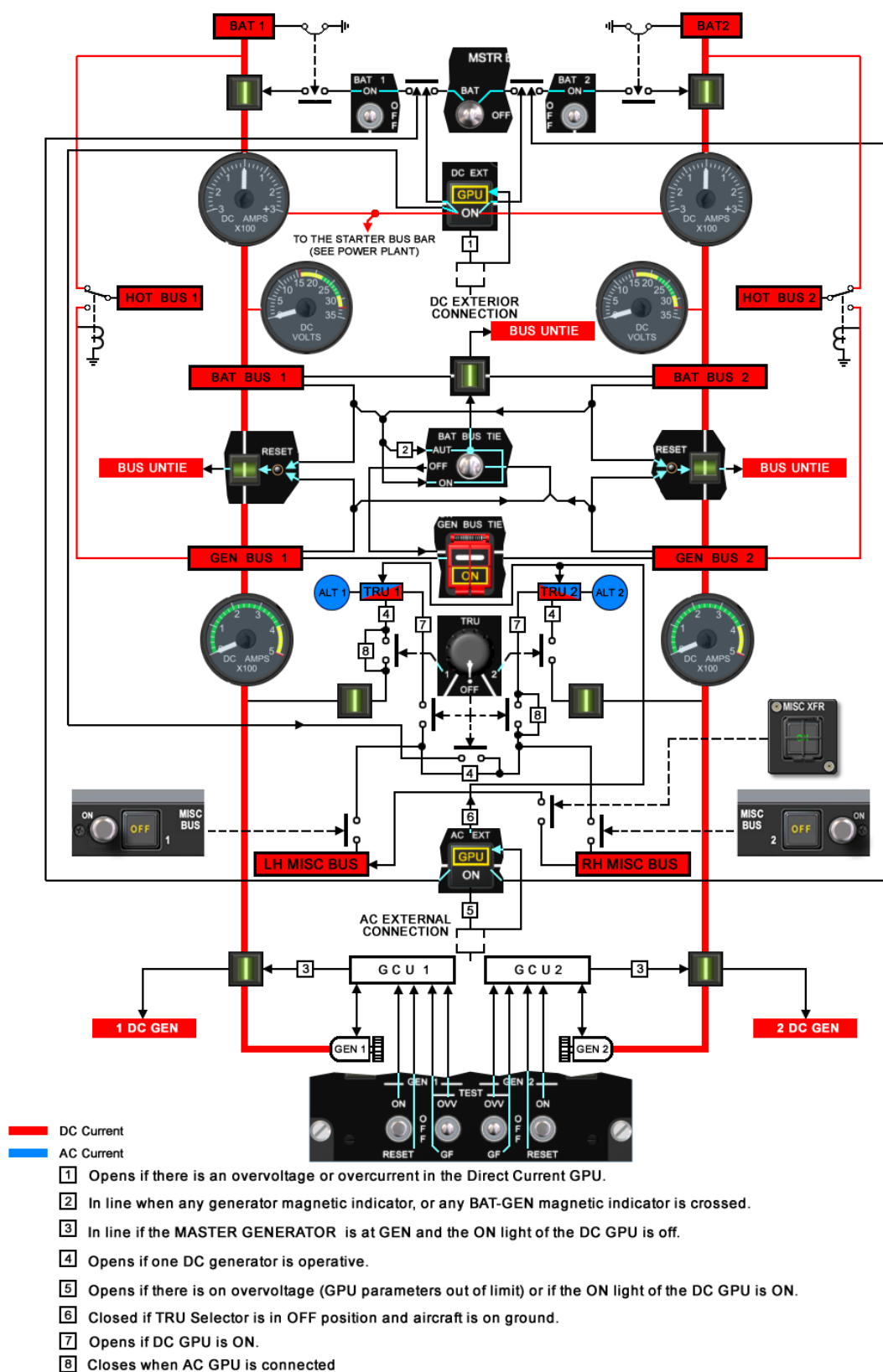


Figure 24-4 DC Power Generation - Architecture

## OPERATION

While on ground, batteries can be used to energize the main DC buses until one of the engines gets running, and the DC generator is ready to go on line (the Ground Power Unit is recommended over batteries, see EXTERIOR POWER SOURCES in this chapter). In flight, they can also energize the main DC buses if both generators and alternators are inoperative.

The backup batteries provide 24 V DC to some avionic equipment during engine start-up. The B/U BAT pushbuttons located in the SYSTEM TEST control panel allows to check the batteries correct condition.

For normal operation, the DC generator and the battery are connected to their bus on each side. Each battery is charged from its generator. The two sides are isolated between them, and the connection is controlled by the BAT BUS TIE selector. While this selector is in the AUT position, both sides are kept isolated until a DC generator is inoperative or it is disengaged. If that happens, either the 1(2) DC GEN warning is displayed on the IEDS, depending on the generator involved, and the BAT BUS TIE connects both sides, to prevent the battery to run dead on the side with the inoperative or disconnected generator (all the main DC buses are powered by the operative generator).

The BUS UNTIE warning is displayed on the IEDS when the connections between BAT BUS 1 and BAT BUS 2, between BAT1 and GEN1 (BUS1), or between BAT2 and GEN2 (BUS2) are not in the required position.

If both sides remain disconnected after a generator failure or disconnection, even with the BAT BUS TIE selector in ON position, the crew has an auxiliary way to connect sides by using the GEN BUS TIE pushbutton. The BAT BUS TIE must be set to the OFF position before pushing-in the GEN BUS TIE pushbutton.

The system has automatic protection devices to prevent the buses from having a short-circuit. When the GCU detects a short-circuit, it disconnects the related generator, and the GEN magnetic indicator will be crossed. If one of the generators temperatures exceeds 165°C, it continues operative but the 1 (2) GEN HOT warning is displayed on the IEDS.

TRU 1 (2) transforms AC power from its alternator into DC power for the MISC 1 (2) bus, only if the related GEN BUS is energized, the TRU selector is in OFF and the related MISC master switch is in ON.

If the MISC 1 bus fails, some of its loads can obtain DC power from the MISC 2 bus by means of the MISC XFR pushbutton, but non-essential loads in the MISC 2 are disconnected.

Additionally, TRU 1 or TRU 2 can supply DC power for the main DC buses in case of both DC generators failure. Then, if the TRU selector is set to 1 (2), the TRU 1 (2) is connected to the alternator 1 (2) and produces DC power for the main DC buses, but the TRU 2 (1) is disconnected from the alternator 2 (1) so both MISC buses are lost. The related magnetic indicator is aligned, and the related ammeter measures the current supplied by the TRU to the generator bus.

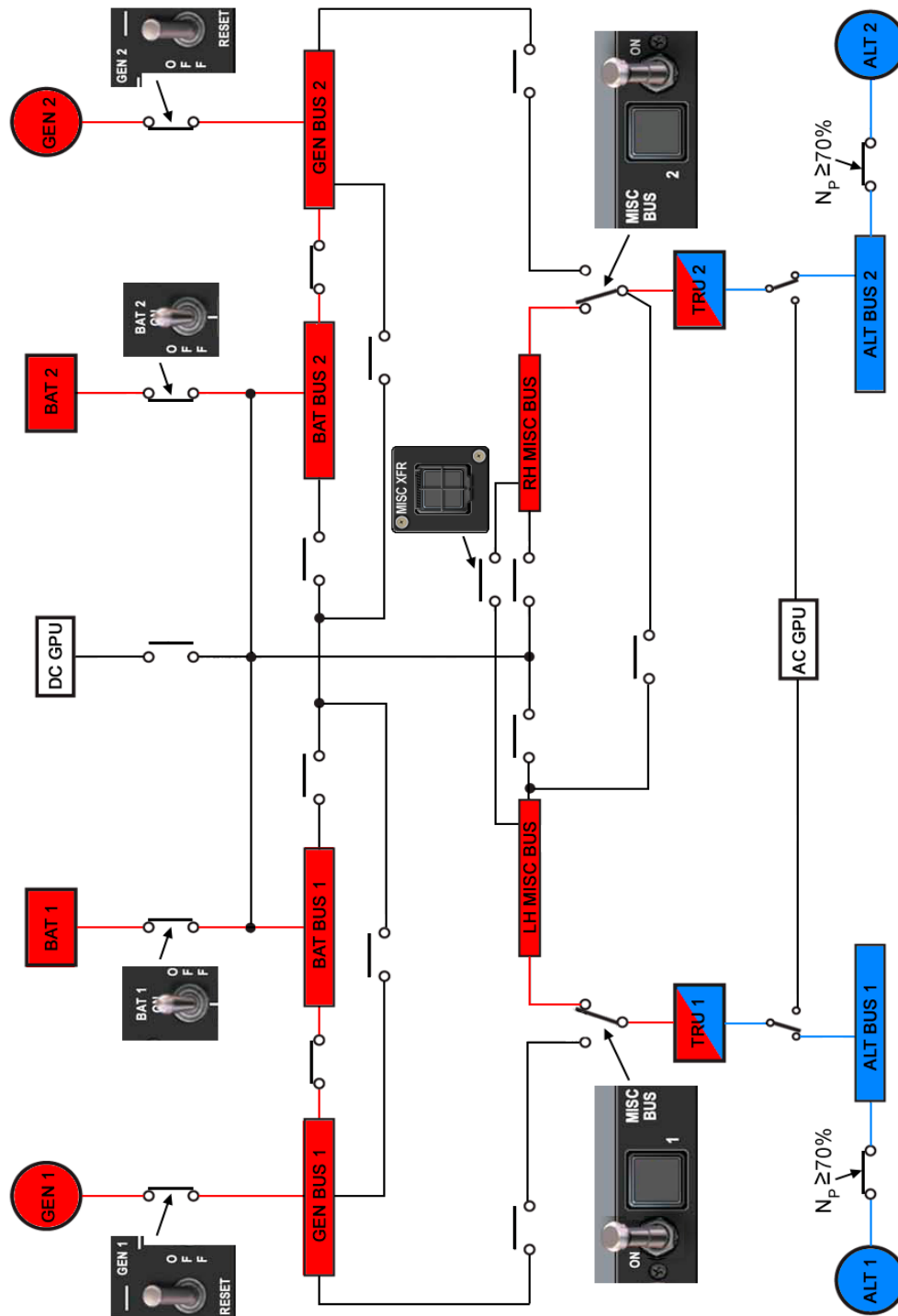


Figure 24-5 DC Power Generation - In-flight normal operation

## CONTROLS AND INDICATORS

### ***DIRECT CURRENT SUPPLY FROM THE BATTERIES***

#### ***(1) HOT Light (red):***

- *On:* the related battery has reached a temperature of 65°C. The BAT HOT warning will also be displayed on the IEDS.

#### ***(2) BAT switch 1, 2:***

- *ON:* connects the battery to its associated bus bar, if the MSTR ELEC BAT switch is set to the BAT position.

#### ***(3) WARM Light (amber):***

- *On:* the related battery has reached a temperature of 49°C.

#### ***(4) BATTERY Indicator:***

displays the temperature in °C for each battery. If the temperature at either of the batteries is below 0°C the associated screen displays the COLD warning, while if the temperature is above 93°C, it shows the HOT! warning. If any battery sensor does not work correctly, or the battery temperature is below -6°C, the related screen displays the ERR! warning.

#### ***(5) BAT BUS TIE magnetic indicator:***

- *Aligned:* battery buses are interconnected.
- *Crossed:* battery buses are not interconnected.

#### ***(6) BAT BUS TIE Selector:***

controls the battery bus bars linkage:

- *ON:* couples one battery bus with the other. Loads are equally shared by both generators, if the battery and the generator buses are linked.
- *OFF:* battery buses remain disengaged from each other, leaving two separate circuits: BAT BUS 1 + GEN BUS 1 and BAT BUS 2 + GEN BUS 2.
- *AUT:* during normal operation there is no connection between battery buses, but when any generator is not providing electricity, or if any generator bus gets isolated, battery buses are automatically connected together. In this case of a inoperative generator, the operative one feeds the two BAT buses and the two GEN buses. In case of isolation of one generator bus, the other three mentioned buses are energized from the operative generator. 2.

#### ***(7) Voltmeter:***

displays voltage on the DC bus. When battery bus is connected to the generator, the voltage displayed is that from the generator. When a GPU is connected, it displays the GPU supplied voltage.

#### ***(8) Battery Ammeter:***

displays the battery current supplied to its bus (positive zone), or consumed by the same battery (negative zone). When a GPU supplies power, it displays the current supplied by the GPU to the bus.

#### ***(9) BAT Magnetic Indicator:***

- *Aligned:* battery is connected to the associated bus.
- *Crossed:* battery is disconnected from the associated bus.

**(10) MSTR ELEC BAT Switch:**

- *BAT*: allows connecting each battery with the bus bar, using the related BAT switch.

**(11) B/U BAT Pushbuttons:**

- *Pressed-in*: it lights (in white) if the backup battery condition is correct (only on ground).

**(12) BAT TEMP Test Switch:**

- *BAT TEMP*: if held in this position, checks the battery temperature indicator. If there is no failure, 'TEST GOOD' message is displayed, flashing alternately on the indicator. HOT and WARM warning lights come on, and BAT HOT warning is displayed on the IEDS. If a failure is detected, 'TEST ERR' message is displayed.

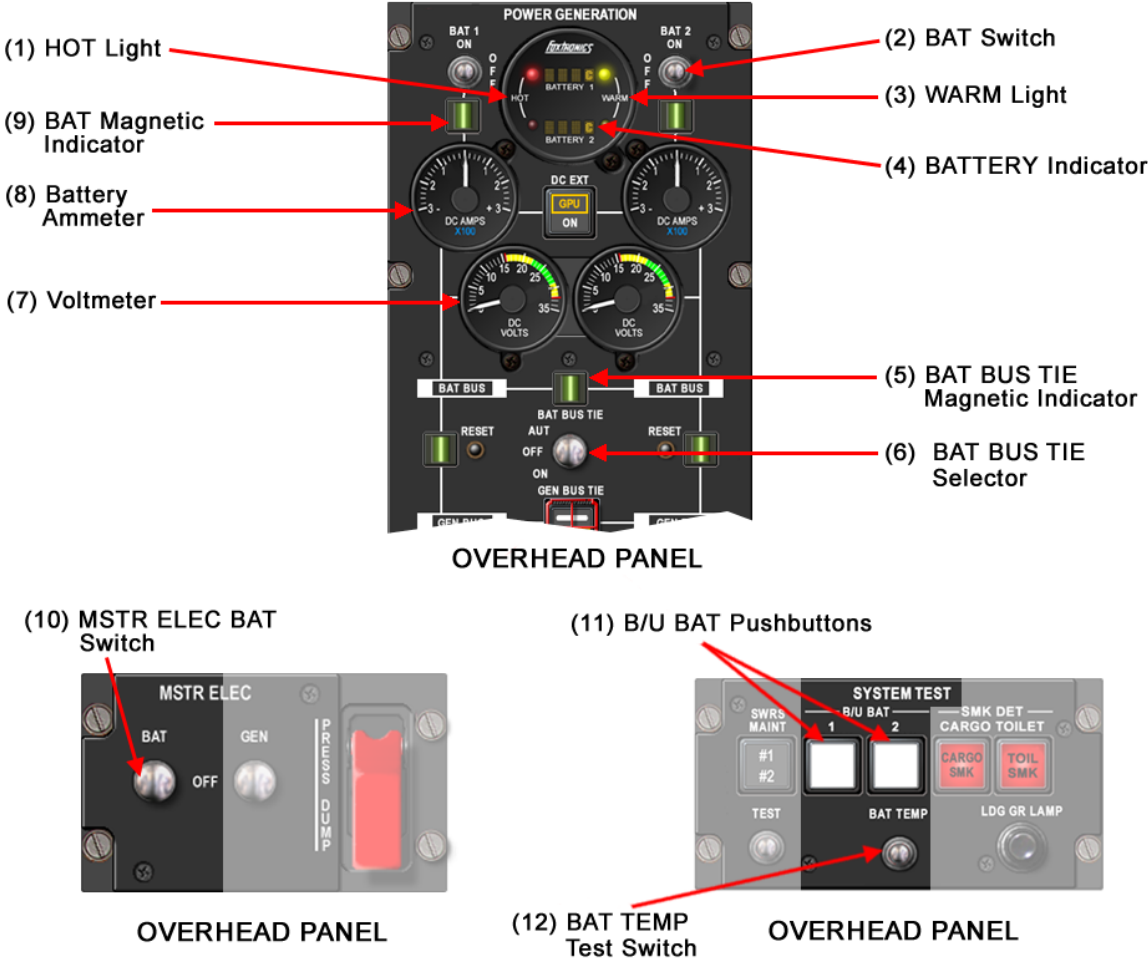


Figure 24-6 DC power from the Batteries - Controls and Indicators



## **DIRECT CURRENT POWER FROM THE GENERATORS**

### **(1) GEN BUS TIE pushbutton (under guard):**

- *Pushed-in:* connects the generators bus bars if the BAT BUS TIE selector is in the OFF position. The ON light and the horizontal visual indicator on the pushbutton come on to indicate the connection has been made.

### **(2) Generator Ammeter:**

displays current supplied by the generator to the related bus bar. When a GPU provides the power, it displays the GPU supplied current to the bus.

### **(3) GEN TEST switch 1, 2:**

- *OVV:* simulates over-voltage for the Generators Control Unit. The generator will be disconnected from its bus bar, and the 1, 2 DC GEN warning will be displayed on the IEDS.
- *GF:* Simulates an earthing failure for the Generator Control Unit. The generator will be disconnected from its bus bar, and the 1, 2 DC GEN warning will be displayed on the IEDS.

### **(4) GEN switch:**

- *ON:* connects the generator to the related bus bar when the MSTR ELEC (GEN) switch is in the GEN position.
- *RESET:* resets the operating conditions of the Generator Control Unit (following a generator disengagement). The switch must be turned to this position prior to set it to ON.

### **NOTE**

When a failure occurs or it is simulated, the circuit must be reset to its initial status by turning the related GEN switch to the RESET position and then back to the ON position.

### **(5) GEN Magnetic Indicator:**

- *Aligned:* generator is connected to its bus bars.
- *Crossed:* generator is not connected to its bus bars.

### **(6) MSTR ELEC (GEN) Switch:**

- *GEN:* connects each generator to its bus bar, using the proper GEN switch.

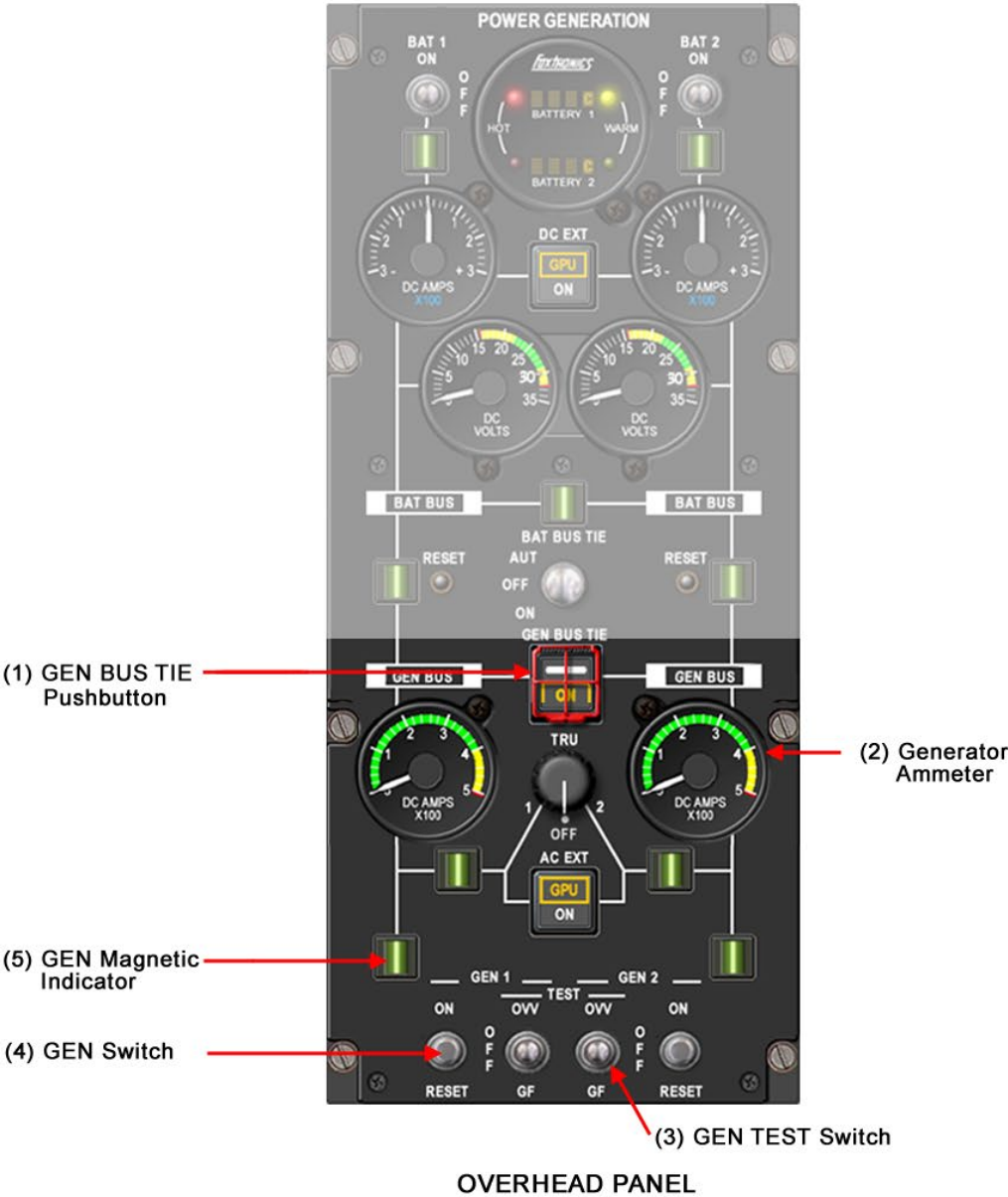


Figure 24-7 DC power from the Generators - Controls and Indicators

***DIRECT CURRENT SUPPLY FROM THE ALTERNATOR-TRU******(1) MISC Master Switches:***

- *ON*: miscellaneous bus is powered by its related alternator through its associated TRU, only if the TRU Selector Switch is in OFF.

***(2) MISC BUS Master Pushbuttons:***

- *OFF light on*: the related miscellaneous bus is not powered.

***(3) TRU selector switch:***

- *1*: bus bar of generator 1 is powered by the left alternator through the TRU.
- *2*: bus bar of generator 2 is powered by the right alternator through the TRU.

***(4) TRU Magnetic Indicator:***

- *Aligned*: TRU output is connected to the bus bar of the selected generator.
- *Crossed*: TRU output is not connected to the bus bar of the selected generator.

***(5) Generator Ammeter:***

displays the current supplied by the TRU to its related bus bar.

***(6) MISC XFR Pushbutton:***

- *ON (green) light on*: LH MISC group 1 is disconnected from the LH miscellaneous bus and connected to the RH miscellaneous bus. Also, the RH MISC group 4 is disconnected from the RH miscellaneous bus.

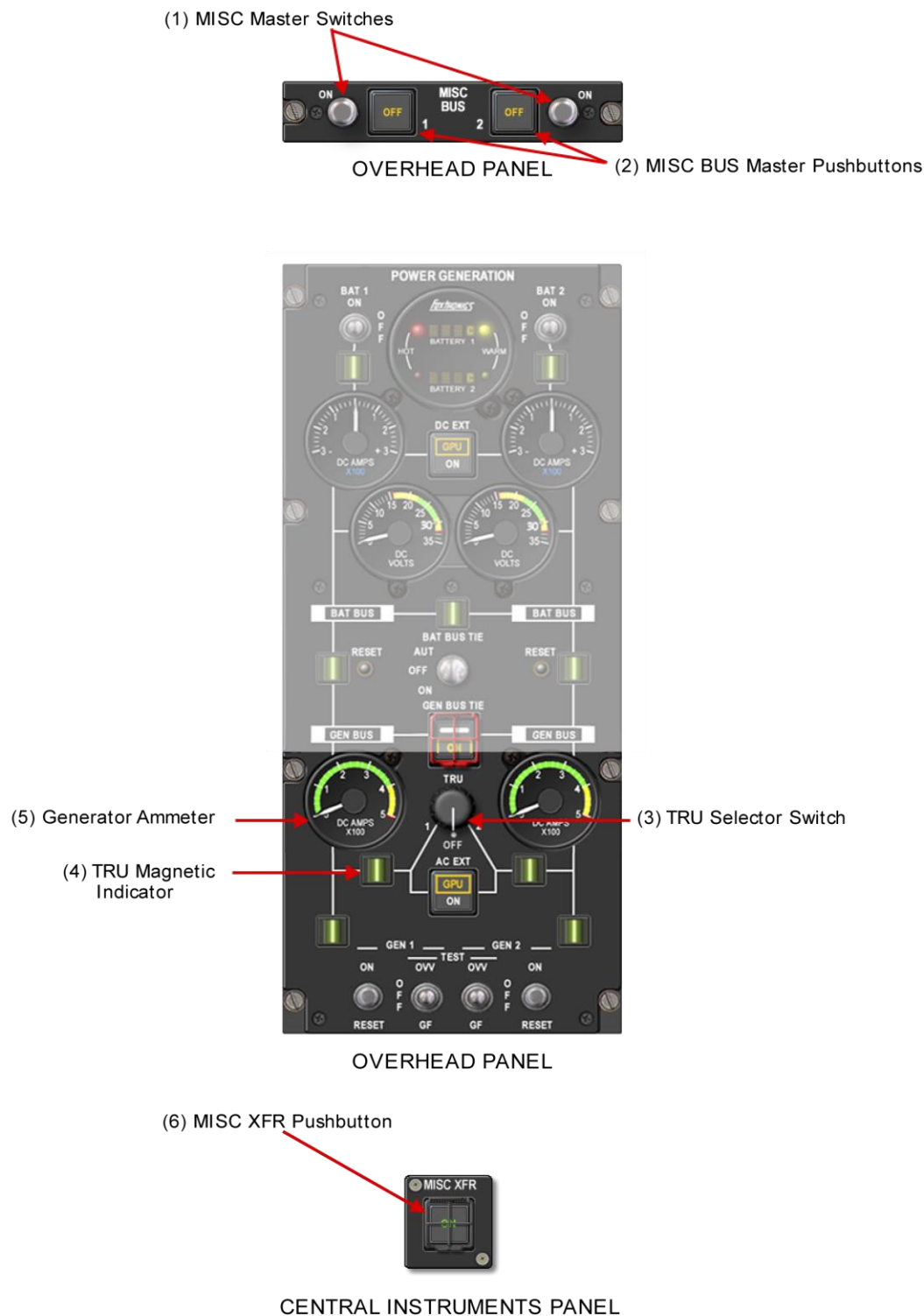


Figure 24-8 DC power from the Alternator/TRU - Controls and Indicators

## GENERATOR BUS/BATTERY BUS INTERCONNECTION

### (1) RESET button:

- *Pushed-in:* restores connections between the associated battery bus and generator bus (while disconnected due to current surges).

### (2) BAT-GEN Magnetic Indicator:

- *Aligned:* battery bus bar and its associated generator are connected.
- *Crossed:* battery bus bar and its associated generator are disconnected.

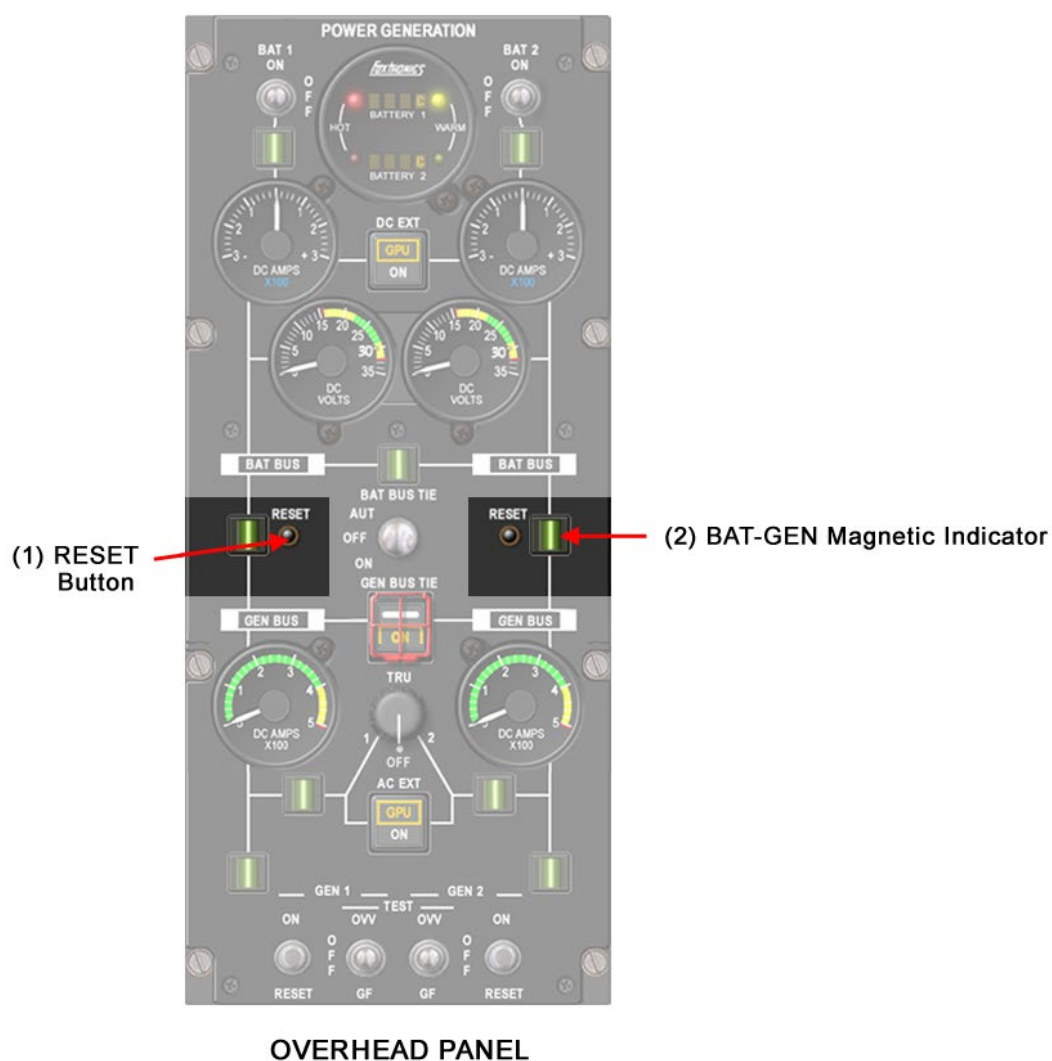


Figure 24-9 DC Power Generation (Generator Bus/Battery Bus Interconnection) - Controls and Indicators

## EXTERIOR POWER SOURCES

The Ground Power Unit (GPU) supplies the aircraft systems with AC and DC current as required while the aircraft is grounded, as well as if onboard generating systems do not work. The use of external power ensures the power stored in the aircraft batteries is not wasted.

### DESCRIPTION

The GPU (that may be either AC or DC) is connected to the external power inputs, and it is controlled by the switches on the POWER GENERATION control panel. The system is protected against voltage and frequency variations, as well as from GPU overloading.

Main components are:

- **Exterior DC Power Socket:** located in the fore right-hand side of the aircraft, it allows 28V DC power supply to the aircraft, providing power to every bus bar.
- **Exterior AC Power Socket:** located in the right-hand fairing of the main landing gear, allows 115/200 V AC power supply to the aircraft. It can provide DC power to the main DC buses through the TRU1, and power to miscellaneous buses through the TRU2. This power input cannot be used to start the engines, or to energize the third hydraulic pump.
- **POWER GENERATION Control Panel:** located in the cockpit overhead panel, provides system control and monitoring.

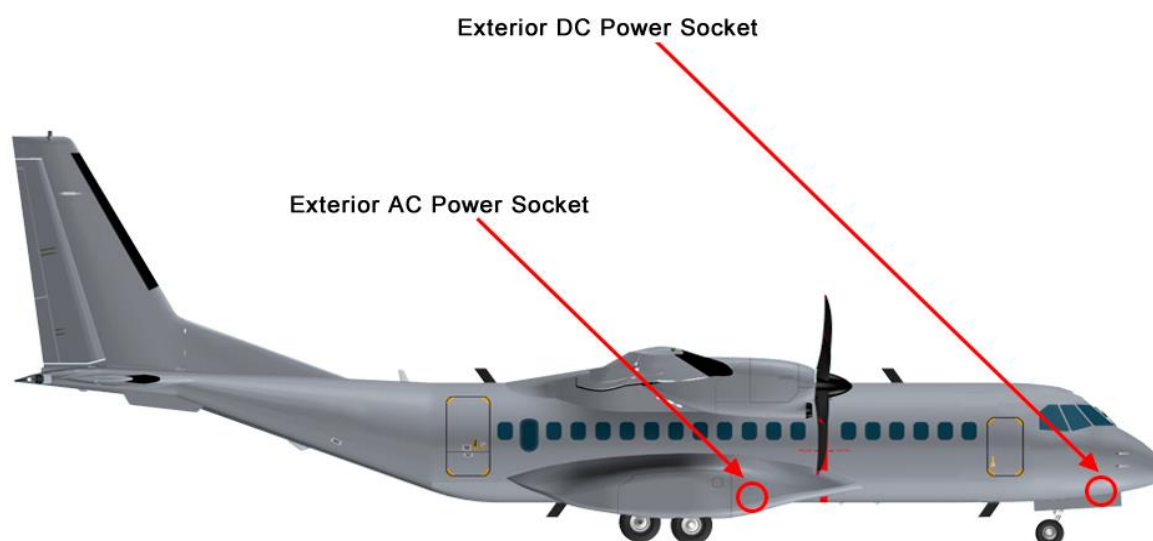


Figure 24-10 Exterior Power Sockets

## OPERATION

When the DC GPU is connected to the related power input, the GPU light on the DC EXT pushbutton comes on to indicate the system is ready to run. When the AC GPU is connected to the related power input, the GPU light on the AC EXT pushbutton will not come on, unless BAT 2 switch and BAT BUS TIE selector are in the ON position. Once the AC GPU, BAT 2 and BAT BUS TIE are connected, the GPU light on the AC EXT pushbutton will come on to indicate the system is ready to run. If both, AC and DC GPU, are simultaneous coupled, the DC EXT connection takes priority, and the AC EXT is not serviceable.

If the DC EXT or AC EXT pushbutton is pushed-in, the GPU light stays on, and the ON light comes on as well, to notify every bus bar is being powered from the GPU.

When the aircraft is being powered from a DC GPU, both current and voltage supplied will be displayed on the batteries ammeter and voltmeter. Batteries, generators, and AC GPU, if previously connected, are automatically disconnected. MISC buses can be electrically fed if the MISC master switches are in ON and the TRU selector is in OFF.

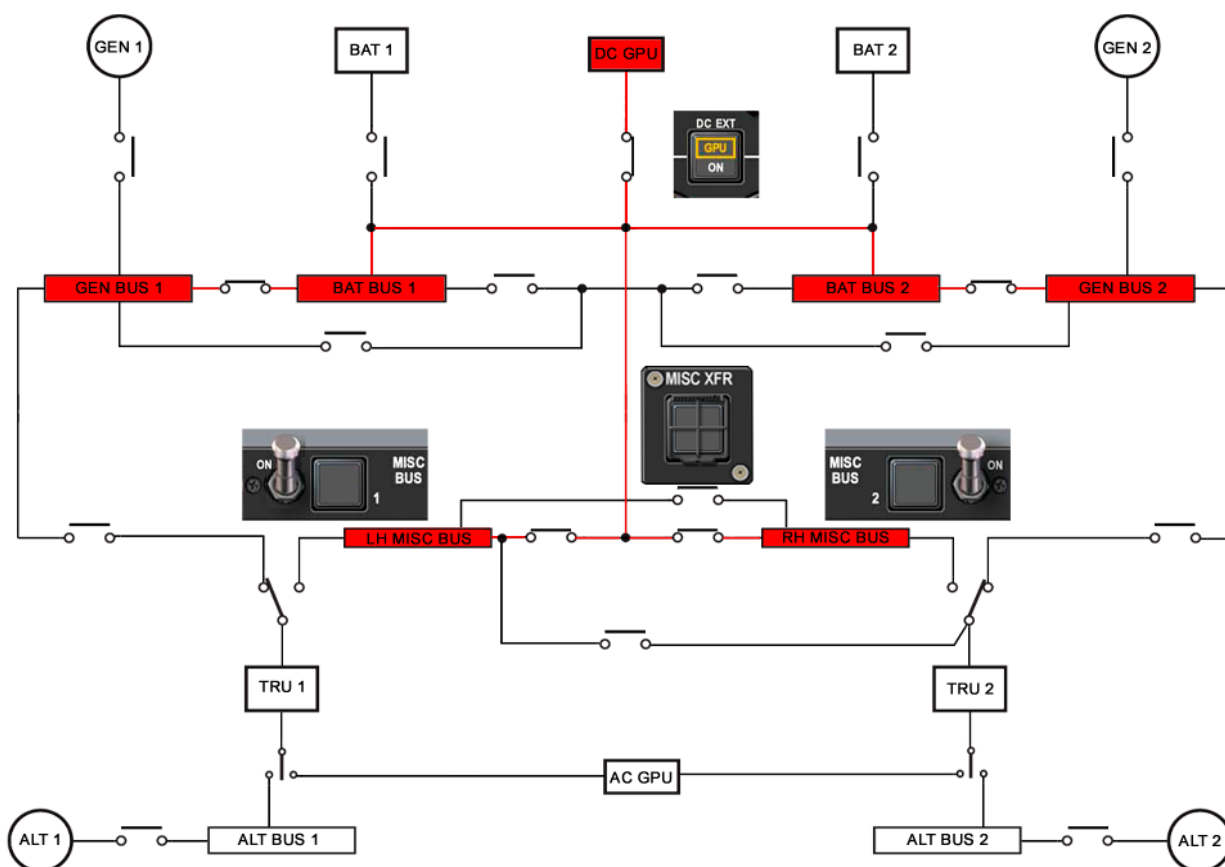


Figure 24-11 DC GPU Normal Operation - Architecture

When the aircraft is being powered from an AC GPU, both current and voltage supplied will be displayed on the related generator ammeter and voltmeter. Batteries and generators, if previously connected, are automatically disconnected.

If the TRU selector is in OFF and RH MISC master switch is in OFF:

- TRU1 feeds GEN BUS 1 and BAT BUS 1.
- TRU2 feeds GEN BUS 2, BAT BUS 2 and also can feed the LH MISC BUS.

If the TRU selector is in OFF and RH MISC master switch is in ON:

- TRU 1 feeds GEN BUS 1 and BAT BUS 1.
- TRU 2 feeds the RH MISC BUS and also can feed the LH MISC BUS.

If the TRU selector is in 1 or 2:

- AC GPU is disconnected.
- The main DC buses can be fed by means of the BAT 2 if the BAT BUS TIE Selector is not in the OFF position.

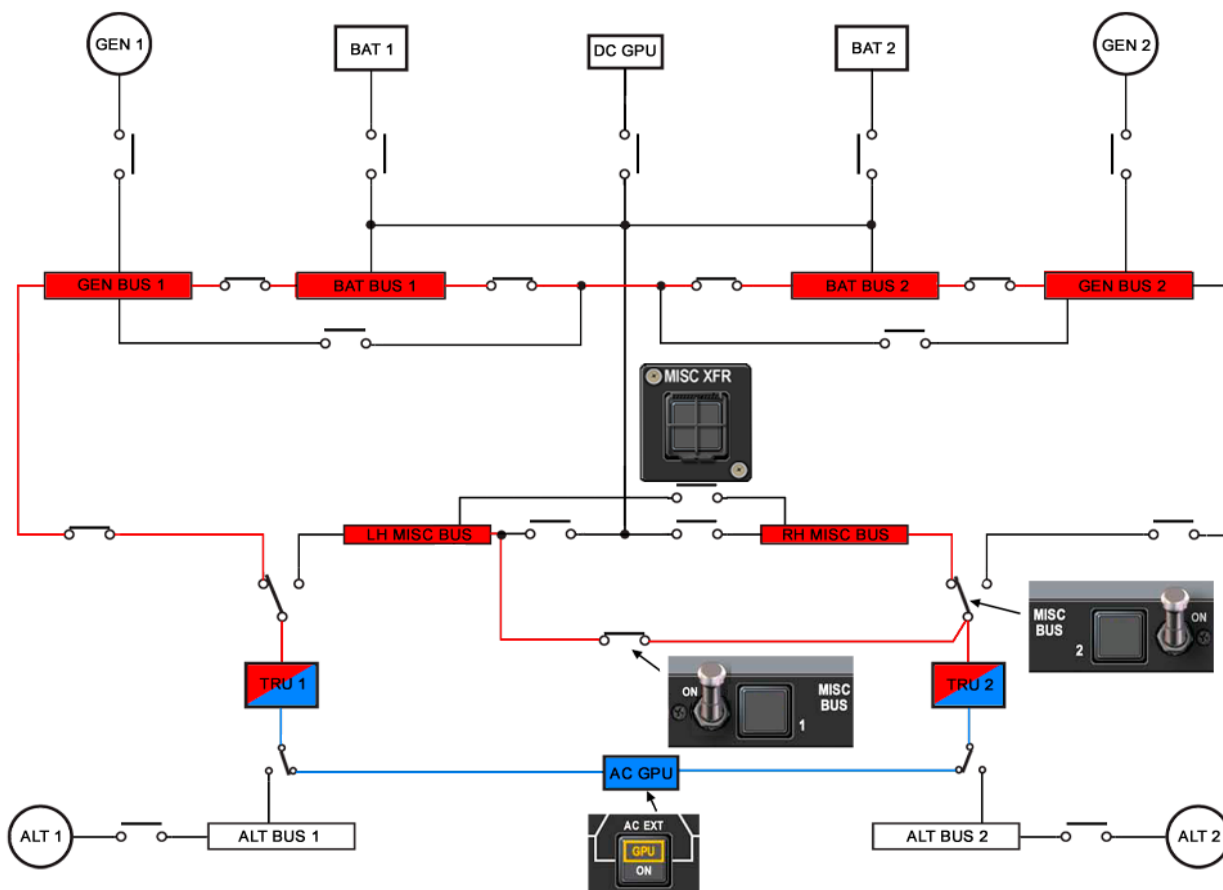


Figure 24-12 AC GPU Normal Operation - Architecture



## CONTROLS AND INDICATORS

### (1) DC EXT Pushbutton:

- *GPU light on (amber):* DC GPU connected to the aircraft.
- *Pushed-in (ON light):* every bus bar is powered from the DC GPU. The batteries, generators and AC GPU (if connected) are also disengaged automatically.

### (2) Battery Ammeter:

measures (in the positive scale) the current supplied by the DC GPU to the related bus bar.

### (3) Voltmeter:

displays the voltage supplied by the GPU.

### (4) AC EXT Pushbutton:

- *GPU light on (amber):* AC GPU connected to the aircraft.
- *Inserted (ON light comes on):* every bus bar is powered from the AC GPU. Batteries and generators are disconnected automatically (if previously connected).

### (5) Generator Ammeter:

displays the current supplied through the selected TRU from the AC GPU.

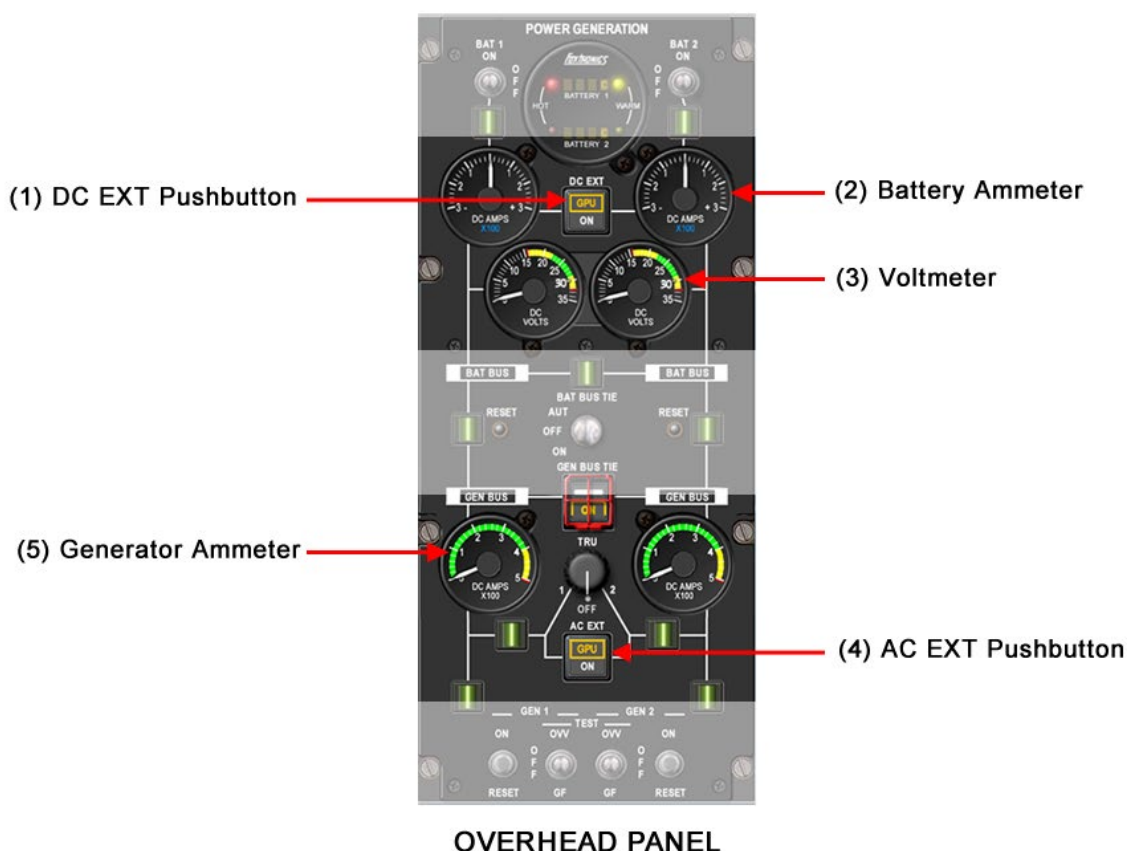


Figure 24-13 Ground Power Unit - Controls and Indicators

# ELECTRICAL LOADS DISTRIBUTION

The electric loads distribution network supplies power to the electrical devices and other consumers on board.

## DESCRIPTION

Main components are:

- ***Circuit Breaker Panels (SYSTEMS 1, SYSTEMS 2, L MISCELLANEOUS and R MISCELLANEOUS)***: located in the cockpit overhead and side panels. Consist of circuit breakers for power distribution to the aircraft electrical devices and consumers.
- ***Avionics Circuit Breakers and Switches (AVIONICS 1, AVIONICS 2)***: located in the cockpit overhead and side panels. Consist of circuit breakers and control switches for power distribution to the aircraft electrical devices.

The Avionics MASTER switches, located in the AVIONICS 1 and AVIONICS 2 panels, control the supply of 28 V DC electrical power from BAT BUS 1, 2 and GEN BUS 1, 2, to those panels, except the following:

- Pilot/Co-pilot INTERPHONE
- Pilot/Co-pilot SECURE COM
- V/UHF 1, V/UHF 2, V/UHF 2 C/P
- Pilot FMM/FGM
- Pilot IOP/IOM
- Pilot MCDU
- FDR

## CIRCUIT BREAKERS AND SWITCHES

The circuit breakers control and protect the connection of systems and equipment by means of fitting bus bars. Gathered in panels are located on both the ceiling and laterals.

To improve the quick finding of each circuit breaker, each panel is identified in the following tables by an U character followed by a number if referred to the overhead panel, and an "L" or "R" (according to each side) if referred to the side panels. These tables comprise a log of the circuit breakers gathered by systems with their coordinates, equipment current consumption (in amps), and the bus bars from where they are powered. Each circuit breaker is identified by both a letter and a number that give its coordinates on the related panel.

If necessary, following the name of the circuit breaker and in brackets, there is a list with the equipment that are lost if the related circuit breaker is out.

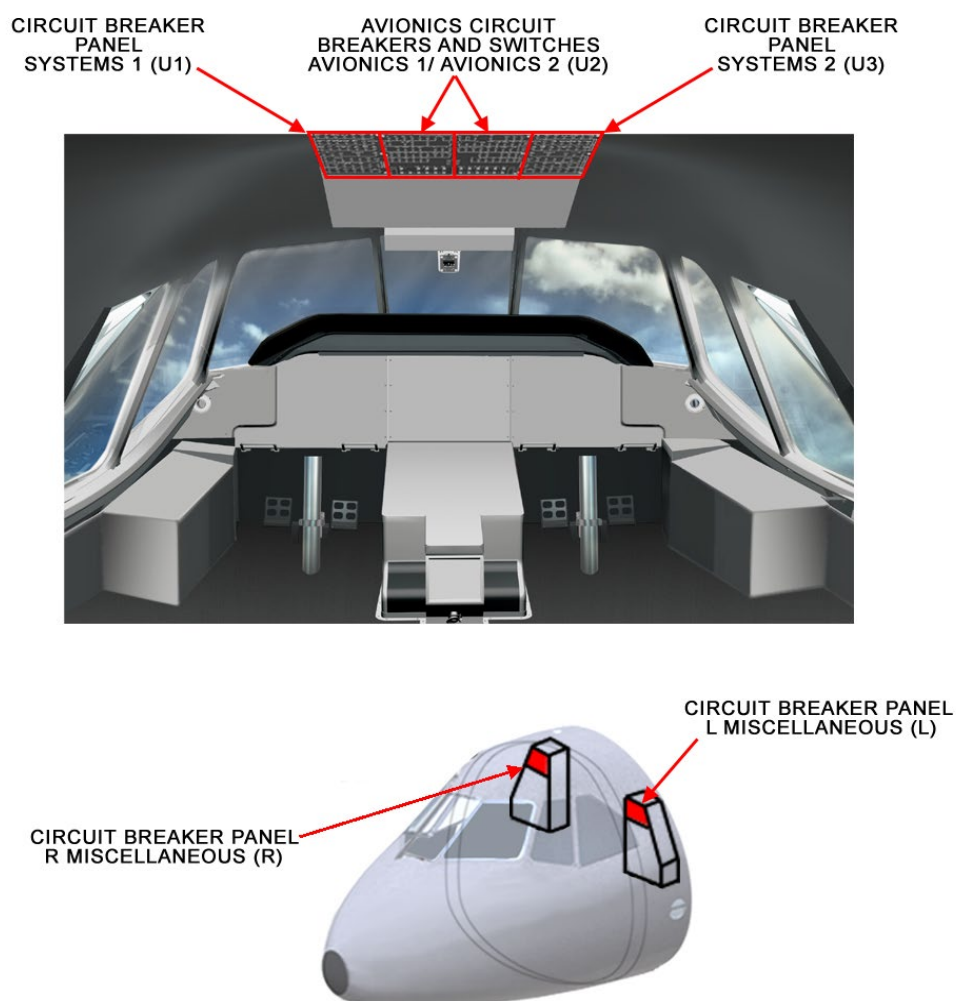


Figure 24-14 Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>ENVIRONMENTAL CONTROL</b>				
AIR CONDITIONING - RH	U3	F-7	5	BAT 2
	U3	G-7	5	GEN 2
	U1	F-1	5	BAT 1
	U1	G-1	5	GEN 1
WARNINGS - RH	U3	G-4	5	GEN 2
	U1	G-4	5	GEN 1
PRESSURIZATION	U3	E-2	5	BAT 2

Table 24-1 Environmental Control - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>AUTO FLIGHT</b>				
CONTROL AND ENGAGEMENT UNIT	U2	D-7	2.5	BAT 1
FLIGHT GUIDANCE CONTROL PANEL	U2	D-8	2.5	BAT 1
	U2	D-10	2.5	BAT 2
SERVOS - ROLL	U2	D-11	7.5	BAT 2
	U2	D-12	7.5	BAT 2
	U2	D-13	7.5	BAT 2

Table 24-2 Auto Flight - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>COMMUNICATIONS</b>				
AUDIO - PILOT	U2	C-7	2	BB/U 1
	U2	E-4	2	BAT 2
	U2	C-12	2	BB/U 2
	U2	E-15	2	BAT 1
	U2	B-4	2	GEN 1
	U2	B-3	2	GEN 1
	U2	B-16	2	GEN 2
	U2	B-17	2	GEN 2
HF	U2	B-6	5	GEN 1
HF Switch	U2	--	--	--
V/UHF 1 - T/R	U2	D-2	7.5	BAT 1

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
V/UHF 2 - T/R	U2	D-17	7.5	BAT 2
- CP	U2	D-18	1	BAT 2
V/UHF 1 and V/UHF 2 Switches	U2	--	--	--
PASSENGER AMPLIFIER	U2	D-15	7.5	BAT 2

Table 24-3 Communications - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>ELECTRICAL POWER</b>				
HOT BUS - N° 1	U1	C-5	0.5	BAT 1
- N° 2	U3	C-3	0.5	BAT 2
BATTERY TEMPERATURE	U1	D-6	5	BAT 1
DC VOLTMETER - BUS 1 VOLTMETER	U1	A-7	1	BAT 1
- BUS 2	U3	A-1	1	BAT 2
CONTROL UNIT - GENERATOR 1	U1	E-4	5	BAT 1
- GENERATOR 2	U3	E-4	5	BAT 2
AC VOLTMETER	U1	E-5	1	115 AC
RECTIFIER/TRANSFORMER	U1	G-2	5	GEN 1
	U3	G-6	5	GEN 2
AC EXTERNAL POWER	R	C-4	5	BB/U 2
AC EXTERNAL POWER	R	E-8	5	GEN 2
B/U BAT 1	L	A-1	2.5	BAT 1
B/U BAT 2	R	A-6	2.5	BAT 2

Table 24-4 Electrical Power - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>EQUIPMENT/FURNISHINGS</b>				
WINCH	L	E-3	5	GEN 1
ELT	U2	D-9	1	BAT 1

Table 24-5 Equipment/Furnishings - Circuit Breakers and Switches

CIRCUIT BREAKER		PANEL	COORDINATES	AMP	BUS
FIRE PROTECTION					
DETECTION SYSTEM	- ENGINE 1	U1	C-3	1	BAT 1
		U3	C-4	1	BAT 2
	- ENGINE 2	U1	C-4	1	BAT 1
		U3	C-5	1	BAT 2
SMOKE DETECTOR		R	A-5	2.5	BAT 2
EXTINGUISHER SYSTEM	- CYLINDER 1	L	E-8	5	HOT 1
		R	C-6	5	HOT 2
	- CYLINDER 2	L	E-9	5	HOT 1
		R	C-7	5	HOT 2

Table 24-6 Fire Protection - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
FLIGHT CONTROLS				
TRIMMING INDICATION	U3	A-4	1	BAT 2
DISENGAGEMENT - FRONT MECHANISMS	U1	A-6	3	BAT 1
- REAR	U3	A-2	2.5	BAT 2
PUSHER	L	A-2	10	BAT 1
FLAP SYSTEM	U1	A-5	7.5	BAT 1
AILERON TRIM TAB - RH	U3	A-6	2.5	BAT 2
- LH	U1	A-2	2.5	BAT 1
EMERGENCY ELEVATOR TRIM TAB	U3	A-5	5	BAT 2
RUDDER ACTUATOR	U1	A-1	7.5	BAT 1
	U3	A-7	7.5	BAT 2
EMERGENCY RUDDER TRIM TAB	U1	A-3	2.5	BAT 1
RUDDER ACTUATOR - CONTROL	U3	D-2	5	BAT 2
- HEATER 1	U3	D-3	2.5	BAT 2
- HEATER 2	U1	D-5	2.5	BAT 1

Table 24-7 Flight Controls - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>FUEL</b>				
ELECTRIC PUMPS - RIGHT	U3	B-7	5	BAT 2
- LEFT	U1	B-1	5	BAT 1
QUANTITY INDICATOR - RIGHT	U3	G-5	1	GEN 2
- LEFT	U1	G-3	1	GEN 1
SHUT-OFF VALVES	U1	B-2	5	BAT 1
	U3	B-6	5	BAT 2
CUTOFF AND CROSSWAY FEEDING VALVE	U1	B-3	5	BAT 1
	U3	B-5	5	BAT 2
GRAVITY TRANSFER VALVE - RIGHT	U3	B-4	5	BAT 2
- LEFT	U1	B-4	5	BAT 1

Table 24-8 Fuel - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>HYDRAULIC POWER</b>				
PUMPS - NUMBER1	U1	D-7	5	BAT 1
- NUMBER 2	U3	D-1	5	BAT 2
- NUMBER 3	U3	F-1	5	GEN 2
INDICATION - HYDRAULIC PRESSURE	U3	E-1	1	BAT 2
- NORMAL BRAKE PRESSURE	R	A-8	1	BAT 2
- EMERGENCY BRAKE PRESSURE	R	A-7	1	BAT 2

Table 24-9 Hydraulic Power - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>ICE AND RAIN PROTECTION</b>				
ENGINE INTAKE ANTI-ICE - RIGHT	U3	F-2	5	GEN 2
- LEFT	U1	F-4	5	GEN 1
WINDSHIELD ANTI-ICE - RIGHT	U3	F-5	5	BAT 2
- LEFT	U1	F-3	5	BAT 1

CIRCUIT BREAKER		PANEL	COORDINATES	AMP	BUS
PITOT ANTI-ICE	- RIGHT	U3	F-6	1	BAT 2
	- LEFT	U1	F-2	1	BAT 1
	- AUX.	U3	G-1	1	GEN 2
AOA SENSORS HEATER	- RIGHT	R	E-4	10	GEN 2
	- LEFT	L	C-4	10	GEN 1
WING AND TAIL DE- ICING	- AUT.	L	C-6	5	GEN 1
	- MAN.	R	E-3	5	GEN 2
	- VALVE	L	C-5	3	GEN 1
PROPELLER DE- ICING	- RIGHT	U3	F-3	5	GEN 2
	- LEFT	U1	F-5	5	GEN 1
ICE DETECTION		U1	E-7	1	115 AC
DRAIN NACELLE		R	E-2	7.5	GEN 2
WINDSHIELD WIPER	- RIGHT	R	E-7	7.5	GEN 2
	- LEFT	L	C-1	7.5	GEN 1

Table 24-10 Ice and Rain Protection - Circuit Breakers and Switches

CIRCUIT BREAKER		PANEL	COORDINATES	AMP	BUS
<b>INDICATING/RECORDING SYSTEMS</b>					
A.O.A. INDICATOR	- C/M 1	L	A-4	5	BAT 1
	- C/M 2	R	B-4	5	BAT 2
WARNING SYSTEM	- RIGHT	U3	E-5	5	BAT 2
		U3	E-6	5	BAT 2
	- LEFT	U1	E-2	5	BAT 1
		U1	E-3	5	BAT 1
IFC 1	- I/O	U2	D-6	7.5	BAT 1
	- FG & MM	U2	C-8	7.5	BB/U 1
IFC 2	- I/O	U2	B-15	7.5	GEN 2
	- FG & MM	U2	C-11	7.5	BB/U 2
IFC 1 and IFC 2 Switches		U2	--	--	--
ACCLRM		L	E-4	3	GEN 1
FDR	- ACQUISITION	U2	B-7	3	BB/U 1
	- RECORDER	U2	B-8	1	BB/U 1
	- CP	U2	B-9	1	BB/U 1
CVR		U2	B-10	2	BB/U 2



CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
IEDS    - LAMP HTR - CLK BAT	U1	D-1	5	BAT 1
	U1	D-2	5	BAT 1
	U3	D-5	5	BAT 2
	U3	D-6	5	BAT 2
	U3	D-4	2.5	BAT 2
	U3	D-7	2.5	BAT 2

Table 24-11 Indicating/Recording Systems - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>LANDING GEAR</b>				
ANTISKID - FRONT	L	C-3	5	GEN 1
- REAR	R	E-5	5	GEN 2
LANDING GEAR POSITION INDICATOR	U3	A-3	1	BAT 2
LANDING GEAR	U1	A-4	5	BAT 1
NOSEWHEEL STEERING	U1	C-7	2.5	BAT 1

Table 24-12 Landing Gear - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>LIGHTS</b>				
COCKPIT LIGHTING - RH	R	D-4	5	GEN 2
- LH	L	D-5	5	GEN 1
FORWARD ENTRY LIGHTING	R	C-5	2.5	HOT 2
REAR ENTRY LIGHTING	L	D-9	5	GEN 1
REAR CARGO LIGHTING	L	D-1	7.5	GEN 1
INSTRUMENT LIGHTING - RH	R	D-5	7.5	GEN 2
	R	D-6	10	GEN 2
	R	D-7	10	GEN 2
INSTRUMENT LIGHTING - LH	L	D-2	10	GEN 1
	L	D-3	10	GEN 1
	L	D-4	7.5	GEN 1
TOILET LIGHTING	R	D-8	5	GEN 2
PASSENGER WARNING LIGHTS	R	B-5	5	BAT 2
EMERGENCY LIGHTING	L	B-4	5	BAT 1
NVG MODE	L	C-7	2.5	GEN 1

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
ANTI-COLLISION LIGHTS - UND	L	B-2	2.5	BAT 1
- TOP	R	B-7	2.5	BAT 2
LANDING LIGHTS - RH	R	B-8	2.5	BAT 2
- LH	L	B-1	2.5	BAT 1
WING INSPECTION LIGHTS - RH	R	D-2	5	GEN 2
- LH	L	D-7	5	GEN 1
NAVIGATION LIGHTS - RH	R	D-1	5	GEN 2
- LH	L	D-8	5	GEN 1
TAXI LIGHTS - RH	R	B-6	1	BAT 2
- LH	L	B-3	1	BAT 1
TAKE-OFF LIGHTS	R	D-3	5	GEN 2
	L	D-6	5	GEN 1
FORMATION LIGHTS	U1	E-6	2.5	115 AC
PARATROOP JUMP LIGHTS	L	E-7	5	HOT 1

Table 24-13 Lights - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>NAVIGATION</b>				
MASTER RADIO 1	L	A-3	2.5	BAT 1
	R	A-4	2.5	BAT 2
ADS 1 and ADS 2 Switches	U2	--	--	--
PRI PLT - AHCP	U2	C-1	1	BB/U 1
	U2	E-1	1	BAT 2
- AHRU	U2	C-2	5	BB/U 1
	U2	E-2	5	BAT 2
- ADU	U2	C-3	2	BB/U 1
	U2	E-3	2	BAT 2
PRI CPLT - AHCP	U2	C-18	1	BB/U 2
	U2	E-18	1	BAT 1
- AHRU	U2	C-17	5	BB/U 2
	U2	E-17	5	BAT 1
- ADU	U2	C-16	2	BB/U 2
	U2	E-16	2	BAT 1
AHRS 1 and AHRS 2 Switches	U2	--	--	--

CIRCUIT BREAKER		PANEL	COORDINATES	AMP	BUS
FDS - PLT	- PRIMARY FLIGHT DISPLAY	U2	C-5	10	BB/U 1
	- INDEX CONTROL PANEL	U2	C-6	2.5	BB/U 1
	- NAVIGATION DISPLAY	U2	E-5	10	BAT 2
	- EFIS CONTROL PANEL	U2	E-6	2.5	BAT 2
FDS - CPLT	- PRIMARY FLIGHT DISPLAY	U2	C-14	10	BB/U 2
	- INDEX CONTROL PANEL	U2	C-13	2.5	BB/U 2
	- NAVIGATION DISPLAY	U2	E-14	10	BAT 1
	- EFIS CONTROL PANEL	U2	E-13	2.5	BAT 1
ICP 1		U2	E-7	2.5	BAT 2
ICP 2		U2	E-12	2.5	BAT 1
MCDU - PLT		U2	D-4	5	BAT 1
MCDU - CPLT		U2	D-14	5	BAT 2
IESI (IESI only if both IESI C/B are out)		U2	C-10	3	BB/U 2
		U2	C-9	3	BB/U 1
WEATHER RADAR	- CP	U2	A-6	1	GEN 1
	- T/R	U2	A-7	7.5	GEN 1
	- NAVCONC	U2	A-8	3	GEN 1
	- NAVCONC	U2	A-9	3	26 AC
	- ANT	U2	A-11	3	115 AC
EGPWS		U2	A-13	2	115 AC
ETCAS	- T/R	U2	B-5	5	GEN 1
ETCAS Switch		U2	--	--	--
ADF 1		U2	A-1	2	GEN 1
ADF 2		U2	A-18	2	GEN 2
ADF 1 and ADF 2 Switches		U2	--	--	--
MULTIMODE RECEIVER	- 1	U2	A-3	5	GEN 1
	- 2	U2	A-16	5	GEN 2
MMR 1 and MMR 2 Switches		U2	--	--	--
DME		U2	A-2	2	GEN 1
DME switch		U2	--	--	--
IFF (T/R)		U2	B-1	5	GEN 1

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
IFF Switch	U2	--	--	--
RADIO-ALTIMETER	U2	A-4	5	GEN 1
RALT Switch	U2	--	--	--
IRS/GPS - 1	U2	C-4	5	BB/U 1
- 2	U2	C-15	5	BB/U 2
IRS/GPS 1 and IRS/GPS 2 Switches	U2	--	--	--
DMM	U2	D-1	7.5	BAT 1
FMS/AIRBORNE DATA LOADER	U2	D-5	1	BAT 1

Table 24-14 Navigation - Circuit Breakers and Switches

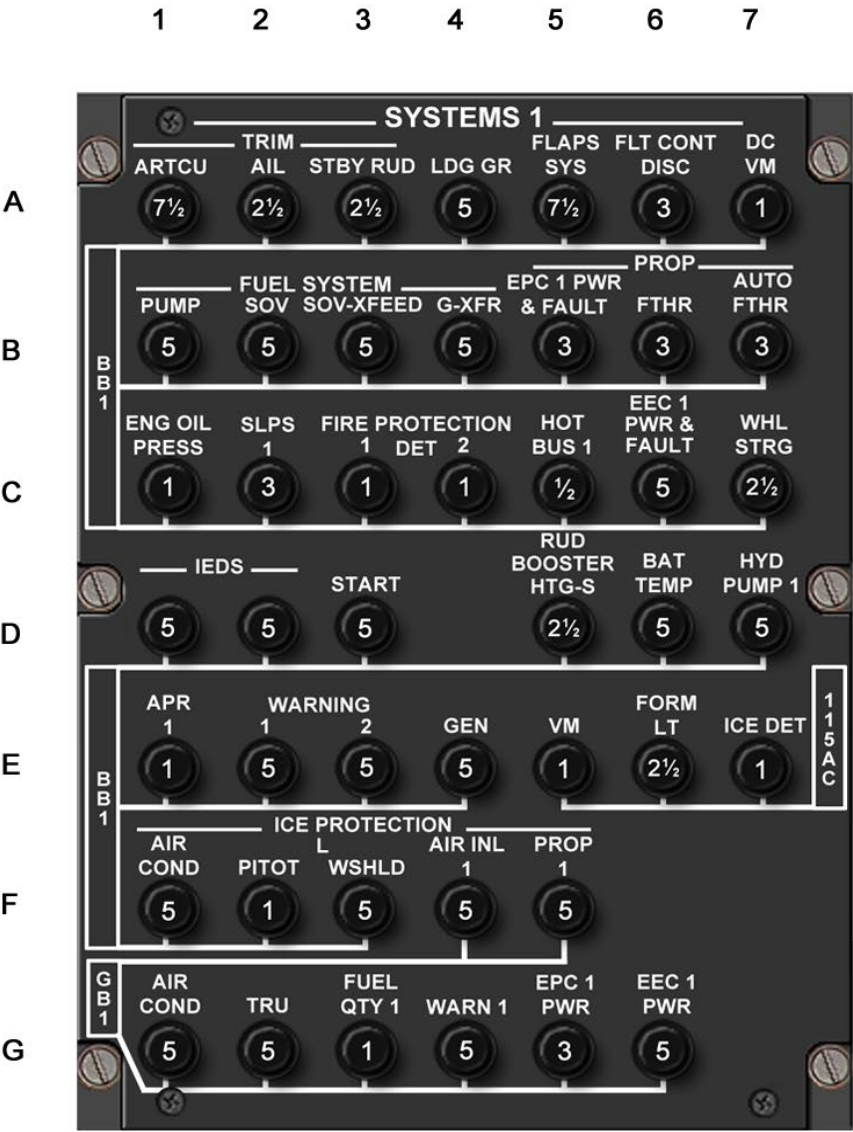
CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>DOORS</b>				
RAMP AND CARGO DOOR	L	C-2	5	GEN 1

Table 24-15 Doors - Circuit Breakers and Switches

CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
<b>POWER PLANT</b>				
PROPELLER - RIGHT FEATHERING	U3	B-3	3	BAT 2
- LEFT	U1	B-6	3	BAT 1
STARTING	U1	D-3	5	BAT 1
PROP. AUTO- FEATHERING - RIGHT	U3	B-2	3	BAT 2
- LEFT	U1	B-7	3	BAT 1
L PROPELLER BRAKE - SYSTEM	L	E-2	3	GEN 1
- CONTROL	L	E-1	5	GEN 1
ENGINE OIL PRESSURE - RIGHT	U3	C-7	1	BAT 2
- LEFT	U1	C-1	1	BAT 1
ENGINE ELEC. CONTROL (POWER) - ENG 1	U1	G-6	5	GEN 1
- ENG 2	U3	G-2	5	GEN 2
ENGINE ELEC. CONTROL (P&F) - ENG 1	U1	C-6	5	BAT 1
- ENG 2	U3	C-2	5	BAT 2
AUTOMATIC STANDBY POWER - ENG 1	U1	E-1	1	BAT 1
- ENG 2	U3	E-7	1	BAT 2

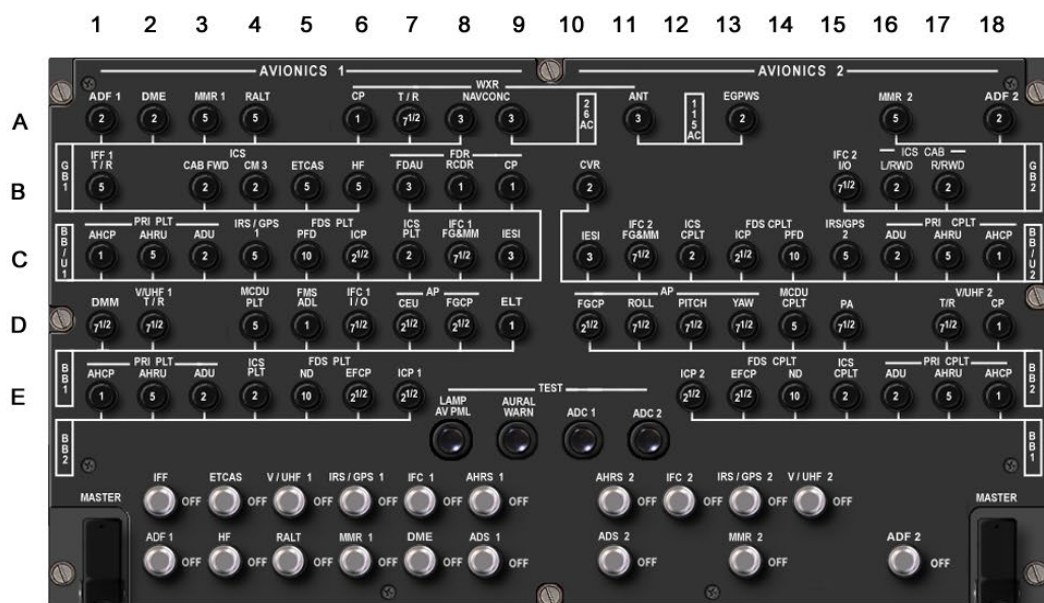
CIRCUIT BREAKER	PANEL	COORDINATES	AMP	BUS
PROPELLER ELEC. - PROP. 1 CONTROL (POWER)	U1	G-5	3	GEN 1
- PROP. 2	U3	G-3	3	GEN 2
PROPELLER ELEC. - PROP. 1 CONTROL (P&F)	U1	B-5	3	BAT 1
- PROP. 2	U3	B-1	3	BAT 2
LOW-PITCH PROTECTION - PROP. 1	U1	C-2	3	BAT 1
- PROP. 2	U3	C-6	3	BAT 2
PP MAINT	U3	C-1	1	BAT 2
PROPELLER DYNAMIC BALANCING	R	E-6	5	GEN 2

Table 24-16 Power Plant - Circuit Breakers and Switches



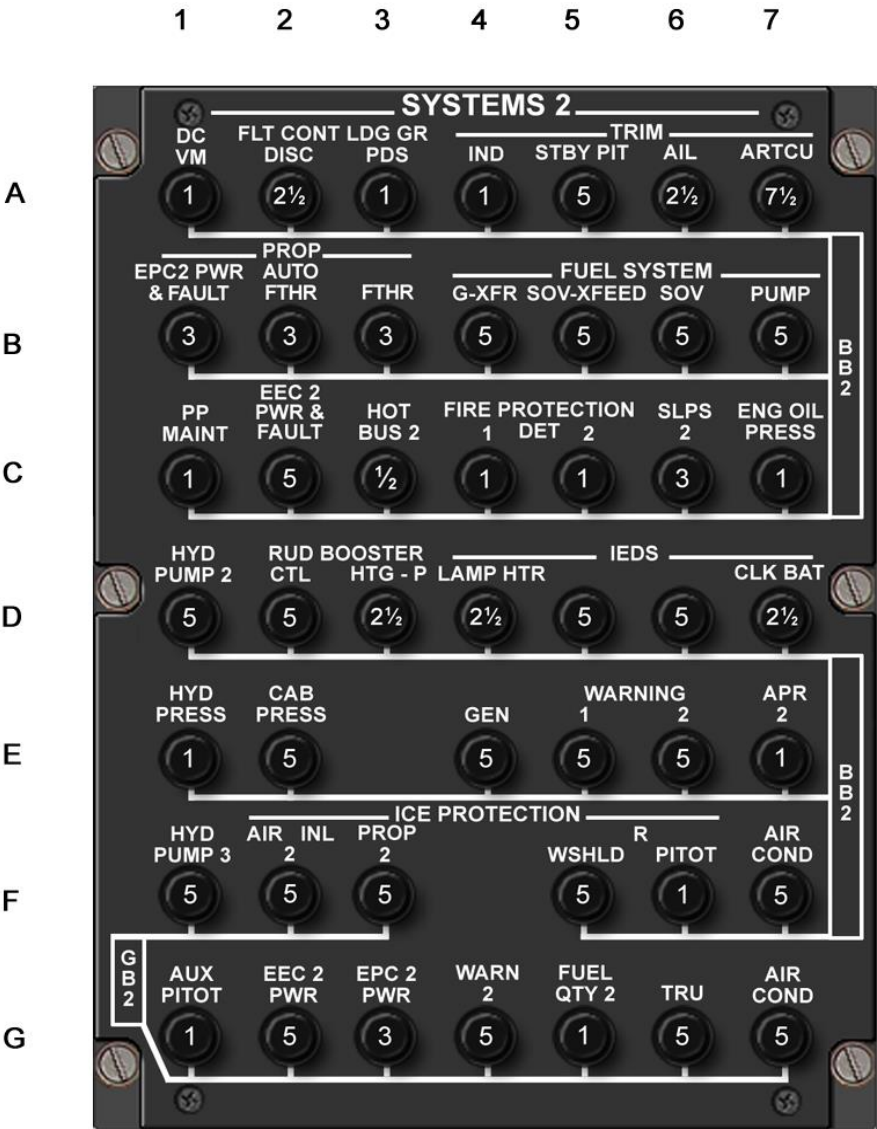
U1 PANEL

Figure 24-15 Circuit Breaker Panel SYSTEMS 1 (U1)



## U2 PANEL

Figure 24-16 Avionic Circuit Breakers and Switches Panel AVIONICS 1, AVIONICS 2 (U2)



U3 PANEL

Figure 24-17 Circuit Breaker Panel SYSTEMS 2 (U3)



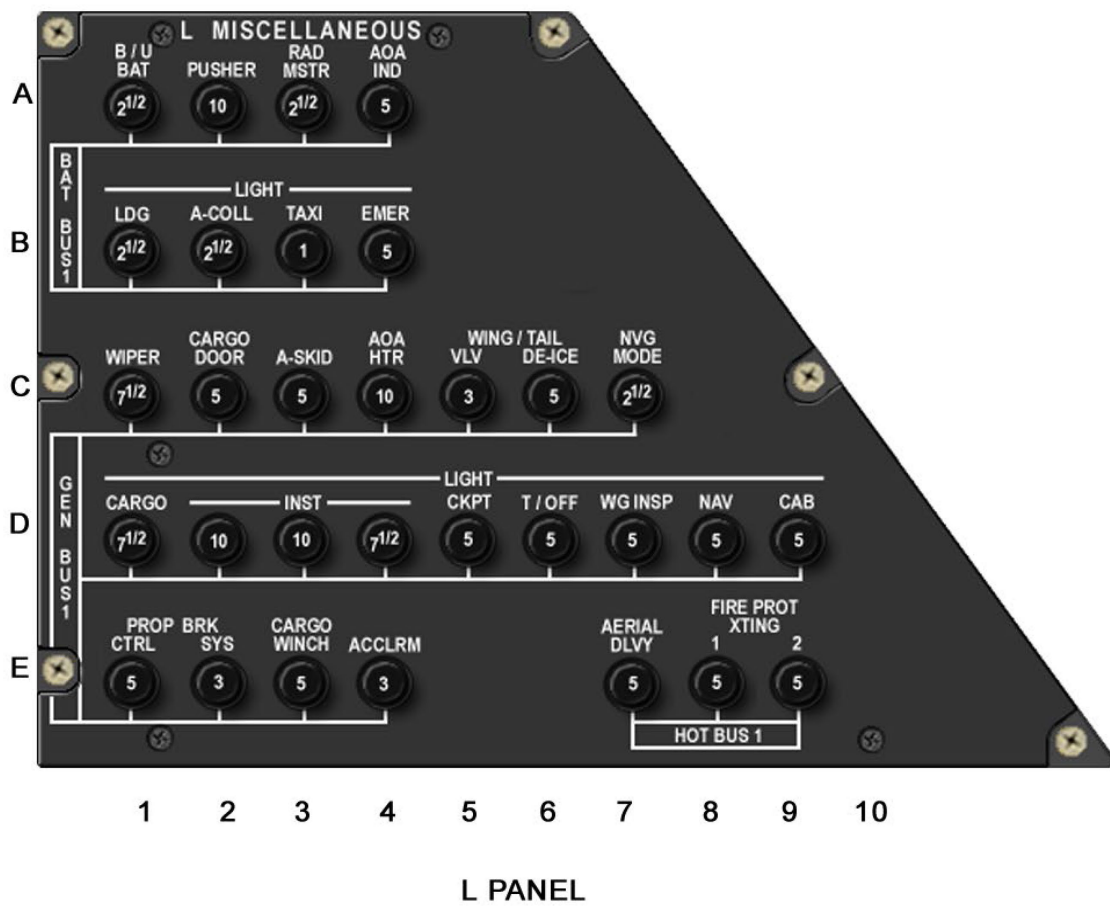


Figure 24-18 L/H Circuit Breaker Panel MISCELLANEOUS (L)

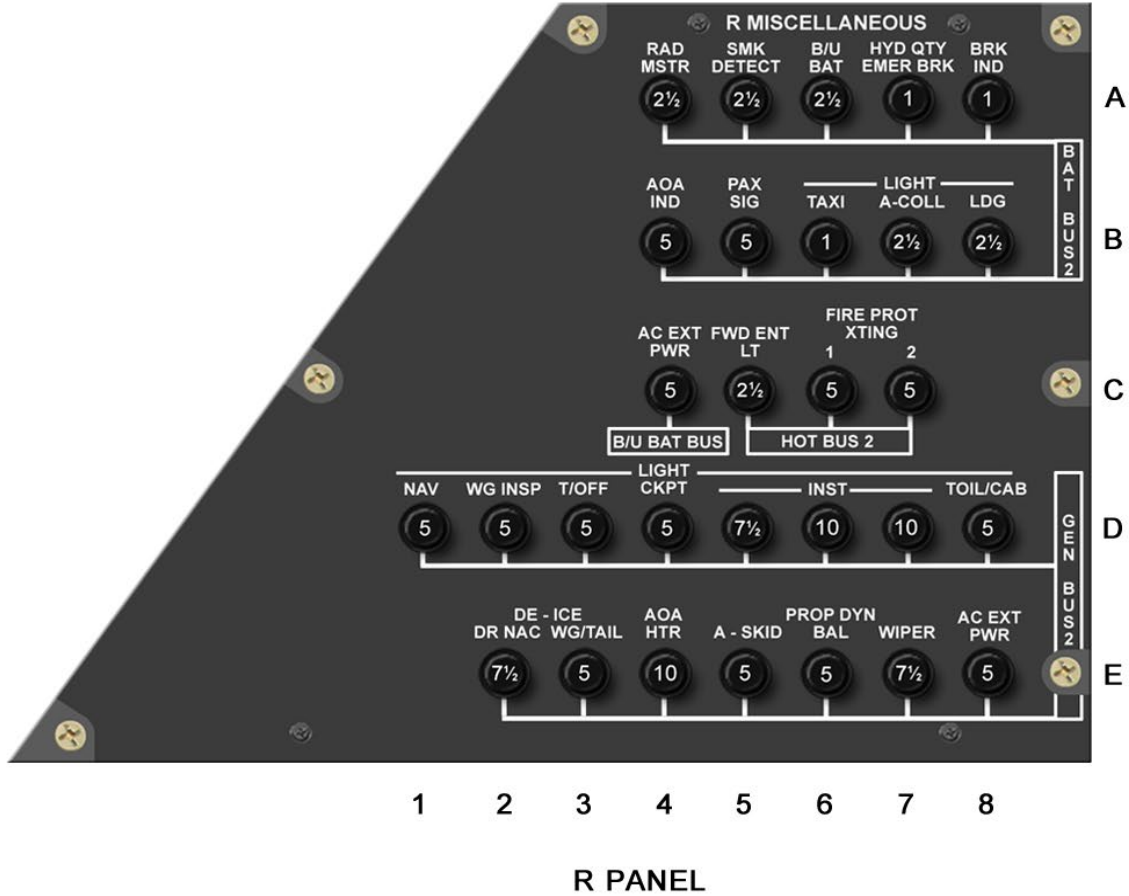


Figure 24-19 R/H Circuit Breaker Panel MISCELLANEOUS (R)

## GENERAL SERVICES

Additionally, a set of common-service DC and AC circuits provides electrical power as required for several aircraft functions. All the sockets are protected by a screwed cap when not in use. The 28 V DC and 115 V AC sockets also have a pin to ensure the circuit is the correct one when connecting a load.

### DESCRIPTION

DC circuit:

- **28 V DC:** three 28 V DC sockets located at the front right, central left and rear left areas of the cargo cabin. They are powered by LH MISC BUS.

AC circuit:

- **115 V AC:** the aircraft has three auxiliary sockets providing 115 V AC at 50 Hz through an inverter powered by the LH MISC BUS. These sockets are located at the front right, central left and rear left areas of the cargo cabin, next to the 28 V DC sockets. They are managed by the AC POWER control panel located in the rack at frame 10.

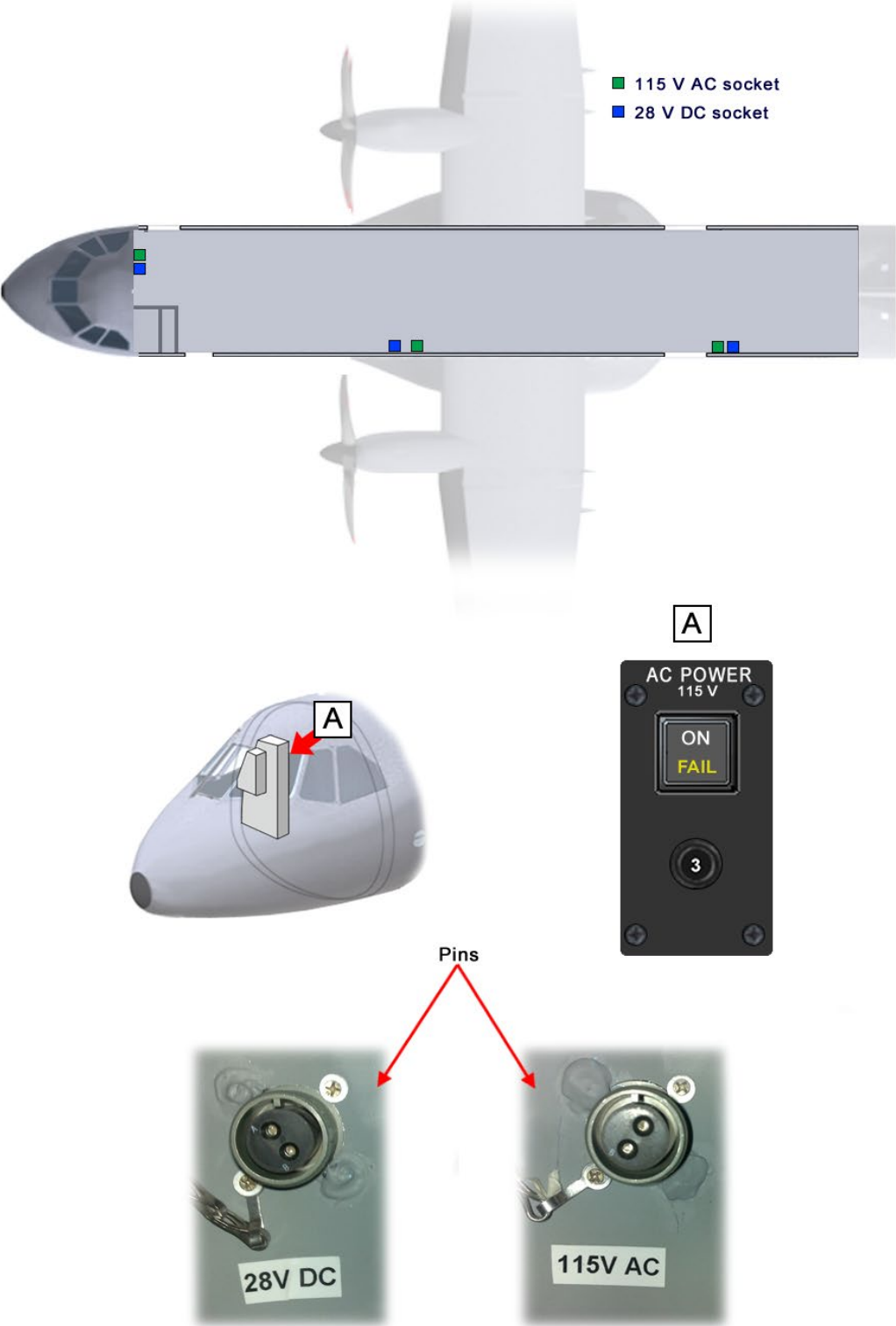


Figure 24-20 General Services - Components

## CONTROLS AND INDICATORS

### (1) AC POWER Pushbutton:

- *Pressed (ON light on):* the inverter supplies power to the 115V AC sockets.
- *FAIL amber light on:* inverter failure.

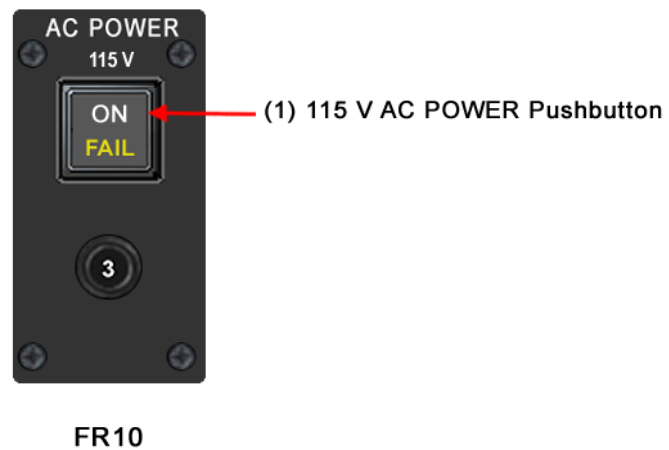


Figure 24-21 General Services - Controls and Indicators

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