DO NOT USE FOR FLIGHT

FLIGHT MANUAL

PART II - **Aircraft Systems**

DO NOT USE FOR FLIGHT

ABOUT THIS MANUAL

VERSION: 05 MAY, 2012

WARNING: THIS MANUAL IS DESIGNED FOR MICROSOFT® FSX USE ONLY. DO NOT USE FOR FLIGHT.

The '737 Captain' FLIGHT MANUAL is organized into four Parts:
Each Part is provided as a separate Acrobat® PDF document:

Click START > Programs > Captain Sim > 737 Captain >

- **Part I – User's Manual**
  - The User's Manual describes the '737 Captain' Sim product as a software title.
- **Part II – Aircraft Systems** - this document.
- **Part III – Normal Procedures**
- **Part IV – Flight Crew Training Manual**

Adobe Acrobat® Reader Required

FOR GENERAL INFORMATION ON THE '737 CAPTAIN' PRODUCT PLEASE USE WWW.CAPTAINSIM.COM .
THIS MANUAL PROVIDES ADDITIONAL INFORMATION ONLY, WHICH IS NOT AVAILABLE ON THE WEB SITE.

737 Captain FLIGHT MANUAL

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SYSTEM DESCRIPTION

The '737 Captain' is one of the most advanced, complete and accurate airliner expansions for MSFS.

But the '737 Captain' (same as MSFS itself and any MSFS expansion) is a flight simulation software game. Therefore this product should not be used as flight training device (FTD) and/or simulator for flight training purposes.

All items should work as described in this manual. If something is not described as functional (therefore it does not work or does not exist in the model) it is not a system 'bug' but a reasonable simplification.

3D CONTROLS ANIMATION (SWITCHES, BUTTONS, KNOBS, LAMPS)

1. Two-positions - left click.

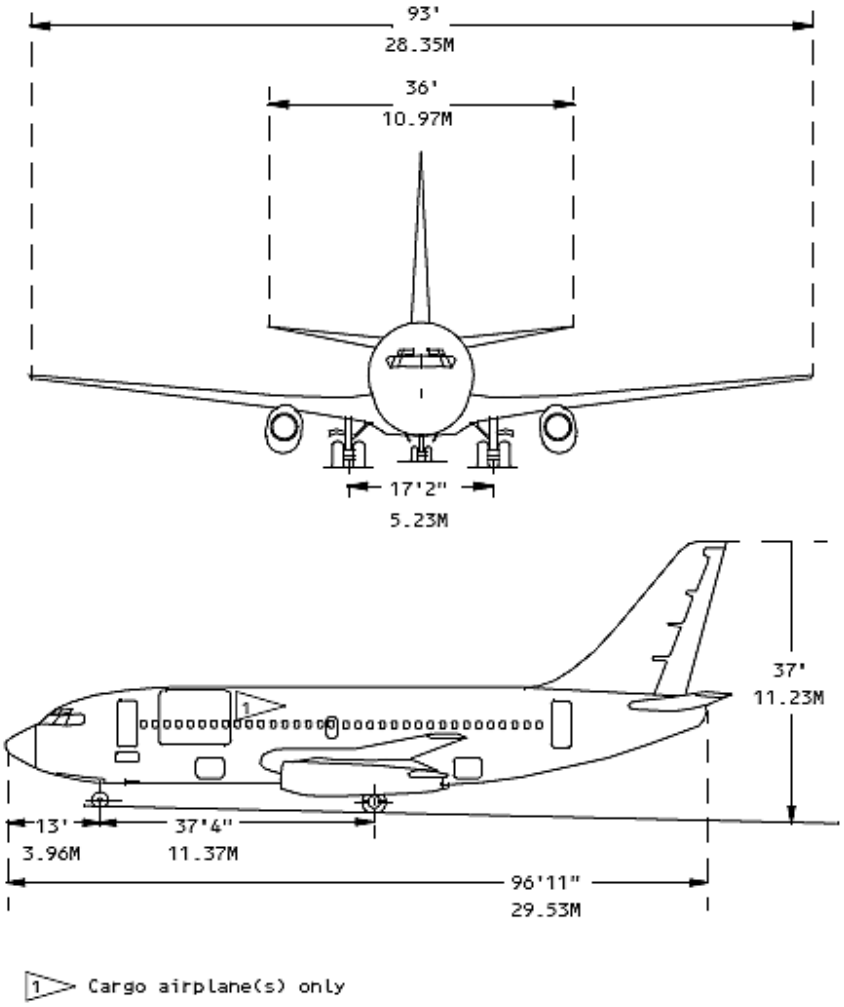
2. Multi-position:
- Counterclockwise (decrease) - left click or mouse wheel outwards oneself;
- Clockwise (increase) – right click or mouse wheel towards oneself.

3. Three-position with middle spring-back position:
- Down-left - left click;
- Up-right – right click.

4. Levers and some wheels like trim and pitch trim wheels:
- Decrease - left click + drag;
- Increase - right click + drag.

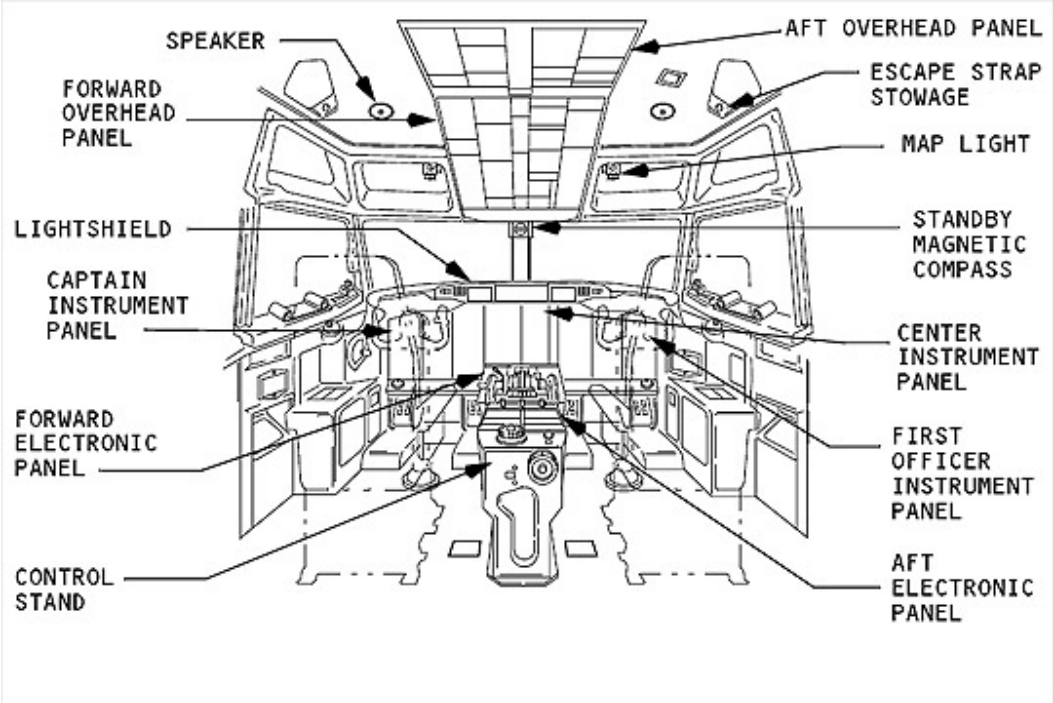
AIRPLANE GENERAL

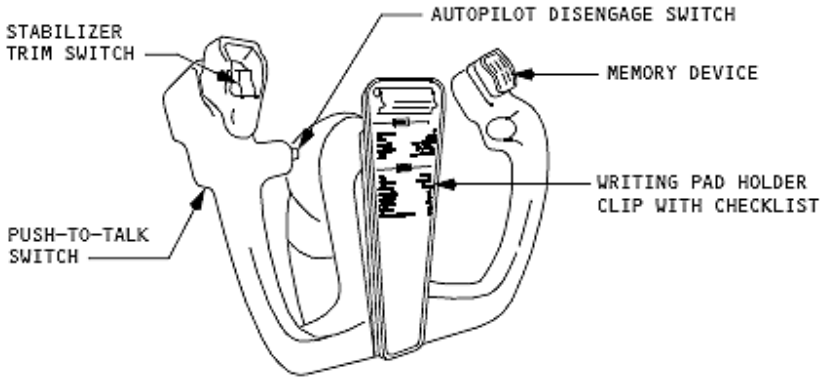
PRINCIPAL DIMENSIONS



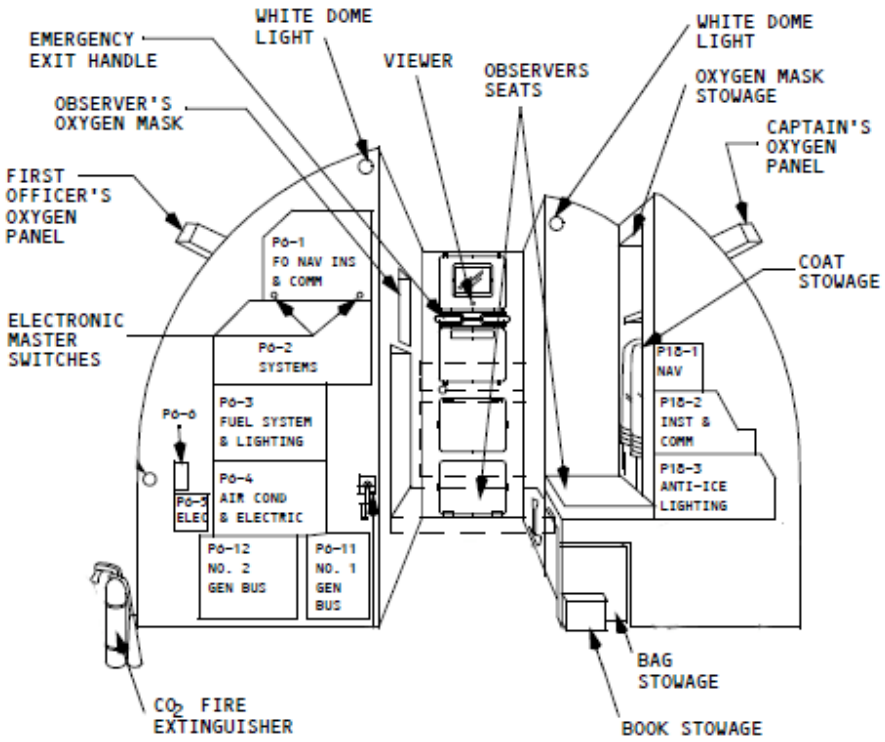
INSTRUMENT PANELS

PANEL ARRANGEMENT

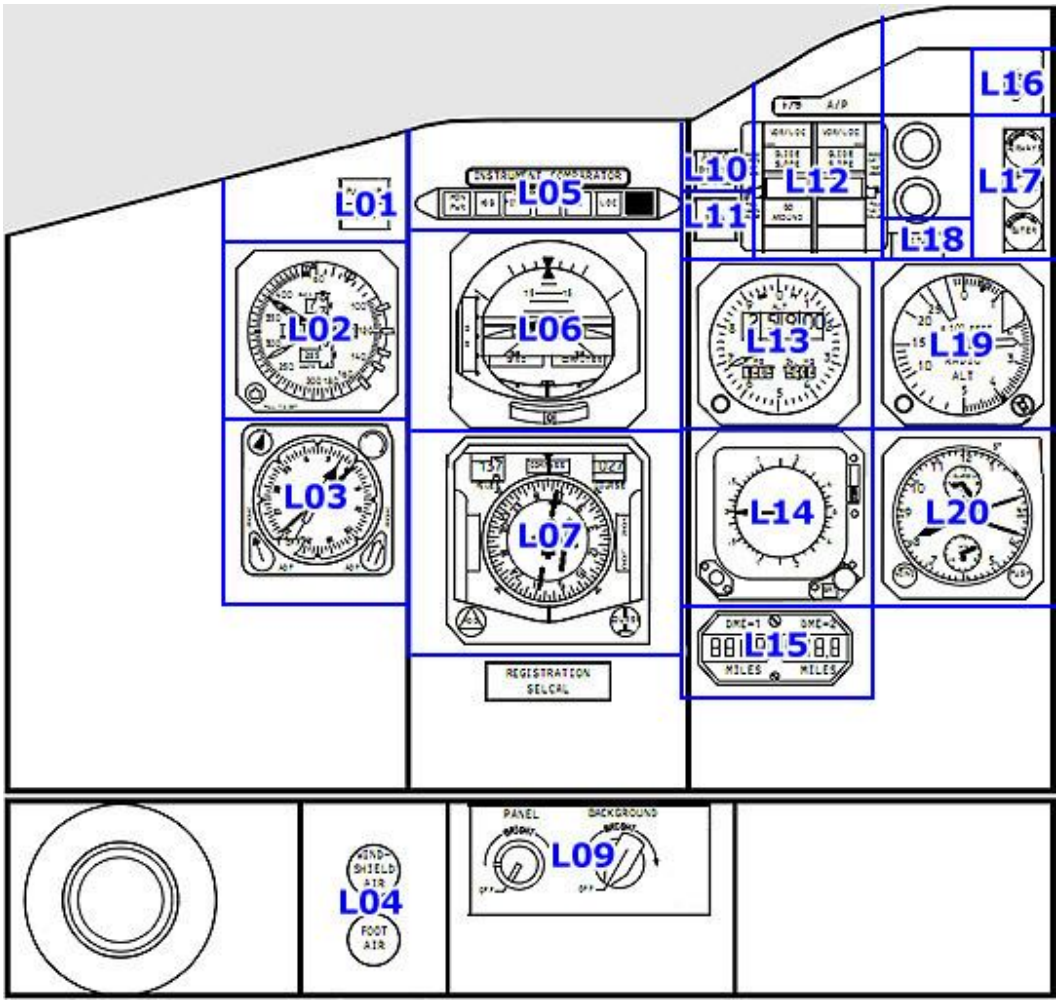




AFT FLIGHT DECK OVERVIEW

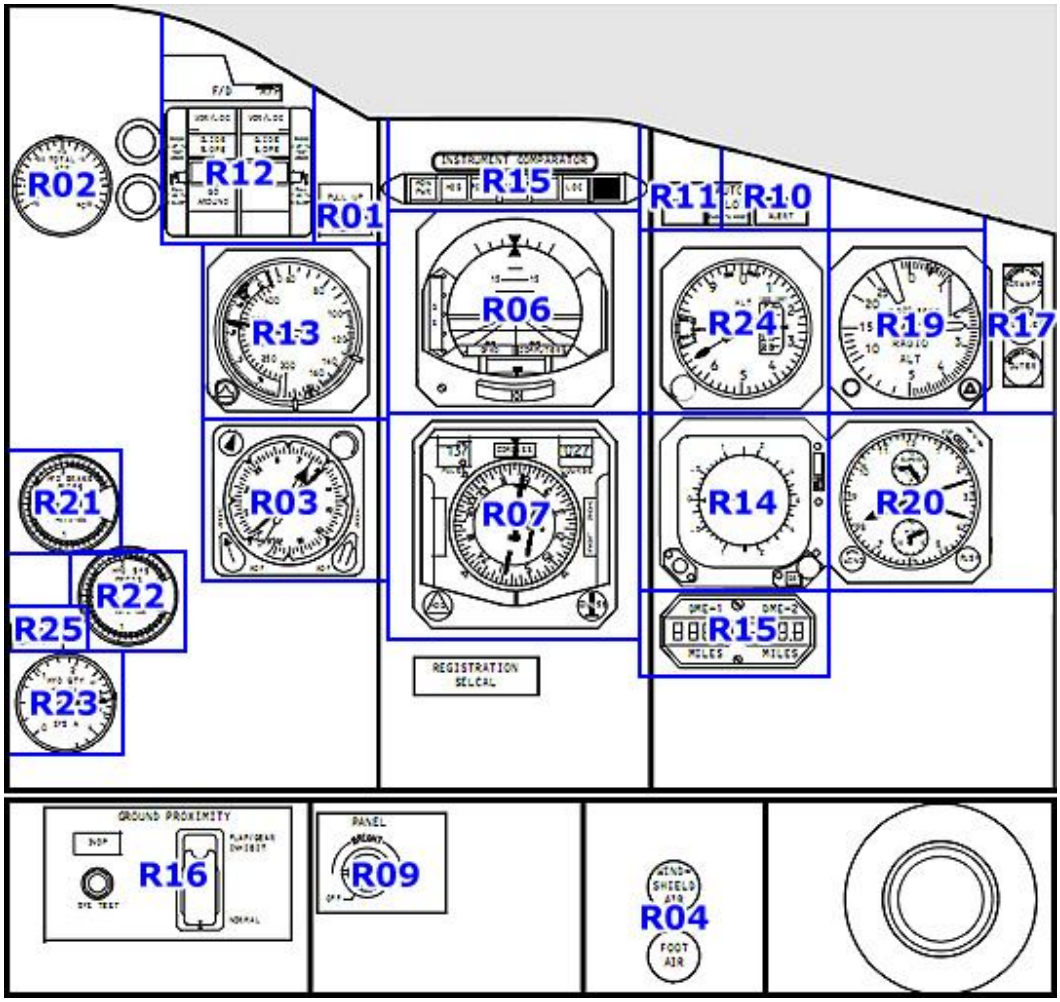


CAPTAIN'S INSTRUMENT PANEL



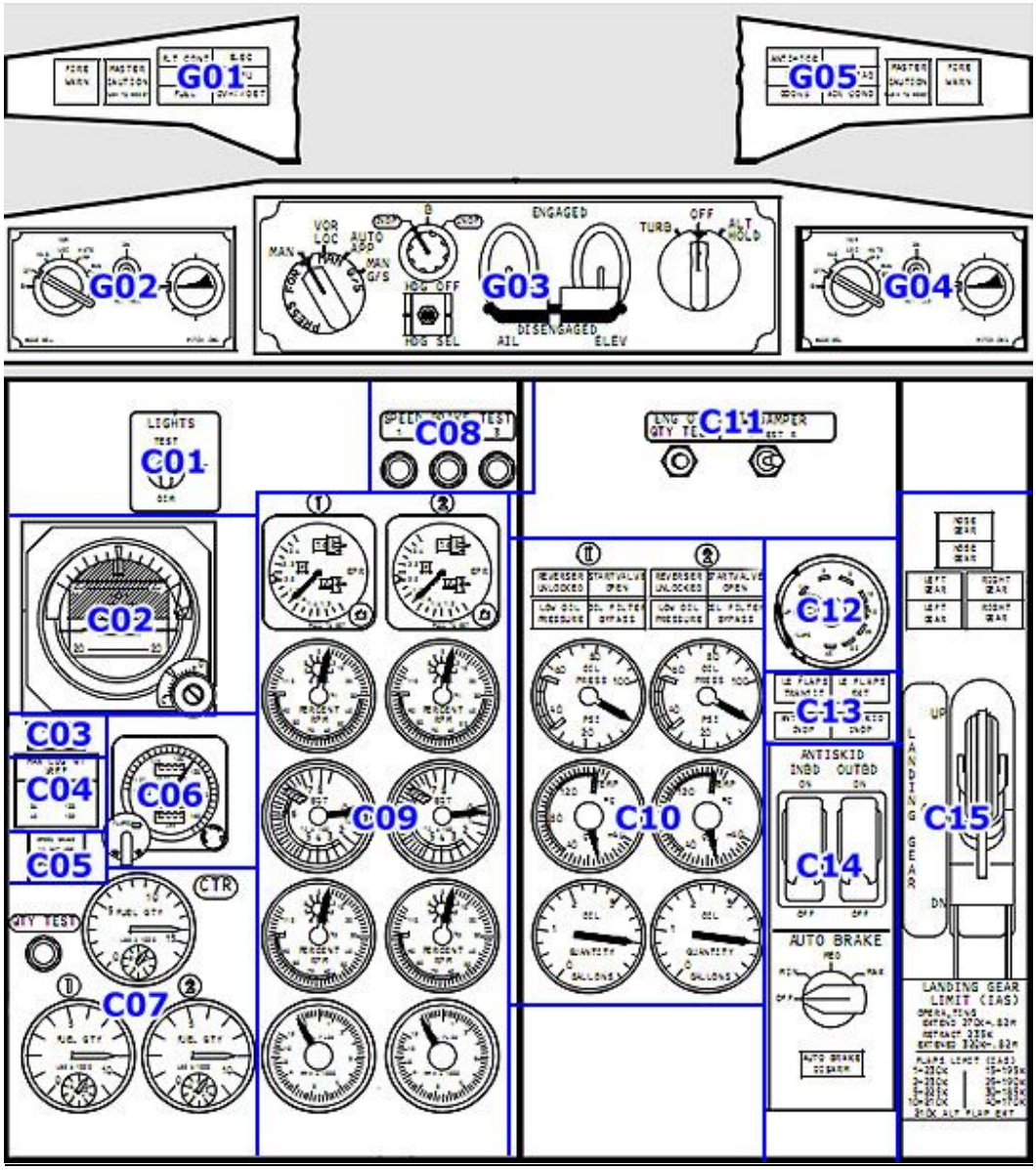
L01, R01. PULL UP WARNING LIGHT/ BELOW GLIDE SLOPE ALERT LIGHT
L02. ELECTRIC MACH/AIRSPEED INDICATOR
L03, R03. RADIO MAGNETIC INDICATOR (RMI)
L04, R04. WINDSHIELD/FOOT AIR CONTROLS
L05, R05. INSTRUMENT COMPARATOR
L06, R06. ATTITUDE DIRECTOR INDICATOR (ADI)
L07, R07. HORIZONTAL SITUATION INDICATOR (HSI)
L09. LIGHTS CONTROL PANEL
L10, R10. AUTOPILOT DISENGAGE LIGHT (RED)
L11, R11. MINIMUM DESCENT ALTITUDE (MDA) LIGHT
L12, R12. APPROACH PROGRESS DISPLAY
L13. ELECTRIC ALTIMETER
L14, R14. VERTICAL SPEED INDICATOR
L15, R15. DIGITAL DME INDICATOR
L16. GPS/NAV SWITCH
L17, R17. MARKER BEACON LIGHTS
L18, R18. ALTITUDE ALERT LIGHT
L19, R19. RADIO ALTIMETER
L20, R20. CLOCK

FIRST OFFICER'S INSTRUMENT PANEL



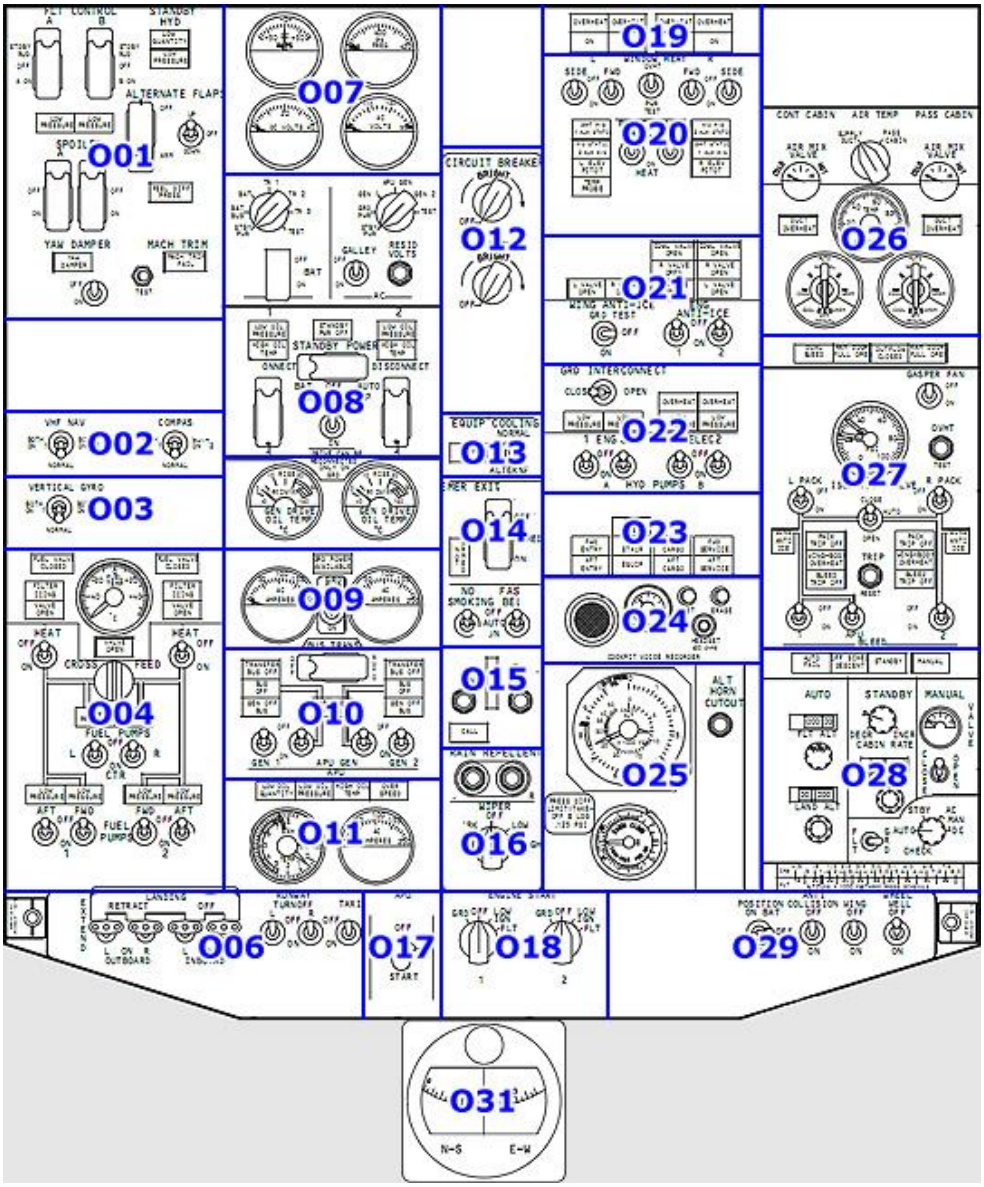
R09. PANEL LIGHT CONTROL
R13. PNEUMATIC MACH/AIRSPEED INDICATOR
R21. HYDRAULIC BRAKE PRESSURE INDICATOR
R22, R23, R25. HYDRAULIC INDICATIONS
R24. PNEUMATIC ALTIMETER

CENTER INSTRUMENT PANEL AND LIGHTSHIELD



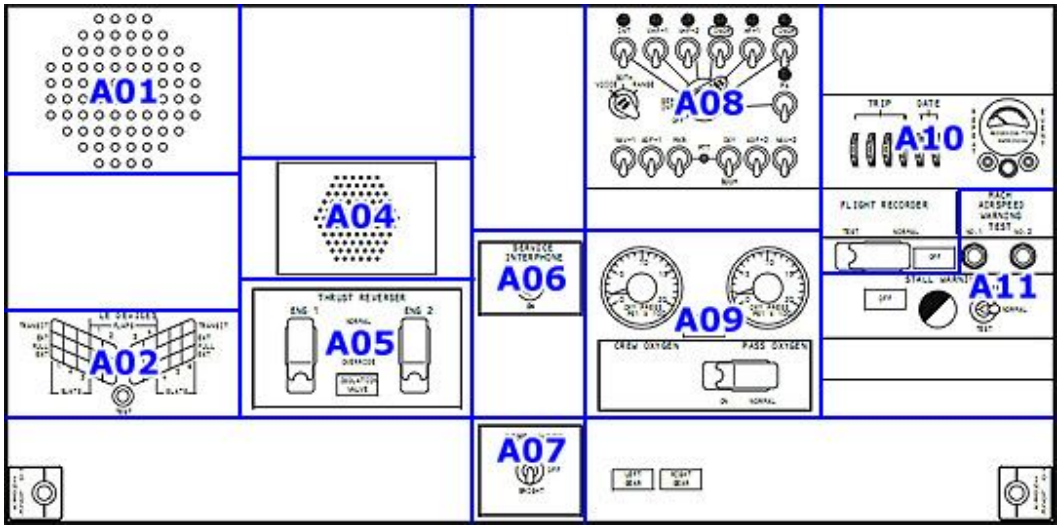
G01, G05. FIRE WARNING AND MASTER CAUTION SYSTEM
G02, G04. FLIGHT DIRECTOR
G03. AUTOPILOT PANEL
C01. MASTER LIGHTS TEST
C02. STANDBY HORIZON
C03. STABILIZER OUT OF TRIM LIGHT (AMBER)
C04. FLAPS LIMIT PLACARD
C05. SPEED BRAKE LIGHTS
C06. TOTAL FUEL AND VREF INDICATOR
C07. FUEL QUANTITY INDICATIONS
C08. SPEED BRAKE TEST SWITCHES
C09. ENGINE INSTRUMENTS PRIMARY PANEL
C10. ENGINE INSTRUMENTS SECONDARY PANEL
C11. ENGINE OIL QUANTITY TEST SWITCH
C12. FLAP POSITION INDICATOR
C13. LEADING EDGE FLAPS LIGHTS
C14. AUTOBRAKE AND ANTISKID CONTROLS
C15. LANDING GEAR PANEL

FORWARD OVERHEAD PANEL



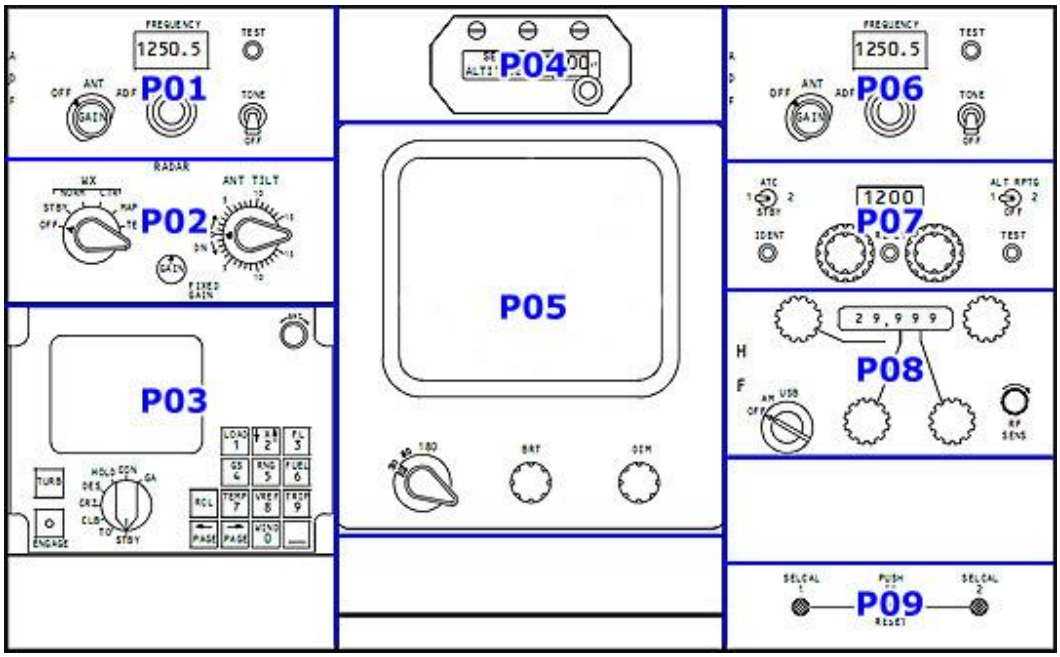
O01. FLIGHT CONTROL PANEL
O02. VHF NAV TRANSFER SWITCH
O03. VERTICAL GYRO TRANSFER SWITCH
O04. FUEL CONTROL PANEL
O06. LANDING, RUNWAY TURNOFF AND TAXI LIGHTS
O07. AC AND DC METERING PANEL
O08. GENERATOR DRIVE AND STANDBY POWER PANEL
O09. GROUND POWER AND GEN AMMETERS PANEL
O10. BUS SWITCHING
O11. APU
O12. OVERHEAD/CIRCUIT BREAKER PANEL LIGHT CONTROLS
O13. EQUIPMENT COOLING PANEL
O14. FLIGHT DECK EMERGENCY LIGHTING AND PASSENGER SIGNS
O15. CALL SYSTEM
O16. WINDSHIELD WIPER PANEL
O18. ENGINE START SWITCHES
O19. WINDOW HEAT PANEL
O20. PITOT STATIC HEAT PANEL
O21. WINGS/ENGINE ANTI-ICE PANEL
O22. HYDRAULIC PANEL
O23. EXTERIOR DOOR ANNUNCIATOR LIGHTS
O24. COCKPIT VOICE RECORDER
O25. CABIN ALTITUDE PANEL
O26. AIR CONDITIONING CONTROLS AND INDICATORS
O27. BLEED AIR CONTROLS AND INDICATORS
O28. CABIN PRESSURIZATION PANEL
O29. MISCELLANEOUS EXTERIOR LIGHTS
O31. STANDBY MAGNETIC COMPASS

AFT OVERHEAD PANEL



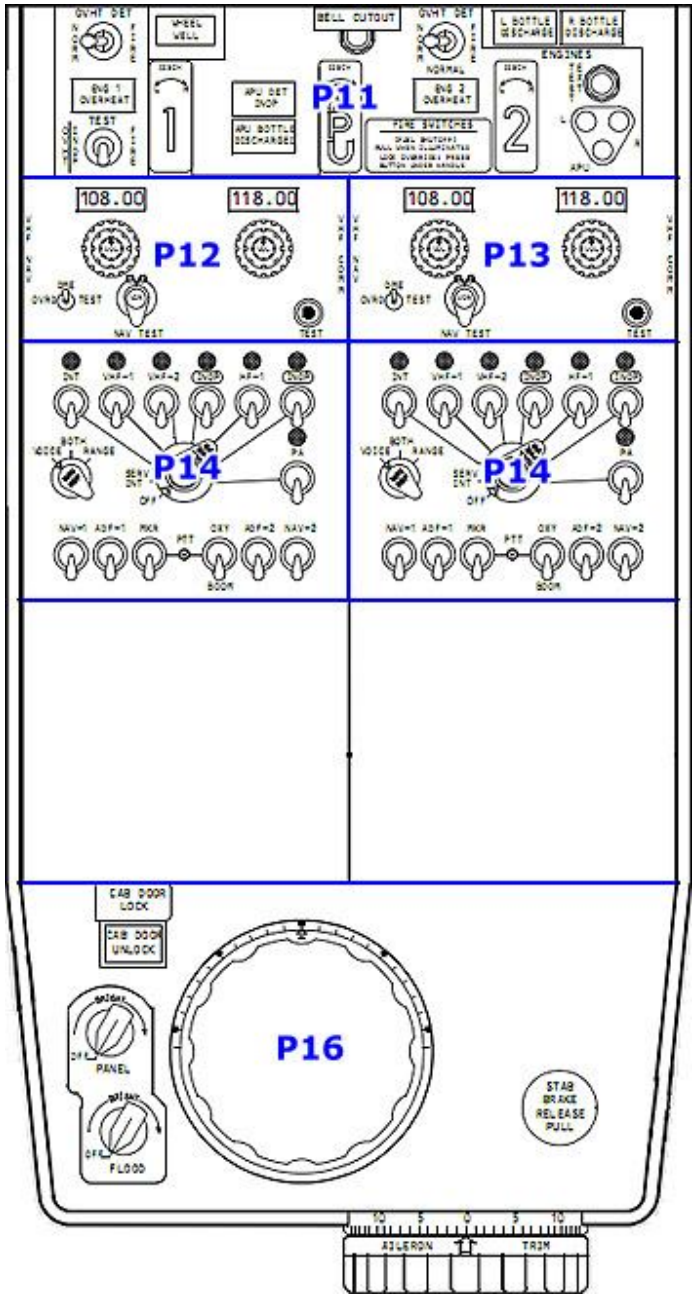
A01. ALTITUDE ALERT – SPEAKER
A02. LEADING EDGE DEVICES (LE DEVICES) ANNUNCIATOR PANEL
A04. SPEAKER
A05. THRUST REVERSER OVERRIDE SWITCHES
A07. DOME LIGHT CONTROL
A08. AUDIO SELECTOR PANEL (ASP)
A09. OXYGEN CONTROLS AND INDICATORS
A10. FLIGHT RECORDER
A11. MACH/AIRSPEED WARNING AND STALL WARNING TEST SWITCHES

FORWARD ELECTRONIC PANEL



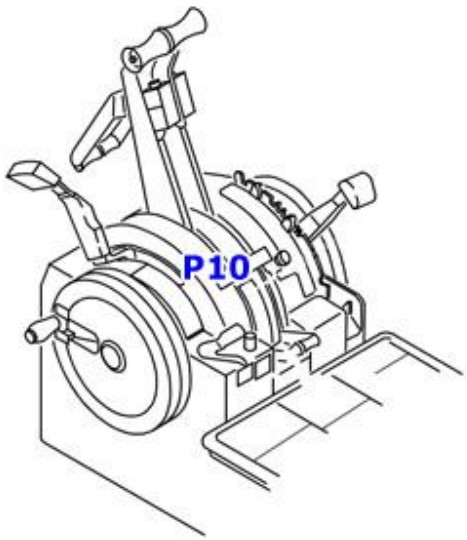
P01.P06. AUTOMATIC DIRECTION FINDING (ADF) CONTROL
P02. WEATHER RADAR CONTROL PANEL
P03. PDCS CONTROL DISPLAY UNIT (CDU)
P04. ALTITUDE ALERT CONTROLLER
P05. WEATHER RADAR PANEL
P07. TRANSPONDER PANEL
P08. HF COMMUNICATION PANEL
P09. SELCAL PANEL

AFT ELECTRONIC PANEL

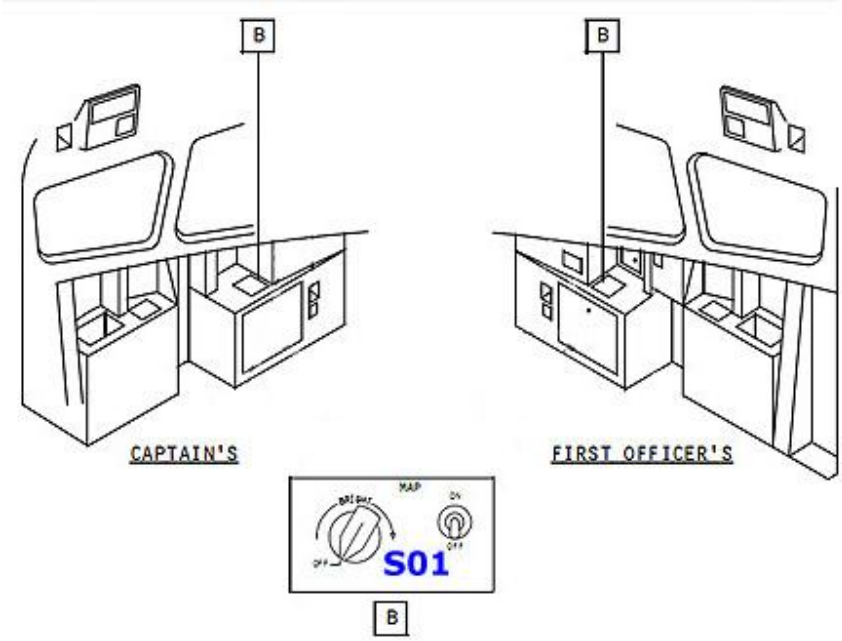


P11. OVERHEAT/FIRE PROTECTION PANEL SWITCHES/LIGHTS
P12, P13. VHF NAVIGATION CONTROL/VHF COMMUNICATION PANEL
P14, P15. AUDIO SELECTOR PANEL (ASP)
P16. CABIN DOOR

CONTROL STAND



AUXILIARY PANELS



S01. MAP LIGHT CONTROLS

LIGHTING

SYSTEM DESCRIPTION

Lighting systems described include:
- exterior lighting
- flight deck lighting

EXTERIOR LIGHTING

Exterior lighting consists of these lights:
- landing
- runway turnoff
- taxi
- position (navigation)
- anti-collision
- wing illumination
- wheel well

OUTBOARD LANDING LIGHTS

Outboard landing lights are installed in the outboard flap track fairings. The lights are designed to extend and shine forward, parallel to the waterline of the airplane.The lights may be extended at any speed.

INBOARD LANDING LIGHTS

Two inboard landing lights are in the wing leading edge. The lights shine forward and down in a fixed position.

RUNWAY TURNOFF LIGHTS

Runway turnoff lights are in each wing root. The lights illuminate the area in front of the main gear.

TAXI LIGHTS

The taxi light is mounted on the nose wheel strut and points in the same direction as the nose wheel. The light will not extinguish automatically when the nose gear is retracted. For increased service life of the taxi light, it is recommended that the taxi light not be used for takeoffs or landings.

POSITION LIGHTS

The navigation lights are the standard red (left forward wingtip), green (right forward wingtip), and white (aft tip of both wings) position lights.

ANTI-COLLISION LIGHTS

Two red anti-collision strobe lights are located on the top and bottom of the fuselage.

WING ILLUMINATION LIGHTS

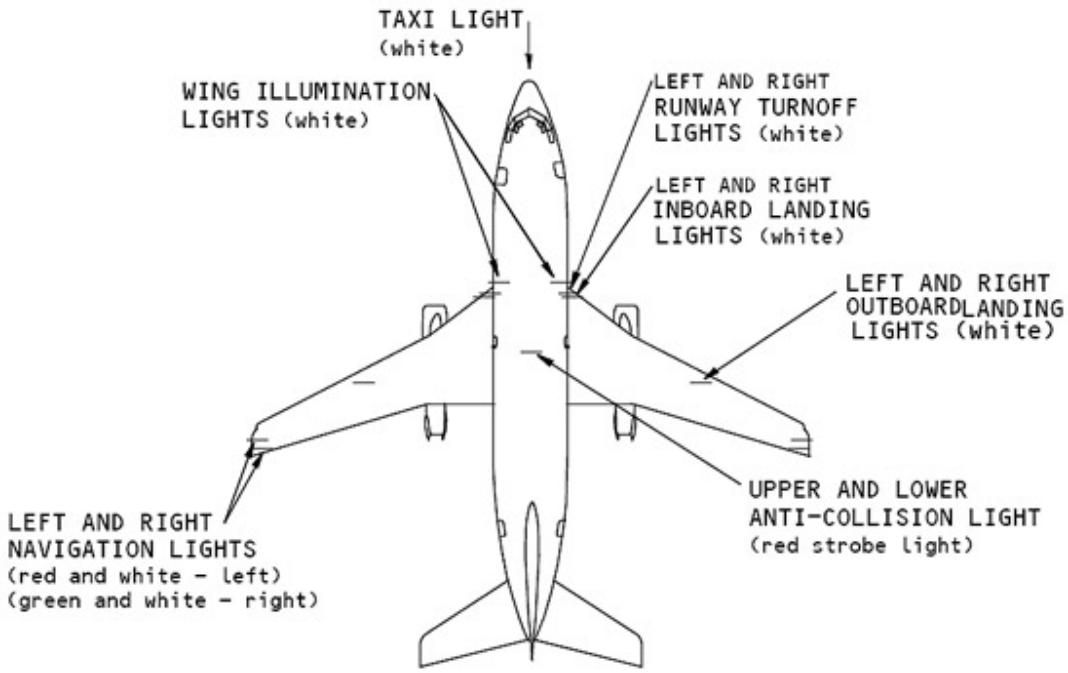
Wing lights are installed on the fuselage and illuminate the leading edge of the wing.

WHEEL WELL LIGHTS

Lights are installed in the wheel well of the nose gear and each main gear.

DO NOT USE FOR FLIGHT

EXTERIOR LIGHTING LOCATIONS

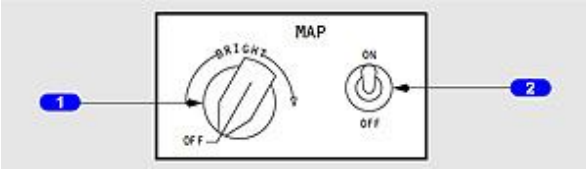


FLIGHT DECK LIGHTING

White dome lights provide general flight deck flood lighting. The Captain's and First Officer's instruments are illuminated by white flood lights under the light shield and by integral white lights in the panels. Overhead, map and circuit breaker panel lights and standby magnetic compass controls compass are controlled by individual switches.

CONTROLS AND INDICATORS

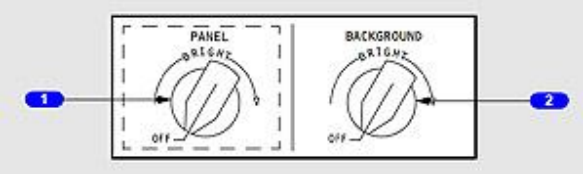
S01. MAP LIGHT CONTROLS



1.Map Light Control
2.Map Light Switch

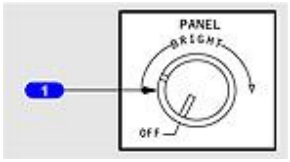
PANEL AND BACKGROUND LIGHTING

L09. LIGHTS CONTROL PANEL



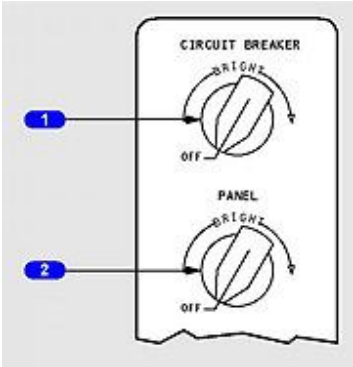
1. Captain and Center panels instruments backlight Control
2. Shift+L Light Control (Aux)

R09. PANEL LIGHT CONTROL



1. First officer panel instruments backlight Control

O12. OVERHEAD/CIRCUIT BREAKER PANEL LIGHT CONTROLS

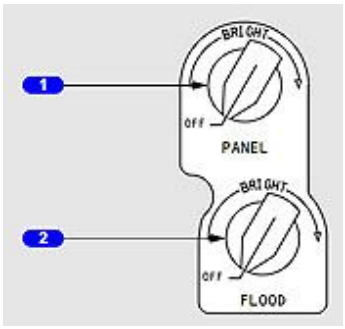


1. Circuit Breaker instruments backlight Control

2. Overhead Panel and and standby magnetic compass controls compass instruments backlight Control

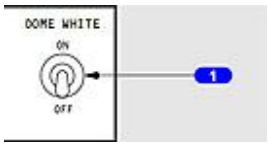
FLOOD AND AFT ELECTRONIC PANEL LIGHTS CONTROLS

P16. FLOOD LIGHT CONTROLS



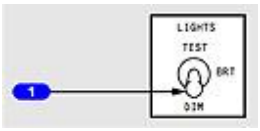
2. Captain's Flood Light Control
3. First Officer's Flood Light Control

A07. DOME LIGHT CONTROL



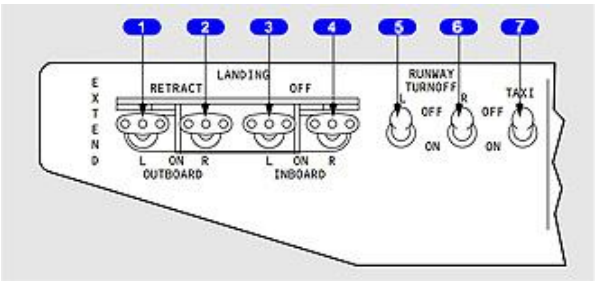
1. White Dome Light Control

C01. MASTER LIGHTS TEST SWITCH



1. Master Lights Test Switch

O06. LANDING, RUNWAY TURNOFF AND TAXI LIGHTS



1,2. Outboard Landing Light Switch (3-Position)
3,4. Inboard Landing Light Switch
5,6. Runway Turnoff Light Switch
7. Taxi Light Switch

1,2. OUTBOARD LANDING Light Switch (3-position)

RETRACT - outboard landing lights are retracted and extinguished EXTEND - outboard landing lights are extended and extinguished ON - outboard landing lights are extended and illuminated.

3,4. INBOARD LANDING Light Switch

OFF - inboard landing lights are extinguished ON - inboard landing lights are illuminated.

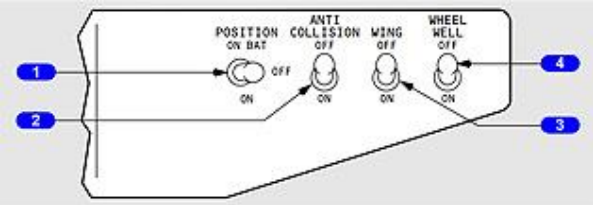
5,6. RUNWAY TURNOFF Light Switch

OFF - runway turnoff lights located in leading edge of wing root are extinguished. ON - runway turnoff lights are illuminated.

7. TAXI Light Switch

OFF - nose wheel taxi light extinguished. ON - nose wheel taxi light illuminated.

O29. MISCELLANEOUS EXTERIOR LIGHTS



1. Position Light Switch
2. Anti-Collision Light Switch
3. Wing Illumination Switch
4. Wheel Well Light Switch

1. POSITION Light Switch

ON BAT - illuminates the red and green wingtip position lights, the white trailing edge wingtip lights from the battery bus if no other power is available. Battery Switch must be positioned to ON.
OFF - position lights extinguished.
ON - illuminates the red and green wingtip position lights and the white trailing edge wingtip lights.

2. ANTI-COLLISION Light Switch

OFF - red high intensity strobe lights extinguished.
ON - red high intensity strobe lights on upper and lower fuselage illuminated.

3. WING Illumination Switch

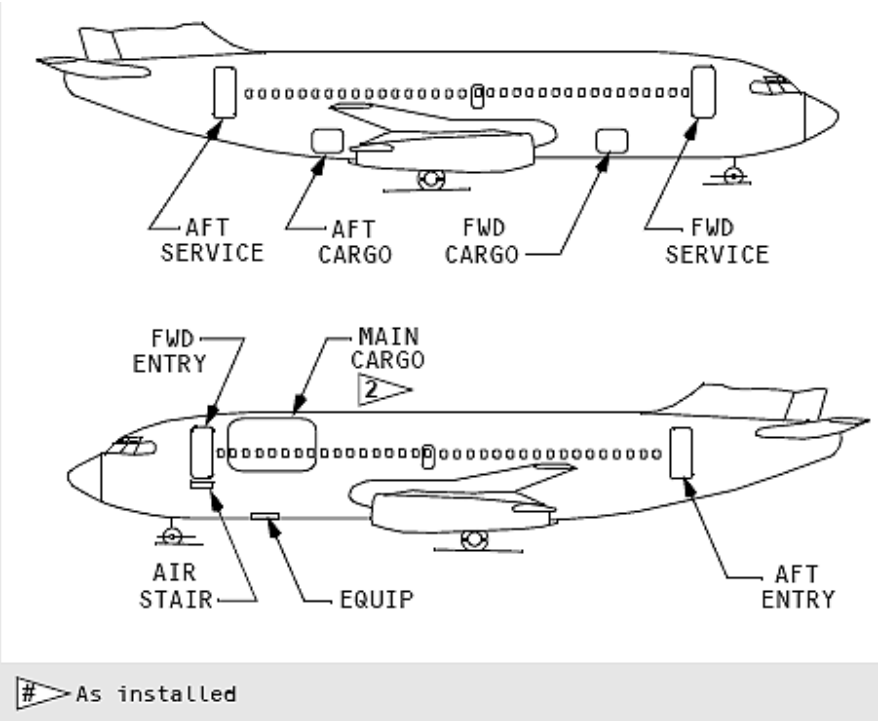
OFF - wing leading edge lights extinguished.
ON - wing leading edge lights on fuselage forward of wing illuminated.

4. WHEEL WELL Light Switch

OFF - three wheel well lights extinguished.
ON - wheel well lights illuminated for checking landing gear down and locked stripes.

DOORS AND WINDOWS

SYSTEM DESCRIPTION



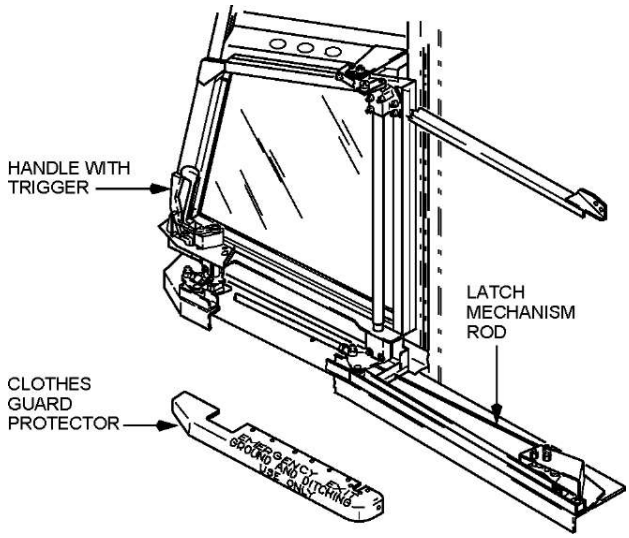
The airplane has two passenger entry doors, one cabin door (the flight deck/passenger cabin entry), and two cargo doors. It also has one center electrical and electronic (E/E) equipment access door on the bottom of the airplane.

The flight deck number two windows, one on the left and one on the right, can be opened by the flight crew.

FLIGHT DECK NUMBER TWO WINDOWS

The flight deck number two windows can be opened on the ground or in flight and can be used for emergency evacuation. To open the window, turn the handle back and inboard. After the window moves inboard, move it back until it locks in the open position.

To close the window move the window forward until the handle can be turned forward and outboard.



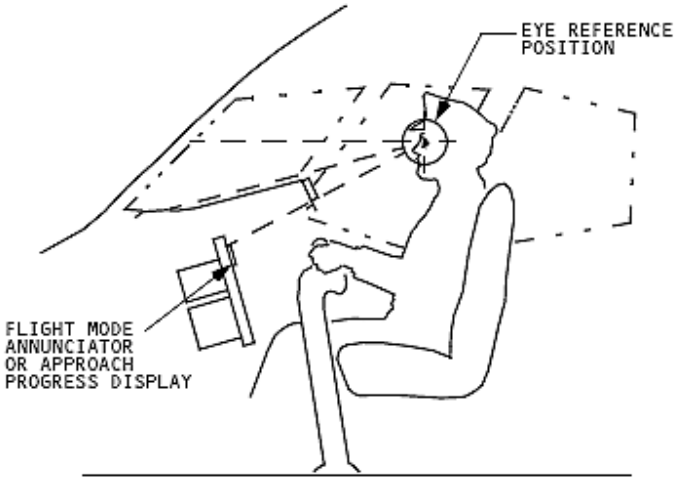
FLIGHT COMPARTMENT WINDOW NO. 2 (RIGHT SIDE SHOWN)

PILOT SEAT ADJUSTMENT

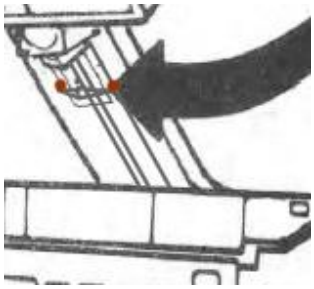
Adjust the seat position with the appropriate controls to obtain the optimum eye reference position. Use the handhold above the forward window to assist.

The correct eye reference position is established when:

- The topmost flight mode annunciators or approach progress displays are just in view below the glareshield
- A slight amount of the aircraft nose structure is visible above the forward lower window sill.



PILOTS' EYE LOCATOR



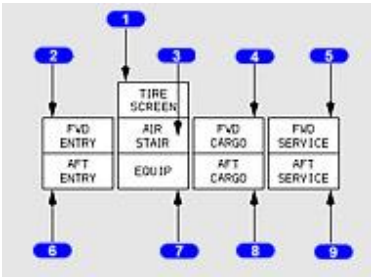
To assist the pilot in obtaining the optimum eye position for panel scan and runway visibility, an eye locator is installed on the center windshield post.

For the optimum eye position the three spheres should be lined up.

CONTROLS AND INDICATORS

To operate the doors use Animation Control Panel.

O23. EXTERIOR DOOR ANNUNCIATOR LIGHTS



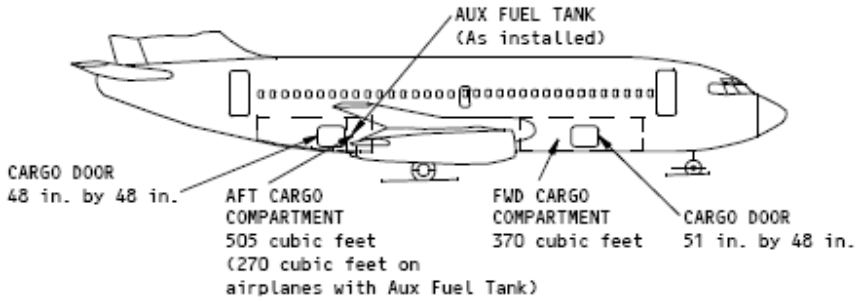
2-9. Door Annunciations

Illuminated (amber) - related door is unlocked.

LOWER CARGO COMPARTMENTS

The lower cargo compartments, if equipped with smoke and fire detectors and with a built-in fire extinguisher system controlled from the flight deck, satisfy the requirements for Class C compartments.

There are two cargo compartment doors on the lower right side of the fuselage. Both are plug type, inward opening pressure doors, hinged at their upper edges and operated manually from either inside or outside the airplane. Except for slight difference in shape, both doors are similar in design and operation. The door is locked closed by four latches.



TOTAL CARGO COMPARTMENT VOLUME 875 CUBIC FEET
(640 cubic feet on airplanes with Aux Fuel Tank)

To operate the cargo doors use Animation Control Panel.

EMERGENCY EQUIPMENT

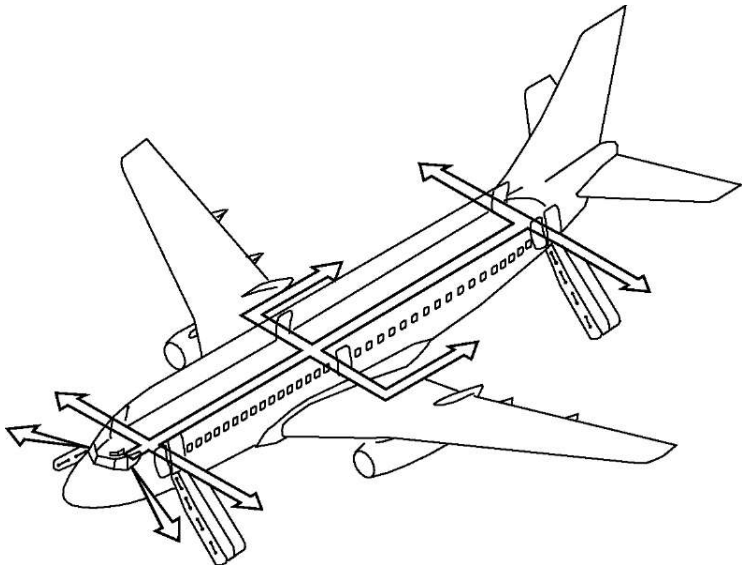
EMERGENCY ESCAPE

Emergency escape information included in this chapter includes:

- Emergency evacuation routes
- Flight deck windows
- Escape slides
- Escape hatches.

EMERGENCY EVACUATION ROUTES

Emergency evacuation may be accomplished through four entry/service doors and two overwing escape hatches. Flight deck crew members may evacuate the airplane through two sliding flight deck windows.

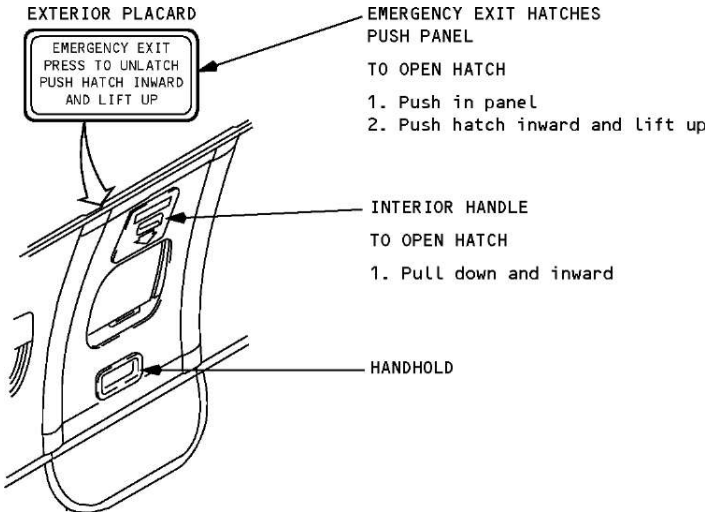


FLIGHT DECK NUMBER TWO WINDOWS

Flight deck sliding windows are opened by squeezing the lock release in the handle, rotating the handle inward, and sliding the window aft until it locks. Window unlocking can also be accomplished using an exterior handle: For passenger airplanes, at the First Officer's window only; for cargo airplanes, at both windows.

OVERWING ESCAPE HATCHES

Two escape hatches are located in the passenger cabin over the wings. These are plug type hatches and are held in place by mechanical locks and airplane cabin pressure. The hatches can be opened from the inside or from outside of the airplane by a spring-loaded handle at the top of the hatch.
A seat back blocking an exit may be pushed forward by applying force to the top of the seat back. For safety reasons, hatches should not be removed in flight.



To operate the OVERWING ESCAPE HATCHES use Animation Control Panel.

WARNING: Do not remove hatches in flight in preparation for passenger evacuation. For emergency evacuation on the ground or in water, remove hatch and place so as not to obstruct egress. The hatch may be thrown out onto the wing.

GALLEYS

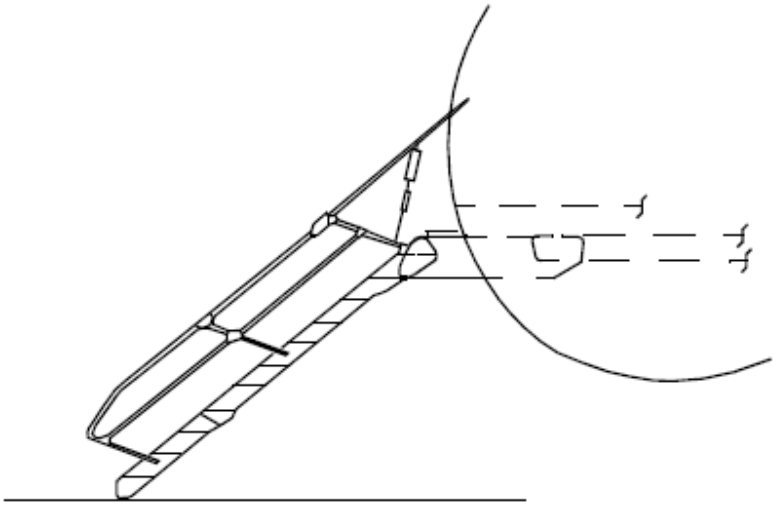
Galleys are located in the passenger cabin to provide convenient and rapid service to the passengers. Generally, they are installed in the cabin adjacent to the forward and aft galley service doors.

In general the equipment of the galley unit consists of the following main items:

- High speed ovens
- Hot beverage containers
- Hot cup receptacles
- Refrigeration and main storage compartments.

AIRSTAIRS

The forward airstair provides the capability of boarding passengers without relying on the availability of airport ground equipment. The airstair is electrically operated and may be controlled from either inside or outside the airplane. The airstair is stowed in a compartment just below the forward entry door. The compartment has a pressure door that automatically opens before the airstair will operate. For passenger safety, upper handrails are attached to support brackets inside the entry door after the airstair is fully extended.



To operate the FORWARD AIR STAIRS use Animation Control Panel.

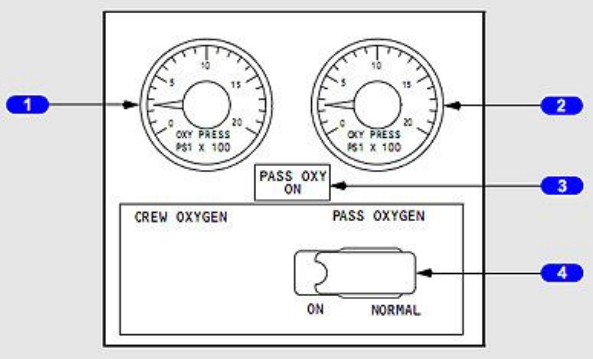
OXYGEN SYSTEMS

SYSTEM DESCRIPTION

Two independent oxygen systems are provided, one for the flight crew and one for the passengers. Portable oxygen cylinders are located throughout the airplane for emergency use.

CONTROLS AND INDICATORS

A09. OXYGEN CONTROLS AND INDICATORS

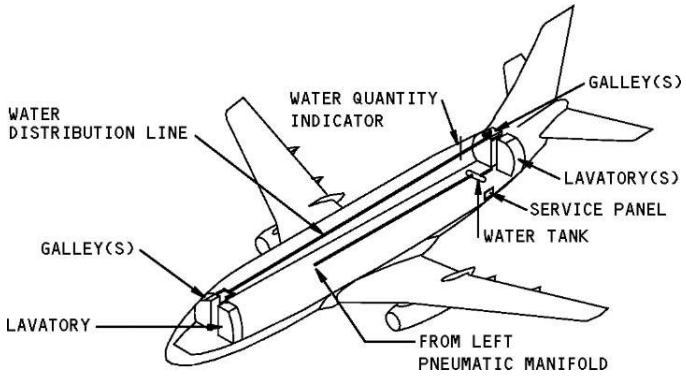


1. Flight Crew Oxygen Pressure Indicator
2. Passenger Oxygen Pressure Indicator
3. Passenger Oxygen On Light
4. Passenger Oxygen Switch

WATER SYSTEM

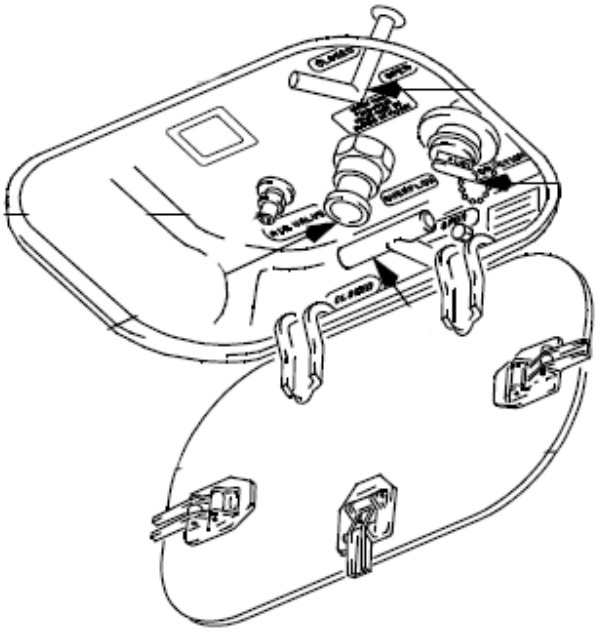
SYSTEM DESCRIPTION

The potable airplane water system is supplied from a single tank located behind the aft cargo compartment. Fresh water is supplied to the galleys and lavatory sinks.



CONTROLS

To operate the WATER SYSTEM use Animation Control Panel.



AIR SYSTEM

BLEED AIR SYSTEM DESCRIPTION

Air for the bleed air system can be supplied by the engines, APU, or an external air cart/source. The APU or external cart supplies air to the bleed air duct prior to engine start. After engine start, air for the bleed air system is normally supplied by the engines.

The following systems rely on the bleed air system for operation:

- Air conditioning/pressurization
- Wing and engine thermal anti-icing
- Engine starting
- Hydraulic reservoirs pressurization
- Water tank pressurization

Switches on the air conditioning panel operate the APU and engine bleed air supply system.

AIR CONDITIONING SYSTEM DESCRIPTION

Conditioned air for the cabin comes from either the airplane air conditioning system or a preconditioned ground source. Air from the preconditioned ground source enters the air conditioning system through the mixing and distribution manifold to the cabin distribution ducts.

The air conditioning system provides temperature controlled air by processing bleed air from the engines, APU, or a ground air source in air conditioning packs. This temperature controlled air is distributed to the cockpit and passenger cabin.

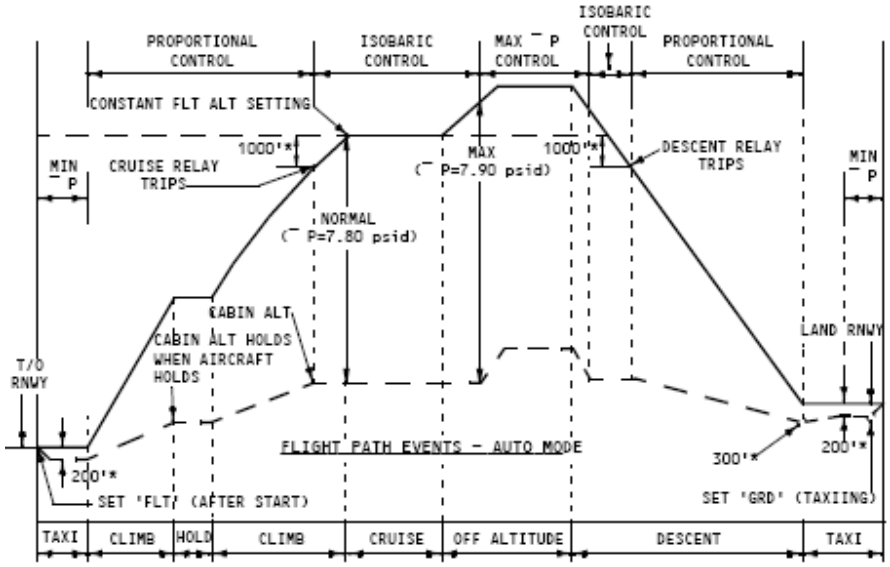
Conditioned air from the left pack flows directly to the flight deck. Excess air from the left pack and the air from the right pack are mixed in a common manifold. The mixed air is then distributed by the sidewall risers to the passenger cabin.

PRESSURIZATION SYSTEM DESCRIPTION

Cabin pressurization is controlled during all phases of airplane operation by the cabin pressure control system (CPCS). The CPCS includes one automatic controller and one standby controller available by selecting AUTO or STBY, and two manual (MAN) pilot-controlled modes.

The system uses bleed air supplied to and distributed by the air conditioning system. Pressurization and ventilation are controlled by modulating the outflow valves.

FLIGHT PATH EVENTS - AUTO MODE

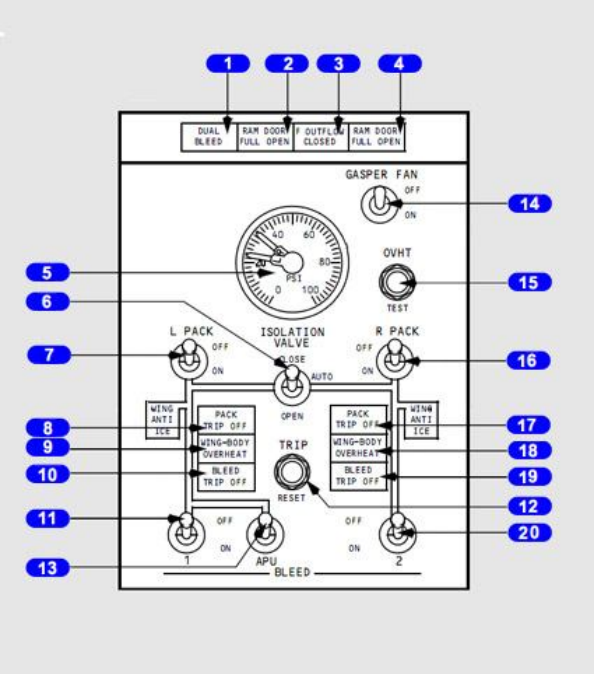


CABIN ALTITUDE VS. AIRPLANE ALTITUDE

* The controller senses only psi. References to altitudes are approximations and vary according to density altitude. As the density of the air decreases, the greater the change in altitude for a given psi.

CONTROLS AND INDICATORS

O27. BLEED AIR CONTROLS AND INDICATORS



1. Dual Bleed Light
2,4. RAM Door Full Open Light
3. Out Flow Closed Light
5. Bleed Air Duct Pressure Indicator
7,16. Air Conditioning Pack Switch
6. Isolation Valve Switch
8,17. Pack Trip Off Light
9,18. Wing-Body Overheat Light
10,19. Bleed Trip Off Light
12. Trip Reset Switch
11,20. Engine Bleed Air Switches
13. APU Bleed Air Switch
14. Gasper Fan Switch
15. Wing-Body Overheat Test Switch

1. DUAL BLEED Light

Illuminated (amber) -

- Either APU bleed air valve open and engine No. 1 BLEED air valve open, or
- APU bleed air valve open, engine No. 2 BLEED air valve open and ISOLATION VALVE open.

2,4. RAM DOOR FULL OPEN Light

Illuminated (blue) - indicates ram door in full open position.

5. Bleed Air DUCT PRESSURE Indicator

Indicates pressure in L and R (left and right) bleed air ducts.

6. ISOLATION VALVE Switch

CLOSE - closes isolation valve. AUTO -

- closes isolation valve if all engine BLEED air and air conditioning PACK switches ON
- opens isolation valve automatically if either engine BLEED air or air conditioning PACK switch positioned OFF.

OPEN - opens isolation valve.

7,16. Air Conditioning PACK Switch

OFF - pack signalled OFF.
ON - opens pack valve to allow bleed air to enter pack. Valve is electrically controlled, pneumatically operated.

8,17. PACK TRIP OFF Light

Illuminated (amber) -

- indicates pack temperature has exceeded limits
- related pack valve automatically closes and mix valves drive full cold
- requires reset.

9,18. WING-BODY OVERHEAT Light

Illuminated (amber) -
- left light indicates overheat from bleed air duct leak in left inboard wing leading edge, left air conditioning bay, keel beam or APU bleed air duct
- right light indicates overheat from bleed air duct leak in right inboard wing leading edge or right air conditioning bay.

10,19. BLEED TRIP OFF Light

Illuminated (amber) - indicates excessive engine bleed air temperature rela
- ted engine bleed air valve closes automatically
- requires reset.

12. TRIP RESET Switch

PUSH (if fault condition is corrected) -
- resets BLEED TRIP OFF, PACK TRIP OFF and DUCT OVERHEAT lights
- lights remain illuminated until reset.

11,20. Engine BLEED Air Switches

OFF - closes engine bleed air valve. ON - opens engine bleed air valve.

13. APU BLEED Air Switch

OFF - closes APU bleed air valve.
ON - opens APU bleed air valve when APU is operating.

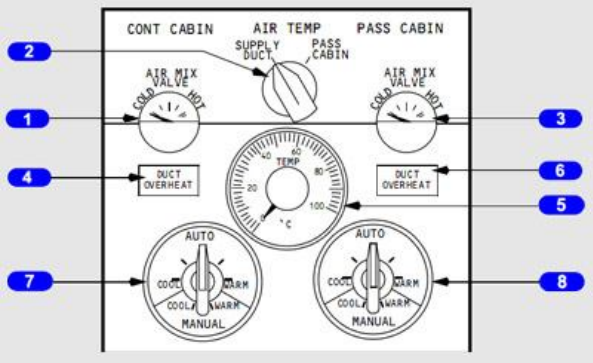
14. GASPER FAN Switch

OFF - gasper fan signalled off.
ON - increases airflow to individual gasper outlets.

15. Wing-Body Overheat (OVHT) TEST Switch

PUSH -
- tests wing-body overheat detector circuits.
- illuminates both WING-BODY OVERHEAT lights.

O26. AIR CONDITIONING CONTROLS AND INDICATORS



1,3. Air Mix Valve Indicator
2. Air Temperature Source Selector
4,6. Duct Overheat Light
5. Air Temperature Indicator
7. Control Cabin Temperature Selector
8. Passenger Cabin Temperature Selector

1,3. AIR MIX VALVE Indicator

Indicates position of air mix valves:
- controlled automatically with related temperature selector in AUTO
- controlled manually with related temperature selector in MANUAL.

2. AIR Temperature (TEMP) Source Selector

SUPPLY DUCT - selects main distribution supply duct sensor for TEMP indicator.
PASS CABIN - selects passenger cabin sensor for TEMP indicator.

4,6. DUCT OVERHEAT Light

Illuminated (amber) -
- bleed air temperature in related duct exceeds limit
- air mix valves drive full cold
- requires reset.

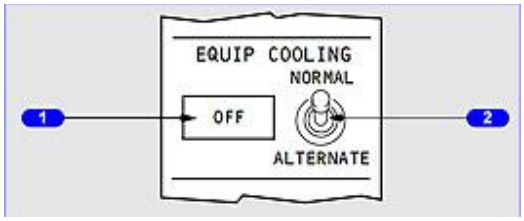
5. Air Temperature (TEMP) Indicator

Indicates temperature at location selected with AIR TEMP source selector.

7,8. Control (CONT) CABIN and Passenger (PASS) CABIN Temperature Selector

AUTO - automatic temperature controller controls passenger cabin or flight deck temperature as selected.
MANUAL - air mix valves controlled manually. Automatic temperature controller bypassed.

O13. EQUIPMENT COOLING PANEL



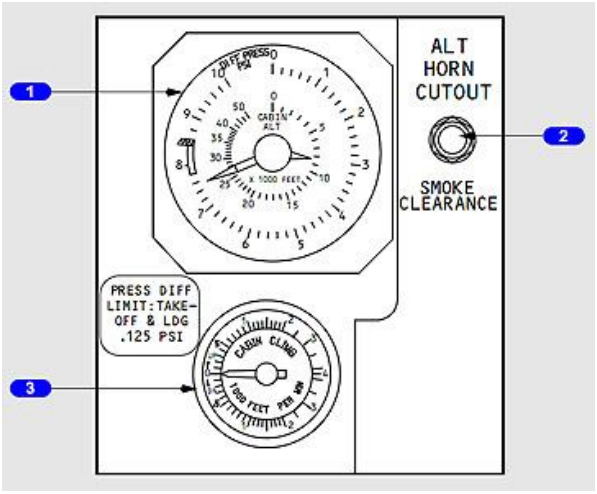
1. Equipment Cooling OFF Light

Illuminated (amber) - no airflow from selected cooling fan.

2. Equipment (EQUIP) COOLING Switch

NORMAL - normal cooling fan activated. ALTERNATE - alternate cooling fan activated.

O25. CABIN ALTITUDE PANEL



1. CABIN Altitude (ALT)/Differential Pressure (DIFF PRESS) Indicator

Inner Scale - indicates cabin altitude in feet.
Outer Scale - indicates the difference between cabin pressure and ambient pressure in psi.

2. Altitude (ALT) HORN CUTOUT Switch

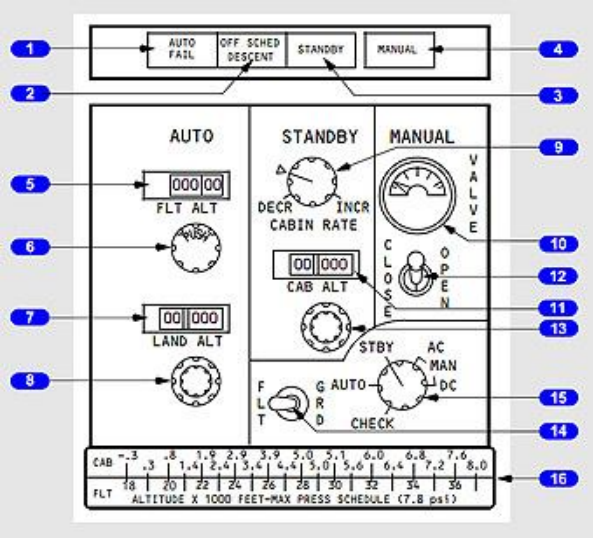
PUSH -

- cuts out intermittent cabin altitude warning horn.
- altitude warning horn sounds when cabin reaches 10,000 feet altitude.

3. CABIN Rate of CLIMB Indicator

Indicates cabin rate of climb or descent in feet per minute.

O28. CABIN PRESSURIZATION PANEL



1. AUTO FAIL Light
2. Off Schedule Descent Light
3. Standby Light
4. Manual Light
5. Flight Altitude Indicator
6. Flight Altitude Selector
7. Landing Altitude Indicator
8. Landing Altitude Selector
9. Cabin Rate Selector
10. Outflow Valve Position Indicator
11. Cabin Altitude Indicator
12. Outflow Valve Switch (Spring-Loaded To Center)
13. Cabin Altitude Selector
14. Flight/Ground Switch
15. Pressurization Mode Selector
16. Cabin/Flight Altitude Placard

1. AUTO FAIL Light

Illuminated (amber) - automatic pressurization control failure. Control automatically transfers to the standby mode.

2. OFF Schedule (SCHED) DESCENT Light

Illuminated (amber) - airplane descended before reaching the planned cruise altitude set in the FLT ALT indicator.

3. Manual Light

Illuminated (green) - pressurization system operating in the manual mode. STANDBY Light
Illuminated (green) - pressurization system operating in the standby mode.

5. Flight Altitude (FLT ALT) Indicator

- indicates selected cruise altitude.
- set before takeoff.

6. Flight Altitude Selector

Push/Rotate to set planned cruise altitude.

7. Landing Altitude (LAND ALT) Indicator

- indicates altitude of intended landing field.
- set before takeoff.

8. Landing Altitude Selector

Rotate to select planned landing field altitude.
- large diameter control sets 1000 foot increments and negative elevations.
- small diameter control sets 10 foot increments.

9. Cabin Rate Selector

- DECR - cabin altitude rate of change equals 50 ft/min.
- INCR - cabin altitude rate of change equals 2000 ft/min.
- Index - cabin altitude rate of change equals 300 ft/min.

10. Outflow VALVE Position Indicator

- indicates position of outflow valve.
- operates in all modes.

Note: Indicator moves to the full left position when no AC power is available.

11. Cabin Altitude (CAB ALT) Indicator

- Indicates selected cabin altitude.
- Set before takeoff.

12. Outflow Valve Switch (spring-loaded to center)

CLOSE - closes main cabin outflow valve electrically with pressurization mode selector in MAN position.
OPEN - opens main cabin outflow valve electrically with pressurization mode selector in MAN position.

13. Cabin Altitude Selector

Rotate to select desired cabin altitude.
- large diameter control sets 1000 foot increments and negative elevations.
- small diameter control sets 10 foot increments.

14. Flight /Ground Switch

AUTO mode -
- GND - on the ground, drives the pressurization outflow valve full open at a controlled rate and depressurizes the airplane. After takeoff, inhibited; functions the same as FLT position
- FLT - on the ground, pressurizes the cabin to approximately 200ft. below airport elevation. After takeoff, cabin pressure is automatically controlled in climb and descent as a function of airplane altitude. In cruise, cabin pressure is held constant.

STANDBY mode -
- GND - on the ground, drives the main outflow valve full open. After takeoff, inhibited; functions the same as FLT position
- FLT - pressurizes the airplane by driving the main outflow valve to attempt to pressurize the cabin to the selected CAB ALT (normally set 200ft. below takeoff field elevation).

15. Pressurization Mode Selector

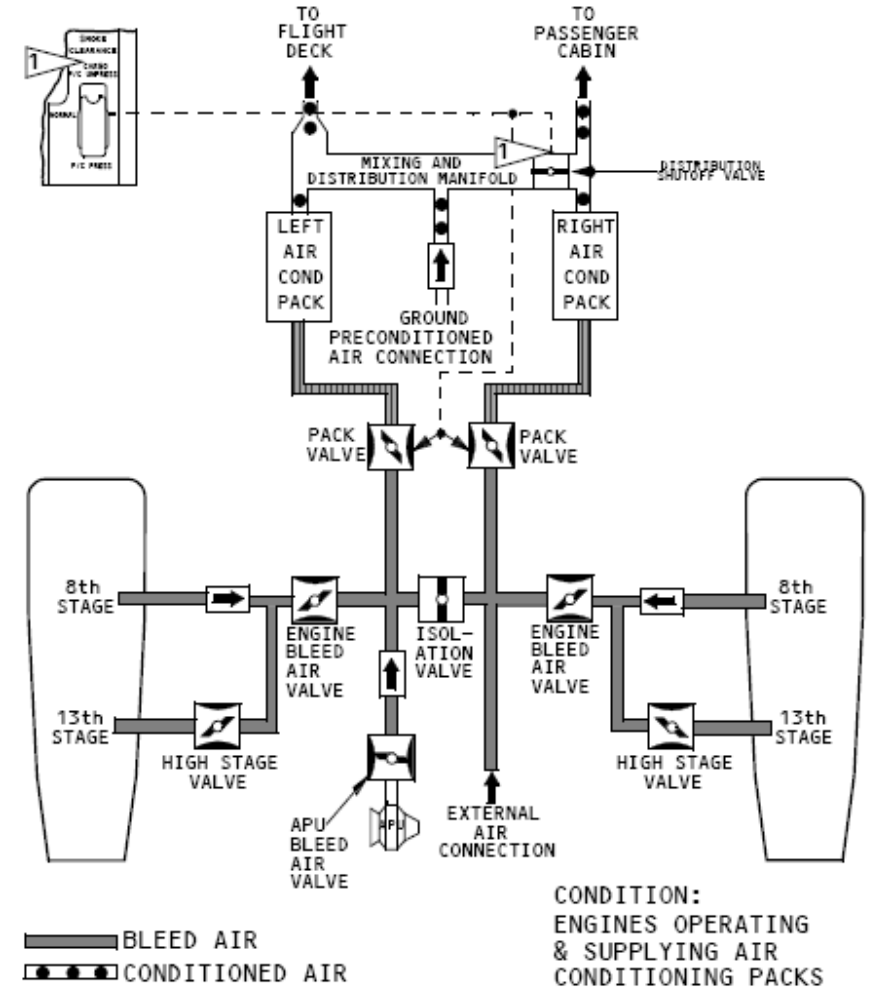
AUTO - pressurization system controlled automatically.
STBY - pressurization system controlled through the standby mode.
MAN -
- pressurization system controlled manually by Outflow Valve Switch.
- AC - outflow valve operates from AC power.
- DC - outflow valve operates from DC power.
- all auto and standby circuits bypassed.

CHECK - Tests auto failure function of AUTO system.

16. Cabin /Flight Altitude (CAB ALT)(FLT ALT) Placard

Used to determine setting for cabin altitude when operating in standby and manual modes.

AIR SYSTEMS SCHEMATIC



ANTI-ICE, RAIN

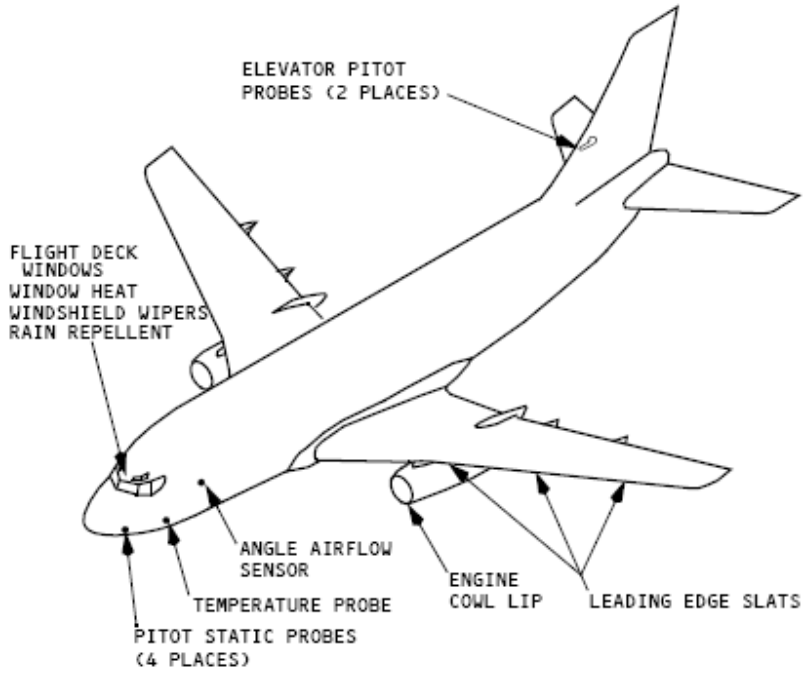
SYSTEM DESCRIPTION

Thermal anti-icing (TAI), electrical anti-icing, rain repellent, and windshield wipers are the systems provided for ice and rain protection.

The anti-ice and rain systems include:

- Flight Deck Window Heat
- Windshield Wipers and Rain
- Wing Anti-Ice System
- Probe and Sensor Heat
- Engine Anti-Ice System Repellent

ANTI-ICE COMPONENTS DIAGRAM



FLIGHT DECK WINDOW HEAT

Flight deck windows 1, 2, 4 and 5 consist of glass panes laminated to each side of a vinyl core. Flight deck window 4 has an additional vinyl layer and acrylic sheet laminated to the inside surface. Flight deck window 3 consists of two acrylic panes separated by an air space.

A conductive coating on the outer glass pane of windows 1 and 2 permits electrical heating to prevent ice build-up and fogging. A conductive coating on the inner glass pane of windows 4 and 5 permits electrical heating to prevent fogging. Window 3 is not electrically heated.

WINDSHIELD WIPERS AND RAIN REPELLENT

The rain removal system for the forward windows consists of windshield wipers and rain repellent. One windshield wiper is located on each No. 1 window. Each wiper is electrically operated by separate systems. Both wiper systems are controlled by a common switch. Each push of a rain repellent switch applies a measured amount of repellent on the related No. 1 windshield.

PROBE AND SENSOR HEAT

All pitot-static probes, the total air temperature probe, and angle airflow sensors are electrically heated to prevent the formation of ice. Alternate static ports are not heated.

ENGINE ANTI-ICE SYSTEM

Engine bleed air thermal anti-icing prevents the formation of ice on the engine nose cowl lip, compressor area, and EPR probe. Engine anti-ice operation is controlled by individual ENG ANTI-ICE switches. The engine anti-ice system may be operated on the ground and in flight.

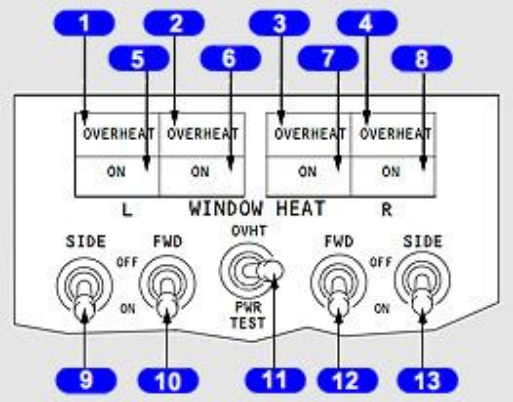
WING ANTI-ICE SYSTEM

The wing anti-ice system provides protection for the leading edge slats by using bleed air. The wing anti-ice system does not include the leading edge flaps.

With a valve open, bleed air flows to the leading edge slats through a telescoping duct, and is then exhausted overboard. The wing anti-ice system is effective with the slats in any position.

CONTROLS AND INDICATORS

O19. WINDOW HEAT PANEL



1-4. Window Overheat Lights
5-8. Window Heat On Lights
9,10,12,13. Window Heat Switches
11. Window Heat Test Switch (spring-loaded to neutral)

1-4. Window OVERHEAT Lights

Illuminated (amber) - overheat condition is detected.

Note: OVERHEAT light also illuminates if electrical power to window is interrupted.

5-8. Window Heat ON Lights

Illuminated (green) - window heat is being applied to selected window. Extinguished -

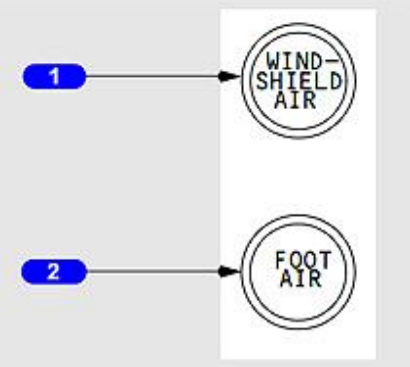
- switch is OFF, or
- an overheat is detected, or
- a system failure has occurred.

9,10,12,13. WINDOW HEAT Switches

ON - window heat is applied to selected window. OFF - window heat not in use.

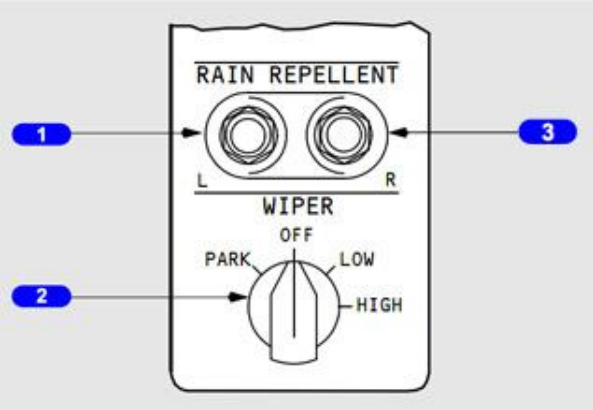
OVHT - simulates an overheat condition. PWR TEST - provides a confidence test.

L04, R04. WINDSHIELD/FOOT AIR CONTROLS



1. Windshield Air Controls
2. Foot Air Controls

O16. WINDSHIELD WIPER PANEL



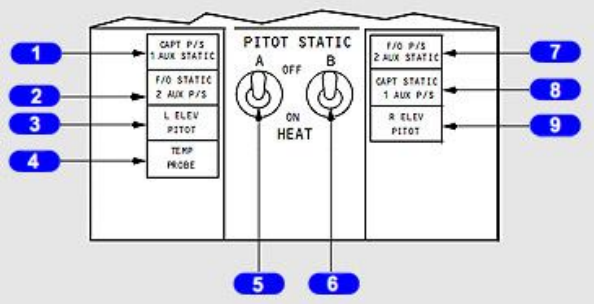
1,2. Repellent Switches

Push - applies measured amount of repellent on related window 1.

3. Windshield WIPER Selector

PARK - turns off wiper motors and stows wiper blades. OFF - turns off wiper motors. LOW - low speed operation. HIGH - high speed operation.

O20. PITOT STATIC HEAT PANEL



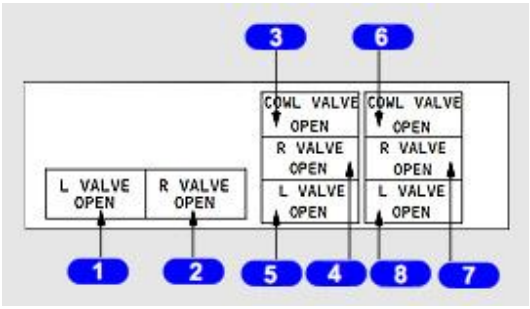
1-4, 7-9. PROBE HEATER Lights

Illuminated (amber) - related probe not heated.

5,6. PITOT STATIC Switches

ON - power is supplied to heat related system. OFF - power off.

O21. WINGS/ENGINE ANTI-ICE PANEL



1,2. Wing Anti–Ice Valve Open Lights
3-8. Valve Open Lights
9,10. Engine Anti-Ice Switch
11. Wing Anti-Ice Switch

1,2. Wing Anti-Ice VALVE OPEN Lights

Illuminated (blue) -

- bright - related wing anti-ice control valve is in transit, or related wing anti-ice control valve position disagrees with WING ANTI-ICE switch position.
- dim - related wing anti-ice control valve is open (switch ON). Extinguished - related wing anti-ice control valve is closed (switch OFF).

3-8. VALVE OPEN Lights

Illuminated (blue) -

- bright - related control valve is in transit, or the valve position disagrees with related ENGINE ANTI-ICE switch position
- dim - related control valve is open (switch ON). Extinguished - related control valve is closed (switch OFF).

9,10. ENGINE ANTI-ICE Switch

ON - related engine anti-ice valve opens. OFF - related engine anti-ice valve closes.

11. WING ANTI-ICE Switch

OFF - wing anti-ice control valves close. ON (in flight) - wing anti-ice control valves open.

AUTOMATIC FLIGHT

SYSTEM DESCRIPTION

The autopilot is made of two independent channels - roll and pitch - and may be used with or without the yaw damper engaged. The two channels may be engaged simultaneously or independently and only in the MANUAL mode.

AUTOPILOT MODES

The following modes are available and will be described in detail later in this section:

- MANUAL
- VOR/LOC
- AUTO APPROACH
- MANUAL GLIDE SLOPE

In conjunction with these modes, the following submodes are available:

- CONTROL WHEEL STEERING
- HEADING OFF
- HEADING HOLD
- HEADING SELECT
- ALTITUDE HOLD

AUTOPILOT SYSTEM

AUTOPILOT HEADING SWITCH

The autopilot heading switch may be used to operate the autopilot in HEADING OFF, HEADING HOLD, or HEADING SELECT. This switch is spring-loaded to the center, HEADING HOLD, position. HEADING SELECT may be used in any mode until VOR/LOC capture, when it trips to the center position automatically.

When in HEADING SELECT, the autopilot uses the Captain's heading marker for reference. The autopilot roll channel is in CWS high detent. If high detent force is exceeded, the heading switch trips to HEADING HOLD.
Pitch mode such as ALT HOLD may be used independently of the heading mode. Bank angles for all modes are limited to 32 degrees.

AUTOPILOT PITCH MODE SELECTOR

The autopilot pitch mode selector is used for altitude hold (ALT HOLD) mode selection. The Altitude Hold mode causes the autopilot to level at the altitude at which the autopilot mode selector is positioned to ALT HOLD.

APPROACH PROGRESS DISPLAY

The approach progress display provides annunciation of autopilot status while in VOR/LOC, AUTO APP, and MAN G/S.

VOR/LOC Mode

The VOR/LOC light:

- Illuminates amber immediately after mode selection
- Illuminates green when capture occurs (2/5 dot in VOR and 2 dots in LOC).

The GLIDE SLOPE light is inoperative in the VOR/LOC mode.

AUTO APP Mode

In the auto approach AUTO APP mode, the VOR/LOC light provides the same annunciations as in the VOR/LOC mode.
The GLIDE SLOPE light:

- Illuminates amber at AUTO APP mode selection
- Illuminates green at glide slope capture (1/3 dot).

AUTOPILOT SCHEMATIC

ENGAGEMENT INTERLOCKS

The autopilot engage switches will be mechanically locked in the disengage position until the following conditions are satisfied:

ROLL (AIL) CHANNEL

- Autopilot roll computer is valid
- ADC airspeed signal is valid
- Vertical and directional gyros are valid.
- B flight control switch is ON.
- No force on control wheel
- Standby power switch is in AUTO position.

PITCH (ELEV) CHANNEL

- Autopilot pitch computer is valid
- ADC airspeed signal is valid
- Vertical gyro is valid
- Flight control switch is ON
- Electric trim is not operating
- A/P trim cutout switch is NORMAL
- No force on control column
- Standby power switch is in AUTO position.

AUTOMATIC DISENGAGEMENTS

ROLL AND PITCH

Automatic disengagement of both channels occurs when:

- Either autopilot disengage switch is pushed
- The vertical gyro signal is lost or transferred
- The airspeed signal from the ADC is lost.
- The B flight control switch is positioned to OFF
- The autopilot system select switch is repositioned
- The standby power switch is positioned to BAT.

ROLL ONLY

Automatic disengagement of the roll channel only occurs when:

- Autopilot roll channel power is lost
- The compass signal is lost or transferred.

PITCH ONLY

Automatic disengagement of the pitch channel only occurs when:

- Autopilot pitch channel power is lost
- The control wheel stabilizer trim switches are used
- The stabilizer trim autopilot cutout switch is positioned to CUTOUT.

AUTOPILOT REVERT-TO-MAN CONDITIONS

The autopilot will revert to MANUAL if the following conditions exist:

- high detent CWS force applied while in VOR/LOC, AUTO APP, or MAN G/S modes after VOR or LOC on course loss of altitude input from the ADC while in AUTO APP or MAN G/S.

CONTROL WHEEL STEERING (CWS)

The airplane may be maneuvered in pitch and roll after autopilot engagement using the control wheel and column. Manual inputs by the pilots using CWS are the same as required for manual flight.

LOW DETENT LEVEL

After autopilot engagement, a low level manual input is required to move the control wheel out of the center (detent) position. This input is comparable to the input required during manual flight.

HIGH DETENT LEVEL

High detent level manual input is provided to prevent inadvertent disengagement of various submodes. The input required to move the control wheel or column out of the detent position is increased. If reversion to CWS inputs only (no automatic heading, course, radio, or pitch commands) is desired, this may be accomplished by exerting an input greater than high detent level.

CWS OPERATION

CWS operates in low or high detent level, depending on which modes or submodes are active:

MAN Mode

CWS pitch and roll are low detent unless various submodes are active (see below).

VOR/LOC Mode

CWS pitch and roll are low detent until VOR or localizer ON COURSE. CWS roll then becomes high detent, and

CWS pitch remains low detent unless ALT HOLD is active. CWS roll may be used to override during the capture phase until ON COURSE. Exceeding high detent in roll reverts the autopilot to MAN.

AUTO APP or MAN G/S Modes

Same as VOR/LOC mode until G/S engaged. Pitch and roll CWS are then high detent. Exceeding high detent reverts the autopilot to MAN.

ALT HOLD Submode

CWS pitch is high detent. Exceeding high detent will revert the Pitch Mode Selector Switch to OFF.

HDG HOLD/HDG OFF Submodes

CWS roll is low detent.

HDG SEL Submode

CWS roll is high detent. Exceeding high detent causes the heading switch to move to the center (HEADING HOLD) position.

FLIGHT DIRECTOR

The flight director computers receive constant inputs from various airplane systems. Loss of one of these inputs will adversely affect the flight director.

The command bars are dependent upon the position of the Flight Director Mode, Selector, Altitude Hold Switch, and Pitch Command Control. The following is a condensed description of the inputs to the computers and the commands to the indicator:

Air data computer - a pitch command to hold altitude if the Altitude Hold Switch is ON.

Radio altimeter and marker beacon receiver - at 1500 feet, gain for pitch commands to maintain glide slope is reduced. Gain is further reduced at 200 feet, or the middle marker, whichever is first.

GA (Go-Around) - a pitch-up command and a wings level roll command.

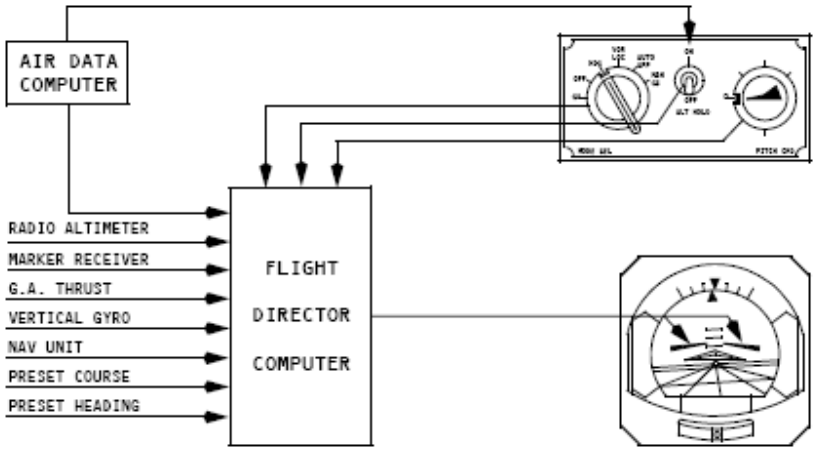
Vertical gyro - pitch and roll commands for stabilization of the indicator

Navigation unit - pitch and roll signals for capturing and tracking VOR radials, localizer courses, and glide slope beams.

Preset course - roll commands to remain on selected course.

Preset heading - roll commands to remain on selected heading.

FLIGHT DIRECTOR SCHEMATIC



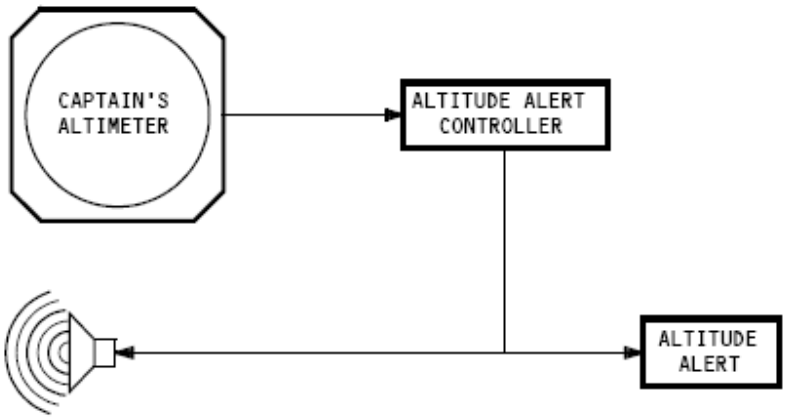
ALTITUDE ALERT SYSTEM

The altitude alert system provides visual and aural reminders when approaching a pre-selected altitude. The system uses the Captain's altimeter to compare actual altitude to the alerting altitude set in the Altitude Alert Controller.

ACQUISITION MODE

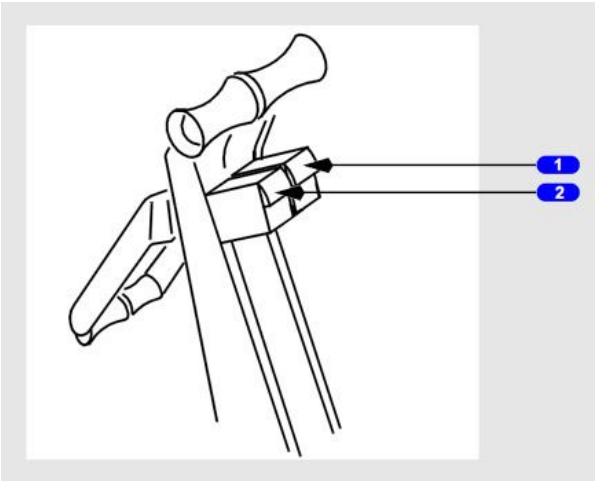
When approaching the selected altitude, a two second tone sounds and the ALTITUDE ALERT lights illuminate 1000 feet above or below the selected altitude. The lights extinguish 375 feet above or below the selected altitude.

ALTITUDE ALERT SYSTEM



AUTOPILOT CONTROLS

T01. GO–AROUND SWITCH

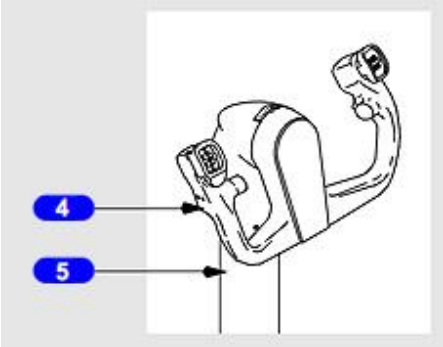


1,2. Go–Around Switch

- Armed with flight director Mode Selector in the AUTO APP or MAN GS positions.

PRESS (either or both switches) - Provides flight director commands for wings level with a pitch up of 14 degrees.

W01, W02. CONTROL WHEEL



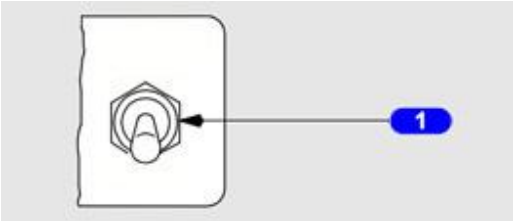
1.Autopilot Disengage Switch

- Disengages the autopilot
- A/P disengage light illuminates
- Resets the Autopilot Disengage Light after automatic disengagement.

Note: Each time the autopilot is disengaged, the pilot should guard the controls for an undetected out-of-trim condition.

AUTOPILOT INDICATORS

L16. GPS/NAV SWITCH



1.GPS/NAV Switch

GPS/NAV switch to select an additional FSX flight plan tracking autopilot (Nav 1/GPS (toggle) should be assigned via FSX Menu-Controls-Assignments).

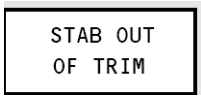
L10, R10. AUTOPILOT DISENGAGE LIGHT (RED)

PRESS - Resets the Autopilot Disengage Light after automatic disengagement.

ILLUMINATED FLASHING - The autopilot is automatically disengaged.

- The light is pressed to test
- The Autopilot Disengage Switch is pushed
- Either manual disengage switch (aileron or elevator) is moved to DISENGAGED
- Pushing the light resets the system after automatic disengagement ILLUMINATED STEADY - The self-test switch in the E/E compartment is on. EXTINGUISHED - The Autopilot Disengage Switch is released.
- The Autopilot Disengage Light is reset.

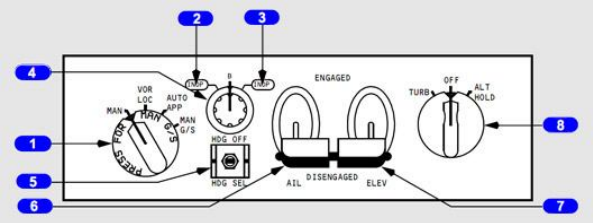
C03. STABILIZER OUT OF TRIM LIGHT (AMBER)



Functions only with the Autopilot Elevator Engage Switch ENGAGED.

ILLUMINATED - The stabilizer is out-of-trim for the condition required by the autopilot.

G03. AUTOPILOT PANEL



1. Autopilot Mode Selector (Spring-Loaded to Man)
4. Autopilot System Select Switch
5. Autopilot Heading Switch
6. Autopilot Aileron (Roll) Engage Switch
7. Autopilot Elevator (Pitch) Engage Switch
8. Autopilot Pitch Mode Selector

1. Autopilot Mode Selector (spring-loaded to MAN)

MAN (Manual Mode) - CWS low detent is used to maneuver the airplane with either or both channels engaged.
- ALT HOLD or TURB is selectable
- HDG SEL or HDG OFF is selectable.

VOR LOC (VOR/LOC Mode) - Used to automatically intercept the selected radio course.
- HDG SEL or CWS is used to achieve the intercept heading
- Captain's HSI is used to select heading and course
- Course capture occurs at 2/5 dot (VOR), 2 dots (LOC), the HDG Switch centers at capture (if HDG SEL is used)
- Roll commands can be increased or reduced manually during the capture phase prior to ON COURSE
- When ON COURSE, CWS roll is high detent
- Crosswind compensation occurs after ON COURSE
- ALT HOLD is selectable.

AUTO APP (Auto Approach Mode) - Used to automatically capture ILS Localizer and glide slope.
- HDG SEL or CWS is used to achieve the intercept heading
- LOC CAPTURE is the same as VOR/LOC mode
- LOC and G/S are armed when:
- ILS frequency is tuned

Autopilot Panel
- Front Course is selected
- AUTO APP is selected.
- G/S is captured at 1/3 dot
- ALT HOLD trips OFF at G/S capture
- Gain programming occurs after G/S capture at 1500 feet radio altitude or below. LOC sensitivity is reduced from 100% to 50% as altitude decreases to 100 feet. G/S sensitivity is reduced to 0% as altitude decreases to 50 feet
- When ON COURSE and on G/S, CWS roll and pitch are high detent
- AUTO APP is not selectable unless ILS frequency is selected.
- MAN G/S (Manual Glide Slope Mode) - Used to capture G/S from above or to re-capture after autopilot disengagement.

Note: Do not select MAN G/S when the airplane is more than 1/2 dot, as depicted on the HSI, from the glide slope.
- Operates the same as AUTO APP after G/S capture

4. Autopilot System Select Switch

Selects the hydraulic system used by the autopilot and yaw damper. Transfer of systems will disengage the autopilot and yaw damper.

5. Autopilot Heading Switch

HDG OFF - Autopilot maintains any bank attitude within limits.
- Selectable in MANUAL mode only.

HDG SEL (solenoid-held on, spring-loaded to the center position) - Establishes preselected heading mode.
- Maintains the heading selected for the Captain's HSI. HEADING HOLD (center position) -
- Autopilot engaged:
- Bank angle < 5 degrees - Airplane rolls wings level and maintains heading
- Bank angle > 5 degrees - Airplane maintains bank attitude.
- CWS input:
- Bank angle < 5 degrees - When the force is released, the airplane rolls wings level
- Bank angle > 5 degrees - When the force is released, the airplane maintains bank attitude.

6. Autopilot Aileron (ROLL) Engage Switch

The aileron (roll) channel may be operated independently of the pitch channel in the MAN or VOR LOC modes of operation.

DISENGAGED - Mechanically locked until interlock circuitry is satisfied.

- Spring-loaded to DISENGAGED if interlock is broken. ENGAGED - Solenoid-held if interlocks are satisfied.
- The Mode Selector must be in MAN
- Will not engage if force is being applied to the control wheel.

7. Autopilot Elevator (PITCH) Engage Switch

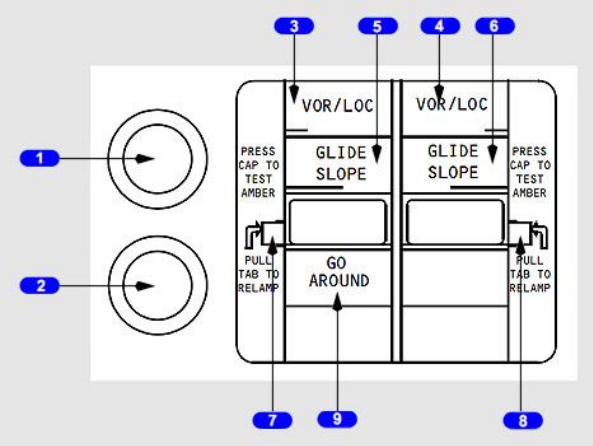
The elevator (pitch) channel may be operated independently of the roll channel in the MAN mode only.
DISENGAGED - Mechanically locked until interlock circuitry is satisfied.

- Spring-loaded to DISENGAGED if interlock is broken. ENGAGED - Solenoid-held if interlocks are satisfied.
- The Mode Selector must be in MAN
- Will not engage if force is being exerted on the control column.

8. Autopilot Pitch Mode Selector

ALT HOLD (Altitude Hold) - Pitch reference is to pressure altitude.
TURB (Turbulence) – INOP.

L12, R12. APPROACH PROGRESS DISPLAY



1,2. Photoelectric Cells
3,4. VOR/LOC
5,6. Glide Slope
9. Go-Around

1,2. Photoelectric Cells

- Overridden by positioning the Master Lights Test Switch to BRT.

3,4. VOR/LOC

AMBER - Radio mode selected.
- Prior to VOR or localizer capture. GREEN - Radio mode selected.
- Capture initiated.

5,6. GLIDE SLOPE

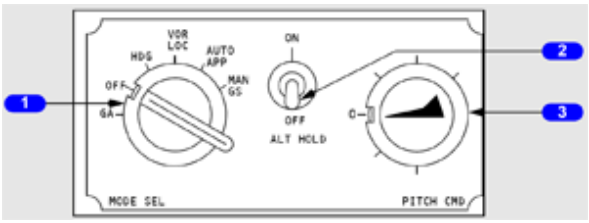
AMBER - AUTO APP selected.
- Prior to glide slope capture.

GREEN - AUTO APP selected and glide slope captured.

9. GO AROUND

GREEN - Captured.

G02, G04. FLIGHT DIRECTOR



1. Mode Selector
2. Altitude Hold Switch
3. Pitch Command Control

1. Mode Selector (MODE SEL)

Rotate - selects flight director computer reference signals provided to command bars.

GA (Go-Around) -
- GA light illuminated (green) -
- command bars provide commands for wings level and a pitch attitude of 14 degrees until the Mode Selector is changed to another position
- mode Selector in AUTO APP or MAN GS, go-around is initiated by pushing the Go-Around switches on the thrust levers
- manual selection to GA can be initiated anytime by positioning the Mode Selector to GA.

OFF - removes command bars.
HDG - command bars provide commands to fly to and maintain selected heading on HSI.
VOR/LOC -
- VOR/LOC light illuminated (amber/armed) -
- command bars provide commands to fly to heading on HSI
- VOR/LOC light illuminated (green/capture) -
- command bars provide commands to fly to or localizer course selected on HSI
- VOR capture - 1 dot (5 degrees)
- LOC capture - 2 dots (2 degrees). AUTO APP -
- VOR/LOC light illuminated (amber/armed) -
- command bars provide commands to fly to and maintain selected heading on HSI

- VOR/LOC light illuminated (green/capture) -
- command bars provide commands to fly to and maintain localizer course
- LOC capture - 2 dots (2 degrees)
- GLIDE SLOPE light illuminated (amber/armed) -
- command bars provide commands to fly existing attitude commands
- GLIDE SLOPE light illuminated (green/capture) -
- command bars provide commands to fly to and maintain glide slope. MAN GS -
- VOR/LOC and GLIDE SLOPE lights illuminated (green/capture) -
- command bars provide commands for fixed intercept angle to the localizer
- command bars provide commands to fly to pitch up or down to intercept the glide slope.

2. Altitude Hold (ALT HOLD) Switch

OFF (spring loaded) -

- Deselects altitude hold
- Trips off at glide slope capture.

ON -

- Command bars reference to pressure altitude from ADC
- Cannot be selected when Mode Selector is in GA position.

3. Pitch Command (PITCH CMD) Control

- Selects fixed pitch angle for climb or descent
- Command bars can be selected to 10 degrees down to 15 degrees up. Not effective if:
- ALT HOLD switch is ON
- Glide slope is captured
- GA mode is active.

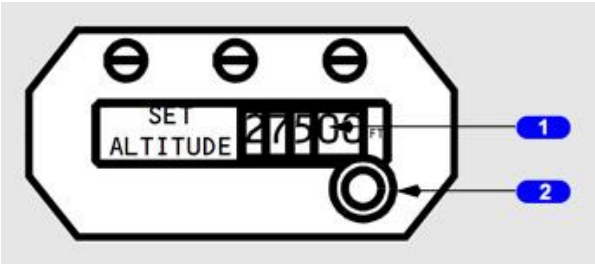
ALTITUDE ALERT

L18, R18. ALTITUDE ALERT LIGHT

Altitude Alert Light

Illuminated (amber)
Airplane is within the range of 1000 to 375 feet of the selected altitude.

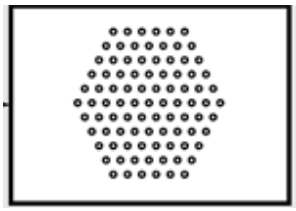
P04. ALTITUDE ALERT CONTROLLER



ALTITUDE ALERT Controller

- Displays the selected alerting altitude
- Covered by a warning flag if the Captain's altimeter signal is lost or if electrical power is lost.

A01. ALTITUDE ALERT - SPEAKER



COMMUNICATIONS

SYSTEM DESCRIPTION

CALL SYSTEM

The call system is used as a means for various crewmembers to gain the attention of other crewmembers and to indicate that interphone communication is desired. Attention is gained through the use of lights and aural signals (chimes or horn).

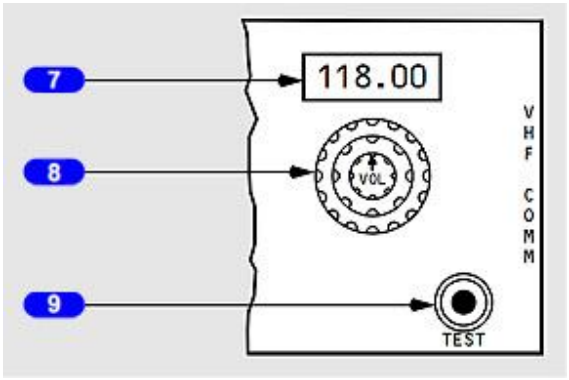
VHF COMMUNICATIONS

Primary short-range voice communications is provided in the VHF range by two independent radios. Each radio provides for selection of an active frequency and an inactive (preselected) frequency. Voice transmission and reception are controlled at the related ASP.

VHF-1 is located on the left aft electronic panel, VHF-2 on the right. The VHF-1 antenna is located on the upper fuselage, VHF-2 on the lower fuselage.

CONTROLS AND INDICATORS

P12, P13. VHF COMMUNICATION PANEL



7. Frequency Indicator
8. Frequency Selector
9. Communication (COMM) Test Switch

1. Frequency Indicator

Indicates selected frequency.

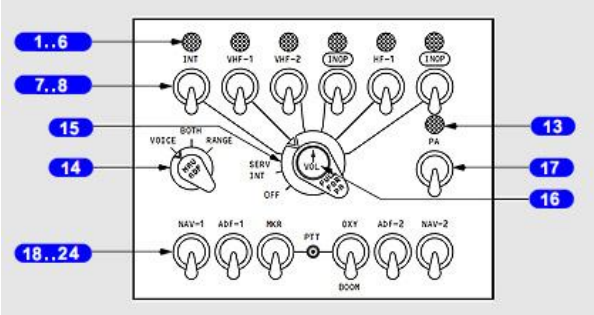
2. Frequency Selector

Rotate - selects frequency in related indicator:
- outer selector changes three left digits
- middle selector changes two right digits.
- inner selector changes receiver volume, but not side tone.

3. Communication (COMM) TEST Switch

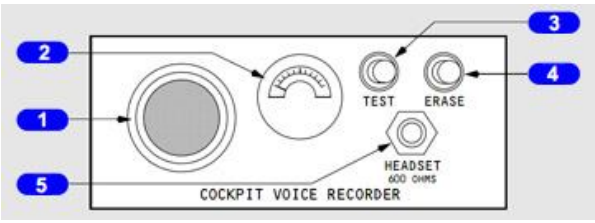
Push -
- removes automatic squelch feature, permitting reception of background noise and thereby testing receiver operation
- improves reception of weak signals.

P14, P15, A08. AUDIO SELECTOR PANEL (ASP)



1-6, 13.Transmitter Light
7-12, 17-20, 23,24. Receiver Switches
14. Filter Switch
15. Transmitter Selector
16. Volume Control
21. Push-to-Talk Switch
22. Oxy-Boom Switch

O24. COCKPIT VOICE RECORDER



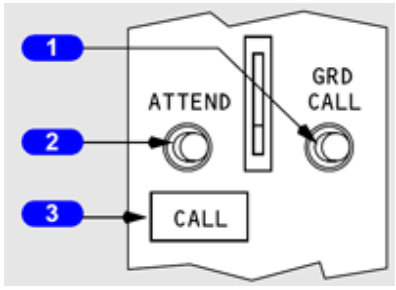
1. Area Microphone
2. Monitor Indicator
3. Test Switch
4. Erase Switch
5. Headset Jack

3. TEST Switch

Push -

- after a slight delay, monitor indicator rises into green band
- a tone may be heard through a headset plugged into HEADSET jack.

O15. CALL SYSTEM



1. Ground Call Switch
2. Attendant Call Switch
3. Flight Deck Call Light

1. Ground Call (GRD CALL) Switch

Push - sounds a horn in nose wheel well until released.

2. Attendant Call (ATTEND CALL) Switch

Push -

- sounds a two-tone chime in the passenger cabin.

3. Flight Deck CALL Light

Illuminated (blue) - flight deck is being called by flight attendants or ground crew. Extinguished when Captain Call or Pilot Call switch released.

ELECTRICAL

SYSTEM DESCRIPTION

Primary electrical power is provided by two engine driven generators which supply three-phase, 115 volt, 400 cycle alternating current. Each generator supplies its own bus system in normal operation and can also supply essential loads of the opposite side bus system when one generator is inoperative. Transformer rectifier (TR) units and a battery supply DC power. The battery also provides backup power for the AC and DC standby systems. The APU operates a generator and can supply power to both AC generator busses on the ground or one AC generator bus in flight.

There are two basic principles of operation for the 737 electrical system:

- There is no paralleling of the AC sources of power.
- The source of power being connected to a generator bus automatically disconnects an existing source.

The electrical power system may be categorized into three main divisions: the AC power system, the DC power system, and the standby power system.

AC POWER SYSTEM

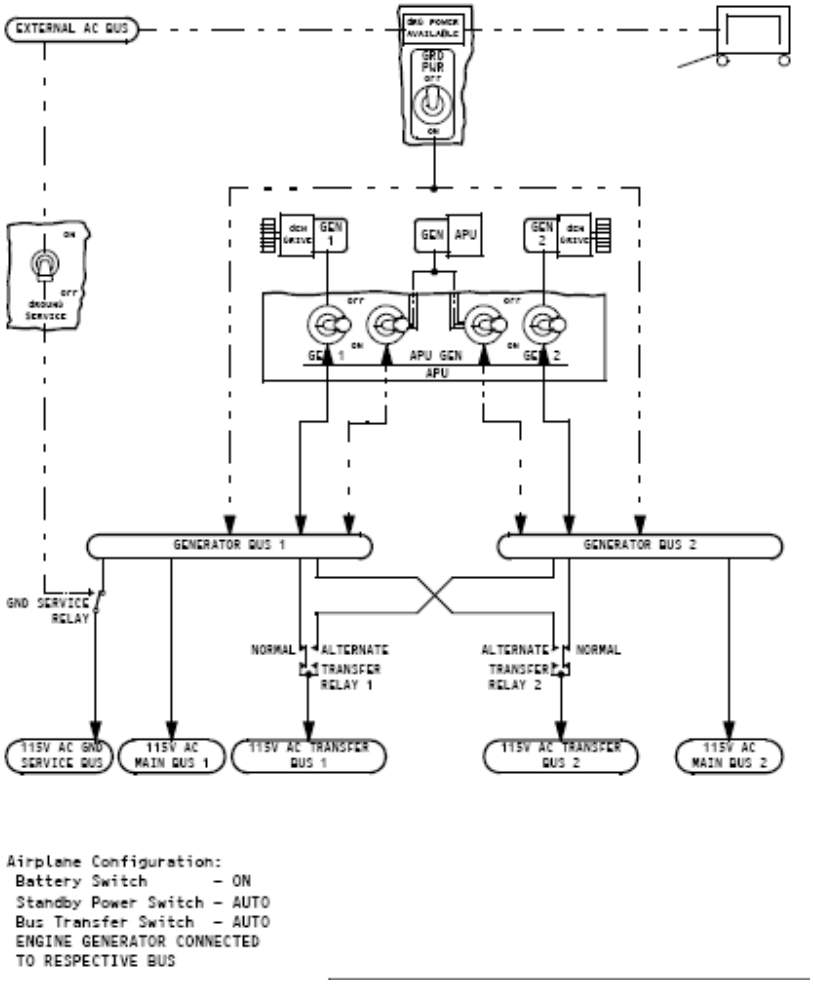
Each AC power system consists of a generator bus, a main bus, and a transfer bus. The left AC power system also includes a ground service bus. Transfer bus 1 supplies power to the AC standby bus. If the source powering either AC power system fails or is disconnected, a transfer relay automatically selects the opposite generator bus as an alternate power source for the transfer bus.

Generator busses can be powered from the engine generators by momentarily positioning the related generator switch to ON. This connects the voltage regulator to the generator and connects the generator to its associated generator bus. Selecting a new power source disconnects the existing power source.

When the APU is operating, selecting either APU GEN switch ON connects APU power to its associated generator bus.

DO NOT USE FOR FLIGHT

AC POWER SCHEMATIC



Airplane Configuration:
Battery Switch – ON
Standby Power Switch – AUTO
Bus Transfer Switch – AUTO
ENGINE GENERATOR CONNECTED
TO RESPECTIVE BUS

DC POWER SYSTEM

28 volt DC power is supplied by three TR units, which are energized from the AC transfer busses and main bus 2. The battery provides 28 V DC power to loads required to be operative when no other source is available.

TRANSFORMER RECTIFIER UNITS

The TRs convert 115 volt AC to 28 volt DC, and are identified as TR1, TR2, and TR3.
TR1 and TR2 receive AC power from transfer bus 1 and transfer bus 2, respectively. TR3 receives AC power from main bus 2.

Under normal conditions, TR1 and TR2 are each powering DC bus 1 and DC bus 2. TR3 powers the battery bus and serves as a backup power source for TR1 and TR2 with the Bus Transfer Switch in the AUTO position.

- Maximum TR Load (with cooling) - 65 amps.
- Maximum TR Load (without cooling) - 50 amps.
- TR voltage range - 24 - 30V

BATTERY POWER

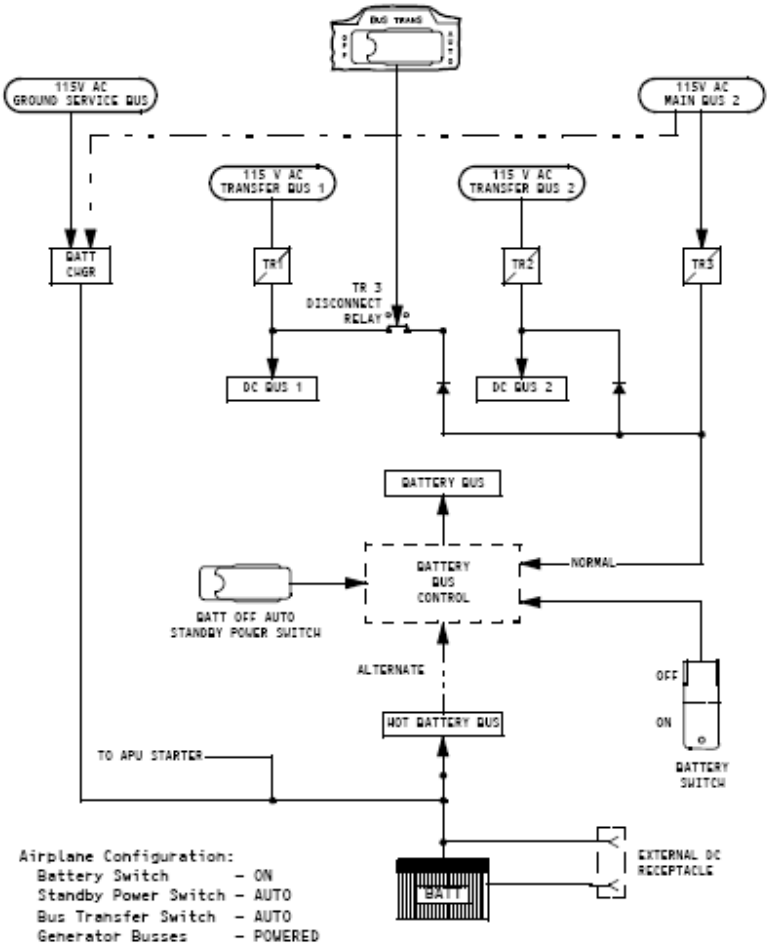
A 24 volt nickel-cadmium battery is located in the electronics compartment. The battery can supply part of the DC system. Battery charging is automatically controlled. A fully charged battery has sufficient capacity to provide standby power for a minimum of 30 minutes. Battery voltage range is 22-30 volts.

DC busses powered from the battery following a loss of both generators are:

- battery bus
- DC standby bus
- hot battery bus

The hot battery bus is always connected to the battery. There is no switch in this circuit. The battery must be above minimum voltage to operate units supplied by this bus.

DC POWER SYSTEM SCHEMATIC



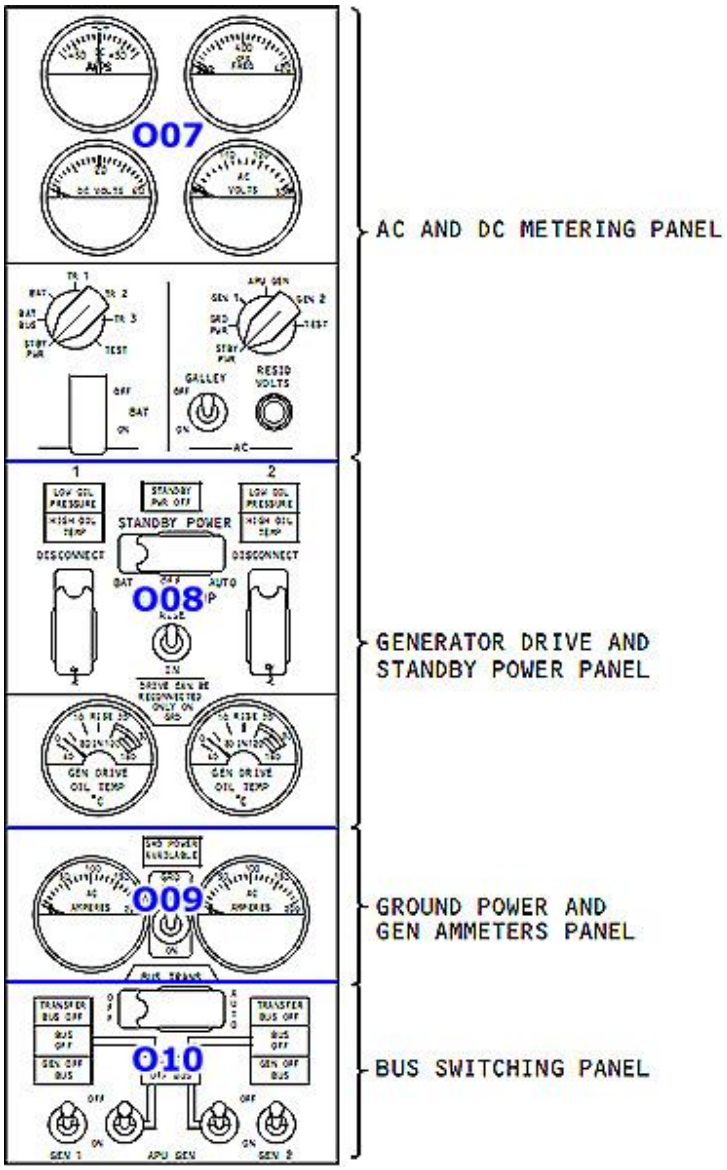
STANDBY POWER SYSTEM

NORMAL OPERATION

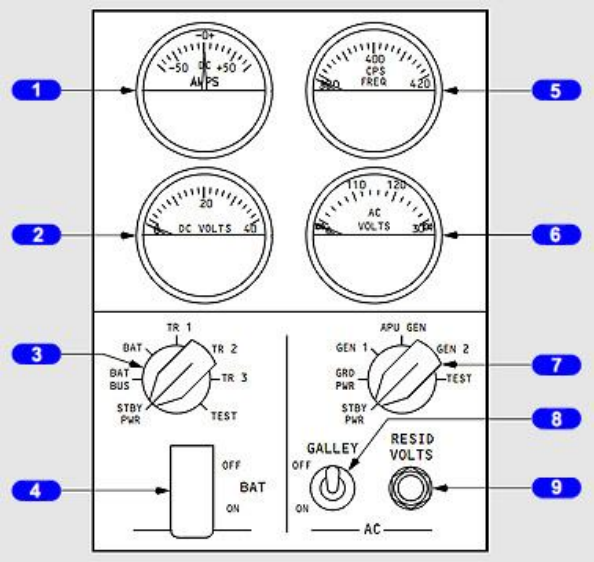
The standby system is used to supply power to essential AC and DC systems. During normal operation the guarded standby power switch is in AUTO and the battery switch is ON. Under normal conditions the AC standby bus is energized from the 115 V AC transfer bus no. 1 and the DC standby bus is energized from DC bus no. 1.

CONTROLS AND INDICATORS

ELECTRICAL PANEL



O07. AC AND DC METERING PANEL



1. DC Ammeter
2. DC Voltmeter
3. DC Meter Selector
4. Battery Switch
5. AC Frequency Meter
6. AC Voltmeter
7. AC Meter Selector
8. Galley Power Switch
9. Residual Volts Switch

1. DC Ammeter

Indicates current of source selected by DC meter selector.

2. DC Voltmeter

Indicates voltage of source selected by DC meter selector.

3. DC Meter Selector

Selects the DC source for the DC voltmeter and DC ammeter indications TEST - used by maintenance.

4. Battery (BAT) Switch

OFF -

- removes power from the battery bus. ON (guarded position) -
- provides power to the battery bus from TR3 when main bus No. 2 is energized.
- provides power to the battery bus from the hot battery bus when main bus No. 2 is not energized.

5. AC Frequency Meter

Indicates frequency of source selected by AC meter selector.

6. AC Voltmeter

130 V scale - indicates voltage of source selected on the AC meter selector.
30V scale - indicates residual voltage of generator selected when RESID VOLTS switch is pressed.

7. AC Meter Selector

Selects the AC source for the AC frequency meter and AC voltmeter. TEST - used by maintenance.

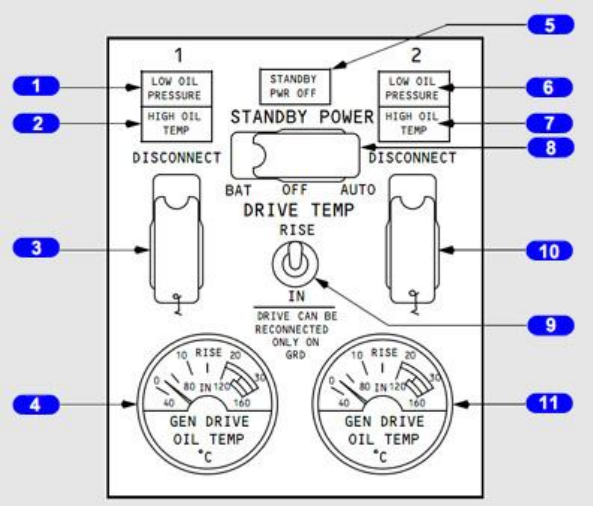
8. GALLEY Power Switch

OFF - removes electrical power from galleys.
ON - electrical power is supplied to galleys when both AC generator busses are powered.

9. Residual Volts (RESID VOLTS) Switch

PRESS - 30V scale of AC voltmeter indicates residual voltage of generator selected.
Associated generator switch must be OFF. With associated generator switch ON, AC voltmeter drives off scale and residual voltage cannot be read.

O08. GENERATOR DRIVE AND STANDBY POWER PANEL



1,6. Low Oil Pressure Lights
2,7. High Oil Temperature Lights
3,10. Disconnect Switches (Guarded And Safetied)
4,11. Generator Drive Oil Temperature Indicator
5. Standby Power Light
8. Standby Power Switch
9. Drive Temperature Switch

1,6. LOW OIL PRESSURE Lights

Illuminated (amber) - generator drive oil pressure is below minimum operating limits.

2,7. High Oil Temperature (HIGH OIL TEMP) Lights

Illuminated (amber) - generator drive oil temperature exceeds operating limits.

3,10. DISCONNECT Switches (guarded and safetied)

Disconnects generator drive.
Generator drive cannot be re-engaged in the air.

4,11. Generator Drive Oil Temperature (GEN DRIVE OIL TEMP) Indicator

Displays the temperature of the oil used in the generator drive.
IN scale (inner) - Displays the temperature of the oil entering the generator drive. RISE scale (outer) - Displays the temperature rise within the generator drive.

- Higher than normal temperature rise indicates excessive generator load or poor condition of the generator drive.
- Lack of adequate cooling will generally cause the temperature RISE to decrease.

5. Standby Power (STANDBY PWR OFF) Light

Illuminated (amber) - AC standby bus is inactive.

8. STANDBY POWER Switch

AUTO (guarded position) -

- In flight, or on the ground, and AC transfer busses powered:
- AC standby bus is powered by AC transfer bus 1
- DC standby bus is powered by DC bus 1.
- In flight, loss of all AC power.
- AC standby bus is powered by the battery bus through the static inverter
- DC standby bus is powered by the battery bus.
- On the ground, loss of all AC power
- No automatic transfer of power. AC and DC standby busses are not powered on 737-200 models with unmodified standby system.

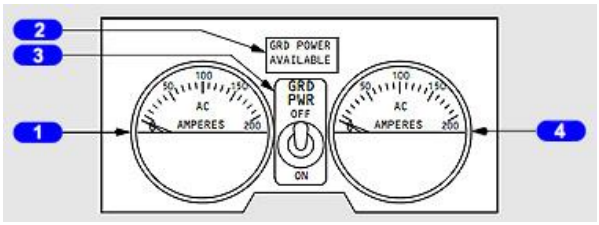
OFF (center position) -

- STANDBY PWR OFF light illuminates
- AC standby bus, static inverter, and DC standby bus are not powered. BAT (unguarded position) -
- AC standby bus is powered by the battery bus through the static inverter.
- DC standby bus is powered by the battery bus.

9. Drive Temperature (DRIVE TEMP) Switch

RISE/IN - Selects RISE or IN temperature to be displayed on the GEN DRIVE OIL TEMP indicator.

O09. GROUND POWER AND GEN AMMETERS PANEL



1,4. AC Ammeter
2. Ground Power Available Light
3. Ground Power Switch

1,4. AC Ammeter

Indicates engine generator load in amperes.

2. Ground Power (GRD POWER AVAILABLE) Light

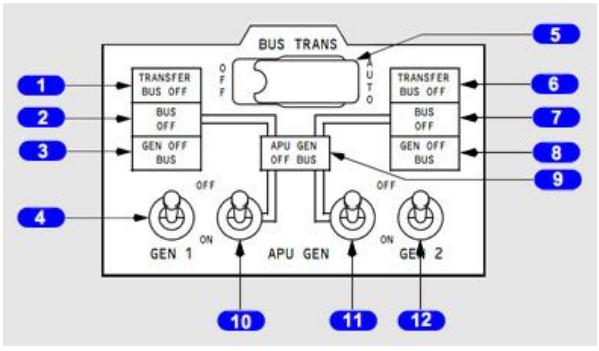
Illuminated (blue) - external power bus is powered by ground power supply.
Remains illuminated as long as an AC ground power source is attached outside the airplane.

3. Ground Power (GRD PWR) Switch

Three position switch, spring-loaded to neutral.
OFF - disconnects ground power from both generator busses.
ON - if momentarily moved to ON position and ground power is available:

- removes previously connected power from AC generator busses
- connects ground power to both AC generator busses if power quality is correct
- switches the ground service bus to the generator bus 1
- deactivates the ground service switch.

O10. BUS SWITCHING



1,6. Transfer Bus Off Light
2,7. Bus Off Light
3,9. Generator Bus Off Light
4,12. Generator Switch
5. Bus Transfer Switch
8. APU Generator Bus Off Light
10,11. APU Generator Switch

1,6. TRANSFER BUS OFF Light

Illuminated (amber) - related transfer bus is inactive.

2,7. BUS OFF Light

Illuminated (amber) - related generator bus is inactive.

3,9. Generator Off Bus (GEN OFF BUS) Light

Illuminated (blue) - related generator is not supplying the generator bus.

4,12. Generator Switch (GEN 1/GEN 2)

Three position switch, spring-loaded to neutral.
OFF - disconnects related engine generator from the generator bus.
ON - connects related engine generator to the generator bus if the power quality is correct. Disconnects the previous power source.

5. Bus Transfer (BUS TRANS) Switch

AUTO (guarded position) - upon failure of one engine generator bus, its transfer bus is switched to the active generator bus. Allows TR3 to supply DC bus No. 1 if TR1 fails.
OFF - Isolates transfer busses by preventing operation of the bus transfer relays, and opens TR3 disconnect relay. Prevents the battery charger from switching to its alternate source of power, main bus 2. Isolates TR3 from DC bus No.1

8. APU Generator Off Bus (GEN OFF BUS) Light

Illuminated (blue) - APU is at its operating speed and not powering a generator bus.

10,11. APU Generator (GEN) Switch

Three position switch, spring-loaded to center position. OFF - disconnects the APU from the generator bus.
ON - connects the APU generator output to the generator bus if the quality is correct.

Note: In flight, if one generator bus is powered by the APU and the other APU GEN switch is moved to ON, the second generator bus will not connect to the APU generator.

ENGINES, APU

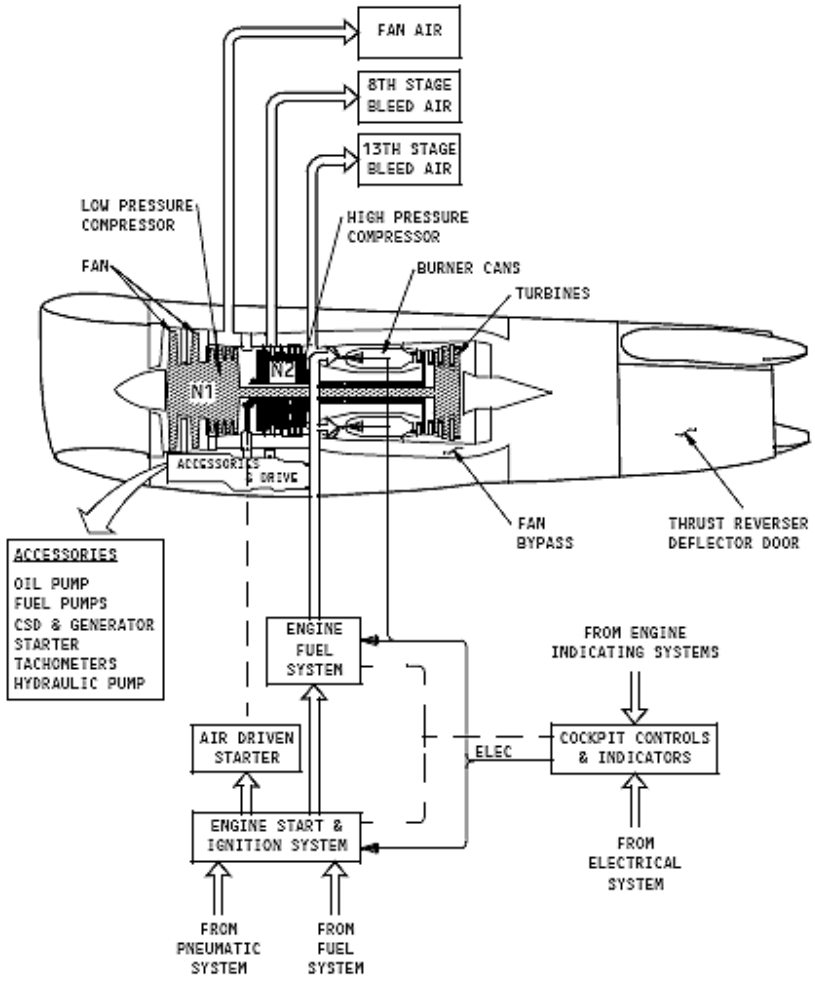
SYSTEM DESCRIPTION

The airplane is equipped with two Pratt and Whitney JT8D ducted turbofan engines having two rotors in series - N1 and N2.

This is a forward fan type engine with a twin spool axial compressor, consisting of a low pressure unit (N1) and a high pressure unit (N2).

Each engine has individual flight deck controls. Thrust is set by positioning the thrust levers. The forward thrust levers control forward thrust from idle to maximum. The reverse thrust levers control thrust from reverse idle to maximum reverse.

POWER PLANT SCHEMATIC



ENGINE FUEL SYSTEM

Fuel is delivered to the engines at pressures and flow rates required to obtain desired engine thrust. Fuel leaves the fuel tank and enters through the engine fuel shutoff valve. The engine fuel shutoff valve is controlled by the engine start lever and the engine fire warning switch. When the engine fuel shutoff valve is closed, the FUEL VALVE CLOSED light located on the forward overhead panel will illuminate dim.

OIL SYSTEM

Oil from the individual engine tank is circulated under pressure, through the engine to lubricate the engine bearings and accessory gearbox. Oil quantity is displayed on the oil quantity indicator located on the center instrument panel.

ENGINE START SYSTEM

Low pressure air, a pneumatic starter, and electrical power are required for starter operation. The engines may be started with air from the APU, from a ground source, or by using engine crossbleed. Engine bleed air valves must be open to allow air from any source to reach the selected engine starter.

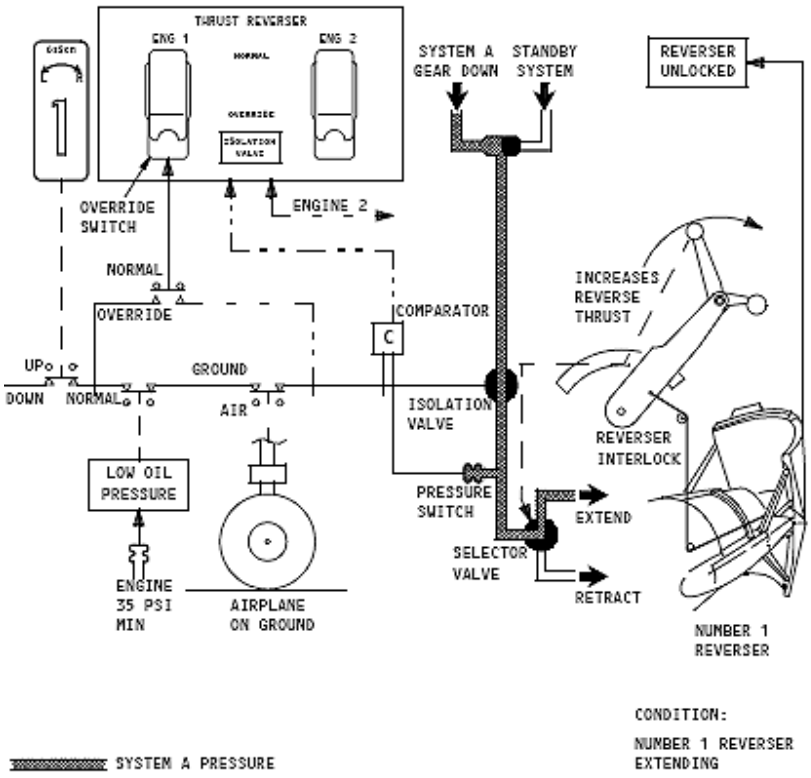
ENGINE IGNITION SYSTEM (4-POSITION START SWITCH)

Two systems are provided. A high energy system is energized with the engine start switch in either the GRD or FLT position when the engine start lever is placed to the IDLE position. The high energy system furnishes pulsating power to plugs in both No. 4 and No. 7 burner cans. The high energy system is used for all engine starts.

THRUST REVERSER

Reverse thrust is accomplished by two doors which block engine exhaust and deflect the exhaust flow forward. The doors operate by system A hydraulic pressure through the gear down hydraulic line. Alternate operation at a reduced rate is available with the standby hydraulic system (the reverser may not stow). A REVERSER UNLOCKED light located on the center instrument panel will illuminate when either thrust reverse door is not in the stowed and locked position.

THRUST REVERSER SCHEMATIC



PDCS SYSTEM DESCRIPTION

GENERAL

The performance data computer system (PDCS) provides the crew with flight guidance data to assist in achieving the most efficient and economical operation of the airplane. The data is presented in the form of digital displays on the CDU and bug displays on the EPR indicator(s).

The PDCS is controlled by the crew and consists of a computer, a control display unit (CDU) and mode annunciator.

The primary function of the PDCS is to compute and display target airspeed and EPR settings for each phase of flight: takeoff, climb, cruise, descent, holding, and go-around. For each of these phases of flight (flight modes) the PDCS computes and displays optimum EPR and airspeed values on the CDU and drives the EPR bug(s) to the computed values.

In addition to the phase of flight data, other flight guidance data (performance functions) are available from the PDCS. These functions are: altitude intercept, flight level calculations, ground speed, range, fuel, temperature, reference speed, trip altitude and wind. Performance functions are displayed on the CDU only and cannot drive the airspeed or EPR bugs.

Most flight modes and performance functions have too much data available to be displayed at one time. The data is therefore divided into separate displays called pages. Each page of data is selected individually for display.

The mode annunciator indicates when a flight mode is engaged.

To allow the crew to "look ahead" in the flight, a performance function or another flight mode may be selected for display on the CDU without disengaging the original mode.

COMPUTER INPUTS

Some inputs from other airplane systems are required for system operation and performance computations.

Temperature
The PDCS receives a total air temperature input for use in temperature dependent computations.

Altitude and Airspeed
Pressure altitude and airspeed are obtained from the Air Data Computer. Fuel Weight
The total weight of fuel aboard the airplane is provided by a fuel summation unit which receives inputs from each of the airplane's fuel tank transmitters.

Bleed Logic
The PDCS receives switch position logic to adjust limit EPR for engine anti-ice bleed, wing anti-ice bleed (except when PDCS is in takeoff mode), gravel protection (on some airplanes), and engine bleed air configurations.

EPR
The existing EPR for each engine is furnished to the PDCS for use in computing actual airplane performance.
Distance

The system also uses distance information from the airplane's DME. This data is used for automatic computation of wind and airplane ground speed.

COMPUTER OUTPUTS

Speed Schedules
For climb, cruise and descent, the PDCS provides a variety of speed schedules, enabling the crew to select that schedule which is best suited to their requirements.

For climb, there is a choice of ECON (minimum cost), RATE (maximum rate of climb) or MANUAL (the crew manually enters a desired speed). ECON is always the first page of data.

For cruise, the crew can select either ECON, LRC or MANUAL. The LRC mode differs from economy Cruise in that LRC computes speed for 99% best range where economy cruise computes speed for minimum trip cost. There is also the TURB (turbulence) speed schedule available in cruise by pressing the TURB key.

For descent, the PDCS offers ECON or MANUAL schedules.

The ECON schedule of climb cruise and descent is computed to provide data for minimum trip cost based on the "flight index" provided to the computer. Flight index is a number between zero and 200 which is a measure of the relative cost effects of flight time and fuel.

An index of zero implies that fuel economy is the exclusive criterion and the PDCS will schedule the ECON speed to minimize fuel consumption. A high flight index infers that flying time is of greater value than fuel. The ECON speed will then be faster, thus reducing flying time at the expense of fuel.

The flight index is programmed into the computer by the airline, but may be changed for any flight if desired from the CDU keyboard.

Engaging the Output
Whenever the display can be engaged, the engage key is illuminated. Pressing the key causes the ENGAGE light to extinguish and the EPR bugs to drive to the displayed values. Engaging any PDC mode causes the EPR bugs to drive to the displayed values.

The PDC drives the airspeed cursors only when PDC SPEED is selected.

Automatic Page Selection
Whenever a page of flight mode data has been engaged, pressing one of the performance function keys causes the PDCS to compute and display the data for the corresponding page of the performance function. For example, if CRZ LRC has been engaged and the RNG key is pressed, the display immediately shows RNG LRC.

Display of Speeds
When a Mach/airspeed schedule is displayed on the manual page of the CDU the controlling value is underlined. For example, if climbing at a speed schedule of 320/.72 at low altitudes the 320 is underlined and at high altitudes the.72 underlined

When accelerating, Mach numbers less than .65 are not displayed; when decelerating, Mach numbers are not displayed after the speed falls below Mach .60.

SYSTEMS SAFEGUARDS

The PDCS has been integrated into the airplane in such a way that it is isolated from each of the primary instruments and sensors. This assures that failures within the PDCS do not affect the other systems.

The performance data computer has a complete built-in self-test capability which allows a complete checkout of the computer and all inputs and outputs. If the PDCS fails, the screen becomes blank. In addition, under some failure conditions, the airspeed bug moves to 440 knots, the EPR bugs move to 1.0, and the indicator inoperative flags appear. If the air data computer fails, the CDU displays a CADC fail message. Failure of CADC causes the PDCS to be inoperative.

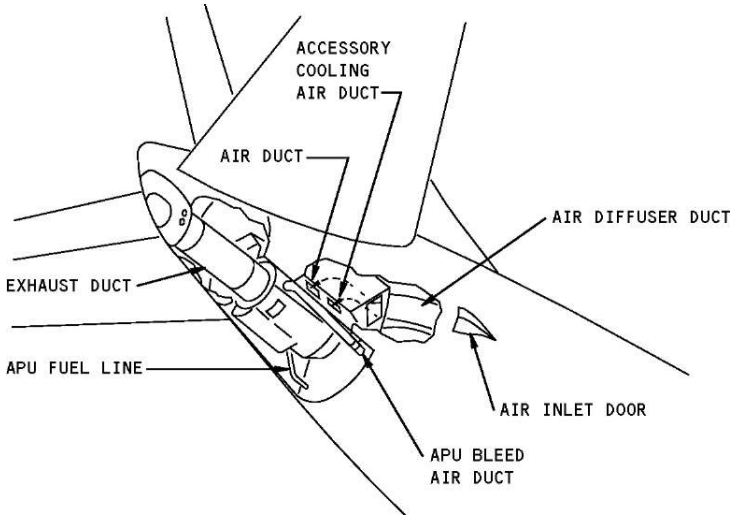
Under certain mode conditions, if the fuel totalizer signal fails, the screen displays "Use EPR limit." Flight crews can initiate self-test procedures if desired.

When either airspeed or EPR validity is questioned, or a self-detection fault develops in the computation process, the computer normally drives the appropriate bugs to 440 knots and 1.0 EPR.

APU SYSTEM

The auxiliary power unit (APU) is a self-contained gas turbine engine installed within a fireproof compartment located in the tail of the airplane.

The APU supplies bleed air for engine starting or air conditioning. An AC electrical generator on the APU provides an auxiliary AC power source.



APU OPERATION

The APU operates up to the airplane maximum certified altitude.

The APU supplies bleed air for one air conditioning pack either on the ground or in flight. Both generator busses can be powered on the ground. In flight only one generator bus can be powered.

ELECTRICAL REQUIREMENTS FOR APU OPERATION

APU operation requires the following:

- APU fire switch on the overheat/fire panel must be IN
- APU fire control handle on the APU ground control panel must be IN
- Battery switch must be ON.

Electrical power to start the APU comes from the airplane battery. Moving the battery switch to OFF on the ground shuts down the APU.

APU START

The automatic start sequence begins by moving the APU switch momentarily to START. This initiates opening of the air inlet door. When the APU inlet door reaches the full open position the start sequence begins. After the APU reaches the proper speed, ignition and fuel are provided. When the APU is ready to accept a bleed air or electrical load the APU GEN OFF BUS light illuminates.

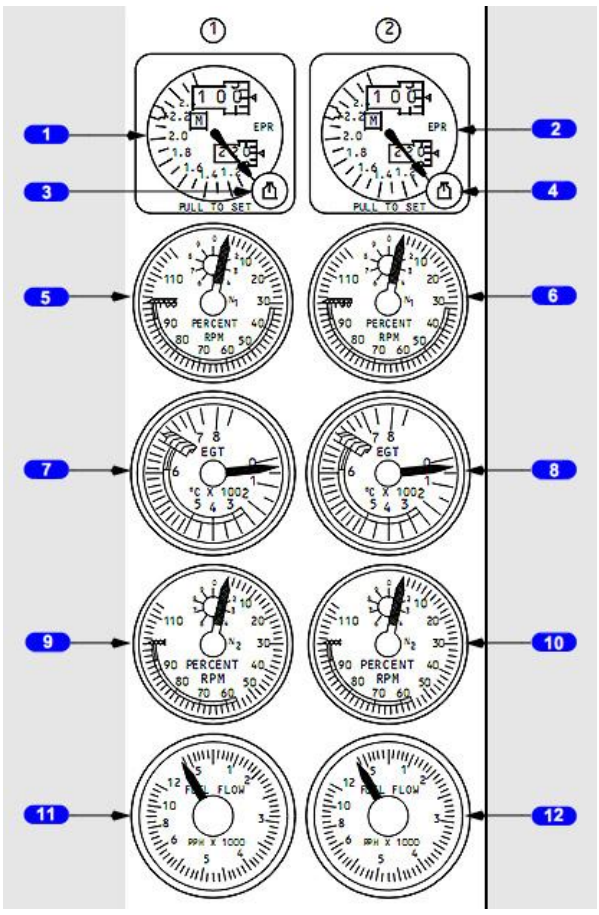
Operate the APU for one full minute before using it as a bleed air source. This one minute stabilization is recommended to extend the service life of the APU.

APU SHUTDOWN

Operate the APU for one full minute with no bleed air load prior to shutdown. This cooling period is recommended to extend the turbine wheel life of the APU.
Moving the APU switch to OFF shuts down the APU, trips the APU generator, and closes the APU bleed air valve. Shutdown can also be accomplished by pulling the APU fire switch.

CONTROLS AND INDICATORS

C09. ENGINE INSTRUMENTS PRIMARY PANEL



1,2. Engine Pressure Ratio Indicator
3,4. EPR Reference Selector
5,6. N1 Rpm Indicator
7,8. Exhaust Gas Temperature (EGT) Indicator
9,10. N2 Indicator
11,12. Fuel Flow Indicator

1,2. Engine Pressure Ratio (EPR) Indicator

- Indicates the ratio of turbine discharge pressure (Pt7) to compressor inlet pressure (Pt2)
- Used as the primary thrust setting reference
- Provides digital display of indicated EPR; Read EPR on outer scale and in the large upper digital display for thrust settings

3,4. EPR Reference Selector

ROTATE - an "M" (indicating manual mode) appears on the dial face, positions the EPR reference "bug" and changes the reference EPR digital readout in the lower window correspondingly

5,6. N1 RPM Indicator

- Indicates low pressure compressor speed in percent of RPM
- Self-powered.

7,8. Exhaust Gas Temperature (EGT) Indicator

- Indicates turbine exhaust gas temperature in degrees C as sensed by thermocouples
- Uses AC power from the Standby Bus.

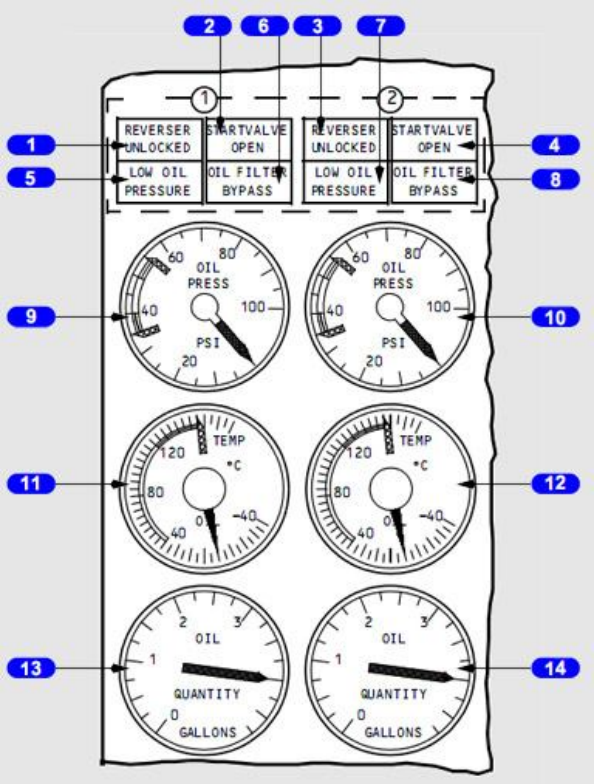
9,10. N2 Indicator

- Indicates high pressure compressor speed in percent of RPM
- Self-powered.

11,12. Fuel Flow Indicator

Indicates fuel consumption rate in pounds per hour.

C10. ENGINE INSTRUMENTS SECONDARY PANEL



1,3. REVERSER UNLOCKED Light

Illuminated (amber) - indicates the thrust reverser doors are not locked.

2,4. START VALVE OPEN Light

Illuminated (amber) - indicates the engine starter valve is open and air is being supplied to the starter motor.

5,7. LOW OIL PRESSURE Light

Illuminated (amber) - indicates engine oil pressure is below 35 psi.

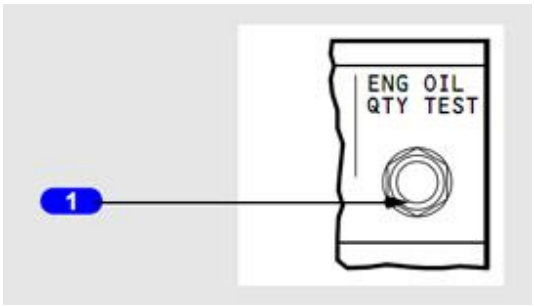
6,8. OIL FILTER BYPASS Light

Illuminated (amber) - indicates an impending bypass of the main oil filter.

9,10. Oil Pressure (OIL PRESS) Indicator

Displays engine oil pressure in psi.

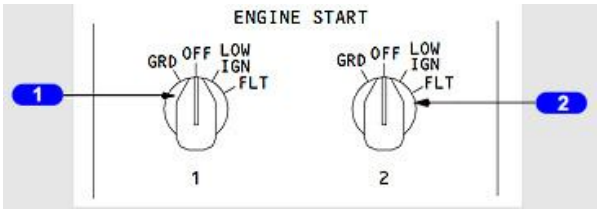
C11. ENGINE OIL QUANTITY TEST SWITCH



1. Engine Oil Quantity Test Switch

Push - oil quantity indicators move toward zero.

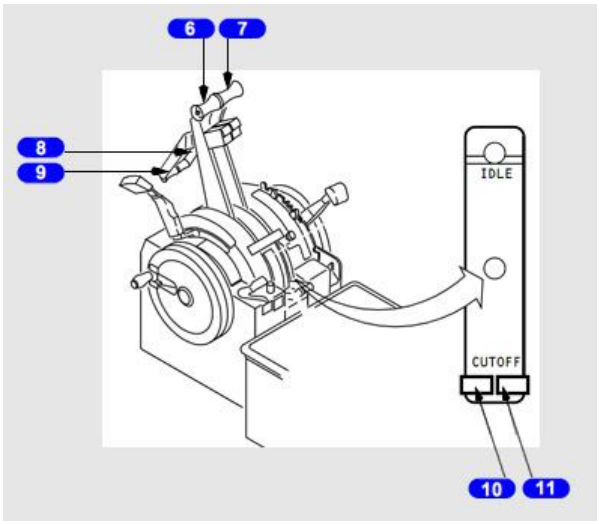
O18. ENGINE START SWITCHES



1,2. Engine Start Switch

GRD - (solenoid held - spring loaded to OFF) Opens the starter valve and provides high energy ignition to two igniters when the Engine Start Lever is moved from CUTOFF to IDLE
OFF - No ignition
LOW IGN- Provides low energy ignition to one igniter with the Engine Start Lever in IDLE
FLT - Provides high energy ignition to two igniters when the Engine Start Lever is in IDLE.

P10. ENGINE CONTROLS



6,7. Forward Thrust Lever
8,9. Reverse Thrust Lever
10,11. Engine Start Lever

6,7. Forward Thrust Lever

- Controls engine thrust
- Cannot be advanced if the reverse thrust lever is in the reverser deployed position.

8,9. Reverse Thrust Lever

- Controls engine reverse thrust
- Reverse thrust cannot be selected unless the forward thrust levers are in IDLE.

Note: When the reverse thrust levers are moved out of IDLE towards reverse thrust, pawls are forced into openings locking the forward thrust levers in the idle position.

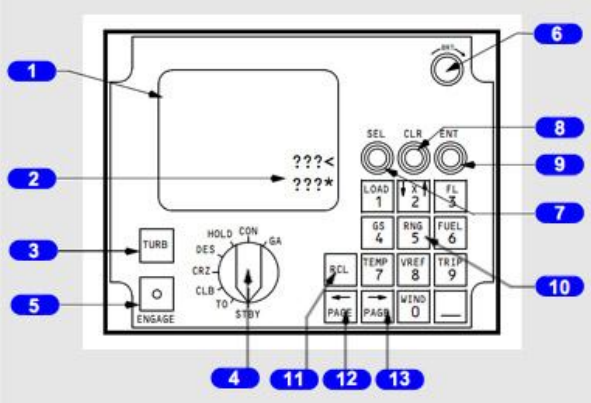
Note: The ability of each reverse thrust lever and its corresponding forward thrust lever to move depends on the position of the other lever because each is capable of "locking out" the other pawl attached to the forward thrust levers.

10,11. Engine Start Lever

IDLE
- Controlled fuel flow is supplied to the engine, and ignition circuits are energized.

CUTOFF
- Closes the main fuel shutoff valve and the main engine control shutoff valve
- Ignition system is de-energized.

P03. PDCS CONTROL DISPLAY UNIT (CDU)



1. Cathode Ray Tube (CRT) Display
2. CRT Display Symbols
3. Turbulence Key
4. Flight Mode Selector
5. Engage Key
6. Brightness Control
7. Select Key
8. Clear Key
9. Enter Key
10. Keyboard
11. Recall Key
12. Page Reverse Key
13. Page Forward Key

1. Cathode Ray Tube (CRT) Display

- Displayed data is called a page
- Each page can display 6 lines, 13 characters per line.

2. CRT Display Symbols

??? (question marks)
- Indicates lines of unentered data. CARET
- Indicates the place where information is to be inserted
- Displaces the asterisk on that line.

* (asterisk) - Identifies the line where an ENT (entry) can be made.

3. TURB (turbulence) KEY

PRESS -
- Causes the CRT to display the turbulent air penetration speed, pitch attitude and N1 settings
- The EPR indicator bugs move to values corresponding to the N1 values
- Overrides the CRZ flight mode position.

4. FLIGHT MODE SELECTOR

ROTATE - Selects the phase of flight for which data is desired
STBY (Standby) - Used for data entry and automatic system verification
TO (Takeoff) - Displays takeoff EPR limits for the temperature entered
CLB (Climb) - Displays climb EPR and speeds for the desired climb profile: Best economy, maximum rate or crew selected speeds
CRZ (Cruise) - Displays cruise EPR and speeds for the desired cruise schedule: Best economy, LRC (long range cruise) or crew selected speeds
DES (Descent) - Provides descent speed, time and distance for best economy or crew selected speeds
HOLDING (Holding) - Used to obtain holding EPR, speed and endurance time
CON (Continuous) - Provides maximum continuous EPR limit and engine out data
GA (Go Around) - Displays go-around EPR limit for existing altitude and temperature.

5. ENGAGE KEY

PRESS (with a flight mode selected) -
- Drives the EPR and/or airspeed bugs to the displayed values
- The key light extinguishes and the engaged mode is displayed on the flight mode annunciator
- Other CDU displays can be selected without changing the engaged mode. ILLUMINATED -
- Indicates the data displayed is not driving the bugs
- When a performance function is displayed, the Engage Key does not illuminate since performance functions cannot be engaged.

6. BRT (brightness) Control

ROTATE - Controls CRT brightness.

7. SEL (Select) Key

PRESS -
- Moves the Caret down one line each time it is pressed
- The possible Caret positions are limited to those lines which display an asterisk
- The Caret cycles to the top line if at the lowest line.

8. CLR (Clear) Key

PRESS -
- Causes data on the line corresponding to the Caret to be removed from the display
- The CLR key must be pressed any time a new numeric entry is desired.

9. ENT (Enter)

PRESS - Commands the computer to accept the data which has been keyed in and displayed.

10. KEYBOARD

- The keyboard contains double function keys for entering numerics and selecting performance functions for display

LOAD KEY - Permits flight data entry to enable the system to compute takeoff EPR, gross weight, optimum descent distance, and airspeeds
ALTITUDE INTERCEPT KEY - Used to solve time, distance, and flight level intercept problems during climb and descent
FL (Flight) KEY - Used to determine optimum flight level, maximum altitude capability and wind altitude trade considerations
GS (Ground Speed) KEY - Computes ground speed and wind, or time and distance to a waypoint or destination
RNG (Range) KEY - Displays total endurance, distance and time remaining to reserve fuel quantity or empty tanks at any flight level
FUEL KEY - Displays total fuel, fuel reserves and fuel over destination
TEMP (Temperature) KEY - Displays ISA deviation, TAT, SAT, TAS
VREF KEY - Displays reference speeds for landing flaps and the current gross weight
TRIP KEY - Displays most economical cruise flight level for trip distances, ISA deviation, and wind, if known
WIND KEY - Displays automatically computed or manually entered wind data.

11. RCL (Recall)

PRESS (with performance function displayed) - Changes the display to the selected flight mode.

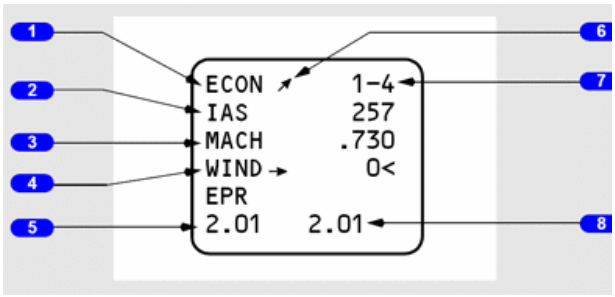
12. PAGE REVERSE KEY

PRESS -
- Reverse the display one page for both flight modes and performance functions wit multiple pages
- After the first page is reached, the system cycles back to the last page.

13. PAGE FORWARD KEY

PRESS -
- Advances the display one page for both flight modes and performance functions with multiple pages
- After the last page is reached, the system cycles back to the first page.

PDCS DISPLAYS (TYPICAL)



1. Page Title
2. Target Airspeed
3. Target Mach
4. Wind Component
5. No. 1 Engine Target/Limit EPR
6. Indicating Arrow
7. Page 1 of 4
8. No. 2 Engine Target/Limit EPR

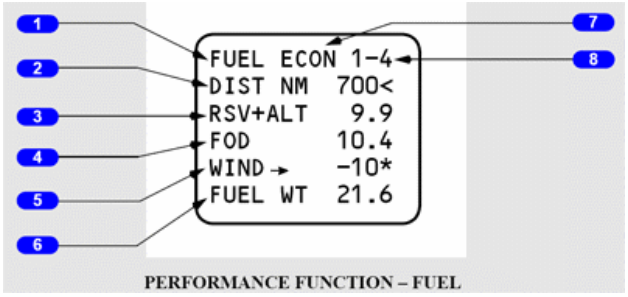
4. Wind Component

Unless a wind is entered the component reads zero.

6. Indicating Arrow

IN VIEW -

- Optimum altitude is still more than 2000 feet above (or below if down arrow is showing)
- Arrow disappears when within 2000 feet of optimum altitude.



1. Performance Function
2. Distance Nautical Miles
3. Reserve+Alternate
4. Fuel Over Distance
5. Wind Component
6. Total Fuel Quantity Remaining
7. Page Title
8. Page 1 Of 4

2. DIST NM (Distance Nautical Miles

Distance to go as entered. May be to a checkpoint or over destination.

3. RSV+ALT (Reserve + Alternate)

Reserve and alternate fuel quantity (LBS X 1000).

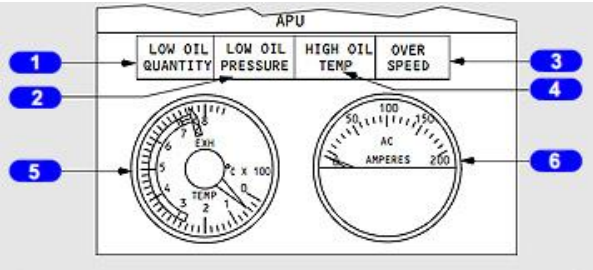
4. FOD (Fuel over distance)

Fuel remaining over destination or waypoint at the CRZ ECON speed for the present altitude and entered distance to go (LBS X 1000).

5. Wind Component

Wind component entered into computer (based on 10 kts headwind).

O11. APU



1. Low Oil Quantity Light
2. APU Low Oil Pressure Light
3. APU High Oil Temperature Light
4. APU Overspeed Light
5. APU Exhaust Gas Temperature (EGT) Indicator
6. APU Generator AC Ammeter

1. Low Oil Quantity Light

Illuminated (blue) –
- APU oil quantity is insufficient for extended operation;
- Light is disarmed when APU switch is OFF.

2. APU LOW OIL PRESSURE Light

Illuminated (amber) -
- during start until the APU oil pressure is normal
- oil pressure is low causing an automatic shutdown (after start cycle is complete)
- light is disarmed when APU switch is OFF.

3. APU HIGH OIL TEMPERATURE Light

Illuminated (amber) -
- APU oil temperature is excessive, causing APU to initiate an automatic shutdown
- light is disarmed when APU switch is OFF.

4. APU OVERSPEED Light

Illuminated (amber) -
- APU RPM limit has been exceeded resulting in an automatic shutdown
- overspeed shutdown protection feature has failed a self-test during a normal APU shutdown
- APU start is aborted prior to reaching governed speed (light will extinguish following a normal start)
- light is disarmed when APU switch is OFF.

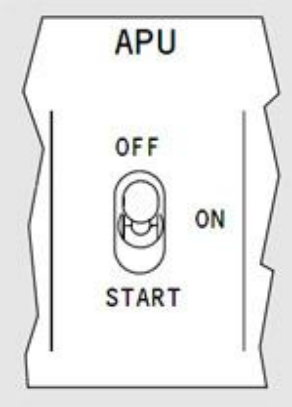
5. APU Exhaust Gas Temperature (EGT) Indicator

Displays APU EGT

6. APU Generator AC Ammeter

Displays APU generator load current

O17. APU SWITCH



OFF - normal position when APU is not running.

- positioning switch to OFF with APU running initiates APU shutdown, trips APU generator off the bus(es), if connected, and closes APU bleed air valve.

ON - normal position when APU is running.

START (momentary) - positioning APU switch from OFF to START and releasing it to ON initiates an automatic start sequence.

FIRE PROTECTION

SYSTEM DESCRIPTION

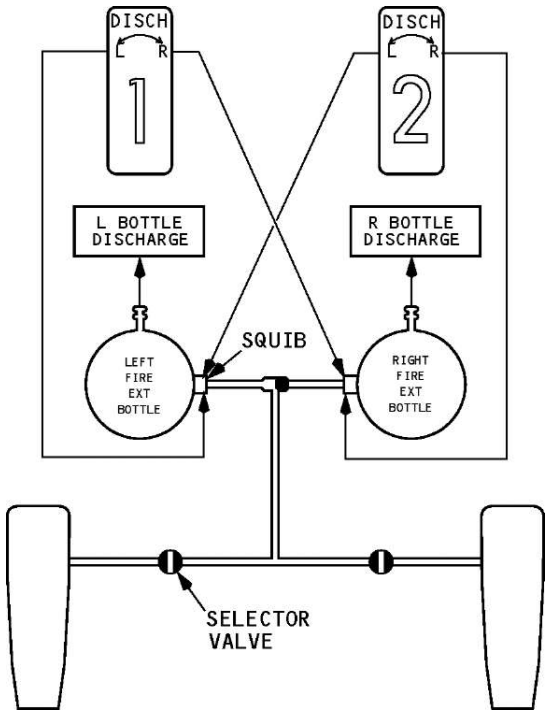
There are fire detection and extinguishing systems for:

- engines
- APU
- lavatories
- cargo compartments.

The engines also have overheat detection systems.

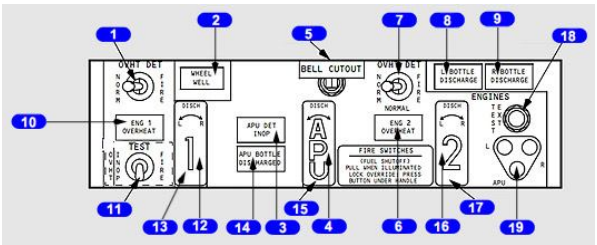
The main gear wheel well has a fire detection system, but no fire extinguishing system.

ENGINE FIRE EXTINGUISHER SCHEMATIC



CONTROLS AND INDICATORS

P11 . OVERHEAT/FIRE PROTECTION PANEL SWITCHES/LIGHTS



1,7. Overheat Detector Switch
2. Wheel Well Fire Warning Light
3. APU Detector Inoperative Light
4. APU Fire Warning Switch
5. Fire Warning Bell Cutout Switch
6,10. Engine Overheat Light
8,9. Engine Bottle Discharge Light
11. Overheat/Inoperative and Fire Test Switch
12,16. Engine Fire Warning Switch
13, 15,17. Fire Warning Switch Override
14. APU Bottle Discharge Light
18. Extinguisher Test Switch
19. Extinguisher Test Lights

FLIGHT CONTROLS

SYSTEMS DESCRIPTION

The primary flight control system uses conventional control wheel, column, and pedals linked mechanically to hydraulic power control units which command the primary flight control surfaces; ailerons, elevators and rudder. The flight controls are powered by redundant hydraulic sources; system A and system B. Either hydraulic system can operate all primary flight controls. The ailerons and elevators may be operated manually if required. The rudder may be operated by the standby hydraulic system if system A and system B pressure is not available.

The secondary flight controls, high lift devices consisting of trailing edge (TE) flaps and leading edge (LE) flaps and slats (LE devices), are powered by hydraulic system A. In the event hydraulic system A fails, the TE flaps can be operated electrically. The leading edge devices may be extended by the Standby hydraulic system. No alternate retraction system is provided for the leading edge devices.

PILOT CONTROLS

- The pilot controls consist of:
- two control columns
- two control wheels
- two pairs of rudder pedals
- SPEED BRAKE lever
- FLAP lever
- stabilizer trim wheel
- AILERON trim wheel
- RUDDER trim wheel
- YAW DAMPER switch

The control wheels are connected through transfer mechanisms which allow the pilots to bypass a jammed control or surface.

There is a rigid connection between both pairs of rudder pedals.

The SPEED BRAKE lever allows manual or automatic symmetric actuation of the spoilers.

FLIGHT CONTROL SURFACES

Pitch control is provided by:
- two elevators
- a movable horizontal stabilizer.

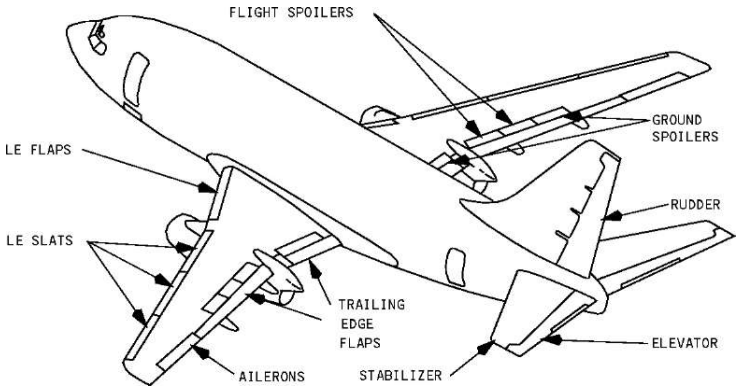
Roll control is provided by:
- two ailerons
- four flight spoilers.

Yaw control is provided by a single rudder. During takeoff, the rudder becomes aerodynamically effective between 40 and 60 knots.

TE flaps, and LE flaps and slats provide high lift for takeoff, approach, and landing.

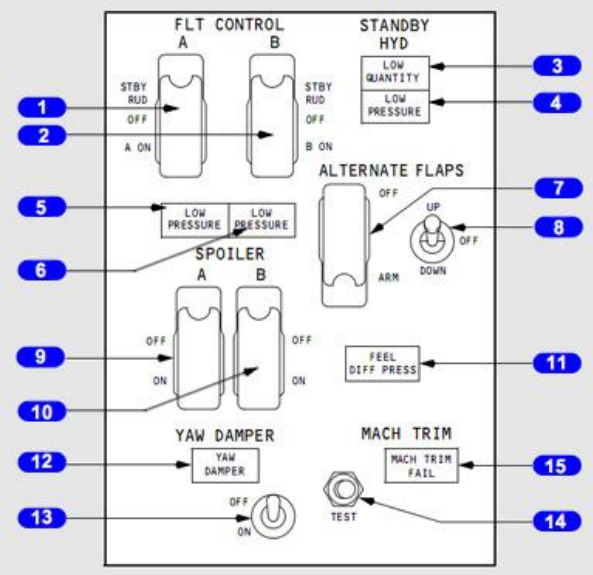
In the air symmetric flight spoilers are used as speed brakes. On the ground symmetric flight and ground spoilers destroy lift and increase braking efficiency.

FLIGHT CONTROL SURFACES LOCATION



CONTROLS AND INDICATORS

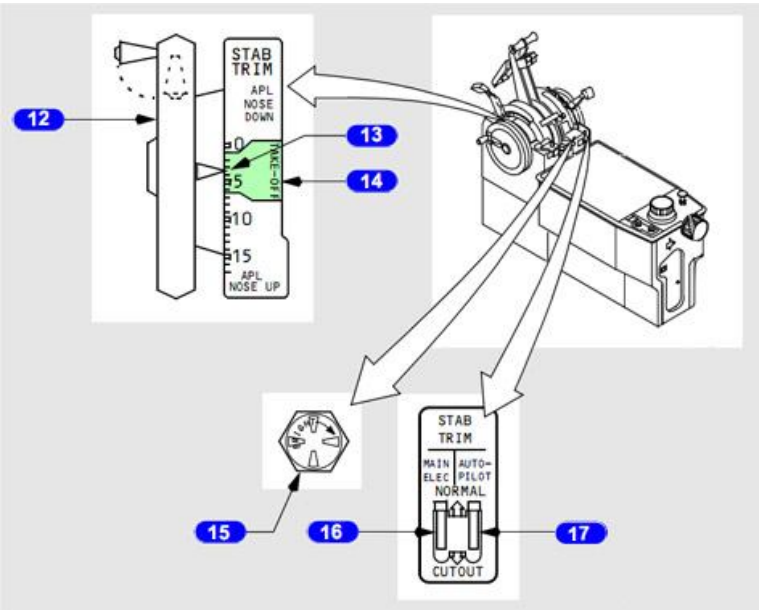
O01. FLIGHT CONTROL PANEL



7. Alternate Flaps Master Switch (Guarded To Off)
8. Alternate Flaps Position Switch
9,10. Flight Spoiler Switches (Guarded To On)
11. Feel Differential Pressure Light
12. Yaw Damper Light
13. Yaw Damper Switch
14. Mach Trim Test switch
15. Mach Trim Failure Light

STABILIZER

P10. STABILIZER CONTROLS



12. Stabilizer Trim Wheel
13. Stabilizer Trim Indicator
14. Stabilizer Trim Green Band Range
15. Stabilizer Trim Light
16. Stabilizer Trim Main Electric Cutout Switch
17. Stabilizer Trim Autopilot Cutout Switch

12. Stabilizer Trim Wheel

- provides for manual operation of stabilizer
- overrides any other stabilizer trim inputs
- rotates when stabilizer is in motion.

Note: handle should be folded inside stabilizer trim wheel for normal operation

13. Stabilizer Trim Indicator

Indicates units of airplane trim on the adjacent scale.

14. Stabilizer Trim Green Band Range

Corresponds to allowable range of trim settings for takeoff.

15. Stabilizer Trim Light

Illuminated (amber) - indicates main electric trim motor is operating.

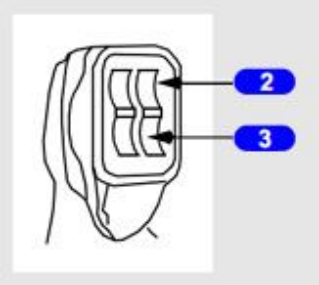
16. Stabilizer Trim Main Electric (MAIN ELECT) Cutout Switch

NORMAL - normal operating position.
CUTOUT - INOP

17. Stabilizer Trim AUTOPILOT Cutout Switch

NORMAL - normal operating position.
CUTOUT - INOP

W01, W02. CONTROL WHEEL

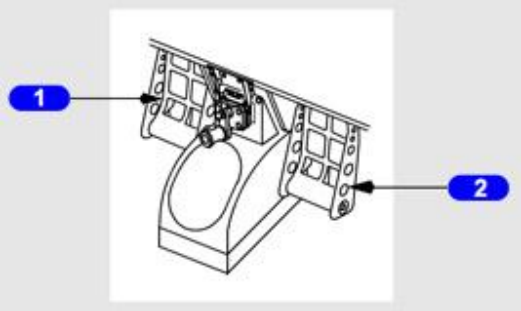


2,3. Stabilizer Trim Switches

Push (both) - electrically commands stabilizer trim in desired direction

RUDDER

RUDDER PEDALS

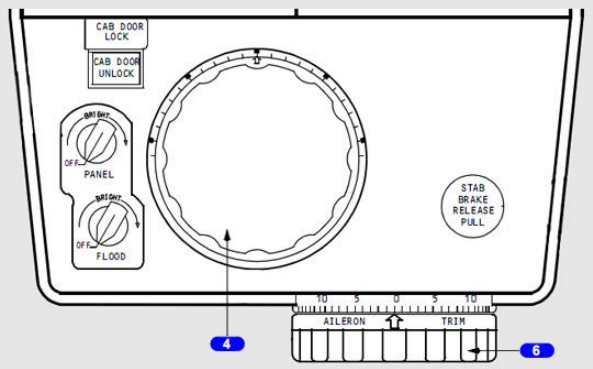


1,2. Rudder/Brake Pedals

Push -

- controls rudder position
- permits limited nose gear steering up to 7 degrees each side of center.

P16. RUDDER/AILERON TRIM WHEELS



4. Rudder Trim Wheel

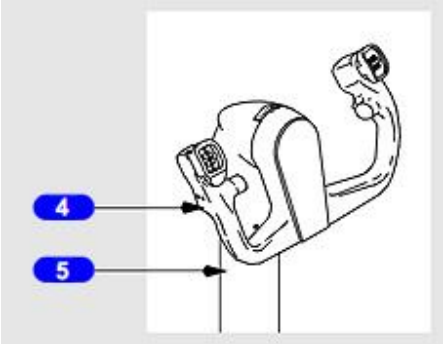
Rotate - repositions the rudder neutral control position.

6. AILERON TRIM Wheel

Rotate - repositions the aileron neutral control position.

AILERON / ELEVATOR / FLIGHT SPOILERS

W01,W02. CONTROL WHEEL



4. Control Wheel

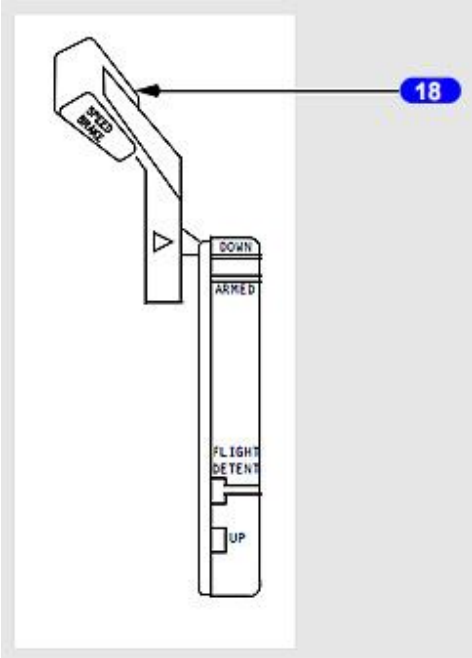
Rotate - operates ailerons and flight spoilers in desired direction.

5. Control Column

Push/Pull - operates elevators in the desired direction. Movement opposing stabilizer trim stops electric trimming.

SPEED BRAKES

P10. SPEED BRAKE LEVER



18. Speed Brake Lever

DOWN (detent) - all flight and ground spoiler panels in faired position.

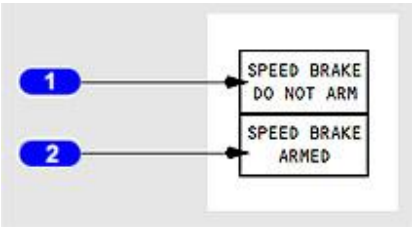
ARMED - (INFLIGHT ONLY)

- automatic speed brake system armed
- upon touchdown, the SPEED BRAKE lever moves to the UP position, and all flight and ground spoilers extend.
- throttle movement or "/" key will retract the spoiles.

FLIGHT DETENT - all flight spoilers are extended to their maximum position for inflight use.

UP - all flight and ground spoilers are extended to their maximum position for ground use.

C05. SPEED BRAKE LIGHTS



1. Speed Brake Do Not Arm Light
2. Speed Brake Armed Light

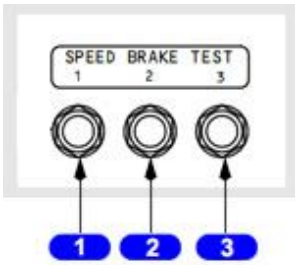
1. SPEED BRAKE DO NOT ARM Light

Light deactivated when SPEED BRAKE lever is in the DOWN position.
Illuminated (amber) - indicates abnormal condition or test inputs to the automatic speed brake system.

2. SPEED BRAKE ARMED Light

Light deactivated when SPEED BRAKE lever is in the DOWN position.

C08. SPEED BRAKE TEST SWITCHES



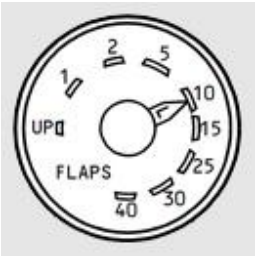
1-3. Speed Brake Test Switches

Used for maintenance purposes only.

Tests fault detection circuits of the automatic speed brake system.

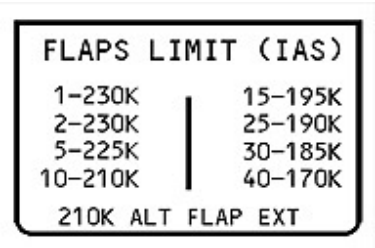
TRAILING EDGE FLAPS

C12. FLAP POSITION INDICATOR



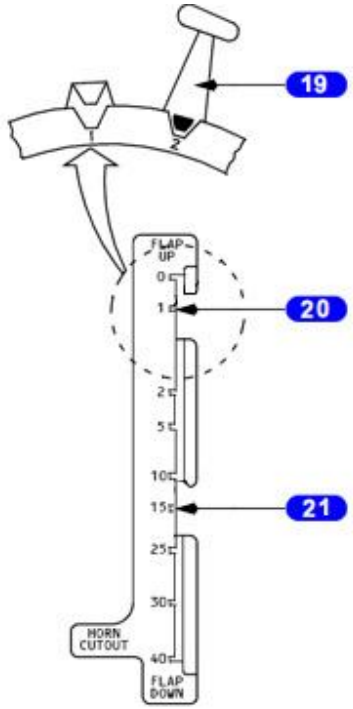
Indicates position of left and right trailing edge flaps provides trailing edge flaps asymmetry protection circuit.

C04. FLAPS LIMIT PLACARD



Indicates maximum speed for each flap setting.

P10. FLAP LEVER/FLAP GATES



19. Flap Lever

Selects position of flap control valve, directing hydraulic pressure for flap drive unit position of the leading edge devices is determined by selecting trailing edge flap position

At flaps position 40, arms the flap load relief system, which automatically will cause flap retraction to position 30 in the event of excess airspeed.

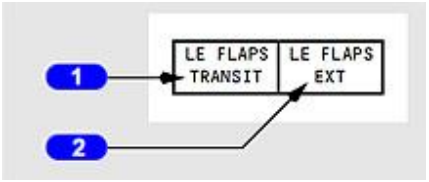
20,21. Flap Gates

Prevents inadvertent flap lever movement beyond:

- position 1 - to check flap position for one engine inoperative go-around
- position 15 - to check flap position for normal go-around.

LEADING EDGE DEVICES

C13. LEADING EDGE FLAPS LIGHTS



1. Leading Edge Flaps Transit Light
2. Leading Edge Flaps Extended Light

1. Leading Edge Flaps Transit (LE FLAPS TRANSIT) Light

Illuminated (amber) - any leading edge device in transit, or not in programmed position with respect to trailing edge flaps.

2. Leading Edge Flaps Extended (LE FLAPS EXT) Light

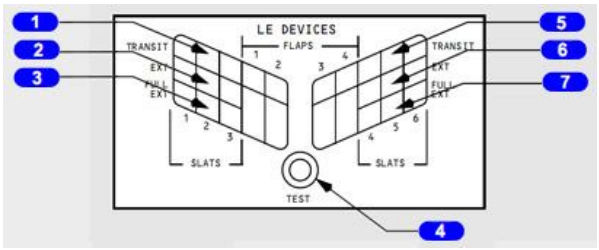
Illuminated (green) -

- all leading edge flaps extended and all leading edge slats in extended (intermediate) position (trailing edge flap positions 1, 2 and 5)

OR:

- all leading edge devices fully extended (trailing edge flap positions 10 through 40).

A02. LEADING EDGE DEVICES (LE DEVICES) ANNUNCIATOR PANEL



1,5. Leading Edge Devices Transit Lights
2,6. Leading Edge Devices Extended Lights
3,7. Leading Edge Devices Full Extended Lights
4. Leading Edge Annunciator Panel Test Switch

Leading Edge Devices (LE DEVICES) Annunciator Panel Indicates position of individual leading edge flaps and slats. Extinguished - corresponding leading edge device retracted.

1,5. Leading Edge Devices TRANSIT Lights

Illuminated (amber) - corresponding leading edge device in transit.

2,6. Leading Edge Devices Extended (EXT) Lights

Illuminated (green) - corresponding leading edge slat in extended (intermediate) position.

3,7. Leading Edge Devices FULL Extended (FULL EXT) Lights

Illuminated (green) - corresponding leading edge device in full extended position.

4. Leading Edge Annunciator Panel TEST Switch

Press - tests all annunciator panel lights.

FLIGHT INSTRUMENTS, DISPLAYS

SYSTEM DESCRIPTION

The flight instruments provide information to aid the pilots in controlling the airplane throughout its flight regime. The electric flight instruments receive input from an air data computer. The pneumatic flight instruments receive input directly from the pitot-static system. An alternate static system is also available and may be selected from the flight deck.

AIR DATA SYSTEM

The air data system consists of the pitot-static system and one or two air data computers. The system provides pitot and/or static pressure information to various flight instruments and airplane systems. The pressure information is provided in one of two ways; either directly from the pitot-static system, or indirectly from an air data computer.

PITOT STATIC SYSTEM

The pitot-static (P/S) system provides pitot and static pressure inputs to pressure-sensing instruments and systems which have functions that vary with altitude and/or airspeed.

A separate pitot system with probes mounted on the vertical stabilizer is provided for the elevator feel system.

A blocked or frozen pitot and/or static system may affect the following primary airplane system:

- Mach/airspeed indicator
- Vmo/Mmo warning
- altimeter
- vertical speed indicator
- true airspeed
- static air temperature
- flap load relief system
- elevator feel system
- autopilot
- ground proximity warning system
- altitude alert
- cabin pressure
- flight recorder
- transponder altitude reporting
- flight director altitude hold
- TAT or TAT/EPRL
- yaw damper
- Mach trim

AIR DATA COMPUTER

The ADC receives pitot and static pressure inputs from the respective pilot's P/S system, or from the alternate static system, if selected. The ADCs converts these pressure inputs to electrical signals used to operate various flight instruments and airplane systems.

ANGLE-OF-ATTACK

There is one angle-of-attack sensor, located on the left side of the forward fuselage. The vane measures airplane angle-of-attack relative to the air mass.

COMPASS SYSTEMS

Two compass systems are installed. Directional gyros are connected to the RMI compass cards. The RMI compass card is then connected to the HSI compass card.

CONTROLS AND INDICATORS

L06, R06. ATTITUDE DIRECTOR INDICATOR (ADI)

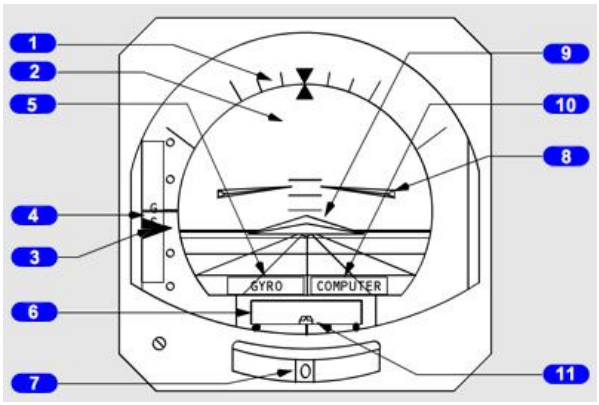
An attitude director indicator (ADI), on each pilot's panel, displays a view of the pitch and roll attitude of the airplane. The attitude display is shown on a colored tape with pitch and roll reference provided by vertical gyros. Computed steering commands from the flight director computer are presented on the ADI by command bars. These commands are viewed with respect to a fixed symbolic airplane.

When the GYRO warning flag is in view, use the Vertical Gyro transfer switch to transfer the associated systems to an operating vertical gyro. When the GS flag is in view, use the VHF NAV switch to transfer to an operating system.

The localizer symbol moves left or right to indicate deviation from localizer centerline. The localizer signal is covered by a mask until the flight director captures the glideslope. After glideslope capture, a VOR LOC failure flag on the HSI will cause the mask to cover the localizer symbol.

The localizer pointer and warning flag remain out of view with VOR frequencies selected.

The COMPUTER flag monitors the flight director system. Switching is not installed for this problem.



1. Bank Indicator and Scale
2. Attitude Display
3. Glideslope Pointer and Deviation Scale
4. Glideslope Warning Flag
5. Gyro Warning Flag
6. Localizer Symbol Shutter
7. Slip/Skid Indicator
8. Flight Director Command Bars
9. Symbolic Airplane
10. Flight Director Computer Warning Flag
11. Localizer Symbol And Deviation Scale

1. Bank Indicator and Scale

- index indicates roll angle against calibrated scale
- scale has minor markings at 10 degrees and 20 degrees and major markings at 30 degrees and 60 degrees.

2. Attitude Display

- tape moves relative to symbolic airplane, displaying pitch and roll signals from the vertical gyro
- pitch up scaled in 5 degree increments to 15 degrees then with marks at 30, 50, 70, and 90 degrees
- pitch down scaled with marks at 5, 10, 20, 30, 50, 70, and 90 degrees.

3. Glideslope Pointer and Deviation Scale

- pointer indicates glideslope position
- scale indicates deviation
- glideslope flag covers the display when the signal is not valid. Pointer out of view - a VOR frequency is tuned.

4. Glideslope (GS) Warning Flag

In view -
- glideslope information is unreliable with ILS frequency tuned
- parallels the glideslope warning flag on the HSI.

5. GYRO Warning Flag

In view -
- display is unreliable (some failures cause indications of 90 degrees left bank)
- electrical power loss.

6. Localizer Symbol Shutter

In view -
- glideslope not captured
- glideslope capture but VOR LOC flag on HSI in view.

7. Slip/Skid Indicator

Ball monitors slip or skid for coordinated flight.

8. Flight Director Command Bars

(yellow) - Displays computed pitch and/or roll commands. Biased out of view -
- flight director switch is positioned OFF
- the required signal inputs are unreliable

9. Symbolic Airplane

(orange) - Represents airplane attitude relative to the horizon.

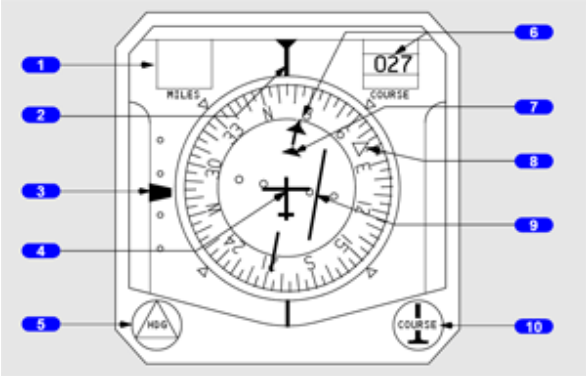
10. Flight Director COMPUTER Warning Flag

In view -
- vertical gyro information unreliable
- electrical power loss
- causes flight director command bars to retract.

11. Localizer Symbol and Deviation Scale

In view -
- localizer frequency is tuned and localizer signal is valid
- scale indicates localizer deviations of one dot or less (one dot is one degree displacement).

L07, R07. HORIZONTAL SITUATION INDICATOR (HSI)



1.DME Miles Window
2.Lubber Line
3.Glideslope Pointer and Scale
4.Airplane Symbol
5.HSI Heading Selector
6.Course Pointer and Course Counter
7.To-From Ambiguity Indicator
8.Heading Marker
9.Course Deviation Bar
10.HSI Cource Selector

1. DME MILES Window

Inoperative.

2. Lubber Line

Displays heading on compass card.

3. Glideslope Pointer and Scale

Indicates displacement above or below glideslope. Pointer in view - localizer frequency tuned and HSI powered.

4. Airplane Symbol

- fixed in the center of the instrument
- displays position of the airplane in relation to movable portions of the indicator.

5. HSI Heading (HDG) Selector

- selects desired flight director heading
- captain's selector can set desired heading for autopilot.

6. Course Pointer and COURSE Counter

Reflects the course set by the HSI course selector.

7. To/From Ambiguity Indicator

Displays direction to a VOR station along the radial selected by the HSI course selector.

8. Heading Marker

Displays the heading set by the HSI heading selector.

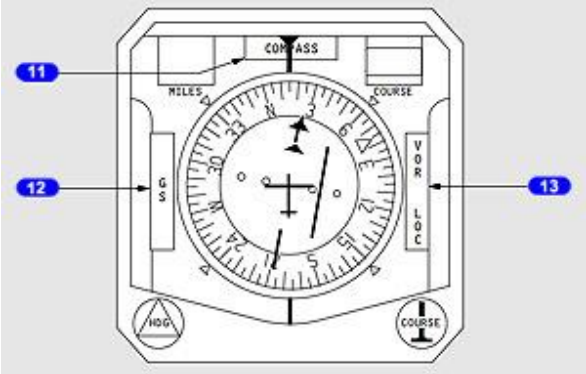
9. Course Deviation Bar

VOR: 1 dot = 5 degrees. LOC: 1 dot = 1 degree.

10. HSI COURSE Selector

- selects VOR radial or LOC course for flight director

- captain's selector can set VOR radial or localizer course for autopilot.



11. Compass Failure Flag
12. Glideslope Failure Flag;
13. VOR/LOC Failure Flag

11. COMPASS Failure Flag

In view -
- selected compass is invalid
- electrical power loss to HSI
- compass card malfunction.

12. Glideslope (GS) Failure Flag

In view - only with localizer frequency tuned
- glideslope signal below acceptable level
- failed glideslope receiver
- electrical power loss.

13. VOR LOC Failure Flag

In view -
- VOR or LOC signal below acceptable level
- NAV receiver malfunction
- electrical power loss.

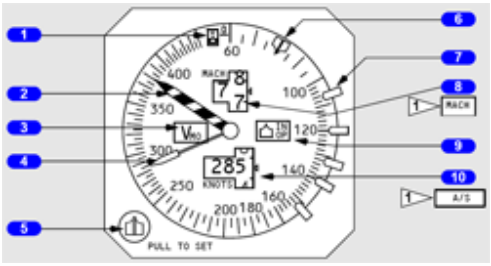
MACH/AIRSPEED INDICATORS

Two Mach/airspeed indicators display indicated airspeed, Mach, and Vmo.

The electric Mach/Airspeed indicator displays information derived from the air data computer.

The pneumatic Mach/Airspeed indicators derives information from the respective captain's or first officer's pitot-static system.

L02. ELECTRIC MACH/AIRSPEED INDICATOR



1.Airspeed Cursor Mode Annunciator
2.Vmo Pointer
3.Vmo Flag
4.Airspeed Pointer
5.Airspeed Cursor Control
6.Airspeed Cursor
7.Airspeed Reference Markers (Bugs)
8.Mach Digital Counter
9.Airspeed Cursor Flag
10.Airspeed Digital Counter

1. Airspeed Cursor Mode Annunciator

Manual mode: in view.

2. Vmo Pointer

Indicates the maximum operating (indicated) airspeed in knots.

3. Vmo Flag

In view - indicates the Vmo pointer is inoperative.

4. Airspeed Pointer

Indicates airspeed in knots.

5. Airspeed Cursor Control

Airspeed cursor is positioned by rotating the control.

6. Airspeed Cursor

Indicates target airspeed positioned manually as selected by the airspeed cursor control.

7. Airspeed Reference Markers (Bugs)

Positioned manually to the desired airspeed reference.

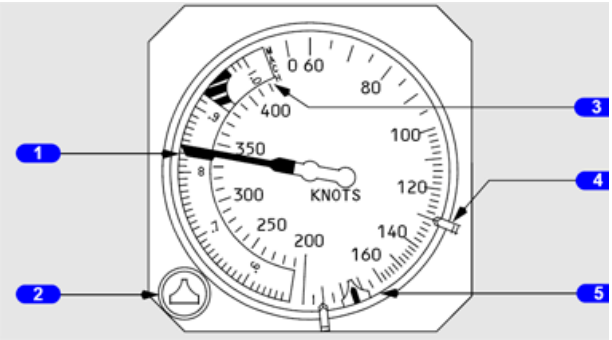
8. MACH Digital Counter

- shows Mach number, from .40 to .99 Mach, in digital form
- masked below .40 Mach
- digits are covered by a warning flag when the display is unreliable.

10. Airspeed Digital Counter

- digital display of indicated airspeed in knots
- warning flag covers the counter when the airspeed pointer and airspeed digital counter are unreliable.

R13. PNEUMATIC MACH/AIRSPEED INDICATOR



1. Mach/Airspeed Pointer
2. Airspeed Cursor Control
3. Mach Dial
4. Airspeed Reference Markers (Bugs)
5. Airspeed Cursor

1. Mach/Airspeed Pointer

Indicates Mach and airspeed in knots.

2. Airspeed Cursor Control

Rotate - manually positions the airspeed cursor.

3. MACH Dial

Rotates - Mach number read under Mach/Airspeed pointer.

4. Airspeed Reference Markers (Bugs)

Positioned manually to the desired airspeed reference.

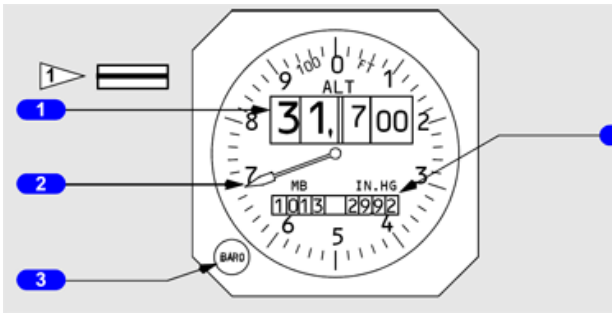
5. Airspeed Cursor

Indicates target airspeed positioned manually by the airspeed cursor control.

ALTIMETER

L13. ELECTRIC ALTIMETER

An electric altimeter is installed on the captain's instrument panel. Altitude is derived from the air data computer.



1. Digital Altitude Counter
2. Altitude Pointer
3. Barometric Setting Control
4. Barometric Setting Window

1. Digital Altitude Counter

Indicates current altitude in increments of thousands, hundreds, and twenty feet.

- warning flag appears whenever the ADC signal is lost or a malfunction exists
- blue flag appears in the left window when the altitude is below 10,000 feet
- a NEG flag appears in the two left-hand windows when altitude below zero feet is displayed.

2. Altitude Pointer

Makes one revolution each one thousand feet.

3. Barometric (BARO) Setting Control

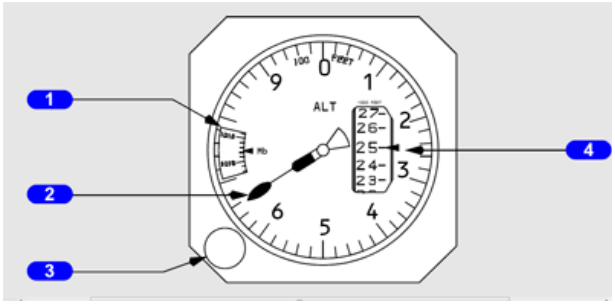
Rotate - adjusts barometric settings.

4. Barometric Setting Window

Displays barometric correction (in millibars and inches of mercury) as set by the barometric setting control.

R24. PNEUMATIC ALTIMETER

A pneumatic altimeter is installed on the first officer's instrument panel. It utilizes the first officer's pitot-static source.



1. Barometric Setting Window
2. Altitude Pointer
3. Barometric Setting Control
4. Digital Altitude Counter

1. Barometric Setting Window

Displays barometric correction (in millibars of mercury) as set by the barometric setting control.

2. Altitude Pointer

Makes one revolution each one thousand feet.

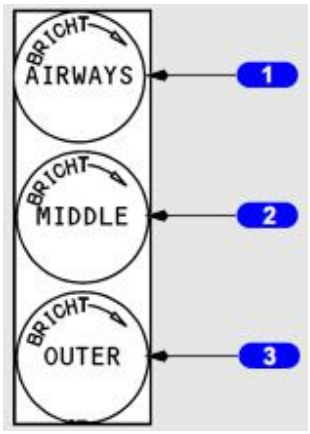
3. Barometric Setting Control

Rotate - adjusts barometric settings.

MARKER BEACON

Each pilot has a set of marker beacon lights that show airways, middle, and outer beacon passage. Both sets are operated by one marker beacon receiver.

L17, R17. MARKER BEACON LIGHTS



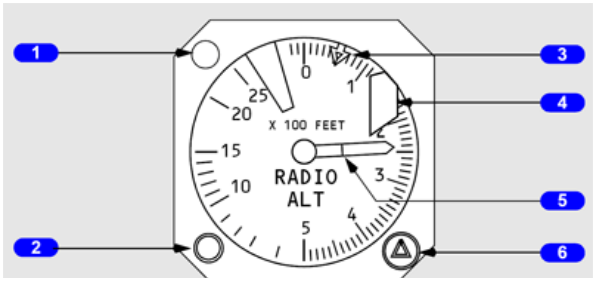
1-3. Marker Beacon Lights

AIRWAYS (white) - illuminates over an inner or airways marker beacon.

MIDDLE (amber) - illuminates over a middle marker beacon. OUTER (blue) - illuminates over an outer marker beacon.

L19, R19. RADIO ALTIMETER

One low range radio altimeter and two indicators provide indication of airplane height above the ground up to 2500 feet absolute altitude. A radio altimeter indicator is located on each pilot instrument panel.
When the captain's radio altimeter is inoperative, all modes of the GPWS are inoperative.



1.Minimum Descent Altitude Light
2.Radio Altimeter Test Switch
3.Minimum Descent Altitude Cursor
4.Warning Flag
5.Altitude Pointer
6.Minimum Descent Altitude Cursor Control

1. Minimum Descent Altitude (MDA) Light

Illuminated (amber) - altitude pointer is at or below MDA cursor.

2. Radio Altimeter Test Switch

Push -

- altitude pointer drives to 100 feet
- warning flag in view

- the MDA light illuminates if the altitude pointer drives to a position at or below the altitude indicated by the minimum descent altitude cursor.

3. Minimum Descent Altitude (MDA) Cursor

Displays selected altitude reference selected by the MDA cursor control.

4. Warning Flag

In view -
- power failure
- loss of return signal below 2500 feet
- incorrect altitude tracking
- radio altimeter test switch pushed.

5. Altitude Pointer

Power off - pointer moves to the top of the scale under the mask.

Power on -
- up to 2500 feet - pointer reads true altitude above ground level
- above 2500 feet - pointer is behind the mask.

6. Minimum Descent Altitude (MDA) Cursor Control

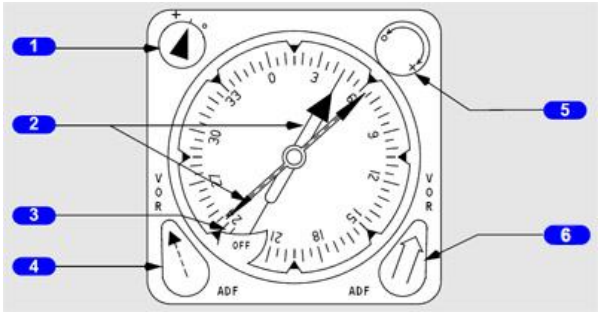
Rotate - sets the MDA cursor.

L11, R11. MINIMUM DESCENT ALTITUDE (MDA) LIGHT

1. Minimum Descent Altitude (MDA) Light

Illuminated (amber) - altitude pointer is at or below MDA cursor setting.

L03, R03. RADIO MAGNETIC INDICATOR (RMI)



1. Synchronizing Annunciator
2. ADF/VOR Bearing Pointers
3. Compass Warning Flag
4,6. ADF/VOR Bearing Pointer Switches
5. Synchronizing Control
7. Scale

1. Synchronizing Annunciator

Indicates the compass is out of synchronization if arrow is pointed toward dot or cross.

2. ADF/VOR Bearing Pointers
- narrow pointer uses signals from selected ADF or VOR receiver No. 1
- wide pointer uses signals from selected ADF or VOR receiver No. 2.

3. Compass Warning Flag

In view - electrical power failure to compass system.

4,6. ADF/VOR Bearing Pointer Switches

Rotate - selects ADF or VOR bearing.

Note: Instrument transfer switching table provides VHF NAV signal sources to pointer.

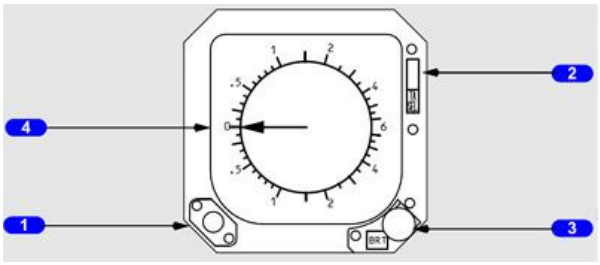
5. Synchronizing Control

Rotate -
- synchronizes RMI with compass system
- direction of rotation determined by synchronizing annunciator.

L14, R14. VERTICAL SPEED INDICATOR

Two pneumatic vertical speed indicators display vertical speed derived from the respective pilots' static system (or alternate static, if selected). On some airplanes, vertical speed information is displayed by two electric vertical speed indicators that receive information derived from their respective air data computer.

On some airplanes, a TCAS VSI display shows air traffic information detected by the TCAS system.



1.Light Sensor
2.TA Select Push-button
3.Brightness Control
4.Vertical Speed Pointer

1. Light Sensor

Automatically adjusts display contrast for ambient light conditions.

2. TA Select Push-button

Push - changes display between modes:
- full-time mode - traffic information is displayed full-time
- popup mode - traffic information is displayed only when a TA or RA is generated. Display remains for the duration of the alert.

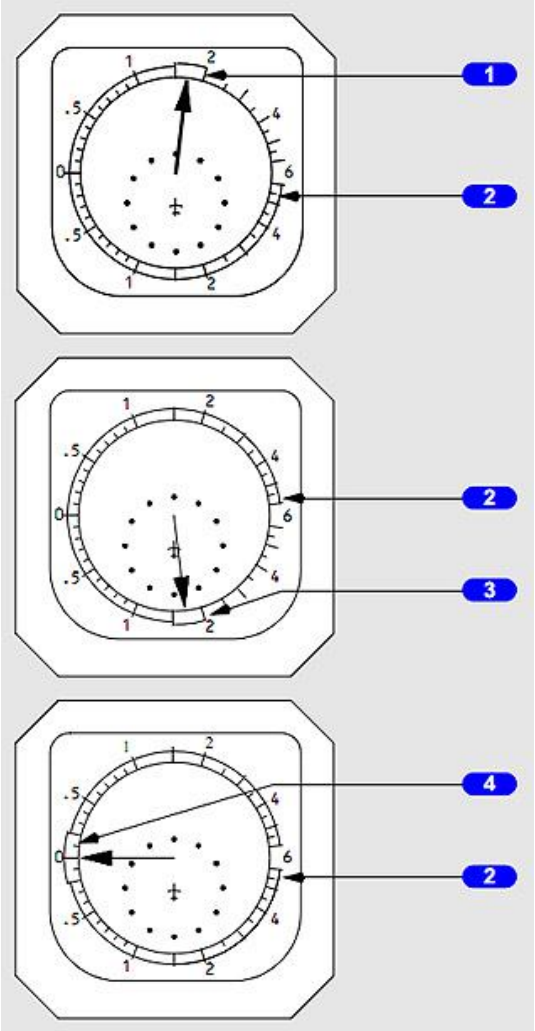
3. Brightness Control

Rotate - adjusts brightness of the VSI display.

4. Vertical Speed Pointer

Displays rate of climb or descent from 0 to 6,000 feet per minute

TCAS RESOLUTION ADVISORY COMMANDS



1. RA Pitch Command (green) (UP Advisory)

Indicates vertical speed range to ensure traffic separation.

2. Command Arc (red)

Indicates vertical speed range to avoid.

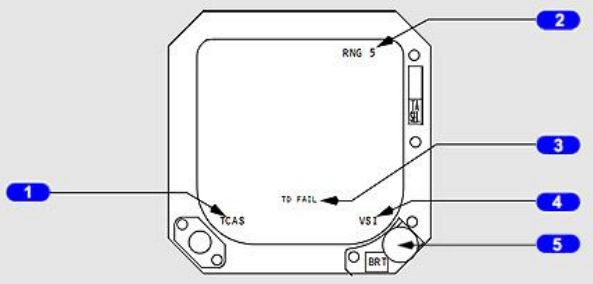
3. RA Pitch Command (green) (DOWN Advisory)

Indicates vertical speed range to ensure traffic separation.

4. RA Pitch Command (green) (LEVEL Advisory)

Indicates vertical speed range to ensure traffic separation.

TCAS VSI MESSAGES



1. TCAS Mode Display
2. TCAS Range
3. Fault Annunciations
4. VSI Flag (amber)

1. TCAS Mode Display

Indicates current TCAS mode/system status

- TCAS (amber) - TCAS system has failed
- TA ONLY (blue) - TCAS TA only mode is selected
- TCAS STBY (blue) - TCAS standby mode is selected
- TEST (amber) - TCAS is in test mode.

2. TCAS Range

Displays TCAS range in nautical miles.

3. Fault Annunciations

TD FAIL (amber) - failure in the operation of the traffic display. RA FAIL (amber) - RA information is not available.

4. VSI Flag (amber)

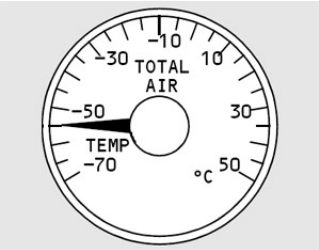
Indicates that vertical speed is unreliable.

TCAS SYMBOLOGY

SYMBOL	NAME	REMARKS
■	RA traffic symbol (R)	Displayed during TCAS Resolution Advisory when traffic selected on the VSI or Weather Radar Indicator.
●	TA traffic symbol (A)	Displayed during TCAS Traffic Advisory when traffic selected on the VSI or Weather Radar Indicator.
◆	Proximate traffic symbol (W)	Displayed when traffic selected on the VSI or Weather Radar Indicator and traffic is within 1200 feet vertical and 6 miles horizontal from present position.
◇	Other traffic symbol (W/outlined)	Displayed when traffic selected on the VSI or Weather Radar Indicator and traffic is greater than 1200 feet vertical or 6 miles horizontal from present position.
+ 05 - 05	Relative altitude (RA,W)	With traffic selected on the VSI or Weather Radar Indicator, displays relative traffic altitude in hundreds of feet.
↑	Vertical motion arrow (RA,W)	Displayed when traffic vertical speed is greater than 500 feet per minute and traffic selected on the VSI or Weather Radar Indicator.

TOTAL AIR TEMPERATURE

R02. TOTAL AIR TEMPERATURE INDICATOR

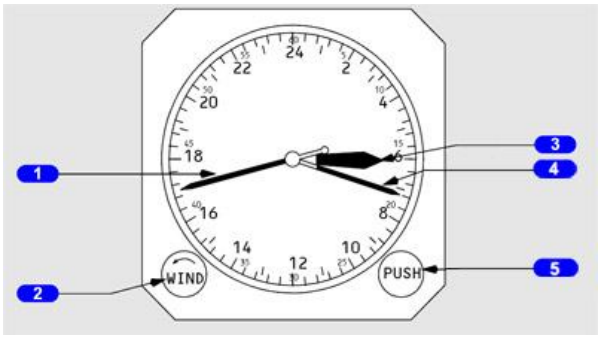


Displays TAT from -70 degrees C to +50 degrees C.

L20, R20. CLOCK

Two spring powered, eight day clocks are installed.

Each clock displays time in a 24-hour format and has a stop-watch timer.



1. Sweep Second Hand
2. Winding And Setting Control
3. Hour Hand
4. Minute Hand
5. Push Control

1. Sweep Second Hand

- controlled by push button
- rotates once each minute.

3,4. Hour and Minute Hands

Twenty-four hour format.

5. PUSH Control

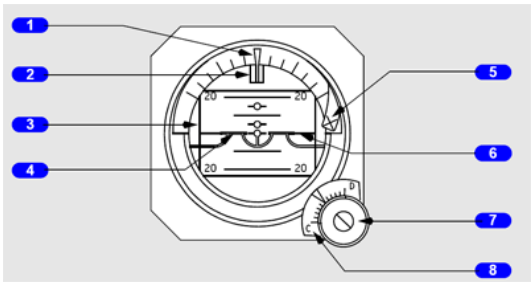
Controls sweep hand.
With sweep second hand at zero (60):

- Push - starts sweep hand timing
- Push again - stops sweep hand timing
- Push again - resets sweep second hand to zero.

STANDBY FLIGHT INSTRUMENTS

C02. STANDBY HORIZON

The standby horizon indicator provides attitude information that is independent of the primary attitude displays. The indicator is powered by the battery bus and remains powered after the loss of all normal AC power as long as battery power is available.



1.Bank Angle Scale
2.Bank Angle Indicator
3.Horizon Drum
4.Symbolic Airplane
5.Warning Flag
6.Horizon Bar
7.Pitch Trim and Gyro Caging Control
8.Pitch Trim Scale

1. Bank Angle Scale

Measures bank angles up to 60° in 10° increments (freedom of roll 360°).

2. Bank Angle Indicator

Indicates airplane bank angle against bank angle scale.

3. Horizon Drum

Provides indication of airplane pitch attitude (freedom of pitch 90°).

4. Symbolic Airplane

Provides an adjustable attitude reference.

5. Warning Flag

In view - loss of power.

7. Pitch Trim and Gyro Caging Control

In - rotate to adjust symbolic airplane pitch presentation.
Pull (momentary) - provides fast erection (caging) of gyro.
Release - control retracts.

Note: Airplane should be level during procedure.

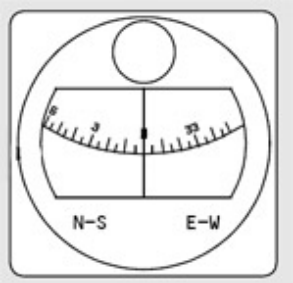
8. Pitch Trim Scale

Provides a reference for adjusting the symbolic airplane pitch presentation. Marked in 1 degree increments

- C - climb
- D - dive.

O31. STANDBY MAGNETIC COMPASS

A standard liquid-damped magnetic standby compass is provided. A card located near the compass provides heading correction factors.



Displays magnetic heading.

The magnetic compass may be folded out of view for an unobstructed view through the windshield.

A standby magnetic compass correction card provides appropriate heading corrections.

FLIGHT MANAGMENT, NAVIGATION

SYSTEM DESCRIPTION

Navigation systems include the radio navigation systems, transponder, and weather radar.

RADIO NAVIGATION SYSTEMS

AUTOMATIC DIRECTION FINDING (ADF)

An automatic direction finding (ADF) system enables automatic determination of magnetic and relative bearings to selected facilities.

Two ADF receivers are installed. The No. 1 receiver uses the narrow pointer on the RMIs. The No. 2 receiver uses the wide pointer. The audio is heard by using the ADF receiver control on the audio selector panel.
ADF bearing pointers will not display correct magnetic bearing when the compass information is lost or invalid. Relative bearings are indicated by pointers if the receiver is operating.

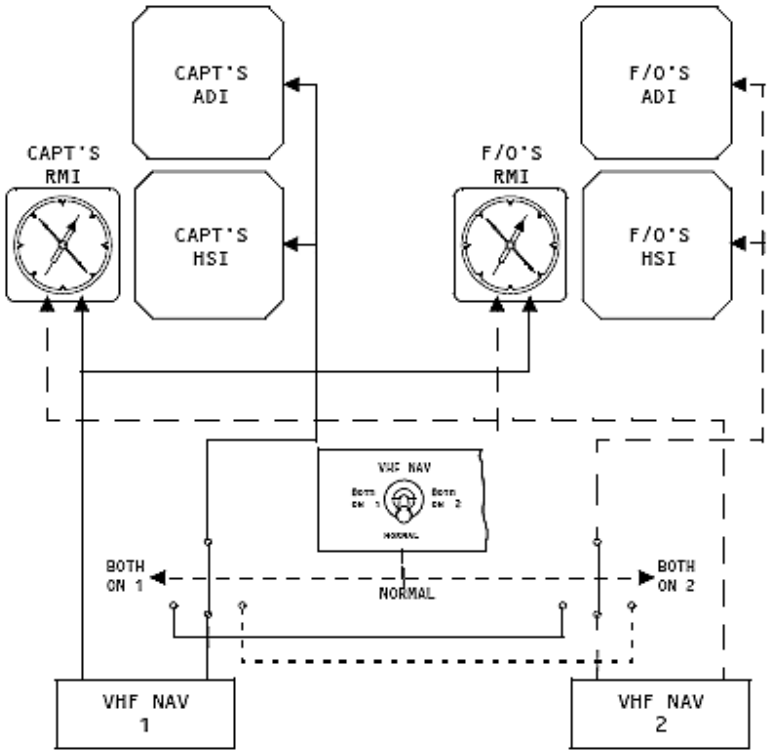
VHF NAVIGATION SYSTEM (VHF NAV)

Two NAV receivers and controls panels are installed. The VHF navigation control panel is used to tune VOR and ILS frequencies.

VOR information is displayed on the RMIs when a valid in-range VOR station is tuned. The HSI displays course deviation when operating in the VOR mode.

The deviation bar and glideslope pointer are controlled by the controls for the operating system.

VHF NAVIGATION SYSTEM SCHEMATIC



SECONDARY NAVIGATION SYSTEMS

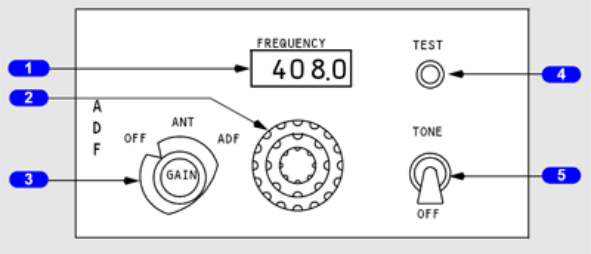
ATC TRANSPONDER

Two ATC transponders are installed and controlled by a single control panel. The ATC transponder system transmits a coded radio signal when interrogated by ATC ground radar. Altitude reporting capability is provided allowing altitude information from the air data computer to be transmitted to an ATC radar facility.

CONTROLS AND INDICATORS

RADIO NAVIGATION SYSTEMS

P01.P06. AUTOMATIC DIRECTION FINDING (ADF) CONTROL



1.Frequency Indicator
2.Frequency Selector
3.ADF Mode Selector
4.Test Switch
5.Tone Switch

1. FREQUENCY Indicator

Indicates the frequency selected with the related frequency selector.

2. Frequency Selector

Rotate -
- outer knob sets the hundreds number
- middle knob sets the tens number
- inner knob sets the tenths and ones number.

3. ADF Mode Selector

OFF - removes power from selected receiver. ANT - only station audio received. ADF - ADF bearing and station audio received. GAIN - adjusts receiver gain.

4. TEST Switch

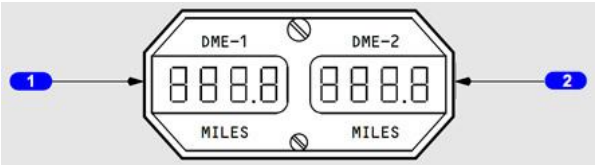
Push - ADF bearing pointer indicates 45 degrees left of lubber line.

5. TONE Switch

TONE - adds tone to receiver audio.

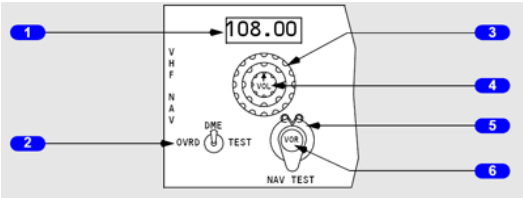
DISTANCE MEASURING EQUIPMENT (DME)

L15, R15. DIGITAL DME INDICATOR



- displays slant range to DME station
- blank with electrical loss
- dashes when not receiving DME station
- brightness controlled by center knob located on pilot's light control panel.

P12, P13. VHF NAVIGATION CONTROL



1.Frequency Indicator
2.DME Mode Selector
3.Frequency Selector
4.Volume Selector
5.Navigation Test Switch
6.VOR Test Switch

1. Frequency Indicator

Indicates the frequency selected by the frequency selector.

2. DME Mode Selector

OVRD - DME searches to 390 nm.
DME - DME searches to 200 nm. Search limited to 50 nm for TVOR.
TEST - Digital DME indicator is:
- blank for one second
- dashes for one second
- zeros for as long as held in test position.

3. Frequency Selector

Rotate - manually selects the desired frequency.

4. Volume (VOL) Selector

Rotate - controls volume of selected station.

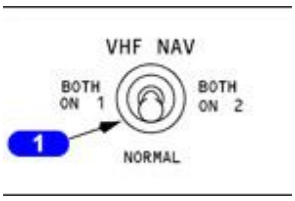
5. Navigation Test (NAV TEST) Switch

With an ILS frequency selected: Rotate Knob Left -
- the glideslope indicates one dot up
- localizer indicates one dot left. Rotate Knob Right -
- the glideslope indicates one dot down
- localizer indicates one dot right.

6. VOR TEST Switch

With a VOR frequency tuned and a course of 000 selected: Push -
- course deviation bar centers
- VOR bearing pointer indicates 180 degrees
- TO-FROM ambiguity indicator show a FROM indication.

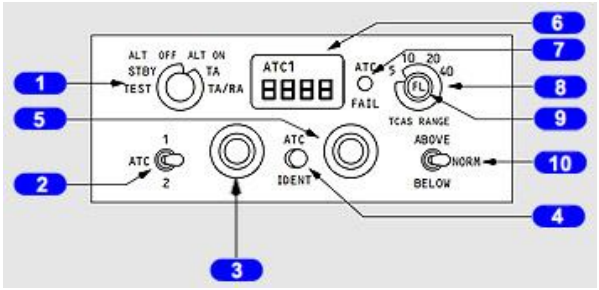
O02. VHF NAV TRANSFER SWITCH



• BOTH ON 1 - switches the VHF navigation source to VHF NAV receiver No. 1
• NORMAL - VHF navigation source is from default VHF NAV receiver
• BOTH ON 2 - switches the VHF navigation source to VHF NAV receiver No. 2.

SECONDARY NAVIGATION SYSTEMS

P07. TRANSPONDER PANEL



1. Transponder Mode Selector
2. Transponder (ATC) Switch
3,5. ATC Code Selector
4. ATC Identification Switch
6. ATC Code Indicator
7. ATC Fail Light
8. Traffic Collision Avoidance System (TCAS) Range Selector
9. Flight Level Switch
10. TAU Envelope Switch

1. Transponder Mode Selector

TEST - starts ATC transponder functional test. STBY - does not transmit.

Note: Transponder modes are enabled only when the airplane is airborne, except for mode S, which operates continuously when the transponder mode selector is out of STBY

ALT OFF - deactivates altitude reporting. ALT ON - enables altitude reporting.
TA - enables display of traffic advisory TCAS targets.
TA/RA - enables display of traffic advisory and resolution advisory TCAS targets.

3,5. ATC Code Selector

Rotate - sets transponder code in transponder.

6. ATC Code Indicator

Displays transponder code. Displays operating transponder (1 or 2). Displays response indicator (R).

7. ATC FAIL Light

Illuminated - indicates transponder malfunction.

8. Traffic Collision Avoidance System (TCAS) Range Selector

Selects range for TCAS operation.

WEATHER RADAR

THEORY OF OPERATION

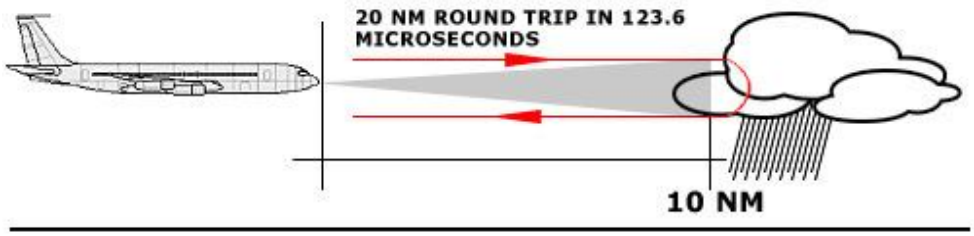
The primary use of this radar is to aid the pilot in avoiding thunderstorms and associated turbulence. Since each operator normally develops specific operational procedures for use of weather avoidance radar, the following information is presented for use at the operator's discretion.

Operational techniques for the radar are similar to earlier generation weather avoidance radars. The proficient operator manages antenna tilt control to achieve best knowledge of storm height, size, and relative direction of movement.

RADAR PRINCIPLES

Radar is fundamentally a distance measuring system using the principle of radio echoing. The term RADAR is an acronym for Radio Detecting and Ranging. It is a method for locating targets by using radio waves. The transmitter generates microwave energy in the form of pulses. These pulses are then transferred to the antenna where they are focused into a beam by the antenna. The radar beam is much like the beam of flashlight. The energy is focused and radiated by the antenna in such a way that it is most intense in the center of the beam with decreasing intensity near the edge. The same antenna is used for both transmitting and receiving. When a pulse intercepts a target, the energy is reflected as an echo, or return signal, back to the antenna. From the antenna, the returned signal is transferred to the receiver and processing circuits located in the receiver transmitter unit. The echoes, or returned signals, are displayed on an indicator.

Radio waves travel at the speed of 300 million meters per second and thus yield nearly instantaneous information when echoing back. Radar ranging is a two-way process that requires 12.36 micro-seconds for the radio wave to travel out and back for each nautical mile of target range. As shown in the distance illustration below, it takes 123.6 micro-seconds for a transmitted pulse of radar energy to travel out and back from an area of precipitation 10 nautical miles away.

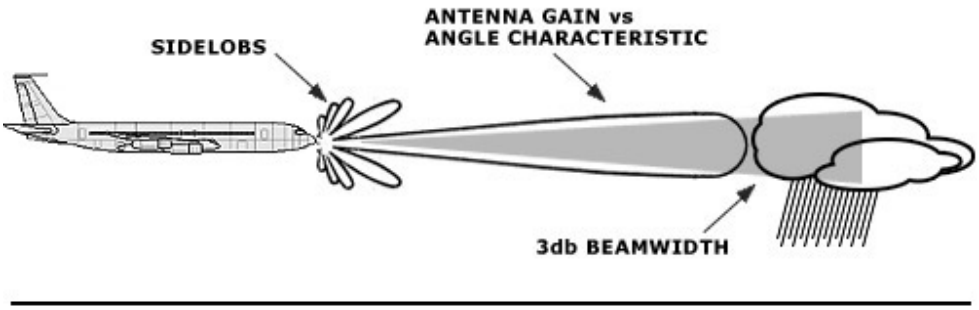


WEATHER RADAR PRINCIPLES

Airborne weather avoidance radar, as its name implies, is for avoiding severe weather, not for penetrating it. Whether to fly into an area of radar echoes depends on echo-intensity, spacing between the echoes, aircraft capabilities and pilot experience. Remember that weather radar detects only precipitation drops; it does not detect minute cloud droplets, nor does it detect turbulence. Therefore, the radar provides no assurance of avoiding instrument weather in clouds and fog. The indicator may be clear between intense echoes; this clear area does not necessarily mean it is safe to fly between the storms and maintain visual sighting of them.

RADAR BEAM ILLUMINATION

Probably the most important aspect of a weather radar is the antenna beam illumination characteristic. To make a proper interpretation of what you are seeing on the display, you must have an understanding of what the radar beam "is seeing". The following figure is a side view of the radar beam characteristic with a storm depicted at a distance that causes the size of the storm to just fill the 3 dB beamwidth. This would be the typical situation for a storm at approximately 40 nautical miles with a 12 inch diameter antenna. It's important to understand and visualize this situation, to enhance your understanding of the rest of this manual.



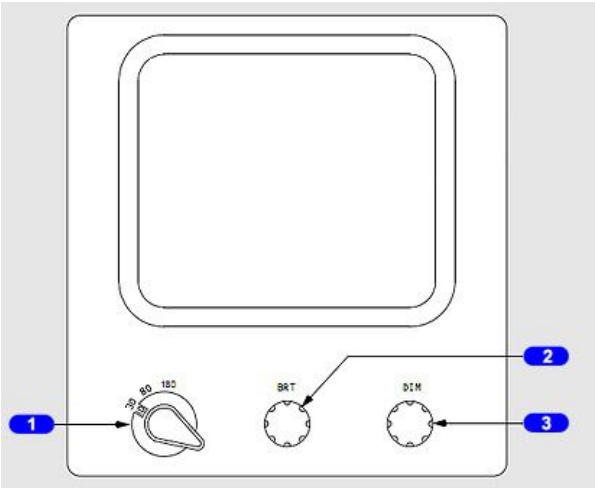
RADAR REFLECTIVITY

What target will reflect the radar's pulses and thus be displayed on the indicator? Only precipitation will be detected by an X-band weather radar. Therefore weather radar does not detect clouds, thunderstorms or turbulence directly. Instead, it detects precipitation which may be associated with dangerous thunderstorms and turbulence. The best radar reflectors are raindrops and wet snow or hail. The larger the raindrop the better it reflects. Because large drops in a small concentrated area are characteristic of a severe thunderstorm, the radar displays the storm as a strong echo. Drop size is the most important factor in high radar reflectivity.

The radar display has been calibrated to show five levels of target intensity: Black (level 0), and levels 1-4 grades of Amber.

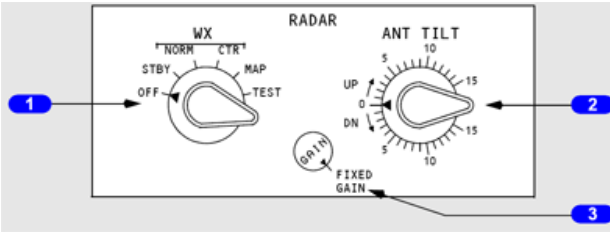
CONTROLS AND INDICATORS

P05. WEATHER RADAR PANEL



1. Range Selector
2. Brightness Control
3. Dimmer Control

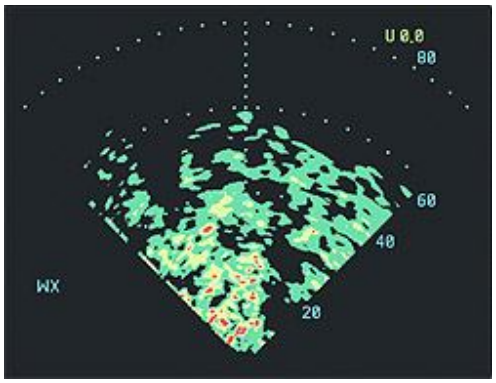
P02. WEATHER RADAR CONTROL PANEL



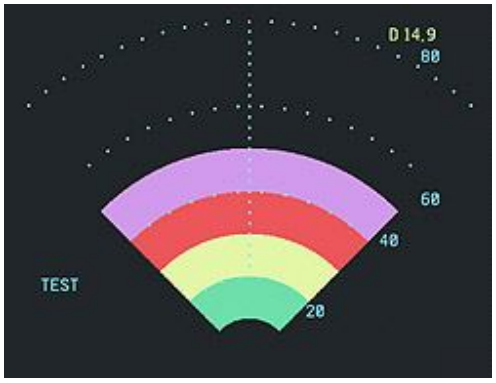
1.Weather (WX) Radar Function Selector
2.Antenna Tilt Control
3.Gain Control

1. Weather (WX) Radar Function Selector

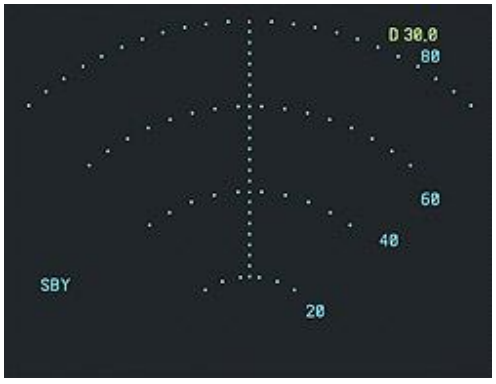
STBY - Fully energizes the system circuitry but no radar transmissions occur in the SBY mode of operation. The antenna is parked at 0 degrees azimuth and 30 degrees tilt down with the antenna drive motors locked.



WX NORM - Selects the normal condition of operation for weather detection. The system will transmit after a 60 second warm-up time is completed. The radar system initializes to the Wx mode, 80 nm.
Note: The 60 second warm up period can be monitored upon power up of the system. When the knob is switched directly from OFF to ON mode, the display will blank. Just before the warm up period is complete, the screen will turn black for a few seconds, then the radar will begin transmitting and the screen will display radar returns. No radar transmissions occur until the warm up period is complete.



TEST - The multicolored arc display test pattern is displayed in this mode of operation. The test pattern is initialized and sized to fit the 80 nm range and can also be scaled with the range select buttons. No radar transmissions occur while TST is selected. TEST will appear in the lower left of the display.



STBY - Fully energizes the system circuitry but no radar transmissions occur in the SBY mode of operation. The antenna is parked at 0 degrees azimuth and 30 degrees tilt down with the antenna drive motors locked. SBY will appear in the lower left of the display.

WX CTR - selects the WxA (weather-alert) mode of operation. "WxA" will appear in the lower left of the display. WxA colors are: Black for no returns, Green for weak returns, Yellow for moderate returns, Red for heavy returns and Magenta for intense returns. When the WxA mode is selected, magenta areas of storms flash between magenta and black at a 1 HZ rate.

OFF - Removes primary power from the radar indicator, but the radar still has power applied. The radar will remain active with no radar transmissions occurring, for up to a maximum time of 30 seconds. This time delay allows time to park the antenna at 0 degrees azimuth and 30 degrees tilt down.

2. Antenna Tilt Control

Permits manual adjustment of antenna tilt 15° up (right click) or down (left click) for best indicator presentation.

3. GAIN Control

The gain control adjusts the radar GAIN

PREFLIGHT PROCEDURES

The system never transmits in the OFF, STBY or TEST modes.
Note: A 60 second warm up time period is required before the system will transmit.

1) Place the radar controls in the following positions:
- Function switch to TEST
- Tilt to UP 7

The test pattern will appear.

2) With the function switch in TEST or STBY, taxi to a clear area where there are no people, aircraft, vehicles, or metallic buildings within approximately 100 yards.

3) Rotate the function switch to NORM. The indicator will automatically display in the Wx mode. Weather targets will be displayed in grades of amber.

4) Select 50 nm range.

5) Select CTR mode to observe black contour areas (if any).

6) Repeat the manual tilt adjustment, this time between the 0 and down 15 degrees positions.

7) Return the function switch to TEST or STBY before taxiing!

8) When you are ready for weather detection (after takeoff or just before), place the function switch to NORM.

OPERATION IN-FLIGHT - GENERAL

It is the purpose of this section to help you become a proficient radar operator as soon as possible. However, it is realized that proficiency can only improve with usage. It is, therefore, recommended that the operator become familiar with the operation of the system during fair weather instead of while trying to penetrate a storm front.

This section concerns itself with a more detailed discussion of some of these controls and how to make the most efficient use of them.

Note

Your radar is a weather-avoidance device. It should never be used for weather-penetration. It will help you see and plan avoidance maneuvers around significant weather encountered during flight.

TILT MANAGEMENT

Effective antenna tilt management is the single, most important key to more informative weather radar displays. The prime factors must be kept in mind for proper tilt management:

- The center of the radar beam is referenced to the horizon by the aircraft vertical reference system.
- Adjusting the antenna tilt control will cause the center of the radar beam to scan above or below the plane of the attitude reference system.

When flying at high altitudes, the use of proper tilt management ensures observation of weather targets without over scanning. For example, a low altitude storm detected on the long range setting may disappear from the display as it is approached. While it may have dissipated during your approach toward the storm, don't count on it. It may be that you are directing the radiated energy from the antenna above the storm as you get closer. Judicious management of the antenna tilt control will avoid over-scanning a weather target.

EARLY DETECTION OF ENROUTE WEATHER

To set the antenna tilt to optimize the radar's ability to quickly identify significant weather, follow these steps:
1) Select the NORM mode of operation. Adjust Brightness control as desired.
2) Select the 50 or 150 nm range.
3) Adjust the antenna tilt to watch the strongest returns seen on the display.

TARGET RESOLUTION

The ability of a weather avoidance radar system to resolve and display two or more closely spaced targets is limited in range by the transmitted pulse width and display range and in azimuth by the antenna beam width.

RANGE RESOLUTION

The transmitter pulse width in the radar is 4 micro-seconds, yielding a receiver range resolution of approximately 1/3 nautical mile.

AZIMUTH RESOLUTION

The ability of the radar to resolve adjacent targets in azimuth is a function of the beam width of the antenna and the range to the target. The diameter of this radiated beam increases as it gets further away from the aircraft.

Targets separated by a distance less than the beam diameter (at the target distance) will merge and appear on the indicator as "one."

PATH PLANNING

Remember to plan a deviation path early. Simply skirting the red or magenta portion of a cell is not enough. Plan an avoidance path for all weather echoes which appear beyond 100 nautical miles since this indicates they are quite intense.

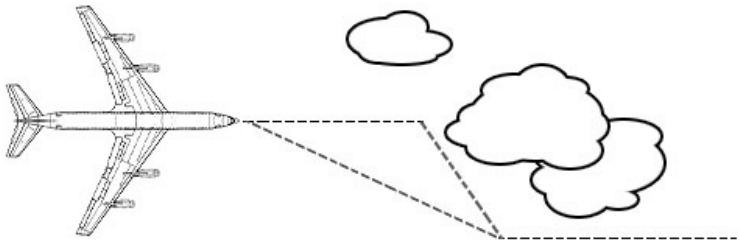
The most intense echoes are severe thunderstorms. Remember that hail may fall several miles from the cloud, and hazardous turbulence may extend as much as 20 nautical miles; therefore, echoes should be separated by at least 40 nautical miles before you fly between them. As echoes diminish in intensity, you can reduce the distance by which you avoid them.

PATH PLANNING CONSIDERATIONS

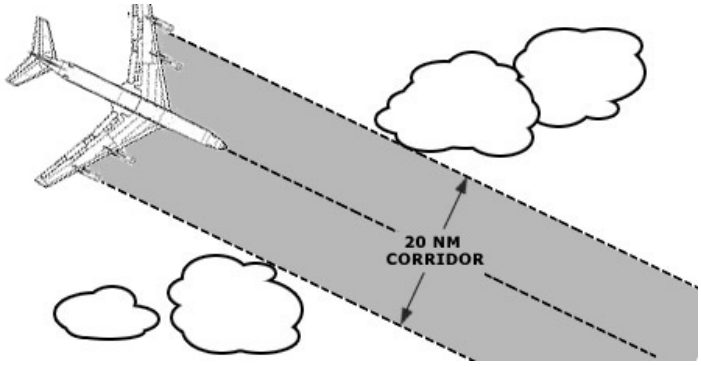
- Avoid cells containing magenta and red areas by at least 20 nautical miles.
- Do not deviate downwind unless absolute necessary. Your chances of encountering severe turbulence and damaging hail are greatly reduced by selecting the upwind side of the storm
- If looking for a corridor, remember corridors between two cells containing magenta and/or red areas should be at least 40 nautical miles wide from the outer fringes of the radar echo. The magenta displays areas of very heavy rainfall and statistically indicates a high probability of hail.

Note

Do not approach a storm cell containing magenta and red any closer than 20 nautical miles. Echoes should be separated by at least 40 nautical miles before attempting to fly between them.



Cells beyond 75 nautical miles are areas of substantial rainfall, do not wait for red or magenta to appear. Plan and execute evasive action quickly to minimize "doglegging."



When a complete detour is impractical, penetration of weather patterns may be required. Avoid adjacent cells by at least 20 nautical miles.

A "Blind Alley" or "Box Canyon" situation can be very dangerous when viewing the short ranges. Periodically switch to longer-range displays to observe distant conditions. As shown below, the short-range returns show an obvious corridor between two areas of heavy rainfall but the long-range setting shows a larger area of heavy rainfall.

FUEL

SYSTEM DESCRIPTION

The fuel system supplies fuel to the engines and the APU. Fuel is contained in three tanks located within the wings and wing center section.
Refer to Engine and APU chapter for a description of the engine and APU fuel systems.

FUEL FEED

Both engines are normally pressure fed from the center tank until the center tank quantity decreases to near zero. The engines are normally then pressure fed from their respective main tanks. Check valves are located throughout the fuel system to ensure the proper direction of fuel flow and to prevent transfer of fuel between tanks.

FUEL PUMPS

Each fuel tank uses two AC powered fuel pumps which are fuel cooled and lubricated. Center tank check valves open at a lower pressure than do the main tank check valves. This ensures that center tank fuel is used before main tank fuel, even though all fuel pumps are operating. Individual pressure sensors monitor the output pressure of each pump.

FUEL CROSSFEED

The engine fuel manifolds are interconnected by use of the crossfeed valve. The valve is DC motor operated from the battery bus. The valve provides a means of directing fuel to both engines from any tank.

FUEL SHUTOFF VALVES

Fuel shutoff valves are located at the engine-mounting wing stations. The valves are DC motor operated from the hot battery bus. They close whenever the respective engine fire warning switch is pulled or engine start lever is placed to CUTOFF.

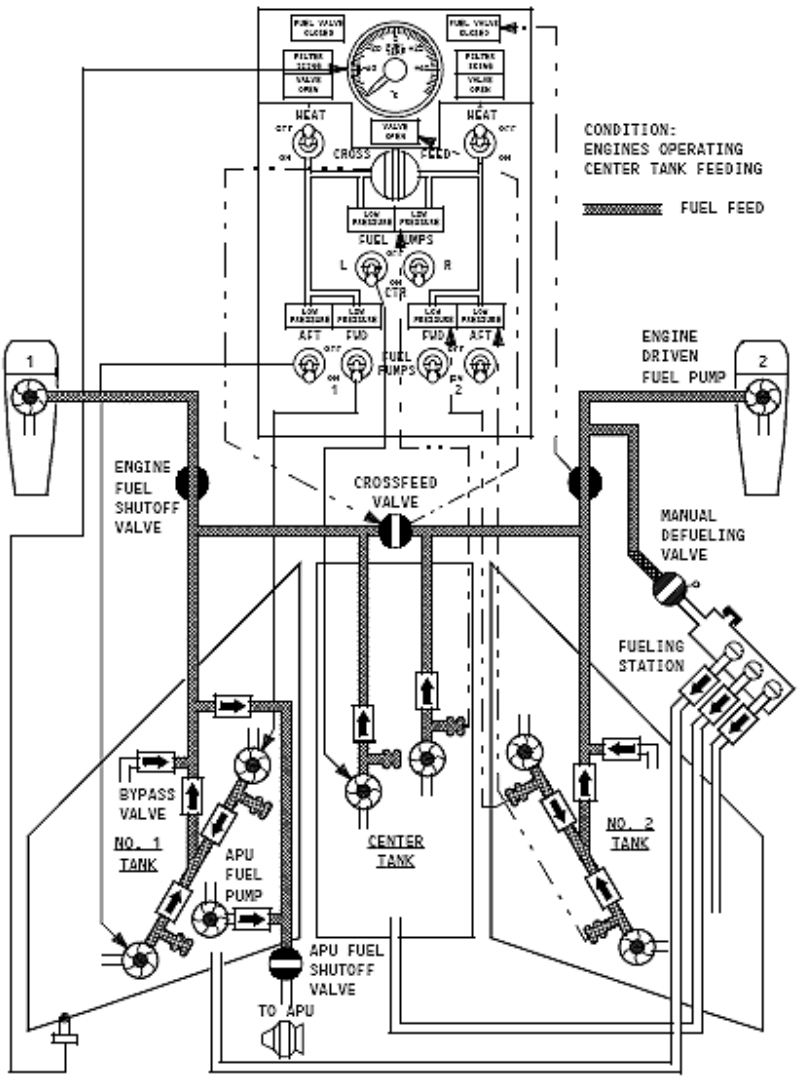
FUEL TANK LOCATION AND CAPACITIES (USABLE FUEL)

Main tanks No. 1 and No. 2 are integral with the wing structure. The center tank lies between the wing roots within the fuselage area and extends out into the wing structure.
These figures represent approximate amounts of usable fuel. The appropriate weight and balance control and loading manual gives exact figures for all conditions.

TANK	GALLONS	POUNDS*
NO. 1	1,430	9,580
NO. 2	1,430	9,580
CENTER	737-100 – 1860 -200 / F / C - 1920 -ADV – 2300	737-100 – 12462 -200 / F / C - 12864 -ADV - 15410
TOTAL	5,163	34,590
AUXILIARY	810	5,429
TOTAL	5,973	40,019

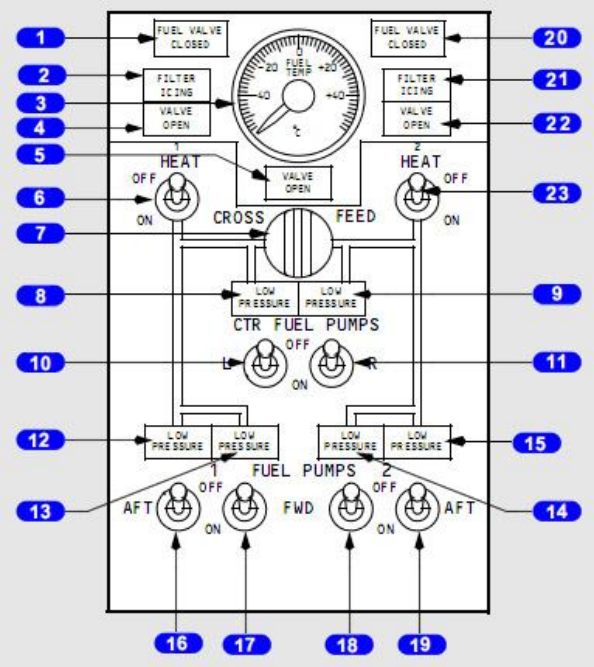
* Usable fuel at level attitude, fuel density = 6.7 pounds per US gallon

FUEL SCHEMATIC



CONTROLS AND INDICATORS

O04. FUEL CONTROL PANEL



1, 20. Fuel Valve Closed Light
2,21. Filter Icing Light
3. Fuel Temperature Indicator
4,22. Fuel Heat Valve Open Light
5. Crossfeed Valve Open Light
6,23. Fuel Heat Switch
7. Crossfeed Selector
8,9. Center Tank Fuel Pump Low Pressure Light
10,11,16-19. Fuel Pump Switch
12-15. Main Tank Fuel Pump Low Pressure Light

1,20. FUEL VALVE CLOSED Light

Extinguished - related engine fuel shutoff valve is open.
Illuminated (blue) -

- bright - related fuel shutoff valve is in transit, or valve position and engine start lever or engine fire warning switch disagree.
- dim - related fuel shutoff valve is closed.

2,21. FILTER ICING Light

Extinguished - fuel filter operating normally.
Illuminated (amber) - indicates an iced or contaminated filter.

3. Fuel Temperature (FUEL TEMP) Indicator

Indicates fuel temperature in No. 1 tank.

4,22. Fuel Heat VALVE OPEN Light

Illuminated (blue)

- bright - fuel heat valve is in transit, or valve position and fuel HEAT switch disagree.
- dim - fuel heat valve is open. Extinguished - fuel heat valve is closed.

5. Crossfeed VALVE OPEN Light

Illuminated (blue) -

- bright - crossfeed valve is in transit, or valve position and CROSSFEED selector disagree.
- dim - crossfeed valve is open. Extinguished - crossfeed valve is closed.

6,23. Fuel HEAT Switch

ON - The solenoid switch opens the respective engine fuel heat valve allowing bleed air to heat the fuel and de-ice the fuel filter. The switch automatically moves to OFF after one minute.

7. CROSSFEED Selector

Controls fuel crossfeed valve.
Closed - isolates engine No. 1 and No. 2 fuel feed lines. Open - connects engine No. 1 and No. 2 fuel feed lines.

8,9. Center Tank Fuel Pump LOW PRESSURE Light

Illuminated (amber) - fuel pump output pressure is low and FUEL PUMP switch is ON.

Note: With both Center(CTR) tank FUEL PUMP switches ON, illumination of both LOW PRESSURE lights illuminates MASTER CAUTION and FUEL system annunciator lights. Illumination of one LOW PRESSURE light illuminates MASTER CAUTION and FUEL system annunciator lights on MASTER CAUTION light recall.

Note: With one CTR tank FUEL PUMP switch OFF, illumination of opposite CTR tank LOW PRESSURE light illuminates the MASTER CAUTION and FUEL system annunciator lights.

Extinguished - fuel pump output pressure is normal, or FUEL PUMP switch is OFF.

10,11,16-19. FUEL PUMP Switch

ON - activates fuel pump. OFF - deactivates fuel pump.

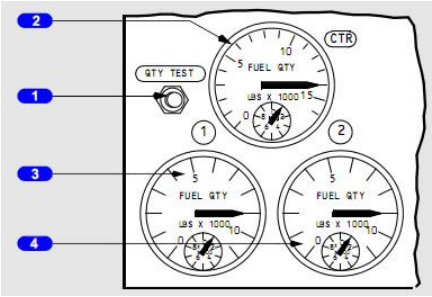
12-15. Main Tank Fuel Pump LOW PRESSURE Light

Illuminated (amber) - fuel pump output pressure is low, or FUEL PUMP switch is OFF.

Note: Two LOW PRESSURE lights illuminated in same tank illuminates MASTER CAUTION and FUEL system annunciator lights. One LOW PRESSURE light causes MASTER CAUTION and FUEL system annunciator lights to illuminate on MASTER CAUTION light recall.

Extinguished - fuel pump output pressure is normal.

C07. FUEL QUANTITY INDICATIONS



1. Fuel Quantity Test Switch
2-4. Fuel Quantity Indicator

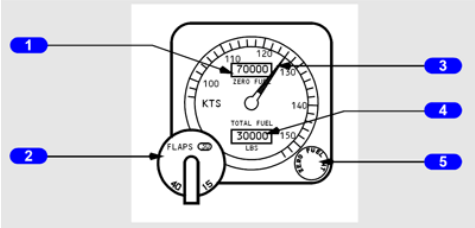
1. Fuel Quantity Test (QTY TEST) Switch

Indicator test is described in Supplementary Procedures.

2-4. Fuel Quantity Indicator

- indicates usable fuel in the related tank.
- standby AC power is required.

C06. TOTAL FUEL AND VREF INDICATOR



1.Zero Fuel Weight Counter
2.Landing Flap Selector
3.Vref Pointer
4.Total Fuel Weight Counter
5.Zero Fuel Weight Selector

1. ZERO FUEL Weight Counter

Indicates airplane zero fuel weight selected by the ZERO FUEL weight selector.

2. Landing Flap Selector

Adjusts the VREF pointer for the landing flap setting.

3. Vref Pointer

Indicates VREF speed for landing.

4. TOTAL FUEL Weight Counter

Indicates the total usable fuel remaining in all tanks.

5. ZERO FUEL Weight Selector

Used to set the ZERO FUEL weight counter to the correct zero fuel weight. Maximum Landing Weight VREF (MAX LDG WT VREF) Placard. Airspeeds on this placard depend on the maximum allowable landing gross weight of the airplane.

HYDRAULICS

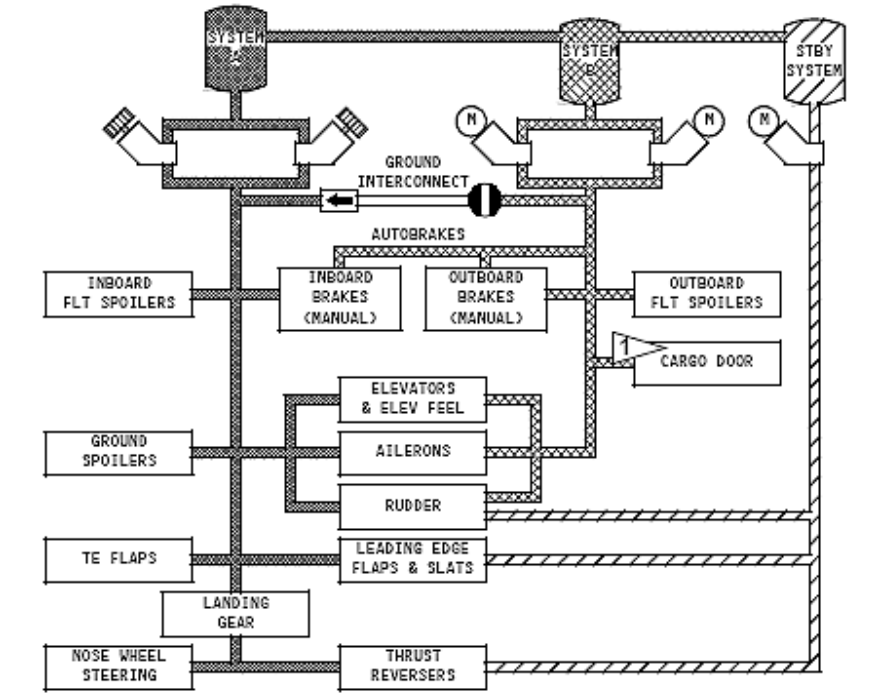
SYSTEM DESCRIPTION

The airplane has three hydraulic systems: A, B and standby. The standby system is used if system A and/or B pressure is lost. The hydraulic systems power the following airplane systems:

- flight controls
- leading edge flaps and slats
- trailing edge flaps
- spoilers
- landing gear
- wheel brakes
- nose wheel steering
- thrust reversers
- yaw damper
- autopilots
- cargo door (cargo airplanes only)

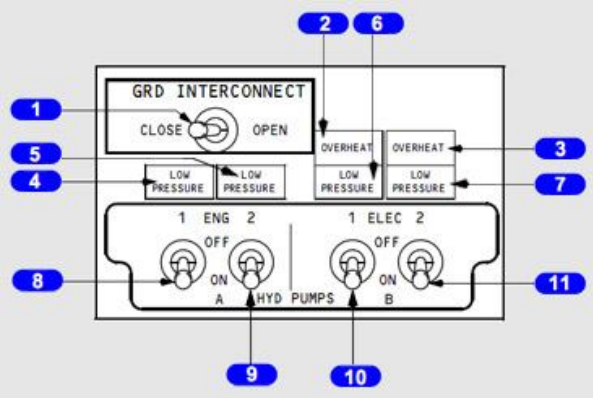
Each hydraulic system has a fluid reservoir located in the main wheel well area. The reservoirs are pressurized by engine bleed air directed into the system A reservoir. Fluid balance lines interconnect all reservoirs. Pressurization of all reservoirs ensures positive fluid supply to all hydraulic pumps and controls the fluid level in the reservoirs.

HYDRAULIC POWER DISTRIBUTION SCHEMATIC



CONTROLS AND INDICATORS

O22. HYDRAULIC PANEL



1. Ground Interconnect Switch
2,3. Electric Hydraulic Pump Overheat Lights
4-7. Hydraulic Pump Low Pressure Lights
8,9. Engine Hydraulic Pump Switches
10,11. Electric Hydraulic Pump Switches

1. GROUND INTERCONNECT Switch

CLOSE - isolates system A using units from system B output.
OPEN - connects system A pressure to system B pressure for ground functional checks. The ground interconnect valve will open only if the parking brake is set, the airplane is on the ground and electrical power is available.

2,3. Electric Hydraulic Pump OVERHEAT Lights

Illuminated (amber) - hydraulic pump or fluid used to cool and lubricate the corresponding electric motor driven pump has overheated.

4-7. Hydraulic Pump LOW PRESSURE Lights

Illuminated (amber) - output pressure of associated pump is low

Note: When an engine fire warning switch is pulled, the associated engine-driven hydraulic pump low pressure light is deactivated.

8,9. Engine Hydraulic Pump Switches

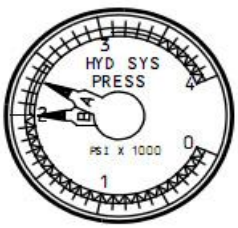
ON - de-energizes blocking valve in pump to allow pump pressure to enter system.

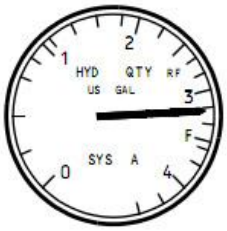
Note: Should remain ON at shutdown to prolong solenoid life. OFF - energizes blocking valve to block pump output.

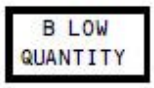
10,11. Electric Hydraulic Pump Switches

ON - provides power to corresponding electric motor-driven pump. OFF - electrical power removed from pump.

R22, R23, R25. HYDRAULIC INDICATIONS







R22. Hydraulic System Pressure Indications

Indicates system A and B pressures:

- Normal pressure - 3000 psi
- Maximum pressure - 3500 psi.

Note: When both pumps for a system are OFF, respective pointer reads zero.

R23. System A Hydraulic quantity Indicator

- Full - 3.5 U.S. gallons.
- Refill - 2.4 U.S. gallons.

Hydraulic System B LOW QUANTITY Light

Illuminated (amber) - indicates reservoir fluid level is low

LANDING GEAR

SYSTEM DESCRIPTION

The airplane has two main landing gear and a single nose gear. Each main gear is a conventional two-wheel landing gear. The nose gear is a conventional steerable two-wheel unit.

Hydraulic power for retraction, extension, and nose wheel steering is normally supplied by hydraulic system A.

Normally, brakes are powered by hydraulic systems A and B. Antiskid protection is provided on all brakes. When autobrakes are selected, pressure is automatically applied in conjunction with the antiskid system.

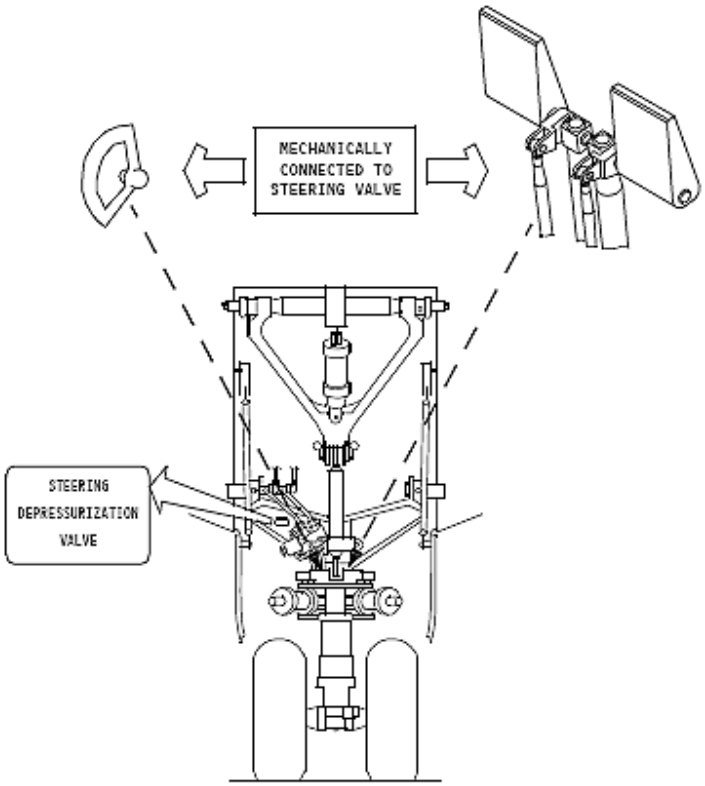
LANDING GEAR OPERATION

The landing gear are normally controlled by the LANDING GEAR lever. On the ground, an override trigger in the lever used to bypass the landing gear lever lock.

NOSE WHEEL STEERING

The airplane is equipped with nose wheel steering.

Primary steering is controlled through the nose wheel steering wheel. Limited steering control is available through the rudder pedals.



NOSE WHEEL STEERING

BRAKE SYSTEM

Each main gear wheel has a multi-disc hydraulic powered brake. The brake pedals provide independent control of the left and right brakes. The brakes are powered by the two independent hydraulic systems. Hydraulic system A supplies pressure to the inboard brakes and hydraulic system B supplies pressure to the outboard brakes. The nose wheels have no brakes. The brake system includes:

- brake accumulator
- antiskid protection
- autobrake system
- parking brake

BRAKE ACCUMULATORS

Each brake system has an accumulator which stores hydraulic pressure and is used as a backup system in the event of a system hydraulic failure. If normal system pressure is lost, trapped hydraulic pressure in the brake accumulator can still provide several braking applications or parking brake application.

ANTISKID PROTECTION

The brake system provides each main gear wheel with individual antiskid protection. The ANTISKID control switches control power to the antiskid controllers. When the system detects a skid, the associated antiskid valve modulates brake pressure until skidding stops. The antiskid system also provides locked wheel, touchdown, and hydroplane protection. An ANTISKID INOP light illuminates anytime there is a system malfunction. Both ANTISKID INOP lights illuminated indicates there is a disagreement between the PARKING BRAKE lever position and the parking brake shutoff valve position.

AUTOBRAKE SYSTEM

The autobrake system uses hydraulic system B pressure to provide automatic braking at preselected deceleration rates immediately after touchdown. The system operates only when the normal brake system is functioning. Antiskid system protection is provided during autobrake operation.

LANDING

The digital autobrake system arms for landing when:

- air/ground safety sensor is in the flight mode
- ANTISKID control switches are ON
- AUTO BRAKE selector switch is positioned to MIN, MED, or MAX. Three levels of deceleration can be selected for landing. However, on dry runways, the maximum autobrake deceleration rate in the landing mode is less than that produced by full pedal braking.

After landing, autobrake application begins when:

- both Thrust Levers are retarded to near IDLE, and
- the main wheels spin-up.

To maintain the selected landing deceleration rate, autobrake pressure is reduced as reverser thrust is applied. The total deceleration of reverse thrust and braking is equal to the selected deceleration rate. The autobrake system brings the airplane to a complete stop unless the braking is terminated by the pilot.

AUTOBRAKE – DISARM

The pilots may disarm the autobrake system by moving the selector switch to the OFF position. This action does not cause the AUTO BRAKE DISARM light to illuminate. After braking has started, any of the following pilot actions disarm the system immediately and illuminate the AUTO BRAKE DISARM light:

- moving the SPEED BRAKE lever to the down detent
- advancing the Thrust Levers (as for go-around), or
- applying manual brakes.

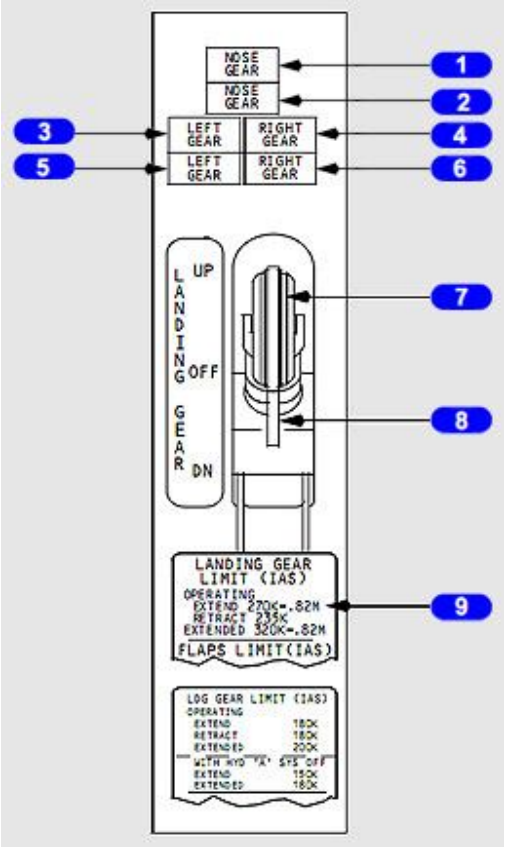
PARKING BRAKE

The parking brake is set by depressing both brake pedals, pulling the PARKING BRAKE lever back, then releasing the pedals. This mechanically latches the pedals in the depressed position and commands the parking brake valve to close.

The parking brake is released by depressing the pedals until the PARKING BRAKE lever releases. A fault in the parking brake system may cause the ANTISKID INOP lights to illuminate.

CONTROLS AND INDICATORS

C15. LANDING GEAR PANEL



1,3,4. Landing Gear Indicator Lights (top)
2,5,6. Landing Gear Indicator Lights (bottom)
7. Landing Gear Lever
8. Override Trigger
9. Landing Gear Limit Speed Placard

1,3,4. Landing Gear Indicator Lights (top)

Illuminated (red) -

- landing gear is not down and either thrust lever is retarded to idle
- related landing gear is in disagreement with LANDING GEAR lever position (in transit or unsafe)
- gear is down and locked and lever is not in the down detent Extinguished -
- landing gear is up and locked with landing gear lever UP or OFF
- landing gear is down and locked with landing gear lever DN.

2,5,6. Landing Gear Indicator Lights (bottom)

Illuminated (green) - related gear down and locked.

Note: Landing gear warning horn is deactivated with all gear down and locked. Extinguished - landing gear is not down and locked.

7. LANDING GEAR Lever

UP - landing gear retract.
OFF - hydraulic pressure is removed from landing gear system. DN - landing gear extend.

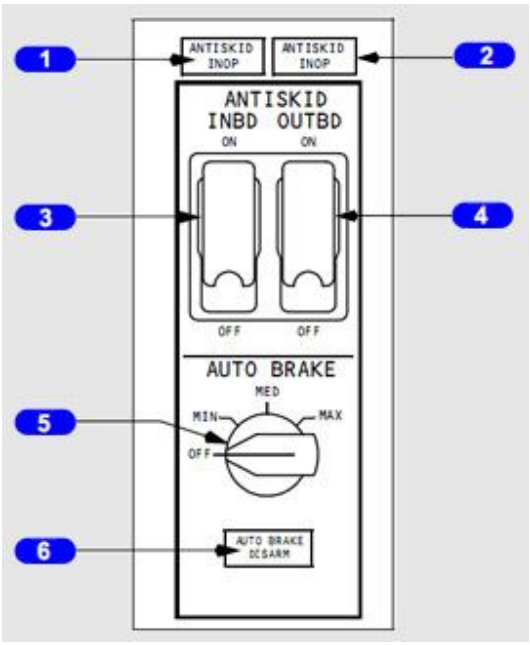
8. Override Trigger

Allows LANDING GEAR lever to be raised, bypassing lever lock.

9. LANDING GEAR LIMIT Speed Placard

Indicates maximum speed while operating landing gear and after gear extension.

C14. AUTOBRAKE AND ANTISKID CONTROLS



1,2. Antiskid Inoperative Light
3,4. Antiskid Control Switch
5. Auto Brake Select Switch
6. Auto Brake Disarm Light

1,2. Antiskid Inoperative (ANTISKID INOP) Light

Illuminated (amber) - a system fault is detected by antiskid monitoring system. Extinguished - antiskid system operating normally.

3,4. ANTISKID Control Switch

ON - guarded position.

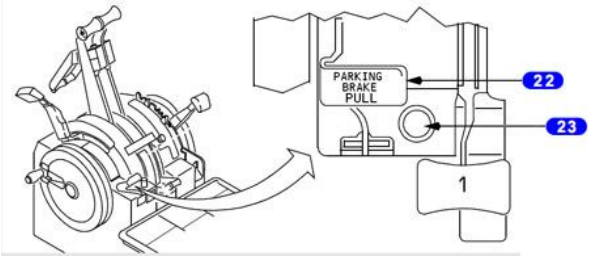
5. AUTO BRAKE Select Switch

Used to select the level of desired braking. The switch must be pulled out to select MAX deceleration.

6. AUTO BRAKE DISARM Light

Illuminated (amber) - a malfunction exists in the automatic braking system.

P10 22,23. PARKING BRAKE



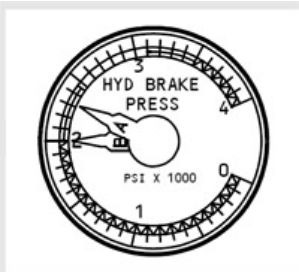
22. PARKING BRAKE Lever

Forward - parking brake is released.
Aft - sets parking brakes when either Captain's or First Officer's brake pedals are fully depressed.

23. Parking Brake Warning Light

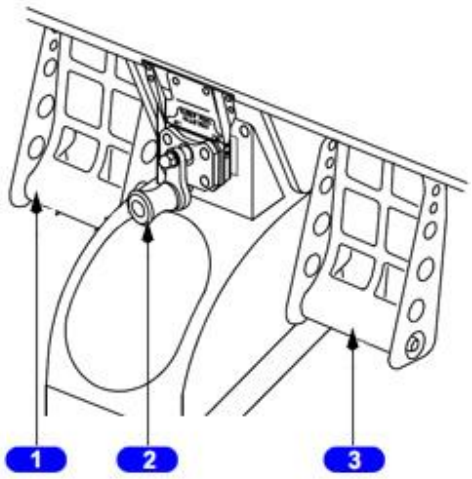
Illuminated (red) - parking brake is set (lights operate from battery power). Extinguished - parking brake is released.

R21. HYDRAULIC BRAKE PRESSURE INDICATOR



Indicates system A and B brake system pressure:
- normal pressure - 3000 psi
- normal precharge - 1000 psi.

RUDDER/BRAKE PEDALS



1,3. Rudder/Brake Pedals

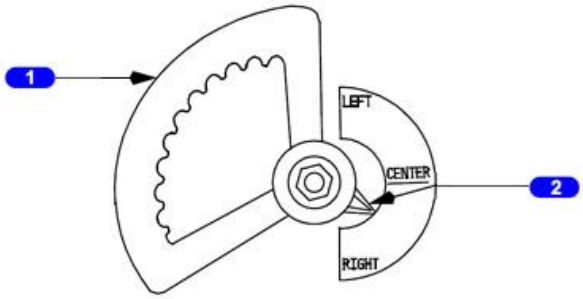
Push full pedal - turns nose wheel up to 7 degrees in either direction.

Push top of pedal only - activates wheel brakes.
Refer to Chapter 9 Flight Controls for rudder description.

2. Rudder Pedal Adjustment Crank

AFT (counter-clockwise) - adjusts rudder pedals aft.
FWD (clockwise) - adjusts rudder pedals forward.

NOSE WHEEL STEERING WHEEL



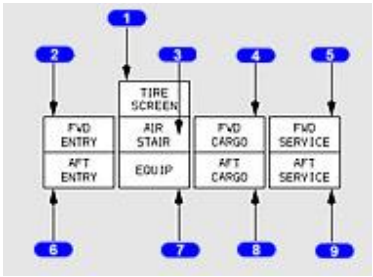
1. Nose Wheel Steering Wheel

Rotate -
- turns nose wheel up to 78 degrees in either direction
- overrides rudder pedal steering.

2. Nose Wheel Steering Indicator

LEFT - indicates nose wheel steering displacement left of center position. CENTER - normal straight ahead position.
RIGHT - indicates nose wheel steering displacement right of center position.

O23. ANNUNCIATOR LIGHTS



1. Tire Screen Light

Illuminated (amber) - indication that the tire screens are not secure.

WARNING SYSTEMS

SYSTEM DESCRIPTION

Aural, tactile and visual warning signals alert the flight crew to conditions requiring action or caution in the operation of the airplane. The character of the signals varies, depending upon the degree of urgency or types of hazards involved. Aural, tactile, and visual signals are used singularly or in combination to simultaneously provide both warnings and information regarding the nature of the condition.

Mach/airspeed warnings, landing gear warnings, takeoff configuration warnings, windshear warnings, and ground proximity warnings are discussed in this section. Cabin altitude warning is discussed in this section and in the Air Systems chapter, and autopilot and autothrottle disconnect warnings are discussed in the Automatic Flight chapter. The conditions which excite the fire warning bell are discussed in the Fire Protection chapter.

Conditions which require the immediate attention of the flight crew are indicated by red warning lights located in the area of the pilots' primary field of vision. These lights indicate APU, engine, or wheel well fires; autopilot and unsafe landing gear conditions.

Conditions which require the timely attention of the flight crew are indicated by amber caution lights.

Blue lights inform the flight crew of electrical power availability, valve position, equipment status, and flight attendant or ground communications. Blue lights are for information and do not require immediate flight crew attention. Some system blue lights indicate a transitional state by illuminating bright as valves or components reposition, then returning to a dim blue when the required configuration is reached.

Green lights indicate a fully extended configuration, e.g., landing gear and leading edge devices.

For specific information regarding red, amber, blue, and green lights refer to the appropriate systems chapters. Stall warning is provided by a control column shaker on the captain's control column, or as installed on each control column.

Various aural signals call attention to warnings and cautions. An aural warning for airspeed limits is given by a clacker, the autopilot disconnect by a warning tone, takeoff configuration and cabin altitude by an intermittent horn, and landing gear positions by a steady horn. The fire warning is given by a fire warning bell. Ground proximity warnings and alerts--as well as windshear warnings and alerts--are given by voice warnings.

Generally, aurals automatically silence when the associated non-normal condition no longer exists.

INTERMITTENT CABIN ALTITUDE/CONFIGURATION WARNING

The takeoff configuration warning is armed when the airplane is on the ground and either or both forward thrust levers are advanced for takeoff. An intermittent warning horn sounds if:

- Leading Edge devices are NOT configured for takeoff, or
- Speed Brake lever is NOT in the DOWN position, or
- Stabilizer Trim is NOT set in the takeoff range, or
- Trailing Edge flaps are NOT in the flaps 1 through 25 takeoff range.

The warning indication is cancelled when the configuration error is corrected.

The Cabin Altitude Warning Horn activates when cabin altitude exceeds 10,000 feet. An intermittent warning horn is heard. The Cabin Altitude Warning Horn may be silenced by momentarily pressing the ALT HORN CUTOUT switch on the Cabin Altitude Panel.

LANDING GEAR CONFIGURATION WARNINGS

Visual indications and aural warnings of landing gear position are provided by the landing gear indicator lights and landing gear warning horn.

VISUAL INDICATIONS

The landing gear indication lights are activated by signals from each gear, the LANDING GEAR lever, and the forward thrust lever position as follows:
Green light illuminated - landing gear is down and locked.

Red light illuminated -

- landing gear is in disagreement with LANDING GEAR lever position (in transit or unsafe).
- landing gear is not down and locked (with either or both forward thrust levers retarded to idle).

All lights extinguished - landing gear is up and locked with the LANDING GEAR lever UP or OFF.

AURAL INDICATIONS

A steady warning horn is provided to alert the flight crew whenever the airplane is in a landing configuration and any gear is not down and locked. The landing gear warning horn is activated by forward thrust lever and flap position as follows:

Flaps 1 through 10-

- with either or both forward thrust levers between idle and approximately 10 degrees thrust lever angle, the landing gear warning horn can be silenced (reset) with the landing gear warning HORN CUTOUT switch.

Flaps 15 or 25-

- with either--but not both--forward thrust lever retarded to idle, the landing gear warning horn can be silenced (reset) with the landing gear warning HORN CUTOUT switch.
- with both forward thrust levers set below approximately 30 degrees, the landing gear warning horn cannot be silenced with the landing gear warning HORN CUTOUT switch.

Flaps greater than 25-

- regardless of forward thrust lever position, the landing gear warning horn cannot be silenced with the
- landing gear warning HORN CUTOUT switch.

The warning indication is cancelled when the configuration error is corrected.

MACH/AIRSPEED WARNING SYSTEM

Two independent Mach/airspeed warning systems provide a distinct aural warning-- a clacking sound--any time the maximum operating airspeed of Vmo/Mmo is exceeded. Each system operates from a mechanism internal to the respective pilot's Mach/airspeed indicator. The warning clacker can be silenced only by reducing airspeed below Vmo/Mmo and can be tested at any time with the test switch.

STALL WARNING SYSTEM

Natural stall warning (buffet) usually occurs at a speed prior to stall. In some configurations the margin between stall and natural stall warning is less than desired. Therefore, an artificial stall warning device a stick shaker is used to provide the required warning.

GROUND PROXIMITY WARNING SYSTEM (GPWS)

The GPWS provides alerts for potentially hazardous flight conditions. GPWS alerts--to the extent they are installed--are for imminent impact with the ground, detected windshear condition, excessive angle of bank, and glideslope deviation.

GPWS may also provide radio altitude and decision height callouts.

Note: GPWS does not provide alerts for flight toward vertically sheer terrain, or of shallow descents when the airplane is in landing configuration.

ALERT CONDITIONS

GPWS provides warnings and/ or alerts if one of the following conditions exists:

- excessive barometric descent rate
- excessive terrain closure rate
- altitude loss after takeoff or go-around
- unsafe terrain clearance (when not in the landing configuration)
- excessive deviation below glideslope

The GPWS alerts and the condition which causes each alert are presented on the following GPWS annunciation chart.

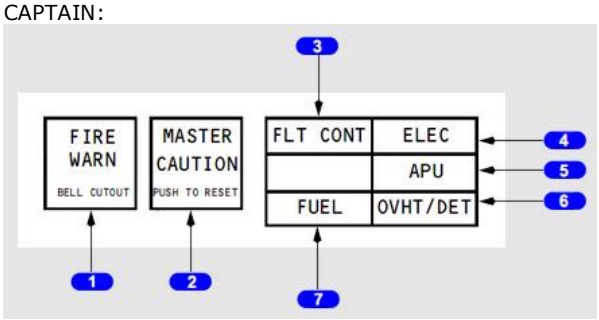
GPWS ANNUNCIATIONS

AURAL ALERT	VISUAL ALERT	DESCRIPTION
MODE 1, MK II "SINK RATE"	PULL UP lights	Excessive descent rate.
MODE 1, MK II (cont) "WHOOP WHOOP PULL UP"	PULL UP lights	Follows "SINK RATE" if sink rate becomes severe. Also follows "TERRAIN" alert if excessive terrain closure rate continues and landing gear and/or flaps not in landing configuration.
MODE 2, MK II "TERRAIN"	PULL UP lights	Excessive terrain closure rate.
MODE 3, MK II "DON'T SINK"	PULL UP lights	Excessive altitude loss after takeoff or go-around.
MODE 4A, MK II "TOO LOW GEAR" or "TOO LOW TERRAIN"	PULL UP lights	Unsafe clearance during approach with landing gear up.
MODE 4B, MK II "TOO LOW FLAPS" or "TOO LOW TERRAIN"	PULL UP lights	Unsafe clearance during approach with flaps not in landing configuration
MODE 5, MK II "GLIDESLOPE"	BELOW G/S w/ P-INHIBIT lights	Deviation below glideslope. The volume and repetition rate increase as deviation continues.

CONTROLS AND INDICATORS

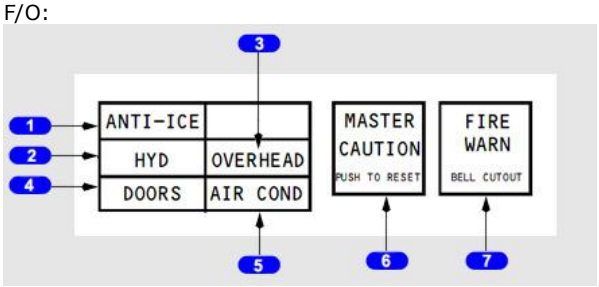
G01, G05. FIRE WARNING AND MASTER CAUTION SYSTEM

CAPTAIN:



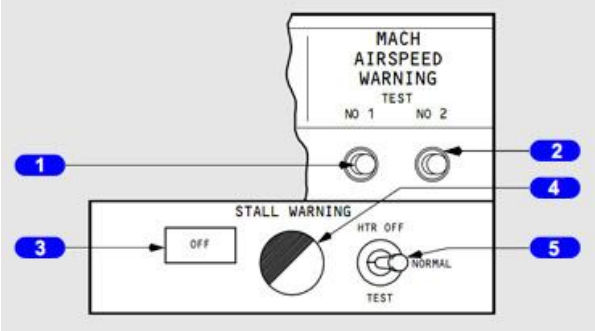
1. Fire Warn Light
2. Master Caution Light
3-7. System Annunciator Panel

F/O:



1-5. System Annunciator Lights
6. Master Caution Light
7. Fire Warn Light

A11. MACH/AIRSPEED WARNING AND STALL WARNING TEST SWITCHES



1,2. Mach Airspeed Warning Test Switch
3. Stall Warning Off Light
4. Test Indicator
5. Stall Warning Switch

1,2. MACH AIRSPEED WARNING TEST Switch

Push -Tests respective Mach/Airspeed warning system
- clacker sounds
- inhibited while airborne.

3. STALL WARNING OFF Light

Illuminated (amber)- indicates a failure of the angle airflow sensor heater, a system signal failure, or a power failure.

4. TEST INDICATOR

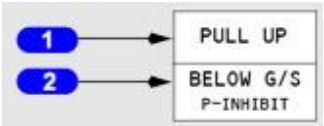
Rotating - indicates electrical continuity through the angle airflow sensor and flap position transmitter during TEST.

5. STALL WARNING SWITCH

Normal - heater power for the angle airflow sensor is available only if engine 1 is operating or the air ground safety sensor is in the air mode.
Test - OFF light, Test Indicator rotates.

GPWS CONTROLS AND INDICATORS

L01, R01. PULL UP WARNING LIGHT/ BELOW GLIDE SLOPE ALERT LIGHT



1. Pull Up Warning Light
2. Below Glide Slope (G/S) Alert Light

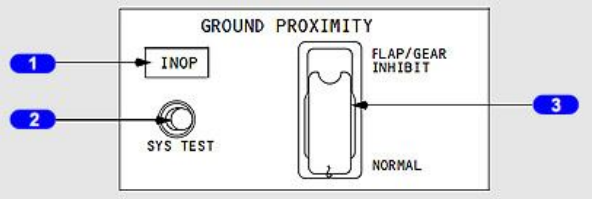
1. PULL UP Warning Light

Illuminated (red) - indicates one or more of the following exist:
- excessive descent rate
- excessive terrain closure rate
- altitude loss after takeoff or go-around
- unsafe terrain clearance when not in the landing configuration

2. BELOW Glide Slope (G/S) Alert Light

Illuminated (amber) - airplane is more than 1.3 dots below glide slope.
Push - inhibits or cancels below glide slope alerting if pushed while in alerting area

R16. GPWS PANEL



1. GPWS Inoperative Light
2. Ground Proximity System Test Switch
3. Ground Proximity Flap/Gear Inhibit Switch

1. GPWS Inoperative (INOP) Light

Illuminated (amber) - GPWS computer malfunction or power loss

- invalid inputs are being received from the VHF NAV receiver, ADC, or radio altimeter.

2. Ground Proximity System (SYS TEST) Switch

Push -

- momentarily on ground—with landing gear not in landing configuration-- or above 1,000 feet radio altitude in flight - with gear up and flaps in any configuration:
- illuminates BELOW G/S, PULL UP and INOP lights, and causes the "GLIDE SLOPE" and "WHOOP, WHOOP, PULL UP" aurals to sound
- at least 10 seconds, on ground - above indications always occur first, followed by any additional aurals, as installed
- system test is inhibited from lift-off to 1000 feet radio altitude.

3. Ground Proximity FLAP/GEAR Inhibit Switch

FLAP/GEAR INHIBIT - inhibits or cancels warnings/alerts caused by flaps not in 30 or 40 position or landing gear not down.
NORMAL (guarded position) - flap and landing gear position logic is provided for GPWS.

DO NOT USE FOR FLIGHT

CUSTOMER CARE

FORUM

You are invited to join Captain Sim community forum

DAILY NEWS

For Captain Sim *daily* news please follow us at Twitter or Facebook.

VIDEO CHANNEL

For Captain Sim videos please watch our YouTube channel.

TECH SUPPORT

The '737 Captain' is one of the most advanced, complete and accurate digital replica of the Boeing 737 aircraft ever available for any game platform.

Our product is not perfect (unfortunately nothing is). But we are working on improvements. If you have some important issue to report, please check-in to Your Profile then click Product Name > Customer Support > and use the Trouble Ticket System. We process all tickets and consider the most significant issues for the next service packs.

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