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Abbreviations Table

A		DEP ARR	Departure Arrival
AC	Alternating Current	DES	Descent
ACARS	Aircraft Communications Addressing and Reporting System	DISC	Disconnect
ADF	Automatic Direction Finder	DME	Distance Measuring Equipment
AFDS	Autopilot Flight Director System	DSP	Display Select Panel
AGL	Above Ground Level	E	
AI	Anti-Ice	E/D	End of Descent
ALT	Altitude	EFIS	Electronic Flight Instrument System
ALTN	Alternate	EGPWS	Enhanced Ground Proximity Warning System
AOA	Angle of Attack	EGT	Exhaust Gas Temperature
A/P	Autopilot	ELEC	Electrical
APP	Approach	EMER	Emergency
APU	Auxiliary Power Unit	ENG	Engine
ARPT	Airport	ETOPS	Extended Range Operation with Twin Engine Airplanes
A/T	Autothrottle	EXEC	Execute
ATA	Actual Time of Arrival	F	
ATC	Air Traffic Control	FCTL	Flight Control
ATT	Attitude	F/D or FLT DIR	Flight Director
AUTO	Automatic	FMA	Flight Mode Annunciations
AUX	Auxiliary	FMC	Flight Management Computer
AVAIL	Available	FMS	Flight Management System
B		FPM	Feet Per Minute
BARO	Barometric	FPV	Flight Path Vector
BRT	Bright	FREQ	Frequency
BTL DISCH	Bottle Discharge (fire extinguishers)	FT	Feet
B/C	Back Course	G	
C		GA	Go-Around
CANC/RCL	Cancel/Recall	GEN	Generator
CDU	Control Display Unit	G/P	Glidepath
CG	Center of Gravity	GPS	Global Positioning System
CHKL	Checklist	GS	Ground Speed
CLB	Climb	G/S	Glide Slope
COMM	Communication	H	
CON	Continuous	HDG	Heading
CONFIG	Configuration	HDG	Heading Select
CRS	Course	HUD	Head-Up Display
CRZ	Cruise	HYD	Hydraulic
D		I	
DC	Direct Current	IAS	Indicated Airspeed

IFE	In-Flight Entertainment System	**R**	
IGN	Ignition	RA	Radio Altitude
IND LTS	Indicator Lights	RECIRC	Recirculation
ILS	Instrument Landing System	REF	Reference
INOP	Inoperative	RPM	Revolutions Per Minute
INTC CRS	Intercept Course	RTE	Route
IRS	Inertial Reference System	RTO	Rejected Takeoff
K		**S**	
KGS	Kilograms	SAT	Static Air Temperature
KIAS	Knots Indicated Airspeed	SEL	Select
L		SPD	Speed
LBS	Pounds	STBY	Standby
LDG ALT	Landing Altitude	STD	Standard
LNAV	Lateral Navigation	**T**	
LOC	Localizer	TAS	True Airspeed
M		TAT	Total Air Temperature
M	Mach	T/C	Top of Climb
MAG	Magnetic	TCAS	Traffic Alert and Collision Avoidance System
MAN	Manual	T/D	Top of Descent
MCP	Mode Control Panel	Temp	Temperature
MDA	Minimum Descent Altitude	TFR	Transfer
MFD	Multifunction Display	THR HOLD	Throttle Hold
MIN	Minimum	TO	Takeoff
MMO	Maximum Mach Operating Speed	TO/GA	Takeoff/Go-Around
MTRS	Meters	**V**	
N		VMO	Maximum Operating Speed
ND	Navigation Display	VNAV	Vertical Navigation
NM	Nautical Miles	VOR	VHF Omnidirectional Range
NORM	Normal	VR	Rotation Speed
N1	Low Pressure Rotor Speed	VREF	Reference Speed
N2	High Pressure Rotor Speed	VSI	Vertical Speed Indicator
O		V/S	Vertical Speed
OAT	Outside Air Temperature	V1	Takeoff Decision Speed
OUTBD DSPL	Outboard Display	V2	Scheduled Takeoff Target Speed
OVHD	Overhead	**W**	
OVHT	Overheat	WPT	Waypoint
P		WXR	Weather Radar
PA	Passenger Address	**X**	
PERF INIT	Performance Initialization	XPDR	Transponder
PFD	Primary Flight Display		
POS INIT	Position Initialization		
PREV	Previous		

Air Systems

Controls and Indicators

Bleed Air Controls and Indicators
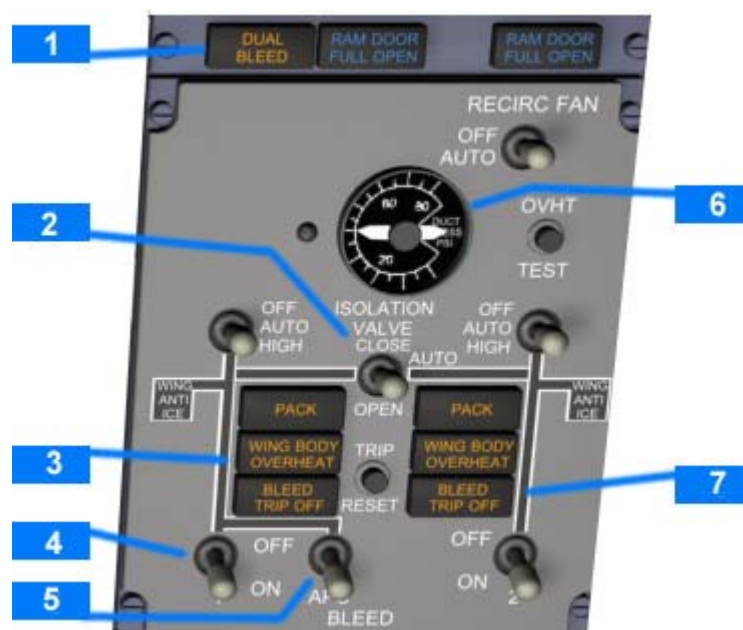
Forward Overhead Panel

(1) DUAL BLEED Light

Illuminated (amber) – APU bleed air valve open and engine No. 1 BLEED air switch ON, or engine No. 2 BLEED air switch ON, APU bleed air valve and isolation valve open.

(2) ISOLATION VALVE Switch

CLOSE – closes isolation valve

AUTO –
- closes isolation valve if both engine BLEED air switches are ON and both air conditioning PACK switches are AUTO or HIGH
- opens isolation valve automatically if either engine BLEED air or air conditioning PACK switch positioned OFF.

OPEN – opens isolation valve.

(3) WING-BODY OVERHEAT Light

Illuminated (amber) –
- light indicates overheat from bleed air duct leak in engine strut, inboard wing leading edge, air conditioning bay or APU bleed air duct.

(4) Engine BLEED Air Switches

OFF – closes engine bleed air valve

ON – opens engine bleed air valve when engines are operating.

(5) APU BLEED Air Switch

OFF – closes APU bleed air valve

ON – opens APU bleed air valve when APU is operating.

(6) Bleed Air DUCT PRESSURE Indicator

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

(7) BLEED TRIP OFF Light

Illuminated (amber) excessive engine bleed air temperature or pressure.

Air Conditioning Controls and Indicators (737-600/700)

Forward Overhead Panel

[1] 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.

[2] Control (CONT) CABIN and Passenger (PASS) CABIN Temperature

AUTO – automatic temperature controller controls passenger cabin or flight deck temperature as selected.

MANUAL – air mix valves controlled manually. Automatic temperature controller bypassed.

[3] RAM DOOR FULL OPEN Light

Illuminated (blue) – indicates ram door in full open position. Occurs when aircraft on ground or both packs high and packs need greater airflow for cabin cooling.

[4] Air Conditioning PACK Switch

OFF – pack signalled OFF.

AUTO – with both packs operating, each pack regulates to low flow.

HIGH – pack regulates to high flow.

[5] 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.

[6] Air Temperature (TEMP) Indicator

Indicates temperature at location selected with AIR TEMP source selector.

[7] Recirculation (RECIRC) FAN Switch

OFF - fan signalled off.

AUTO – fan signalled on except when both packs operating with either PACK switch in HIGH.

Air Conditioning Controls and Indicators (737-800/900)

Forward Overhead Panel

[1] 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.

[2] Control (CONT) CABIN and Passenger (FWD/AFT) CABIN Temperature

AUTO – automatic temperature controller controls passenger cabin or flight deck temperature as selected.

MANUAL – air mix valves controlled manually. Automatic temperature controller bypassed. Ranges from C (colder) to W (warmer)

[3] TRIM AIR – Activates trim air regulating valve between OFF and ON in accordance with TRIM AIR switch.

ON: Allows bleed air from upstream of the packs to be directed to the three trim air modulating valves.

OFF: L/R controllers will operate packs independently. Left pack will operate in response to the CONT CAB selector to establish teh temp for the flight deck. Right pack will supply the coldest temperature demand of the FWD or AFT cab zones.

Equipment Cooling Panel

Forward Overhead Panel

(1) Equipment (EQUIP) COOLING SUPPLY Switch

NORM – normal cooling supply fan activated.

ALTN – alternate cooling supply fan activated.

(2) Equipment Cooling Supply OFF Light

Illuminated (amber) – no airflow from selected cooling supply fan.

(3) Equipment (EQUIP) COOLING EXHAUST Switch

NORM – normal cooling exhaust fan activated.

ALTN – alternate cooling exhaust fan activated.

(4) Equipment Cooling Exhaust OFF Light

Illuminated (amber) – no airflow from selected cooling exhaust fan.

Cabin Altitude Panel
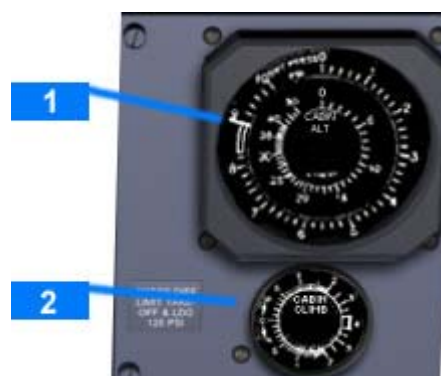
Forward Overhead Panel

(1) CABIN Altimeter (ALT)/Differential Pressure (DIFF PRESS) Indicator

Inner Scale – indicates cabin altitude in feet.

Outer Scale – indicates differential pressure between cabin and ambient in psi.

(2) CABIN Rate of CLIMB Indicator

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

Cabin Pressurization Panel
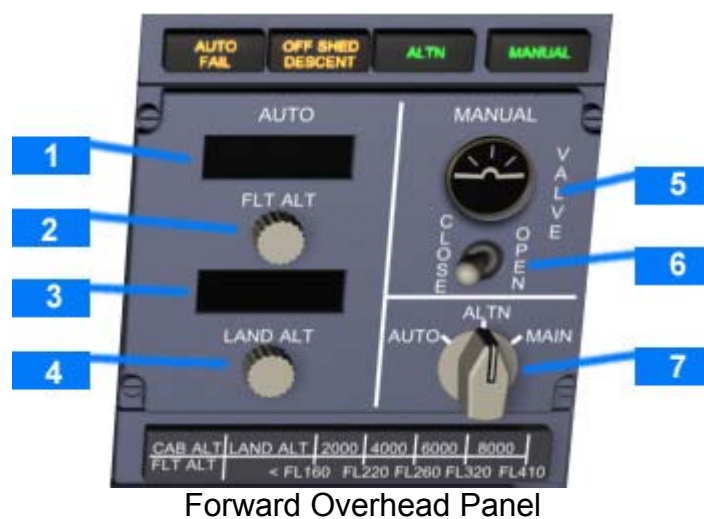
Forward Overhead Panel

(1) Flight Altitude (FLT ALT) Indicator

- indicates selected cruise altitude
- set before takeoff.

(2) Flight Altitude Selector

Rotate – set planned cruise altitude.

(3) Landing Altitude (LAND ALT) Indicator

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

(4) Landing Altitude Selector

Rotate – select planned landing field altitude.

(5) Outflow VALVE Position Indicator

- indicates position of outflow valve
- operates in all modes

(6) Outflow Valve Switch (spring-loaded to center)

CLOSE – closes outflow valve electrically with pressurization mode selector in MAN position.

OPEN – opens outflow valve electrically with pressurization mode in MAN position.

(7) Pressurization Mode Selector

AUTO – pressurization system controlled automatically.

ALTN – pressurization system controlled automatically using ALTN controller.

MAN – pressurization system controlled manually by outflow valve switch.

Anti-Ice, Rain

Controls and Indicators

Window Heat Panel

Forward Overhead Panel

(1) Window OVERHEAT Lights

Illuminated (amber) – overhead condition is detected.

(2) Window Heat ON Lights

Illuminated (green) – window heat is being applied to selected window(s).

Extinguished –
- switch is OFF; or
- an overheat is detected.

(3) WINDOW HEAT Switches

ON – window heat is applied to selected window(s).

OFF – window heat not in use.

[4] WINDOW HEAT Test Switch (spring-loaded to neutral)

OVHT – simulates an overheat condition

PWR TEST – provides a confidence test.

Windshield Wiper Selector Panel

Forward Overhead Panel

[1] Windshield WIPER Selector

PARK – turns off wiper motors and stows wiper blades.

INT – seven second intermittent operation.

LOW – low speed operation.

HIGH – high speed operation.

Probe Heat Panel

Forward Overhead Panel

[1] PROBE HEAT Switches

ON – power is supplied to heat related system.

OFF – power off.

Engine Anti-Ice Panel

Forward Overhead Panel

[1] L VALVE / R VALVE / COWL VALVE

Illuminated (blue) – related anti-ice valve is open (switch ON).

Illuminated (bright blue) – related anti-ice valve/switch position disagree.

Extinguished – related anti-ice valve is closed (switch OFF).

NOTE: If WAI selected on during taxi, it will deselect automatically if throttles are advanced to takeoff power in order to preserve takeoff thrust.

[2] ENGINE / WING ANTI-ICE Switches

ON – related anti-ice valve is open.

OFF – related anti-ice valve is closed.

Automatic Flight

Controls and Indicators

Mode Control Panel (MCP)

[Option without speed and altitude intervention]

Glareshield

Speed Controls
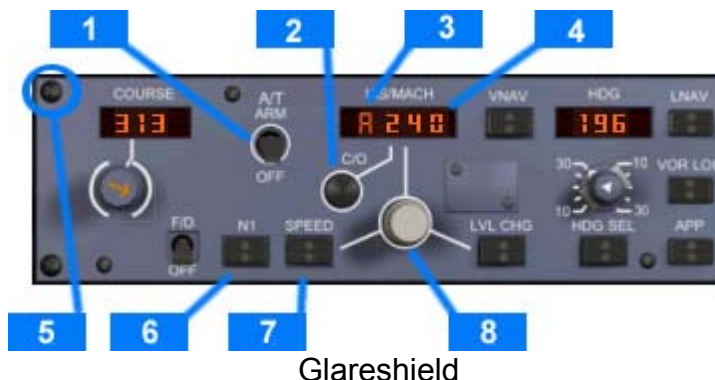
Glareshield

(1) Autothrottle (A/T) Arm Switch

ARM – Arms A/T for engagement. A/T engages automatically when following AFDS modes are engages:

- LVL CHG
- V/S
- VNAV
- ALT HOLD
- G/S capture
- TO/GA

OFF – disengages A/T and prevents A/T engagement.

(2) Changeover (C/O) Switch

Push –
- Changes IAS/MACH display between IAS and MACH
- Automatic changeover occurs at approximately FL260.

(3) MCP Speed Condition Symbol

Underspeed limiting symbol appears when commanded speed cannot be reached. Underspeed limiting (flashing character "A") – minimum speed.

(4) IAS/MACH Display

Displays speed selected by IAS/MACH selector
- display is blank when:
  - VNAV mode engaged
  - A/T engaged in FMC SPD mode
  - during 2 engine AFDS go-around
- displays 100 knots when power is first applied
- displays range is:
  - 100 KIAS – Vmo in 1 knot increments
  - .60M – Mmo in .01M increments.

(5) TO/GA Switch

Pushing top left MCP screw simulates TO/GA activation.

(6) N1 Switch

Push – (light not illuminated)
- engages A/T in N1 mode if compatible with AFDS modes already engages
- illuminates N1 switch light
- annunciates N1 autothrottle mode.

Push – (light illuminated)
- deselects N1 mode and extinguishes switch light
- engages autothrottles in ARM mode.

N1 Mode
- A/T maintains thrust at N1 limit selected from FMC CDU. N1 mode engaged manually by pushing N1 switch if N1 mode is compatible with existing AFDS modes. N1 mode engages automatically when:
  - Engaging LVL CHG in climb
  - Engaging VNAV in climb

(7) SPEED Switch

Push – (light not illuminated)
- engages A/T in SPEED mode if compatible with AFDS modes
- illuminates SPEED switch light
- annunciates MCP SPD autothrottle mode.
- maintains speed in MCP IAS/MACH display

Push – (light illuminated)
- deselects speed mode and extinguishes switch light
- engages autothrottles in ARM mode.

Speed Mode

Autothrottle holds speed in IAS/MACH display or a performance or limit speed. Speed mode engaged manually by pushing SPEED switch if speed mode is compatible with existing AFDS modes. Speed mode engages automatically when:
- ALT HOLD engages
- V/S engages
- G/S capture occurs

(8) IAS/MACH Selector

Rotate –
- sets speed in IAS/MACH display and positions airspeed cursor
- selected speed is reference speed for AFDS and A/T
- not operative when IAS/MACH display is blank.

Vertical Navigation

Glareshield

(1) VNAV Switch

Push –
- VNAV switch light illuminates
- pitch mode annunciates VNAV SPD, VNAV PTH
- A/T mode annunciates FMC SPD, N1, RETARD, or ARM
- IAS/MACH display blanks and airspeed cursors positioned to FMC commanded airspeed.

(2) ALTITUDE Display

Displays selected altitude
- displayed altitude is reference for altitude alerting and automatic level-offs
- altitude range is 0 to 50,000 feet in 100 foot increments

(3) Vertical Speed (VERT SPEED) Display

Displays:
- blank when V/S mode not active
- present V/S when V/S mode is engaged with V/S switch
- selected V/S when V/S set with thumbwheel
- range is –7900 to +6000 fpm

Display increments are:
- 50 fpm if V/S is less than 1000 fpm
- 100 fpm if V/S is 1000 fpm or greater.

(4) Vertical Speed Thumbwheel

Rotate –
- DN –
  - sets vertical speed in VERT SPEED display
  - increases rate of descent or reduces rate of ascent
- UP –
  - sets vertical speed in VERT SPEED display
  - increases rate of ascent or reduces rate of descent.

(5) LVL Change (LVL CHG) Switch

Push –
- LVL CHG switch light illuminates
- pitch mode annunciates MCP SPD for climb or descent
- autothrottle mode annunciates N1 for climb and RETARD followed by ARM for descent
- IAS/MACH display and airspeed cursors display target speed.

LVL CHG Mode

The LVL CHG mode coordinates pitch and thrust commands to make automatic climbs and descents to preselected altitudes at selected airspeeds.

A LVL CHG climb or descent is initiated by:
- selected a new altitude
- pushing LVL CHG switch
- setting desired airspeed.

Climb –
- autothrottle holds limit thrust
- AFDS holds selected airspeed.

Descent –
- autothrottle holds idle thrust
- AFDS holds selected airspeed.

Airspeed –
- if a speed mode is active when LVL CHG is engages, this speed is retained as target speed
- if a speed mode is not active when LVL CHG is engages, existing speed becomes target speed
- speed can be changed with MCP IAS/MACH Selector.

The LVL CHG mode is inhibited after glideslope capture.

(6) Approach (APP) Switch

(See Lateral Navigation)

(7) Altitude Selector (SEL)

Rotate –
- sets altitude in ALTITUDE display in 100 foot increments.
- arms V/S mode if rotated while in ALT HOLD at selected altitude.

(8) Altitude Hold (ALT HLD) Switch

Push –
- engages ALT HOLD command mode
- commands pitch to hold uncorrected barometric altitude at which switch was pressed
- annunciates ALT HOLD pitch mode and illuminates ALT HLD switch light.

(9) Vertical Speed (V/S) Switch

Push –
- arms or engages V/S command mode
- commands pitch to hold vertical speed
- engages A/T in speed mode to hold selected airspeed
- annunciates V/S pitch mode and illuminates V/S switch light.

Lateral Navigation

Glareshield

(1) COURSE Display

Displays course set by course selector.

(2) Heading Selector

Rotate –
- sets heading in HEADING display
- positions selected heading bugs on the DUs.

(3) HEADING Display

Displays selected heading.

(4) LNAV Switch

Push –

- commands AFDS roll to intercept and track the active FMC route
- annunciates LNAV as roll mode and illuminates LNAV switch light.

LNAV Mode

LNAV engagement criteria on the ground:
- origin runway in flight plan
- active route entered in FMC
- track of first leg within 5 degrees of runway heading
- LNAV selected prior to TO/GA.

LNAV engagement criteria in flight:
- active route entered in FMC
- within 3NM of active route, LNAV engagement occurs with any airplane heading
- outside of 3NM, airplane must:
  o be on intercept course of 90 degrees or less
  o intercept route segment before active waypoint

LNAV automatically disconnects for following reasons:
- reaching end of active route
- reaching a route discontinuity
- intercepting a selected approach course in VOR LOC or APP modes (VOR/LOC armed)
- selecting HDG SEL

(5) VOR Localizer (LOC) Switch

Push –
- commands AFDS roll to capture and track selected VOR or LOC course
- annunciates VOR/LOC armed or engaged as roll mode and illuminates VOR LOC switch light

(6) Course Selector

Sets course in COURSE display for related VHF NAV receiver, AFDS and DU.

(7) Bank Angle Selector

Rotate –
- sets maximum bank angle for AFDS operation in HDG SEL or VOR modes
- commanded bank angle can be selected at 10, 15, 20, 25 or 30 degrees.

(8) Heading Select (HDG SEL) Switch

Push –
- engages HDG SEL command mode

- commands roll to follow selected heading
- annunciates HDG SEL as FMA roll mode and illuminates HDG SEL switch light.

(9) Approach (APP) Switch

Push –
- illuminates APP switch light
- arms the AFDS for localizer and glideslope capture
- roll mode annunciates VOR/LOC armed
- pitch mode annunciates G/S armed
- enables engagement of both autopilots.

APP Mode

The approach mode arms AFDS to capture and track localizer and glideslope and can be engaged for dual or single autopilot operation.

One VHF NAV receiver must be tuned to an ILS frequency before approach mode can be engaged. With one VHF NAV receiver tuned, onside AFDS is enabled for guidance and operation.

For dual autopilot operation, both VHF NAV receivers must be tuned to the ILS frequency and both autopilots must be selected in CMD prior to 800 feet RA.

Autopilot / Flight Director

Glareshield
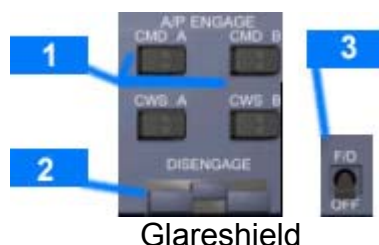
(1) Command Engage (CMD ENGAGE) Switch (A or B) / CWS (A or B)

CMD A or CMD B Push –
- engages A/P and autopilot control servos.
- enables all command modes
- displays CMD in A/P status display
- pushing an engage switch for second A/P, while not in approach mode, engages second A/P and disengages first A/P
- Autopilot will follow commands from Flight Director as entered via the MCP.

CWS A or CWS B Push –
- engages A/P in Control Wheel Steering mode.
- CWS R (Roll Mode) and CWS P (Pitch Mode) displayed on PFD.
- In CWS Pitch mode, aircraft pitch is adjusted using control pressure. When pressure is released aircraft will maintain established pitch.

- In CWS Roll mode, aircraft roll is adjusted using control pressure. When pressure is released, aircraft will maintain bank angle. (Note: If within 6 degrees of wings level, aircraft will level wings and maintain heading.)
- NOTE: Aircraft will not follow flight director cues while in respective CWS modes.
- CWS R and/or CWS P will be displayed if the flight controls are used to over-ride the autopilot while engaged. CWS R and/or CWS P will be displayed on the PFD in place of the previously displayed roll/pitch modes.

(2) Autopilot Disengage (DISENGAGE) Bar

Pull down –
- disengages both A/Ps
- prevents A/P engagement

Lift up –
- enables A/P engagement

(3) Flight Director (F/D) Switch

ON –
- in flight with A/P ON and F/Ds OFF, turning a F/D switch ON engages F/D in currently selected A/P modes
- enables command bar display on pilot's attitude indicator
- command bars are displayed if command pitch and/or roll modes are engaged
- command bars are displayed if command pitch and roll modes are engaged
- on ground, arms pitch and roll modes for engagement in TO/GA and wings level when TOGA switch is pushed.
- on ground, arms pitch and roll modes for engagement in TO/GA and HDG SEL when TOGA switch is pushed.

OFF – command bars retract from pilot's attitude indicator.

Autopilot / Autothrottle Indicators

Forward Panel

(1) Autopilot (A/P) Disengage Light

Illuminated (red) –
- flashing and tone sounds when autopilot has disengaged
- reset by either pushing disengage light or A/P disengage switch

Illuminated (amber) –
- steady – disengage light test switch held in position 1.

2 Autothrottle (A/T) Disengage Light

Illuminated (red) –
- flashing – autothrottle has disengaged
- steady – disengage light test switch held in position 2.

Illuminated (amber) –
- steady – disengage light test switch held in position 1.

3 Disengage Light Test (TEST) Switch

TEST 1 – illuminates autopilot/autothrottle disengage and FMC alert lights steady amber.

TEST 2 – illuminates autopilot/autothrottle disengage lights steady red and FMC alert light steady amber.

Spring – loaded to center position.

Flight Mode Annunciations (FMAs)
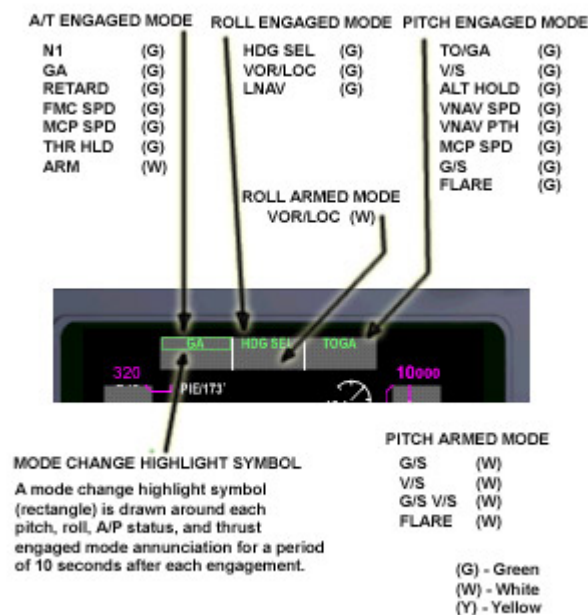
Primary Flight Display

Communications

Controls and Indicators

VHF Communication Panel

Aft Electronic Panel

(1) VHF Communication Transfer (TFR) Switch

Switches standby frequency to active and active frequency to standby.

(2) Frequency Indicator

Indicates selected frequency.

(3) Frequency Selector

Rotate – selects frequency in related indicator.

Electrical

Controls and Indicators

AC and DC Metering Panel
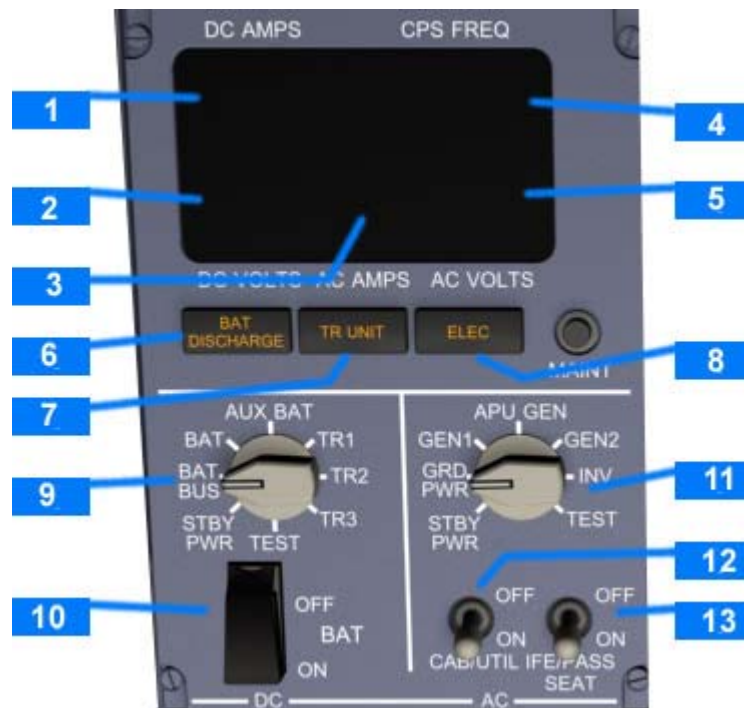
Forward Overhead Panel

(1) DC Ammeter

Indicates amperage of source selected by DC meters selector.

(2) DC Voltmeter

Indicates voltage of source selected by DC meters selector.

(3) AC Ammeter

Indicates amperage of source selected by AC meters selector.

(4) Frequency Meter

Indicates frequency of source selected by AC meters selector.

(5) AC Voltmeter

Indicates voltage of source selected by AC meters selector.

(6) Battery Discharge (BAT DISCHARGE) Light

Illuminated (amber) – with BAT switch ON, excessive battery discharge detected.

(7) TR UNIT Light

Illuminated (amber) –
- on the ground – any TR has failed
- in flight –
    o TR1 failed; or
    o TR2 and TR3 failed.

(8) Electrical (ELEC) Light

Illuminated (amber) – a fault exists in DC power system or standby power system.

(9) DC Meter Selector

Selects DC source for DC voltmeter and DC ammeter indications

(10) Battery (BAT) Switch

OFF –
- removes power from battery bus and switched hot battery bus when operating with normal power sources available
- removes power from battery bus, switched hot battery bus, DC standby bus, static inverter, and AC standby bus when battery is only power source.

ON (guarded position) –
- provides power to switched hot battery bus

- energizes relays to provide automatic switching of standby electrical system to battery power with loss of normal power.

(11) AC Meters Selector

Selects AC source for AC voltmeter, AC ammeter and frequency meter indications.

(12) CAB/UTIL Switch

OFF – removes electrical power from cabin recirculation fan, fwd & aft door area heaters, drain mast heaters, lavatory water heaters, all 115V AC galley busses, logo lights, potable water compressor.

ON – supplies electrical power to cabin recirculation fan, fwd & aft door area heaters, drain mast heaters, lavatory water heaters, all 115V AC galley busses, logo lights, potable water compressor.

(13) IFE/PASS SEAT Switch

OFF – removes electrical power from installed components of the passenger seats and in-flight entertainment systems.

ON – supplies electrical power to installed components of the passenger seats and in-flight entertainment systems.

Generator Drive and Standby Power Panel

Forward Overhead Panel

(1) Generator Drive (DRIVE) Lights

Illuminated (amber) – Integrated drive generator (IDG) low oil pressure caused by one of the following:
- IDG failure
- engine shutdown
- IDG disconnected through generator drive DISCONNECT switch.

(2) Generator Drive Disconnect (DISCONNECT) Switches (guarded)

Disconnects IDG if electrical power is available and engine start lever in IDLE. IDG cannot be reconnected in the air. (Cannot currently be reset in sim, so be careful!)

(3) STANDBY Power Off (PWR OFF) Light

Illuminated (amber) – one or more of the following busses unpowered:
- AC standby bus
- DC standby bus
- battery bus

(4) 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 TR1 and TR2. TR3 is a backup source
- In flight, or on the ground, loss of all AC power
  - AC standby bus is powered by battery through static inverter
  - DC standby bus is powered by battery

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 battery through static inverter
- DC standby bus and battery bus are powered directly by battery.

Ground Power Panel and Bus Switching Panel

Forward Overhead Panel

(1) Ground Power Available (GRD POWER AVAILABLE) Light

Illuminated (blue) – ground power is connected and meets airplane power quality standards (simulated on ground by parking brake set).

(2) Ground Power (GRD PWR) Switch

Three position switch, spring loaded to neutral

OFF – disconnects ground power from AC transfer busses.

ON – if momentarily moved to ON position and ground power is available connects ground power to AC transfer busses.

[3] TRANSFER BUS OFF Lights

Illuminated (amber) – related transfer bus is not powered.

[4] SOURCE OFF Lights

Illuminated (amber) – no source has been manually selected to power the related transfer bus, or the manually selected source has been disconnected.

[5] Generator Off Bus (GEN OFF BUS) Lights

Illuminated (blue) – IDG is not supplying power to related transfer bus.

[6] Generator (GEN) Switches

Three position switch, spring-loaded to neutral.

OFF – disconnects IDG from related AC transfer bus by opening generator circuit breaker.

Note: If APU gen powering both busses after takeoff and APU is shut down, IDGs will select themselves to ON uncommanded to preserve electrical system integrity.

ON – connects IDG to related AC transfer bus by disconnecting previous power source and closing generator circuit breaker.

[7] BUS TRANSFER Switch

AUTO (guarded position) – BTBs operate automatically to maintain power to AC transfer busses from any operating generator or external power

OFF – isolates AC transfer bus 1 from AC transfer bus 2 if one IDG is supplying power to both AC transfer busses.

[8] APU Generator Off Bus (GEN OFF BUS) Light

Illuminated (blue) – APU is running and not powering a bus

[9] APU Generator (GEN) Switches

Three position switch, spring- loaded to neutral.

OFF –
  ▪ moving APU GEN switches to OFF disconnects APU generator from tie bus and removes APU power from AC transfer busses.

ON –
- moving APU GEN switches to ON powers the related AC transfer bus from the APU generator.

Engines and APU

Side by Side – Displays

Primary and Secondary Engine Indications

Upper Display Unit

(1) Primary Engine Indications

(2) Fuel Quantity Indications

(3) Secondary Engine Indications

(4) Hydraulics Indications

Thrust Mode Display and Total Air Temperature

Upper Display Unit

(1) Thrust Mode Display

Displayed (green) – the active N1 limit reference mode.
With N1 manual select knob on engine display control panel in AUTO, active N1 limit is displayed by reference N1 bugs.

Active N1 limit is normally calculated by FMC.

Thrust mode display annunciations are:
- R-TO – reduced takeoff
- R-CLB – reduced climb
- TO – takeoff
- CLB – climb
- CRZ – cruise
- G/A – go-around
- CON – continuous
- ---- FMC not computing thrust limit

(2) Total Air Temperature (TAT) Indication

Displayed (label – cyan, temp – white) – total air temperature (degrees C).

N1 Indications

Center Forward Panel   Upper Display Unit
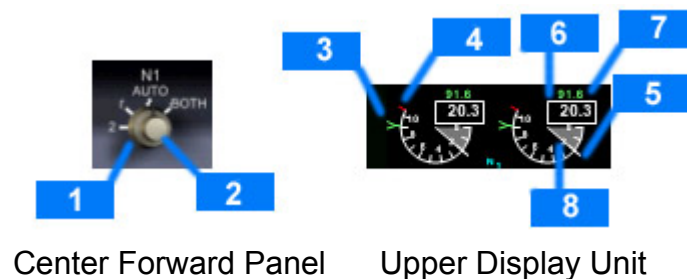
(1) N1 SET Outer Knob

AUTO-
- both reference N1 bugs set by FMC based on N1 limit page and takeoff reference page
- displays reference N1 bugs at active N1 limit for A/T

BOTH-
- both reference N1 bugs and readouts manually set by turning N1 SET inner knob
- has no effect on A/T operation

1 or 2
- respective N1 reference bug and readout manually set by turning N1 SET inner knob
- has no effect on A/T operation

(2) N1 SET Inner Knob

Rotate – positions reference N1 bug(s) and readouts when N1 SET outer knob is set to BOTH, 1 or 2.

(3) Reference N1 Bugs

Displayed (green) – with N1 SET outer knob in AUTO, 1, 2 or BOTH position.

(4) N1 Redlines

Displayed (red) – N1% RPM operating limit

(5) N1 Command Sectors
Displayed (white) – momentary difference between actual N1 and value commanded by thrust lever position.

(6) N1 RPM Readouts (digital)

Displayed (white) – normal operating range.

Displayed (red) – operating limit exceeded.

(7) Reference N1 Readouts

Displayed (green) – manually set N1% RPM:
  ▪ set with N1 SET inner knob when N1 SET in BOTH, 1, or 2 position
  ▪ blank when N1 SET outer knob in AUTO position
  ▪ ---- when N1 SET outer knob in AUTO and FMC source invalid.

(8) N1 RPM Indications

Displayed N1% RPM
  ▪ displayed (white) – normal operating range
  ▪ displayed (red) – operating limit exceeded

Thrust Reverser Indications

Upper Display Unit

(1) Thrust Reverser (REV) Indications

Displayed (amber) – thrust reverser is moved from stowed position.

Display (green) – thrust reverser is deployed.

Thermal Anti-Ice Indication

Upper Display Unit

(1) Thermal Anti-Ice (TAI) Indications

Displayed (green) – cowl anti-ice valve(s) open.

EGT Indications

Upper Display Unit
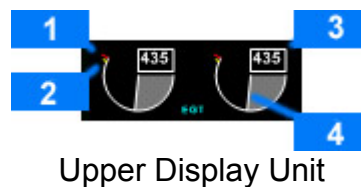
(1) Exhaust Gas Temperature (EGT) Redlines

Displayed (red) – maximum takeoff EGT limit.

(2) Exhaust Gas Temperature (EGT) Amber Bands

Displayed (amber) – lower end of band displays maximum continuous EGT limit.

(3) Exhaust Gas Temperature (EGT) Start Limit Lines

Displayed (red) – N2 less than 50%.

(4) Exhaust Gas Temperature (EGT) Readouts (digital)

Displayed (white) – normal operating range (degrees C).

(5) Exhaust Gas Temperature (EGT) Indications

Displayed (white) – normal operating range

Engine Fail Alert

Upper Display Unit
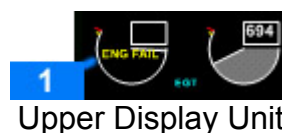
(1) Engine Fail (ENG FAIL) Alert

Displayed (amber) –
- engine N2 below sustainable idle (less than 50%); and
- engine start lever in IDLE position

Alert remains until –
- engine N2 above sustainable idle (50% or greater); or
- start lever moved to CUTOFF; or
- engine fire warning switch pulled

N2 Indications

Upper Display Unit
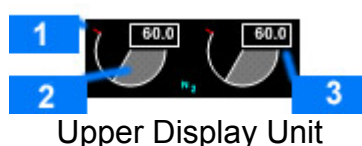
(1) N2 Redlines

Displayed (red) – N2 % RPM operating limit

(2) N2 RPM Indications

Displays N2 % RPM
- displayed (white) – normal operating range
- displayed (red) – operating limit exceeded.

(2) N2 Readouts (digital)

Displayed (white) – normal operating range.

Displayed (red) – operating limit exceeded.

Fuel Flow/Fuel Used Indications

Center Forward Panel   Upper Display Unit

(1) FUEL FLOW Switch (spring-loaded to RATE)

RATE – displays fuel flow to engine.

USED –
- pointer and shading are removed
- displays fuel used since last reset

RESET –
- pointer and shading are removed
- resets fuel used to zero

[2] Fuel (FF) Readout (digital)

Displayed (white) – fuel flow to engine with FUEL FLOW switch in RATE position (pounds per hours x 1000)

[3] Fuel Flow (FF) Dial/Index Markers & Digits (white)

Displayed (white) – fuel flow to engine with FUEL FLOW switch in RATE position (pounds per hour x 1000).

Engine Oil Indications

Upper Display Unit

[1] Oil Pressure (OIL P) Indication

Displays engine oil pressure (psi)
- displayed (white) – normal operating range
- displayed (amber) – caution range
- displayed (red) – operating limit reached.

[2] Low Oil Pressure (OIL P) Redline

Displayed (red) – oil pressure operating limit.

[3] Low Oil Pressure (OIL P) Amber Band

Displayed (amber) – low oil pressure caution range beginning at red line.

[4] High Oil Temperature (OIL T) Redline

Displayed (red) – oil temperature operating limit.

(5) High Oil Temperature (OIL T) Amber Band

Displayed (amber) – oil temperature caution range.

(6) Oil Temperature (OIL T) Indication

Displays oil temperature (degrees C)
- displayed (white) – normal operating range
- displayed (amber) – caution range reached
- displayed (red) – operating limit reached.

(7) Oil Quantity (OIL Q)% Readout

Displays usable oil quantity as a percentage of full quantity.

Engine Vibration Indications

Upper Display Unit

(1) Vibration (VIB) Pointer

Displayed (white) – engine vibration level.
(2) High Engine Vibration Indication

Displayed (white)

Engines and APU

General Controls and Indicators

Engine Start Switches

Forward Overhead Panel

(1) ENGINE START Switches

GRD – (Use for engine starts on ground)
  ▪ opens start valve
  ▪ closes engine bleed valve
  ▪ for ground starts, arms selected igniter(s) to provide ignition when engine start lever is moved to IDLE
  ▪ for inflight starts, arms both igniters to provide ignition when engine start lever is moved to IDLE
  ▪ releases to OFF at start valve cutout.

OFF – ignition normally off

CONT – provides ignition to selected igniters when engine is operating and engine start lever is in IDLE

FLT – (Use for inflight engine restart) provides ignition to both igniters when engine start lever is in IDLE.

(2) Ignition Select Switch

IGN L – selects the left igniter for use on both engines.
BOTH – selects both igniters for use on both engines.
IGN R – selects the right igniter for use on both engines.

Engine Display Control Panel

(1) N1 SET Knob

Refer to section Side by Side – Displays

(2) FUEL FLOW Switch

Refer to section Side by Side – Displays

(3) Speed Reference Selector

Refer to section Side by Side – Displays

Engine Controls

Control Stand

(1) Thrust Levers -

- controls engine thrust

- cannot be advanced if the reverse thrust lever is in the deployed position

(2) Reverse Thrust Levers –

- controls engine reverse thrust
- cannot select reverse thrust unless related forward thrust lever is at IDLE

(3) Engine Start Levers

IDLE –
- energizes ignition system through EEC
- electrically opens spar fuel shutoff valve in the wing leading edge outboard of the pylon
- electrically opens engine-mounted fuel shutoff valve via the EEC.

CUTOFF –
- closes both spar and engine fuel shutoff valves
- de-energizes ignition system.

APU

Forward Overhead Panel

(1) APU Maintenance (MAINT) Light

Illuminated (blue) – APU maintenance problem exists :
- APU may be operated
- light is disarmed when APU switch is in OFF.

(2) APU Exhaust Gas Temperature (EGT) Indicator

Displays APU EGT

EGT indicator remains powered for 5 minutes after shutdown.

(3) APU OVERSPEED Light

Illuminated (amber) –
- APU RPM limit has been exceeded resulting in an automatic shutdown
- light is disarmed when APU switch is in OFF position.

(4) APU FAULT Light

Illuminated (amber) –
- A malfunction exists causing APU to initiate an automatic shutdown
- light is disarmed when APU switch is in OFF position.

(5) APU LOW OIL PRESSURE Light

Illuminated (amber) –
- during start until the APU oil pressure is normal
- light is disarmed when APU switch is in OFF position.

(6) APU Switch

OFF – normal position when APU is not running
- positioning switch to OFF with APU running trips APU generator off the bus(es), if connected, and closes APU bleed air valve. APU continues to run for a 60 second cooling period.
- APU air inlet door automatically closes after shutdown.

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

Controls and Indicators

Overhead/Fire Protection Panel Switches and Lights

Aft Electronics Panel

[1] Overheat Detector (OVHT DET) Switch

NORMAL – detection loop A and loop B are active

A – detection loop A is active

B – detection loop B is active

[2] Extinguisher (EXT) TEST Switch

(spring–loaded to center)

1 or 2 – tests bottle discharge circuits for all three extinguisher bottles.

[3] Fault/Inoperative (FAULT/INOP) and Overheat/Firs (OVHT/FIRE) TEST Switch

(spring–loaded to center)

FAULT/INOP – tests fault detection circuits for both engines and the APU.

[4] APU BOTTLE DISCHARGE Light

Illuminated (amber) – indicates APU extinguisher bottle has discharged.

[5] APU Fire Warning Switch

Illuminated (red) – Indicates fire in APU

In – normal position, mechanically locked if no fire signal.

Up –
- Arms APU extinguisher circuit
- closes fuel shutoff valve, APU bleed air valve, and APU inlet door
- trips generator control relay and breaker
- allows APU fire warning switch to rotate

Rotate (left or right) –
- discharges APU fire bottle.

(6) Engine Fire Warning Switch

Illuminated (red) –
- Indicates fire in related engine

In – normal position, mechanically locked if no fire signal.

Up –
- Arms one discharge squib on each engine fire extinguisher
- closes fuel, hydraulic shutoff and engine bleed air valves.
- trips generator control relay and breaker
- deactivates engine driven hydraulic pump LOW PRESSURE light
- allows engine fire warning switch to rotate.

Rotate (left or right) – discharges related fire bottle.

(7) Engine BOTTLE DISCHARGE Light

Illuminated (amber) – indicates related fire extinguisher bottle has discharged.

Two engine fire bottles are provided. Use only one bottle, time for 30 seconds to determine if fire has extinguished. If fire continues to be indicated, consider using second bottle by twisting fire control level to opposite side.

Master Fire Warning Light

Glareshield

(1) Master Fire Warning (FIRE WARN) Lights
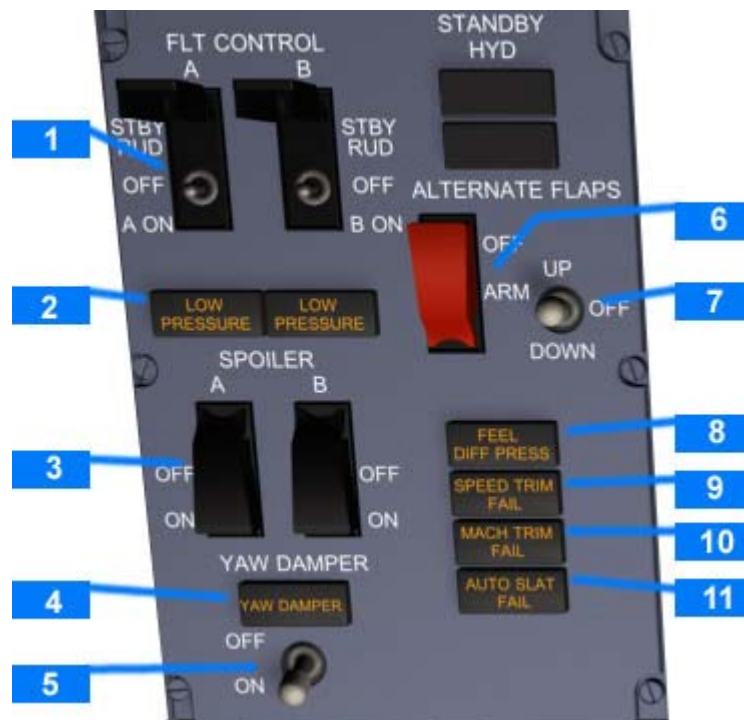
Illuminated (red) – indicates a fire warning in engine or APU.

Push – extinguishes both master FIRE WARN lights

Flight Controls

Controls and Indicators

Flight Control Panel

Forward Overhead Panel

(1) FLIGHT CONTROL Switches

STBY RUD – activates standby hydraulic system pump and opens standby rudder shutoff valve to pressurize standby rudder power control unit.

OFF – closes flight control shutoff valve isolating ailerons, elevators and rudder from associated hydraulic system pressure.

ON (guarded position) – normal operating position.

(2) FLIGHT CONTROL Switches

Illuminated (amber) – indicates low hydraulic system, (A or B) pressure to ailerons, elevator and rudder

(3) Flight SPOILER Switches

ON (guarded position) – normal operating position

OFF – closes the respective flight spoiler shutoff valve.

Note: Used for maintenance purposes only.

(4) YAW DAMPER Light

Illuminated (amber) – yaw damper is not engaged

(5) YAW DAMPER Switch

OFF – disengages yaw

ON – engages main yaw damper to main rudder power control unit if the B FLT CONTROL switch is in the ON position

(6) ALTERNATE FLAPS Master Switch

OFF (guarded position) – normal operating position.

ARM – closes TE flap bypass valve, activates standby pump, and arms the ALTERNATE FLAPS position switch.

(7) ALTERNATE FLAPS Position Switch

Functions only when the ALTERNATE FLAPS master switch is in ARM.

(8) Feel Differential Pressure (FEEL DIFF PRESS) Light

Armed when the TE flaps are up or down.

Illuminated (amber) – indicates excessive differential pressure in the elevator feel computer.

(9) Speed Trim Failure (SPEED TRIM FAIL) Light

Illuminated (amber) – indicates failure of the speed trim system.

(10) Mach Trim Failure (MACH TRIM FAIL) Light

Illuminated (amber) – indicates failure of the mach trim system.

(11) Automatic Slat Failure (AUTO SLAT FAIL) Light

Illuminated (amber) – indicates failure of the auto slat system.

Stabilizer
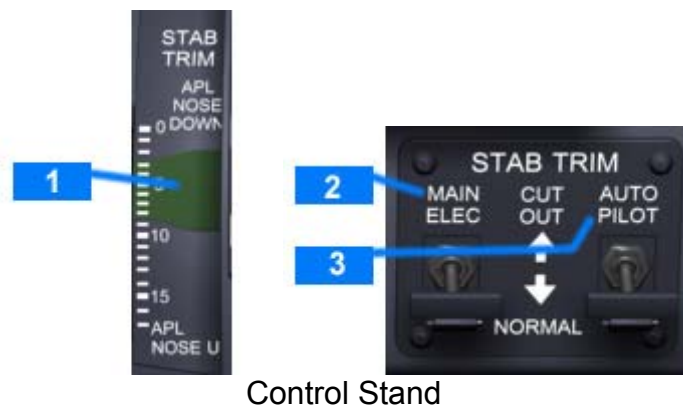
Control Stand

(1) Stabilizer Trim Green Band Range

Corresponds to allowable range of trim settings for takeoff.

(2) Stabilizer Trim Main Electric (MAIN ELECT) Cutout Switch

NORMAL – normal operating position.

CUTOUT – deactivates stabilizer trim switch operation.

(2) Stabilizer Trim AUTOPILOT Cutout Switch

NORMAL – normal operating position.

CUTOUT – deactivates autopilot stabilizer trim operation.

Speed Brakes

Control Stand   Forward Panel
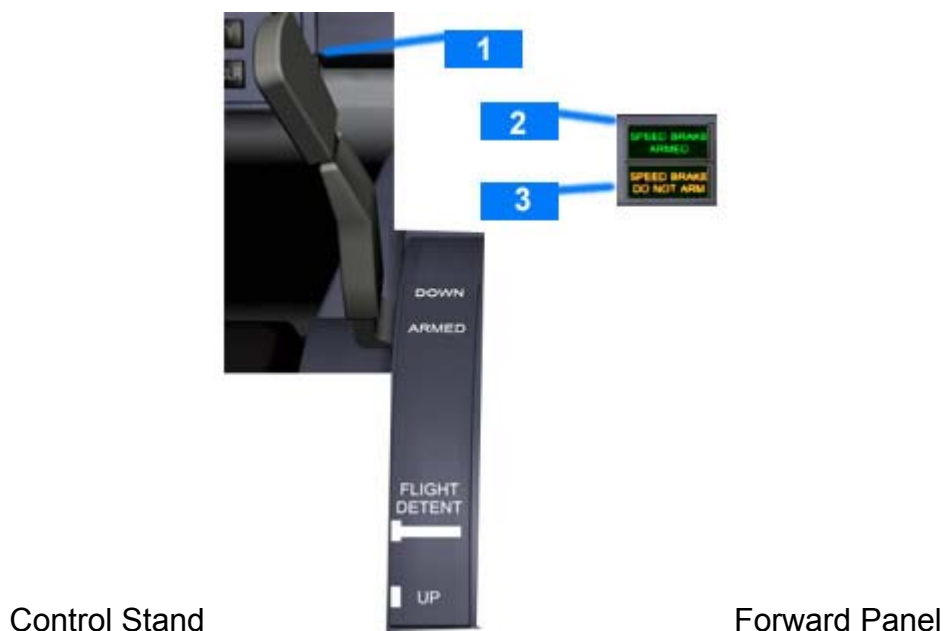
(1) SPEED BRAKE Lever

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

ARMED –
- automatic speed brake system armed
- upon touchdown, the SPEED BRAKE lever moves to the UP position and all flight and ground spoilers extend.

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.

(2) SPEED BRAKE ARMED Light

Illuminated (green) – indicates valid automatic speed brake system inputs.

(3) SPEED BRAKE DO NOT ARM Light

Illuminated (amber) – indicates abnormal condition of the automatic speed brake system.

Trailing Edge Flaps

Control Stand   Center Forward Panel

(1) FLAP Lever

- selects position of flap control valve, directing hydraulic pressure for flap drive unit
- flap positions 30 and 40 arm the flap load relief system.

(2) 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.

(3) Flap Position Indicator

- indicates position of left and right TE flaps

(4) FLAPS LIMIT Placard

Indicates maximum speed for each flap setting.

Leading Edge Devices

Center Forward Panel

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

Illuminated (amber) – any LE device in transit

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

Illuminated (green) –
  ▪ all LE flaps extended and all LE slats in extended position (TE flap positions 1, 2 and 5)
  ▪ all LE devices fully extended (TE flap positions 10 through 40).

Flight Instruments, Displays

EFIS/Map – Controls and Indicators

Captain Outboard Display

Left Forward Panel

(1) Flight Mode Annunciator

(2) Airspeed Indications

(3) Autopilot, Flight Director System Status

(4) Autopilot, Flight Director System Status

(5) Altitude Indications

(6) Vertical Speed Indications

(7) Heading/Track Indications

Captain Inboard Display
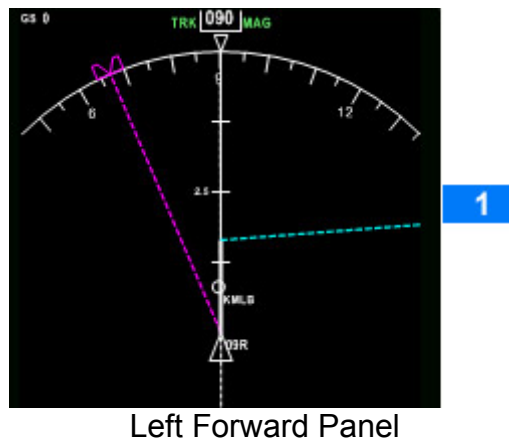
Left Forward Panel

(1) Navigation Display

Displays map, approach, VOR, or plan modes as selected on the EFIS control panel.

Primary Flight Display (PFD) –

PFD Airspeed Indications

(1) Selected Speed (magenta)

Displays target airspeed:
- indicates the airspeed manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

(2) Speed Trend Vector (green)

Tip of arrow indicates the predicted airspeed in the next 10 seconds based on the current airspeed and acceleration.

(3) Current Airspeed (white)

Indicates current calibrated airspeed in knots.

(4) Maximum Speed (red and black)

Bottom of the bar indicates the maximum airspeed as limited by the lowest of the following:
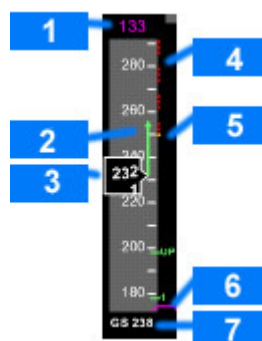- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

(5) Maximum Maneuver Speed (amber)

Bottom of the bar indicates the airspeed that provides a 0.3 g maneuver margin to high speed buffet. May be displayed at high altitude with flaps up, at relatively high gross weights.

(6) Speed Bug (magenta)

Points to the airspeed:
- manually selected in the IAS/MACH window
- indicates the FMC computed airspeed when the IAS/MACH window is blank.

When the selected speed is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

(7) Current Mach/Groundspeed (white)

Indicates current Mach or groundspeed:
- displays Mach when airspeed is 0.40 Mach and above
- displays groundspeed when airspeed decreases below 0.40 Mach

Angle of Attack Indications

(1) Digital AOA Readout (white)

Indicates digital AOA value to the nearest 0.2 degrees. When on the ground and ground speed less than 80 knots, the readout is fixed at 0.0 degrees.

[2] Analog Needle (white)

Indicates analog AOA value.
- needle travel is limited to a range of –6 degrees and +21 degrees
- fixed at 0.0 degrees when on the ground and ground speed less than 80 knots.

[3] Zero Degree Reference Line (white)

Indicates zero degrees angle of attack. Reference lines are displayed every 5 degrees from –5 degrees to +20 degrees.

Attitude Indications

[1] Bank Scale (white)

Provides fixed reference for the bank pointer; scale marks are at 0, 10, 20, 30, 45 and 60 degrees.

[2] Flight Director Bar (magenta)

Indicates flight director steering commands.

[3] Horizon Line and Pitch Scale (white)

Indicates the horizon relative to the airplane symbol; pitch scale is in 2.5 degree increments.

[4] Bank Pointer

Indicates bank angle; fills and turns amber if bank angle is 35 degrees or more.

[5] Slip/Skid Indication

Displaces beneath the bank pointer to indicate slip or skid.
- fills white at full scale deflection
- turns amber if bank angle is 35 degrees or more; fills amber if the slip/skid indication is also at full scale deflection.

[6] Airplane Symbol

Indicates airplane attitude relative to the horizon.

PFD Instrument Landing System Indications
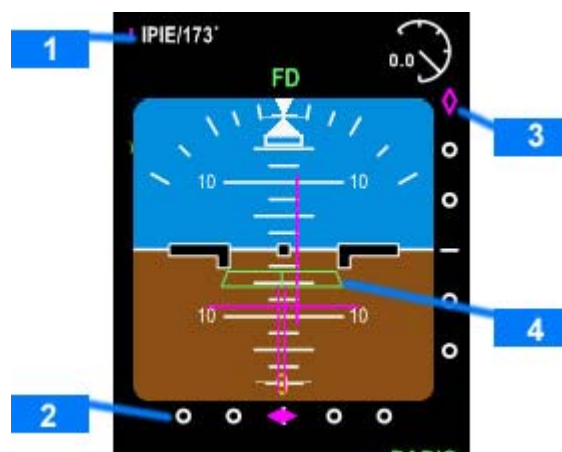
(1) Approach Reference

Displays the selected ILS identifier or frequency, approach front course, and ISL/DME distances.

(2) Approach Reference

The pointer:
- indicates localizer position relative to the airplane
- in view when the localizer signal is received
- fills in solid magenta when within 2 ½ dots from center.

The scale:
- indicates deviation
- in view when the localizer frequency is tuned
- expands when the localizer is engaged and deviation is slightly more than one-half dot.

(3) Approach Reference

The pointer:

- indicates glide slope position
- in view when the glide slope signal is received
- fills in solid magenta when within 2 ½ dots from center.

The scale:
- indicates deviation
- in view when the localizer frequency is tuned.

(5) Rising Runway (green with magenta stem)

Displayed when:
- localizer signal usable and pointer is in view
- radio altitude is less than 2,500 feet.

Rises towards airplane symbol when radio altitude is below 200 feet.

Altitude Indications
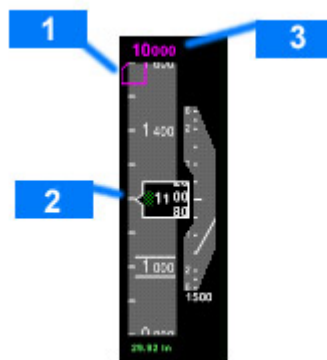
(1) Selected Altitude Bug (magenta)

Indicates the altitude set in the MCP altitude window.

When the selected altitude is off scale, the bug is parked at the top or bottom of the tape, with only one half bug visible.

(2) Current Altitude

Displays current altitude in increments of thousands, hundreds and twenty feet.
- for positive values of altitude below 10,000 feet, a green crosshatch symbol is displayed.
- readout box becomes bold to denote altitude acquisition

- readout box is highlighted in amber and flashes to denote altitude deviation.

(3) Selected Altitude (magenta)

Displays the altitude set in the MCP altitude window.

The selected altitude box appears in white during an altitude alert.

PFD Barometric Indications

(1) Barometric Settings (green)

Indicates the barometric setting in either inches of mercury (IN) or hectopascals (HPA) as selected on the EFIS control panel.

STD is displayed when the Barometric Standard (STD) switch is selected on the EFIS control panel.

Landing Altitude / Minimums Indications / Metric Indications
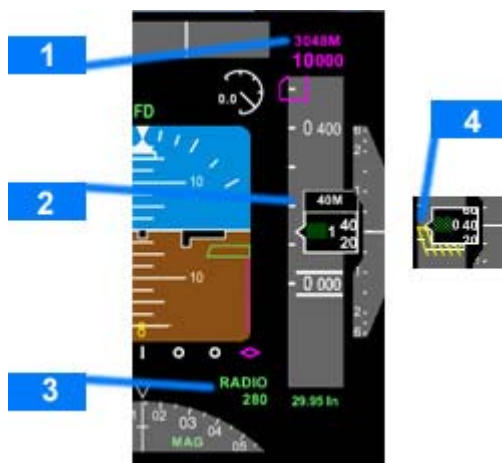
(1) Metric Selected Altitude Readout (readout-magenta, metric symbol-cyan)

Displays MCP altitude in meters when MTRS is selected on the EFIS control panel.

(2) Metric Digital Readout (readout and box-white, metric symbol-cyan)

Displays current altitude in meters when MTRS is selected on the EFIS control panel.

(3) Minimums Reference/Altitude (green)

Displays approach minimum reference and altitude set by the MINS selector on the EFIS control panel.

Heading and Track Indications

(1) Current Heading Pointer (white)

Indicates current heading.

(2) Track Pointer (white)

Indicates current track.

(3) Selected Heading (magenta)

Digital display of the selected heading bug.

(4) Selected Heading Bug (magenta)

Indicates the heading selected on the mode control panel. If the selected heading exceeds the display range, the bug parks on the side of the compass rose in the direction of the shorter turn to the heading.

(5) Magnetic/True Heading Annunciation (green)

MAG indicates display is oriented relative to magnetic north.

Navigation Displays

Expanded and Center MAP Modes

Expanded Map

Center Map
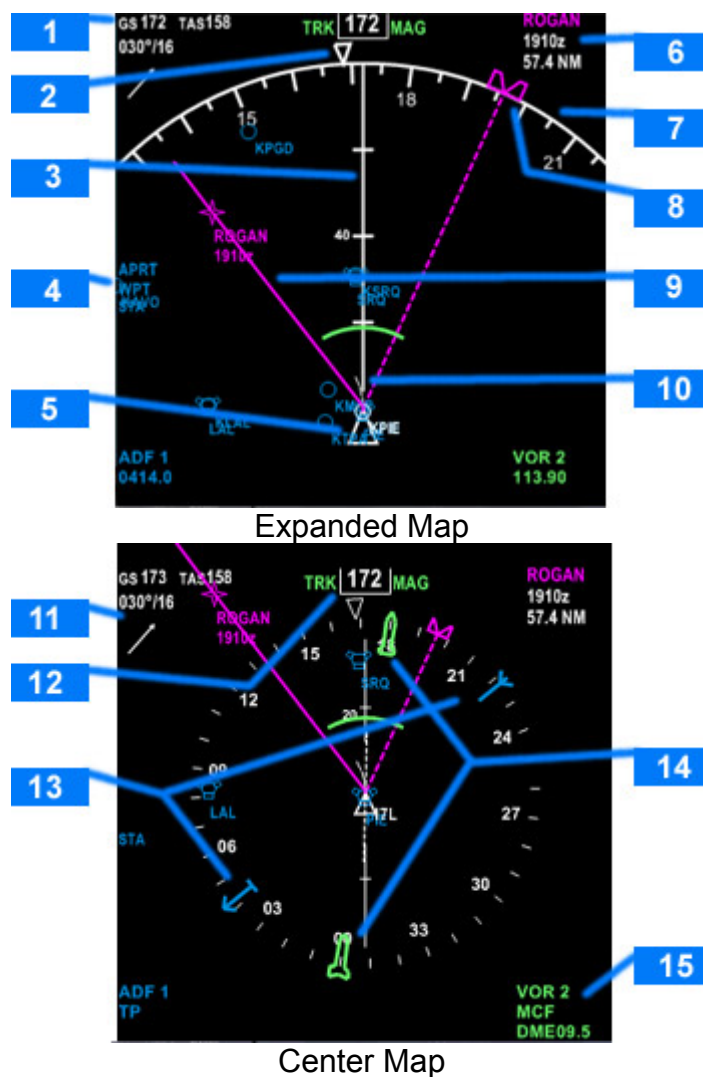
(1) Groundspeed / True Airspeed

(2) Heading Pointer

(3) Track Line and Range Scale

(4) Map Options

(5) Airplane Symbol

(6) Active Waypoint/ETA/Distance-To-Go

(7) Compass Rose

(8) Selected Heading Bug

(9) Active LNAV Route

(10) Position Trend Vector

(11) Wind Direction/Speed/Arrow

(12) Current Track

(13) Number 1 VOR/ADF Pointer

(14) Number 2 VOR/ADF Pointer

(15) VOR/ADF Selection, Ident/Frequency, VOR DME

Expanded and Center Approach Modes

Expanded Approach Mode

Center Approach Mode

(1) Wind Direction/Speed/Arrow
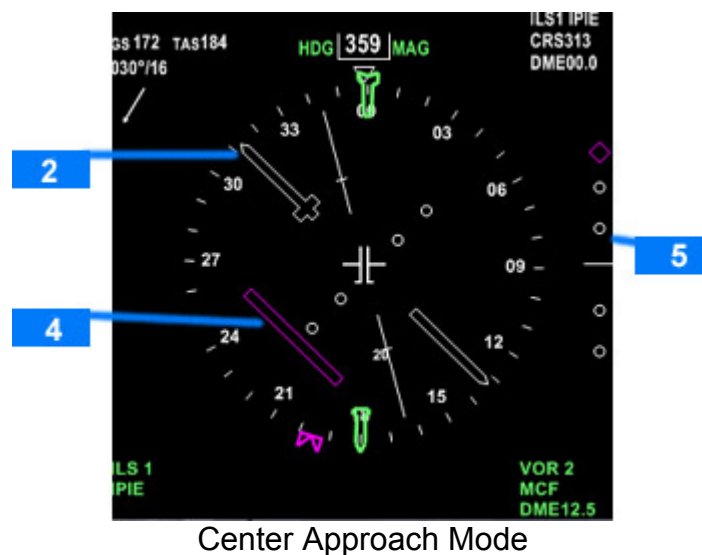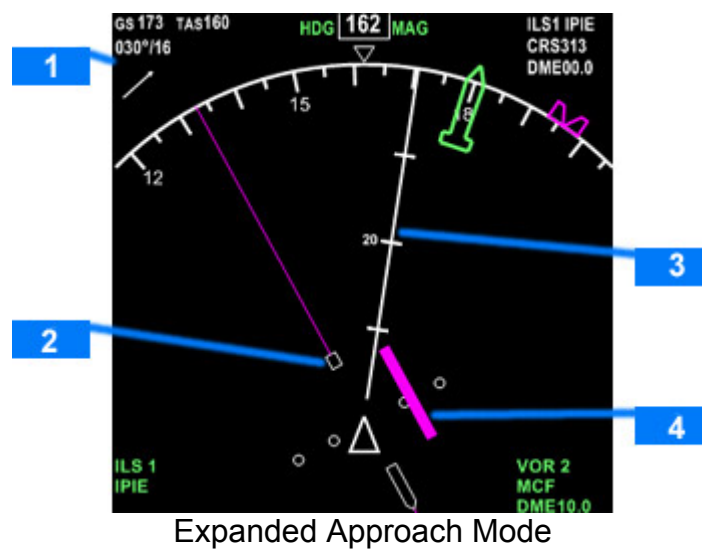
(2) Selected Course Pointer

(3) Track Line

(4) Localizer Deviation Indication and Scale

(5) Glideslope Pointer and Scale

Expanded and Center VOR Modes

Expanded VOR Mode
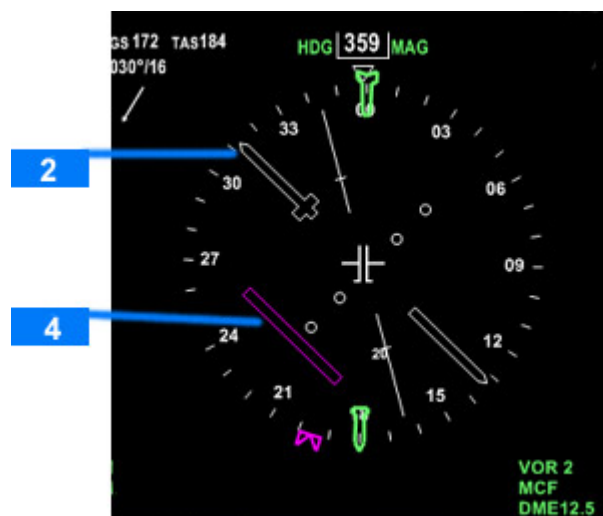
Centered VOR Mode

(1) Wind Direction/Speed/Arrow

(2) Selected Course Pointer

(3) Track Line

(4) Courser Deviation Indication and Scale

Plan Mode
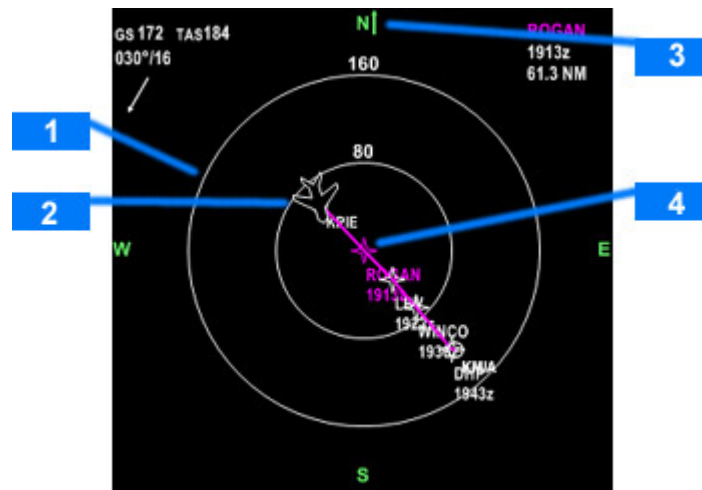
(1) Range Circle

(2) Airplane Symbol

(3) True North Up Arrow

(4) Center Waypoint

The waypoint located at the display center is identified as CTR on the CDU RTE LEGS page.

Mode/Frequency Disagree Annunciation

(1) EFIS MODE/NAV FREQ DISAGREE (amber)

The ILS or VOR source annunciation corresponds to the position selected on the EFIS control panel and the tuned VOR/ILS frequency.

The annunciation is displayed:
- if APP is selected with a VOR frequency tuned
- If VOR is selected with an ILS frequency tuned.

Flight Instruments, Displays

EFIS Instruments – Controls and Indicators

EFIS Control Panel Controls – Flight Instrument Displays

Glare shield

(1) Minimums (MINS) Reference Selector (outer) (two positions)

RADIO – selects radio altitude as the minimums reference.

BARO – selects barometric altitude as the minimums reference.

(2) Minimums (MINS) Selector (middle)

ROTATE – adjusts the radio or baro minimums altitude.

(3) Minimums (MINS) Reset (RST) Switch (inner) (momentary action)

PUSH –
- blanks radio height ALT alert
- resets the radio altitude minimums alert display on the attitude indicator

(4) Meters (MTRS) Switch (momentary action)

PUSH – displays altitude indications in meters.

(5) Barometric (BARO) Reference Selector (outer) (two position)

IN – selects inches of mercury as the barometric altitude reference.

HPA – selects hectopascals as the barometric altitude reference.

(6) Barometric (BARO) Selector (middle) (slew)

ROTATE – adjusts the barometric altitude setting on the altimeter.

(7) Barometric (BARO) Standard (STD) Switch (inner) (momentary action)

PUSH – selects the standard barometric setting (29.92 inches Hg/1013 HPA) for barometric altitude reference.

(8) Flight Path Vector (FPV) Switch (momentary action)

PUSH – displays flight path vector on the attitude indicator.

EFIS Control Panel Controls – Navigation Displays

[1] VOR/ADF Switch (three position)

Displays VOR or ADF information on the respective RDMI.

VOR – displays the selected VOR bearing pointer and VOR bearing pointer source indicator.

OFF – removes the VOR or ADF displays and displays "OFF" in place of the bearing pointer source indicators.

ADF – displays the selected ADF pointer and ADF bearing pointer source indicator.

[2] Center (CTR) Switch (inner)

PUSH –
- displays the full compass rose (center) for APP, VOR and MAP modes
- subsequent pushes alternate between expanded and center displays.

[3] Mode Selector (outer)

Selects the desired display.

APP –
- displays localizer and glideslope information in heading-up format
- displays reference ILS receiver, ILS frequency, course and DME.

VOR –
- displays VOR navigation information in heading-up format
- displays reference VOR receiver, VOR frequency, course, DME and TO/FROM information.

MAP –
- displays FMC generated route and MAP information, airplane position, heading and track, in a heading-up format
- displays waypoints, including the active waypoint, within the selected range
- displays VNAV path deviation.

PLN –
- displays a non-moving, true north up, route depiction

- the airplane symbol represents actual airplane position
- allows route step-through using the CDU LEGS page

(4) Range Selector (outer)

Selects desired display range in nautical miles for APP, VOR, MAP or PLN modes.

(5) Traffic (TFC) Switch (inner)

(6) MAP Switches (momentary action)

The MAP switches:
- add background data/symbols to MAP and center MAP modes
- displays can be selected simultaneously
- second push removes the information

STA (station)
- displays all FMC data base navigation aids if on map scales 5, 10, 20 or 40 nm.

WPT (waypoint) – displays the waypoints in the FMC data base which are not in the flight plan route if the selected range is 40 nm or less.

ARPT (airport) – displays all airports which are stored in the FMC data base and which are within the viewable map area.

DATA – displays altitude constraints, if applicable, and estimated time of arrival for each active route waypoint.

POS (position) – displays VOR and ADF bearing vectors extended from the nose of the airplane symbol to the stations.

Speed Reference Selector

Center Forward Panel

(1) Speed Reference Selector (outer)

Sets the reference airspeed bugs on the Mach/airspeed indicator:
- AUTO – the reference airspeeds and gross weight are provided automatically through the FMC
- V1 – used to manually set decision speed on the ground; in flight, displays "INVALID ENTRY"
- VR - used to manually set rotation speed on the ground; in flight, displays "INVALID ENTRY"
- WT – allows manual entry of reference gross weight
- VREF - used to manually set landing reference speed in flight; on the ground, displays "INVALID ENTRY"
- Bug 5 – used to manually set the white bug 5 to the desired value
- SET – removes the digital readout above the Mach/airspeed indicator.

(2) Speed Reference Selector (inner)

ROTATE –
- Manually sets the appropriate reference airspeed or gross weight
- The digital display appears above the Mach/airspeed indicator.

Standby Radio Magnetic Indicator

Center Forward Panel

(1) Bearing Pointers

- narrow pointer uses signals from the VHF NAV receiver No. 1 or ADF receiver No. 1.
- wide pointer uses signals from the VHF NAV receiver No. 2 or ADF receiver No. 2.

(2) VOR/ADF Bearing Pointer No. 1 Switch

ROTATE – selects VOR or ADF for the bearing pointer.

[3] VOR/ADF Bearing Pointer No. 2 Switch

ROTATE – selects VOR or ADF for the bearing pointer.

Flight Management, Navigation

Controls and Indicators

Flight Management System

Note: This airplane is capable of displaying two CDUs simultaneously. Select CDU1 by clicking on the "F" key in the panel switcher window. Select CDU2 by selecting it from the VIEW menu within Microsoft Flight Simulator. (Each CDU updates individually within the simulator and within the VC. You cannot alter a function simultaneously on two CDUs, as the CDU logic will prevent it.)

Control Display Unit (CDU)

Forward Electronic Panel

[1] Control Display Unit (CDU) Display

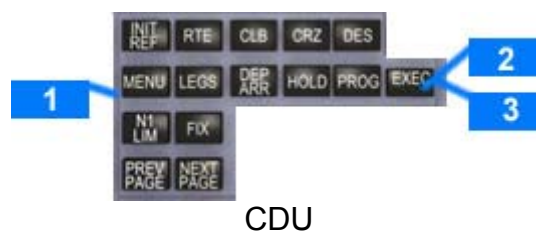Shows FMS data pages

[2] Line Select Keys

Push –
- moves data from scratchpad to selected line
- moves data from selected line to scratchpad
- select page, procedure, or performance mode as applicable
- deletes data from selected line when DELETE is shown in scratchpad.

(3) Brightness Control

Rotate – controls display brightness

Function and Execute Keys

CDU

(1) CDU Function keys

Push –
- INIT REF – shows page for data initialization or for reference data
- RTE – shows page to input or change origin, destination, or route
- CLB – shows page to view or change climb data
- CRZ – shows page to view or change cruise data
- DES – shows page to view or change descent data
- MENU – shows page to choose subsystems controlled by CDU
- LEGS –
  - shows page to evaluate or modify lateral and vertical data
  - shows page to control PLAN mode display
- DEP ARR – shows page to input or change departure and arrival procedures
- HOLD – shows page to create holding patterns and show holding pattern data
- PROG – shows page to view dynamic flight and navigation data, including waypoint and destination ETAs, fuel remaining, and arrival estimates.
- N1 Limit – shows page to view or change N1 thrust limits
- FIX – shows page to create reference points on map display
- PREV PAGE – shows previous page of related pages (for example, LEGS pages)
- NEXT PAGE – shows next page of related pages.

(2) Execute Light

Illuminated (white) – active data is modified but no executed

(3) Execute (EXEC) Key

Push –

- makes data modification(s) active
- extinguishes execute light.

Alpha/Numeric and Miscellaneous Keys

CDU
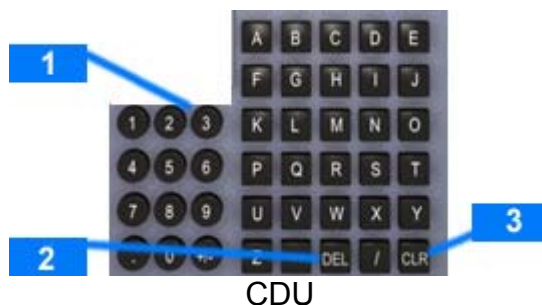
(1) Alpha/Numeric Keys

Push –
- puts selected character in scratchpad
- Slash (/) key – puts "/" in scratchpad
- Plus Minus (+/-) key – first push puts "-" in scratchpad. Subsequent pushes alternate between "+" and "-".

(2) Delete (DEL) Key

Push – puts DELETE in scratchpad.

(3) Clear (CLR) Key

Push –
- Clears the last scratchpad character
- Clears scratchpad message.

CDU Page Components

CDU
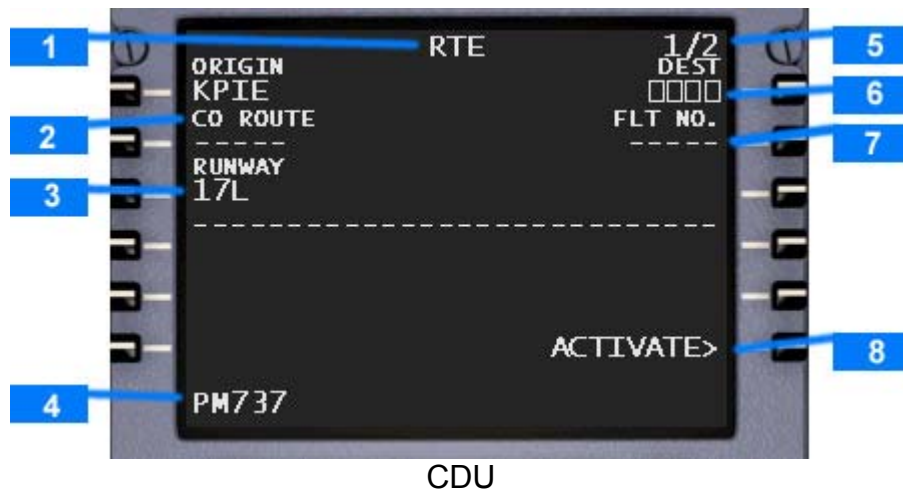
(1) Page Title

Subject or name of data shown on page.

ACT (active) or MOD (modified) shows whether page contains active or modified data.

(2) Line Title

Title of data on line shown

(3) Line

Shows –
- Prompts
- Selections
- Options
- Data

(4) Scratchpad

Shows messages, alpha-numeric entries or line selected data.

(5) Page Number

Left number is page number. Right number is total number of related pages.

(6) Boxes

Data input is mandatory.

(7) Dashes

Data input is optional. The data is not mandatory.

(8) Prompts

Shows pages, select modes, and control displays. Cared "<" or ">" is before or after prompt.

FMC Alert Light

Forward Panel

(1) FMC Alert Light

Illuminated (amber) –
- An alerting message exists for both CDUs, or
- Test switch is in position 1 or 2.

Push – FMC alert light extinguishes.

Radio Navigation Systems

Automatic Direction Finding (ADF) Control

Aft Electronic Panel

(1) Frequency Indicator

Shows the frequency selected.

(2) Frequency Selector

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

[3] Mode Selector Switch

ADF – ADF bearing sent to the DUs and the standby radio magnetic indicator.

OFF – removes power from selected receiver.

VHF Navigation Control

Aft Electronic Panel

[1] Frequency Indicator

Indicates the frequency selected by the frequency selector
- tuned frequency displayed in STANDBY display
- TFR switch moves STANDBY frequency to ACTIVE frequency.

[2] Frequency Selector

Rotate – manually selects the standby frequency.

Transponder Panel

Aft Electronic Panel

[1] Air Traffic Code (ATC) Code Indicator

Shows transponder code.

[2] Transponder Mode Selector

TEST – starts ATC transponder functional test.

STBY (standby) – does not transmit.

XPDR (Transponder) – Transponder operates with altitude reporting.

[3] Air Traffic Code (ATC) Code Selector

Rotate – sets transponder code in transponder.

Flight Management, Navigation

Flight Management System Operation

Introduction

When first powered, the FMS is in the preflight phase. As a phase is completed, the FMS automatically transitions to the next phase in this order:

- preflight
- takeoff
- climb
- cruise
- descent
- approach
- flight complete.

Preflight

During preflight, flight plan and load sheet information are entered into the CDU. The flight plan defines the route of flight from origin to the destination and initializes LNAV. Flight plan and load sheet information provide performance information to initialize VNAV.

Required preflight information consists of:
- initial position
- route of flight
- performance data
- takeoff data.

Optional preflight data includes:
- navigation database
- SID
- STAR
- Reduced takeoff and climb thrust limit.

Each required or optional data item is entered on specific preflight pages.

Preflight begins with the IDENT page. If the IDENT page is not displayed, it can be selected from the IDENT prompt on the INIT/REF INDEX page. Preflight pages can be manually selected in any order.

After entering and checking the necessary data on each preflight page, the lower right line select key is pushed to select the next page. When ACTIVATE is selected on the RTE page, the execute light illuminates. The EXEC key is then pushed to complete the task of making the route active before continuing with the preflight.

If a standard instrument departure (SID) is to be entered into the route, the departure/arrival (DEP/ARR) page is selected (SIDSTAR procedures available at www.precisionmanuals.com). After selecting the desired SID, the resulting modification must be appropriately linked to the existing route and executed. This can be accomplished on the RTE or RTE LEGS page.

When all required preflight entries are complete, the preflight status prompts on the TAKEOFF REF page are no longer displayed.

Takeoff

The takeoff phase begins with selection of TO/GA and extends to the thrust reduction altitude where climb thrust is normally selected.

Climb

The climb phase begins at the thrust reduction altitude and extends to the top of climb (T/C) point. The T/C point is where the airplane reaches the cruise altitude entered on the PERF INIT page.

Cruise

The cruise phase begins at the T/C point and extends to the top of descent (T/D) point. Cruise can include step climbs and en route descents.

Descent

The descent phase begins at the T/D point or when either a level change or vertical speed descent is initiated. The descent phase extends to the beginning of the approach phase.

Approach

The approach phase begins two miles from the first waypoint of a published approach or approach transition selected from the ARRIVALS page.

Flight Complete

After landing, the flight complete phase clears the active flight plan and load data. Some preflight data fields initialize to default values in preparation for the next flight.

LNAV

LNAV provides steering commands to the next waypoint. If selected, LNAV engages when laterally within 3 nautical miles of the active route leg. If outside of 3 nautical miles of the active route leg, LNAV engages if on an intercept heading of 90 degrees or less and the intercept will occur before the active waypoint. FMC LNAV guidance normally provides great circle courses between waypoints. However, when an arrival or approach from the FMC database is entered into the active route, the FMC can supply commands to fly a constant heading, track, or follow an arc, as required by the procedure.

Waypoints

Waypoint (navigation fix) identifiers are displayed on the CDU and navigation display.

The CDU message NOT IN DATA BASE is displayed if a manually entered waypoint identifier is not stored in the database.

Navaid Waypoint Names
VHF – waypoints located at VHF navaids (VOR/DME/LOC) are identified by the official one, two, three or four character facility identifier. Example:
  - Las Angeles VORTAC – LAX.

NDB – waypoints located at NDBs are identified by use of station identifier. Example:
  - Hanau, Germany – HU.

Fix Waypoint Names
Fixes with one-word names – waypoints located at fixes with names containing five or fewer characters are identified by the name. Example:
  - ALPHA.

Unnamed Point Waypoint Names

Unnamed oceanic control area reporting points – positions in the northern hemisphere use the letters N and E, while positions in the southern hemisphere use the letters S and W. Latitude always precedes longitude. For longitude, only the last two digits of the three digit values are used.

Placement of the designator in the five character set indicates whether the first longitude digit is 0 or 1. The letter is the last character if the longitude is less than 100° and is the third character if the longitude is 100° or greater.

N is used for north latitude, west longitude. E is used for north latitude, east longitude. S is used for south latitude, east longitude. W is used for south latitude, west longitude. Examples:
  - N50° W040° becomes 5040N

- N50° E020° becomes 5020E
- S52° W075° becomes 5275W
- S50° E020° becomes 5020S.

Navigation Displays

The route is displayed on the navigation display in the map, map center, and plan modes. The display color and format represent the following status:
- an inactive route is displayed as a cyan dashed line
- an inactive but not yet executed route is displayed as a cyan dashed line
- the active route is displayed in magenta
- modifications to an active route are displayed as dashed white lines
- modified waypoints are displayed in white

Vertical Navigation (VNAV)

VNAV provides vertical profile guidance through the climb, cruise, and descent phases of flight.

Speed/Altitude Restrictions

VNAV controls the path and speed to comply with waypoints crossing restrictions. Waypoint crossing restrictions are entered on the LEGS page waypoint line by pushing the applicable key on the right side of the CDU. Barometric altitude restrictions must be below the cruise altitude to be valid. Values entered as part of a procedure and manually entered restrictions are shown in large font. FMC predicted values do not act as restrictions, and are shown in small font.

Takeoff and Climb

No diagram provided for explanation

VNAV Operation during takeoff and climb.

(1) Thrust Reduction

Climb thrust is selected by pushing the N1 switch or automatically upon reaching the thrust reduction altitude.

(2) VNAV Engagement

VNAV commands an airspeed increase to the planned climb speed profile, limited by configuration.

(3) VNAV Climb

The VNAV climb profile uses VNAV SPD at the default climb speed or pilot selected climb speed to remain within all airspeed and altitude restrictions that are part of the SID entered into the active route. Autothrottle uses selected climb thrust limit.

If the climb speed profile cannot achieve an altitude restriction, the UNABLE NEXT ALTITUDE scratchpad message is shown.

(4) Climb Restrictions

VNAV enters the VNAV PTH mode to remain within departure or waypoint restrictions. Speed maintained during this time can be:
- procedure based speed restriction
- waypoint speed restriction
- default VNAV climb speed
- manually entered climb speed

(5) Top Of Climb (T/C)

The point where the climb phase meets the cruise altitude is called the top of climb. Approach this point, the FMC changes from the climb phase to the cruise phase. The T/C is shown any time the FMC calculates a change from a climb phase to a cruise phase, such as a step climb.

Cruise

At cruise altitude, the FMC sets cruise speed at the default or pilot entered speed until reaching the top-of-descent (T/D) point.

Cruise thrust is set as required to maintain level flight at the target speed, with the autothrottle engaged.

Fuel and ETA predictions are based on a constant altitude cruise unless a step climb altitude is entered.

Descent

VNAV can perform a descent in either of two modes – path descent or speed descent. During a path descent, the FMC uses idle thrust and pitch control to maintain a vertical path. During a speed descent, the FMC uses idle thrust and pitch control to maintain a target descent speed, similar to a level change descent.

Top Of Descent (T/D)

The point where the cruise phase changes to the descent phase is the top of descent. The T/D point is shown on the map as a green open circle with the label T/D. T/D is calculated from an end of descent (E/D) point.

End Of Descent (E/D)

The FMC calculates a descent path based on airspeed restrictions, altitude restrictions and the end of descent (E/D) point. The E/D point is shown on the map as a green open circle with the label (E/D).

VNAV Descent and Approach Path

The descent path starts at the calculated top of descent (T/D) point and includes waypoint altitude restrictions. The path is based on:
- idle thrust
- speedbrakes retracted
- applicable target speed

Normally, the target speed is economy speed above the airspeed restriction altitude and 240 knots below that altitude, until deceleration for approach. VNAV will not permit descent below the airspeed restriction altitude until the airspeed is at or below the restricted value plus ten knots.

VNAV Path Descent

The path descent normally begins automatically at the calculated T/D point, provided the MCP altitude is reset for the descent. If descent is not initiated by the T/D, a path descent may not be available. At the T/D, the FMC commands idle thrust and pitch to follow the descent path. The descent complies with waypoint altitude restrictions by following the calculated vertical path.

A path descent will automatically revert to a speed descent, or VNAV will disengage, if all required parameters are not maintained during descent.

The CDU message DRAG REQUIRED is displayed if an unexpected tailwind results in a significant increase in airspeed to maintain path.

VNAV Cruise and Speed Descent Profile

No diagram provided for explanation

VNAV Operation during cruise and descent.

[1] Cruise

Before the top of descent, FMC is in cruise mode and uses VNAV PTH and ECON cruise speed.

[2] Descent

After top of descent, FMC is in descent mode and VNAV changes to economy descent speed and descends in VNAV SPD.

[3] Speed Restriction Deceleration

Before the speed restriction altitude, VNAV decelerates to commanded speed using VNAV SPD.

When at restricted speed, VNAV commands decreased pitch and descends in VNAV SPD.

[4] VNAV Path

During a speed descent, VNAV may not maintain the FMC computed VNAV path. However, if E/D shows, a VNAV path is available.

Go-Around

Below 2000 feet radio altitude, a go-around can be initiated by pushing the TO/GA switch while in a descent.

Once the go-around is initiated the thrust limit changes to go-around thrust.

Flight Management, Navigation

Flight Management Computer

Thrust Management

The autothrottle operates in response to flight crew mode control panel inputs or to automatic FMC commands. Reference thrust can be selected on the N1 LIMIT page. Automatic FMC autothrottle commands are made while VNAV is engaged.

Thrust limits are express as N1 limits. The FMC calculates a reference thrust for the following modes:
- takeoff
- derated takeoff
- climb
- reduced climb
- cruise
- continuous
- go-around.

The thrust reference mode automatically transitions for the respective phase of flight. These modes can be selected on the N1 LIMIT page. The selected thrust reference mode is displayed on the thrust mode display.

The flight crew can specify the thrust reduction height where the transition from takeoff to climb thrust takes place by making an entry on TAKEOFF REF page 2. Allowable entries are 800 feet to 15,000 feet.

Reduced Thrust Takeoff

Fixed takeoff derates can be selected on the N1 LIMIT page.

Derated Thrust Climb

Two fixed climb thrust derates can be selected on the N1 LIMIT page. CLB-1 provides a climb reduced by 3% N1. CLB-2 provides a climb limit reduced by 6% N1. The reduced climb setting gradually increases to full rated climb thrust by 15,000 feet. In cruise, the thrust reference automatically changes to CRZ. The reference can be manually selected on the N1 LIMIT page.

Fuel Monitoring

Fuel quantity values show on the PERF INIT page and on PROGRESS page. The CDU message INSUFFICIENT FUEL is displayed if predicted fuel at destination will be 2000 lb (900 kg) or less.

Flight Management, Navigation

FMC Preflight

Preflight Page Sequence

The normal preflight sequence follows paging prompts on each CDU page.

The normal FMC power-up page is the identification page. Preflight flow continues in this sequence:
- identification (IDENT) page
- position initialization (POS INIT) page
- route (RTE) page
- DEPARTURES page (no automatic prompt)
- Performance initialization (PERF INIT)
- N1 LIMIT page
- Takeoff reference (TAKEOFF REF) page.

Some of these pages are also used in flight.

Fuel

Controls and Indicators

Fuel Control Panel
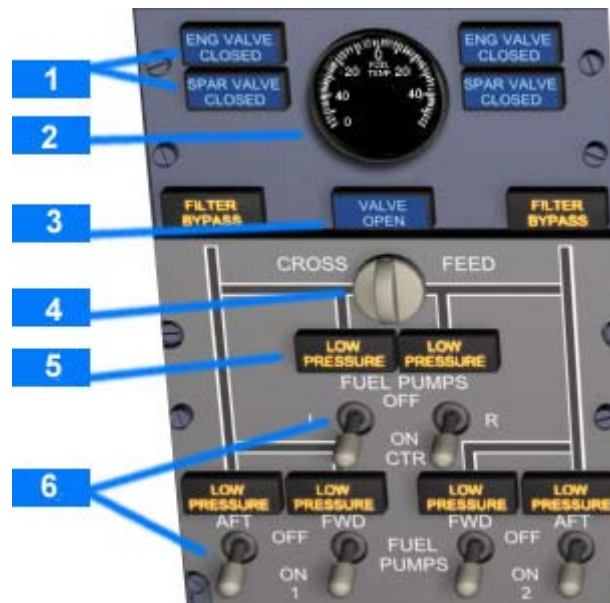
Forward Overhead Panel

(1) Engine Valve Closed (ENG VALVE CLOSED) and SPAR VALVE CLOSED Lights

Extinguished – related engine or spar fuel shutoff valve is open.

Illuminated (blue) – related engine or spar fuel shutoff valve is closed

Illuminated (bright blue) – related engine or spar fuel shutoff valve position in transit or disagrees with commanded switch position.

(2) FUEL Temperature (TEMP) Indicator

Indicates fuel temperature in No. 1 tank.

(3) Crossfeed VALVE OPEN Light

Extinguished – crossfeed valve is closed.

Illuminated (blue) – crossfeed valve is open.

Illuminated (bright blue) – valve in transit or disagrees with commanded position.

(4) 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.

(5) Center Tank FUEL PUMP LOW PRESSURE Lights

Illuminated (amber) – fuel pump output pressure is low and FUEL TEMP switch is ON.

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

(6) FUEL PUMP Switches

ON – activates fuel pump.

OFF – deactivates fuel pump.

NOTE: The 737 is not capable of crossfeeding fuel tank to tank. The airplane can feed both engines from a single tank, however. To crossfeed fuel, select Left/Right pumps ON and open cross feed valve. Turn off pumps on the side fuel should NOT be drawn from. To stop cross feeding, turn Left/Right fuel pumps ON then close crossfeed valve.

Hydraulics

Controls and Indicators

Hydraulic Panel

Forward Overhead Panel

(1) Electric Hydraulic Pump OVERHEAT Lights

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

(2) Hydraulic Pump LOW PRESSURE Lights

Illuminated (amber) – output pressure of associated pump is low.

(3) ELECTRIC HYDRAULICS PUMPS Switches

ON – provides power to associated electric motor-driven pump.

OFF – electrical power removed from pump.

(4) ENGINE HYDRAULIC PUMPS Switches

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

OFF – energizes blocking valve to block pump output.

NOTE: EDPs are generally left on to promote lubrication of pumps.

Landing Gear

Controls and Indicators

Landing Gear Panel

Center Forward Panel

(1) Landing Gear Indicator Lights (top)

Illuminated (red) – landing gear is not down and locked.

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) Landing Gear Indicator Lights (bottom)

Illuminated (green) – related gear down and locked.

Extinguished – landing gear is not down and locked.

(3) LANDING GEAR Lever

UP – landing gear retract

OFF – hydraulic pressure is removed from the landing gear system

DN – landing gear extend.

Autobrake Controls

Center Forward Panel

(1) AUTO BRAKE DISARM Light

Illuminated (amber) – manual brakes applied during RTO or landing.

Extinguished –
- AUTO BRAKE select switch set to OFF
- Autobrakes armed.

(2) AUTO BRAKE Select Switch

OFF – autobrake system deactivated

1, 2, 3, or MAX – selects desired deceleration rate for landing.

RTO – automatically applies maximum brake pressure when thrust levers are retarded to idle at or above 90 knots.