

# CHAPTER 31 - INDICATING/RECORDING SYSTEMS

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# CLOCK

The aircraft includes two mechanical clocks, with 8-day lasting and separate running. All of them located on each pilot Instruments Panel, and playing both actual and elapsed time (chronometer) functions.

## CONTROLS AND INDICATORS

### (1) Chronometer Seconds Pointer:

shows elapsed time in seconds, since chronometer button was pressed (maximum 60 seconds).

### (2) Chronometer Button:

- *Pressed once*: chronometer starts.
- *Pressed twice*: chronometer stops.
- *Twisted to the right*: chronometer hands return to zero.

### (3) Hours Hand:

shows the hours.

### (4) Chronometer Minutes Hand:

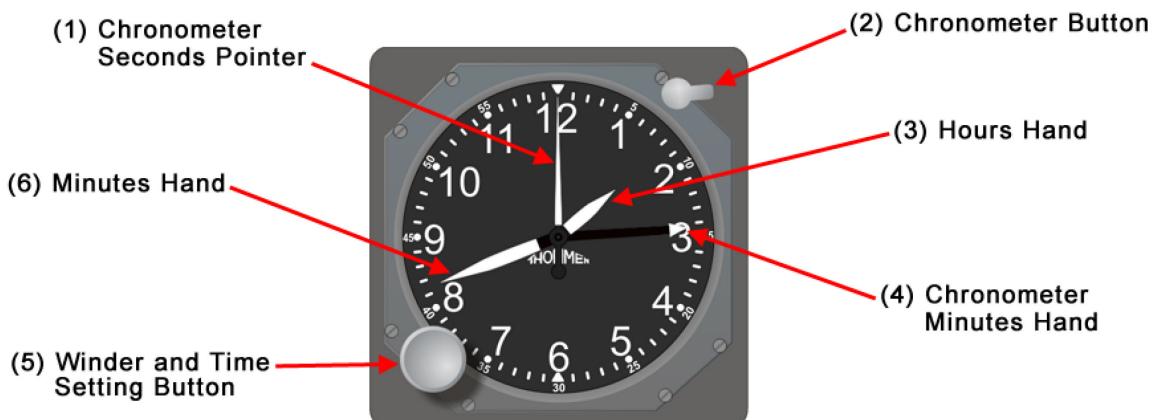
shows elapsed time in minutes, since chronometer button was pressed (maximum 60 minutes).

### (5) Winder and Time Setting Button:

- *Twisting once pushed*: winds-up the clock spring. When fully loaded, the clock spring lasts running for 8 days.
- *Twisting once pulled*: for time setting.

### (6) Minutes Hand:

shows the minutes.



C/M-1 AND C/M-2 INSTRUMENTS PANEL

Figure 31-1 Clock - Controls and Indicators

# ACCELEROMETER

It shows the maximum (positive or negative) instantaneous G-force reached during flight. It is located on the central instruments panel.

## CONTROLS AND INDICATORS

### (1) *G-Force Indicating Pointer:*

shows the instantaneous G-force.

### (2) *Highest Drawn Pointer:*

stays at the maximum positive G-force pointed since last reset.

### (3) *Reset Button:*

- *Pressed:* both drawn pointers move to get aligned with the G-force indicating pointer.

### (4) *Lowest Drawn Pointer:*

stays at the maximum negative G-force pointed since last reset.

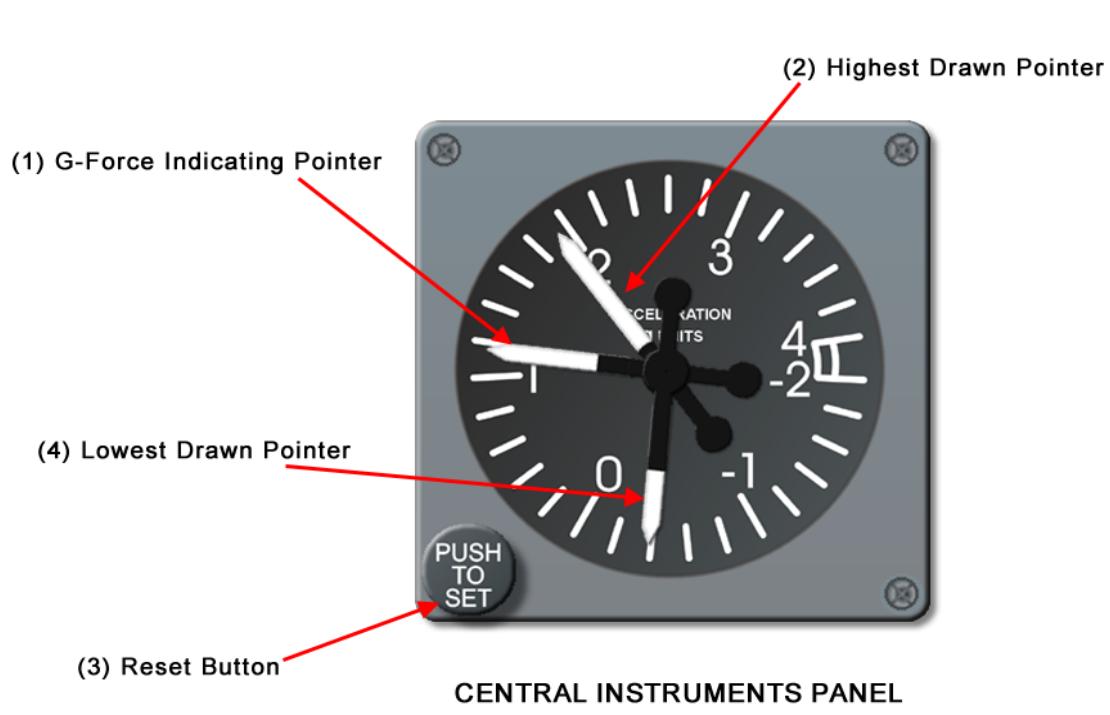


Figure 31-2 Accelerometer - Controls and Indicators

# COCKPIT VOICE RECORDER (CVR)

The Cockpit Voice Recorder (CVR) records, in a non-volatile memory, the communications, talks and aural warnings produced in the cockpit area.

## OPERATION

The CVR is always recording when it receives electricity, but only the last thirty minutes remain recorded.

The memory can be totally erased only on ground and with the parking brakes on. Successful erasure is indicated by a three seconds tone.

The CVR can check its own status by means of a test. If the test is correctly performed, the STATUS light comes on for one second and a tone is emitted, through the headphone connector, for two seconds.

## CONTROLS AND INDICATORS

### (1) *Ambient Microphone*:

detects the general communication that is being made in the cockpit.

### (2) *ERASE Button*:

- Pressed (for 0.5 seconds): erases the memory only if the necessary conditions are met.

### (3) *TEST Button*:

- Pressed (for 0.5 seconds): performs the test.

### (4) *HEADPHONE Connector*:

allows to connect a headset to hear the audio tone during test and erase procedures.

### (5) *STATUS Indicator*:

- On (during the test): the system is operative.
- On (during the operation): a failure has been detected.

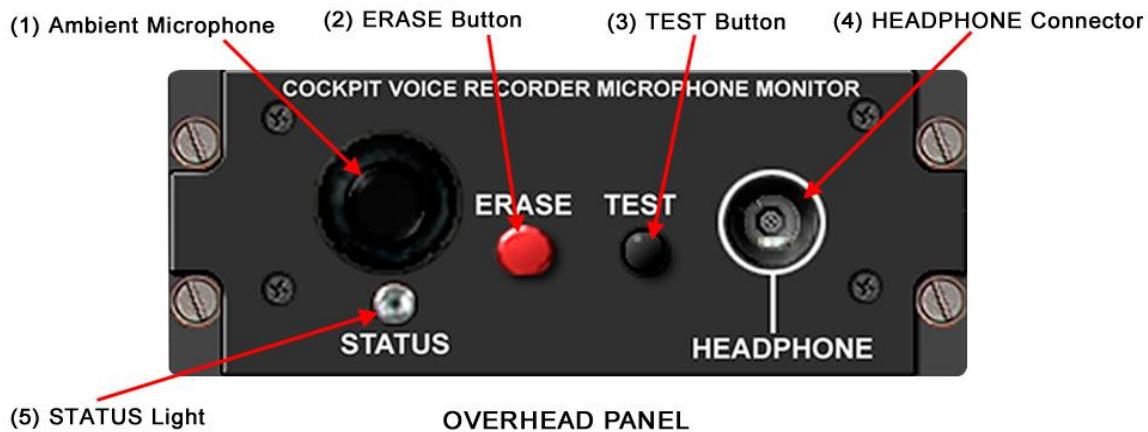


Figure 31-3 Cockpit Voice Recorder (CVR) - Controls and Indicators

# FLIGHT DATA RECORDER (FDR)

The Flight Data Recorder (FDR) receives and saves several flight data and parameters.

## DESCRIPTION

Main components of the system are:

- **Digital Flight Data Recorder (DFDR):** located in the tail area, records parameters in non-volatile memory.
- **Flight Data Acquisition Unit (FDAU):** receives, formats and sends the data to the DFDR.
- **Accelerometer:** located close to the aircraft gravity centre, it measures the acceleration component along the three axes (vertical, longitudinal and transverse).
- **Inertia Detector Switches:** when the aircraft suffers a violent shock, the switches de-energize the DFDR to stop recording.
- **FDR Control Panel:** located at the C/M-1 console, enables system management and monitoring.

The DFDR has a memory capacity for up to 25 hours, and records the following data:

- Date
- Aircraft Weight
- Events Marks Recording
- Susceptible Parameter Override Record Activation
- GMT clock
- Barometric Altitude and Radio Altimeter Reading
- Static Air Outer Temperature
- Indicated Airspeed
- Acceleration along all three axes
- Attitude and Heading
- Control Surfaces Position
- Elevator Trim Tabs Position
- Rudder and Aileron Trim Tabs Position
- Navigation Data
- Landing Gear Position
- Hydraulic System Low Pressure Condition
- MASTER Warning
- AFCS Mode and Engagement Status
- Air/Ground Micro-switches Status
- Deviation from indicated Glide Path
- Localizer Deviation
- Marker Pass-over
- V/UHF and HF Transmission Selection

- VOR/ILS 1 and 2 Frequencies
- DME Distance
- Reverse Thrust Status
- Engine Torque
- Additional Engine Parameters
- Engine Throttles Position
- Commanded Torque and Target Power
- Engine Oil Low Pressure Warning
- Engine Over-speed Warning
- Angle of Attack
- Flap Position
- Barometric Correction
- Selected Altitude
- Selected Airspeed
- Selected Vertical Speed
- Selected Course
- Selected Route
- Decision Height
- Stall Warning and Recovery System (SWRS)
- Wind Direction and Speed
- Selected Navigation System
- EFIS Format
- IEDS Format
- ADC, AHRS, FGM, FMS, IEDS, EEC and EPC Failures
- Rudder Travel Limit Control Actuator
- Rudder Booster Pneumatic Actuator Three-way and By-pass Valves
- ARTCU Warnings
- Hydraulic System Pressures
- Cabin Pressure Loss
- AC and DC Electrical Bus-bar Status
- Engine Bleed Valves Position
- Anti-Icing and De-icing Systems Selection
- EGPWS Warnings

The system also allows overriding the recording of the following Susceptible Parameters:

- Barometric Altitude and Radio Altimeter Reading
- Indicated Airspeed
- Attitude and Course
- VOR/ILS 1 and 2 Frequencies
- DME Distance
- Navigation Data: Latitude, Longitude and Ground Speed
- Selected Altitude
- Selected Airspeed
- Selected Vertical Speed
- Selected Course
- Selected Route
- Decision Height
- Selected Navigation System

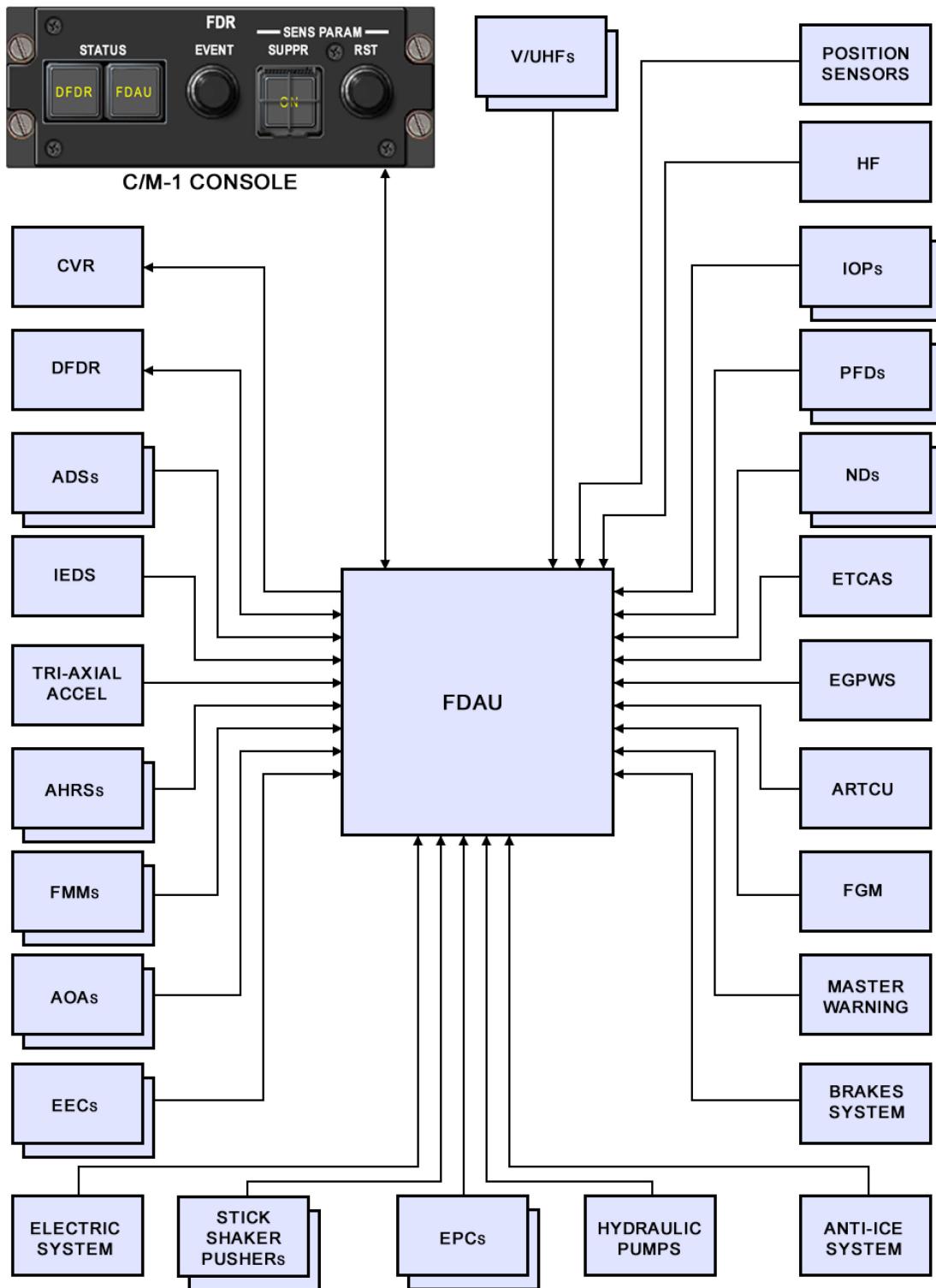


Figure 31-4 Flight Data Recorder (FDR) - Architecture

## OPERATION

The DFDR and the FDAU performs their initial tests, and upon successful completion, the data starts to be recorded in memory. Recording stops when the electricity is removed or when a crash activates the inertia detector switches.

The system allows inserting Event Marks in the memory at pilot's choice.

If necessary, the recording of susceptible parameters can be overridden. This override is cancelled when the system power is switched off, or with the RST button.

If a failure is detected, the related DFDR or FDAU light comes on. It allows entering of Event Marks, and manages certain susceptible parameters recording.

## CONTROLS AND INDICATORS

### (1) DFDR Indicator:

- *DFDR (amber) light on:* a failure has been detected in the DFDR or DFDR is not energized because acceleration limits have been exceeded.

### (2) FDAU Indicator:

- *FDAU light on:* a failure has been detected in the FDAU.

### (3) EVENT Button:

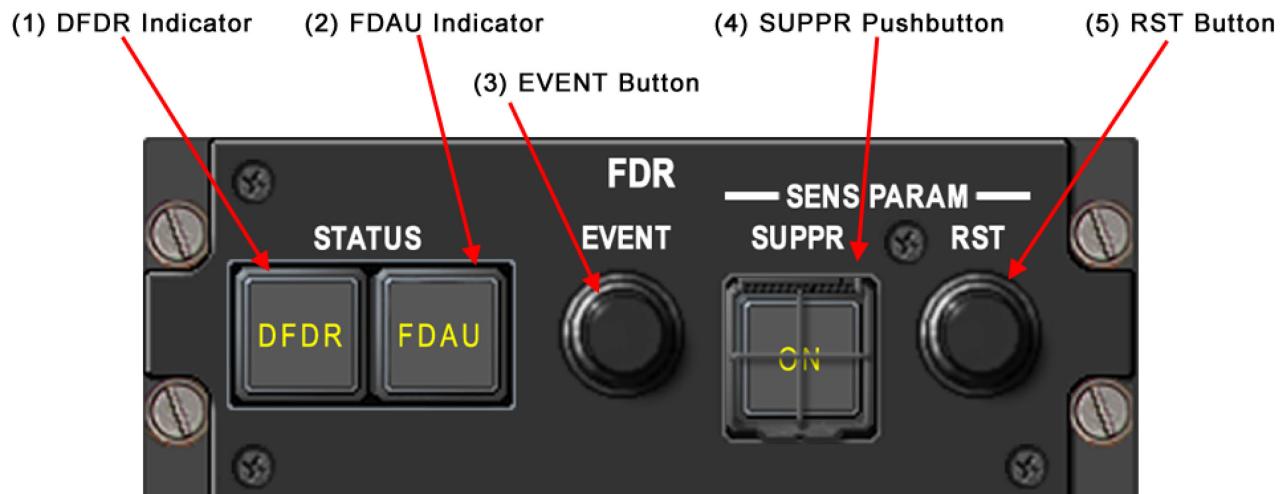
- *Pressed shortly:* a mark is memory entered, to indicate an event has occurred.

### (4) SUPPR Button:

- *ON (amber) light on:* avoids susceptible parameters recording.

### (5) RST Button:

- *Pressed shortly:* allows complete data recording (susceptible parameters start to be recorded again).



C/M-1 CONSOLE

Figure 31-5 Flight Data Recorder (FDR) - Controls and Indicators

## AVIONICS SYSTEM CORE

The Avionics System Core comprises a variety of devices that complete the avionics system calculation, display, and main reference functions. Comprising:

- **FMS (Flight Management System):** (refer to CHAPTER 34 - NAVIGATION).
- **IESI (Integrated Electronic Standby Instrument):** (refer to CHAPTER 34 - NAVIGATION).
- **EFIS (Electronic Flight Instrument System):** (refer to ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS), in this chapter).
- **FDS (Flight Deck System):** (includes the EFIS and the IESI) (refer to ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS) in this chapter, and CHAPTER 34 - NAVIGATION).
- **AFCS (Automatic Flight Control System):** (refer to CHAPTER 22 - AUTO FLIGHT).
- **PRS (Principal Reference System):** it includes Air Data System (ADS) and Attitude/Heading Reference System (AHRS) (refer to CHAPTER 34 - NAVIGATION).

# MULTIPURPOSE CONTROL AND DISPLAY SYSTEM

The Multipurpose Control and Display System is an interface between the crew and the Avionics System.

## DESCRIPTION

Main components of the system are:

- ***Multipurpose Control Display Unit (MCDU)***: two MCDU devices located on the pedestal, each unit includes one display, indicators, line selection keys and a keyboard (divided into function keys, direct access keys and alphanumeric keys).
- ***LAMP AV PNL Button***: located on the overhead panel.

The display has 14 lines and each one contains up to 24 characters:

- Line 1: the main title line.
- Lines 2 to 13: are divided into 6 pairs of lines (lines 2-3, 4-5, 6-7, 8-9, 10-11 and 12-13). The upper line of each pair is the heading line, and the bottom one is the data line. The data line is close to the Line Selection Key (LSK) which controls the actions that can be done on the line. When (as for columns) two sets of headers and data are used in the lines, these columns are identified as L (Left) and R (Right). The LSKs are also identified in the same way (this is: LSK 1L, LSK 1R, etc.)
- Line 14: the temporary memory line. It is used for keyboard entries, and messages display.

The line selection keys are in both sides of the display and allow to enter a data or access to a function identified in that field.

The keyboard includes 0 to 9 figures, A to Z characters, spacing bar, +/- key and the decimal point key. The ' / ' key is used only to separate data fields in the temporary memory, through data entry. The characters 'N', 'S', 'E' and 'W' are circled to ease the keyboard management (North, South, East and West).

## OPERATION

Once the MCDU is energized, if no internal failure is detected, the unit displays the start page, showing the self-test results and the version mark concerning the FMS program of the priority sub-system (FMM1 or FMM2 respectively for MCDU1 or MCDU2). If this priority system is not available, the main menu (MENU page) is displayed. The MENU page displays a list of all the available sub-systems in order of priority. These sub-systems can be selected using the related line selection key (LSK):

- Radio Management System (RMS): gives access to functions concerning control and monitoring of the communications, navigation and identification equipment.
- Flight Management System (FMS): carries out flight plans and performances assessment management, and allows planning for automatic tuning of navigation, communications and identification equipment (refer to CHAPTER 34 - NAVIGATION).
- Centralized Diagnostics System (CDS): provides access to those features required to detect and identify failures, manages self-tests and displays their returns, and allows Mission Data downloading for later on-ground analysis (refer to CHAPTER 45 - CENTRAL MAINTENANCE SYSTEM).

There are two different ways of accessing the Radio Management System (RMS): by pressing the RMS key (the selected IOP is the one connected to the highest priority MCDU port, IOP 1 or 2 respectively for MCDU 1 or 2) or by selecting on the MENU page the RMS function, what links to the RCOM page. Thereafter, while operating, the last selected RMS page is memorized by the IOP, and the next time the RMS is accessed this is the one displayed.

There are two different ways for accessing the Flight Management System (FMS): by pressing the FPLN, PROG, DTO, PERF or HOLD shortcut keys (the selected FMM is that one connected to the highest priority MCDU port, IOP 1 or 2 respectively for MCDU 1 or 2); or by selecting the FMS function on the MENU page.

## **CONTROLS AND INDICATORS**

### **(1) Display**

#### **(2) Indicators:**

- *FAIL (amber) light on*: a fatal failure has been detected in the MCDU.
- *MSG (amber) light on*: there is at least one unread message from the sub-systems. These messages can be a warning, caution or advice ones.
- *OFST (amber) light on*: an offset value has been inserted in the flight plan.
- *MENU (green) light on*: another system linked to the MCDU requests to be selected.
- *EXEC (green) light on*: EXEC key is available.

#### **(3) Shortcut Keys:**

- *FPLN*: access to the FPLN 1/X page.
- *PROG*: access to the PROG 1/3 page.
- *DTO*: access to the DIRECT TO page.
- *PERF*: access to the PERF page related to the flight phase.
- *MSG*: access to the MSG 1/X page.
- *DATA (pressed once)*: access to the DATA MENU page.
- *DATA (pressed twice)*: access to the DATA LIST page.
- *HOLD*: access to the HOLD page, and to the updated, stored position function.
- *RMS*: access to the Radio Management System operation mode.

#### **(4) Alphanumeric Keyboard**

#### **(5) Function Keys:**

- *MENU*: access the MCDU MENU page.
- *PREV*: displays the last (previous) display selected on screen.
- *NEXT*: displays the next available screen display (when applicable).
- *EXEC*: confirms the execution of a command.
- *CLR*: provides delete and cancel functions. If momentarily pressed, only erases the last character of the insertion line, but if pressed for more than 1 second, erases all the characters of the insertion line.

#### **(6) Line Selection Keys (LSK)**

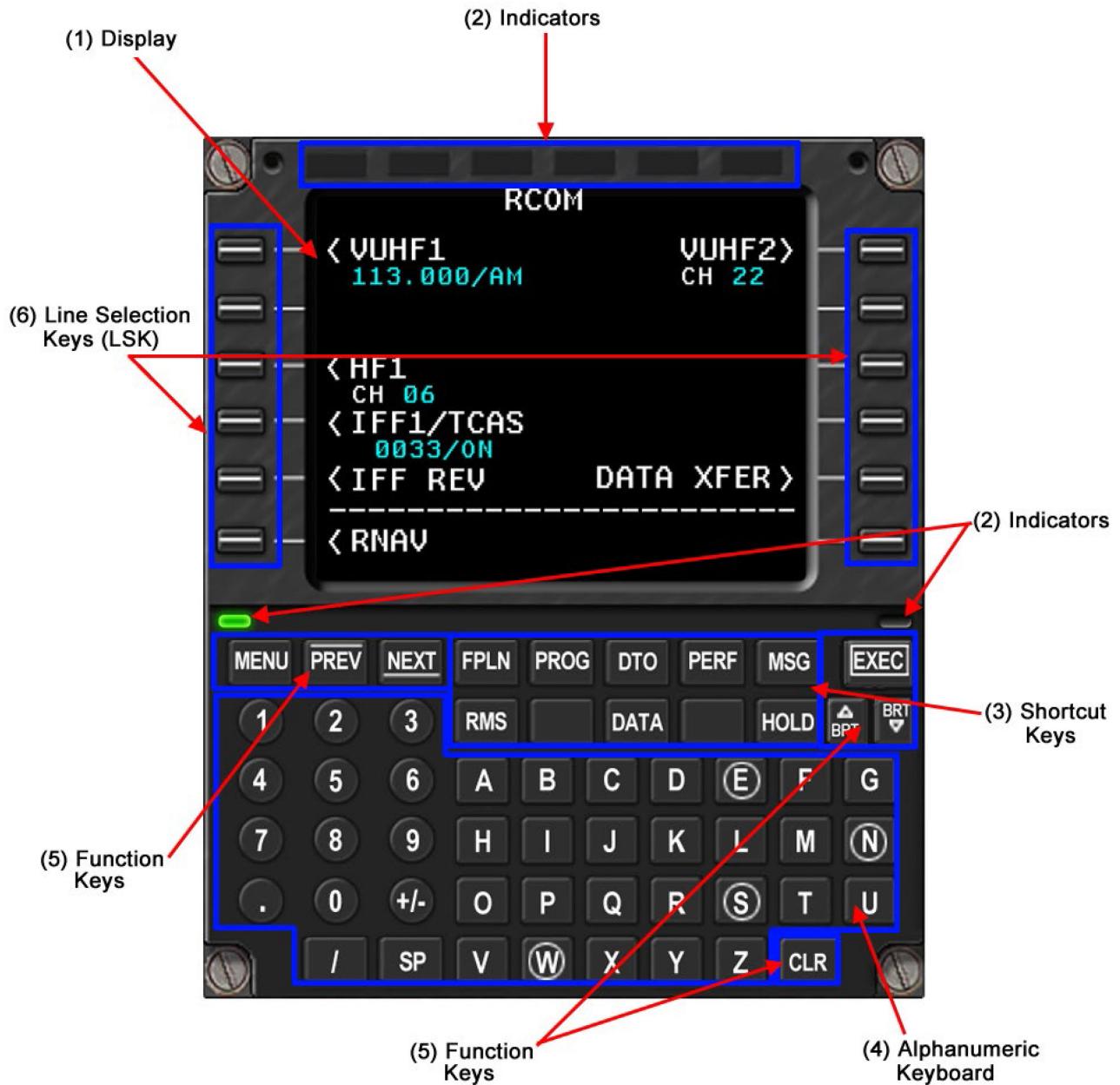
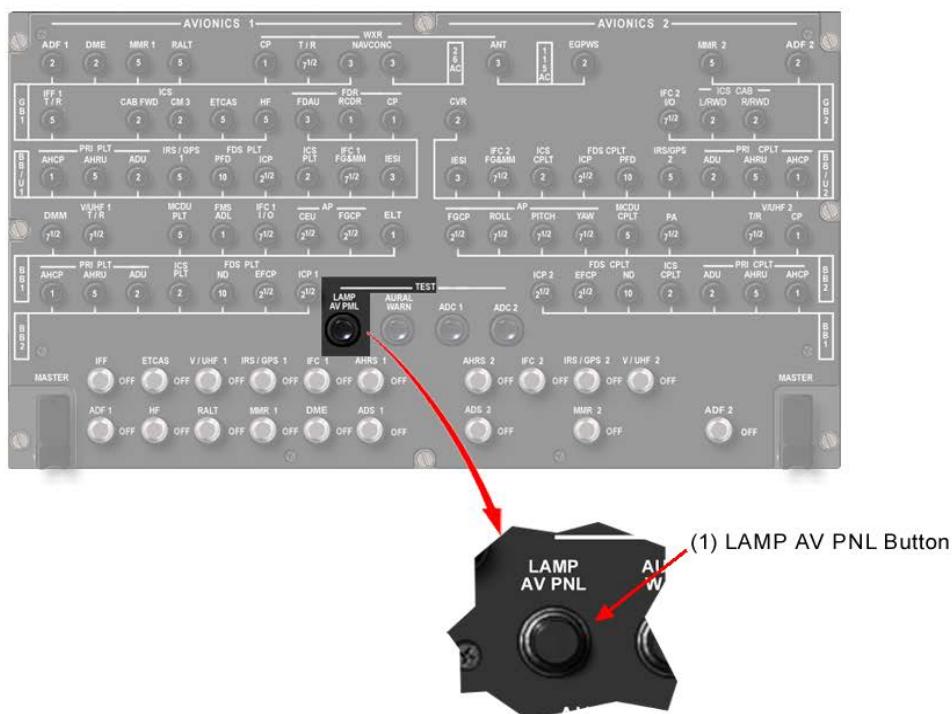


Figure 31-6 MCDU - Controls and Indicators

## OVERHEAD PANEL

### (1) LAMP AV PNL Button:

- Pressed and held: MCDU warning 1 and 2 (FAIL, MSG, POS, OFST, EXEC and MENU) lights come on. HSI SEL light in FGCP and DG, SLAVE, BASIC and ALING lights in both AHRS panels also come on.



OVERHEAD PANEL

Figure 31-7 MCDU light test - Controls and Indicators

# INTEGRATED ENGINE DISPLAY SYSTEM (IEDS)

The Integrated Engine Display System (IEDS) manages and displays information about the engine and most of the aircraft critical systems.

## DESCRIPTION

Main components of the system are:

- **IEDS Unit:** located in the instruments central panel, includes two liquid crystal displays with separate processors.
- **MASTER CAUTION and MASTER WARNING Lights:** two pairs located in the glareshield (one in front of each pilot), indicating a caution or warning message has been displayed in the IEDS (refer to IEDS CENTRALIZED WARNING SYSTEM, in this chapter).
- **Remote IEDS Control Panel:** located in the pedestal, enables system management and monitoring.
- **IEDS Battery:** energizes the IEDS integrated clock when the electricity is removed.

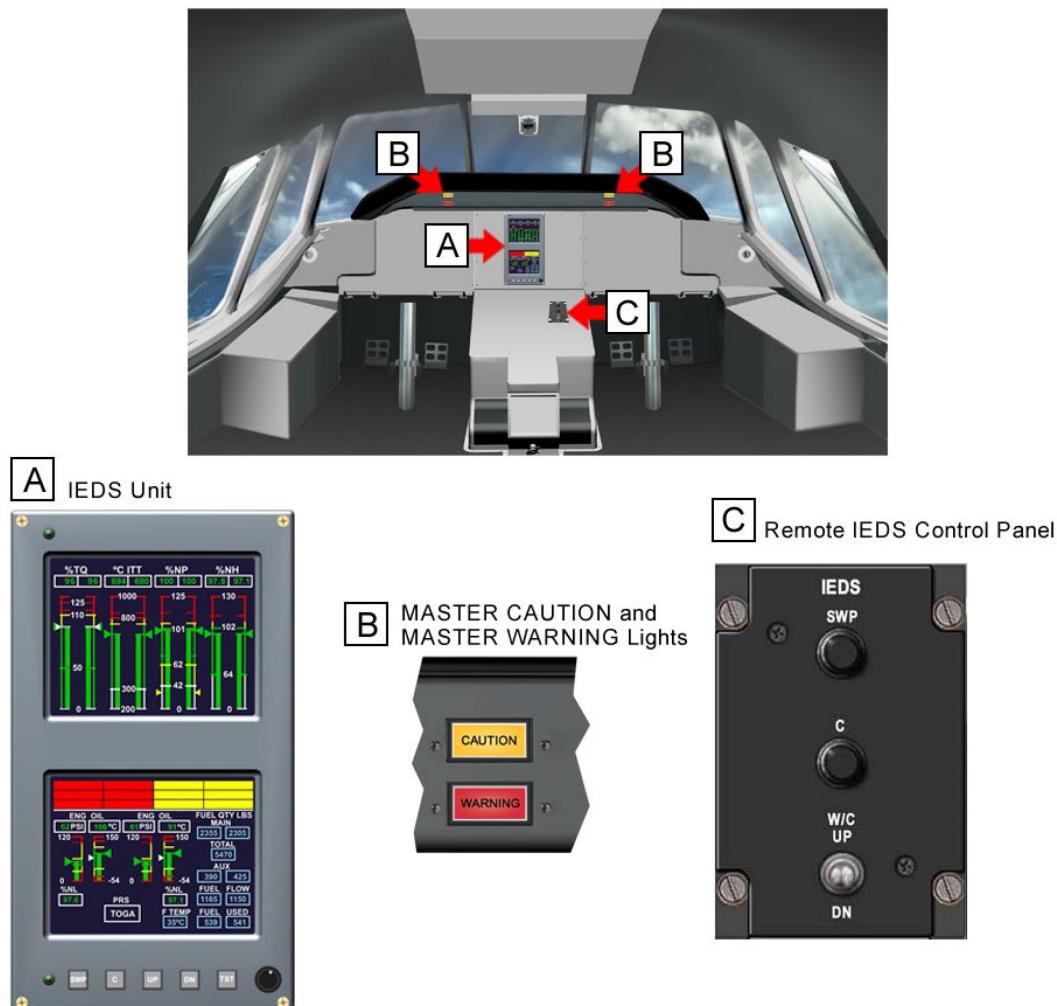


Figure 31-8 Integrated Engine Display System (IEDS) - Components

## OPERATION

The IEDS has three functions:

- IEDS Centralized Warning Systems: displays failures in the systems connected to the IEDS, turns on the related master lights and emits audio tones (refer to IEDS CENTRALIZED WARNING SYSTEM, in this chapter).
- IEDS Power Plant Indicating System: monitors engine parameters to detect if operational limits are exceeded or if there is a failure, recording it in a non-volatile memory (refer to CHAPTER 71 - POWER PLANT).
- IEDS Fuel Indicating System: displays fuel parameters (refer to CHAPTER 28 - FUEL).

During normal operation, the upper display only displays engine parameters and the lower display is divided in two screens (the upper one displays caution and warning messages, and the lower one displays engine, fuel and engine oil parameters). Nevertheless, the displays can be swapped or both displays can display the same combined mode.

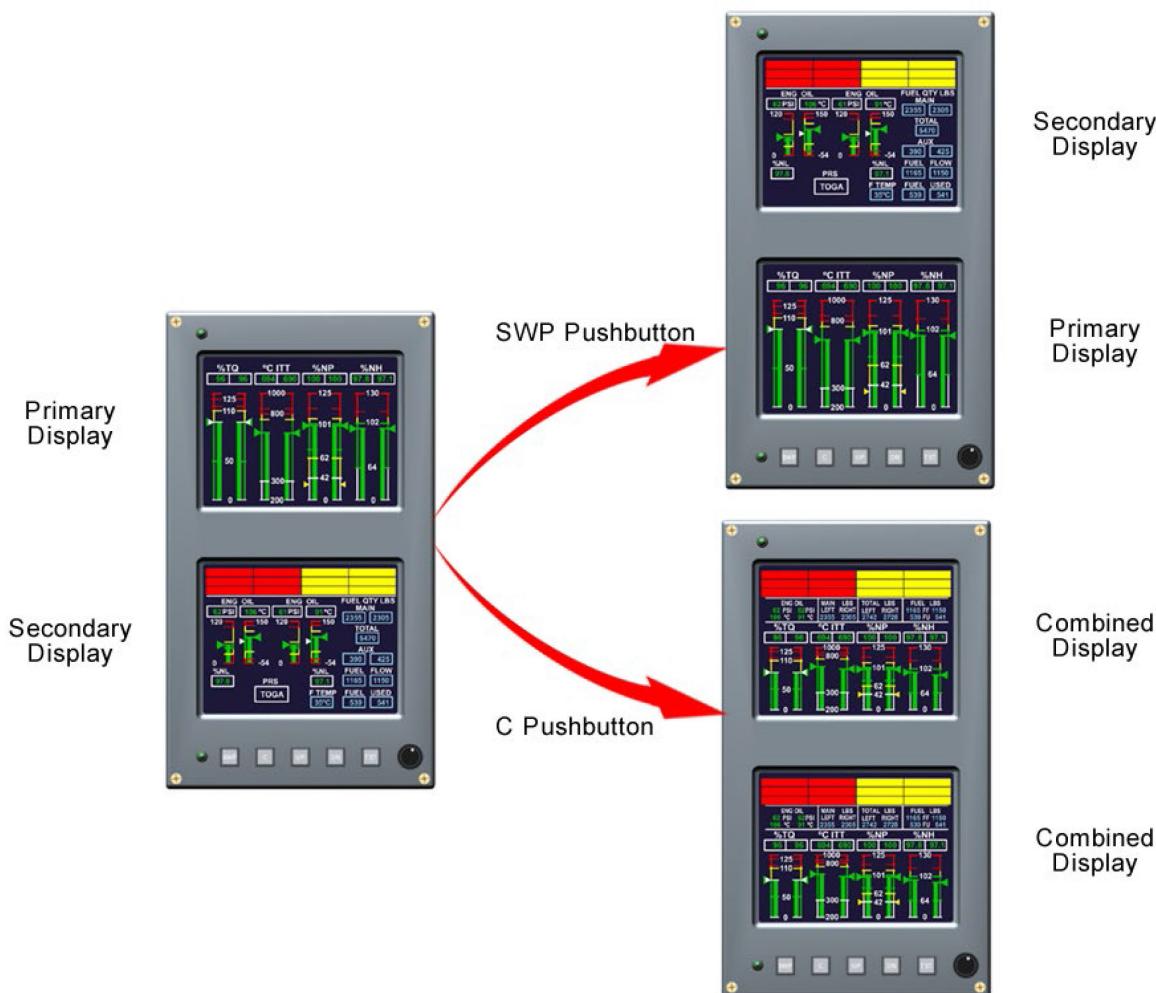


Figure 31-9 Integrated Engine Display System (IEDS)

The system checks its own status with three tests:

- Power Up Built In Test (PBIT): it is automatically performed when the system is turned on.
- Continuous Built In Test (CBIT): performs a continuous status monitoring to ensure data integrity and process completion.
- Initiated Built In Test (IBIT): it is started by the crew members, and:
  - The test page is simultaneously displayed in both displays.
  - The LYRE BIRD, CRICKET, HORN, FIRE BELL and MASTER audio tones are emitted.
  - MASTER CAUTION and MASTER WARNING lights come on.
  - Test results are displayed in the IEDS.

## CONTROLS AND INDICATORS

### (1) **Photoelectric Sensors:**

adapts display brightness according to cockpit conditions.

### (2) **Brightness Control:**

controls the display brightness.

### (3) **TST Pushbutton:**

- *Pressed*: the IBIT is performed.

### (4) **DN Pushbutton:**

(refer to IEDS CENTRALIZED WARNING SYSTEM, in this chapter)

### (5) **UP Pushbutton:**

(refer to IEDS CENTRALIZED WARNING SYSTEM, in this chapter)

### (6) **C Pushbutton:**

- *Pressed*: combined display mode is selected in both displays.

### (7) **SWP Pushbutton:**

- *Pressed*: both displays are swapped.

### (8) **SWP Button:**

- *Pressed*: both displays are swapped.

### (9) **C Button:**

- *Pressed*: combined display mode is selected in both displays.

### (10) **W/C Switch:**

(refer to IEDS CENTRALIZED WARNING SYSTEM, in this chapter)

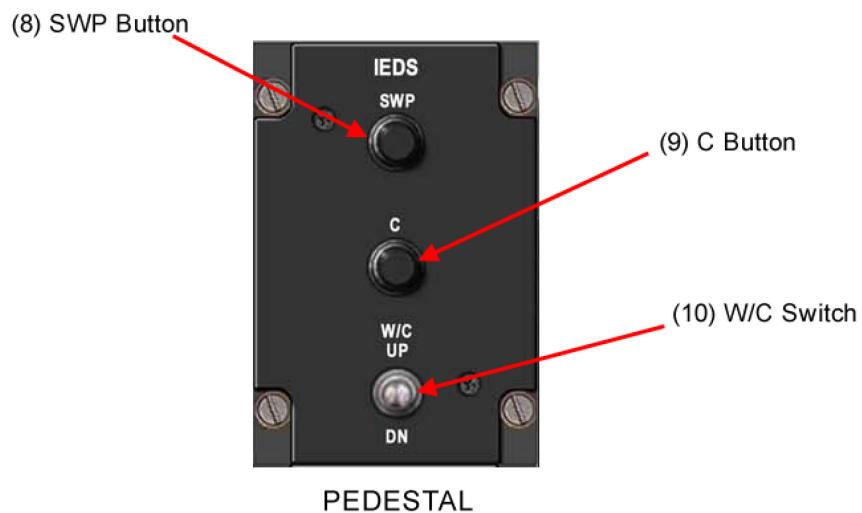
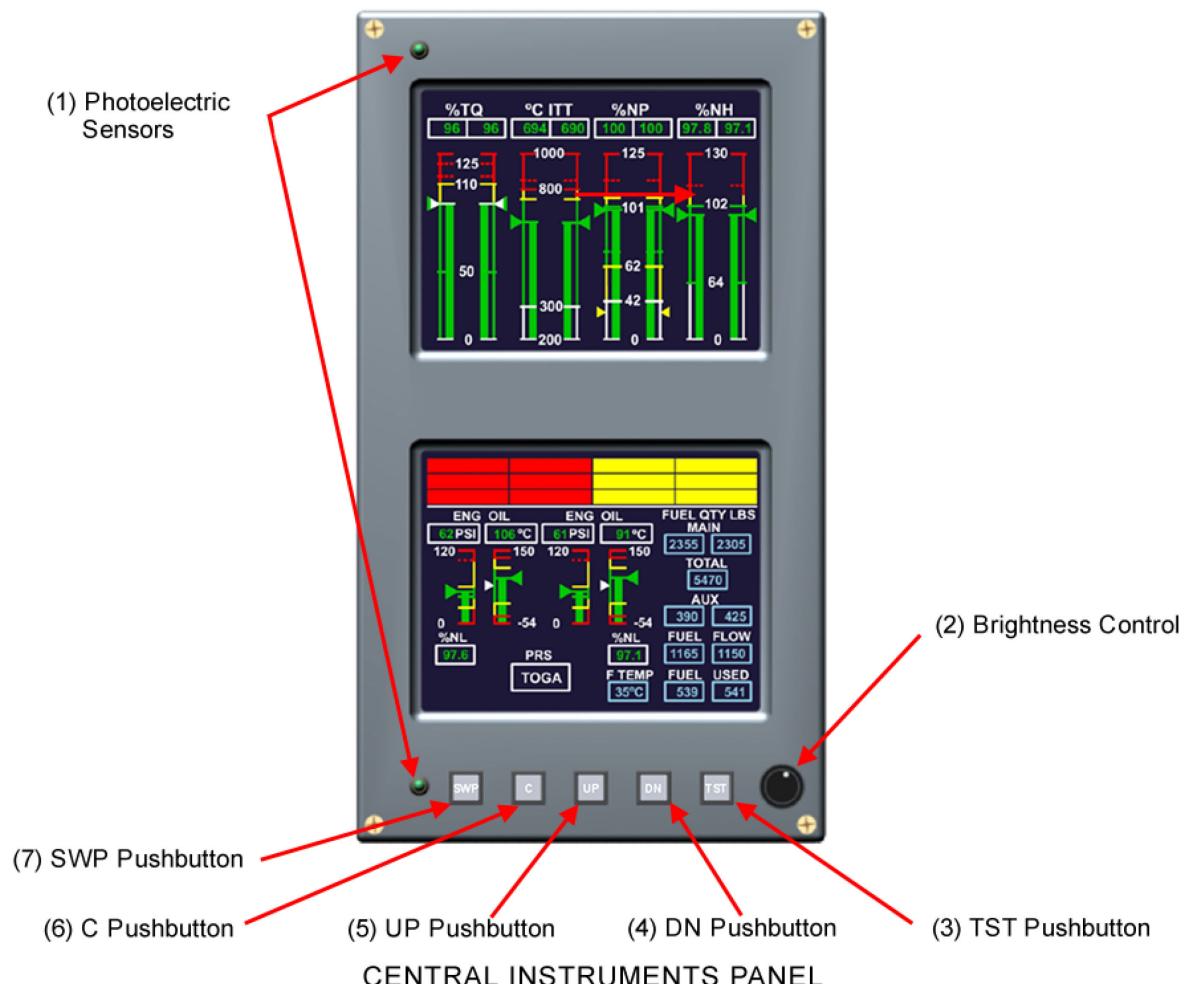


Figure 31-10 Integrated Engine Display System (IEDS) - Controls and Indicators

# IEDS CENTRALIZED WARNING SYSTEM

The IEDS acts as a Centralized Warnings System and displays malfunction or failure messages from most of the aircraft critical systems. It also informs the crew members if the aircraft configuration is unsafe for takeoff.

## DESCRIPTION

The main components of the system are:

- ***Caution and Warning Messages:*** amber (for caution) or red (for warning) enlightened boxes, displayed in the IEDS.
- ***MASTER CAUTION and MASTER WARNING Lights:*** two pairs located in the glareshield (one in front of each C/M), indicating a caution or warning message has been displayed in the IEDS.

Warning Messages	Caution Messages
1 E/OIL P	1 FUEL P
2 E/OIL P	2 FUEL P
1 E/FIRE	1 FUEL C
2 E/FIRE	2 FUEL C
1 NL OVSP	1 FUEL LOW
2 NL OVSP	2 FUEL LOW
AUTFTR	1 EEC
PROP BRK	2 EEC
GEAR UP	1 EPC
UNSAFE TO	2 EPC
OVERSPEED	1 FIRE DET
WING OVHT	2 FIRE DET
CARGO SMK	1 HYD P
LAV SMK	2 HYD P
FLAP ASYM	3 HYD P
DOOR UNLK	HYD HOT
CABIN	A-SKD DGD
BAT HOT	A-SKD FLD
1 GEN HOT	FLAP FAIL
2 GEN HOT	RUD HT
BUS UNTIE	RTCS AUTO
1 DC GEN	RUD TRIM
2 DC GEN	
	RTCS EXP
	ELEV TRIM
	1 SWRS
	2 SWRS
	1 PITOT
	2 PITOT
	AUX PITOT
	ICE FORM
	WSHLD
	W&T D-ICE
	W&T DEGRD
	1P/D-ICE
	2P/D-ICE
	1E/D-ICE
	2E/D-ICE
	1 INV
	STBY INV
	1 AC GEN
	2 AC GEN
	EMER LTS
	IEDS
	RTCS MAN

Figure 31-11 IEDS Centralized Warning System - Components

## OPERATION

When one of the systems connected to the IEDS detects a failure, an input signal is sent to the IEDS. Then, the IEDS displays the related caution or warning message in the upper screen of the lower display, turns on the related MASTER CAUTION or MASTER WARNING lights and, in the case of a warning message, emits an audio tone through the cockpit loudspeakers.

Additionally to inform about failures in systems, the IEDS detects if the aircraft configuration is unsafe for takeoff and informs the crew members about this situation (refer to UNSAFE TAKEOFF CONFIGURATION (UNSAFE TO) WARNING, in this chapter).

There IEDS can produce five audio tones, and their IEDS associated messages are:

- MASTER: associated to a warning message.
- FIRE BELL: associated to 1 E/FIRE and 2 E/FIRE warnings.
- CRICKET: associated to an OVERSPEED warning.
- HORN: associated to a GEAR UP warning.
- LYRE: associated to an UNSAFE TO warning.

In the Secondary Display and Combined Display, the messages are displayed in the three upper lines of the display. These three lines are arranged in four columns (columns 1, 2, 3 and 4, named from left to right).

If a warning message is displayed in the IEDS, the related MASTER WARNING lights come on and the audio tone MASTER is emitted, together with any other specific audio tone it may have associated. Warning messages and MASTER WARNING lights will remain flashing until one of the pilots presses one of the MASTER WARNING flashing lights; at that moment both MASTER WARNING lights will go off, and warning message will stop flashing in the IEDS. Thus, the system is reset again to detect any new alert. The same applies to caution messages and MASTER CAUTION lights (but with no associated audio tone).

IEDS messages remain on until the not-operative system is repaired or the failure goes off. If so, the associated messages list moves one line up (until filling the column) and one position to the left.

If there are less than six warning message, columns 1 and 2 will be assigned to display warning messages, and columns 3 and 4 to display caution messages. Messages are placed by input order, at the top of column 1 (warning) or column 3 (caution messages); so most recent messages move the older messages one line down (until filling the column) and to the right. At this point, if more than six caution messages are present, a scroll arrow is displayed in the third row of column 4, indicating that some caution messages are hidden.

If there are more than six warning messages, column 3 begins to be used to display warning messages and caution messages are displayed only in column 4. Messages are placed by input order, at the top of column 1 (warnings) or column 4 (caution messages); so most recent messages move the older messages one line down (until filling the column) and to the right. At this point, if more than three caution messages are present, a scroll arrow is displayed in the third row of column 4, indicating that some caution messages are hidden.

If there are hidden messages in the IEDS, it is possible to go one row up or down among the list by means of the IEDS controls. When the screen is at the top of the caution messages list, there is only one scroll arrow pointing down; when the screen is at a mid-position in the list, there are two arrows (one pointing up, and the other down); and when the screen is at the bottom of the list, there is only one arrow pointing up.

If more than nine warning messages are received, the oldest messages will go off.

When received caution messages exceed the number of available lines to display them (normally 5, but 2 when only the column 4 is available), most recent caution messages will be displayed, and the oldest ones will be hidden at the bottom of the screen. When this happens, the scroll arrow shown in the third row of column 4, will flash. If the messages list is scrolled down and a new caution message is received, the list will automatically scroll up the list to display the new caution message.

If the IEDS detects an internal failure, the caution message "IEDS" is displayed.

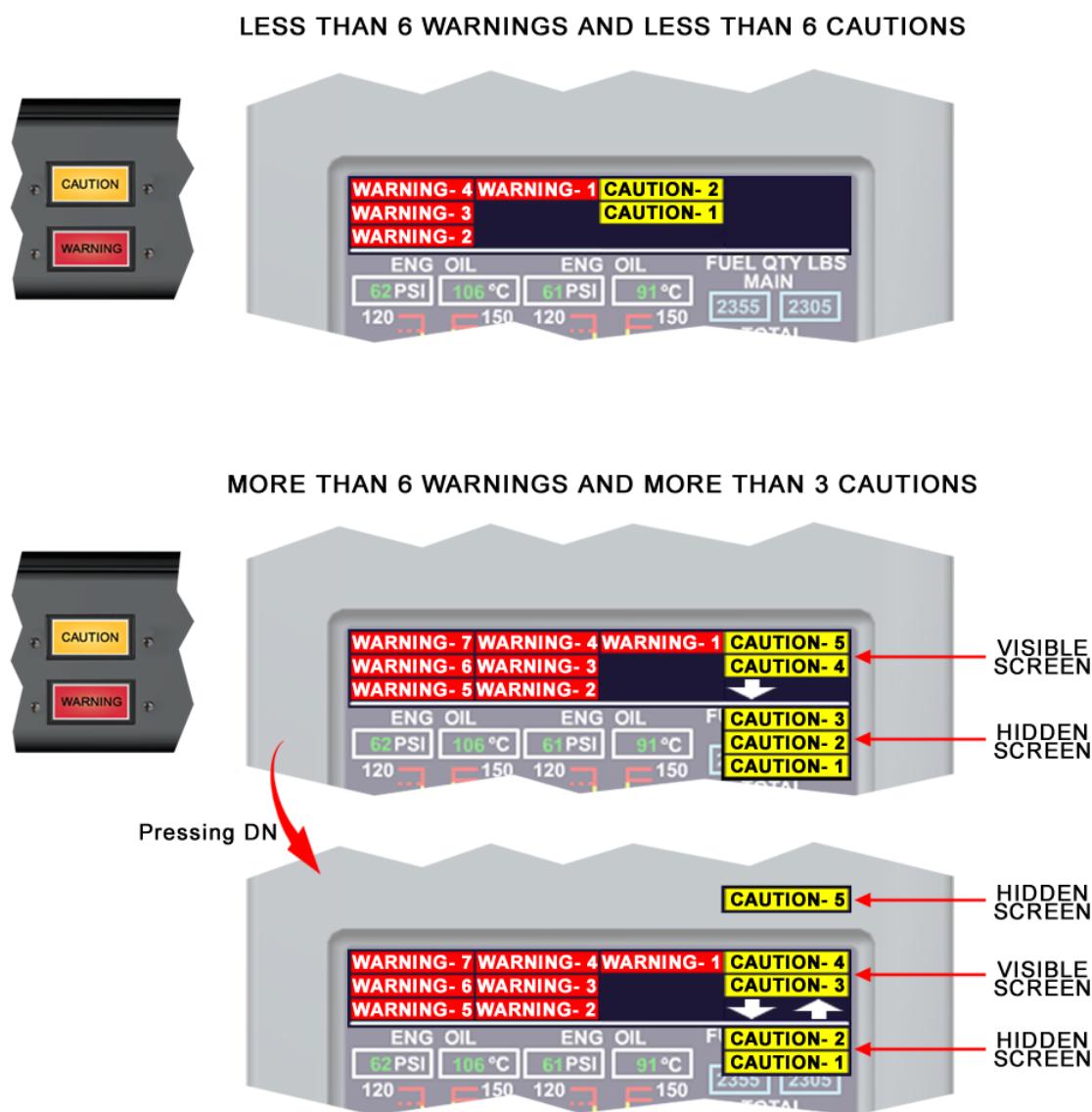


Figure 31-12 IEDS Centralized Warning System

## CONTROLS AND INDICATORS

### (1) **MASTER CAUTION Lights:**

- *Flashing*: a caution message has been received.

### (2) **MASTER WARNING Lights:**

- *Flashing*: a warning message has been received.

### (3) **Caution and Warning Messages Screen:**

displays the caution and warning messages, with a legend to identify the failed system.

### (4) **DN Pushbutton:**

- *Pressed*: caution messages list scrolls one step down.
- *Pressed (and held)*: caution messages list scrolls down continuously, until the button is released or the end of the list is reached.

### (5) **UP Pushbutton:**

- *Pressed*: caution messages list scrolls one step up.
- *Pressed (and held)*: caution messages list scrolls up continuously, until the button is released or the top of the list is reached.

### (6) **W/C switch:**

- *UP*: caution messages list scrolls one step up.
- *DN*: caution messages list scrolls one step down.

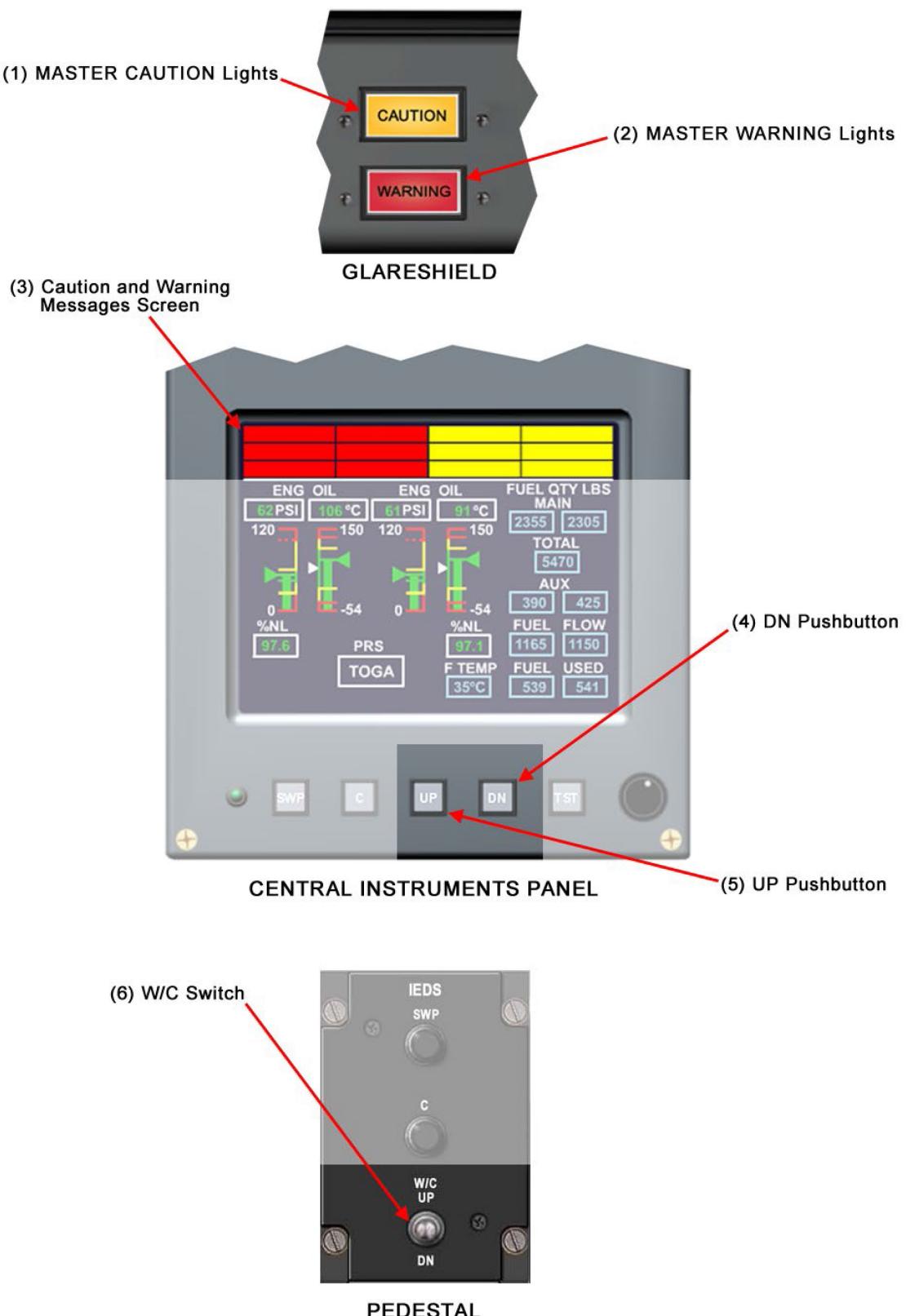


Figure 31-13 IEDS Centralized Warning System - Controls and Indicators

# UNSAFE TAKEOFF CONFIGURATION (UNSAFE TO) WARNING

The Unsafe Takeoff (UNSAFE TO) Warning informs the crew members that the aircraft configuration is unsafe for takeoff.

## DESCRIPTION

The IEDS receives signals from the following systems:

- **Weight-On-Wheels (nose landing gear) Microswitches**
- **Power Levers Microswitches**
- **Flap Electronic Control Unit (FECU)**
- **Auto trim and Rudder Travel Limit Control Unit (ARTCU)**
- **Automatic Feathering Control Unit (AFU)**
- **Parking Brake Microswitch**
- **Rudder Trim Control Panel:** located on the pedestal, it has a MUTE WARN LDG GR TAKE OFF pushbutton allowing to override the LYRE acoustic warning.

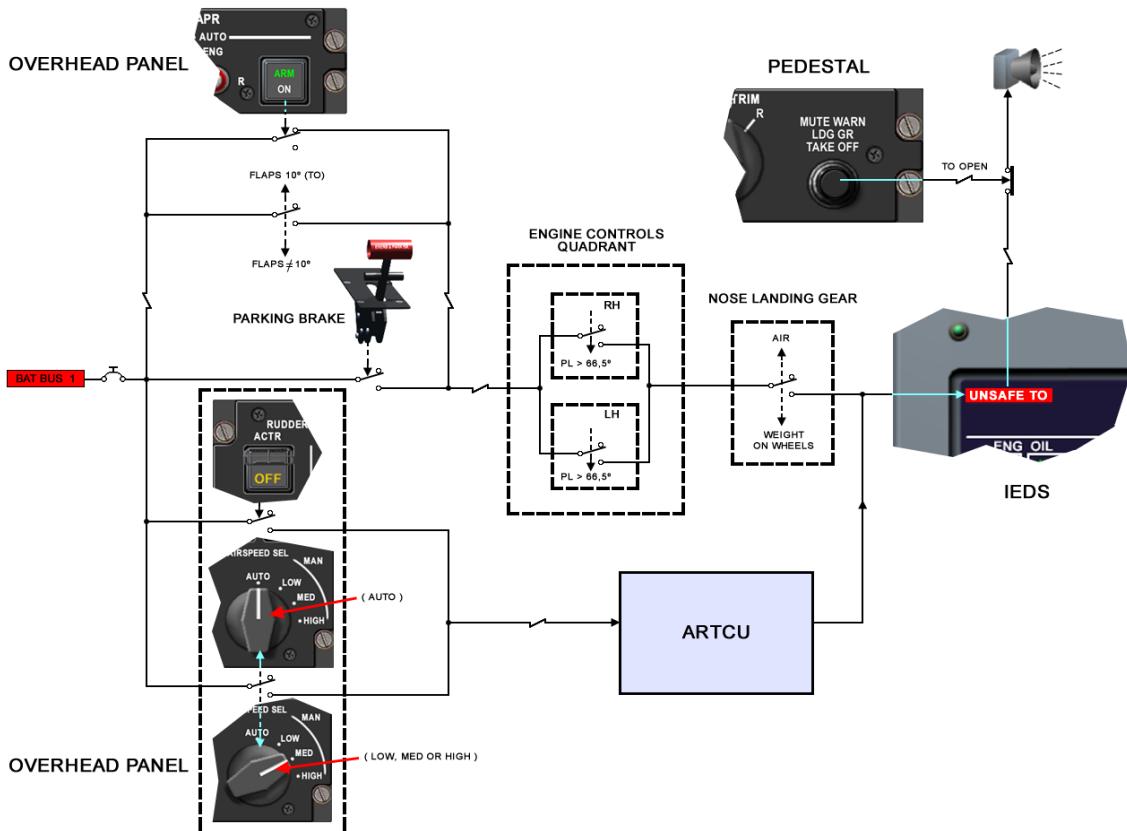


Figure 31-14 Unsafe Takeoff Configuration (UNSAFE TO) Warning - Architecture

## OPERATION

When there is weight-on-wheels signal, from the nose wheel, and one of the PLs is at an angle above 66.5°, the IEDS will turn on the UNSAFE TO warning if one of the following conditions happens:

- Flaps are not in 10° position (TO).
- Elevator trim-tab indicator pointer is not in the green band.
- Rudder Booster is OFF or STBY.
- The ON light in the AUTO ARM/ON pushbutton is off.
- AIRSPEED SEL selector is not in AUTO position.
- Parking Brake is on.

When the UNSAFE TO is turned on, the MASTER and LYRE audio tones are emitted. LYRE acoustic warning can be muted by pressing the MUTE WARN LDG GR TAKE OFF pushbutton on the control unit.

## CONTROLS AND INDICATORS

### (1) MUTE WARN LDG GR TAKE OFF Pushbutton:

- *Pressed:* the LYRE audio tone is muted.



Figure 31-15 Unsafe Takeoff Configuration (UNSAFE TO) Warning - Controls and Indicators

# SYSTEMS WARNINGS

## DESCRIPTION

In addition to the IEDS displayed messages, some aircraft systems have warning lights in their panels to inform about failures, deviations, and systems working under limited operation or special conditions.

Each signal is explained in the related system description as follows:

- CHAPTER 21 - ENVIRONMENTAL CONTROL:
  - AIR CONDITIONING Control Panel: O.TEMP Indicator
  - Pressurization System Control Panel: FAULT Indicator
- CHAPTER 22 - AUTO FLIGHT:
  - AP DSENG Indicator
- CHAPTER 24 - ELECTRICAL POWER:
  - AC INVERTERS Control Panel: FAIL Indicator in the MAIN Pushbutton
- CHAPTER 26 - FIRE PROTECTION:
  - FIRE Control Panel: FIRE light in Fire Handles, and READY and EMPTY Indicators.
  - SYSTEM TEST Control Panel: CARGO SMK DET and TOILET SMK DET Indicators.
  - ENGINE Control Quadrant: FIRE light below the Fuel and Feathering Levers
- CHAPTER 27 - FLIGHT CONTROLS:
  - FLT CONT DISC Control Panel: FWD and REAR indicators
  - FLIGHT CONTROL Panel: STBY light in the ACTR button, and MAINT and MAN indicators
  - SWRS Control Panels: PSHR OFF indicator, and ON light in the SHIFT button
  - SYSTEM TEST Control Panel: SWRS MAINT #1 and #2 indicators
  - FLAPS Control Panel: FLAPS SEQ and VFE indicators
- CHAPTER 28 - FUEL:
  - REFUEL-DEFUEL Control Panel (at RH Landing Gear fairing): OVERFILL Indicator
- CHAPTER 29 - HYDRAULIC POWER:
  - HYDRAULIC SYS Control Panel: O.TEMP indicator
- CHAPTER 30 - ICE AND RAIN PROTECTION:
  - ICE PROTECTION Control Panel: FAIL Indicator in the L, R PROPELLER Pushbuttons, FAIL Indicator in the L, R AIR INLET Pushbuttons, and FAIL Indicator in the L, R WINDSHIELD Pushbuttons.
- CHAPTER 31 - INDICATING AND RECORDING:
  - COCKPIT VOICE RECORDER MICROPHONE MONITOR Control Panel: STATUS Light
  - FDR Control Panel: DFDR and FDAU Indicators
- CHAPTER 32 - LANDING GEAR:
  - BRAKE TEMP Control Panel: OVHT Indicator

- CHAPTER 36 - PNEUMATIC:
  - AIR CONDITIONING Control Panel: BLEED O.TEMP and PCKG BLEED Indicators
- CHAPTER 52 - DOORS:
  - EXT DOORS Control Panel: EXT. DOORS annunciators
  - HYDR UTILITY Control Panel: OPEN and UNLKD Indicators
  - ATTENDANT CONTROL Panel (at Cargo Cabin rear area): CYL, SW, CARGO DOOR OPEN/UNLKD, and RAMP OPEN/UNLKD Indicators
- CHAPTER 71 - POWER PLANT:
  - Glare shield: BETA MODE and BETA UNLKD Indicators
  - POWERPLANT MAINTENANCE Control Panel: L, R PROP FAIL, L, R PROP MAINT, and L, R ENG MAINT Indicators
  - HYDR UTILITY Control Panel: PROPELLER BRAKE UNLKD/BRK and RDY Indicators

# ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The Electronic Flight Instrument System (EFIS) displays data information for flight/navigation purposes.

## DESCRIPTION

EFIS displays data as required by the pilots by means of four screens: two for each pilot. Attitude data are displayed on the Primary Flight Screen, and navigation data on the Navigation Screen. Control of the system operation modes is made through the Index and EFIS control panels.

Main components of the system are:

- **Primary Flight Displays (PFD):** located at C/M-1 and C/M-2 instruments panels, display primary flight data and the automatic flight control system status.
- **Navigation Display (ND):** located at C/M-1 and C/M-2 instruments panels, display FMS/ETCAS and WXR data. It also displays navigation and communications information, as well as air data.
- **Electronic Flight Control Panel (EFCP):** located at C/M-1 and C/M-2 instruments panels, enables system management and monitoring.
- **Index Control Panel (ICP):** located at C/M-1 and C/M-2 instruments panels, enables system management and monitoring.
- **Integrated Electronic Standby Instrument (IESI):** located at the instrument central panel (refer to INTEGRATED ELECTRONIC STANDBY INSTRUMENT (IESI), in CHAPTER 34).

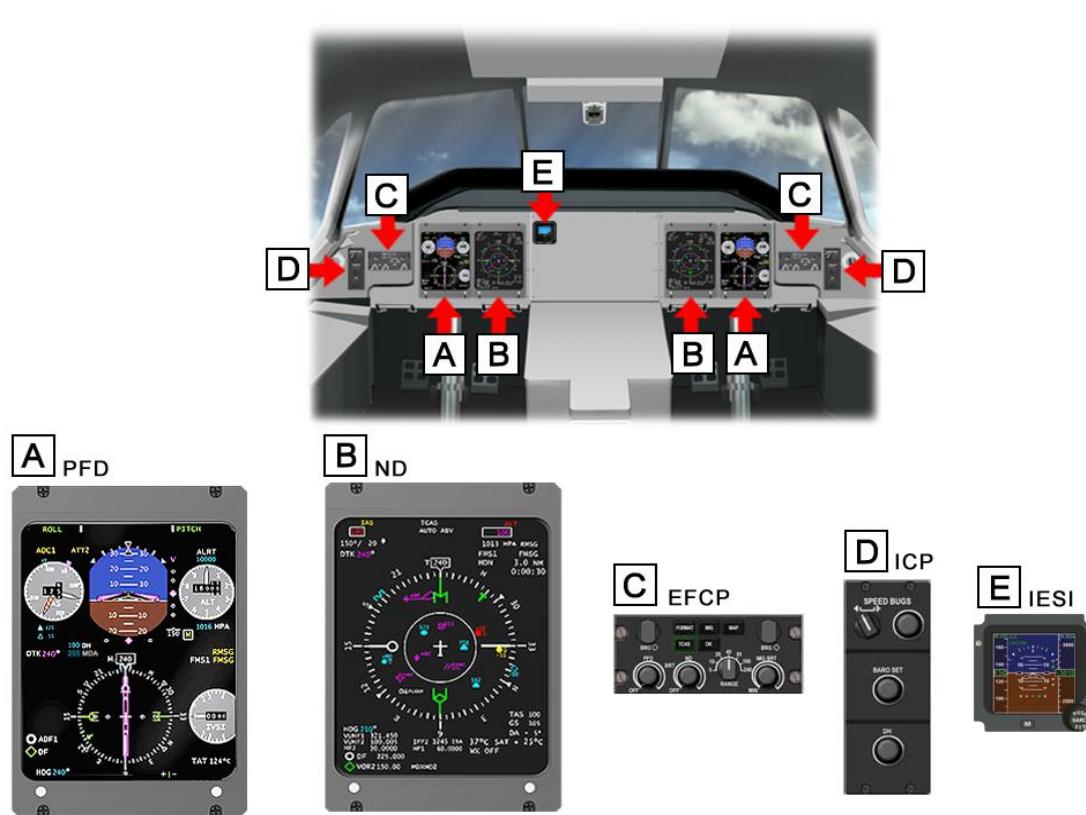


Figure 31-16 Electronic Flight Instrument System (EFIS) - Components

## OPERATION

Once the system is energized, and both PFD and ND displays are turned on, the system performs a built in test, being ready to operate after its completion.

If the temperature in one of the displays is greater than 55°C, the DU HOT message is displayed in white colour in the lower right corner of the display. If the temperature increases over 70°C, the DU HOT message is displayed in amber.

In case of ICP fail, the operator will lose the air data information on the side primary flight display.

## PRIMARY FLIGHT DISPLAY (PFD) DESCRIPTION

The PFD is divided in:

- Airspeed Area: displays IAS, reference speeds, maximum operating speed, FMS target speed and failures in the air data computers.
- Altitude Area: displays barometric altitude in feet, reference pressure values and AP/FD altitude selection.
- Vertical Speed Area: displays vertical speed and TCAS several resolution bands.
- Electronic Attitude Direction Indication (EADI): displays aircraft attitude and FD commands, skid and slip indications, lateral deviations associated to the selected navigation system, vertical divergence with preset altitude, glide slope (ILS) and vertical path (FMS). It also gives additional information on, radio altitude, radio beacons and decision height.
- Electronic Horizontal Situation Indicator (EHSI): displays actual heading, course and route, lateral deviations associated to VOR/ILS or FMS, selected azimuth and VOR, FMS and ADF station course to. It also displays navigation sources, DME and FMS distances, VOR/ILS frequency, FMS “way-points” identifier, DME HOLD mode indication, “back course” indication, TAT, DG, “slaving” error, and RMS, FMS and VNAV warning messages.

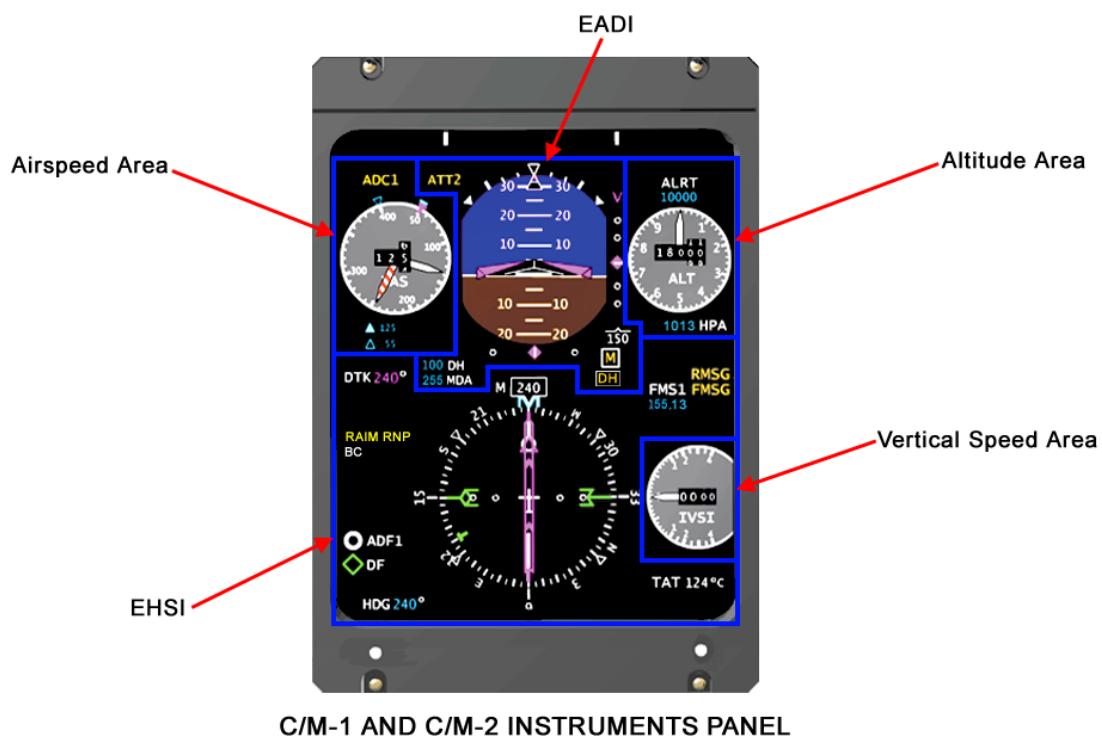


Figure 31-17 Primary Flight Display (PFD) - Components

## PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS

### AIRSPEED AREA

#### (1) *Indicated Airspeed Window:*

displays, in knots, the indicated airspeed from air data computer (ADC). If on ground or at speeds below 20 kt., it displays 20 kt. Reading color varies depending on pointer movement. Digital reading prevails upon the airspeed pointer. In case of a non-valid measure, no number is displayed.

#### (2) *Air Data Sources Status:*

- *ADC1 (amber)*: both PFDs display data from ADC1.
- *ADC2 (amber)*: both PFDs display data from ADC2.

#### (3) *FMS Target Airspeed Bug:*

indicates the IAS target, calculated by the FMS.

#### (4) *Indicated Airspeed Pointer:*

indicates the airspeed between 20 and 400 kt. It is not visible for non-valid IAS values.

- *In white*: IAS < VMO - 2 kt.
- *In amber*: VMO - 2 kt < IAS < VMO + 3 kt (returns to white below VMO - 4 kt)
- *In red*: IAS > VMO + 3 kt (returns to amber below VMO +1 kt)

#### (5) *Speed Bugs:*

not displayed for any speed below 50 kt., non-valid value or non-valid IAS.

#### (6) *Maximum Operating Speed Pointer:*

indicates maximum operating speed, calculated by the FMS. Not visible for non-valid VMO readings.

#### (7) *Airspeed Reference Indicators:*

displays, in knots, the value of the speed bugs. Not displayed for readings below 50 kt. In case of a non-valid measure, three dashes are displayed.

#### (8) *IAS Status Indicator:*

- *White*: the system is working properly.
- *Amber (flashing for five seconds, then steady)*: there is a mismatch between both ADC for IAS data (threshold: 10 kt), or there is an IAS failure monitoring.

#### (9) *SPEED BUGS Selector:*

- *Left*: to select the first speed bug on the PFD airspeed area, for subsequent adjustment.
- *Right*: to select the second speed bug on the PFD airspeed area, for subsequent adjustment.

#### (10) *SPEED BUGS Knob:*

increases or decreases the speed of the selected speed bug.

**(11) ADS Selector:**

- NORM: the left PFD displays data from ADC1, and the right PFD displays data from ADC2.
- 1: both PFDs are forced to display data from ADC1.
- 2: both PFDs are forced to display data from ADC2.

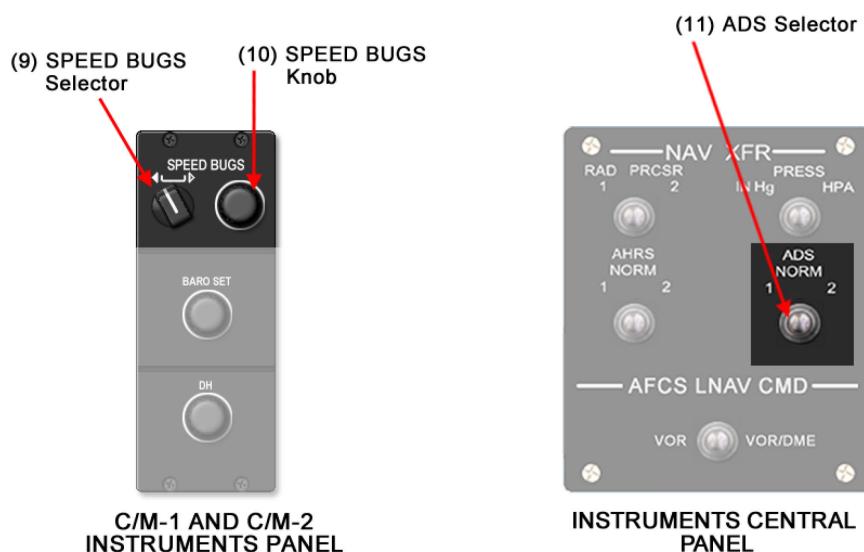
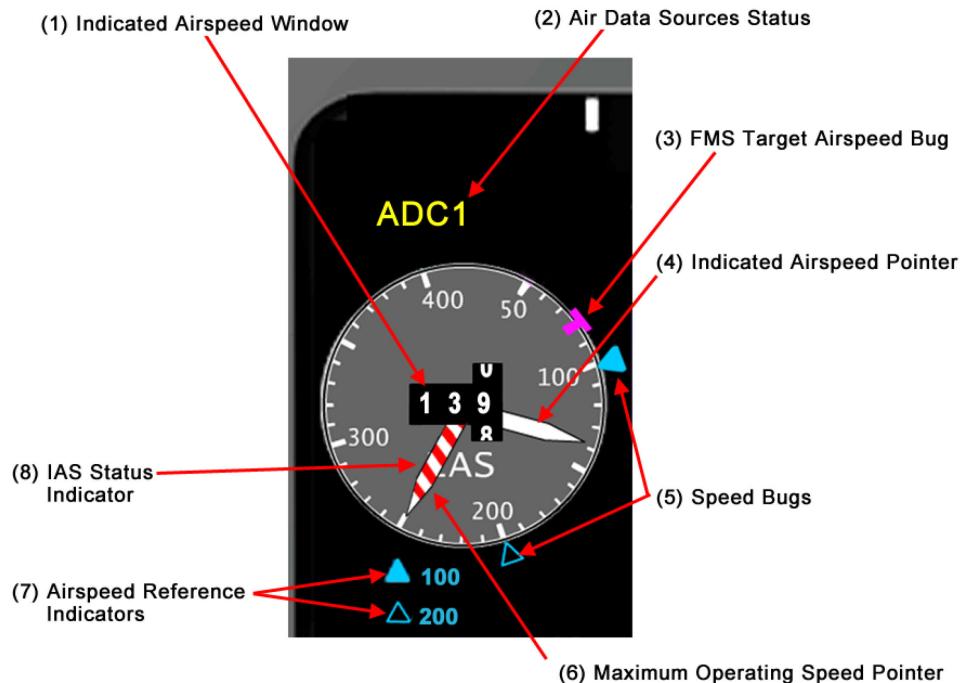


Figure 31-18 PFD (Airspeed Area) - Controls and Indicators

## ALTITUDE AREA

### (1) Altitude Window:

displays, in feet, the altitude from ADU. Negative values are denoted by a NEG annunciator. Digital reading prevails upon the altitude pointer. In case of a non-valid measure, no number is displayed.

### (2) Altitude Alert Indicator:

- *ALRT (inverse video)*: the aircraft is reaching the altitude selected on the FGCP (within the range 1000 ft to 200 ft), or if getting out from it (more than 200 ft).
- *ALRT (white)*: the aircraft is not in the above mentioned range.

### (3) Selected Altitude Indicator:

displays altitude as FGCP selected. Value is not displayed for any selected altitude below 0 ft. If the vertical speed direction to reach the selected altitude is not valid, the value will flash in amber. In case of non-valid selected value, five dashes are displayed.

### (4) Altitude Pointer:

indicates the altitude. A complete turn involves 1000 feet in altitude change. In case of a non-valid measure, it is not displayed.

### (5) Barometric Correction Indicator:

displays the barometric corrections (in Hg or HPa). In case of a non-valid measure, four dashes are displayed.

### (6) ALT Status Indicator:

- *White*: the system is working properly.
- *Amber (flashing for five seconds, then steady)*: there is a mismatch between both ADC for altitude data, or there is an altitude failure monitoring.

### (7) BARO SET Knob:

increases or decreases the barometric correction for the altimeter.

### (8) PRESS InHg/HPA Selector:

- *InHg*: the barometric correction for the altimeter is displayed in inches of mercury and IN is displayed.
- *HPA*: the barometric correction for the altimeter is displayed in hecto pascals (equal to milibars) and HPA is displayed.

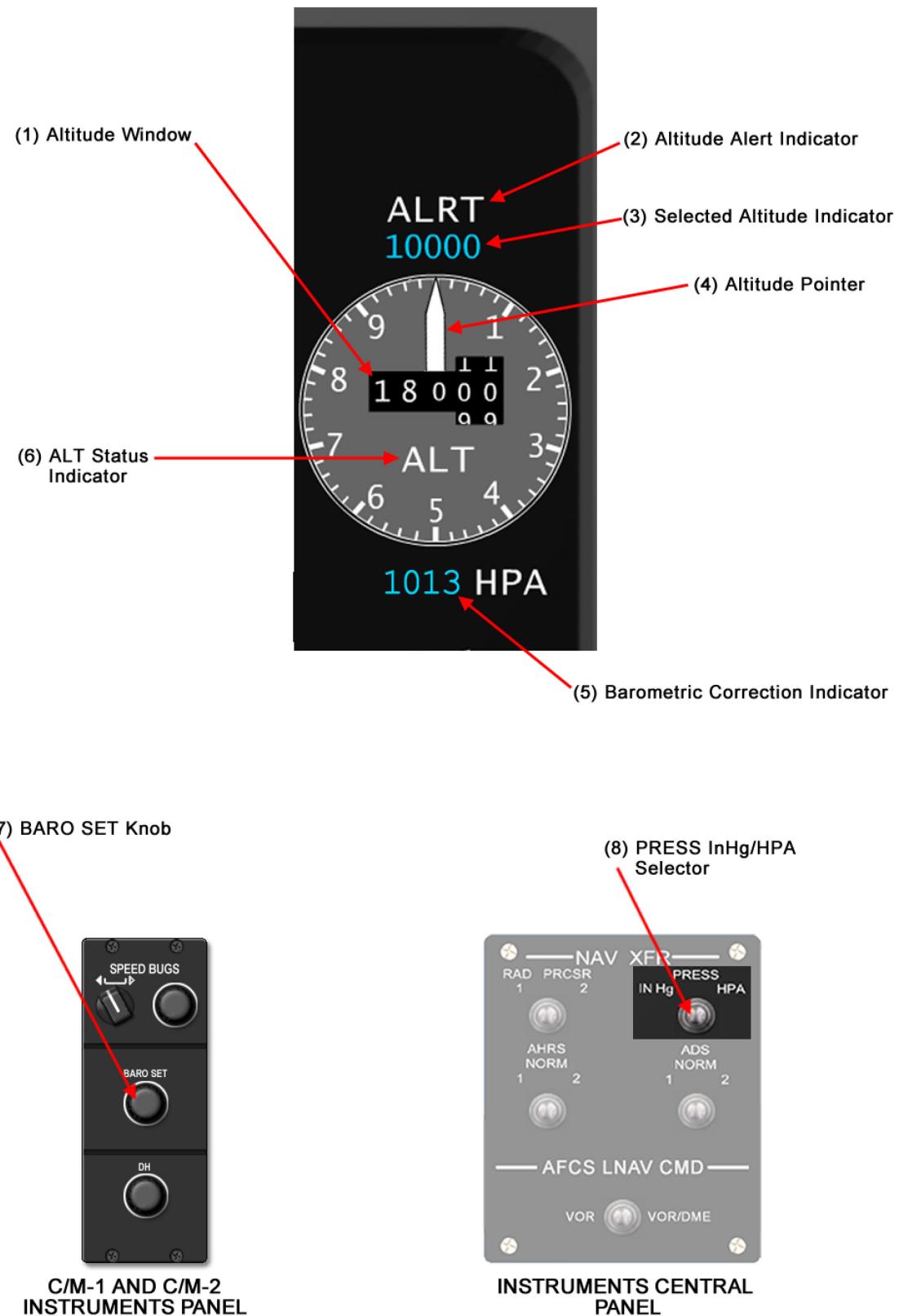


Figure 31-19 PFD (Altitude Area) - Controls and Indicators

## VERTICAL SPEED AREA

### (1) Vertical Speed Window:

displays, in feet per minute, the vertical speed as a merge from ADU and AHRS data. Digital reading prevails upon the vertical speed pointer. It is displayed in red in case of a TCAS RA warning (refer to TCAS, in Chapter 34). In case of a non-valid measure, no number is displayed.

### (2) Vertical Speed Pointer:

indicates the vertical speed.

- *Red Pointer*: there is a TCAS RA warning.
- *White Pointer*: there is not a TCAS RA warning.

### (3) Resolution Arcs:

only displayed in case of a TCAS RA warning, alert the crew of a manoeuvre to be performed/avoided to prevent from collision.

- *Red Arc*: vertical speeds to avoid.
- *Green Arc*: vertical speeds to maintain.

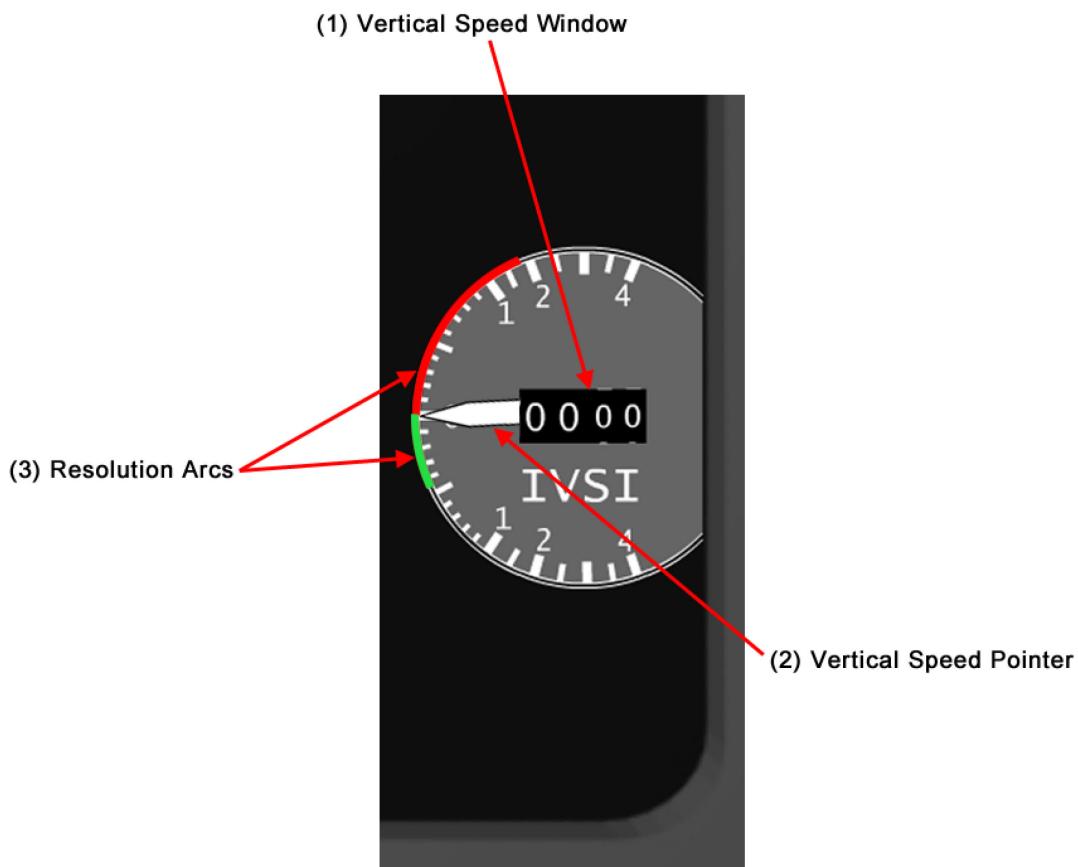


Figure 31-20 PFD (Vertical Speed Area) - Controls and Indicators

## ELECTRONIC ATTITUDE DIRECTION INDICATION (EADI)

### (1) *Roll Index:*

indicates the roll attitude with reference to the markings of the roll scale.

### (2) *Roll Scale and Pointer:*

the markings on each side show 0, 10, 20, 30, 45 and 60° of roll (60° mark is only displayed when roll angle is higher than 30°). If roll signal is not valid, both scale and pointer go off.

### (3) *Sideslip Index:*

this trapezoidal index moves beneath the roll index, displaying the lateral acceleration when on ground and the sideslip during flight. It is only displayed in case of valid information, or if roll angle is below 60°.

### (4) *Pitch Scale:*

measures pitch between +/- 90°. The pitch scale displays in a different way (in terms of marks size and length) depending on pitch interval.

### (5) *Deviation Source:*

specifies the sensor data are obtained from: 'G' for ILS and 'V' for FMS.

### (6) *Vertical Deviation Scale:*

measures the vertical deviation from the glide slope (ILS) or glide path (FMS). The central mark refers a null deviation. In case of failure of glide, a red cross will be displayed over the scale.

### (7) *Vertical Deviation Pointer:*

indicates the vertical deviation from the glideslope (data from ILS and cyan pointer) or glidepath (data from FMS and magenta pointer). If scale limits are exceeded, an arrow is displayed indicating where the pointer is hidden.

If FMS is generating a vertical path change alert, the pointer flashes.

### (8) *Roll Mismatch Annunciator:*

there is a mismatch higher than 3° between the AHRSs roll data or between the roll data of the related AHRS and the IRS.

### (9) *Vertical Deviation Scale Sensitivity:*

for FMS vertical path, displays the elevation, in feet, for two dots of deviation.

### (10) *Marker Annunciator:*

- *O (cyan):* the aircraft is passing over the outer marker.
- *M (amber):* the aircraft is passing over the middle marker.
- *I (white):* the aircraft is passing over the inner marker.

### (11) *Radio Altimeter Indicator:*

displays the radio altitude in feet. It also displays radio altimeters status:

- *RA (white):* the system is correctly operating.
- *RA (red):* the radio altimeter has a failure.

**(12) Decision Height Annunciator:**

warns the crew when the aircraft approaches the decision height. A white box is displayed when radio altitude is below DH+100 ft, and a white box with a DH amber label inside when radio altitude is below DH. In case of a non-valid measure or if DH is not available, no symbol is displayed.

**(13) Command Bars:**

indicates required manoeuvres according to the mode of operation selected on the Flight Director (FD). The bars will only display when the AFCS is active. In case of immoderate/non-valid attitude, or FD non-valid commands, the bars are not displayed.

**(14) Lateral Deviation Scale:**

measures the lateral deviation as given by the selected navigation sensor. The central mark refers a null deviation. If scale limits are exceeded, the mark will be outside the range defined by white dots. In case of failure of lateral deviation source, a red cross will be displayed over the scale.

**(15) Lateral Deviation Pointer:**

indicates the lateral deviation from VOR selected course (cyan pointer) or FMS flight plan (magenta pointer). If scale limits are exceeded, an arrow is displayed indicating where the pointer is hidden.

**(16) Minimum Descent Altitude:**

- *MDA (cyan)*: in descent and approach with FMS as the navigation source, displays the Minimum Descent Altitude (MDA) selected in the MCDU. In case of a non-valid selected MDA, three dashes are displayed. In case of a non-valid baro corrected altitude, MDA data not available or FMS not selected as navigation source, no symbol is displayed.
- *MDA (inverse video)*: the aircraft baro corrected altitude is below MDA+1000 ft.

**(17) Decision Height Indicator:**

displays, in feet, the selected decision. The range goes from 0 ft to 990 ft, thus for selected heights below 0 ft nothing is displayed. In case of a non-valid heights, three dashes are displayed.

**(18) Airplane Symbol:**

indicates pitch attitude (symbol apex) in reference to pitch scale. It also gives a reference of the aircraft concerning the flight director icon. If attitude information is not operative, the airplane symbol is not displayed.

**(19) Pitch Mismatch Annunciator:**

there is a mismatch higher than 3° between the AHRSs pitch data or between the pitch data of the related AHRS and the IRS1.

**(20) Attitude Sources Status:**

- *ATT1 (amber)*: both PFDs display data from AHRS 1 (because AHRS 2 has a failure, or AHRS 1 has been selected in the AHRS Selector).
- *ATT2 (amber)*: both PFDs display data from AHRS 2 (because AHRS 1 has a failure, or AHRS 2 has been selected in the AHRS Selector).

**(21) DH Knob:**

increases or decreases the decision height (DH).

**(22) AHRS Selector:**

- NORM: the left PFD displays attitude from sensor 1, and the right PFD displays attitude from sensor 2.
- 1: both PFDs are forced to display attitude from sensor 1.
- 2: both PFDs are forced to display attitude from sensor 2.

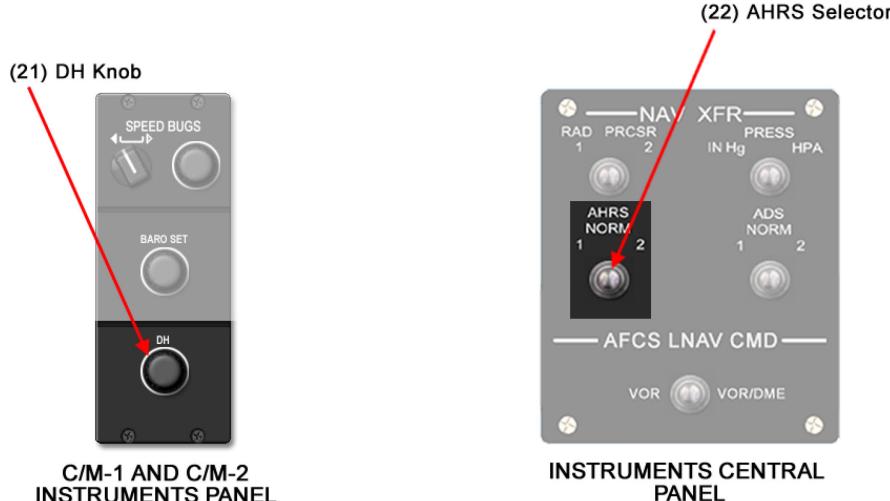
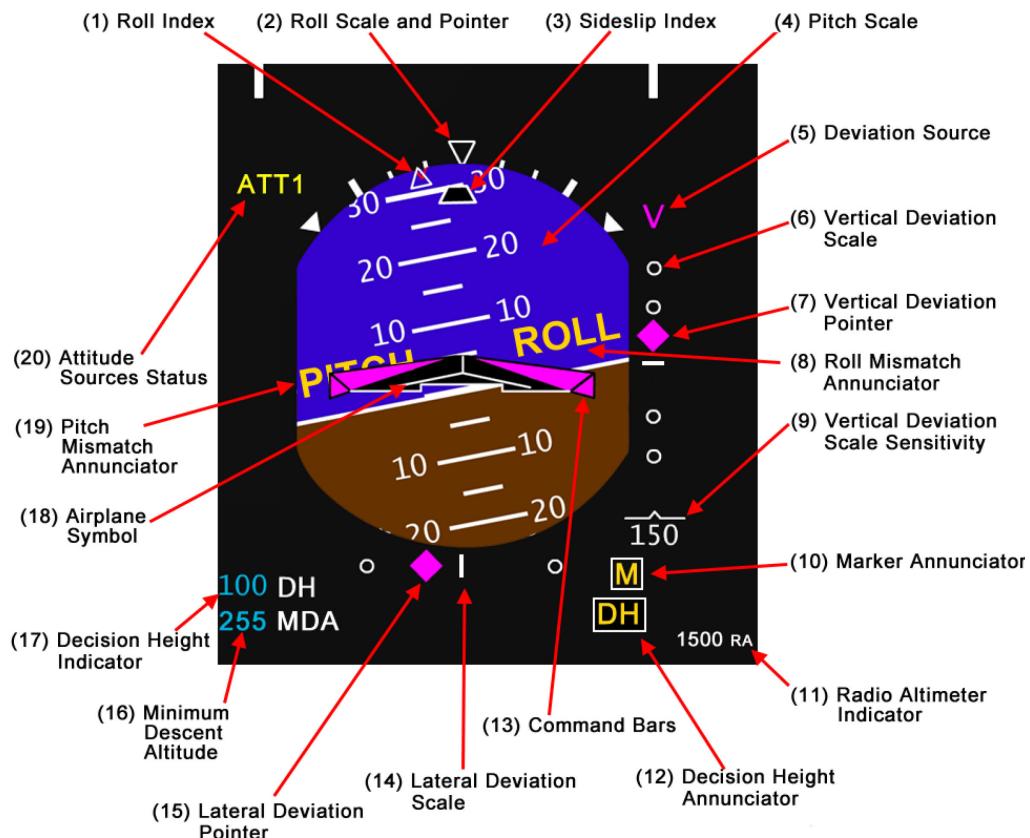


Figure 31-21 PFD (EADI) - Controls and Indicators

## ELECTRONIC HORIZONTAL SITUATION INDICATOR (EHSI)

### (1) Selected Course Indicator:

displays the FGCP selected course, but when the lateral navigation source is FMS1 or FMS2 it displays the FMS desired track. The text 'CRS' is displayed for VOR and ILS (with cyan numbers); and 'DTK' is displayed for FMS (with magenta numbers).

In FMS1 or FMS2 modes, if the FMS is generating a waypoint alert, the numeric value will flash.

In case of non-valid data, three dashes are displayed.

### (2) Actual Heading Window:

- *M*: displays the actual heading referenced to the magnetic heading.
- *T*: displays the actual heading referenced to the true heading.

The magnetic or true heading is selected in the MCDU.

### (3) Selected Course Pointer:

indicates the active selected course. It is FGCP or FMS selected. It is displayed in cyan for VOR and ILS; and in magenta for FMS.

If there is a discrepancy between VHF1 and VHF2 data (between 300 ft and DH), it will flash for 5 seconds.

In FMS1 or FMS2 modes, if the FMS is generating a waypoint alert, it will flash.

### (4) VNAV Alert:

only if the on-side navigation source is FMS, the FMS VNAV requires a flight level change.

### (5) Track Angle Bug:

indicates the track angle of the aircraft. It is not displayed on the ground.

### (6) Navigation Source Indicator:

displays, for the selected course pointer, the navigation source. It is displayed in amber when using a cross side selection or when both PFDs are using the same source.

### (7) MCDU Messages Announciators:

- *RMSG (amber) (flashing for five seconds, then steady)*: there is a message in the MSG page on radio management pages in the MCDU.
- *FMSG (amber) (flashing for five seconds, then steady)*: there is a message in the MSG page in the MCDU. It can be displayed only if FMS is selected as navigation source, and it is displayed on the side that has the related FMS selected as navigation source, if both FMSs raise a message, the annunciator is shown on both sides.

### (8) DME Distance Indicator:

displays, in nautical miles, the distance to the selected DME station when in VOR, ILS or FMS. In case of non-valid data, four dashes are displayed.

If DME Hold is selected on the current DME channel, the symbol 'H' is displayed, in amber, at the left of the DME distance.

**(9) Course Deviation Scale:**

measures the lateral deviation from the selected path for navigation. It rotates with the selected course data in ILS or FMS operation, and it is horizontally displayed with VOR operation. In case of failure, a red cross will be displayed over the scale.

**(10) Course Deviation Scale Sensitivity:**

for FMS operation, displays the deviation, in nautical miles, for two dots.

**(11) Selected Heading Bug:**

indicates the FGCP selected heading. In case of non-valid heading, it is not displayed.

**(12) Temperature Indicator:**

displays, in °C, the Total Air Temperature (TAT) from ADU.

**(13) Lateral Deviation Bar:**

indicates, on the course deviation scale, the position of the active course in relation to the aircraft.

**(14) AHRS Slaving Annunciator:**

there is a slaving error of the selected AHRS.

**(15) Bearing Pointer 2:**

indicates the related heading, selected in the FGCP.

**(16) Bearing Pointer 1:**

indicates the related heading, selected in the FGCP.

**(17) Selected Heading Indicator:**

displays the FGCP selected heading. In case of non-valid data, three dashes are displayed.

**(18) Bearing Source Indicators:**

displays, for the bearing pointers, the selected bearing sources.

**(19) TO/FROM Pointer:**

when navigation source is VOR or FMS, it indicates the direction to the station on the selected course.

**(20) Back Course Annunciator:**

*BC (white)*: ILS navigation source and selected course is different from aircraft heading of more than 105°.

**(21) FMS Messages Annunciators:**

if the navigation source is FMS1 or FMS2, the following messages can be displayed:

- *RAIM (amber)*: the GPS RAIM function has detected that one of the GPS satellites is sending a wrong signal, or the GPS RAIM function is not available.
- *RAIM RNP (amber)*: the Required Navigation Performances (RNP) are not guaranteed by the FMS.
- *RAIM DR (amber)*: the FMS is in Dead Reckoning mode (the FMS estimates current position based upon a previously determined position, and advancing that position based upon known speed, elapsed time and course).

- *APPR (green)*: FMS is in approach flight phase.
- *APPR (amber)*: FMS accuracy during approach is unknown.
- *TERM (green)*: the lateral deviation sensitivity value is the one for terminal area.

**(22) Heading and Gyro Annunciators:**

- *HDG (amber) (flashing for five seconds, then steady)*: there is a mismatch higher than 5° between the AHRSs heading data.
- *HDG1 (amber)*: both PFDs are displaying data from sensor 1.
- *HDG2 (amber)*: both PFDs are displaying data from sensor 2.
- *DG (white)*: the on-side sensor is in DG mode.
- *DG1 (amber)*: both sides are on sensor 1, and sensor 1 is in DG mode.
- *DG2 (amber)*: both sides are on sensor 2, and sensor 2 is in DG mode.

**(23) Bearing Pointer 1 Knob:**

adjusts the bearing pointer 1.

**(24) Bearing Pointer 2 Knob:**

adjusts the bearing pointer 2.

**(25) PFD Brightness Knob:**

adjusts the PFD brightness, and allows to turn it on or off.

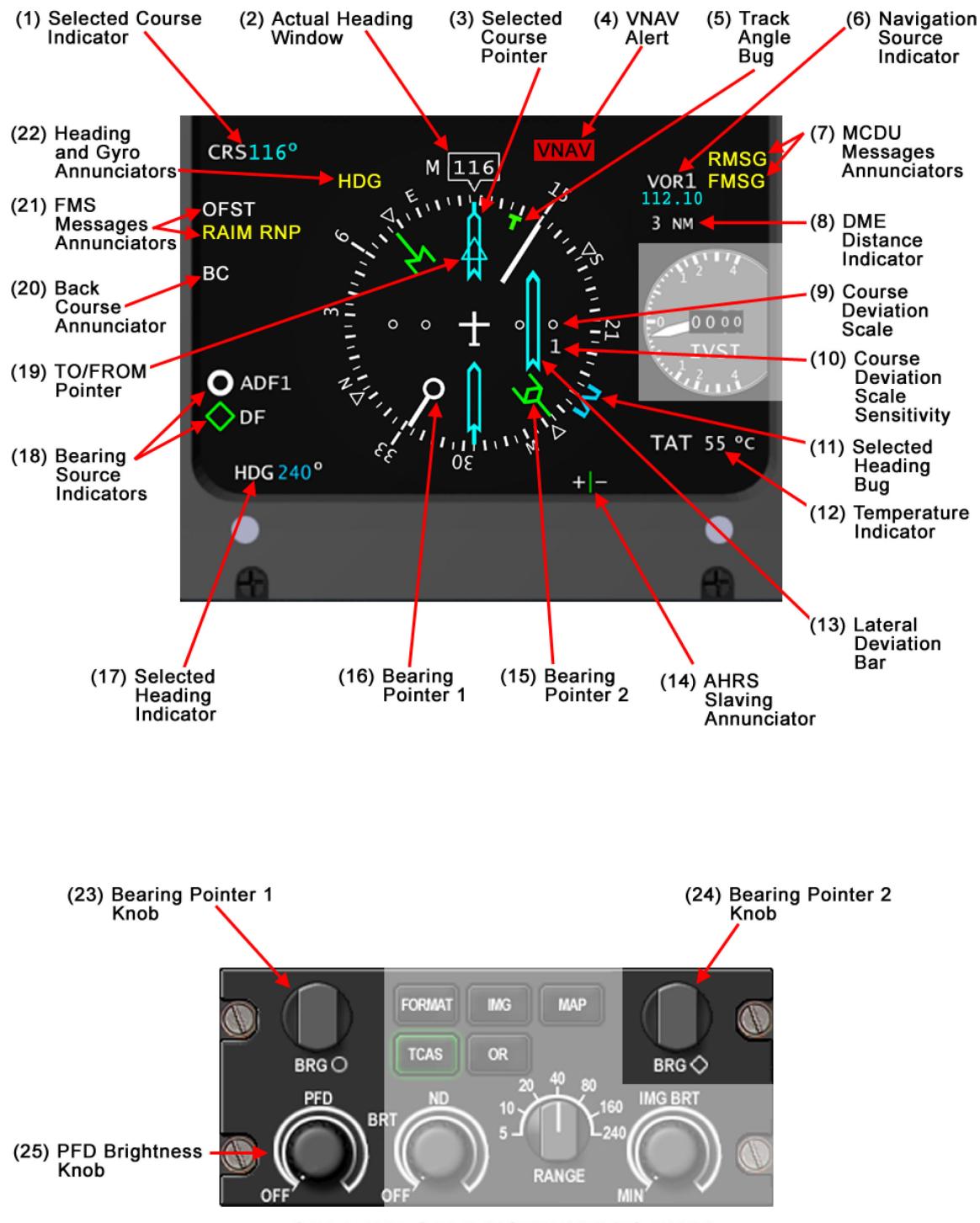


Figure 31-22 PFD (EHSI) - Controls and Indicators

## FAILURE INDICATIONS

Additionally to the mentioned failures, if any PFD indication has a total failure, the warning message 'IAS FAIL', 'ATT FAIL', 'ALT FAIL', 'HDG FAIL' or 'IVSI FAIL' will be displayed, in red, in the related area. Moreover, 'HDG CALIBRATION' can be displayed in amber to indicate the AHRS providing heading data is in calibration mode.

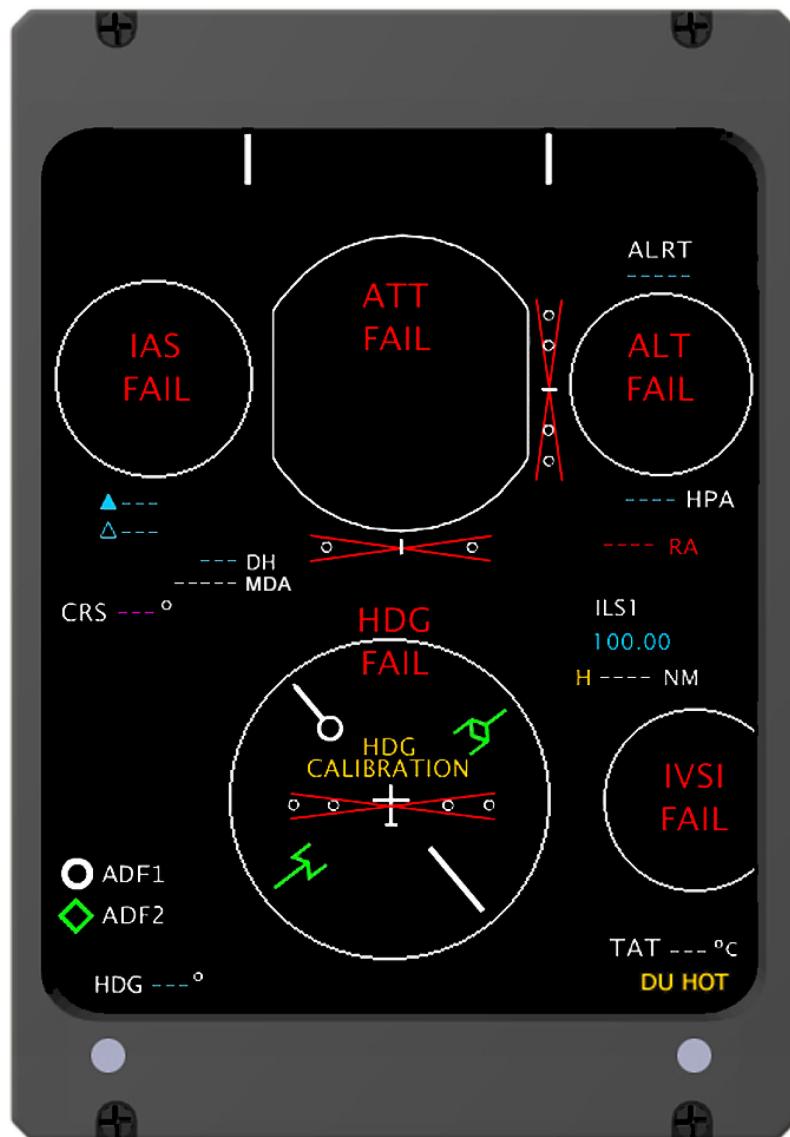


Figure 31-23 PFD (Failure Annunciators)

## NAVIGATION DISPLAY (ND) DESCRIPTION

The ND is divided in:

- Air-data Area: displays aircraft IAS and wind.
- Altitude Area: displays altitude and barometric correction.
- Navigation Area: displays aircraft heading, flight plan, TCAS information, radar information, time to waypoint, distance to waypoint... This area can display the information in three modes:
  - ROSE mode: information is displayed as full wind-rose diagram (360°) pointing towards true/magnetic north, actual/magnetic course, or aircraft route.
  - ARC mode: information is displayed as an enlarged arc (120°) at the top, with an airplane icon centred at the bottom, pointing towards true/magnetic north, or aircraft route.
  - MAP mode: information is displayed as an enlarged arc or as a full wind-rose diagram, but presenting icons concerning flight schedule, navigation aids, airfields, way-points, and hazard areas, shown in their true position as for the aircraft is concerned.
- Communications and Navigation Area: displays the selected frequencies in several systems.

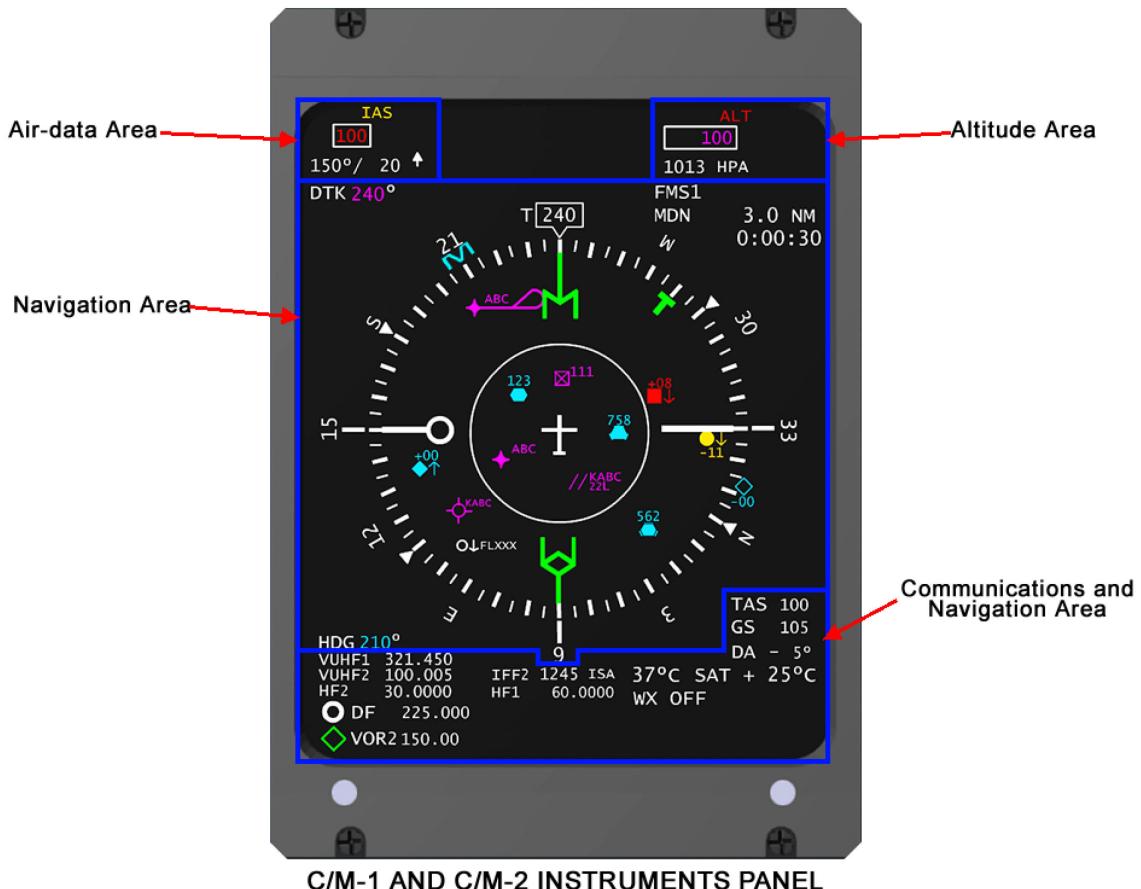


Figure 31-24 Navigation Display (ND) - Components

## NAVIGATION DISPLAY (ND) - CONTROLS AND INDICATORS

### AIR-DATA AREA

#### (1) IAS Indicator:

in case of non-valid data, three dashes are displayed.

- *White*: IAS <  $V_{MO} - 2 \text{ kt}$
- *Amber*:  $V_{MO} - 2 \text{ kt} < \text{IAS} < V_{MO} + 3 \text{ kt}$
- *Red*: IAS >  $V_{MO} + 3 \text{ kt}$

#### (2) FMS Target Airspeed Indicator:

displays the IAS target, calculated by the FMS.

#### (3) Wind Indicator:

displays wind direction and speed, computed by FMS. In case of non-valid data, three dashes are displayed.

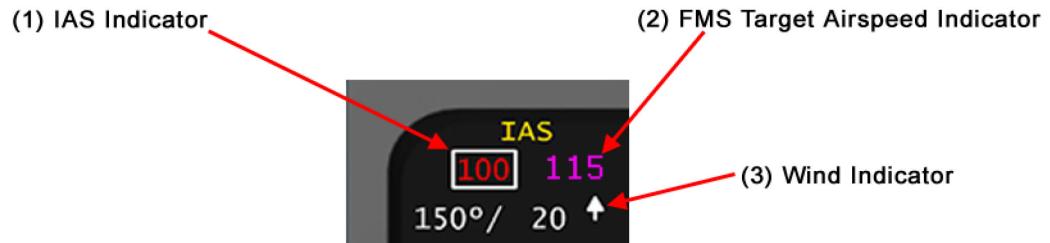


Figure 31-25 ND (Air-data Area) - Controls and Indicators

## ALTITUDE AREA

### (1) Altitude Indicator:

in case of non-valid data, five dashes are displayed

- *White*: the system is operating correctly.
- *Amber (flashing for 5 sec)*: there is a discrepancy between both ADUs.
- *Red*: barometric altitude has failed.

### (2) FMS Altitude Constraint:

only in tactical navigation and if FMS1 or FMS2 is the navigation source, it displays the altitude constraint in the current leg.

### (3) Barometric Correction Indicator:

displays the barometric corrections (in Hg or HPa). In case of non-valid data, five dashes are displayed

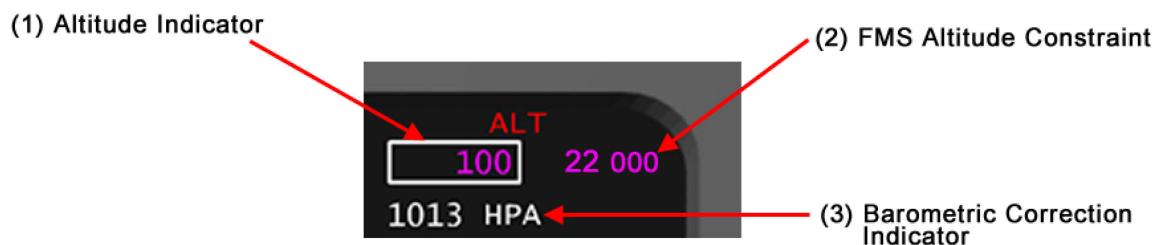


Figure 31-26 ND (Altitude Area) - Controls and Indicators

## NAVIGATION AREA - ROSE MODE

### (1) Selected Course Indicator:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

### (2) Heading and Gyro Annunciators:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

### (3) Actual Heading Window:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

### (4) Navigation Source Indicator:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

### (5) Active Waypoint:

only displayed when at least one active waypoint is selected and FMS1 or FMS2 is the navigation source.

- *In logistical or 'direct-to' navigation:* displays active waypoint label (up to 6 characters).
- *In tactical navigation or SAR pattern:* displays active waypoint number (3 digits).

### (6) MCDU Messages Announciators:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

### (7) Distance to Waypoint

### (8) Time to Waypoint:

- *In logistical or 'direct-to' navigation:* estimated time of arrival to the waypoint.
- *In tactical navigation or SAR pattern:* time to go to the waypoint.

### (9) Track Angle Bug:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

### (10) Traffic Symbols:

- *Solid square (red):* displays a Resolution Advisory (RA). Refer to CHAPTER 34 - TCAS.
- *Solid circle (yellow):* displays a Traffic Advisory (TA). Refer to CHAPTER 34 - TCAS.
- *Solid diamond (cyan):* displays a Proximity Traffic (PT). Refer to CHAPTER 34 - TCAS.
- *Diamond (cyan):* displays an Other Traffic (OT). Refer to CHAPTER 34 - TCAS.

### (11) Cross Track Error:

only displayed if FMS1 or FMS2 is the navigation source, it displays the aircraft track deviation from the horizontal flight plan. It also displays the deviation side:

- *L:* the aircraft is left of the desired track.
- *R:* the aircraft is right of the desired track.

**(12) Bearing Pointer 2:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

**(13) Selected Heading Indicator:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

**(14) Flight Plan Symbols**

**(15) Bearing Pointer 1:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

**(16) Selected Heading Bug:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

**(17) Back Course Annunciator:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

**(18) FMS Messages Annunciators:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

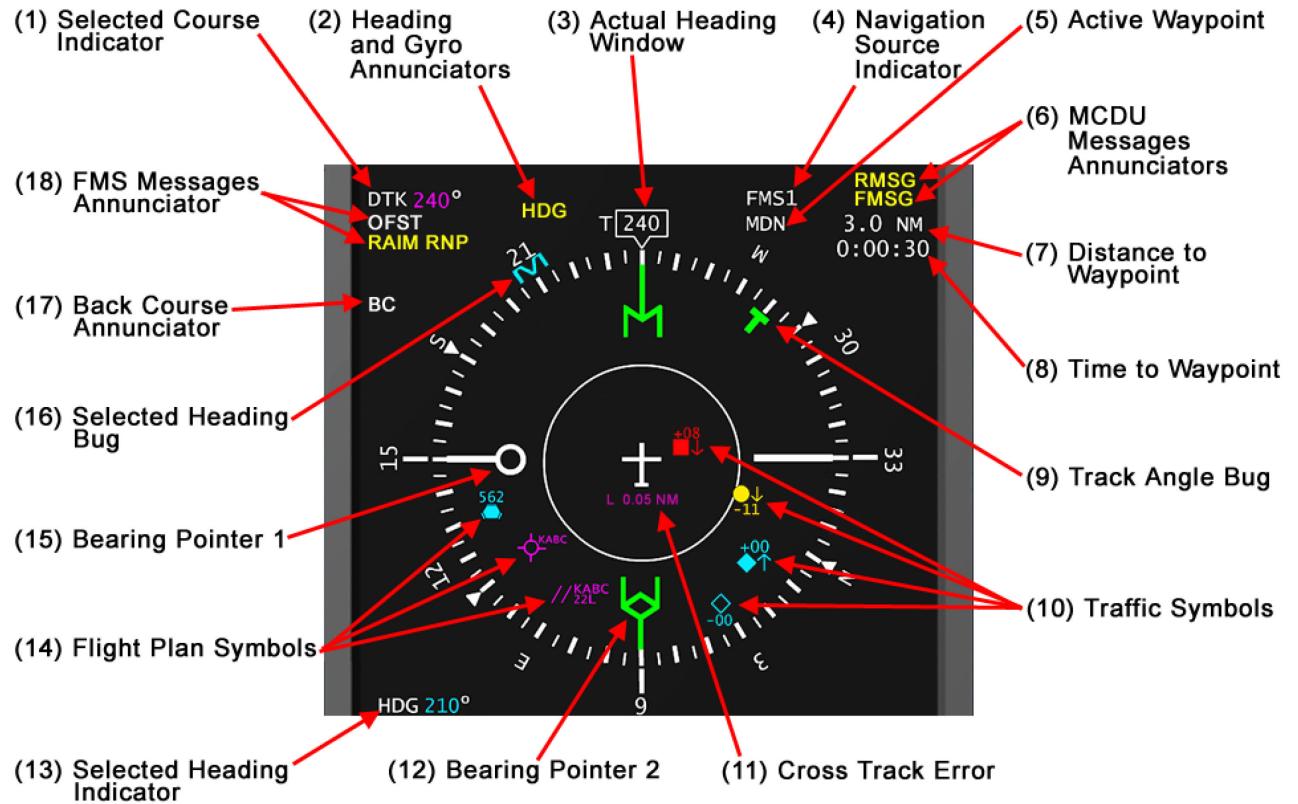


Figure 31-27 ND (Navigation Area - Rose Mode) - Controls and Indicators

	Waypoint in Logistical navigation
	Waypoint in Tactical navigation or SAR pattern
	VOR
	DME/TACAN
	VOR/DME
	Airport
	Top of descent point
	Non return point
	Bottom of descent point
	Top of climb point
	Holding pattern
	Dropping zone
	Procedure turn
	Warning zones

Figure 31-28 ND (Navigation Area - Flight Plan Symbols)

## NAVIGATION AREA - ARC MODE

(allows course readings on a 120° scale and ND ordinary data are displayed as well)

### (1) Range Indicators:

display the range ring radius, in nautical miles.

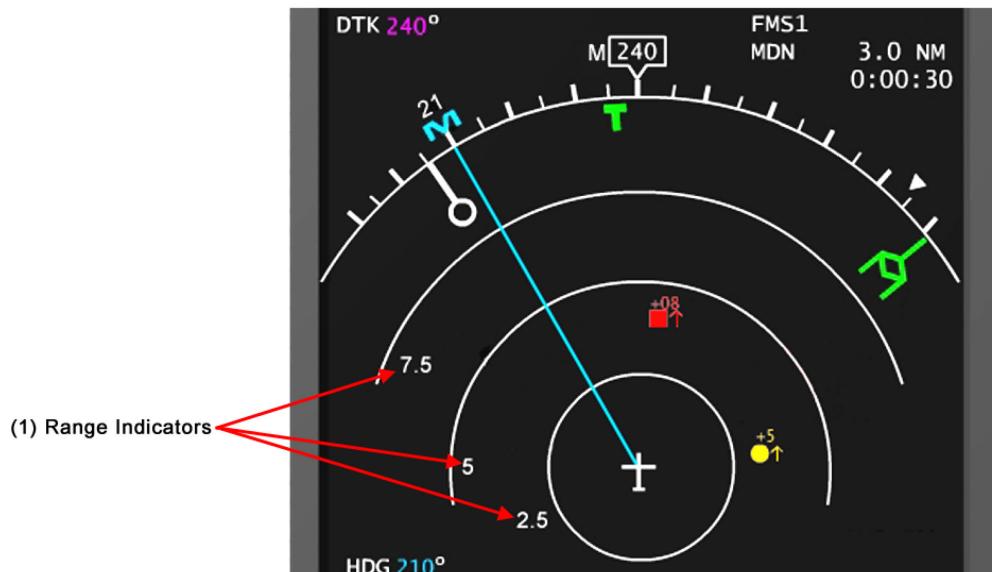


Figure 31-29 ND (Navigation Area - Arc Mode) - Controls and Indicators

## NAVIGATION AREA - MAP MODE

(allows to display weather and map information)

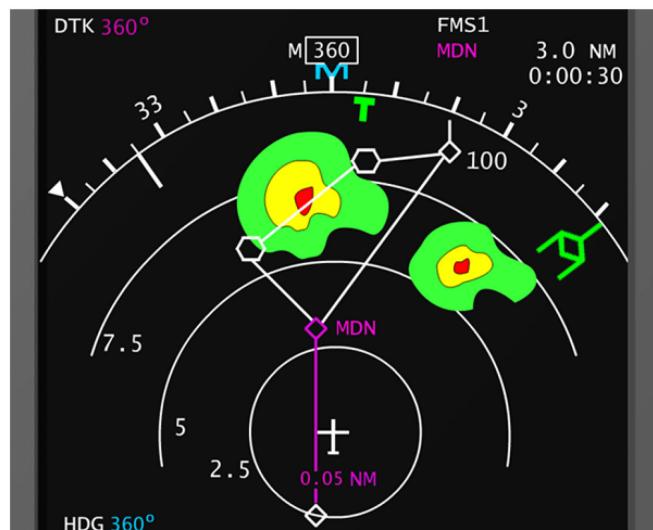


Figure 31-30 ND (Navigation Area - Map Mode) - Controls and Indicators

## COMMUNICATIONS AND NAVIGATION AREA

### (1) Frequencies Indicators

### (2) ISA:

displays the ISA deviation.

### (3) True Airspeed

### (4) Ground Speed

### (5) Drift Angle

### (6) Static Air Temperature

### (7) Radar and GPWS Annunciator:

(refer to WEATHER RADAR, in CHAPTER 34, and CHAPTER 34 - ENHANCED GROUND PROXIMITY WARNING SYSTEM)

### (8) DME Distance Indicator:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

### (9) Bearing Source Indicators:

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

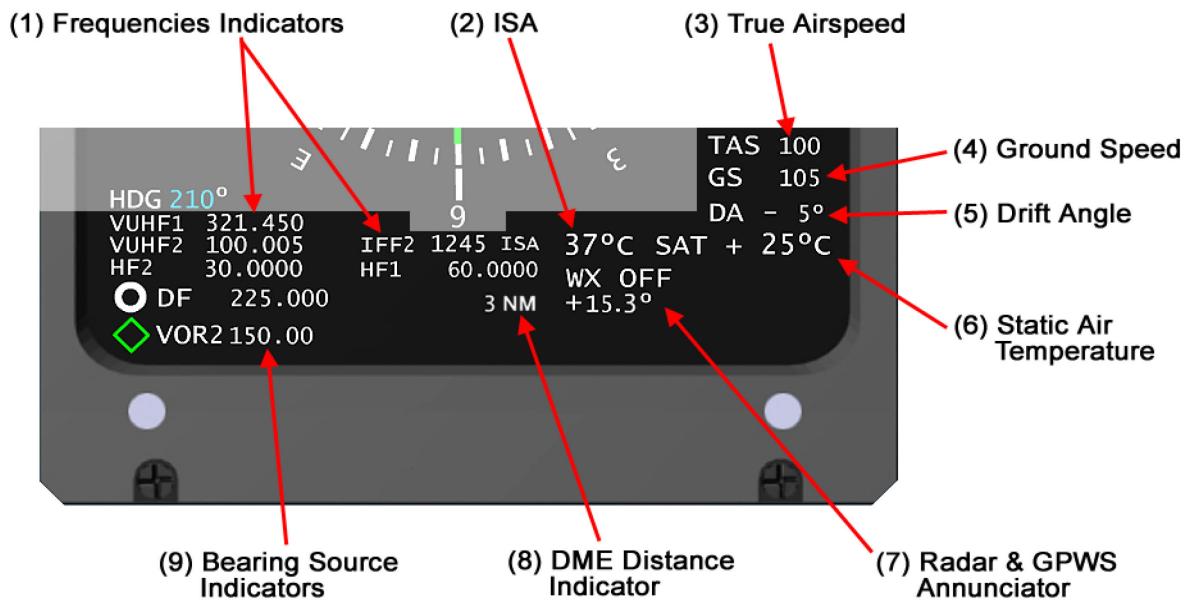


Figure 31-31 ND (Communications and Navigation Area) - Controls and Indicators

**EFCP****(1) Bearing Pointer 1 Knob:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

**(2) TCAS Pushbutton:**

activates TCAS system, or sets it to AUTO mode (default operating mode).

**(3) FORMAT Pushbutton:**

allows ND display modes selection (ROSE/ARC).

**(4) IMG Pushbutton:**

enables successive selection of radar image (WXR) or EGPWS terrain full time picture (TERR).

**(5) MAP Pushbutton:**

displays additional information on flight plan progress. When a flight plan is activated, first, only the flight plan and the navaids tuned by the FMS within the map area shall be displayed:

- *pressed again*: adds the other navaids (maximum 10 nearest) within the map area.
- *pressed again*: displays the other airports (maximum 10 nearest except the origin and destination airports) within the map area.
- *pressed again*: displays the warning zones (maximum 10) within the map area.

**NOTE**

Warning zones are symbolized by a fixed circle when the warning zone range is lower than 12% of the ND range and by a variable size circle when warning zone range is greater than 12% of the ND range.

- *pressed again*: displays all the options (i.e. navaids, airports and warning zones) as described above within the map area.
- *pressed again*: displays no option and no flight plan.
- *pressed again*: displays flight plan.
- *pressed again*: returns to the beginning of the cycle.

**(6) Bearing Pointer 2 Knob:**

(refer to HEADING AREA in PRIMARY FLIGHT DISPLAY (PFD) - CONTROLS AND INDICATORS)

**(7) IMG BRT Knob:**

adjusts ND brightness when displaying in WXR mode.

**(8) RANGE Selector:**

adjusts ND visualization range.

**(9) OR Pushbutton**

selects ND orientation between Heading Up, Track Up and North Up.

**(10) ND Brightness Knob:**

adjusts the ND brightness and allows to turn it on or off.

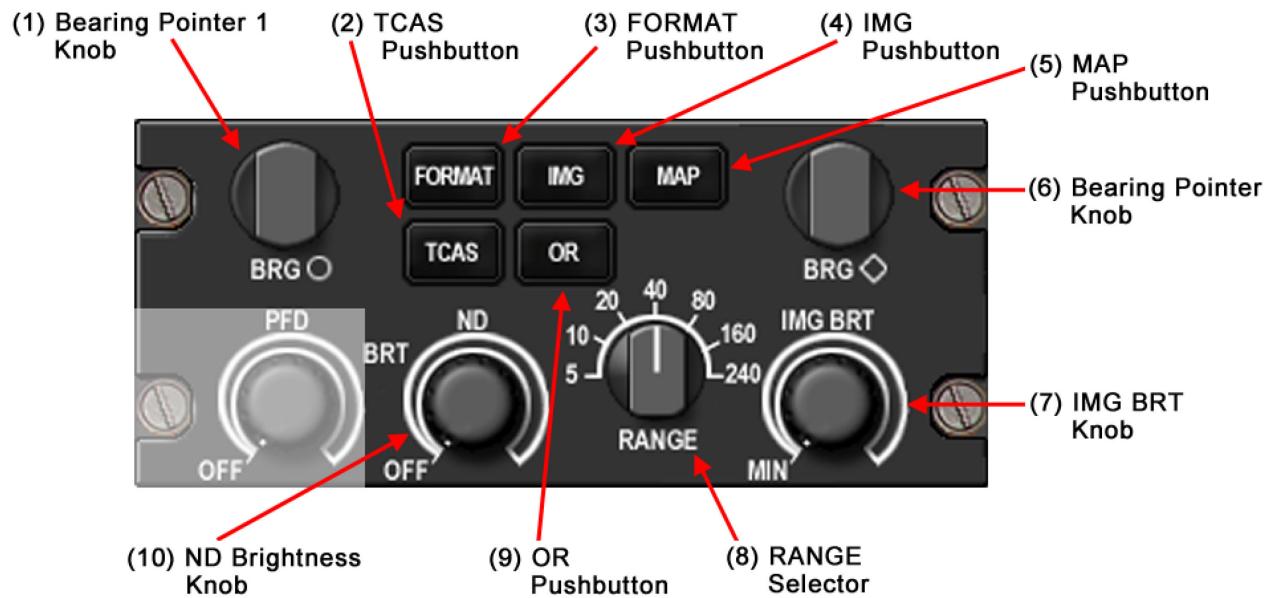


Figure 31-32 ND (EFCP) - Controls and Indicators

## FAILURE ANNUNCIATORS

The ND can display messages to inform about failures. Moreover, 'FMS PARTIAL MAP' can be displayed in amber to indicate the ND is not able to display all the information inside the map area, and 'CHECK PFD1' or 'CHECK PFD2' in amber when a display unit monitoring fault has been detected.



Figure 31-33 ND (Failure Indications)

## IOP - CONTROLS AND INDICATORS

### (1) RAD PRCSR Selector:

- 1: sets IOP1 as master.
- 2: sets IOP2 as master.

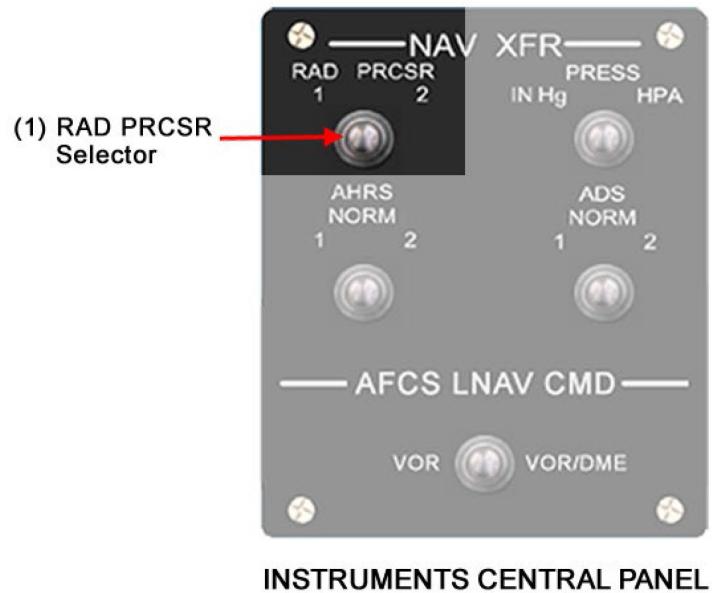


Figure 31-34 IOP - Controls and Indicators