

# B737 NG

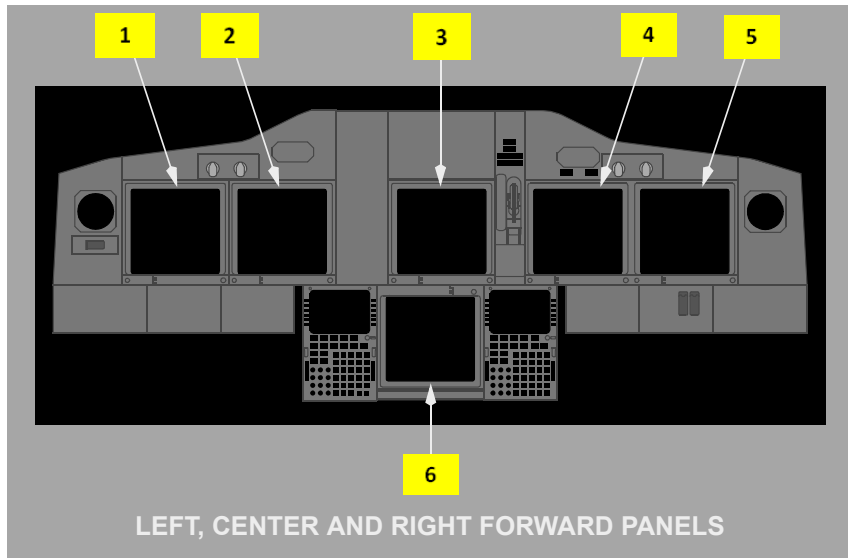


## Flight Instruments

Do not use for flight

## EFIS/Map Display System – Overview

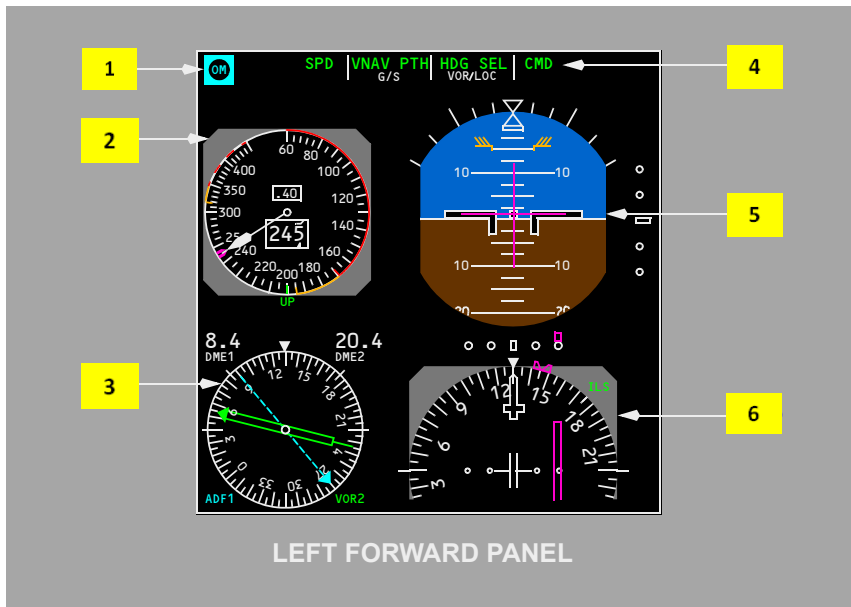
### Display Units



- 1** Captain Outboard Display Unit
- 2** Captain Inboard Display Unit
- 3** Upper Display Unit
- 4** First Officer Inboard Display Unit
- 5** First Officer Outboard Display Unit
- 6** Lower Display Unit

## Captain Outboard Display

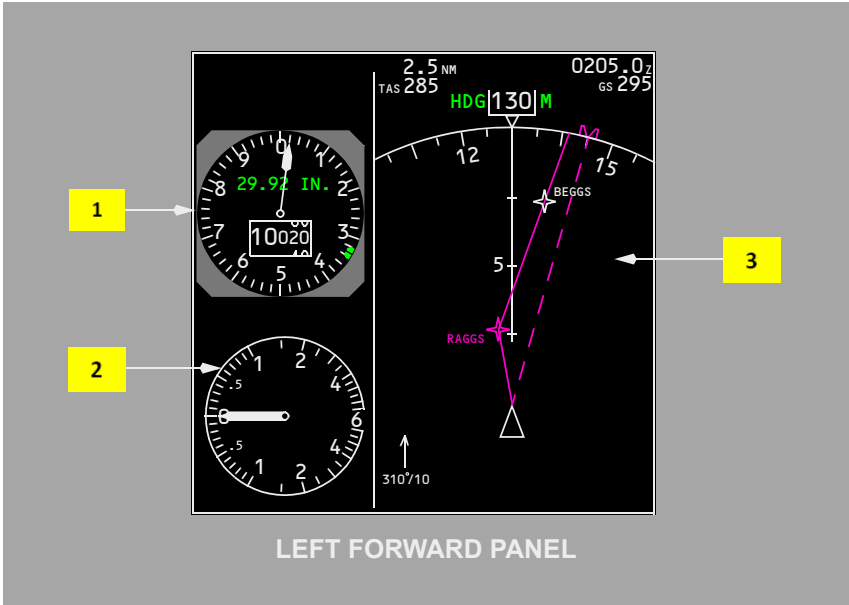
[B737 with Split axis command bars]



- 1** Marker Beacon
- 2** Mach/Airspeed Indicator
- 3** Radio Distance Magnetic Indicator
- 4** Flight Mode Annunciations
- 5** Attitude Indicator
- 6** Horizontal Situation Indicator

# Captain Inboard Display

[B737 with Heading-up display]



**1** Altimeter

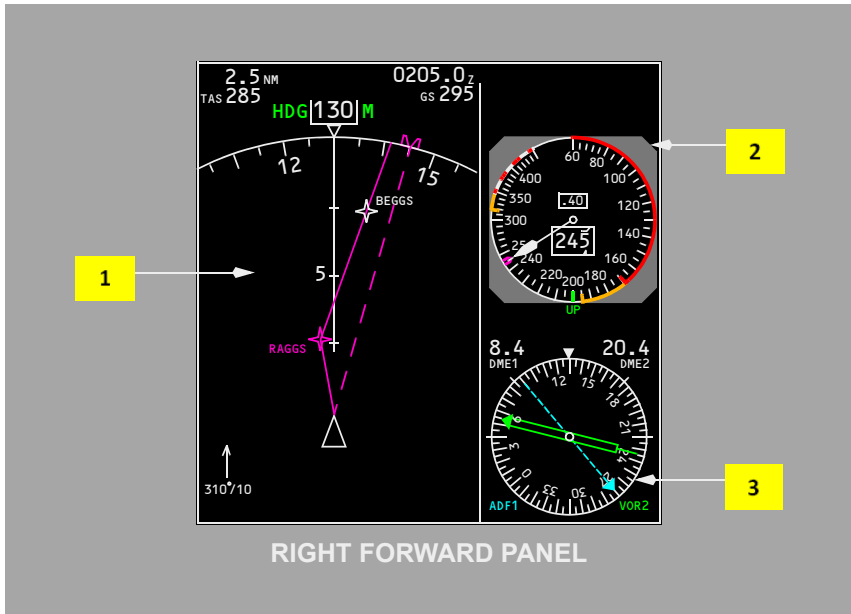
**2** Vertical Speed Indicator

**3** Navigation Display

Displays approach, VOR, moving map, or static map as selected on the EFIS control panel.

## First Officer Inboard Display

[B737 with Heading-up display]



### 1 Navigation Display

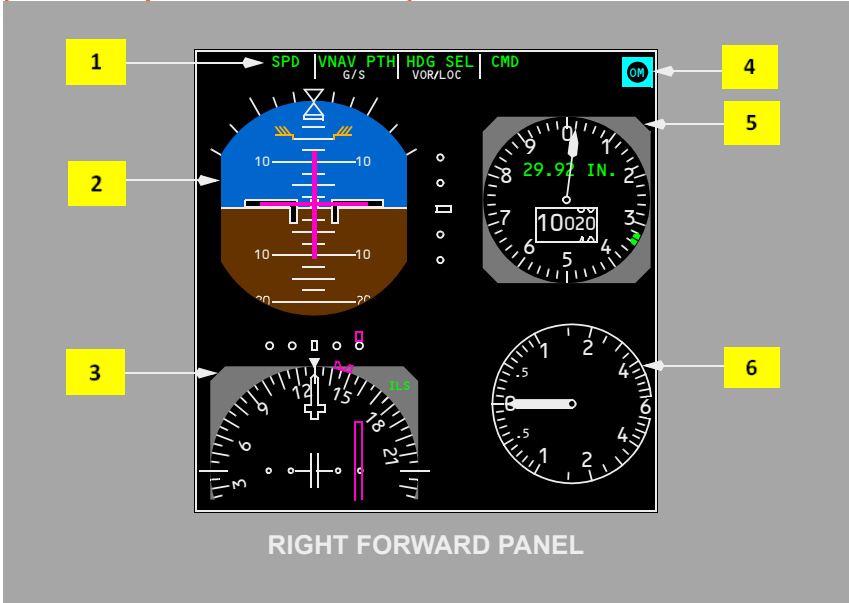
Displays approach, VOR, moving map, or static map as selected on the EFIS control panel.

### 2 Mach/Airspeed Indicator

### 3 Radio Distance Magnetic Indicator

# First Officer Outboard Display

[B737 with Split axis command bars]



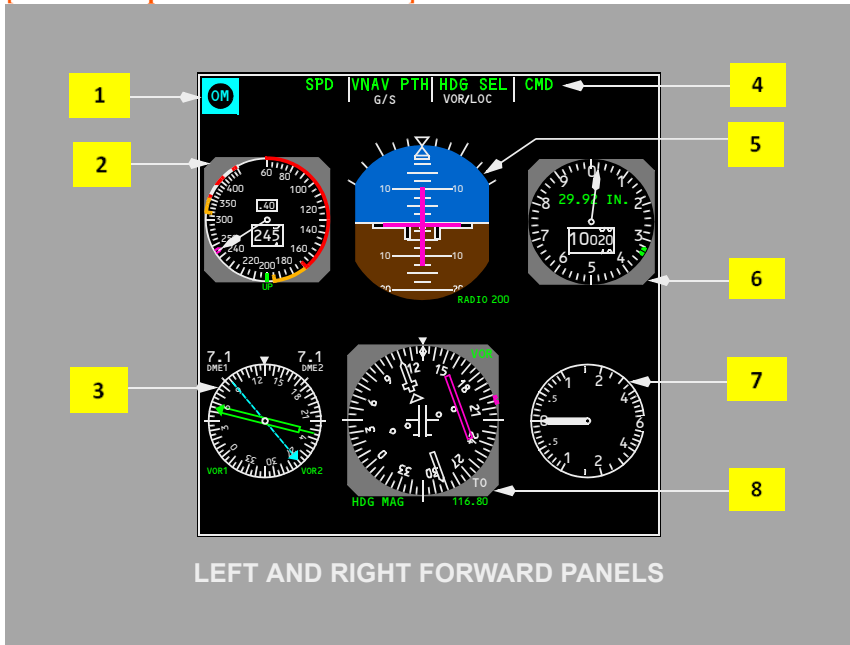
- 1 Flight Mode Annunciation
- 2 Attitude Indicator
- 3 Horizontal Situation Indicator
- 4 Marker Beacon
- 5 Altimeter
- 6 Vertical Speed Indicator

## Compact EFIS Format

The compact EFIS format is displayed automatically upon failure of either an inboard or an outboard display unit. The compact format can also be selected manually with the MAIN PANEL DUs selectors on the display select panel.

In the compact format, a full rose HSI is displayed. Other displays are about 25% smaller than normal.

### [B737 with Split axis command bars]



**1** Marker Beacon

**7** Vertical Speed Indicator

**2** Mach/Airspeed Indicator

**8** Horizontal Situation Indicator

**3** Radio Distance Magnetic Indicator

**4** Flight Mode Annunciations

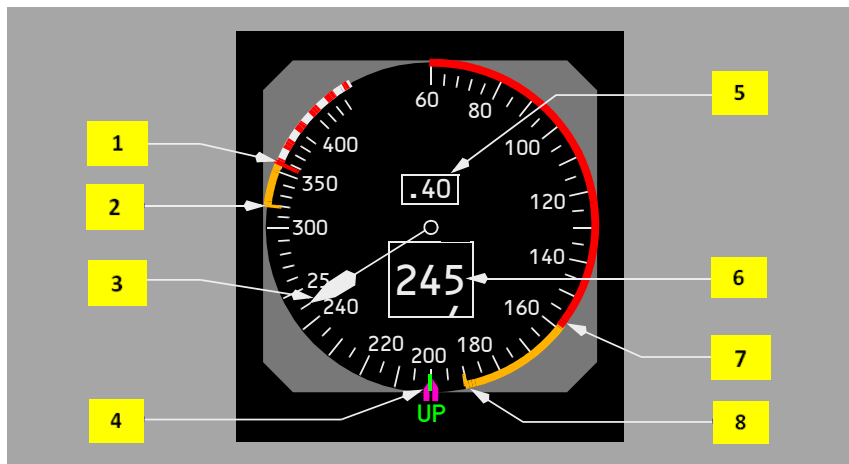
**5** Attitude Indicator

**6** Altimeter

## Electronic Flight Instrument System (EFIS) – Mach/Airspeed Indicator (MASI)

### Mach/Airspeed Indicator – General

The mach/airspeed indicator displays air data inertial reference system (ADIRS) airspeed and other airspeed related information.



#### 1 Maximum Operating Speed (red and white)

Start of the arc indicates the maximum speed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

#### 2 High Speed Buffet/Flap Extension Speed (amber)

At high altitudes and flaps up, the start of the arc indicates the airspeed that provides a 0.3 g maneuver margin to high speed buffet.

#### [Aircraft with CDS Software Upgrade]

When flaps are not up, the start of the arc indicates flap extension placard speed for the next normal flap setting. The arc is removed when the flap handle is moved to the landing gear placard selected on the APPROACH REF page or when the flap lever is moved to flaps 40.

#### 3 Airspeed Pointer (white)

Indicates current calibrated airspeed in knots.



#### 4 **Airspeed Cursor (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.

#### 5 **Mach Digital Counter (white)**

Indicates current Mach number:

- displays when airspeed increases above 0.40 Mach
- blanks when airspeed decreases below 0.38 Mach.

#### 6 **Airspeed Digital Counter (white)**

Indicates current calibrated airspeed in knots.

When current airspeed decreases into the minimum maneuver speed amber bar:

- airspeed readout box turns amber and flashes for 10 seconds.
- box returns to white when airspeed is above minimum maneuver speed.

#### 7 **Stick Shaker Speed (red)**

Red index mark indicates the speed at which stick shaker occurs.

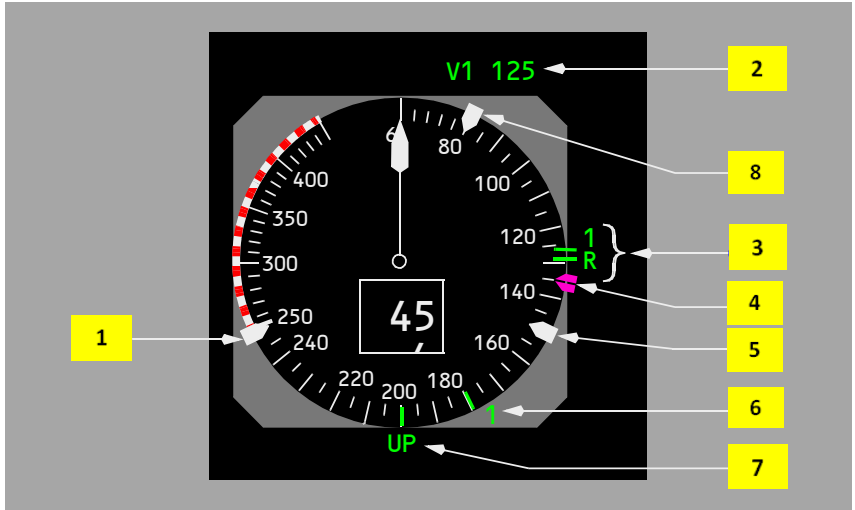
#### 8 **Minimum Maneuver Speed (amber)**

Amber index mark indicates minimum maneuver speed.

Inhibited on takeoff until first flap retraction or valid VREF entered.

## Mach/Airspeed Indicator – Takeoff

[Aircraft with 80 knot speed bug]



### 1 Bug 5 (white)

Displayed if the speed reference selector on the engine display control panel is in the bug 5 position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

### 2 Speed Reference Display (green)

Displayed if the airspeed and/or weight is entered via the speed reference selector on the engine display control panel:

- on the ground, V1, VR, and takeoff gross weight may be selected; if VREF is selected, INVALID ENTRY is displayed
- in flight, VREF and landing gross weight may be selected; if V1 or VR is selected, INVALID ENTRY is displayed
- removed when the speed reference selector is moved to the SET position.

### 3 Takeoff Reference Speeds (green)

Indicates V1 (decision speed) and VR (rotation speed) as selected on the CDU TAKEOFF REF page or as set with the speed reference selector on the engine display control panel:

- amber NO VSPD flag is displayed on the ground if V1 or VR is not selected on the CDU or is not set with the speed reference selector
- displayed for takeoff when speed is greater than 80 knots
- removed at lift-off.

**[B737 with V1 aural enabled]**

- V1 is automatically called out by voice aural.

**Note:** The Look Ahead Terrain Alerting system must be incorporated for the automatic V1 aural callout to be functional.

**4 Airspeed Cursor (magenta)**

Set with the speed selector on the mode control panel.

**5 V2+15 (white)**

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered.

**6 Flap Maneuvering Speed (green)**

Indicates flap maneuvering speed for the displayed flap position:

- when the V2+15 bug is displayed for takeoff, the flap maneuvering speed bug for the current flap setting is not displayed except for a flaps 1 takeoff
- flap bugs inhibited if less than VREF +4.

**7 Flaps Up Airspeed (green)**

Displayed after zero fuel weight is entered in the CDU and takeoff gross weight is calculated, or after takeoff gross weight is set with the speed reference selector.

Not displayed above approximately 20,000 feet altitude.

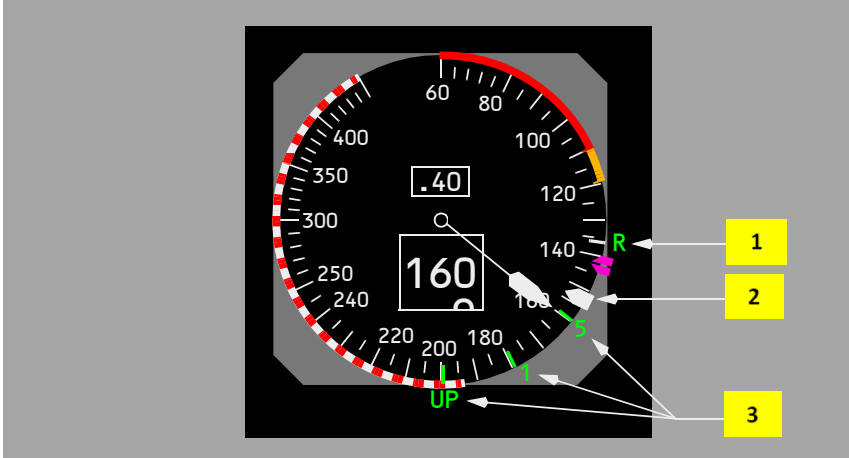
**8 80 Knots Airspeed Bug (white)**

**[Aircraft with 80 knot speed bug]**

Indicates 80 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

# Mach/Airspeed Indicator – Approach



**1** Landing Reference Speed (green)

Indicates VREF (reference speed) as selected on the CDU APPROACH REF page or as set with the speed reference selector on the engine display control panel.

**2** VREF+15 (white)

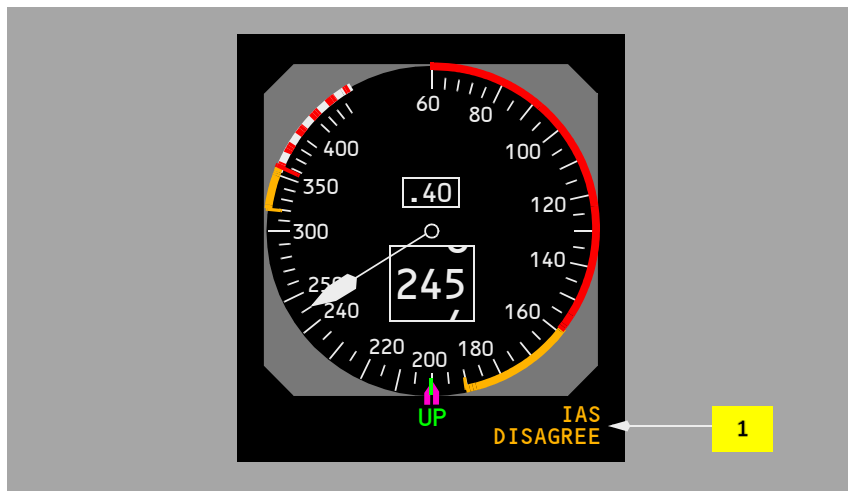
Displayed after selection of VREF.

**3** Flap Maneuvering Speeds (green)

Indicate flap maneuvering speeds for the displayed flap position:

- not shown if less than or equal to VREF+4
- numbered flap maneuvering speed bugs are removed when the flap lever is moved to flaps 30 or 40.

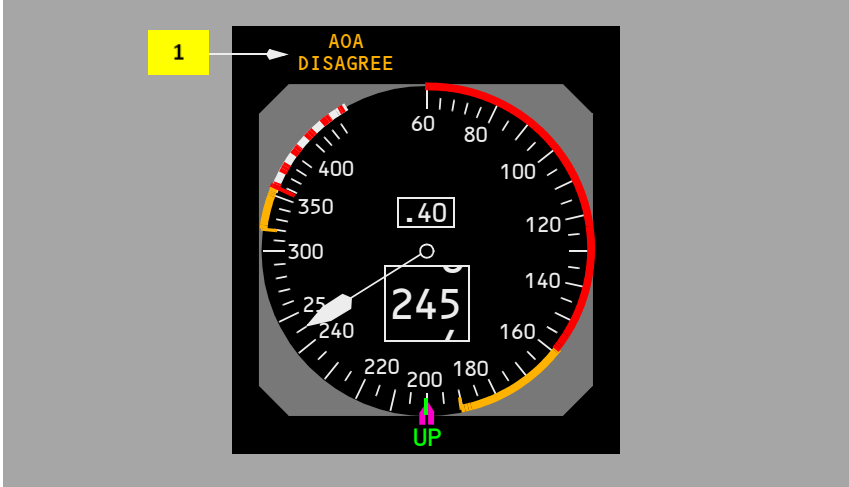
## Mach/Airspeed Indicator – IAS Disagree Alert



### 1 Airspeed Disagree Alert (amber)

Indicates the Captain's and F/O's airspeed indications disagree by more than 5 knots for 5 continuous seconds.

# Mach/Airspeed Indicator – Angle of Attack (AOA) Disagree Alert

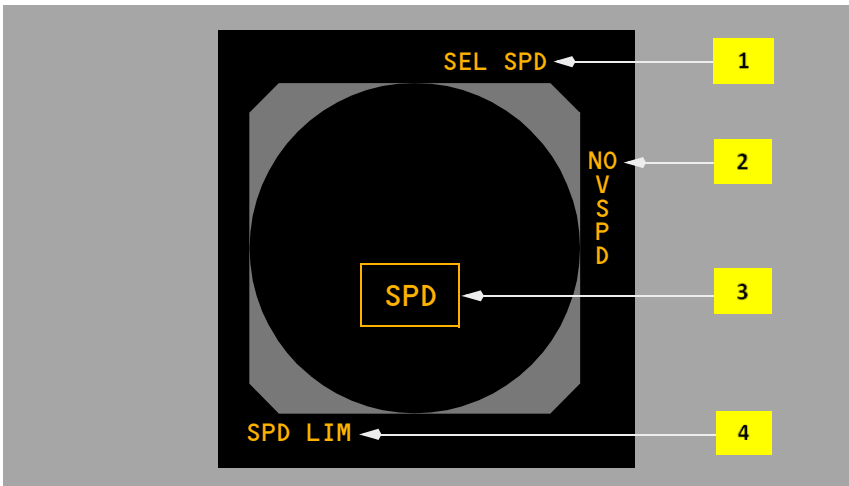


## 1 AOA Disagree Alert (amber)

Indicates the left and right AOA values disagree by more than 10 degrees for more than 10 continuous seconds.

## Mach/Airspeed Indicator Failure Flags

The flag replaces the appropriate display to indicate source system failure or lack of computed information.



**1 Selected Speed Flag (amber)**

The airspeed cursor is inoperative. The airspeed cursor is removed.

**2 No VSPD Flag (amber)**

V1 (decision speed) or VR (rotation speed) has not been entered or is invalid.

**3 Speed Flag (amber)**

The Mach/airspeed indicator is inoperative. All indicator markings are removed.

**4 Speed Limit Flag (amber)**

Displays related with stick shaker or maximum operating speed has failed:

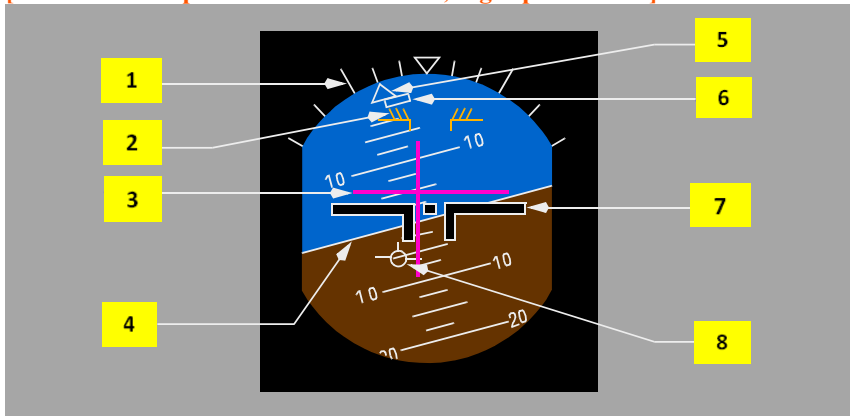
- if the stick shaker warning has failed, the red stick shaker speed arc is removed
- if the maximum operating speed has failed, the red and white maximum operating speed arc is removed.

**EFIS – Attitude Indicator**

**Attitude Indicator – General**

The attitude indicator displays ADIRS attitude information.

[Aircraft with Split axis command bars, flight path vector]



**1 Bank Scale (white)**

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

## 2 Pitch Limit Indicator (amber)

Indicates pitch limit (stick shaker activation for existing flight conditions).

- displayed when flaps are not up

### [B737 with PLI pop-up]

- displayed at slow speed with flaps up

## 3 Flight Director (magenta)

Indicates flight director steering commands.

## 4 Horizon Line and Pitch Scale (white)

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

## 5 Bank Pointer

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

## 6 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 indicator is also at full scale deflection.

## 7 Airplane Symbol

Indicates airplane attitude relative to the horizon.

## 8 Flight Path Vector (FPV) Indication (white)

### [B737 with Flight path vector]

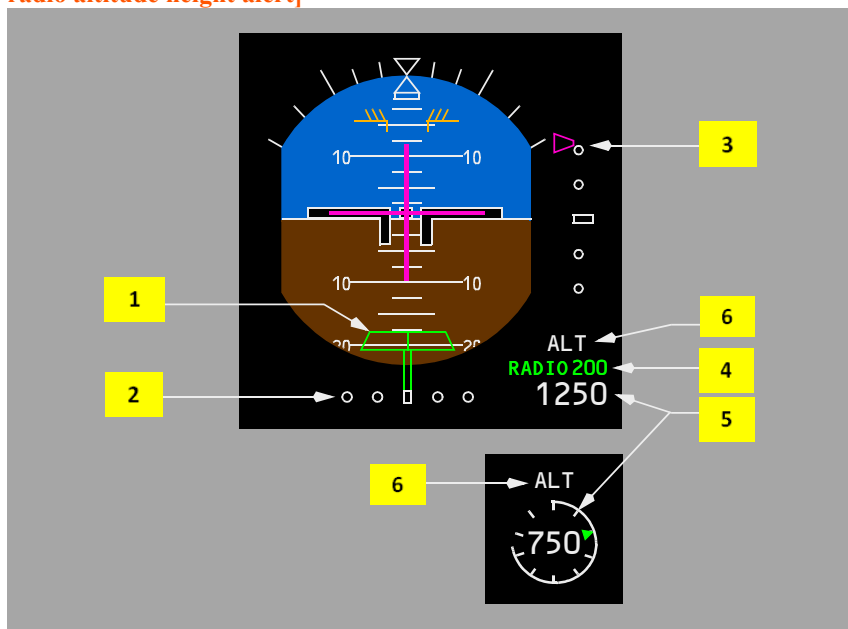
Displays flight path angle and drift when selected on the EFIS control panel:

- flight path angle is displayed relative to the horizon line
- drift angle is displayed relative to display center.



## Attitude Indicator – Instrument Landing System Indications

[B737 with Split axis command bars, round dial, radio altitude below, rising runway, radio altitude height alert]



### 1 Rising Runway (green)

[Aircraft with Rising runway]

- displayed when localizer pointer is in view and radio altitude is less than 2500 feet
- rises towards airplane symbol when radio altitude is below 200 feet
- is not displayed when the localizer signal is unusable.

### 2 Localizer Pointer and Deviation Scale

The pointer:

- indicates localizer position relative to the airplane.
- in view when the localizer signal is received.

The scale:

- indicates deviation.
- expands when the localizer is engaged and deviation is slightly more than one-half dot.

[Aircraft with Localizer/Glideslope fail flags displayed]

- in view when the localizer signal is received.

At low radio altitudes with autopilot engaged, the scale turns amber and the pointer flashes to indicate excessive localizer deviation.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC deviation alerting display on each attitude indicator.

### 3 **Glide Slope Pointer and Deviation Scale**

The pointer:

- indicates glide slope position.
- in view when the glide slope signal is received.
- the pointer is not displayed when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The scale:

- indicates deviation

#### **[Aircraft with Localizer/Glideslope fail flags displayed]**

- in view when the localizer signal is received.

At low radio altitudes with autopilot engaged, the scale turns amber and the pointer flashes to indicate excessive glide slope deviation.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second G/S deviation alerting display on each attitude indicator.

### 4 **Selected Radio Altitude Approach Minimums (green)**

- displays selected minimums as set on the EFIS control panel
- blank when an altitude less than 0 feet is selected
- "RADIO" legend and readout turn amber and flash for 3 seconds when descending through the selected minimum altitude; the legend and readout become steady amber after 3 seconds
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go-around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

### 5 **Radio Altitude (display –white, selected radio altitude pointer–green)**

#### **[Aircraft with Round dial]**

- displayed below 2500 feet AGL
- blanked above 2500 feet AGL
- digital display from 2500 to 1000 feet AGL
- round dial display below 1000 feet AGL:

- pointer replaces digital display of selected radio minimum altitude
- the circumference of the dial is added to, or taken away from, to depict the airplane's radio altitude
- dial and readout turn amber and dial flashes for 3 seconds when descending through the selected minimum altitude; the dial becomes steady amber after 3 seconds
- changes back to white:
  - when passing through the selected minimum altitude plus 75 feet during go-around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

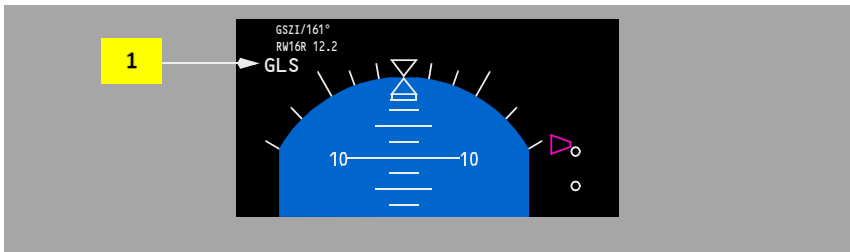
## 6 Radio Altitude Height Alert (white)

### [Aircraft with 2500 ft height alert]

Displayed when radio altitude is less than or equal to 2500 feet. Blanked when descent continues below 500 feet AGL, or after pressing the RST switch on the EFIS control panel.

## Attitude Indicator – GLS Source Annunciation Indication

### [Aircraft with GLS]



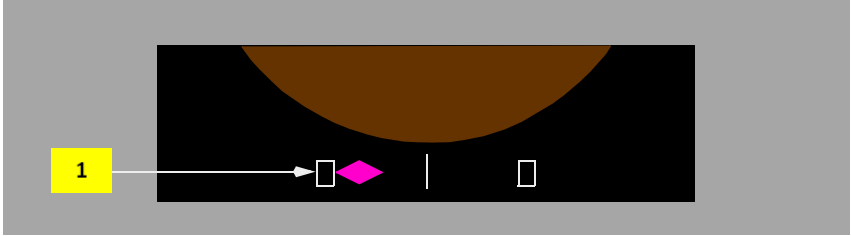
## 1 GLS Source Annunciation

Displays the selected GLS identifier, channel, selected course and source annunciation.

If the tuned GLS channels disagree, the channel turns amber with an amber horizontal line through it.

If the GLS approach courses entered in the MCP disagree, the course turns amber with an amber horizontal line through it.

## Expanded Localizer Indications



### 1 Expanded Localizer Scale

**[Aircraft with Autopilot or flight director activated]**

Displayed when the autopilot or flight director is in LOC mode, deviation is slightly more than one half dot and track is within 5 degrees of the MCP selected course.

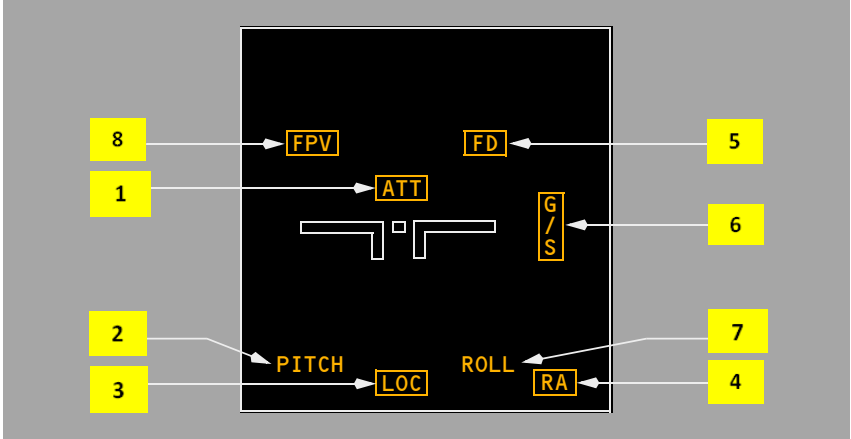
Reverts to standard scale when out of LOC mode, and groundspeed is less than 30 knots or radio altitude is greater than 200 feet.

A rectangle equals 1/2 dot deviation.

## Attitude Indicator Failure Flags

Flags replace the attitude displays to indicate source system failure or lack of computed information.

**[Aircraft with Split axis command bars, radio altitude below, flight path vector]**



### 1 Attitude Flag (amber)

The attitude display has failed.

## 2 Pitch Flag (amber)

The Captain and First Officer pitch angle displays differ by more than 5 degrees.

### [Aircraft with Attitude comparator flashing]

The flag flashes for 10 seconds then remains steady.

## 3 Localizer Flag (amber)

An ILS frequency is tuned and the ILS localizer deviation display on the attitude indicator has failed.

## 4 Radio Altitude Flag (amber)

The radio altitude display has failed.

## 5 Flight Director Flag (amber)

The flight director has failed.

## 6 Glide Slope Flag (amber)

An ILS frequency is tuned and the ILS glide slope deviation display on the attitude indicator has failed.

## 7 Roll Flag (amber)

The Captain and First Officer roll displays differ by more than 5 degrees.

### [Aircraft with Attitude comparator flashing]

The flag flashes for 10 seconds then remains steady.

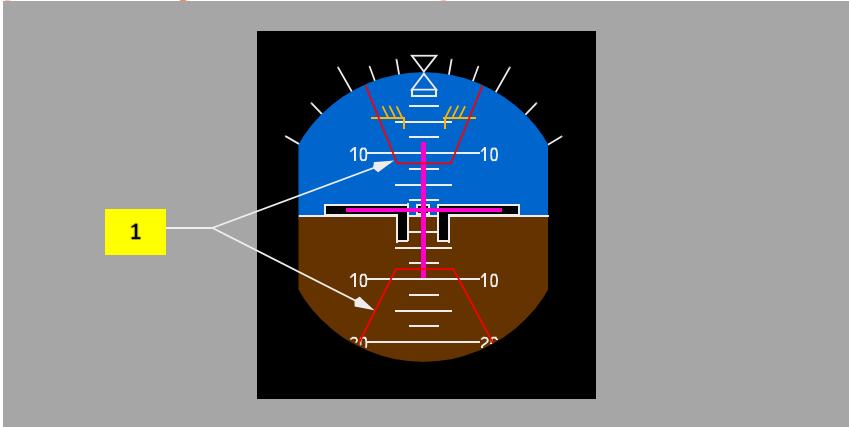
## 8 Flight Path Vector Flag (amber)

### [Aircraft with Flight path vector]

FPV is selected on the EFIS control panel, but has failed. De-selection of FPV removes the flag.

## Traffic Alert and Collision Avoidance Indications

[Aircraft with Split axis command bars]

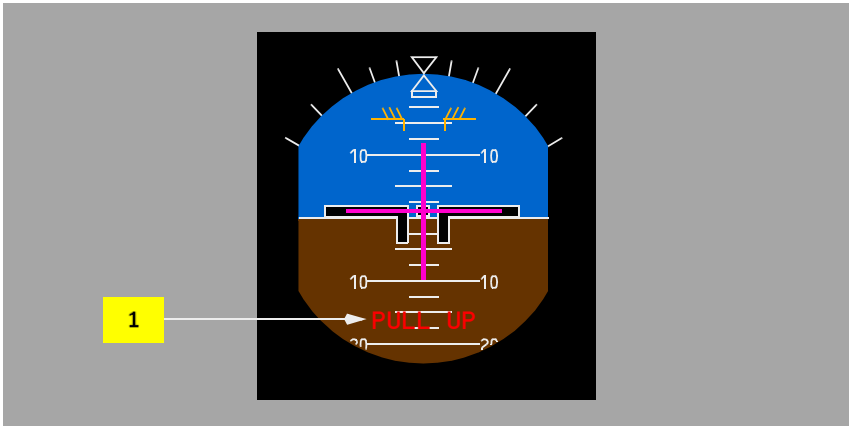


### 1 Traffic Alert and Collision Avoidance System Pitch Command (red)

The area(s) inside the red lines indicate(s) the pitch region(s) to avoid in order to resolve the traffic conflict. The airplane symbol must be outside the TCAS pitch command area(s) to ensure traffic avoidance.

## GPWS Annunciations

[Aircraft with Split axis command bars]



### 1 GPWS Annunciations (red)

## EFIS – Altimeter

### Altimeter – General

The altimeter displays ADIRS altitude and other altitude related information.



#### 1 Altitude Pointer

Makes one revolution each one thousand feet.

#### 2 Reference Altitude Marker (green)

Indicates the barometric minimums as set by the minimums selector on the EFIS control panel.

The minimums reference selector must be in the BARO position to adjust the reference altitude marker.

#### 3 Altitude Alert Annunciation (amber)

- appears steady for altitude acquisition
- flashes during altitude deviation

#### 4 Metric Selected Altitude Readout (readout–magenta, caption–cyan)

Displays MCP altitude in meters when MTRS is selected on the EFIS control panel. Not available in compact mode.

**5 Barometric Setting (green)**

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

**6 Metric Digital Readout (readout–white, caption–cyan)**

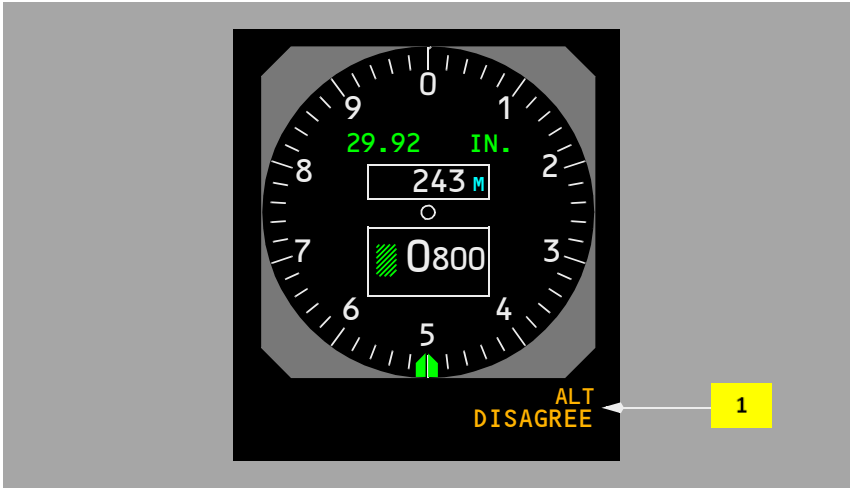
Displays current altitude in meters when MTRS is selected on the EFIS control panel. Not available in compact mode.

**7 Digital Readout (white)**

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
- a negative sign appears when altitude below zero feet is displayed.

**Altimeter – Altitude Disagree Alert**



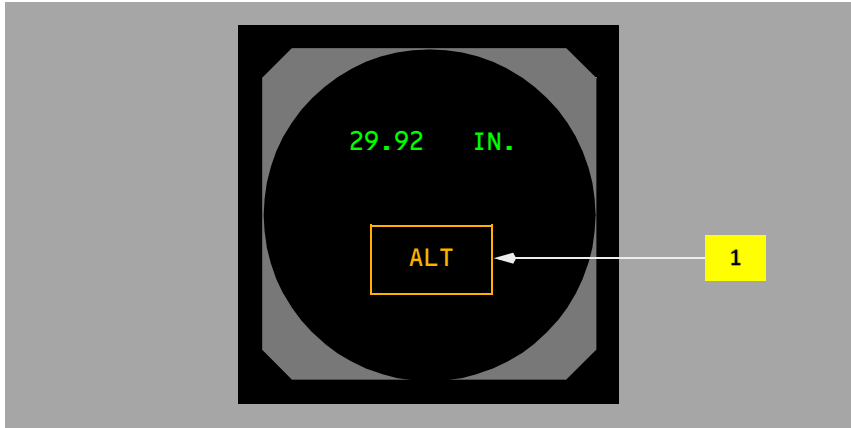
**1 Altitude Disagree Alert (amber)**

Indicates the Captain’s and F/O’s altitude indications disagree by more than 200 feet for more than 5 continuous seconds.



## Altimeter Failure Flag

The failure flag replaces the altitude displays to indicate system failure.



### 1 Altimeter Failure Flag (amber)

The barometric altitude or barometric correction has failed:

- all altimeter symbols are removed except the ALT ALERT annunciation and the barometric setting.

## EFIS – Vertical Speed Indicator

### Vertical Speed Indicator – General

The vertical speed indicator displays ADIRS instantaneous vertical speed.

[Aircraft with TCAS advisory]



**1 Vertical Speed Pointer (white)**

Depicts rate of climb or descent from 0 to 6000 feet per minute.

**2 TCAS Corrective Advisory (green)**

**[Aircraft with TCAS advisory]**

Indicates range of recommended vertical speed.

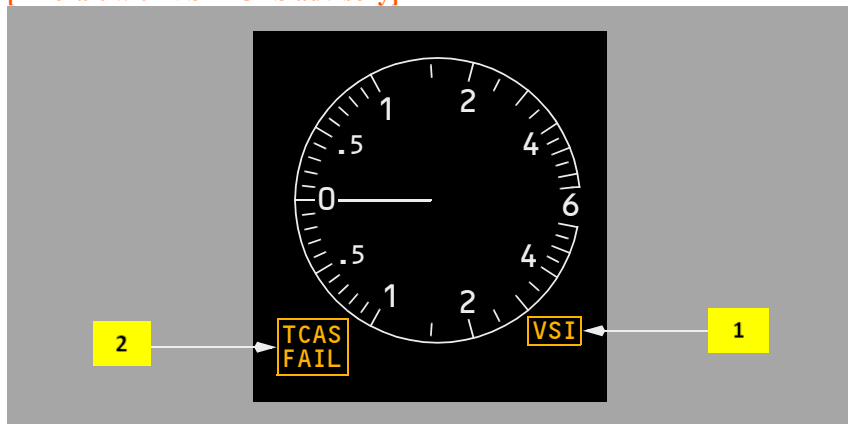
**3 TCAS Preventative Advisory (red)**

**[Aircraft with TCAS advisory]**

Indicates range of vertical speed to be avoided.

### Vertical Speed Indicator Failure Flag

**[Aircraft with VSI TCAS advisory]**



**1 VSI Failure Flag (amber)**

Vertical speed has failed. The pointer is also removed.

**2 TCAS Failure Flag (amber)**

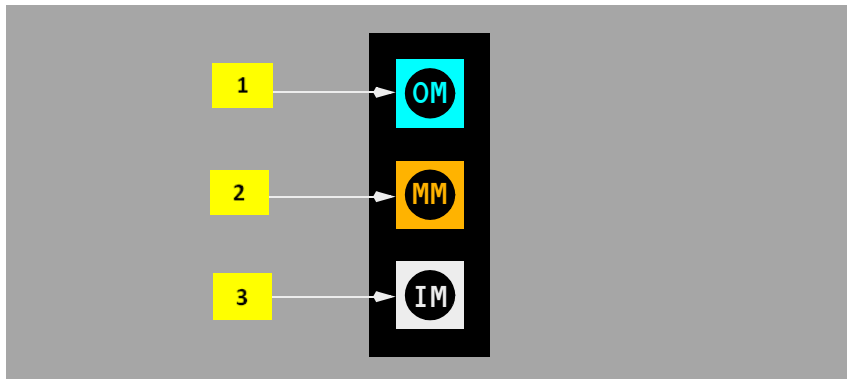
**[Aircraft with VSI TCAS advisory]**

TCAS advisory function has failed. Compact format only.

## EFIS – Marker Beacon Indications

### Marker Beacons Indications

The marker beacon indication flashes when over one of the marker beacon transmitters.



#### **1 Outer Marker (cyan)**

Flashes when over an outer marker beacon.

#### **2 Middle Marker (amber)**

Flashes when over a middle marker beacon.

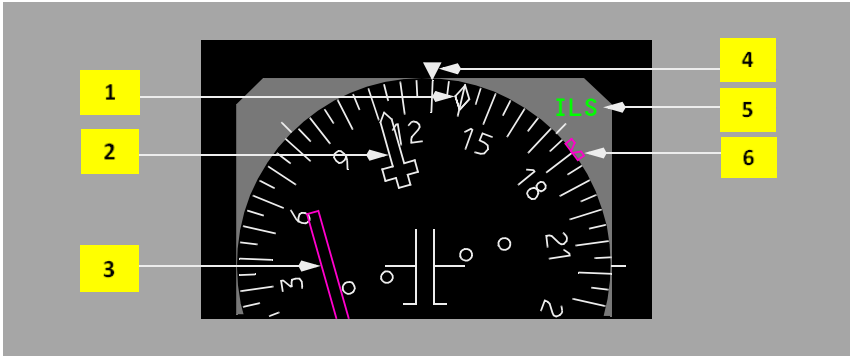
#### **3 Inner Marker (white)**

Flashes when over an inner marker beacon.

## Navigation Displays – Horizontal Situation Indicator (HSI)

### Horizontal Situation Indicator – General

The HSI displays current ADIRS heading, track and other information.



**1 Drift Angle Pointer (white)**

Indicates current drift angle or track.

**2 Selected Course Pointer (white)**

Indicates the course set on the mode control panel. Set by the related mode control panel course selector.

**3 Course Deviation Indicator (magenta)**

Indicates deviation from the selected localizer or VOR course.

**4 Heading Pointer (white)**

Indicates current heading.

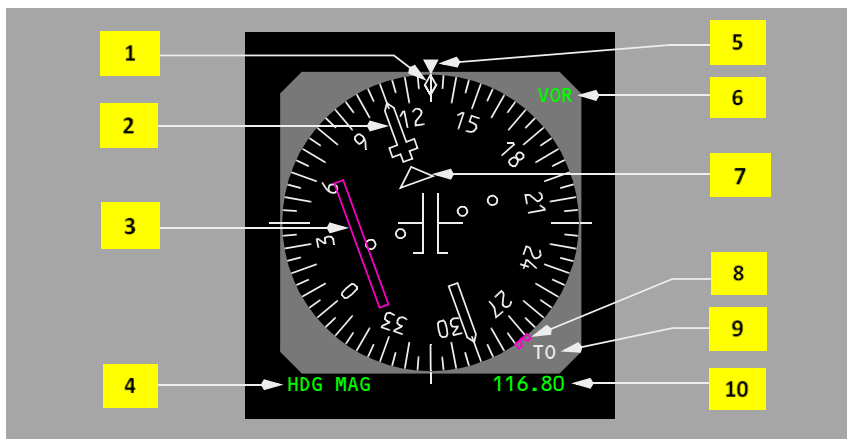
**5 Lateral Deviation Source Annunciation (green)**

Identifies the selected navigation source as VOR or ILS.

**6 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.

## Horizontal Situation Indicator – Compact Display



### 1 Drift Angle Pointer (white)

Indicates current drift angle or track.

### 2 Selected Course Pointer (white)

Indicates the course set on the mode control panel. Set by the related mode control panel course selector.

### 3 Course Deviation Indicator (magenta)

Indicates deviation from the selected localizer or VOR course.

### 4 Magnetic/True Heading Annunciation (green)

Indicates the HSI reference:

- HDG MAG (green) indicates display is oriented relative to magnetic north
- TRU HDG (green) indicates display is oriented relative to true north; a white box is displayed continuously around TRU HDG
- transition from TRU HDG to HDG MAG results in a green box around HDG MAG for 10 seconds
- when TRU HDG is displayed and the airplane descends more than 2000 feet at a descent rate greater than  $-800$  feet per minute, an amber box is drawn around TRU HDG; the box flashes for 10 seconds, then turns steady amber.

### 5 Heading Pointer (white)

Indicates current heading.

**6 Lateral Deviation Source Annunciation (green)**

Identifies the selected navigation source as VOR or ILS.

**7 TO/FROM Pointer (white)**

**8 Selected Heading Bug (magenta)**

Indicates the heading selected on the mode control panel.

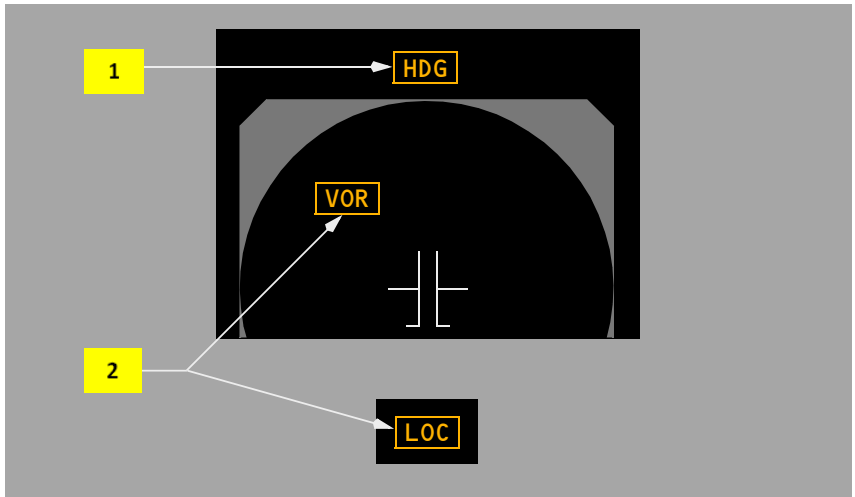
**9 TO/FROM Annunciation (white)**

**10 Frequency Display (green)**

Indicates selected navigation radio frequency.

### Horizontal Situation Indicator Failure Flags

The flags replace the horizontal situation indicator displays to indicate source system failure or lack of computed data.



**1 Heading Failure Flag (amber)**

The heading source has failed. The compass rose is removed.

**2 VOR/LOC Failure Flag (amber)**

The airplane navigation data source has failed.

## Navigation Displays – Radio Distance Magnetic Indicator (RDMI)

### Radio Distance Magnetic Indicator – General

The RDMI provides the same information as a conventional RDMI.



#### 1 DME Indications (white)

Displayed if DME information is available from the navigation aid tuned in the VHF navigation control panel.

#### 2 Bearing Pointers (VOR source–green, ADF source–cyan)

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

#### [Aircraft with 2 ADF receivers]

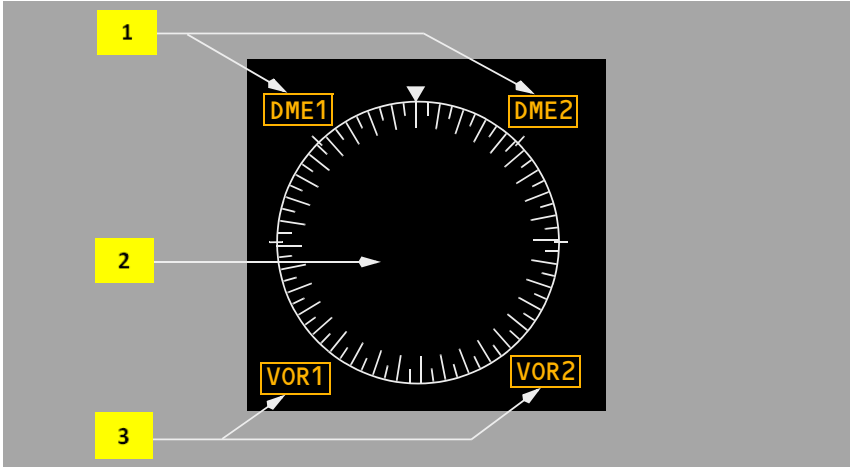
- wide pointer uses signals from the VHF NAV receiver No. 2 or ADF receiver No. 2.

#### 3 Bearing Source Indications (VOR source–green, ADF source–cyan)

- indicates “OFF” (white) if related VOR/ADF switch on the EFIS control panel is in the OFF position

## Radio Distance Magnetic Indicator Failure Flags

The flags replace the RDMI displays to indicate source system failure.



**1 DME Failure Flags (amber)**

The DME system has failed.

**2 Heading Failure**

The heading display is removed if heading information has failed.

**3 VOR, ADF Failure Flags (amber)**

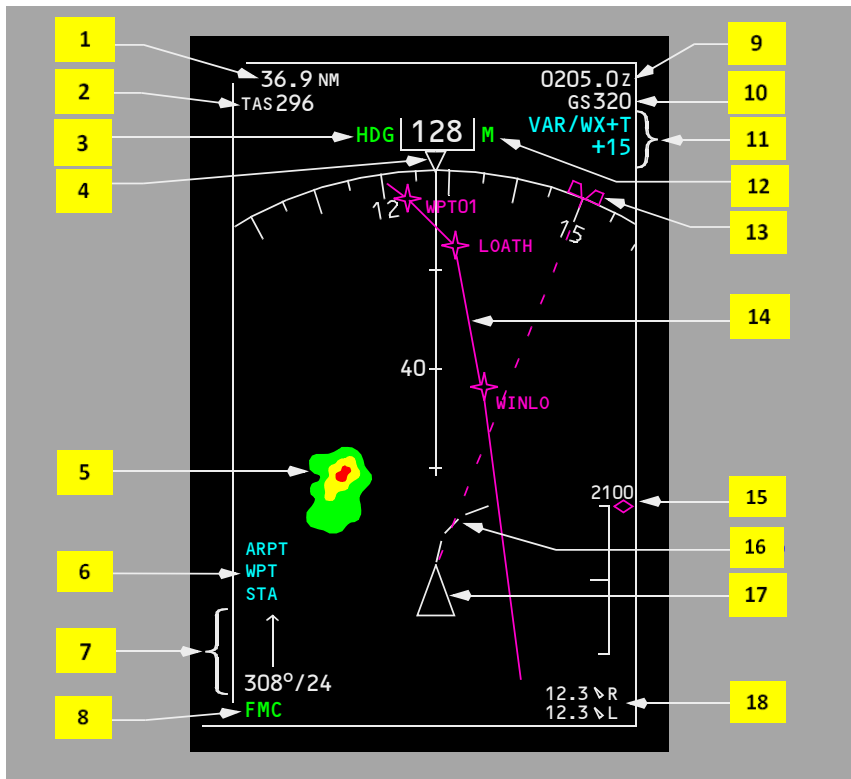
The selected VOR or ADF information is invalid.



## Navigation Displays – MAP Mode

### Expanded MAP Mode

[Aircraft with Heading-up display, weather radar range marks, single FMC]



1 Distance to Next Active Waypoint

2 True Airspeed

3 Current Heading

[Aircraft with Heading-up display]

4 Heading Pointer

**5 Weather Radar Returns**

**6 MAP Options**

**7 Wind Direction and Speed**

**8 MAP Source Annunciation**

**9 Estimated Time of Arrival at Next Active Waypoint**

**10 Groundspeed**

**11 Weather Radar Annunciations**

**12 Magnetic/True Reference**

**13 Selected Heading Bug**

**14 Active LNAV Route**

**15 Vertical Deviation Scale and Pointer**

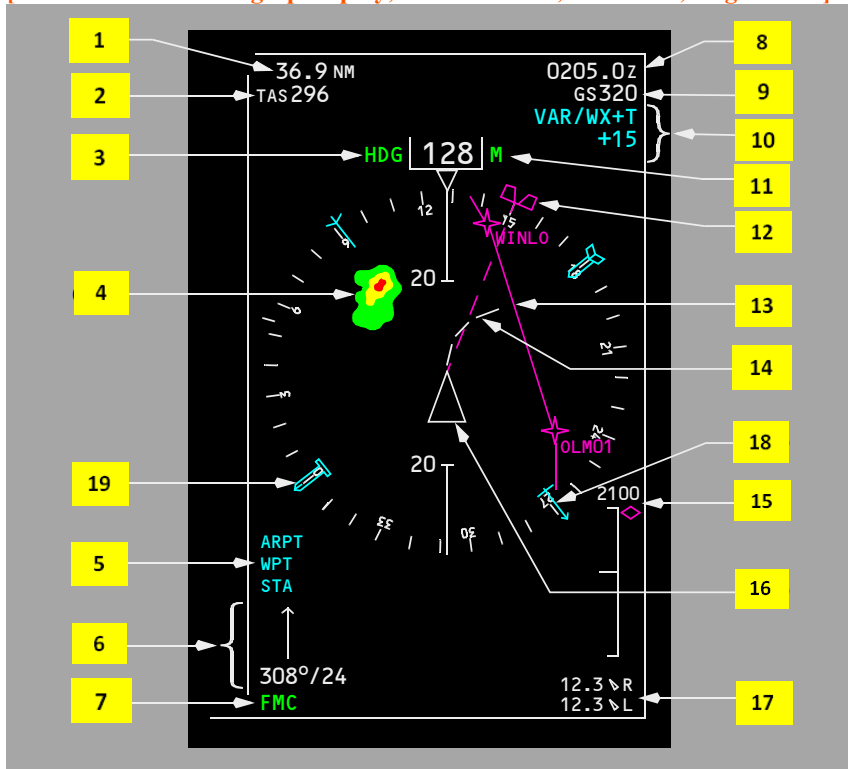
**16 Position Trend Vector**

**17 Airplane Symbol**

**18 Position Difference Display**

## Center MAP Mode

[Aircraft with Heading-up display, full-time ADF, dual ADF, single FMC]



1 Distance to Next Active Waypoint

2 True Airspeed

3 Current Heading

[Aircraft with Heading-up display]

4 Weather Radar Returns

5 MAP Options

6 Wind Direction and Speed

7 MAP Source Annunciation

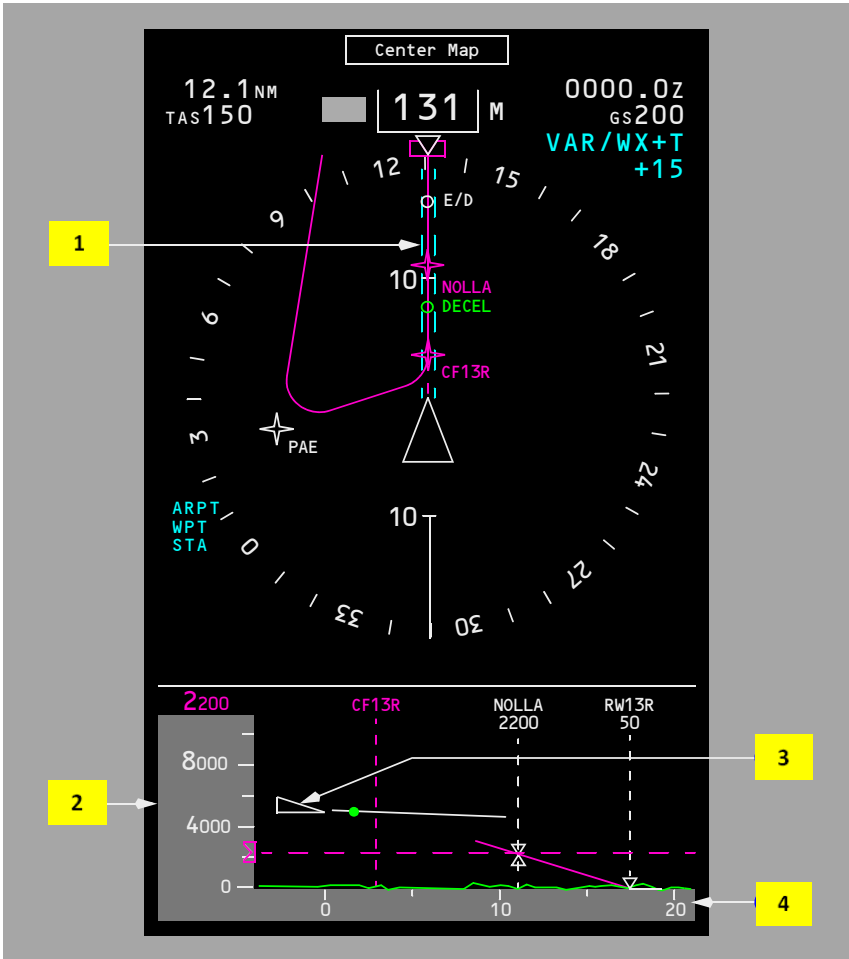
- 8 Estimated Time of Arrival at Next Active Waypoint**
- 9 Groundspeed**
- 10 Weather Radar Annunciations**
- 11 Magnetic/True Reference**
- 12 Selected Heading Bug**
- 13 Active Route**
- 14 Position Trend Vector**
- 15 Vertical Deviation Scale and Pointer**
- 16 Airplane Symbol**
- 17 Position Difference Display**
- 18 ADF1 Bearing Pointer**  
**[Aircraft with Full-time ADF]**
- 19 ADF2 Bearing Pointer**  
**[Aircraft with Full-time ADF, 2 ADF receivers]**

# Vertical Situation Display (VSD)

## [Aircraft with VSD]

The VSD represents a profile view of the airplane and its environment along the current track. Information shown within the cyan dashed lines (enroute corridor) on the ND is shown in profile on the VSD.

## Vertical Situation Display (VSD) - Reference Scales



**1 Enroute Swath**

Indicates area mapped by the VSD.

**2 Altitude Reference Scale**

Displays altitude in reference to the vertical position of the airplane symbol, terrain, and other objects in the VSD background display.

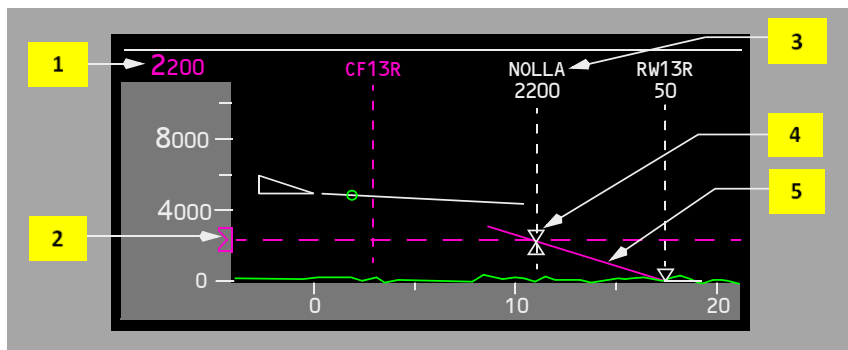
**3 Airplane Symbol**

Indicates current airplane altitude (bottom of the triangle) and lateral position (point of the triangle) relative to terrain.

**4 Horizontal Reference Scale**

Displays range in nautical miles. Actual range shown on VSD is one half the range selected on the EFIS control panel.

## Vertical Situation Display (VSD) - General Background



### 1 MCP Selected Altitude Readout

Displays the altitude set in the MCP altitude window.

### 2 Selected Altitude Bug

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, with only one half the bug visible. The dashed line does not park.

### 3 Waypoint ID and Anchor Line

Displayed with any altitude constraint directly beneath. Dashed vertical line depicts lateral position. Conditional waypoints are depicted as a dashed vertical line only.

### 4 Altitude Constraint Symbol

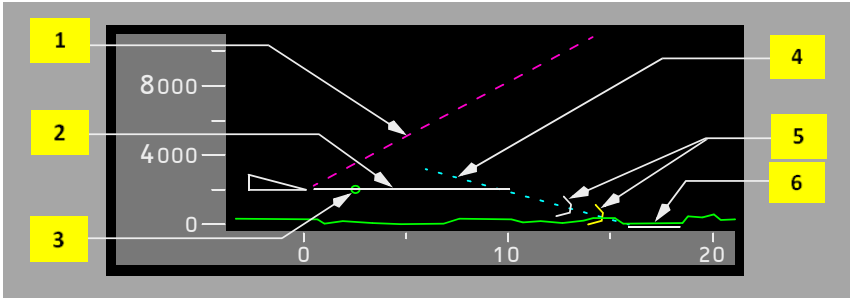
Displayed as triangle(s).

### 5 FMC Approach Glidepath Angle Line

Displayed for approaches that include a designated approach angle.

- extends 10 NM for situational awareness.
- anchored to the missed approach waypoint, not the runway.

## Vertical Situation Display (VSD) - Flight Path Background



### 1 MCP Selected Vertical Speed (V/S)

Displays the selected vertical speed as a dashed target angle line when the MCP V/S mode is selected.

### 2 Vertical Flight Path Vector

Indicates current flight path angle as a function of vertical speed and ground speed. The length of the vector is fixed at one half of the VSD range.

### 3 Range to Target Speed Dot (RTSD)

Indicates where the airplane will achieve the FMC or MCP target speed.

- dot is blanked within 5 knots of target speed.
- dot reappears if speed increases 10 knots or more faster than target speed.
- replaced with an unfilled dot at vector end if target speed will not be achieved within length of the vertical flight path vector line.

### 4 3-Degree Reference Line

Displayed for approaches that do not have a designated approach angle.

- dashed line extends 10 NM for situational awareness.
- anchored to the runway threshold.
- for reference only, line may intersect terrain.

### 5 Decision Gates

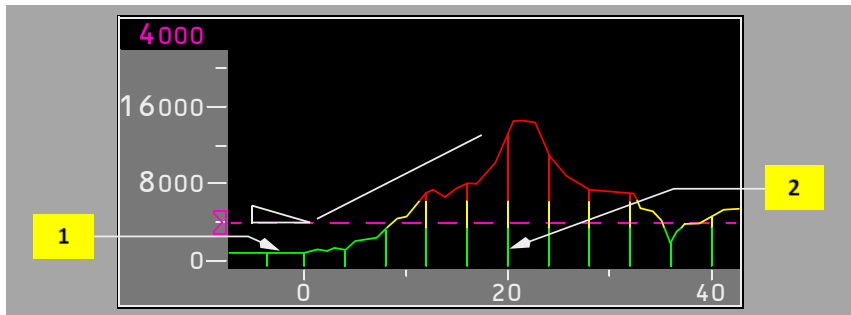
Displayed on the FMC approach glidepath angle line or 3 degree reference line at 500 feet and 1000 feet above field elevation.

### 6 Runway

Represents the selected runway.



## Vertical Situation Display (VSD) - Terrain Background



### 1 Terrain Profile Line

Represents the highest terrain within the enroute swath.

- highest points of the terrain below and ahead of the airplane.
- terrain is depicted so the true altitude separation between the airplane and terrain is shown.
- terrain behind the airplane is drawn equal to the terrain at the current position.
- VSD terrain uses the same color coding that is used to depict EGPWS terrain on the lateral map:
  - green: terrain 250-500 feet or more below the airplane.
  - amber: terrain from 250-500 feet below to 2000 feet above the airplane.
  - red: terrain more than 2,000 feet above the airplane.

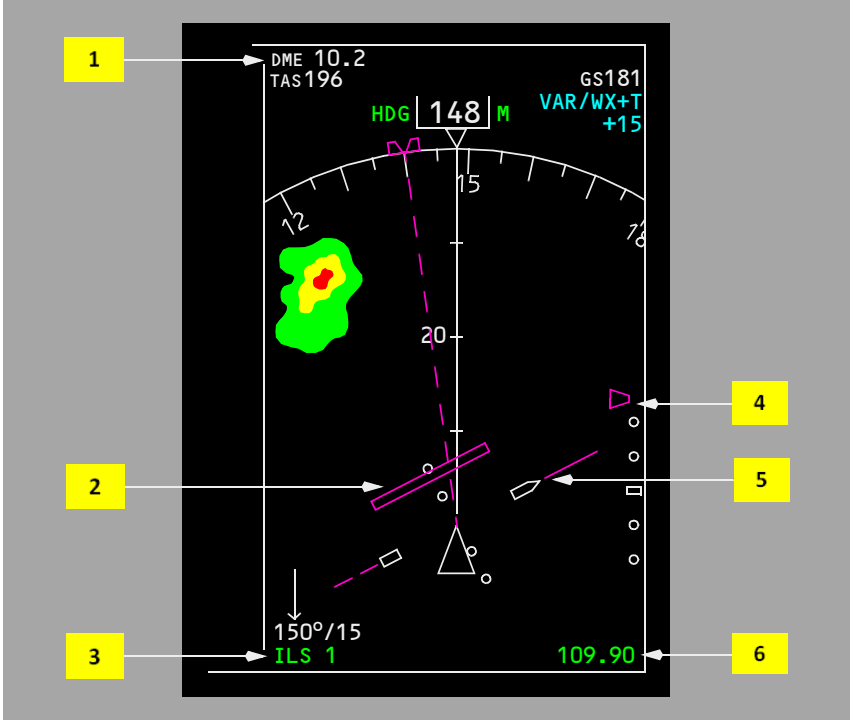
### 2 Vertical Support Lines

Vertical terrain vectors placed at constant intervals along the terrain profile line.

# Navigation Displays – Approach Mode

## Expanded Approach Mode

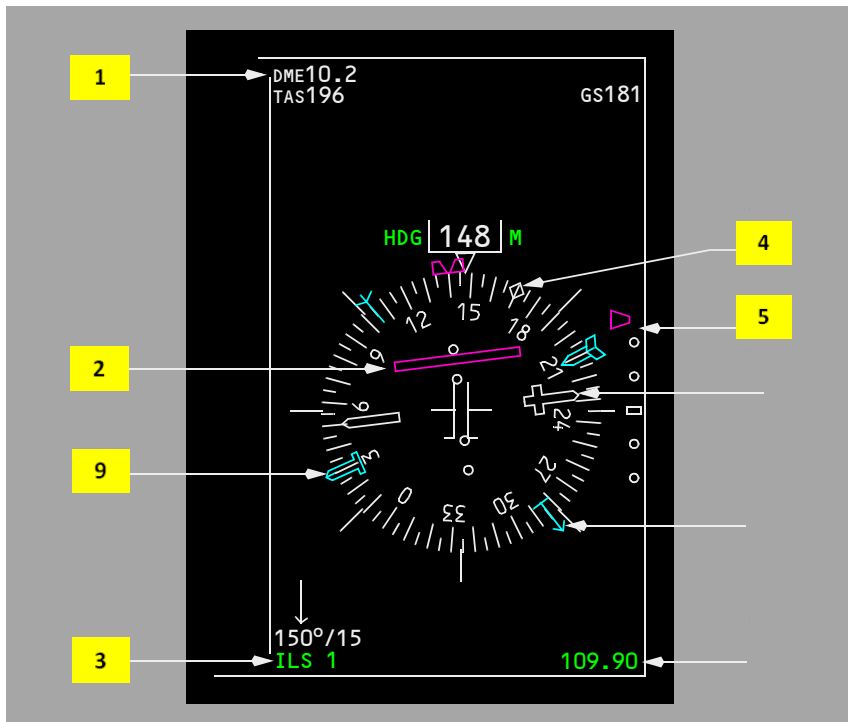
[Aircraft with Weather radar range marks]



- 1 Reference ILS DME
- 2 Localizer Deviation Indication and Scale
- 3 Reference ILS Receiver
- 4 Glide Slope Pointer and Scale
- 5 Selected Course Pointer
- 6 Reference ILS Frequency

## Center Approach Mode

[Aircraft with Dual ADF]



1 Reference ILS DME

7 Reference ILS Frequency

2 Localizer Deviation Indication and Scale

8 ADF1 Bearing Pointer

3 Reference ILS Receiver

9 ADF2 Bearing Pointer

4 Drift Angle Pointer

[Aircraft with Dual ADF]

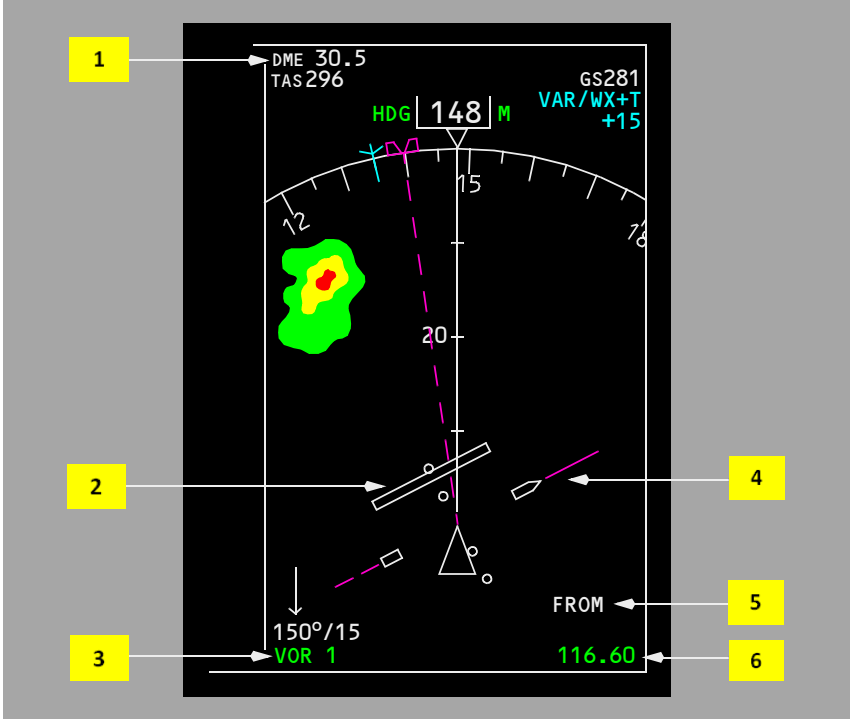
5 Glide Slope Pointer and Scale

6 Selected Course Pointer

# Navigation Displays – VOR Mode

## Expanded VOR Mode

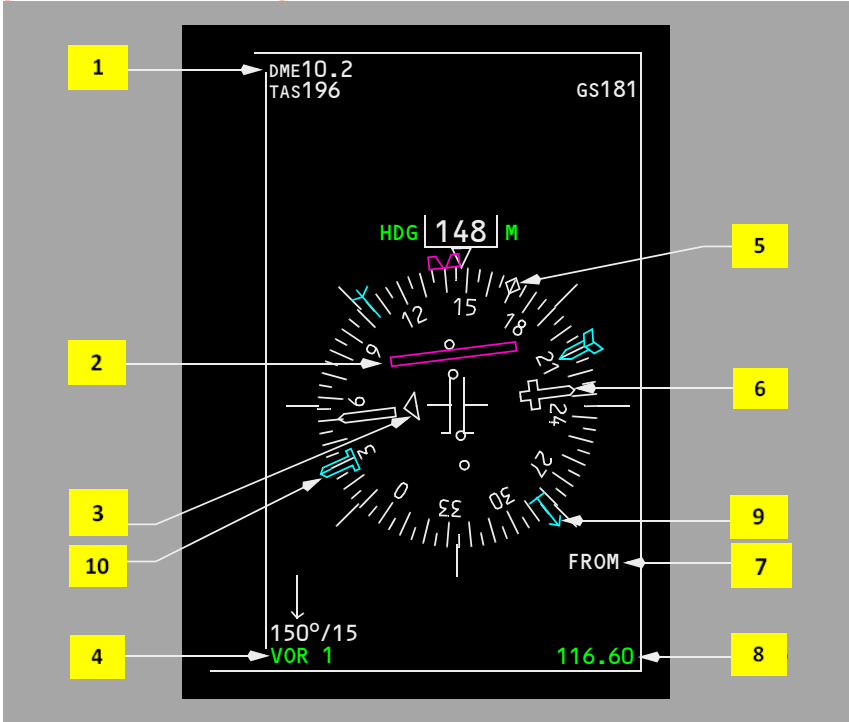
[Aircraft with Weather radar range marks]



- 1 Reference VOR DME
- 2 Lateral Deviation Indication and Scale
- 3 Reference VOR Receiver
- 4 Selected Course Pointer
- 5 TO/FROM Indication
- 6 Reference VOR Frequency

# Center VOR Mode

[Aircraft with Dual ADF]



- 1** Reference VOR DME
- 2** Lateral Deviation Indication and Scale
- 3** TO/FROM Pointer
- 4** Reference VOR Receiver
- 5** Drift Angle Pointer
- 6** Selected Course Pointer
- 7** TO/FROM Indication

**8 Reference VOR Frequency**      **9 ADF1 Bearing Pointer**

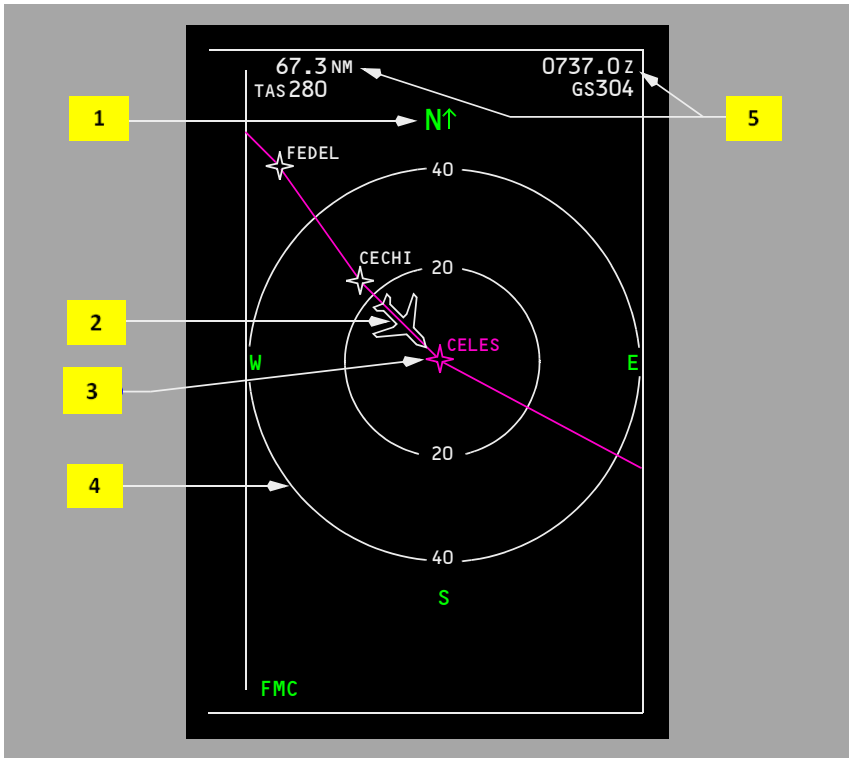
**10 ADF2 Bearing Pointer**

[Aircraft with Dual ADF]

## Navigation Displays – Plan Mode

### Plan Mode

[Aircraft with Single FMC]



**1 True North Up Arrow**      **4 Range Circle**

**2 Airplane Symbol**      **5 Active Waypoint Information**

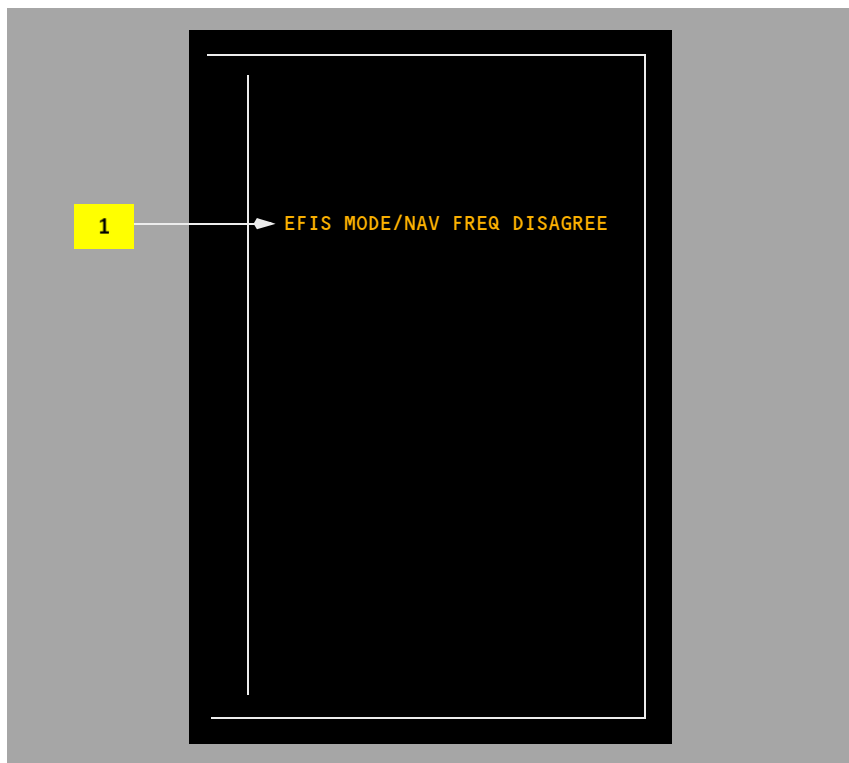
Denotes current position and true heading. Symbol does not display north of 82N latitude or south of 82S latitude.

**3 Center Waypoint**

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

## Navigation Displays – Advisory Messages

### Mode/Frequency Disagree Annunciation

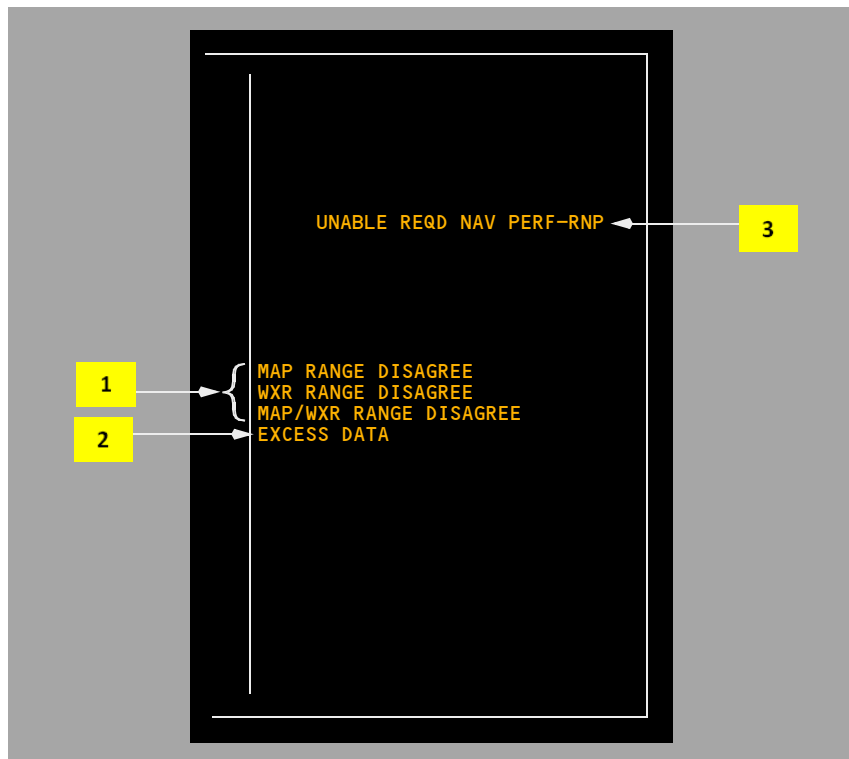


#### 1 Mode/Frequency Disagree Annunciation (amber)

Indicates APP is selected with a VOR frequency tuned, or VOR is selected with an ILS frequency tuned.

- the annunciation only applies to an on-side comparison of the EFIS control panel mode and tuned VOR/ILS frequency
- applicable to expanded and center APP and VOR modes
- dashes displayed on DME display and ILS/VOR frequency display
- localizer deviation bar, VOR course deviation bar, and glide slope pointer (for APP mode) are not displayed.

## Navigation Advisory Messages



### 1 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the WXR display range.

MAP/WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and WXR display ranges.

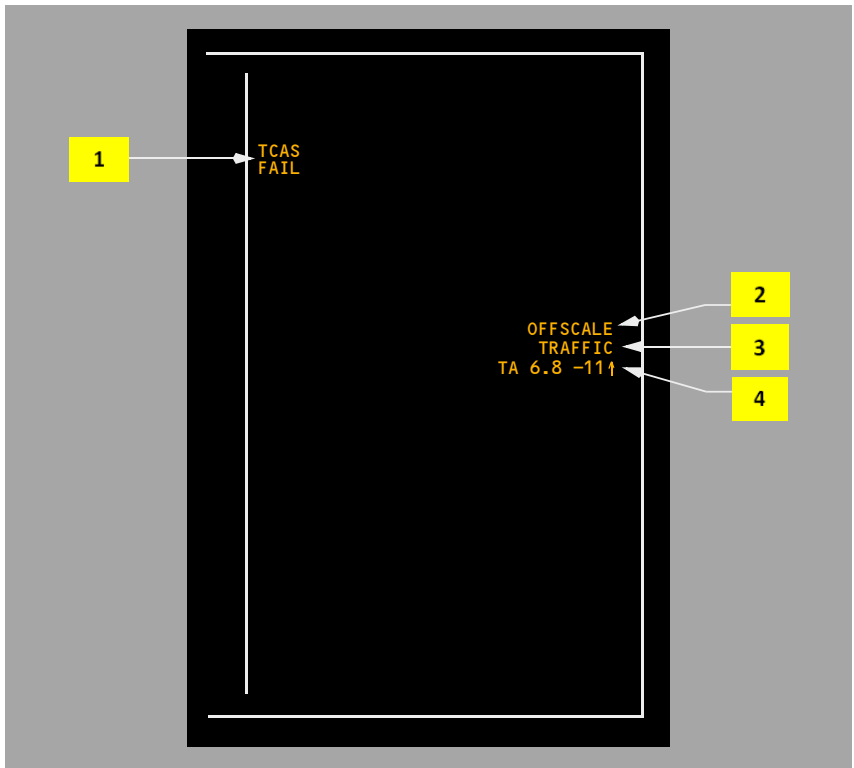
### 2 EXCESS DATA Annunciation (amber)

The amount of data sent to the navigation display exceeds the display capability.

### 3 Nav Advisory Message (amber)

UNABLE REQD NAV PERF-RNP – Displayed in MAP or Center MAP during approach.





**1 TCAS Annunciations**

TFC (cyan) – TFC selected on the EFIS control panel in Expanded MAP, Center MAP, Expanded APP or Expanded VOR modes.

TCAS TEST (cyan) – TCAS in test mode.

TCAS FAIL (amber) – TCAS has failed.

TA ONLY (cyan) – TCAS TA only mode.

TCAS OFF (amber) – TCAS off.

**2 OFFSCALE (red or amber)**

TA (amber) or RA (red) is beyond the display range.

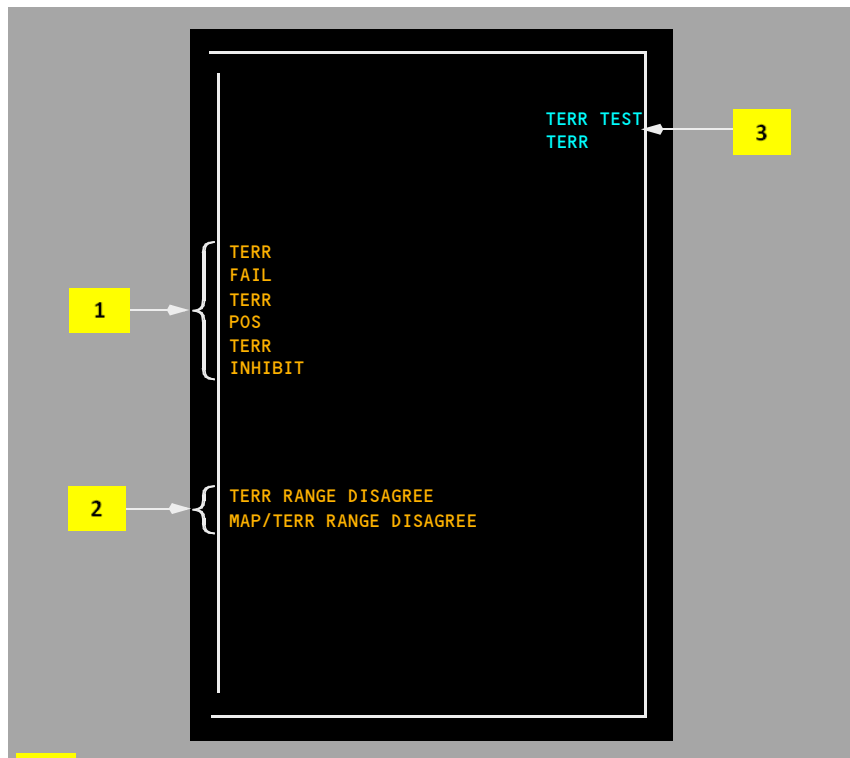
**3 TRAFFIC (red or amber)**

Displayed during a TA (amber) or RA (red) condition.

**4 No Bearing Message (red or amber)**

Displayed when no bearing information is available for traffic.

## Look-Ahead Terrain Messages (GPWS)



### 1 Terrain Status Annunciation (amber)

TERR FAIL – Look-ahead terrain alerting and display have failed.

TERR POS – Look-ahead terrain alerting and display unavailable due to position uncertainty.

TERR INHIBIT – GPWS terrain inhibit switch in TERR INHIBIT position.

### 2 Terrain Range Status Annunciation (amber)

TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range.

MAP/TERR RANGE DISAGREE –

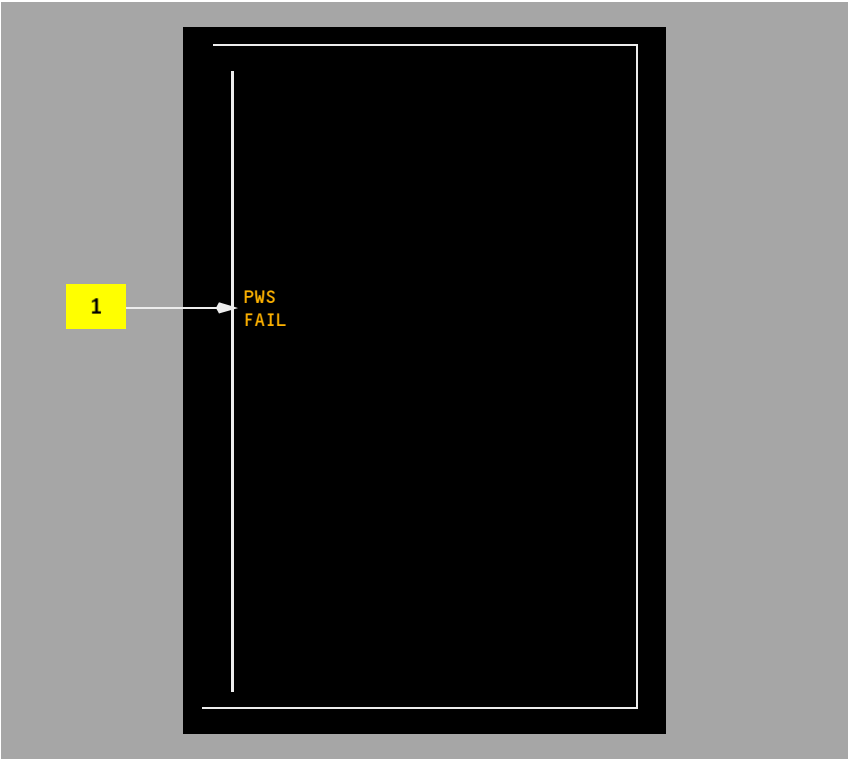
- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range, and
- map display output range disagrees with selected EFIS control panel range.

### 3 Terrain Mode Annunciation (cyan)

TERR TEST – GPWS is operating in self-test mode.

TERR – Terrain display enabled (manual or automatic display).

### Predictive Windshear System (PWS) Message



**1 PWS FAIL Annunciation (amber)**

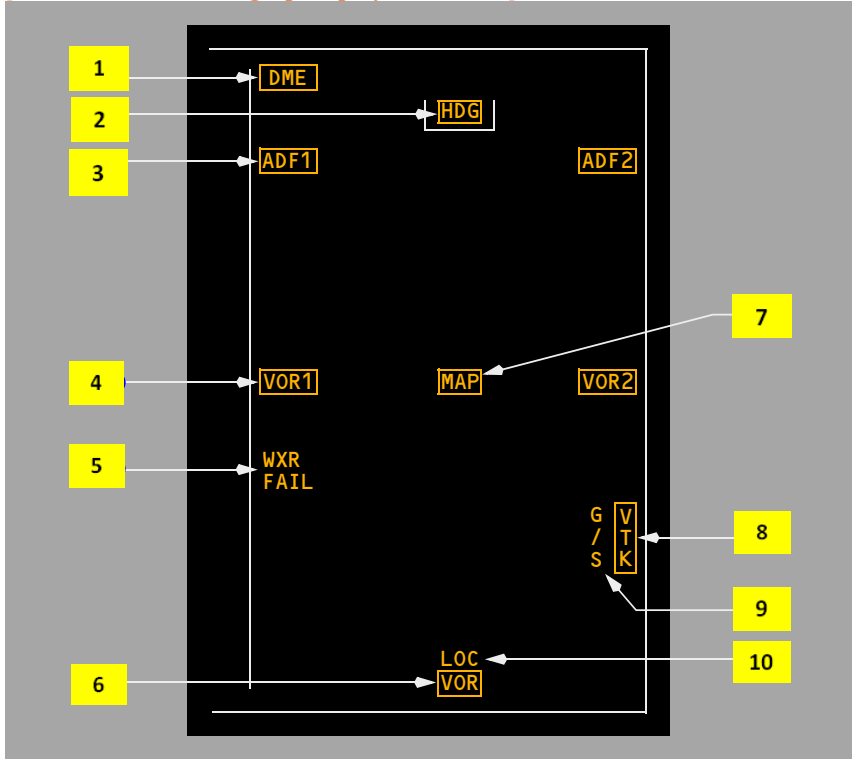
Predictive windshear alerting and display have failed.

## Navigation Displays – Failure Indications and Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

### Failure Flags – Expanded MAP, Center MAP, Expanded APP, Expanded VOR Modes

[Aircraft with Heading-up display, dual ADF]



#### 1 DME Failure Flag (APP and VOR modes)

DME display has failed.

#### 2 Heading Failure Flag (MAP, APP and VOR modes)

[Aircraft with Heading-up display]

Heading display has failed.

**3 ADF Failure Flag (MAP, APP and VOR modes)**

**[Aircraft with Full time ADF in MAP mode]**

ADF display has failed.

**4 VOR Failure Flag (MAP modes)**

EFIS control panel POS switch selected and VOR display failed.

**5 Weather Radar Annunciations (MAP, APP and VOR modes)**

WXR FAIL – Weather radar has failed. No weather data are displayed.

WXR WEAK – Weather radar calibration fault.

WXR ATT – Attitude stabilization for antenna has been lost.

WXR STAB – Antenna stabilization is off.

WXR DSP – Display unit cooling has been lost or an overheat condition has occurred. Weather radar display is blanked.

**6 VOR Failure Flag (VOR modes)**

VOR display has failed.

**7 MAP Failure Flag (MAP modes)**

The related FMC generated map display has failed.

**8 Vertical Track Failure Flag (MAP modes)**

FMC vertical track data are invalid.

**9 ILS Glide Slope Failure Flag (APP modes)**

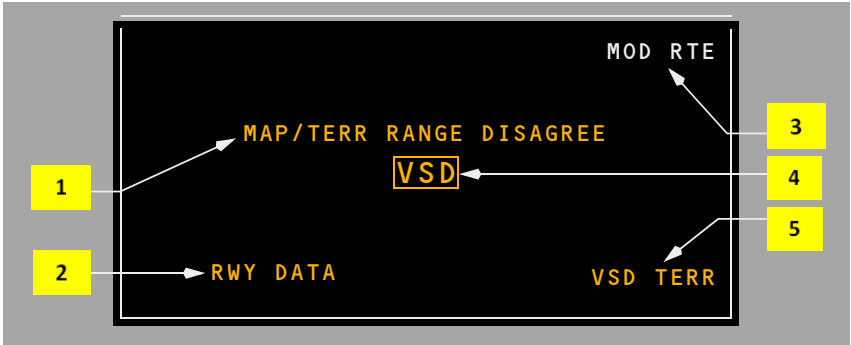
ILS glide slope display has failed.

**10 ILS Localizer Failure Flag (APP modes)**

ILS localizer display has failed.

# Vertical Situation Display (VSD)

[Aircraft with VSD]



## 1 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the Terrain display range.

MAP/TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and Terrain display ranges.

## 2 Runway Data Annunciation (amber)

FMC runway data is not available.

## 3 Route Waypoints Modification Annunciation (white)

FMC active route is being modified. Only active waypoint is displayed.

## 4 VSD Failure Flag (amber)

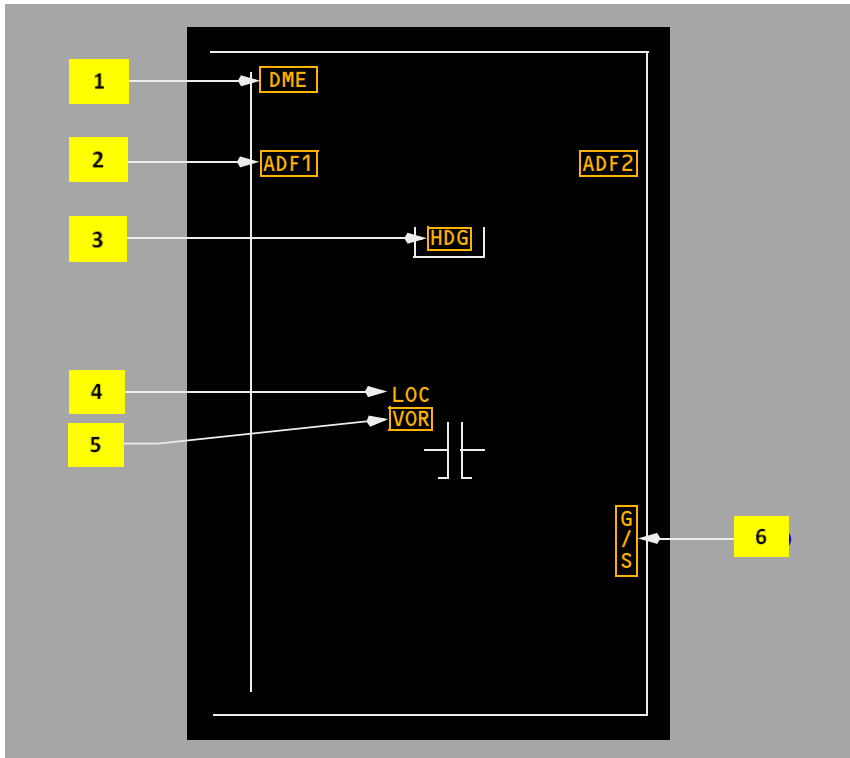
VSD cannot be displayed.

## 5 Terrain Data Failure Annunciation (amber)

EGPWS terrain data is not available. Annunciation is replaced with VSD TERR INHIBIT when GPWS control panel TERR INHIBIT switch is in the inhibit position.

## Failure Flags – Center APP and Center VOR Modes

[Aircraft with Dual ADF]



**1 DME Failure Flag (APP and VOR modes)**

DME display has failed.

**2 ADF Failure Flag (APP and VOR modes)**

ADF display has failed.

**3 Heading Failure Flag (APP and VOR modes)**

Heading display has failed.

**4 ILS Localizer Failure Flag (APP modes)**

ILS localizer display has failed.

**5 VOR Failure Flag (VOR modes)**

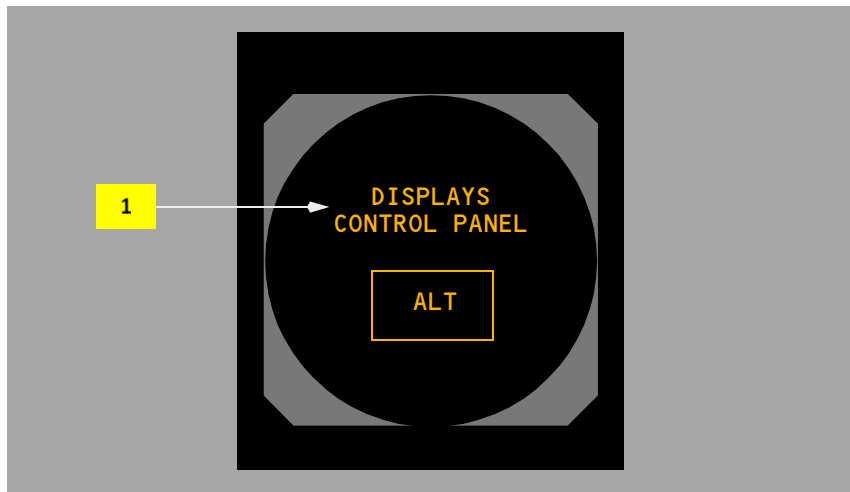
VOR display has failed.

**6 ILS Glide Slope Failure Flag (APP modes)**

ILS glide slope display has failed.

## Additional Flags and Annunciations

### Displays Control Panel Annunciation



#### **1** Displays Control Panel Annunciation (amber)

With the CONTROL PANEL select switch on the overhead panel in:

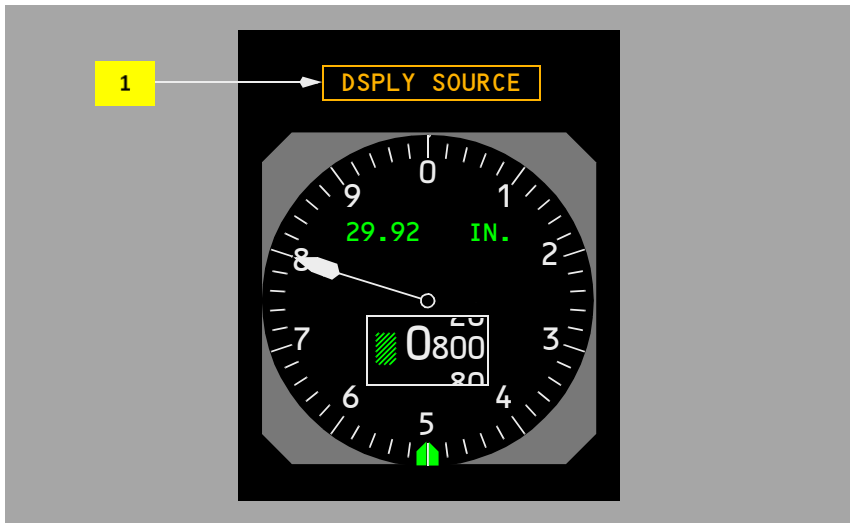
- BOTH ON 1 - left (Capt) EFIS control panel has failed
- NORMAL - corresponding EFIS control panel has failed
- BOTH ON 2 - right (F/O) EFIS control panel has failed.

Altitude information is removed.



## Display System Annunciations

**Note:** The following annunciations occupy the same display location above the altimeter.



### 1 Display System Annunciations

**DSPLY SOURCE (amber)** – A single DEU has been selected, either manually or automatically, to drive all six display units.

- If the DEU fails on the same side as the engaged autopilot during climb or descent –

#### [Aircraft with Split axis command bars]

- the flight director pitch command bars are removed from both pilots' displays. The pitch command bars reappear at ALT ACQ
- the pitch mode reverts to CWS pitch
- the autopilot remains engaged.
- If the DEU fails on the same side as the engaged autopilot during level flight –
  - climb or descent to a new MCP altitude is not possible in LVL CHG, VNAV, or V/S modes with the autopilot engaged.
- If the DEU fails on the opposite side as the engaged autopilot or while in manual F/D mode during climb or descent –

#### [Aircraft with Split axis command bars]

- the flight director pitch command bar is removed from the pilot's display on the failed side until ALT ACQ

- climb or descent is possible in LVL CHG, VNAV or V/S modes with the autopilot engaged.
- If the DEU fails on the same side as the engaged autopilot in the APPROACH mode –

**[Aircraft with Split axis command bars]**

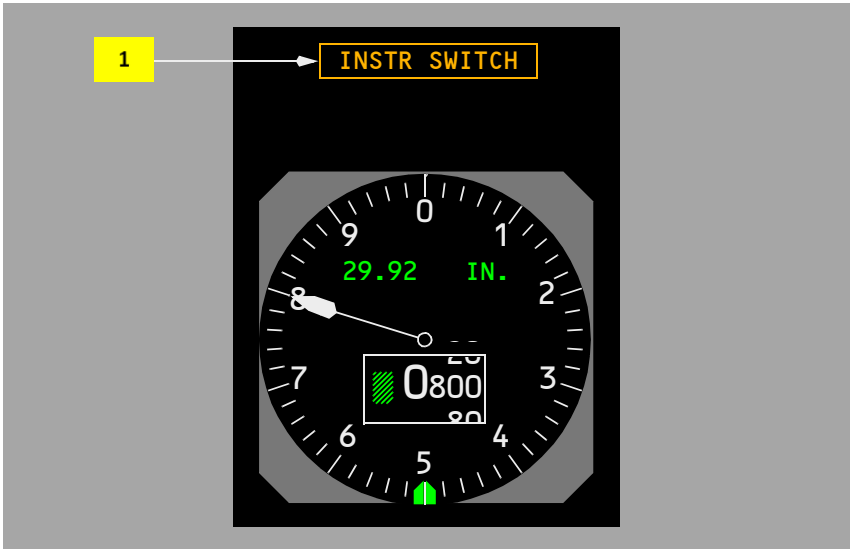
- the flight director pitch and roll command bars are removed from the pilot’s display on the failed side.

**[Aircraft with With CDS Block software upgrade]**

CDS MAINT (white) – A dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

CDS FAULT (amber) – A non–dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

**Instrument Switch Annunciation**

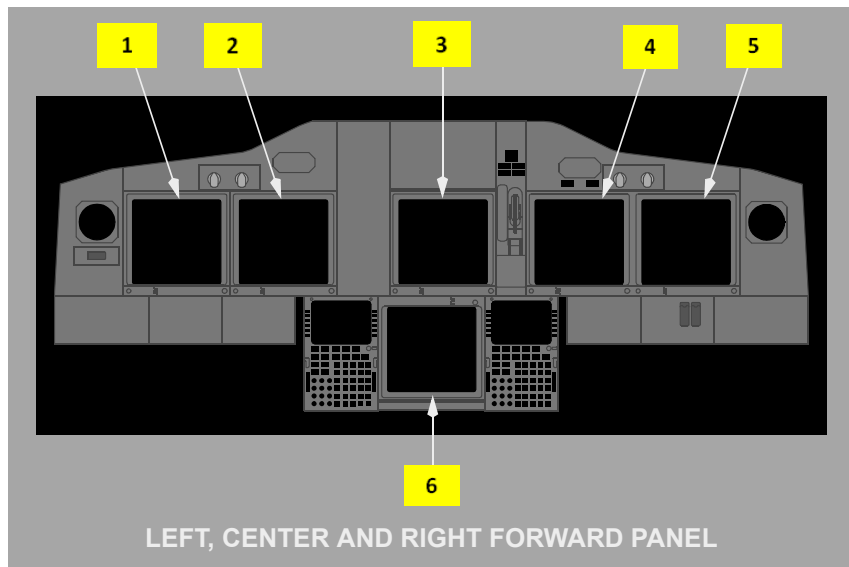


**1 INSTR SWITCH Annunciation (amber)**

Indicates both the Captain’s and First Officer’s displays are using the same source of IRU data. Displayed when the IRS switch on the overhead panel is not in the NORMAL position.

## PFD/ND Display System – Overview

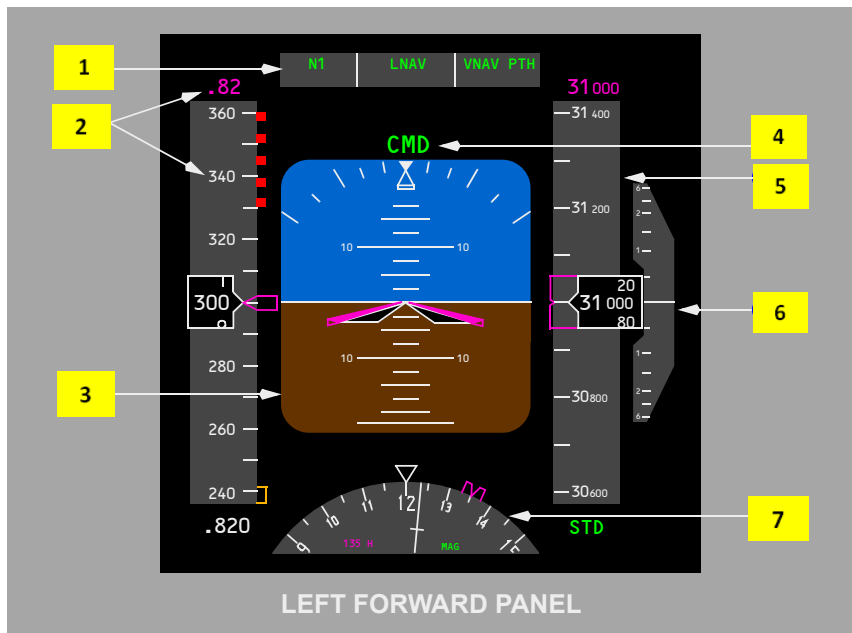
### Display Units



- 1 Captain Outboard Display Unit
- 2 Captain Inboard Display Unit
- 3 Upper Display Unit
- 4 First Officer Inboard Display Unit
- 5 First Officer Outboard Display Unit
- 6 Lower Display Unit

## Captain Outboard Display

[Aircraft with Integrated cue command bar]



**1** Flight Mode Annunciator

**2** Airspeed/Mach Indications

**3** Attitude Indications

**4** Autopilot, Flight Director System Status

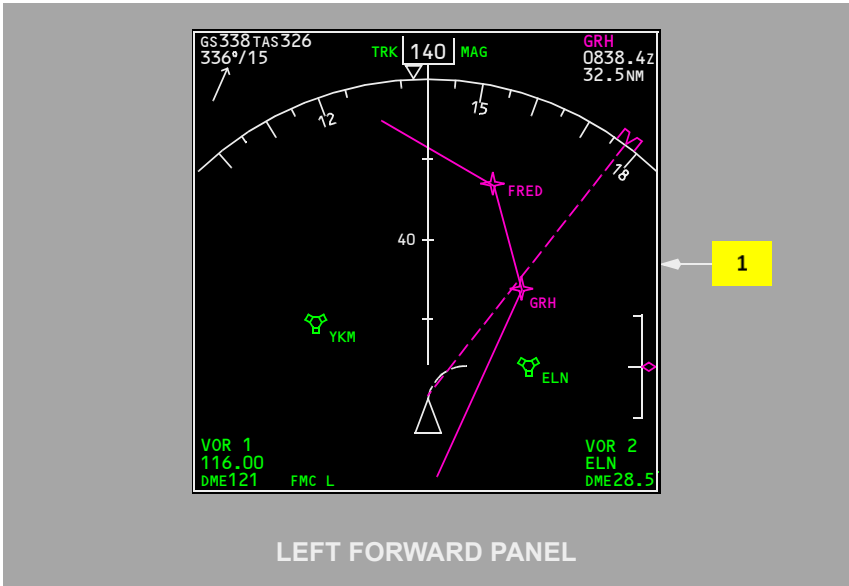
**5** Altitude Indications

**6** Vertical Speed Indications

**7** Heading/Track Indications

# Captain Inboard Display

[Aircraft with Track-up display, dual FMC]



## 1 Navigation Display

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

# First Officer Inboard Display

[Aircraft with Track-up display, dual FMC]

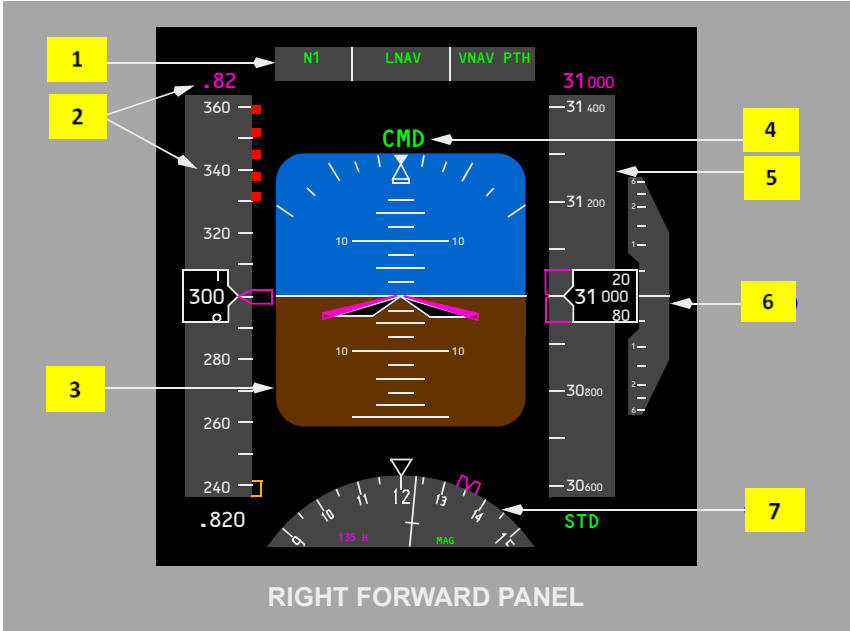


## 1 Navigation Display

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

# First Officer Outboard Display

[Aircraft with Integrated cue command bar]

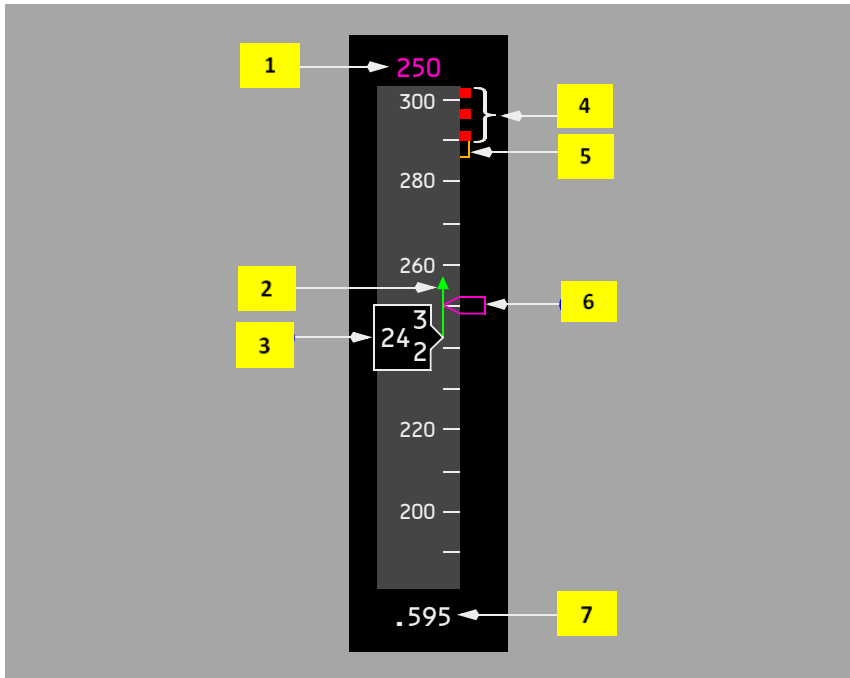


- 1 Flight Mode Annunciator
- 2 Airspeed/Mach Indications
- 3 Attitude Indications
- 4 Autopilot, Flight Director System Status
- 5 Altitude Indications
- 6 Vertical Speed Indications
- 7 Heading/Track Indications

## Primary Flight Display (PFD)– PFD Airspeed Indications

### PFD Airspeed Indications – General

The PFD airspeed indication displays air data inertial reference system (ADIRS) airspeed and other airspeed related information.



#### 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 predicted airspeed in the next 10 seconds based on the current airspeed and acceleration.



### 3 Current Airspeed (white)

Indicates current calibrated airspeed in knots.

#### [Aircraft with Low airspeed alert]

When current airspeed decreases into the minimum maneuver speed amber bar:

- airspeed readout box turns amber and flashes for 10 seconds.
- box returns to white when airspeed is above minimum maneuver speed.

### 4 Maximum Speed (red and black)

Bottom of the bar indicates the maximum speed as limited by the lowest of the following:

- Vmo/Mmo
- landing gear placard speed
- flap placard speed.

### 5 Maximum Maneuvering 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 (white)

#### [Option - Without groundspeed displayed]

Indicates current Mach number:

- displays when airspeed is 0.40 Mach and above
- blanks when airspeed decreases below 0.40 Mach.

**7 Current Mach/Groundspeed (white)**

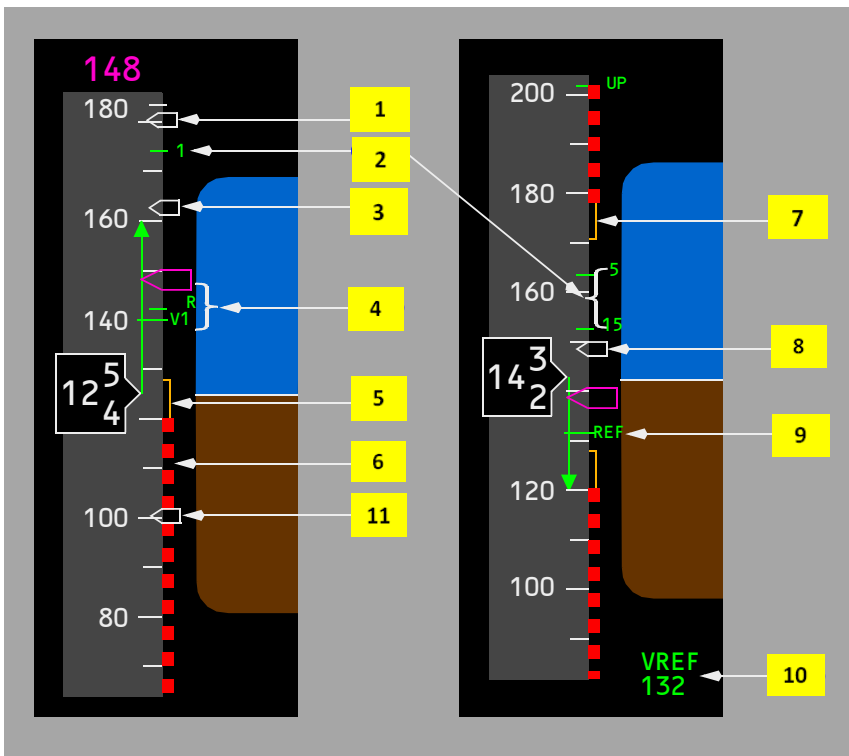
**[Aircraft with groundspeed displayed]**

Indicates current Mach or groundspeed:

- displays Mach when airspeed is 0.40 Mach and above
- displays groundspeed when airspeed decreases below 0.40 Mach
- when transitioning from Mach to groundspeed or from groundspeed to Mach, a white box shows around the numeric value for 10 seconds.

**PFD Airspeed Indications – Takeoff and Approach**

**[Aircraft with 100 knot airspeed bug]**



**1 Bug 5 (white)**

Displayed if speed reference selector on the engine display control panel is in the bug 5 position or SET position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

## 2 Flaps Maneuvering Speeds (green)

Indicates flap maneuvering speed for the displayed flap position:

- displayed after gross weight is entered in the CDU or after takeoff gross weight is set with the speed reference selector
- when the V2+15 bug is displayed for takeoff, the flap maneuvering speed bug for the current flap setting is not displayed, except for flaps 1 takeoff.
- numbered flap maneuvering speed bugs are removed when flap lever is moved to flaps 30 or 40
- flap bugs inhibited if less than VREF +4
- UP bug not displayed above approximately 20,000 feet altitude.

## 3 V2+15 (white)

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered in the CDU.

## 4 Takeoff Reference Speeds (green)

Indicates V1 (decision speed) and VR (rotation speed) as selected on the CDU TAKEOFF REF page or as set with the speed reference selector on the engine display control panel:

- amber NO VSPD is displayed on the ground if V1 or VR is not selected on the CDU or is not set with the speed reference selector
- displayed for takeoff when speed is greater than 80 knots
- removed at lift-off
- V1 speed is displayed at the top of airspeed indication when selected and value is off scale.

### [Aircraft with V1 aural alert]

- V1 is automatically called out by voice aural.

**Note:** The Look Ahead Terrain Alerting system must be incorporated for the automatic V1 aural callout to be functional.

## 5 Minimum Maneuver Speed (amber)

Top of bar indicates minimum maneuver speed for full maneuver capability and provides 40° bank capability in 1g flight to stick shaker or initial buffet.

Inhibited on takeoff until first flap retraction or valid VREF entered.

## 6 Minimum Speed (red and black)

Top of bar indicates the speed at which stick shaker occurs.

## 7 Maximum Maneuvering Speed (amber)

### [Aircraft with CDS Software Upgrade]

When flaps are not up, bottom of the bar indicates flap limit placard speed for the next normal flap setting. The display logic is based on a normal flap setting sequence of 1, 5, 15, 30. The bar is removed when the flap lever is moved to the landing flap selected on the APPROACH REF page or when the flap lever is moved to flaps 40.

## 8 VREF+20 (white)

### [Aircraft with VREF+20 airspeed bug for -800/900]

Displayed after selection of VREF.

## 9 Landing Reference Speed (green)

Indicates REF (reference speed) as selected on the CDU APPROACH REF page or as set with the speed reference selector on the engine display control panel.

REF speed is displayed at the bottom of airspeed indication when selected and value is off scale.

## 10 Speed Reference Display (green)

Displayed if the airspeed and/or weight is entered via the speed reference selector on the engine display control panel:

- on the ground, V1, VR, and takeoff gross weight may be selected; if VREF is selected, INVALID ENTRY is displayed
- in flight, VREF and landing gross weight may be selected; if V1 or VR is selected, INVALID ENTRY is displayed
- removed when the speed reference selector is moved to the SET position.

## 11 100 Knot Airspeed Bug (white)

### [Aircraft with 100 knot airspeed bug]

Indicates 100 knots:

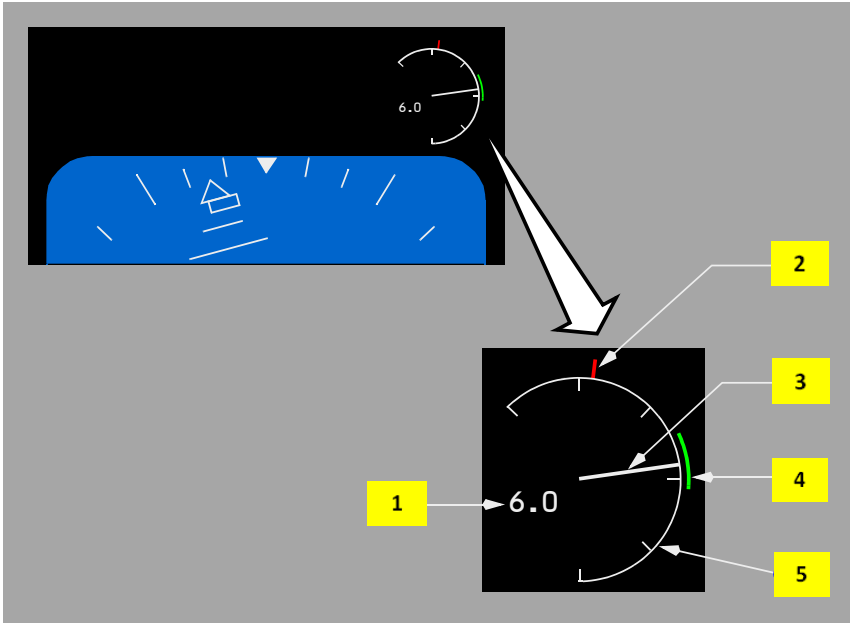
- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

## PFD Angle of Attack (AOA) Indications

### [Aircraft with AOA Indications]

#### Angle of Attack Indications - General

The angle of attack indications display ADIRU aircraft body angle of attack.



#### 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 Stick Shaker Indicator (red)

Indicates point at which stick shaker activation occurs for existing flight conditions.

Blank if AOA signal is invalid.

#### 3 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 is less than 80 knots.

**4 Approach Reference Band (green)**

Indicates appropriate range of approach AOA for a  $V_{ref}(xx) + 5$  approach.

- displayed when in normal or single engine landing flaps (15, 30, 40)
- moves with flap position
- inhibited on takeoff and initial climb.

**5 Zero Degree Reference Line (white)**

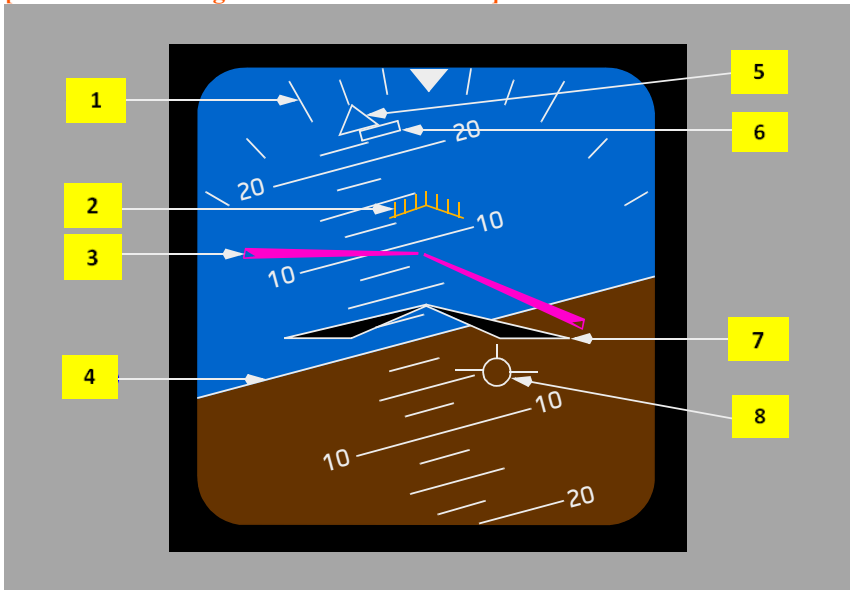
Indicates zero degrees angle of attack. Reference lines are displayed every 5 degrees from -5 degrees to +20 degrees.

**PFD – Attitude Indications**

**Attitude Indications – General**

The attitude indication displays ADIRS attitude information.

[Aircraft with Integrated cue command bar]



**1 Bank Scale (white)**

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

## 2 Pitch Limit Indication (amber)

Indicates pitch limit (stick shaker activation for existing flight conditions).

- displayed when the flaps are not up.

### [Aircraft with PLI pop-up]

- displayed at slow speeds with the flaps up.

## 3 Flight Director Bar (magenta)

Indicates flight director steering commands.

## 4 Horizon Line and Pitch Scale (white)

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

## 5 Bank Pointer

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

## 6 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.

## 7 Airplane Symbol

Indicates airplane attitude relative to the horizon.

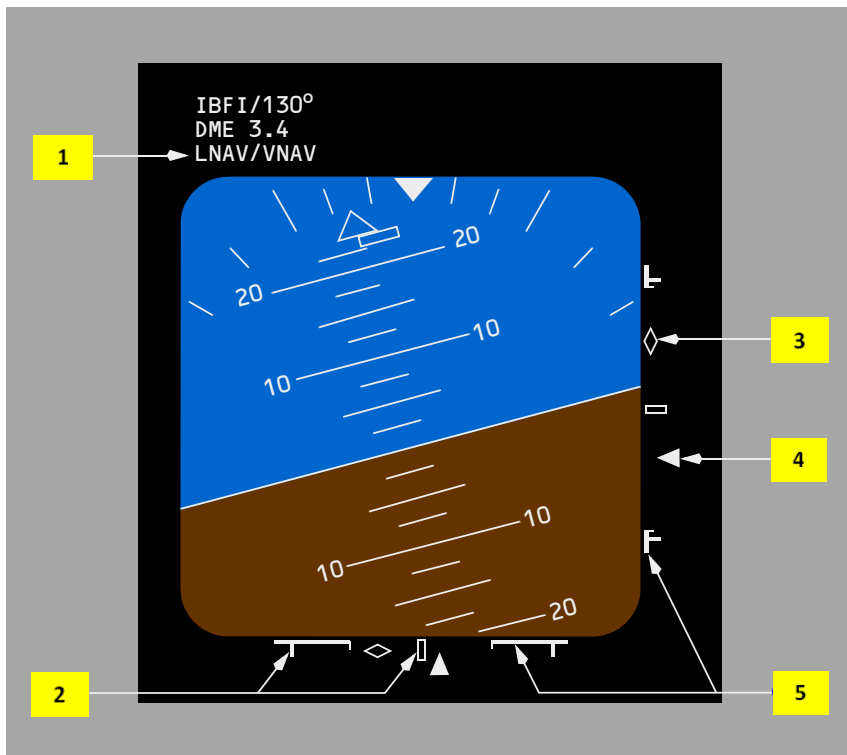
## 8 Flight Path Vector (FPV) Indication (white)

Displays flight path angle and drift when selected on the EFIS control panel:

- flight path angle is displayed relative to the horizon line
- drift angle is displayed relative to display center.

## PFID Navigation Performance Scales (NPS) Indications

[Aircraft with NPS scale and pointer]



### 1 Scale ID Annunciation (white)

- indicates the source of displayed deviation for each scale.
- displayed above the left corner of ADI.
- displayed when LNAV, VNAV, or TO/GA is engaged.
- Possible annunciations include:
  - LNAV/VNAV - (LNAV and VNAV deviations)
  - LOC/VNAV - (Localizer with VNAV deviation)
  - FAC/VNAV - (IAN final approach course with VNAV deviation)
  - LNAV/G/S - (LNAV deviation with glideslope)
  - LNAV/G/P - (LNAV deviation with IAN glidepath)
  - ILS - (ILS approach)
  - FMC - (IAN approach)
  - GLS - (GLS approach)



## 2 NPS Deviation Scale

- lateral NPS deviation scale represents current FMC lateral RNP.
- vertical NPS deviation scale represents current FMC vertical RNP.
- displayed if an approach mode is not engaged and either TO/GA, LNAV or any VNAV mode is engaged.

## 3 Anticipation Cues

- displayed if valid approach course deviation information is being received while corresponding NPS deviation scale and pointer are displayed.
- an unfilled white diamond symbol.
- if engaged lateral mode subsequently transitions to LOC or IAN FAC, lateral NPS deviation indications will be removed, and normal ILS localizer or IAN FAC indications will be displayed.
- if engaged vertical mode subsequently transitions to G/S or IAN G/P, vertical NPS deviation indications will be removed, and normal ILS G/S or IAN G/P indications will be displayed.

## 4 NPS Pointer

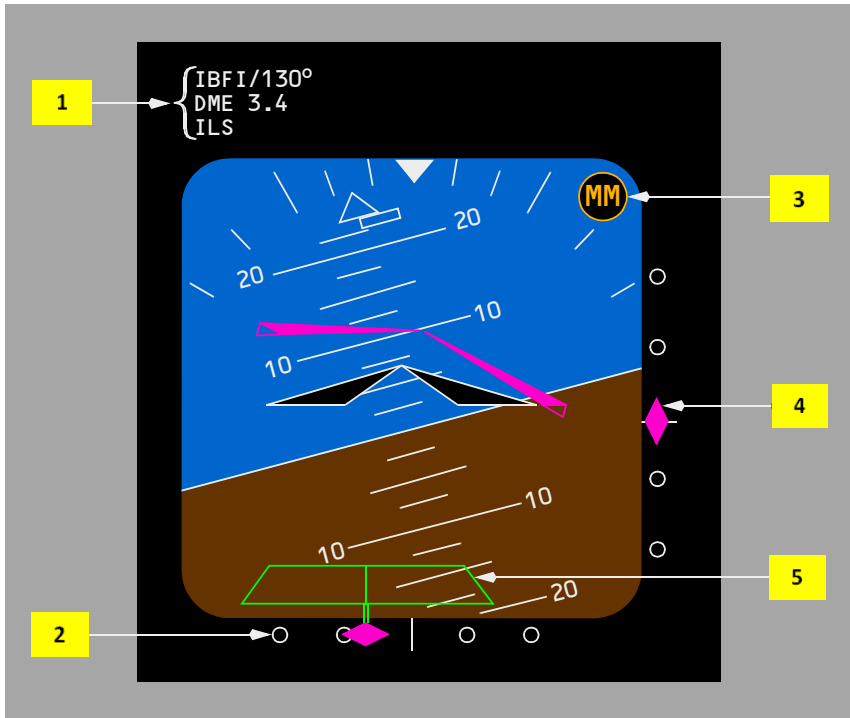
- a filled magenta symbol when it is not parked at deflection limit.
- an unfilled pointer outline when at deflection limit.
- indicates lateral/vertical paths relative to the airplane.
- will flash for 10 seconds if deviation is within ANP bar limits for 10 continuous seconds.

## 5 Actual Navigation Performance (ANP) Bars

- lateral/vertical indication of available flight technical error remaining based on total system error.
- lateral ANP bars can be displayed in all phases of flight.
- vertical ANP bars can be displayed only after reaching top-of-descent.
- originate from outer scale and expand inward as a function of increasing ANP relative to RNP.
- will just touch at center of scale when ANP equals RNP.
- turn from white to amber if current deviation is within the ANP bar limits for 10 continuous seconds.

## PFD Instrument Landing System Indications

[Aircraft with Integrated cue command bar, rising runway, IAN]



### 1 Approach Reference

[Aircraft with IAN]

Displays the selected ILS/IAN identifier or frequency, approach front course, ILS/DME/FMC distance and source annunciation.

[Aircraft with GLS]

Displays the selected GLS identifier, channel, selected course, GLS approach distance and source annunciation.

If the tuned ILS frequencies disagree, the frequency turns amber with an amber horizontal line through it.

If the tuned GLS channels disagree, the channel turns amber with an amber horizontal line through it.

If the approach courses entered in the MCP disagree, the course turns amber with an amber horizontal line through it.

## 2 Localizer/FAC Pointer and Deviation Scale

### [Aircraft with IAN]

The pointer:

- indicates localizer or FAC position relative to the airplane.
- in view when the localizer signal is received or IAN approach selected.
- fills in solid magenta when within 2 1/2 dots from center.

The scale:

- indicates deviation.
- in view when the localizer frequency is tuned or IAN approach selected.
- expands when the localizer or FAC is engaged and deviation is slightly more than one-half dot.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive localizer or FAC deviation.

Below 1,000 feet AGL, with LNAV engaged and LOC or FAC armed, the localizer/FAC scale turns amber and the pointer flashes if the localizer or FAC is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC or FAC deviation alerting display on each attitude indicator.

## 3 Marker Beacon symbol

Flashes when over one of the marker beacons:

OM (cyan) - an outer marker beacon

MM (amber) - a middle marker beacon

IM (white) - an inner marker beacon.

## 4 Glide Slope/Glide Path Pointer and Deviation Scale

### [Aircraft with IAN]

The pointer:

- indicates glide slope/glide path position.
- in view when the glide slope signal is received or IAN approach is selected.
- fills in solid magenta when within 2 1/2 dots from center.
- the pointer is not displayed when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The scale:

- indicates deviation.
- in view when the localizer frequency is tuned or IAN approach is selected.

At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive glide slope/glide path deviation.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second G/S or G/P deviation alerting display on each attitude indicator.

## 5 Rising Runway (green with magenta stem)

[Aircraft with Rising runway]

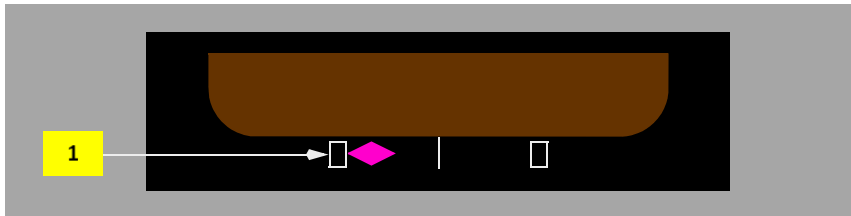
Displayed when:

[Aircraft with IAN]

- localizer signal usable or IAN approach selected and pointer is in view.
- radio altitude is less than 2500 feet.

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

## Expanded Localizer/FAC Indications



## 1 Expanded Localizer/FAC Scale

[Aircraft with Autopilot or flight director activation]

Displayed when the autopilot or flight director is in LOC or FAC mode, deviation is slightly more than one half dot and track is within 5 degrees of the MCP selected course.

As deviation increases, the deviation pointer remains filled in solid magenta and parks at the limit of the expanded scale. Once the deviation reaches the equivalent of 2.4 dots from center on the standard scale, the pointer becomes unfilled.

Reverts to standard scale when out of LOC or FAC mode, and groundspeed is less than 30 knots or radio altitude is greater than 200 feet.

A rectangle equals 1/2 dot deviation.

## PFD Radio Altitude Indications

[Aircraft with Radio altitude above, round dial]



### 1 Radio Altitude – Round Dial

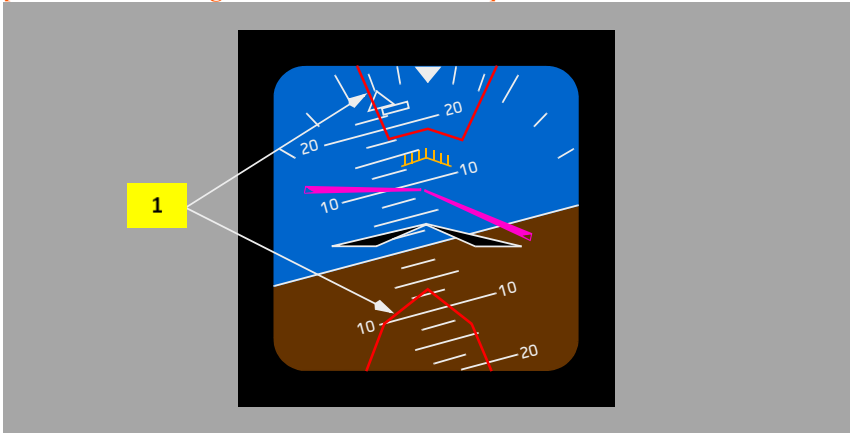
[Aircraft with Radio altitude above, round dial]

Displayed below 2500 feet AGL:

- digital display from 2500 to 1000 feet AGL
- box highlighted white for 10 seconds upon descent below 2500 feet
- round dial displays below 1000 feet AGL
- pointer indicates selected radio altitude minimums
- the circumference of the dial is added to, or taken away from, to depict the airplane's radio altitude
- the remaining perimeter and pointer turn amber and flash for 3 seconds when below radio altitude minimums, the numeric readout does not flash.

## Traffic Alert and Collision Avoidance Indications

[Aircraft with Integrated cue command bar]

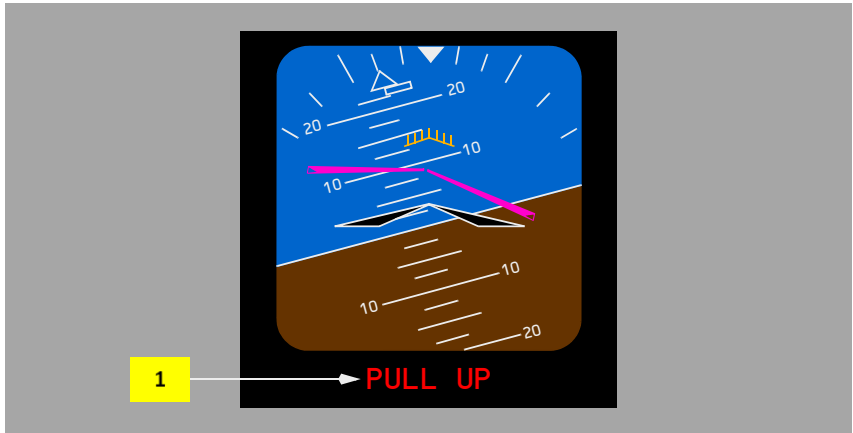


**1 Traffic Alert and Collision Avoidance System Pitch Command (red)**

The area(s) inside the red lines indicate(s) the pitch region(s) to avoid in order to resolve the traffic conflict. The airplane symbol must be outside the TCAS pitch command area(s) to ensure traffic avoidance.

**GPWS Annunciations**

[Aircraft with Integrated cue command bar]



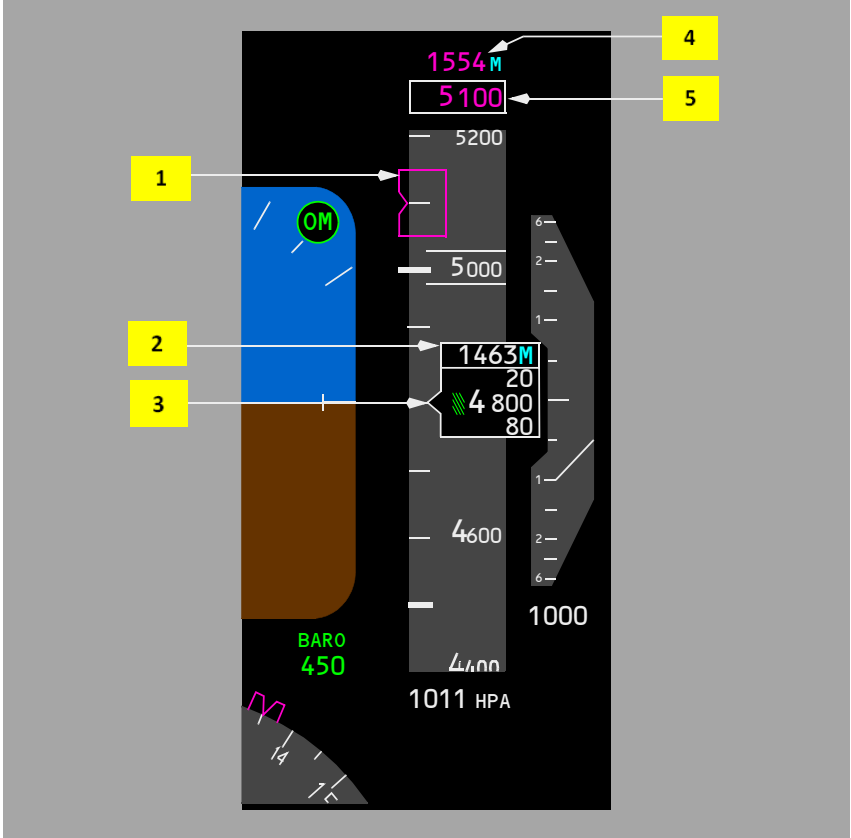
**1 GPWS Annunciations (red)**

Displays WINDSHEAR or Pull UP alert.

# PFD – Altitude Indications

## Altitude Indications– General

The altitude indication displays ADIRS altitude and other altitude related information.



### 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 the bug visible.

### 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 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
- a negative sign appears when altitude below zero feet is displayed
- readout box becomes bold to denote altitude acquisition
- readout box is highlighted in amber and flashes to denote altitude deviation

### 4 Metric Selected Altitude Readout (readout—magenta, metric symbol—cyan)

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

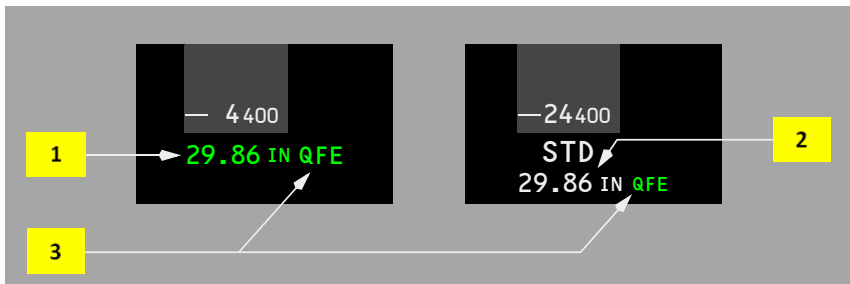
### 5 Selected Altitude (magenta)

Displays the altitude set in the MCP altitude window.

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

## PFD Barometric Indications

[Aircraft with Altimeter with QFE]



### 1 Barometric Settings (green)

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

Display is boxed amber if numeric is set and airplane is climbing above transition altitude, or if STD is set and descending below transition flight level.



## **2 Preselected Barometric Setting (white)**

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

When STD is displayed, a barometric setting can be preselected on the EFIS control panel barometric selector and is displayed in small white characters below STD.

## **3 QFE Altitude Reference (green)**

### **[Aircraft with Altimeter with QFE]**

Indicates QFE altitude reference if selected on the CDU APPROACH REF Page or TAKEOFF REF Page 2/2.

When selected, QFE is boxed for 10 seconds.

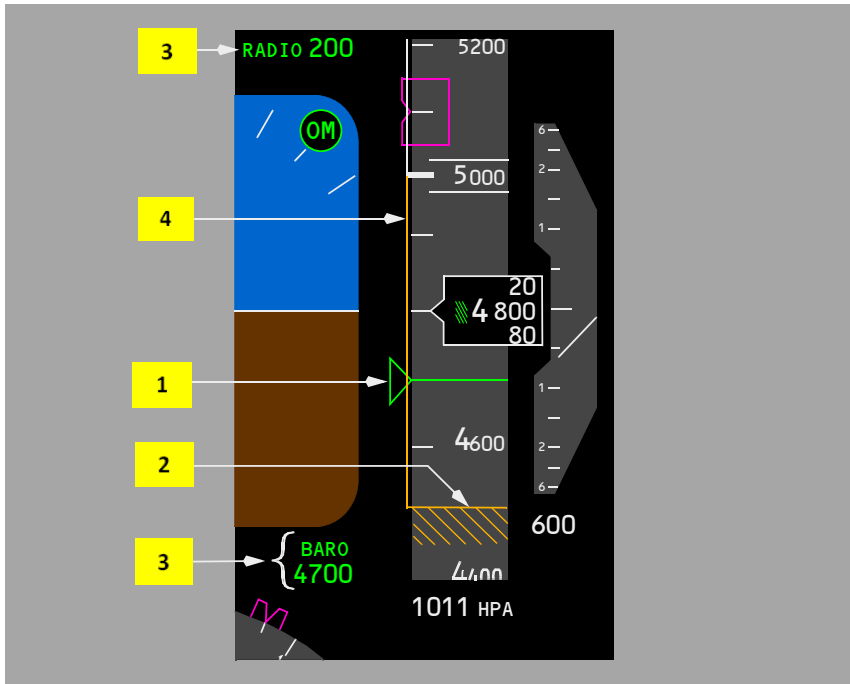
The altitude tape is shaded green during QFE operation.

When QNH is selected, the green shading is removed; QNH is displayed for 10 seconds, then blanks.

When STD is displayed, QFE in small white characters is displayed below STD, and a QFE altimeter setting can be preselected.

## Landing Altitude/Minimums Indications

[Aircraft with Radio altitude above ADI, landing altitude reference bar]



### 1 BARO Minimums Pointer (green)

Indicates the barometric minimums selected on the EFIS control panel:

- pointer and line turn amber when airplane descends below selected minimum altitude
- reset with the RST switch on the EFIS control panel.

### 2 Landing Altitude Indication (amber)

The crosshatched area indicates:

- the FMC landing altitude for the destination runway or airport, or
- the landing altitude for departure runway or airport until 400 NM from departure or one-half the distance to destination, whichever occurs first.

### 3 Minimums Reference/Altitude (green)

[Aircraft with Radio altitude above ADI]

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

#### BARO -

- displayed below ADI when selector is set to BARO, minimums are in feet MSL
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude.
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go-around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

#### RADIO -

- displayed above ADI when selector is set to RADIO, minimums are in feet AGL
- blank when an altitude less than 0 feet is selected
- turns amber and flashes for 3 seconds when airplane descends below selected minimum altitude
- changes back to green:
  - when passing the selected minimum altitude plus 75 feet during go-around
  - at touchdown
  - after pressing the RST switch on the EFIS control panel.

#### **4 Landing Altitude Reference Bar**

##### **[Option]**

Indicates height above touchdown:

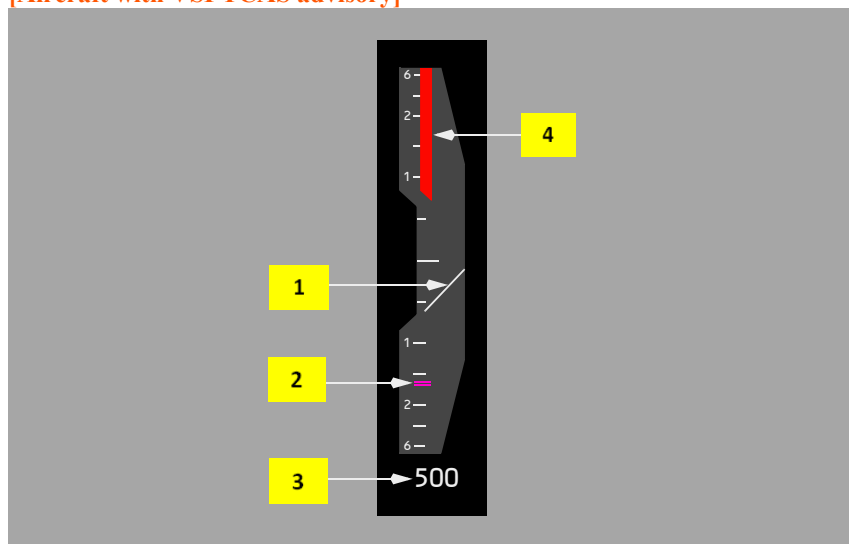
- White bar - 500 to 1000 feet above landing altitude
- Amber bar - 0 to 500 feet above landing altitude.

## PFD – Vertical Speed Indications

### Vertical Speed Indications – General

The vertical speed indication displays ADIRS instantaneous vertical speed.

**[Aircraft with VSI TCAS advisory]**



#### 1 Vertical Speed Pointer (white)

Indicates current vertical speed.

#### 2 Selected Vertical speed Bug (magenta)

Indicates the speed selected in the MCP vertical speed window with V/S pitch mode engaged.

#### 3 Vertical speed (white)

Displays vertical speed when greater than 400 feet per minute.

The display is located above the vertical speed indication when climbing and below when descending.

#### 4 TCAS Vertical Speed Tape (red)

**[Aircraft with VSI TCAS advisory]**

Tape turns red to indicate vertical speed values to avoid or exit during a TCAS resolution advisory.

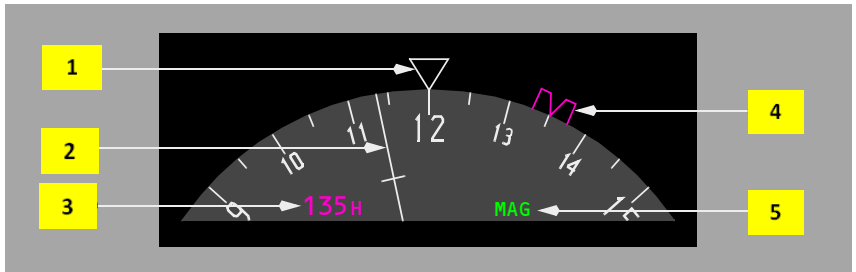
Vertical speed pointer is red if it is within the vertical speed tape range.

Supplements TCAS resolution advisory pitch commands on the attitude indication.

## PFD - Heading and Track Indications

### Heading and Track Indications– General

The heading and track indications display current FMC/ADIRS heading, track and other information.



#### 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)

Displays selected heading reference:

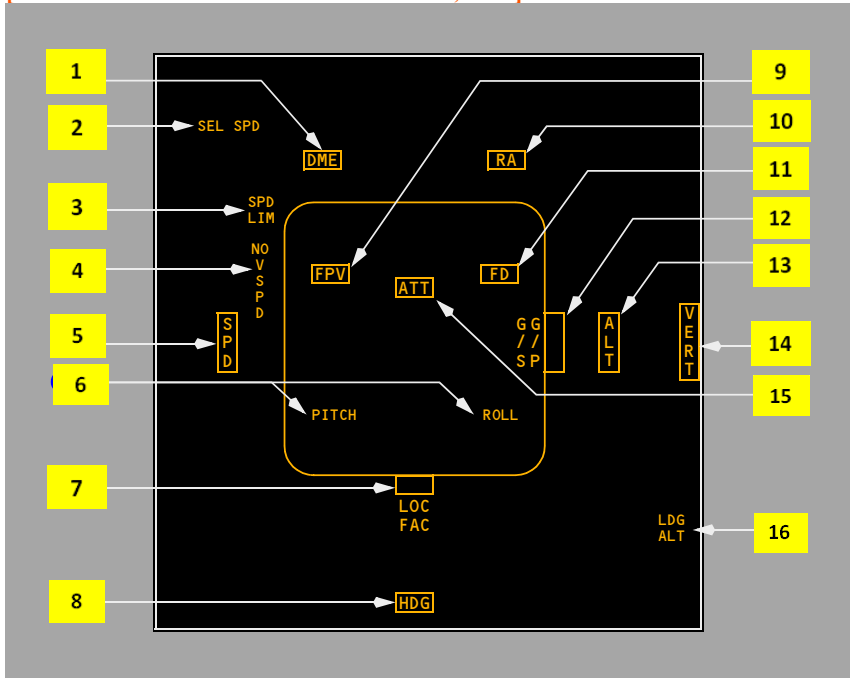
- MAG indicates display is oriented relative to magnetic north
- TRU indicates display is oriented relative to true north; a white box is displayed continuously around TRU

- transition from TRU to MAG results in a green box around MAG for 10 seconds
- when TRU is displayed and the airplane descends more than 2000 feet at a descent rate greater than  $-800$  feet per minute, an amber box is drawn around TRU; the box flashes for 10 seconds, then turns steady amber.

## PFD Failure Flags

The flag replaces the appropriate display to indicate source system failure or lack of computed information.

[Aircraft with Radio altitude above ADI, IAN]



### 1 Distance Measuring Equipment (amber)

The DME system has failed.

### 2 Selected Speed (amber)

Invalid data.

**3 Speed Limit Flag (amber)**

Displays related with stick shaker or maximum operating speed has failed:

- if the stick shaker warning has failed, the red and black stick shaker speed bar is removed
- if the maximum operating speed has failed, the red and black maximum operating speed bar is removed.

**4 No V Speeds Flag (amber)**

V1 (decision speed) or VR (rotation speed) has not been entered or is invalid.

**5 Speed Flag (amber)**

The speed indication is inoperative. All indication markings are removed.

**6 Pitch/Roll Comparator Annunciation (amber)**

PITCH displayed when Captain's and F/O's pitch angle displays differ by more than 5 degrees.

ROLL displayed when Captain's and F/O's roll angle displays differ by more than 5 degrees.

**[Aircraft with Attitude comparator flashing]**

The flags flash for 10 seconds then remain steady.

**7 Localizer/FAC Flag (amber)**

**[Aircraft with IAN]**

An ILS frequency is tuned and the ILS localizer deviation display on the attitude indication has failed. An IAN approach is active and the FAC deviation display on the attitude indication has failed.

**8 Heading Flag (amber)**

Heading information failed.

**9 Flight Path Vector Flag (amber)**

FPV is selected on the EFIS control panel, but has failed. De-selection of FPV removes the flag.

**10 Radio Altitude Flag (amber)**

The radio altitude display has failed.

**11 Flight Director Flag (amber)**

The flight director has failed.

**12 Glide Slope/Glide Path Flag (amber)**

**[Aircraft with IAN]**

An ILS frequency is tuned and the ILS glide slope deviation display on the attitude indication has failed. An IAN approach is active and the glide path deviation display on the attitude indication has failed.

**13 Altitude Flag (amber)**

The attitude display has failed.

**14 Vertical Speed Flag (amber)**

Vertical speed has failed.

**15 Attitude Flag (amber)**

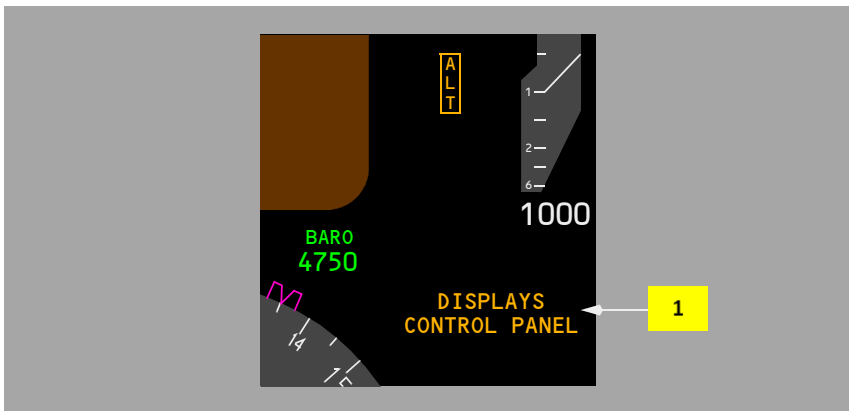
The attitude display has failed.

**16 Landing Altitude Flag (amber)**

The landing altitude input is not available or invalid.

## Additional Annunciations and Alerts

### Displays Control Panel Annunciation





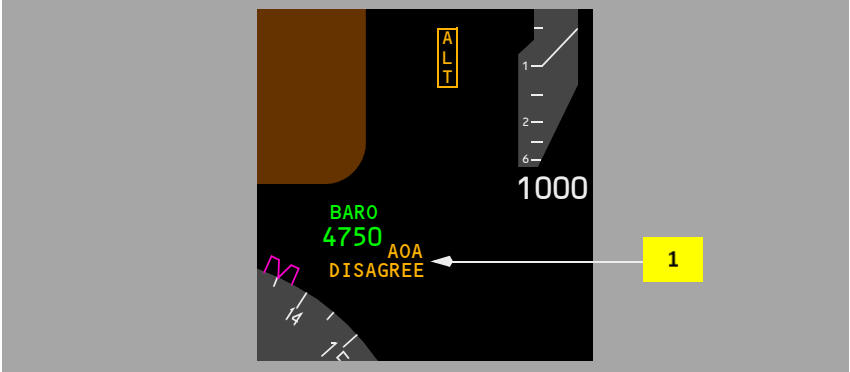
**1 Displays Control Panel Annunciation (amber)**

With the CONTROL PANEL select switch on the overhead panel in:

- BOTH ON 1 - left (Capt) EFIS control panel has failed
- NORMAL - corresponding EFIS control panel has failed
- BOTH ON 2 - right (F/O) EFIS control panel has failed.

Altitude information is removed.

**Angle of Attack (AOA) Disagree Alert**

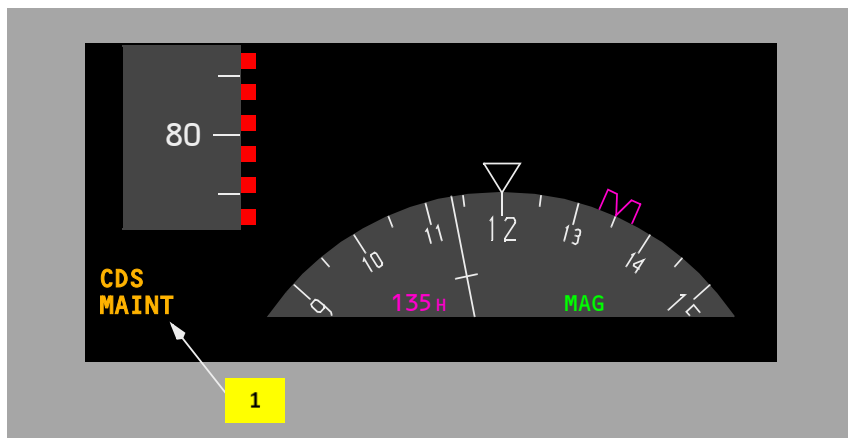


**1 AOA Disagree Alert (amber)**

Indicates the left and right AOA values disagree by more than 10 degrees for more than 10 continuous seconds.

## Display System Annunciations

**Note:** The following annunciations occupy the same display location in the lower left corner of the primary flight display.



### 1 Display System Annunciations

DSPLY SOURCE (amber) – A single DEU has been selected, either manually or automatically, to drive all six display units.

- If the DEU fails on the same side as the engaged autopilot during climb or descent –

#### [Aircraft with Integrated cue command bar]

- the flight directors are removed from both pilots' displays. The flight directors reappear at ALT ACQ
- the pitch mode reverts to CWS pitch
- the autopilot remains engaged.
- If the DEU fails on the same side as the engaged autopilot during level flight –
  - climb or descent to a new MCP altitude is not possible in LVL CHG, VNAV, or V/S modes with the autopilot engaged.
- If the DEU fails on the opposite side as the engaged autopilot or while in manual F/D mode during climb or descent –

#### [Aircraft with Integrated cue command bar]

- the flight director is removed from the pilot's display on the failed side until ALT ACQ
- climb or descent is possible in LVL CHG, VNAV or V/S modes with the autopilot engaged.

- If the DEU fails on the same side as the engaged autopilot in the APPROACH mode –

**[Aircraft with Integrated cue command bar]**

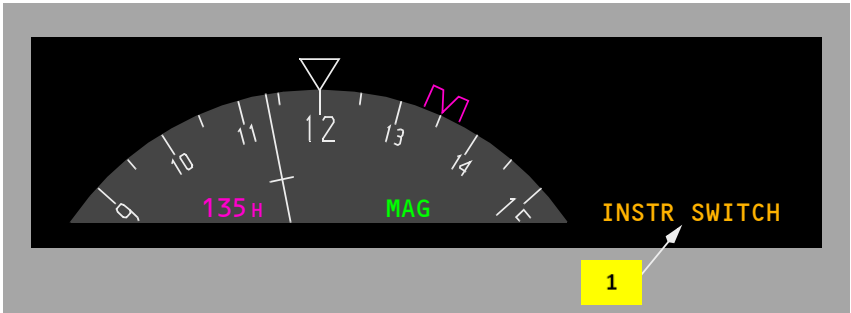
- the flight directors are removed from the pilot’s display on the failed side.

**[Aircraft with CDS Block software upgrade]**

CDS MAINT (white) – A dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

CDS FAULT (amber) – A non–dispatchable CDS fault has occurred. Displayed on the ground only, prior to start of the second engine.

**Instrument Switch Annunciation**

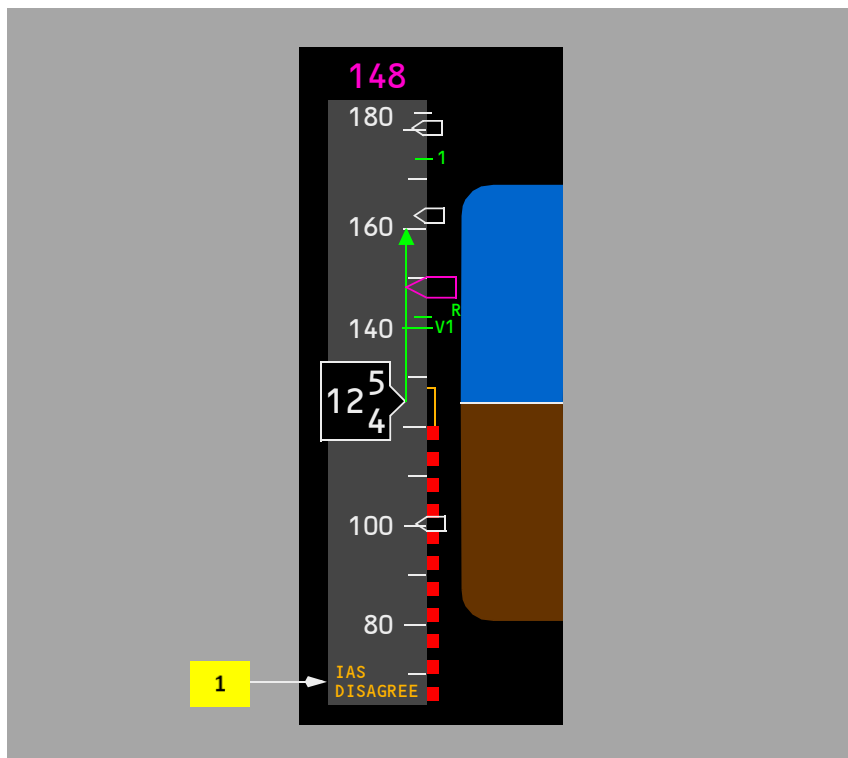


**1 INSTR SWITCH Annunciation (amber)**

Indicates both the Captain’s and First Officer’s displays are using the same source of IRU data.

Displayed when the IRS switch on the overhead panel is not in the NORMAL position.

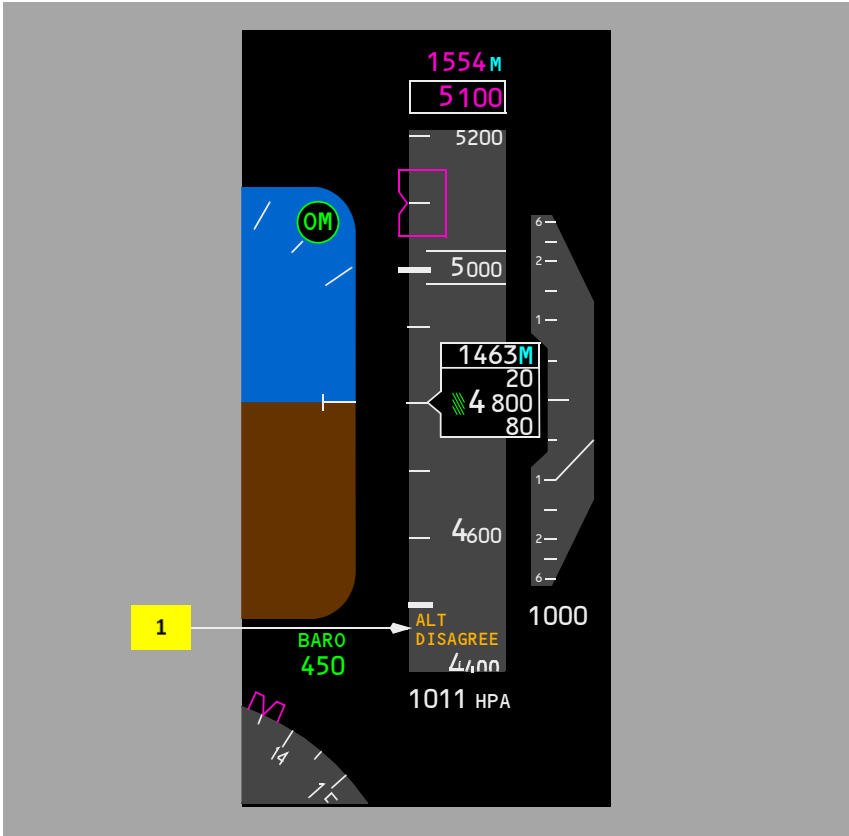
## Airspeed Disagree Alert



### **1** Airspeed Disagree Alert (amber)

Indicates the Captain's and F/O's airspeed indications disagree by more than 5 knots for 5 continuous seconds.

### Altitude Disagree Alert

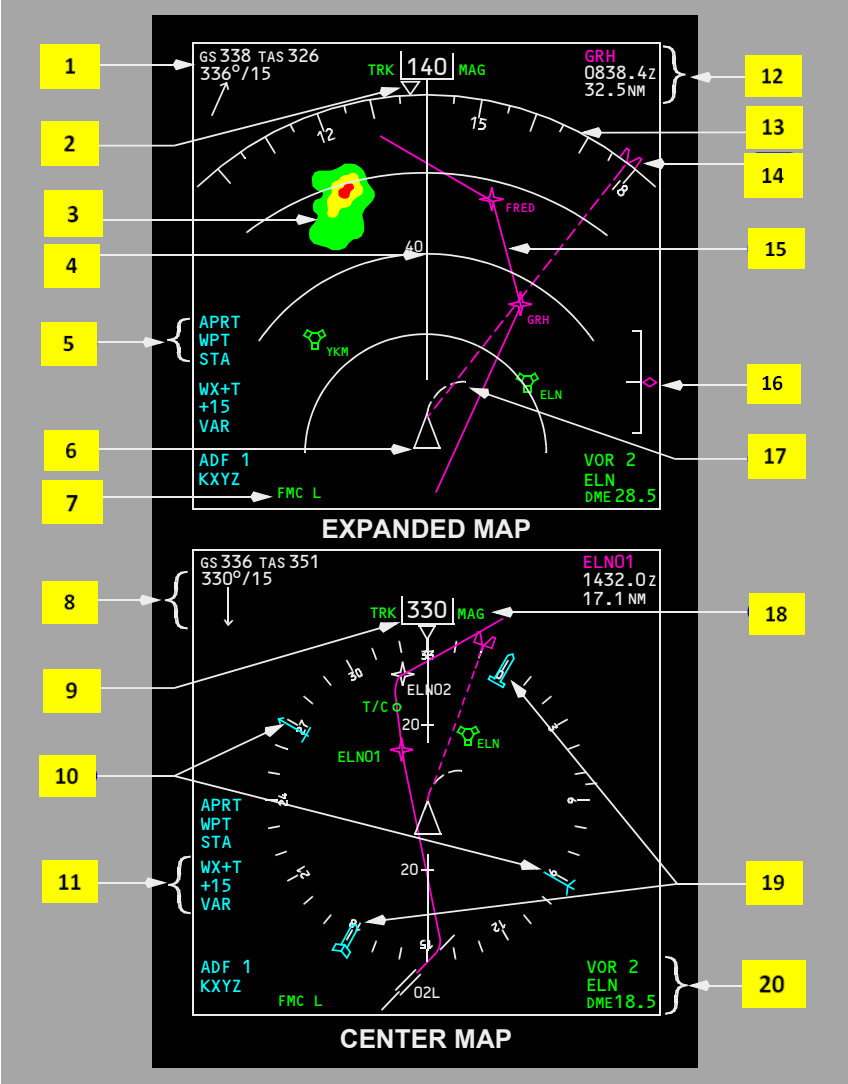


**1** Altitude Disagree Alert (amber)

Indicates the Captain's and F/O's altitude indications disagree by more than 200 feet for more than 5 continuous seconds.

### Expanded and Center MAP Modes

[Aircraft with Track-up display, weather radar range arcs, dual FMC, ADF]



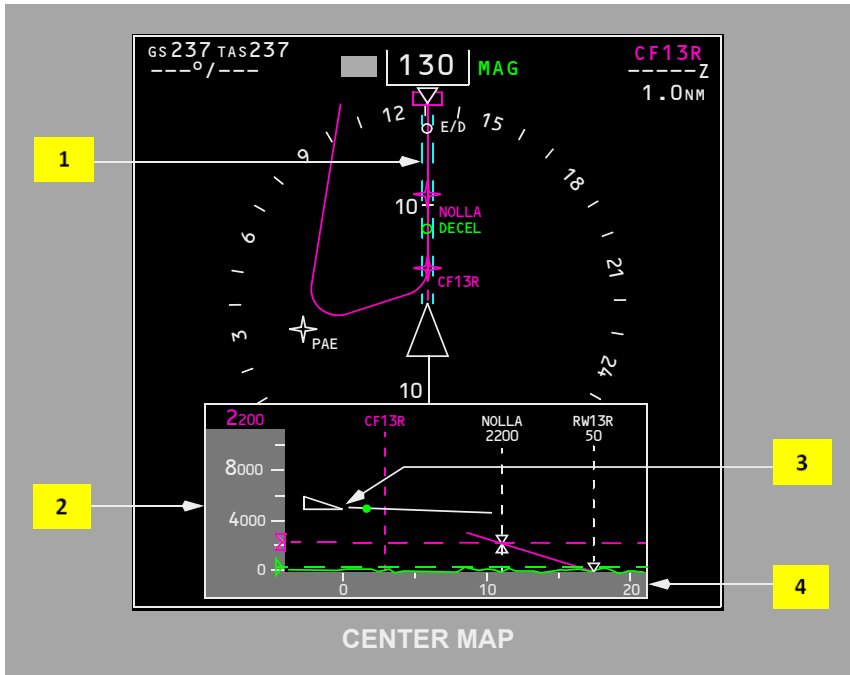
- 1 Groundspeed/True Airspeed
- 2 Heading Pointer
- 3 Weather Radar Returns
- 4 Track Line and Range Scale
- 5 Map Options
- 6 Airplane Symbol
- 7 Map Source Annunciation
- 8 Wind Direction/Speed/Arrow
- 9 Current Track **[Aircraft with Track-up display]**
- 10 Number 1 VOR/ADF Pointer **[Aircraft with ADF]**
- 11 Weather Radar Annunciations
- 12 Active Waypoint/ETA/Distance-To-Go
- 13 Compass Rose
- 14 Selected Heading Bug
- 15 Active LNAV Route
- 16 Vertical Deviation Scale and Pointer
- 17 Position Trend Vector
- 18 Magnetic/True Reference
- 19 Number 2 VOR/ADF Pointer **[Aircraft with 2 ADF receivers]**
- 20 VOR/ADF Selection, Ident/Frequency, VOR DME  
**[Aircraft with 2 ADF receivers]**

## Vertical Situation Display (VSD)

### [Aircraft with VSD]

The VSD represents a profile view of the airplane and its environment along the current track. Information shown within the cyan dashed lines (enroute corridor) on the ND is shown in profile on the VSD.

### Vertical Situation Display (VSD) - Reference Scales



#### 1 Enroute Swath

Indicates area mapped by the VSD.

#### 2 Altitude Reference Scale

Displays altitude in reference to the vertical position of the airplane symbol, terrain, and other objects in the VSD background display.

#### 3 Airplane Symbol

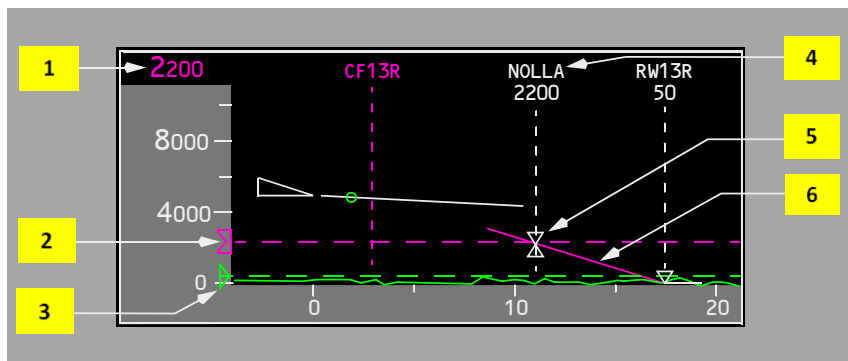
Indicates current airplane altitude (bottom of the triangle) and lateral position (point of the triangle) relative to terrain.

#### 4 Horizontal Reference Scale

Displays range in nautical miles. Actual range shown on VSD is one half the range selected on the EFIS control panel.



## Vertical Situation Display (VSD) - General Background



### 1 MCP Selected Altitude Readout

Displays the altitude set in the MCP altitude window.

### 2 Selected Altitude Bug

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, with only one half the bug visible. The dashed line does not park.

### 3 BARO Minimums Pointer

Indicates the barometric minimums selected on the EFIS control panel:

- pointer and dashed line turn amber when airplane descends below selected minimum altitude
- reset with the RST switch on the EFIS control panel.

### 4 Waypoint ID and Anchor Line

Displayed with any altitude constraint directly beneath. Dashed vertical line depicts lateral position.

### 5 Altitude Constraint Symbol

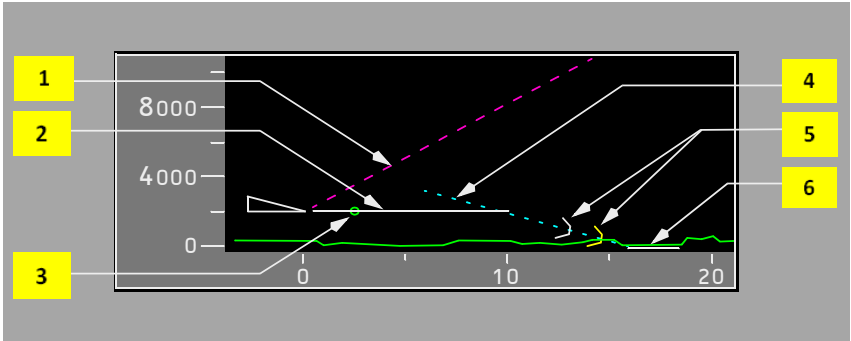
Displayed as triangle(s) on waypoint anchor line.

### 6 FMC Approach Glidepath Angle Line

Displayed for approaches that include a designated approach angle.

- extends 10 NM for situational awareness.
- anchored to the missed approach waypoint, not the runway.

### Vertical Situation Display (VSD) - Flight Path Background



#### 1 MCP Selected Vertical Speed (V/S)

Displays the selected vertical speed as a dashed target angle line when the MCP V/S mode is selected.

#### 2 Vertical Flight Path Vector

Indicates current flight path angle as a function of vertical speed and ground speed. The length of the vector is fixed at one half of the VSD range.

#### 3 Range to Target Speed Dot (RTSD)

Indicates where the airplane will achieve the FMC or MCP target speed.

- dot is blanked within 5 knots of target speed.
- dot reappears if speed increases 10 knots or more faster than target speed.
- replaced with an unfilled dot at vector end if target speed will not be achieved within length of the vertical flight path vector line.

#### 4 3-Degree Reference Line

Displayed for approaches that do not have a designated approach angle.

- dashed line extends 10 NM for situational awareness.
- anchored to the runway threshold.
- for reference only, line may intersect terrain.

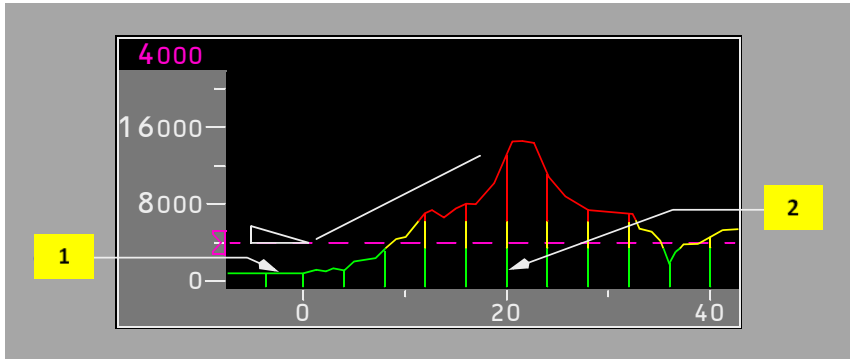
#### 5 Decision Gates

Displayed on the FMC approach glidepath angle line or 3 degree reference line at 500 feet and 1000 feet above field elevation.

#### 6 Runway

Represents the selected runway.

## Vertical Situation Display (VSD) - Terrain Background



### 1 Terrain Profile Line

Represents the highest terrain within the enroute swath.

- highest points of the terrain below and ahead of the airplane.
- terrain is depicted so the true altitude separation between the airplane and terrain is shown.
- terrain behind the airplane is drawn equal to the terrain at the current position.
- VSD terrain uses the same color coding that is used to depict EGPWS terrain on the lateral map:
  - green: terrain 250-500 feet or more below the airplane.
  - amber: terrain from 250-500 feet below to 2000 feet above the airplane.
  - red: terrain more than 2,000 feet above the airplane.

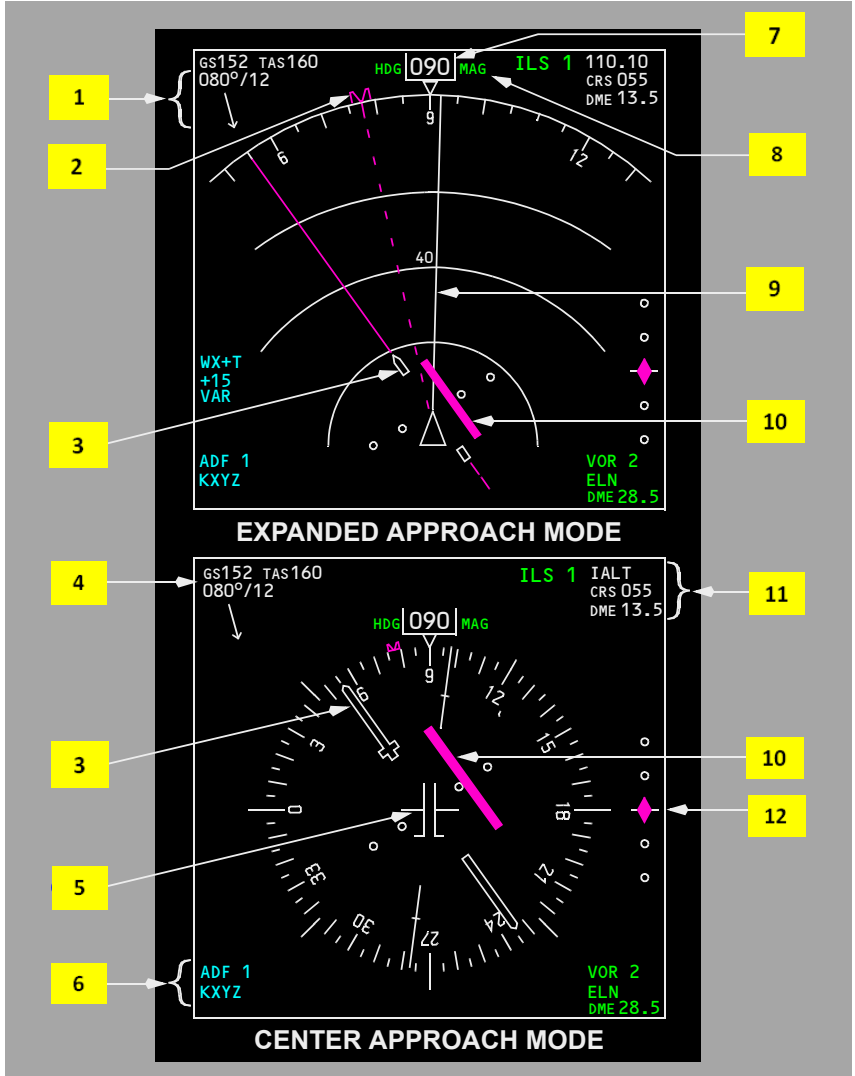
### 2 Vertical Support Lines

Vertical terrain vectors placed at constant intervals along the terrain profile line.

# Navigation Displays – Approach Mode

## Expanded and Center Approach Modes

[Aircraft with Weather radar range arcs, ADF]



**1 Wind Direction/Speed/Arrow**

**2 Selected Heading Bug**

**3 Selected Course Pointer**

**4 Groundspeed/True Airspeed**

**5 Airplane symbol**

**6 VOR/ADF Selection/Ident or Frequency/VOR DME**

**[Aircraft with ADF]**

**7 Current Heading**

**8 Magnetic/True Reference**

**9 Track Line**

**10 ILS Localizer/IAN FAC Deviation Indication and Scale**

**[Aircraft with IAN]**

**11 Reference ILS Frequency or Ident/Course/DME/Distance and Source  
Annunciation**

**[Aircraft with IAN]**

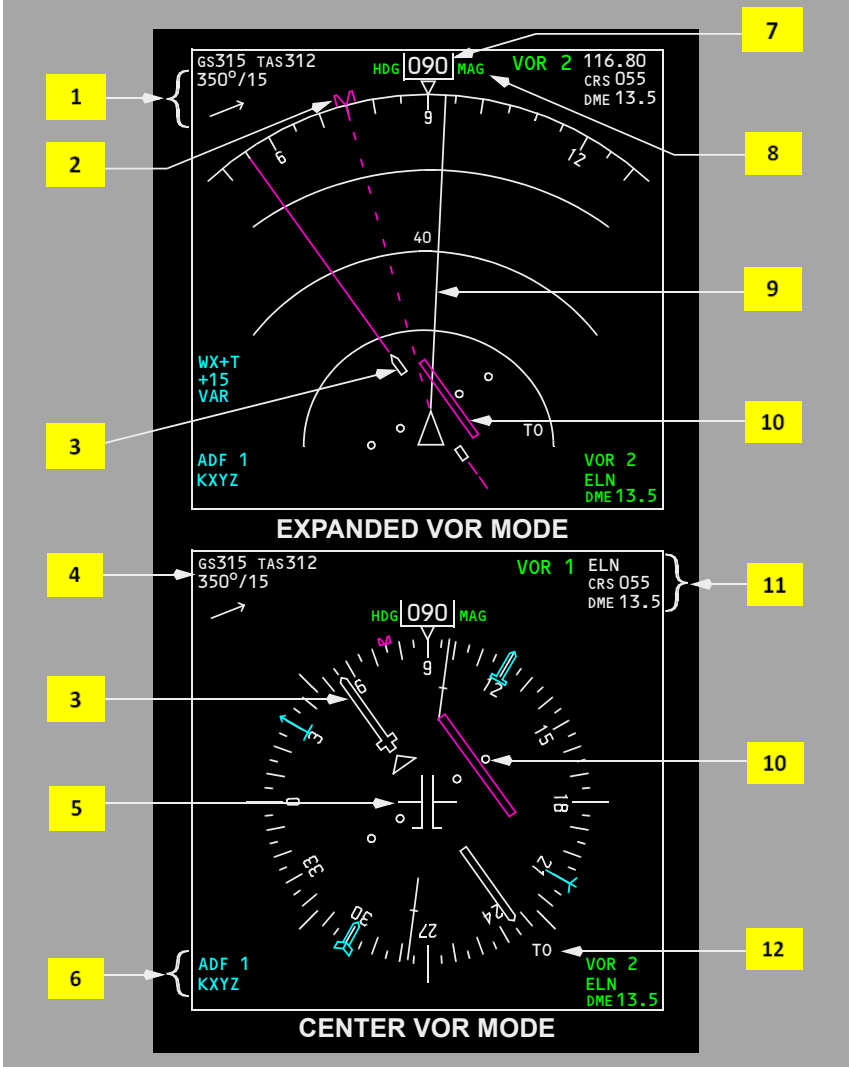
**12 ILS Glideslope/IAN Glidepath Pointer and Scale**

**[Aircraft with IAN]**

# Navigation Displays – VOR Mode

## Expanded and Center VOR Modes

[Aircraft with Weather radar range arcs, ADF]

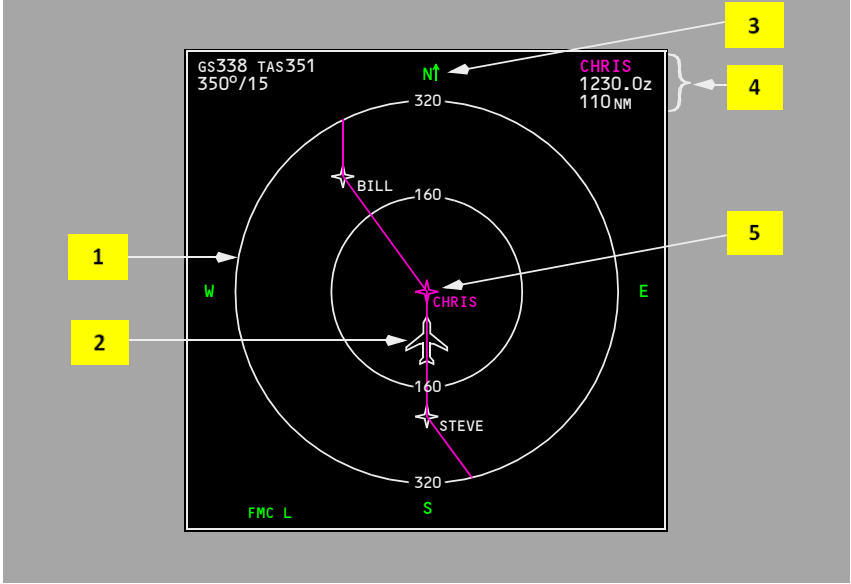


- 1 Wind Direction/Speed/Arrow
- 2 Selected Heading Bug
- 3 Selected Course Pointer
- 4 Groundspeed/True Airspeed
- 5 Airplane symbol
- 6 VOR/ADF Selection/Ident or Frequency/VOR DME  
[Aircraft with ADF]
- 7 Current Heading
- 8 Magnetic/True Reference
- 9 Track Line
- 10 Course Deviation Indication and Scale
- 11 Reference VOR Receiver/Frequency or Ident/Course/DME
- 12 TO/FROM Indication and TO pointer

# Navigation Displays – Plan Mode

## Plan Mode

[Aircraft with Dual FMC]



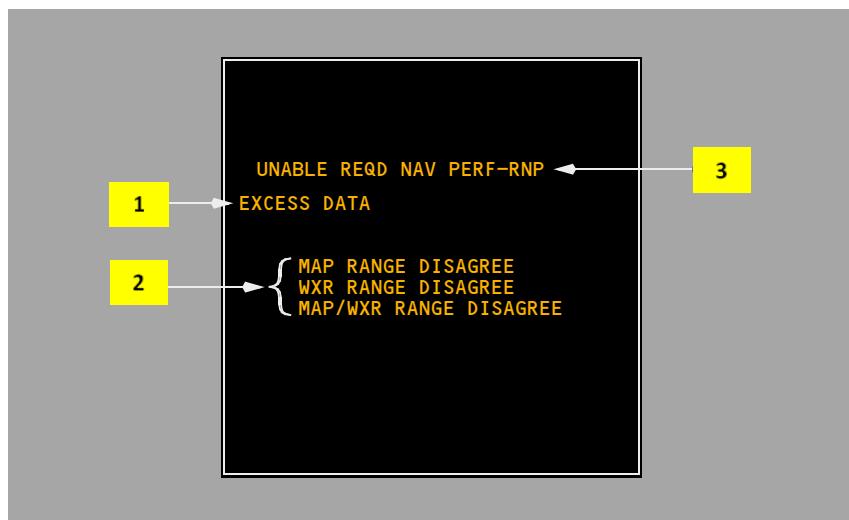
- 1 Range Circle**
- 2 Airplane Symbol**
- 3 True North Up Arrow**
- 4 Active Waypoint Information**
- 5 Center Waypoint**

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



## Navigation Displays – Advisory Messages

### Navigation Advisory Messages



#### 1 Excess Data Annunciation (amber)

The amount of map information sent to the primary display system is too great to display.

#### 2 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the WXR display range.

MAP/WXR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and WXR display ranges.

#### 3 Nav Advisory Message (amber)

UNABLE REQD NAV PERF-RNP – Displayed in MAP or Center MAP during approach.

# Mode/Frequency Disagree Annunciation

[Aircraft with Track-up display, ADF]



## 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.

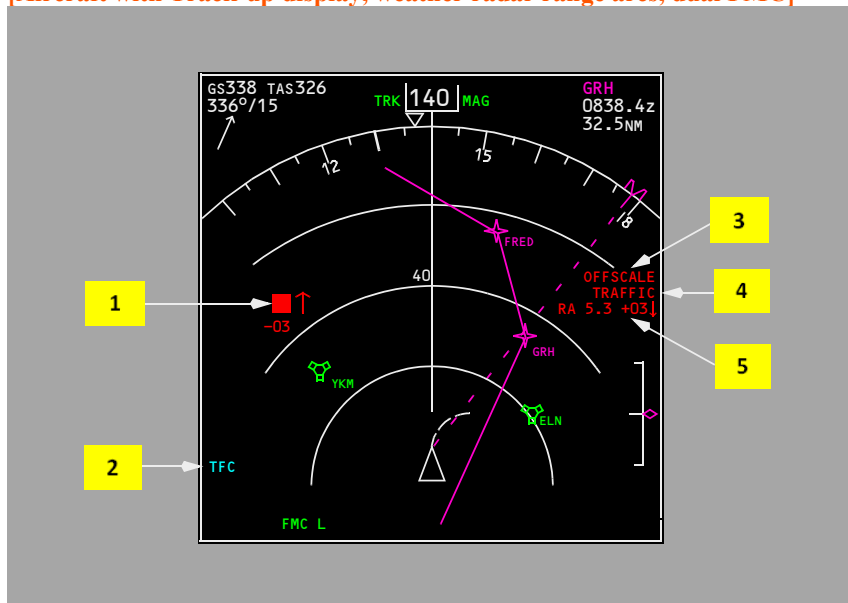
The DME display and ILS/VOR frequency at the upper right corner display dashes.

The localizer deviation bar, VOR course deviation bar and glide slope pointer are not displayed.

The annunciation is displayed in the expanded APP, center APP, expanded VOR and center VOR modes.

## TCAS Messages

[Aircraft with Track-up display, weather radar range arcs, dual FMC]



### 1 TCAS Traffic Symbols

Indicates position of traffic targets.

Displayed in expanded MAP, center MAP, expanded APP and expanded VOR modes and TFC is selected on the EFIS control panel.

### 2 TCAS Annunciations

TFC (cyan) – Indicates TFC selected on EFIS control panel in expanded MAP, center MAP, expanded APP and expanded VOR.

TCAS TEST (cyan) – TCAS in test mode.

TA ONLY (cyan) – TCAS TA mode only.

TCAS OFF (amber) – TCAS off.

### 3 Offscale (red or amber)

TA (amber) or RA (red) is beyond the selected display range and TFC is selected on the EFIS control panel.

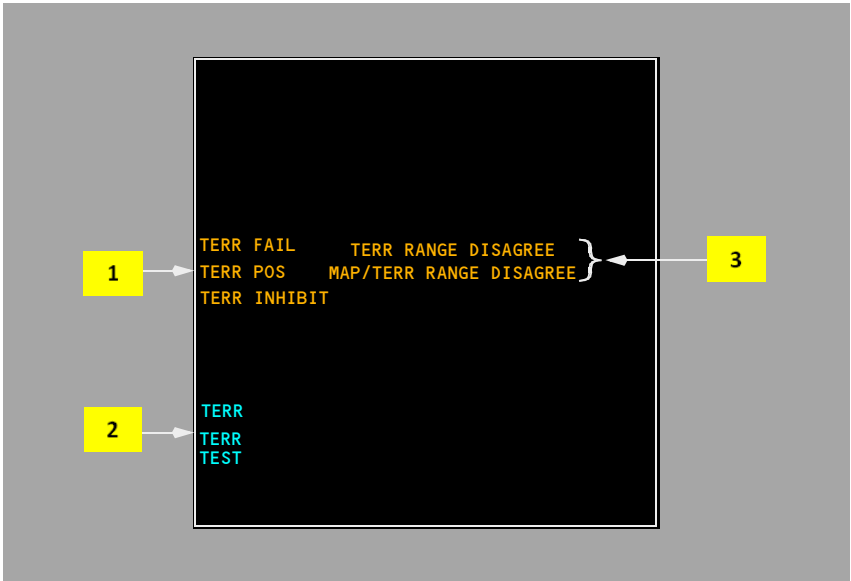
### 4 Traffic (red or amber)

Displayed during a TA (amber) or RA (red) condition whether or not TFC is selected on the EFIS control panel.

**5 No-Bearing Messages (red or amber)**

Textual description of TA (amber) or RA (red) traffic with no associated bearing. Message provides traffic type, range in NM, altitude and a vertical motion arrow. A maximum of two messages can be displayed simultaneously. TFC selected on the EFIS control panel.

**Look-Ahead Terrain Messages (GPWS)**



**1 Terrain Status Annunciation (amber)**

TERR FAIL – Look-ahead terrain alerting and display have failed.  
TERR POSS – Look-ahead terrain alerting and display unavailable due to position uncertainty.  
TERR INHIBIT – GPWS terrain inhibit switch in TERR INHIBIT position.

**2 Terrain Mode Annunciation (cyan)**

TERR – Terrain display enabled (manual or automatic display).  
TERR TEST – GPWS is operating in self-test mode.

### 3 Terrain Range Status Annunciation (amber)

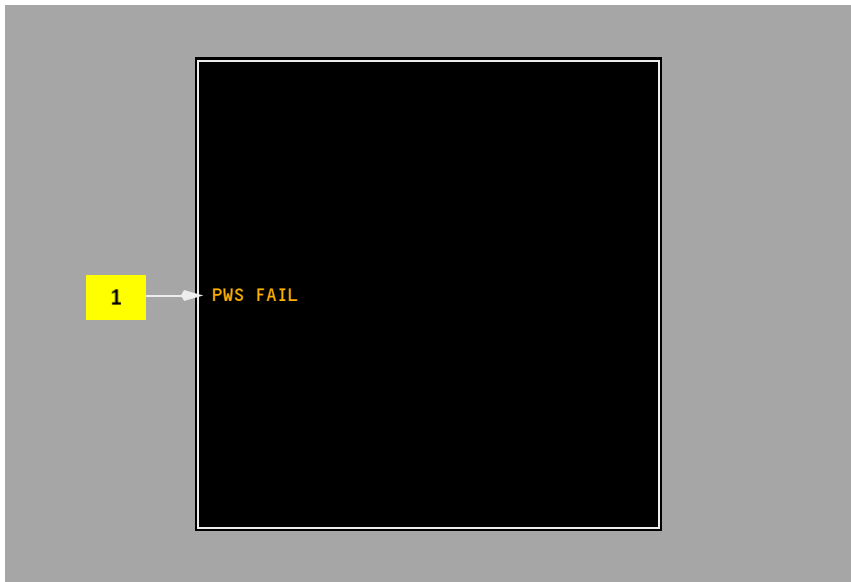
TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range.

MAP/TERR RANGE DISAGREE –

- terrain display enabled, and
- terrain output range disagrees with selected EFIS control panel range, and
- map display output range disagrees with selected EFIS control panel range.

### Predictive Windshear System (PWS) Message



### 1 PWS FAIL Annunciation (amber)

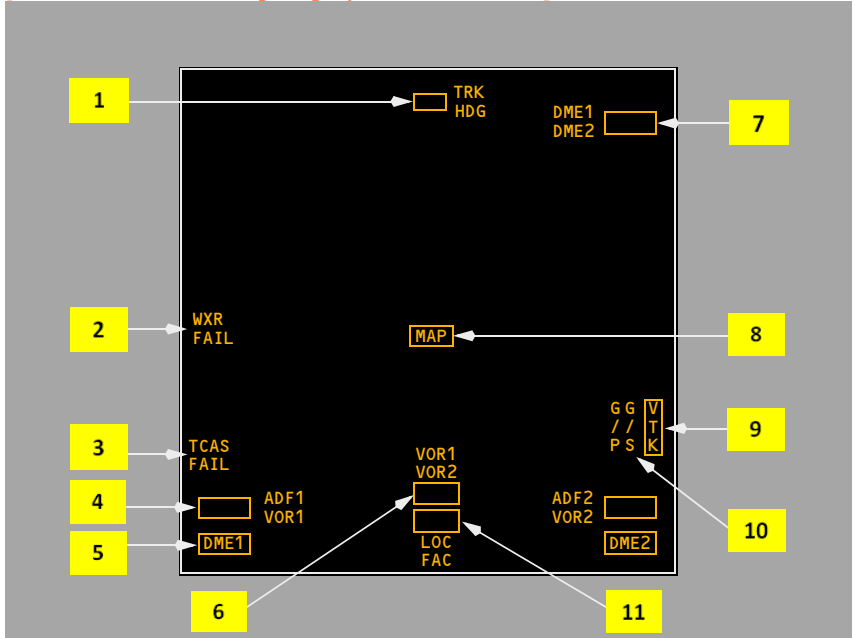
Predictive windshear alerting and display have failed.

## Navigation Displays – Failure Indications and Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

### Expanded MAP, Center MAP, Expanded APP, Expanded VOR Modes

[Aircraft with Track-up display, dual ADF, IAN]



**1 Track Failure Flag (expanded and center MAP modes)**

[Aircraft with Track-up display]

Track or heading display has failed.

**2 Weather Radar Annunciations (expanded and center MAP, expanded APP, expanded VOR modes)**

WXR FAIL – Weather radar has failed. No weather data are displayed.

WXR WEAK – Weather radar calibration fault.

WXR ATT – Attitude stabilization for antenna has been lost.

WXR STAB – Antenna stabilization is off.

WXR DSP – Range data input has failed. Only displayed in WXR TEST

**3 TCAS Failure Flag (expanded and center MAP, expanded VOR, expanded APP, PLAN modes)**

TCAS has failed.

**4 ADF 1 and ADF 2 or VOR 1 and VOR 2 Failure Flag (expanded and center MAP, expanded APP, expanded VOR modes)**

**[Aircraft with Dual ADF]**

ADF or VOR display has failed.

**5 DME 1 and DME 2 Failure Flag (expanded and center MAP, expanded APP, expanded VOR modes)**

Selected VOR DME display has failed.

**6 VOR 1, 2 Failure Flag (expanded VOR mode)**

VOR display has failed.

**7 Reference VOR DME (expanded VOR mode) and Reference ILS DME (expanded APP mode)**

Reference VOR or ILS DME display has failed.

**8 MAP Failure Flag (expanded and center MAP, PLAN modes)**

The related FMC generated map display has failed.

**9 Vertical Track Failure Flag (expanded and center MAP modes)**

FMC vertical track data are invalid.

**10 ILS Glideslope/IAN Glidepath Failure Flag (expanded APP mode)**

**[Aircraft with IAN]**

ILS glideslope or IAN glidepath display has failed.

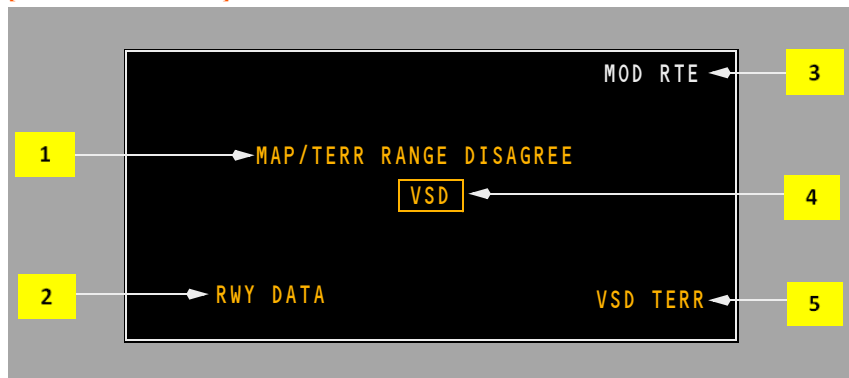
**11 ILS Localizer/IAN FAC Failure Flag (expanded APP mode)**

**[Aircraft with IAN]**

ILS localizer or IAN FAC display has failed.

## Vertical Situation Display (VSD)

[Aircraft with VSD]



### 1 Range Disagreement Annunciations (amber)

MAP RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP display range.

TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the Terrain display range.

MAP/TERR RANGE DISAGREE – Indicates selected range on the EFIS control panel is different than the MAP and Terrain display ranges.

### 2 Runway Data Annunciation (amber)

FMC runway data is not available.

### 3 Route Waypoints Modification Annunciation (white)

FMC active route is being modified. Only active waypoint is displayed.

### 4 VSD Failure Flag (amber)

VSD cannot be displayed.

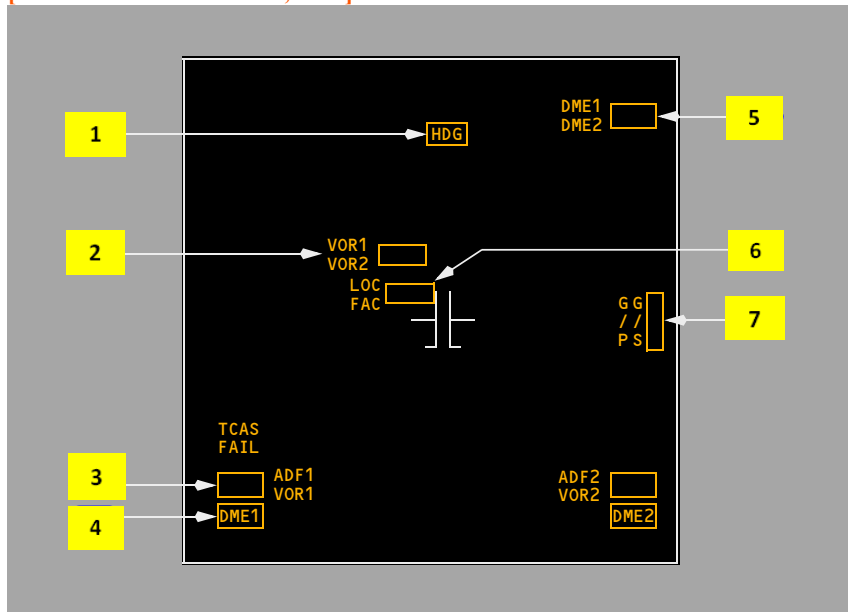
### 5 Terrain Data Failure Annunciation (amber)

EGPWS terrain data is not available. Annunciation is replaced with VSD TERR INHIBIT when GPWS control panel TERR INHIBIT switch is in the inhibit position.



## ND Failure Flags – Center APP and Center VOR Modes

[Aircraft with Dual ADF, IAN]



### 1 Heading Failure Flag (center APP, center VOR modes)

Heading display has failed.

### 2 VOR Failure Flag (center VOR mode)

VOR display has failed.

### 3 ADF 1 and ADF 2 or VOR 1 and VOR 2 Failure Flag (center APP, center VOR modes)

[Aircraft with Dual ADF]

VOR or ADF display has failed.

### 4 DME 1 and DME 2 Failure Flag (center APP, center VOR modes)

Selected VOR DME display has failed.

### 5 Reference VOR DME (center VOR mode) and Reference ILS DME (center APP mode)

Reference VOR or ILS DME display has failed.

**6 ILS Localizer/IAN FAC Failure Flag (center APP mode)**

**[Aircraft with IAN]**

ILS localizer or IAN FAC display has failed.

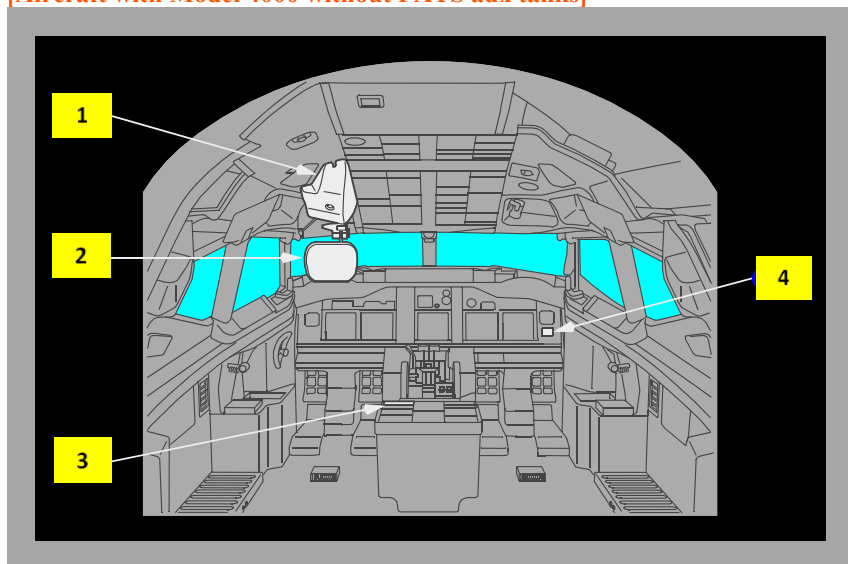
**7 ILS Glideslope/IAN Glidepath Failure Flag (center APP mode)**

**[Aircraft with IAN]**

ILS glideslope or IAN glidepath display has failed.

## System Components

[Aircraft with Model 4000 without PATS aux tanks]



### 1 Overhead Unit

Contains the CRT and projection optics to display the symbolic image on the combiner.

### 2 Combiner

Combines displayed flight symbology with the pilot's view through window No. 1.

### 3 Control Panel

Used for data entry and to select modes of operation.

### 4 Annunciator

Provides system status and warning annunciations during a CAT III approach.

## Combiner Display

The combiner displays symbology and fault indications for the HUD system. Display modes of operation include:

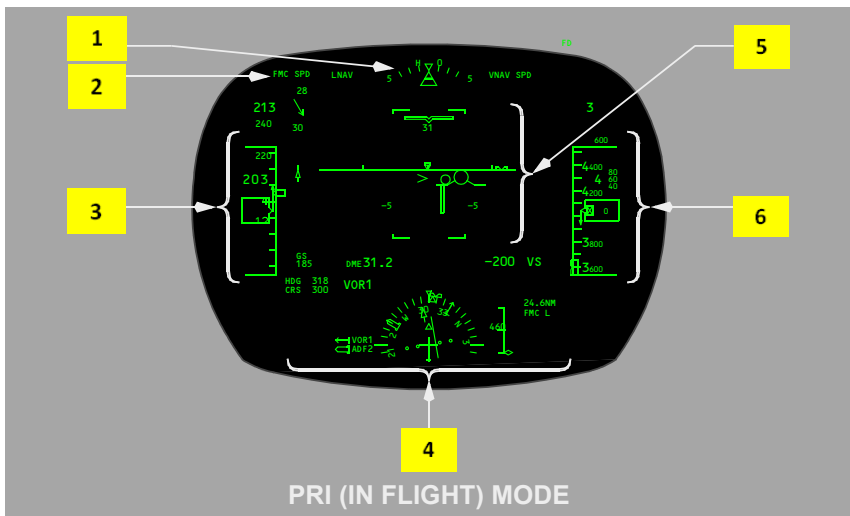
- Primary (PRI)
- AIII approach
- Instrument Meteorological Conditions (IMC) approach
- Visual Meteorological Conditions (VMC) approach

Typical display modes are shown below.

## Primary (PRI) Mode Display

### [Aircraft with Model 4000]

The primary mode can be used for all phases of flight from takeoff to landing including low visibility takeoff and landing rollout operations.



**1** Bank Scale and Pointer

**4** Navigation Indications

**2** Flight Mode Annunciations (FMAs)

**5** Attitude Indications

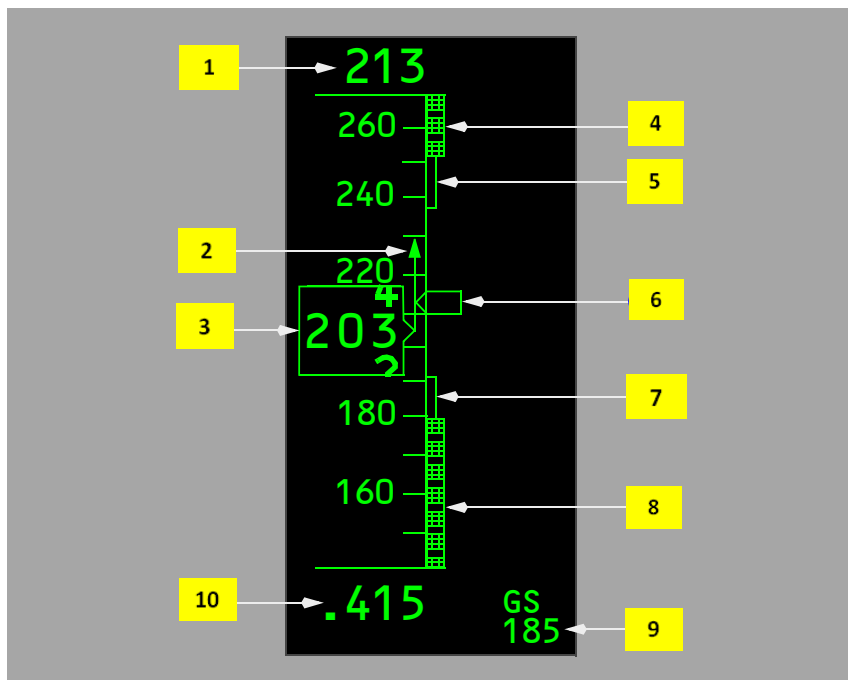
**3** Airspeed Indications

**6** Altitude Indications



**7** Ground Localizer Line

## Airspeed Indications - General



### 1 Selected Speed (all modes)

Displays target airspeed:

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

### 2 Speed Trend Vector (PRI in flight, PRI ground modes)

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

### 3 Computed Airspeed (PRI in flight, PRI ground modes)

Indicates current computed airspeed in knots.

Displayed relative to a vertical scale along the edge of the tape and as a digital value.

#### 4 Maximum Speed (PRI in flight mode)

Bottom of bar indicates the maximum speed as limited by the lowest of the following:

- V<sub>mo</sub>/M<sub>mo</sub>
- landing gear placard speed
- flap placard speed.

Inhibited on the ground.

#### 5 Maximum Maneuvering Speed (PRI in flight mode)

At high altitudes and flaps up, the 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.

When flaps are not up, bottom of the bar indicates flap limit placard speed for the next normal flap setting. The display logic is based on a normal flap setting sequence of 1, 5, 15, 30. The bar is removed when the flap lever is moved to the landing flap selected on the APPROACH REF page or when the flap lever is moved to flaps 30 or 40.

#### 6 Speed Bug (PRI in flight, PRI ground modes)

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 Minimum Maneuver Speed (PRI in flight, PRI ground modes)

Top of bar indicates minimum maneuver speed.

#### 8 Minimum Speed (PRI in flight mode)

Top of bar indicates the speed at which stick shaker occurs.

Inhibited on the ground.

#### 9 Ground Speed (all modes)

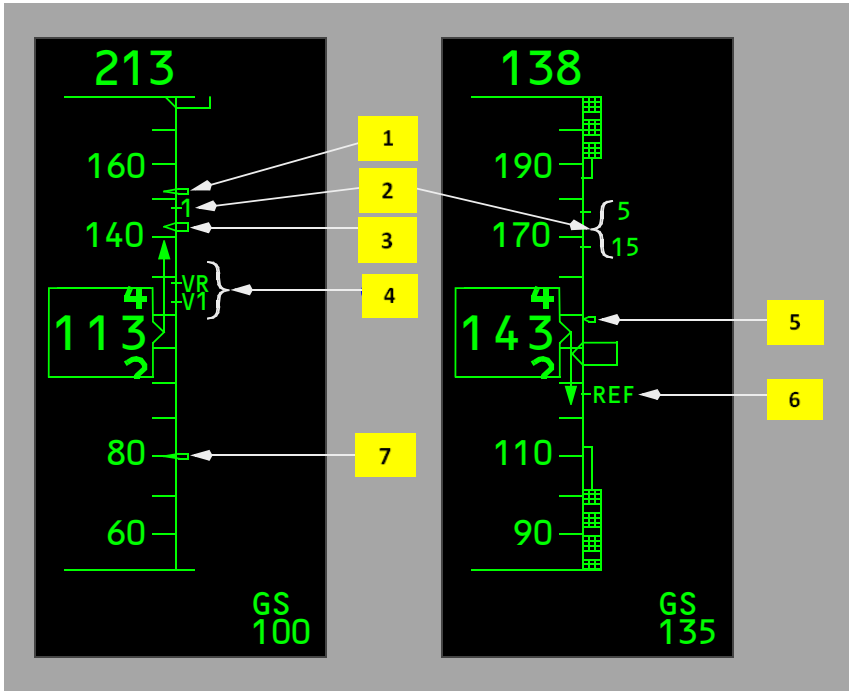
Indicates current ground speed in one knot increments.

**10 Mach Speed (PRI in flight)**

Indicates current mach speed when mach increases above .400 and removed when mach decreases below .380.

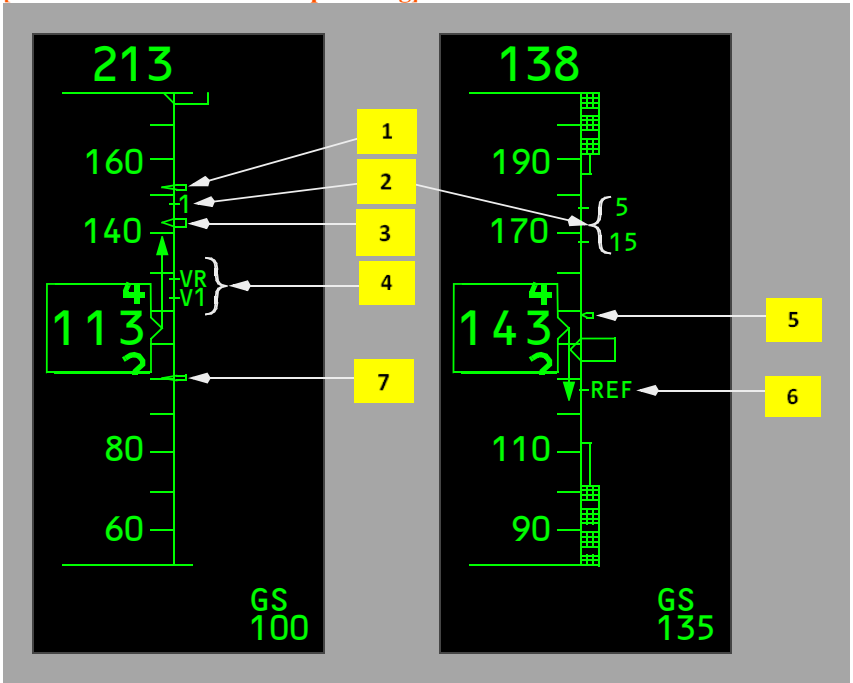
**Note:** In other than the PRI mode, the airspeed scale and associated symbols are replaced with a digital readout. The readout is positioned relative to the flight path vector. If the flight path vector is not displayed, the readout is positioned relative to the airplane reference symbol.

**Airspeed Indications - Takeoff and Approach**





[Aircraft with 100 knot airspeed bug]



**1 Bug 5 (PRI in flight, PRI ground modes)**

Displayed if speed reference selector on the engine display control panel is in the bug 5 position or SET position and a value greater than 60 knots has been selected. Not available if the speed reference selector is in the AUTO position.

**2 Flaps Maneuvering Speeds (PRI in flight mode)**

Indicates flap maneuvering speed for the displayed flap position.

**3 V2+15 (PRI in flight mode)**

Displayed for takeoff.

Removed when either of the following occurs:

- at first flap retraction
- when VREF is entered in the CDU.

#### **4 Takeoff Reference Speeds (PRI ground mode)**

Indicates V1 (decision speed) and VR (rotation speed) as selected on the CDU TAKEOFF REF page or as set with the speed reference selector on the engine display control panel.

#### **5 VREF+15 (PRI in flight, PRI ground modes)**

Displayed after selection of VREF.

#### **6 Landing Reference Speed (PRI in flight, PRI ground modes)**

Indicates REF (reference speed) as selected on the CDU APPROACH REF page or as set with the speed reference selector on the engine display control panel. Replaced by a digital readout when off-scale at the bottom of the airspeed tape.

#### **7 80 Knot Airspeed Bug (PRI in flight, PRI ground modes)**

Indicates 80 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

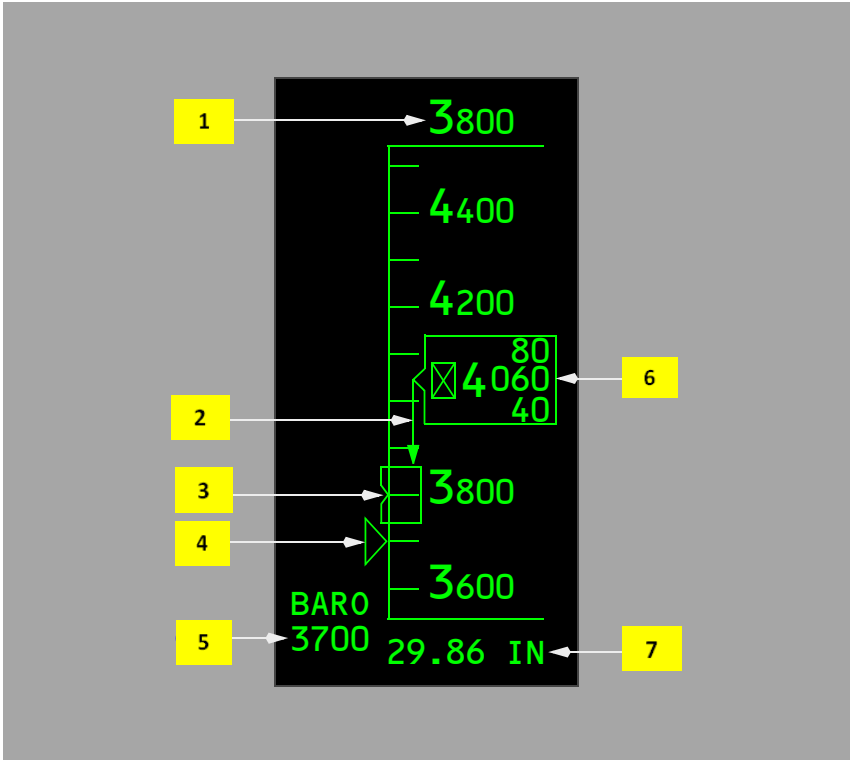
#### **7 100 Knot Airspeed Bug (PRI in flight, PRI ground modes)**

**[Aircraft with 100 knot airspeed bug]**

Indicates 100 knots:

- displayed automatically during preflight
- removed at first flap retraction or when VREF is entered.

### Altitude Indications



**1 Selected Altitude (PRI in flight, PRI ground modes)**

Displays the altitude set in the MCP altitude window.

**2 Altitude Trend Vector (PRI in flight mode)**

Tip of arrow indicates predicted altitude in the next 6 seconds based on the current vertical speed.

**3 Selected Altitude Bug (PRI in flight, PRI ground modes)**

Points to 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.

**4 BARO Minimums Pointer (PRI in flight, PRI ground modes)**

Displays the barometric minimums selected on the EFIS control panel.

**5 Minimums Reference/Altitude (PRI in flight, PRI ground modes)**

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

**6 Current Altitude (PRI in flight, PRI ground modes)**

Displays current altitude in increments of thousands, hundreds and twenty feet. For positive values of altitude below 10,000 feet, an “X” symbol is displayed.

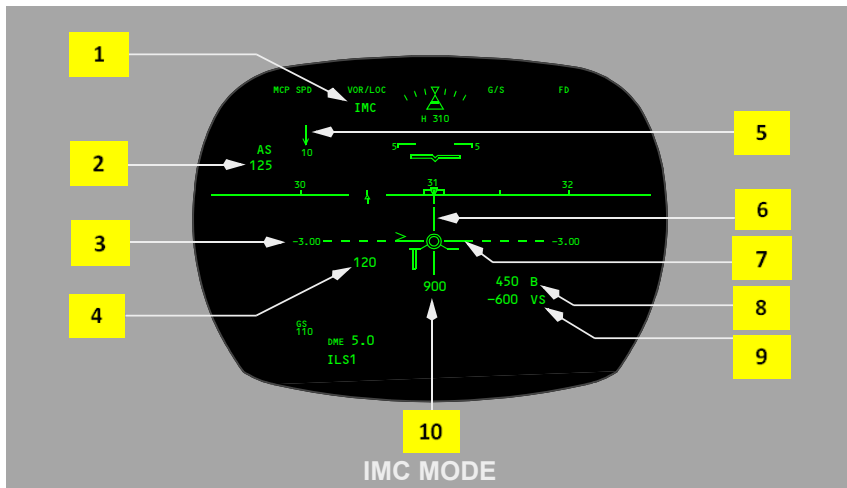
**7 Barometric Setting (PRI in flight, PRI ground modes)**

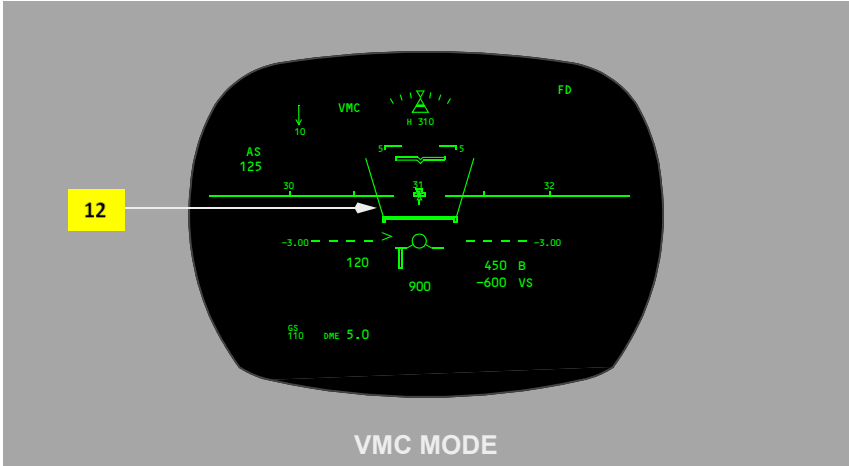
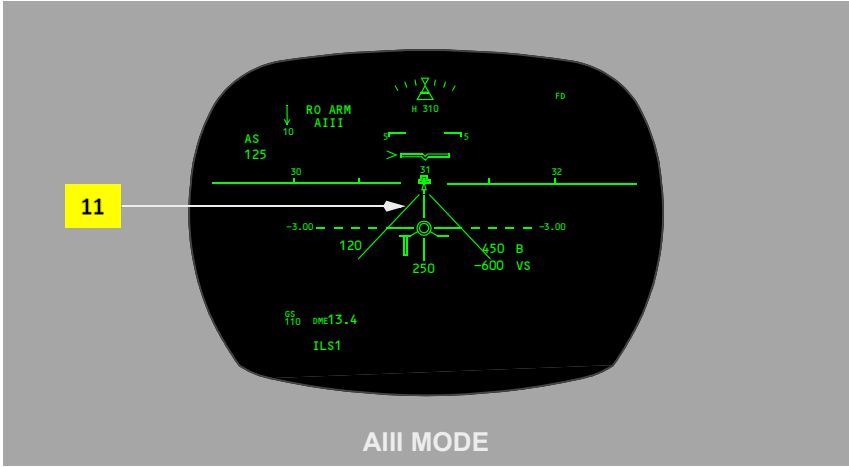
Displays the barometric setting in either inches of mercury (IN) or hectopascals (HPA) as selected on the EFIS control panel.

**Note:** In other than the PRI mode, the altitude scale and associated symbols are replaced with a digital readout. The readout is positioned relative to the flight path vector. If the flight path vector is not displayed, the readout is positioned relative to the airplane reference symbol.

## Approach Mode Displays

[Aircraft with Model 4000]





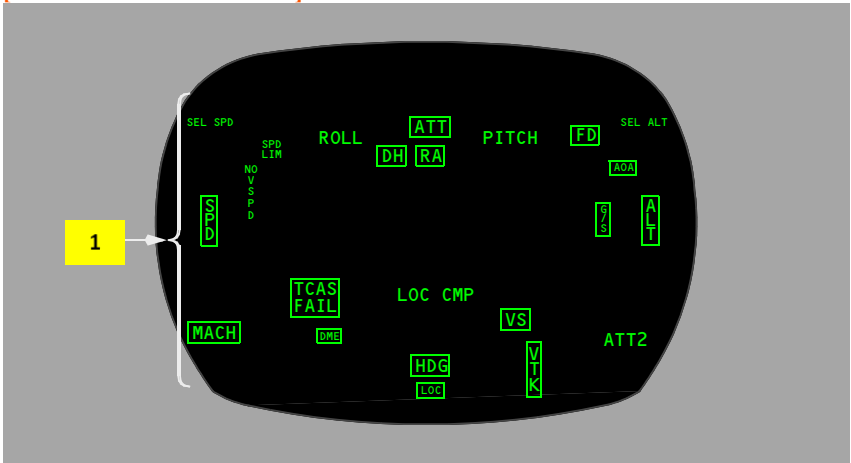
- |                                    |                                      |
|------------------------------------|--------------------------------------|
| <b>1</b> Mode/Status               | <b>7</b> Glideslope Deviation Line   |
| <b>2</b> Digital Selected Airspeed | <b>8</b> Digital Barometric Altitude |
| <b>3</b> Glideslope Reference Line | <b>9</b> Digital Vertical Speed      |
| <b>4</b> Digital Airspeed          | <b>10</b> Radio Altitude             |
| <b>5</b> Wind Indications          | <b>11</b> Runway Edge Lines          |
| <b>6</b> Lateral Deviation Line    | <b>12</b> TCAS Resolution Advisory   |

## Failure Indications and Flags

Dashes replace numbers if there is no computed information. Failure flags replace symbols or failure messages are displayed, as appropriate.

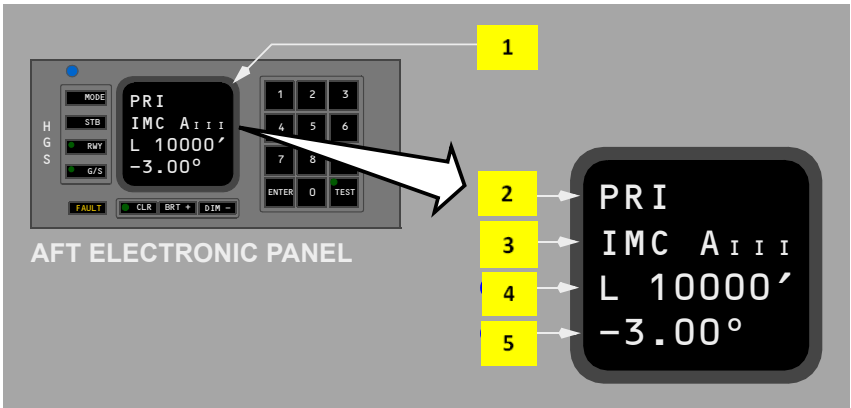
Data source flags are provided in a few cases to annunciate the source of displayed data when other than normal.

### [Aircraft with Model 4000]



### 1 HUD System Failure Indications and Flags

## Control Panel Display



## 1 Control Panel Display Window

Displays selected modes, entered values, system test and system status.

## 2 Mode Display Line

Displays current mode:

- PRI - primary flight mode
- AIII - Cat III approach mode
- IMC - instrument meteorological conditions approach mode
- VMC - visual meteorological conditions approach mode
- NO AIII - AIII capability lost
- CLR - combiner display cleared.

## 3 Standby Mode Display Line

Displays standby mode:

- PRI - primary flight mode
- AIII - Cat III approach mode
- IMC - instrument meteorological conditions approach
- VMC - visual meteorological conditions approach.

### [Aircraft with Model 4000]

Automatic AIII arming is indicated by “AIII ARM” displayed as the standby mode. Once all requirements are satisfied for an AIII mode approach, AIII mode is automatically activated.

## 4 Runway Length/Elevation Line

Displays runway length or elevation:

- L XXXXX - valid entry is 0 to 99999 feet, however, entries between 7500 and 13500 feet are required to display ground roll guidance for low visibility takeoff operations.
- E XXXXX - valid entry is -9999 to 99999 feet.

## 5 Reference Glideslope Line

Displays runway glideslope:

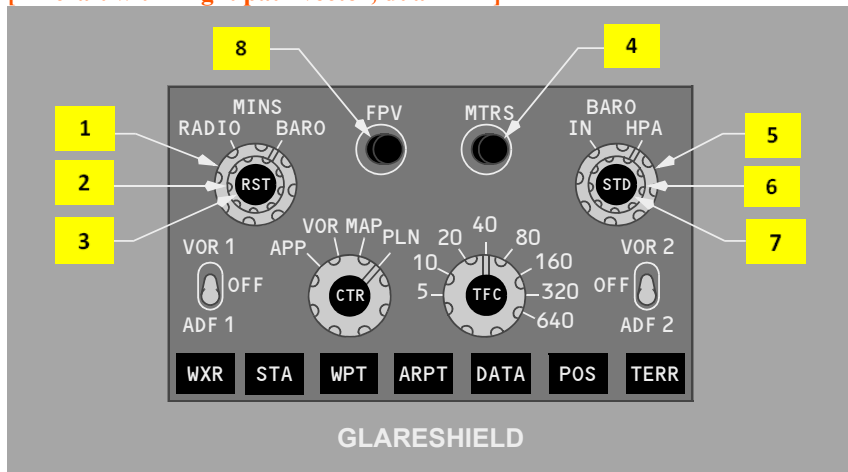
- valid entry is 0.00° to -9.99°.
- entered values are required to be between -2.51° and -3.00° for AIII approach operations.

## EFIS Control Panel (EFIS/Map Display)

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

### EFIS Control Panel Controls – Flight Instrument Displays

[Aircraft with Flight path vector, dual ADF]



#### 1 Minimums (MINS) Reference Selector (outer) (two position)

RADIO – selects radio altitude as the minimums reference.

BARO – selects barometric altitude as the minimums reference.

#### 2 Minimums (MINS) Selector (middle) (slew)

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
- blanks the reference altitude marker on the altimeter if displayed; sets the reference altitude marker to zero if not previously displayed.



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

PUSH – displays altitude indications in meters. Not available in compact display format.

**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)**

[Aircraft with Flight path vector]

PUSH – displays flight path vector on the attitude indicator.

**EFIS Control Panel Controls – Navigation Displays**

[Aircraft with Dual ADF, flight path vector]



**1 VOR/ADF Switch (three position)**

Displays VOR or ADF information on the respective RDML.

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 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
- displays reference GLS receiver, GLS channel/course and GLS distance.
- weather radar and TCAS are not displayed in center APP mode.

VOR –

- displays VOR navigation information in heading–up format
- displays reference VOR receiver, VOR frequency, course, DME and TO/FROM information
- weather radar and TCAS are not displayed in center VOR mode.

MAP –

### [Aircraft with Heading-up display]

- 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
- weather radar and TCAS are not displayed.

## 3 Center (CTR) Switch (inner)

PUSH –

- displays the full compass rose (center) for APP, VOR and MAP modes

### [Aircraft with VSD]

- subsequent pushes alternate between center with VSD, expanded and center without VSD.

#### **4 Range Selector (outer)**

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

#### **5 Traffic (TFC) Switch (inner)**

PUSH – displays TCAS information

#### **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.

WXR (weather radar) – energizes weather radar transmitter and displays weather radar returns in MAP, center MAP, expanded VOR and expanded APP modes.

When the 640 nm range is selected, weather radar returns are limited to 320 nm

STA (station) –

- displays all FMC data base navigation aids if on map scales 5, 10, 20 or 40 nm.
- displays FMC data base high altitude navigation aids on map scales 80, 160, 320 or 640 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.

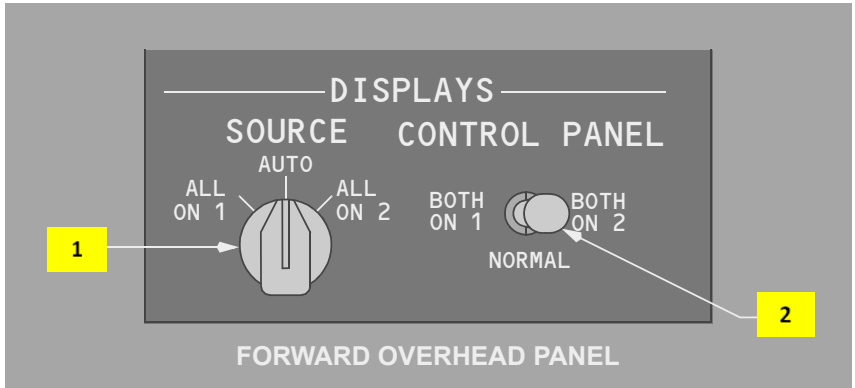
ARPT (airport) – displays all airports which are stored in the FMC data base and which are within the viewable map area.

DATA – displays altitude constraint, 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.

TERR (terrain) – displays GPWS generated terrain data in MAP, center MAP, VOR, and APP modes

## Displays Source Panel



### 1 DISPLAYS SOURCE Selector

AUTO – DEU 1 controls the Captain outboard, Captain inboard, and the upper display units; DEU 2 controls the First Officer outboard, First Officer inboard, and the lower display units. When a DEU fails, the other DEU controls all display units.

ALL ON 1/ALL ON 2 – provides a means of manually switching to a single DEU as the source of information for all six display units.

**Note:** Used on the ground for maintenance purposes.

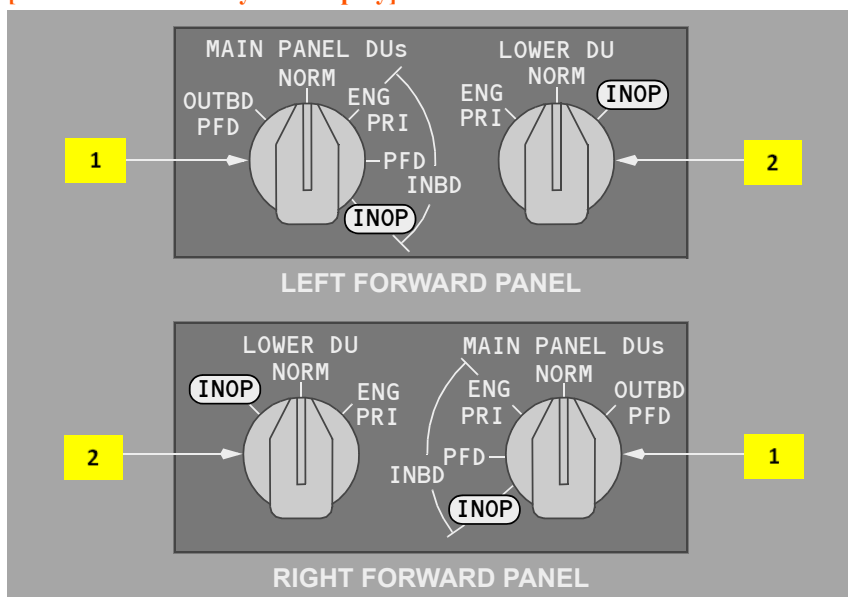
### 2 CONTROL PANEL Select Switch

NORMAL – the left EFIS control panel controls the Captain’s displays and the right EFIS control panel controls the First Officer’s displays.

BOTH ON 1/BOTH ON 2 – provides a means of manually switching control of the Captain’s and First Officer’s displays to a single EFIS control panel.

## Display Select Panels

[Aircraft with Side by side display]



### 1 Main Panel Display Units (MAIN PANEL DUs) Selector

Selects what is displayed on the respective outboard and inboard display units:

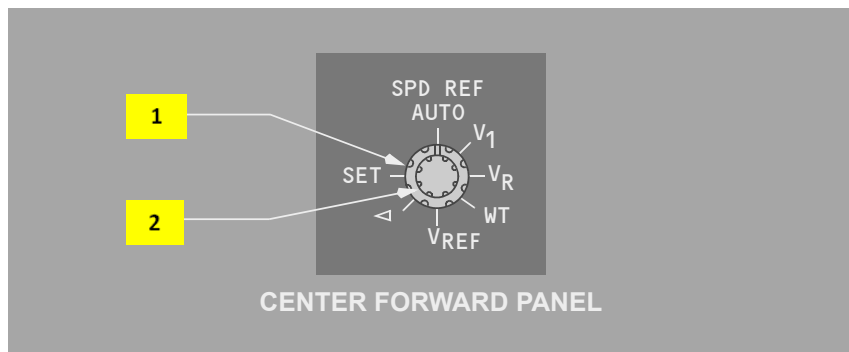
- Outboard Primary Flight Display (OUTBD PFD) – displays the compact EFIS format on the outboard display unit and blanks the inboard display unit.
- Normal (NORM) – displays normal EFIS and MAP displays on the outboard and inboard display units; provides automatic display switching if a display unit fails.
- Inboard Engine Primary (INBD ENG PRI) – displays the engine display on the inboard display unit and the compact EFIS format on the outboard display unit.
- Inboard Primary Flight Display (INBD PFD) – displays the compact EFIS format on the inboard display unit and blanks the outboard display unit.

## 2 Lower Display Unit (LOWER DU) Selector

Selects what is displayed on the lower display unit:

- Engine Primary (ENG PRI) – displays the engine display on the lower display unit and blanks the upper display unit.
- Normal (NORM) – displays the engine display on the upper display unit and no display on the lower display unit; provides automatic display switching to the lower display unit if the upper display unit fails.

## Speed Reference Selector



### 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 the 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.

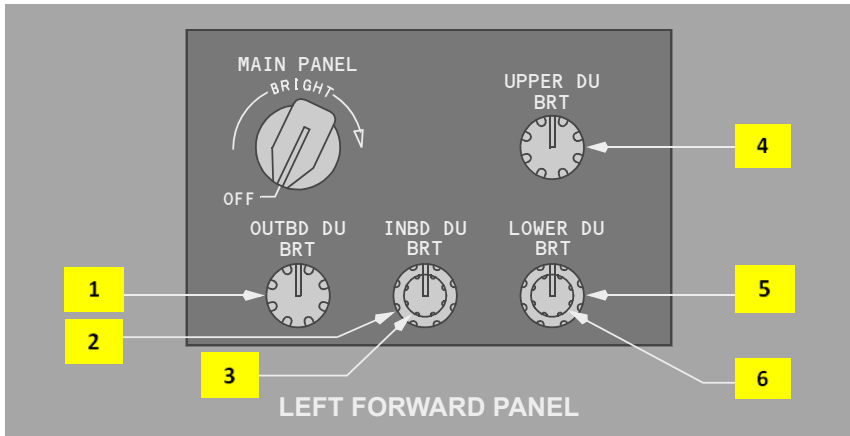
### 2 Speed Reference Selector (inner) (two speed slew)

ROTATE –

- manually sets the appropriate reference airspeed or gross weight
- the digital display appears above the Mach/airspeed indicator.

## Display Brightness Controls

### Captain Brightness Controls



#### 1 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the Captain outboard display unit.

#### 2 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the Captain inboard display unit.

#### 3 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the Captain inboard display unit.

#### 4 Upper Display Unit Brightness (UPPER DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the upper display unit.

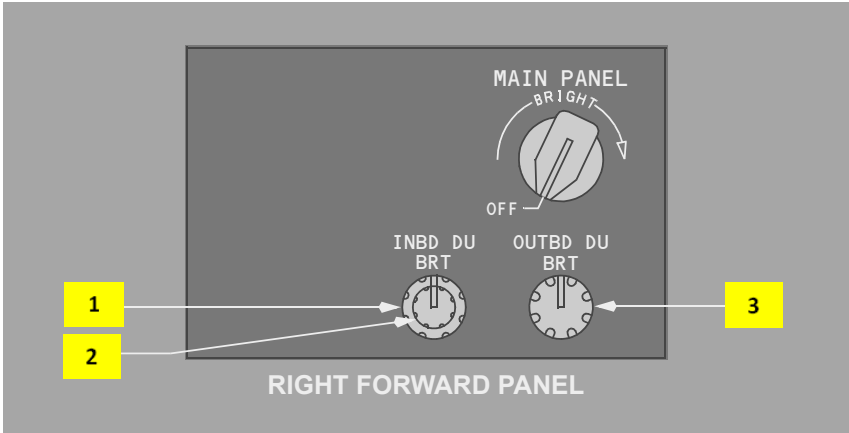
#### 5 Lower Display Unit Brightness (LOWER DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the lower display unit.

#### 6 Lower Display Unit Brightness (LOWER DU BRT) Control (inner) (rotary)

Inoperative.

## First Officer Brightness Controls



**1 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)**

ROTATE – adjusts the brightness of the First Officer inboard display unit.

**2 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)**

ROTATE – adjusts weather radar and terrain display brightness on the First Officer inboard display unit.

**3 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)**

ROTATE – adjusts the brightness of the First Officer outboard display unit.

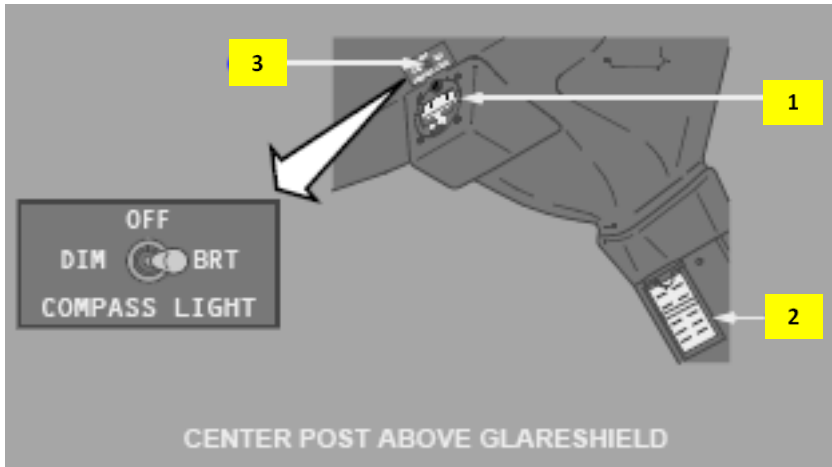


## Standby Flight Instruments

The standby flight instruments include the:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator.

## Standby Magnetic Compass



### 1 Standby Magnetic Compass

Displays magnetic heading.

### 2 Standby Magnetic Compass Correction Card

Provides appropriate heading corrections.

### 3 Compass Light Switch

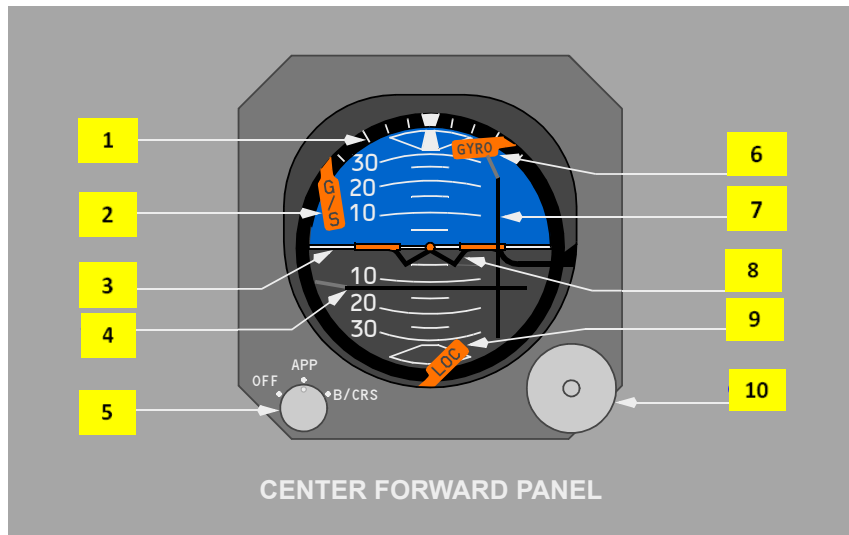
OFF – compass light is extinguished.

BRT – sets compass light to full brightness.

DIM – sets compass light to low brightness.

## Standby Attitude Indicator

[Aircraft with Sextant 705-7V4]



### 1 Bank Indicator and Scale

Scale marks are at 0, 10, 20, 30, 45 and 60 degrees.

### 2 Glideslope Flag

- glideslope receiver has failed
- glideslope pointer is removed.

### 3 Horizon Line and Pitch Angle Scale

Pitch scale is in 5 degree increments.

### 4 Glideslope Pointer and Deviation Scale

- pointer indicates glideslope position
- pointer is not displayed when
  - approach selector is off or in B/CRS
  - no computed data exists
  - glideslope receiver has failed
- scale indicates deviation.

5

**Approach Mode Selector**

OFF – glideslope and localizer pointers retracted from view.

APP – glideslope and localizer pointers in view; ILS signals provided by the No. 1 ILS receiver.

B/CRS – reverses sensing for localizer pointer during back course approaches; glideslope pointer not displayed.

**6 GYRO Flag**

Attitude is unreliable.

**7 Localizer Pointer and Deviation Scale**

- pointer indicates localizer position
- pointer is not displayed when
  - approach selector is off
  - no computed data exists
  - localizer receiver has failed
- scale indicates deviation.

**8 Airplane Symbol****9 Localizer Flag**

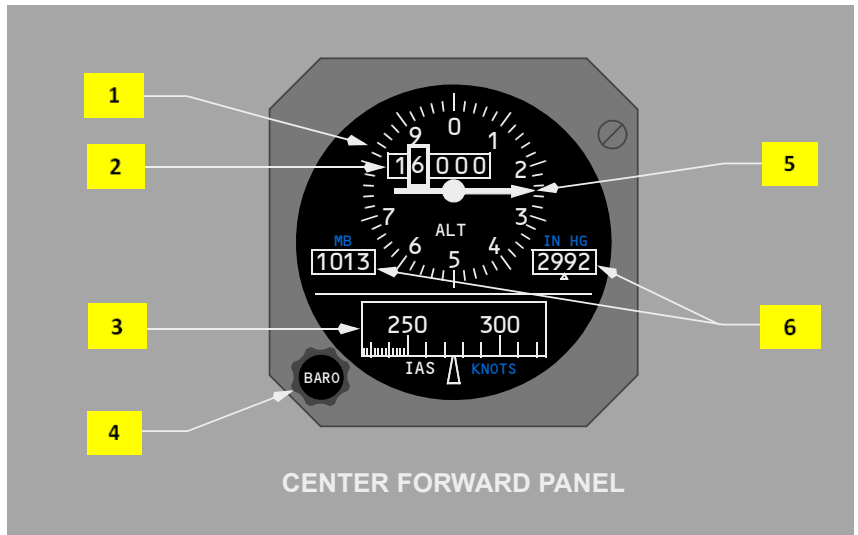
- localizer receiver has failed
- localizer pointer is removed.

**10 Caging Control**

PULL – aligns horizon line with the airplane symbol.

RELEASE – the control contracts.

## Standby Altimeter/Airspeed Indicator



### 1 Standby Altimeter

Receives static pressure from the alternate static ports.

### 2 Digital Counter

- indicates thousand foot increments of current altitude
- a green flag appears in the left window when altitude is less than 10,000 feet
- a striped flag appears in the left window when altitude is less than zero feet.

### 3 Standby Airspeed Indicator

Receives ram pressure from the auxiliary pitot probe and static pressure from the alternate static ports.

### 4 Barometric Setting Control

ROTATE – adjusts the barometric correction in both barometric windows.

### 5 Altitude Pointer

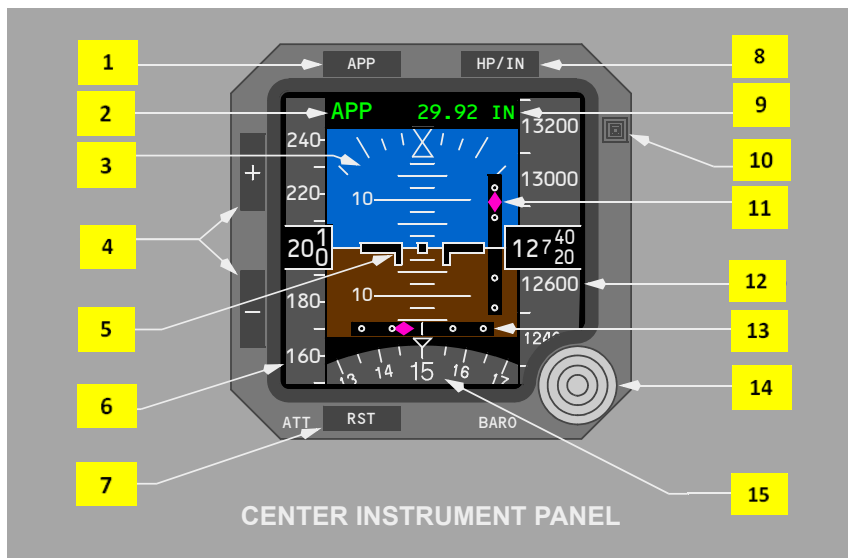
Indicates hundred foot increments of current altitude.

### 6 Barometric Setting Windows

Indicates barometric correction in millibars and inches of mercury as set by the barometric setting control.

## Integrated Standby Flight Display

[Aircraft with Sextant S231A120]



### 1 Approach (APP) Switch

Push –

- when blank, selects APP
- when APP displayed, selects BCRS
- when BCRS displayed, blanks

### 2 Approach Mode Annunciation

Indicates approach mode selected.

- Blank – no approach deviation data displayed
- APP – ILS localizer and glideslope deviation data displayed
- BCRS (Back course) – reverses sensing for localizer pointer during back course approaches

### 3 Attitude Display

Displays airplane attitude.

- Indicates bank in reference to the bank scale
- Indicates the horizon relative to the airplane symbol
- Beyond 30 degrees pitch, large red arrowheads (V-shaped) indicate the attitude has become excessive, and the direction to the horizon line.

#### **4 Display Brightness Switches**

Push –

- + increases display brightness
- - decreases display brightness

#### **5 Airplane Symbol**

Indicates airplane attitude with reference to the horizon.

#### **6 Airspeed Indications**

Indicates current airspeed when above 30 knots.

#### **7 Attitude Reset (RST) Switch**

Push and hold at least two seconds

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds

#### **8 Hectopascal/Inch (HP/IN) Switch**

Push – changes the units of the barometric reference.

#### **9 Barometric Setting**

Indicates the barometric setting selected with the barometric selector.

STD is displayed when selected with the barometric selector.

#### **10 Ambient Light Sensor**

Automatically adjusts display intensity for ambient lighting condition.

#### **11 Glideslope Pointer and Deviation Scale**

The glideslope pointer indicates glideslope position relative to the airplane.

- the pointer is in view when the glideslope signal is received
- the scale is in view when the APP mode is selected
- the pointer and scale are removed when the BCRS mode is selected

#### **12 Current Altitude**

#### **13 Localizer Pointer and Deviation Scale**

The localizer pointer indicates localizer position relative to the airplane.

- the pointer is in view when the localizer signal is received
- the scale is in view when either the APP or BCRS mode is selected

## 14 Barometric (BARO) Selector

Rotate – changes barometric setting

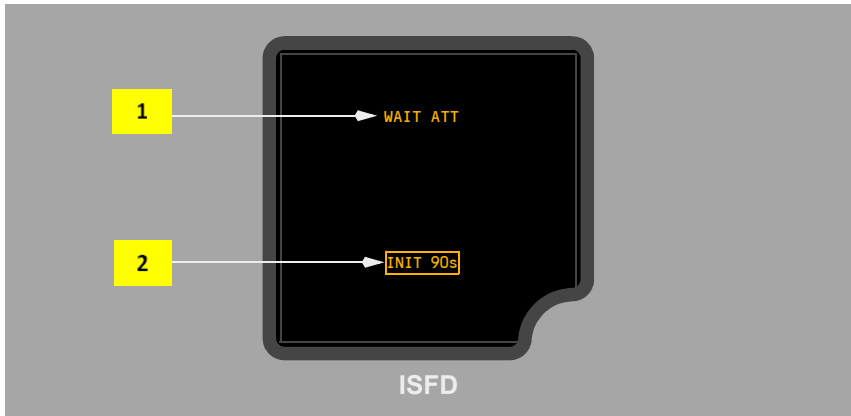
Push –

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD is displayed, selects the preselected barometric setting

## 15 Heading Indication

Displays airplane heading.

### ISFD Messages



### 1 Attitude Messages

Indicates attitude display status.

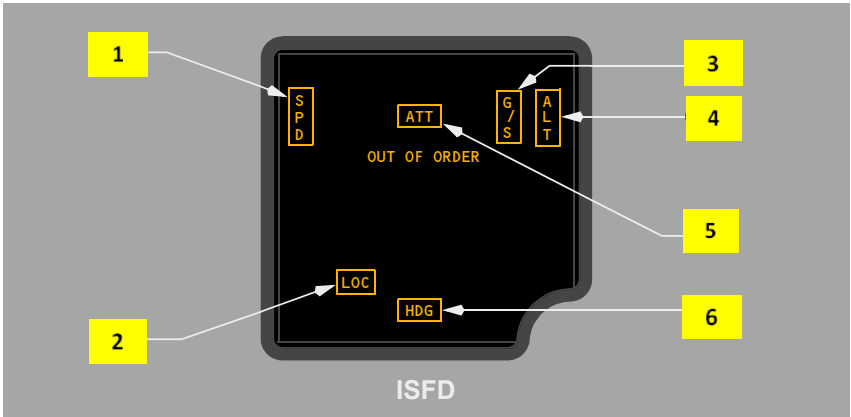
- ATT:RST (amber) – attitude must be reset using the attitude reset switch
- ATT 10s (amber) – 10 second attitude realignment in progress
- WAIT ATT (amber) – indicates temporary self correcting loss of attitude

### 2 Initialization Message

INIT 90s (amber) – 90 second initialization in progress.

### ISFD Failure Flags

The OUT OF ORDER annunciation replaces the display when a total ISFD system failure occurs.



**1** **Airspeed flag**

Airspeed information has failed.

**2** **ILS localizer failure flag**

ILS localizer has failed.

**3** **ILS glideslope failure flag**

ILS glideslope has failed.

**4** **Altitude flag**

Altitude information has failed.

**5** **Attitude flag**

Attitude information has failed.

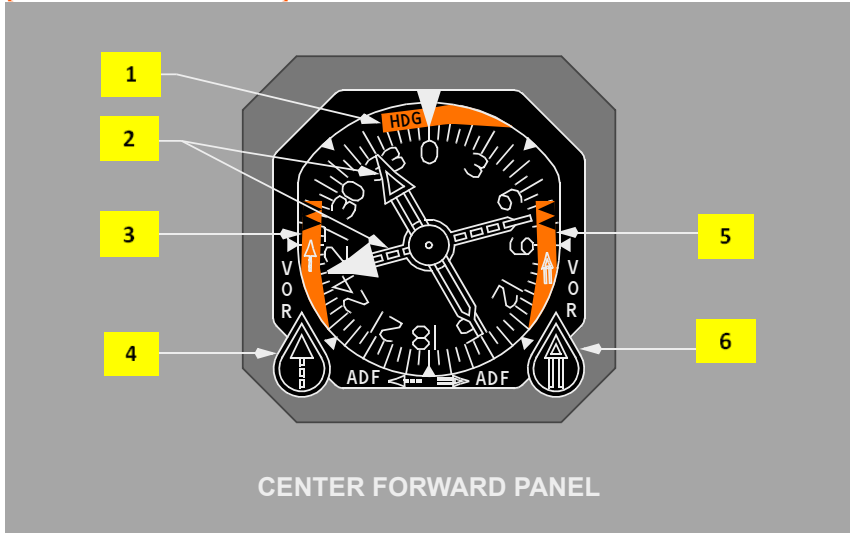
**6** **Heading flag**

Heading data has failed.



## Standby Radio Magnetic Indicator

[Aircraft with Dual ADF]



### 1 Heading Warning Flag

The compass signal from the air data inertial reference system is lost.

### 2 Bearing Pointers

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

[Aircraft with Dual ADF]

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

### 3 Bearing Pointer No. 1 Warning Flag

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

ADF mode:

- RMI power failure
- ADF failure or signal unreliable.

### 4 VOR/ADF Bearing Pointer No. 1 Switch

ROTATE – selects VOR or ADF for the bearing pointer.

**5 Bearing Pointer No. 2 Warning Flag**

VOR mode

- RMI power failure
- VHF NAV signal unreliable.

[Aircraft with Dual ADF]

ADF mode

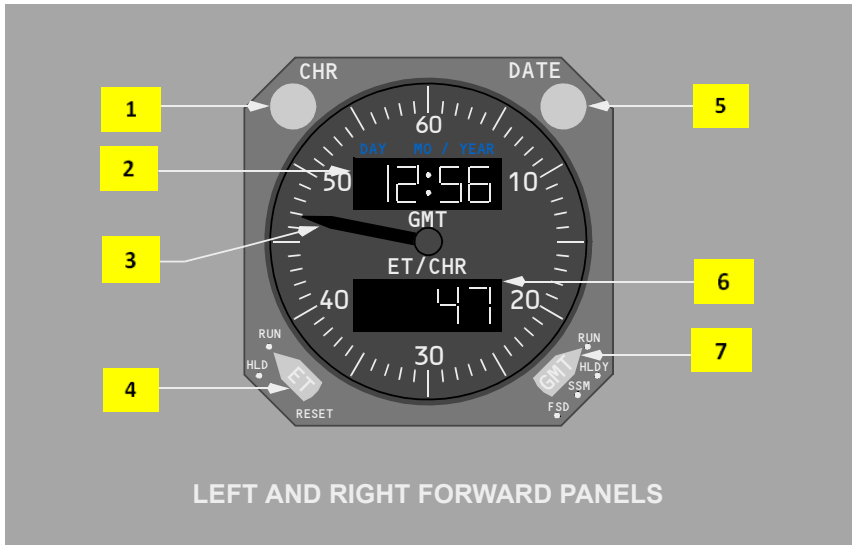
- RMI power failure
- ADF failure or signal unreliable.

**6 VOR/ADF Bearing Pointer No. 2 Switch**

[Aircraft with Dual ADF]

ROTATE – selects VOR or ADF for the bearing pointer.

**Clock**



**1 Chronograph (CHR) Control**

PUSH –

- controls the start, stop and reset functions of the CHR display and second hand with successive pushing
- overrides any existing ET display.

## 2 Time/Date Window

- displays time (hours, minutes) when time is selected with the date control
- alternately displays day–month and year when date is selected with the date control.

## 3 Chronograph Second Hand

- indicates chronograph seconds
- controlled by the CHR control

## 4 Elapsed Time (ET) Selector (three position, rotary)

Controls the elapsed time function.

RESET – returns ET display to zero (spring loaded to HLD).

HLD (hold) – stops the elapsed time display.

RUN – starts the elapsed time display.

## 5 Date Control

Controls the date display.

PUSH – displays date (day, month) alternating with year.

PUSH – returns display to time.

## 6 Elapsed Time (ET)/Chronograph Window

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

## 7 Time Control (four position, rotary)

Sets the time and date when the time or date is selected with the date control.

FS D (fast slew, day) –

- advances hours when time is selected with the date control
- advances days when date is selected with the date control.

SS M (slow slew, month) –

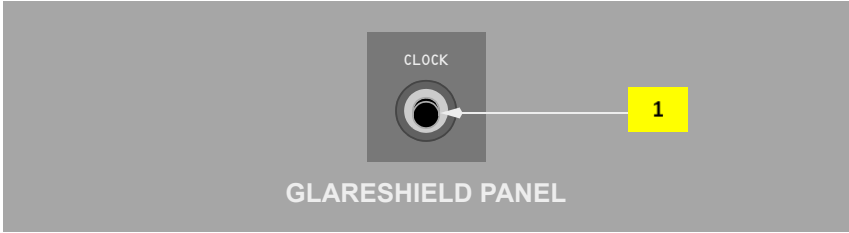
- advances minutes when time is selected with the date control
- advances months when date is selected with the date control.

HLD Y (hold, year) –

- stops the time indicator and sets the seconds to zero when time is selected with the date control
- advances years when date is selected with the date control.

RUN – starts the time indicator.

### Clock Switch

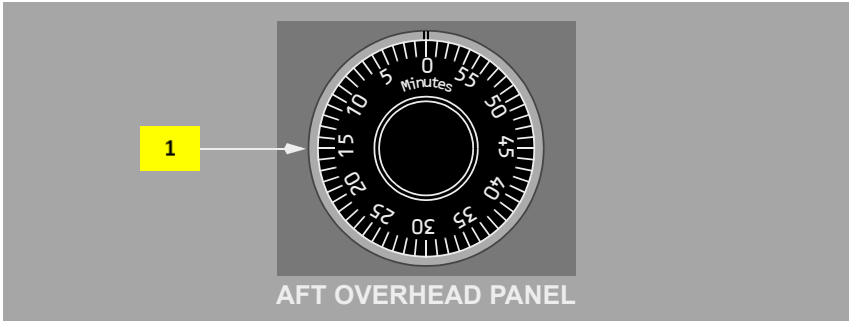


**1** Clock Switch

Operates the same as the chronograph (CHR) control.

### Timer

[Option]



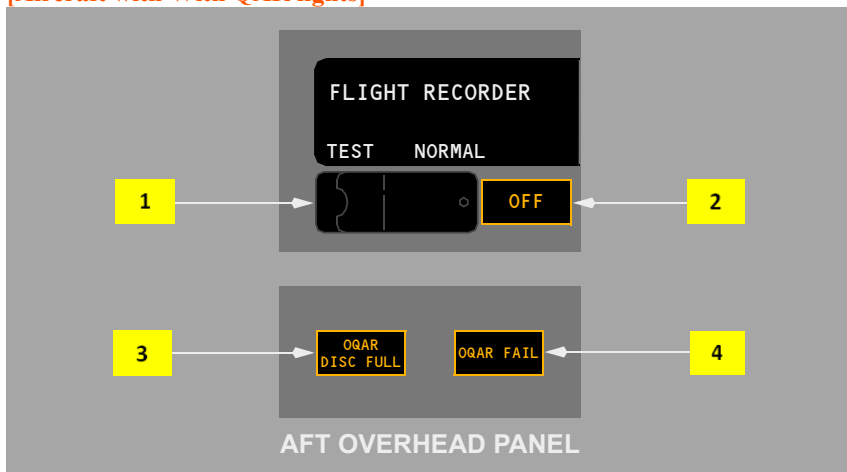
**1** Mechanical Timer

## Flight Recorder

### [Aircraft Without QAR lights]



### [Aircraft with With QAR lights]



#### 1 Flight Recorder Test Switch

NORMAL (guarded position) –

- inflight – the recorder operates anytime electrical power is available
- on the ground – either engine must also be operating.

TEST – powers the flight recorder on the ground.

#### 2 OFF Light (amber)

ILLUMINATED –

- indicates the recorder is not operating or the test is invalid
- may indicate power failure, loss of input data, or electronic malfunction.

**3 Optical Quick Access Recorder (OQAR) Disc Full (blue)**

**[Aircraft with QAR lights]**

ILLUMINATED –

- indicates the quick access recorder is full

**4 Optical Quick Access Recorder (OQAR) FAIL (blue)**

**[Aircraft with QAR lights]**

ILLUMINATED –

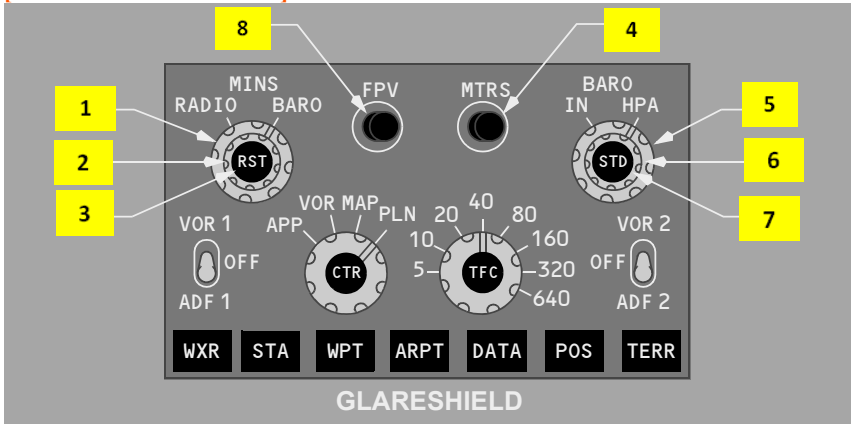
- indicates the quick access recorder has failed

## EFIS Control Panel (PFD/ND Display)

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

### EFIS Control Panel Controls – Flight Instrument Displays

[Aircraft with Dual ADF]



**1 Minimums (MINS) Reference Selector (outer) (two position)**

RADIO – selects radio altitude as the minimums reference

BARO – selects barometric altitude as the minimums reference.

**2 Minimums (MINS) Selector (middle) (slew)**

ROTATE – adjusts the radio or baro minimums altitude.

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

PUSH –

- resets the alert minimums annunciation
- blanks minimums display if alert is not active.

**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 altitude tape
- if STD is displayed, adjusts the preselected BARO reference.

## 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
- if STD is displayed, selects the preselected barometric reference
- if no preselected barometric is displayed, displays the last value before STD was selected.

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

PUSH – displays flight path vector on the attitude indicator.

## EFIS Control Panel Controls – Navigation Displays

[Aircraft with Dual ADF]



### 1 VOR/ADF Switch (three position)

Displays VOR or ADF information on all navigation modes except PLAN.

VOR – displays the selected VOR bearing pointer, frequency or identification and DME.

OFF – removes the VOR or ADF displays.

ADF – displays the selected ADF pointer and ADF frequency or identification.



## 2 Mode Selector (outer)

Selects the desired display.

APP –

- displays localizer and glideslope information in heading–up format.

### [Aircraft with IAN]

- displays FAC and glidepath information in heading–up format.
- displays reference IAN procedure, distance to missed approach point and source of IAN deviations.
- displays reference ILS receiver, ILS frequency or identification, course and DME.
- displays reference GLS receiver, GLS channel/course and GLS distance.
- weather radar and TCAS are not displayed in center APP mode.

VOR –

- displays VOR navigation information in heading–up format
- displays reference VOR receiver, VOR frequency or identification, course, DME and TO/FROM information
- weather radar and TCAS are not displayed in center VOR mode.

MAP –

### [Aircraft with Track-up display]

- displays FMC generated route and MAP information, airplane position, heading and track, in a track–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 and orientation
- allows route step–through using the CDU LEGS page
- weather radar and TCAS are not displayed.

## 3 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.

### [Aircraft with VSD]

- subsequent pushes alternate between center with VSD, expanded and center without VSD.

**4 Range Selector (outer)**

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

**5 Traffic (TFC) Switch (inner)**

PUSH – displays TCAS information on the navigation display

**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.

WXR (weather radar) – energizes weather radar transmitter and displays weather radar returns in MAP, center MAP, expanded VOR, and expanded APP modes.

When the 640 nm range is selected, weather radar returns are limited to 320 nm

STA (station) –

- displays all FMC data base navigation aids if on map scales 5, 10, 20 or 40 nm
- displays FMC data base high altitude navigation aids on map scales 80, 160, 320 or 640 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.

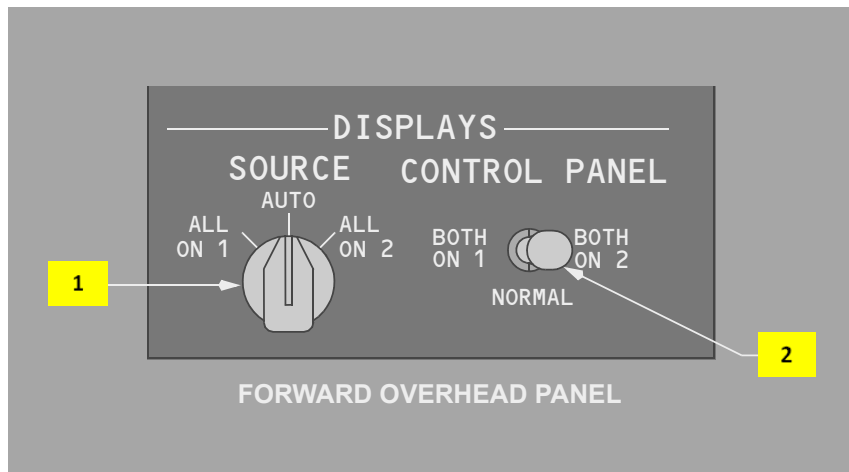
ARPT (airport) – displays all airports which are stored in the FMC data base and which are within the viewable map area.

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

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

TERR (terrain) – displays GPWS generated terrain data in MAP, center MAP, VOR, and APP modes

## Displays Source Panel



### 1 DISPLAYS SOURCE Selector

AUTO – DEU 1 controls the Captain outboard, Captain inboard, and the upper display units; DEU 2 controls the First Officer outboard, First Officer inboard, and the lower display units. When a DEU fails, the other DEU controls all display units.

ALL ON 1/ALL ON 2 – provides a means of manually switching to a single DEU as the source of information for all six display units.

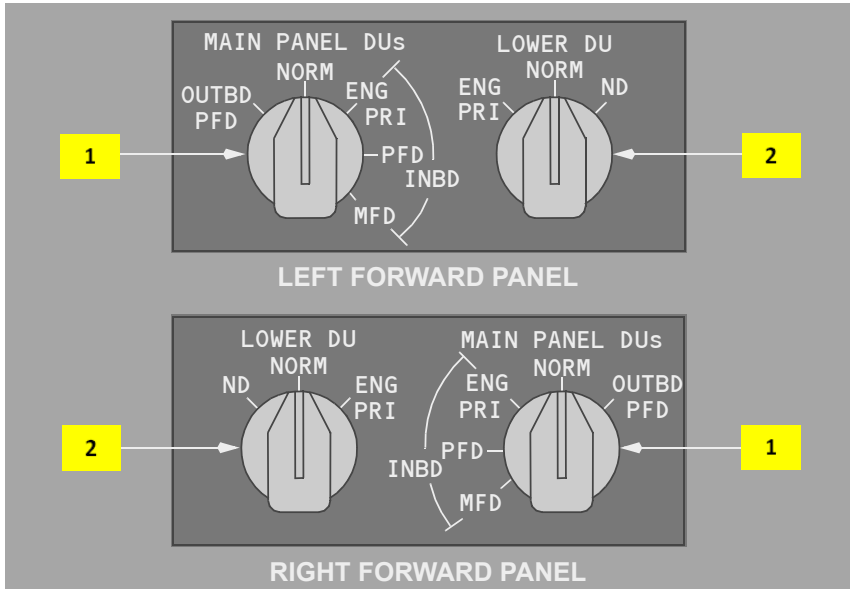
**Note:** Used on the ground for maintenance purposes.

### 2 CONTROL PANEL Select Switch

NORMAL – the left EFIS control panel controls the Captain’s displays and the right EFIS control panel controls the First Officer’s displays.

BOTH ON 1/BOTH ON 2 – provides a means of manually switching control of the Captain’s and First Officer’s displays to a single EFIS control panel.

## Display Select Panels



### 1 Main Panel Display Units (MAIN PANEL DUs) Selector

Selects what is displayed on the respective outboard and inboard display units:

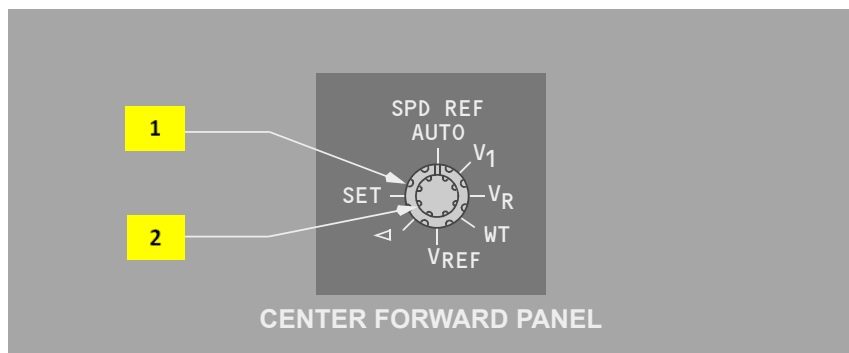
- Outboard Primary Flight Display (OUTBD PFD) – displays the PFD on the outboard display unit and blanks the inboard display unit
- Normal (NORM) – displays PFD on the outboard display unit and ND on the inboard display unit
- Inboard Engine Primary (INBD ENG PRI) – displays the primary engine instruments on the inboard display unit and the PFD on the outboard display unit
- Inboard Primary Flight Display (INBD PFD) – displays the PFD on the inboard display unit and blanks the outboard display unit
- Inboard Multifunction Display (INBD MFD) – displays PFD on the outboard display unit and blanks the inboard display unit. The inboard display unit stays blank until system format (SYS) or secondary engine format (ENG) is selected with MFD switches on the engine display control panel.

## 2 Lower Display Unit (LOWER DU) Selector

Selects what is displayed on the lower display unit:

- Engine Primary (ENG PRI) – displays the primary engine instruments on the lower display unit and blanks the upper display unit
- Normal (NORM) – display unit is normally blank or displays MFD format selected on the engine display control panel
- Navigation Display (ND) – displays the navigation display on the lower unit.

## Speed Reference Selector



### 1 Speed Reference Selector (outer)

Sets the reference airspeed bugs on the airspeed indication:

- 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 the 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 speed reference display.

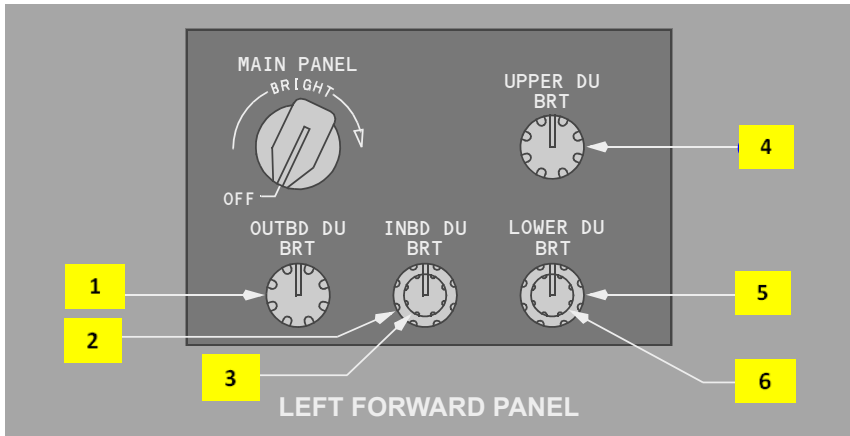
### 2 Speed Reference Selector (inner) (two speed slew)

ROTATE –

- manually sets the appropriate reference airspeed or gross weight
- the digital display appears below the airspeed indication.

## Display Brightness Controls

### Captain Brightness Controls



#### 1 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the Captain outboard display unit.

#### 2 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the Captain inboard display unit.

#### 3 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the Captain inboard display unit.

#### 4 Upper Display Unit Brightness (UPPER DU BRT) Control (rotary)

ROTATE – adjusts the brightness of the upper display unit.

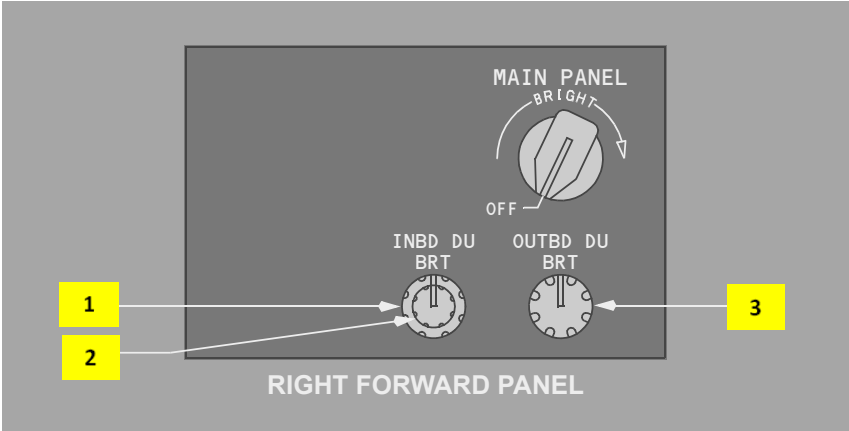
#### 5 Lower Display Unit Brightness (LOWER DU BRT) Control (outer) (rotary)

ROTATE – adjusts the brightness of the lower display unit.

#### 6 Lower Display Unit Brightness (LOWER DU BRT) Control (inner) (rotary)

ROTATE – adjusts weather radar and terrain display brightness on the lower display unit.

## First Officer Brightness Controls



**1 Inboard Display Unit Brightness (INBD DU BRT) Control (outer) (rotary)**

ROTATE – adjusts the brightness of the First Officer inboard display unit.

**2 Inboard Display Unit Radar Brightness (INBD DU BRT) Control (inner) (rotary)**

ROTATE – adjusts weather radar and terrain display brightness on the First Officer inboard display unit.

**3 Outboard Display Unit Brightness (OUTBD DU BRT) Control (rotary)**

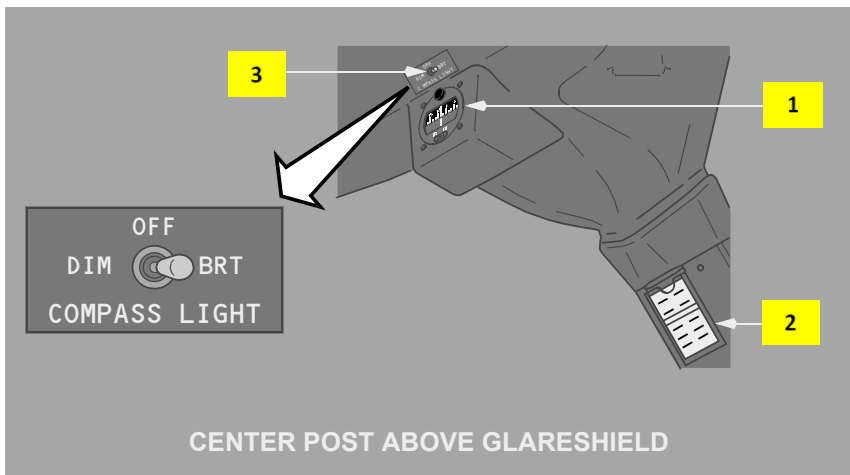
ROTATE – adjusts the brightness of the First Officer outboard display unit.

## Standby Flight Instruments

The standby flight instruments include the:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator.

### Standby Magnetic Compass



#### 1 Standby Magnetic Compass

Displays magnetic heading.

#### 2 Standby Magnetic Compass Correction Card

Provides appropriate heading corrections.

#### 3 Compass Light Switch

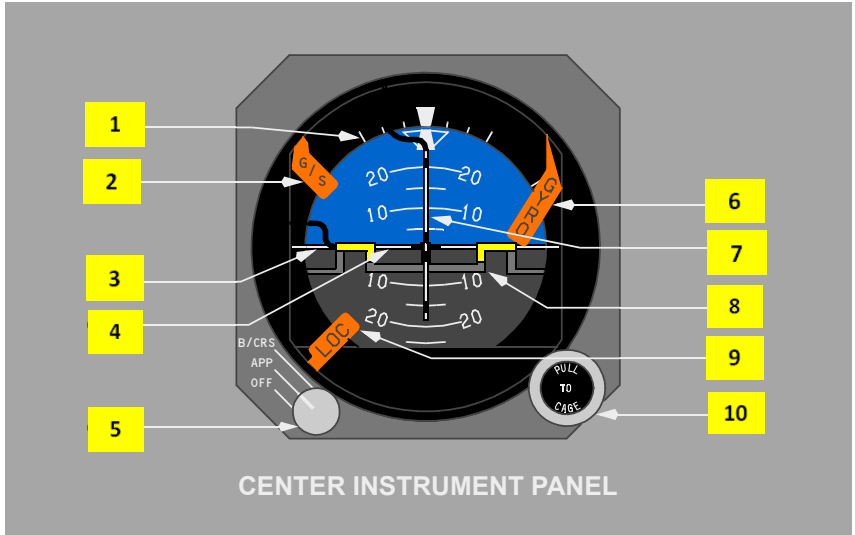
OFF – compass light is extinguished.

BRT – sets compass light to full brightness.

DIM – sets compass light to low brightness.



# Standby Attitude Indicator



## 1 Bank Indicator and Scale

Scale marks are at 0, 10, 20, 30, 45 and 60 degrees.

## 2 Glide Slope Flag

- glide slope receiver has failed
- glide slope pointer is removed.

## 3 Horizon Line and Pitch Angle Scale

Pitch scale is in 5 degree increments.

## 4 Glide Slope Pointer and Deviation Scale

- pointer indicates glide slope position
- pointer is not displayed when
  - approach selector is off or in B/CRS
  - no computed data exists
  - glide slope receiver has failed
- scale indicates deviation.

## 5 Approach Mode Selector

OFF – glide slope and localizer pointers retracted from view.

APP – glide slope and localizer pointers in view; ILS signals provided by the No. 1 ILS receiver.

B/CRS – reverses sensing for localizer pointer during back course approaches; glide slope pointer not displayed.

**6 GYRO Flag**

Attitude is unreliable.

**7 Localizer Pointer and Deviation Scale**

- pointer indicates localizer position
- pointer is not displayed when
  - approach selector is off
  - no computed data exists
  - localizer receiver has failed
- scale indicates deviation.

**8 Airplane Symbol****9 Localizer Flag**

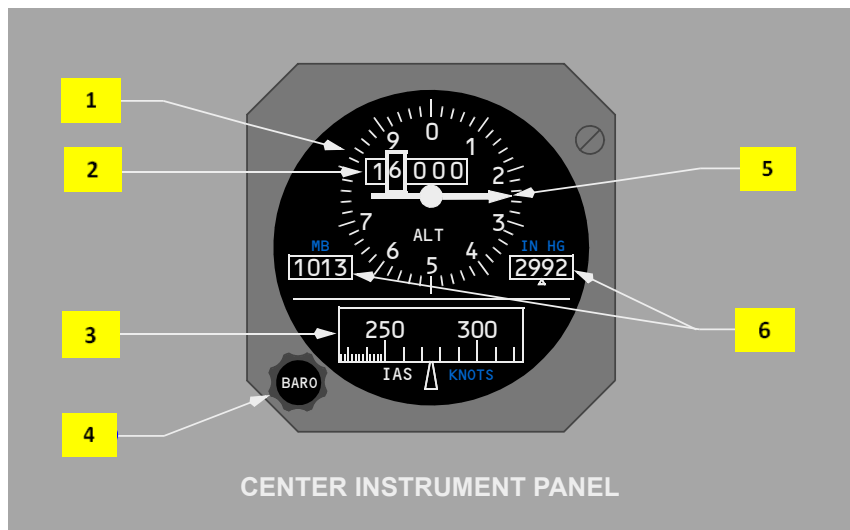
- localizer receiver has failed
- localizer pointer is removed.

**10 Caging Control**

PULL – aligns horizon line with the airplane symbol

RELEASE – the control contracts.

## Standby Altimeter/Airspeed Indicator



### 1 Standby Altimeter

Receives static pressure from the alternate static ports.

### 2 Digital Counter

- indicates thousand foot increments of current altitude
- a green flag appears in the left side of the window when altitude is less than 10,000 feet
- a striped flag appears in the left side of the window when altitude is less than zero feet.

### 3 Standby Airspeed Indicator

Receives ram air pressure from the auxiliary pitot probe and static pressure from the alternate static ports.

### 4 Barometric Setting Control

ROTATE – adjusts the barometric correction in both barometric windows.

### 5 Altitude Pointer

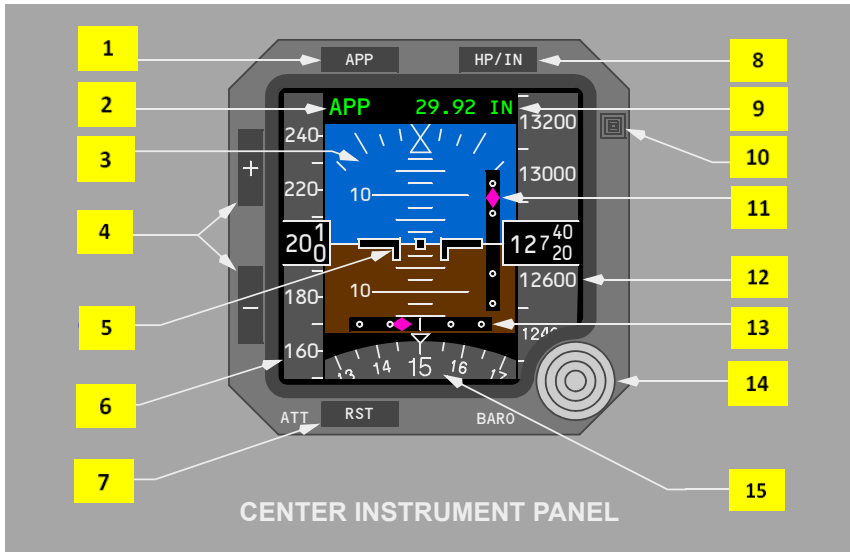
Indicates hundred foot increments of current altitude.

### 6 Barometric Setting Windows

Indicates barometric correction in millibars and inches of mercury as set by the barometric setting control.

## Integrated Standby Flight Display

[Aircraft with Sextant System]



### 1 Approach (APP) Switch

Push –

- when blank, selects APP
- when APP displayed, selects BCRS
- when BCRS displayed, blanks

### 2 Approach Mode Annunciation

Indicates approach mode selected.

- Blank – no approach deviation data displayed
- APP – ILS localizer and glideslope deviation data displayed
- BCRS (Back course) – reverses sensing for localizer pointer during back course approaches

### 3 Attitude Display

Displays airplane attitude.

- Indicates bank in reference to the bank scale
- Indicates the horizon relative to the airplane symbol
- Beyond 30 degrees pitch, large red arrowheads (V-shaped) indicate the attitude has become excessive, and the direction to the horizon line.

#### 4 Display Brightness Switches

Push –

- + increases display brightness
- - decreases display brightness

#### 5 Airplane Symbol

Indicates airplane attitude with reference to the horizon.

#### 6 Airspeed Indications

Indicates current airspeed when above 30 knots.

#### 7 Attitude Reset (RST) Switch

Push and hold at least two seconds

- aligns horizon with the airplane symbol
- reset takes approximately ten seconds

#### 8 Hectopascal/Inch (HP/IN) Switch

Push – changes the units of the barometric reference.

#### 9 Barometric Setting

Indicates the barometric setting selected with the barometric selector.

STD is displayed when selected with the barometric selector.

#### 10 Ambient Light Sensor

Automatically adjusts display intensity for ambient lighting condition.

#### 11 Glideslope Pointer and Deviation Scale

The glideslope pointer indicates glideslope position relative to the airplane.

- the pointer is in view when the glideslope signal is received
- the scale is in view when the APP mode is selected
- the pointer and scale are removed when the BCRS mode is selected

#### 12 Current Altitude

#### 13 Localizer Pointer and Deviation Scale

The localizer pointer indicates localizer position relative to the airplane.

- the pointer is in view when the localizer signal is received
- the scale is in view when either the APP or BCRS mode is selected

## 14 Barometric (BARO) Selector

Rotate – changes barometric setting

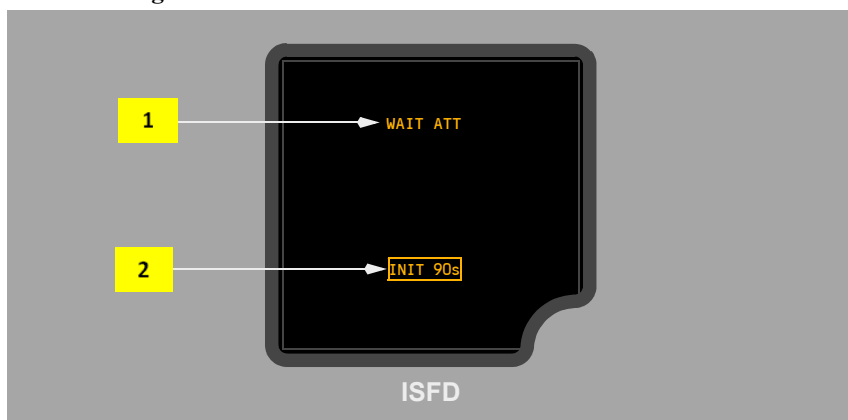
Push –

- selects standard barometric setting (29.92 inches Hg/1013 HPA)
- if STD is displayed, selects the preselected barometric setting

## 15 Heading Indication

Displays airplane heading

## ISFD Messages



### 1 Attitude Messages

Indicates attitude display status.

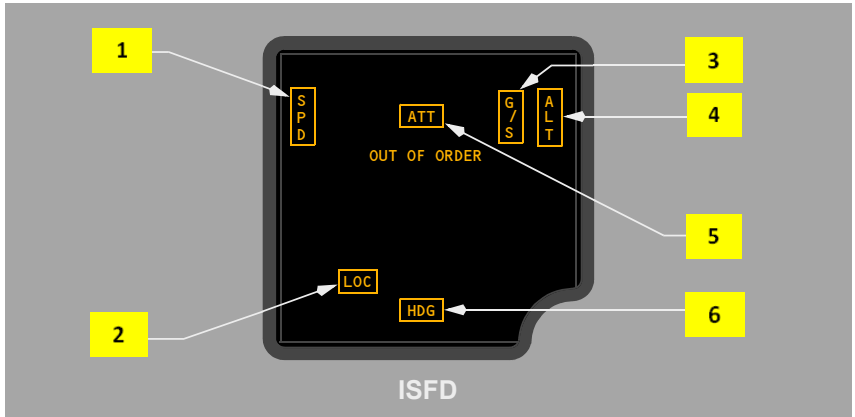
- ATT:RST (amber) – attitude must be reset using the attitude reset switch
- ATT 10s (amber) – 10 second attitude realignment in progress
- WAIT ATT (amber) – indicates temporary self correcting loss of attitude

### 2 Initialization Message

INIT 90s (amber) – 90 second initialization in progress.

### ISFD Failure Flags

The OUT OF ORDER annunciation replaces the display when a total ISFD system failure occurs.



**1** **Airspeed flag**

Airspeed information has failed.

**2** **ILS localizer failure flag**

ILS localizer has failed.

**3** **ILS glideslope failure flag**

ILS glideslope has failed.

**4** **Altitude flag**

Altitude information has failed.

**5** **Attitude flag**

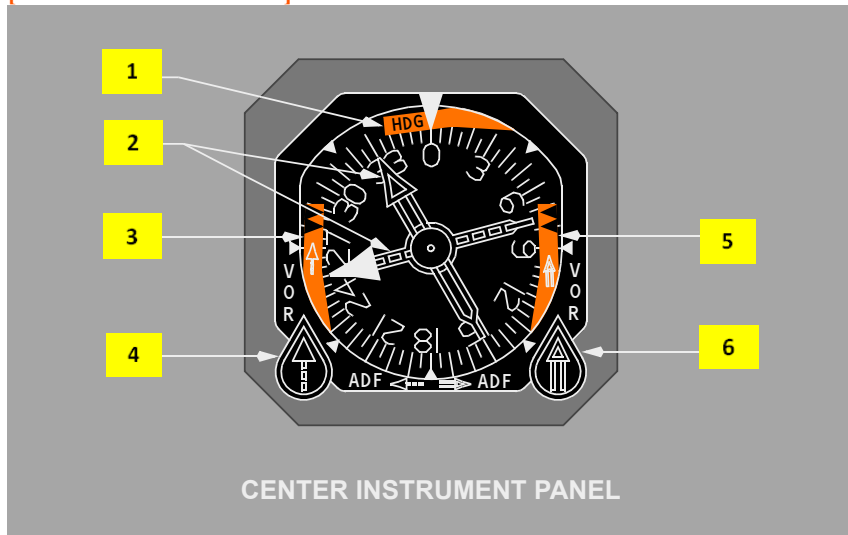
Attitude information has failed.

**6** **Heading flag**

Heading data has failed.

## Standby Radio Magnetic Indicator

[Aircraft with Dual ADF]



### 1 Heading Warning Flag

The compass signal from the air data inertial reference system is lost.

### 2 Bearing Pointers

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

[Aircraft with Dual ADF]

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

### 3 Bearing Pointer No. 1 Warning Flag

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

ADF mode:

- RMI power failure
- ADF failure or signal unreliable.

### 4 VOR/ADF Bearing Pointer No. 1 Switch

ROTATE – selects VOR or ADF for the bearing pointer.



**5 Bearing Pointer No. 2 Warning Flag**

VOR mode:

- RMI power failure
- VHF NAV signal unreliable.

[Aircraft with Dual ADF]

ADF mode:

- RMI power failure
- ADF failure or signal unreliable.

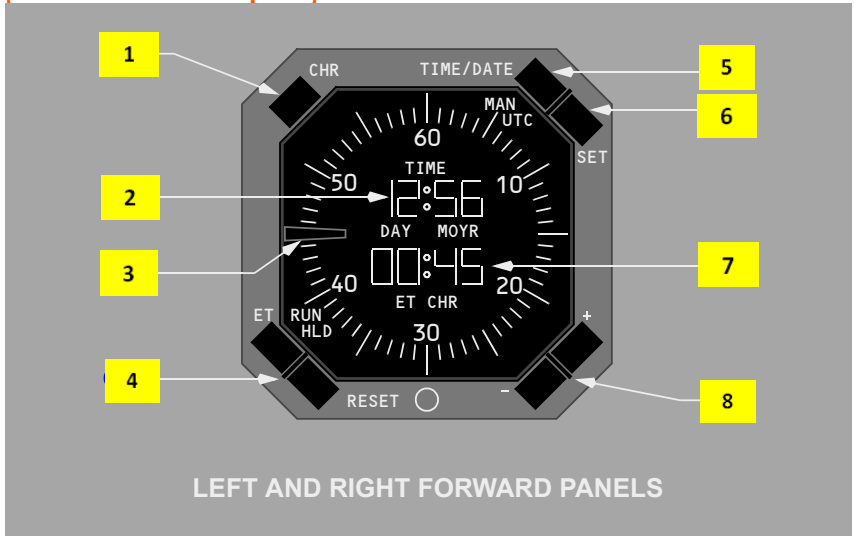
**6 VOR/ADF Bearing Pointer No. 2 Switch**

[Aircraft with Dual ADF]

ROTATE – selects VOR or ADF for the bearing pointer.

**Clock**

[Aircraft with GPS capable]



**1 Chronograph (CHR) Control**

PUSH –

- controls the start, stop and reset functions of the CHR display and second hand with successive pushing
- overrides any existing ET display.

## 2 Time/Date Indicator

- displays UTC or manual time (hours, minutes) when time is selected with the time/date pushbutton
- alternately displays day–month and year when date is selected with the time/date pushbutton.

## 3 Chronograph Second Hand

- indicates chronograph seconds
- controlled by the CHR control.

## 4 Elapsed Time (ET) and RESET Pushbutton

Controls the elapsed time function:

- select the ET pushbutton once to run the elapsed time
- select the ET pushbutton again to hold the elapsed time
- select the RESET pushbutton to set the elapsed time to 0.

The RUN or HLD symbol is displayed on the lower left part of the LCD display.

## 5 TIME/DATE Pushbutton

Controls the time/date function:

- select the TIME/DATE pushbutton once to see UTC time
- select the TIME/DATE pushbutton again to see UTC date
- select the TIME/DATE pushbutton again to see manual time
- select the TIME/DATE pushbutton again to see manual date.

The UTC or MAN symbol is displayed on the upper right part of the LCD display.

In MAN mode, clock time and date come from the clock. In UTC mode, clock time and date come from the global positioning system.

## 6 SET Pushbutton

Controls the setting of manual time and date:

With manual time displayed:

- select the SET pushbutton once and the hours flash, use the plus or minus pushbutton to adjust the hours
- select the SET pushbutton again and the minutes flash, use the plus or minus pushbutton to adjust the minutes
- select the SET pushbutton again to run the time.

With manual date displayed:

- select the SET pushbutton once and the day flashes, use the plus or minus pushbutton to adjust the day
- select the SET pushbutton again and the month flashes, use the plus or minus pushbutton to adjust the month
- select the SET pushbutton again and the year flashes, use the plus or minus pushbutton to adjust the year
- select the SET pushbutton again to run the date.

**Note:** A delay greater than one minute while setting the time or date results in the clock reverting to the previous time/date setting.

**7 Elapsed Time (ET)/Chronograph Indicator**

- displays elapsed time (hours, minutes) or chronograph minutes
- the chronograph display replaces the elapsed time display
- elapsed time continues to run in the background and displays after the chronograph is reset.

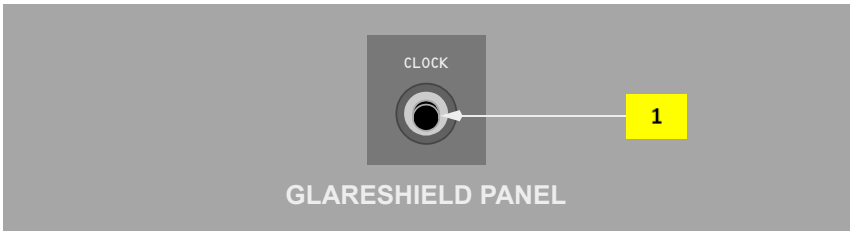
**8 Plus (+) and Minus (-) Pushbuttons**

Used to set the manual time and date:

- select the + pushbutton to increase the value
- select the - pushbutton to decrease the value.

**Clock Switch**

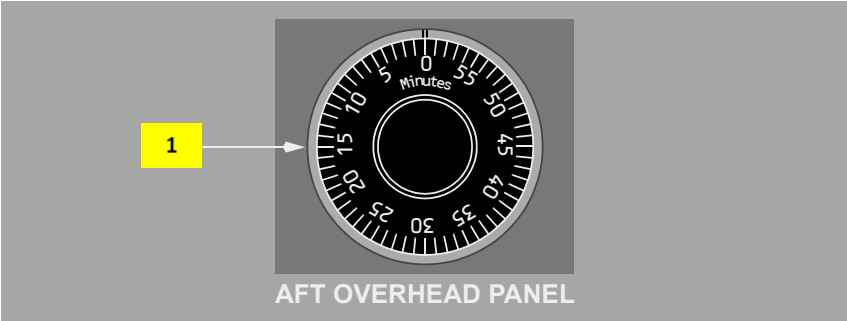
[Option]



**1 Clock Switch**

Operates the same as the chronograph (CHR) control.

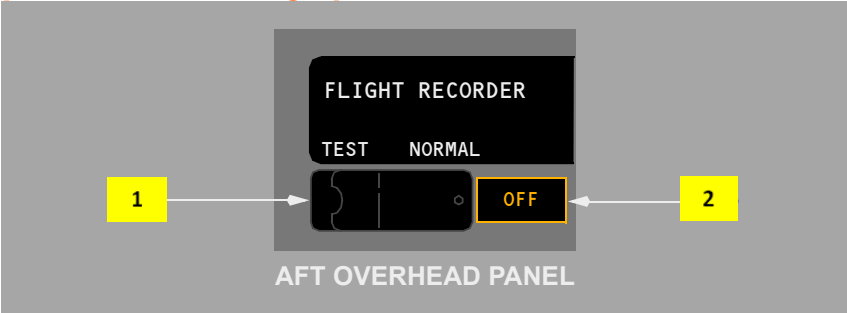
# Timer

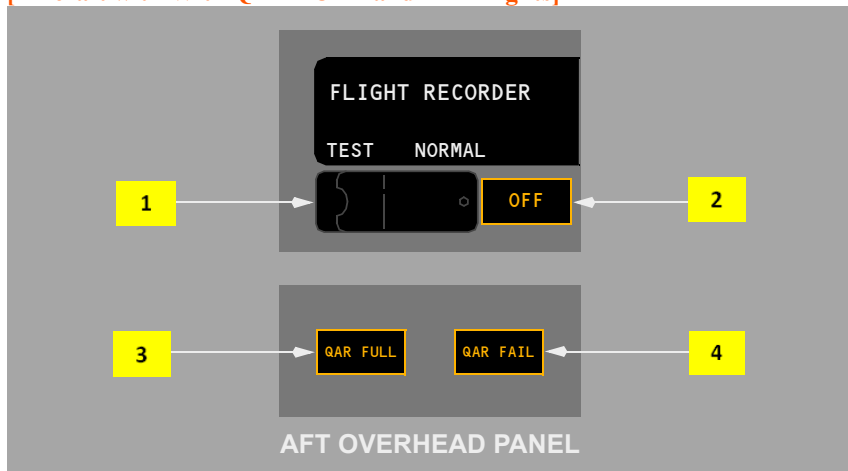


**1** Mechanical Timer

# Flight Recorder

[Aircraft Without QAR lights]



**[Aircraft with With QAR FULL and FAIL lights]****1 Flight Recorder Test Switch**

NORMAL (guarded position) –

- in flight – the recorder operates anytime electrical power is available
- on the ground – either engine must also be operating.

TEST – powers the flight recorder on the ground.

**2 OFF Light (white)**

ILLUMINATED –

- indicates the recorder is not operating or the test is invalid
- may indicate power failure, loss of input data, or electronic malfunction.

**3 Optical Quick Access Recorder (QAR) FULL (white)****[Aircraft with QAR FULL lights]**

ILLUMINATED –

- indicates the quick access recorder is full

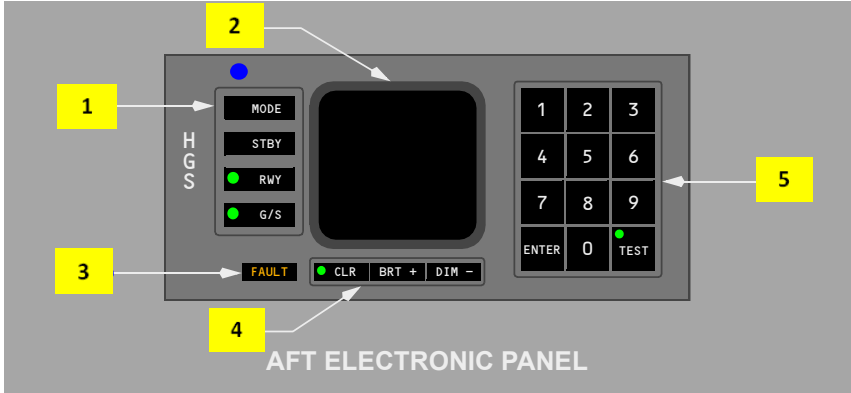
**4 Optical Quick Access Recorder (QAR) FAIL (white)****[Aircraft with QAR FAIL lights]**

ILLUMINATED –

- indicates the quick access recorder has failed

# Head-Up Display Control Panel Controls – Flight Instrument Displays

The HUD control panel controls modes of operation, display values, and system test and status information.



## 1 Mode/Function Keys

Push - selects mode or allows data entry:

- MODE – selects desired mode from available modes on the standby display line.
- STBY – selects standby mode.
- RWY – used to enter runway length and elevation or to toggle between entered values. Select once to enter runway length, select again to enter runway elevation. Use the DIM - (minus) key to enter negative values.
- G/S – used to enter the glideslope angle for the landing runway.

**Note:** Values entered using the mode/function keys are stored in the HUD computer. If a power interruption should occur, the last mode and value will be displayed once power is restored.

## 2 Control Panel Display

Displays information entered using the mode/function keys.

## 3 FAULT Light

Illuminated (amber) - HUD BITE fault.

#### 4 Clear and Brightness Keys

CLR – used to clear all symbology from the combiner display. Symbology can be re-displayed by selecting CLR again, changing modes, or entering TEST. CLR can also be used as a backspace key during data entry and TEST operations.

BRT + (plus) – used to manually increase control panel display intensity.

DIM - (minus) – used to manually decrease control panel display intensity.

**Note:** Display brightness is adjusted automatically based on ambient light measured by a sensor located in the upper left corner of the control panel.

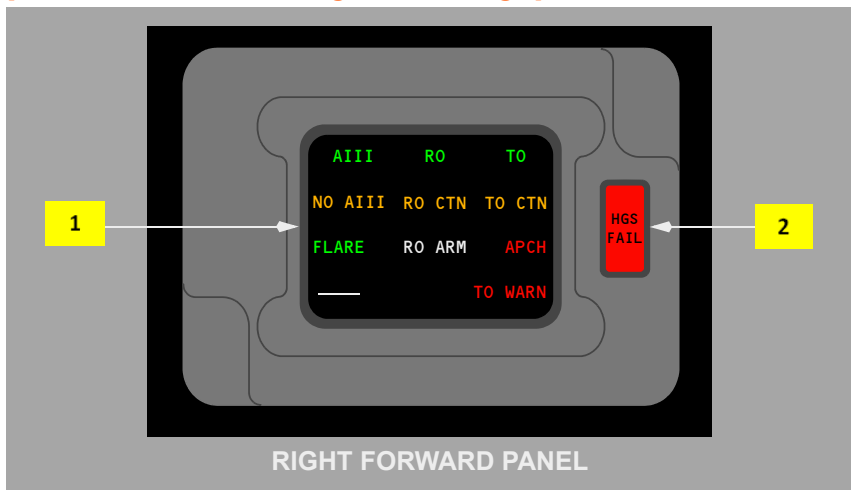
#### 5 Numeric Keys

Push -

- 0 through 9 – puts selected number in display
- ENTER – used to enter selected values
- TEST – used by maintenance for system tests and troubleshooting.

### HUD Annunciator Panel

[Aircraft with Model 4000 Digital Twelve Light]



#### 1 HGS Status Annunciations

- AIII (green) - AIII mode is active and all required systems and equipment are valid.
- NO AIII (amber) - loss of AIII capability above 500 feet AGL.
- APCH WARN (red) - system or approach conditions out of tolerance.
- FLARE (green) - system derived flare guidance is active.

- RO ARM (white) - system capable of providing ground roll guidance during rollout. Displayed prior to touchdown during an AIII approach.
- RO CTN (amber) - loss of rollout guidance below 500 feet AGL.
- RO (green) - rollout guidance is active.
- TO (green) - not used, displayed only during maintenance test.
- TO CTN (amber) - not used, displayed only during maintenance test.
- TO WARN (red) - not used, displayed only during maintenance test.

## **2 HGS FAIL Light (red)**

Illuminated (red) - indicates HGS failure below 500 ft AGL.

Push -

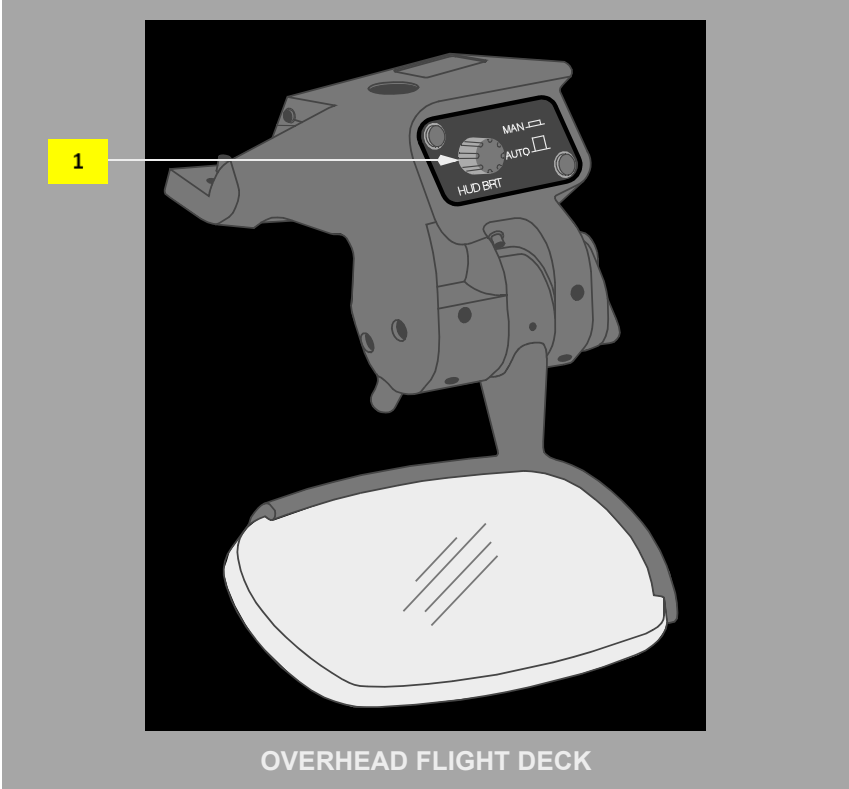
- extinguishes the HGS Fail Light.
- will not illuminate again until failure is cleared and another failure occurs.
- resets system for another failure.



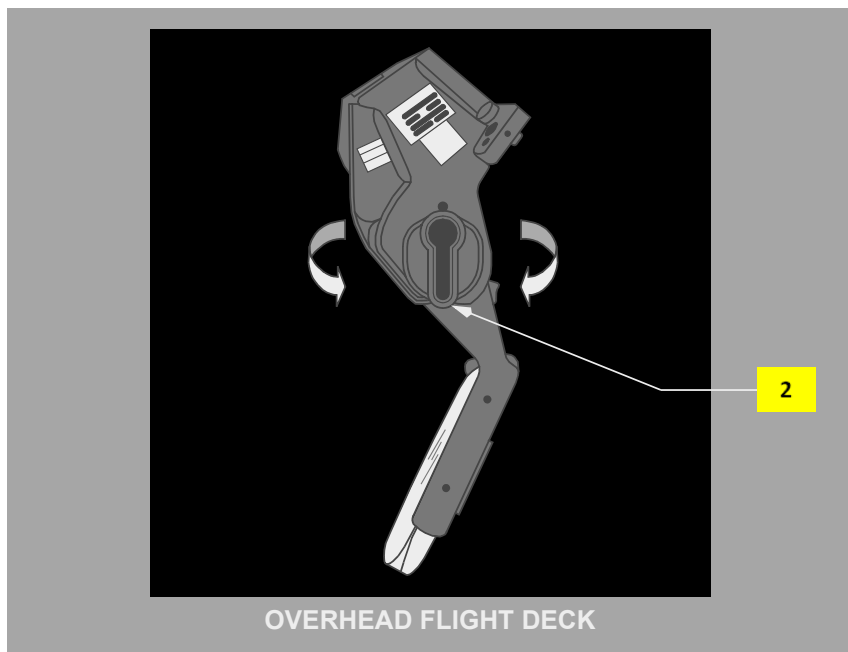
# Combiner Controls

[Aircraft with Model 4000]

## Brightness and Stow Controls



OVERHEAD FLIGHT DECK



### 1 Brightness Control Knob

MAN – push knob in for manual brightness adjustment.

AUTO – pull knob out for automatic brightness adjustment. Display intensity varies based on ambient light detected by a sensor on the combiner.

HUD BRT – rotate knob clockwise to increase display intensity. Rotate knob counter-clockwise to decrease display intensity.

### 2 Stow Lever

Pull lower portion of stow lever toward the pilot and rotate the glass down and forward to the normal operating detent. To stow the combiner glass, grasp and rotate aft and up until it locks in the stowed position.

The combiner also incorporates a breakaway position that allows the combiner glass to be displaced forward from its normal operating position. The combiner glass can be returned from the breakaway position by rotating the stow lever away from the pilot and rotating the glass aft to the normal operating detent.

**Note:** In the IMC or VMC modes, a combiner alignment out of tolerance condition results in an ALIGN HUD message on the combiner display. Gently push the combiner glass in the breakaway direction (forward) and release it to remove the message. If the message cannot be removed, the IMC or VMC mode should not be used.

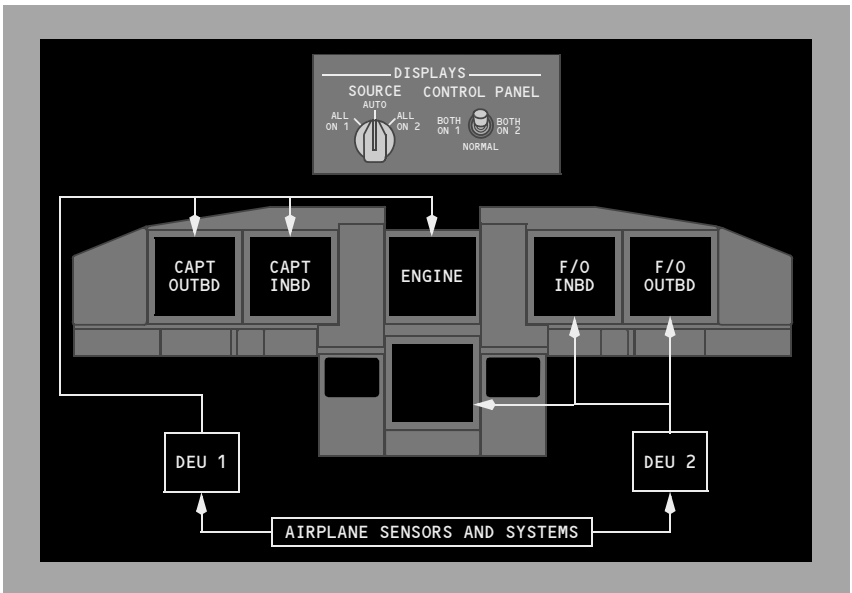
## Introduction to EFIS/MAP System

The Common Display System (CDS) supplies information to the flight crew on six flat panel liquid crystal display units (DUs). The outboard and inboard display units present all primary flight and navigation information. Engine and system data are normally shown on the upper display unit. The lower display unit serves as a spare.

## Display Brightness Control

Adjustment of the brightness of each DU is controlled by a combination of light sensors and brightness controls. Two remote light sensors, located left and right on the top of the glareshield, compensate for the amount of ambient light entering through the flight deck windows and adjust the brightness of the related DUs. Each DU also has an integral light sensor which provides automatic control of brightness as a function of ambient light striking the face of the DU. Brightness controls are used by the pilot to further adjust the intensity of each display unit.

### DISPLAYS SOURCE Panel



The DISPLAYS source panel, located on the forward overhead panel, contains source controls for the display electronic units (DEUs) and EFIS control panels.

Two DEUs receive data from sensors and airplane systems and supply data to the DUs. During normal operation, with the display SOURCE selector in the AUTO position, DEU1 supplies data to the Captain outboard, Captain inboard and upper DUs while DEU2 supplies data to the First Officer outboard, First Officer inboard and lower DUs. If a DEU fails, the remaining DEU automatically supplies data to all six displays. A single DEU failure will continue to supply each pilot with flight instrument information from independent sources. Each DEU receives data from both ADIRUs.

The display SOURCE selector, used on the ground for maintenance purposes, allows manual selection of either DEU1 or DEU2 for all six display units. If the displays are automatically or manually switched to a single DEU source, a “DSPLY SOURCE” annunciation illuminates above both pilot’s altimeters.

The CONTROL PANEL select switch determines which EFIS control panel controls the pilots’ display functions. With the switch positioned to either BOTH ON 1 or BOTH ON 2, the selected EFIS control panel provides inputs for both sets of pilot displays. When in the NORMAL position, a “DISPLAYS CONTROL PANEL” annunciation illuminates on the pilot’s altimeters and indicates a failure of the associated EFIS control panel.

## **EFIS Control Panels**

The EFIS control panels, located on the glareshield, control display options, mode, and range for the related pilot’s displays.

If an EFIS control panel fails, the displays can be controlled by the remaining control panel.

## **Display Select Panel**

The display select panel, located on the left and right forward panels, controls the displays on the inboard, outboard and lower DUs. Normal operation is all selectors in the NORMAL position. The pilots’ outboard and inboard DUs display primary flight and navigation data and the upper DU displays engine data.

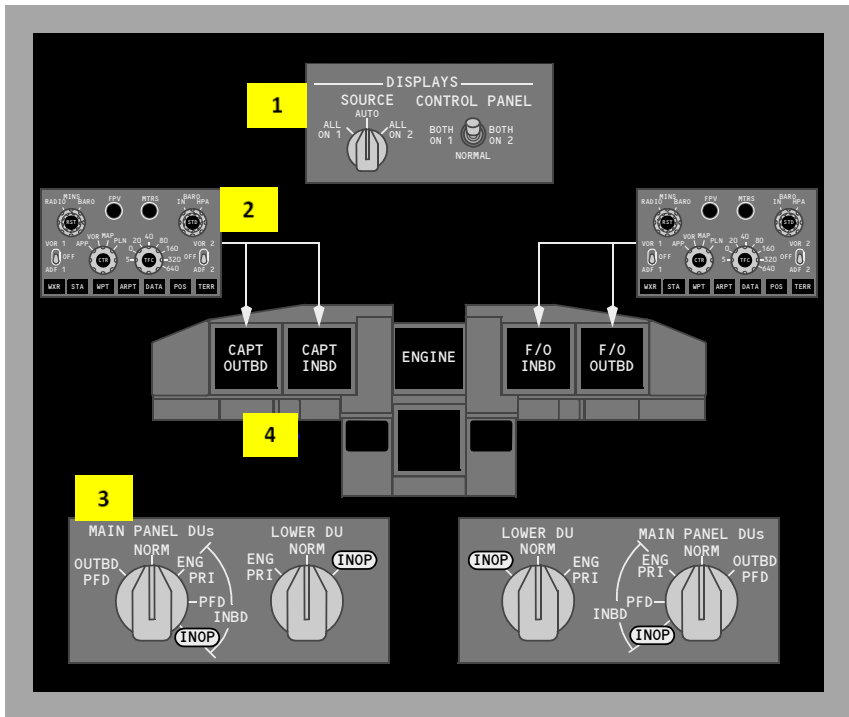
If a DU fails, automatic display switching ensures critical information remains available to the pilots at all times. If the system detects an operational failure on an outboard DU, the compact EFIS format automatically moves to the inboard DU and the failed outboard DU blanks. If the system detects a failure on an inboard DU, the compact EFIS format automatically moves to the outboard DU and the failed inboard DU blanks. If the upper DU fails, the engine display automatically moves to the lower DU.

Manual control of display formats is provided for undetected failures. The outboard rotary switch on the display select panel controls the formats displayed on either the outboard or inboard DUs. The inboard rotary switch controls the display format shown on the lower DU.

## Display Selection and Control Examples

The following examples show display selections.

### Normal Display Configuration



#### 1 DISPLAYS Source Panel

The display SOURCE select switch is in AUTO and the CONTROL PANEL select switch is in NORMAL.

#### 2 EFIS Control Panel

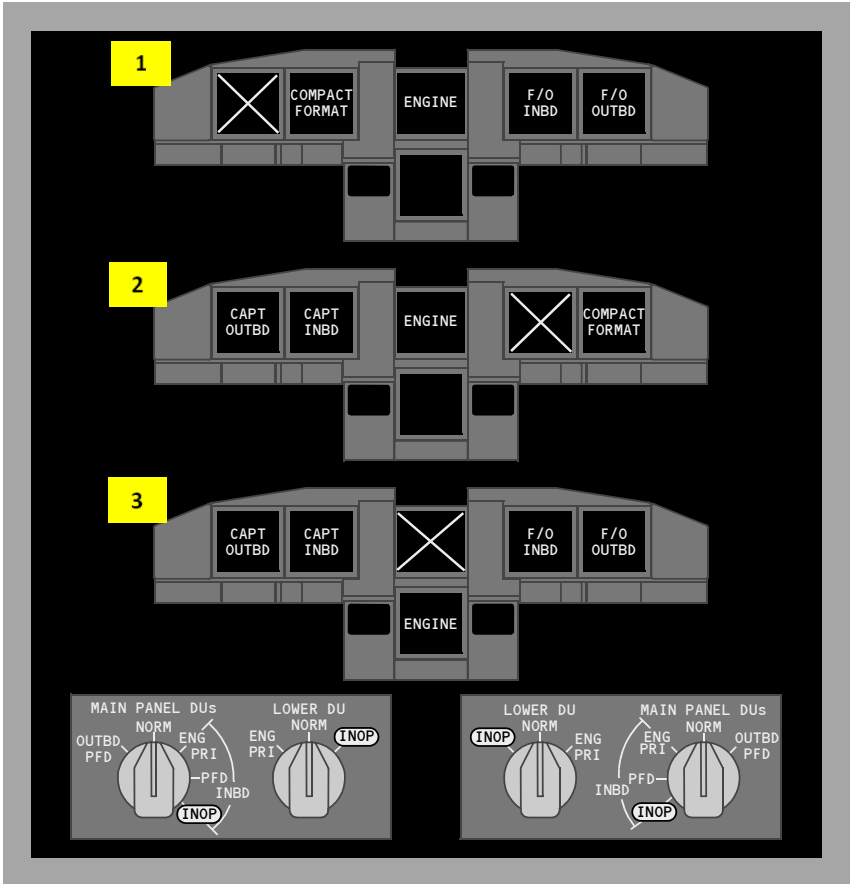
The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

#### 3 Display Select Panel

All selectors are in NORMAL.

#### 4 Display Units

The pilots' outboard and inboard DUs show the normal EFIS/MAP displays.



**1 Outboard Display Unit Fails**

If an outboard display unit fails, the compact EFIS format is automatically displayed on the inboard display unit and the outboard display unit blanks.

**2 Inboard Display Unit Fails**

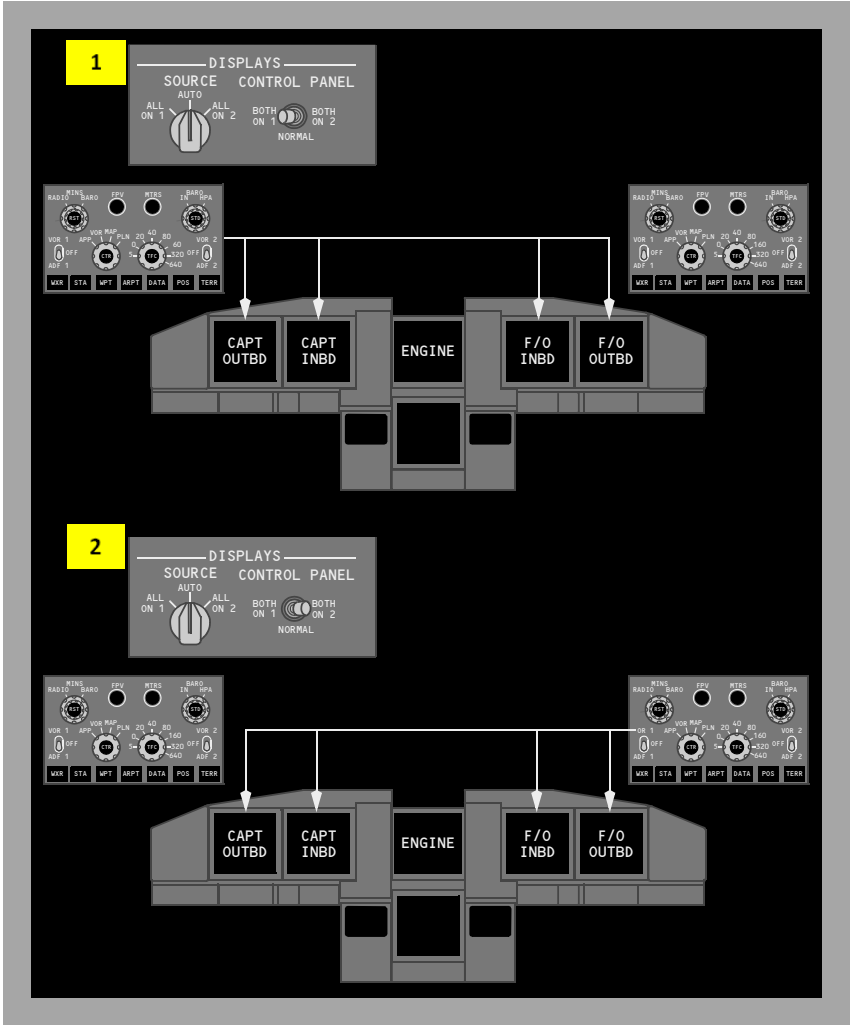
If an inboard display unit fails, the compact EFIS format is automatically displayed on the outboard display unit and the inboard display unit blanks.

**3 Upper Display Unit Fails**

If the upper display unit fails, the engine display automatically moves to the lower display unit and the upper display unit blanks.

**Note:** There is no automatic switching for a lower DU failure.

# EFIS Control Panel



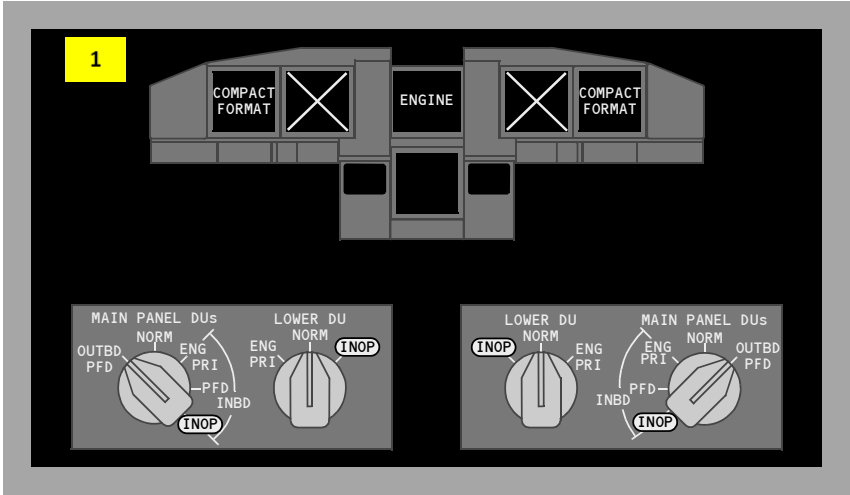
## 1 CONTROL PANEL Select Switch BOTH ON 1

The left EFIS control panel controls both pilots' outboard and inboard display units.

## 2 CONTROL PANEL Select Switch BOTH ON 2

The right EFIS control panel controls both pilots' outboard and inboard display units.

## Outboard Display Switching

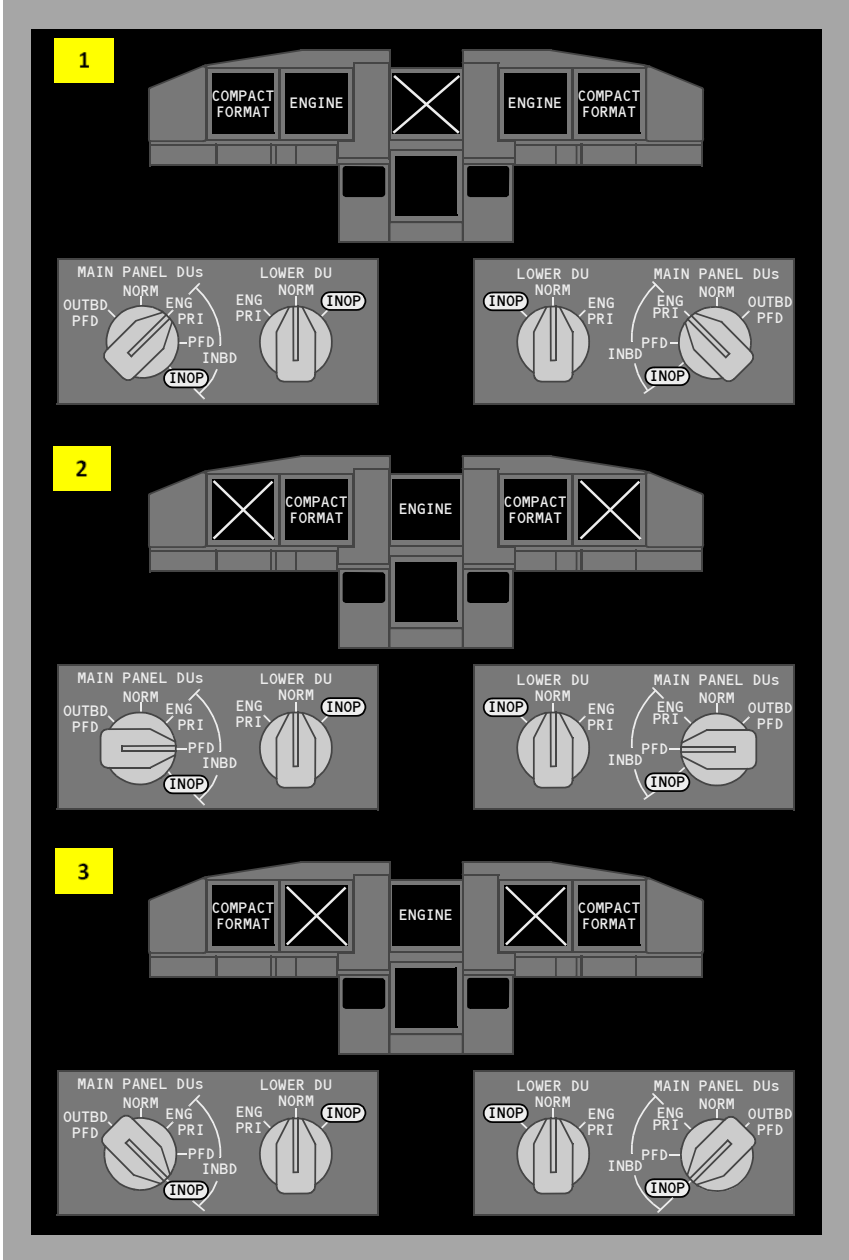


### **1 MAIN PANEL DUs Switch to OUTBD PFD**

If the MAIN PANEL DUs switch is turned to Outboard Primary Flight Display (OUTBD PFD), the compact EFIS format is displayed on the outboard display unit and the inboard display unit blanks.



# Inboard Display Switching



**1 MAIN PANEL DUs Switch to INBD ENG PRI**

If the MAIN PANEL DUs switch is turned to INBD ENG PRI, the engine display moves to the inboard DU, the compact EFIS format is displayed on the outboard DU and the upper DU blanks.

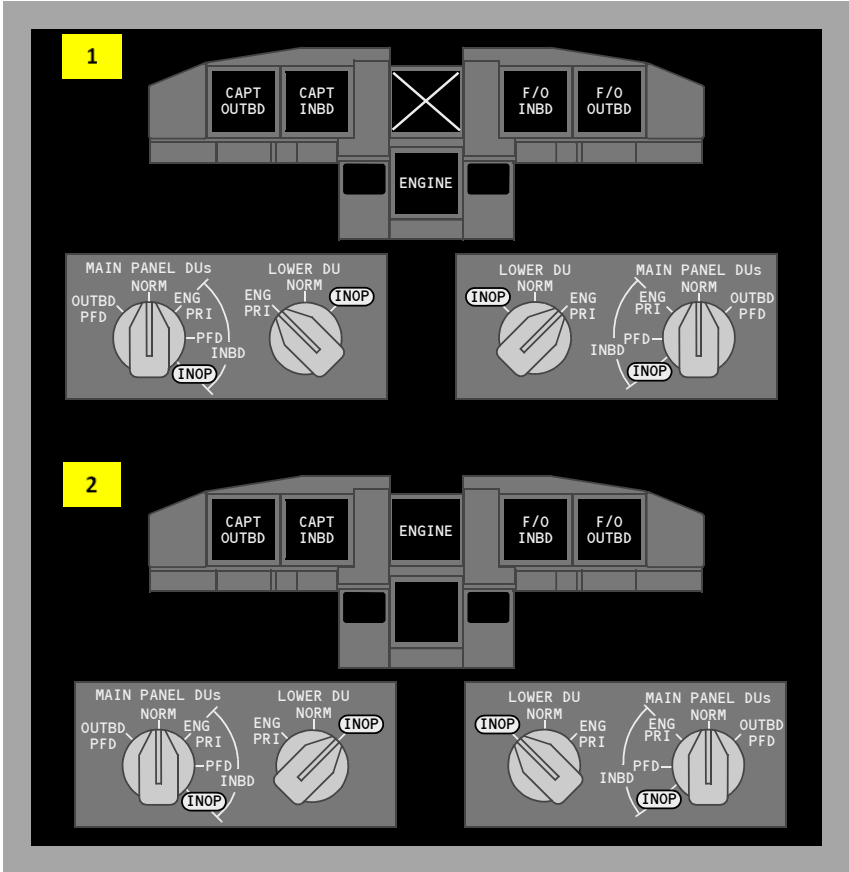
**2 MAIN PANEL DUs Switch to INBD PFD**

If the MAIN PANEL DUs switch is turned to INBD PFD the compact EFIS format is displayed on the inboard DU and the outboard DU blanks.

**3 MAIN PANEL DUs Switch to INOP**

If the MAIN PANEL DUs switch is turned to INBD INOP the compact EFIS format is displayed on the outboard DU and the inboard DU blanks.

# Lower Display Switching



## 1 LOWER DU Switch to ENG PRI

If the LOWER DU switch is turned to ENG PRI, the engine display moves to the lower DU and the upper DU blanks.

## 2 LOWER DU Switch to INOP

If the LOWER DU switch is turned to INOP the engine display is shown on the upper DU and the lower DU blanks.

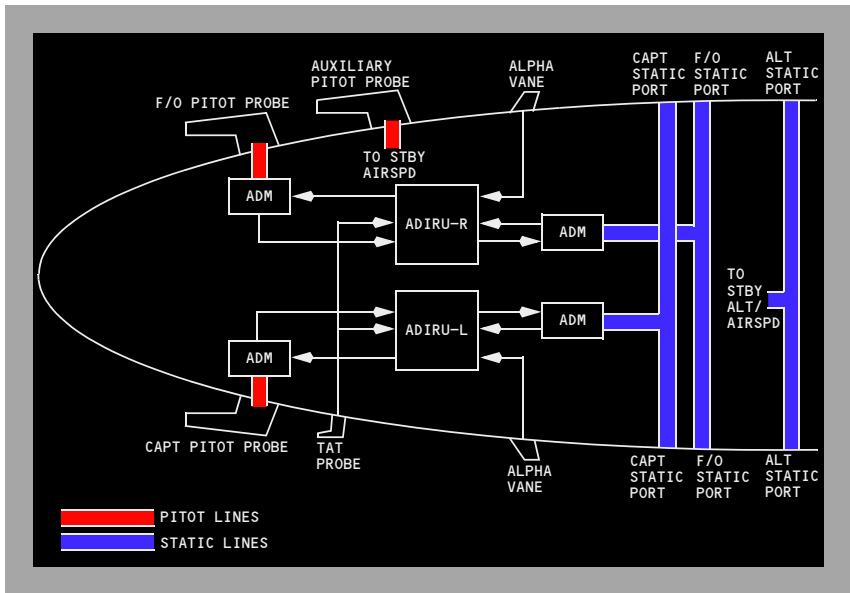
## Display System Information Sources

### Air Data Inertial Reference System (ADIRS)

The ADIRS produces flight data such as position, speed, altitude and attitude for the flight displays, flight management computers, flight controls, engine controls and all other systems requiring inertial and air data.

The major components of the ADIRS are:

- two air data inertial reference units (ADIRUs)
- four air data modules (ADMs)
- one inertial system display unit (ISDU)
- one dual mode select unit (MSU)
- six static ports
- three pitot probes
- two alpha vanes
- one total air temperature probe



### Air Data Inertial Reference Unit (ADIRU)

The ADIRUs provide inertial position and track data to the FMC as well as attitude, altitude and airspeed data to the displays. The ADIRUs process information measured by internal gyros and accelerometers, and from air data module inputs, the alpha vanes and other systems.

## Air Data

The pitot static system is comprised of three separate pitot probes and six flush static ports. Two pitot probes and four static ports interface with the air data modules. The remaining auxiliary pitot probe and alternate static ports provide pitot and static pressure to the standby instruments. The auxiliary pitot probe is located on the first officer's side of the airplane.

The air data modules convert pneumatic pressure to electrical signals and send these data to the ADIRUs. Each pitot air data module is connected to its on-side pitot probe; there is no cross connection. The air data module connected to the Captain's pitot probe sends information to the left ADIRU, while the air data module connected to the First Officer's pitot probe sends information to the right ADIRU. The remaining air data modules are located at the balance centers of the Captain's and First Officer's static ports. The air data module connected to the Captain's static ports sends information to the left ADIRU, while the air data module connected to the First Officer's static ports sends information to the right ADIRU.

## Angle-of-Attack

There are two alpha vanes, one located on each side of the forward fuselage. The vanes measure airplane angle-of-attack relative to the air mass.

## Total Air Temperature (TAT)

A total air temperature probe is mounted outside the airplane to sense air mass temperature. The temperature sensed by the probe is used by the ADIRUs to compute total air temperature.

**Note:** For manual CDU input of OAT on the ground, TAT indication is approximate and should not be used in lieu of ambient OAT for takeoff performance.

## Static Air Temperature (SAT)

Static air temperature, displayed on the CDU PROGRESS page, comes from the ADIRUs, using total air temperature probe information.

## Standby Flight Instruments

The standby flight instruments include:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator

## Standby Magnetic Compass

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

## Standby Attitude Indicator

The standby attitude indicator provides attitude information that is independent of the primary attitude displays. The indicator is powered by the battery bus and remains powered after the loss of all normal AC power as long as battery power is available. The gyro reaches operational speed approximately 60 seconds after power is applied. The indicator requires three minutes to achieve accuracy requirements.

## Integrated Standby Flight Display (ISFD)

The ISFD displays attitude, airspeed, altitude, ILS, and magnetic heading information. It is connected directly to the auxiliary pitot and alternate static sources. Attitude information is provided by internal inertial sensors. ILS information is provided by the No. 1 ILS receiver. The display receives its heading information from the same source as the captain's primary flight display. Heading information is not available in polar regions.

**Note:** The standby magnetic compass must be used to validate heading information.

The battery bus powers the ISFD. Selecting the battery switch ON activates the ISFD. After 10 seconds, an initialization sequence begins that requires 90 seconds to complete. ATT and INIT 90s messages are displayed during initialization. Upon completion of the initialization sequence, attitude information is displayed.

**Note:** Any change in airplane position during the initialization sequence may result in an inaccurate alignment. Inaccurate alignment is not annunciated and may result in the display of inaccurate attitude prior to, and during flight. Re-initialization can only be accomplished through maintenance action.

Detection of a momentary out-of-limit ISFD condition may cause the attitude display to blank and the WAIT ATT or ATT:RST message to display. Operation of the attitude reset switch is required in response to the ATT:RST message. This will reset the horizon line with the airplane symbol.

**Note:** Operation of the attitude reset switch will not correct an inaccurate alignment.

On the ground, operation of the attitude reset switch must be performed with the airplane stationary. In flight, operation of the attitude reset switch must be performed with the airplane in wings level, non-accelerated flight. During the process, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If the reset attempt is unsuccessful, the ATT:RST message remains displayed and the ISFD does not enter normal operation.

## **Standby Altimeter/Airspeed Indicator**

Standby altitude and airspeed are displayed on a single indicator.

The standby altimeter receives static pressure from the alternate static ports. Current altitude is displayed digitally. A pointer indicates altitude in hundreds of feet. Barometric setting windows display the barometric setting in both millibars and inches of mercury as set by the barometric setting control. The altimeter has a range of -1000 to 50,000 feet.

The standby airspeed indicator receives ram pressure from the auxiliary pitot probe and static pressure from the alternate static ports. It provides current airspeed in knots.

## **Standby Radio Magnetic Indicator**

The standby radio magnetic indicator (RMI) displays magnetic heading and VOR/ADF bearing to the station. The RMI is powered by the AC standby bus and remains powered after the loss of all normal AC power as long as battery power is available.

## **Clocks**

### **[Smiths]**

Two electronic clocks are installed, with two digital displays on each clock. Either Greenwich Mean Time (GMT) or local time may be set on the upper time display. The lower ET/CHR display is used for either elapsed time or the chronograph. Separate controls are provided for each display.

## **Clock Switch**

### **[Aircraft with Remote clock switch]**

A remote clock switch, on the glareshield panel, operates the same as the chronograph (CHR) control.

## Flight Recorder

The flight recorder provides a permanent record of selected operational and systems information such as altitude, heading, acceleration, and airspeed. The recorder is housed in a sealed, fire-resistant container located behind an access door in the aft cabin ceiling.

Operational and systems information is automatically recorded whenever the flight recorder is powered. On the ground, the recorder begins operating when one of the engines is operating. In the air, the flight recorder is powered even with both engines shut down as long as APU electrical power is available.

## Aircraft Condition Monitoring System (ACMS)

### [Aircraft with ACMS]

The ACMS consists of:

- digital flight data acquisition unit (DFDAU). The DFDAU receives signals representing certain flight condition and airplane systems' operating performance and converts them to a digital form for recording on the DFDR.
- digital flight data recorder (DFDR). The DFDR records airplane systems and flight data for at least the last 25 hours of operation. The DFDR is located in the aft fuselage area.

### [Aircraft with Quick Access Recorder (QAR) lights]

- indicator on the aft overhead panel that illuminates when the QAR is full.



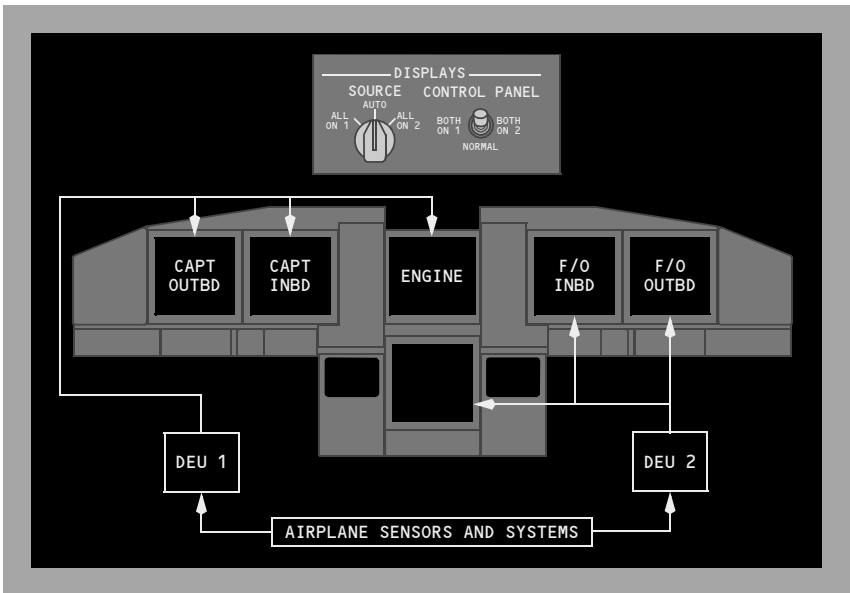
## Introduction PFD/ND Aircraft

The Common Display System (CDS) supplies information to the flight crew on six flat panel liquid crystal display units (DUs). The outboard and inboard display units present all primary flight and navigation information. Primary engine indications are normally displayed on the upper DU. Secondary engine indications or system data are normally displayed on the lower DU.

## Display Brightness Control

Adjustment of the brightness of each DU is controlled by a combination of light sensors and brightness controls. Two remote light sensors, located left and right on the top of the glareshield, compensate for the amount of ambient light entering through the flight deck windows and adjust the brightness of the related DUs. Each DU also has an integral light sensor which provides automatic control of brightness as a function of ambient light striking the face of the DU. Brightness controls are used by the pilot to further adjust the intensity of each display unit.

### DISPLAYS SOURCE Panel



The DISPLAYS source panel, located on the forward overhead panel, contains source controls for the display electronic units (DEUs) and EFIS control panels.

Two DEUs receive data from sensors and airplane systems and supply data to the DUs. During normal operation, with the display SOURCE selector switch in the AUTO position, DEU1 supplies data to the Captain outboard, Captain inboard and upper DUs while DEU2 supplies data to the First Officer outboard, First Officer inboard and lower DUs.

If a DEU fails, the remaining DEU automatically supplies data to all six displays. A single DEU failure will continue to supply each pilot with flight instrument information from independent sources. Each DEU receives data from both ADIRUs.

The display SOURCE selector, used on the ground for maintenance purposes, allows manual selection of either DEU1 or DEU2 for all six display units. If the displays are automatically or manually switched to a single DEU source, a “DSPLY SOURCE” annunciation illuminates on both pilot’s primary flight display.

The CONTROL PANEL select switch determines which EFIS control panel controls the pilots’ display functions. With the switch positioned to either BOTH ON 1 or BOTH ON 2, the selected EFIS control panel provides inputs for both sets of pilot displays. When in the NORMAL position, a “DISPLAYS CONTROL PANEL” annunciation illuminates below the altitude indication showing a failure of the associated EFIS control panel.

## **EFIS Control Panels**

The EFIS control panels, located on the glareshield, controls display options, mode, and range for the related pilot’s displays.

If an EFIS control panel fails, the displays can be controlled by the remaining control panel.

## **Display Select Panel**

The display select panel, located on the left and right forward panels, controls the displays on the inboard, outboard and lower DUs. Normal operation is all selectors in the NORMAL position. The pilots’ outboard and inboard DUs display primary flight and navigation data and the upper DU displays primary engine data and fuel quantity.

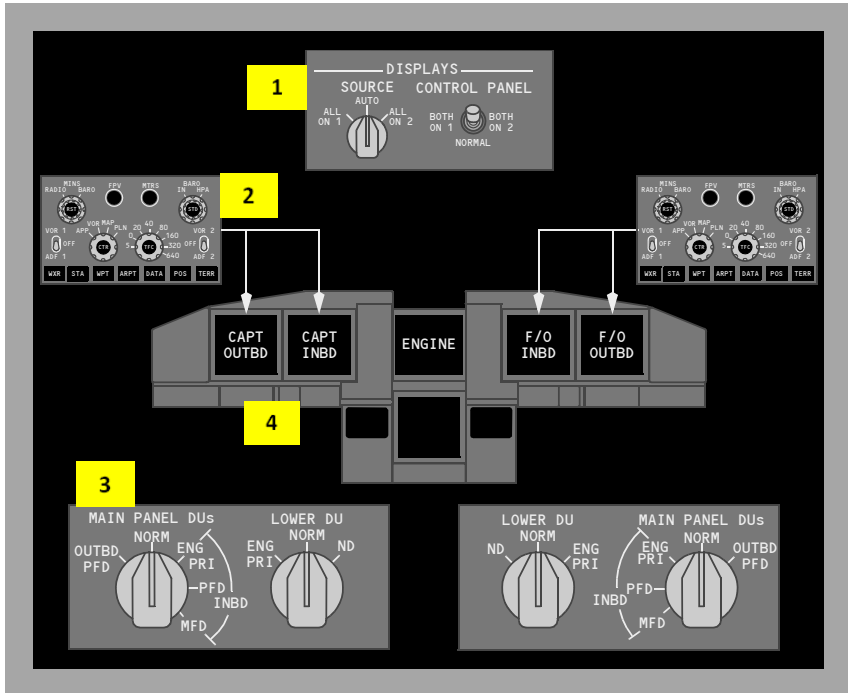
If a DU fails, automatic display switching ensures critical information remains available to the pilots at all times. If the system detects an operational failure on an outboard DU, the primary flight display automatically moves to the inboard DU and the failed outboard DU blanks. The OUTBD/INDB selector no longer has control over that display unit. If the upper DU fails, the engine display automatically moves to the lower DU.

Manual control of display formats is provided for undetected failures. The outboard rotary switch on the display select panel controls the formats displayed on either the outboard or inboard DUs. The inboard rotary switch controls the display format shown on the lower DU.

## Display Selection and Control Examples

The following examples show display selections.

### Normal Display Configuration



#### 1 DISPLAYS Source Panel

The display SOURCE select switch is in AUTO and the CONTROL PANEL select switch is in NORMAL.

#### 2 EFIS Control Panel

The left EFIS control panel controls the Captain outboard and inboard display units. The right EFIS control panel controls the First Officer outboard and inboard display units.

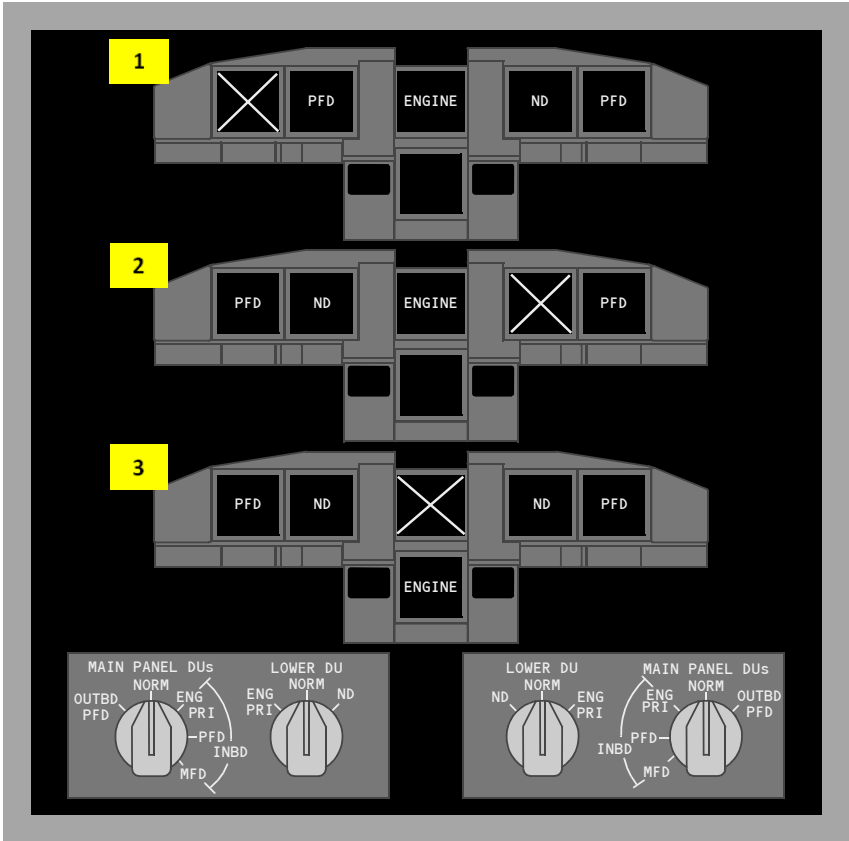
#### 3 Display Select Panel

All selectors are in NORMAL.

#### 4 Display Units

The pilots' outboard and inboard DUs show the normal PFD/ND displays.

# Display Unit Failure Automatic Switching



## 1 Outboard Display Unit Fails

If an outboard display unit fails, the PFD is automatically displayed on the inboard display unit and the outboard display unit blanks.

## 2 Inboard Display Unit Fails

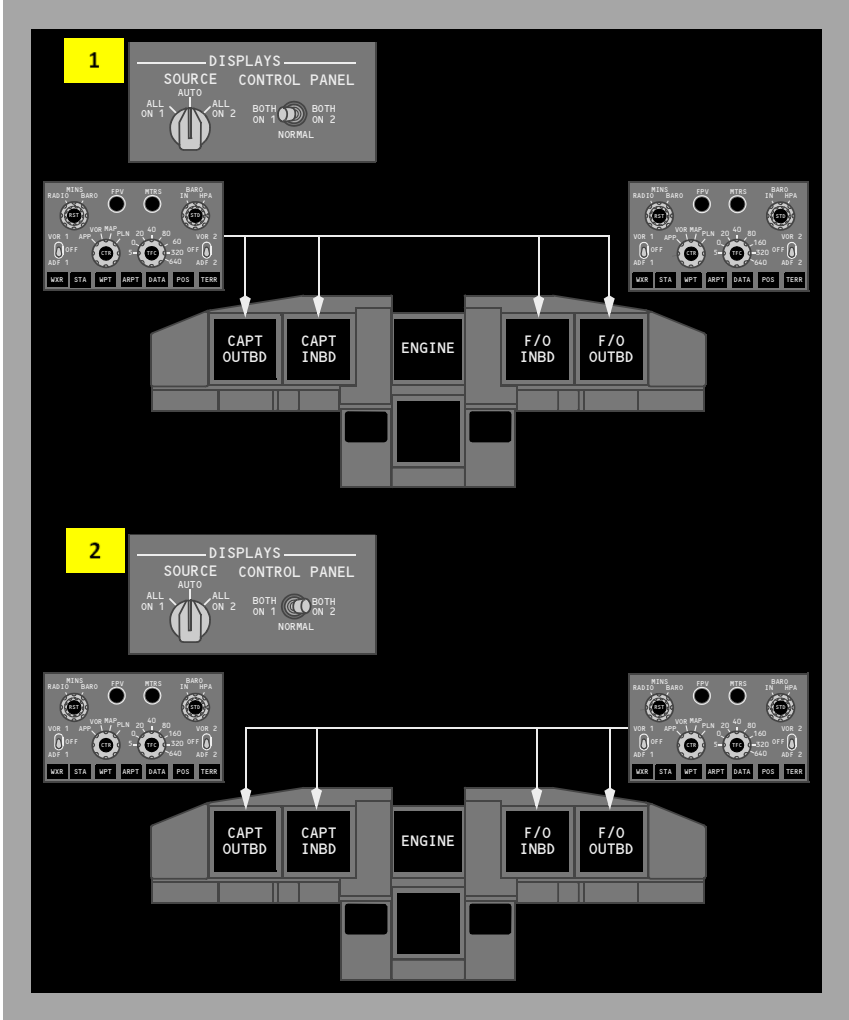
If an inboard display unit fails, the PFD format remains displayed on the outboard display unit and the inboard display unit blanks.

## 3 Upper Display Unit Fails

If the upper display unit fails, the primary engine display automatically moves to the lower display unit and the upper display unit blanks. If the secondary engine display is already on the lower display unit, a compact engine display is then displayed.

**Note:** There is no automatic switching for a lower DU failure.

# EFIS Control Panel



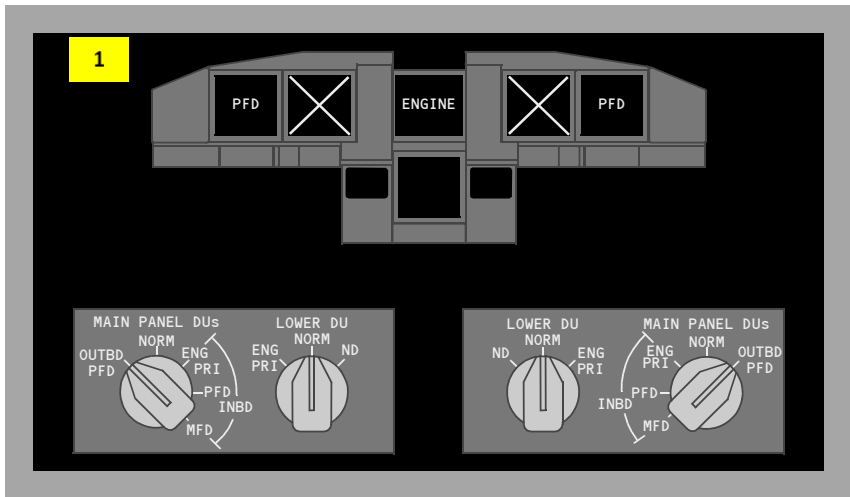
**1 CONTROL PANEL Select Switch BOTH ON 1**

The left EFIS control panel controls both pilots’ outboard and inboard display units.

**2 CONTROL PANEL Select Switch BOTH ON 2**

The right EFIS control panel controls both pilots’ outboard and inboard display units.

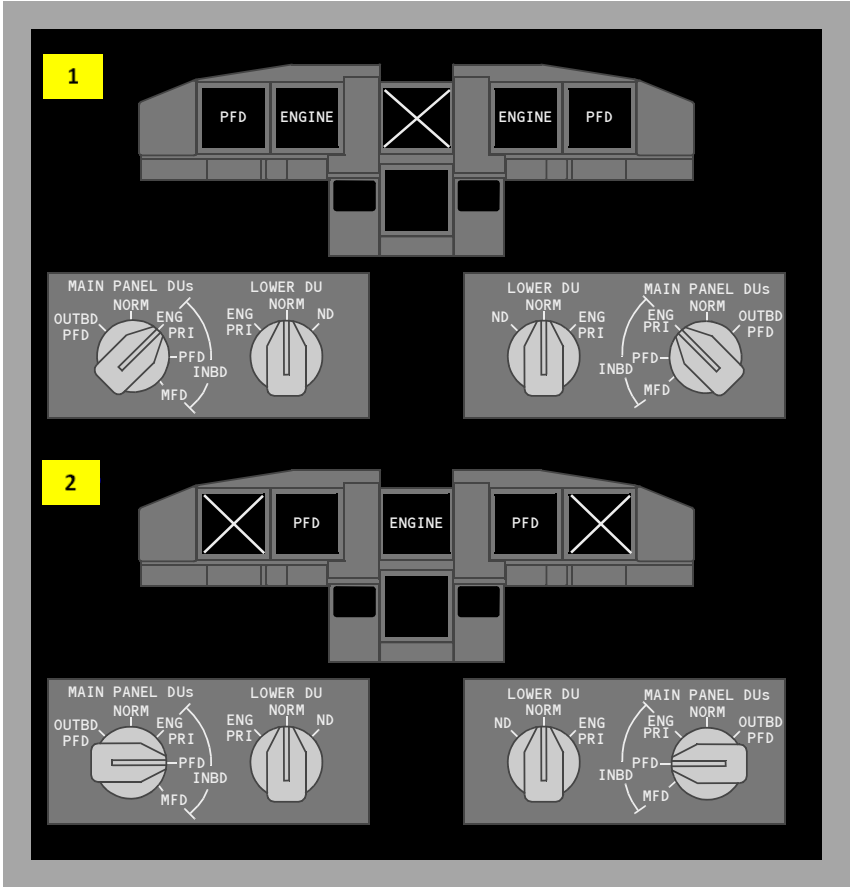
## Outboard Display Switching



### 1 MAIN PANEL DUs Switch to OUTBD PFD

If the MAIN PANEL DUs switch is turned to Outboard Primary Flight Display (OUTBD PFD), the PFD format is displayed on the outboard display unit and the inboard display unit blanks.

# Inboard Display Switching

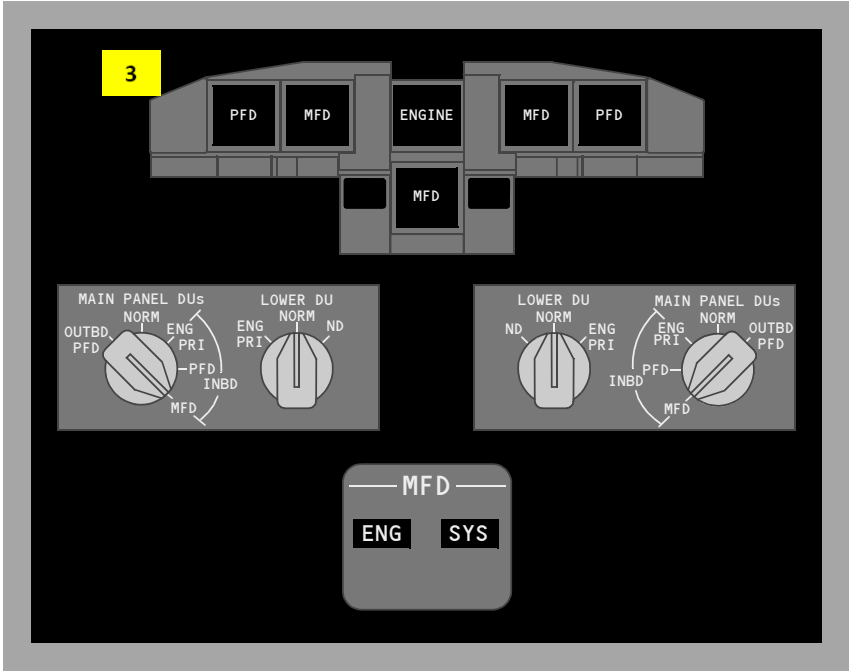


**1 MAIN PANEL DUs Switch to INBD ENG PRI**

If the MAIN PANEL DUs switch is turned to INBD ENG PRI, the primary engine display moves to the inboard DU, the PFD format is displayed on the outboard DU and the upper DU blanks.

**2 MAIN PANEL DUs Switch to INBD PFD**

If the MAIN PANEL DUs switch is turned to INBD PFD, the PFD format is displayed on the inboard DU and the outboard DU blanks.

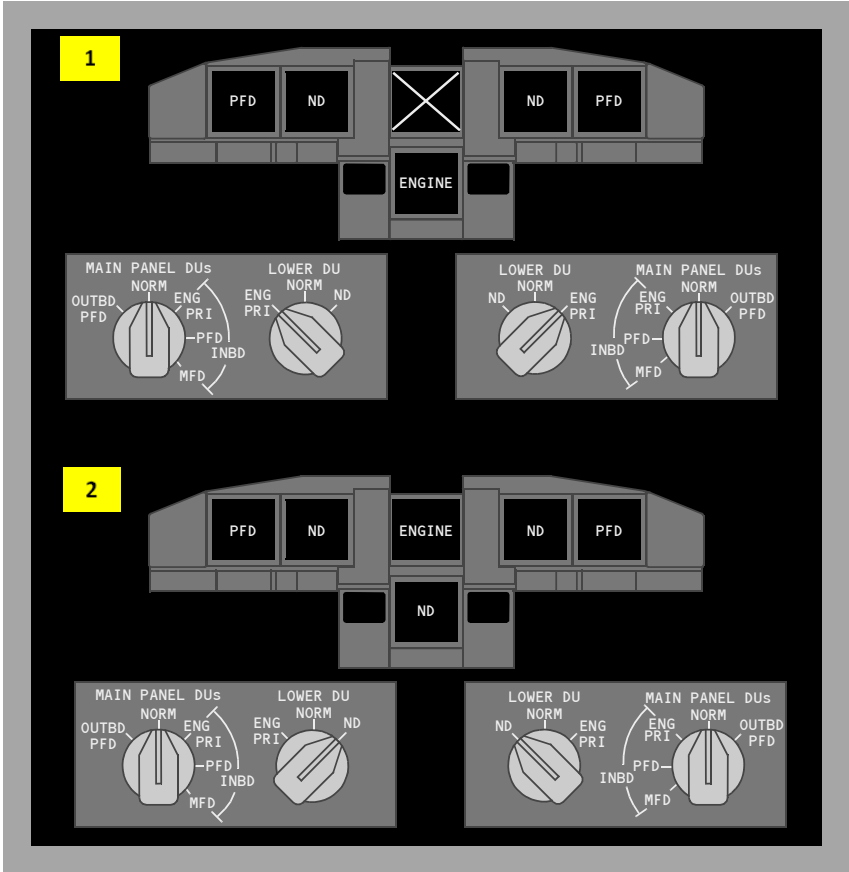


**3 MAIN PANEL DUs Switch to MFD**

If the MAIN PANEL DUs switch is turned to INBD MFD, the PFD continues to be displayed on the outboard display unit and the inboard display is blank. The system format (SYS) or secondary engine format (ENG) can then be selected to the inboard display unit and lower display unit with the MFD switches on the engine display control unit.



# Lower Display Switching



## 1 LOWER DU Switch to ENG PRI

If the LOWER DU switch is turned to ENG PRI, the engine display moves to the lower DU and the upper DU blanks.

## 2 LOWER DU Switch to ND

If the LOWER DU switch is turned to ND, the engine display is shown on the upper DU and the navigation display is shown on the lower DU. When the MFD ENG switch is selected, the compact engine display is shown on the upper DU.

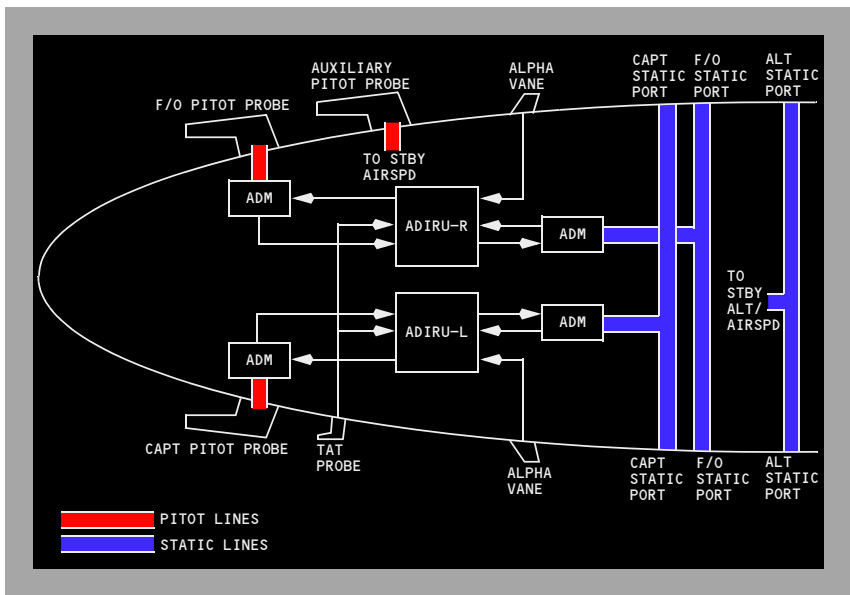
## Display System Information Sources

### Air Data Inertial Reference System (ADIRS)

The ADIRS produces flight data such as position, speed, altitude and attitude for the flight displays, flight management computers, flight controls, engine controls and all other systems requiring inertial and air data.

The major components of the ADIRS are:

- two air data inertial reference units (ADIRUs)
- four air data modules (ADMs)
- one inertial system display unit (ISDU)
- one dual mode select unit (MSU)
- six static ports
- three pitot probes
- two alpha vanes
- one total air temperature probe.



### Air Data Inertial Reference Unit (ADIRU)

The ADIRUs provide inertial position and track data to the FMC as well as attitude, altitude and airspeed data to the displays. The ADIRUs process information measured by internal gyros and accelerometers, and from air data module inputs, the alpha vanes and other systems.

## Air Data

The pitot static system is comprised of three separate pitot probes and six flush static ports. Two pitot probes and four static ports interface with the air data modules. The remaining auxiliary pitot probe and alternate static ports provide pitot and static pressure to the standby instruments. The auxiliary pitot probe is located on the first officer's side of the airplane.

The air data modules convert pneumatic pressure to electrical signals and send these data to the ADIRUs. Each pitot air data module is connected to its on-side pitot probe; there is no cross connection. The air data module connected to the Captain's pitot probe sends information to the left ADIRU, while the air data module connected to the First Officer's pitot probe sends information to the right ADIRU. The remaining air data modules are located at the balance centers of the Captain's and First Officer's static ports. The air data module connected to the Captain's static ports sends information to the left ADIRU, while the air data module connected to the First Officer's static ports sends information to the right ADIRU.

## Angle-of-Attack

There are two alpha vanes, one located on each side of the forward fuselage. The vanes measure airplane angle-of-attack relative to the air mass.

### [Aircraft with Angle of attack indicator]

The primary source of data for the AOA indicator on the PFD is supplied by the ADIRU, with the SMYD as the backup source. The source selection is automatic in the event of primary source failure. Slight differences between the Captain's and FO's indications may be noticed due to sideslip or vane installation errors. These differences could be as large as 2 degrees alpha.

## Total Air Temperature (TAT)

A total air temperature probe is mounted outside the airplane to sense air mass temperature. The temperature sensed by the probe is used by the ADIRUs to compute total air temperature.

**Note:** For manual CDU input of OAT on the ground, TAT indication is approximate and should not be used in lieu of ambient OAT for takeoff performance.

## Static Air Temperature (SAT)

Static air temperature, displayed on the CDU PROGRESS page, comes from the ADIRUs, using total air temperature probe information.

## Standby Flight Instruments

The standby flight instruments include:

- standby magnetic compass
- standby attitude indicator
- standby altimeter/airspeed indicator
- integrated standby flight display
- standby radio magnetic indicator.

## Standby Magnetic Compass

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

## Standby Attitude Indicator

The standby attitude indicator provides attitude information that is independent of the primary attitude displays. The indicator is powered by the battery bus and remains powered after the loss of all normal AC power as long as battery power is available. The gyro reaches operational speed approximately 60 seconds after power is applied. The indicator requires three minutes to achieve accuracy requirements.

## Integrated Standby Flight Display (ISFD)

The ISFD displays attitude, airspeed, altitude, ILS, and magnetic heading information. It is connected directly to the auxiliary pitot and alternate static sources. Attitude information is provided by internal inertial sensors. ILS information is provided by the No. 1 ILS receiver. The display receives its heading information from the same source as the captain’s primary flight display. Heading information is not available in polar regions.

**Note:** The standby magnetic compass must be used to validate heading information.

The battery bus powers the ISFD. Selecting the battery switch ON activates the ISFD. After 10 seconds, an initialization sequence begins that requires 90 seconds to complete. ATT and INIT 90s messages are displayed during initialization. Upon completion of the initialization sequence, attitude information is displayed.

**Note:** Any change in airplane position during the initialization sequence may result in an inaccurate alignment. Inaccurate alignment is not annunciated and may result in the display of inaccurate attitude prior to, and during flight. Re-initialization can only be accomplished through maintenance action.

Detection of a momentary out-of-limit ISFD condition may cause the attitude display to blank and the WAIT ATT or ATT:RST message to display. Operation of the attitude reset switch is required in response to the ATT:RST message. This will reset the horizon line with the airplane symbol.

**Note:** Operation of the attitude reset switch will not correct an inaccurate alignment.

On the ground, operation of the attitude reset switch must be performed with the airplane stationary. In flight, operation of the attitude reset switch must be performed with the airplane in wings level, non-accelerated flight. During the process, the ATT 10s message displays. Failure to maintain straight and level flight for 10 seconds may result in an ATT:RST message. If the reset attempt is unsuccessful, the ATT:RST message remains displayed and the ISFD does not enter normal operation.

## **Standby Altimeter/Airspeed Indicator**

Standby altitude and airspeed are displayed on a single indicator.

The standby altimeter receives static pressure from the alternate static ports. Current altitude is displayed digitally. A pointer indicates altitude in hundreds of feet. Barometric setting windows display the barometric setting in both millibars and inches of mercury as set by the barometric setting control. The altimeter has a range of -1000 to 50,000 feet.

The standby airspeed indicator receives ram air pressure from the auxiliary pitot probe and static pressure from the alternate static ports. It provides current airspeed in knots.

## **Standby Radio Magnetic Indicator**

The standby radio magnetic indicator (RMI) displays magnetic heading and VOR/ADF bearing to the station. The RMI is powered by the AC standby bus and remains powered after the loss of all normal AC power as long as battery power is available.

## **Clocks**

### **[Aircraft with GPS capable]**

Two electronic clocks are installed, with two digital displays on each clock. Universal time coordinated (UTC) time, UTC date, manual time or manual date may be set on the upper time display. The lower ET/CHR display is used for either elapsed time or the chronograph. Separate controls are provided for each display.

Each clock is powered by the hot battery bus when the battery bus is not available. The clock reverts to hot battery bus power when the airplane is powered down. The hot battery bus power keeps the time base but does not provide power for the display or output of clock data and the clock reverts to manual mode. When the airplane is powered up and Global Position System (GPS) data is restored, the clock continues to operate in manual mode and will not automatically display UTC time. UTC time can be manually selected by using the TIME/DATE pushbutton.

**Note:** When on standby power, the F/O clock display is dim and UTC time is not available.

## Clock Switch

### [Aircraft with Remote clock switch]

A remote clock switch, on the glareshield panel, operates the same as the chronograph (CHR) control.

## Flight Recorder

The flight recorder provides a permanent record of selected operational and systems information such as altitude, heading, acceleration, and airspeed. The recorder is housed in a sealed, fire-resistant container located behind an access door in the aft cabin ceiling.

Operational and systems information is automatically recorded whenever the flight recorder is powered. On the ground, the recorder begins operating when one of the engines is operating. In the air, the flight recorder is powered even with both engines shut down as long as APU electrical power is available.

## Aircraft Condition Monitoring System (ACMS)

### [Aircraft with ACMS]

The ACMS consists of:

- digital flight data acquisition unit (DFDAU). The DFDAU receives signals representing certain flight condition and airplane systems' operating performance and converts them to a digital form for recording on the DFDR.
- digital flight data recorder (DFDR). The DFDR records airplane systems and flight data for at least the last 25 hours of operation. The DFDR is located in the aft fuselage area.
- aircraft communication addressing and reporting system (ACARS).

### [Aircraft with Quick Access Recorder (QAR) lights]

- indicator on the aft overhead panel that illuminates when the QAR is full.

## Introduction Head-Up Display

The Head-Up Display (HUD) system uses electronics and optics to calculate and display flight information. The flight information is displayed as flight symbols which project on to a transparent glass screen in front of the pilot. The flight symbols overlay and combine with the outside view through window No. 1.

The HUD system can be used during manual flight operations, or with the AFDS engaged during automatic flight operations. When used manually, internal HUD guidance is used to control flight symbology and is independent of any AFDS derived or displayed flight director guidance.

HUD system components, combined with other airplane systems, produce flight symbology displayed in four distinct modes of operation. Each mode of operation has unique characteristics, and is intended to be used during a particular phase of flight based on system capability and meteorological conditions. TCAS resolution advisories and system failure flags are also displayed when active.

The HUD system consists of the following components:

- HUD computer
- Overhead unit (OHU)
- Combiner
- Control panel
- Annunciator panel

## HUD Computer

The HUD computer receives input signals from aircraft sensors and equipment and converts this data to symbology for display on the combiner. The computer also evaluates system and approach performance through extensive Built-In Test Equipment (BITE), input validation, and approach monitor processing. If an out of tolerance condition exists, the applicable annunciation appears on the combiner and/or annunciator panel. Internal components control the following functions:

- Guidance control
- Shape and position of flight symbols
- Airplane sensor status
- HUD system status
- HUD system mode.

## Overhead Unit (OHU)

The OHU contains the CRT and projection optics to display flight symbology on the combiner. Electronic circuitry within the OHU controls display intensity and system monitoring.

## Combiner

The combiner optically combines flight symbology from the OHU, with the pilot's view through window No.1. It acts as a wavelength selective mirror, reflecting only the flight symbology color (green) and lets other colors pass through.

The combiner alignment detector monitors the angular position of the combiner. The HUD computer uses the detector to verify correct combiner position for normal viewing. If the combiner is not in the correct position, and the HUD is in the IMC or VMC modes, the ALIGN HUD message appears on the combiner.

The combiner glass element has a break away safety feature which allows the element to rotate forward from the normal position, in case of abnormal deceleration.

## Control Panel

The HUD control panel is used to select and display modes of operation and enter data. Display intensity is controlled by panel switches or by an ambient light sensor located on the upper left corner of the panel.

## Annunciator Panel

The annunciator panel consists of lights to indicate HUD system status annunciations during AIII mode approach and landing operations.

## Modes of Operation

The HUD system provides a mode-selectable display on the combiner. The modes are:

- PRI (Primary) - used for most HUD operations
- AIII - primarily used for manually flown CAT II or IIIa ILS approach and landing operations
- IMC - used for AFDS autopilot/flight director approaches
- VMC - used for visual approaches.

## Primary (PRI) Mode

The primary mode may be used during all phases of flight from takeoff to landing. This can include low visibility takeoff operations utilizing ground roll guidance, all enroute operations and either non-precision or precision approaches to CAT I or II minimums utilizing flight director guidance and/or raw data.



Attitude information is displayed in the form of a horizon line and pitch scales positioned relative to an airplane reference symbol. Airspeed and altitude are displayed in tapes along the left and right edges of the display. A sectored HSI is displayed in flight in the lower center of the display. On the ground, the HSI, flight path and guidance cue are not displayed. These symbols are automatically displayed once the aircraft is in flight.

During takeoff, a TOGA pitch target line and a guidance cue are displayed. The TOGA pitch target line is displayed as a horizontal dash line initially positioned at the top of the display. As the pitch attitude increases during rotation, its vertical position relative to the airplane reference symbol is adjusted to display the pitch command from the Captain's flight director. Initially, the flight director guidance cue is displayed when the airplane reference is within 2 degrees of the TOGA pitch target line or when climbing through 50 feet radar altitude, whichever occurs first. The TOGA pitch target line remains until the TO/GA mode is exited. The flight director guidance cue is displayed throughout flight when the Captain's flight director is selected on and both pitch and roll commands remain valid.

A full time slip-skid symbol is displayed as part of the roll scale. During any takeoff (after rotation) or go-around (below 1000 feet), additional slip-skid symbols are displayed to enhance lateral control in the event of an engine failure. These two additional symbols are displayed relative to the airplane reference and the flight path symbols and are removed above 1500 feet.

AFDS engaged modes, autothrottle modes and autopilot status is indicated across the top of the display similar to the flight mode annunciator display. Navigation information is displayed dependent on the selected navigation source and active AFDS mode. During LNAV operations, vertical and lateral deviations are similarly displayed based on FMC data. During ILS/VOR operations, course deviation is displayed within the HSI. Glideslope data is presented on a glideslope deviation scale adjacent to the altitude tape.

If the HUD is in a mode other than primary, depressing a TO/GA switch activates the primary mode independent of the standby mode indicated on the HUD control panel.

### **Primary Mode - Low Visibility Takeoff**

The primary mode includes special symbology used for a low visibility takeoff. The display supports visual runway centerline tracking and enhances situational awareness.

**Note:** Approval must be obtained from the appropriate regulatory authority prior to conducting HUD low visibility takeoff operations.

The low visibility takeoff display incorporates a ground roll reference symbol, ground roll guidance cue and a ground localizer line (if an ILS frequency is tuned on both nav receivers). The HUD derived ground roll guidance cue provides lateral guidance relative to the ground roll reference symbol to track the localizer. The ground localizer line provides raw localizer information any time the aircraft is on the ground and the Captain's navigation receiver is tuned to a localizer frequency. The localizer deviation is presented relative to the selected course mark on the horizon.

### **Primary Mode - Approach and Landing**

#### **[Aircraft with Model 4000]**

If the primary mode is used for an approach and landing, flight director guidance and navigation raw data is displayed. Once on the ground, the ground localizer line and ground localizer scale is displayed (if an ILS frequency is tuned on both nav receivers) to enhance centerline tracking.

### **AIII Approach Mode**

#### **[Aircraft with Model 4000]**

The HUD AIII mode is specifically designed for manual ILS approach and landing operations to CAT II or CAT IIIa minimums. Altitude and airspeed tape displays are replaced with digital values. The HSI is also replaced with ILS raw data displayed in proximity to the flight path group around the center of the display. In the AIII mode, flight path guidance is provided by the guidance cue which is derived from internal approach and landing guidance algorithms, and is independent of any AFDS derived or displayed flight director guidance.

**Note:** Approval must be obtained from the appropriate regulatory authority prior to conducting HUD Cat II or CAT IIIa operations.

AIII mode is dependent on the availability of all required systems and ILS approach criteria. Because of these requirements, the AIII mode is not identified as a selectable standby mode until these requirements are met. AIII capability is displayed on the control panel at any time, and on the combiner after LOC and G/S capture in the PRI mode.

ILS approach criteria requirements are satisfied when:

- Both VHF navigation receivers tuned to an ILS frequency, and
- VHF #1 or VHF #2 localizer deviation is less than approximately 1/4 dot and glideslope deviation is less than approximately 1 and 1/4 dots for at least five seconds, and

- The difference between the airplane's magnetic track and the captain's selected course is less than 15 degrees, and
- Radio altitude is greater than 500 feet.

**Note:** Once these criteria have been satisfied, subsequent deviations outside the criteria prior to AIII mode selection, will result in a loss of ability to select the AIII mode.

Automatic AIII mode arming requirements are satisfied when:

- PRI or IMC mode selected, and
- all required systems operating normally (AIII capable), and
- ILS frequency tuned on VHF NAV receiver No. 1 or No. 2, and
- radio altitude is greater than 500 feet, and
- TOGA mode not active.

To activate AIII ARM, push the STBY function key on the HUD control panel. When armed, "AIII ARM" is displayed on the standby mode display line and "AIII ARM" is displayed on the combiner. Approximately five seconds after the requirements for ILS approach criteria are satisfied, the AIII mode is automatically activated.

Once the AIII mode is active, the AIII mode symbology and related annunciations are displayed on the combiner, the control panel display, and the HUD annunciator panel.

Any sensor or equipment condition that results in a loss of AIII capability will cause a NO AIII annunciation displayed on the combiner and on the control panel display. The first officer's AIII annunciation is also extinguished. The annunciation will remain until another mode is selected or AIII capability is regained.

Below 500 feet radar altitude, with a loss of AIII capability or if the approach or flare performance does not ensure a safe touchdown within the required touchdown zone, an APCH WARN annunciation will be displayed on the combiner and on the HUD annunciator panel.

## **IMC Mode**

The IMC mode is an alternate approach mode primarily intended for autopilot approaches. Like the PRI mode, the IMC mode guidance cue utilizes AFDS derived guidance. The guidance cue is displayed when the Captain's flight director is active and both pitch and roll commands are valid.

Approach symbology format for the IMC mode is similar to the AIII approach mode. Altitude and airspeed data is displayed as digital values and navigation raw data is displayed in close proximity to the flight path vector.

## **VMC Mode**

The VMC mode is intended for visual approach operations. No flight director or HUD guidance is displayed. The flight path vector is used to control the approach to the runway.

Approach symbology format for the VMC mode is similar to the AIII and IMC modes. However, navigation data is not displayed.

The proper mechanical alignment of the combiner is critical during visual operations. Combiner position is monitored by the combiner alignment detector, to determine if the combiner is within allowable position tolerances while in the IMC or VMC mode. If its position is out of tolerance, an ALIGN HUD message is displayed on the combiner. Elimination of the message is accomplished by gently pushing the combiner in the breakaway direction and releasing. This allows the combiner to reposition itself. If the message cannot be removed, the IMC or VMC mode should not be used.

## **TCAS Resolution Advisory**

TCAS resolution advisories are displayed as preventive and corrective symbols, and are similar to the pitch commands displayed on the attitude indicator.

Preventive advisories do not require any crew action, but indicate an unsafe zone, displayed as a double lined bracket. On the unsafe side of the bracket, two angled lines are extended from the corners. The position of the bracket is determined by TCAS, and represents the vertical flight path position that is safe.

Corrective advisories require positive action by the crew and are indicated by a double lined box. The position of the box is determined by the vertical speed requirements from TCAS, and represents the vertical flight path position that is safe.

## **Failure Flags and Data Source Annunciations**

Failure flags are displayed for invalid sensor status and miscompares between similar parameters. These flags are generally indicated by boxed annunciations for the affected parameters, and in the case of failure, the removal of all symbols related to the fault. In some cases, symbols are removed as a result of other symbols being removed due to a fault.

Flags associated with a miscompare of similar data result in the display of a flag without the removal of the related symbols. The flag indicates the applicable data should be verified by cross-checks with other flight deck displays. Data source annunciations are provided in a few cases to annunciate the source of displayed data when other than normal. Dashes replace numbers if there is no computed data

## Introduction EFIS

The Electronic Flight Instrument system (EFIS) presents a dynamic color display of the parameters necessary for flight path control. The displays provide the following information:

- flight mode annunciation
- approach minimums
- airspeed
- radio altitude
- attitude
- altitude
- steering information
- vertical speed
- instrument landing system display
- GPWS annunciations
- TCAS indications.

Failure flags are displayed for airplane system failures. Displayed information is removed or replaced by dashes if no valid information is available to the display system (because of out-of-range or malfunctioning navigation aids). Displays are removed when a source fails or when no system source information is available.

## Airspeed

Airspeed is displayed on a round dial Mach/airspeed indicator, or MASI. Current airspeed is displayed by an airspeed pointer and digital counter. Current Mach number is digitally displayed when the Mach number is greater than 0.40. Target airspeed is shown by the magenta airspeed cursor.

Takeoff and landing reference speeds and flap maneuvering speeds are shown along the circumference of the indicator. Maximum and minimum airspeeds are also displayed.

## Attitude

The attitude indicator displays airplane pitch and roll attitude referenced to the horizon.

Pitch attitude is displayed by an airplane symbol against a pitch scale. The pitch scale is in 2.5 degree increments.

A pointer indicates bank angle in increments of 10, 20, and 30 degrees. Single marks indicate 45 and 60 degrees of bank. A small rectangle under the bank angle pointer indicates slip and skid conditions. Bank angle is also represented by the attitude of the airplane symbol against the horizon line and pitch scale.

### [Aircraft with PLI pop-up]

A pitch limit indication is displayed at all times when the flaps are not up, or when flaps are up and airspeed approaches stick shaker activation for existing flight conditions.

## Steering Indications

### [Aircraft with Split axis command bars]

Flight director pitch and roll bars are displayed when the related flight director switch is on. Pitch and roll commands are displayed independently.

### [Aircraft with Flight path vector]

The Flight Path Vector (FPV) symbol represents airplane flight path angle vertically and drift angle laterally. The flight path vector is displayed on the attitude indicator when the EFIS control panel FPV switch is selected on. The FPV shows the Flight Path Angle (FPA) above or below the horizon line and drift angle left or right of the pitch scale's center. The FPA uses inertial and barometric altitude inputs. The vertical FPA is unreliable with unreliable primary altitude displays.

The FPV symbol is displayed in two brightness levels. The FPV symbol is displayed dim when either the flight director or a TCAS resolution advisory is displayed. The FPV symbol is displayed bright when the flight director is off and there is no TCAS resolution advisory displayed.

## Instrument Landing System Indications

ILS glide slope and localizer deviation are provided.

The glide slope pointer and scale appear on the right side of the attitude indication when a valid signal is received. The scale turns amber and the pointer flashes to indicate an excessive glide slope deviation. The pointer is not displayed when the glide slope signal is unusable or when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The localizer pointer and scale appear at the bottom of the attitude indicator when a valid signal is received. When the course deviation is slightly more than one-half dot and the localizer mode is engaged and track is within 5 degrees of the MCP selected course, the scale automatically expands. At low radio altitudes, with autopilot or flight director engaged, the scale turns amber and the pointer flashes to indicate excessive deviation. Below 1,000 feet AGL, with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC and G/S deviation alerting display on each attitude indicator.

### [Aircraft with Rising runway]

Below 2500 feet radio altitude, with the localizer pointer in view, a rising runway symbol comes into view. The symbol provides lateral guidance. At 200 feet radio altitude, the symbol rises toward the airplane symbol.

## Approach Minimums

### [Aircraft with Radio altitude below ADI]

The selected radio altitude set on the EFIS control panel is displayed near the bottom right of the attitude indicator. The barometric approach minimums is displayed as a marker on the altimeter.

## Radio Altitude

### [Aircraft with Radio altitude below ADI, round dial]

The current radio altitude is displayed near the bottom right of the attitude indicator when radio altitude is below 2,500 feet AGL. When between 1000 feet and 2500 feet AGL, the readout is digital. When below 1000 feet AGL, the readout is displayed in a round dial format. The display turns amber and the circumference flashes for 3 seconds as the radio altitude descends through the selected minimum altitude. The display changes back to white after one of the following occurs:

- when passing the selected minimum altitude plus 75 feet during go-around
- at touchdown
- after pressing the RST switch on the EFIS control panel.

## Radio Altitude Alert

### [Aircraft with 2500 ft height alert]

The altitude alert is triggered and “ALT” is shown above the radio altitude display when radio altitude is less than or equal to 2500 feet AGL.

## Altitude

Altitude is displayed on a round dial altimeter. Current altitude is displayed by an altitude pointer and a digital readout. A green reference altitude marker indicates the barometric minimums set on the EFIS control panel.

When meters is selected on the EFIS control panel, current altitude in meters is shown above the altitude window and the metric altitude equivalent of the selected MCP altitude is displayed above the altimeter. Metric readouts are not available in the compact EFIS mode.

The current barometric reference is displayed in either inches of mercury or hectopascals as selected on the EFIS control panel.

## **Vertical Speed**

Vertical speed is indicated by a vertical speed pointer. The pointer depicts rate of climb or descent from 0 to 6000 feet.

## **Traffic Alert and Collision Avoidance (TCAS) Indications**

### **[Aircraft with VSI TCAS advisory]**

TCAS resolution advisories are displayed on the attitude indicator and vertical speed indicator.

## **GPWS Warnings**

GPWS warnings are displayed in large capital letters on the attitude indicator.



## Introduction PFD

The Primary Flight Displays (PFDs) present a dynamic color display of all the parameters necessary for flight path control. The displays provide the following information:

- flight mode annunciation
- airspeed
- altitude
- vertical speed
- attitude
- steering information
- radio altitude
- instrument landing system display
- approach minimums
- heading/track indications
- TCAS indications
- GPWS annunciations.

Failure flags are displayed for airplane system failures. Displayed information is removed or replaced by dashes if no valid information is available to the display system (because of out-of-range or malfunctioning navigation aids). Displays are removed when a source fails or when no system source information is available.

## Airspeed

### [Aircraft Without groundspeed displayed]

Airspeed is displayed on a tape and in a digital window on the left side of the PFD. The current Mach number is digitally displayed below the airspeed tape when the current Mach number is greater than 0.40. An airspeed trend vector indicates predicted airspeed in 10 seconds. Selected airspeed is displayed above the airspeed tape.

### [Aircraft with With groundspeed displayed]

Airspeed is displayed on a tape and in a digital window on the left side of the PFD. The current Mach number is digitally displayed below the airspeed tape when the current Mach number is 0.40 Mach or above. Ground speed is displayed when airspeed decreases below 0.40 Mach. An airspeed trend vector indicates predicted airspeed in 10 seconds. Selected airspeed is displayed above the airspeed tape.

Takeoff and landing reference speeds and flap maneuvering speeds are shown along the right edge of the airspeed tape. Maximum and minimum airspeeds are also displayed along the right edge of the airspeed tape.

## Attitude

The attitude indication displays the airplane pitch and roll attitude referenced to the horizon.

Pitch attitude is displayed by an airplane symbol against a pitch scale. The pitch scale is in 2.5 degree increments.

A pointer indicates bank angle in increments of 10, 20, and 30 degrees. Single marks indicate 45 and 60 degrees of bank. A small rectangle under the bank angle pointer indicates slip and skid conditions. Bank angle is also represented by the attitude of the airplane symbol against the horizon line and pitch scale.

### [Aircraft with- PLI pop-up]

A pitch limit indication is displayed at all times when the flaps are not up, or when flaps are up and airspeed approaches stick shaker activation for existing flight conditions.

## Angle of Attack

### [Aircraft with Angle of Attack Indicator]

The Angle of Attack (AOA) indicator displays aircraft body angle of attack, stick shaker angle of attack, and the appropriate range of approach angle of attack. The indicator is located in the upper-right corner of the PFD, above the ADI.

If the AOA signal is determined to have failed or is invalid when ground speed is greater than 80 knots, the AOA indicator will be blanked and replaced with a fail flag.

During normal operation, the approach reference band moves with flap handle position. When the flap handle is in a landing flap detent, the band will depict the appropriate range of AOA for a  $V_{ref}(xx)+5$  approach, where  $V_{ref}(xx)$  is for the corresponding flap detent position. If the flaps are driven in alternate mode, the band moves depending on actual flap position. If flap position is determined to be invalid, the band is blanked.

If an approach is flown faster than  $V_{ref}(xx)+5$ , AOA is lower than normal and could potentially be below the band. If a slower approach is flown, AOA is higher than normal and could be above the band.

## Steering Indications

### [Aircraft with Integrated cue command bar]

The flight director is displayed when the related flight director switch is on. Pitch and roll commands are combined on a single display.

The flight path vector (FPV) symbol represents airplane flight path angle vertically and drift angle laterally. The flight path vector is displayed on the PFD when the EFIS control panel FPV switch is selected on. The FPV shows the Flight Path Angle (FPA) above or below the horizon line and drift angle left or right of the pitch scale's center. The FPA uses inertial and barometric altitude inputs. The vertical FPA is unreliable with unreliable primary altitude displays.

The FPV symbol is displayed in two brightness levels. The FPV symbol is displayed dim when either the flight director or a TCAS resolution advisory is displayed. The FPV symbol is displayed bright when the flight director is off and there is no TCAS resolution advisory displayed.

## **Instrument Landing System Indications**

ILS glide slope and localizer deviation, frequency/identification, DME, course, and marker beacon indications are provided.

The approach reference information appears above and to the left of the attitude display. The ILS station identification or frequency, course, and (if available) DME are displayed.

The marker beacon indication (OM – outer marker, IM – inner marker, or MM – middle marker) is displayed in the upper right corner of the attitude display area.

The glide slope pointer and scale appear on the right side of the attitude indication when a valid signal is received. At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate an excessive glide slope deviation. The pointer is not displayed when the glide slope signal is unusable or when the track and the front course on the mode control panel differ by more than 90 degrees (backcourse).

The localizer pointer and scale appear at the bottom of the attitude indication when a valid signal is received. When the course deviation is slightly more than one-half dot, the localizer mode is engaged and track is within 5 degrees of the MCP selected course, the scale automatically expands. At low radio altitudes with autopilot engaged the scale turns amber and the pointer flashes to indicate excessive deviation. Below 1,000 feet AGL with LNAV engaged and LOC armed, the localizer scale turns amber and the pointer flashes if the localizer is not captured.

Each pilot's deviation alerting system self-tests upon becoming armed at 1500 feet radio altitude. This self-test generates a two second LOC and G/S deviation alerting display on each attitude indicator.

### **[Aircraft with Rising runway]**

Below 2500 feet radio altitude with the localizer pointer in view, a rising runway symbol comes into view. The symbol provides lateral guidance. At 200 feet radio altitude, the symbol rises toward the airplane symbol.

## Integrated Approach Navigation (IAN) Indications

### [Aircraft with IAN]

FMC glide path and FAC deviation, approach identifier, distance, and course are provided. The approach data appears above and to the left of the attitude display. Below the approach data is the IAN deviation source annunciation. Marker beacon indications are provided as in an ILS approach.

IAN glide path and FAC deviation indications and alerts are displayed like ILS. Deviation indications appear when a valid IAN approach is selected. IAN approach deviations are not available with QFE selected in the FMC.

## Approach Minimums

### [Option - Radio altitude above ADI]

The selected radio altitude or barometric approach minimums are set on the EFIS control panel. The radio altitude approach minimum is displayed near the top left of the altitude display and the barometric approach minimums is displayed near the bottom left of the altitude display.

## Radio Altitude

### [Aircraft with Radio altitude above ADI, round dial]

The current radio altitude is displayed above the upper right corner of the attitude indication area when radio altitude is below 2,500 feet AGL. When between 1000 feet and 2500 feet AGL, the readout is digital. When below 1000 feet AGL, the readout is displayed in a round dial format. The display turns amber when the radio altimeter is below the radio altitude minimums.

## Altitude

Altitude is displayed on an altitude tape along the right side of the PFD. It is also shown digitally in a window in the middle of the tape. When meters is selected on the EFIS control panel:

- current altitude in meters is also shown above the altitude window
- selected altitude in meters is displayed above the altitude tape.

Selected altitude is displayed above the altitude tape and is boxed when approaching the selected altitude. Selected altitude is also depicted with a bug on the altitude tape.

The selected barometric approach minimum is indicated on the altitude tape with a triangular pointer and a line when BARO minimums are selected.

### [Aircraft with Landing altitude reference bar]

A landing altitude reference bar is displayed along the inner edge of the altitude indication. The reference bar indicates the height above touchdown. A white bar is displayed from 1000 to 500 feet above landing altitude. An amber bar is displayed from 500 feet to the landing altitude.

A landing altitude indication is displayed as a crosshatched area and indicates:

- the FMC landing altitude for destination runway or airport, or
- the landing altitude for departure runway or airport until 400 NM from departure or one-half the distance to destination, whichever occurs first.

The current barometric reference is displayed below the altitude tape in either inches of mercury or hectopascals as selected on the EFIS control panel. A preselected barometric reference can be displayed when STD is displayed.

### [Aircraft with Altimeter with QFE]

Altitude reference is selectable between QNH and QFE. QNH is the normal operating mode.

## Vertical Speed

Vertical speed is displayed to the right of the altitude tape with a tape and pointer. Vertical speed is digitally displayed above or below the vertical speed display when vertical speed is greater than 400 feet per minute. It is displayed above with positive vertical speed and below with negative vertical speed. The selected vertical speed bug shows the selected vertical speed when in the AFDS vertical speed (V/S) pitch mode.

## Heading/Track Indications

Heading/track information is displayed in the bottom section of the PFD on a section of the compass rose. Current heading is displayed under a pointer at the top of the compass rose. The MCP selected heading is displayed as a bug on the outside of the compass rose and digitally in the left half of the compass rose.

The current heading/track reference (MAG/TRU) is shown in the right half of the compass rose. A line drawn perpendicular to the edge of the compass rose from the invisible center depicts the current airplane track.

## Traffic Alert and Collision Avoidance (TCAS) Indications

### [Aircraft with VSI TCAS advisory]

TCAS resolution advisories are displayed in the attitude indication and vertical speed indication areas.

## GPWS Warnings

GPWS warnings are displayed in large capital letters between the attitude display and the heading/track compass rose.

## Introduction Navigation Displays

The navigation displays provide a color display of flight progress. The displays consist of the following:

- horizontal situation indicator
- radio distance magnetic indicator
- navigation display with MAP, APP (approach), VOR, and PLN (plan) modes.

The MAP, VOR, and APP modes can be switched between an expanded mode with a partial compass rose and a center mode with a full compass rose.

## Horizontal Situation Indicator (HSI)

The HSI provides heading and track data with VOR navigation or ILS approach information. The data are normally displayed on a compass rose with 200 degrees of heading. In the compact EFIS mode, the data are presented on a 360 degree display.

## Radio Distance Magnetic Indicator (RDMI)

The RDMI provides the same information as a conventional RDMI.

## Navigation Display – MAP Mode

The MAP mode is recommended for most phases of flight. This mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- current track
- selected and current heading
- position trend vector
- range to selected altitude
- map range scale
- ground speed
- true airspeed
- wind direction and speed
- next waypoint distance
- waypoint estimated time of arrival
- selected navigation data points.

## Navigation Data Points

Additional navigation facility (STA), waypoint (WPT), airport (ARPT), route progress (DATA) and position (POS) data are available for display in both the expanded and center MAP modes.

## VOR and Approach Modes

The VOR and APP modes are presented heading up. The VOR and APP modes display track, heading, and wind speed and direction with VOR navigation or approach information.

## Plan Mode

The PLN mode is presented true north up. The active route may be viewed using the STEP prompt on the CDU LEGS pages.

## Navigation Display Information

### Heading

Heading is supplied by air data inertial reference system (ADIRS). The compass rose can be referenced to magnetic north or true north.

### Track

Track is supplied by the FMC during normal operation.

### Traffic

Traffic information from the TCAS can be displayed on the navigation display when in MAP, Center MAP, APP and VOR modes.

### Weather Radar

Weather radar information can be displayed on the navigation display when in MAP, Center MAP, APP and VOR modes.

## Failure Flags and Messages

Failure flags are displayed for system failures or invalid information. Indications are removed or replaced by dashes when source system information is not available.

The message EXCESS DATA is displayed if the amount of information sent to the navigation display exceeds the display capability. The message can be removed by:

- reducing the amount of map information
- reducing range, or
- deselecting one or more of the EFIS control panel map switches (STA, WPT, ARPT, DATA, POS).



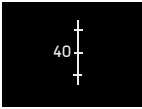





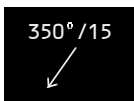

## Navigation Display Symbology

The following symbols can be displayed, depending on EFIS control panel switch selections. Colors indicate the following:


- W (white) – present status, range scales
- G (green) – dynamic conditions
- M (magenta) – command information, pointers, symbols, fly-to condition
- C (cyan) – nonactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings
- B (black) – blank area, off condition.

## Heading, Track, and Speed



SYMBOL	NAME	MODE	REMARKS
	Selected heading bug (M)	All except PLN	Displays the MCP–selected heading. A dashed reference line (M) extends from the marker to the airplane symbol (VOR CTR and APP CTR do not display dashed line).
	Current heading pointer (W)	All except PLN	Points to current heading on the compass rose.
	Track line and range scale (W)	MAP, MAP CTR, APP, VOR	Indicates current track.
	Expanded compass (W)	MAP, APP, VOR	Displays 60 degrees of compass rose.
	Groundspeed (W)	All	Current ground speed.
	True airspeed (W)	All	Current true airspeed displayed above 100 knots.

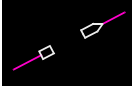


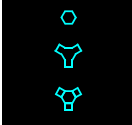
SYMBOL	NAME	MODE	REMARKS
	Wind direction/speed and wind arrow (W)	All	Indicates wind speed and direction, with respect to display orientation and heading/track reference. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots. Blank until TAS is greater than 101 knots. PLN mode displays speed/direction only.
	Heading/track reference (G), box (W) in TRU, box (A) if TRU displayed in descent	All except PLN	Indicates heading/track is referenced to magnetic north or true north. On transition from TRU to M, a highlight box is displayed around M for 10 seconds. When TRU is the reference, the highlight box is displayed full time (white).

**[Aircraft with Heading-up display]**

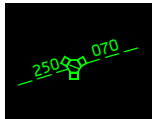
	Heading orientation (G), current heading (W), heading reference (G), heading pointer (W)	All except PLN	Displays HDG as the display orientation, current heading, MAG or TRU as the heading reference, and points to the heading on the compass rose.
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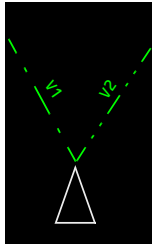
**Radio Navigation**

SYMBOL	NAME	MODE	REMARKS
	ILS/VOR frequency display (G)	APP, APP CTR, VOR, VOR CTR	Displays frequency of manually tuned navaid.
	DME distance (W)	APP, APP CTR, VOR, VOR CTR	Indicates DME distance to the reference navaid.

SYMBOL	NAME	MODE	REMARKS
	Selected course pointer (W) and line (M)	VOR, APP	Displays selected course as set by the related MCP course selector.
	Selected course pointer (W) TO/FROM pointer (W)	APP CTR, VOR CTR	Displays selected course as set by the related MCP course selector. TO/FROM pointer is displayed when VOR navigation is being used.
	To/from indication (W)	VOR, VOR CTR	Displays VOR to/from indication.
	VOR (C, G), DME/TACAN (C, G), VORTAC (C, G)	MAP, MAP CTR, PLN	When the EFIS control panel STA map switch is selected on, appropriate navaids are displayed. All navaids contained in the FMC data base and within the MAP area are displayed when the selected range is 5, 10, 20 or 40 nm. Only high altitude navaids are displayed when the selected range is 80, 160, 320 or 640 nm. Nav aids not being used are displayed in cyan. Manually tuned VHF navaids are displayed in green, regardless of STA map switch selection.

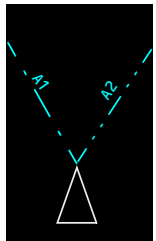
**[Aircraft with VOR course lines displayed]**

	Manually tuned VOR radials (G)	MAP, MAP CTR, PLN	When a navaid is manually tuned, the selected course and reciprocal are displayed.
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	VOR radials (G)	MAP, MAP CTR	When the POS map switch is selected on and a valid VOR signal is received, the station radial is displayed.
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SYMBOL	NAME	MODE	REMARKS
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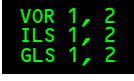
**[Aircraft with Dual ADF]**

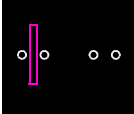

	ADF bearings (C)	MAP, MAP CTR	When the POS map switch is selected on and a valid ADF signal is received, the relative bearing to the tuned ADF station is displayed.
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**[Option - ADF Full time MAP]**


	ADF 1 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station. Not displayed if POS selected on the EFIS control panel.
	ADF 2 (C) pointer head and tail		



**[Aircraft with GLS]**

	System source annunciation (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.
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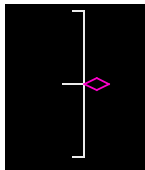
	ILS localizer or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC or VOR course deviation.
	Glide slope pointer (M) and scale (W)	APP, APP CTR	Displays glide slope position and deviation.



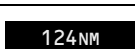
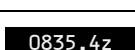
**MAP**



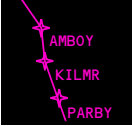


SYMBOL	NAME	MODE	REMARKS
	Airplane symbol (W)	VOR CTR, APP CTR	Current airplane position is at the center of the symbol.

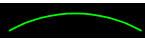
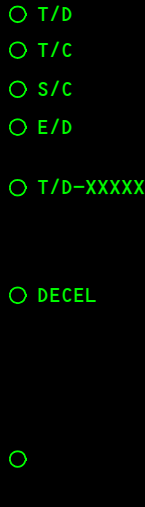
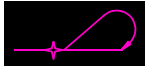


SYMBOL	NAME	MODE	REMARKS
	Airplane symbol (W)	PLN	Indicates actual position and track along the flight plan route. Inhibited north of 82N latitude and south of 82S latitude.
	Airplane symbol (W)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle.

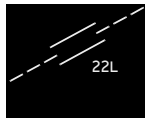



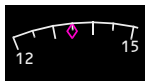
**[Option]**

	VNAV path pointer (M) and deviation scale (W)	MAP, MAP CTR	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates $\pm$ 400 feet deviation. Digital display is provided when the pointer deviates more than $\pm$ 30 feet from center.
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	Position trend vector (W) (dashed line)	MAP, MAP CTR	Predicts position at the end of 30, 60, and 90 second intervals. Each segment represents 30 seconds. Based on bank angle and ground speed. Selected range determines the number of segments displayed. For range: <ul style="list-style-type: none"> <li>• &gt; 20 NM, 3 segments</li> <li>• = 20 NM, 2 segments</li> <li>• &lt;= 10 NM, 1 segment.</li> </ul>
	Active waypoint identifier (M)	MAP, MAP CTR, PLN	Indicates the active flight plan waypoint, the next waypoint on the route of flight.
	Active waypoint distance (W)	MAP, MAP CTR, PLN	Distance to the active waypoint.
	Active waypoint ETA (W)	MAP, MAP CTR, PLN	Indicates FMS-calculated ETA at the active waypoint.

SYMBOL	NAME	MODE	REMARKS
	Waypoint: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	<p>Active– represents the waypoint the airplane is currently navigating to.</p> <p>Modified – represents the waypoints on the active route that are being modified.</p> <p>Inactive – represents the waypoints on the active route.</p>
	Off route waypoint (C)	MAP, MAP CTR, PLN	When the EFIS control panel WPT map switch is selected on, waypoints not on the selected route are displayed, for ranges of 5, 10, 20, or 40 NM.
	Flight plan route: active (M), modified (W), inactive (C), offset (M)	MAP, MAP CTR, PLN	<p>The active route is displayed with a continuous line (M) between waypoints.</p> <p>Active route modifications are displayed with short dashes (W) between waypoints.</p> <p>Inactive routes are displayed with long dashes between waypoints.</p> <p>An offset route, selected through the FMC, is displayed with a dot-dash line (M) parallel to the active route.</p>
	Route data: active (M), inactive (W)	MAP, MAP CTR, PLN	When the EFIS control panel DATA switch is selected on, entered or procedural altitude and ETAs for route waypoints are displayed.
	Holding pattern: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	<p>A holding pattern appears when in the flight plan.</p> <p>The holding pattern appears as a fixed size if the selected range is greater than 80 NM.</p> <p>A scaled representation of the holding pattern is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the holding fix.</p>


SYMBOL	NAME	MODE	REMARKS
	Altitude range arc (G)	MAP, MAP CTR	Based on vertical speed and groundspeed, indicates the approximate map position where the MCP altitude will be reached.
	Altitude profile point and identifier (G)	MAP, MAP CTR, PLN	Indicates the approximate map position of the FMC-calculated T/C (top-of-climb), T/D (top-of-descent), S/C (step climb), and E/D (end of descent) points.  Indicates intermediate T/D points for level flight path segments during descent. Level flight path segment altitude is displayed.  Indicates the beginning of a deceleration segment resulting from deceleration to a holding pattern, a waypoint speed restriction or flaps up maneuvering speed.  Indicates airport speed restriction deceleration point (no identifier).
	Procedure turn: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	A procedure turn appears when in the flight plan.  The procedure turn appears as a fixed size if the selected range is greater than 80 NM.  A scaled representation of the procedure turn is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the procedure turn.
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 80, 160, 320, or 640 NM.
	Airport (C)	MAP, MAP CTR, PLN	Displayed if the EFIS control panel ARPT map switch is selected on.  Origin and destination airports are always displayed, regardless of map switch selection.

SYMBOL	NAME	MODE	REMARKS
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 5, 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.
	Selected reference point and bearing distance information (G)	MAP, MAP CTR, PLN	Displays the reference point selected on the CDU FIX page. Bearing and/or distance from the fix are displayed with dashes (G).
	Weather radar returns (R, A, G, M)	MAP, MAP CTR, VOR, APP	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green. Turbulence is displayed in magenta.
	Selected map options (C)	MAP, MAP CTR, PLN	Displays EFIS control panel selected map options.
	Drift angle pointer (W)	VOR CTR, APP CTR	Indicates airplane's present track. Replaces track line in the center APP and VOR modes.


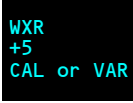
**[Aircraft with AUTO Position Difference]**

	Position difference display (W)	MAP, MAP CTR	<p>Values indicate NM difference between present FMC position and IRS-L/R present positions. The selected IRS source is displayed on the first line.</p> <p>Arrows indicate the relative bearing to IRS present positions.</p> <p>Displayed when the position difference of the IRS-L and/or IRS-R exceeds limits.</p>
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**[Aircraft with GPS]**


	Position shift: Active (M), Update (W), Other position (G)	PLN	Displays the position of each navigation sensor. Symbols only appear if the POS SHIFT page is displayed on the CDU.
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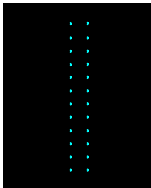
SYMBOL	NAME	MODE	REMARKS
<b>[Aircraft with 1 FMC]</b>			
	MAP source annunciation (G)	MAP, MAP CTR, PLN	Displays source of FMC data used by CDS for data presentation.
	Weather radar annunciations: Mode (C), Tilt (C), Gain (C)	MAP, MAP CTR, VOR, APP	Annunciations vary with option selected


## Vertical Situation Display (VSD)

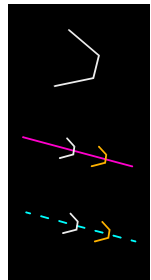
### [Option VSD]

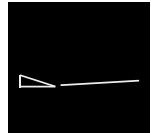
SYMBOL	NAME	REMARKS
	Airplane symbol (W)	Current airplane altitude is the bottom of the triangle. Current airplane lateral position relative to terrain is the point of the triangle.

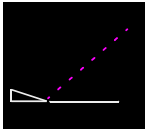
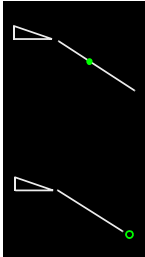
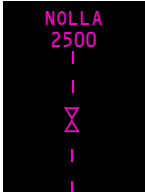

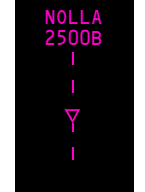

### [Option]

	Enroute swath (C) (dashed line)	Indicates area of the map that is shown on the VSD. Display is inhibited both on takeoff and approach when the airplane is within 6 NM of the runway and less than 3000 feet above field elevation. During turns, the swath edge leading the turn opens in the direction of the turn.
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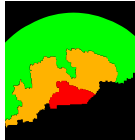








	Selected altitude bug and line (M)	Bug indicates the altitude set in the MCP altitude window. When the selected altitude is off scale, the bug is parked at the top or bottom, with only one half the bug visible.  Dashed line extends from bug to background display boundary. Line does not park.
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	Decision gates (W, A)	Indicates suggested points where airplane should be path and speed stable on approach. Gates are placed on the 3 Degree Reference Line or FMC Approach Glidepath Angle Line: <ul style="list-style-type: none"> <li>at 1000 feet above field elevation(W).</li> <li>at 500 feet above field elevation(A).</li> </ul> Decision gates that are below the missed approach waypoint altitude will not be displayed.
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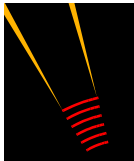


	Flight path vector (W)	Fixed length line indicates current flight path angle and rotates about the point of the triangle.  Angle of the line is dependent on the vertical speed and ground speed of the airplane.
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SYMBOL	NAME	REMARKS
	MCP selected vertical speed vector (M)	Dashed line indicates the selected vertical speed as a target angle when the MCP V/S mode is selected.  Extends to the edge of the background display and rotates about the point of the triangle.
	Range to target speed dot (G)	Indicates where the airplane will achieve the FMC or MCP target speed. If the airplane is within 5 knots of the target speed the dot will be blanked. If the airplane increases 10 knots or more faster than the target speed the dot will reappear.  Displayed at the end of the Flight Path Vector as an un-filled dot if the target speed will not be achieved within the vector length.
	Waypoint altitude constraint: active (M), inactive (W)	At Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Above Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Below Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	Block Altitude example.





## Look-Ahead Terrain

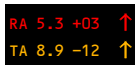



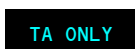



SYMBOL	NAME	MODE	REMARKS
	Terrain display (R, A, G, M)	MAP, MAP CTR, VOR, APP	Displays terrain data from the GPWS terrain data base. Color and density vary based on terrain height vs. airplane altitude.
	Terrain mode annunciation (C)	MAP, MAP CTR, VOR, APP	Terrain display enabled (manual or automatic display).
	Terrain test mode annunciation (C)	All	GPWS operating in self-test mode.
	Terrain annunciation (R, A)	All	Look-ahead terrain caution alert active (A), look-ahead terrain warning alert active (R).
	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display have failed.
	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display unavailable due to position uncertainty.
	Terrain status annunciations (A)	All	GPWS terrain inhibit switch in TERR INHIBIT position.
	Terrain range status annunciations (A)	MAP, MAP CTR, VOR, APP	Terrain output range disagrees with selected EFIS control panel range.
	Terrain range status annunciations (A)	MAP, MAP CTR	Terrain output range and map display output range disagree with selected EFIS control panel range.

## Predictive Windshear

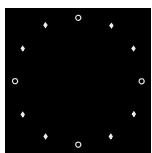
SYMBOL	NAME	ND MODE	REMARKS
	Predictive windshear symbol (R, B, A)	MAP, MAP CTR, VOR, APP	Displays windshear location and approximate geometric size (width and depth).  Amber radials extend from predictive windshear symbol to help identify location of windshear event.
	Windshear annunciation (R, A)	All	Predictive windshear caution active (A).  Predictive windshear warning active (R).
	Predictive windshear status annunciation (A)	All	Predictive windshear alerting and display have failed.

## TCAS

SYMBOL	NAME	MODE	REMARKS
	TCAS resolution advisory (RA), relative altitude (R)	MAP, MAP CTR, VOR, APP	These symbols are displayed only when the EFIS control panel traffic (TFC) switch is selected on.  The arrow indicates traffic climbing or descending at a rate $\geq 500$ fpm. At rates $< 500$ fpm, the arrow is not displayed.  The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane.  The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.
	TCAS traffic advisory (TA), relative altitude (A)		
	TCAS proximate traffic, relative altitude (W)		
	TCAS other traffic, relative altitude (W)		

SYMBOL	NAME	MODE	REMARKS
	TCAS no bearing message (RA-R, TA-A)	MAP, MAP CTR, VOR, APP	Message provides traffic type, range in NM, altitude and vertical direction. TFC must be selected on.
	TCAS traffic alert message (RA-R, TA-A)	All	Displayed whenever a TCAS RA or TA is active. EFIS control panel TFC switch does not have to be selected on.
	TCAS off scale message (RA-R, TA-A)	MAP, MAP CTR, VOR, APP	Displayed whenever RA or TA traffic is outside the traffic area covered by the ND range. Displayed only if the EFIS control panel TFC switch is selected on.
	TCAS mode (C)	MAP, MAP CTR, VOR, APP	Indicates the ND TCAS display is active; the EFIS control panel TFC switch is selected on.
	TCAS mode (C)	All	Indicates TCAS computer is not computing RAs. Displayed whether the EFIS control panel TFC switch is selected on or off.
	TCAS mode (C)	All	Indicates TCAS is operating in the test mode. Displayed whether EFIS control panel TFC switch is selected on or off.
	TCAS mode (A)	All	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA. Not displayed if TCAS is failed.
	TCAS mode (A)	All	Indicates TCAS failure, if traffic is selected.

**[Aircraft with 3NM TCAS range ring]**

	Range Ring (W)	MAP, MAP CTR, VOR, APP	Displayed when TFC selected on EFIS Control Panel. Shows 3 NM range ring oriented to aircraft heading. Displayed at ranges of 80 NM or less.
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## Introduction ND

The NDs provide a mode-selectable color flight progress display. The modes are:

- MAP
- APP (approach)
- VOR
- PLN (plan).

The MAP, VOR, and APP modes can be switched between an expanded mode with a partial compass rose and a centered mode with a full compass rose.

## Map Mode

The MAP mode is recommended for most phases of flight. This mode shows airplane position relative to the route of flight against a moving map background.

Displayed information can include:

- current track
- selected and current heading
- position trend vector
- range to selected altitude
- map range scale
- ground speed
- true airspeed
- wind direction and speed
- next waypoint distance
- waypoint estimated time of arrival
- selected navigation data points.

## Navigation Data Points

Additional navigation facility (STA), waypoint (WPT), airport (ARPT), route progress (DATA) and position (POS) data are available for display on the ND in both the expanded and center map modes.

## VOR and Approach Modes

The VOR and APP modes are presented heading up. The VOR and APP modes display track, heading, and wind speed and direction with VOR navigation or approach information.

## Plan Mode

The PLN mode is presented true north up. The active route may be viewed using the STEP prompt on the CDU LEGS pages.

## **ND Information**

### **Heading**

Heading is supplied by the FMC or air data inertial reference system (ADIRS). The ND compass rose can be referenced to magnetic north or true north.

### **Track**

Track is supplied by the FMC during normal operation.

### **Traffic**

Traffic information from the TCAS can be displayed on the ND.

### **Weather Radar**

Weather radar information can be displayed on the ND.

### **Failure Flags and Messages**

Failure flags are displayed for system failures or invalid information. Indications are removed or replaced by dashes when source system information is not available.

The message EXCESS DATA is displayed if the amount of information sent to the ND exceeds the display capability. When this occurs, the primary display system removes information from the outer edge of the display. The message can be removed by:

- reducing the amount of map information
- reducing range, or
- deselecting one or more of the EFIS control panel map switches (STA, WPT, ARPT, DATA, POS).



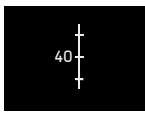


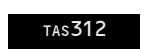



### ND Symbolology

The following symbols can be displayed on each ND, depending on EFIS control panel switch selections. Colors indicate the following:



- W (white) – present status, range scales
- G (green) – dynamic conditions
- M (magenta) – command information, pointers, symbols, fly-to condition
- C (cyan) – nonactive or background information
- A (amber) – cautions, faults, flags
- R (red) – warnings
- B (black) – blank area, off condition.

### Heading, Track, and Speed

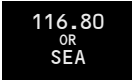


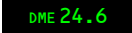
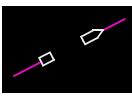
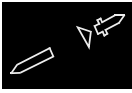

SYMBOL	NAME	MODE	REMARKS
	Selected heading bug (M)	All except PLN	Displays the MCP–selected heading. A dashed reference line (M) extends from the marker to the airplane symbol (VOR CTR and APP CTR do not display dashed line).  In the MAP mode with LNAV or VORLOC engaged, the dashed line is removed 10 seconds after the selected heading bug is moved.
	Current heading pointer (W)	All except PLN	Points to current heading on the compass rose.
	Track line and range scale (W)	All except PLN	Indicates current track.  Number indicates range (VOR CTR and APP CTR do not display range).
	Expanded compass (W)	MAP, VOR, APP	Displays 90 degrees of compass rose.
	Groundspeed (W)	All	Current ground speed.
	True airspeed (W)	All	Current true airspeed displayed above 100 knots.


SYMBOL	NAME	MODE	REMARKS
	Wind direction/speed and wind arrow (W)	All	Indicates wind speed and direction, with respect to display orientation and heading/track reference. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots. Blank until TAS is greater than 101 knots. PLN mode displays speed/direction only.

**[Aircraft with Track-up display]**

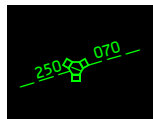
	Track orientation (G), current track (W), track reference (G)	MAP, MAP CTR	Displays TRK as the orientation, the current track, and MAG or TRU as the reference, and points to the heading on the compass rose.
	Heading orientation (G), current heading (W), heading reference (G), heading pointer (W)	VOR, VOR CTR, APP, APP CTR	Displays HDG as the display orientation, current heading, MAG or TRU as the heading reference, and points to the heading on the compass rose.

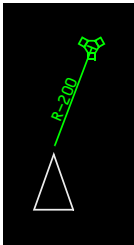
## Radio Navigation

SYMBOL	NAME	MODE	REMARKS
	ILS /VOR Reference receiver frequency or identifier display (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Frequency displayed before the identifier is decoded. The decoded identifier replaces the frequency. Medium size characters for VOR, small size characters for DME only.
	Reference ILS or VOR course (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Indicates the VOR course or ILS localizer course.
	Reference VOR or ILS DME (W)	VOR, VOR CTR, APP, APP CTR	Located upper right corner. Indicates DME distance to the reference navaid.
	DME distance (G)	All except PLN	Located lower left or right corner. Indicates DME distance to navaid.
	Selected course pointer (W) and line (M)	VOR, APP	Displays selected course as set by the related MCP course selector.
	Selected course pointer (W) TO/FROM pointer (W)	APP CTR, VOR CTR	Displays selected course as set by the related MCP course selector. TO/FROM pointer is displayed when VOR navigation is being used.
	To/from indication (W)	VOR, VOR CTR	Displays VOR to/from indication.

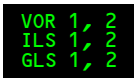
SYMBOL	NAME	MODE	REMARKS
	VOR (C, G), DME/TACAN (C, G), VORTAC (C, G)	MAP, MAP CTR, PLN	When the EFIS control panel STA map switch is selected on, appropriate nav aids are displayed. All nav aids contained in the FMC data base and within the MAP area are displayed when the selected range is 5, 10, 20 or 40 nm. Only high altitude nav aids are displayed when the selected range is 80, 160, 320 or 640 nm. Nav aids not being used are displayed in cyan.  Manually tuned VHF nav aids are displayed in green, regardless of STA map switch selection.

**[Aircraft with VOR course lines displayed]**

	Manually tuned VOR radials (G)	MAP, MAP CTR, PLN	When a nav aid is manually tuned, the selected course and reciprocal are displayed.
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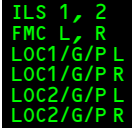
	VOR/DME raw data radial and distance (G)	MAP, MAP CTR	When the POS map switch is selected on, the station radial extends to the airplane.
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**[Aircraft with GLS]**

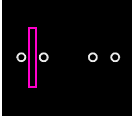

	System source annunciation (G)	VOR, VOR CTR, APP, APP CTR	Indicates the selected receiver as the display reference.
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SYMBOL	NAME	MODE	REMARKS
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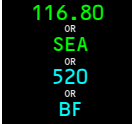
**[Aircraft with IAN]**




	IAN source annunciation (G)	APP, APP CTR	Indicates the selected source of the deviation displays.
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**[Aircraft with IAN]**




	ILS localizer, FMC IAN or VOR course deviation indication (M) and scale (W)	VOR, VOR CTR, APP, APP CTR	Displays LOC, FMC IAN or VOR course deviation. Deviation indicator points in direction selected course. For ILS and FMC IAN deviation, indicator fills (M) when less than 2 1/2 dots from center.
	ILS Glide slope or FMC IAN Glide path pointer (M) and scale (W)	APP, APP CTR	Displays glide slope or glide path position and deviation.

**[Aircraft with ADF]**


	VOR frequency or identifier (G), ADF frequency or identifier (C)	All except PLN	Located lower left or right corner. Frequency is displayed before identifier is decoded. Decoded identifier replaces the frequency. For VORs, small size characters indicate only DME information is being received.
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SYMBOL	NAME	MODE	REMARKS
<b>[Aircraft with Dual ADF]</b>			
	VOR (G) or ADF (C) selection	All except PLN	Located lower left or right corner. Represents positions of the EFIS control panel VOR/ADF switches.
	VOR 1 (G) or ADF 1 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.
	VOR 2 (G) or ADF 2 (C) pointer head and tail	All except PLN	Indicates bearing to (head) or from (tail) the tuned station, if selected on the respective EFIS control panel.

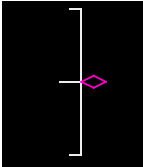
## Map

SYMBOL	NAME	MODE	REMARKS
	Airplane symbol (W)	VOR CTR, APP CTR	Current airplane position is at the center of the symbol.
	Airplane symbol (W)	PLN	Indicates actual position and track along the flight plan route. Inhibited north of 82N latitude and south of 82S latitude.
	Airplane symbol (W)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle.

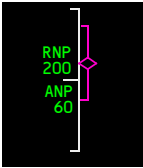
**[Option]**

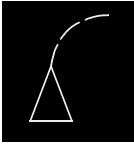





	Airplane symbol (W), Lateral ANP/RNP values (G)	MAP, MAP CTR, VOR, APP	Current airplane position is at the apex of the triangle. Displays lateral path deviation distance in MAP and MAP CTR mode only. Whenever ANP exceeds RNP, the ANP/RNP labels and values are displayed in amber.
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**[Option]**

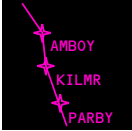


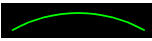
	VNAV path pointer (M) and deviation scale (W)	MAP, MAP CTR	Displays vertical deviation from selected VNAV PATH during descent only. Scale indicates ± 400 feet deviation. Digital display is provided when the pointer deviates more than ± 30 feet from center.
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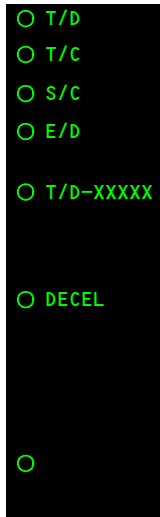
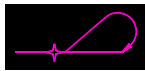


**[Option]**

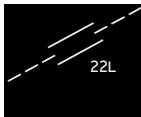

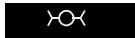

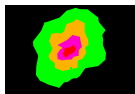

	Path deviation band (M), Vertical ANP/RNP values (G)	MAP, MAP CTR	Path deviation band is symmetric about the pointer and represents vertical RNP. Whenever ANP exceeds RNP, the ANP/RNP labels and values are displayed in amber.
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SYMBOL	NAME	MODE	REMARKS
	Position trend vector (W) (dashed line)	MAP, MAP CTR	Predicts position at the end of 30, 60, and 90 second intervals. Each segment represents 30 seconds. Based on bank angle and ground speed. Selected range determines the number of segments displayed. For range: <ul style="list-style-type: none"> <li>• &gt; 20 NM, 3 segments</li> <li>• = 20 NM, 2 segments</li> <li>• &lt;= 10 NM, 1 segment.</li> </ul>
	Active waypoint identifier (M)	MAP, MAP CTR, PLN	Indicates the active flight plan waypoint, the next waypoint on the route of flight.
	Active waypoint distance (W)	MAP, MAP CTR, PLN	Distance to the active waypoint.
	Active waypoint ETA (W)	MAP, MAP CTR, PLN	Indicates FMS-calculated ETA at the active waypoint.
	Waypoint: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	Active– represents the waypoint the airplane is currently navigating to. Modified – represents the waypoints on the active route that are being modified. Inactive – represents the waypoints on the active route.
	Off route waypoint (C)	MAP, MAP CTR, PLN	When the EFIS control panel WPT map switch is selected on, waypoints not on the selected route are displayed, for ranges of 5, 10, 20, or 40 NM.




SYMBOL	NAME	MODE	REMARKS
	<p>Flight plan route: active (M), modified (W), inactive (C), offset (M)</p>	<p>MAP, MAP CTR, PLN</p>	<p>The active route is displayed with a continuous line (M) between waypoints.</p> <p>Active route modifications are displayed with short dashes (W) between waypoints.</p> <p>Inactive routes are displayed with long dashes between waypoints.</p> <p>An offset route, selected through the FMC, is displayed with a dot-dash line (M) parallel to the active route.</p>
	<p>Route data: active (M), inactive (W)</p>	<p>MAP, MAP CTR, PLN</p>	<p>When the EFIS control panel DATA switch is selected on, entered or procedural altitude and ETAs for route waypoints are displayed.</p>
	<p>Holding pattern: active (M), modified (W), inactive (C)</p>	<p>MAP, MAP CTR, PLN</p>	<p>A holding pattern appears when in the flight plan.</p> <p>The holding pattern appears as a fixed size if the selected range is greater than 80 NM.</p> <p>A scaled representation of the holding pattern is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the holding fix.</p>
	<p>Altitude range arc (G)</p>	<p>MAP, MAP CTR</p>	<p>Based on vertical speed and groundspeed, indicates the approximate map position where the MCP altitude will be reached.</p>

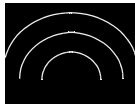
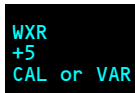
SYMBOL	NAME	MODE	REMARKS
	Altitude profile point and identifier (G)	MAP, MAP CTR, PLN	<p>Indicates the approximate map position of the FMC-calculated T/C (top-of-climb), T/D (top-of-descent), S/C (step climb), and E/D (end of descent) points.</p> <p>Indicates intermediate T/D points for level flight path segments during descent. Level flight path segment altitude is displayed.</p> <p>Indicates the beginning of a deceleration segment resulting from deceleration to a holding pattern, a waypoint speed restriction or flaps up maneuvering speed.</p> <p>Indicates airport speed restriction deceleration point (no identifier).</p>
	Procedure turn: active (M), modified (W), inactive (C)	MAP, MAP CTR, PLN	<p>A procedure turn appears when in the flight plan.</p> <p>The procedure turn appears as a fixed size if the selected range is greater than 80 NM.</p> <p>A scaled representation of the procedure turn is displayed when the selected range is 80 NM or less and the airplane is within 3 minutes of the procedure turn.</p>
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 80, 160, 320, or 640 NM.
	Airport (C)	MAP, MAP CTR, PLN	<p>Displayed if the EFIS control panel ARPT map switch is selected on.</p> <p>Origin and destination airports are always displayed, regardless of map switch selection.</p>

SYMBOL	NAME	MODE	REMARKS
	Airport and runway (W)	MAP, MAP CTR, PLN	Displayed when selected as the origin or destination and selected range is 5, 10, 20, or 40 NM. Dashed runway centerlines extend 14.2 NM.
	Selected reference point and bearing distance information (G)	MAP, MAP CTR, PLN	Displays the reference point selected on the CDU FIX page. Bearing and/or distance from the fix are displayed with dashes (G).
	GPS position (W)	MAP, MAP CTR	When the EFIS POS map switch is selected on, indicates GPS position relative to FMC position.
	ADIRU position (W)	MAP, MAP CTR	When the EFIS control panel POS map switch is selected on, the star indicates ADIRU position relative to FMC position.
	Weather radar returns (R, A, G, M)	MAP, MAP CTR, VOR, APP	The most intense areas are displayed in red, lesser intensity in amber, and lowest intensity green. Turbulence is displayed in magenta.
	Selected map options (C)	MAP, MAP CTR, PLN	Displays EFIS control panel selected map options.

**[Aircraft with FMC Qty 2]**


	MAP source annunciation (G)	MAP, MAP CTR, PLN	Displays source of FMC data used by CDS for data presentation.
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**[Aircraft with Range Arcs]**

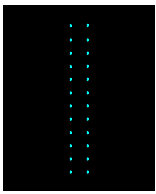
	Range arcs (W)	MAP, VOR, APP	Displayed in APP and VOR modes when the WXR map, TERR map or TCAS TFC switches are selected.
	Weather radar annunciations: Mode (C), Tilt (C), Gain (C)	MAP, MAP CTR, VOR, APP	Annunciations vary with option selected

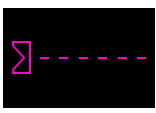
## Vertical Situation Display (VSD)


### [Aircraft with VSD]

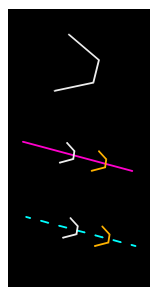
SYMBOL	NAME	REMARKS
	Airplane symbol (W)	Current airplane altitude is the bottom of the triangle. Current airplane lateral position relative to terrain is the point of the triangle.

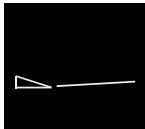
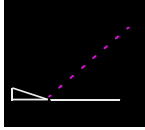
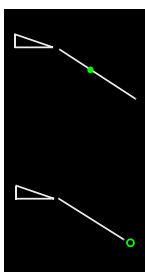
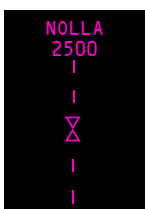
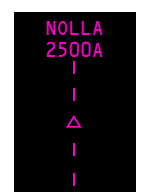
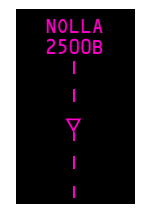
### [Option]


	Enroute swath (C) (dashed line)	Indicates area of the map that is shown on the VSD. Display is inhibited both on takeoff and approach when the airplane is within 6 NM of the runway and less than 3000 feet above field elevation. During turns, the swath edge leading the turn opens in the direction of the turn.
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	Selected altitude bug and line (M)	Bug 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, with only one half the bug visible.  Dashed line extends from bug to background display boundary. Line does not park.
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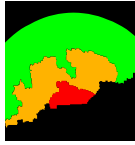







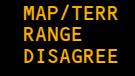
	BARO minimums pointer and line (G)	Pointer indicates the barometric minimums selected on the EFIS control panel.  Dashed line extends from pointer to background display boundary.  Pointer and line turn amber when airplane descends below selected minimum altitude. Reset with the RST switch on the EFIS control panel.
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	Decision gates (W, A)	Indicates suggested points where airplane should be path and speed stable on approach. Gates are placed on the 3 Degree Reference Line or FMC Approach Glidepath Angle Line: <ul style="list-style-type: none"> <li>at 1000 feet above field elevation(W).</li> <li>at 500 feet above field elevation(A).</li> </ul> Decision gates that are below the missed approach waypoint altitude will not be displayed.
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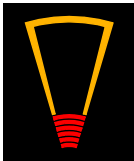


SYMBOL	NAME	REMARKS
	Flight path vector (W)	Fixed length line indicates current flight path angle and rotates about the point of the triangle.  Angle of the line is dependent on the vertical speed and ground speed of the airplane.
	MCP selected vertical speed vector (M)	Dashed line indicates the selected vertical speed as a target angle when the MCP V/S mode is selected.  Extends to the edge of the background display and rotates about the point of the triangle.
	Range to target speed dot (G)	Indicates where the airplane will achieve the FMC or MCP target speed. If the airplane is within 5 knots of the target speed the dot will be blanked. If the airplane increases 10 knots or more faster than the target speed the dot will reappear.  Displayed at the end of the Flight Path Vector as an unfilled dot if the target speed will not be achieved within the vector length.
	Waypoint altitude constraint: active (M), inactive (W)	At Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Above Altitude example.
	Waypoint altitude constraint: active (M), inactive (W)	At or Below Altitude example.

SYMBOL	NAME	REMARKS
	Waypoint altitude constraint: active (M), inactive (W)	Block Altitude example.

### Look-Ahead Terrain





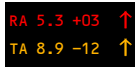



SYMBOL	NAME	MODE	REMARKS
	Terrain display (R, A, G, M)	MAP, MAP CTR, VOR, APP	Displays terrain data from the GPWS terrain data base. Color and density vary based on terrain height vs. airplane altitude.
	Terrain mode annunciation (C)	MAP, MAP CTR, VOR, APP	Terrain display enabled (manual or automatic display).
	Terrain test mode annunciation (C)	All	GPWS operating in self-test mode.
	Terrain annunciation (R, A)	All	Look-ahead terrain caution alert active (A), look-ahead terrain warning alert active (R).
	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display have failed.
	Terrain status annunciations (A)	All	Look-ahead terrain alerting and display unavailable due to position uncertainty.
	Terrain status annunciations (A)	All	GPWS terrain inhibit switch in TERR INHIBIT position.
	Terrain range status annunciations (A)	MAP, MAP CTR, VOR, APP	Terrain output range disagrees with selected EFIS control panel range.
	Terrain range status annunciations (A)	MAP, MAP CTR	Terrain output range and map display output range disagree with selected EFIS control panel range.

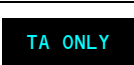
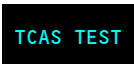


## Predictive Windshear

SYMBOL	NAME	MODE	REMARKS
	Predictive windshear symbol (R, B, A)	MAP, MAP CTR, VOR, APP	Displays windshear location and approximate geometric size (width and depth). Amber radials extend from predictive windshear symbol to help identify location of windshear event.
	Windshear annunciation (R, A)	All	Predictive windshear caution active (A). Predictive windshear warning active (R).
	Predictive windshear status annunciation (A)	All	Predictive windshear alerting and display have failed.

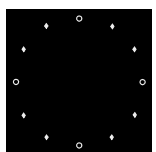


**TCAS**

SYMBOL	NAME	MODE	REMARKS
	TCAS resolution advisory (RA), relative altitude (R)	MAP, MAP CTR, VOR, APP	<p>These symbols are displayed only when the EFIS control panel traffic (TFC) switch is selected on.</p> <p>The arrow indicates traffic climbing or descending at a rate <math>\geq 500</math> fpm. At rates <math>&lt; 500</math> fpm, the arrow is not displayed.</p> <p>The number and associated signs indicate altitude of traffic in hundreds of feet relative to the airplane.</p> <p>The number is below the traffic symbol when the traffic is below, and above the traffic symbol when the traffic is above the airplane. Absence of the number implies altitude unknown.</p>
	TCAS traffic advisory (TA), relative altitude (A)		
	TCAS proximate traffic, relative altitude (W)		
	TCAS other traffic, relative altitude (W)		
	TCAS no bearing message (RA-R, TA-A)	MAP, MAP CTR, VOR, APP	Message provides traffic type, range in NM, altitude and vertical direction. TFC must be selected on.
	TCAS traffic alert message (RA-R, TA-A)	All	Displayed whenever a TCAS RA or TA is active. EFIS control panel TFC switch does not have to be selected on.
	TCAS off scale message (RA-R, TA-A)	MAP, MAP CTR, VOR, APP	Displayed whenever RA or TA traffic is outside the traffic area covered by the ND range. Displayed only if the EFIS control panel TFC switch is selected on.
	TCAS mode (C)	MAP, MAP CTR, VOR, APP	Indicates the ND TCAS display is active; the EFIS control panel TFC switch is selected on.

SYMBOL	NAME	MODE	REMARKS
	TCAS mode (C)	All	Indicates TCAS computer is not computing RAs. Displayed whether the EFIS control panel TFC switch is selected on or off.
	TCAS mode (C)	All	Indicates TCAS is operating in the test mode. Displayed whether EFIS control panel TFC switch is selected on or off.
	TCAS mode (A)	All	Displayed when the TCAS/ATC mode switch is not in TA ONLY or TA/RA. Not displayed if TCAS is failed.
	TCAS mode (A)	All	Indicates TCAS failure, if traffic is selected.

**[3NM TCAS range ring]**

	Range Ring (W)	MAP, MAP CTR, VOR, APP	Displayed when TFC selected on EFIS Control Panel. Shows 3 NM range ring oriented to aircraft heading. Displayed at ranges of 80 NM or less.
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## Introduction HUD Symbology

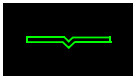

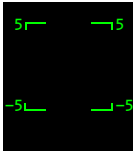
HUD symbology consists of green symbols projected on the combiner from the OHU. The PRI mode display symbols are similar to those on the CDS, and can be used for all phases of flight. The approach mode displays (AIII, IMC, VMC) are optimized to enhance aircraft control and situational awareness during final approach, flare, and touchdown.

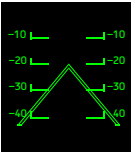





In addition to flight symbology, TCAS resolution advisories and HUD system failure flags and data source annunciations are displayed when active.



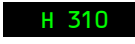
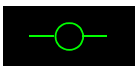

## Head-Up Guidance Display Symbology

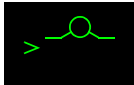
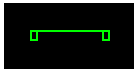

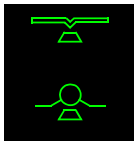
### [Model 4000]

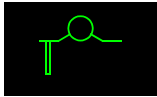
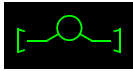
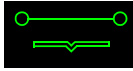

The following symbols can be displayed on the combiner, depending on HUD and EFIS control panel switch selections.




SYMBOL	NAME	MODE	REMARKS
	Airplane reference	All	Top center point of the symbol represents airplane projected centerline. The symbol is positioned at a fixed position 7 ° above the display's vertical center. Symbol is fixed at display center when the unusual attitude display is active.
	Horizon Line	All	Indicates the horizon relative to the airplane reference symbol. Position based on current airplane pitch and roll attitude.
	Pitch Scale	PRI in flight, AIII approach, IMC, VMC	Displays airplane pitch in five degree increments between -20 ° and +25 °.

SYMBOL	NAME	MODE	REMARKS
	Compressed pitch scale	PRI in flight, AIII approach, IMC, VMC	<p>Displays airplane pitch in ten degree increments between <math>\pm 30^\circ</math> and <math>\pm 90^\circ</math>.</p> <p>A chevron appears on the pitch scale at <math>-20^\circ</math> and <math>+30^\circ</math>.</p>
	Bank Scale and Pointer	All	<p>Displays the corresponding roll attitude in ten degree increments between <math>0^\circ</math> and <math>\pm 30^\circ</math>. Tic marks at <math>\pm 45^\circ</math> and <math>\pm 60^\circ</math> are added when the airplane exceeds <math>\pm 35^\circ</math> and <math>\pm 50^\circ</math> respectively.</p>
	Horizon heading scale	All	<p>Magnetic heading is displayed in five degree increments (and labeled every <math>10^\circ</math>) on the horizon line.</p> <p>A downward pointing triangle indicates current airplane magnetic heading.</p>
	HSI heading scale	PRI in flight	<p>Displays airplane magnetic heading in a <math>210^\circ</math> compass rose format.</p>
	Heading pointer	PRI in flight	Indicates current heading.
	Drift angle pointer	PRI in flight	Indicates current drift angle or track.

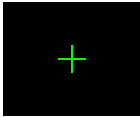
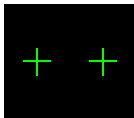
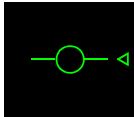
SYMBOL	NAME	MODE	REMARKS
	Selected heading bug	All	<p>Displays selected heading on the horizon line and on the HSI (when in view).</p> <p>Not displayed if the selected heading is outside of the currently displayed heading scale.</p>
	Digital selected heading	All	<p>Displayed full time in PRI mode and for five seconds after selection in the IMC, VMC or AIII modes.</p>
	Digital heading	All	<p>Displays current magnetic heading directly below the roll scale pointer.</p>
	Ground roll reference	PRI ground	<p>Provides a reference for ground roll guidance during low visibility takeoff operations.</p> <p>Displayed on the horizon line until 3° of attitude is achieved.</p>
	Flight path symbol	PRI in flight, AIII approach, IMC, VMC	<p>Displays the actual flight path vector of the aircraft.</p> <p>Has display priority over all other symbols except the guidance cue and the FLARE command.</p>

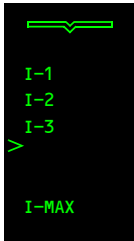
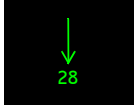
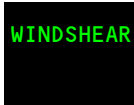
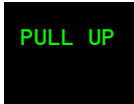
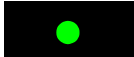
SYMBOL	NAME	MODE	REMARKS
	Flight path acceleration	All	<p>Positioned left of the flight path vector; indicates sum of all forces affecting the airplane including thrust, drag, and wind.</p> <p>Positioned above flight path vector; airplane is accelerating. Positioned below flight path vector; airplane is decelerating.</p> <p>Removed from display when a decreasing performance low-level windshear is detected below 400 feet AGL.</p>
	Pitch limit indication (also called angle of attack limit)	PRI in flight, AIII approach, IMC, VMC	Displayed whenever the airplane's angle of attack is within 5° of stick shaker, any time stick shaker is active, or whenever WINDSHEAR guidance cue is displayed.
	Slip/skid indicator	All	The bottom portion of the bank scale pointer moves laterally with respect to the top triangle portion of the pointer.
	Additional slip/skid indicators	PRI in flight, AIII approach, IMC, VMC	<p>Positioned below the airplane reference and flight path symbols.</p> <p>Displayed during takeoff or low altitude go-around.</p>

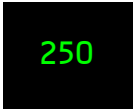




SYMBOL	NAME	MODE	REMARKS
	Speed error tape	PRI in flight, AIII approach, IMC, VMC	Displays the difference between indicated airspeed and the reference speed selected on the mode control panel.  Tape length equal to the diameter of the flight path circle represents approximately 5 knots of error. Maximum tape length is limited to 15 knots of error.
	Bank warning	PRI in flight, AIII approach, IMC, VMC	Displayed if radio altitude is less than 100 feet and airplane roll angle exceeds 5°. Symbol remains until roll angle is less than 3° or radio altitude greater than 100 feet.
	Tail strike pitch limit	PRI ground	Tail strike occurs if this symbol meets the aircraft reference symbol.  Displayed if the airplane pitch angle approaches the tail strike angle or the pitch rate is too excessive during takeoff rotation, below 10 feet AGL.
	Unusual attitude	PRI in flight, AIII approach, IMC, VMC	Automatically displayed when pitch exceeds -20°/+35° or roll exceeds 55°.






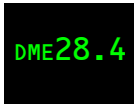
SYMBOL	NAME	MODE	REMARKS
	Flight director guidance cue	PRI in flight, IMC	<p>Functions similar to the flight director, but is designed for control of flight path.</p> <p>Automatically displayed when within 2° of pitch command or radio altimeter indicates 50 feet.</p> <p>The objective is to capture the guidance cue inside the flight path vector circle.</p>
	HUD guidance cue	PRI ground, AIII approach	<p>Similar to flight director guidance cue, but driven by HUD computer.</p> <p>During low visibility takeoff, the cue provides localizer tracking.</p> <p>During AIII approach, the cue provides approach and flare commands.</p> <p>The objective is to capture the guidance cue inside the flight path vector or ground roll reference circle.</p>
	TO/GA pitch target line	PRI in flight	<p>Displayed when greater than 65 knots, AFDS TO/GA mode active and a valid pitch command input of greater than 10 ° is received. Symbol remains until TO/GA mode is exited.</p> <p>The objective is to place the airplane reference symbol on the target line.</p>


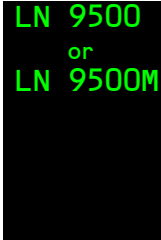

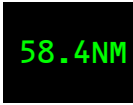





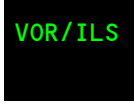
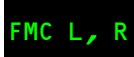
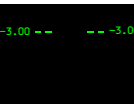

SYMBOL	NAME	MODE	REMARKS
	AIII flare command	AIII approach	<p>Initially displayed 2-3 ° directly below the guidance cue at 105 feet above runway elevation.</p> <p>The symbol flashes for one second and rises toward the guidance cue at a rate proportional to the expected flare pitch rate.</p> <p>At an altitude between 45 and 55 feet, the flare command and guidance cue meet and continue rising to command the flare maneuver until touchdown.</p>
	Flare cues	PRI in flight, IMC, VMC	<p>Displayed on each side of the flight path symbol, indicating the flare maneuver must be accomplished. The cues flash continuously as the airplane descends through 55 feet radio altitude, until 10 feet radio altitude is reached.</p>
	Rollout excessive deviation triangle	AIII rollout	<p>Points in the direction of runway centerline during excessive deviation from the localizer on rollout.</p>

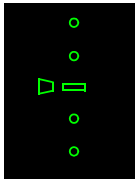
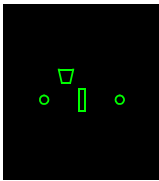
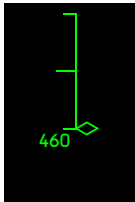
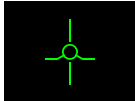
SYMBOL	NAME	MODE	REMARKS
	Ground deceleration scale	PRI ground, AIII rollout, IMC, VMC	Scale marks are labeled with autobrake settings.  Displayed during all landings.  Displayed during takeoff if deceleration is sensed when groundspeed above 50 knots. Removed when groundspeed below 25 knots, airplane is accelerating or after lift off.
	Wind speed and direction	PRI in flight, AIII approach, IMC, VMC	Indicates wind speed and direction, with respect to airplane magnetic heading. Displayed if wind magnitude is greater than 6 knots and blanked if wind magnitude becomes less than 4 knots.
	Windshear warning	PRI in flight, AIII approach, IMC, VMC	Displayed above the airplane reference symbol during a GPWS or PWS windshear warning.
	Ground proximity warning	PRI in flight, AIII approach, IMC, VMC	Displayed whenever the GPWS is activated.
	Windshear guidance cue	PRI in flight	During a windshear warning, and in TO/GA mode, the PRI mode is automatically selected and the guidance cue becomes a solid circle to provide guidance to exit windshear conditions.

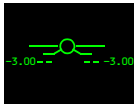

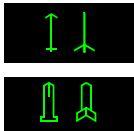
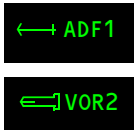


SYMBOL	NAME	MODE	REMARKS
	Radio altitude	PRI in flight, AIII approach, IMC, VMC	<p>Displayed below the flight path symbol, or relative to the airplane reference symbol if the flight path symbol is not displayed.</p> <p>The value is removed from the display at 1500 feet when ascending and again displayed at 1400 feet when descending.</p> <p>This value is displayed in ten foot increments between 50 and 1500 feet, five foot increments between 10 and 50 feet and one foot increments below 10 feet.</p>
	Decision height	PRI in flight, AIII approach, IMC	<p>Displayed left of radio altitude when selected decision height is reached.</p> <p>When decision height is reached, the message flashes for 3 seconds and then remains steady.</p>
	Marker beacon	PRI in flight, AIII approach, IMC	Displayed below the airplane reference symbol for marker beacon passage.
	Digital airspeed	AIII approach, AIII rollout, IMC, VMC	Displays airspeed next to the flight path symbol if it is displayed, and next to the airplane reference symbol if flight path is not displayed.
	Digital selected airspeed	All	Displays speed selected on the MCP.

SYMBOL	NAME	MODE	REMARKS
	Digital ground speed	All	Displays digital ground speed.
	Digital mach	PRI in flight	Displays mach speed below airspeed scale when mach speed is above .400. Removed when below .380.
	Selected mach	All	Displays selected mach speed above airspeed scale (PFD/ND format only).
	Digital barometric altitude	AIII approach, AIII rollout, IMC, VMC	Displays barometric altitude relative to the flight path symbol if it is displayed, and relative to the airplane reference symbol if flight path is not displayed.
	Digital vertical speed	PRI in flight, AIII approach, IMC, VMC	In PRI mode, displayed in the lower right corner of the display. In all other modes, displayed to the right of the flight path symbol.  Value displayed in 50 feet/minute increments.
	DME distance	PRI in flight, AIII approach, IMC, VMC	Indicates DME distance to the reference navaid.




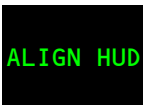

SYMBOL	NAME	MODE	REMARKS
	Digital runway elevation	AIII approach	Displays runway elevation entered on the HUD control panel for 5 seconds: <ul style="list-style-type: none"> <li>• after AIII mode selected, or</li> <li>• runway elevation value changed during an AIII mode approach.</li> </ul>
	Digital runway length in feet. Digital runway length in meters.	AIII approach, AIII rollout	Displays runway length entered on the HUD control panel for 5 seconds: <ul style="list-style-type: none"> <li>• after AIII mode selected, or</li> <li>• runway length value changed during an AIII mode approach.</li> </ul> When AIII mode active and above 500 feet AGL, display flashes when runway length entered is outside of rollout guidance capability.
	Digital runway remaining in feet Digital runway remaining in meters	PRI ground, AIII rollout	Displays the length of runway remaining between airplane and end of runway based on runway length entered on the HUD control panel.
	Distance to go	PRI in flight, IMC	Distance to next waypoint.





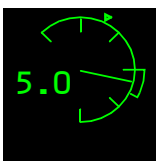
SYMBOL	NAME	MODE	REMARKS
	Selected course (digital)	All	Displayed full time in PRI mode and for five seconds after selection in the IMC, VMC or AIII modes.
	Selected course pointer	All	Displays MCP selected course below the horizon line and on the HSI (PRI mode only).  The horizon line pointer is surrounded by a 3 ° gap in the horizon line.
	System source annunciation	PRI in flight, PRI ground, AIII approach, AIII rollout IMC	Indicates the selected receiver as the display source.
			Indicates source cannot be determined.
	FMC source annunciation	All	Indicates the selected FMC as the system source.
	Glideslope reference line	AIII approach, IMC, VMC	Displays the glideslope value entered on the HUD control panel.  Positioning the flight path symbol over the glideslope reference line results in a descent angle equal to the value entered.
	ILS localizer or VOR deviation indication and scale	PRI in flight	Displays LOC or VOR course deviation on the HSI.  With excessive localizer deviation during an ILS approach, the symbol will flash until the excessive deviation is no longer present.

SYMBOL	NAME	MODE	REMARKS
	Glideslope pointer and deviation scale	PRI in flight	Displays glideslope position and deviation during ILS approach.  With excessive glideslope deviation, the pointer will flash until the excessive deviation is no longer present.
	Ground localizer pointer and deviation scale	PRI ground, AIII rollout	Displays airplane lateral deviation relative to the runway centerline.
	Vertical deviation pointer and scale	PRI in flight, IMC	Full scale represents 400 feet of vertical deviation.  When the deviation is off scale, the pointer is parked at the top or bottom of the tape, and the digital value is displayed at the appropriate end of the scale.
	Lateral deviation line	AIII approach, IMC	Displayed as vertical lines referenced to the selected course.  In IMC mode, the line will flash during excessive localizer deviation.

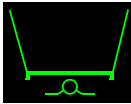
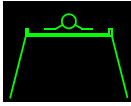
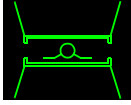
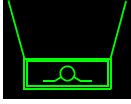
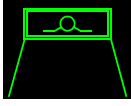
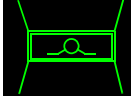
SYMBOL	NAME	MODE	REMARKS
	Glideslope deviation line	AIII approach, IMC	Displayed as horizontal lines referenced to the glideslope reference line.  In IMC mode, the line will flash during excessive glideslope deviation.  The line is removed below 70 feet radio altitude.
	Ground localizer line	PRI ground, AIII rollout, IMC	Displays localizer deviation as a vertical line below the airplane reference symbol and is referenced to the selected course.
	VOR1/ADF 1 pointer head and tail  VOR2/ADF 2 pointer head and tail	PRI in flight	Indicates bearing to (head) or from (tail) the tuned station.
	Bearing source annunciations	PRI in flight	Indicates pointer source.
	To/from pointer	PRI in flight, PRI ground	A triangle pointing in the same direction as the selected course indicates a "to" condition. Pointing away from the selected course indicates a "from" condition.
	TO/FROM annunciation	AIII approach, IMC	Displayed below the VOR system source annunciation. Indicates movement to or from a VOR station.







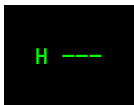
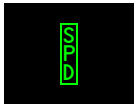
SYMBOL	NAME	MODE	REMARKS
	Runway elevation	AIII approach	Indicates entered runway elevation for 5 seconds after AIII mode is selected or if elevation value is changed during AIII mode operation.
	Runway edge lines	AIII approach	Displayed between 300 and 60 feet radio altitude. The lines are scaled to a width of 200 feet and a length of 8000 feet.  Tic marks are displayed at the touchdown aimpoint representing 1050 feet from the runway threshold.
	IDLE message	AIII approach	Displayed below the radio altitude when flare guidance commands a thrust reduction to idle for touchdown.  Message is displayed between 25 to 5 feet radio altitude, depending on airspeed.
	ALIGN HUD message	IMC, VMC	Indicates the combiner is not properly aligned with the OHU.
	HUD system mode	AIII approach, AIII rollout, IMC, VMC	Indicates current HUD system mode.  The PRI mode is not indicated as it is uniquely identifiable by the airspeed and altitude tapes.


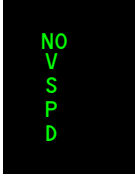





SYMBOL	NAME	MODE	REMARKS
	AIII approach status	PRI in flight	A flashing “AIII” indicates availability of AIII approach mode.
		AIII approach	Indicates AIII mode selection once all AIII approach requirements have been satisfied.  If AIII capability is lost, the “NO AIII” status message is displayed.
	Approach warning	AIII approach	Displayed below 500 feet if approach monitoring tolerances are exceeded or AIII capability is lost.
	Tail strike warning	PRI in flight, AIII approach, IMC, VMC	Displayed when a tail strike is likely during landing. Tail strike monitoring is active below 100 feet AGL.
	Angle of attack scale and indicator	PRI in flight, AIII approach, IMC, VMC	Displays current angle of attack, stick shaker trip point and approach reference band. Tic marks every 5°. Approach reference band is added after the first flap retraction.




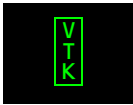





### TCAS Resolution Advisory

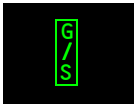






SYMBOL	NAME	MODE	REMARKS
	Down preventive	PRI in flight, AIII approach, IMC, VMC	Area(s) inside the lines indicate the pitch region(s) to avoid in order to resolve the traffic conflict. The flight path symbol should be positioned outside the pitch command area(s) to ensure traffic avoidance. A double-lined box indicates a corrective action is required, and represents TCAS maneuver guidance to maintain or increase separation from the traffic.
	Up preventive		
	Up and down preventive		
	Descend corrective		
	Climb corrective		
	Combined corrective		

## Failure Flags and Data Source Annunciations

SYMBOL	NAME	MODE	REMARKS
	IRS attitude flag	All	IRS pitch or roll attitude has failed.
	Pitch miscompare flag	All	Indicates a pitch miscompare of greater than 5 ° for more than 1.5 seconds.
	Roll miscompare flag	All	Indicates a roll miscompare of greater than 5 ° for more than 1.5 seconds.
	Heading flag	All	Heading data has failed.
	No heading	All	IRU heading has no computed data.
	Airspeed flag	All	Airspeed information has failed. In PRI mode, if airspeed has no computed data, airspeed data is removed and no failure flag is displayed.  The boxed characters are positioned vertically in the PRI mode or horizontally in the AIII, IMC or VMC modes.

SYMBOL	NAME	MODE	REMARKS
	Altitude flag	All	Altitude information has failed. In PRI mode, if altitude has no computed data, altitude data is removed and no failure flag is displayed.  The boxed characters are positioned vertically in the PRI mode or horizontally in the AIII, IMC or VMC modes.
	Decision speed flag	PRI ground	V1 decision speed or VR rotation speed has not been entered or is invalid.
	Speed limit flag	PRI in flight, PRI ground	Maximum operating speed data has failed.
	Mach flag	PRI in flight, PRI ground	MACH airspeed has failed.
	Vertical speed flag	All	Vertical speed has failed. In AIII, IMC or VMC modes, may also show for no computed data.
	Vertical speed	PRI in flight	Vertical speed has no computed data.
	Selected altitude flag	PRI in flight, PRI ground	Selected altitude has failed.

SYMBOL	NAME	MODE	REMARKS
	Selected airspeed flag	All	Selected speed has failed.
	Radio altitude flag	All	Radio altitude has failed.
	Localizer miscompare flag	PRI in flight PRI ground; AIII rollout	Localizer miscompare has occurred during low visibility takeoff or rollout.
	Vertical deviation flag	PRI in flight, IMC	FMC vertical track data is invalid.  Vertical deviation pointer is removed if there is no computed data.
	DME flag	All	DME has failed.
	DME	All	DME has no computed data.
	Flight director flag	PRI in flight, PRI ground, IMC	Flight director has failed.
	TCAS fault	PRI in flight, AIII approach, IMC, VMC	TCAS has a fault.
	Right (#2) IRS source	All	All IRS information used or displayed by the HUD is taken from the right (#2) IRS.

<b>SYMBOL</b>	<b>NAME</b>	<b>MODE</b>	<b>REMARKS</b>
	Glideslope flag	PRI in flight, AIII approach, IMC	ILS has failed.
	Ground speed	All	Ground speed has no computed data.
	Lateral deviation fault	PRI in flight, PRI ground	ILS has failed.
	Distance to next waypoint	PRI in flight, AIII approach, IMC, VMC	Distance to next waypoint has no computed data.
	Decision height flag	PRI in flight, AIII approach, IMC	Decision height data has failed. Displayed below 1500 feet radio altitude.
	VOR failure flag	PRI in flight, AIII approach, IMC	VOR has failed.
	Angle of attack fault	PRI in flight, AIII approach, IMC, VMC	Loss of valid angle of attack data.