GENERAL

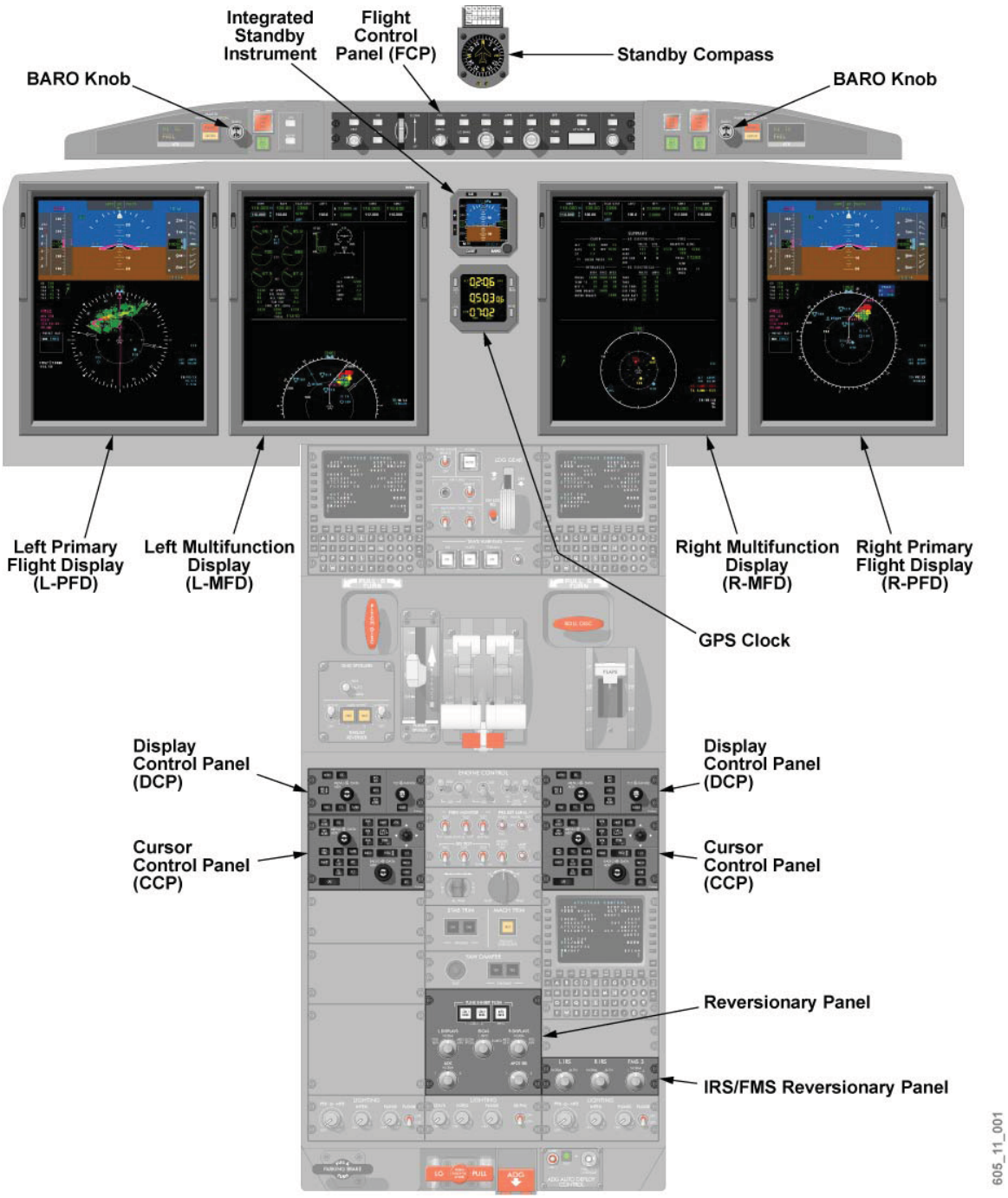
The flight instruments chapter includes the electronic flight instruments system (EFIS), pitot static & air data system, inertial reference system (IRS), standby flight instruments and clock/chronometer.

The Challenger 605 is equipped with an electronic flight instruments system (EFIS),which is comprised of the following:

- Two adaptive flight displays to act as primary flight displays (PFDs);
- Two adaptive flight displays to act as multi-function displays (MFDs);
- Two display control panels (DCPs);
- Two cursor control panels (CCPs);
- One reversion panel; and
- Two BARO knobs.

EFIS interfaces with the integrated avionics processing system (IAPS). The IAPS is the focal point of information flow for the entire aircraft. In addition to performing the integration functions required to connect the various aircraft systems, the IAPS contains the flight control computers (FCCs), flight management computers (FMCs), and maintenance diagnostic computer (MDC). Other systems provide information to the EFIS for display as conventional flight instruments. This includes the air data system and the inertial reference system (IRS).

GENERAL (CONT'D)



Integrated Flight Instruments
Figure 11–10–1

PRIMARY FLIGHT DISPLAY (PFD)

Description

The two primary flight displays (PFDs) provide the pilots with the information necessary for the safe operation of the aircraft. They are integrated displays of attitude, air data, and navigation information. The PFD is divided into the following main areas:

- Attitude ADI;
- Airspeed/Mach;
- AOA;
- Altitude;
- Vertical speed;
- Flight mode annunciator (FMA) for the AFCS;
- Lateral deviation indicator; and
- Navigation display.

PRIMARY FLIGHT DISPLAY (PFD) (CONT'D)

Primary Flight Display
Figure 11–10–2

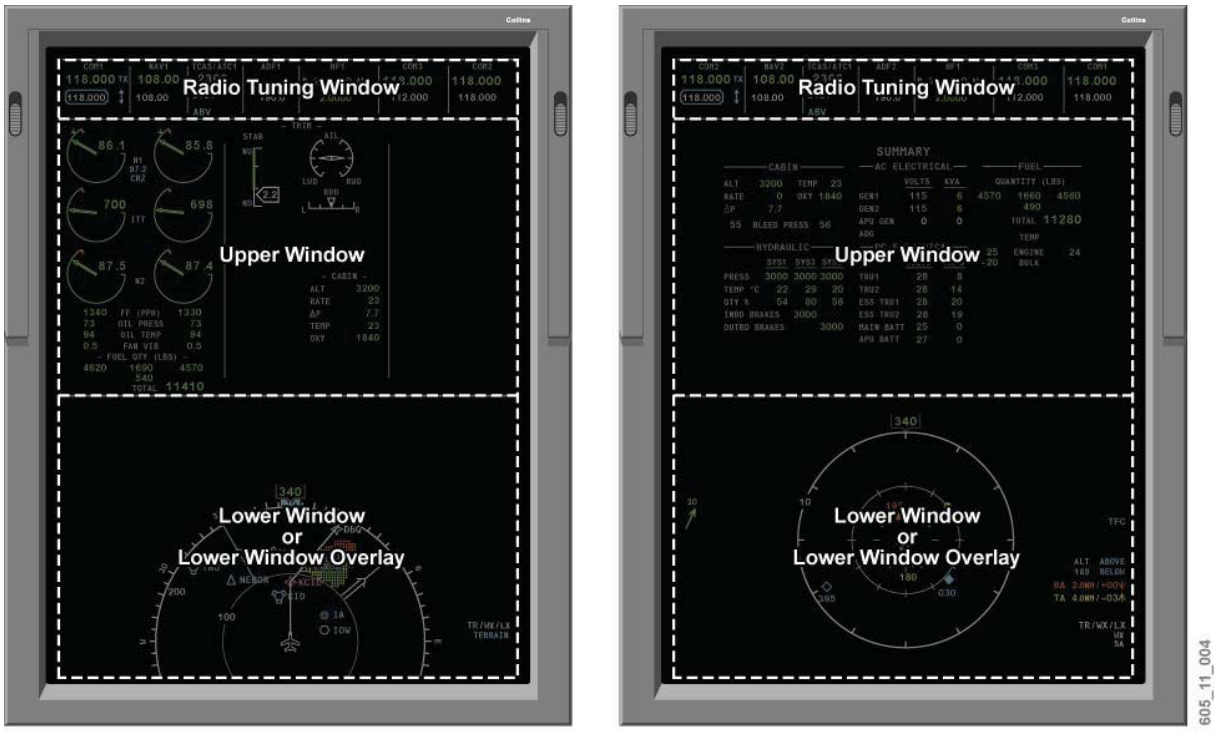
MULTIFUNCTION DISPLAY (MFD)

Description

The two multifunction displays (MFDs) can be operated in three basic configurations: split window, chart window and STAT window. The most common configuration for normal operation is the split window, which consists of four distinct windows:

- Radio tuning window;
- Upper window;
- Lower window; and
- Lower window overlay.

During normal operation, the upper window of the left MFD displays the EICAS page, including engine indications, full time system indications, and CAS messages. The upper window of the right MFD displays the SUMMARY page, or the electronic checklist. For maintenance actions, the upper window of the right MFD can also display maintenance diagnostic system information. The lower window of both the left and right MFDs can display synoptic pages or navigation information. Overlays such as TCAS traffic, terrain, weather and lightning can be presented on PPOS navigation format. The MFDs are controlled using the cursor control panel (CCP).



LEFT MULTIFUNCTION DISPLAY (L-MFD)

RIGHT MULTIFUNCTION DISPLAY (R-MFD)

L and R MFDs – Split Window Configuration
Figure 11–10–3

EFIS CONTROL PANELS

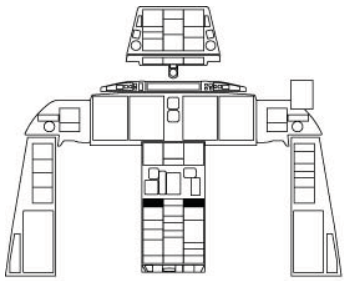
Description

Information related to speed, altitude, barometric setting, navaid source, navigation display formats and system reversion (adaptive flight display AFD, ADC, IRS) is inserted through controls on the following control panels:

- Display control panel (DCP);
- Cursor control panel (CCP);
- Flight control panel (FCP);
- BARO knob (glareshield); and
- Reversionary panel.

Display Control Panel (DCP)

The display control panels (DCPs), located on the center pedestal, are the primary pilot interface to select the information presented on the PFDs. The left DCP controls the selectable information displayed on the left PFD. The right DCP controls the selectable information displayed on the right PFD.



Display Control Panel (DCP)
Figure 11–10–4

Each DCP provides control for the following:

NAV SRC (Navigation Source) Pushbutton

This pushbutton interchanges the active and preset navigation sources.

MENU Pushbutton

This pushbutton selects the PFD MENU. The items on the PFD MENU are changed using the selection box method. The menu list automatically times out after 20 secs of inactivity.

ESC (Escape) Pushbutton

This pushbutton steps one level out of a selected menu.

EFIS CONTROL PANELS (CONT'D)

MENU ADV/DATA/PUSH SELECT Knob

This is a double stack knob that consists of the following:

- MENU ADV (outer knob) – Provides control to move the focus indicator* within the menu.
- DATA (inner knob) – Provides control to change the selection in the focus indicator*.
- PUSH SELECT (center knob) – Makes DATA knob entries active, or changes the status of the item in the selection box.

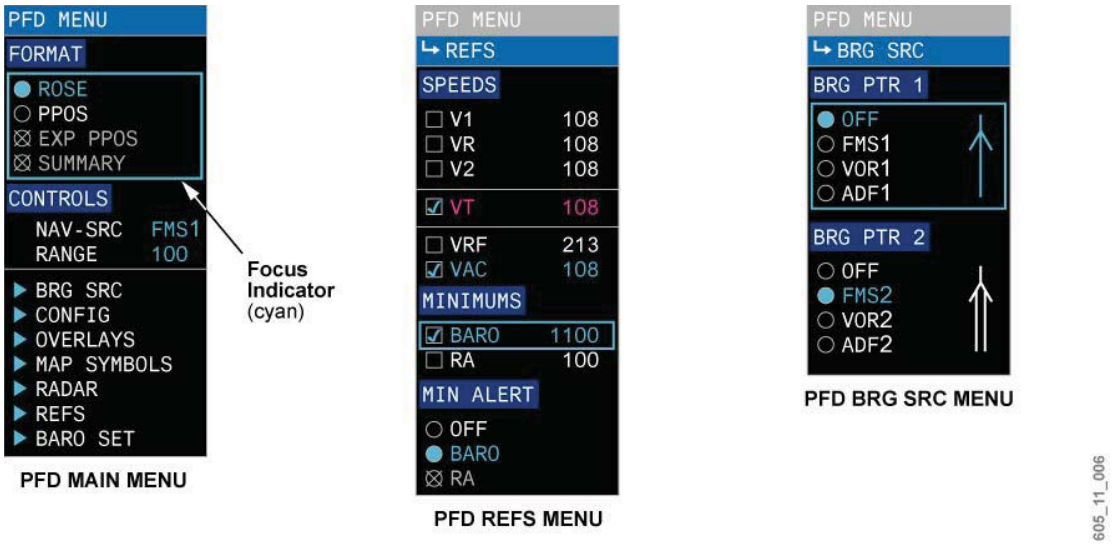
* The focus indicator is the symbol (cyan box) indicating which control is currently highlighted. The highlighted control can then be modified.

REFS (Reference) Pushbutton

The REFS pushbutton selects the REFS menu on the PFD. The REFS menu allows the pilot to set and/or activate V-speed references and approach minimums. The items on the REFS menu are changed using the selection box method. The menu list automatically times out after 20 seconds of inactivity.

BRG SRC (Bearing Source) Pushbutton

This pushbutton activates the bearing source menu, and the MENU ADV/DATA/PUSH SELECT knob is used to scroll and activate the appropriate selection.



PFD Menus
Figure 11–10–5

FRMT (FORMAT)

The FRMT button selects the next available PFD display format. With the displays not reverted, the format selections are ROSE and present position map (PPOS).

When displays are reverted with a compressed display format, the selections will be ROSE, PPOS and a system SUMMARY display.

EFIS CONTROL PANELS (CONT'D)

PFD Direct Access FORMAT Menu
Figure 11–10–6

TFC (Traffic) Pushbutton

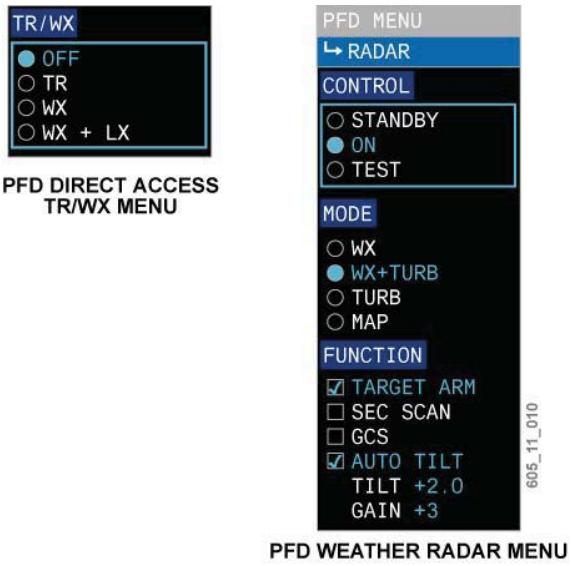
Pressing this pushbutton, when no TCAS Traffic Alert is active, selects or deselects a TCAS overlay on the PFD navigation format presented.

TR/WX (Terrain/Weather/Lightning) Pushbutton

TR/WX is a multiple press pushbutton, used to select or deselect the display of Terrain, Weather or Lightning on the PFD. The first press of the TR/WX pushbutton selects the next overlay available on the PFD. A subsequent press selects the next overlay available within the menu.

RDR MENU (Radar Menu) Pushbutton

The RDR MENU pushbutton selects or deselects the RADAR menu on the PFD. The RADAR menu provides control, mode and function selections of the weather radar system. The items on the RADAR menu change using the selection box method. The menu automatically times out after 20 secs of inactivity.



PFD Weather Radar Menus
Figure 11–10–7

RADAR (Radar Control) Pushbutton

This pushbutton turns the RADAR from STANDBY to ON, and from TEST or ON to STANDBY.

EFIS CONTROL PANELS (CONT'D)

RANGE/TILT/PUSH AUTO TILT Knob

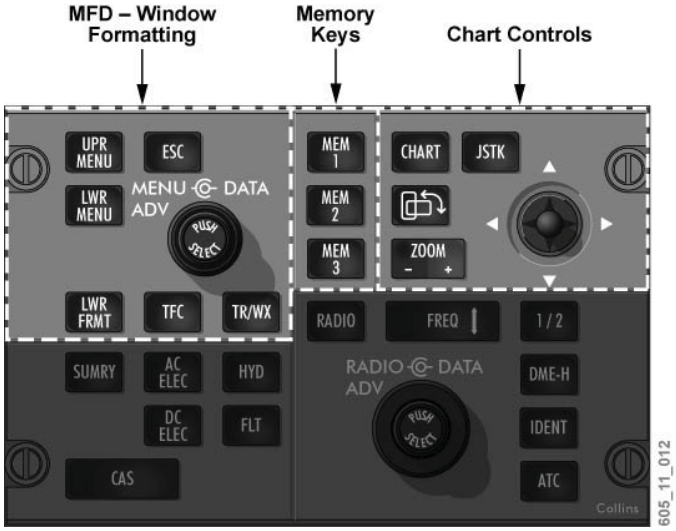
The RANGE knob decreases or increases the PFD and MFD NAV display range. The TILT knob selects the radar antenna tilt angle, –15 to +15 degrees. The PUSH AUTO TILT button, located in the center of the RANGE/TILT knob, selects or deselects automatic tilt control.

Cursor Control Panel (CCP)

The cursor control panels (CCPs), located on the center pedestal, permit the pilots to select the information for presentation on the MFDs. The left CCP controls the selectable information displayed on the left MFD. The right CCP controls the selectable information displayed on the right MFD.

The CCP is divided into 5 functional sections, of which the following 3 sections are applicable to Flight Instruments:

- MFD window formatting – Allows selection of navigation formats, display and control of on-screen menus, and enables overlays.
- Memory keys – Allow the crew to save specific display formats to memory for quick access.
- Chart controls – Display charts from the optional chart system.



Cursor Control Panel (CCP)
Figure 11–10–8

MFD Window Formatting

MENU ADV/DATA/PUSH SELECT Knob (Double Stack Knob)

Like on the DCP, the menu advance and data rotary knob is used to control the display menus.

After a menu has been selected, the MENU ADV (outer knob) provides rotary control to move the focus indicator within the menu, and the DATA (inner knob) provides rotary control to change the selection in the focus indicator.

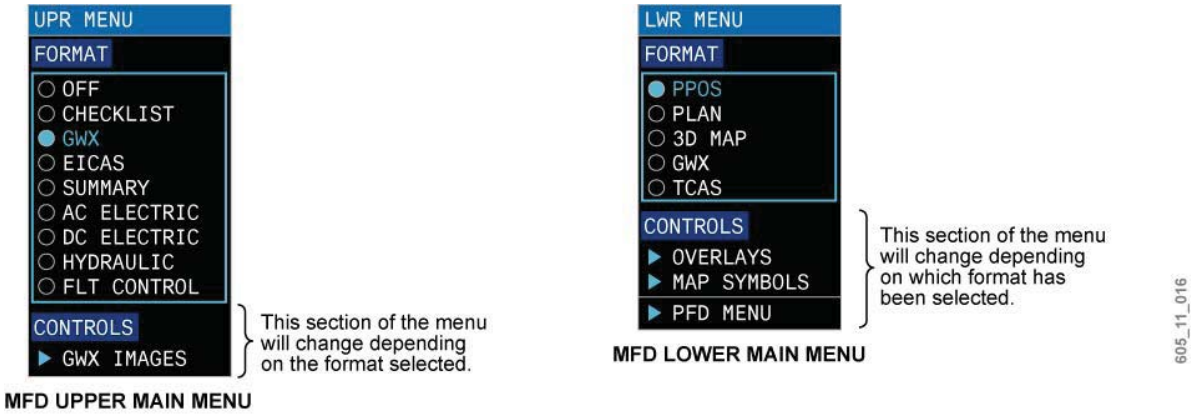
UPR MENU (Upper Menu) Pushbutton

The UPR MENU pushbutton selects the menu for the MFD upper window.

EFIS CONTROL PANELS (CONT'D)

LWR MENU (Lower Menu) Pushbutton

The LWR MENU pushbutton selects the menu for the MFD lower window.



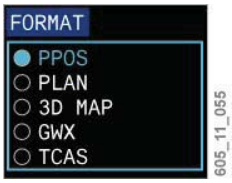
MFD Main Menus
Figure 11–10–9

ESC (Escape) Pushbutton

The ESC pushbutton provides the means to back out of a menu selection.

LWR FRMT (Lower Window Format) Pushbutton

This pushbutton removes any synoptic overlays from the lower window. Additional presses cycle through the available formats.



MFD Direct Access FORMAT Menu
Figure 11–10–10

TR/WX (Terrain/Weather/Lightning) Pushbutton

TR/WX is a multiple press pushbutton, used to select or deselect the display of Terrain, Weather and Lightning on the MFD. The first press of the TR/WX pushbutton selects the next overlay available on the MFD. A subsequent press selects the next overlay available.

MFD Direct Access TR/WX Menu
Figure 11–10–11

EFIS CONTROL PANELS (CONT'D)

TFC (Traffic) Pushbutton

The TFC pushbutton selects or deselects a traffic display overlay on the current MFD format. If traffic is selected for display, and the current format/range is not compatible, the MFD will automatically display TRAFFIC ONLY, and change the range to 10 NM.

Memory Keys

MEM 1, MEM 2, MEM 3 (Quick Access Keys) Pushbuttons

The quick access keys permit the pilot to store three configurations of upper and lower MFD windows. A momentary press of a quick access key selects the desired combination. Pressing and holding the key for more than 3 seconds causes the current upper and lower MFD window configuration and selections to be stored for future recall.

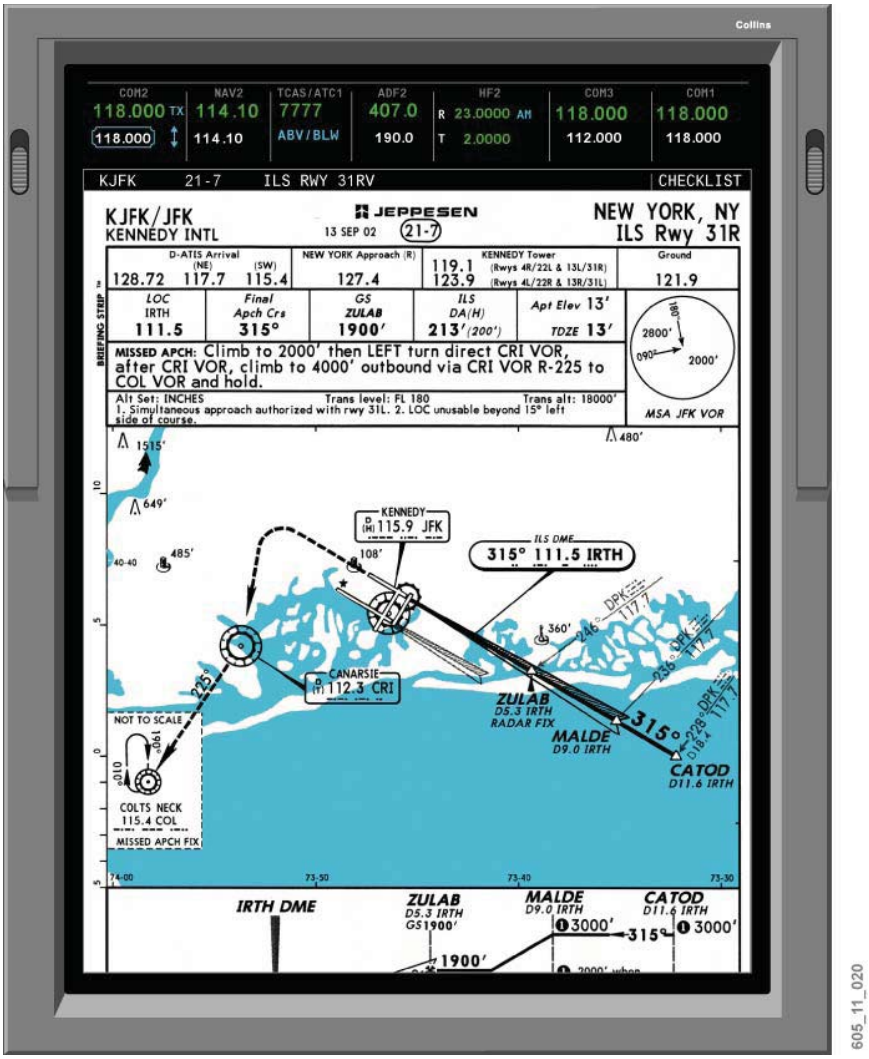
Chart Control

The chart control displays charts from the optional chart system. In general, pressing a switch for an optional function that is not enabled will display a SELECTION INACTIVE message on the MFD.

CHART Pushbutton

The CHART pushbutton selects and deselects the chart display on the MFD.

EFIS CONTROL PANELS (CONT'D)



MFD with a Chart (Full Window)
Figure 11–10–12

Orientate (Graphic Key Legend) Pushbutton

With a chart displayed, pressing the orientate button rotates the chart 90 degrees. A second press returns the chart to its previous position.

ZOOM +/–

With a chart displayed, pressing ZOOM + increases the size of the chart, and pressing ZOOM – returns the chart to its normal size.

JSTK Pushbutton

The joystick pushbutton selects joystick control between the upper and lower windows of the MFD.

EFIS CONTROL PANELS (CONT'D)

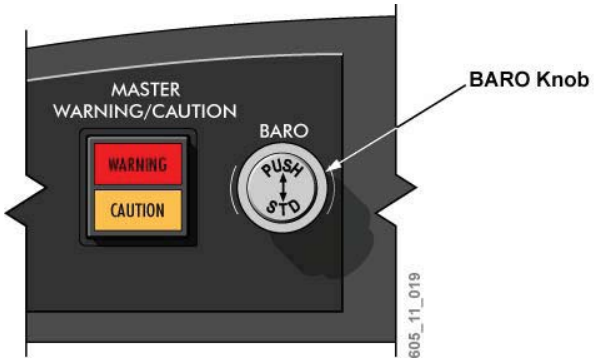
Flight Control Panel (FCP)

Flight director (FD) modes, autopilot engagement, selected heading, preselect altitude and course pointers are set through controls on the flight control panel (FCP).

Flight Control Panel (FCP)
Figure 11–10–13

BARO Knob (Glareshield)

The BARO knob is rotated to change the barometric pressure setting displayed on the PFD. Pressing the center of the BARO knob changes the altimeter setting to the standard barometric pressure of 29.92 inches of mercury, or 1013 hPa.



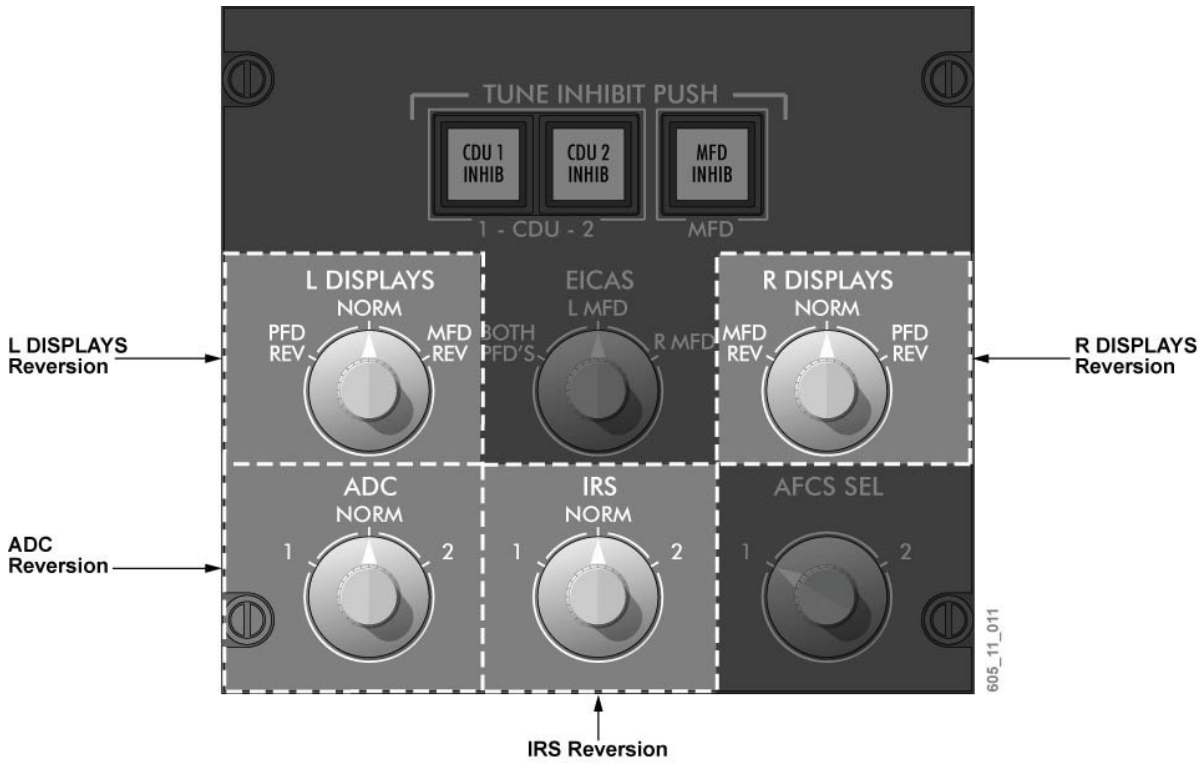
BARO Knob
Figure 11–10–14

Reversionary Panel

The reversionary panel, located on the center pedestal, controls the reversionary functions of the following system:

- TUNE INHIBIT (see Chapter 6, Communications, and Chapter 17, Navigation Systems);
- L (R) DISPLAYS reversion (discussed in this chapter);
- EICAS reversion (see Chapter 3, Aural/Visual Warnings);
- Air data reversion (discussed in this chapter);
- IRS reversion (discussed in this chapter); and
- AFCS SEL reversion (see Chapter 4, Automatic Flight Control Systems).

EFIS CONTROL PANELS (CONT'D)



Reversionary Panel
Figure 11–10–15

PITOT STATIC & AIR DATA SYSTEM

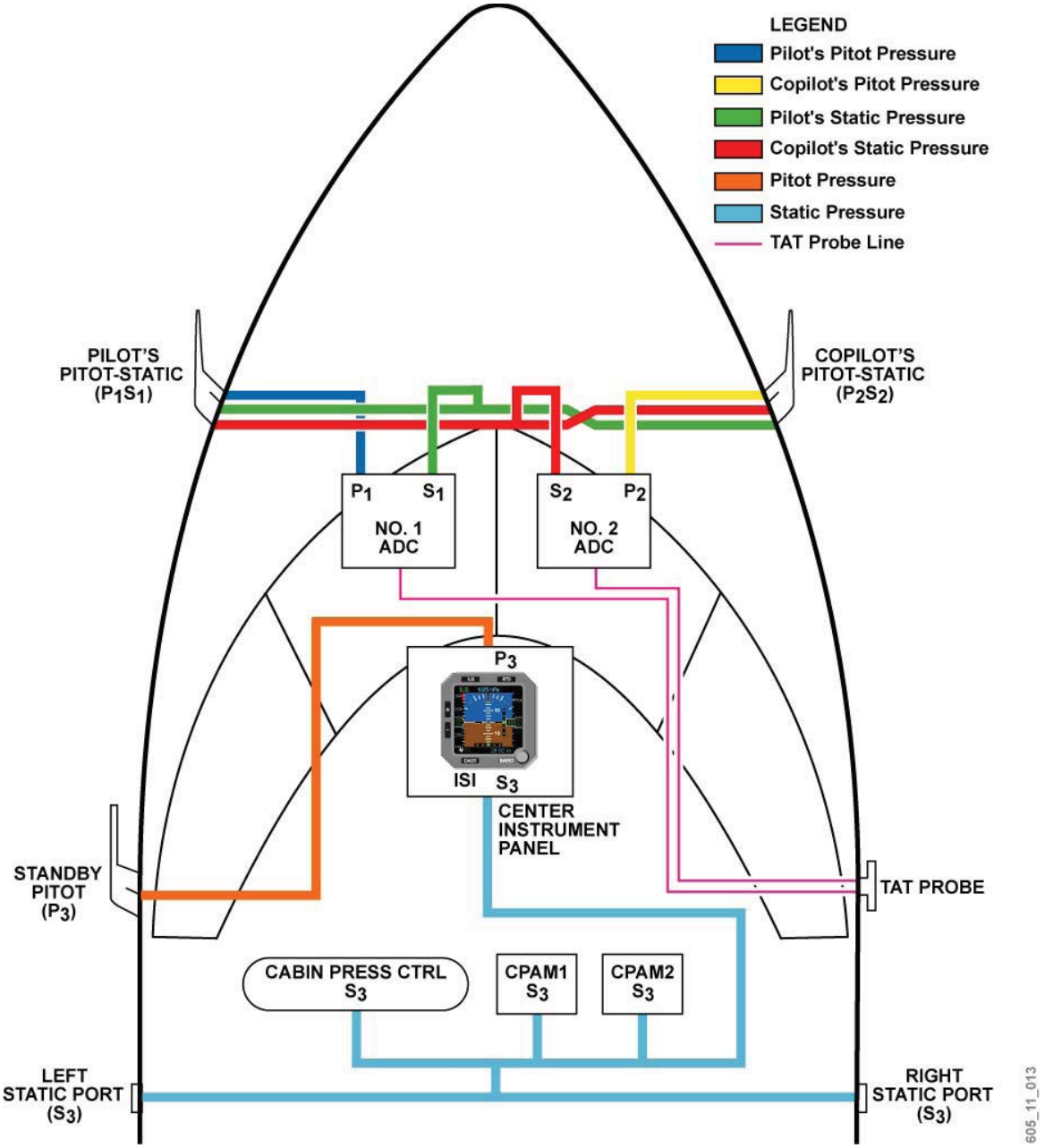
Description

The pitot static system supplies variable air pressure inputs to the air data computers (ADC 1 and ADC 2), stall protection system (SPS), cabin pressure controller (CPC), cabin pressure acquisition modules (CPAM 1 and 2), and the integrated standby instrument (ISI).

The use and distribution of the pitot and static sources are as follows:

- P1 is the normal pitot input to ADC 1.
- S1 is the normal static input to ADC 1.
- P2 is the normal pitot input to ADC 2.
- S2 is the normal static input to ADC 2.
- P3 is the pitot input to the ISI.
- S3 is the static input to the ISI, CPC and the CPAMs.

PITOT STATIC & AIR DATA SYSTEM (CONT'D)



Pitot Static System
Figure 11–10–16

Total Air Temperature Probe

An electrically-heated total air temperature (TAT) probe is mounted on the fuselage beneath the copilot side window. The probe measures the TAT, and supplies this information to the air data computers (ADC 1 and ADC 2).

PITOT STATIC & AIR DATA SYSTEM (CONT'D)

Air Data Computer

Each ADC receives pitot static pressures and temperatures from the pitot, static and TAT probes and pilot-selected inputs. Pilot-selected input cockpit controls include the BARO knob, ADC reversion switch, several FCP control selections, and the reference speeds (REFS) menu settings.

This data is processed by the air data computers (ADCs), and sent to the EFIS displays, IAPS, and several aircraft systems.

The ADC calculates the following air data system parameters:

- Pressure altitude and barometric-corrected altitude;
- Static air temperature (SAT);
- Total air temperature (TAT);
- Temperature variations from standard (ISA);
- Vertical speed;
- Indicated airspeed;
- Mach number;
- True airspeed;
- IAS reference;
- Vertical speed reference;
- Airspeed trend vector;
- Transition FL alert (default FL180);
- Static source error correction;
- Maximum speed (V_{MO} and M_{MO}); and
- Overspeed warning.

AIR DATA SYSTEM INDICATIONS

Description

The PFD display presents airspeed, altitude and vertical speed indications. Airspeed information is displayed on the left side of the PFD. Altitude and vertical speed information are displayed on the right side.

Airspeed

The pilot can choose either an IAS or Mach airspeed tape as the primary indication of speed. Both speed tapes provide similar information. The airspeed display is a moving vertical tape, with the digital display of the current airspeed in the fixed window.

IAS Airspeed Display

The indicated airspeed tape has an airspeed range from 40 to 400 kt. The tape has short tick marks every 5 knots, long tick marks every 10 knots, and is numerically marked every 20 knots.

AIR DATA SYSTEM INDICATIONS (CONT'D)

Mach Number and Mach Display

When the IAS airspeed tape is displayed, and the equivalent Mach is 0.40 or greater, a green 3 digit readout of current Mach number is displayed at the bottom of the tape. A grey "M" indicator also appears in front of the readout.

The Mach based tape is only available when current Mach is greater than 0.40M. The Mach based tape is automatically selected for display when climbing through approximately 33,600 ft. The crew can select a Mach tape (provided M >0.40) which replaces the IAS airspeed tape.

Airspeed Trend Vector

The airspeed trend vector originates from the tail of the indicated airspeed arrow. The magenta trend vector moves vertically in response to aircraft acceleration (extends up) or deceleration (extends down).

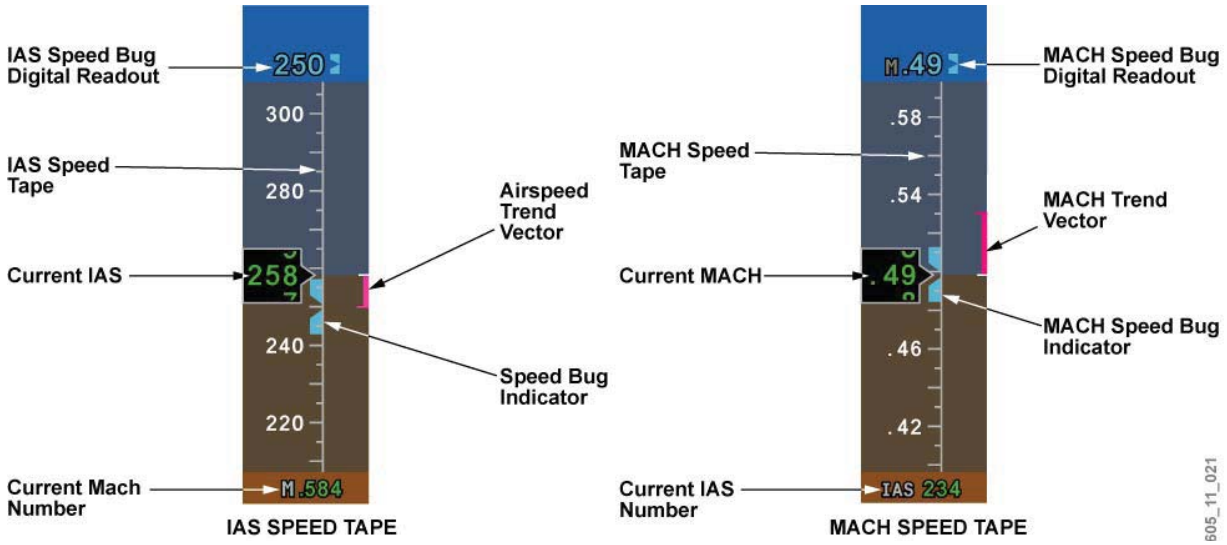
If acceleration remains unchanged, the trend vector continuously predicts the aircraft's speed in 10 seconds.

Speed Bug

The speed bug is sometimes referred to as the speed bucket because of its unique design. The bug is 10 knots wide. Measuring from the center, there is a ±5 knot speed deviation to the outer edges of the indicator.

The SPEED knob, on the flight control panel (FCP), is used to set the airspeed reference bug to the desired speed on the airspeed tape. When the center of the SPEED knob is pressed, the speed reference toggles between Mach and IAS. When the FLC pushbutton on the FCP is pressed, the speed bug automatically aligns itself with the aircraft's current airspeed. The speed bug can also be commanded by the FMS in VNAV sub modes.

The speed bug icon and digital readout are cyan when set with the FCP speed knob, and magenta when set by the FMS.



PFD Airspeed Information
Figure 11–10–17

AIR DATA SYSTEM INDICATIONS (CONT'D)

Reference Speeds

V-speed reference values V_1, V_R, V_2, V_T, V_{AC}, and V_{REF} can be presented on the airspeed tape during takeoff and approach phases of flight. The speeds can be manually set and displayed (cyan characters) using the PFD REFS menu. They can also be automatically computed and displayed (magenta characters) by the FMS.

V-Speeds Setting

Control of the V-speeds within the menu is achieved using the focus indicator and the standard menu controls on the DCP (MENU ADV/DATA knob and PUSH SELECT knob).

Each of the reference speed values can be selected either on or off. When selected to on, the associated reference value is displayed on the airspeed tape. Toggling the reference value between on and off is achieved by first highlighting the desired control using the focus indicator, and then pressing the PUSH SELECT button. Each press of this button toggles the reference value back and forth between on and off. As V-speeds are toggled on, the focus indicator moves forward to the next selectable V-speed.

The following selectable V-speed REFS are identified as:

V_1

The reference marker is a cyan line followed by a 1. The V_1 marker is the takeoff decision speed reference. The V_1 marker is automatically removed at lift-off.

V_R

The reference marker is a cyan line followed by an R. The V_R marker is the rotation speed reference. The marker is automatically removed after the V_2 speed is exceeded.

V_2

The reference marker is a cyan line followed by a 2. The V_2 marker is the takeoff safety speed reference. The marker is automatically removed after the V_2 speed is exceeded (V_2 + 40 knots + weight off wheels for 7 seconds).

V_T

The reference marker is a cyan line followed by a T. The V_T marker is the target speed reference.

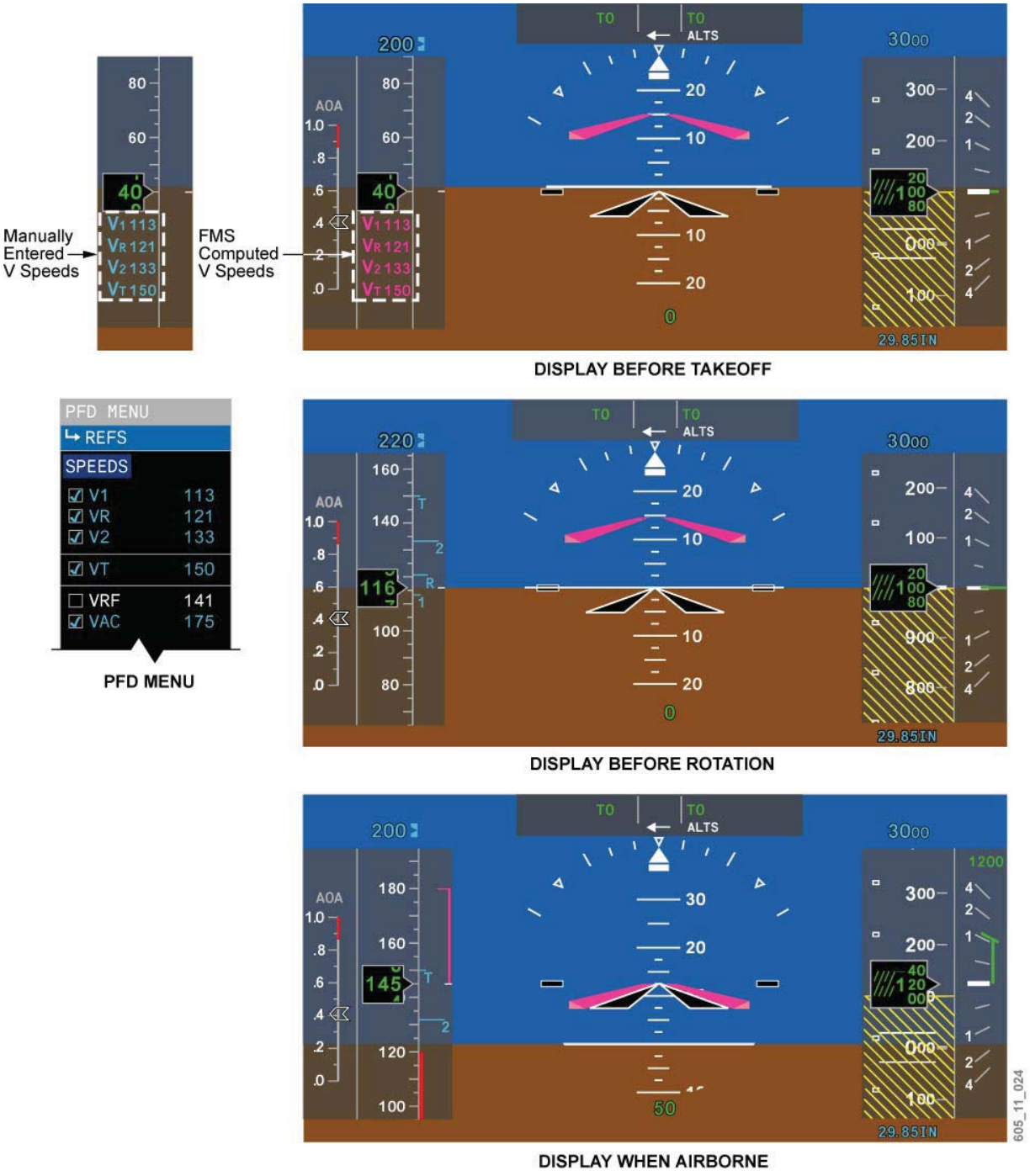
V_{REF}

The reference marker is a cyan line followed by a REF. The V_{REF} marker is the reference approach speed (not presented in graphic).

V_{AC}

The reference marker is a cyan line followed by an AC. The V_{AC} marker is the approach climb speed reference during a go-around (not presented in graphic).

AIR DATA SYSTEM INDICATIONS (CONT'D)



PFD REFs Speed Indications
Figure 11–10–18

AIR DATA SYSTEM INDICATIONS (CONT'D)

High-Speed/Flap Overspeed Cue

An overspeed cue is provided to indicate the maximum operating speed. It appears in the upper portion of the airspeed scale, and is displayed as a solid red line.

An overspeed pre-alert occurs when the solid red line changes to an expanded alternating red and black checkerboard band, and airspeed/Mach digital readout changes from green to yellow.

When the aircraft is operated near the top of its speed envelope, the cue indicates the airspeed at which V_{MO}/M_{MO} will be exceeded. The overspeed clacker sounds if V_{MO}/M_{MO} is exceeded by 3 knots, and airspeed/Mach digital readout changes from yellow to red.

When the flaps are extended, the checkerboard cue is overlaid on the airspeed indicator. The bottom of the cue represents the V_{FE} speed for the existing flaps selection. The overspeed clacker sounds if V_{FE} is exceeded.

Low-Speed Cue

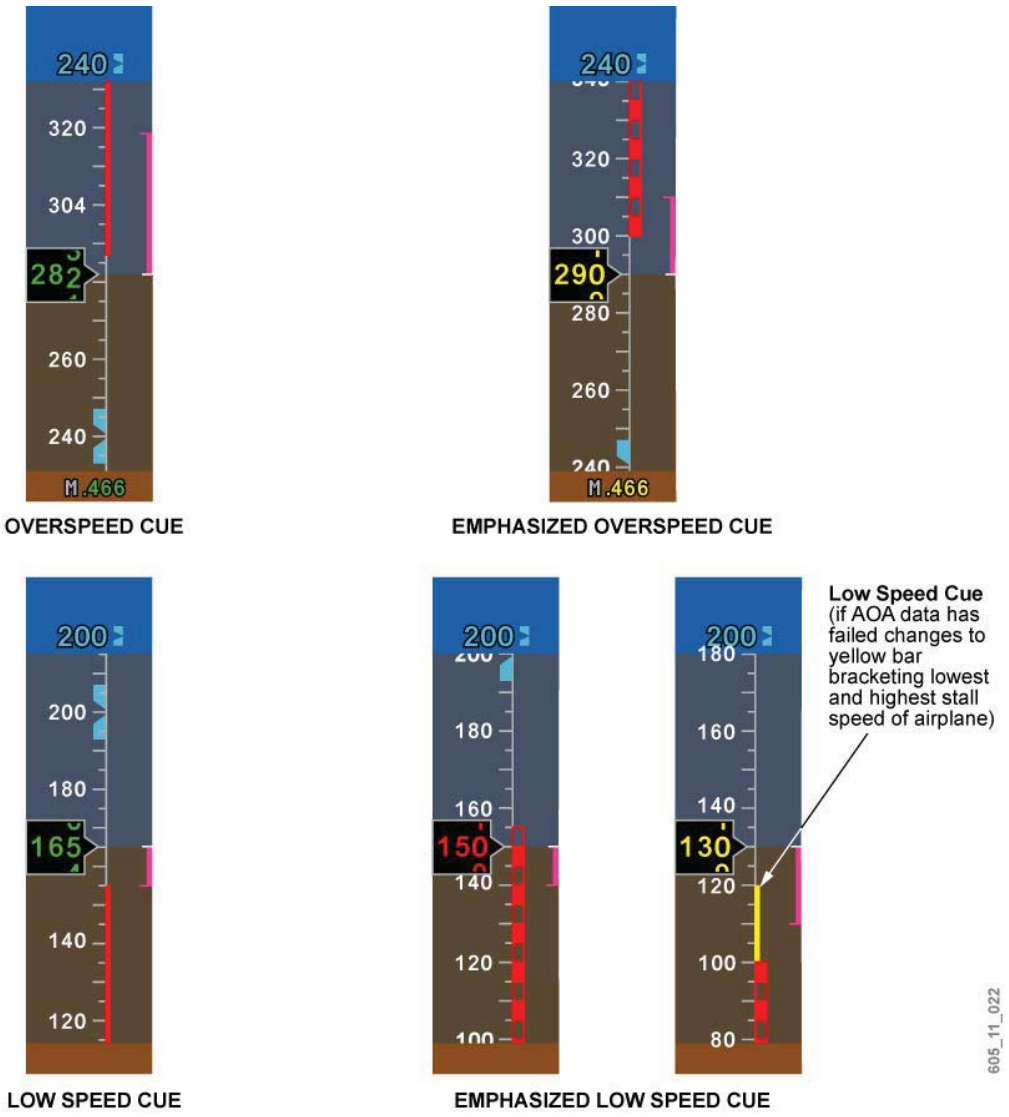
The low-speed cue is generated by angle-of-attack information from the auxiliary angle-of-attack vane. It appears three seconds after lift-off, from the lower portion of the airspeed scale, and is displayed as a solid red line.

A low-speed pre-alert occurs when the solid red line cue changes to an expanded alternating red and black checkerboard band, and airspeed/Mach digital readout changes from green to yellow (the aircraft is within a few knots of activating the stick shaker). In the landing configuration (gear down, flaps 45), the top of the cue represents a calculated airspeed of 1.06 V_S, the speed at which the stick shaker will activate.

If current airspeed becomes less than the top of the low speed cue, the airspeed/Mach digital readout changes color to red.

When AOA data fails or is missing (which may or may not be due to a stall system failure), the low-speed cue changes to its default setting. The speed cue stops at 100 knots, and a yellow line extends upwards from the top of the checkerboard to 120 knots. The intent of this defaulted failure indication is to provide some remaining indication of low speed awareness, while indicating that the low-speed cue is in a degraded and defaulted mode.

AIR DATA SYSTEM INDICATIONS (CONT'D)



Overspeed/Low-Speed Cues
Figure 11–10–19

Angle-of-Attack (AOA)

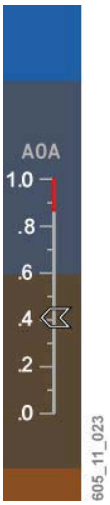
The AOA display is a vertical tape located immediately to the left of the airspeed tape. Like the low-speed cue, this display is generated by angle-of-attack information from the auxiliary angle-of-attack vane. The AOA display function is advisory only, and indicated airspeed must always be used as the primary reference.

A reading of 0.0 AOA corresponds to zero lift. The pusher activation is equal to a reading of 1.0 AOA.

The AOA scale is marked with a red band from 0.8734 to 1.0. Shaker activation is 1.07 V_S or 0.8734 AOA.

AIR DATA SYSTEM INDICATIONS (CONT'D)

1.3 V_S corresponds to 0.5917 AOA. This is approximately equal to the AOA for V_{REF} in nonaccelerated flight.



AOA Indicator
Figure 11–10–20

Altitude

Barometric altitude information displayed on the PFD consists of:

- Altitude display and readout;
- Barometric pressure setting;
- Preselect altitude;
- Altitude alert; and
- Barometric altitude minimums (BARO MIN).

The ADC calculates the pressure altitude and barometric-corrected altitude. The preselected altitude is set via the FCP. Barometric pressure readout and BARO MIN are set through controls on the DCP or CCP.

Altitude Display and Readout

The altitude display is shown on the right side of the PFD as a moving tape with a fixed digital readout window. The barometric altitude readout ranges from –1000 to 55,000 feet, or –300 to 16,765 meters. The digital readout in the fixed altitude window indicates the actual altitude.

The fine portion of the tape is marked and numbered every 100 feet. The coarse portion of the tape is used to assist the pilot in altitude captures and gross altitude awareness. It is not numbered, and is marked with rectangles for increments of 500 feet.

For aircraft with the optional metric altitude readout, a gray boxed metric altitude above the altitude window is displayed. A gray “M” is also displayed next to the metric altitude readout.

AIR DATA SYSTEM INDICATIONS (CONT'D)

Barometric Pressure Setting

The barometric pressure setting is used to correct altitude for local barometric pressure effects. The barometric pressure setting can be accomplished in one of two ways. It can be directly set via the BARO knob on the glareshield, or via the PFD menu/BARO SET submenu controls.

The BARO knob is rotated to increase or decrease barometric pressure setting. The barometric setting is displayed below the altitude tape. The standard barometric pressure setting of 29.92 inches of mercury, or 1013 hPa, is selected when the center of the BARO knob is pressed. Settings via the BARO knob are reflected in the BARO SET menu.

A yellow line under the barometric pressure setting indicates a different BARO setting between pilot and copilot.

BARO MENU (IN) BARO MENU (HPA)

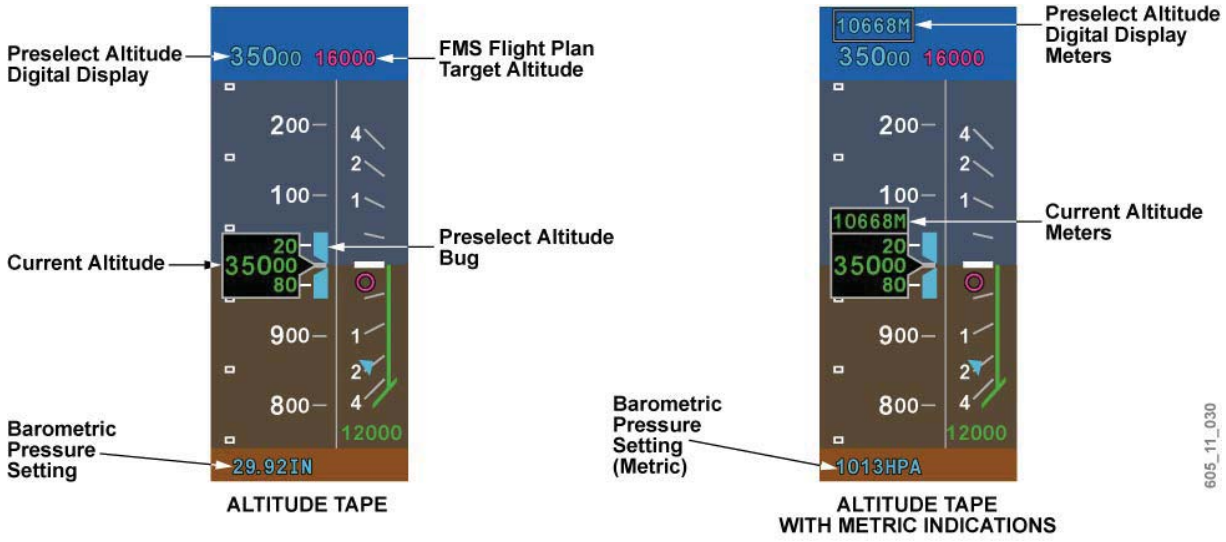
BARO SET Menu/BARO Knob
Figure 11–10–21

Preselect Altitude

The preselect altitude bug and digital readout are selected using the ALT knob on the FCP. The preselect altitude is a reference for the altitude alert and flight director systems. The preselect altitude setting is displayed digitally above the altitude tape, and as a preselect altitude reference bug on the altitude scale.

The cyan preselect altitude readout, displayed above the altitude tape, has a selection range of 0 to 41,000 feet in increments of 100 feet. The range of the metric preselect altitude is from 0 to 12,497 meters.

AIR DATA SYSTEM INDICATIONS (CONT'D)



Altitude Display and Readout
Figure 11–10–22

Altitude Alert Modes

The altitude alert functions in the acquisition mode and deviation mode.

Acquisition Mode

During the climb or descent, both the pilot and copilot's preselected altitude bugs flash cyan, and a "C-chord" tone sounds when the aircraft is within 1,000 feet of the preselected altitude.

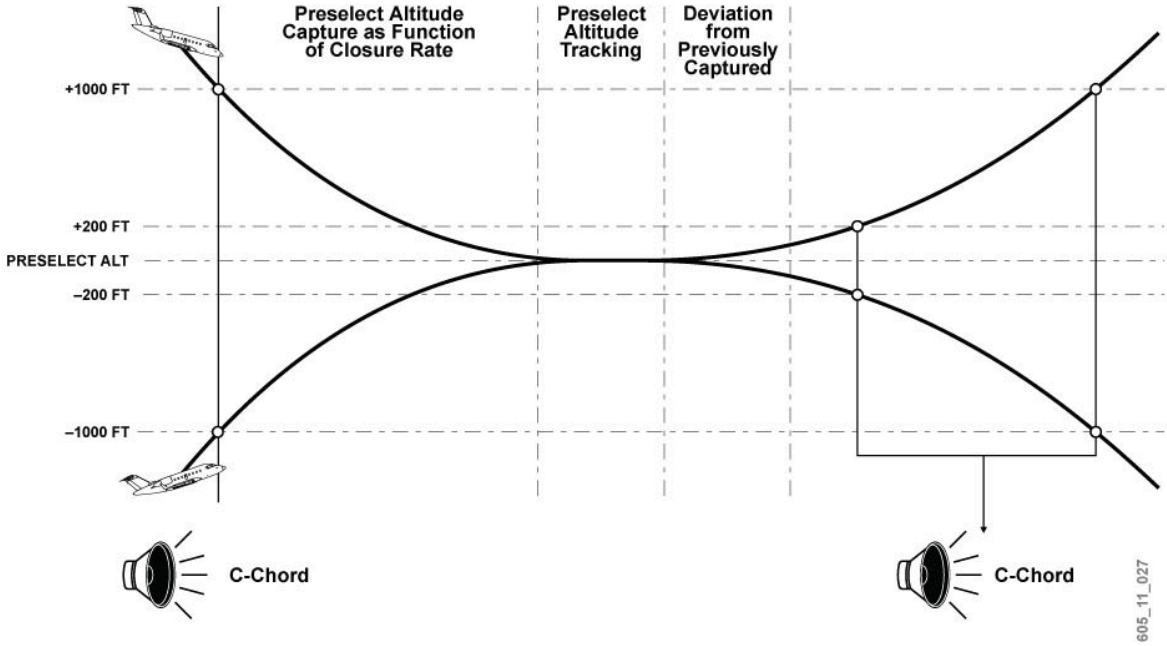
Deviation Mode

When an altitude deviation of 200 feet or more occurs when in altitude tracking mode, both preselected altitude readouts flash yellow and the "C-chord" tone sounds. With minor altitude deviations, the preselected altitude bug flashes cyan.

ADC Monitoring

Monitoring of the preselected altitude tracking is a function of the ADCs.

AIR DATA SYSTEM INDICATIONS (CONT'D)



Altitude Alert Operation
Figure 11–10–23

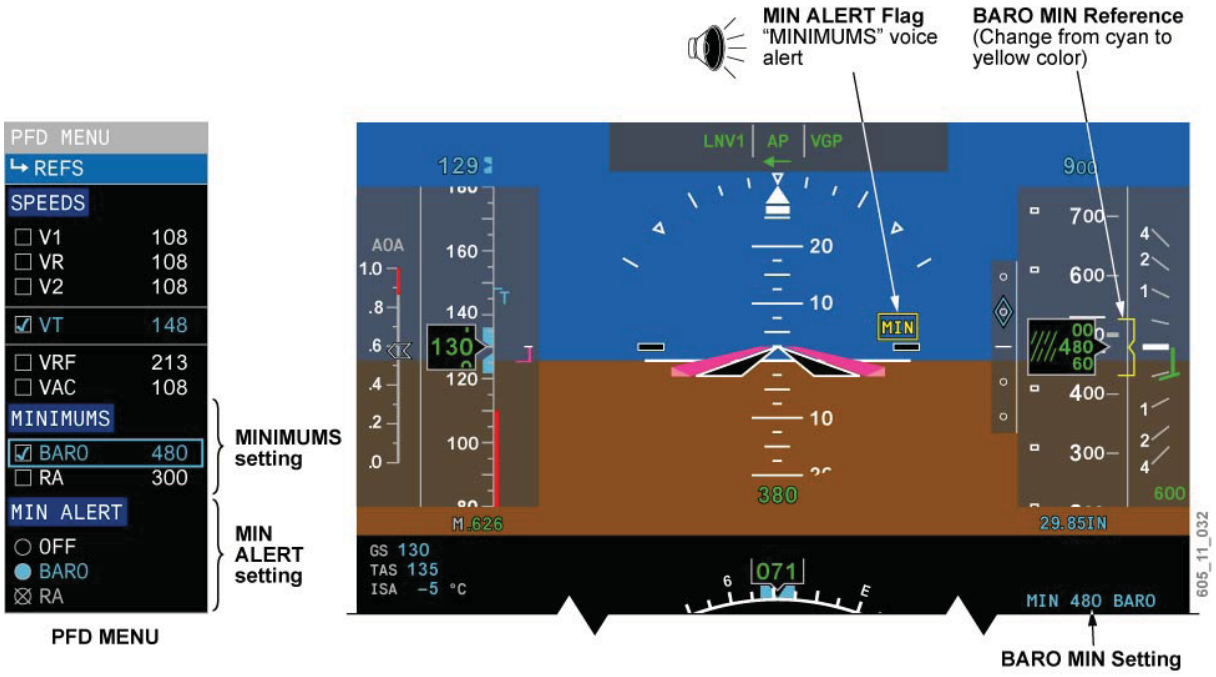
BARO MIN

The barometric altitude minimums (BARO MIN) is a function of barometric altitude, and all references are related to the pilot's altimeter display. BARO MIN has a range of 10 to 15,000 feet, and is set under the MINIMUMS section of the REFS menu. The selected minimums will display in cyan below the altitude tape as MIN XXX BARO. The XXX represents the selected digital value. The BARO alert is set under the MIN ALERT section of the REFS menu.

BARO MIN Analog Reference

As minimum descent altitude is approached, the cyan minimums pointer (reverse sigma shape) appears on the altitude tape. When the aircraft reaches minimums (BARO MIN ALERT), a flashing yellow MIN indication is presented on the right edge of the ADI for 5 seconds, and the analog reference changes from cyan to yellow and flashes for 5 seconds.

AIR DATA SYSTEM INDICATIONS (CONT'D)



BARO MIN Display
Figure 11–10–24

Radio Altimeter

The radio altimeter (RA) is part of the radio sensor system (RSS), and is independent from the air data system. The RA is a frequency modulated continuous wave (FM CW) type of altimeter that measures aircraft height above ground level (AGL). The RA altimeter is used by the flight control computers (FCCs), TAWS, and TCAS, and is displayed on the PFDs.

The PFD radio altitude display is presented as a digital readout. The readout is displayed from 0 to 2,500 feet above ground. The numeric display appears at the bottom of the attitude indicator as the airplane descends through 2,500 feet above ground level (AGL), and disappears as the airplane climbs through 2,500 feet AGL.

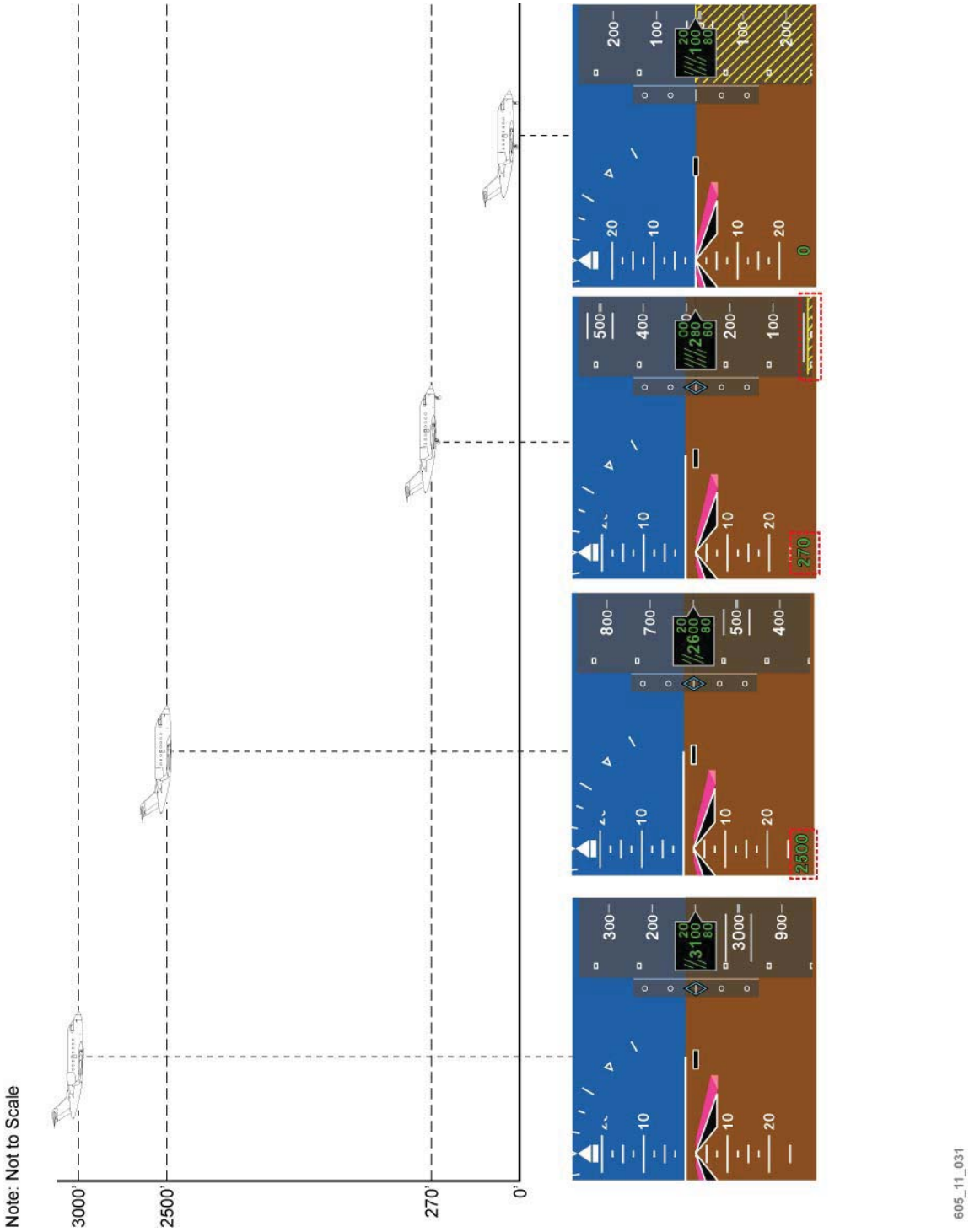
Radio Altitude Analog

An analog radio altitude display is shown at the bottom of the barometric altitude tape area, to improve ground awareness. The analog radio altitude ground awareness cue is displayed as crosshatch yellow tape, with a range of 0 to 270 ft. When radio altitude is approximately 270 ft, the ground awareness cue comes into view at the bottom of the barometric altitude tape, and moves up to meet 0 ft radio altitude.

NOTE

In order to conform to JAA CAT II certification requirements, service bulletin 605–34–005 indicates that the installation of a second RA is required.

AIR DATA SYSTEM INDICATIONS (CONT'D)



Radio Altitude (RA) Displays
Figure 11–10–25

AIR DATA SYSTEM INDICATIONS (CONT'D)

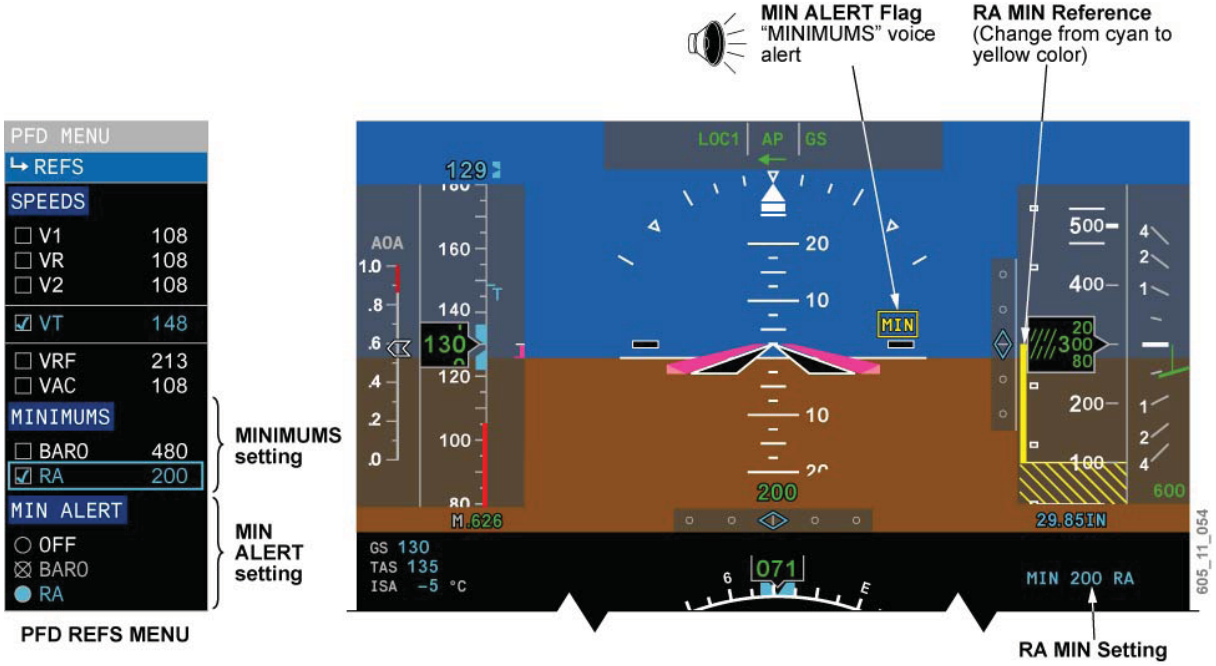
RA MIN

The radio altitude minimum (RA MIN) is a function of radio altimeter altitude, and all references are above ground level (AGL). RA MIN has a range of 5 to 999 feet, and is set under the MINIMUMS section of the REFS menu. The selected minimums are displayed in cyan below the altitude tape as MIN XXX RA. The XXX represents the selected digital value. The RA alert is set under the MIN ALERT section of the REFS menu.

RA MIN Analog Reference

The RA MIN reference, located on the left side of the barometric altitude tape, is a cyan pole with a flag at the top, which extends up from the analog radio altitude display. The analog reference rises towards the "0 ft" RA.

When the aircraft descends to decision height (RA MIN ALERT), the analog reference changes from cyan to yellow and flashes for 5 seconds. The analog RA MIN reference continues to rise until radio altitude is zero. A flashing yellow MIN indication is also displayed on the right edge of the ADI for 5 seconds, as selected minimums are reached.



RA MIN Display
Figure 11–10–26

Vertical Speed

The vertical speed (VS) display consists of a vertical analog scale and pointer with a green drag line. A part-time digital readout of the vertical speed is also provided when VS is 300 feet/minute or greater.

The VS pointer moves up and down the scale to indicate current VS. As the pointer moves, the drag line appears to emphasize the VS. The vertical speed scale has a range of ±4000 fpm. The digital readout of the vertical speed is displayed on either the top or bottom of the vertical speed scale, respective of climb or descent, and has a range of ±15,000 fpm.

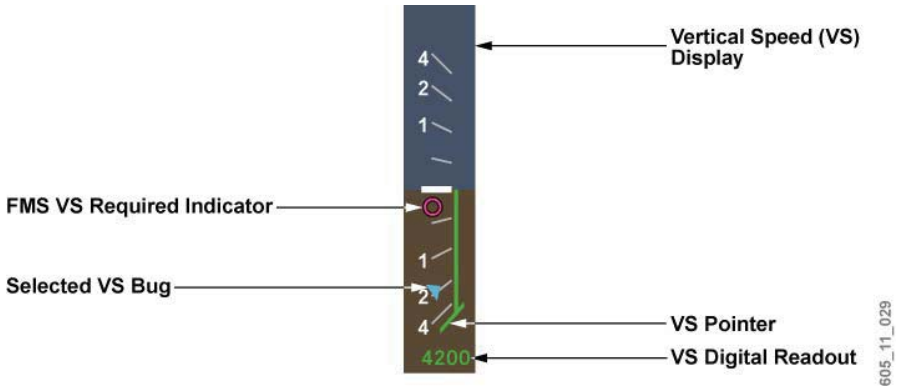
AIR DATA SYSTEM INDICATIONS (CONT'D)

In AFCS vertical speed mode (VS), using the FCP/pitch wheel, two indications are displayed: a reference bug on the VS scale, and a digital readout in the flight mode annunciation (FMA) field.

During FMS VNAV operations, the VS advisory pointer is a magenta open circle that indicates the average VS required to climb or descend from the present position to the next climb (or descend) altitude constraint. The FMS must be the active NAV source for the pointer to be displayed.

The vertical speed scale is also used to display TCAS resolution advisories (see Chapter 17, Navigation Systems).

Vertical speed source data comes from the ADCs. Vertical acceleration from the onside IRS is used to filter vertical speed in order to provide a smoother presentation to the pilot. The filtered vertical speed is referred to as inertial vertical speed.



Vertical Speed Display
Figure 11–10–27

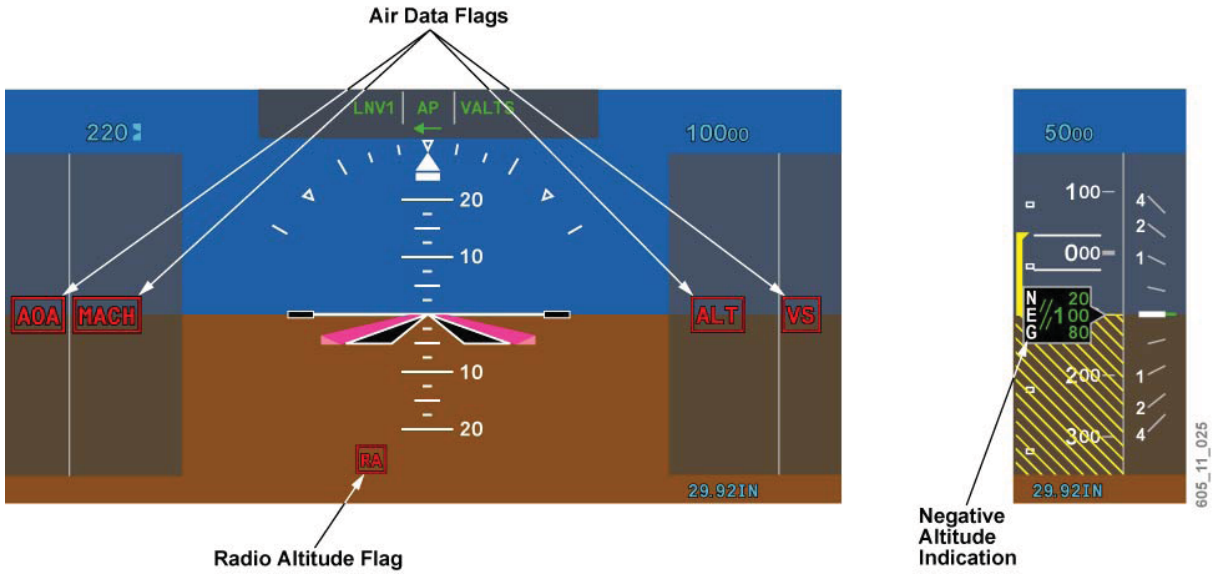
Air Data Flags

When ADC airspeed, altitude or vertical speed data is invalid, red air data flags are presented to replace the affected system's information. An invalid inertial vertical speed may also cause a VS red flag to appear.

Negative Altitude Warning

A white vertically positioned NEG is displayed in the current altitude window to indicate negative barometric altitudes.

AIR DATA SYSTEM INDICATIONS (CONT'D)



Air Data Flags/RA Flag/Negative Altitude Indication
Figure 11–10–28

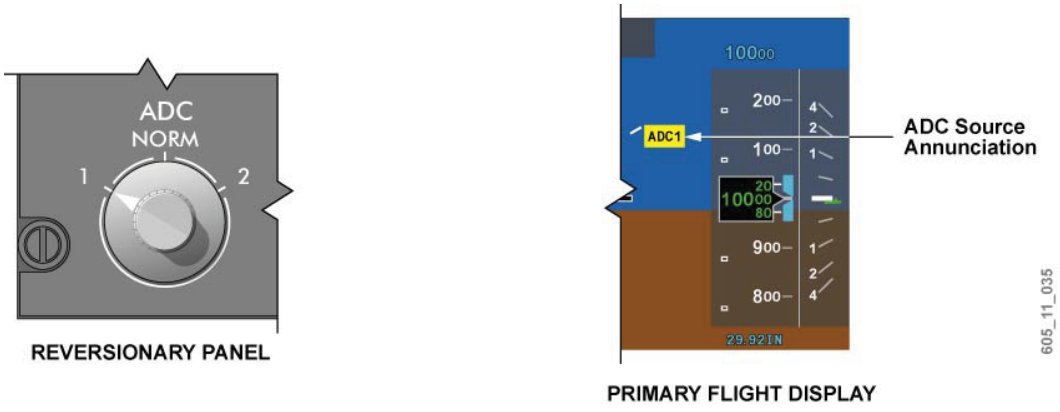
Air Data Reversionary Function

ADC Switch (Reversionary Panel)

When NORM is selected, the pilot and copilot electronic flight displays receive data from their individual, onside air data computers (ADCs).

When 1 is selected, the pilot and copilot electronic flight displays receive data from ADC 1 only. A yellow ADC 1 message is displayed on both L and R PFDs.

When 2 is selected, the pilot and copilot electronic flight displays receive data from ADC 2 only. A yellow ADC 2 message is displayed on both L and R PFDs.



ADC Reversionary Annunciation
Figure 11–10–29

ATTITUDE DISPLAY

Description

The attitude information provides pilot orientation to the aircraft's axes of inclination with respect to the horizon. The PFD's pitch, roll and yaw indications are generated by the IRS computers. Attitude information displayed on the PFD includes:

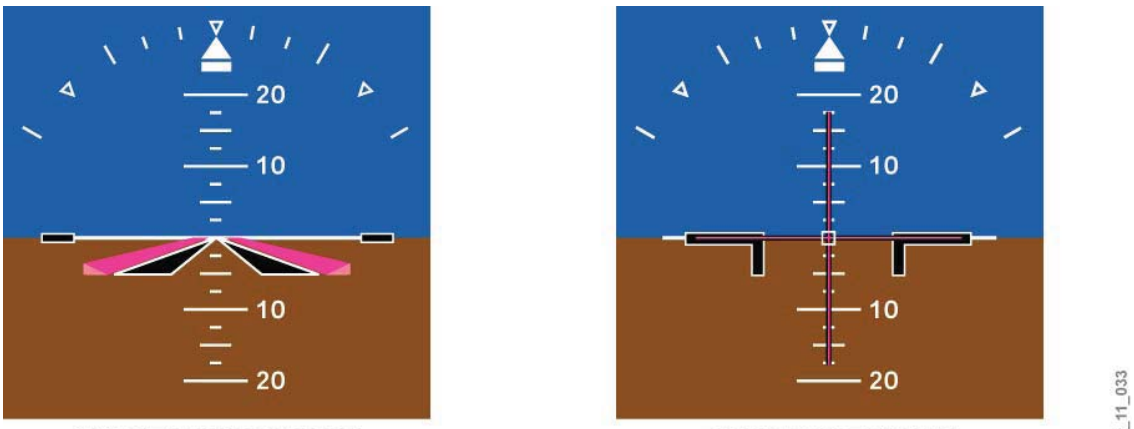
- Aircraft and wing symbols;
- Horizon line;
- Sky/ground display;
- Pitch tape and chevrons;
- Roll scale and pointer;
- Slip/skid indicator; and
- Unusual attitude display (PFD declutter).

Attitude Information Field

Aircraft and Wing Symbols

The aircraft symbol is an inverted black V-shape. It is a stationary representation of the aircraft, and is represented by a black symbol with a white outline. Two small white rectangular wing symbols are shown to the left and right of the aircraft symbol. The V-shaped aircraft symbol appears when the flight director V-Bar (single cue) is selected.

The split T-shaped aircraft symbol appears when the flight director X-PTR (cross pointers split cue) is selected.



Aircraft Symbols
Figure 11–10–30

Horizon Line

The horizon line is the ADI's representation of the outside horizon. With zero degrees of pitch and roll, the white horizon line touches the apex of the aircraft symbol, and passes through the center of the aircraft wing symbol.

ATTITUDE DISPLAY (CONT'D)

Sky/Ground Display

Separated by the horizon line, this blue-and-brown image (wall to wall or coast to coast) provides a visual representation of the actual position of the sky and ground with respect to the aircraft.

Pitch Tape

The pitch tape is fixed on the attitude sphere and moves with the horizon line. The tape has wide line markings every 10 degrees, medium line markings every 5 degrees and small line markings every 2.5 degrees.

Roll Scale and Pointer

At the top of the blue raster is a roll scale and pointer. The scale range is ±60 degrees from a wings level attitude.

The scale is marked as follows:

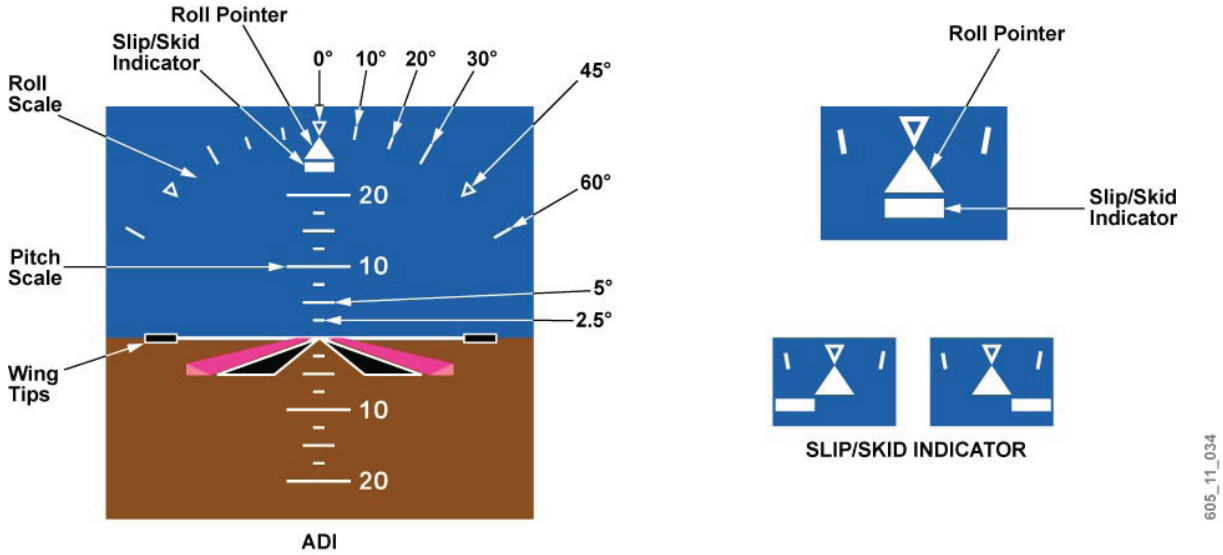
- Large tick marks at ±30 and ±60 degrees
- Small tick marks at ±10 and ±20 degrees
- Small triangle at ±45 degrees

The roll pointer moves in reference to the center of the aircraft symbol, and indicates the aircraft roll angle.

Slip/Skid Indicator

The slip/skid indicator is a small rectangle located below the roll pointer. The slip/skid indicator is driven by lateral acceleration. It turns with the roll pointer, and moves laterally with respect to the base of the roll pointer.

One brick-width deflection of the rectangle is equivalent to a displacement of two ball-widths on a conventional slip/skid indicator.



Normal Attitude Display
Figure 11–10–31

ATTITUDE DISPLAY (CONT'D)

Unusual Attitude Display

All nonessential information is removed from the PFD during aircraft upset or unusual attitudes. This function is called PFD declutter.

When the pitch angle exceeds +30 or –20 degrees, or roll exceeds 65 degrees left or right, only the following information is displayed on the PFD:

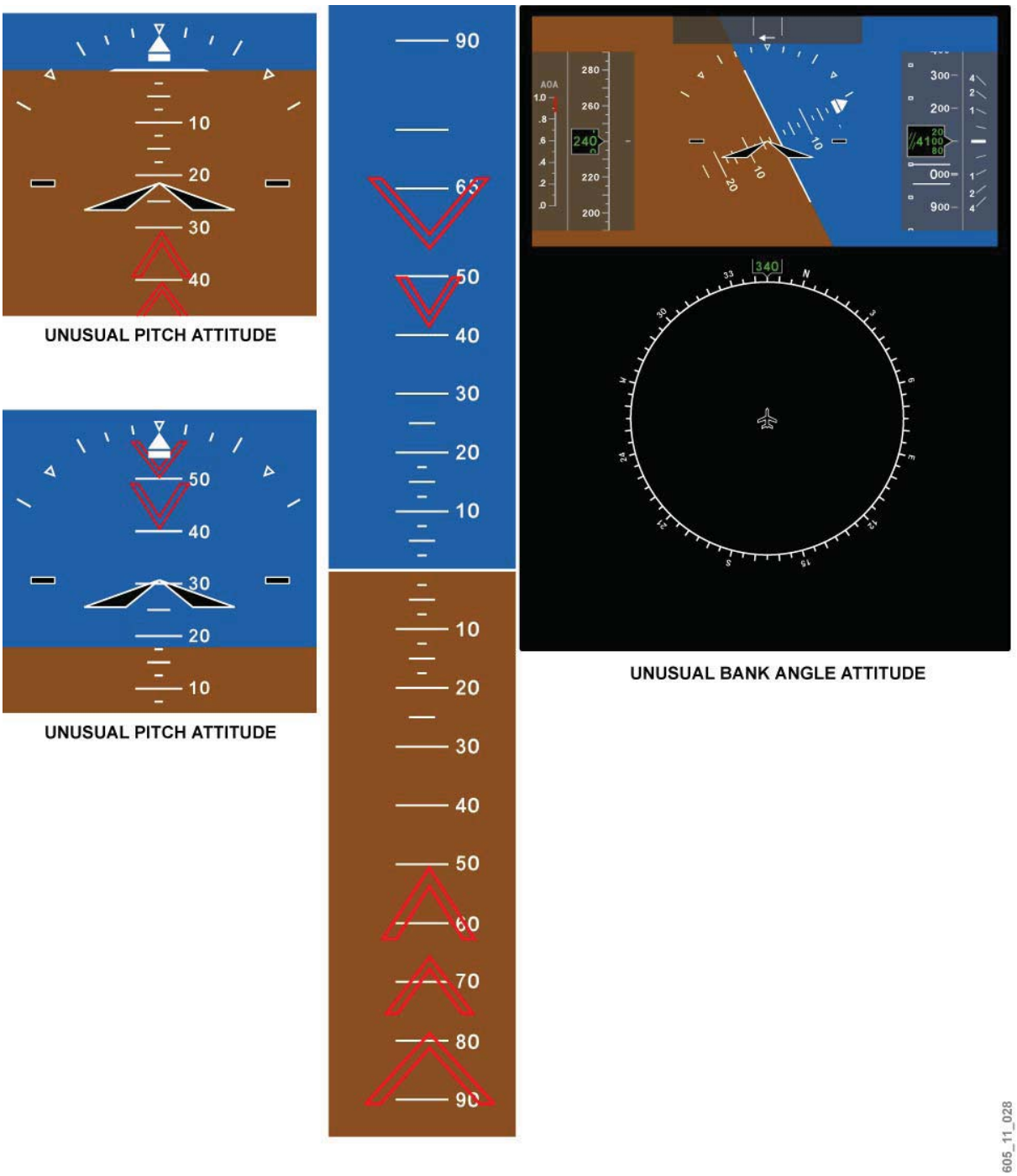
- Attitude;
- Altitude;
- AOA;
- Airspeed;
- Airspeed trend vector;
- Slip/skid;
- Vertical speed;
- Compass;
- YD disengage indication; and
- AP engage/disengage status annunciator.

Red warning chevrons appear during maneuvers of extreme pitch attitude. The chevrons always point toward the zero degree position, or the direction of level flight

When the pitch and roll attitudes are less than the prescribed exceedances, all PFD information previously removed during the declutter is restored.

During unusual attitudes, all inputs to the DCP are inhibited including the menu/list selection, which ensures that references are not inadvertently changed. The following information is also inhibited: Range, radar tilt, barometric correction, preselect altitude, speed bug, heading bug, and the course pointer.

ATTITUDE DISPLAY (CONT'D)



PFD Declutter
Figure 11–10–32

HEADING DISPLAY

Description

The aircraft heading is displayed on a full compass rose (ROSE format) or on a present position FMS map (PPOS format), located at the bottom of the PFD/MFD. Heading data is supplied by the IRS system, and may be displayed in “magnetic” or “true”.

Heading Information

Heading information displayed on the PFD/MFD includes:

- Compass card;
- Lubber line;
- Selected heading bug and vector;
- Selected heading display; and
- Aircraft symbol.

Heading Indicators

The heading indications are represented on the full compass card. The compass card has 10 degree major indices, 5 degree minor indices, cardinal point characters at N, S, E, W, and numeric labels at 30 degree intervals.

At the top center position of the compass card is the fixed lubber line, which indicates the current aircraft heading. To assist in heading visualization, two fixed index marks are presented at 45 degrees on either side of the lubber line (ROSE format only).

An aircraft symbol is centered on the compass card, and is aligned with the lubber line.

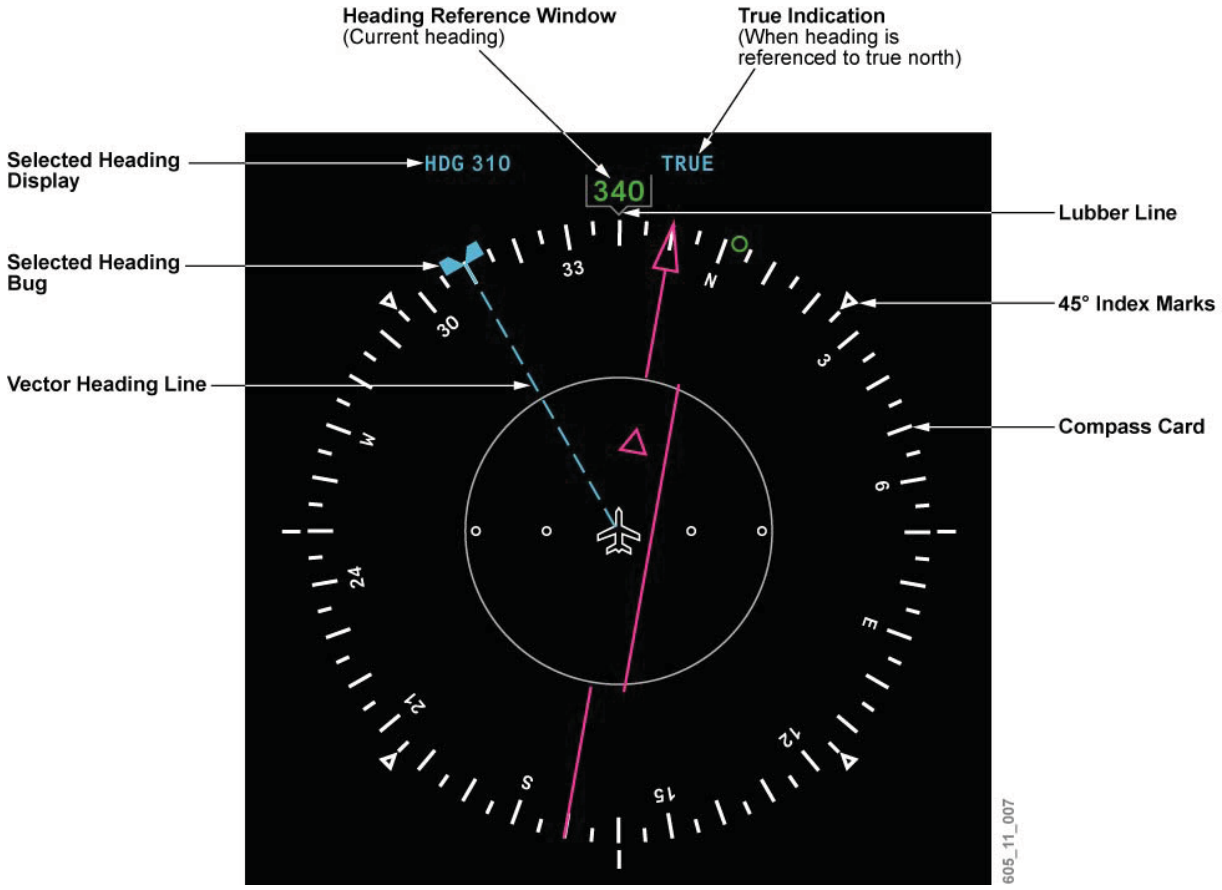
When heading is referenced to true north, a cyan TRUE indication is displayed to the right of the heading readout.

Selected Heading Reference

The selected heading reference is presented on the heading display as a permanently displayed heading bug, and temporarily as a bug vector line and digital readout.

The heading bug indicates the heading selected by the HDG knob on the FCP. When a new heading is selected, the heading vector line and digital heading readout are displayed for 5 seconds, and then removed from view.

HEADING DISPLAY (CONT'D)

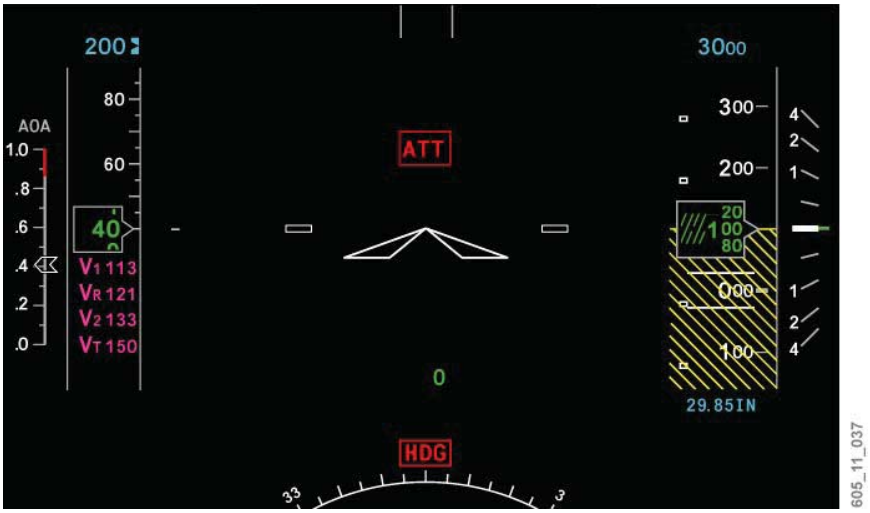


Heading Information
Figure 11–10–33

Attitude and Heading Flags

When attitude or heading data is invalid, red ATT or HDG flags are presented to replace the affected system's information.

HEADING DISPLAY (CONT'D)



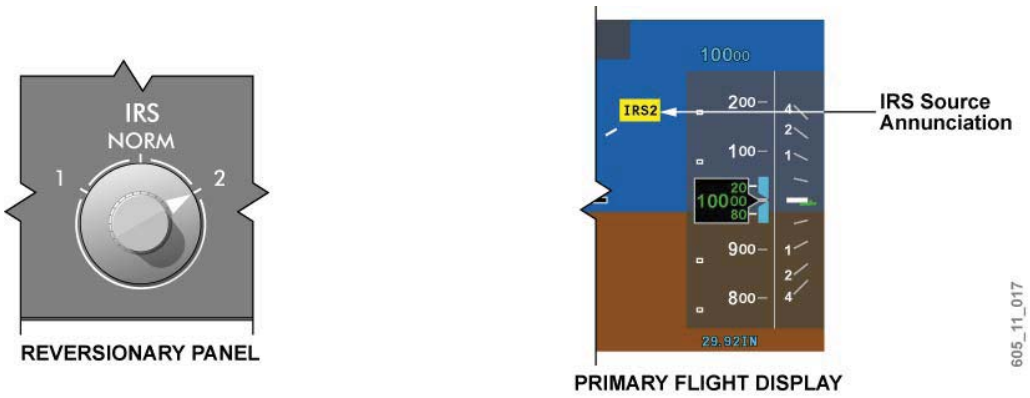
Attitude and Heading Failure Flags
Figure 11–10–34

IRS Reversionary Function (Dual IRS Configuration)

When NORM is selected, the pilot and copilot electronic flight displays receive data from their individual, onside IRS.

When 1 is selected, the pilot and copilot electronic flight displays receive data from IRS 1 only. A yellow source message is displayed on the PFD and/or MFD.

When 2 is selected, the pilot and copilot electronic flight displays receive data from IRS 2 only. A yellow source message is displayed on the PFD and/or MFD.



IRS Reversionary Annunciation (Dual IRS Configuration)
Figure 11–10–35

IRS Reversionary Function (Triple IRS Configuration)

A third IRS is installed to supply an auxiliary source of inertial data, to increase dispatch and en route reliability. An alternate sensor reversion panel (L IRS/R IRS reversionary panel) is also installed in the center pedestal.

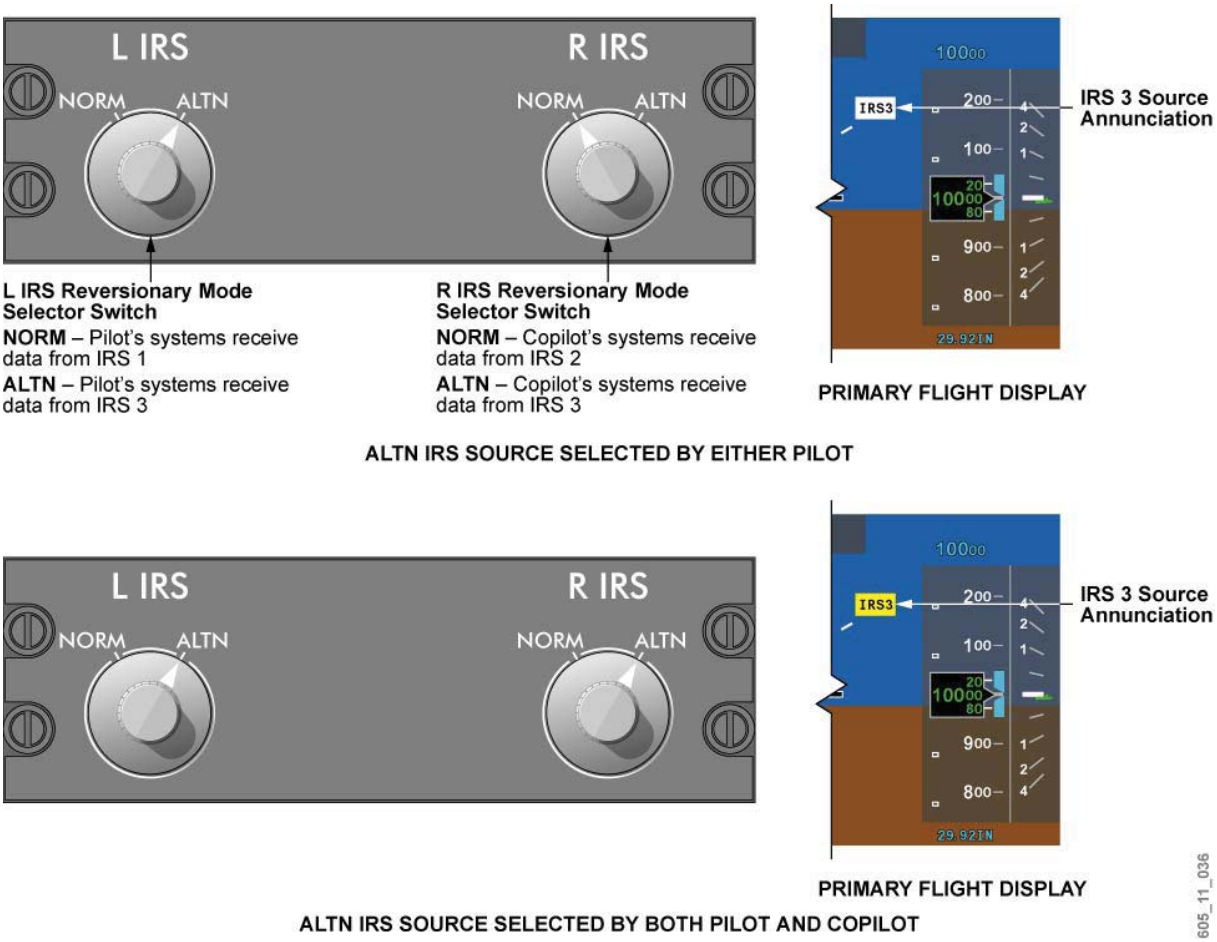
HEADING DISPLAY (CONT'D)

When both L and R IRS rotary switches are selected to NORM, the pilot and copilot electronic flight displays receive data from their individual, onside IRS sensor.

When the L IRS switch is selected to ALTN, the pilot electronic flight displays receive data from IRS 3 only. An IRS 3 annunciation is displayed on the left PFD, left of the altimeter tape.

When the R IRS switch is selected to ALTN, the copilot electronic flight displays receive data from IRS 3 only. An IRS 3 annunciation is displayed on the right PFD, left of the altimeter tape.

When the ALTN IRS source is selected by both the pilot and copilot, a yellow IRS 3 annunciation is displayed on both L and R PFDs.



IRS Reversionary Annunciation (Triple IRS Configuration)
Figure 11–10–36

NAVIGATION DISPLAYS

Description

The PFD and MFD display several navigation formats. The lower half of the PFD displays navigation information, full compass ROSE format, flight management maps on PPOS format, and overlays such as radar/lightning (WX/LX), terrain (TR) and TCAS.

NAVIGATION DISPLAYS (CONT'D)

The lower window of the MFD displays compass, navigation information, and flight management maps on PPOS and PLAN formats. Radar or optional radar/lightning (WX/LX), terrain (TR) and TCAS may be overlayed on compatible MFD formats.

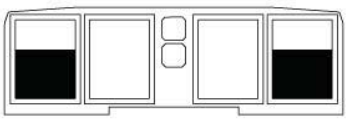
PFD Navigation Formats

PFD navigation formats can be selected by using either the FRMT pushbutton on the DCP, or the FORMAT section of the PFD MENU.

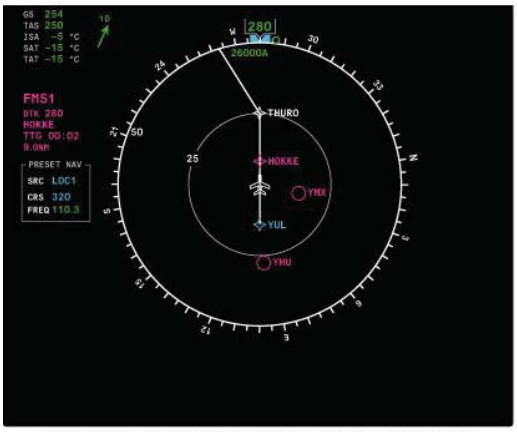
MFD Navigation Formats

MFD navigation formats can be selected by using either the FRMT pushbutton on the CCP, or the FORMAT section of the LWR MENU pushbutton on the CCP.

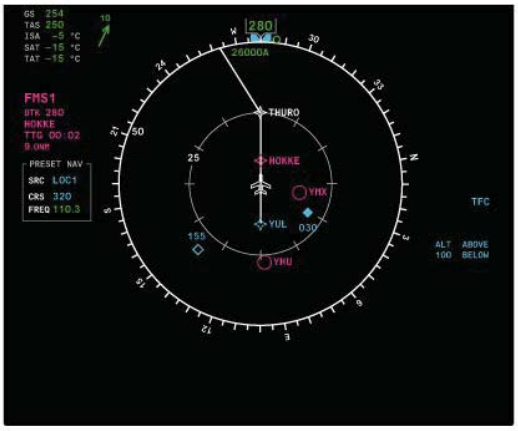
NAVIGATION DISPLAYS (CONT'D)



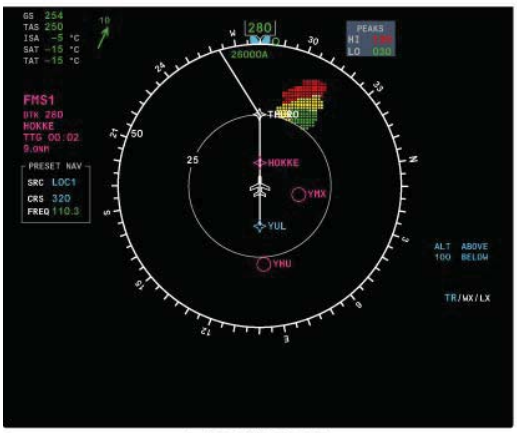
ROSE FORMAT



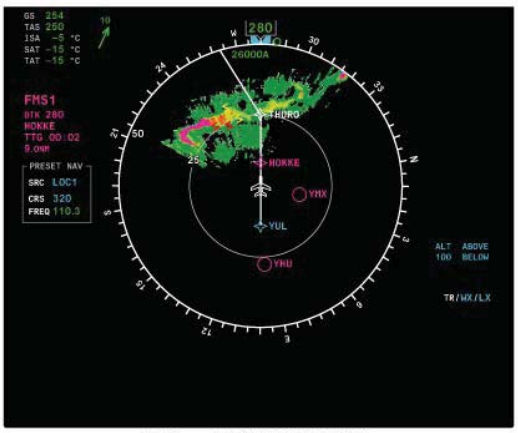
PPOS FORMAT (Present Position FMS map)



TRAFFIC OVERLAY



TR OVERLAY

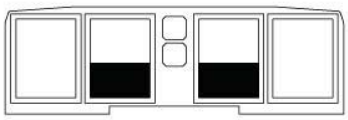


WX and LX OVERLAYS

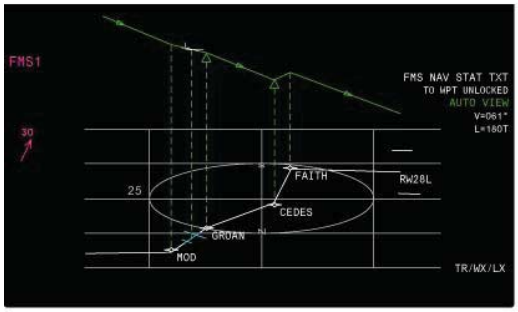
605_11_039

PFD Navigation Formats
Figure 11–10–37

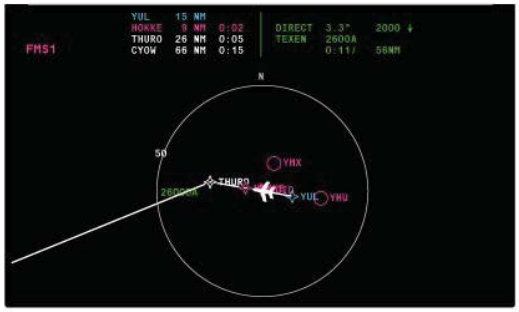
NAVIGATION DISPLAYS (CONT'D)



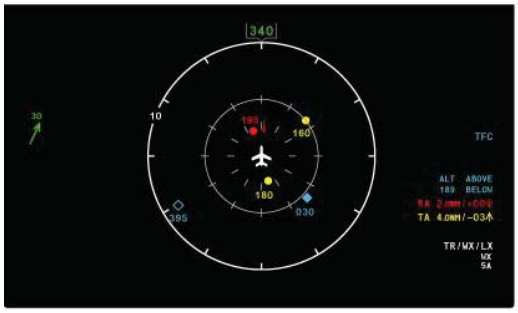
PPOS FORMAT



3D FMS MAP FORMAT



PLAN MAP



TCAS FORMAT

TRAFFIC OVERLAY

TR OVERLAY

WX and LX OVERLAYS

605_11_040

MFD Navigation Formats
Figure 11–10–38

NAVIGATION DISPLAYS (CONT'D)

PFD Rose Format

The full compass ROSE format represents the 360° compass card with 45° index marks, overlaid selectable navaids, bearing and course pointers. The indications include course pointers, lateral deviation bar, lateral deviation scale and to/from indicators.

PPOS Present Position Navigation Map

PPOS, displayed on both PFD and MFD, is a present position navigational map with a heading display window. The PPOS map displays geographically positioned FMS symbols, representing active flight plans, airports, waypoints, intersections, NDBs, VORs, VORTACs and holding patterns.

The following overlays can be superimposed on the PPOS map: weather radar, lightning, terrain and TCAS.

The active NAV source, FMS1/FMS2, remains annunciated on the left side of the map, to identify the source of the map. If any navigation source other than FMS1/FMS2 is selected, or if an automatic transition of PRESELECT NAV source to active source occurs during a NAV to NAV capture, the FMS flight plan information will be removed and replaced by the course/deviation display.

FMS PLAN Map

The FMS PLAN MAP format is used during the initial flight plan setup, or to plan a deviation from the flight plan route.

This format always shows true north at the top of the display. Modified FMS flight plan information can be verified by selecting the up or down scroll keys on the FMS CDU. The weather radar, terrain and TCAS cannot be overlaid onto the (static) PLAN map.

PLAN map and TEXT displays are MAP features exclusive to the MFD, and are not available on the PFD navigation field.

Navigation Display Indications

Navigation Source Indications

The PFD displays the active NAV data block information on and beside the full compass ROSE and PPOS Map. The navigation source is selectable from the PFD menu NAV SRC control, the MFD/PFD menu, and the DCP NAV SRC swap button. The current navigation source is always displayed below the airspeed tape.

The navigation sources displayed in the left PFD Menu:

- FMS3 (magenta)
- FMS1 (magenta)
- VOR1 or LOC1 (green)
- FMS2 (yellow – cross-side)
- VOR2 or LOC2 (yellow – cross-side)

NAVIGATION DISPLAYS (CONT'D)

The navigation sources displayed in the right PFD Menu:

- FMS3 (magenta)
- FMS2 (magenta)
- VOR2 or LOC2 (green)
- FMS1 (yellow – cross-side)
- VOR1 or LOC1 (yellow – cross-side)

A preset navigation (PRESET NAV) source selection is displayed below the active navigation data block. Preset navigation source is selectable either by the pilot using the DCP NAV SRC swap button, or automatically controlled by the FMS.

Pushing the NAV SRC swap button will cause the PRESET NAV source to become the new active NAV source, and the active NAV source to become the new PRESET NAV source.

Course Pointer

The course pointer is an arrow that points to the pilot-selected course. When VOR or LOC is the active NAV source, the selected course is set via the CRS selector knob on the FCP. The on-side color is green and cross-side is yellow.

When the FMS is the active NAV source, the associated CRS knob is inactive.

Lateral Deviation Scale (Compass)

The lateral deviation scale has two dots on each side of the course arrow. When in VOR, each dot represents five degrees of deviation. In LOC, each dot represents one degree of deviation.

In FMS the lateral deviation sensitivity is:

Enroute:

- ±5 NM

In terminal area within 30 NM from ARP:

- ±1.0 NM for RNAV approach
- ±1.0 NM for GPS approach (±0.3 NM at the FAF)

Lateral Deviation Indicator (ADI)

If LOC is the preselect or active NAV Source, a lateral deviation indicator is displayed below the ADI. The lateral deviation indicator has two dots on each side of the center portion.

The lateral deviation is displayed as a diamond-shaped pointer against a lateral analog scale. The deviation pointer goes out of view when LOC is no longer the active NAV source.

In case of a LOC failure, the diamond pointer will be removed, and a red boxed LOC will be displayed on the left side of the deviation indicator.

When FMS is the active NAV source, the lateral deviation indicator is also in view for lateral commands to be displayed. The lateral deviation pointer is displayed as an FMS waypoint symbol (magenta).

If the active NAV or PRESET NAV source is missing, the lateral deviation pointer will not be displayed.

NAVIGATION DISPLAYS (CONT'D)

TO/FROM Indicator

The TO/FROM indicator is a small triangle indicating the relative direction of the selected VOR station or FMS waypoint.

The color of the TO/FROM indicator is green for VOR on-side information and yellow for cross-side information. In FMS mode the NAV data is magenta.

Bearing Source and Pointers

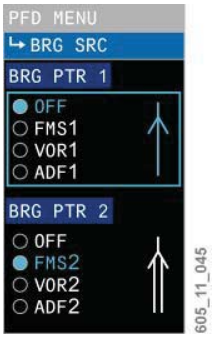
The bearing pointers are selected for display from the PFD Main Menu, BRG SRC submenu. The bearing source and pointers are displayed to the left of the ROSE and PPOS formats.

The pointer for left side sensors (BRG PTR 1) is a cyan single bar arrow, and the pointer for right side sensors (BRG PTR 2) is a white double bar arrow. A valid bearing distance, associated with the bearing source, is also displayed to the right of the bearing icon.

If the selected bearing is also displayed as active NAV source, the bearing distance and ident will not be displayed.

For VOR bearing: The distance will be blank if DME Hold is selected or, when LOC is tuned, the pointer will be removed.

If a VOR bearing is displayed with true heading selected, the bearing pointer will be displayed without correction for magnetic variation, and a white “T” is displayed after the bearing icon.



Bearing Pointer Menu
Figure 11–10–39

Drift Angle Pointer (Track Pointer Display)

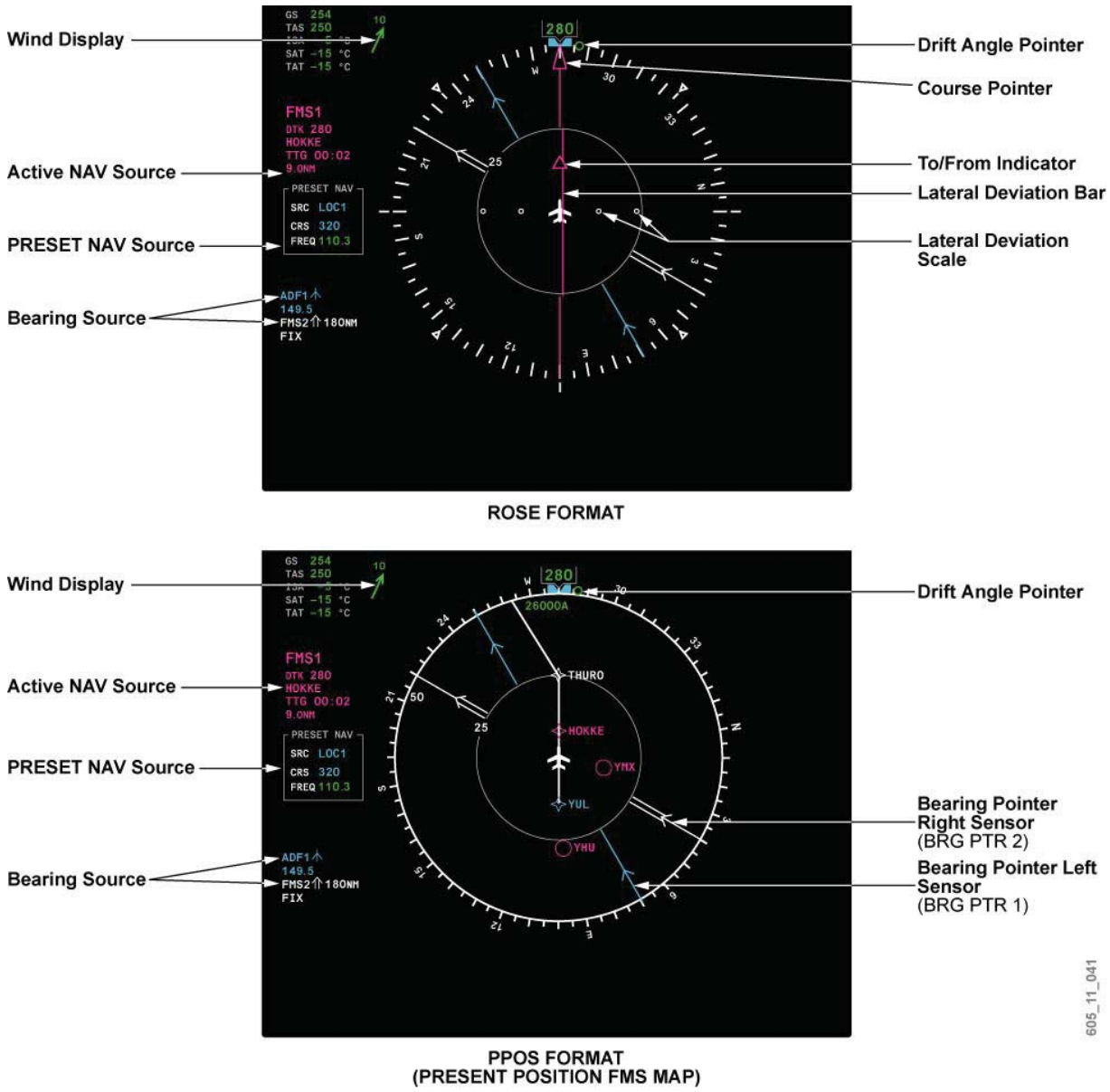
The drift angle pointer (green circle) indicates the aircraft drift angle in relationship to a programmed FMS route. The amount of aircraft drift is indicated by the angular displacement of the green circle from the aircraft heading indicator. The drift angle pointer is green when the on-side FMS is the NAV source.

Wind Display

When FMS-sensed winds are more than 5 knots, a green wind speed magnitude direction arrow and a digital readout are displayed on the left side of the PFD/MFD navigation formats.

The wind is computed by the onside FMS regardless of the active NAV source, and its magnitude values are from 5 to 255 knots.

NAVIGATION DISPLAYS (CONT'D)



Navigation Display Indications
Figure 11–10–40

FMS (VNAV) and ILS (GS) Vertical Deviation Display

If LOC is the preselect or active NAV Source, a glideslope deviation scale is displayed to the left of the altitude tape. The vertical deviation is displayed as a diamond-shaped pointer against a vertical analog scale. The vertical deviation scale goes out of view when LOC is no longer the active NAV source.

In the case of a GS failure, the diamond pointer will be removed, and a red boxed GS will be displayed at the lower end of the scale.

NAVIGATION DISPLAYS (CONT'D)

When the FMS is the active NAV source, the vertical deviation scale is also in view for VNAV commands to be displayed. The VNAV pointer is displayed as an FMS magenta waypoint symbol, or yellow waypoint from cross-side FMS.

In the case of a VNAV failure, the pointer will be removed, and a red boxed VNV will be displayed above the deviation scale.

Flight Path Vector (FPV)

The Flight Path Vector (FPV) symbol indicates the actual flight path vector in space. The lateral position, computed by IRS, represents the angular distance of the aircraft track to the heading. The vertical position represents the climb or descent angle relative to the horizon.

The FPV is displayed by selecting FLT PATH VCTR in the CONFIG submenu of the PFD Menu.

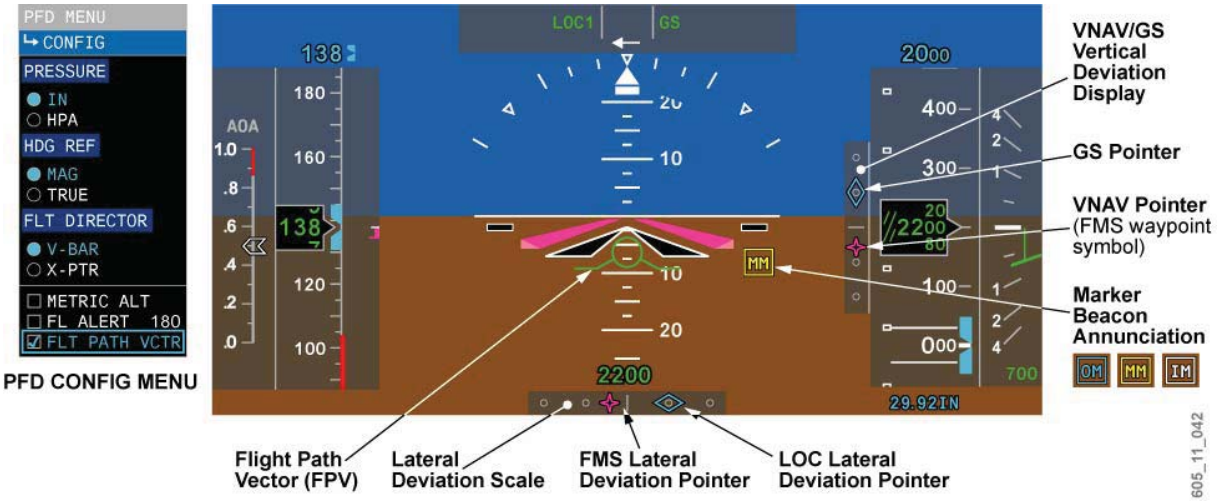
The FPV is limited laterally between the airspeed tape and the altitude tape, and vertically limited between the lateral deviation scale and the FMA.

Maker Beacon Display

On the ADI, the marker beacon is used in conjunction with the ILS, and is displayed to the right of the airplane symbol.

When the aircraft is flying over a marker beacon, the following annunciation is presented:

- Outer marker is a boxed, cyan OM legend (GS intercept approximately 1,400 ft above touchdown).
- Middle marker is a boxed, yellow MM legend (GS intercept approximately 200 ft above touchdown).
- Airway/inner marker is a boxed, white IM legend (GS intercept approximately 100 ft above touchdown).



Navigation Indications on ADI and FLT PATH VCTR Menu Selection
Figure 11–10–41

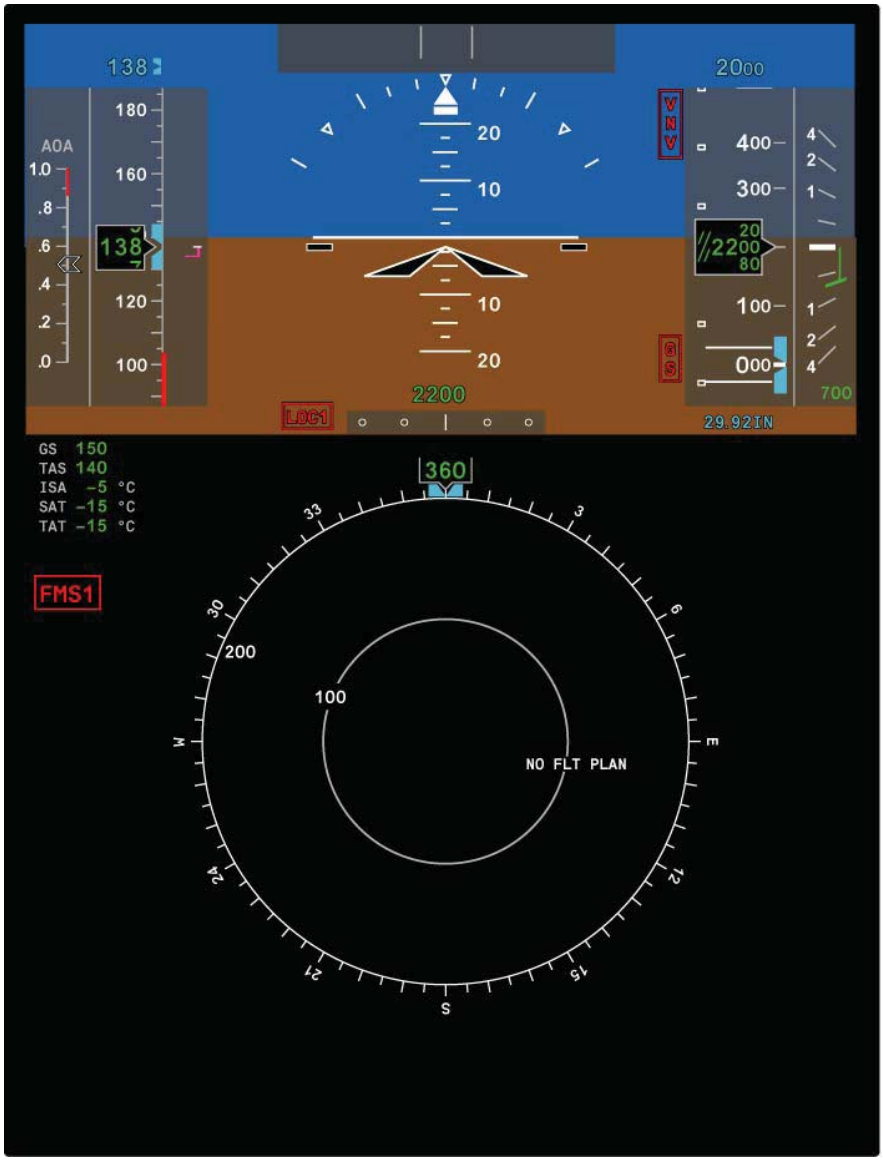
NAVIGATION DISPLAYS (CONT'D)

Navigation Source Warning Flags

A red boxed navigation source flag (VOR, LOC or FMS) is displayed during a failure of the selected NAV source. The navigation display is removed from view when the flag is displayed.

A red boxed GS will be displayed at the lower end of the vertical deviation scale for a GS failure. For an FMS VNAV failure, a red boxed VNV will be displayed above the vertical deviation scale.

In case of a LOC failure, a red boxed LOC will be displayed on the left side of the lateral deviation scale of the ADI.



Navigation Source Warning Flags
Figure 11–10–42

EFIS COMPARATOR MONITOR

Description

Comparators alert the pilots of any disagreement of data between specific systems. Each PFD performs its own software monitoring, and continuously compares its information with the data presented on the other PFD.

When an EFIS comparison disagreement between the PFDs is detected, a flashing yellow data message is presented on the PFD. If, after 5 seconds, the comparison disagreement is still valid, the flashing message is replaced by a steady message, and the **EFIS MISCOMP** caution message is displayed on the EICAS page.

The messages are displayed as long as the comparison error exists. If the comparison monitor fails, the **EFIS COMP INOP** caution message is displayed on the EICAS page.

PFD Comparison Monitor Annunciations

Heading (HDG)

The HDG annunciation is displayed when a difference of more than 6 degrees is detected between each IRS system.

Pitch Attitude (PIT)

The PIT annunciation is displayed when a difference of more than 4 degrees before glideslope capture and 3 degrees after glideslope capture is detected.

Roll Attitude (ROL)

The ROL annunciation is displayed when a difference of more than 4 degrees before glideslope capture and 3 degrees after glideslope capture is detected.

Attitude (ATT)

The ATT annunciation is displayed for a dual axis miscompare (PIT and ROL).

Indicated Airspeed (IAS)

The IAS annunciation is displayed when a difference of more than 10 knots is detected.

Mach Airspeed (MACH)

The MACH annunciation is displayed when a difference of more than 0.03 Mach is detected.

Altitude (ALT)

The ALT annunciation is displayed when a difference of more than 60 feet at sea level is detected. The allowable difference between PFDs increases with increasing altitude.

Localizer (LOC)

The LOC annunciation is displayed when a difference is detected between the two localizer receivers.

EFIS COMPARATOR MONITOR (CONT'D)

*CAT II Excessive Deviation**

When an excessive LOC deviation occurs, the LOC lateral deviation pointer flashes in yellow for the duration of excessive deviation.

Glideslope (GS)

The GS annunciation is displayed when a difference is detected between the two glideslope receivers.

*CAT II Excessive Deviation**

When an excessive GS deviation occurs, the GS vertical deviation pointer flashes in yellow for the duration of excessive deviation.

Radio Altimeter (RA)

The RA annunciation is displayed when the radio altimeters are indicating below 1,000 feet AGL and a difference is detected.

Flight Director (FD)

The FD annunciation is displayed when a difference in pitch command or roll command is detected between the FCCs.

FMS V-Speed (VSPD)

The VSPD annunciation is displayed when a cross-side FMS V-speed difference of more than 2 knots is detected.

NOTE

* Category II is enabled when:

- Left PFD active NAV source is LOC1 and right PFD active NAV source is LOC2, and both sides LOC frequencies are identical and valid;
- Not in BACK COURSE;
- No go-around mode;
- Radio altitude is below 600 feet;
- RA MIN is below 200 feet; and
- Expanded localizer is enabled.

EFIS COMPARATOR MONITOR (CONT'D)

COMPARATOR ANNUNCIATION	COMPARATOR FUNCTION
HDG	Heading
PIT	Pitch
ROL	Roll
ATT	Pitch & Roll
ALT	Altitude
IAS	Airspeed
MACH	Mach
LOC	ILS Localizer Dev
GS	ILS Glideslope Dev
RA	Radio Altitude
FD	Flight Director
VSPD	FMS Vspeed

605_11_044

Comparator Annunciations
Figure 11–10–43

DISPLAY REVERSION

Detailed description of EICAS display reversion is provided in Chapter 3, Aural/Visual Warnings.

Description

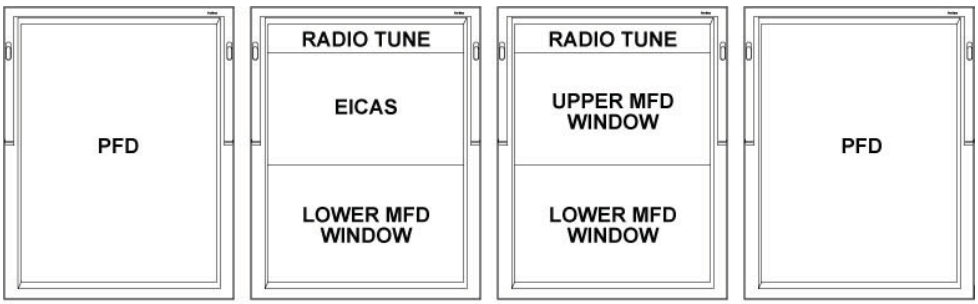
The reversionary panel allows the management of the basic configuration (either PFD or MFD) of the AFDs, and controls the location of the EICAS page.

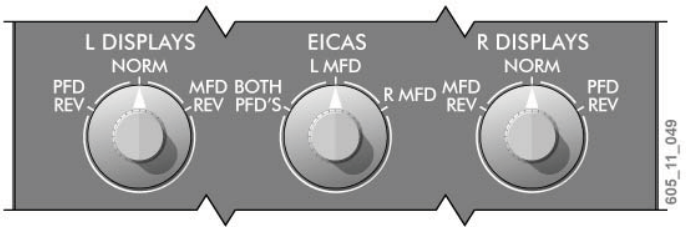
DISPLAY REVERSION (CONT'D)

The reversionary panel can also be used to regain information lost due to an AFD failure. A PFD can be displayed on either the inboard or outboard AFD, and can be configured with EICAS compressed or uncompressed. The compression state of the PFD depends upon the position of the EICAS reversion switch (see Chapter 3, Aural/Visual Warnings).

If an MFD fails, the pilot has the capability of manually selecting engine data on either the remaining MFD, or both of the PFDs (in a compressed format).

If a PFD fails, the remaining MFD can be reverted into a PFD via the appropriate display reversion switch selection. Placing a PFD inboard will not necessarily compress it to show compressed EICAS. Compression of the PFD depends solely on the position of the EICAS selector.





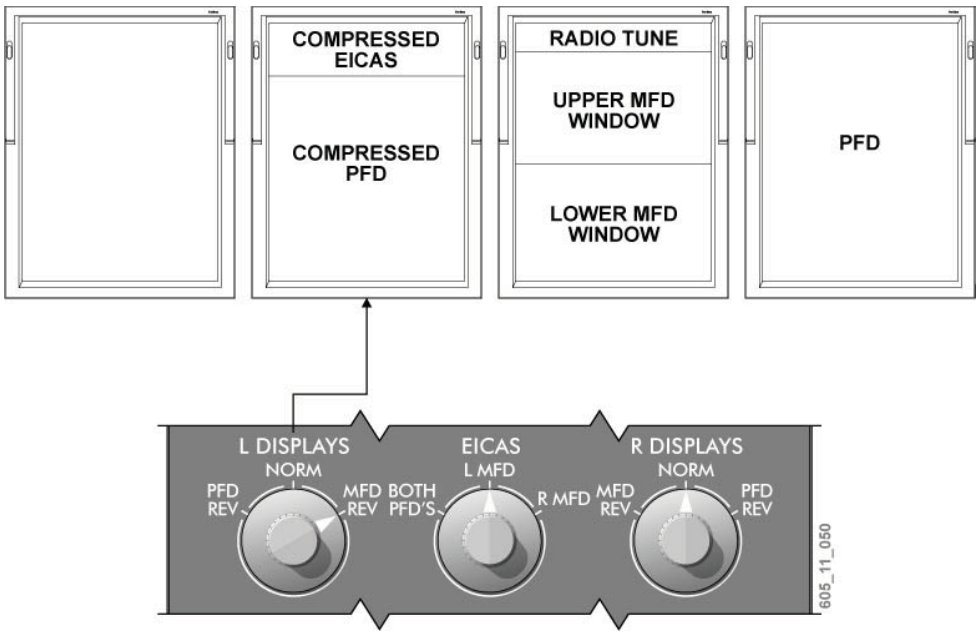
Reversion Normal Switch Selections
Figure 11–10–44

PFD Display Reversion

L-PFD Failure

Turning the L DISPLAYS selector knob to MFD REV reverts the L–MFD to a compressed format, disables the radio tuning, and turns off the L–PFD. The MFD includes a compressed EICAS page and a compressed PFD.

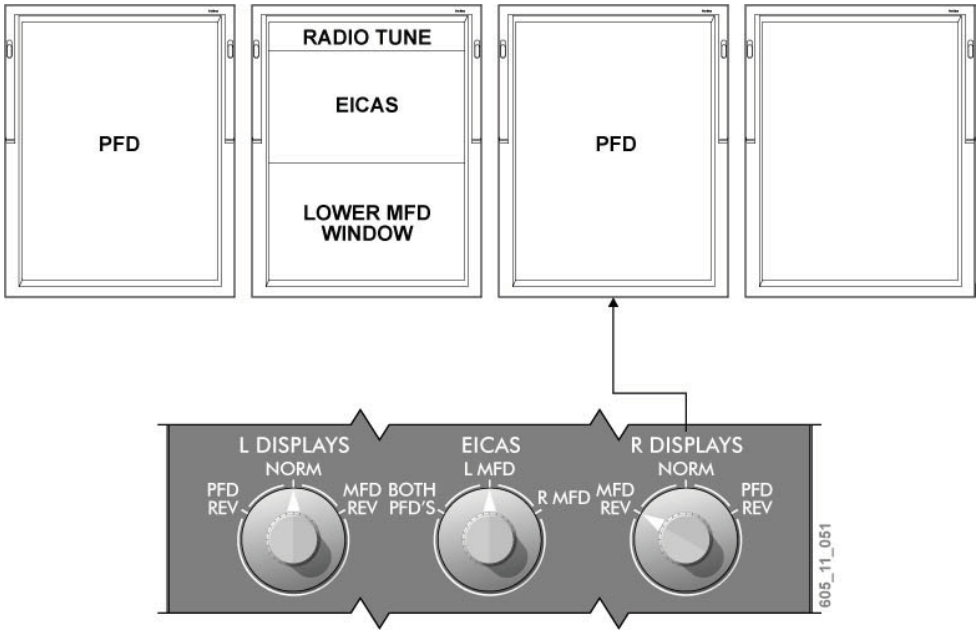
DISPLAY REVERSION (CONT'D)



Reversion L–PFD Failure
Figure 11–10–45

R-PFD Failure

Turning the R DISPLAYS selector knob to MFD REV reverts the R–MFD to a PFD format, disables the radio tuning, and turns off the R–PFD. Maintenance and checklist functionality are also lost.



Reversion R–PFD Failure
Figure 11–10–46

DISPLAY REVERSION (CONT'D)

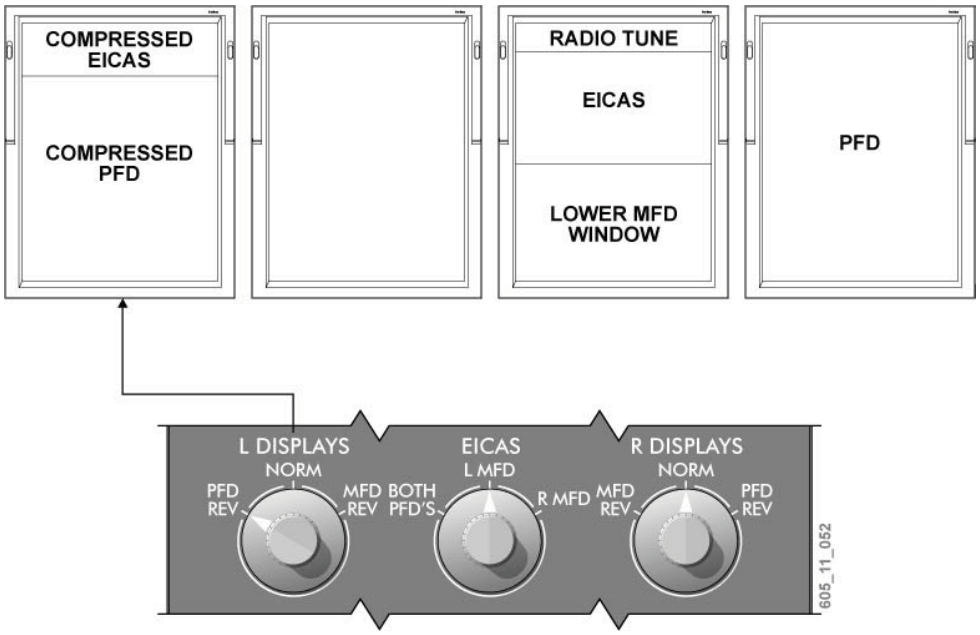
MFD Display Reversion

L-MFD Failure

When the L-MFD fails, EICAS data is automatically presented on the R-MFD, and radio tuning is lost until PFD is reverted.

Turning the L DISPLAYS selector knob to PFD REV reverts the L-PFD to a compressed format and turns off the L-MFD. The PFD includes a compressed EICAS page and a compressed PFD.

When compressed, the L-PFD can display a SUMMARY page (set via DCP FRMT pushbutton).



Reversion L–MFD Failure
Figure 11–10–47

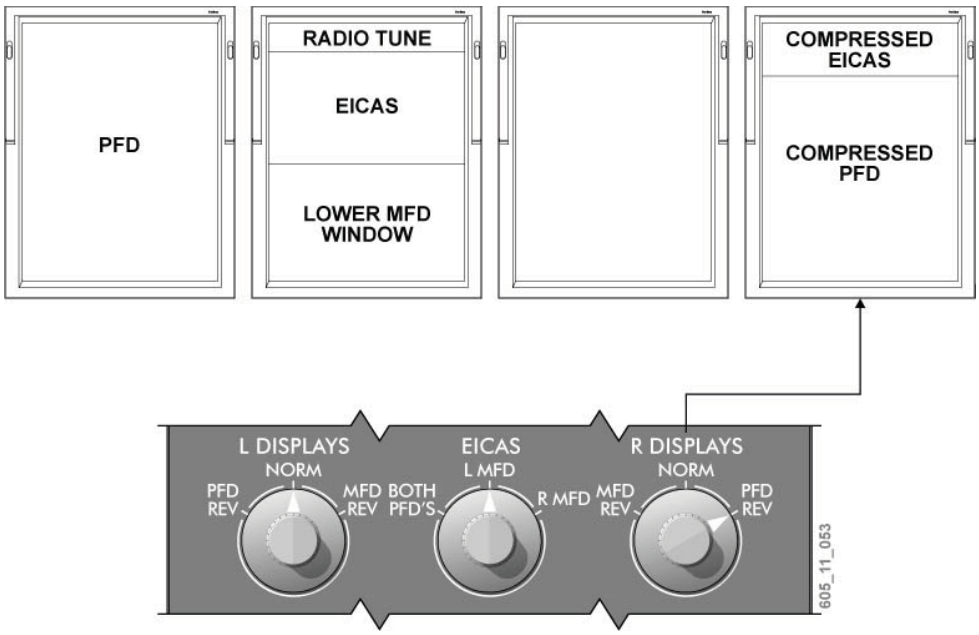
R-MFD Failure

When the R–MFD fails, radio tuning is lost until PFD is reverted.

Turning the R DISPLAYS selector knob to PFD REV reverts the R–PFD to a compressed format and turns off the R–MFD. The PFD includes a compressed EICAS page and a compressed PFD.

When compressed, the R–PFD can display a SUMMARY page (set via DCP FRMT pushbutton). Maintenance and checklist functionality are also lost.

DISPLAY REVERSION (CONT'D)



Reversion R–MFD Failure
Figure 11–10–48

STANDBY FLIGHT INSTRUMENTS

Description

The standby flight instruments are comprised of a self–contained Thales model no. J42551AA LCD integrated standby instrument (ISI) and a standby compass.

The standby flight instruments are used as an alternative source of flight and navigation data, or as a cross–check to the electronic flight instrument system.

Integrated Standby Instrument (ISI)

The integrated standby instrument (ISI) replaces the 3 conventional standby flight instruments (ADI, altimeter and airspeed). In addition, the ISI provides the flight crew with:

- Slip/skid indicator;
- V_{MO}/M_{MO} indications
- MACH number;
- Barometric unit in inches and/or hectopascals;
- Altitude in feet and meters;
- ILS deviation scales; and
- Static source error correction (SSEC).

The ISI receives air data information from the standby pitot static system (P3 and S3). The ISI receives electrical power from the DC ESS BUS.

An internal inertial measurement unit measures the rotation speed and acceleration, in order to compute and display the attitude (pitch and roll).

STANDBY FLIGHT INSTRUMENTS (CONT'D)

An internal pressure measurement unit measures the total and static pressures, in order to compute and display the altitude and the airspeed, taking into account the static source error correction (SSEC) law tables.

A yellow SSEC flag may be displayed if the ISI is not able to compute A/C airspeed and altitude, by taking into account SSEC law correction tables.

Localizer and glideslope data comes from VHF NAV 1. The localizer and glideslope pointers and scales do not come into view until a valid ILS frequency is received. If the localizer or glideslope data becomes invalid, the appropriate red (LOC or GS) flag comes into view, and the corresponding pointer and scale are removed.

ISI Alignment

When the ISI is first energized, a self–test is initiated (10 to 20 sec) for airspeed and altitude, then an alignment is in progress (attitude) with an ALIGNING flag in view. After approximately 70 seconds, the flag is removed from view and ISI becomes operational.

ISI Alignment (Attitude)
Figure 11–10–49

ISI Functions

The brightness control buttons (+) and (–) provide adjustment independent of the instrument panel lighting.

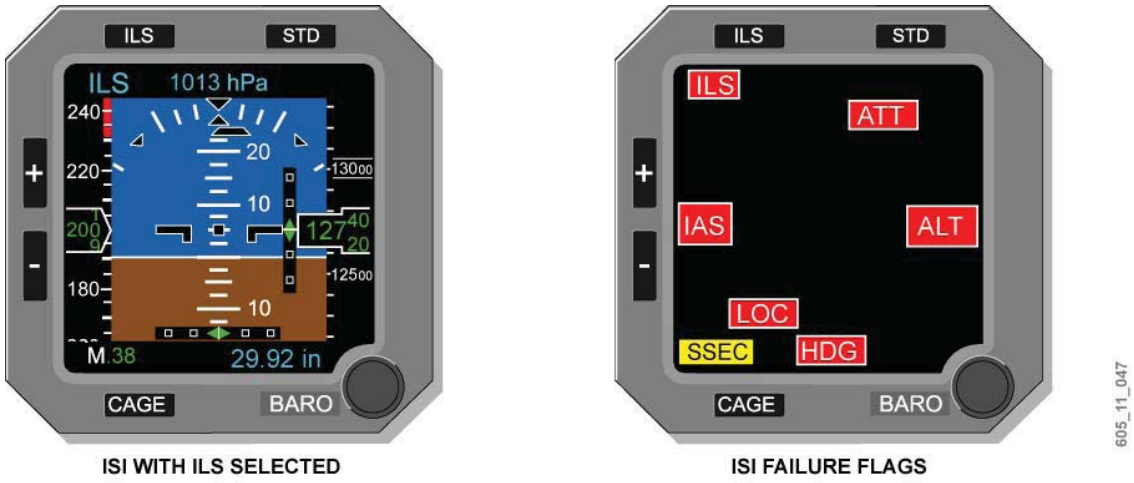
The cage button resets the attitude to zero when depressed for more than two seconds.

STANDBY FLIGHT INSTRUMENTS (CONT'D)

The standard (STD) pushbutton switches the altimeter display from standard pressure to barometric (BARO) pressure. The rotary BARO knob allows for barometric altimeter adjustment.

The ILS is a multiple-press pushbutton to select or deselect ILS front-course and localizer back-course (BCRS).

Annunciation for both ILS and BCRS is presented on the top left corner of the display as a green ILS or a green B/C.



ISI WITH ILS SELECTED

ISI FAILURE FLAGS

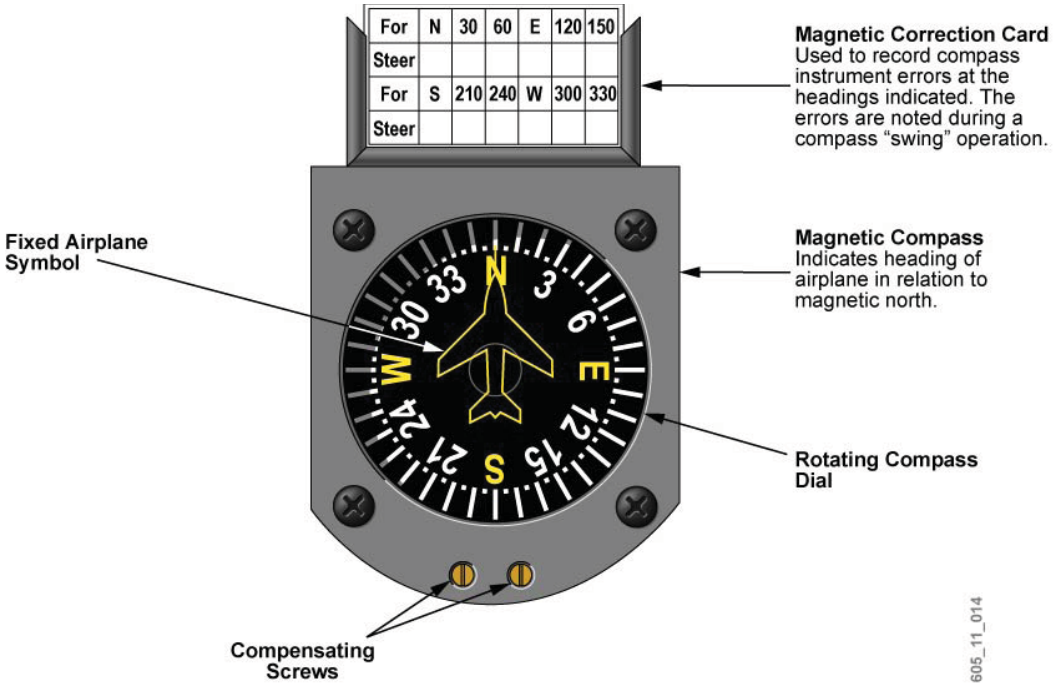
ISI Functions
Figure 11–10–50

Standby Magnetic Compass

The standby compass is independent, and does not interface with other systems. It is a self-contained, dry compass which uses eddy current damping to prevent overshooting. A miniature aircraft pointer indicates aircraft heading, in relation to magnetic north, on a rotating vertical compass card.

A compass correction card, mounted above the instrument, is used to record the values that must be added to or subtracted from the compass indications, in order to correct for the influence of magnetic materials contained in the aircraft, and magnetic fields from the avionics systems near the compass.

STANDBY FLIGHT INSTRUMENTS (CONT'D)



Standby Magnetic Compass
Figure 11–10–51

CLOCK/CHRONOMETER (GPS-SYNCHRONIZED)

Description

A Smiths GPS clock/chronometer, model no. SR261902, is installed on the center of the instrument panel just below the ISI.

The clock is comprised of an LCD display, divided into three segments:

- The upper segment provides the flight time, in hours and minutes, from 00:00 to 99:59.
- The middle segment provides either Coordinated Universal Time (UTC) (in hours, minutes, and seconds, from 00:00:00 to 23:59:59), local time (LOC) (in hours, minutes, and seconds, from 00:00:00 to 23:59:59) or date (in day, month and year).
- The lower segment provides a digital presentation of chronograph time (in minutes and seconds, from 00:00 to 99:59).

The clock will receive and process an external GPS time source when in GPS mode, provided the signal is valid. If the GPS signal is not valid, or the clock is placed in MANUAL mode, it will use its own internal time base.

While in GPS mode, the clock uses the external GPS time to synchronize its internal time base.

Flight Time (FLT/RST)

Flight time (FLT) represents the time that the aircraft is airborne, as determined by the status of the in–air/on–ground discrete input. The FLT starts counting from zero (00:00) when the on–ground/in–air input transitions from ground to airborne. The FLT stops counting when the on–ground/in–air input transitions from airborne to ground.

CLOCK/CHRONOMETER (GPS-SYNCHRONIZED) (CONT'D)

The FLT resets to 00:00 by pressing the FLT RST pushbutton for a period of 2 or more seconds.

Chronograph (CHR)

The chronograph (CHR) begins counting upon depression of the CHR pushbutton. The first press starts the CHR from zero (00:00). The second press stops the CHR timer. A third press deletes the display and resets the CHR timer.

GPS/MAN

GPS

The clock uses external GPS time when the user has selected GPS mode. GPS mode is indicated by an illuminated GPS indication on the LCD display.

MAN

The clock uses its internal time base when the user has selected manual mode. Manual mode is indicated by the absence of the GPS indication on the LCD display.

MODE

The MODE pushbutton provides two functions:

- UTC/LOC/Date display mode switching; pressing the mode pushbutton will toggle between the UTC (Coordinated Universal Time), LOC (local time) and date displays.
- UTC/LOC/Date set modes; pressing and holding the mode pushbutton for more than two seconds, the clock will enter the UTC, LOC and date set mode.

Clock/Chronometer (GPS-Synchronized)
Figure 11–10–52

EICAS MESSAGES

MESSAGE	MEANING
EFIS MISCOMP	A comparator miscompare has been detected.
EFIS COMP INOP	Comparator information for one or both PFDs is not available.
PFD X-TALK FAIL	The PFDs have lost the ability to cross-talk information.
IRS 3 ALIGNING	IRS 3 is in align mode or ATT mode with no IRS 3 INOP status message.
IRS 1 (2) (3) POWER FAULT	Indicates the respective IRS DC power supply failed.
IRS 1 (2) (3) IN ATT	Indicates the respective IRS is operating in attitude mode.
IRS 3 INOP	Indicates a failure of IRS 3.
MFD X-TALK FAIL	The MFDs have lost the ability to cross-talk information. Cross-radio tuning from the MFD may be inoperative.

POWER SUPPLY AND CIRCUIT BREAKER SUMMARY

SYSTEM	SUB-SYSTEM	CB NAME	BUS BAR	CB PANEL	CB LOCATION	NOTES
Standby Instruments	Standby Instruments	ISI	DC ESS	4	D7	
	Air Data Computer	ADC 2 STBY	DC BATT	1	P6	
Pilot's Flight Data	Primary Flight Display	PFD 1	DC ESS	4	C1	
	Multi-Function Display	MFD 1	DC BATT	2	Q4	
	Display Control Panel	DCP 1	DC ESS	4	C2	
	Cursor Control Panel	CCP 1	DC BATT	2	Q2	
	Multi-Function Display Heater	MFD 1 HTR	DC BUS 1	1	H4	
	Primary Flight Display Heater	PFD 1 HTR	DC BUS 1	1	H3	
	Air Data Computer	ADC 1	DC ESS	4	C6	
	Airplane Clock	STANDBY CLOCK	DC BATT DIRECT	6	A2	
Copilot's Flight Data	Primary Flight Display	PFD 2	DC BUS 2	2	L1	
	Multi-Function Display	MFD 2	DC BUS 2	2	L2	
	Display Control Panel	DCP 2	DC BUS 2	2	L4	
	Cursor Control Panel	CCP 2	DC BUS 2	2	L3	
	Multi-Function Display Heater	MFD 2HTR	DC BUS 2	2	L6	
	Primary Flight Display Heater	PFD 2 HTR	DC BUS 2	2	L5	
	Air Data Computer	ADC 2	DC BUS 2	2	K6	
	Airplane Clock	CLOCK	DC ESS	4	C7	