

12.12 (ATA 31) INDICATING/RECORDING SYSTEMS

12.12.1 Flight Instruments

12.12.1.1 Introduction

The Dash 8-Q400 aeroplane has an array of flight instruments to allow for full certification under day and night VFR and IFR operations.

12.12.1.2 General

The Flight Data Processing System (FDPS) acquires and sends data to the Electronic Instrument System (EIS). The EIS displays primary flight data, navigation, engine and system parameters on five identical and interchangeable active matrix liquid crystal Display Units (DU). The five DU are designated as follows (Figure 12.12-1):

- Pilot's and Copilot's Primary Flight Displays (PFD1, PFD2)
- Pilot's and Copilot's Multi Function Displays (MFD1, MFD2)
- Engine and System Integrated Display (ED)

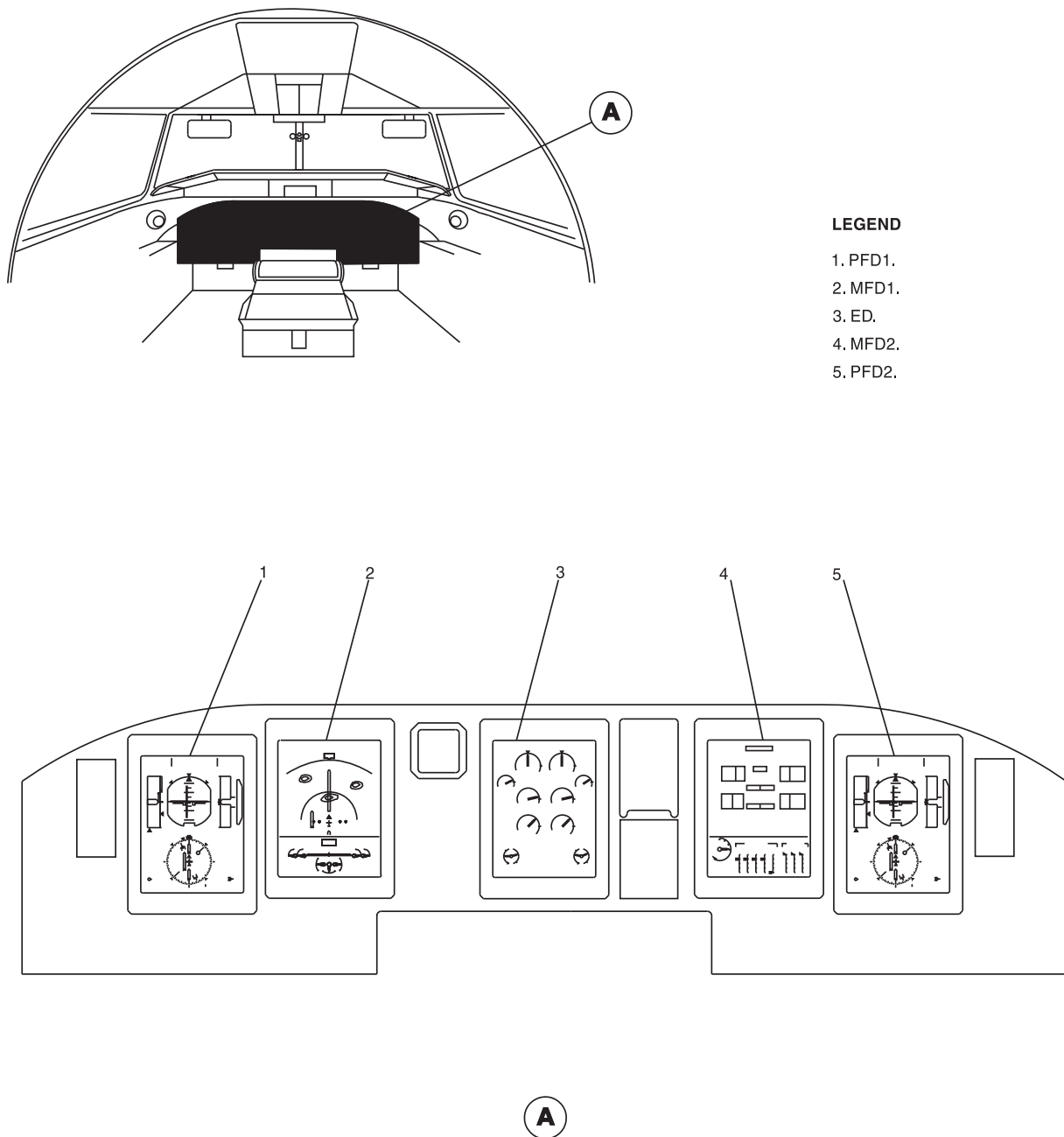
The two PFDs and the two MFDs comprise the Electronic Flight Instrument System (EFIS). The EFIS DU display the following flight instruments:

- Airspeed indicator (ASI)
- Altimeter
- Inertial Vertical Speed Indicator (IVSI)
- Electronic Attitude Director Indicator (EADI)
- Electronic Horizontal Situation Indicator (EHSI)
- Radar Altimeter

Additional instruments located on the instrument panels and glareshield include:

- Integrated Electronic Standby Instrument
- Two digital clocks

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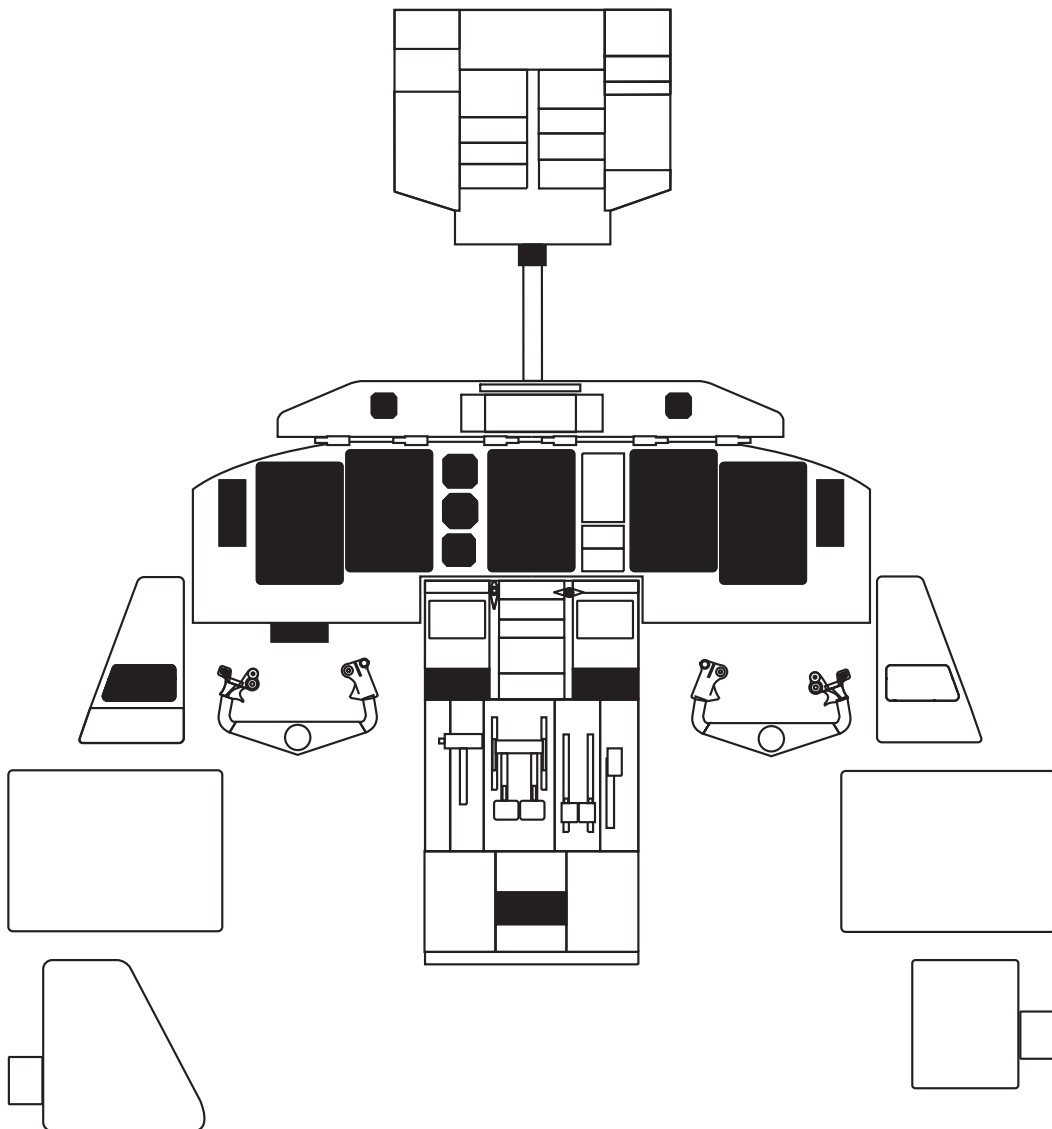
Figure 12.12-1 Pilot's and Copilot's Flight Instrument

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The following systems supply critical data to the flight instruments:

- Air Data System (ADS)
- Attitude Heading Reference System (AHRS)
- Standby Air Data System
- Standby Attitude Heading Reference System

12.12.1.3 Controls and Indications - Flight Instruments



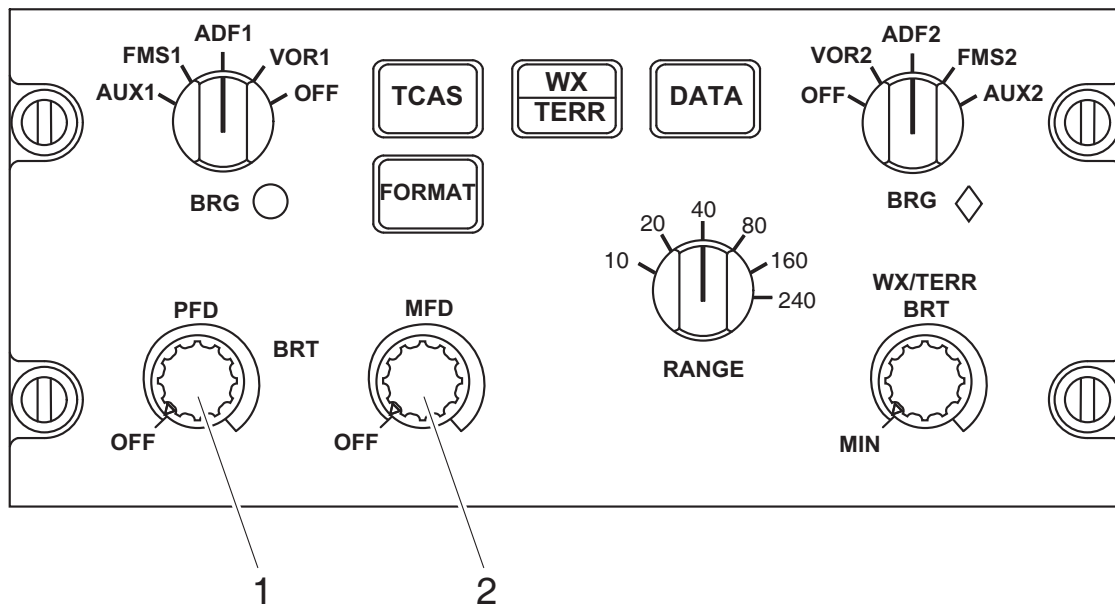
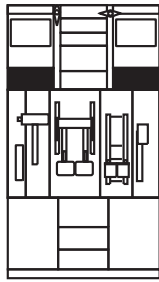


Figure 12.12-2 EFIS Control Panel

EFIS CALLOUTS PERTAINING TO FLIGHT INSTRUMENTS

1. **PFD BRIGHTNESS CONTROL KNOB ROTATE (rotary action, detent at OFF)**
ROTATE - manually adjusts brightness of respective side PFD
OFF - Display Unit (DU) goes blank
2. **MFD BRIGHTNESS CONTROL KNOB (rotary action, detent at OFF)**
ROTATE - manually adjusts brightness of respective side MFD
OFF - Display Unit (DU) goes blank

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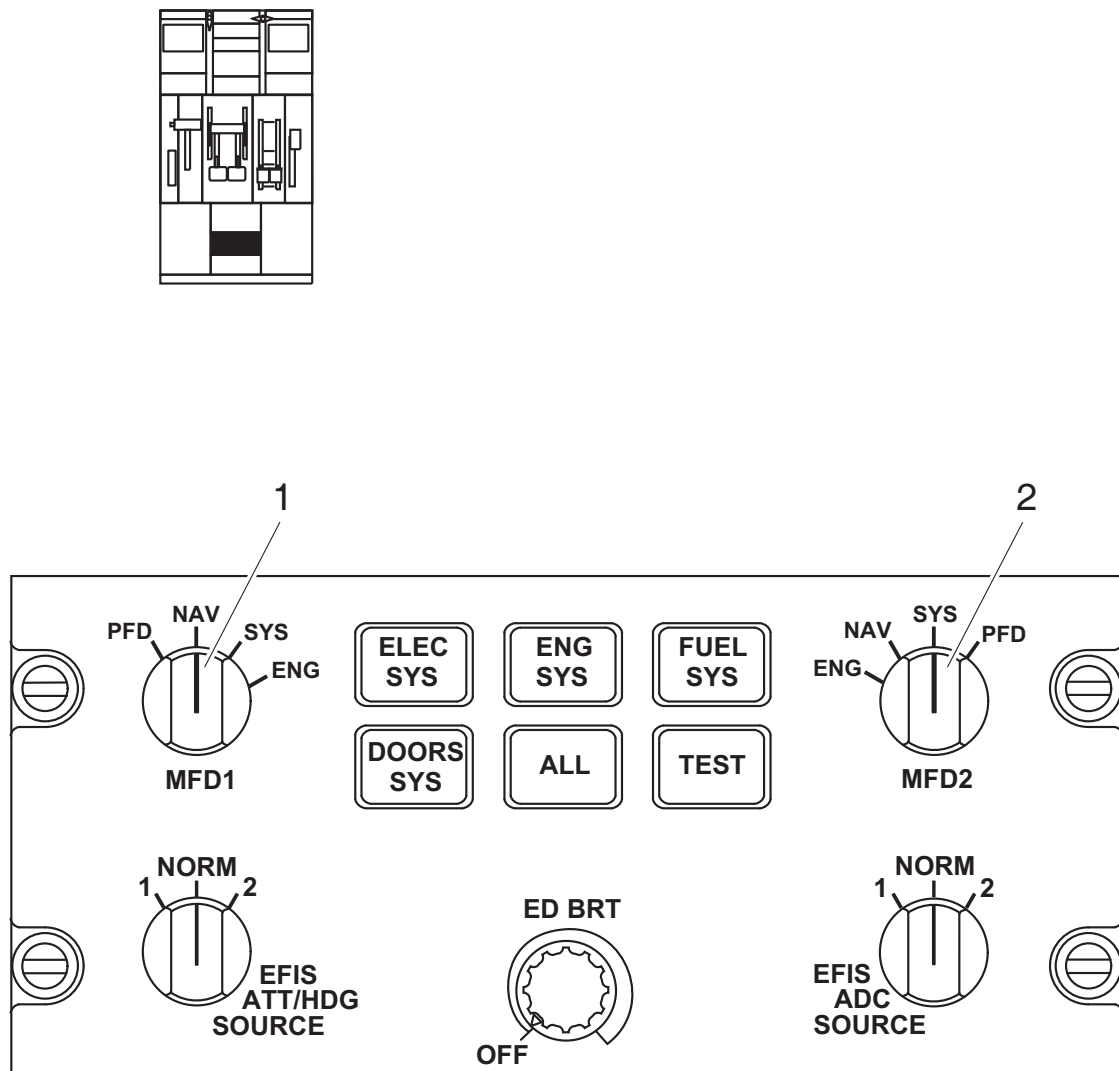


Figure 12.12-3 Engine and System Integrated Display Control Panel (1 of 3)

ESCP CALLOUTS

1. MFD 1 SELECTOR (Rotary Action, 4 Position)

TURN - selectable positions are PFD, NAV, SYS, ENG

- ESCP provides the pilot with the ability to select any page on the MFD1 and to control the EIS reversion after display failures

PFD - selects PFD information to the adjacent MFD

- causes AVAIL (white) to appear in the center of the PFD

NAV - MFD displays a NAV page in the ARC format by default

- FULL format, WX, MAP, and TCAS information may also be selected using the EFIS control panel

SYS - the electrical system page (default) is displayed on the MFD even if the opposite MFD shows another system page

- the display of a given system page is achieved by pressing the relevant pushbutton of the ESCP

ENG - displays a digital engine page on the MFD

- same indications as on the primary ED except that A/F and OSG test messages are not displayed
- if both MFDs are failed or when no MFD is selected to SYS mode, pressing and holding down on a dedicated system page key allows the appropriate System Page to be displayed in a composite system format on the Engine Display, replacing the ED format
- the ED displayed again when the key is released. If the All key is pressed, the ED remembers the previous selected system page, and steps through the next page when ALL key is pressed
- MFD 1 selector is still operative after an ESCP power loss

2. MFD 2 SELECTOR (rotary action, 4 position)

- same as MFD 1 reversion selector, except:
 - MFD 2 selector is not operative after an ESCP power loss

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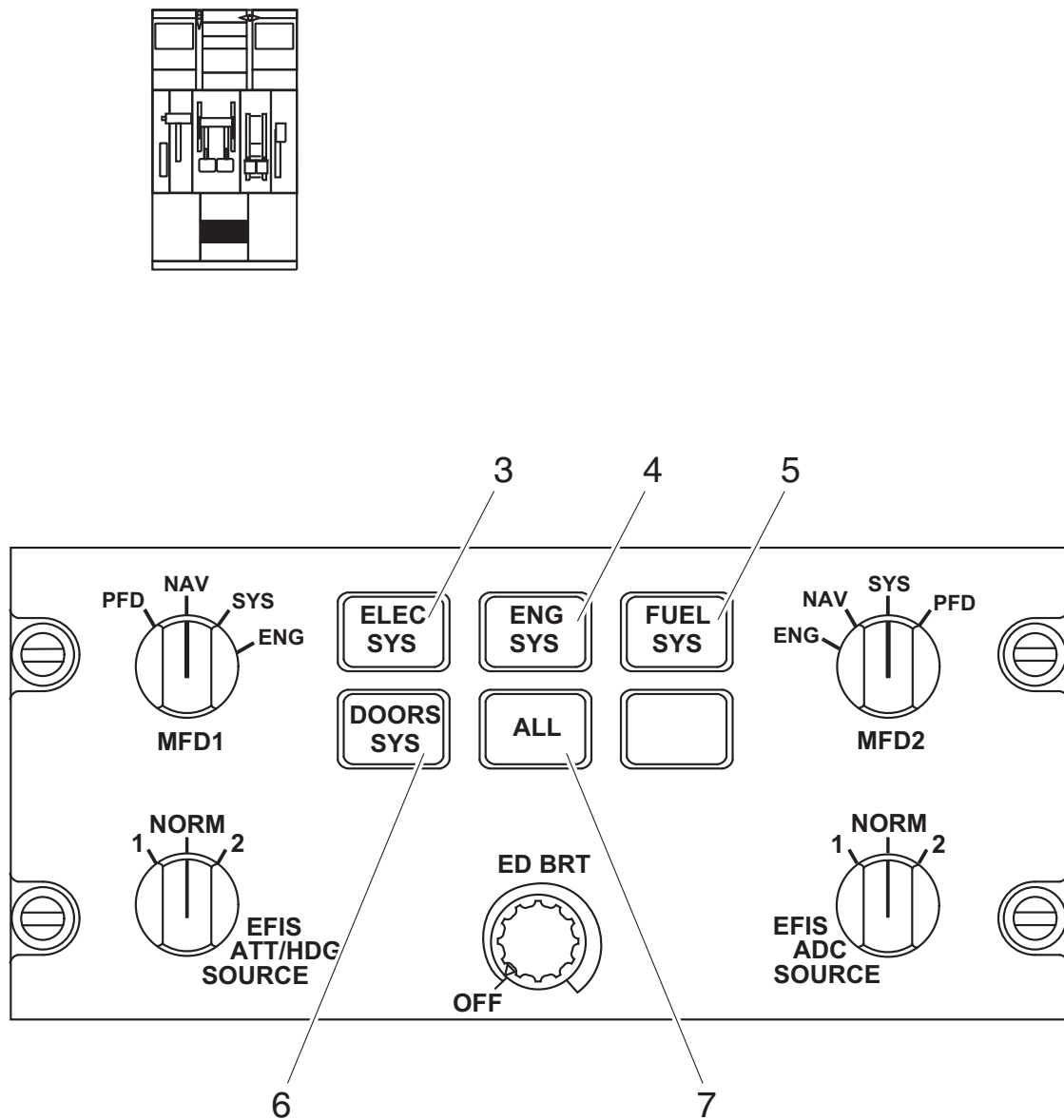


Figure 12.12-4 Engine and System Integrated Display Control Panel (2 of 3)

ESCP CALLOUTS (CONT'D)

3. ELEC SYS PUSHBUTTON (momentary action)

PUSH - provides a display of the electrical system page on the MFD (upper area) with MFD set at SYS

- there is no action with another push

4. ENG SYS PUSHBUTTON (momentary action)

PUSH - provides a display of the composite engine system page on the MFD (upper area) with MFD set at SYS

- there is no action with another push

5. FUEL SYS PUSHBUTTON (momentary action)

PUSH - provides a display of the fuel system page on the MFD (upper area) with MFD set at SYS

- there is no action with another push

6. DOORS SYS PUSHBUTTON (momentary action)

PUSH - provides a display of the door system page on the MFD (upper area) with MFD set at SYS

- there is no action with another push

7. ALL PUSHBUTTON (momentary action)

PUSH - if MFD is set to SYS, repeated selection of the ALL push-button causes the MFD (upper area) display to cycle as follows: ENG, FUEL, DOORS, ELEC, ENG, etc.

NOTE: System or ALL pushbuttons are also operative when both MFDs are failed or when no MFD is selected to SYS mode. In this case:

- continuous pressing on the pushbutton displays the selected system page on ED/DU if operative
- releasing the push-button removes the current system page to restore the basic ENG page
- ALL pushbutton is still operative after an ESCP power loss

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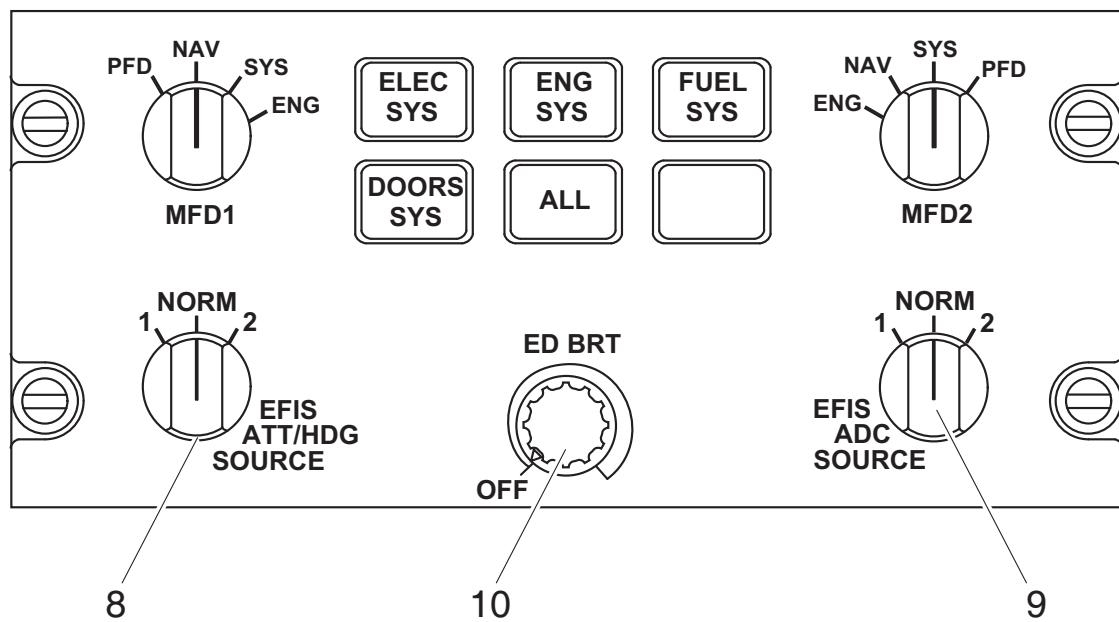
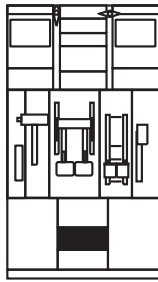


Figure 12.12-5 Engine and System Integrated Display Control Panel (3 of 3)

ESCP CALLOUTS (CONT'D)

8. EFIS ATT / HDG SOURCE REVERSION SELECTOR (three position, rotary action)

- the ESCP provides the crew with the ability to control the AHRS source reversion on EFIS

NORM - each side receives their own attitude source:

- AHRS 1 for pilot side
- AHRS 2 for copilot side

1, 2 - selection from the NORM position either to side1 (pilot side) or to side 2 (copilot side), indicates cross side AHRS source of attitude and heading is displayed

- when both sides are selected to the same attitude source, ATT1/HDG1 or ATT2/HDG2 annunciation is displayed in yellow on each PFD and NAV pages

9. EFIS ADC SOURCE REVERSION SELECTOR (three position, rotary action)

- ESCP provides the crew with the ability to control the ADC source reversion on EFIS

NORM - each side receives their own air data source:

- ADC 1 for pilot side
- ADC 2 for copilot side

1, 2 - selection from the NORM position either to side1 or to side 2, indicates crossed air data source of attitude and heading is displayed

- when both sides are selected to the same air data source, ADC1 or ADC2 annunciation is displayed in yellow on each PFD

10. ED BRIGHTNESS (rotary selector, detent at off)

ROTATE - adjusts brightness of ED

OFF - ED data will automatically revert to MFD1 when the ED/DU is OFF or not valid for more than 1 second and if:

- MFD1 rotary switch is selected to NAV or SYS position, and
- IAS from ADC1 is above 50 kts or is invalid

- when an ED automatic reversion has been performed, the ED image will remain on the MFD even if the ED/DU becomes valid again
- the automatic reversion is cancelled as soon as the pilot operates the MFD1 rotary selector

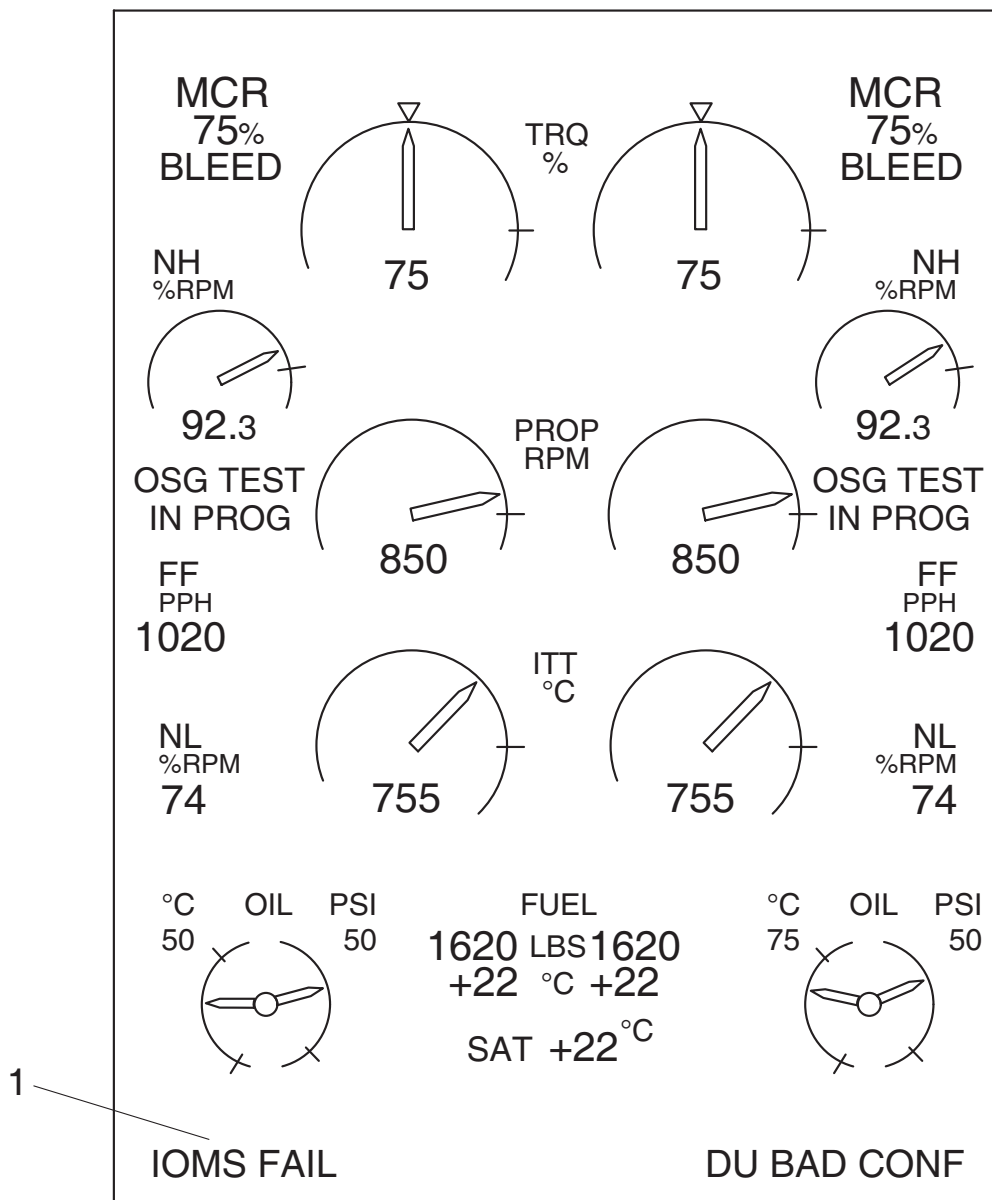
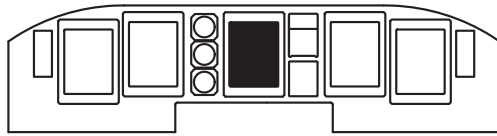


Figure 12.12-6 Avionics Advisory Message Engine Display Panel (1 of 2)

ED CALLOUTS PERTAINING TO FDPS

1. IFC MESSAGES (white)

- the following messages are classified in decreasing priority level. The message with the highest priority appears on the left part of the bottom line

IOPx FAIL message (NO DISPATCH) (x=1 or 2 or S if both are concerned) - appears when IOP1 or IOP2 are confirmed failed

- the AVIONICS caution light will come on as well (on ground only)

IOP BAD CONF message - appears when a bad aircraft configuration is detected by either IOP

- the message can only be activated on ground after a power-up. No dispatch will be authorized with such a message and the AVIONICS caution light will come on as well (on ground only)

IOMx FAIL message (x=1 or 2 or S if both are concerned) appears when IOMx status is set to fail by IOPx, upon severe failure of the I/O Module

- no dispatch will be authorized with such a message and the AVIONICS caution light will come on as well (on ground only)

WTGS FAIL message - appears when WTGx status is set to fail by both IOPs, upon total failure of the Warning Tone Generator. No dispatch will be authorized with such a message and the AVIONICS caution light will come on as well (on ground only)

WTGx FAIL message (x=1 or 2) - appears when WTGx status is set to fail by both IOPx, upon failure of the Warning Tone Generator x

- no dispatch, caution light on ground only

WOW/IOPx FAIL message (x=1 or 2 or S if both are concerned)

- appears when IOPx detects a failure leading to a discrepancy between Main and Nose Weight On Wheel signals coming from PSEU
- the message will be displayed during ground stop phase only
- no dispatch, caution light on ground only

GPWS I/F FAIL message - appears when GPWS can not be considered operative

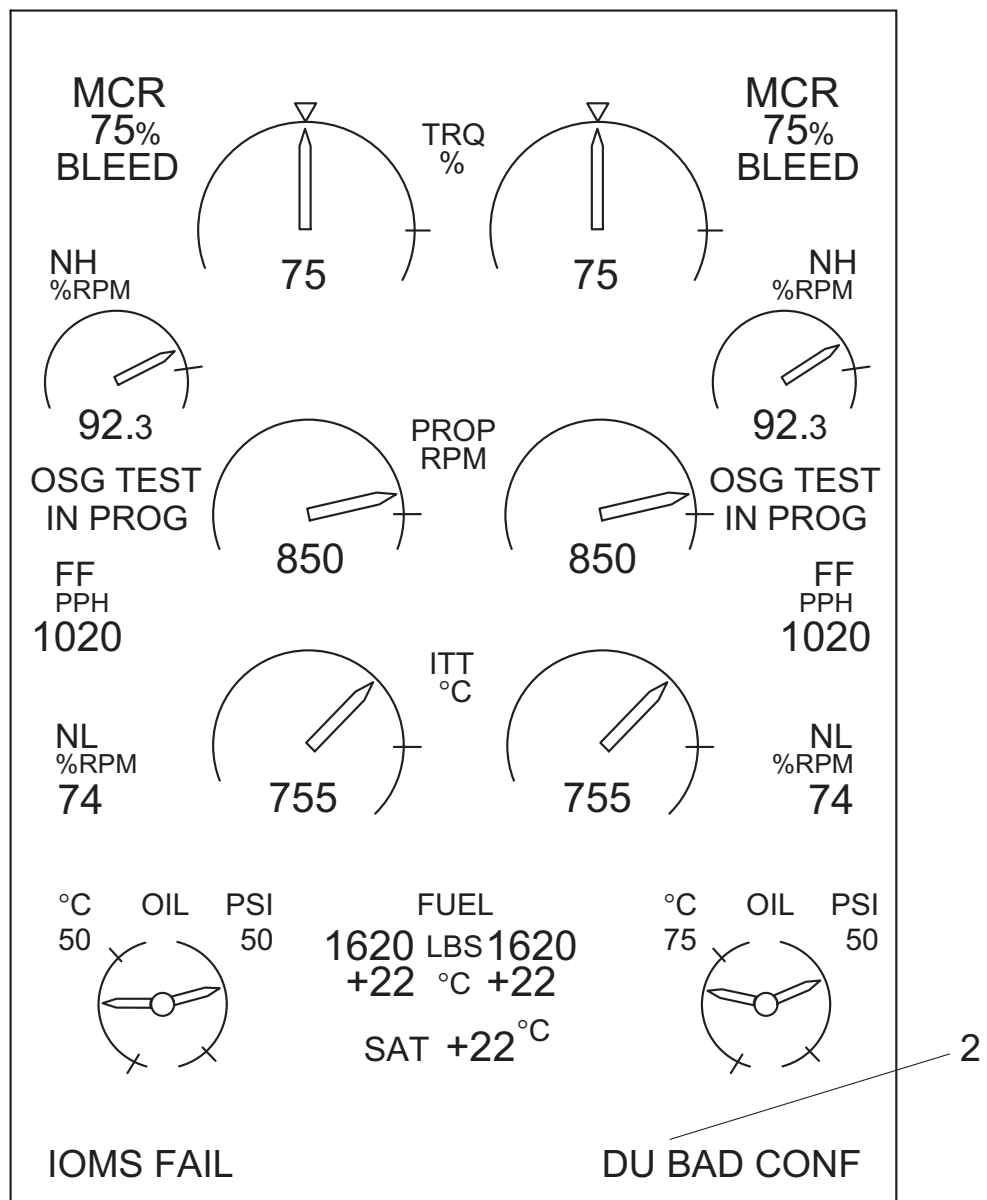
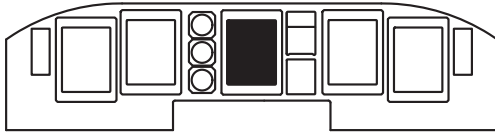


Figure 12.12-7 Avionics Advisory Message Engine Display Panel (2 of 2)

ED CALLOUTS PERTAINING TO FDPS (CONT'D)

2. DISPLAY MESSAGES (white)

- the following messages are classified in decreasing priority level. The message with the highest priority appears on the right part of the bottom line

DU BAD CONF message - appears whenever a bad or inconsistent aircraft configuration is detected by a display. For information, the message can only be activated on ground after a power-up. No dispatch will be authorized with such a message and the AVIONICS caution light will come on as well (on ground only)

FANS FAIL message - appears in flight when at least 2 fans do not run, or on ground when at least 2 fans do not run and are not inhibited by the thermal switch #1 or #2. No dispatch will be authorized with such a message and the AVIONICS caution light will come on as well (on ground only)

ED MON FAIL message - appears when the active ED critical parameters are not monitored by any other display. Dispatch of the aircraft is not allowed and the AVIONICS caution light will come on as well (on ground only)

PFDx MON FAIL message (x=1 or 2 or S if both are concerned) - appears when the PFDx critical parameters is not monitored by any other display. Dispatch of the aircraft is not allowed and the AVIONICS caution light will come on as well (on ground only)

HOT DISPLAYS message - appears when at least 2 displays declare an overheat status. No dispatch will be authorized if such a message persists while cabin temperature is normal, and the AVIONICS caution light will come on as well (on ground only)

HOT DISPLAY message (display = PFD1, MFD1, ED, MFD2 or PFD2) - dispatch = same HOT DISPLAYS

LINK FAIL - means that failure that could occur to that display are no more received and displayed by the active ED. As the dispatch of the aircraft may be authorized for a limited period of time according to MEL, the message will be displayed during ground stop phase only

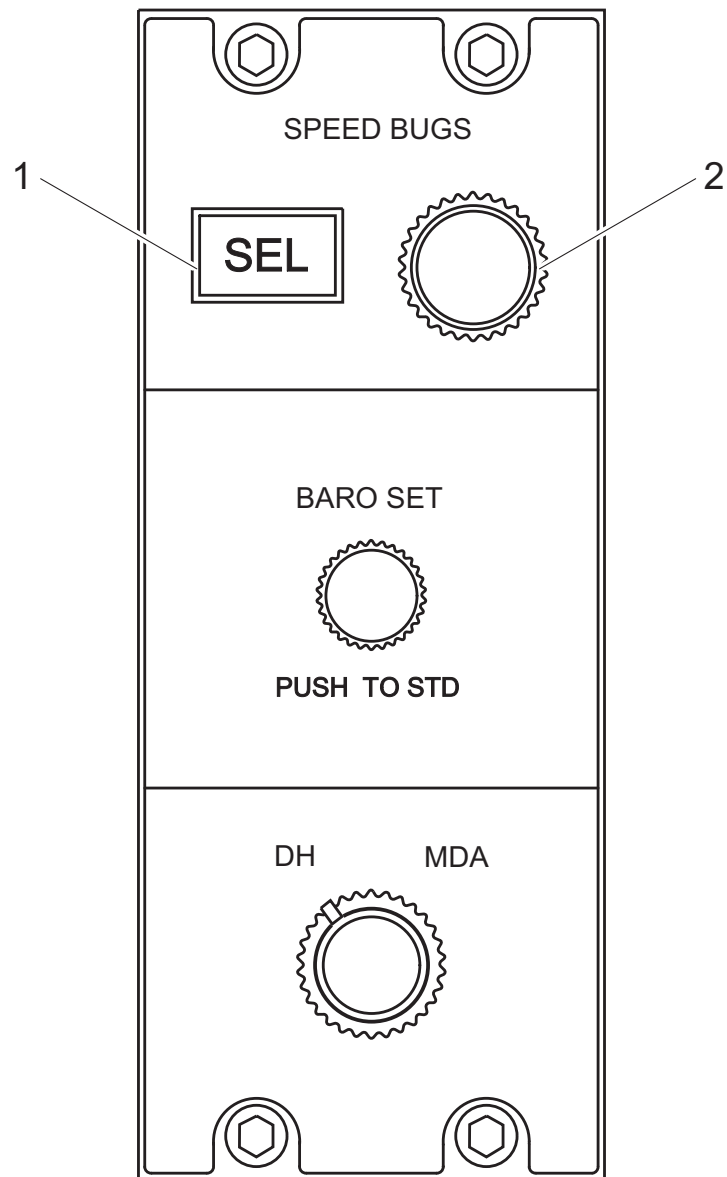
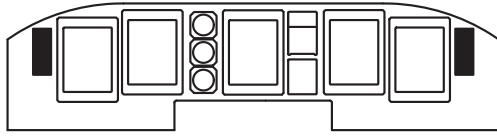


Figure 12.12-8 Index Control Panel (ICP) (1 of 2)

INDEX CONTROL PANEL (ICP) CALLOUTS

1. SEL SPEED BUG index PUSHBUTTON (momentary action)

PUSH - allows pilot to select up to 5 speed bugs on the ASI scale which include:

- V_1 (1)
- V_R (R)
- V_2 (2)
- #1 (solid cyan)
- #2 (outline cyan)
- V_1 , V_R , V_2 can only be selected on ground below 50 kts
- when the index bugs are outside the ASI tape, they are not shown
- V_1 , V_R are removed after takeoff and V_2 is removed at $V_2 + 40$ kts
- V_1 , V_R , V_2 will be displayed again at former setting if SEL is pressed after landing
- either SEL pushbutton selects V_1 , V_R , V_2 on both PFDs
- pilot's SEL pushbutton sets bug #1 and #2 on PFD1
- co-pilot's SEL pushbutton sets bug #1 and #2 on PFD2

ON GROUND - first push- V_1 , second push- V_R , third push- V_2 , fourth push-#1, fifth push-#2.

IN AIR - first push-#1, second push-#2

- if no bug is set within 5 seconds, selection is cancelled
- when data is invalid, V_1 , V_R , V_2 digits and bug reminder are removed; #1 and #2 index bug digits are replaced by 3 white dashes with the bug reminder still shown

2. SPEED BUG rotary KNOB (rotary action)

ROTATE - adjusts the speed bug value displayed on PFD ASI

- they are increased from 51 kt to 400 kt
- clockwise rotation increases the value; counterclockwise rotation decreases the value

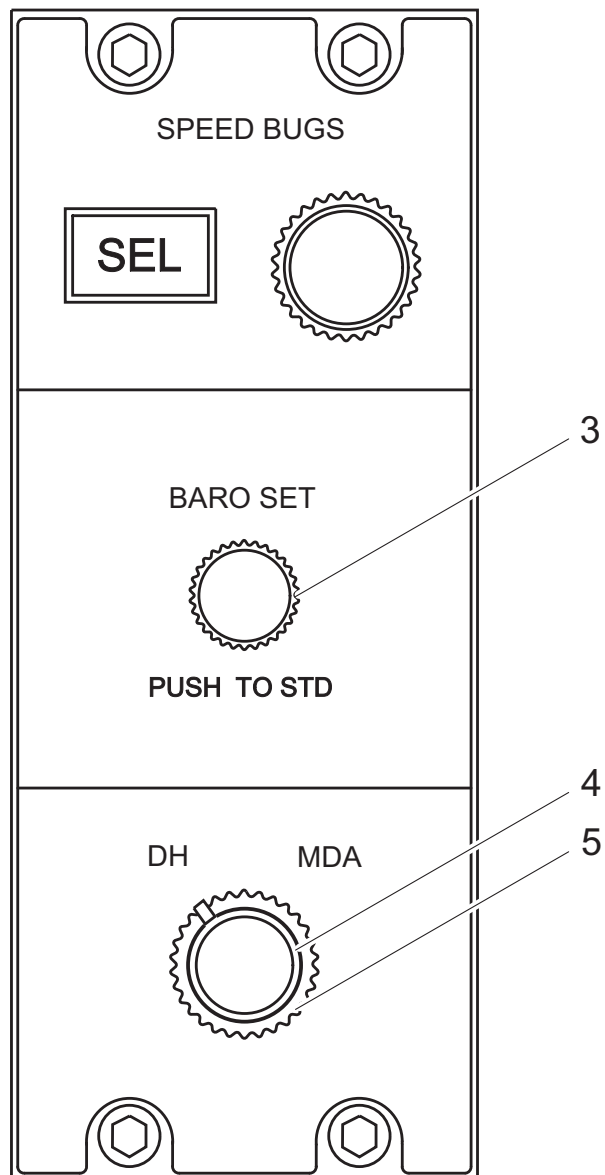
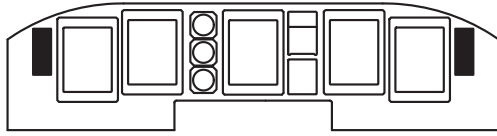


Figure 12.12-9 Index Control Panel (ICP) (2 of 2)

INDEX CONTROL PANEL (ICP) CALLOUTS (CONT'D)

3. **BARO SET / PUSH to STD ROTARY KNOB (rotary action, momentary action)**

ROTATE - enables selection of baro correction on the PFD altitude indicator

- clockwise rotation increases the value; counterclockwise rotation decreases the value
- if the baro correction is selected below the normal operating range, altitude indication becomes invalid and red ALT FAIL is displayed on the PFD

PUSH - automatic standard barometric correction setting

- baro set displayed as HPA
- invalid information is displayed as 4 white dashes

4. **DH / MDA ROTARY KNOB (rotary action)**

ROTATE - allows selection of decision height or minimum descent altitude on the PFD

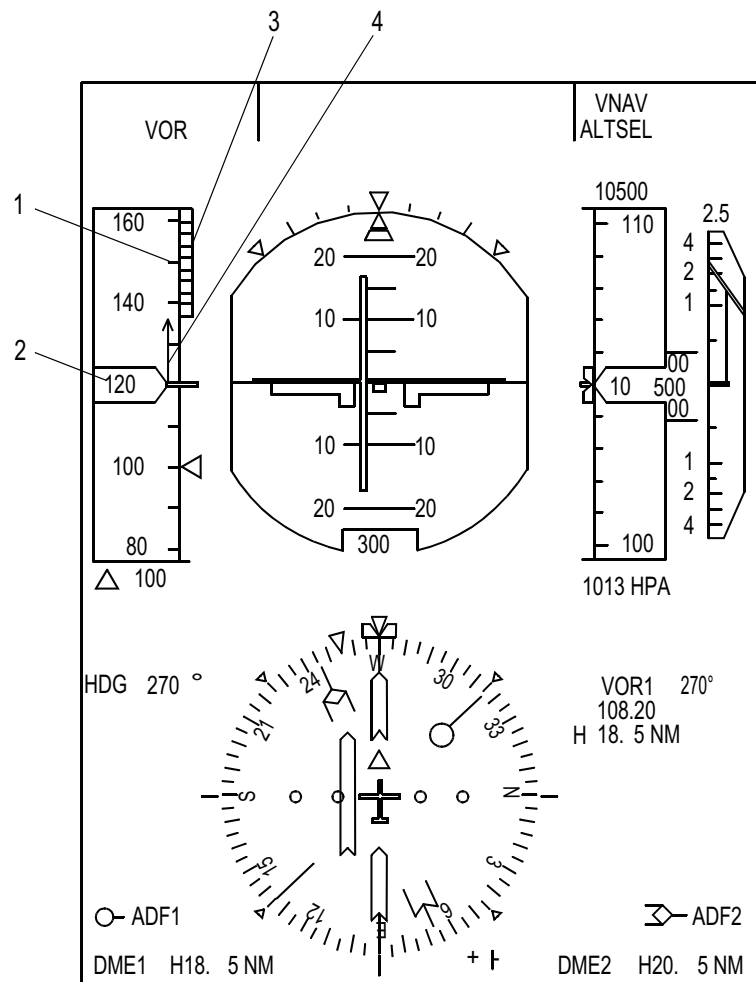
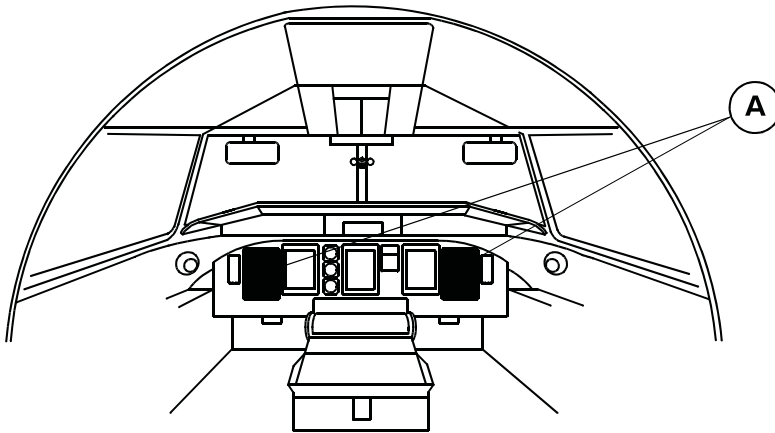
- clockwise rotation increases the value; counterclockwise rotation decreases the value

5. **DH / MDA SELECTOR (two position, rotary action)**

- allows the pilot to select either the DH or MDA bug on the altitude scale of the PFD
- DH value is displayed below and to the left of the ADI; MDA value is displayed below and to the right of the ADI
- MDA is removed from display when altitude is not valid
- the bug is displayed on the altitude scale
- normally displayed in cyan
- when aeroplane is DH or MDA, the DH or MDA will turn yellow flashing for 3 seconds then turn steady
- DH or MDA will also be displayed on the ADI inside a box as the aeroplane goes below the set altitude

NOTE: All ICP controls employ rate-aiding, i.e. the faster the rotation, the greater the incremental value.

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Figure 12.12-10 Primary Flight Display (1 of 4)

PFD CALLOUTS PERTAINING TO ADU PARAMETERS

1. ASI TAPE SCALE

- vertical scale with increments from 30 kt to 500 kt with marks every 10 kt
- tape displays ± 42 kt around actual aircraft IAS
- in case of IAS failure, the scale is removed and replaced by an open white rectangle with a red IAS FAIL label

2. ASI DIGITAL READOUT

- it shows the aircraft's current IAS from 30 KIAS up to 500 KIAS as a rolling drum indication
- as long as IAS is received on ground at "no computed data" from the ADC, the information is still considered as valid but the digits and the needle are forced at the value of 30 kts. As soon as the IAS is computed valid, the numerical readout will start rolling consistently with the needle
- digital readout is removed when IAS is not valid
- when the IAS is greater than or equal to V_{MO} , the digital display changes to red
- the display returns back to white when the IAS decreases 2 kt below V_{MO}
- when IAS is less than or equal to the low speed warning, the digital display changes to red
- the display returns back to white when the IAS increases 2 kt above the low speed warning

3. V_{MO} SPEED CUE (red and black box)

- indicates maximum operating speed in knots
- the band starts at V_{MO} and extends to the top of the scale
- the band is removed when V_{MO} is invalid and an IAS fail flag will also be displayed

4. PREDICTED AIRSPEED TREND

Predicted airspeed trend is shorter than required

- displays predicted airspeed trend of aircraft
- when the difference between predicted airspeed and actual IAS is less than 1 kt or when IAS is invalid, it is removed from view

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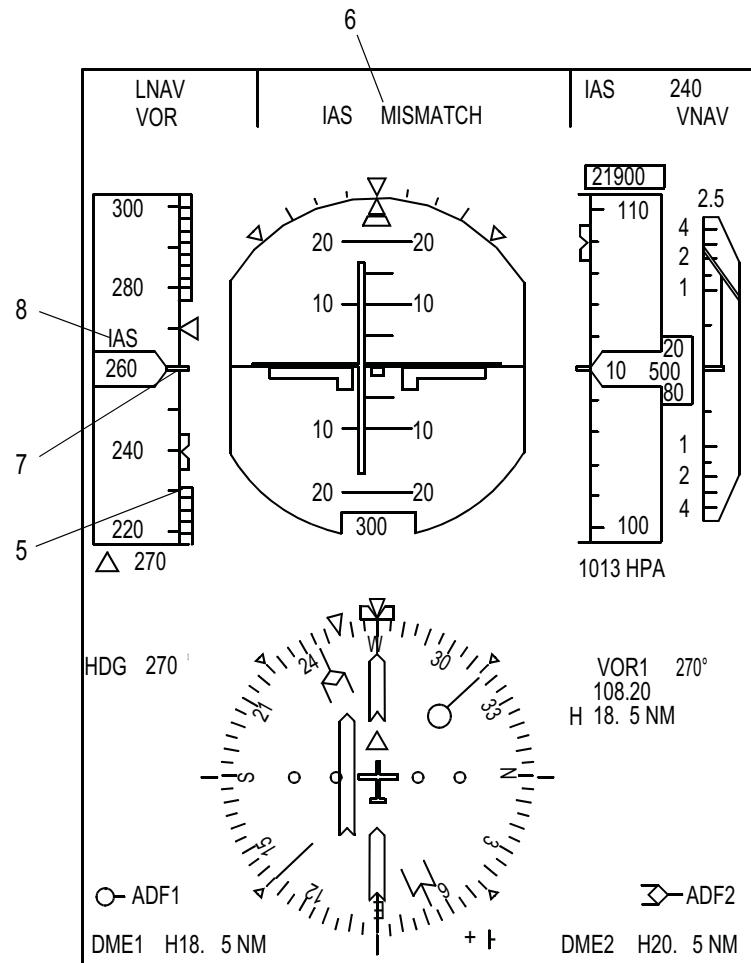
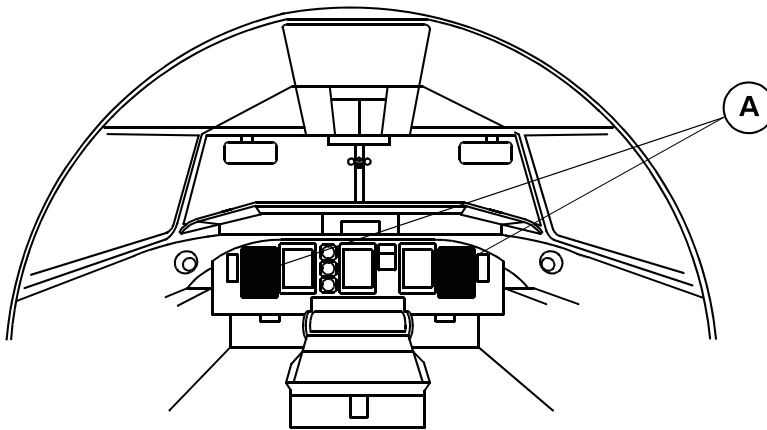


Figure 12.12-11 Primary Flight Display (2 of 4)

PFD CALLOUTS PERTAINING TO ADU PARAMETERS (CONT'D)

5. LOW SPEED CUE

- computed by the Stall Protection System and provides indication of minimum operating speed
- the band starts at the low speed value and extends to the bottom of the scale
- when IAS is invalid or received as no computed data it is removed from view
- it is replaced by CUE when IAS is valid but low speed cue information is invalid

6. MISMATCH MESSAGE (yellow)

- see IAS mismatch flag

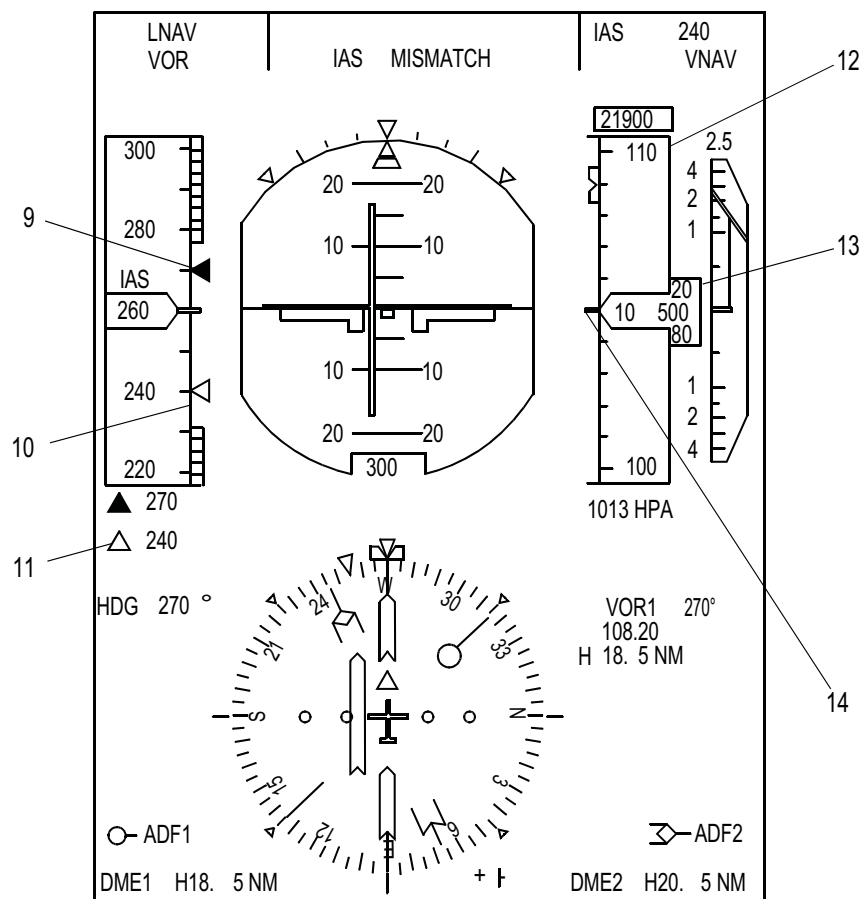
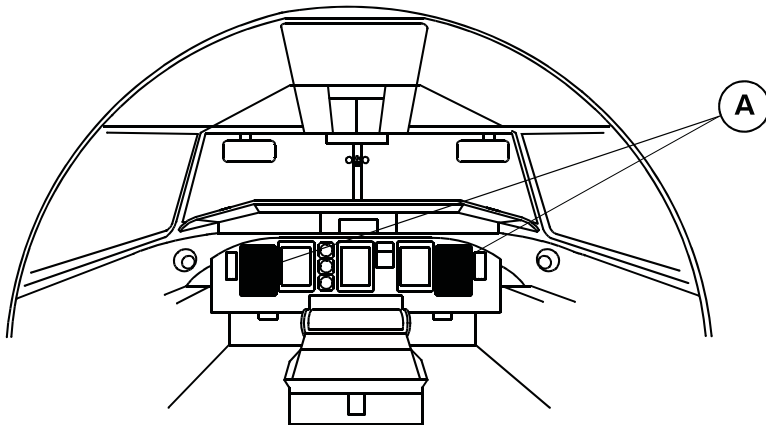
7. ASI REFERENCE LINE (white)

- points to the current air speed value along the IAS dial scale
- this line is removed when IAS is not valid

8. IAS MISMATCH FLAG

- indicates both ADC sources are providing different IAS values
- the yellow IAS flag distinctively overwrites other IAS information and both Flight Mode **Annunciators** (FMA) located at the top of both PFDs may show yellow IAS MISMATCH messages
- the airspeed mismatch threshold is equal to 10 kt
- the indications flash for five seconds when they come into view and then go steady
- when the CAS is not valid, IAS mismatch message and flag are removed

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Figure 12.12-12 Primary Flight Display (3 of 4)

PFD CALLOUTS PERTAINING TO ADU PARAMETERS (CONT'D)

9. IAS INDEX BUG #1 (solid cyan)

- indicates a manually set reference airspeed
- the position and selection of the bug is controlled through the ICP
- the ICP controls are independent between pilot and copilot
- speed bug is used for advisory purposes only, it is not an autopilot target
- this cyan bug moves along the IAS scale from 50 to 400 kt
- when the index value is lower than 50 kt or when no longer valid, it is removed from the display

10. IAS INDEX BUG #2 (outline cyan)

- same principle as for index bug #1

11. IAS INDEX BUG DIGITAL READOUTS (cyan)

- each index bug has a digital readout to give a digital value for the ICP selection. Each digital value has a bug reminder
- the indication is out of view when selection is less than 50 kt or invalid

12. ALTITUDE TAPE SCALE

- vertical scale with increments from -990 ft to 50,000 ft with marks every 100 ft and numbers and longer marks every 500 ft
- tape displays ± 550 ft around actual aircraft altitude
- in case of altitude failure, or if the baro corrected altitude is out of range, the scale is removed and replaced by an open white rectangle with a red ALT FAIL label

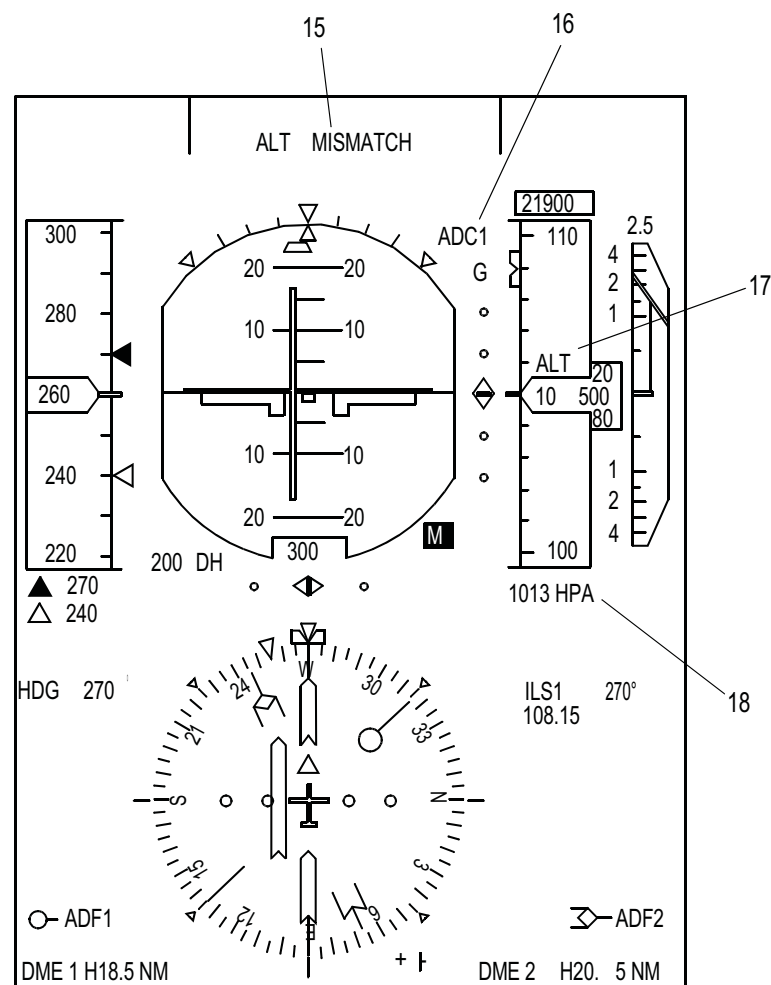
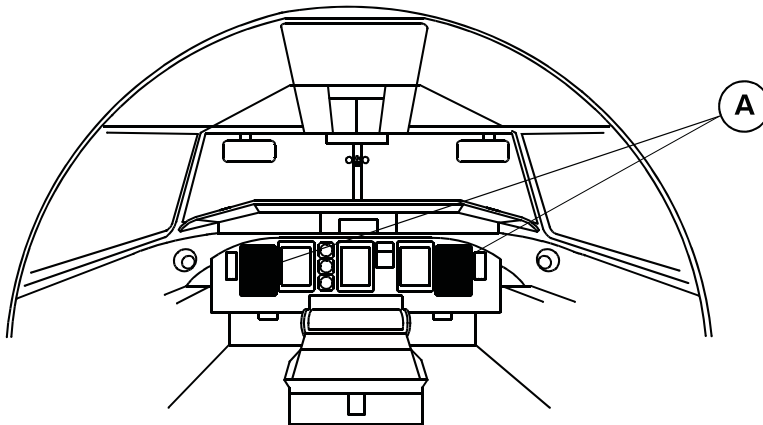
13. ALTITUDE DIGITAL READOUT

- displays the aircraft's current altitude in 20 ft increments from negative 980 ft up to 50,000 ft as a rolling drum indication
- a black and a white hatched window comes into view when the altitude is less than 10,000 ft
- for negative altitude, the numerical value will match the value pointed to by the reference line on the altitude scale. A "NEG" label indicates negative altitudes and is displayed in white on the left of the lead digit
- digits are removed when Baro-Inertial-Altitude is not valid

14. ALTITUDE REFERENCE LINE (white)

- the needle points to the current altitude
- it is removed when Baro-Inertial-Altitude is not valid

Dash8 - Q400 - Indicating & Recording Systems



A

Figure 12.12-13 Primary Flight Display (4 of 4)

PFD CALLOUTS PERTAINING TO ADU PARAMETERS (CONT'D)

15. MISMATCH MESSAGE (yellow)

- see ALT mismatch flag

16. ADC REVERSION SOURCE ANNUNCIATOR (yellow)

- indicates both PFDs are showing the same air data source
- when the EFIS ADC SOURCE reversion selector is set to 1 or 2 on the ESID Control Panel (ESCP), both PFDs will show data from the selected Air Data Unit (ADU1, ADU2) as ADC1 or ADC2 yellow flags
- if NORM is selected on the ADC source knob on the ESCP, nothing is displayed

17. ALTITUDE MISMATCH FLAG

- it indicates to the pilot that ADC sources are providing different baro altitude values
- the yellow ALT flag distinctively overwrites other ALT information and both Flight Mode Annunciators (FMA) located at the top of the PFDs may show a yellow ALT MISMATCH message
- altitude mismatch threshold increases from 60 ft on the ground to 180 ft at 27,000 ft
- the indications flash for five seconds when they come into view and then go steady
- when the altitude is no longer invalid, ALT MISMATCH message and flag are removed

18. BARO SETTING DIGITAL READOUT

(digital value cyan, units designator white)

- set by the BARO SET knob on the Index Control Panel (ICP)
- it is shown in HPA
- if a power interruption occurs, the barometric selection value is stored by the ADU for use when restarting
- when unit or baro setting is not valid, digits are replaced by 4 white dashes and the unit is removed
- if the baro correction is selected below the normal operating range, altitude indication becomes invalid and red ALT FAIL is displayed on both PFD.

1. METRIC BARO-ALTITUDE DIGITAL READOUT

Upon manual selection on a dedicated switch in the cockpit, flight crew can activate the digital display of the current baro-altitude in meter, in addition with the existing PFD symbology (Altitude Indicator remains displayed and still provides altitude in feet).

Digits are displayed in white font T1, with 5 meters resolution, right justified, from -500 to 15900 meters. They are followed by the unit M in white. The whole readout is surrounded by a white box.

Digits are replaced by 5 white dashes when the Baro-Altitude is not valid from the selected ADC.

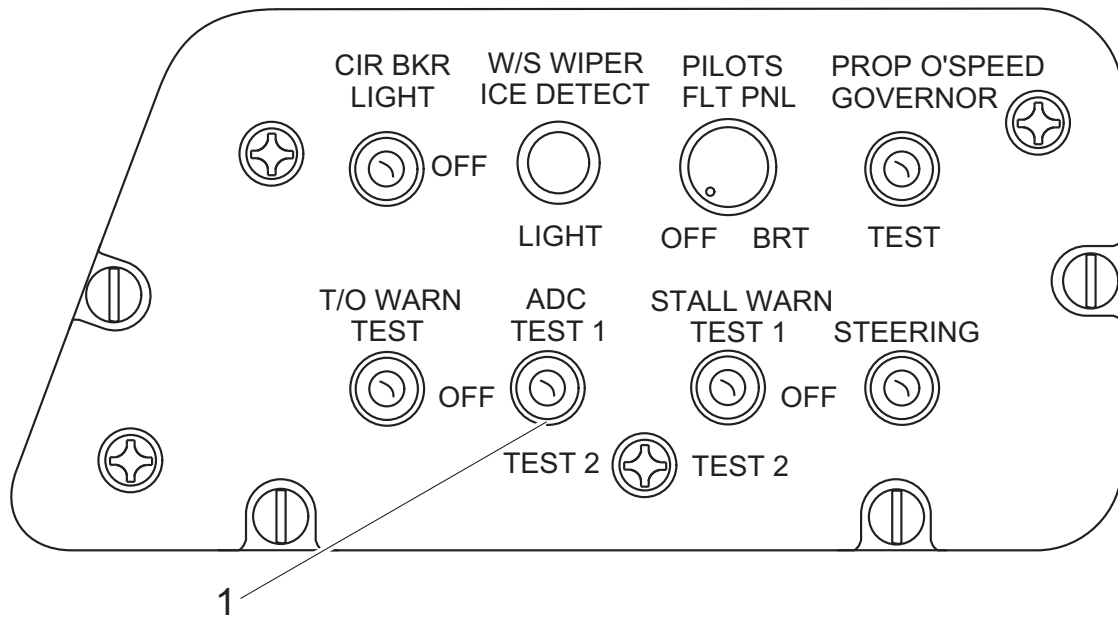
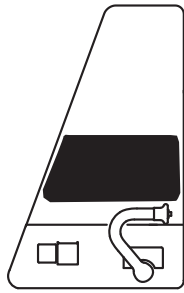


Figure 12.12-14 Pilot's Side Panel

PILOT'S SIDE PANEL CALLOUT PERTAINING TO ADU

1. ADC TEST SWITCH (three position, spring loaded to center)

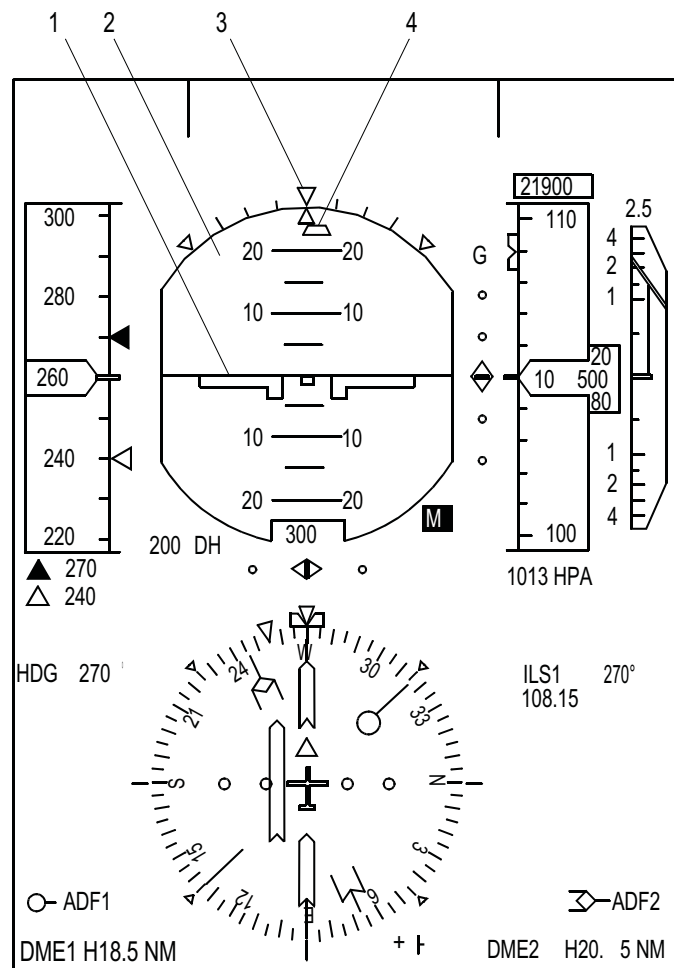
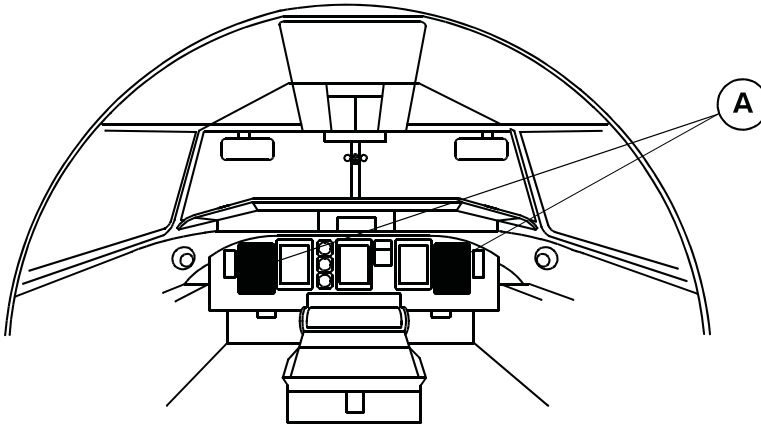
TEST 1 - checks V_{MO} Warning Tone Generator (WTG) and the related ADU 1 interfaces

- check EFIS ADC SOURCE switch is in the NORM position
- check ALT FAIL, IAS FAIL and IVSI FAIL flags are out on the pilot's and copilot's PFDs
- check valid SAT is displayed on the ED
- hold ADC test switch at TEST 1 and check:
 - barometric altimeter reading changes to 14,360 ft on pilot's PFD
 - altimeter baro setting changes to 990 HPa on pilot's PFD
 - V_{MO} is displayed as 284 KIAS on pilot's PFD
 - ASI displays 285 KIAS in red on pilot's PFD
 - indicated SAT is -15°C on the ED
 - overspeed warning horn is activated after 5 seconds
- release test switch and indications should return to normal, and the warning horn should silence

TEST 2 - checks V_{MO} Warning Tone Generator (WTG) and the related ADU 2 interfaces

- hold ADC test switch at TEST 2 and check for above items on copilot's PFD, with the exception of SAT -15°C, which is displayed by ADC #1 when the ADC source is in NORM position

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Figure 12.12-15 Primary Flight Display (1 of 5)

PFD CALLOUTS PERTAINING TO AHRS PARAMETERS

1. AEROPLANE SYMBOL (black surrounded by a white frame)

- double-cue includes two simplified wing-landing gear parts plus a center square. The top part of the square at the center of the sphere gives the reference of the pitch scale
- single-cue includes an inverted V symbol (Figure 12.12-15). The top point gives the reference of the pitch scale, complemented by two marks located on each side of the attitude sphere
- the aeroplane symbol has priority over the pitch scale
- in case of attitude data failure, the symbol is removed from the sphere

2. ATTITUDE SPHERE

- the attitude sphere indicates like a conventional attitude indicator

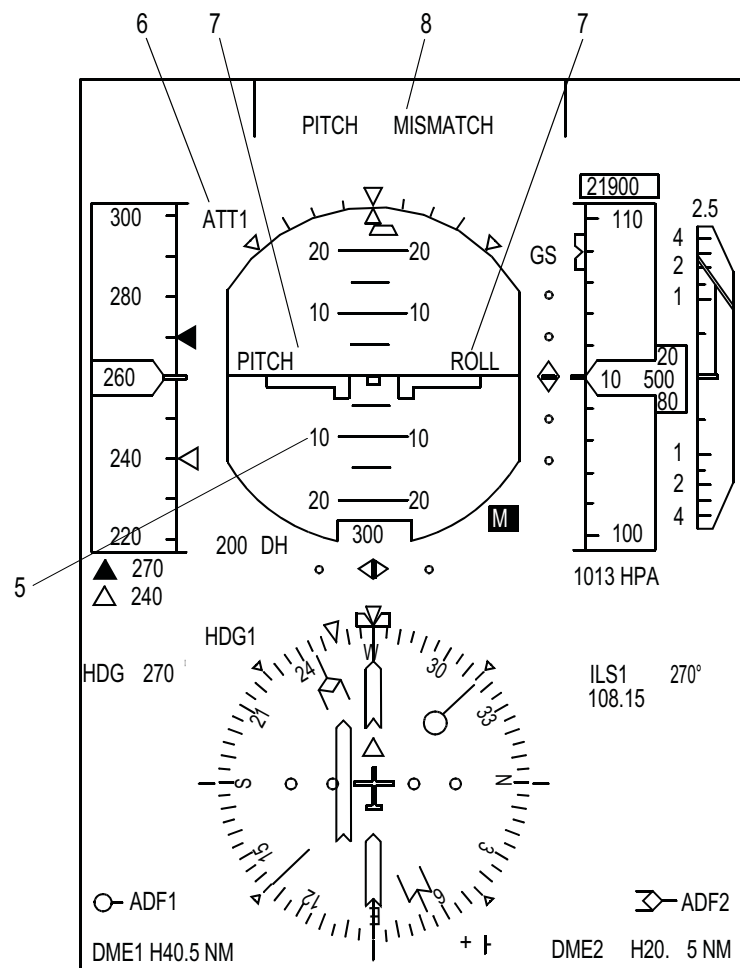
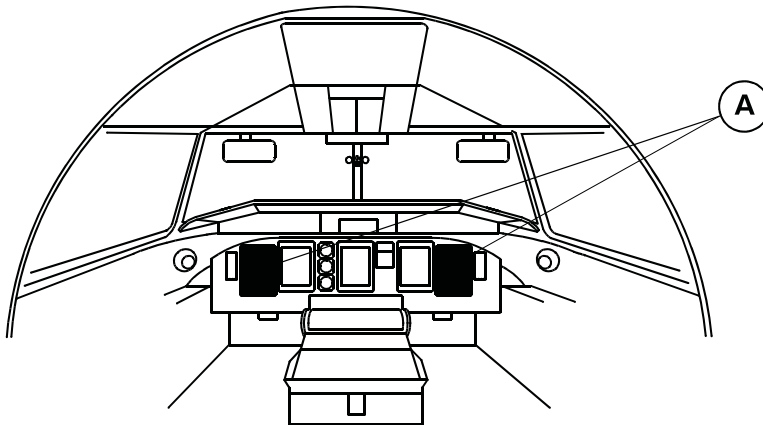
3. ROLL POINTER AND SCALE (white)

- marks are provided for 0, 10, 20, 30, 45 and 60 degrees roll
- 45 and 0 degrees marks are triangle shape, the other marks are ticks
- in order to de clutter the display, the 60 degrees roll marks will only appear when the roll angle is above 30 degrees
- when attitude (pitch or roll) data are no longer valid, the scale and the pointer are removed

4. SLIP/SKID INDICATOR (white)

- the Slip/Skid Indicator shows the lateral acceleration of the aeroplane and is a trapezoid symbol. It turns with the roll pointer
- the maximum deflection indication shows a 0.14 g lateral acceleration. This is equivalent to one and a half the thickness of the upper part of the slip/skid symbol (trapezoid shape)
- the slip skid Indicator is shown to the left when the aeroplane is slipping to the right and to the right when the aeroplane is slipping to the left
- the indicator goes out of view when the aeroplane roll is more than 60 degrees or the related AHRU attitude has malfunctioned

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Figure 12.12-16 Primary Flight Display (2 of 5)

PFD CALLOUTS PERTAINING TO AHRS PARAMETERS (CONT'D)

5. PITCH SCALE (white)

- it has narrow pitch graduations every 5 degrees from - 30 deg to + 30 deg and progressively wider markings with pitch angle numerals at 10, 20, 30, 40, 60, 90 and - 10, - 20, - 30, - 45, - 60, - 90 deg
- red chevrons beginning, at + 40 and - 30 deg, warn of excessive pitch attitudes and point toward the artificial horizon

6. ATTITUDE REVERSION SOURCE ANNUNCIATOR (yellow)

- indicates both PFDs are showing the same attitude source
- when the EFIS ATT/HDG SOURCE reversion selector is set to 1 or 2 on the ESID Control Panel (ESCP), both PFDs will show data from the selected Attitude and Heading Reference Unit (AHRU 1, AHRU 2) as ATT1 or ATT2 yellow flags
- if NORM "ownside" selection is set on the ESCP, nothing is displayed

7. ATT MISMATCH FLAG (yellow)

- indicates that inertial sources are providing different pitch and/or roll values
- both Flight Mode Annunciators (FMA) located at the top of the PFDs may show yellow PITCH MISMATCH or ROLL MISMATCH messages in the centre row of the centre column. If a pitch and roll mismatch condition occur at the same time, the pitch mismatch message will be shown. It has a higher indication priority than the roll mismatch message
- the indications flash for five seconds when they come into view and then go steady
- the attitude mismatch threshold is equal to 3 degrees
- when the attitude is no more valid, the flag and the message are removed

8. MISMATCH MESSAGE (yellow)

- see attitude mismatch flag above

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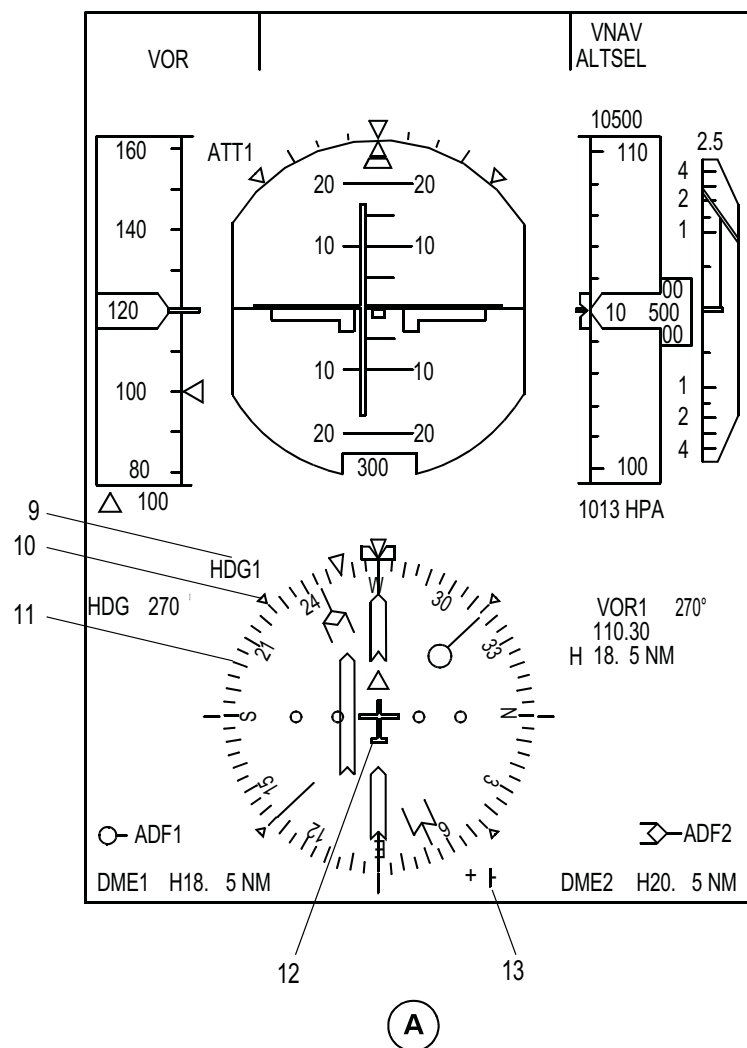
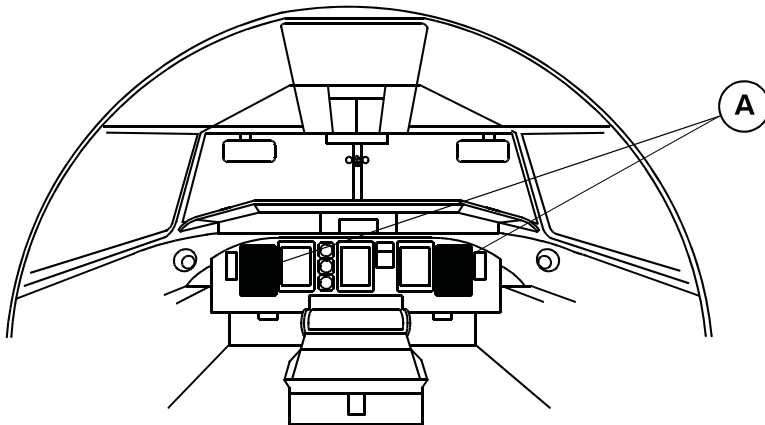


Figure 12.12-17 Primary Flight Display (3 of 5)

PFD CALLOUTS PERTAINING TO AHRS PARAMETERS (CONT'D)

9. HEADING REVERSION SOURCE ANNUNCIATOR (yellow)

- indicates both PFDs are showing the same heading source
- when the EFIS ATT/HDG SOURCE reversion selector is set to 1 or 2 on the ESID Control Panel (ESCP), both PFDs will show data from the selected Attitude and Heading Reference Unit (AHRU 1, AHRU 2) as HDG1 or HDG2 yellow flags
- if NORM "ownside" selection is set on the ESCP, nothing is displayed

10. FIXED MARKINGS (white)

- positioned at 45 degrees from each cardinal heading

11. ROTATING HEADING DIAL (white)

- the rotating heading dial is a full compass rose indication with markings at 5 degree intervals and numbers at 30 degree intervals
- cardinal headings are labelled N, E, S, W
- in case of heading failure, the rotating part of the dial is removed

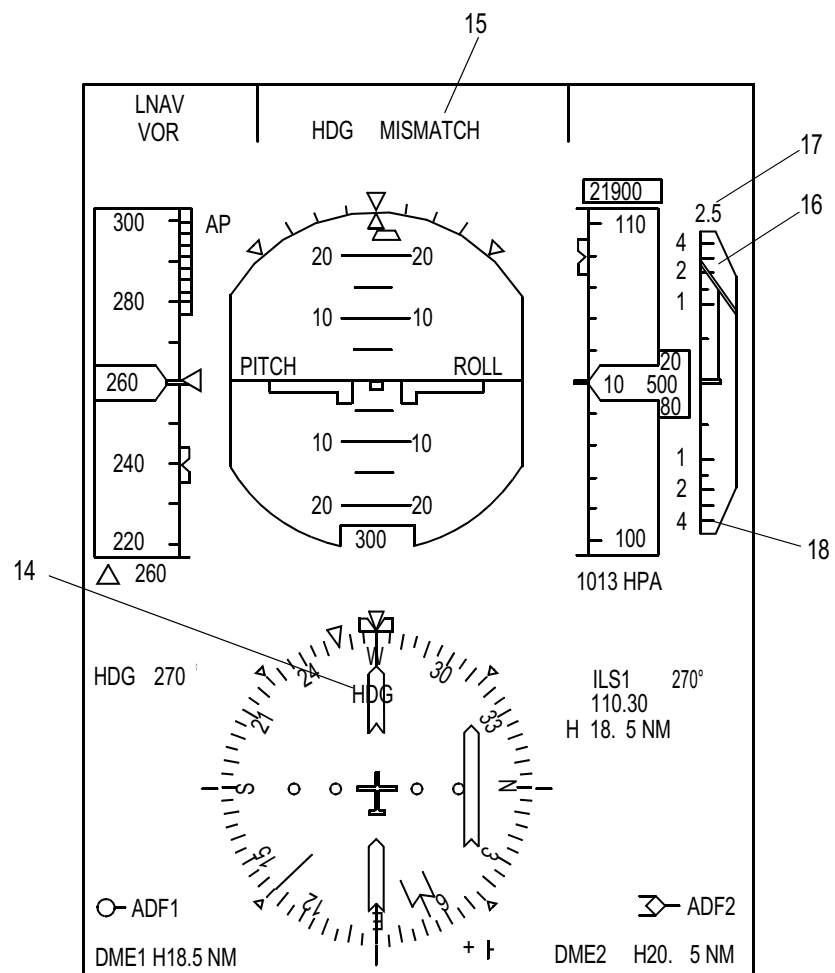
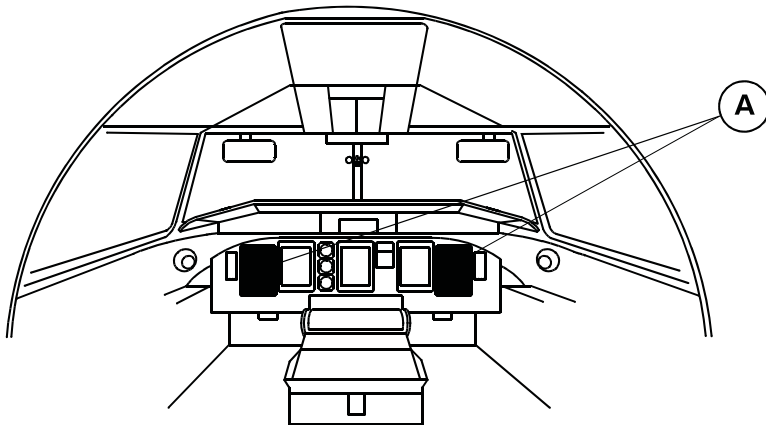
12. ACTUAL HEADING MARKER AND AEROPLANE SYMBOL (white)

- aeroplane symbol is always displayed at the center of the full compass rose representation
- a white triangle positioned on the edge of the heading dial and pointing down towards the aeroplane symbol provides the reference (lubber line) for the analog readout of the magnetic heading

13. SLAVING ERROR ANNUNCIATION (white vertical pointer, green + and -)

- the compass slaving error annunciator shows the difference between the Attitude and Heading Reference Unit (AHRU 1, AHRU 2) heading and its related flux valve (FDU 1, FDU 2) heading
- a green vertical pointer that moves between a white + and -; symbol is shown near the rotating heading dial indication
- the maximum indication is plus or minus 4 degrees and is obtained when the pointer reaches the external part of the minus/cross
- when the information is not valid from the selected AHRS, the pointer and the scale are removed

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Figure 12.12-18 Primary Flight Display (4 of 5)

PFD CALLOUTS PERTAINING TO AHRS PARAMETERS (CONT'D)

14. HDG MISMATCH FLAG (yellow)

- indicates that inertial sources are providing different heading values
- both Flight Mode Annunciators (FMA) located at the top of the PFDs may show yellow HDG MISMATCH messages in the centre row of the centre column
- if an attitude and heading mismatch condition occurs at the same time, the related attitude mismatch message will be shown. It has a higher indication priority than the heading mismatch message
- the indications flash for five seconds when they come into view and then go steady
- the heading mismatch threshold is 8 degrees
- when the heading is no more invalid, the flag and the message are removed
- the message over writes the other HDG information (scale, pointer and bugs)

15. MISMATCH MESSAGE (yellow)

- also see mismatch message above

16. POINTER NEEDLE (white)

- points at the current aeroplane vertical speed from -5000 and +5000 ft/min
- the needle is parked at these positions for greater values
- pointer position is emphasized by vertical line connected between pointer and VS reference line, and is same color as pointer
- shown in red if in RA red band when TCAS installed

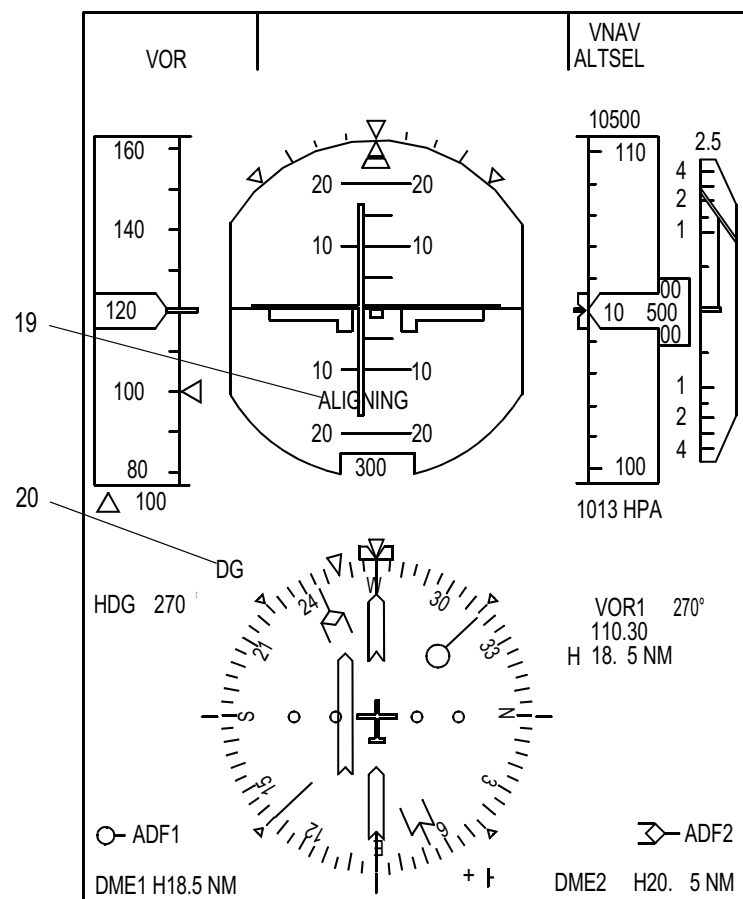
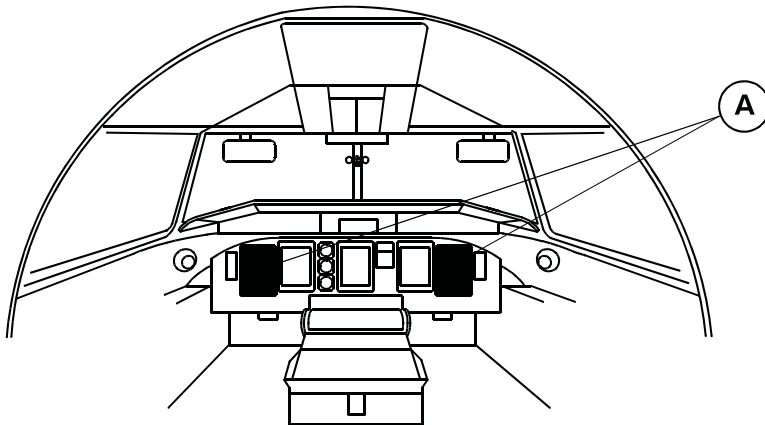
17. IVSI DIGITAL READOUT (white)

- shown on top of VS scale for climb rate
- shown in bottom of VS scale for descent rate
- the digital readout shows thousands of ft/min
- the digital readout can show the inertial vertical speed value from -9900 to 9900 ft/min
- same color as pointer
- no $\pm$ sign is displayed

18. IVSI SCALE (white)

- this symbol provides the crew with vertical speed scale with range from -5000 to 5000 ft/min
- expanded scale for values between ± 1000 ft/min
- compressed scale between 1000 and 2000 ft/min or -1000 and -2000 ft/min
- linear more compressed scale between 2000 and 5000 ft/min or -2000 and -5000 ft/min
- small thin marks are provided for ± 500 and ± 1500 ft/min
- larger ticks every 1000 ft/min
- no mark at ± 5000 ft/min
- wider mark for the VS reference line at 0
- the markings for 1000, 2000, and 4000 feet per minute are shown as 1, 2, and 4

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A

Figure 12.12-19 Primary Flight Display (5 of 5)

PFD CALLOUTS PERTAINING TO AHRS PARAMETERS (cont'd)

19. ALIGNING MESSAGE (yellow)

- indicates the AHRS is in alignment mode
- the message flashes for five seconds and then changes to steady
- the alignment mode is automatically entered on initial AHRS power application. It may also be entered in flight or on the ground by pushing the ATT/HDG ALIGN annunciator switch located on the AHRS Control Panel (AHCP)
- the aeroplane must be in a straight and level attitude when making an alignment mode selection
- the alignment mode continues for 60 seconds on the ground and 90 seconds in flight
- Altitude, Heading and vertical speed are shown as failed during the first 20 seconds of alignment
- the message will appear whether the attitude data is valid or not

20. DG MODE/HDG SOURCE ANNUNCIATION

- indicates which heading source feeds EHSI or when the AHRS is in DG mode:
 - white DG when the DG switch on the AHRS Control Panel (AHCP 1, AHCP 2) is pushed to manually set the DG Mode
 - yellow DG1 or DG2 when the EFIS ATT/HDG SOURCE reversion selector is set to 1 or 2 on the ESID Control Panel (ESCP) following a manual DG switch selection

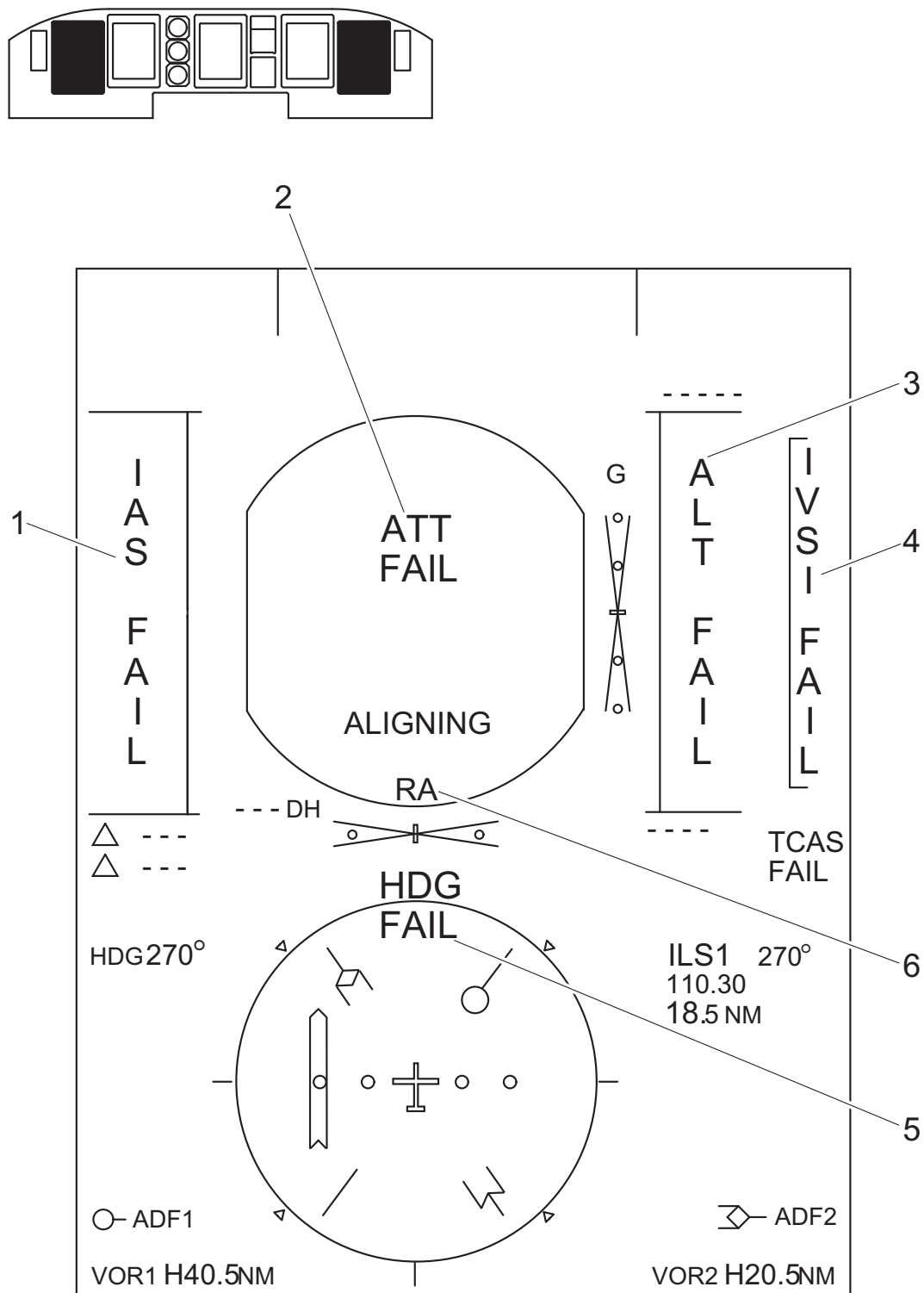


Figure 12.12-20 Primary Flight Display Failure Indications

PFD CALLOUTS PERTAINING TO ADU AND AHRS FAILURES

1. IAS FAIL FLAG (red message inside white circle)

- when the airspeed parameter malfunctions, the whole scale, the IAS and VMO cue and Low Speed cue, the IAS digital readout and the index bugs/targets are replaced by the flag that comes into view as a red IAS FAIL message inside a white open rectangle

2. ATT FAIL FLAG (red message inside white truncated circle)

- when the attitude parameters malfunction, the roll scale, attitude sphere, slipskid and aeroplane symbol are replaced by a flag that comes into view as a red ATT FAIL message

3. ALT FAIL FLAG (red message inside white circle)

- when the altitude parameter fails, the whole scale, the pointer needle, bugs and the altitude digital readout are replaced by the flag that appears as a red ALT FAIL message inside a white open rectangle

4. HDG FAIL FLAG (red message inside white circle)

- when the heading parameters malfunction, the rotating heading dial, lubber line, and slaving error annunciator are replaced by a flag that comes into view as a red HDG FAIL message inside a white circle
- the fixed markings remain in view
- bearing pointers will continue to provide relative bearing information
- ILS/LOC indications will continue to be displayed

5. IVSI FAIL FLAG (red message inside white arc)

- when the IVSI parameters malfunction, the scale, pointer needle, and digital selectors VS readout are replaced by a flag that comes into view as a red IVSI FAIL message inside a white open rectangle

6. RA FAIL FLAG (red message inside black rectangle)

- RA data not valid

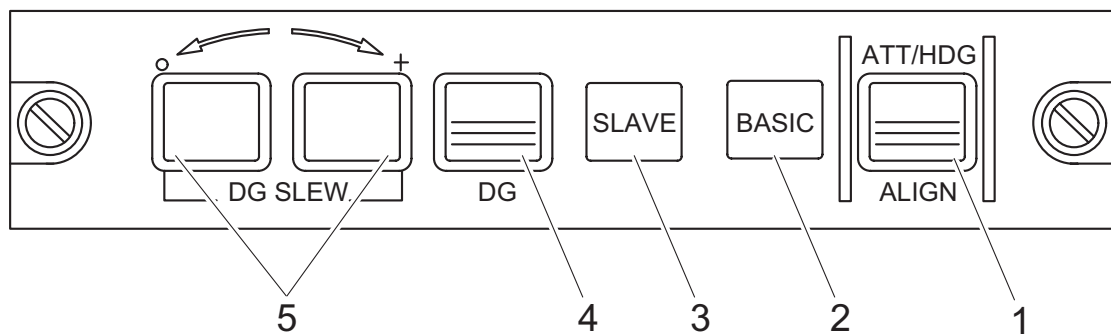
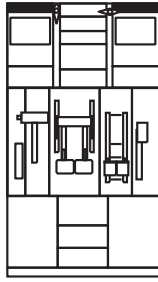


Figure 12.12-21 Attitude and Heading Reference System Control Panel (AHCP)

AHRS CONTROL PANEL CALLOUTS

1. ALIGN ANNUNCIATOR SWITCH (momentary action)

PUSH - key bar segment (amber) initiates alignment mode on the ground or in-flight

- EADI shows an ALIGNING message which appears in yellow that flashes for five seconds and then changes to steady
- the aeroplane must be in a straight and level attitude when making an alignment mode selection in flight
- the alignment mode continues for 60 seconds on the ground and 90 seconds in flight
- the AHRS parameters are available 20 seconds after starting the alignment mode
- the align message will appear during the align period in the PFD (ADI)

2. BASIC ANNUNCIATOR LIGHT (green)

- comes on to show the automatic reversion to the Basic mode if the TAS parameter is not available from either ADCS
- no additional indications appear on the EADI

3. SLAVE ANNUNCIATOR LIGHT (red)

- comes on to show a flux valve (MDU 1, MDU 2) malfunction
- the EHSI is replaced by a red HDG FAIL message inside a white circle

4. DG ANNUNCIATOR SWITCH (momentary action)

PUSH - key bar segment (green)

- manually selects the DG Mode for display on the EHSI (selected after the SLAVE annunciator comes on)
- the EHSI shows a DG heading source annunciation, the HDG FAIL annunciation and the slaving error indication goes out of view upon DG mode selection

PUSH - key bar segment (blank), return to SLAVED mode

5. SLEW PUSHBUTTON SWITCHES (momentary action)

PUSH - corrects the rotating heading dial for gyro drift

- the rotating heading dial turns in a clockwise direction while the + DG SLEW switch is pushed, and it moves in a counterclockwise when the ° DG SLEW switch is pushed
- if one slew switch or the other is initially pushed and held, the rotating heading dial turns at the low speed rate of 1 degree per second, and if held for more than 3 seconds, it will then turn at the high rate of 10 degrees per second

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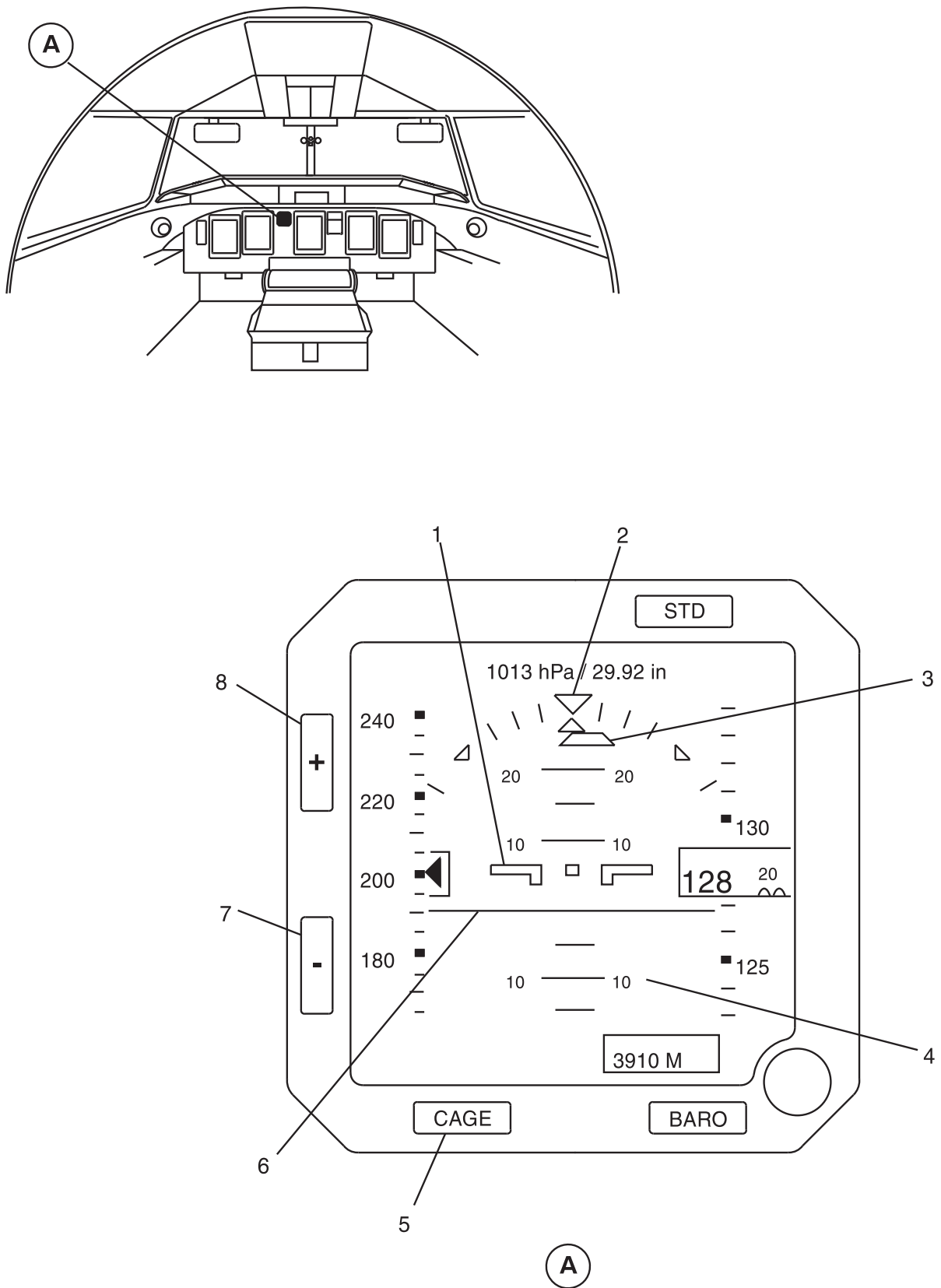


Figure 12.12-22 Integrated Stand by Instrument - HSI

INTEGRATED STANDBY ATTITUDE CALLOUTS

1. AEROPLANE SYMBOL (WHITE)

- the aeroplane symbol is a fixed aeroplane reference against the attitude sphere and shows the amount of aeroplane pitch and roll

2. INDEX POINTER AND ROLL SCALE (WHITE)

- a index pointer moves against a scale that has 10 degree graduations between ± 60 degrees, at ± 45 degrees and at ± 60 degrees

3. SIDE-SLIP INDICATION

- indicates lateral acceleration left or right to a maximum of $\pm 0.14g$

4. PITCH SCALE (WHITE)

- the pitch scale is shown on the attitude sphere in 5 degree increments from 0 to ± 30 degrees, at ± 40 degrees, at ± 60 degrees and at ± 90 degrees

5. CAGE BUTTON

- CAGE button resets the horizontal function to zero when depressed for more than 2 seconds and causes CAGE warning flag to appear

6. ATTITUDE SPHERE AND HORIZON LINE

- the attitude sphere has a sky permanent sector in blue above a ground permanent sector in brown and a white horizon line to divide the sectors
- the attitude sphere moves to show pitch and roll

7. '-' BUTTON

- lighting adjustment; press to decrease intensity

8. '+' BUTTON

- lighting adjustment; press to increase intensity

ATTITUDE WARNING FLAG (not shown)

- attitude display replaced by a black background and 'ATT' flag appears near top, right of center
- occurs when failure of the attitude function is detected by internal monitors

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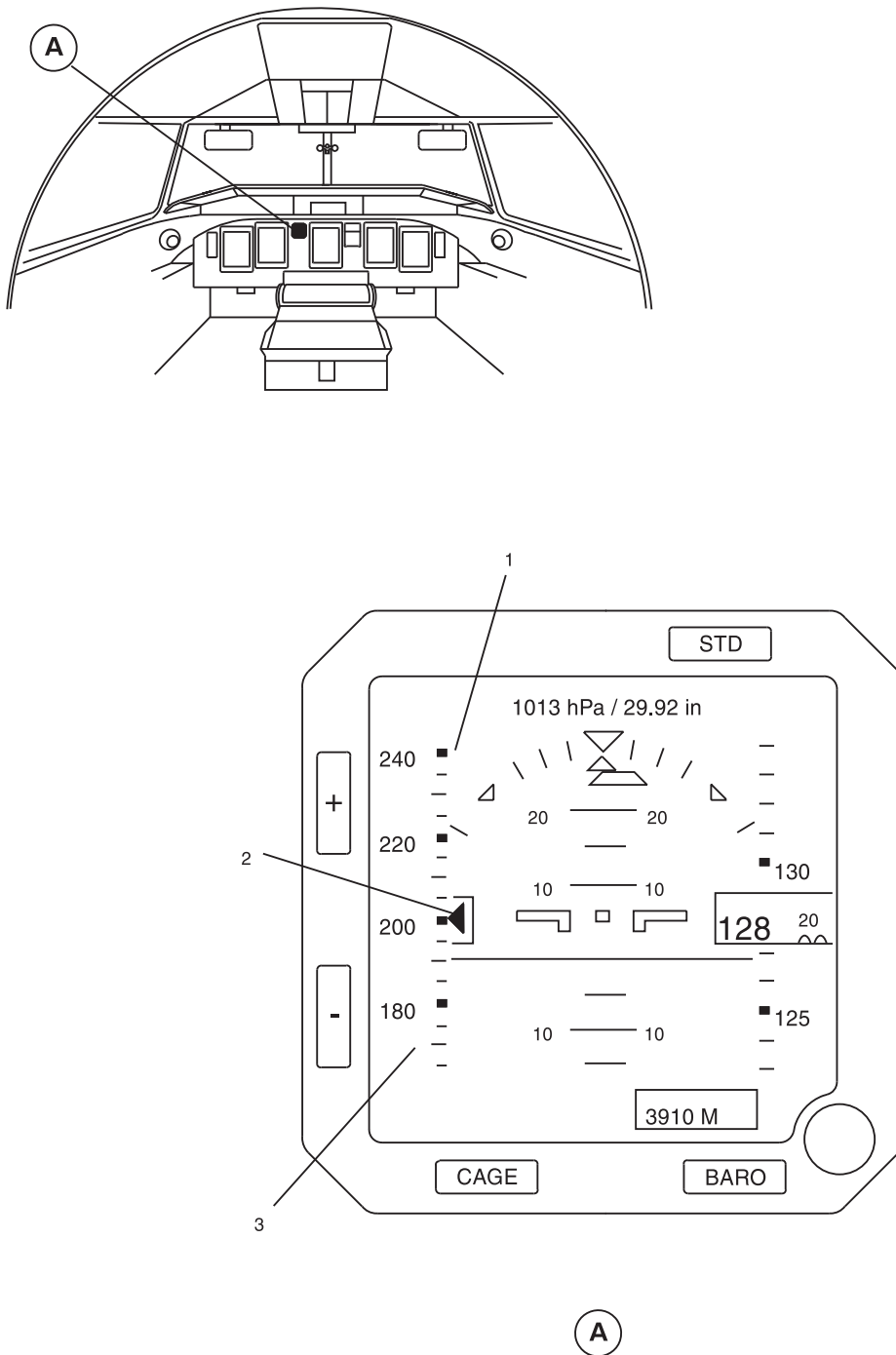


Figure 12.12-23 Integrated Stand by Instrument - Airspeed

INTEGRATED STANDBY AIRSPEED INDICATOR CALLOUTS

1. V_{MO} (red limit)

- V_{MO} (maximum operating speed) is displayed as a red tape in the left Airspeed display area

2. AIRSPEED POINTER AND INDEX (white)

- indicates airspeed from 40 to 520 kts

3. AIRSPEED SCALE (white)

- tape scale is graduated every 5 kt between 40 kt and 250 kt
- above 250 kt, scale is graduated every 10 kt up to 520 kt

IAS FAILURE FLAG (not shown)

- 'IAS' flag replaces airspeed tape in the event of an airspeed function failure as detected by internal monitors

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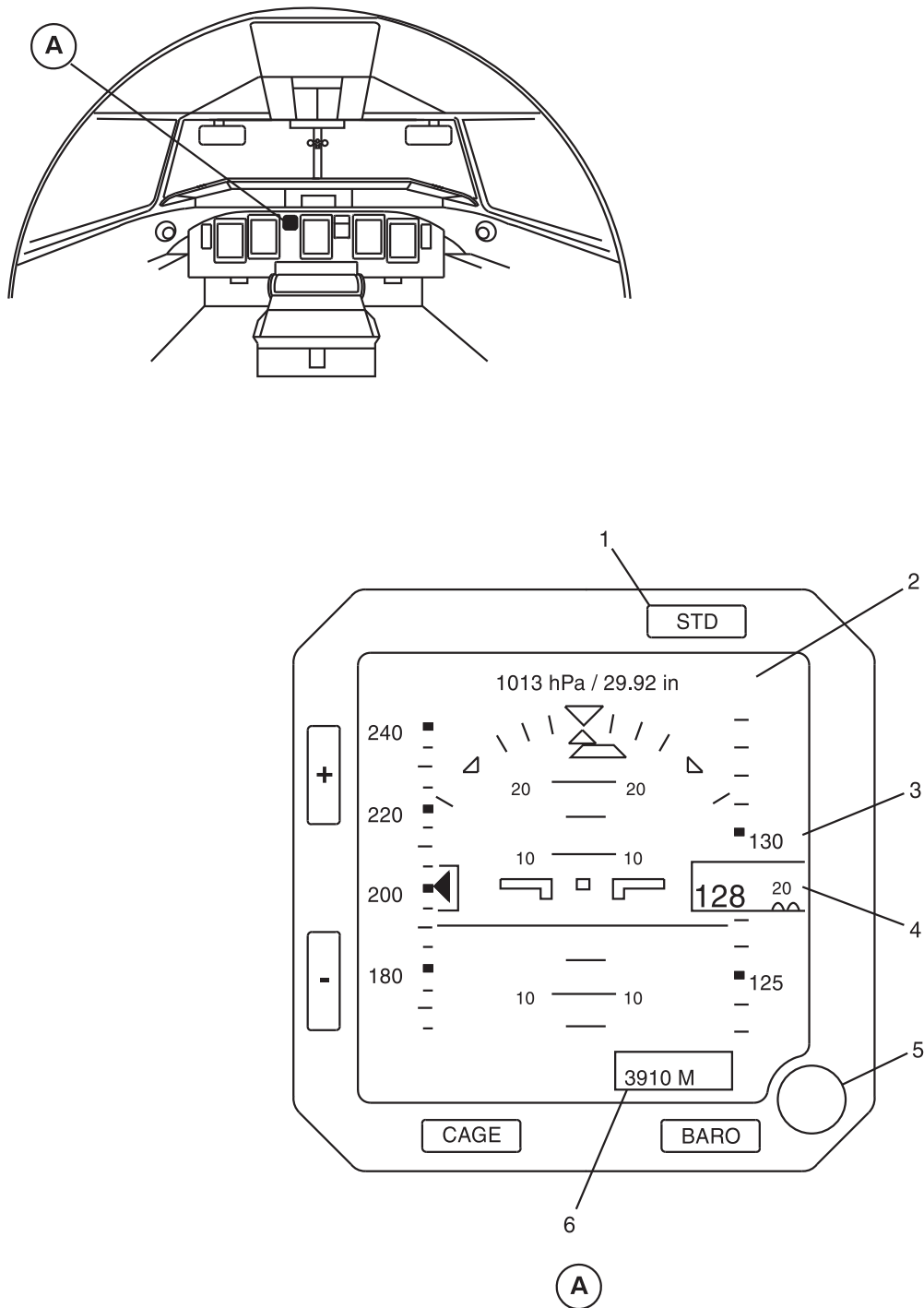


Figure 12.12-24 Integrated Stand by Instrument - Altimeter

INTEGRATED STANDBY ALTITUDE INDICATOR

1. 'STD' BUTTON

- **Push** - resets the baro setting to the standard pressure

2. BARO SETTING READOUTS (hPa / in Hg)

- set by the baro selector knob
- the barometric correction range is 740 to 1100 hPa (21.85 to 32.48 in Hg)

3. ALTITUDE SCALE (white)

- moving tape scale is graduated every 100 feet from -2000 ft to + 50,000 ft, and identified every 500 ft

4. ALTITUDE COUNTER (white)

- digital readout in 20 ft increments
- white hatch marks displayed below 10,000 ft
- an 'N' in place of the ten thousands digit indicates negative altitudes

5. BARO SELECTOR KNOB (rotary action)

ROTATE - enables selection of baro correction in mb or in Hg

- clockwise rotation increments the value; counterclockwise rotation decrements the value

6. ALTIMETER UNIT

- when the PFD ALTIMETER UNIT switch on overhead panel set to 'FT', display is baro-setting in in Hg
- when the PFD ALTIMETER UNI switch set to 'Ft+.M', display is altitude in meters

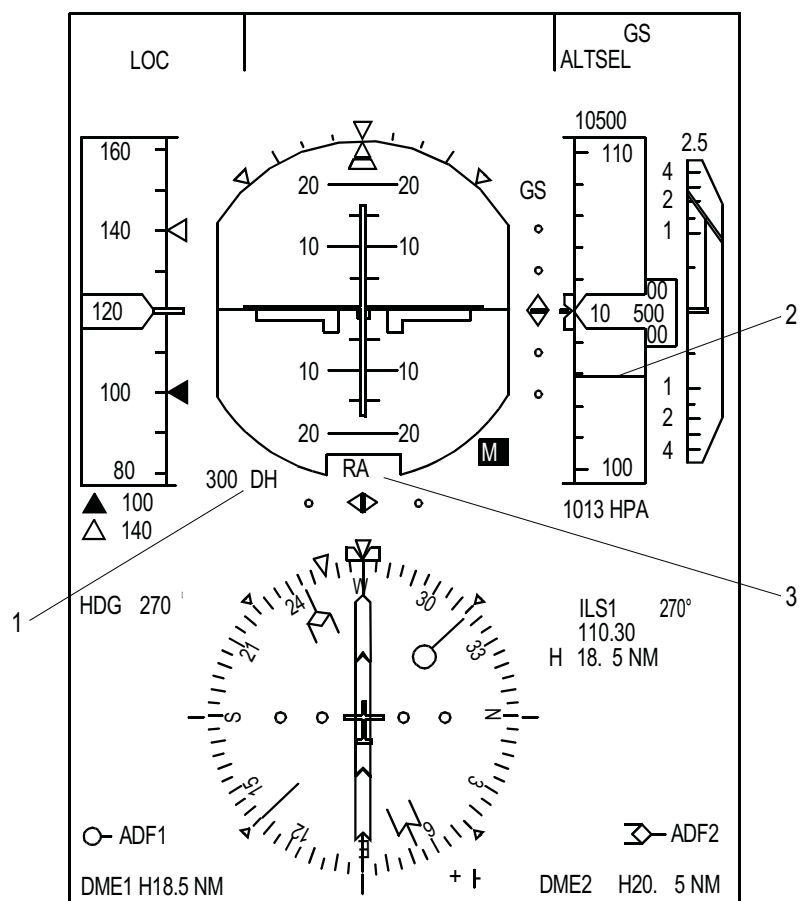
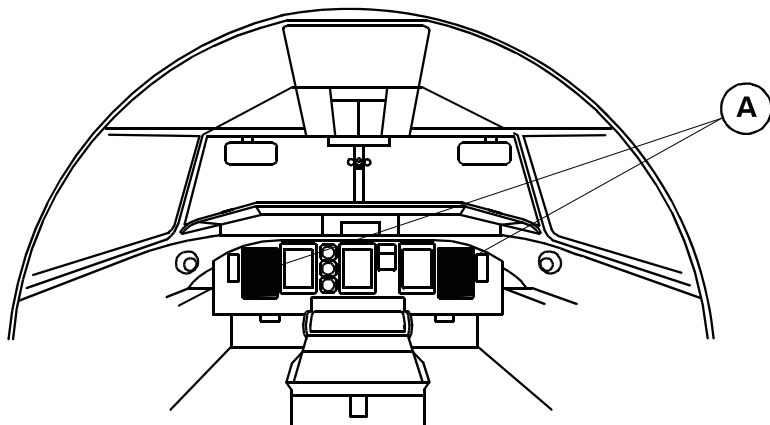
ALTITUDE FAILURE FLAG (not shown)

- 'ALT' Flag replaces altitude tape in event of failure of the altitude function as detected by internal monitors

SSEC FAILURE FLAG (not shown)

- Static Source Error Correction 'SSEC' flag is displayed in the top left corner when SSEC corrections are longer available for altitude computation

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FIGURE 12.12-25 PRIMARY FLIGHT DISPLAY (1 OF 2)

PFD CALLOUTS PERTAINING TO RAD ALT PARAMETERS

1. DECISION HEIGHT INDICATION (digital value cyan, DH in white)

- shows the altitude selection in one foot increments from zero through 990 feet as set using the DH selector knob on the ICP
- digit and label are removed from display if set below 0 ft
- when RA data is not valid, the 3 digits are replaced by 3 white dashes

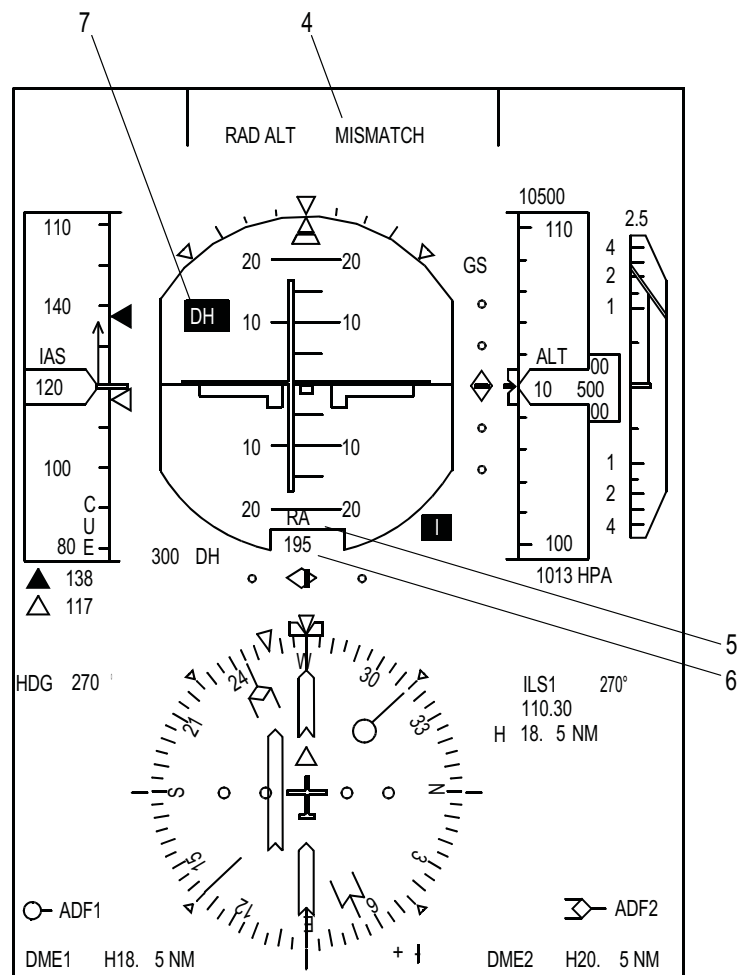
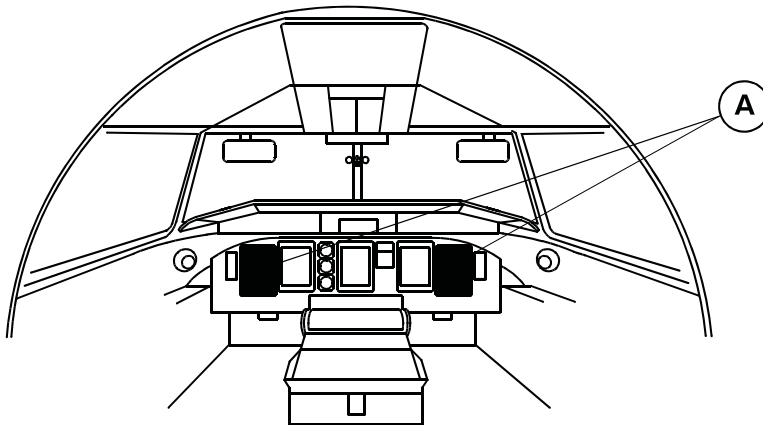
2. ANALOG RAD ALT (brown band)

- gives an indication of AGL altitude
- shown when RA is less than 550 ft
- moves vertically, corresponding to the altitude AGL
- moves up towards altitude reference line as the altitude AGL decreases and touches the altitude reference line
- not shown when no data available

3. RA ALT FAILURE INDICATION

- with dual R/A is installed, information comes from the ownside R/A. If one R/A fails, failure status will be indicated to the flight crew on the English Display Advisory area, and information comes from the remaining R/A and is still displayed in white
- when R/A is above 2500 ft the radio altitude display is removed, and replaced by a red RA label

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FIGURE 12.12-26 PRIMARY FLIGHT DISPLAY (2 OF 2)

PFD CALLOUTS PERTAINING TO RAD ALT PARAMETERS (CONT'D)

4. RAD ALT MISMATCH MESSAGE

(yellow, initially flashes for 5 seconds, then stays on steady)

- RA value shown is different than RA receiver output during dual FD mode approach
- yellow RA flag is also shown above RA indication

5. RA MISMATCH FLAG

(yellow, initially flashes for 5 seconds, then stays on steady)

- RA value shown is different than RA receiver output during Dual FD mode approach
- RAD ALT MISMATCH message is also shown in the FMA

6. RA INDICATION (white)

- shows altitude AGL as four white numbers
- shows altitude from zero to 2,500 feet AGL
- increases and decreases in 5 ft increments below 200 ft AGL
- increases and decreases in 10 ft increments above 200 ft AGL

7. DH ANNUNCIATION (white outline box, yellow DH)

(DECISION HEIGHT ANNUNCIATOR (going through DH))

- indicates to the pilot that the aeroplane is going down through decision height
- when A/C Rad Alt just decreases below DH value, the DH annunciation is displayed inside the attitude sphere, in yellow color and inside a black window. It will remain displayed until the Rad Alt goes upward DH plus 100 ft so as to keep displaying steady the DH annunciation during a flight level hold at DH
- it is shown in T3 font, flashing for the first 3 seconds, then steady. Note that if the DH annunciation is set, flashing display will start with a ON display in order to immediately alert the pilot
- no annunciation is performed when selected DH or Rad Alt is not valid, or when DH is below 0 ft.

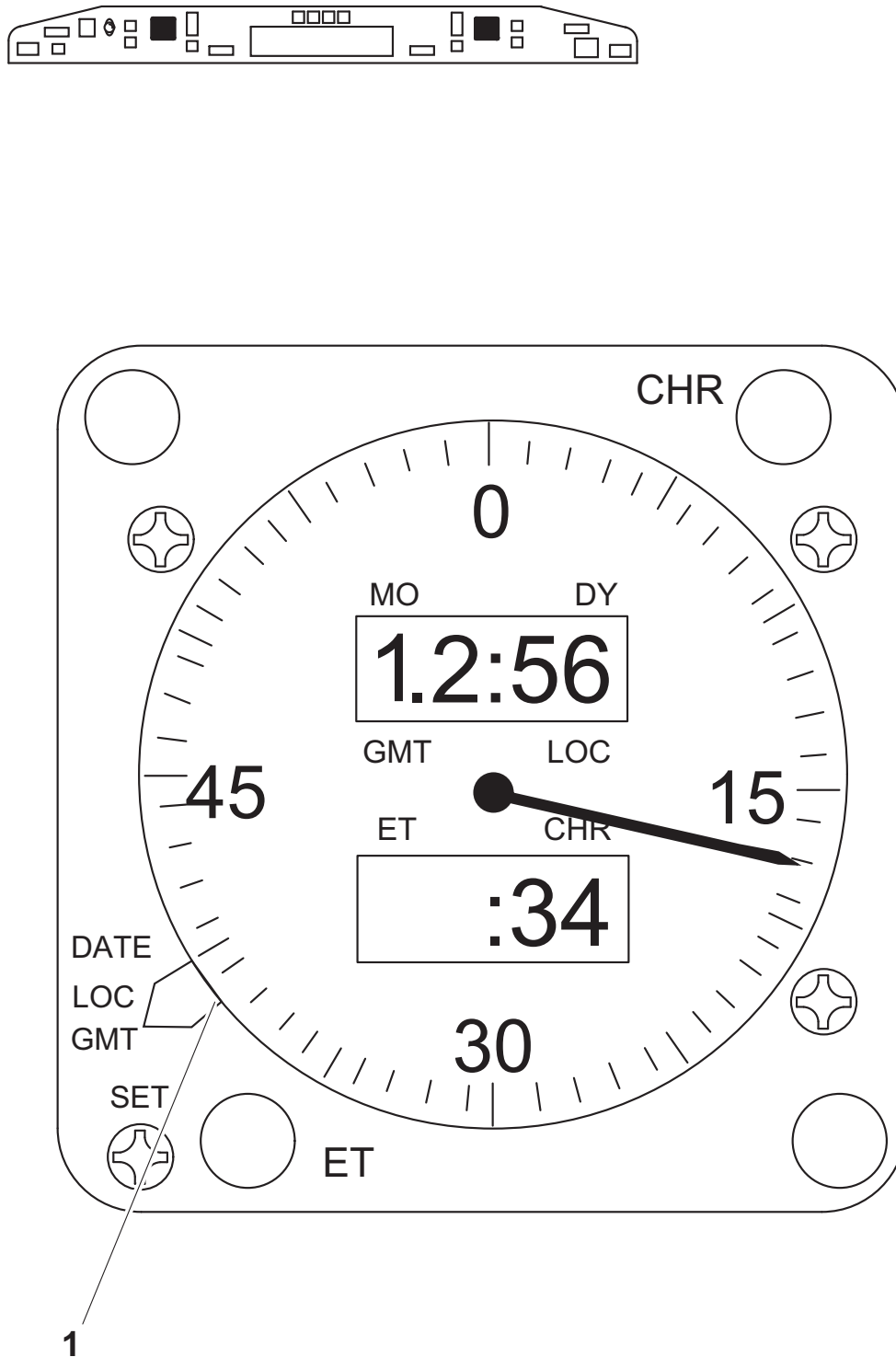


FIGURE 12.12-27 CLOCK (1 OF 2)

CLOCK CALLOUTS

1. FUNCTION SELECTOR SWITCH (four position)

DATE - the day and month are shown in the top 4-digit area of the clock face

- the two left digits identify the month and the two right digits identify the day and the year
- as the day and year occupy the same area, the display alternates each second between the two parameters
- to aid interpretation while displaying the year, the left digits are blank
- leap years are programmed into clock operation

LOC - local time is shown in the same location as Greenwich Mean Time (GMT)

- a single dot appears above the LOC legend, to give an alternative means of distinguishing local time from GMT, in addition to switch position

GMT - Greenwich Mean Time is shown in the top 4-digit readout area of the clock face from 00:00 to 23:59 minutes

- a single dot is displayed above the GMT legend

SET - (push and turn counterclockwise from the GMT position)

- used to set clock parameters
- when the function selector is placed in the SET position, the Elapsed Time (ET) button is pushed to cycle through the modes that follow:
 - GMT minutes (displayed immediately when SET is selected)
 - GMT hours
 - LOC minutes
 - LOC hours
 - Days
 - Months
 - Years (default on power-up is 90)
- at each momentary activation of the ET switch, the applicable area of the display flashes and the data is then entered using the CHR button
- the CHR button may either be pushed steadily to cause the target display to increment automatically at a rate of 1 unit per 0.5 seconds, or may be activated by the operator in discrete steps

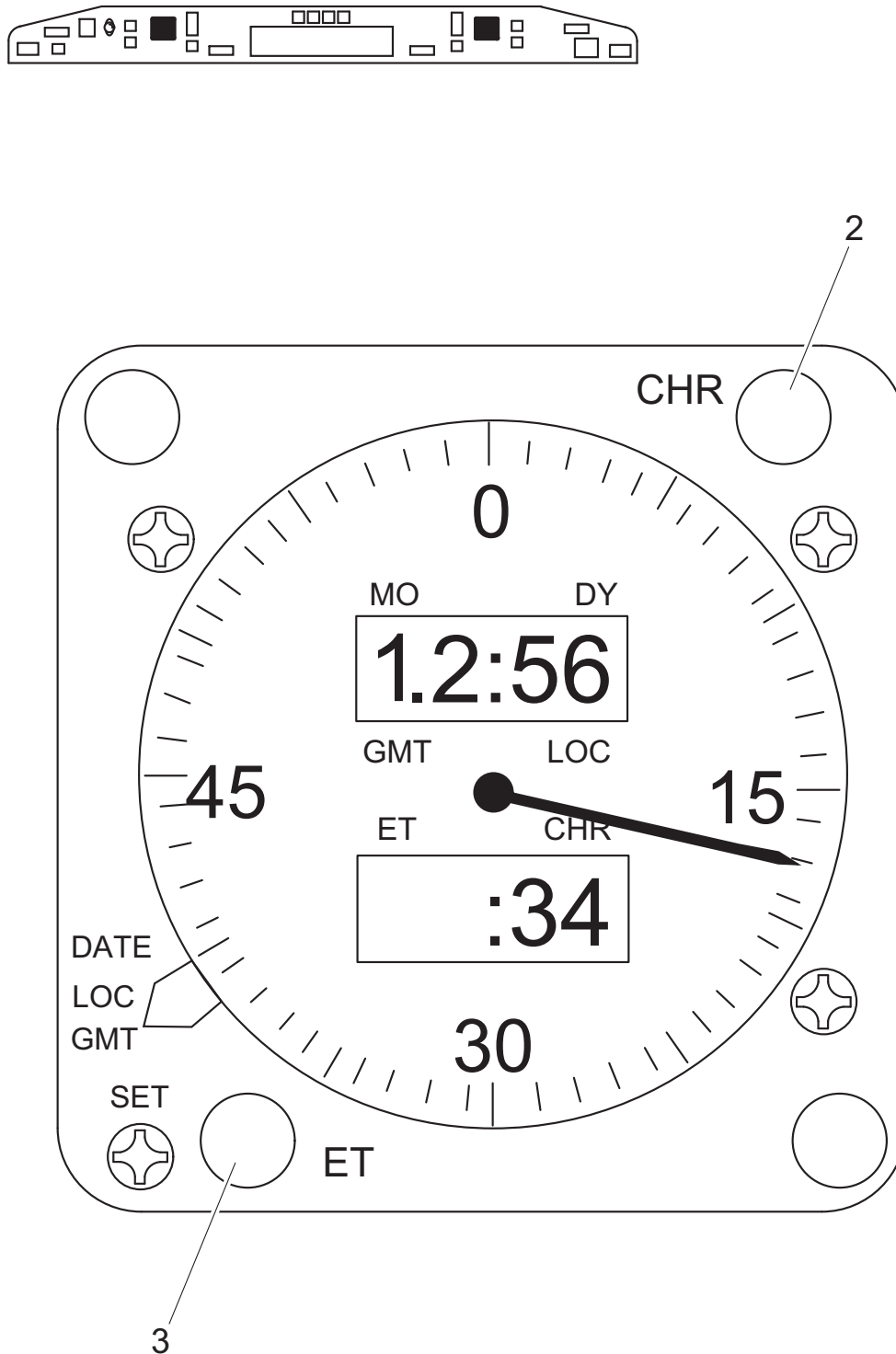


Figure 12.12-28 Clock (2 of 2)

CLOCK CALLOUTS (CONT'D)

2. CHRONOMETER FUNCTION SWITCH (momentary action)

PUSH - (when not in set mode) supplies the three states, in order, that follow:

First activation: START

- temporary removal of the elapsed time
- time hour display
- return to zero
- chronometer minute count start
- chronometer sweep hand start

Second activation: STOP

- maintains the display of the current indication

Third activation: RESET

- sweep hand returns to zero
- elapsed time display returns

3. ELAPSED TIME SWITCH (momentary action)

- gives 3-state and 2-state sequences dependent on the Weight On Wheels (WOW) status of the aeroplane:

On the ground:

- first activation: Display of Elapsed Time
- second Activation: Elapsed Time is reset to zero
- third activation: Display of Chronometer minutes

In the air:

- first Activation: Display of Elapsed Time
- second Activation: Display of Chronometer minutes
- Elapsed Time (ET) is indicated from 0 to 99:59 in the lower digital display area of the clock face and gives an indication of aeroplane flight time
- the mode is automatically enabled when the aeroplane becomes airborne and can only be reset on the ground
- a colon separates the hours and minutes
- minutes are indicated from 0 to 59 by the two right digits in the lower display area of the clock face with the left digits blanked
- seconds are shown against the round dial of the clock face by a sweep-hand activated by a stepper motor

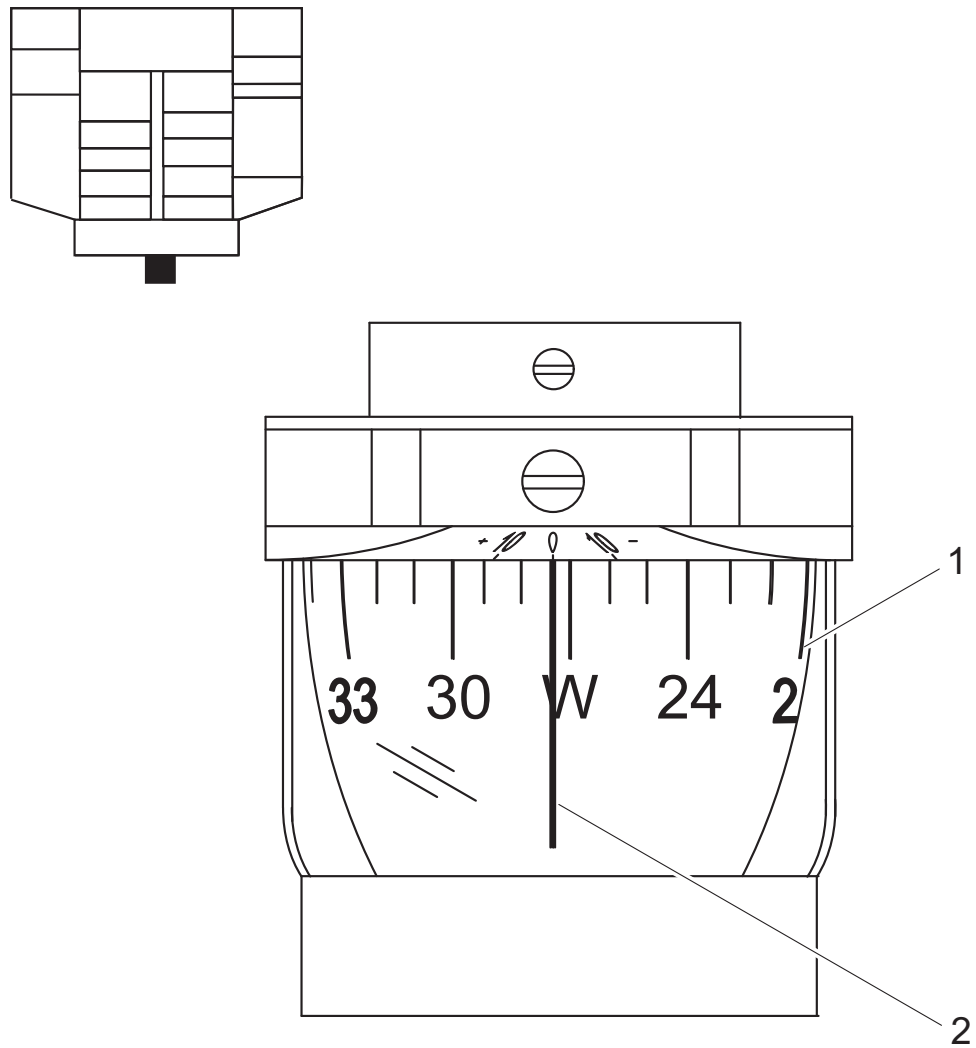


Figure 12.12-29 Standby Compass

STANDBY COMPASS CALLOUTS

1. HEADING SCALE

- shows the heading of the aeroplane
- the compass card is marked in 10 degree graduations with a numerical value every 30 degrees

2. LUBBER LINE

- reference line by which to reading standby magnetic heading

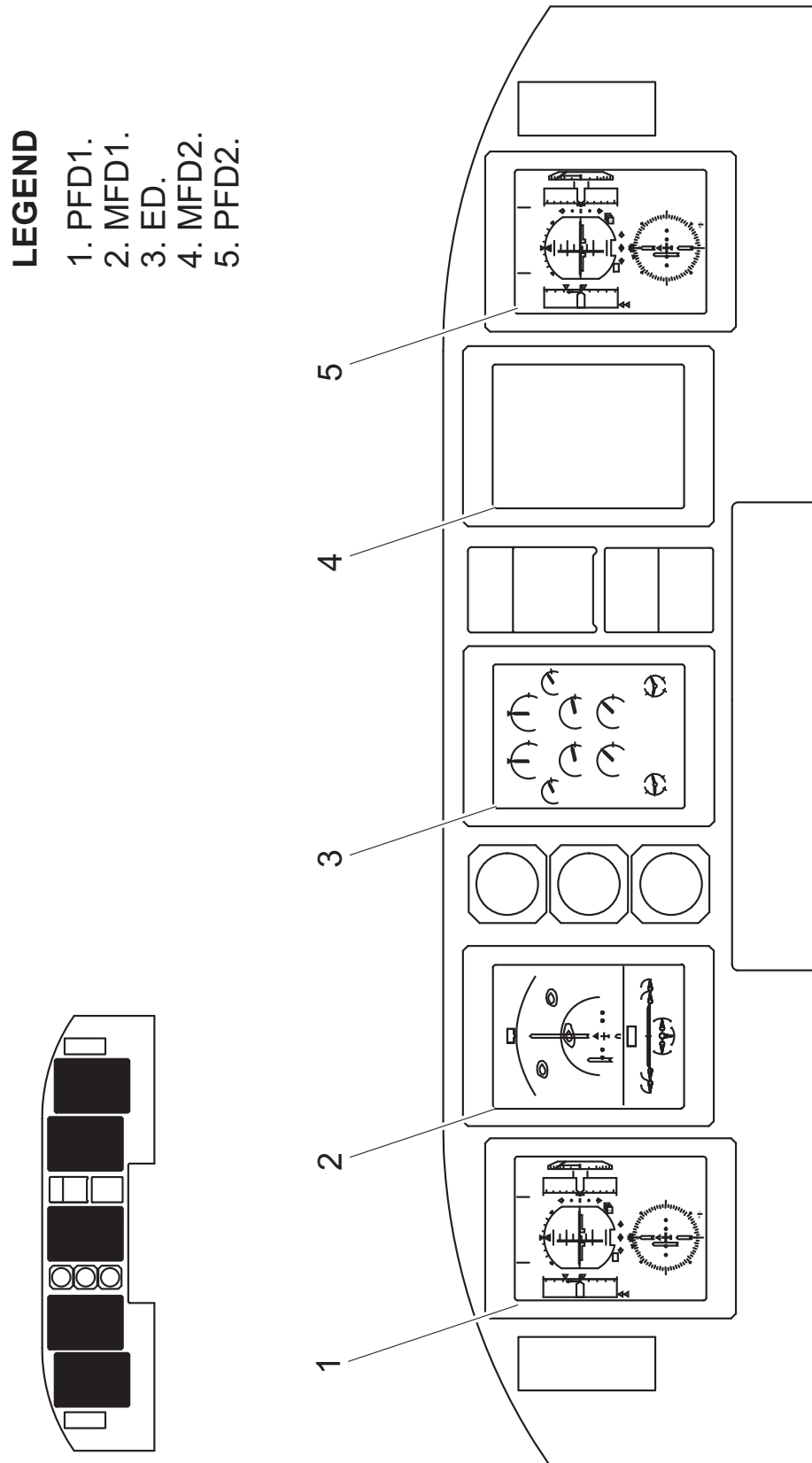


Figure 12.12-30 EIS Displays

12.12.1.4 Flight Data Processing System (FDPS)

The Flight Data Processing System (FDPS) is central to the Avionics Suite installed in the Dash 8-Q400 aeroplane. Its main functions are to acquire and compute parameters derived from external sensors and avionics equipment and to concentrate and route them to Avionics subscriber systems such as the:

- Electronic Instrument System (EIS)
- Flight Data Recorder (FDR), see chapter 12.4
- Audio and Radio Control Display Unit (ARCDU), see chapter 12.4
- Autopilot, see chapter 12.3
- Stall Warning, see chapter 12.3
- Traffic Collision Avoidance System (TCAS)
- and additional support systems.

It also computes and provides the Warning tones (see chapter 12.12.2) which alert the flight crew to specific events or system failures.

Each Flight Data Processing System (FDPS 1, FDPS 2) consists of five modules located in two Integrated Flight Cabinets (IFC 1, IFC 2) installed in the Avionics rack. 1 FDPS is located in 1 IFC.

12.12.1.5 Electronic Instrument System (EIS)

The EIS is used as a primary means of display for primary flight data (airspeed, altitude, attitude, heading, IVSI, etc.) and navigation, and includes Weather Radar, EGPWS terrain and TCAS display functions when installed. EIS is also the primary means of display for monitoring engine and some aeroplane system data including advisory during all flight phases of the aeroplane.

This system is divided into two sub-systems:

- Electronic Flight Instrument System (EFIS)
- Engine and System Integrated Displays (ESID)

The EIS is composed of five (Figure 12.12-30) identical liquid crystal Display Units (DU):

- Pilot's Primary Flight Display (PFD1)
- Pilot's Multi-Function Display (MFD1)
- Engine and System Integrated Display (ED)
- Copilot's Primary Flight Display (PFD2)
- Copilot's Multi-Function Display (MFD2)

The following control panels interface with the Display Units to command display modes and reversion (Figure 12.12-31):

- Pilot's Index Control Panel (ICP1)
- Copilot's Index Control Panel (ICP2)
- Pilot's EFIS Control Panel (EFCP1)
- Copilot's EFIS Control Panel (EFCP1)
- ESID Control Panel (ESCP)

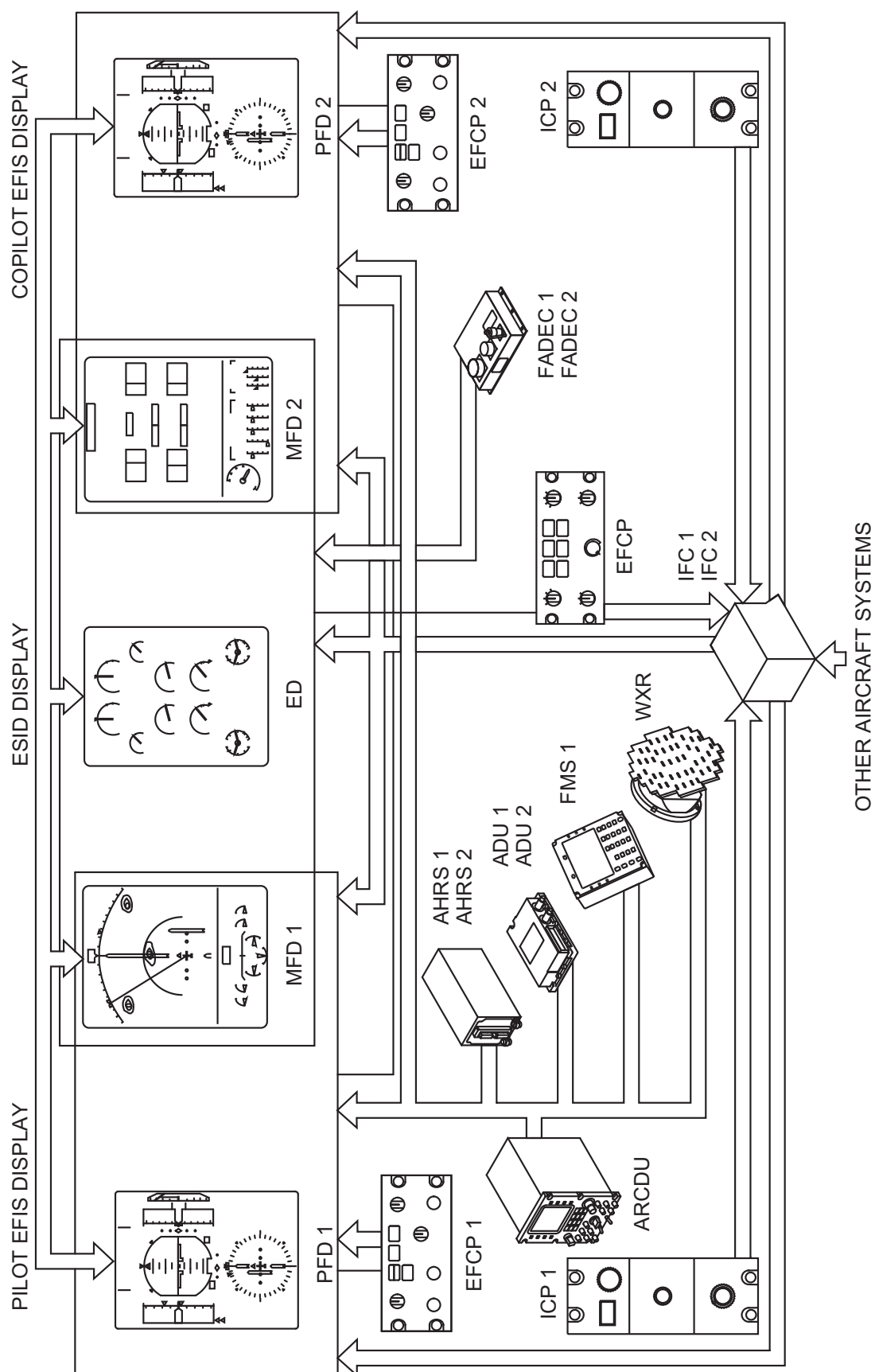


Figure 12.12-31 EIS Schematic

Dash8 - Q400 - Indicating & Recording Systems

The EFIS system uses the two PFDs and the two MFDs to display information. The ESID system uses the two MFDs and the ED to display information.

The system is interfaced as follows (Figure 12.12-31):

- EFCP1 controls PFD1 and MFD1
- EFCP2 controls PFD2 and MFD2
- ESCP controls MFD1, MFD2 and the ED
- AHRS (Attitude and Heading Reference System) interfaces with all EFIS DUs. There is one AHRS per side.
- ADC (Air Data Computer) interfaces with all EFIS DUs. There is one ADC per side.
- FMS (Flight Management System) interfaces with all EFIS DUs.
- IFC (Integrated Flight Cabinet) interfaces with ESID and EFIS DUs. There is one IFC per side including.
- One Flight Guidance Module that interfaces with EFIS Displays only.
- FADEC (Full Authority Digital Engine Control) interfaces with all ESID DUs. There is one FADEC per engine, with 2 redundant channels per FADEC.
- WXR (Weather Radar) interfaces with MFD1 and MFD2. There is one WXR in the aeroplane.

Each display is interconnected with the others with a feedback bus to exchange system information and provide feedback of critical parameters.

The Electronic Instrument System (EIS) calculates the position, size and value of all parameters being shown and also controls the automatic and manual display brightness.

The Display Unit's (DU) brightness varies with changing ambient lighting conditions in the flight deck. To help see the display, a light detector located on the front face of each Display Unit (DU) gives an ambient light input for automatic brightness control.

The brightness of each Display Unit (DU) can also be adjusted by manual brightness controls that vary the brightness from minimum to maximum level. The Display Unit (DU) keeps the brightness level throughout a power interruption.

12.12.1.5.1 Symbology Description

USE OF COLOUR

Display symbology uses the following color rules:

- RED: for warning visual alert where immediate recognition and corrective or compensatory action by the crew is required. It applies for emergency situation or red limitation exceedance, i.e. Engine red line exceedance, VMO exceedance, TCAS Resolution advisory, etc.
- YELLOW: for caution visual alert where immediate crew awareness is required and subsequent crew action will be required. It applies for abnormal situation or yellow limitation exceedance, i.e. mismatch and AFCS caution messages, Excessive Deviation, altitude alert, cross-side source selection, Engine yellow line exceedance, TCAS Traffic advisory, display caution message, altitude alert, etc.
- WHITE: A/C actual parameter and status, advisory messages, legends, scales, A/C reference, AFCS armed modes, non-active flight-plan part, bearing pointer 1, unit (on EFIS)
- GREEN: for active controlling modes/functions i.e. AFCS active modes, passed test, bearing pointer 2
- CYAN: for pilot selectable parameters, i.e. Selected Heading / Course / Altitude, Speed/Torque bugs, Baro-correction/DH setting
- MAGENTA: TCAS proximate and other traffics, VOR / ILS / DME related data or pointer flight director commands, FMS related data or pointer

Digital indications are displayed in the same color as the associated graphic symbol when applicable.

The following additional attributes are used for EIS messages:

- FLASHING: used to provide attention getting for new messages requiring subsequent pilot action. Flashing can be time-limited (for 5 seconds in most cases) or can be maintained until the crew action is completed. Flashing frequency is 1 Hz with 50% duty cycle.
- REVERSE VIDEO: used to annunciate a change in an operating state of the A/C that was not pilot initiated. By its nature, this is used in a time-limited period (for 5 seconds in most cases). When reverse video is used, digits or letters are in black on a uniform rectangular background of the same color as the indication is in normal video.
- BRACKETS: messages in between brackets correspond to flight crew instructions or required action.

12.12.1.6 Primary Flight Display (PFD)

The Primary Flight Displays (PFD1, PFD2) are the outer displays of the Electronic Flight Instrument System (EFIS) and show primary flight data and navigation data that follow:

- Flight Mode Annunciator (FMA)
- Air Speed Indicator (ASI)
- Electronic Attitude Direction Indicator (EADI)
- Altimeter (ALT)
- Electronic Horizontal Situation Indicator (EHSI)
- Inertial Vertical Speed Indicator (IVSI)
- Traffic Collision Avoidance System II (TCAS II)
- Flight Management System (FMS)
- Global Positioning System (GPS)

12.12.1.7 Multi Function Display (MFD)

The Multi-Function Displays (MFD1, MD2) are located inboard of the Primary Flight Displays (PFD). Each Multi-Function Display (MFD) shows the pages that follow:

- MFD1 with Navigation Page or System Page with a PFCS Permanent System Data Area
- MFD2 System Page or Navigation Page with a Flap/Hydraulic Permanent System Data Area
- Primary Flight Display (PFD) Reversions
- Engine Display (ED) Reversions

The Multi-Function Displays (MFD) show the System pages that follow:

- Electrical
- Engine
- Fuel
- Doors

12.12.1.8 Engine Display (ED)

The ED shows the engine and aeroplane system data that follows:

- Engine related parameters (see chapter 12.25)

Advisory Messages:

- FUEL and ICE system advisories
- Avionics and Powerplant/Maintenance messages

Miscellaneous messages:

- Digital display of SAT
- EIS Display monitoring message
- Engine limits table

12.12.1.9 Index Control Panels

The Index Control Panels (ICP1, ICP2) interface with their related Primary Flight Displays (PFD1, PFD2) to command the selections that follow:

- SEL SPEED BUG index selector
- SPEED BUG rotary setting
- BARO SET/PUSH TO STANDARD rotary knob
- DH/MDA rotary setting
- DH/MDA selector

12.12.1.10 EFIS Control Panel (EFCP)

The pilot and co-pilot's Electronic Flight Control Panels (EFCP) interface with their related Primary Display Unit (PFD1, PFD2) and Multi-Function Displays (MFD1, MFD2) to command the selections that follow:

- Bearing Source Selection, Side 1; Side 2 (BRG)
- MFD NAV source selection (short push), full/partial arc compass scale (long push) (FORMAT)
- Weather radar and terrain display selector (WX/TERR)
- Map mode (DATA)
- Traffic Collision Avoidance System (TCAS)
- Weather radar (RANGE)
- Brightness OFF and on control for Primary Displays and Multi-function displays (PFD and MFD)
- Brightness control for the weather radar images (WX/TERR BRT)

12.12.1.11 ESID Control Panel (ESCP)

The ESCP Control Panel interfaces with the Engine Display (ED) and the Multi-Function Displays (MFD) to command the selections and reversionions that follow:

- Multi-Function Display (MFD1 and MFD2) display configuration
- System pages
- Attitude and Heading Reference System (AHRS) source reversion
- Air Data Unit source reversion
- OFF and on brightness control for the Engine Display (ED)

12.12.1.12 Display Unit (DU) failures

When a Primary Flight Display (PFD) or the Engine Display (ED) fails, its images can be manually transferred to the Multi-Function Display (MFD) as a reversionary mode using the ESID Control Panel (ESCP).

The MFD1, MFD2 control switch sets the desired display configuration on the Multi-Function Display (MFD).

In the event of an Engine Display (ED) failure, the display information automatically transfers to the Multi-Function Display (MFD1). This automatic reversion occurs only if the Multi-Function Display (MFD1) on the ESCP is not set to show the Primary Flight Display (PFD). In addition, the remaining Multi-Function Display (MFD) shows both the Permanent Data Areas as a composite image.

The Engine and System Integrated Display (ESID) Mono Mode allows the selection of a System page when both Multi-Function Displays (MFD1, MFD2) fail or are selected on the ESCP Control Panel to show both Primary Flight Displays (PFD) (Figure 12.12-33). A permanent press on a dedicated System page key allows the appropriate System Page to be displayed in a composite system format on the Engine Display, replacing the ED format. The Engine Display (ED) format returns when the push button switch is released. If the ALL key is pressed, the ED remembers the previous selected system page, and steps through the next page when ALL key is pressed.

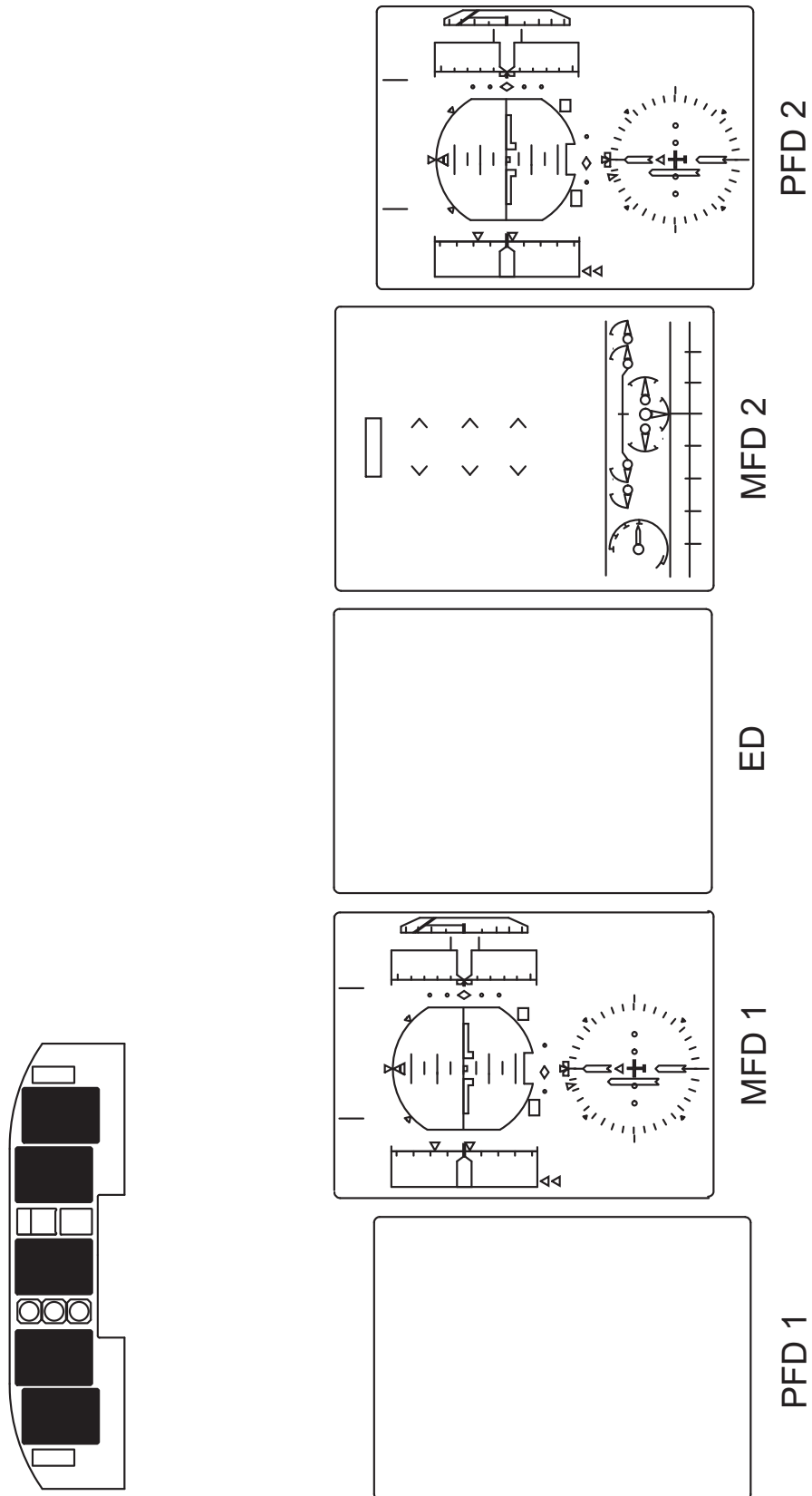


Figure 12.12-32 PFD Priority Over ED

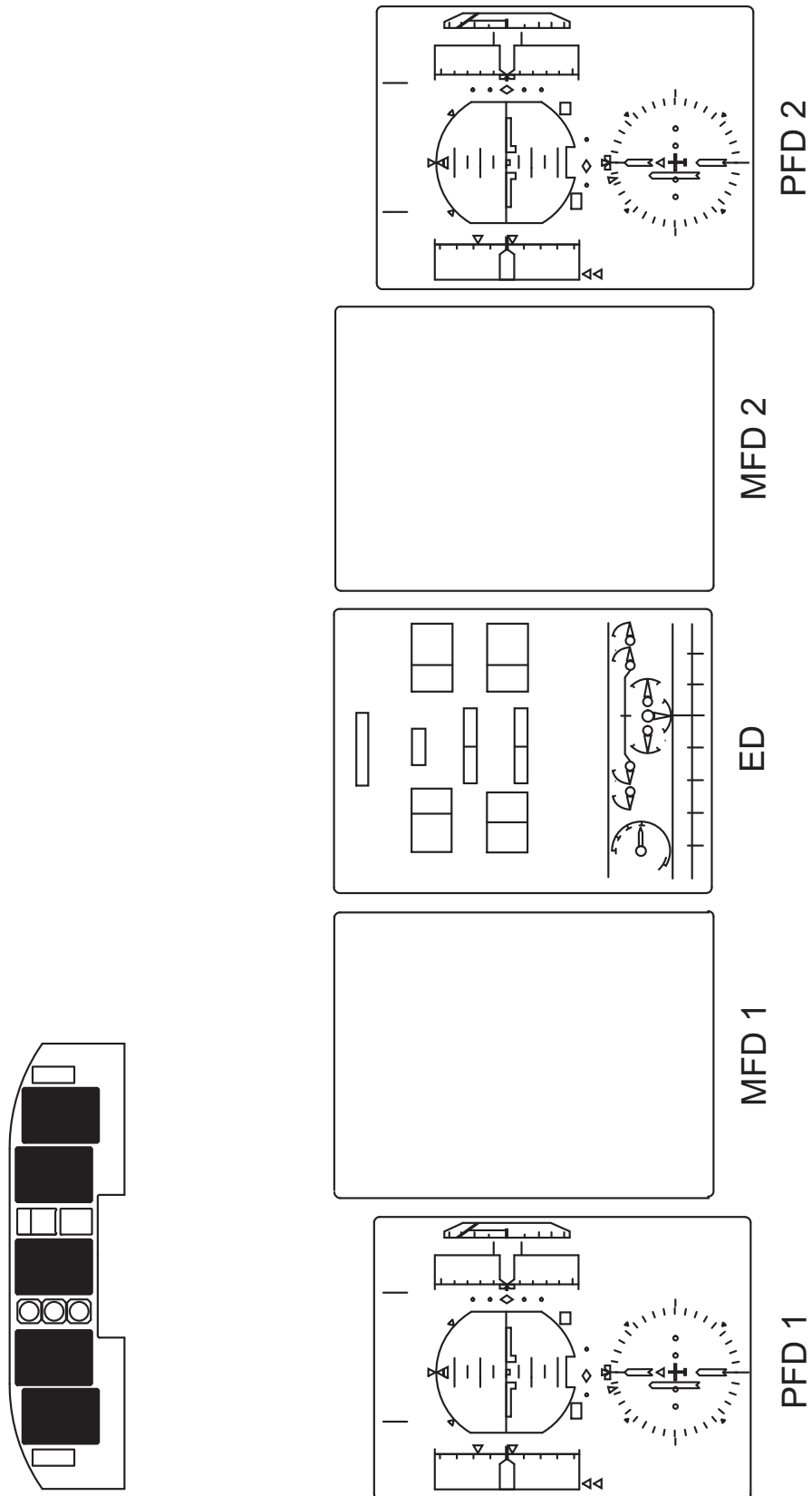


Figure 12.12-33 MFD1 and MFD2 Failed, and ELEC Pushbutton Being Held

12.12.1.13 Manual Reversion

In normal configuration, the following data may be selected on the ESCP Control Panel for display on the MFDs as follows:

- MFD1: PFD, NAV, SYS, ENG
- MFD2: ENG, NAV, SYS, PFD

When NAV is selected, the MFD displays a NAV page in the ARC format by default (Figure 12.12-34).

If SYS is selected, the Electrical system page is displayed on MFD1, even if MFD2 is selected to SYS and is showing another system page on MFD2. A particular system page can be displayed by pressing the relevant push-button on the ESCP. There is no change if the selected page is already being displayed.

The ALL push button when pressed cycles the displays as follows:

- ELEC (default page) (Figure 12.12-36, 12.12-37)
- ENG (Figure 12.12-38, 12.12-39)
- FUEL (Figure 12.12-42, 12.12-43)
- DOORS (Figure 12.12-40, 12.12-41)
- ELEC
- etc.

The ALL function is computed from the ALL discrete signal from the ESCP. This permits access to all system pages in the event of the loss of power to the ESCP.

Refer to page 12.12-66, section 12.12.1.12 Display Unit (DU) Failures.

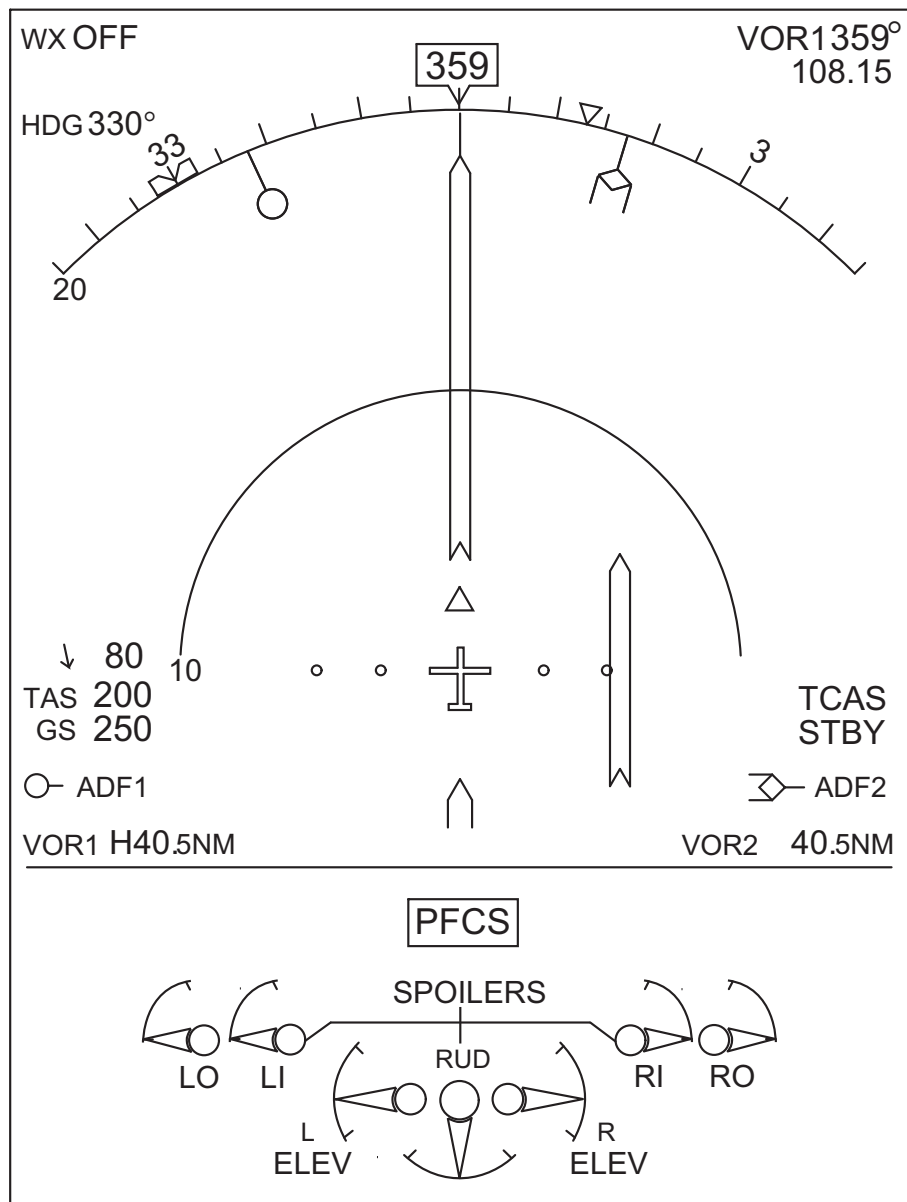
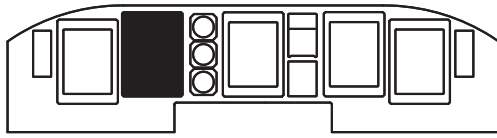


Figure 12.12-34 MFD1 NAV Page - ARC Mode

Dash8 - Q400 - Indicating & Recording Systems

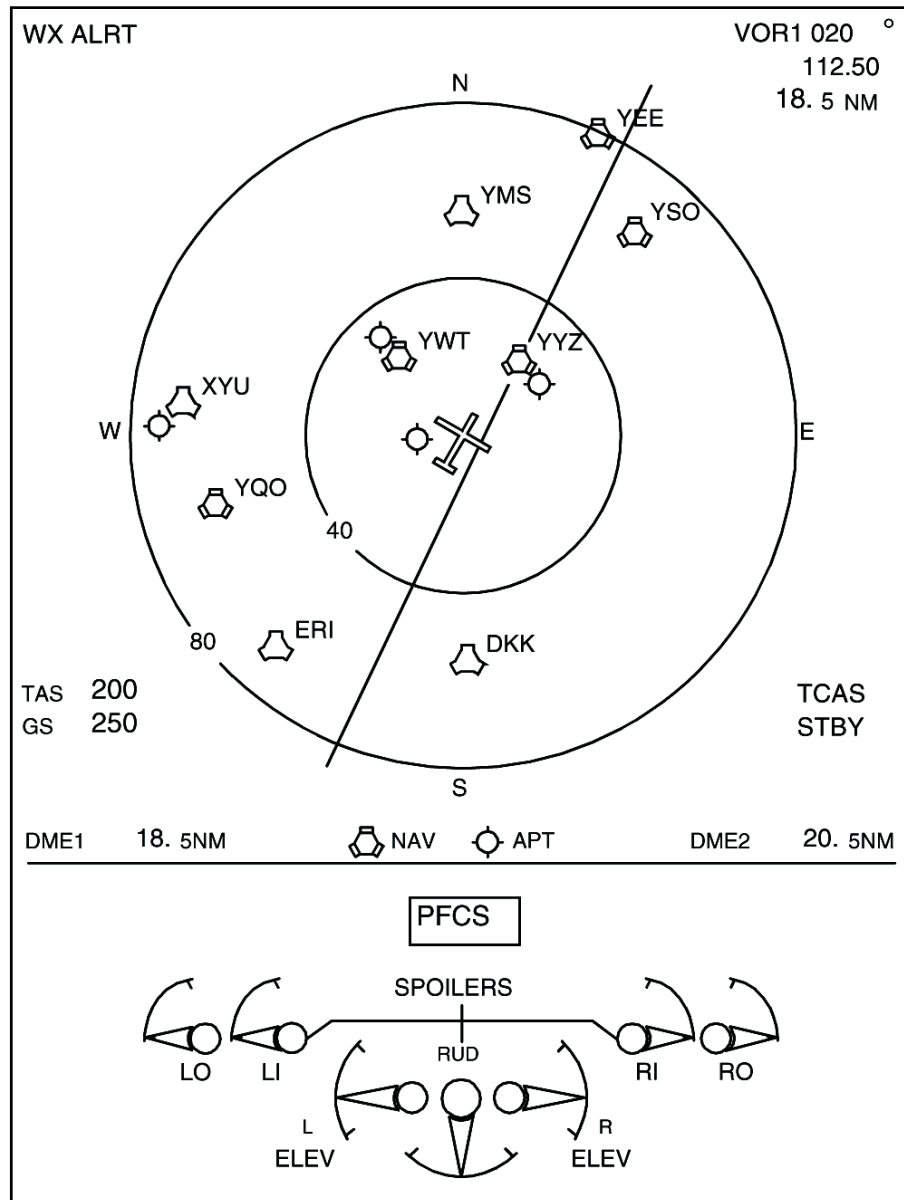
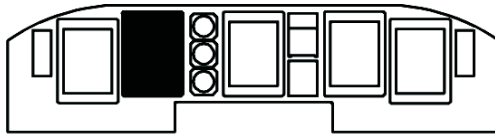


Figure 12.12-35 MFD1 NAV Page - FULL Mode

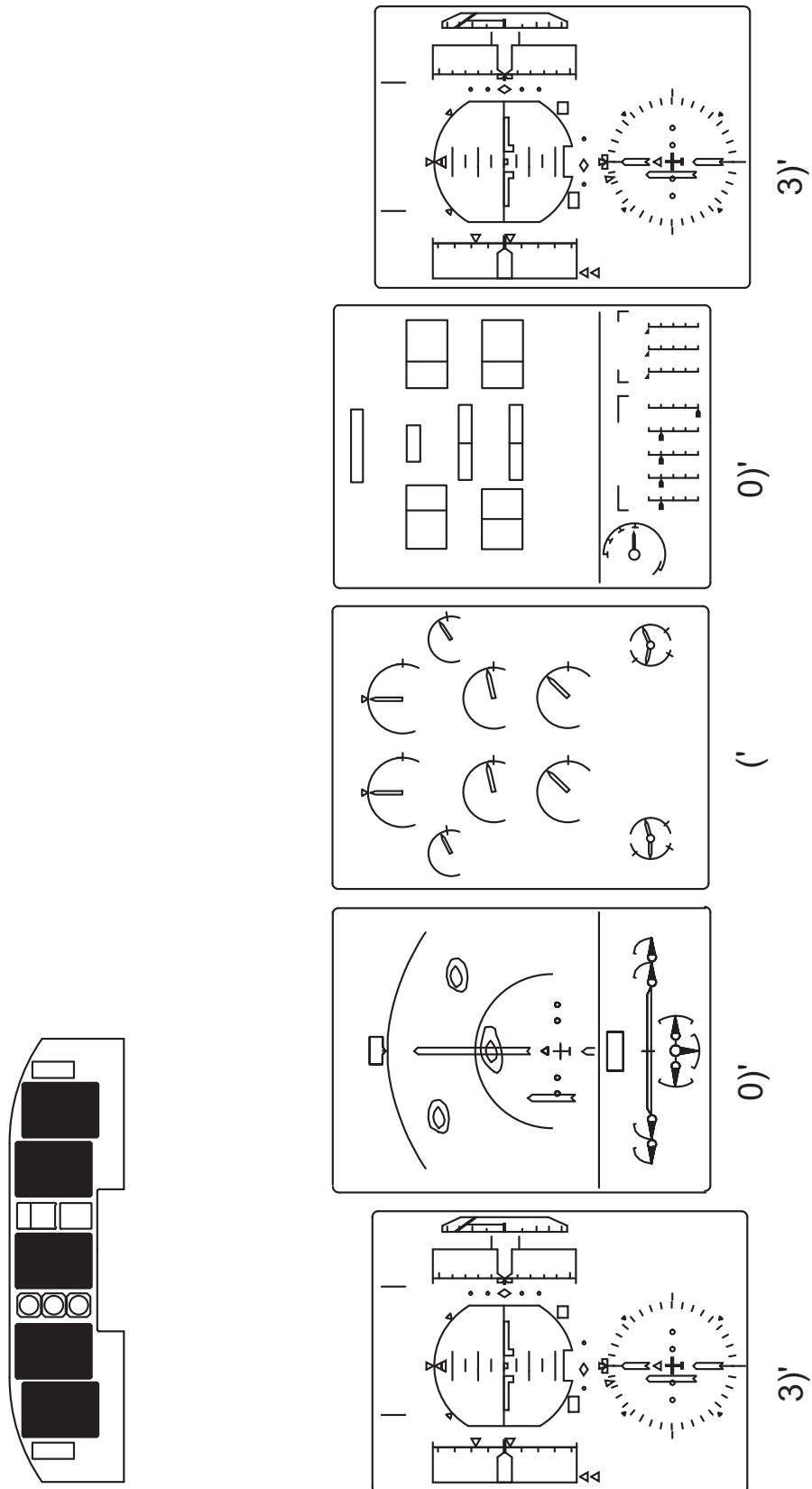


Figure 12.12-36 MFD2 Selected to ELEC Page

Dash8 - Q400 - Indicating & Recording Systems

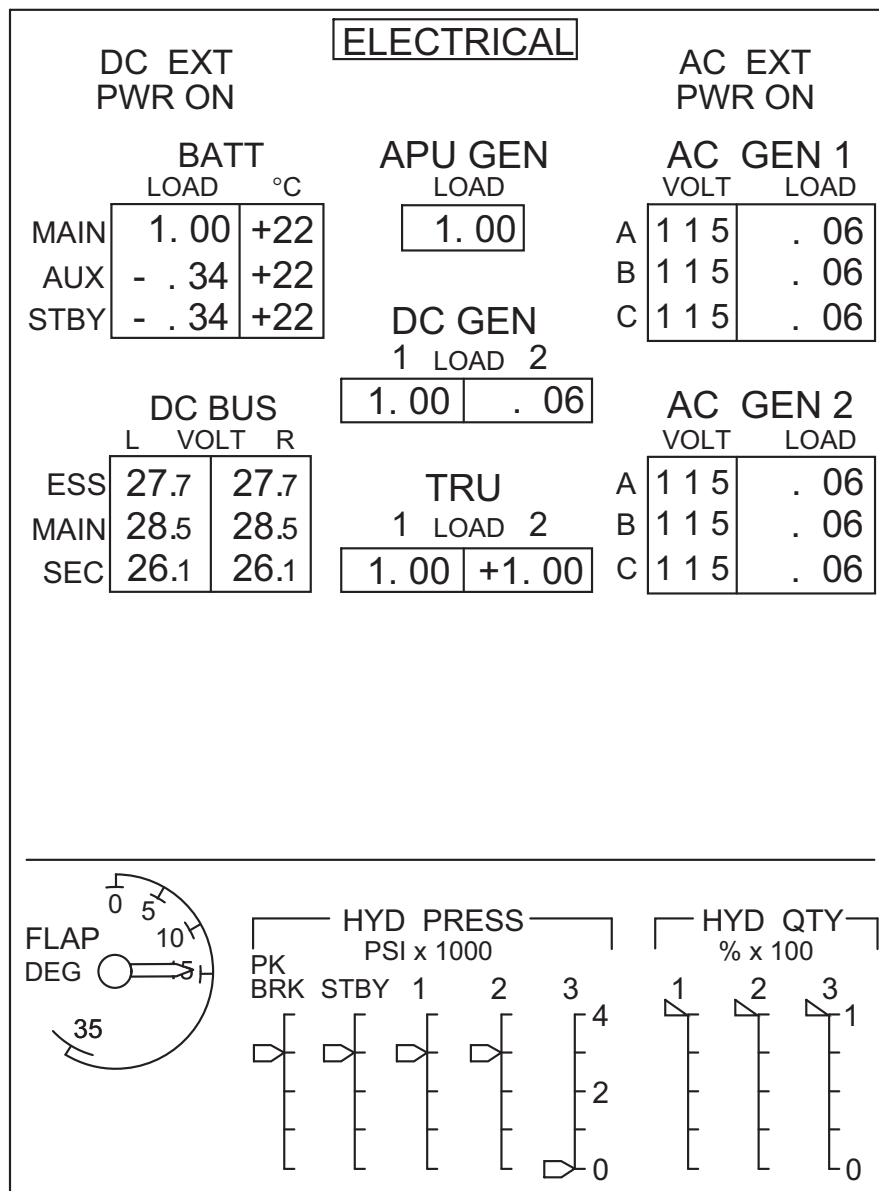
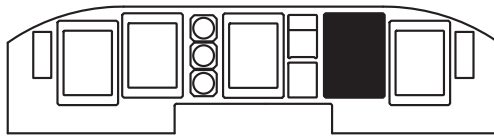


Figure 12.12-37 MFD2 ELEC Page

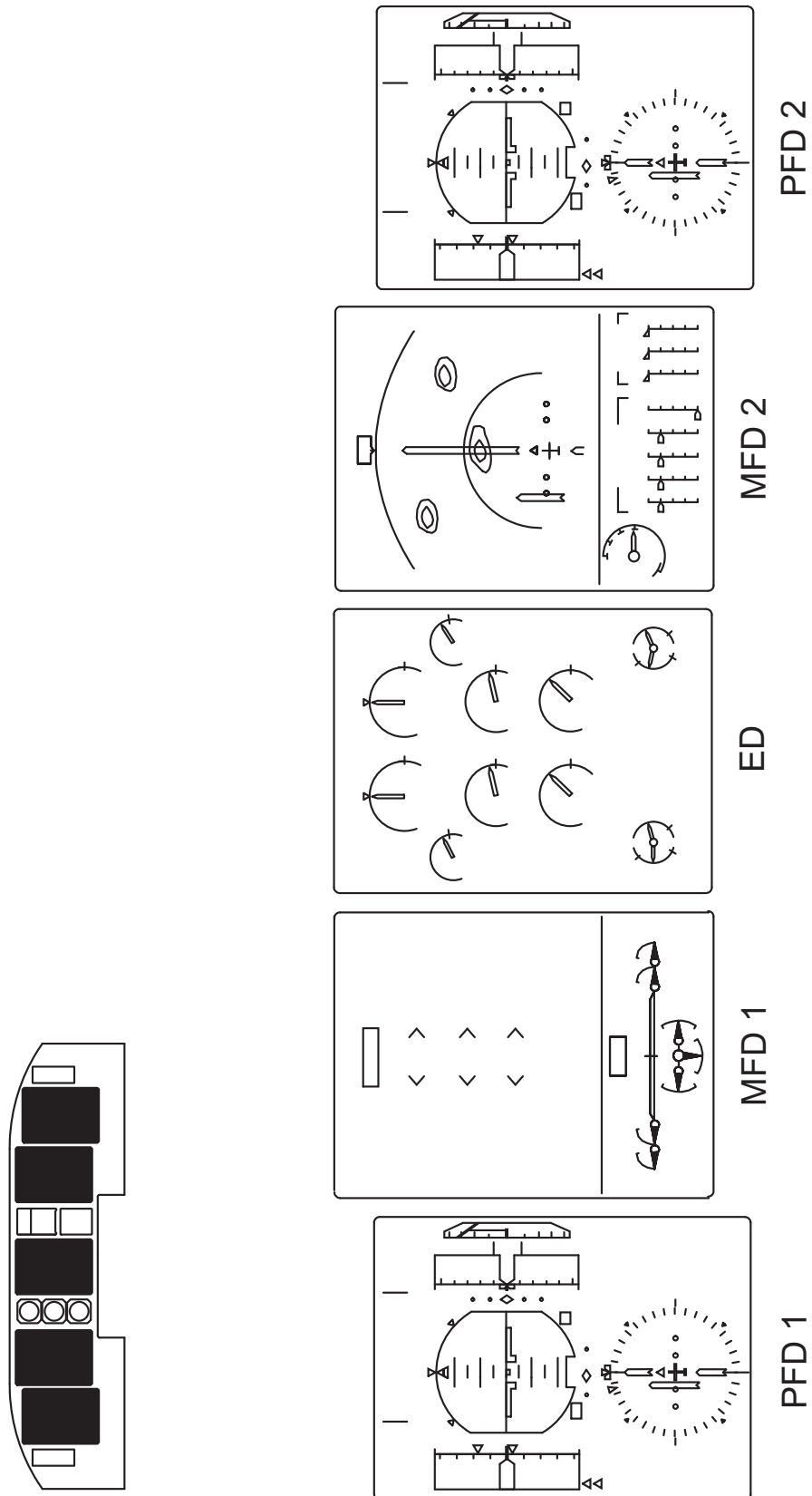


Figure 12.12-38 MFD1 Selected to ENG Page

Dash8 - Q400 - Indicating & Recording Systems

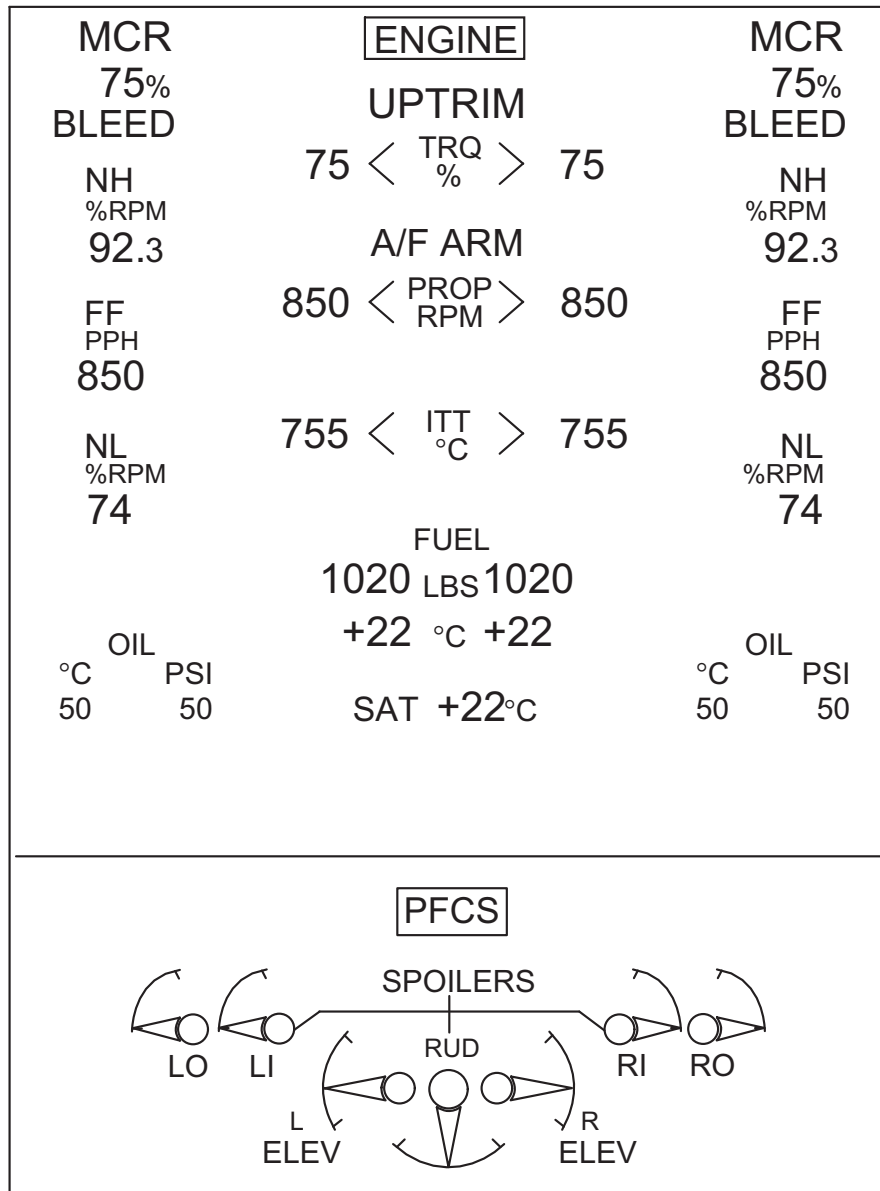
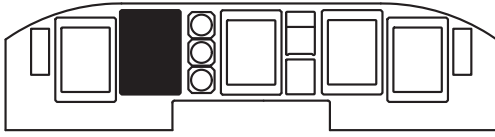


Figure 12.12-39 MFD1 ENG Page

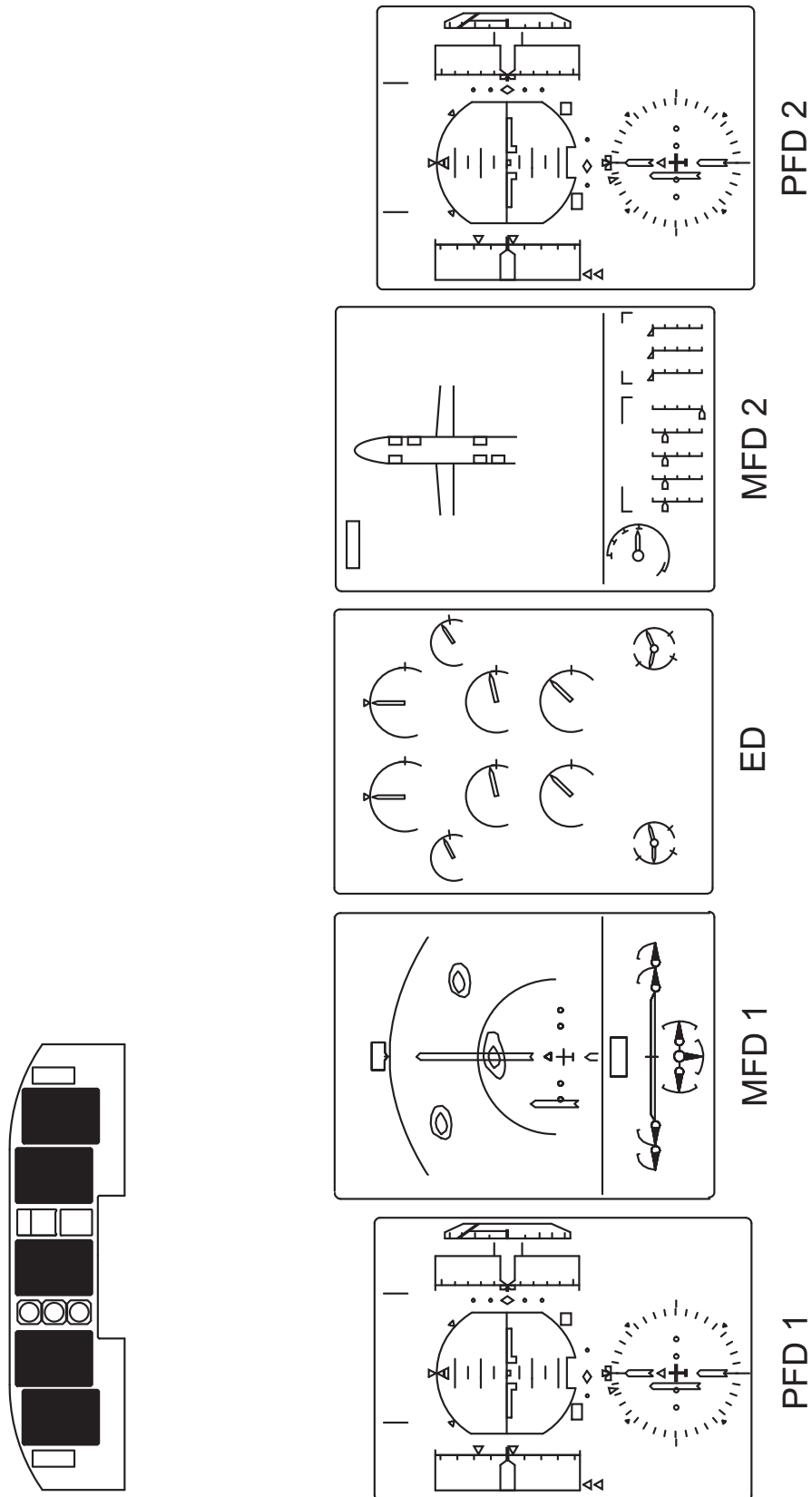


Figure 12.12-40 MFD2 Selected to DOORS Page

12.12.1.14 Auto Shutdown

The auto shutdown mode blanks the image on the display when activated:

- On the PFD when the PFD image is selected on the adjacent MFD
- On the ED when the ED image is selected on MFD1 or MFD2

During this mode, the DU still computes the Input/Output (I/O) and displays functions, but stops the feedback monitoring function. A white message AVAIL is displayed in the centre of the screen if the DU is still operational, but not selected.

12.12.1.15 MFD Permanent Data Reversion

Permanent data are available on the MFDs and are displayed when the NAV or SYS page is selected. In the normal configuration, the permanent system data are shared between the two MFDs as follows:

- PFCS indicator on MFD1
- Flap angle position and hydraulic indications on MFD2

When only one MFD is available for the display of the NAV or SYS pages, a composite image (Figure 12.12-42, 12.12-43) showing all permanent system data is displayed on the remaining MFD.

A display of composite image permanent system data will be displayed on the MFD:

- When a PFD or ED page is manually selected on the opposite MFD, or
- When ED is displayed on MFD1 after auto reversion, or
- When the opposite MFD is not valid for more than one (1) second.

MFD will revert to the normal mode of permanent system data display:

- When the opposite MFD is returned to SYS or NAV position, or
- Fifteen (15) seconds after the opposite MFD is valid again.

Dash8 - Q400 - Indicating & Recording Systems

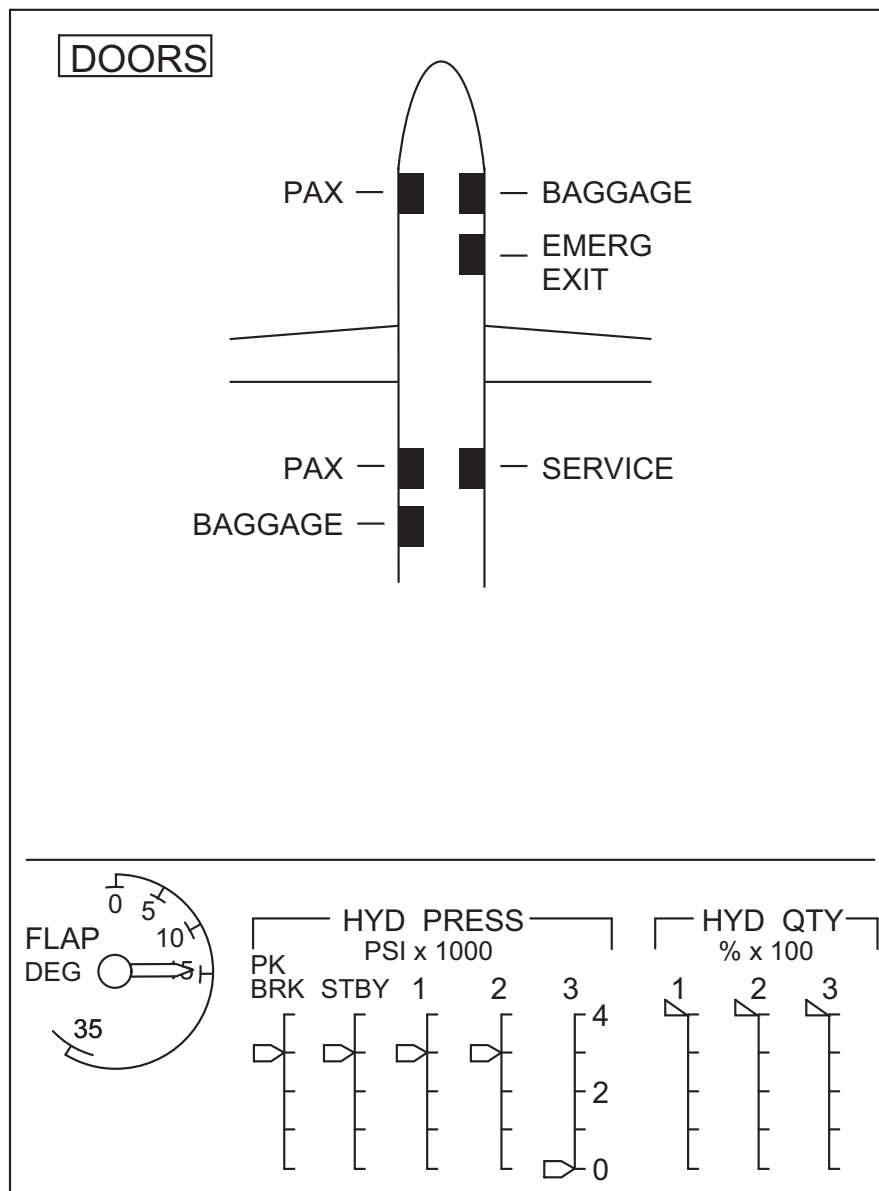
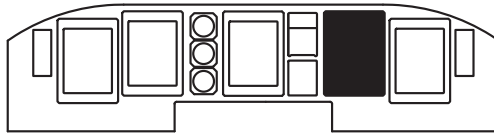


Figure 12.12-41 MFD2 DOORS Page

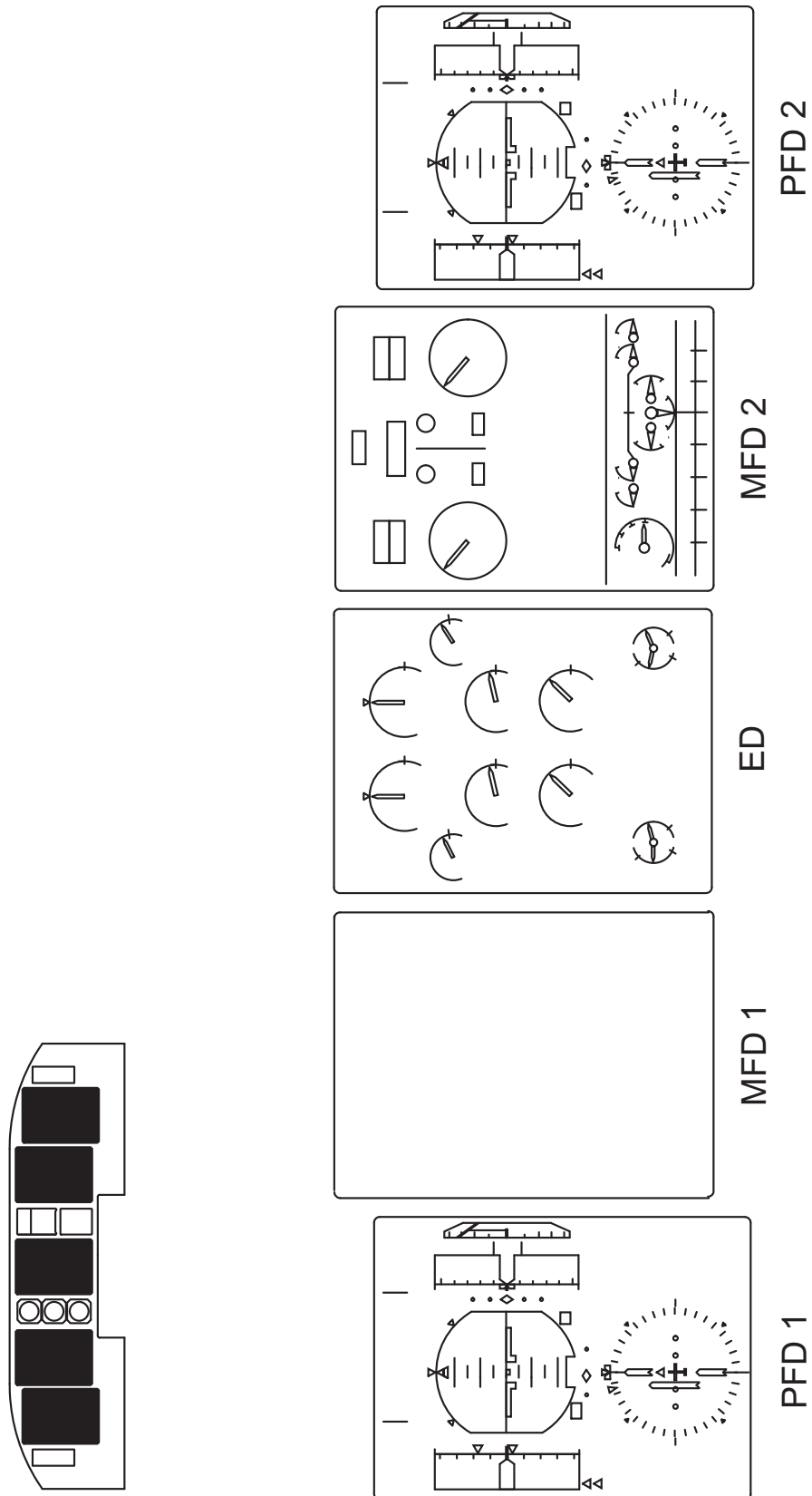


Figure 12.12-42 MFD1 Failed, MFD 2 Selected to FUEL Page (Composite)

Dash8 - Q400 - Indicating & Recording Systems

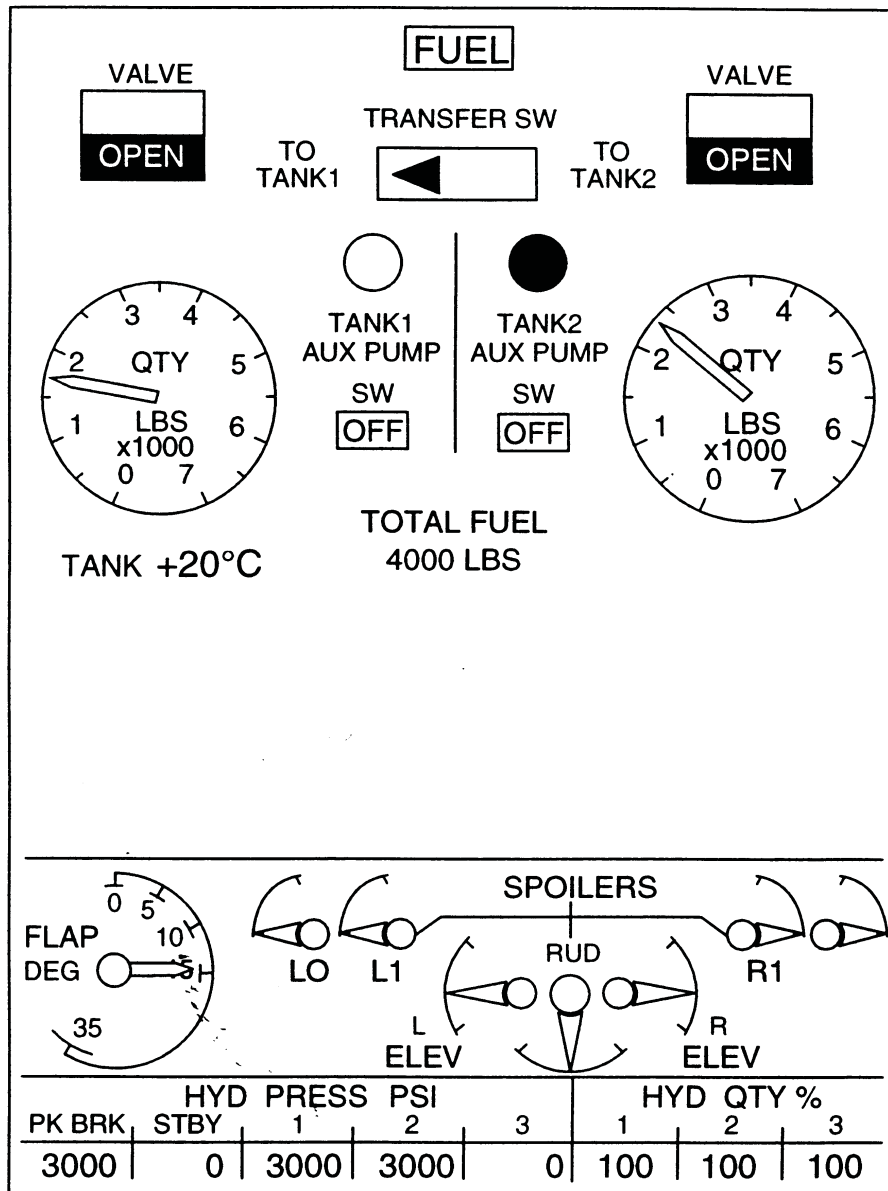
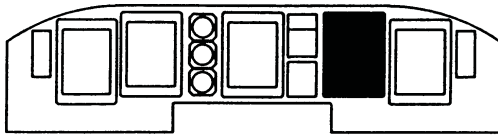


Figure 12.12-43 MFD2 FUEL Page with Composite Permanent Data

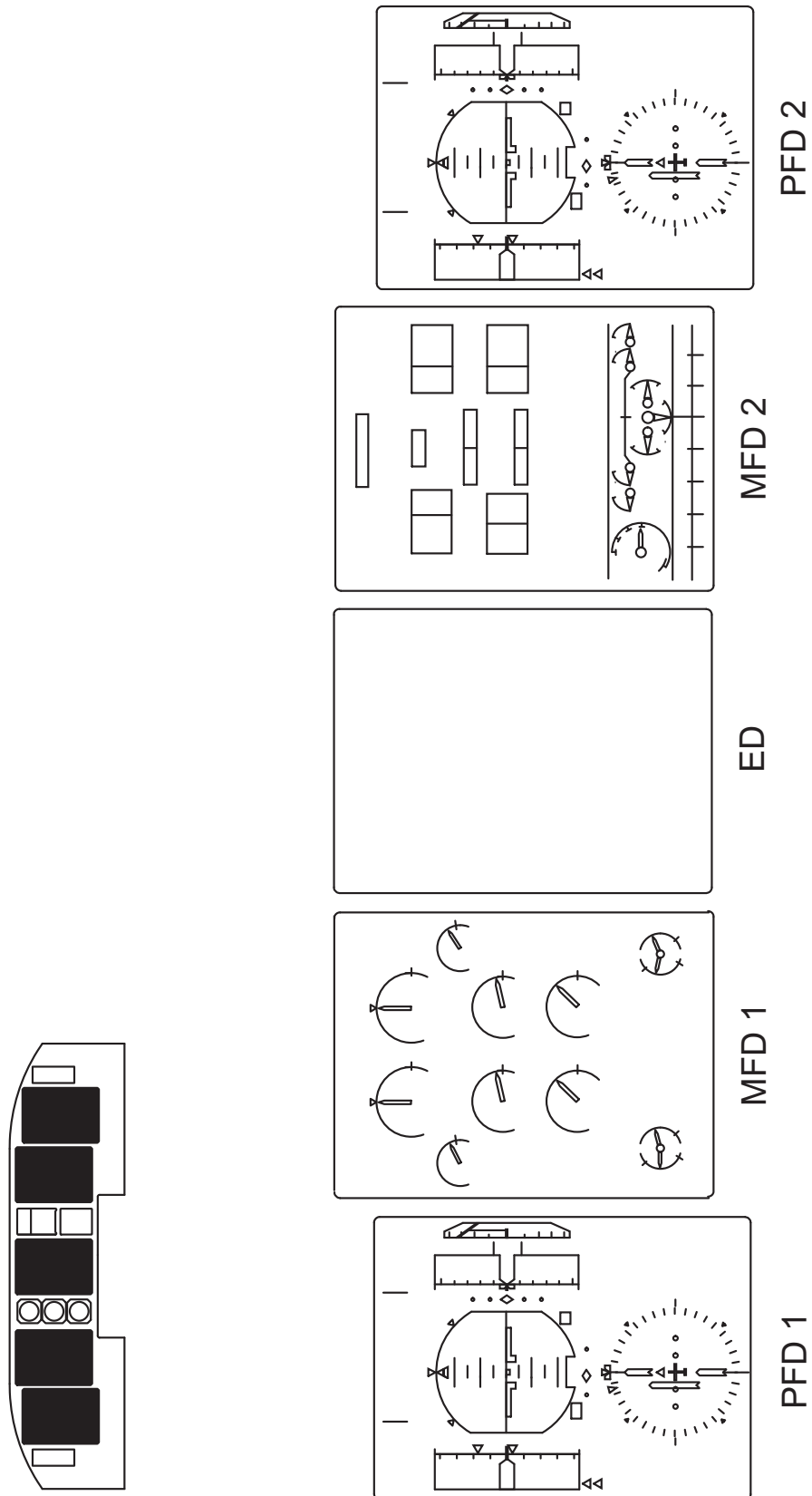


Figure 12.12-44 ED Failure with Auto Reserve to MFD1

12.12.1.16 ED Automatic Reversion To MFD1

ED data will automatically revert to MFD1 (Figure 12.12-44) when the ED/DU is not valid for more than one (1) second and if:

- MFD1 rotary switch on the ESCP is selected to NAV or SYS position, and
- IAS from ADC1 is above 50 kt or is invalid

When an automatic reversion has been performed, the ED image will remain on the MFD even if the ED/DU becomes valid again. The automatic reversion is cancelled as soon as the MFD1 rotary selector is operated.

12.12.1.17 Battery Power Only

With only the BATTERY MASTER selected on, the following EIS services are available:

- MFD1
- ED
- MFD1 reversion selector on the ESCP
- ALL pushbutton on the ESCP

12.12.1.18 Standby Flight Instruments

The standby flight instruments operate independently and do not interface with any other systems.

Standby Magnetic Compass

A standby magnetic compass is located at the top of the windshield center-post. The standby compass must be used in conjunction with the compass correction card on the flight deck ceiling adjacent to the compass. The compass card represents the correct readings taken for normal electrical operating loads of the aeroplane (windshield heat, pitot heat, anti-collision light, etc.).

Integrated Electronic Standby Instruments (ISI)

An Integrated Electronic Standby Instrument (ISI) replaces the Standby Indicated Air Speed (IAS), Standby Altimeter, and Standby Attitude Indicator. The ISI displays all three standby instruments on a single High Resolution Active Matrix LCD using Vertical Tape Symbolology for the IAS and Altimeter. It also provides standby display for VMO and Side-slip.

ISI System Operation Check Procedures

1. Set the aircraft to WOW - ground mode.

- a) Check that 'ALIGNING' message and the A/C symbol appear for 90 seconds. After the initialization phase, verify that the following data are displayed:
 - attitude on ADI with A/C Symbol
 - airspeed tape and pointer
 - altitude tape and window
 - slip/skid indicator
 - barosetting value in hPa and/or inHg
- b) Check that the attitude displayed on ISI and on both PFDs are consistent (tolerance: +/- 1degree)

2. Check lighting:

- a) Depress the '+' button
 - brightness of the screen increases
- b) Depress the '-' button
 - brightness of the screen decreases
- c) On the pilot's side console turn CW and CCW PILOT PLT PNL knob
 - background light of the buttons changes ('CAGE', 'STD', 'BARO', '+', '-')

3. Check attitude:

- a) Press and hold the 'CAGE' button for more than 2 seconds
- b) Verify that:
 - the 'CAGE' flag appears
 - the pitch angle is reinitialized to 0 degrees (horizontal line in the central dot)
 - the roll angle is 0 degrees (roll pointer coinciding with 0 roll graduation)
 - the slip/skid indicator is centered
- c) Release the 'CAGE' button
 - verify that the pitch and roll angle move towards the aircraft level condition

4. Barosetting

- a) Turn clockwise the 'BARO' button. Increase the barosetting up to the maximum value (1100 hPa/32.48 inHg)
 - verify that the displayed barosetting and the barosetting altitude are increasing.
- b) Depress the 'STD' button
 - verify that the barosetting is reset at the default value (1013 hPa and/or 29.92 inHg)
- c) Turn counterclockwise the 'BARO' button
 - verify that the displayed barosetting and displayed altitude are decreasing.
- d) Decrease the barosetting up to the minimum value (740 hPa/21.85 inHg)
- e) Depress the 'STD' button
 - verify that the barosetting is reset at the default value (1013 hPa and/or 29.92 inHg)

5. Display of altitude in meters

- a) On the overhead panel set the ALT/METRIC switch on position 'FT' & 'M'
 - check that the altitude in meters is displayed at the bottom right of the screen
- b) Set the ALT/METRIC switch on position 'FT'
 - check that the altitude in meters is no longer displayed at the bottom right of the screen and is replaced by the barosetting in inHg
- c) Press 'PUSH TO STD' button on ICP1
 - on PFD1, check the value of barosetting is 29.92 inHg (1013mB)
- d) Press 'PUSH TO STD' button on ICP2
 - on PFD2, check the value of barosetting is 29.92 inHg (1013mB)

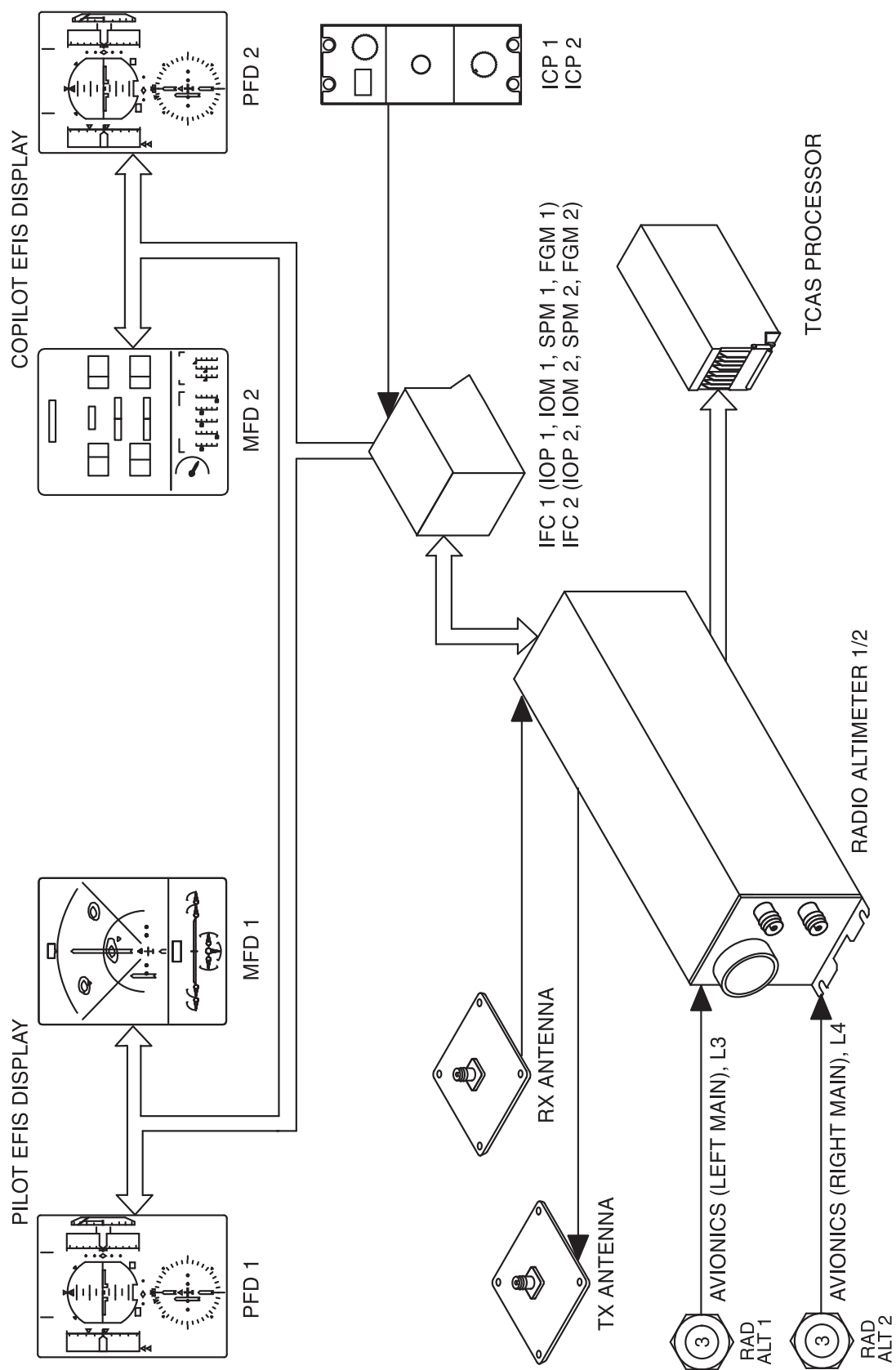


Figure 12.12-45 RA Schematic

12.12.1.19 Miscellaneous Flight Instruments

RADIO ALTIMETER

The RA system supplies data (Figure 12.12-45) directly to the Traffic Collision Avoidance System (TCAS) and through both Integrated Flight Cabinets (IFC1, IFC2) to the systems that follow:

- Auto Flight Control System (AFCS)
- Stall Protection Module (SPM1, SPM2)
- Primary Flight Displays (PFD1, PFD2)
- Solid State Flight Data Recorder (SSFDR)
- Ground Proximity Warning System (GPWS)
- Central Diagnostic System (CDS)
- Warning Tone Generator (WTG)

The aircraft Primary Flight Displays (PFD1, PFD2) show the Radio Altimeter (RA) system parameters that follow:

- Above Ground Level (AGL) altitude
- RA mismatch and failure
- Analog Rad Alt
- DH status

AGL ALTITUDE

The PFD1 and PFD2 display altitude AGL as four white numbers. It shows the altitude from zero to 2,500 feet AGL.

RA MISMATCH AND FAILURE

If there is a mismatch condition, the FDPS shows a yellow RA label above the RA indication when in dual FD. It initially flashes, then stays on steady.

- with dual R/A is installed, information comes from the ownside R/A. If one R/A fails, failure status will be indicated to the flight crew on the English Display Advisory area, and information comes from the remaining R/A and is still displayed in white
- when R/A is above 2500 ft the radio altitude display is removed, and replaced by a red RA label

ANALOG RAD ALT

An analog band is used to give an analog indication of AGL altitude. It moves vertically, linearly and correspondingly to the AGL altitude.

DH STATUS

For Decision Height (DH) calculations, the DH knob located on the Index Control Panel is turned to set a DH altitude. The DH label shows that the aircraft is at the selected height. When the higher DH setting is reached the FDPS sends the DH data to the GPWS. The "MINIMUMS, MINIMUMS" aural warnings come on if the highest DH setting is more than 50 feet.

Each Stall Protection Module receives a discrete 500 feet altitude trip output that is used to prevent stick pusher operation when the AGL altitude is below 500 feet.

CLOCK

The electronic clock has a quartz time base that supplies a continuous display of Universal Time Coordinated (UTC) or Local Time (LOC). The electronic clock can also be set to show the Elapsed Time (ET), the date or set to the chronometer function (CHR).

There are two independent clocks located in the flight compartment one on each side of the glareshield. The pilots set the type of time based information to be shown on the display using a four-position switch, located on the lower left corner of the clock face.

When primary electrical power is removed, the time base is maintained by the aircraft battery bus, all displays are blanked, and the sweep-hand, if active, stops. Current parameters continue to increment with the exception of the Chronometer and Elapsed Time functions. When primary power is restored, the upper LCD display shows the original function data and the lower display indicates 00 00. The Chronometer sweep-hand returns to zero and can be re-enabled if set to start from zero.

Each clock operates independently. The No. 1 Clock is interfaced directly with the Cockpit Voice Recorder and both clocks are interfaced with the Flight Data Recorder (FDR) through the Flight Data Processing System (FDPS). The FDR normally records time from the No. 1 Clock but will switch to No. 2 Clock if the No. 1 Clock fails. Real time is recorded on both the Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR) to establish synchronization between the two recording systems.

12.12.2 Central Warning System

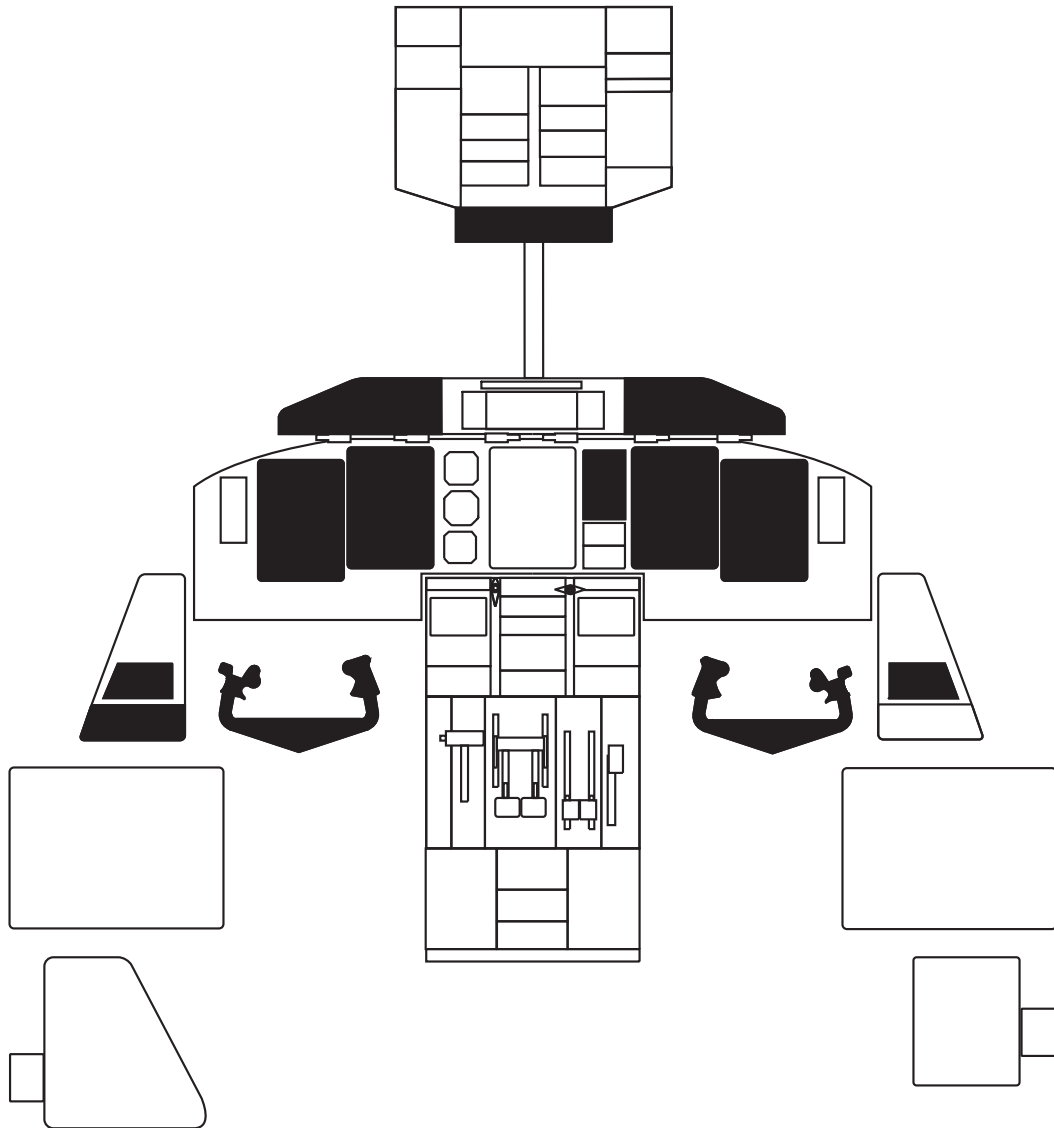
12.12.2.1 Introduction

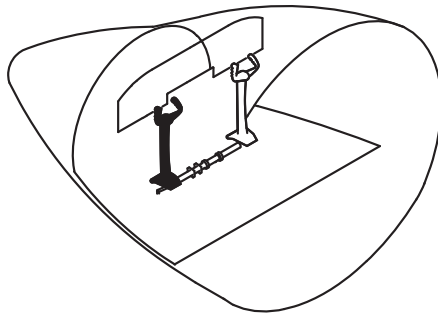
The crew alerting system for the Dash 8-Q400 gives visual and aural indications to the flight crew. The Central Warning System monitors aeroplane equipment malfunctions, unsafe operating conditions requiring immediate attention, or advisory messages for various systems (avionics and electrical).

12.12.2.2 General

A Warning Tone Generator (WTG) computes and provides the Warning tones which alert the flight crew to specific events or system failures. There is also a Ground Proximity Warning System (GPWS) and Traffic Alert and Collision and Avoidance System (TCAS).

12.12.2.3 Controls and Indications - Crew Alerting System





NOTE

Pilot side shown.
Copilot side similar.

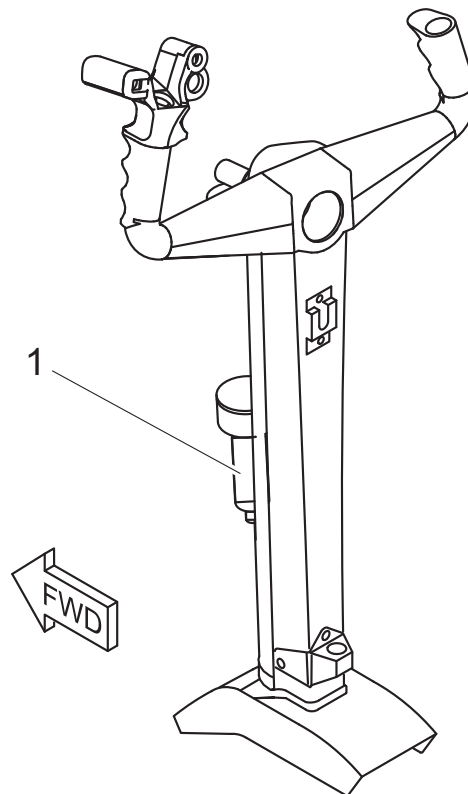


Figure 12.12-46 Stall Warning Stick Shaker Motor

CONTROL COLUMN SHAKER CALLOUT

1. CONTROL SHAKER (2)

- attached to forward side of pilot's and copilot's control columns control shakers vibrate control columns at pre-determined stall threshold speed appropriate to selected flap setting
- L or R shaker operates when energized by related stall warning computer

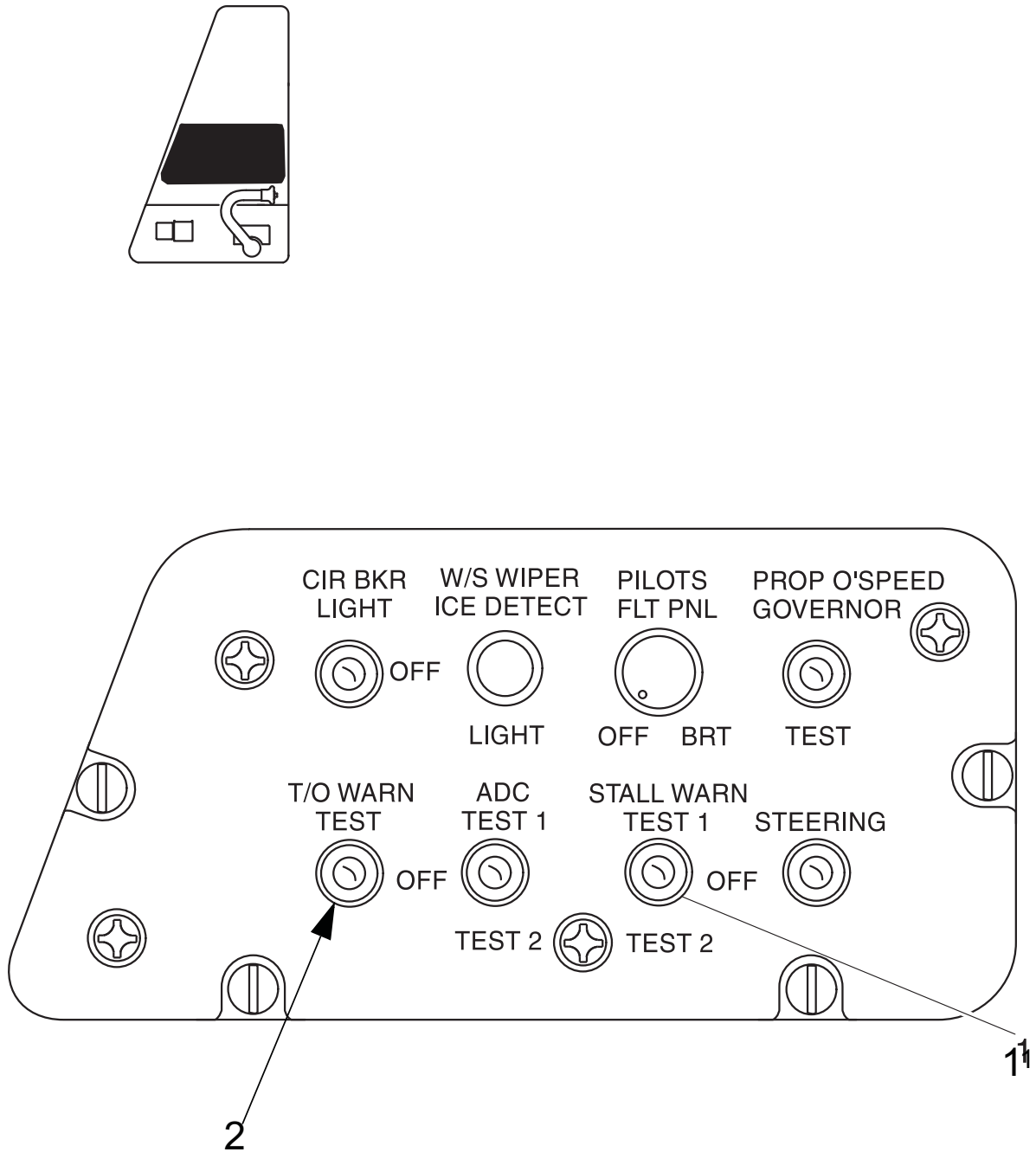


Figure 12.12-47 Stall Warning Test Switch

STALL WARNING CALLOUTS

1. STALL WARNING TEST SWITCH

(three position momentary test spring loaded to centre OFF)

TEST 1 - tests the channel No. 1 of the Stall Protection System (SPS)

- observe the following:
- RA increases to above 500 ft on pilot's PFD and analog indication is correct (may disappear if >550 ft)
- RA decreases to 50 ft and analog indication reappears
- L stick shaker activates
- #1 STALL SYST FAIL and PUSHERSYSTFAIL caution lights come on

OFF - selects No.1 and No. 2 SPSs tests off

- check #1 and #2 STALL SYST FAIL and PUSHERSYSTFAIL caution lights go out

TEST 2 - tests the channel #2 of the SPS (R shaker, #2 STALL SYST FAIL) on copilot's PFD

2. T/O WARNING HORN TEST (two position, spring loaded to center)

ENGINE NOT RUNNING

TEST - tests the take-off warning horn

ENGINE RUNNING

TEST-The take off warning horn will sound if the following condition exists:

- Inboard or outboard spoilers extended
- Elevator trim out of the take-off range
- Parking brake lever set to PARK
- One or both condition levers not at MAX/1020
- Flaps extended more than 20° or less than 3.5°

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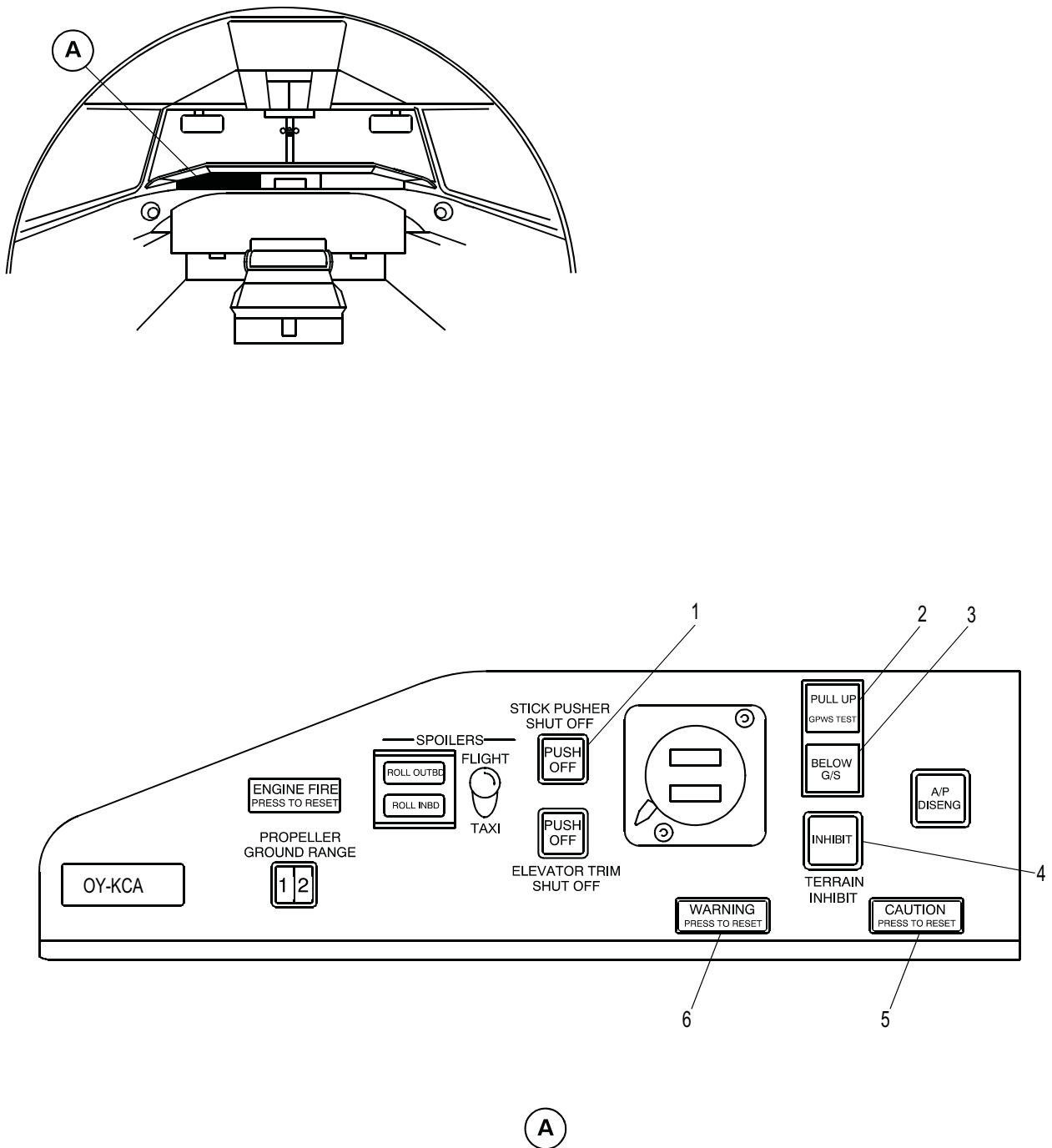


Figure 12.12-48 Left Glareshield

1. **STICK PUSHER SHUT-OFF SWITCHLIGHT (alternate action)**

PUSH - segment (amber) pilot's and copilot's

- turns off the stick pusher
- PUSHER SYST FAIL caution light turns on
- "OFF" inscriptions on both pilot's and copilot's pushbuttons illuminate

2. **PULL UP GPWS TEST SWITCH (momentary action, red)**

PUSH and **HOLD** - observe the following:

- the GPWS light located on the caution and warning panel comes on immediately
- the GPWS flap override annunciator switch on the pilot's side console comes on immediately
- both BELOW G/S annunciator switches come on
- the "GLIDESLOPE" aural alert sounds
- both PULL UP GPWS TEST annunciator switches turn on approximately 2 seconds after the annunciator switch is pushed
- the "PULL UP" aural alert sounds twice
- cycles through all GPWS aural calls

3. **BELOW G/S SWITCH (momentary action, amber)**

PUSH - cancels "BELOW GLIDESLOPE" aural warning

4. **TERRAIN INHIBIT SWITCHLIGHT (alternate action, white)**

PUSH - segment (white) pilot's and copilot's

- inhibits TAD and TCF alerting and display
- "TERRAIN INHIBIT" annunciation appears on the MFD
- push switchlight again to deactivate "TERRAIN INHIBIT"

5. **MASTER CAUTION SWITCHLIGHT (flashing amber, momentary action)**

PUSH - resets master caution light

- light goes out, but the caution light on the caution/warning panel remains on; if fault persists

6. **MASTER WARNING SWITCHLIGHT (flashing red, momentary action)**

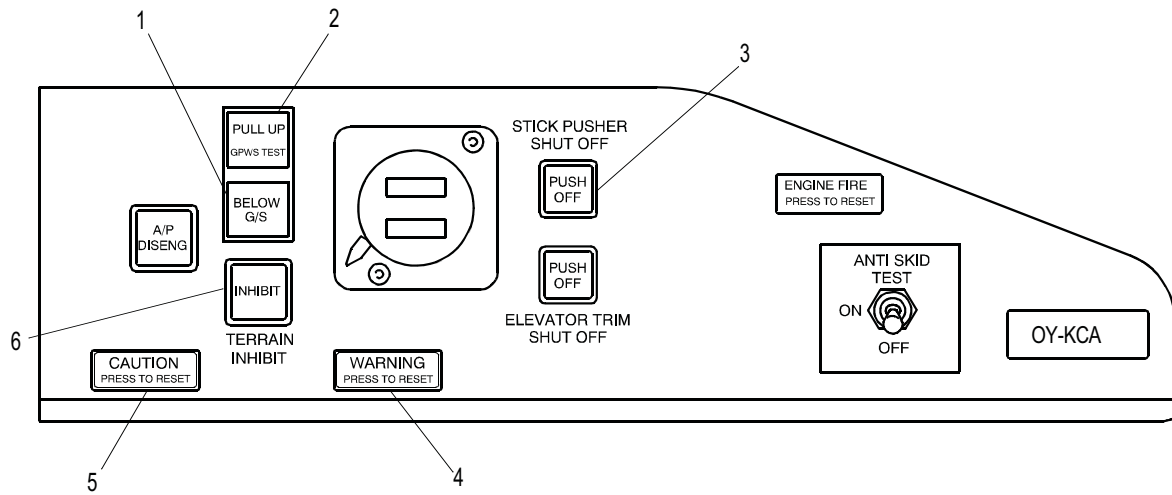
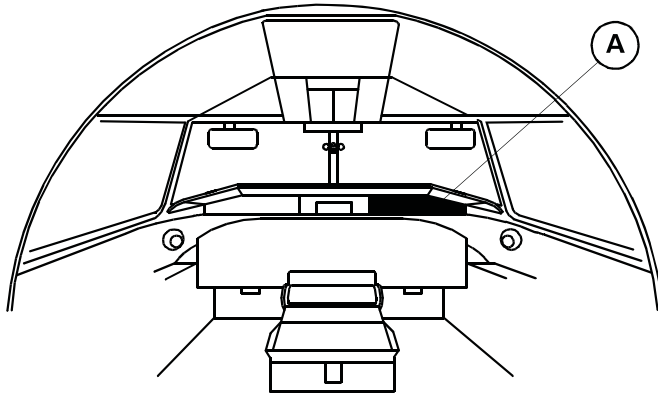
PUSH - resets master warning light

- light goes out, but warning light on the caution/warning panel remains on steady; if fault persists

Dual Master Warning and Master Caution Switchlight

Dual Master Warning and Master Caution Switchlights are installed on the flight deck glaseshield to eliminate the requirement for the pilot or co-pilot to reach across the flight deck to reset respective master warning or master caution reset switch.

Dash8 - Q400 - Indicating & Recording Systems



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1. BELOW G/S SWITCH (momentary action, amber)

PUSH - cancels "BELOW GLIDESLOPE" aural warning

2. PULL UP GPWS TEST SWITCH (momentary action, red)

PUSH and **HOLD** - observe the following:

- the GPWS light located on the caution and warning panel comes on immediately
- the GPWS flap override annunciator switch on the pilot's side console comes on immediately
- both BELOW G/S annunciator switches come on
- the "GLIDESLOPE" aural alert sounds
- both PULL UP GPWS TEST annunciator switches turn on approximately 2 seconds after the annunciator switch is pushed
- the "PULL UP" aural alert sounds twice
- cycles through all GPWS aural calls
- "TERRAIN INHIBIT" switch

3. STICK PUSHER SHUT-OFF SWITCHLIGHT (alternate action)

PUSH - OFF segment (amber) pilot's and copilot's

- turns off the stick pusher
- PUSHER SYST FAIL caution light turns on

| 4. MASTER WARNING SWITCHLIGHT (FLASHING RED, MOMENTARY ACTION)

PUSH - resets master warning light

- light goes out, but the warning light on the caution/warning panel remains on steady; if fault persists

5. MASTER CAUTION SWITCHLIGHT (flashing red, momentary action)

PUSH - resets master caution light

- light goes out, but caution light on the caution/warning panel remains on if fault persists

6. TERRAIN INHIBIT SWITCHLIGHT (alternate action, white)

PUSH - segment (white) pilot's and copilot's

- inhibits TAD and TCF alerting and display
- "TERRAIN INHIBIT" annunciation appears on the MFD
- push switchlight again to deactivate "TERRAIN INHIBIT"

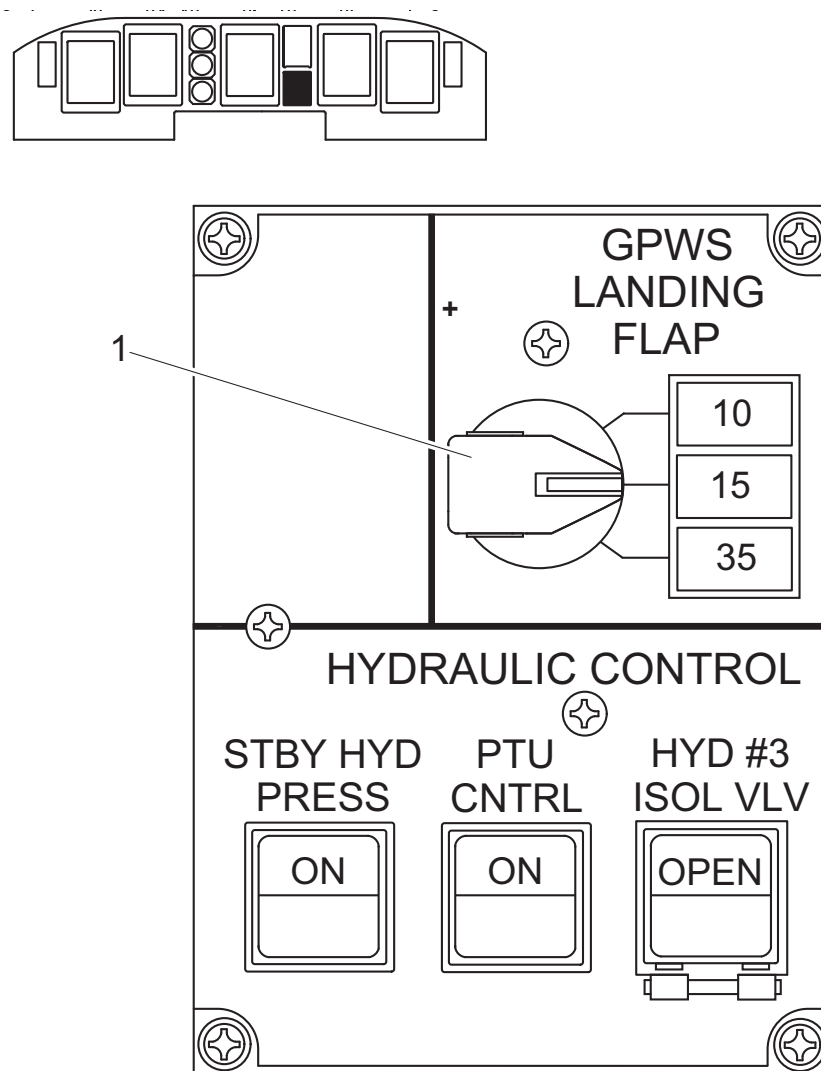


Figure 12.12-50 GWPS Landing Flap Select Switch

HYDRAULIC PANEL CALLOUT PERTAINING TO GPWS

1. GPWS LANDING FLAP SELECT SWITCH (three position, rotary action)

TURN - 10, 15, or 35 segment (green)

- when the aeroplane flaps select lever is set at less than the Landing Flap Selector Switch (LFSS) setting, a "TOO LOW FLAPS" aural alert will sound when the AGL altitude becomes less than 200 feet.

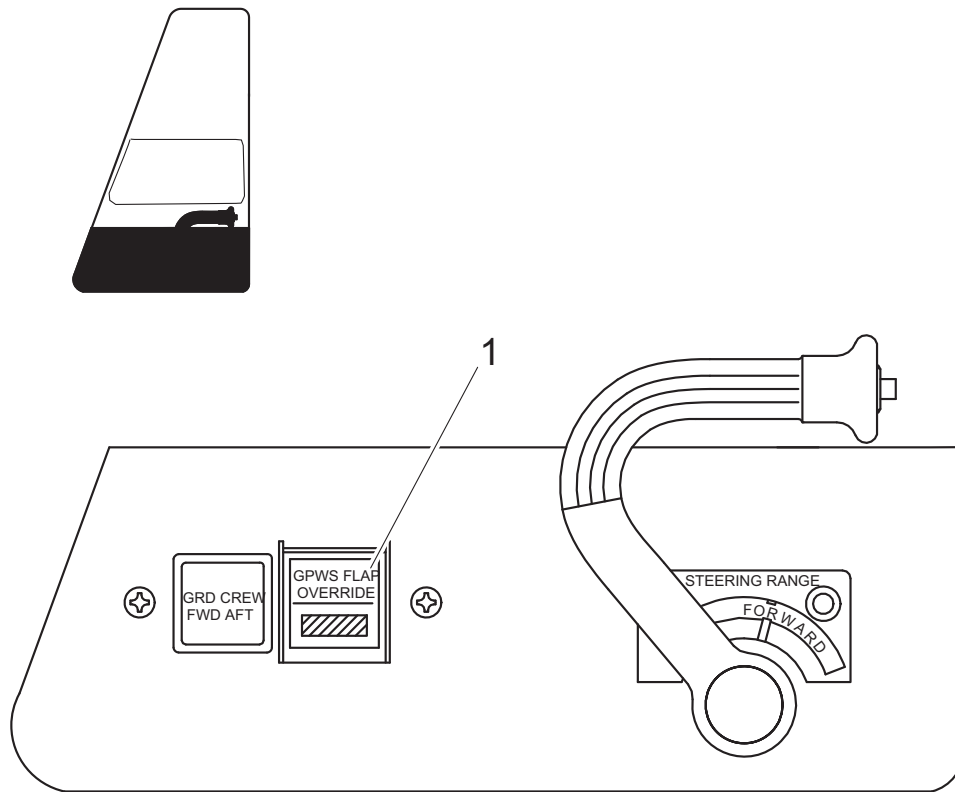


Figure 12.12-51 GPWS Flap Override Switch

PILOT'S SIDE PANEL CALLOUT PERTAINING TO GPWS

1. GPWS FLAP OVERRIDE SWITCH (alternate action)

CROSS HATCHED segment (amber)

- inhibits GPWS mode 4B
- permits 0° flap landings without aural warning
- all other GPWS modes remain active
- when the AGL is less than 50 feet, the override feature automatically cancels

12.12.2.4 Warning Tone Generator

Two Warning Tone Generators (WTG) compute and provide the Warning tones which alert the flight crew to specific events or system failures. The Flight Data Processing System (FDPS) prioritizes all aural warnings including the management of GPWS and TCAS alerts.

The WTG generates 11 tones and controls the aural warning of GPWS and TCAS which generate their own synthetic voice warnings. All tones (WTG) and synthetic voice (GPWS, TCAS) warnings are prioritized.

Both WTGs receive parameters from aeroplane equipment and generate and prioritize the associated tones. The master WTG, if it is valid, transmits to the Remote Control Audio Unit (RCAU) the appropriate signal and the RCAU amplifies the signal and outputs the tone to the cockpit speakers and the pilots' headsets. The GPWS and TCAS transmit their output directly to the RCAU.

It generates the following various alerts according to the following logic:

- Engine fire: The WTG generates a tone triggered by the Fire bell discrete from the Fire protection system (see Chapter 12.7).
- Incorrect Take-off warning: The WTG automatically provides a tone when the aeroplane is not in a safe take-off configuration (see below).
- Autopilot disengagement: This tone is generated when the A/P is manually or automatically disengaged. The FGM transmits to the WTG the A/P disengagement signal. Simultaneously the message "A/P DIS" is displayed in the FMA (Flight Mode Annunciator) (see Chapter 12.3).
- Pitch trim in motion: This tone is generated when the pitch trim is in motion for more than 3 sec. The WTG directly receives this status from FCECU system (see Chapter 12.8).
- Overspeed Warning: This tone is generated when the speed exceeds VMO. This tone is associated with a red pointer displayed on the Airspeed Indicator on the PFDs. The VMO status is transmitted by the ADU (see Chapter 12.12.1).
- Incorrect Landing gear configuration: The WTG provides a tone whenever the A/C is in the landing phase and when the landing gear is not Down and Locked (see Chapter 12.13).
- Altitude Alert: The WTG generates this tone whenever the aeroplane penetrates the selected Altitude input envelope (± 1000 ft of the selected altitude), and when it exits the Selected Altitude output envelope (± 250 ft from the selected altitude) (see Chapter 12.3).
- Beta lockout warning: The WTG generates a tone when the Power Lever Angle is below IDLE position while in flight (see Chapter 12.22/12.25/12.26).
- Master Warning tone: The WTG generates three tones, triggered by Warning and Caution Panel inputs, whenever a RED Warning light is illuminated.
- Master Caution tone: The WTG generates a tone, triggered by Warning and Caution Panel inputs, whenever an AMBER Caution light is illuminated.

Dash8 - Q400 - Indicating & Recording Systems

The priority of the aural alerts is as follows:

- GPWS Warning
- TCAS Collision
- Fire Bell
- Incorrect take-off Configuration
- Autopilot Disengagement
- Pitch Trim in Motion
- Overspeed Warning
- Incorrect Landing Gear Configuration
- Altitude Alert Warning
- Beta Lockout Warning
- Warning Annunciation
- Caution Annunciation
- TCAS Traffic

WTG#1 and WTG#2 monitor independently the required tone. WTG#1 transmits its health status to WTG#2. Should WTG#1 fail, it declares this state to WTG#2 which then becomes master. If a discrepancy occurs in the tone computation between the two WTGs (i.e two different tones are generated), WTG#1, if valid, generates the tone with the higher priority. A WTG failure is stored and the message "WTG 1/2 FAIL" is displayed in the ED Advisory message location.

12.12.2.5 Take-off Warning Horn

The take-off warning horn sounds an intermittent tone in the flight deck if a take-off is started with an incorrect configuration existing. The take-off warning horn sounds if there is weight on the nose wheel with both power levers advanced above 50% torque, and any one of the following conditions are present:

- Inboard or outboard spoilers extended
- Elevator trim out of the take-off range
- Parking brake lever set to PARK
- One or both condition levers not at MAX/1020
- Flaps extended more than 20° or less than 3.5°

12.12.2.6 Landing Flap Selector Switch (LFSS)

The Landing Flap Selector Switch (LFSS) attached to the hydraulic control panel is turned to one of three landing flap settings for the insufficient terrain clearance mode as follows:

- 10 degrees
- 15 degrees
- 35 degrees

A related indication on the hydraulic control panel comes on to show the landing flap position selection. When the aeroplane flaps select lever is set at less than the Landing Flap Selector Switch (LFSS) setting, a "TOO LOW FLAPS" aural alert will sound when the AGL altitude becomes less than 200 feet.

The GPWS operates in the modes that follows:

- Ground self test
- Mode 1: Excessive descent rate
- Mode 2: Excessive closure rate to terrain
- Mode 3: Descent after take-off
- Mode 4: Insufficient terrain clearance
- Mode 5: Descent below glideslope
- Mode 6: Minimum callout and excessive bank angle

12.12.2.7 Ground Self Test

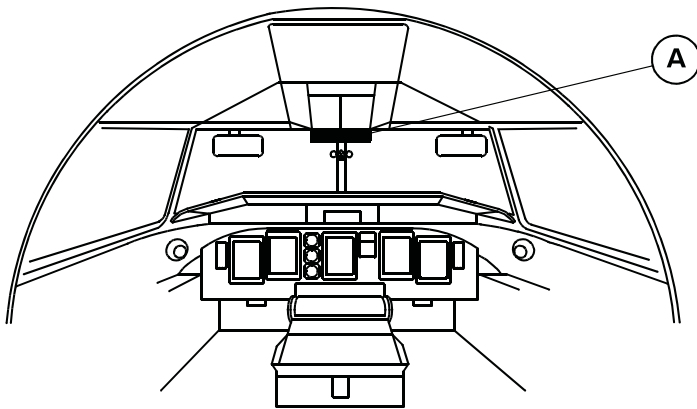
The GPWS can be self tested when the aeroplane is on the ground. One GPWS Annunciator Switch or the other is pushed to test the GPWS. Allow thirty seconds before initiating another self test. If this time limit is not met, the GPWS will not re-initialize. For the systems that do not supply correct data, the Ground Proximity Warning System (GPWS) gives an appropriate aural alert.

Verify that the following are observed:

1. Yellow GPWS failure annunciator on the WCP illuminates.
2. Yellow "TERRAIN FAIL" annunciator on each MFD illuminates.
3. Yellow "BELOW G/S" annunciator on each glareshield illuminates.
4. "GLIDESLOPE" voice is heard.
5. Yellow "BELOW G/S" annunciator on each glareshield extinguishes.
6. Red "PULL UP" annunciator on each glareshield illuminates.
7. "PULL UP" voice is heard.
8. Red "PULL UP" annunciator on each glareshield extinguishes.
9. Terrain Display Test Pattern appears on each MFD.
10. Red "PULL UP" annunciator on each glareshield illuminates.
11. "TERRAIN, TERRAIN PULL UP" voice is heard.
12. Red "TERRAIN INHIBIT" annunciator on each glareshield extinguishes.
13. Unless Self Test continues, the Terrain Display Text Pattern is removed from both MFDs, the yellow GPWS failure annunciator on the WCP extinguishes and the yellow TERRAIN FAIL annunciator is removed from each MFD.

A defective Internal Ground Proximity Warning Computer (GPWC) may not give an aural alert.

Dash8 - Q400 - Indicating & Recording Systems



PITCH TRIM	L AC BUS	PITOT HEAT STBY	ICE DETECT FAIL	FLT COMPT DUCT HOT	#1 HYD ISO VLV	#1 PEC
ELEVATOR FEEL	R AC BUS	PITOT HEAT 1	PITOT HEAT 2	CABIN DUCT HOT	#2 HYD ISO VLV	#1 BLEED HOT
ELEVATOR ASYMMETRY	DC BUS	ENG ADPT HEAT 1	ENG ADPT HEAT 2	CABIN PACK HOT	STBY BATTERY	#1 DC GEN HOT
ELEVATOR PRESS	L TRU	WSHLD CTRL	PROP DEICE	FLT COMPT PACK HOT	MAIN BATTERY	#1 AC GEN HOT
#3 STBY HYD PUMP	R TRU	WSHLD HOT	DEICE TIMER	L TRU HOT	AUX BATTERY	#1 HYD FLUID HOT
EMER LTS DISARMED	INTERNAL BAGG DOOR	SIDE WDO HOT	DEICE PRESS	R TRU HOT	AVIONICS	#1 FUEL FLTR BYPASS
CABIN PRESS	CHECK FIRE DET	SMOKE	TOUCHED RUNWAY	—	—	#1 ENG OIL PRESS

#1 ENG FUEL PRESS	#2 ENG FUEL PRESS	#2 PEC	ROLL SPLR INBD GND	ROLL SPLR OUTBD GND	#1 STALL SYST FAIL	FLT DATA RECORDER
#1 ENG HYD PUMP	#2 ENG HYD PUMP	#2 BLEED HOT	#1 STBY HYD PUMP HOT	SPLR OUTBD	#2 STALL SYST FAIL	GPWS
#1 DC GEN	#2 DC GEN	#2 DC GEN HOT	ROLL SPLR INBD HYD	ROLL SPLR OUTBD HYD	PUSHER SYST FAIL	PARKING BRAKE
#1 AC GEN	#2 AC GEN	#2 AC GEN HOT	#1RUD HYD	#2RUD HYD	INBD ANTISKID	OUTBD ANTISKID
#1 ENG FADEC	#2 ENG FADEC	#2 HYD FLUID HOT	RUD CTRL	FLAP DRIVE	LDG GEAR INOP	WT ON WHEELS
#1 TANK FUEL LOW	#2 TANK FUEL LOW	#2 FUEL FLTR BYPASS	APU	FLAP POWER	NOSE STEERING	FUELING ON
#1 ENG FADEC FAIL	#2 ENG FADEC FAIL	#2 ENG OIL PRESS	STBY BAT HOT	AUX BAT HOT	MAIN BAT HOT	FUSELAGE DOORS

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br60a01.dwg, rev. 02/05/00

Figure 12.12-52 All Caution and Warning Lights

12.12.2.8 Cautions and Warnings

The caution and warning lights provide a visual indication to the flight crew of a non-normal condition.

The lights are housed in a panel located forward of the overhead console. Amber caution lights turn on to indicate a caution, while red warning lights turn on to indicate a warning.

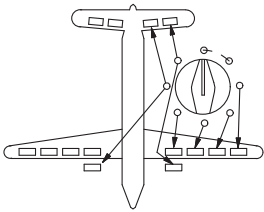
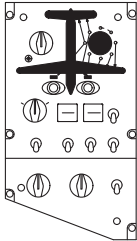
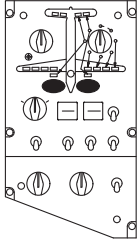
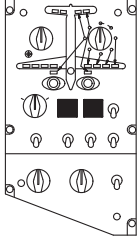
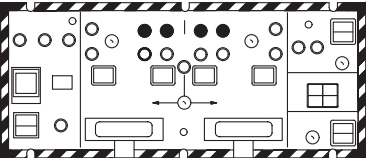
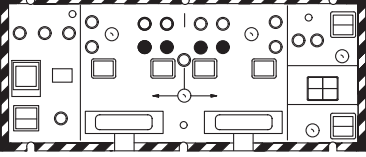
A MASTER WARNING and MASTER CAUTION light, located at eye level on the center glareshield panel, flashes to alert the flight crew of a system fault or warning. Simultaneously, the associated system's caution light turns on steady or warning light flashes on the CAUTION/WARNING panel. The MASTER CAUTION light is associated with one chime, and the MASTER WARNING light is associated with three chimes.

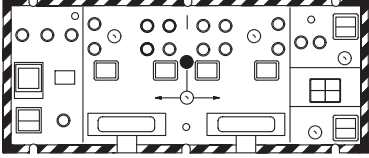
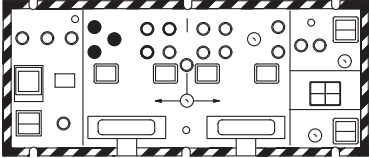
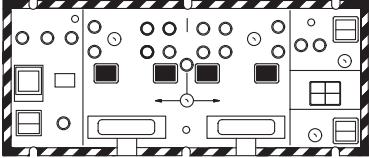
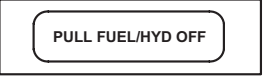
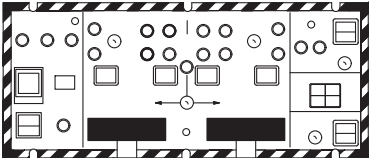
Pressing either the MASTER CAUTION or MASTER WARNING light resets that light. Pressing the MASTER WARNING light also causes the fault causing panel warning light to stop flashing and remain on steady. If a subsequent fault occurs from another system, the MASTER CAUTION or MASTER WARNING light flashes with the new caution light. A caution/warning light remains on as long as the non-normal condition exists.

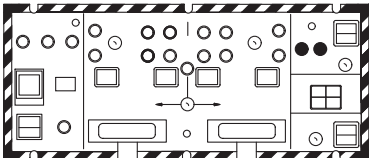
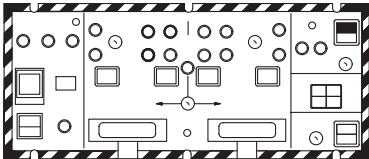
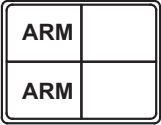
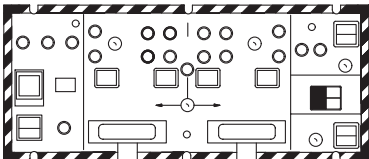
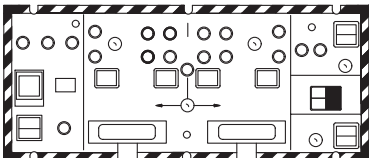
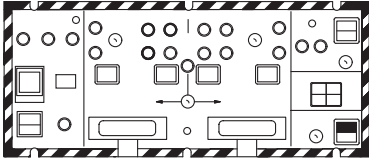
The FUELING ON caution light turns only when refueling or defueling is in progress, but does not cause the MASTER CAUTION light to turn on.

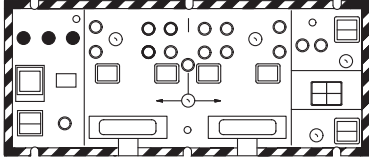
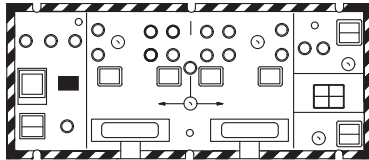
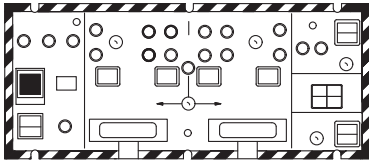
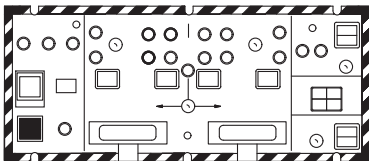
All caution and warning light corresponds to the chapter in which the related system is described, and arranged similarly.

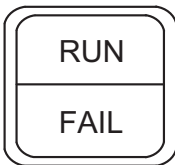
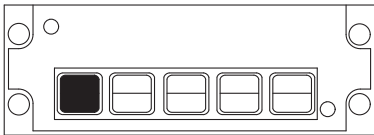
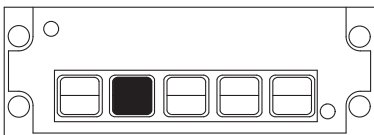
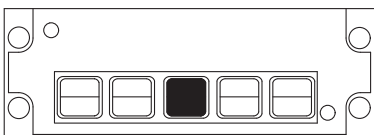
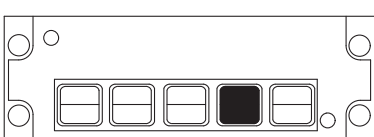
A table of all warning, caution, and advisory lights and information relative to their reasons for turning on follows.

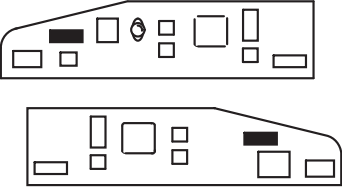
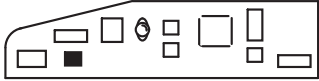
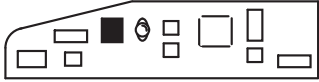
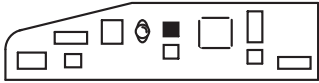
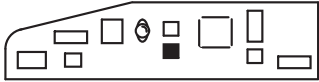
Annunciator	Panel Location	Cause for Illumination
 PROPS  PROPS  ENGINE OPN HTR CLOSED INTAKE OPN HTR CLOSED VALVES FUEL  OPEN  CLOSED OPEN CLOSED  HYD 	    	Boot inflation is 15 psi or more. Boot operation sequence shown at the same time that the system pressure is satisfactory. Related propeller heaters are on. OPN segment shows engine bypass door open. CLOSED segment shows engine bypass door closed. HTR segment shows engine intake heater is on. Fuel valve position. Green shows open, fuel pressure present. White shows closed, no fuel pressure. Hydraulic valve position. Green shows open. White shows closed.

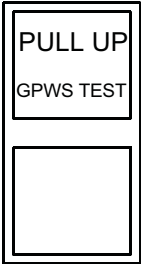
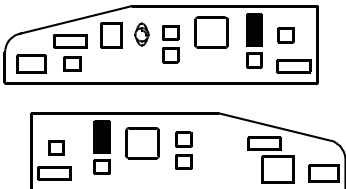
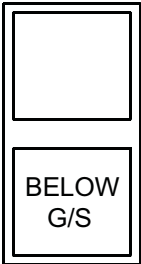
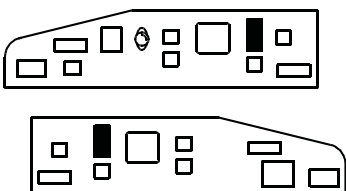
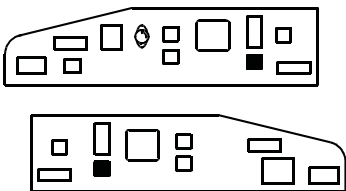
Annunciator	Panel Location	Cause for Illumination
BTL LOW 		Low extinguishing bottle pressure.
EXTG AFT BTL  FWD BTL 		When PULL FUEL/HYD OFF handle is pulled, lights come on to show related aft and forward extinguishing bottles have sufficient pressure for discharge into respective nacelle and explosive squibs are armed.
FAULT A  FAULT B 		Detector loop malfunction. The CHECK FIRE DET warning light also comes on.
PULL FUEL/HYD OFF 		Fire condition sensed by a loop in the related nacelle. The ENGINE FIRE light and CHECK FIRE DET warning light also come on.

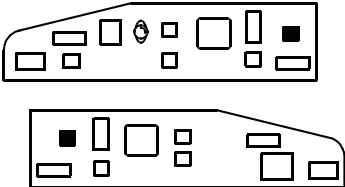
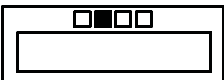
Annunciator	Panel Location	Cause for Illumination
VENT VALVE INLT OTLT  CLOSED		Aft baggage compartment vent valve position. Off shows open, and white shows closed.
		Smoke is sensed in aft baggage compartment.
FIRE BOTTLE AFT  FWD		Extinguishing bottle is armed.
FIRE BOTTLE  AFT FWD		Lights come on when the extinguishing bottle pressure is low.
		Smoke is sensed in forward baggage compartment.

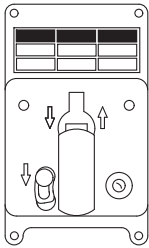
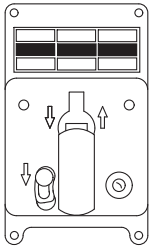
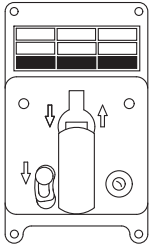
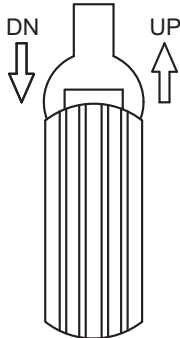
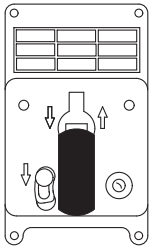
Annunciator	Panel Location	Cause for Illumination
APU FUEL VALVE BTL OPEN CLOSED ARM FIRE EXTG BTL LOW FAULT	   	APU fuel valve position. Green shows open, fuel pressure present. White shows closed, no fuel pressure. APU extinguishing bottle is armed. Fire is sensed in the APU. A fire is detected in the APU. BTL LOW - Low APU fire extinguishing bottle pressure. FAULT - APU fire detection system malfunction.

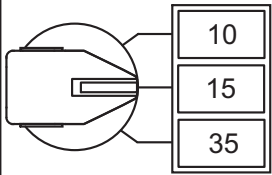
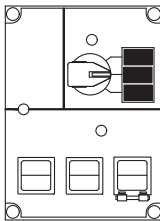
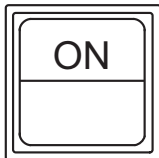
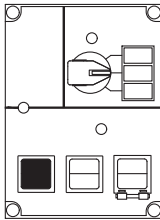
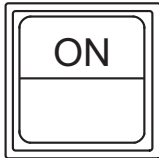
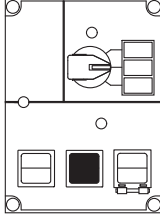
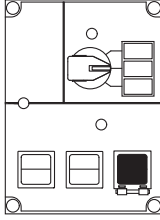
Annunciator	Panel Location	Cause for Illumination
PWR 		RUN indication shows that the APU is functioning at operating speed. FAIL indication shows an APU malfunction.
START 		STARTER indication shows APU starter engagement.
GEN 		ON segment shows that the APU generator is on line. WARN segment shows generator is not online.
BL AIR 		OPEN indication shows APU bleed valve is open.

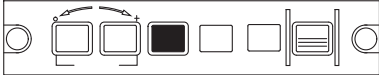
Annunciator	Panel Location	Cause for Illumination
ENGINE FIRE PRESS TO RESET		Both come on with PULL FUEL/HYD OFF, CHECK FIRE DET and master WARNING lights to warn of an engine fire.
PROPELLER GROUND RANGE 1 2		Propellers are in ground operation range (slightly below FLT IDLE to MAX REVERSE).
ROLL OUTBD ROLL INBD		ROLL OUTD - outboard spoilers are at full extension. ROLL INBD - inboard spoilers are at full extension.
STICK PUSHER SHUT OFF OFF		Either STICK PUSHER SHUT OFF switchlight is pushed.
PUSH OFF ELEVATOR TRIM SHUT OFF		Elevator trim switch failure. Elevator trim in motion for > 3 sec.

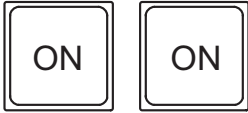
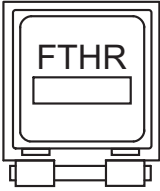
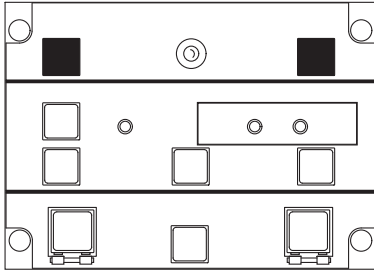
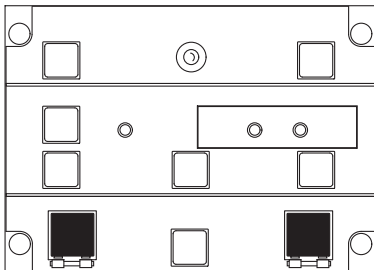
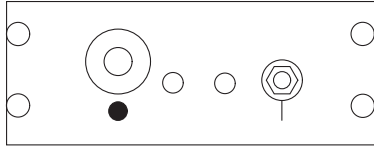
Annunciator	Panel Location	Cause for Illumination
 PULL UP GPWS TEST		PULL UP Ground Proximity Warning System (GPWS) calculates Mode 1 to Mode 4 warnings. PULL UP lights stay on while the aircraft is in the warning area.
 BELOW G/S		BELOW G/S annunciator to show a Mode 5 excessive descent below the Glideslope.
 INHIBIT		INHIBIT Terrain Inhibit switch inhibits TAD and TCF alerting and display. Selection causes the "Terrain Inhibit" annunciation on the MFD.

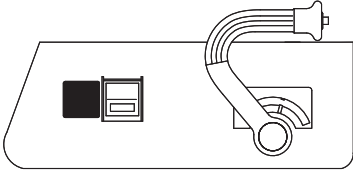
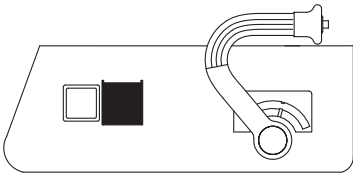
Annunciator	Panel Location	Cause for Illumination
		Flashes at a 1 Hz rate when AP is automatically disengaged.
RUD 1 		Jam in the lower actuator linkage.
SPLR 1 		Inboard roll spoiler system jam.
SPLR 2 		Outboard roll spoiler system jam.
RUD 2 		Jam in the upper actuator linkage.

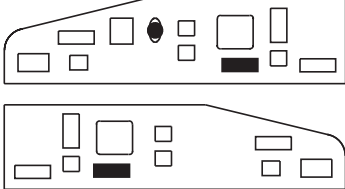
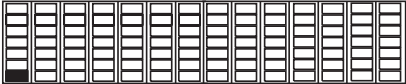
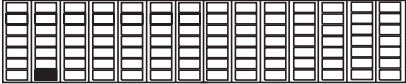
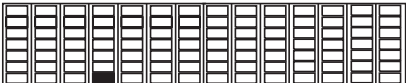
Annunciator	Panel Location	Cause for Illumination
L. DOOR N. DOOR R. DOOR		Hydraulic gear doors are not closed.
LEFT NOSE RIGHT		Landing gear is down and locked.
LEFT NOSE RIGHT		Landing gear is not locked in selected position.
		Amber light in handle comes on with red gear lights to show gear is not in position selected.

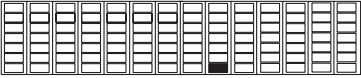
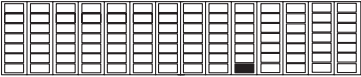
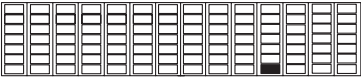
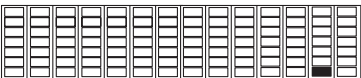
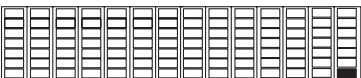
Annunciator	Panel Location	Cause for Illumination
GPWS LANDING FLAP 		Landing flap position setting for the use with GPWS system.
STBY HYD PRESS 		No. 1 standby hydraulic pump is selected on.
PTU CNTRL 		ON segment indicates pressure in the PTU output line.
HYD #3 ISOL VLV 		No. 3 isolation valve is selected open.

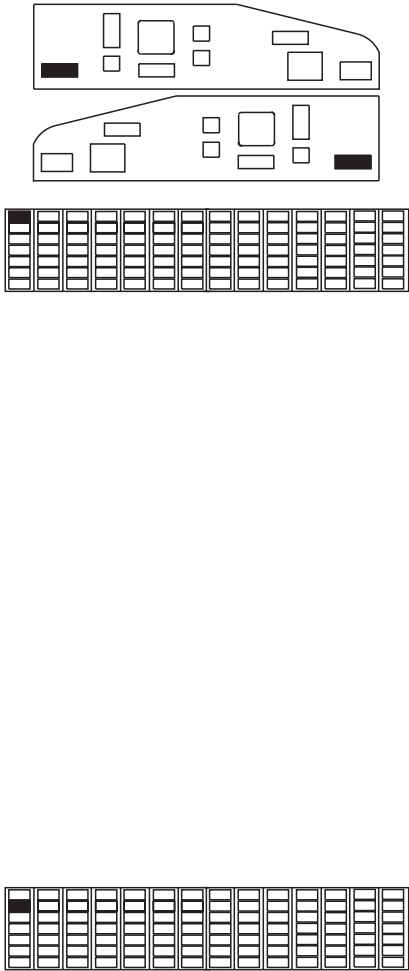
Annunciator	Panel Location	Cause for Illumination
 DG		DG mode is engaged.
 SLAVE		Magnetic Detector Unit malfunction
 BASIC		True Airspeed reference is not available to AHRS.
ATT/HDG  ALIGN		AHRS in alignment mode for 60 seconds on the ground and 90 seconds in flight.

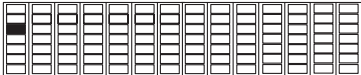
Annunciator	Panel Location	Cause for Illumination
TANK 1 AUX PUMP TANK 2 AUX PUMP   	  	Fuel pressure in auxiliary boost pump output line. Auxiliary feathering pump is operating. CVR malfunction.

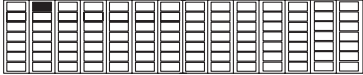
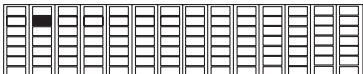
Annunciator	Panel Location	Cause for Illumination
		Ground crew is connected to the interphone system. FWD/AFT shows the location of active jack.
		GPWS FLAP OVERRIDE selection.

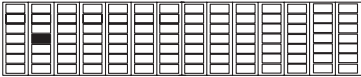
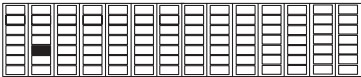
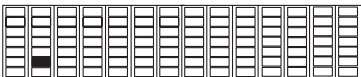
Annunciator	Panel Location	Cause for Illumination
WARNING PRESS TO RESET		Comes on flashing with a warning annunciator.
CABIN PRESS		Cabin altitude is more than 9,800 feet.
CHECK FIRE DET		Engine fire, APU fire, or detector loop circuit malfunction is sensed.
SMOKE		Smoke is sensed in the forward or aft baggage compartment.
TOUCHED RUNWAY		Rear outer fuselage surface has touched the runway.
#1 ENG OIL PRESS		No. 1 engine oil pressure is less than 44 psi.
#1 ENG FADEC FAIL		No. 1 FADEC has a critical fault.

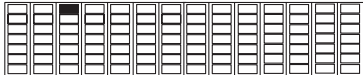
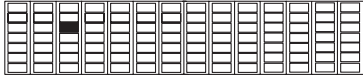
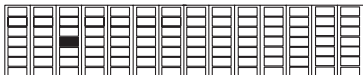
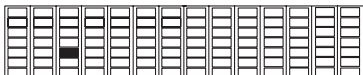
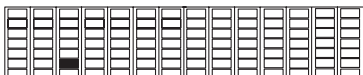
Annunciator	Panel Location	Cause for Illumination
#2 ENG FADEC FAIL		No. 2 FADEC has a critical fault.
#2 ENG OIL PRESS		No. 2 engine oil pressure is less than 44 psi.
STBY BAT HOT		Battery temperature is more than 71 deg C (160 deg F).
AUX BAT HOT		Battery temperature is more than 71 deg C (160 deg F).
MAIN BAT HOT		Battery temperature is more than 71 deg C (160 deg F).
FUSELAGE DOORS		One or more fuselage doors are not closed or locked.

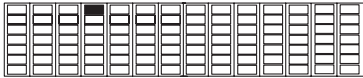
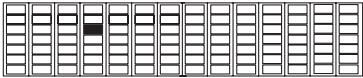
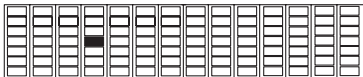
Annunciator	Panel Location	Cause for Illumination
CAUTION PRESS TO RESET PITCH TRIM ELEVATOR FEEL		Comes on flashing with a steady warning annunciator. One of the FCECU channels is not able to control its related pitch trim actuator or pilot and copilot pitch trim input commands are different. Airspeed 1 and 2 mismatch (RUD PRESS, SPLR OUTBD, and ELEVATOR FEEL caution lights will also come on). One of the FCECU channels is not able to control the pitch feel actuator or acceleration 1 and 2 mismatch. Airspeed 1 and 2 mismatch (RUD PRESS, SPLR OUTBD, and PITCH TRIM caution lights will also come on).

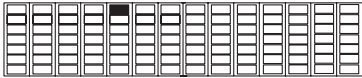
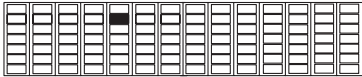
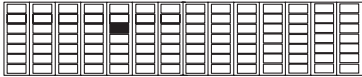
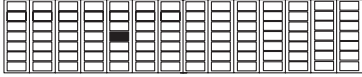
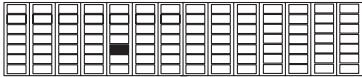
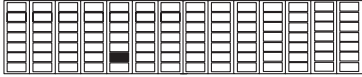
Annunciator	Panel Location	Cause for Illumination
ELEVATOR ASYMMETRY		Right and Left elevators have a difference in angle of 4° for IAS > 185 KIAS and 6° for IAS < 185 KIAS.
ELEVATOR PRESS		Hydraulic systems 1, 2 and 3 are supplying pressure to the elevators.
#3 STBY HYD PUMP		Direct Current Motor Pump (DCMP) contactor has been energized for more than 60 seconds on ground. The #3 system pressure is below 900 psi.
EMER LTS DISARMED		Emergency lights are not armed.

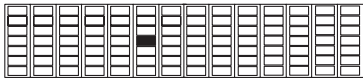
Annunciator	Panel Location	Cause for Illumination
L AC BUS		A left variable frequency bus fault is sensed.
R AC BUS		A right variable frequency bus fault is sensed.
DC BUS		EPCU has reconfigured the main 28 VDC generation sytem because of a source or bus fault condition.

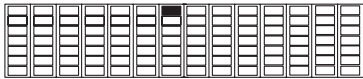
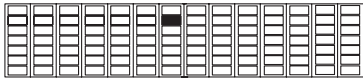
Annunciator	Panel Location	Cause for Illumination
L TRU		AC secondary feeder bus is not energized by its related TRU because of a source fault condition or the AC generator toggle switches are set to the OFF position.
R TRU		AC secondary feeder bus is not energized by its related TRU because of a source fault condition or the AC generator toggle switches are set to the OFF position.
INTERNAL BAGG DOOR		Internal Baggage door not closed and latched.

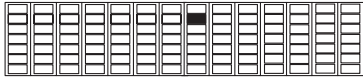
Annunciator	Panel Location	Cause for Illumination
PITOT HEAT STBY		STBY toggle switch set to OFF or standby pitot/static heater malfunction.
PITOT HEAT 1		No. 1 toggle switch set to OFF or No. 1 pitot/static heater malfunction.
ENG ADPT HEAT 1		Malfunction of both No. 1 air intake heating elements.
WSHLD CTRL		Left or right anti-ice control malfunction.
WSHLD HOT		Either the left or right windshield has overheated.
SIDE WDO HOT		The pilot's side window has overheated.

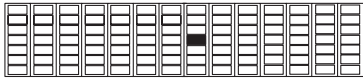
Annunciator	Panel Location	Cause for Illumination
ICE DETECT FAIL		The two ice detector probes have malfunctioned.
PITOT HEAT 2		No. 2 toggle switch set to OFF or No. 2 pitot/static heater malfunction.
ENG ADPT HEAT 2		Malfunction of both No. 2 air intake heating elements.
PROP DEICE		Time Monitor Control Unit (TMCU) has malfunctioned or it has sensed a malfunction in the prop deice system.
DEICE TIMER		Timer and Monitor Unit (TMU) malfunction.
DEICE PRESS		Airframe deice system pressure is too low and/or there is a distributor valve malfunction.

Annunciator	Panel Location	Cause for Illumination
FLT COMPT DUCT HOT		Flight compartment supply duct temperature is 88 deg C(190 deg F).
CABIN DUCT HOT		Cabin supply duct temperature is 88 deg C(190 deg F).
CABIN PACK HOT		Right Air Cycle Machine (ACM) discharge temperature is hot.
FLT COMPT PACK HOT		Left Air Cycle Machine (ACM) discharge temperature is hot.
L TRU HOT		Left TRU temperature is hot.
R TRU HOT		Right TRU temperature is hot.

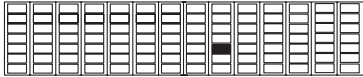
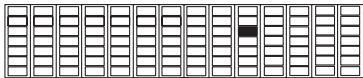
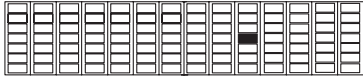
Annunciator	Panel Location	Cause for Illumination
#1 HYD ISO VLV		No.1 isolation valve is closed.
#2 HYD ISO VLV		No. 2 isolation valve is closed.
STBY BATTERY		Standby battery is not connected to its main feeder bus for charging.
MAIN BATTERY		Main battery is not connected to its main feeder bus for charging.
AUX BATTERY		Auxiliary battery is not connected to its main feeder bus for charging.
AVIONICS		An avionics no dispatch condition is sensed, when the aircraft is on the ground.

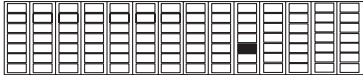
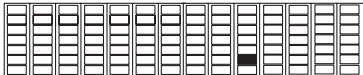
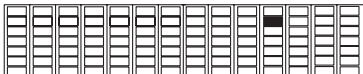
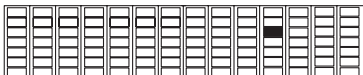
Annunciator	Panel Location	Cause for Illumination
#1 PEC		No. 1 Propeller Electronic Control(PEC) malfunction.
#1 BLEED HOT		No. 1 bleed air supply duct temperature is hot or duct overpressure or duct leak.
#1 DC GEN HOT		No. 1 DC generator temperature is hot.
#1 AC GEN HOT		No. 1 AC generator temperature is hot.
#1 HYD FLUID HOT		No. 1 reservoir temperature is hot.
#1 FUEL FLTR BYPASS		No. 1 fuel filter bypass impending.

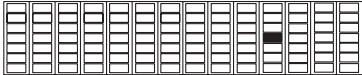
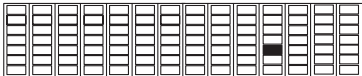
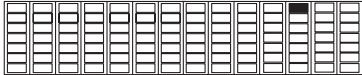
Annunciator	Panel Location	Cause for Illumination
#1 ENG FUEL PRESS		Pressure at engine-driven pump No.1 inlet is low.
#1 ENG HYD PUMP		No. 1 engine driven pump pressure low or when the condition lever is set to the FUEL OFF position.
#1 DC GEN		No. 1 DC generator is not connected to its bus because of a source fault condition. The DC GEN 1 toggle switch is set to the OFF position, or the external DC power is energizing the left and right main feeder busses.

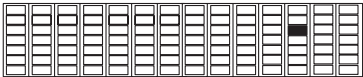
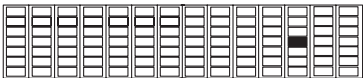
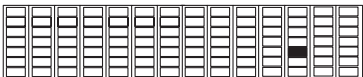
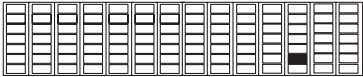
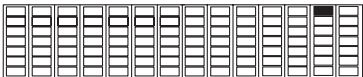
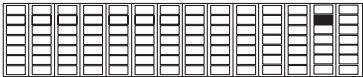
Annunciator	Panel Location	Cause for Illumination
#1 AC GEN		No. 1 AC generator is not connected to its bus because of a source fault condition. The AC GEN 1 toggle switch is set to the OFF position, or the external AC power is on.
#1 ENG FADEC		No. 1 FADEC has a cautionary fault.
#1 TANK FUEL LOW		No. 1 fuel collector bay quantity is low.
#2 ENG FUEL PRESS		Pressure at engine-driven pump No. 2 inlet is low.

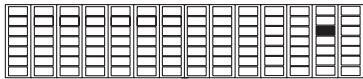
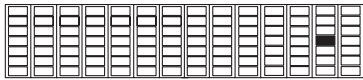
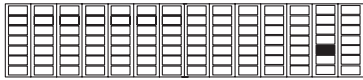
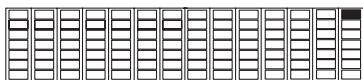
Annunciator	Panel Location	Cause for Illumination
#2 ENG HYD PUMP		No. 2 Engine Driven Hydraulic Pump pressure is low or the condition lever is set to the FUEL OFF position.
#2 DC GEN		No. 2 DC generator is not connected to its bus because of a source fault condition. The DC GEN 2 toggle switch is set to the OFF position, or the external DC power is energizing the left and right main feeder busses.
#2 AC GEN		No. 2 AC generator is not connected to its bus because of a source fault condition. The AC GEN 2 toggle switch is set to the OFF position, or the external AC power is on.

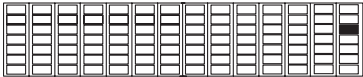
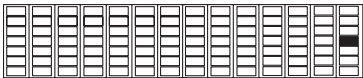
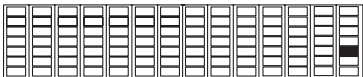
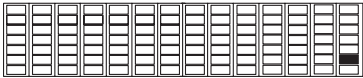
Annunciator	Panel Location	Cause for Illumination
#2 ENG FADEC		No. 2 FADEC has a cautionary fault.
#2 TANK FUEL LOW		No. 2 fuel collector bay quantity is low.
#2 PEC		No. 2 propeller electronic control (PEC) malfunction.
#2 BLEED HOT		No. 2 bleed air supply duct temperature is hot, or duct overpressure or duct leak.
#2 DC GEN HOT		No. 2 DC generator temperature is hot.
#2 AC GEN HOT		No. 2 AC generator temperature is hot.

Annunciator	Panel Location	Cause for Illumination
#2 HYD FLUID HOT		No. 2 reservoir temperature switch is hot.
#2 FUEL FLTR BYPASS		No. 2 fuel filter bypass impending.
ROLL SPLR INBD GND		FCECU is not able to control the inboard spoiler lift dump operation. The inboard spoilers do not extend at touchdown or the inboard spoilers extend after the TAXI mode selection after touchdown.
#1 STBY HYD PUMP HOT		The temperature of the electric motor windings on the No. 1 standby hydraulic pump is too hot.
ROLL SPLR INBD HYD		Hydraulic pressure to the inboard roll spoiler actuators is low.

Annunciator	Panel Location	Cause for Illumination
#1 RUD HYD		Hydraulic pressure to the No. 1 rudder actuator is low.
RUD CTRL		FCECU has detected a malfunction, or loss of hydraulic pressure to both rudder actuators, or there is an airspeed mismatch.
APU		APU FADEC has sensed a fault and shut down the APU.
ROLL SPLR OUTBD GND		FCECU is not able to control the outboard spoiler lift dump operation. The outboard spoilers do not extend at touchdown or the outboard spoilers extend after the TAXI mode selection after touchdown.
SPLR OUTBD		FCECU has failed to inhibit outboard spoiler pressure at greater than 170 KIAS or has failed to re-enable below 165 KIAS.

Annunciator	Panel Location	Cause for Illumination
ROLL SPLR OUTBD HYD		Hydraulic pressure to the outboard spoiler actuators is low.
#2 RUD HYD		Hydraulic pressure to the No. 2 rudder actuator is low.
FLAP DRIVE		Flap drive system fault.
FLAP POWER		Flap drive system failure.
#1 STALL SYST FAIL		No. 1 stall warning system malfunction, or a loss of a valid AOA parameter.
#2 STALL SYST FAIL		No. 2 stall warning system malfunction, or a loss of a valid AOA parameter.

Annunciator	Panel Location	Cause for Illumination
PUSHER SYST FAIL		Stick pusher inhibited by SPS logic, or stick pusher SHUT OFF Switchlight pushed.
INBD ANTISKID		Inboard antiskid control unit malfunction or toggle switch is set to OFF.
LDG GEAR INOP		Landing gear sequence malfunction or the INHIBIT switch has been set to INHIBIT.
NOSE STEERING		Steering system fault with nose steering ON, or system remains pressurized after steering switch set to OFF.
FLT DATA RECORDER		Flight data recorder malfunction or it is not energized.
GPWS		Ground Proximity Warning System (GPWS) has malfunctioned or there is an RA failure.

Annunciator	Panel Location	Cause for Illumination
PARKING BRAKE		Emergency/parking brake is set.
OUTBD ANTISKID		Outboard antiskid control unit malfunction or toggle switch is OFF.
WT ON WHEELS		PSEU has sensed a weight-on-wheels sensor malfunction.
FUELING ON		Refuel/Defuel access panel is open.