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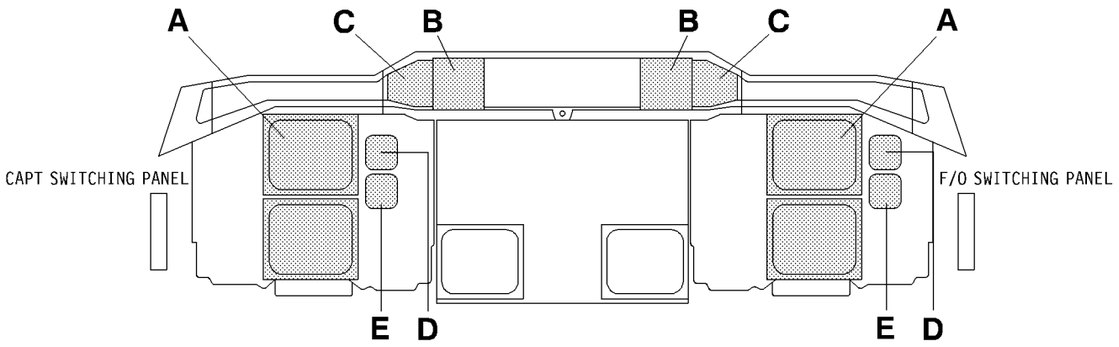
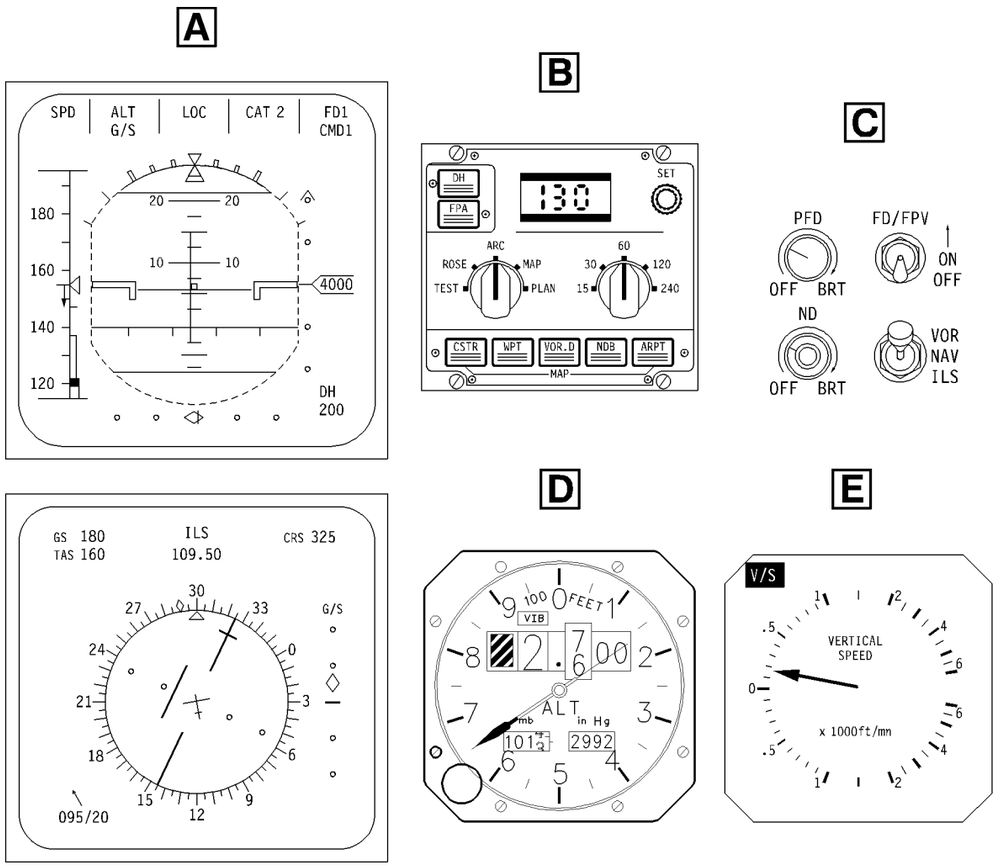




MAIN

SYSTEM CONTROLS

AND DISPLAYS

Mod : 8601 or 10107 or (8601 + 10107)

AI / V-F 1000

FLIGHT INSTRUMENTS

- The flight instruments includes the following equipment :
  - Electronic Flight Instruments System (EFIS), which includes :
    - the Primary Flight Display (PFD), and
    - the Navigation Display (ND) (refer to the section 1.15.20 for description and operation of the Navigation Display – ND),
  - Main Altimeters,
  - Vertical Speed Indicators,
  - Standby Airspeed Indicator,
  - Standby Artificial Horizon,
  - Standby Altimeter.

DATA SOURCES

- The flight instruments use two types of data from two different sources :
  - Airspeed, altitude and temperature data provided by three independent Air Data Systems :
    - two main systems (CAPT and F/O), and
    - one standby system.
  - Attitude data and inertial data provided by three independent Inertial Reference Systems (IRS).

Main Air Data Systems

- There are two independent main Air Data Systems. Each system includes one Air Data Computer (ADC).
  - ADC 1 primarily supplies the Captain's (CAPT) instruments,
  - ADC 2 primarily supplies the First Officer's (F/O) instruments.

  Note : If one ADC fails, the remaining ADC can supply both CAPT and F/O instruments.

  Switching is accomplished using the ADC INST pushbutton switch on the CAPT and F/O SWITCHING panels.

- Each ADC receives environmental data from :
  - One pitot probe for total air pressure,
  - Two static ports for static air pressure,
  - One temperature probe for Total Air Temperature,
  - One alpha probe for Angle-of-Attack.

  Note 1 : The probes and ports are located on the lower left and right hand side of the forward fuselage and are electrically anti-iced.

  Note 2 : PROBE HEAT controls are located on the overhead panel (refer to chapter 1.13 – ICE AND RAIN PROTECTION).

- The following ADC data are displayed on the Captain's and First Officer's flight instruments :
  - Airspeed on the Primary Flight Display (PFD) speed scales,
  - Altitude on the Main Altimeters and on the PFD Vertical Deviation scales,
  - Vertical Speed on both Vertical Speed Indicators,
  - True Air Speed (TAS) on both Navigation Displays (ND).

- Static Air Temperature (SAT) and Total Air Temperature (TAT) are displayed as follows :
  - SAT on the ECAM CRUISE page,
  - TAT on the ECAM MEMO page and on the Thrust Rating Panel (TRP).

Note 1 : SAT and TAT are supplied by ADC 1. If ADC 1 fails, SAT and TAT are automatically supplied by ADC 2.

Note 2 : The TRP displays the TAT supplied by the Thrust Control Computer (TCC).

Standby Air Data System

- If both ADC fail, the standby Air Data System provides attitude, airspeed and altitude information on the following instruments :
  - One standby artificial horizon,
  - One (or two, if installed) standby altimeters,
  - Two standby airspeed indicators.

- Standby Air Data System information is not processed by a computer.
  - The standby airspeed indicators and altimeter(s) are strictly pitot-static instruments requiring no electrical power for their primary operation.
  - The standby horizon is supplied by DC ESS BUS.

- The standby system receives data from :
  - One dedicated pitot probe,
  - Two dedicated static ports.

- Additionally, an electrically heated standby alpha probe, located on the right hand side of the fuselage, provides Angle-of-Attack data for the Flight Augmentation Computers (FAC 1 and FAC 2).

Inertial Reference Systems (IRS)

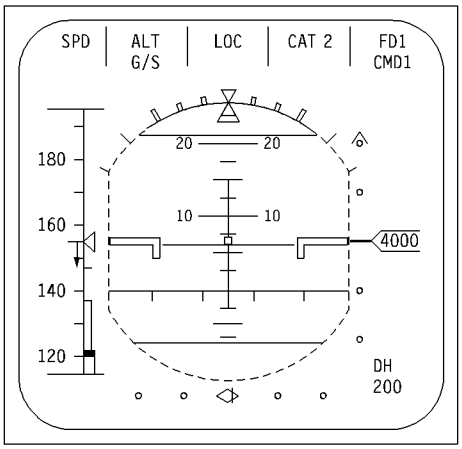
- The Inertial Reference Systems (IRS) primarily provide :
  - Attitude data to the PFD,
  - Heading data to the ND (refer to the chapter 1.15 – NAVIGATION).
- There are three independent Inertial Reference Systems (refer to the sections 1.15.10 thru 1.15.13 for description and operation of the Inertial Reference System) :
  - IRS 1 primarily supplies the Captain's (CAPT) instruments,
  - IRS 2 primarily supplies the First Officer's (F/O) instruments,
  - IRS 3 is in standby.

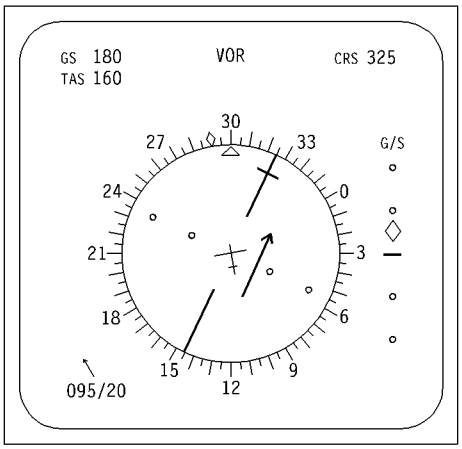
Note 1 : If either IRS 1 or IRS 2 fails, the attitude and heading data supply can be switched to the IRS 3.

Switching is accomplished using the ATT HDG pushbutton switch on the CAPT and F/O SWITCHING panel.

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

- The Electronic Flight Instrument System (EFIS) provides the flight crew with most of the data needed for flight path and navigation control.
- The EFIS data are displayed on four Cathode Ray Tubes (CRT) :
  - Two Primary Flight Displays (PFD),
  - Two Navigation Displays (ND).
- PFD and ND are displayed as follows :
  - upper CRT : PFD,
  - lower CRT : ND.





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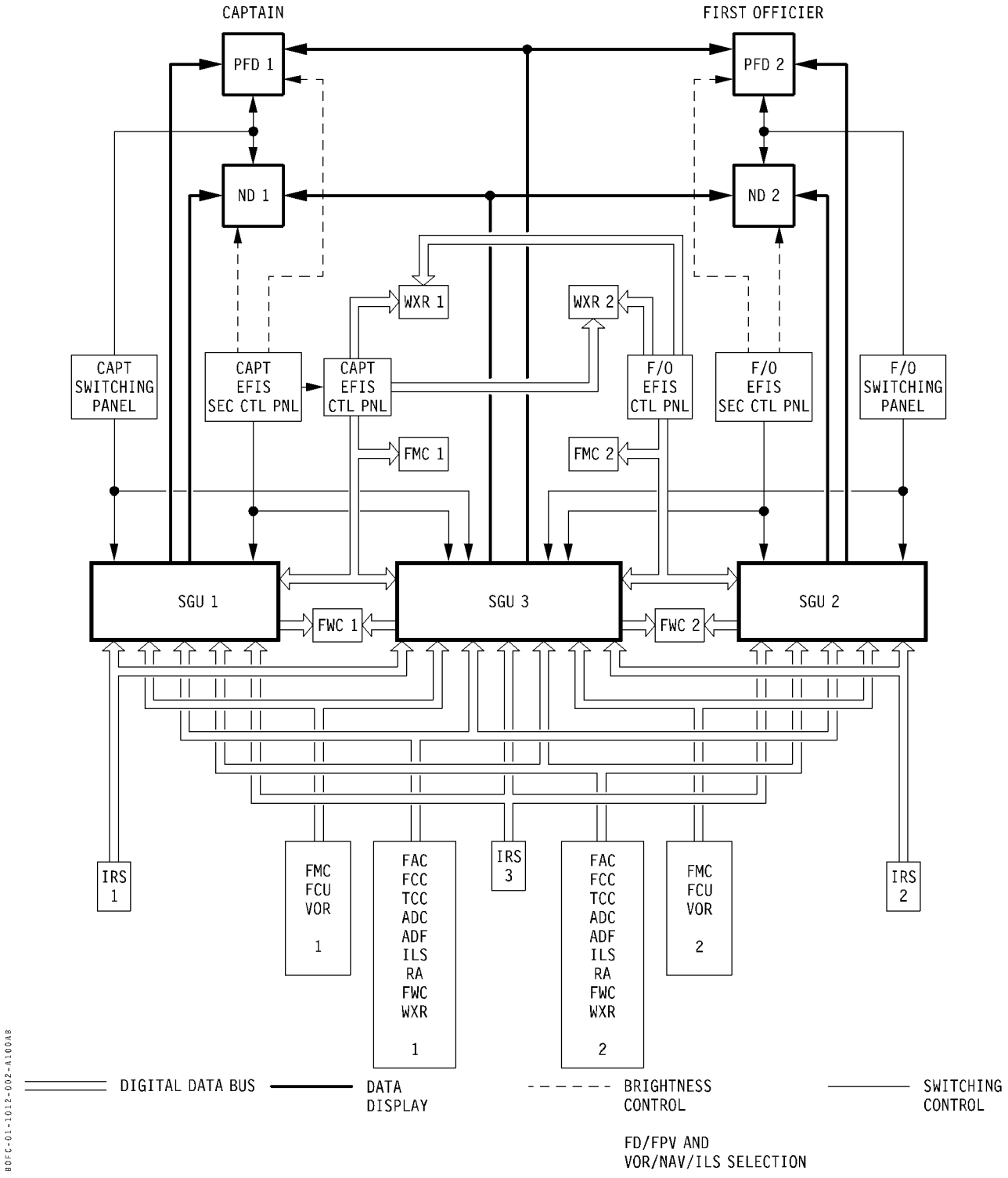
- PFD and ND are controlled by :
  - One EFIS control panel and one secondary control panel located on the glareshield,
  - A SWITCHING panel located beside the main instrument panel.
- Information displayed on the PFD and ND is generated by three Symbol Generator Units (SGU):
  - SGU 1 normally supplies the CAPT's PFD and ND,
  - SGU 2 normally supplies the F/O's PFD and ND,
  - SGU 3 is in standby.

  Note : If either SGU 1 or SGU 2 fails, it can be replaced by SGU 3 (see EFIS SGU SWITCHING).
- In case of SGU failure, the associated displays become black with a diagonal white line.

  Note : In case of excessive pitch or roll rate (in excess of 45°/seconds for more than one second), the PFD and ND also become black with a diagonal white line, until the SGU has completed a reset cycle (i.e. for approximately 4 seconds).
- In case of CRT failure, the associated display become totally blank.
- A PFD/ND XFR pushbutton switch enables switching over the PFD and ND displays between the upper and lower CRT.

STD or Mod : (5846 + 11123)

R



Mod : MPS 5063 or 6523

DATA SOURCES AND INPUTS TO EFIS SGU's

- The following table recalls the data sources and inputs received by the EFIS SGU's for display on the PFD and ND.

SOURCE	PFD	ND
IRS	– Pitch– Roll– Magnetic heading – Side-slip – Flight path vector (drift angle and slope)	– Magnetic heading – Magnetic track – Ground speed
ADC	– Baro altitude – Mach – Computed airspeed	– TAS
FCC	– AP modes – Landing capability – FD bard	
TCC	– ATS modes	
FAC	– V_{SS} – V_{LS} – F – S – Green dot speed – V_{max} – Speed trend	
FCU	– Selected speed – Selected altitude – Selected heading	– Selected heading
VOR	– Selected course (for flight path reference)	– Selected course – VOR deviation – TO/FROM indication
ILS	– G/S and LOC deviations – Runway heading (for flight path reference)	– G/S and LOC deviations – Runway heading
RA	– Radio height – H < DH warning	
ADF		– ADF 1 and 2
FWC	– CHECK ATT warning	– CHECK HDG warning
EFIS CTL PNL	– Flight path reference slope (FPA) – DH	– WR range
WR		– WR image
FMC	– DME ILS – V_1 – FMS target speed	– Flight plan – Wind

Mod : 5735

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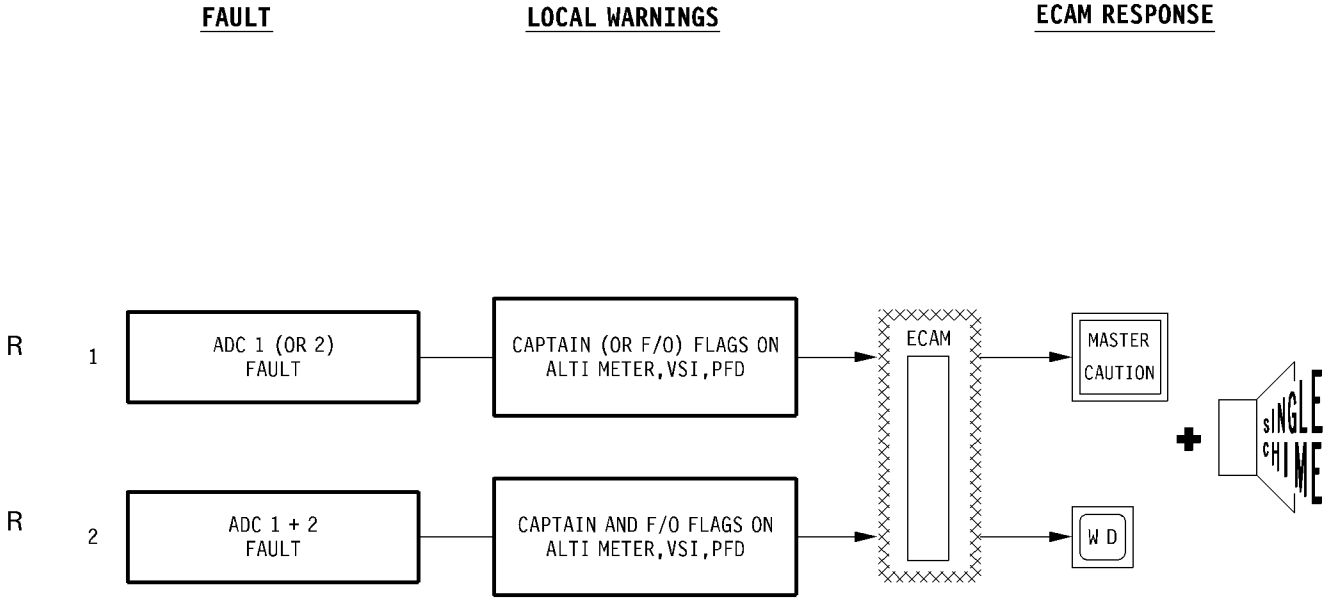
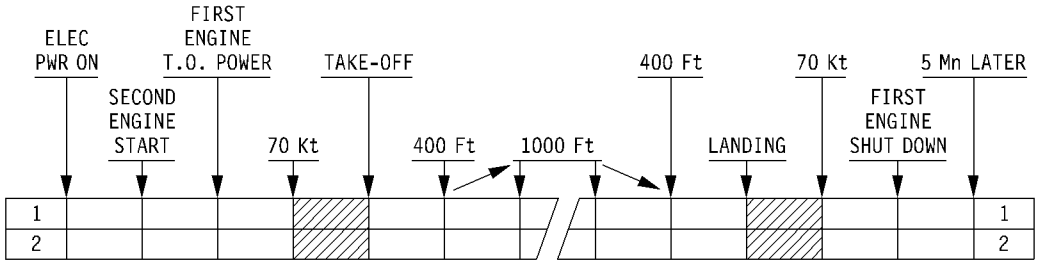


ECAM AUTOMATIC FLIGHT PHASE INHIBITION



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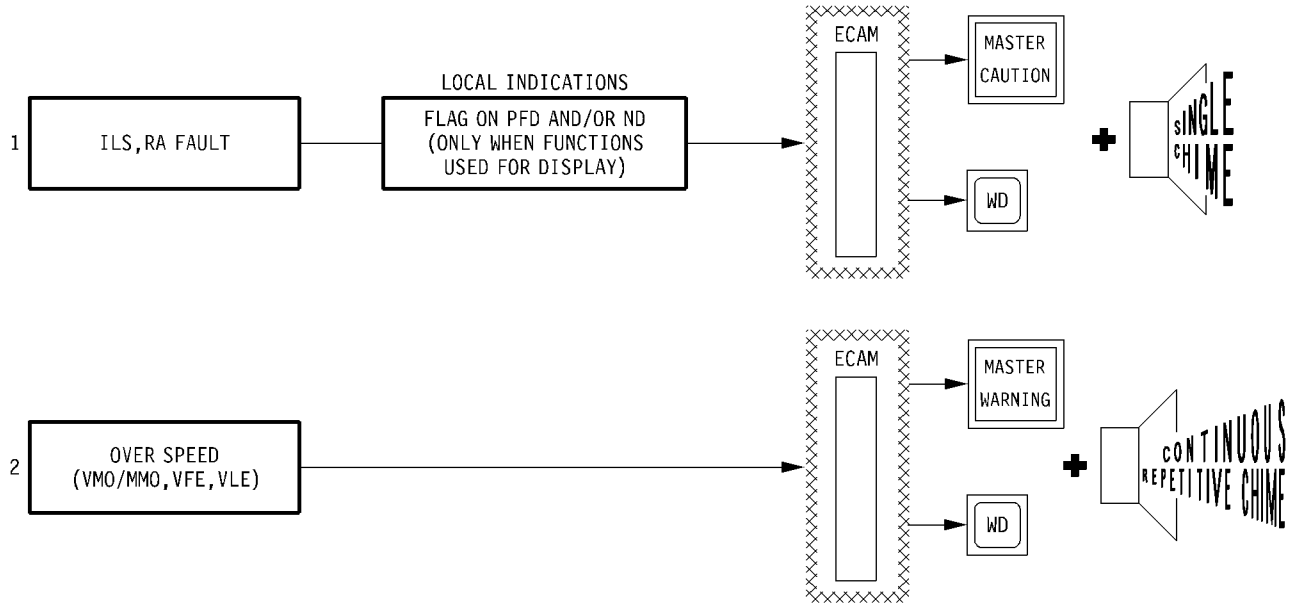
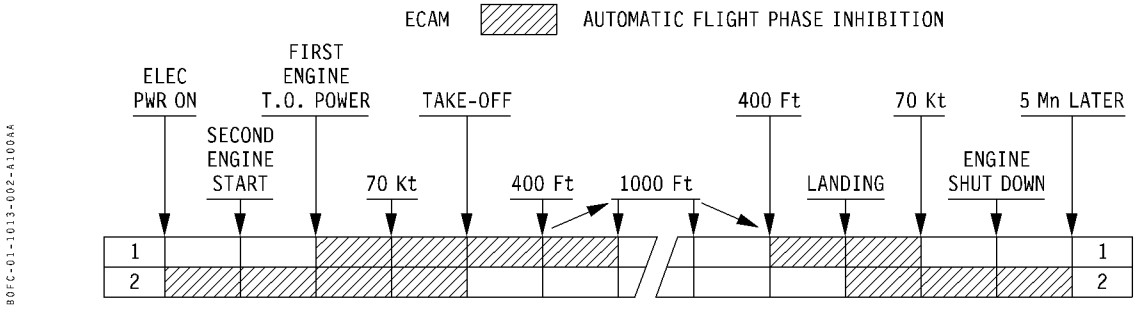
Mod : 5051

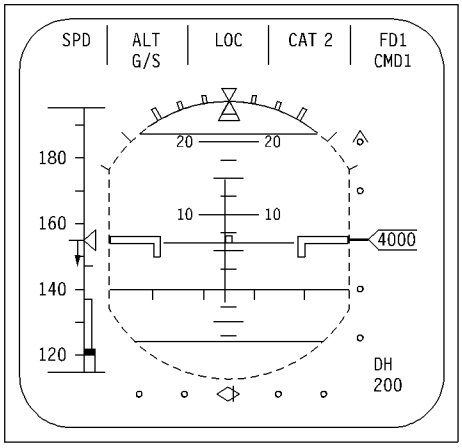


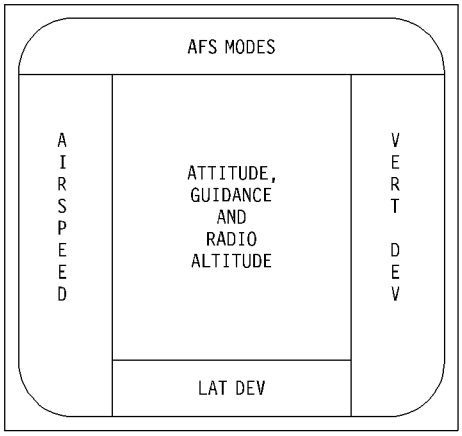
NOTE: MAINTENANCE ACTIONS ARE ONLY REQUIRED WHEN COMPLETE OVER SPEED WARNING HAS BEEN TRIGGERED (ECAM DISPLAY+ AURAL WARNING)



Mod : 5051

PRIMARY FLIGHT DISPLAY (PFD)





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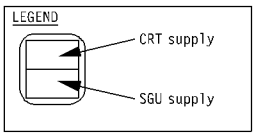
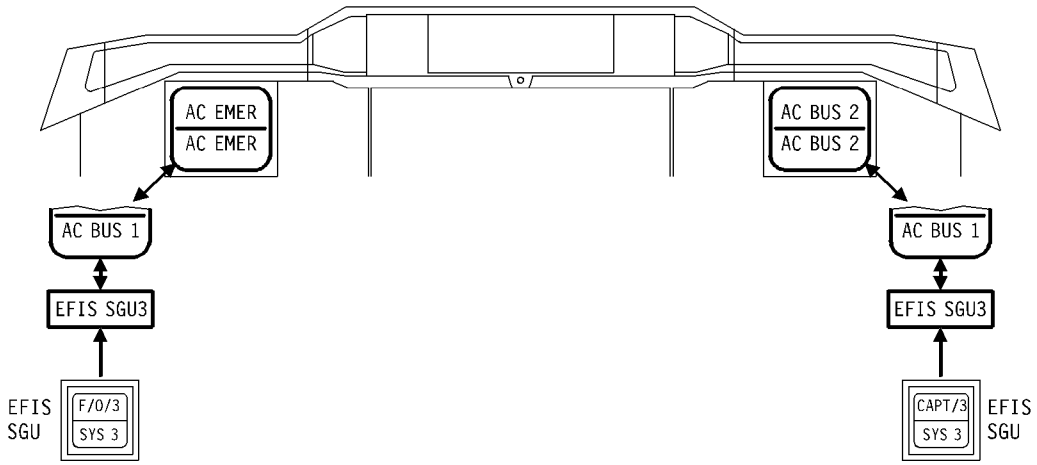
- The Primary Flight Display (PFD) provides the following information in five separate areas :
  - Auto Flight System (AFS) modes on the Flight Mode Annunciator (FMA),
  - Airspeed (selected speed, IAS, speed trend arrow, green dot speed or S speed or F speed, VLS, VSS).
  - Attitude (pitch, roll and heading scales), guidance (Flight Director) and Radio Altitude,
  - Vertical deviation from selected altitude or glide slope,
  - Lateral deviation from a localizer beam, if selected.
- If a failure affects information which is displayed on the PFD, the affected information is blanked.
  - In most cases a red failure message replaces the affected information.
  - The red failure message first flashes for a few seconds in order to attract the crew's attention.
  - The red failure message then remains steady as long as the fault exists, or until a backup source is selected to replace the affected system.
  - Some failure modes are associated with ECAM warning activation.
- The CAPT and F/O PFD CRT's and SGU's are electrically powered as illustrated hereafter :





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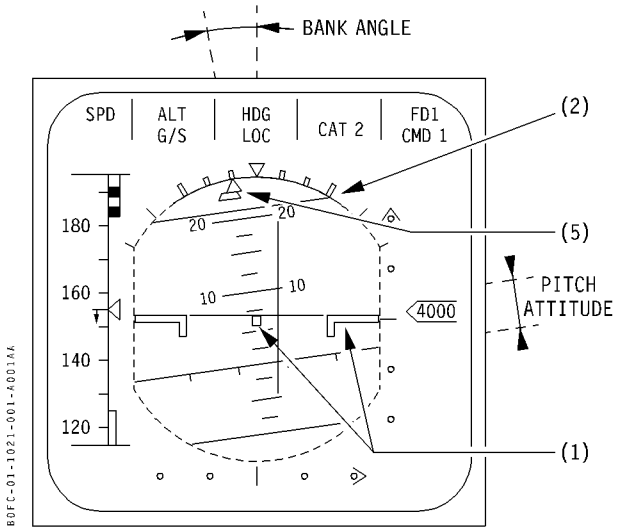
ATTITUDE DATA DISPLAY



- The aircraft attitude is indicated in the center area of the PFD in a conventional Attitude Director Indicator (ADI) presentation.
  - The distance between the aircraft symbol and the horizon indicates the aircraft pitch attitude.
  - The angle between the aircraft symbol and the horizon indicates the aircraft bank angle.
  - The sky is colored blue, and the earth is brown.

(1) Fixed Aircraft Symbol

- Black, outlined in yellow.

(2) Bank Angle Scale

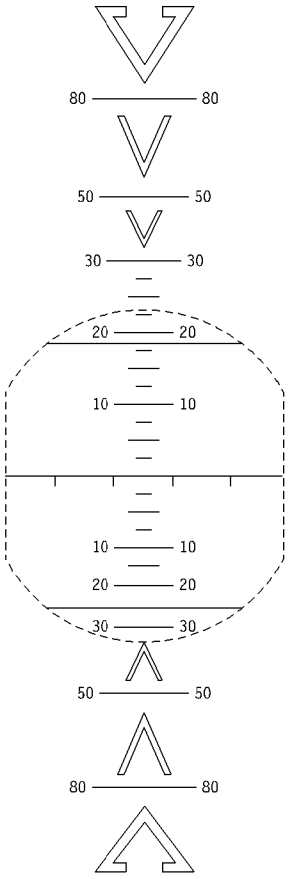
- White scale graduated at 0, 10, 20, 30, 45 and 60° of bank angle.
- The 0 position is marked by a yellow triangle (sky pointer).

(3) Roll Pointer

- A yellow pointer rolls with the aircraft and points at the bank angle on the bank angle scale.

(4) Pitch Scale

- The pitch scale is white, and is graduated in :
  - 2.5° increments between 0° and 30° nose up and between 0° and 10° nose down,
  - 5° increments between 10° and 20° nose down,
  - 10° increments between 20° and 30° nose down.
- In case of excessive nose up or nose down pitch attitude, red V's indicate the direction to the nearest horizon.
- On ground, the nose down scale is not displayed.



(5) Turn Coordination Indicator (side-slip index)

- Below the roll pointer a yellow trapezoid-shaped box indicates the aircraft side-slip.
- The trapezoid replace the conventional side-slip ball :
  - When the trapezoid is centered under the roll pointer, the aircraft is in coordinated flight (no side-slip).
  - If the box is located to one side of the roll pointer, more rudder input is required on that side to cancel the side-slip.

UNUSUAL ATTITUDES

- In order to attract the flight crew attention in case of excessive pitch attitude or bank angle, the PFD display is decluterred in order to display only the information necessary for the recovery of a usual pitch and/or roll attitude.

- **Excessive bank angle :**
  - If the bank angle exceeds 45°, the following information only remain displayed :
    - pitch and roll attitudes,
    - speed,
    - heading,
    - FPV (if selected),

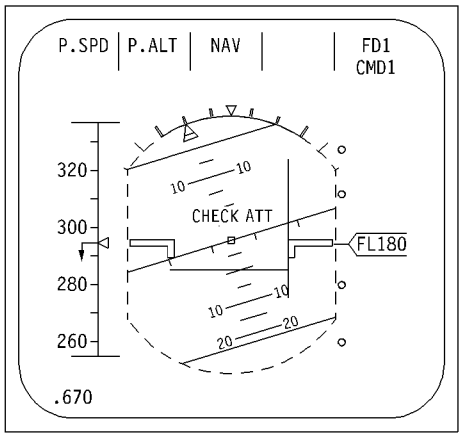
    all other information are cleared from display.
  - The PFD display returns to normal when the bank angle decreases below 40°.

- **Excessive pitch attitudes :**
  - If the pitch attitude exceeds 25° nose up or 13° nose down, the following information only remain displayed :
    - pitch and roll attitudes,
    - speed,
    - heading,
    - FPV (if selected),

    all other information are cleared from display.
  - The PFD display returns to normal when the pitch attitude decreases below 22° nose up or increases above 10° nose down.

DISPLAY IN FAILURE CASES

- If IRS pitch or roll data is lost, the entire attitude sphere is erased and is replaced by a red "ATT" message (refer to section 1.10.71 – IRS SWITCHING).
- If there is a difference of more than 4° in pitch or roll between the two PFD a red "CHECK ATT" message is displayed on both PFD.



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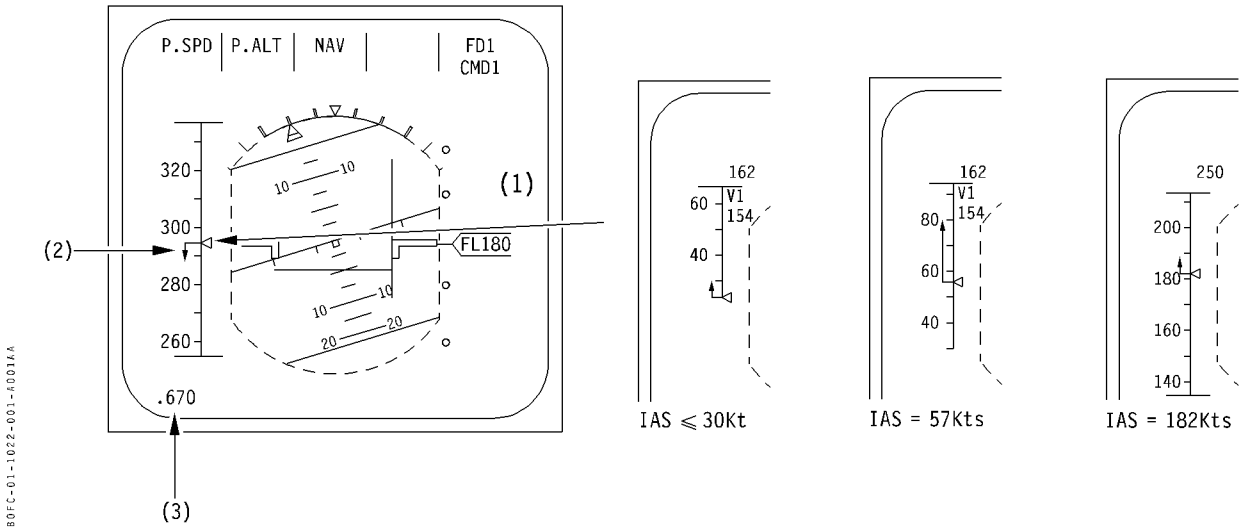
AIRSPEED SCALE



(1) Airspeed Scale and Symbol

- The speed scale is displayed on the left side of the PFD.
- The speed scale has graduated marks every 10 kt and numbers for every 20 kt.
- The maximum visible range of the scale is 80 kt.
- R Airspeed computed by the Air Data Computer is indicated on the speed scale by a yellow triangular pointer.

(2) Speed Trend

- The speed trend, which is displayed as a yellow arrow starting from the speed symbol, is representative of the aircraft present acceleration.
- The end of the arrow indicates the speed which will be reached within 10 seconds if the present rate of acceleration or deceleration is maintained.

Note : The arrow is displayed if greater than 2 kt/10 seconds and is cleared if lower than 1 kt/10 seconds.

- The speed trend data is supplied by the Flight Augmentation Computer (FAC).
- In case of FAC failure, the speed trend arrow is cleared from display.

(3) Mach Number

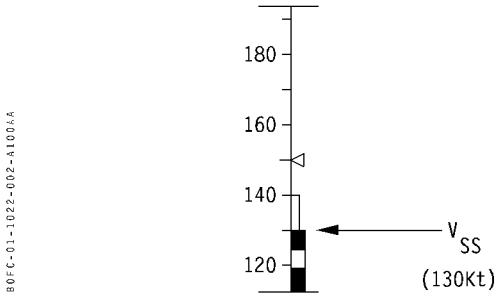
- Mach number is displayed when MN value is greater than 0.5, and is cleared from display when MN value decreases below 0.45.
- If Mach number data is lost, a red MACH flag is displayed.

LIMIT SPEEDS AND MANEUVERING SPEEDS

- Five seconds after lift-off, each Flight Augmentation Computer (FAC) provides the following speeds on the PFD speed scale :
  - Limit speeds :
    - VSS : Stick Shaker speed,
    - VLS : Lowest Selectable speed,
    - VMAX : Maximum selectable speed.
  - Maneuvering speeds :
    - F : Minimum Flaps retraction speed, or maneuvering speed with flaps 20.
    - S : Minimum Slats retraction speed, or maneuvering speed with slats 15.
    - O : Green Dot - Single engine operating speed, or clean maneuvering speed.

LIMIT SPEEDS

- **VSS – Stick Shaker Speed :**
  - The Stick Shaker speed VSS is displayed as a red and black strip at the bottom of the speed scale.

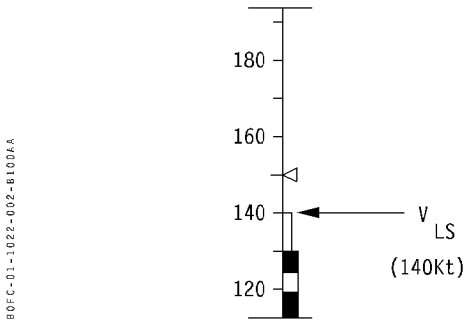


  - The stick shaker speed VSS is the IAS at which the Stick Shaker will be activated for the prevailing gross weight and configuration.
  - The VSS value varies with the g-load factor.
  - The Stick Shaker activation is solely based on the aircraft angle of attack :
    - approximately 8.5° in clean configuration,
    - approximately 15° in other configurations.

Note 1 : The actual stick shaker warning is triggered by the Flight Warning Computer (FWC) and is independent from the VSS value computed by the FAC.

Note 2 : A difference may exist between the VSS indication and the actual IAS at which the stick shaker is activated.

- **VLS – Lowest Selectable Speed :**



  - The Lowest Selectable speed VLS is displayed as an amber strip above VSS on the speed scale.
  - VLS is the lower limit of the flight envelope.
  - For take-off : VLS = 1.2 × Vs.
  - After take-off, as soon as flaps or slats configuration is changed : VLS = 1.3 × Vs.
  - Above 25,000 ft, VLS provides a 0.3 g margin above Mach buffet.
  - During configuration changes, VLS progressively changes to reflect the actual configuration.

    Note : In order to offer a speed margin relative to VFE, VLS is limited to VFE – 20 kt, based on the VFE corresponding to the slats/flaps lever position.

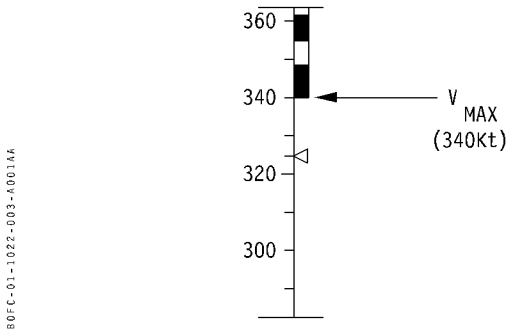
    Note : At speedbrakes extension, VLS becomes equal to :
    . Green dot – 1 kt in clean configuration,
    . S – 1 kt in 15/0 configuration,
    . F – 1 kt in 15/15 and 20/20 configuration.

    In case of abnormal configuration, configuration increments may be required to correct the VLS.
  - In the final landing configuration, VLS = VREF.
  - At touchdown VLS returns to the take-off value (1.2×Vs).

Code : 0157

LIMIT SPEEDS (continued)

- **VMAX – Maximum Selectable Speed :**



– The Maximum selectable speed is displayed as a red and black strip at top of speed scale.

– VMAX represents the following :

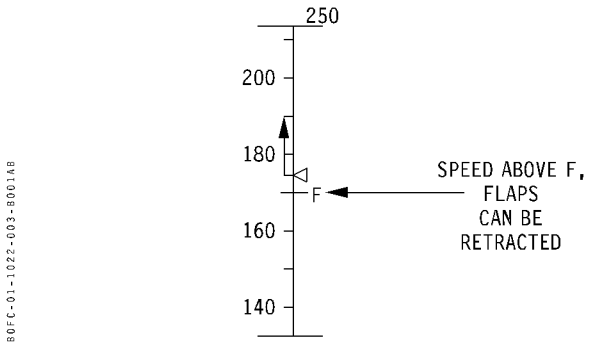
- MMO or VMO (Maximum Operating speeds) in clean configuration.
- VFE (Maximum speed Flaps/slats Extended) when slats or flaps are extended.
- VLE (Maximum speed Landing gear Extended), when landing gear is extended.

R *Note 1 : The VFE displayed on the PFD depends on the S/F lever position.*

R *Note 2 : The VMAX exceedance warning triggered by the FWC is based on the actual aircraft configuration and is independent of the VFE value displayed on the PFD.*

MANEUVERING SPEEDS

- **F – Minimum Flaps Retraction Speed :**



– The minimum Flaps retraction speed F is displayed as a green "-F" on the speed scale.

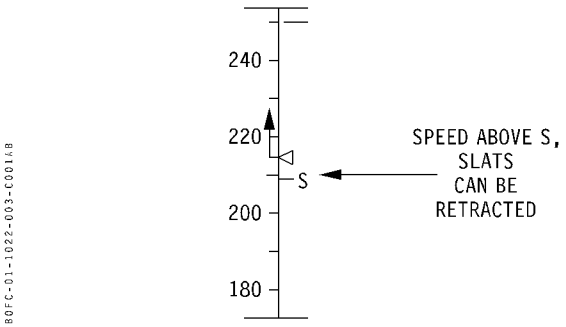
– F is displayed when the SLAT/FLAP lever is in the 15/15 or 20/20 positions.

– The flaps must only be retracted when the speed is above F-speed.

– F = 1.25 × stall speed of the slats 15 / flaps 0 configuration.

– F is also the approach maneuvering speed in Flaps 20 configuration (i.e. F = 1.4 to 1.5 × stall speed in 20/20 configuration).

- **S – Minimum Slats Retraction Speed :**



R

– The minimum Slats retraction speed is displayed as a green "-S" on the speed scale.

– S is displayed when the SLAT/FLAP lever is in the 15/0 position.

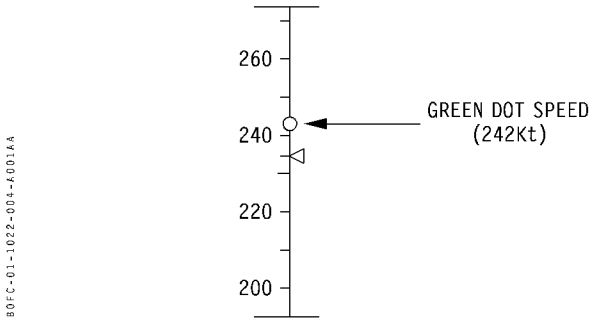
– The slats must only be retracted when the speed is above S-speed.

– S = 1.25 × Stall speed of the clean configuration.

– S is also the maneuvering speed in Slats 15 configuration (i.e. S = 1.4 to 1.5 × stall speed in 15/0 configuration).

MANEUVERING SPEEDS (continued)

- **O – Green Dot - Single Engine Operating Speed**



– The Single Engine Operating Speed "Green Dot" is displayed as a green dot "o" on the speed scale.

– Green Dot speed is only displayed in clean configuration.

– Green Dot speed is the speed which provides the best climb gradient in clean configuration. Green dot is also the best Lift / Drag ratio speed.

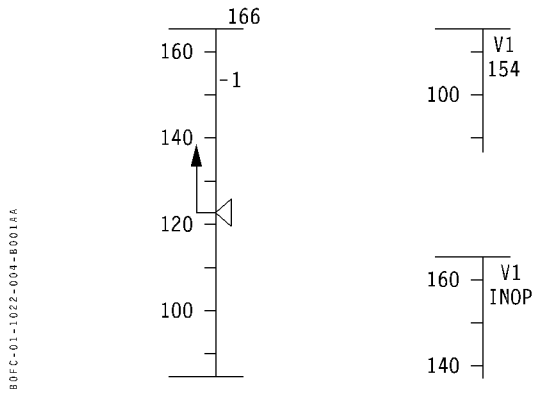
Green Dot is mainly used as the :

- maneuvering speed in clean configuration
- optimum engine out climb speed,
- optimum single engine driftdown speed,
- optimum climb gradient speed,
- maximum endurance speed for holding patterns.

– Green Dot speed is computed by the FAC, based on the aircraft weight and altitude.

Note 1 : The Green Dot speed displayed on the PFD speed scale is computed by the FAC. It may be up to 10 kt above the Green Dot speed computed by the FMC and displayed on the CDU.

V1 – Decision Speed :

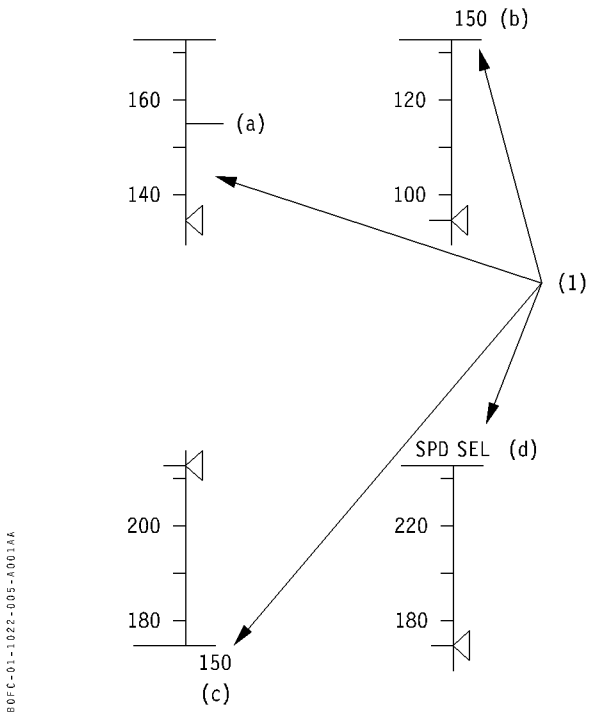


- The decision speed V1 is displayed as a blue "-1" on the speed scale.
- When V1 is out of the displayed range, it is displayed (e.g. V1 154) at the top of the speed scale.
- V1 is manually entered by the crew on the Flight Management System (FMS) CDU during cockpit preparation.
- V1 is not displayed after take-off.
- If V1 data is lost a red V1 INOP flag is displayed.

V2 – Second segment safe speed :

- The second segment safe speed target is entered in the FCU SPD/MACH window.
- As long as V2 is out of scale, the V2 speed is indicated at the top of the speed scale.
- Within the scale range, V2 is indicated by the blue target speed index (blue line).

TARGET SPEED



(1) Selected Target Speed

- The target speed is :
  - the speed selected and displayed on the FCU,

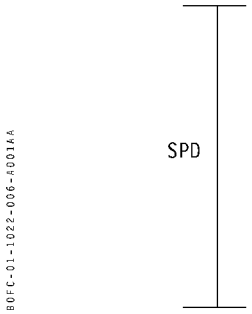
  or

  - the target speed computed by the FMC when PROFILE mode is engaged.
- The target speed is represented by a blue index which moves along the speed scale - item (a).
- When out of the indication range, the target speed is displayed either above - item (b) - or below - item (c) - the speed scale.
- In case of failure of the FCU or SFCC, a red SPD SEL message is displayed - item (d).

INDICATION IN CASE OF ADC FAILURE

- In normal operation, ADC 1 supplies PFD 1 and ADC 2 supplies PFD 2.
- If the ADC speed data is lost, all speed information is blanked.

  The speed scale turns red and a red SPD message is displayed.



- Airspeed information can be recovered by switching to the operative ADC.

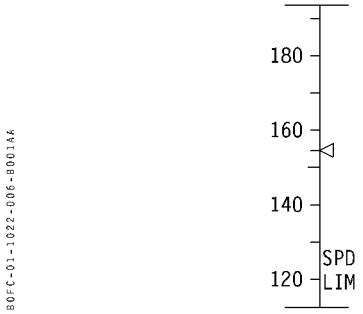
  Switching is accomplished using the ADC INST pushbutton switch on the CAPT (F/O) SWITCHING panel (refer to section 1.10.72 – ADC AND FAC SWITCHING).

R

INDICATION IN CASE OF FAC FAILURE

- In normal operation, FAC 1 supplies PFD 1 and FAC 2 supplies PFD 2.
- In case of FAC failure, all the speeds (Speed trend, VLS, VSS, VMAX, F, S and Green Dot) are cleared from the associated PFD.

  A red SPD LIM message is displayed at the bottom of the speed scale.



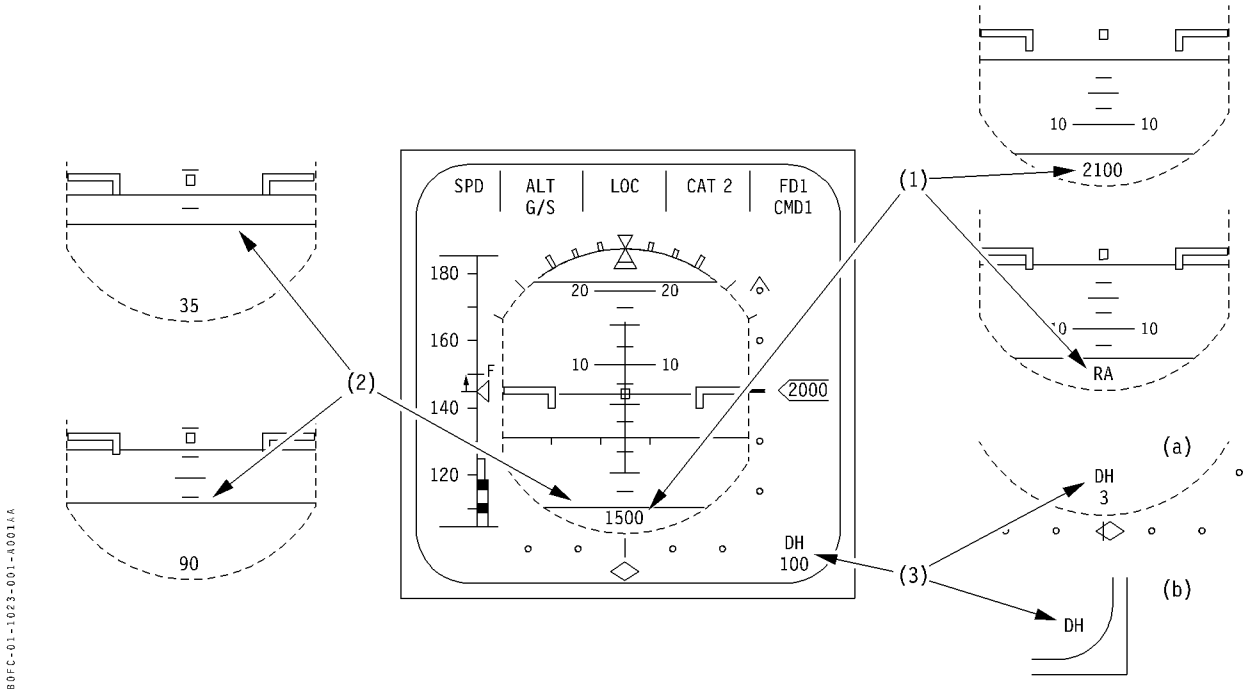
- Limit speeds and maneuvering speeds can be recovered by switching to the operative FAC.

  Switching is accomplished using the ADC INST pushbutton switch on the CAPT (F/O) SWITCHING panel (refer to section 1.10.72 – ADC AND FAC SWITCHING).

Note : The SPD LIM message is also displayed in case of loss of :

- *a Slats/Flaps Control Computer (SFCC) (or if the SLAT/FLAP control lever position is lost),*
- *an Angle-of-Attack (AoA) sensor,*
- *an Inertial Reference System (IRS).*

RADIO ALTITUDE



(1) Digital Radio Altitude (RA)

- Radio Altitude is displayed when the aircraft is below 2500 ft RA.
- The size and color of the RA indication depend on the Radio Altitude (RA) :
  - Above 1000 ft RA, small green digits,
  - Below 1000 ft RA, large green digits,
  - RA indication becomes amber at 100 ft above the Decision Height.
- The RA indication is displayed in steps as follows :
  - Above 50 ft RA : 10 ft steps,
  - Between 5 and 50 ft RA : 5 ft steps,
  - Below 5 ft RA : 1 ft steps.
- If both Radio Altimeters fail, when slats are extended, a red RA message replaces the Radio Altimeter data.

(2) Radio Altitude Line

- During final approach the lower white line moves up towards the horizon line to give a visual indication of approaching ground level.
- The distance between the horizon line and the RA line decreases progressively with decreasing radio altitude (at touchdown, the RA line and the horizon line merge as a single line).

(3) Decision Height (DH)

- The Decision Height set on the primary EFIS control panel is displayed in blue when the Radio Altitude is displayed.
- When the Radio Altitude is lower than the set Decision Height, an amber DH message, is displayed above the RA - item (a).
- If DH information is lost, DH value is cleared and a red DH message replaces the DH - item (b).

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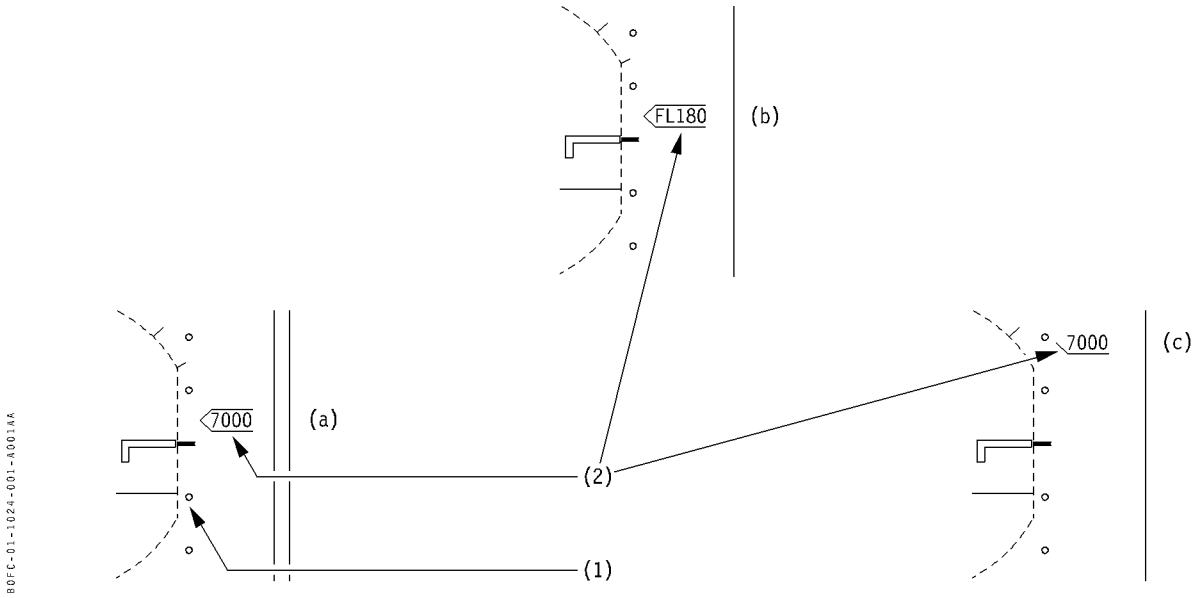
ALTITUDE DEVIATION



(1) Altitude Deviation Scale

- The vertical deviation scale is displayed in white and indicates the altitude deviation from the altitude selected on the Flight Control Unit (FCU) :
  - Each dot represents 500 ft.
  - The maximum deviation displayed is ± 1 000 ft.

(2) Selected Altitude Index

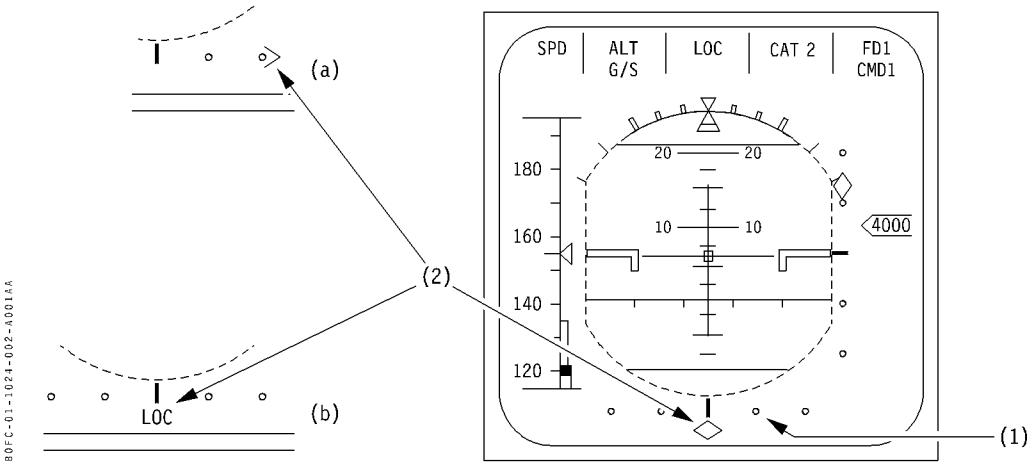
- The altitude selected on the FCU is shown in blue in a white index.
- The index moves up or down to reflect the difference between the aircraft actual altitude and the target altitude selected on the FCU.
- The value in the index box is either:
  - an altitude in ft - item (a) - if the altimeter BARO set knob is pushed to set the local QNH or QFE, R

  or
  - a Flight Level - item (b) - if the altimeter BARO set knob is pulled to set STD.
- When the deviation from the selected altitude is more than 1 000 ft, only half of the selected altitude index reaches is displayed at the top or bottom of the PFD - item (c).
- If the altitude data is lost, the index is cleared from display.

ILS DEVIATION INFORMATION

- When the VOR/NAV/ILS switch on the EFIS control panel is placed in the ILS position, the following ILS deviation information is presented on the associated PFD.

LATERAL DEVIATION



(1) Localizer Deviation Scale

- The localizer deviation scale is displayed as four white dots and a yellow center bar.

  It is displayed at the bottom of the PFD deviation only when the VOR/NAV/ILS switch is in the ILS position.

- A one-dot deviation represents approximately :
  - at 4 nm (typical OM) : 180 m (600 ft),
  - at 0.5 nm (typical MM) : 70 m (230 ft),
  - at runway threshold : 50 m (175 ft).

(2) Localizer Deviation Index

- The localizer deviation index (pink diamond) is displayed when a localizer signal is received and the VOR/NAV/ILS switch is in the ILS position.

- When the index is outside of the deviation scale, only half a diamond is displayed - item (a).

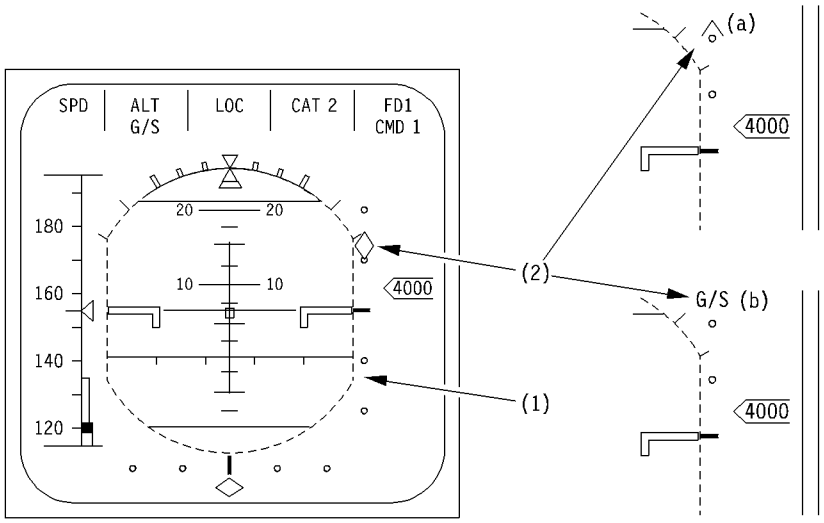
- If the localizer on-board receiver fails, the index is cleared and a red LOC message is displayed under the scale - item (b).

- With LAND mode engaged in LOC track phase (LOC green on FMA), an excessive LOC deviation (greater than 1/3 dot) is indicated by the flashing of the LOC index and scale.

  The LOC excessive deviation warning is activated only if CAT2 or CAT3 landing capability is indicated on FMA.

- If the localizer ground transmitter fails during the capture (LOC*) or track phase (LOC green) of LOC mode, the FD roll bar and localizer deviation scales flash on both PFD, and the deviation index is cleared from display.

VERTICAL DEVIATION



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(1) Vertical (G/S) Deviation Scale

- The ILS vertical (Glide Slope) deviation scale is displayed as four white dots and a yellow center bar.
- The Glide Slope deviation index is displayed on the vertical deviation scale when the VOR/NAV/ILS switch is in ILS position.
- A two dot deviation represents approximately a 0.7° deviation for a 3° glide slope.

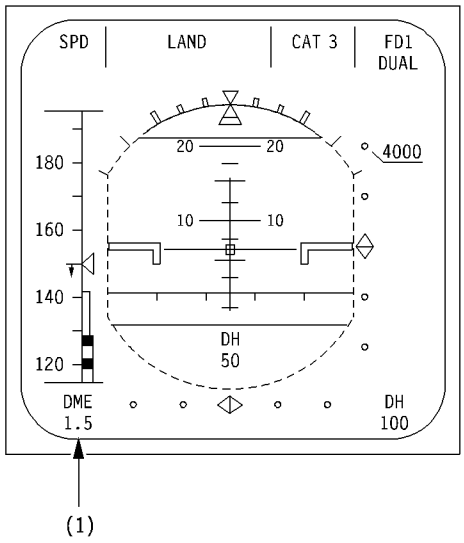
  This deviation represents approximately 75 ft at 1 nm from the runway touchdown zone.

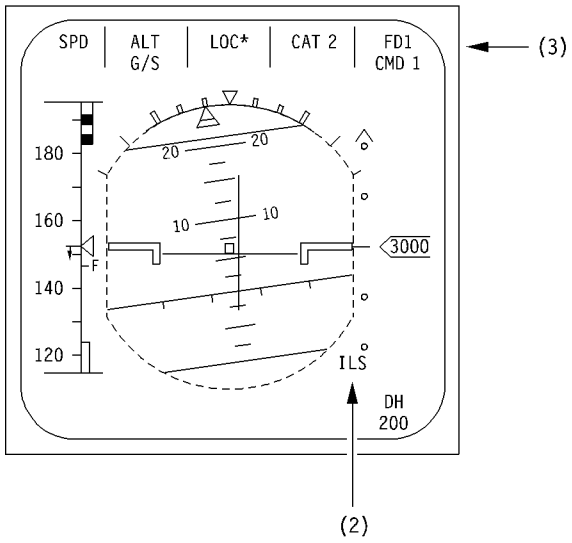
(2) Glide Slope Deviation Index

- The glide slope deviation index (pink diamond) is displayed when a glide slope signal is received and the VOR/NAV/ILS switch is in the ILS position.
- When the deviation is outside of the deviation scale, only half a diamond is displayed - item (a).
- With LAND mode engaged in GS track phase (GS green on FMA), an excessive GS deviation (greater than 1 dot) is indicated by the flashing of the GS index and scale.

  The GS excessive deviation warning is activated only if CAT 2 or CAT 3 landing capability is indicated on FMA. R
- If the glide slope on-board receiver fails, the index is cleared and a red G/S message is displayed above the deviation scale - item (b).
- If the glide slope ground transmitter fails during the capture (GS*) or track phase (GS green) of G/S mode, the FD pitch bar and vertical deviation scales flash on both PFD, and the deviation index is cleared from display.

OTHER ILS INFORMATION





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(1) ILS DME

- During approach, the ILS/DME is autotuned by the FMS and the ILS/DME distance is displayed in the lower left corner of both PFD if :
  - the ILS/DME frequency is set on the ILS control panel

  and

R - the ILS/DME is within 30 NM of the aircraft

R and

  - the VOR/NAV/ILS switch is in the ILS position,

  and

  - Mach number is below 0.45 (Mach number not displayed on PFD).

R *Note : if there are more than one possible ILS/DME*
R *on the selected frequency, the FMS will*
R *check the ILS approach in the F-PLN and*
R *display the corresponding DME distance. If*
R *no ILS approach is entered in the F-PLN, then*
R *the FMS cannot choose which DME to display,*
R *and no DME distance will be displayed.*

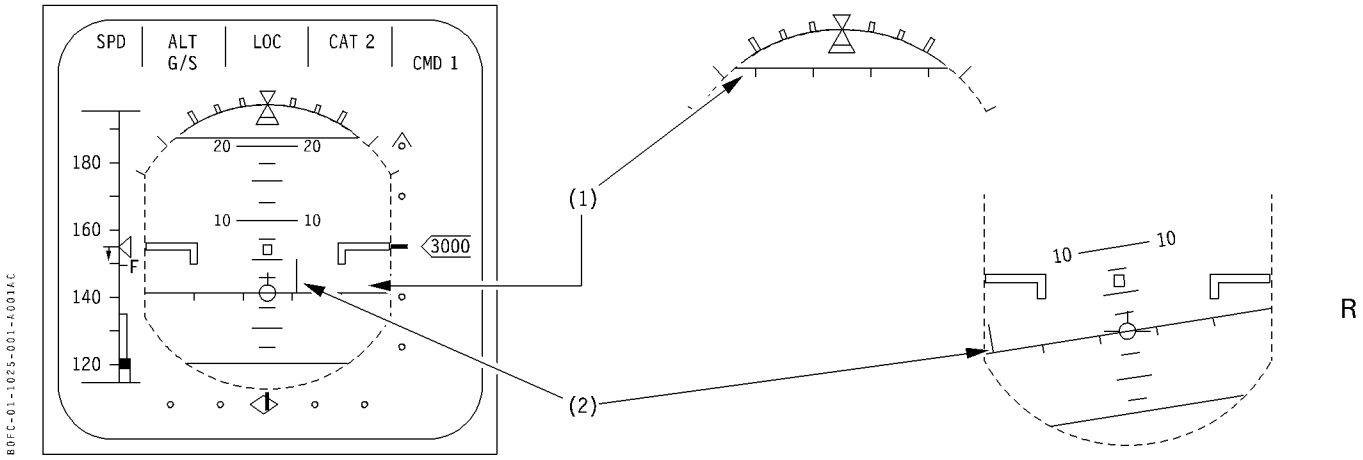
(2) ILS Reminder

- The ILS reminder flashes amber if :
  - LAND mode is armed (G/S blue, LOC blue) or engaged (LOC green), and
  - The onside VOR/NAV/ILS switch is not in the ILS position.
- The purpose of the ILS reminder is to direct the pilot to set the VOR/NAV/ILS switch in the ILS position.

(3) Flight Mode Annunciator (FMA) Indications

- When LAND mode is armed, "G/S" and "LOC" are displayed in blue in the second line of the FMA.
- "GS*" and "LOC*" are displayed in green in the first line of the FMA during the capture of the glide slope and localizer beams.
- "GS" and "LOC" are displayed in green in the first line of the FMA when tracking the glide slope and localizer beams.

HEADING DATA



(1) Heading Scale

- A heading scale (graduated in 10° increments) which moves as the aircraft turns, is provided on the PFD horizon line.

R
- In case of excessive nose up or nose down pitch attitudes, the horizon line is out-of-view, but the heading scale remains visible at the bottom or at the top of the display.

(2) Selected Heading

- When the Flight Path Vector (FPV) is displayed (FPV/FD switch in the FPV position) the heading selected on the FCU is indicated by a blue vertical line on the heading scale.

  Refer to section 1.10.27 for description of the Flight Path Vector (FPV).

- If the selected heading is out of the display range, the symbol remains against the stop on the corresponding side of the heading scale.

- If IRS heading information is lost, the heading scale and symbol (as well as the FPV) are cleared from display.

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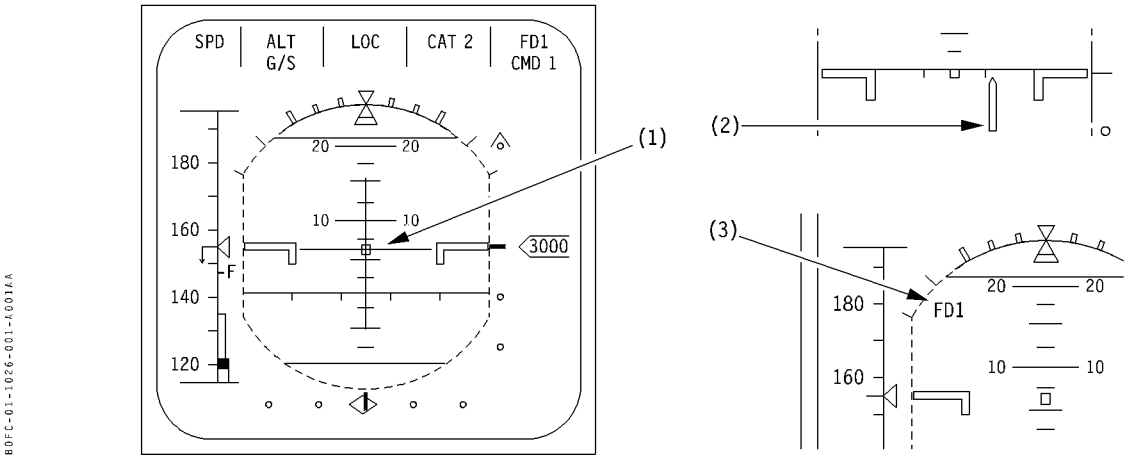
FLIGHT DIRECTOR DISPLAY

R



(1) FD Command Bars

- The Flight Director (FD) is displayed using the FD/FPV toggle switch located on the EFIS secondary control panel.
- When FD is selected, the green pitch and roll command bars are displayed.
- If the AP/FD reverts to the basic V/S and/or HDG modes, the FD bars flash for five seconds.
- R R For detailed description of the FD, refer to chapter 1.03.30–AUTOFLIGHT SYSTEM–FLIGHT DIRECTOR.

(2) FD Yaw Bar

- For take-off (in RWY mode) and during landing (in FLARE and ROLL OUT modes), the roll bar is replaced by a yellow yaw bar which provides steering commands to the localizer centerline.

(3) FD Failure Message

- In case of FD failure, the command bars are cleared from display and a red FD1 (or FD2 depending on which FD is displayed) message is displayed.

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GENERAL

- The Flight Path Vector (FPV) symbol indicates the actual inertial trajectory of the aircraft, in terms of :
  - Flight Path Angle (FPA),
  - Track or Course (CRS).
- The Flight Path Reference (FPR) symbol indicates the intended trajectory. The FPR can be set in order to provide :
  - a Flight Path Angle (FPA) reference,
  - a Track or Course (CRS) reference.
- The FPV/FPR provide assistance to the flight crew to fly a trajectory following a desired FPA and CRS.
- The FPV/FPR can be used :
  - in manual flying, by keeping the FPV on the FPR,
  - with AP engaged in CMD, with V/S and HDG SEL modes :
    - as a monitoring means by the PNF,

    or
    - as a reference for both the PF and PNF.
- The FPV/FPR can be used under the following circumstances :
  - to conduct a non-precision (non-ILS) approach with a constant slope final descent from the FAF (or final descent point) down to the Visual Descent Point (VDP),
  - to conduct visual approaches (monitoring of flight path angle and drift correction),
  - to perform visual patterns,
  - in case of loss of both FMS,
  - in case of unreliable airspeed indication.
- The following features and design characteristics of the FPV/FPR must be highlighted :
  - The FPV/FPR are not linked to any navaid.
  - The FPV indicates the actual inertial trajectory (velocity vector) of the aircraft.
  - The FPR is an index indicating the intended

Rreference trajectory.
  - The FPV/FPR do not provide correction commands and do not constitute a flight director.
  - The use of the FPV/FPR must be associated with the use of navaid(s) raw data for monitoring.
  - The FPV/FPR cannot be coupled to the AP.
  - The AP can be used in CMD with :
    - V/S mode to adjust and maintain the FPV on the FPR,
    - HDG SEL mode to adjust and maintain the FPV on the reference CRS (or track).

(1) Flight Path Vector (FPV)

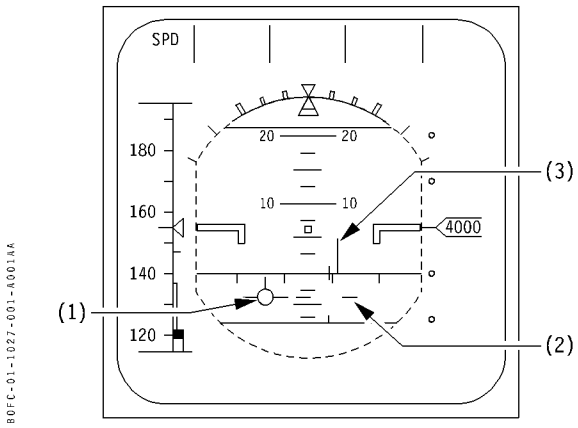
- The Flight Path Vector symbol is displayed by using FD/FPV toggle switch located on the EFIS secondary control panel.
- The FPV simultaneously displays the aircraft's vertical and lateral inertial trajectory.

(2) Flight Path Reference (FPR)

- The FPR is used as a reference for the FPV.
- The FPR is displayed by :
  - Selecting the FPV using the FD/FPV switch, and
  - Pressing the FPA key on the EFIS control panel.

(3) Selected Heading

- Refer to section 1.10.25 – HEADING.



FLIGHT PATH VECTOR (FPV)

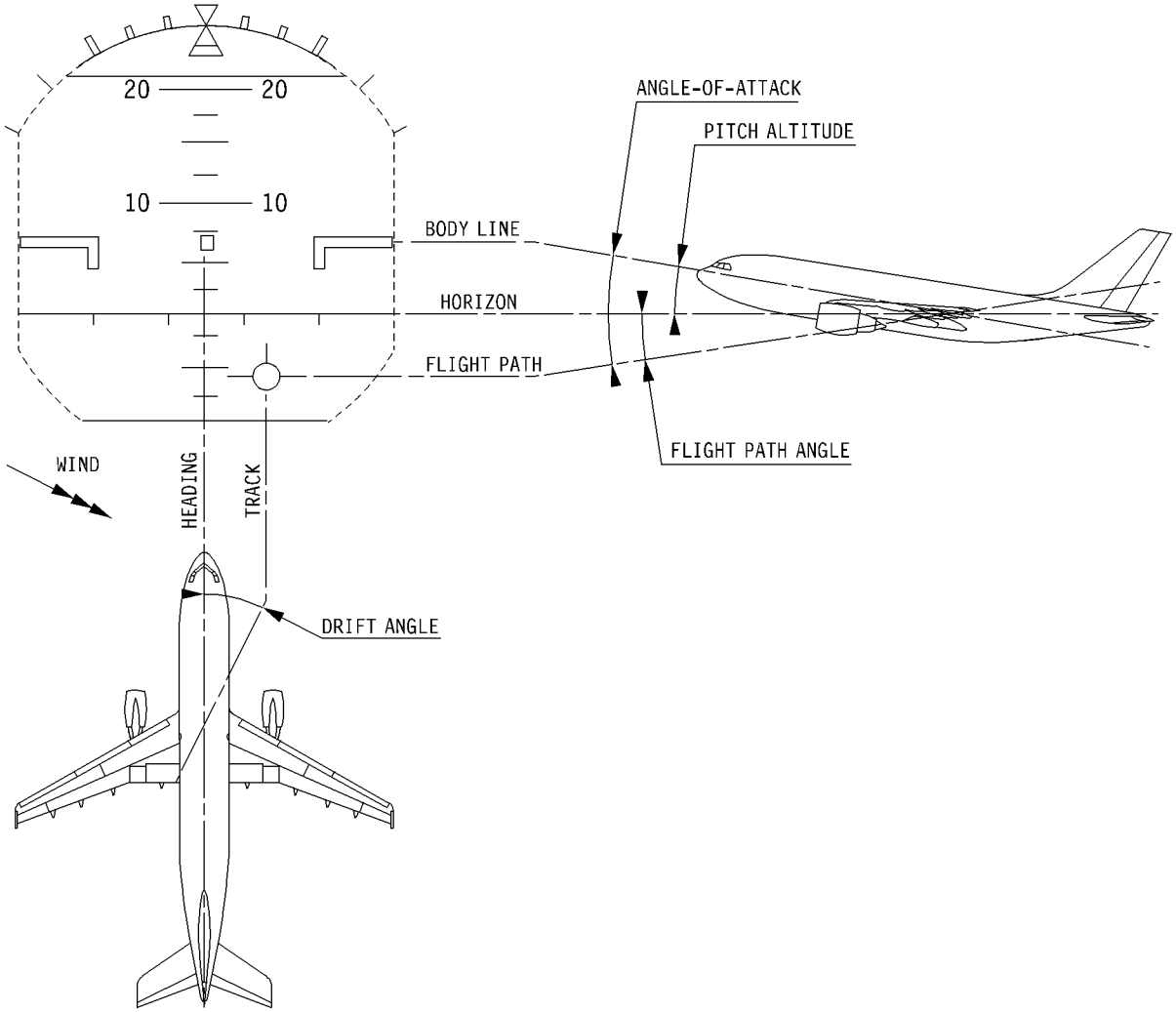
R • The vertical distance between the FPV and the
R horizon line represents the Flight Path Angle.

R • The lateral distance between the FPV and the
R nose of the aircraft symbol represents the drift
R angle.

• The vertical distance between the FPV and the nose of the aircraft symbol indicates the Angle-of-Attack (AoA).

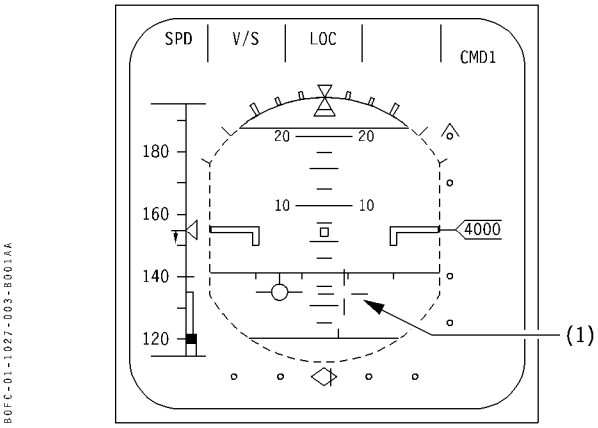
The AoA information can be used (in addition to pitch and thrust) in case of unreliable airspeed or loss of airspeed indication.

• In case of failure, the FPV symbol is cleared from display and a red FPV flag appears below the right wing of the aircraft symbol.

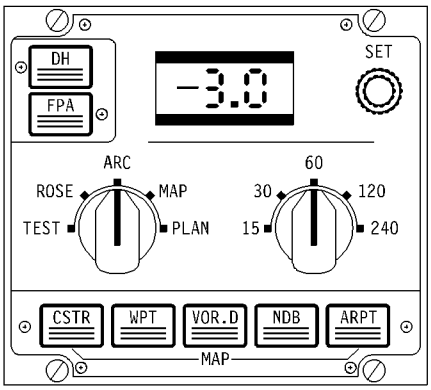


FLIGHT PATH REFERENCE (FPR)

- The Flight Path Reference (FPR) symbol (1) can be set to provide :
  - a flight path angle (FPA) reference,
  - a track/course (CRS) reference.



Flight Path Angle (FPA)



- Selecting the FPA pushbutton switch when the FPV is displayed on the PFD will display the Flight Path Reference (FPR) for use with the FPV.
- When selected, the FPA pushbutton switch light illuminates.

  If the pushbutton is pressed a second time, the display returns to dashes.
- The FPR symbol is positioned vertically by turning the SET knob :
  - Clockwise rotation raises the FPR,
  - Counterclockwise rotation lowers the FPR.
- The numbers displayed in the window when FPA is pressed are in degrees and tenths of a degree (from – 9.9° to + 9.9° by 0.1° increments).

Course/Track (CRS)

- The lateral position of the FPR is set on a fixed course or track, which depends on the position of the VOR/NAV/ILS switch, located on the secondary EFIS control panel.
- If the switch is in :
  - the VOR position : the FPR is set on the course selected on the VOR control panel.
  - the ILS position : the FPR is set on the course selected on the ILS control panel.
- By setting the FPR to a desired FPA (using the FPA SET knob), and a desired track (by setting a course on either the VOR or ILS control panel), the FPR can be used as a reference for the FPV to enable the pilot to maintain a desired flight path or to monitor the actual flight path relative to a desired FPA and track.
- If the course selected is out of display range, half of the FPR is presented against the side of the attitude display.

CAUTION

When using the FPV and FPR together for course and glide path control during an approach, raw data must be used to ensure that the aircraft is on course and on the published vertical profile.

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AFS Flight Mode Annunciator (FMA)

- Annunciation of AFS modes is provided at the top of the PFD, on the FMA.

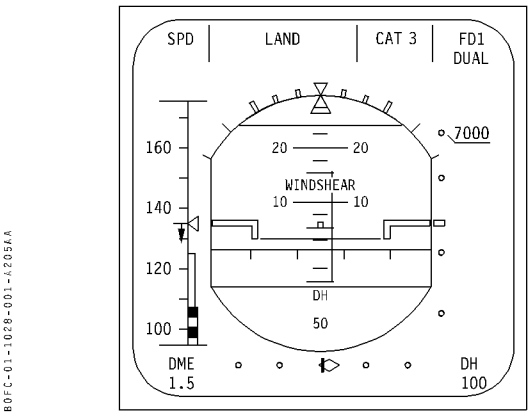
  Refer to section 1.03.12 – AFS PILOT INTERFACE– FLIGHT MODE ANNUNCIATOR for detailed description of the FMA.

Special Message Display

- In certain conditions (refer to chapter 1.19 FLIGHT MANAGEMENT SYSTEM), specific amber messages are flashing to direct the crew to take specific actions.
- These messages are :
  - MORE DRAG,
  - DECELERATE.

WINDSHEAR Alert

- If windshear conditions are detected by the FAC, the following warnings are activated :
  - Red "WINDSHEAR" message in the center of the PFD,
  - Audio WINDSHEAR warning given three times over the loudspeaker.



BOFC-01-1028-001-A205KA

- This detection and warning system is available : R
  - During take-off, from lift-off up to 1 000 ft Radio Altitude,
  - During approach, from 1 000 ft down to 50 ft Radio Altitude,
  - For go-around, up to 1 000 ft Radio Altitude.

  The associated guidance function is available provided one AP or FD is engaged. R R
- Failures of the WINDSHEAR detection system are indicated on the ECAM as soon as slats are extended (except during lift off up to 1 000 ft).

  In this case :
  - Single chime audio signal is generated.
  - The MASTER CAUTION light illuminates.
  - The WINDSHEAR ALERT NOT AVAIL message is displayed on the left ECAM CRT.

Note : On ground, with engines shut down and at least one PFD supplied, the windshear alert can be tested by triggering the annunciator lights test.

Mod : 5051 + 7985

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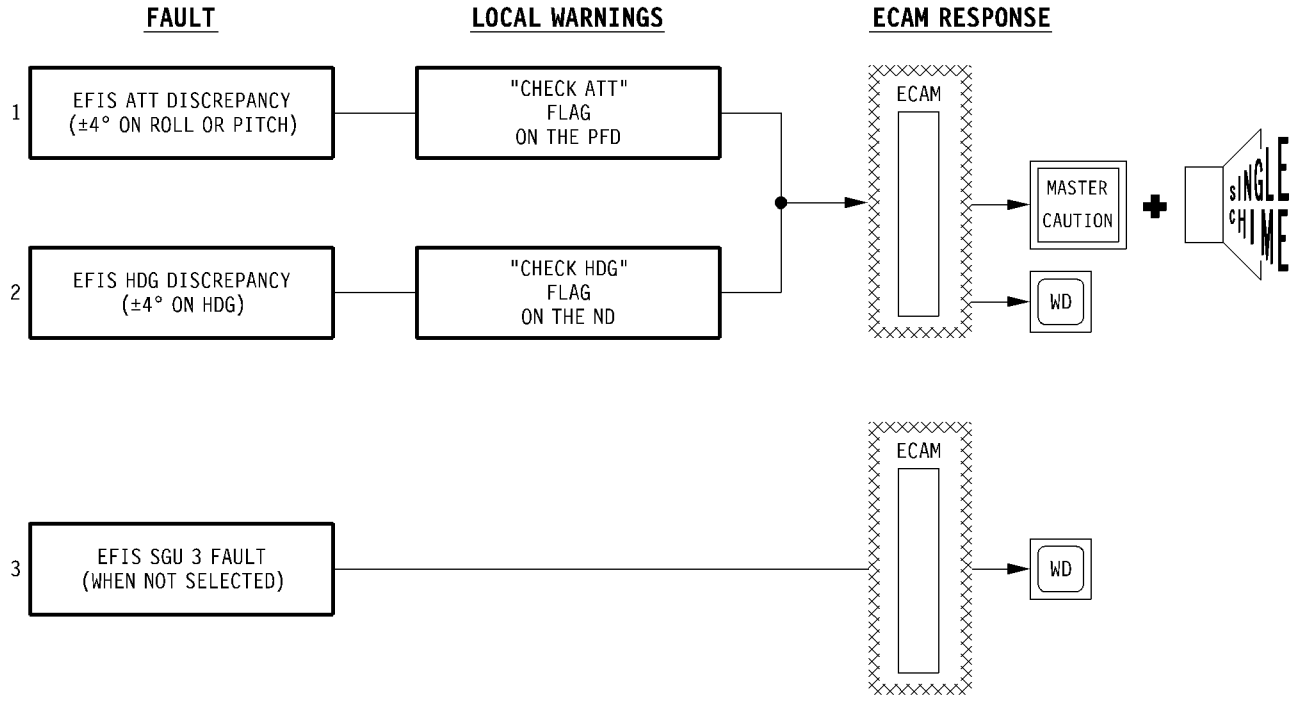
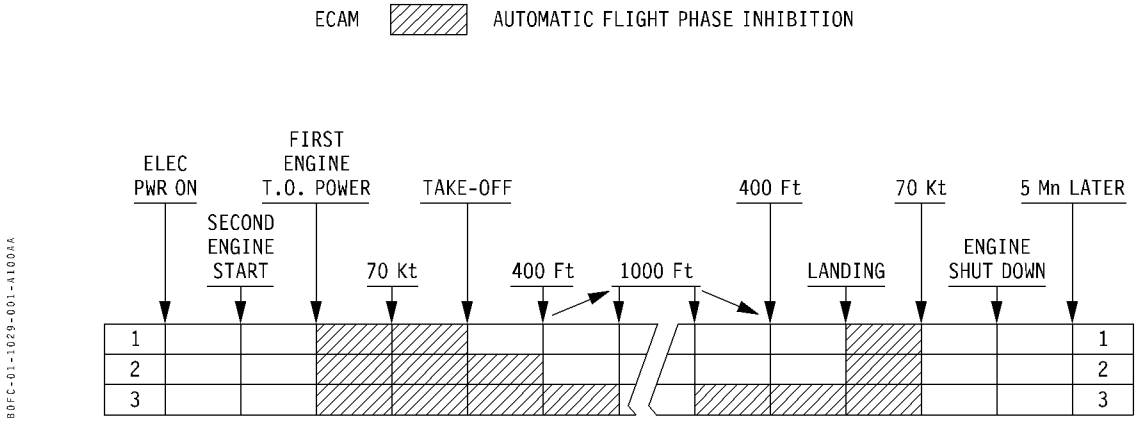

FAULT
LOCAL WARNINGS
ECAM RESPONSE
1
EFIS ATT DISCREPANCY
(±4° ON ROLL OR PITCH)
"CHECK ATT"
FLAG
ON THE PFD
2
EFIS HDG DISCREPANCY
(±4° ON HDG)
"CHECK HDG"
FLAG
ON THE ND
ECAM
MASTER
CAUTION
WD
SINGLE CHIME
3
EFIS SGU 3 FAULT
(WHEN NOT SELECTED)
ECAM
WD


ECAM
AUTOMATIC FLIGHT PHASE INHIBITION
ELEC PWR ON
SECOND ENGINE START
FIRST ENGINE T.O. POWER
70 Kt
TAKE-OFF
400 Ft
1000 Ft
400 Ft
LANDING
70 Kt
ENGINE SHUT DOWN
5 Mn LATER
1
2
3
B0FC-01-1029-001-A1004A

Mod : 5051

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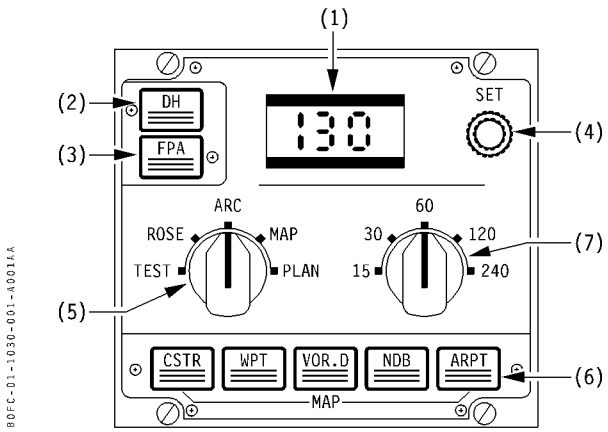
EFIS CONTROLS PANEL



PFD CONTROLS

(1) DH/FPA Display Window

- Decision Height (in ft) is displayed if the DH pushbutton switch is pressed-in.

R *Note : A Radio Altimeter DH is to be set for CAT II and CAT III ILS approach only.*

For CAT I ILS approaches, a barometric DH (DA) is set on the altimeter.

For non-ILS approaches, a barometric MDH (MDA) is set on the altimeter.

- Flight Path Angle (FPA) value is displayed (in degrees) if the FPA pushbutton switch is pressed-in.
- If neither pushbutton switch is pressed-in, dashes are displayed.

(2) DH Pushbutton Switch

- The Decision Height (DH) can be entered, for the Radio Altitude DH automatic callout system, by pressing this pushbutton switch. When selected, the pushbutton switch light illuminates. Another press cancels this, and the display returns to dashes.

(3) FPA Pushbutton Switch

- Refer to section 1.10.27 for description and operation of the FPV and FPR (FPA and CRS).

(4) SET Knob

- When the FPA or DH pushbutton switches are selected, this knob is used to set the DH or FPA to the desired value.
  - The DH value is adjustable in increments of 5 ft from – 5 ft to 995 ft.
  - The FPA value is adjustable in increments of 0.1° from – 9.9° to + 9.9°.

ND CONTROLS

(5) Mode Selector

(6) Display Options (in MAP or PLAN mode only)

(7) Range Selector

Note : Descriptions of the ND mode selector, of the MAP and PLAN modes display options and of the range selector can be found in section 1.15.21 NAVIGATION SYSTEMS–ND–CONTROLS AND INDICATORS.

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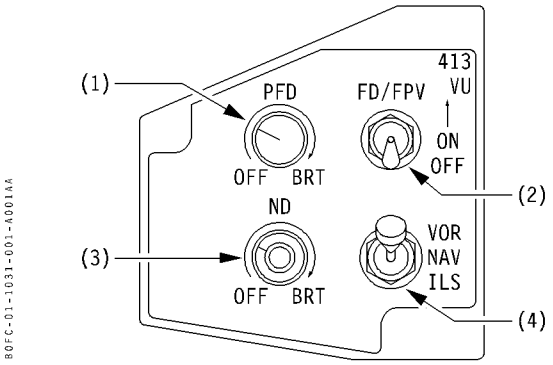
SECONDARY EFIS CONTROL PANEL



(1) PFD Brightness

- The knob controls the brightness of the PFD (upper CRT).

R • If the knob is turned OFF while the ND is still on, the PFD display is automatically transferred to the lower CRT (ND display is no more available).

Note : The brightness of the PFD and ND displays is automatically adjusted for small changes in ambient lighting conditions.

(2) FD/FPV Switch

- This 3-position switch selects either Flight Director bars or the Flight Path Vector for display on the PFD.

■ **OFF**

– FD bars and FPV symbols are cleared from the PFD.

■ **ON**

– The PFD displays either the FD bars or the Flight Path Vector (FPV).

■ **↑ (upper position)**

– When the switch is pressed up to this position and released (it is springloaded back to ON), the display switches from FD bars to FPV, or from FPV to FD bars.

- If the FPV is selected, **the FD bars replace automatically the FPV** as soon as the following modes engage :
  – TAKE-OFF (THR/SRS), by pressing go-levers,
  – GO AROUND, by pressing go-levers,
  – LAND during ALIGN (FLARE) or ROLL OUT phases.

(3) ND Brightness Knob

(4) VOR/NAV/ILS Switch

Note : Refer to section 1.15.21 for the description of the ND brightness knob and VOR/NAV/ILS switch.

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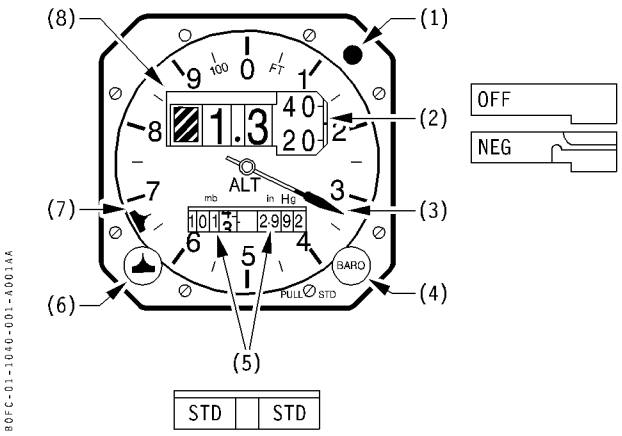
ALTIMETERS



(1) Altitude Alert Light

- The light illuminates amber when an Altitude Alert warning is triggered.

(2) Altitude Counter

- The digital counter indicates ten-thousands, thousands, hundreds and twenty-foot increments.
  - A black and white striped flag covers the ten-thousands digit when altitude is below 10 000 ft.
  - A black NEG flag covers the counter if the altitude is below zero.
  - A red OFF flag covers the counter for ADC failure, indicator failure or power supply failure.

(3) Altitude Pointer

- Each revolution of pointer equals 1000 ft altitude change.

(4) BARO Set Knob

- The knob is to set barometric pressure reference in millibars (mb) and in inches of mercury (inHg) :

■ **Pressed-in**

  - Turning the BARO set knob allows to set the altimeters to the QNH or QFE pressure setting. When supplied from the onside ADC, the altimeter reading is corrected accordingly.

Note : If the ADC/INST pushbutton switch has been pressed to receive offside ADC data, the altimeter reading remains corrected by its own BARO set reference.

■ **Pulled-out**

  - Pulling the BARO set knob automatically sets the altimeters to the standard altimeter setting (1013 mb or 29.92 inHg). The BARO set counters are now covered by grey "STD" flags.

(5) Baro Set Counters

- Two counters, one indicates barometric pressure in millibars (745 to 1050 mb), and the other in inches of mercury (22 to 31 inHg) display pressure as selected and set with the BARO set knob.
- Two grey "STD" flags cover these counters when BARO Set knob is pulled.

(6) Altitude Index Set Knob

- This knob is used to set the orange altitude index bug.

Note : The altitude index is used to set the barometric DH (DA) for a CAT I ILS approach or the barometric MDH (MDA) for a non-ILS approach.

(7) Altitude Index

- The orange altimeter bug may be set, with the altitude index set knob, to any position on the analog dial to mark certain critical altitudes (e.g. : CAT I DA/DH, MDA/MDH, acceleration altitude,...).

(8) Analog Altitude Dial

- The dial is graduated from 0 to 1000, in 50 ft increments.
- The 100 ft graduations are numbered from 0 to 9.

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GENERAL

- Altitude alerts are provided by the FWC, based on comparison of the indicated altitude against the Flight Control Unit (FCU) selected altitude (ALT SEL).

- When each FWC determines that an alert is required it illuminates its associated altimeter's amber warning light and, in certain cases, provides a C-chord audio alert through the cockpit loudspeakers.

R - Altitude alert is inhibited when the following conditions are fulfilled :

R – in G/S track or,

R – in G/S capture or,

R – in LAND track or,

R – with slats extended and L/G lever down or,

R – the FCU ALT SEL rotary selector is turning or,

R – conditions 1, described hereafter, are fulfilled :

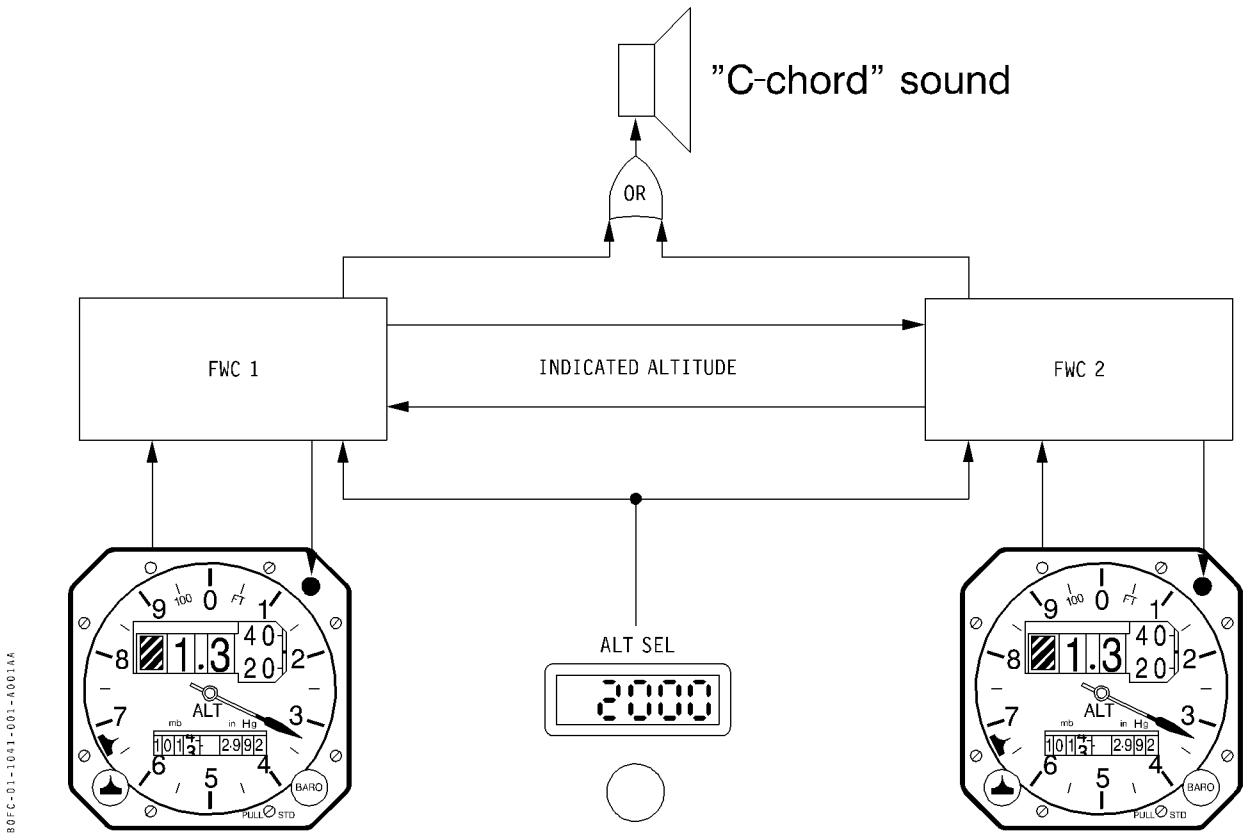
Conditions 1 : R

Profile mode is engaged and AP is engaged in CMD or FD is engaged and conditions 2, described below, are fulfilled. R

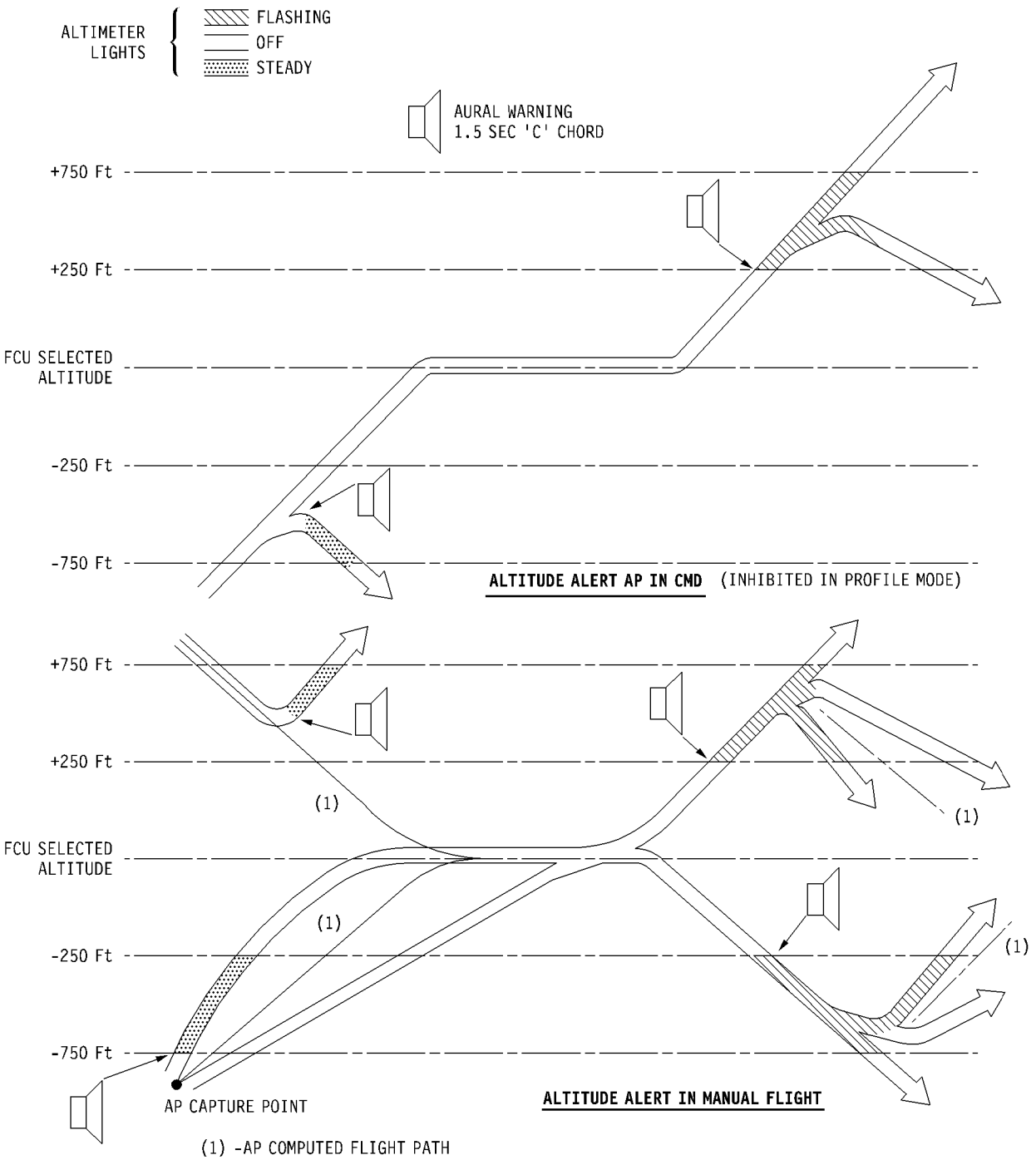
Conditions 2 : R

FMC is in APPR phase and MDA is valid. R

The above logic features general inhibitions, however they are completed by local inhibitions such as "When AP engaged and reaching the selected altitude" as described in the schematic on page 2. R

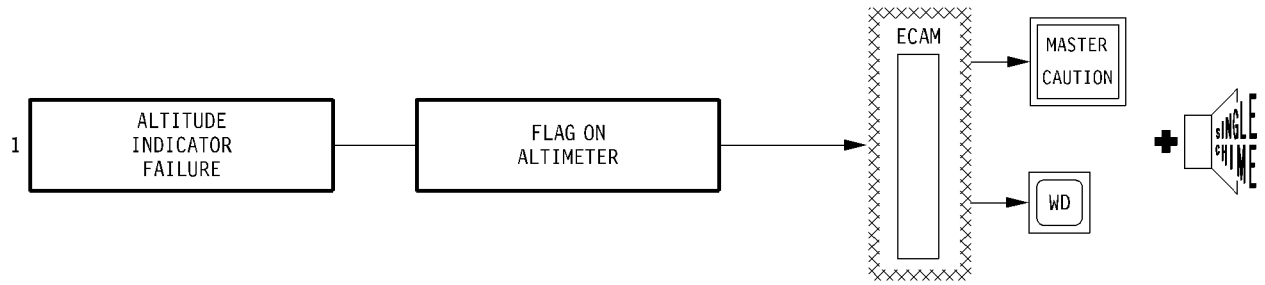


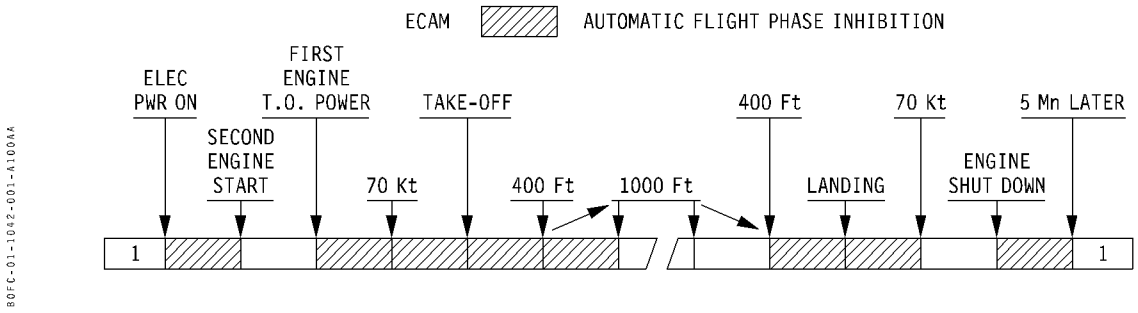
ALTITUDE ALERT LOGIC



R

Mod : 4024


FAULT
LOCAL WARNINGS
ECAM RESPONSE
1
ALTITUDE INDICATOR FAILURE
FLAG ON ALTIMETER
ECAM
MASTER CAUTION
WD
SINGLE CHIME


ECAM
AUTOMATIC FLIGHT PHASE INHIBITION
ELEC PWR ON
SECOND ENGINE START
FIRST ENGINE T.O. POWER
70 Kt
TAKE-OFF
400 Ft
1000 Ft
400 Ft
LANDING
70 Kt
ENGINE SHUT DOWN
5 Mn LATER
1
1
B0FC-01-1042-001-A100AA

Mod : 5051

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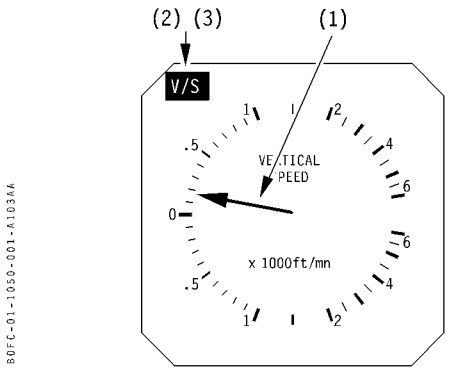
VERTICAL SPEED INDICATOR (VSI)



- The Vertical Speed Indicators (VSI) display the aircraft vertical speed in thousands of feet per minute.
  - The primary source of Vertical Speed (V/S) indication is the IRS. An automatic switch over to ADC occurs when an anomaly is detected on the Inertial Vertical Speed (IVS).
  - In normal operation, the VSI repeats the IVS data provided by the IRS. However, the IRS inputs are filtered by a barometric information for the stabilization of V/S indication.
  - If IRS input is lost, the VSI will continuously operate on ADC only (the indicated vertical speed then has a time "lag").
  - If ADC data is lost the VSI will operate on IRS data for only 30 seconds.

(1) Vertical Speed pointer

- Indicates rates of climb or descent between ± 6 000 ft/min.
- Scale increments :
  - 0 to ± 1 000 ft/min : 100 ft/min
  - ± 1 000 ft/min to ± 6 000 ft/min : 500 ft/min
- Display accuracy is ± 30 ft/min or 2 % of the actual value.

(2) IVS Flag

- The amber "IVS" flag is displayed in case of loss of the IRS Vertical Speed data.
- Automatic switching occurs to ADC data.

Mod : 10107 or (8601 + 10107)

(3) V/S Flag

- The red "V/S" flag is displayed when the indicator is inoperative.

Note : In case of ADC failure, the VSI displays IVS for 30 seconds.

Then the OFF flag appears and the pointer returns to 0 (unless the offside ADC is selected using the ADC/INST pushbutton switch).

Once the OFF flag appears, if onside ADC data is regained (or offside ADC data is selected by switching) it will take two minutes before V/S information is displayed again.

- In this case, the pointer is cleared from the display.

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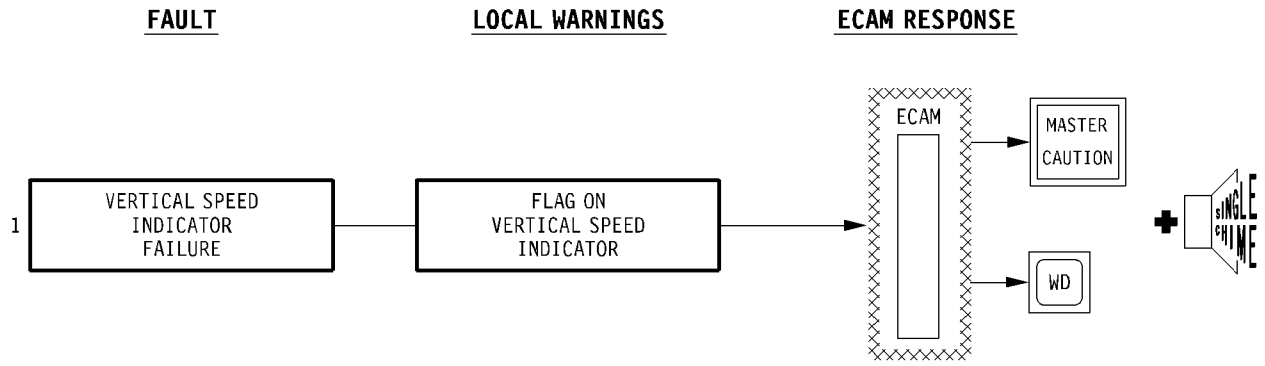
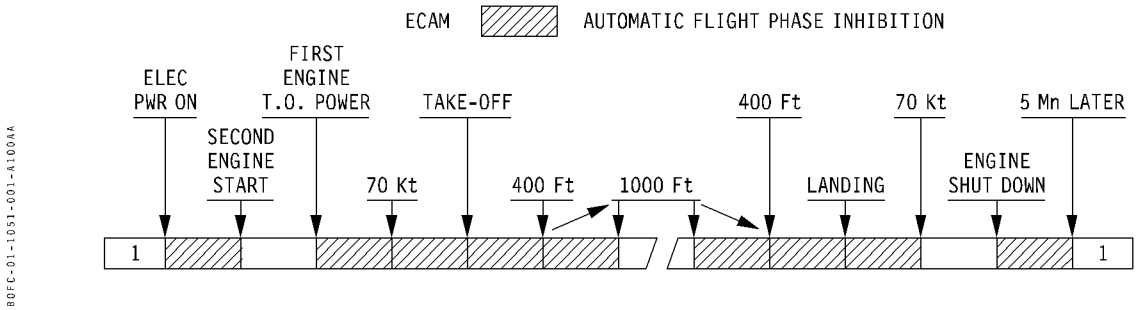

FAULT
LOCAL WARNINGS
ECAM RESPONSE
1
VERTICAL SPEED INDICATOR FAILURE
FLAG ON VERTICAL SPEED INDICATOR
ECAM
MASTER CAUTION
WD
SINGLE CHIME


ECAM
AUTOMATIC FLIGHT PHASE INHIBITION
ELEC PWR ON
SECOND ENGINE START
FIRST ENGINE T.O. POWER
70 Kt
TAKE-OFF
400 Ft
1000 Ft
400 Ft
LANDING
70 Kt
ENGINE SHUT DOWN
5 Mn LATER
1
1
80FC-01-1051-001-A100AA

Mod : 5051

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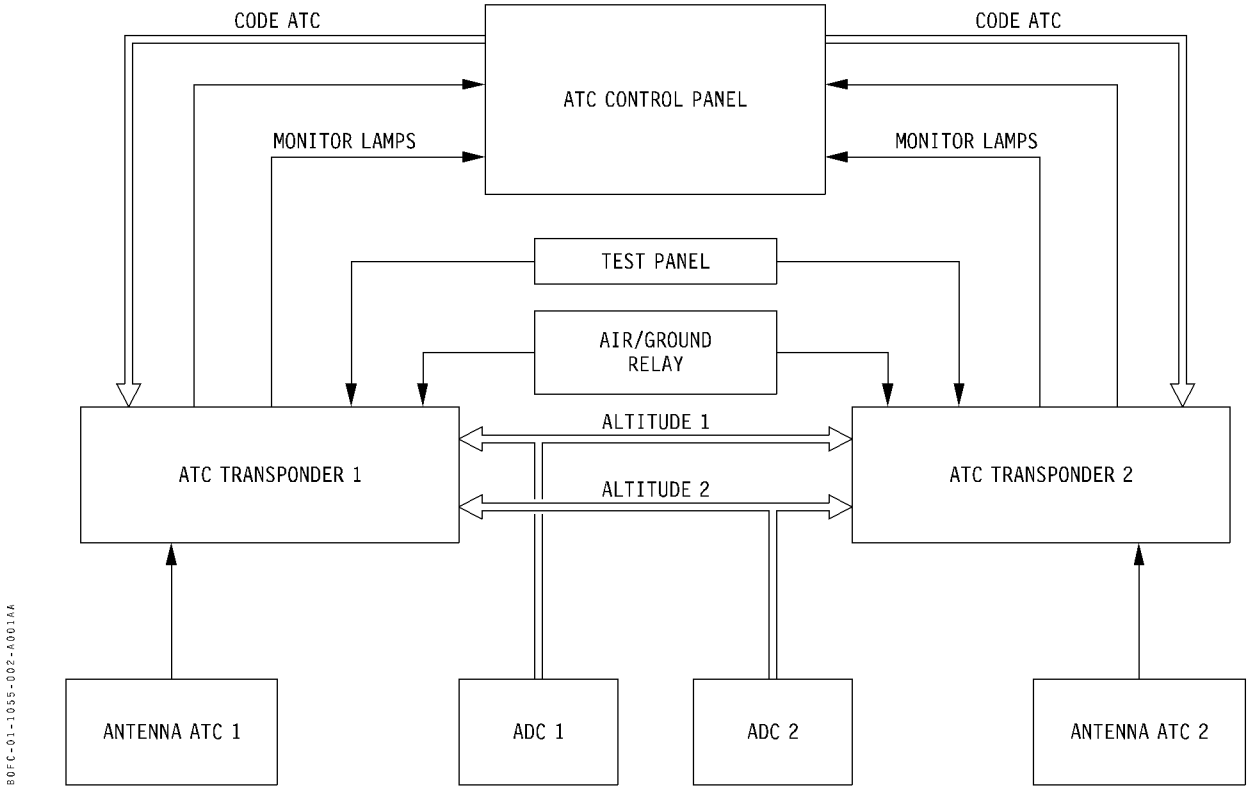
GENERAL

- The ATC (Air Traffic Control) Transponder (Transmitter/responder) enables the encoding and display of one or several of the following data on the ATC radar scope :
  - coded aircraft symbol,
  - flight number or aircraft registration,
  - flight level,
  - climb descent or level flight symbol,
  - ground speed,
  - alert messages (squawk codes 7500, 7600, 7700).
- Whenever ground radar beam hits the aircraft, the onboard ATC transponder transmits a reply.
- There are two interrogation modes :
  - Mode which transmits a selectable code number for aircraft identification.
  - Mode which transmits the aircraft's flight altitude.
- Two transponders are installed (SYS 1 or SYS 2), and are controlled by a common control panel on the center pedestal.
- Only one transponder is operating while the other is in stand-by.
- ADC 1 and 2 provide altitude information to their respective transponder.
- Transponder 1 is supplied by the AC EMER BUS, and transponder 2 is supplied by the AC BUS 2.
- Transponder faults are indicated on the control panel.
- The ATC control panel includes the following controls and indications :
  - A switch to activate the selected transponder.
  - A switch to select transponder 1 or 2.
  - A switch to activate the altitude reporting.
  - Fault and reply indication lights.
  - A display window and rotary selector knobs, for selection and display of the assigned transponder code.
  - An IDENT pushbutton switch.

Note 1 : The ATC transponder system can be tested using ATC pushbutton switch on the AVIONICS SYST TEST panel.

Note 2 : At high aircraft pitch attitudes the transponder's transmission of ATC information can be lost.

SYSTEM INTERFACE

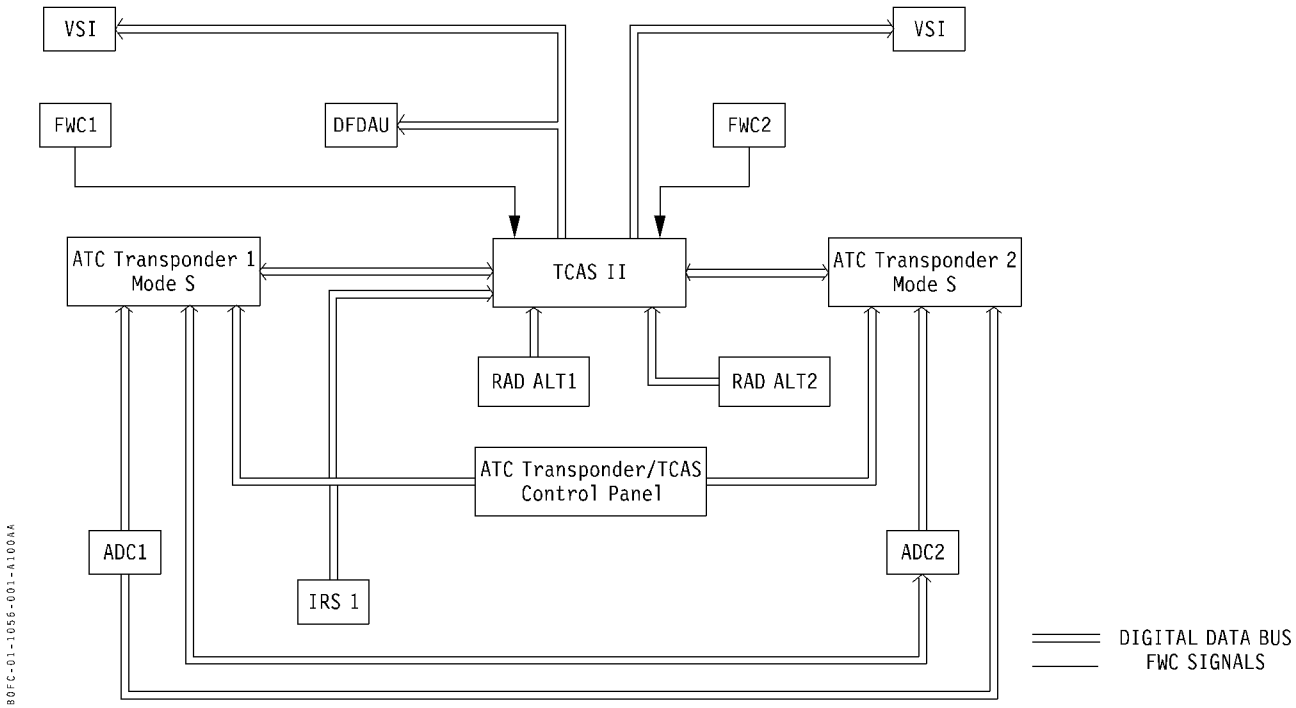


GENERAL

- The Traffic and Collision Avoidance System (TCAS) is a back-up and supplement to the separation services provided by the ground based Air Traffic Control (ATC).
- The TCAS preserves the ATC separation by :
  - tracking of the nearby aircraft equipped with mode A, mode C or mode S transponders,
  - evaluating the potential for separation conflicts,
  - providing Traffic Advisory (TA) alerts and display,
  - providing Resolution Advisory (RA) alerts and associated guidance for evasive maneuver (vertical speed target for evasive action in the vertical plane).

SYSTEM COMPONENTS AND INTERFACES

- The system consists of :
  - a computer which :
    - performs airspace surveillance,
    - track nearby intruder(s),
    - generates traffic information for display,
    - assesses the potential for separation conflicts,
    - generates resolution guidance for display,
    - activates audio messages,
  - two omnidirectional antennas,
  - two mode S ATC Transponders and a combined ATC Transponder / TCAS control panel,
  - two modified Vertical Speed Indicators (VSI) to display TCAS information and guidance.



R Code : 0013

PRINCIPLE

- The system is designed to protect a volume of airspace around the TCAS equipped aircraft. The TCAS detects the presence of nearby intruder aircraft equipped with mode A, mode C or mode S ATC Transponders.
- From an intruder transponder replies, the TCAS computes the following information :
  - distance between the aircraft and the intruder,
  - relative bearing to the intruder,
  - altitude and vertical speed of the intruder (if intruder reports altitude),
  - closing rate between the intruder and the aircraft.
- Using these data the TCAS predicts the time to, and the separation at, the intruders closest point of approach.
- If the TCAS predicts that an intruder will violate a first protection envelope, a Traffic Advisory (TA) is generated to alert the flight crew that a closing traffic is in the vicinity.
- If the intruder continues to converge and violate a second protection envelope, a Resolution Advisory (RA) is generated together with vertical speed guidance in order to maintain a safe vertical separation between the aircraft and the intruder.
- Due to the limitation of the display, only 8 intruders can be represented in a volume of + 2700 ft/ – 9900 ft or – 2700 ft/+ 9900 ft relative to the aircraft altitude and 6 nm range. R R

INTRUDER CLASSIFICATION

OTHER

- Any intruder which is between 9 900 ft and 1 200 ft above or below the aircraft altitude and within 6 nm range. R

PROXIMATE ADVISORY (PA)

- Any intruder which is within ± 1 200 ft and within 6 nm range. R
- It is not considered as a threat.

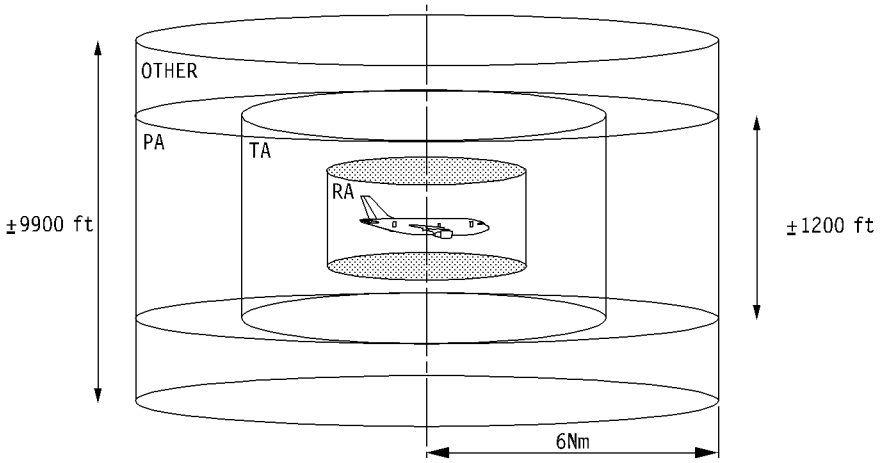
TRAFFIC ADVISORY (TA)

- The intruder is considered to be a potential threat and approximately 40 seconds from the closest point of approach.
- "TRAFFIC, TRAFFIC" audio message is activated.

RESOLUTION ADVISORY (RA)

- The intruder is predicted to be a collision threat and approximately 25 seconds from the closest point of approach.
- An appropriate audio message is triggered and a vertical speed target range is displayed on the VSI as guidance to conduct the evasive maneuver.

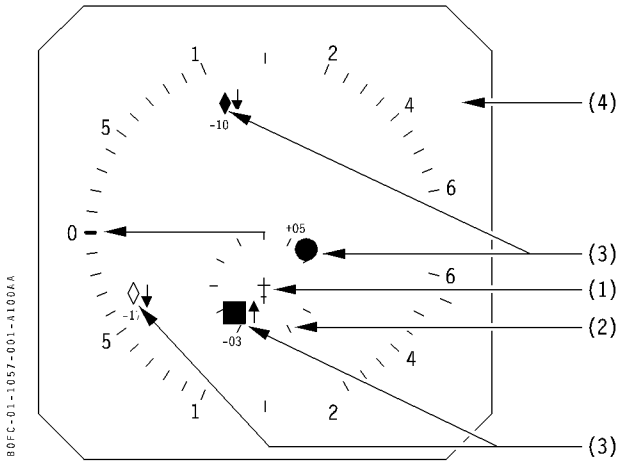
R



80FC-01-1056-002-A200AA

Code : 0136

INFORMATION DISPLAYED ON THE VSI



(1) Own Aircraft Symbol

(2) 2 nm Scale

- It corresponds to a 2 nm scale around the own aircraft position.

(3) Intruder Symbols

- Form and color :
  - RA : filled-in red square,
  - TA : filled-in yellow circle,
  - PA : filled-in cyan diamond,
  - OTHER : unfilled cyan diamond.
- A + (-) indicates that the intruder is above (below) the own aircraft.
- The two digits indicate the relative altitude of the intruder rounded to the nearest one hundred feet.

  When the intruder is above (below) own aircraft, the digits are above (below) the intruder symbol.
- The arrows indicate that the intruder is climbing (↑) or descending (↓), at a rate of at least 500 ft/min.

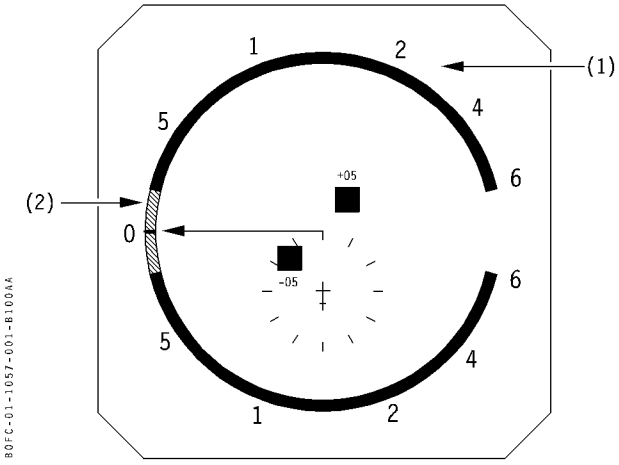
(4) VSI Scale

- See VERTICAL SPEED INDICATOR in this chapter.

PREVENTIVE AND CORRECTIVE RESOLUTION ADVISORIES

- Resolution advisories alert the flight crew to a vertical maneuver that :
  - must be avoided (preventive advisory), or
  - must be performed (corrective advisory),

  in order to prevent a separation conflict or a possible mid air collision.



(1) Red Arc(s)

- Whenever a TA or RA alert is generated, a red arc is displayed on the VSI.
  - TA : the red arc indicates the vertical speed range to be avoided and advises the flight crew against a change in the vertical flight path (preventive advisory).
  - RA : the red arc indicates the vertical speed range which, if penetrated, would result in a separation conflict or a possible collision.

(2) Green Arc

- When a RA alert is generated, a green arc is displayed on the VSI to indicate that a change in the present flight path is required and to provide the vertical speed range to be achieved during the evasive maneuver (corrective advisory).

R Code : 0013

ADVISORY MESSAGES

- TA / RA alerts are accompanied by one of the following messages :

"TRAFFIC, TRAFFIC"

- TA alert.

"CLIMB, CLIMB"

- Climb at the V/S indicated by the green arc on the VSI.

"CLIMB, CROSSING, CLIMB" (twice)

- Same as above. Indicates that the aircraft will cross through intruder altitude.

"INCREASE CLIMB" (twice)

- Triggered after CLIMB message if the aircraft V/S is not sufficient to achieve a safe vertical separation, increase the V/S as indicated on the VSI by the green arc.

"ADJUST VERTICAL SPEED, ADJUST"

- Adjust V/S as indicated on the VSI by the green arc, reducing climb speed or descent speed as appropriate.

"DESCEND, DESCEND"

- Descend at the V/S indicated by the green arc on the VSI.

"DESCEND, CROSSING, DESCEND" (twice)

- Same as above. Indicates that the aircraft will cross through intruder altitude.

"INCREASE DESCENT" (twice)

- Triggered after DESCENT message if the aircraft V/S is not sufficient to achieve safe vertical separation, increase the V/S as indicated on the VSI by the green arc.

"CLIMB, CLIMB NOW" (twice)

- Triggered after DESCEND message if the intruder trajectory has changed.

"DESCEND, DESCEND NOW" (twice)

- Triggered after CLIMB message if the intruder trajectory has changed.

"MONITOR VERTICAL SPEED"

- Ensure that V/S remains outside the red area (preventive advisory).

- Triggered only once if leaving from a previous corrective resolution advisory.

"MAINTAIN VERTICAL SPEED, MAINTAIN"

- Indicates a non -crossing advisory type, maintain V/S indicated by the green arc on the VSI.

"MAINTAIN VERTICAL SPEED, CROSSING MAINTAIN"

- Indicates an altitude crossing advisory type, maintain V/S indicated by the green arc on the VSI.

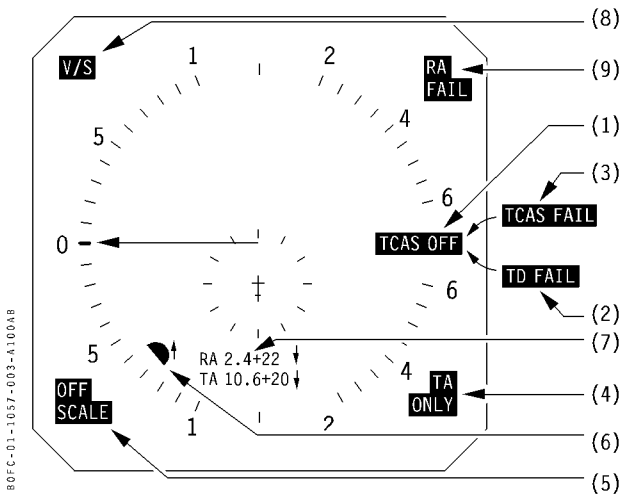
"CLEAR OF CONFLICT"

- Range is increasing and separation id adequate.

- The pilot can return to assigned clearance.

Code : 0126

FLAG DISPLAYED ON THE VSI



(1) TCAS OFF Message

- This message is displayed in white when the TCAS mode selector is in the STBY position.

(2) TD FAIL Message

- This message is displayed in yellow in case of failure in the Traffic Display (TD) function.
- When this flag is displayed, no traffic is displayed.

(3) TCAS FAIL Message

- This message is displayed in yellow if the TCAS computer or the TCAS system fails.

(4) TA ONLY Message

- This message is displayed when the TCAS mode selector is in the TA position.
- The message is white during normal operation, and yellow when one or more TA are displayed.

(5) OFF SCALE Message

- This message is displayed in white when the TCAS computer is tracking RA or TA intruders that are beyond the display range.

(6) Intruder Off Scale

- Half of the appropriate symbol is displayed at the edge of the display area in the direction of the traffic bearing.
- Data and vertical trend arrows can be off scale.

(7) No-bearing Intruders

- When bearing data is not available, positioning the intruder symbol is not possible. However a message for RA and TA (two maximum) is displayed.
- The message is displayed in red (RA), yellow (TA) or white (PA).
- In the above example, the two non-bearing messages indicate the following traffics:
  - RA, 2.4 nm, 2200 ft above aircraft level, descending.
  - TA, 10.6 nm, 2200 ft above aircraft level, descending.

(8) V/S Message

- Refer to VERTICAL SPEED INDICATOR section.

(9) RA FAIL Message

- This message is displayed in yellow when the indicator has an internal failure associated with one or the following functions:
  - Resolution Advisory,
  - Vertical Speed.

Note : When the red flag V/S is displayed, the flag RA FAIL is displayed.

R Code : 0003

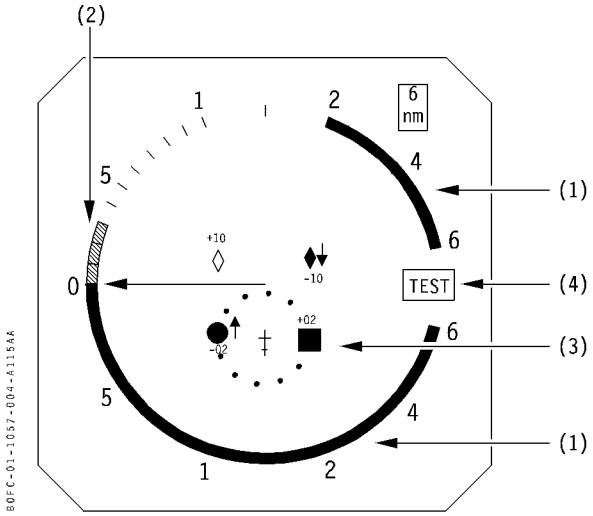
TEST FUNCTION
(Maintenance purposes)

- To check the correct operation of the TCAS, press the ATC transponder TCAS pushbutton switch installed on the maintenance panel.

  This test can also be performed by the TEST pushbutton switch located on the ATC/TCAS control panel (if installed).

- At the end of the sequence test, the system generates an audio message :
  - TCAS SYSTEM TEST OK, or
  - TCAS SYSTEM TEST FAIL.

- The auto test controls the main functions of the TCAS computer and displays on the VSI :



(1) Red Arc (Vertical Speed Range)

(2) Green Arc (Vertical Speed Range)

(3) Intruder Data

- Four intruders are displayed as indicated on the schematic above.

(4) Test Message

INHIBITIONS

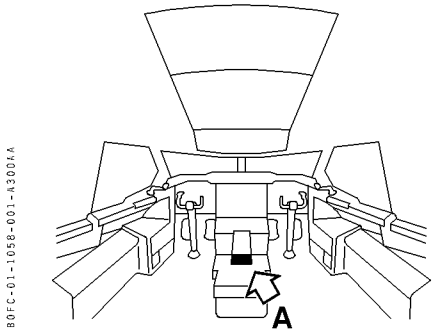
- Some advisories are inhibited depending on the aircraft altitude :
  - Below 1100 ft AGL in climb and 900 ft AGL in descent, all RA displays and aural messages are inhibited. R R R
  - Below 600 ft in climb and 400 ft in descent, all TA aural messages are inhibited. R
  - TCAS systematically eliminates responses from aircraft at an altitude below 400 ft in climb, and below 260 ft in descent when its own altitude is below 1700 ft Above Ground Level (AGL).
  - Below 1000 ft AGL in descent, RA "DESCEND" message is inhibited. R
  - Below 1200 ft AGL in climb, RA "DESCEND" message is inhibited. R
  - Below 1450 ft AGL in descent, RA "INCREASE DESCENT" message is inhibited. R
  - Below 1650 ft AGL in climb, RA "INCREASE DESCENT" message is inhibited. R R

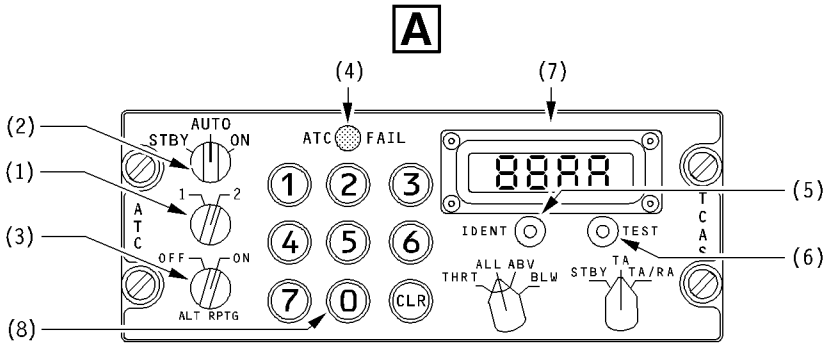
Note : Windshear, stall and GPWS messages have priority over TCAS messages.

Code : 0129

ATC / TCAS CONTROL PANEL

- ATC and TCAS use a common control panel.





ATC PART

(1) SYS 1/2 Selector

- Selects the desired ATC transponder (1 or 2).

(2) STBY/AUTO/ON Selector

■ **STBY**

– The selected ATC transponder is electrically supplied but not operating.

■ **AUTO**

– In flight, selected ATC transponder operates.

– On ground, modes A and C replies are inhibited, only mode S data link transmissions are operative.

■ **ON**

– The selected ATC transponder operates.

(3) ALT RPTG Selector

R ■ **ON**

– Altitude reporting is active.

■ **OFF**

– There is no altitude data transmission.

– TCAS is inoperative.

(4) ATC FAIL Light

- Illuminates in case of failure of the selected ATC transponder.

(5) IDENT Pushbutton Switch

- When pressed, identification signal is transmitted.

(6) TEST Pushbutton Switch

- Initiates the ATC/TCAS test sequence.

(7) Code Display

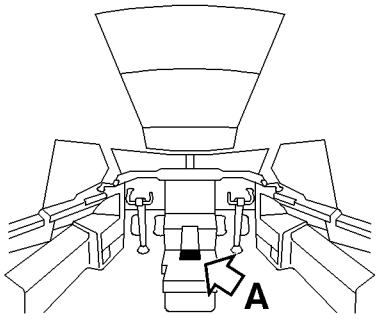
- Displays the assigned or selected code.

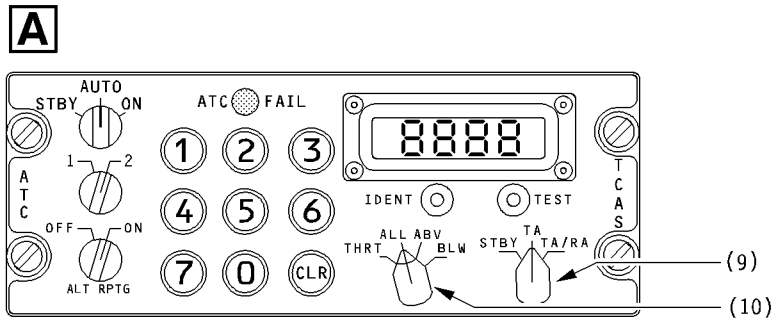
(8) ATC Code Selection Keys

- Used for entering a new code and/or clearing the display code.

Code : 0197

ATC / TCAS CONTROL PANEL (continued)





TCAS PART

(9) STBY / TA / TA/RA Selector

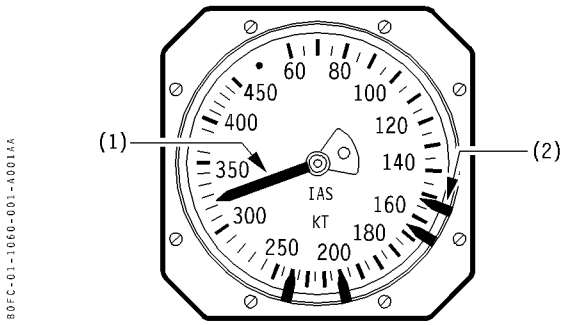
- **TA/RA**
  - If ATC transponder and ALT RPTG switches are in ON position, all TCAS functions are operable.
- **TA**
  - If ATC transponder switch is in ON position, only the Traffic Advisory TA function is active.
- **STBY**
  - TCAS is inoperative.

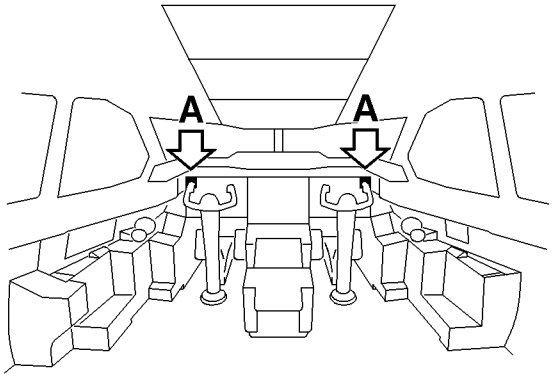
(10) THRT/ALL/ABV/BLW Selector

- **THRT**
  - If selected, the display is in THREAT TRAFFIC configuration. OTHER and PA intruders are only displayed if a RA or a TA is already displayed.
- **ALL**
  - ALL traffic configuration is full time displayed.
- **ABV**
  - Allows to display the intruders flying from 2 700 ft below to 9 900 ft above the aircraft altitude.
- **BLW**
  - Allows to display the intruders flying from 9 900 ft below to 2 700 ft above the aircraft altitude.

Mod : 11351

A. STANDBY AIRSPEED INDICATORS





- The Standby Airspeed Indicators (ASI) are directly supplied with standby static and standby pitot pressures.
- Standby ASI do not require electrical power.

(1) Airspeed Pointer

- Pointer indicates the airspeed on a graduated scale from 60 to 450 kt.
- When the aircraft is stopped (no headwind), pointer should be aligned with the white dot.

(2) Airspeed Index Bugs

- Theses moveable bugs are provided for marking speed references (V_R, V_2, Green Dot, V_{REF}, etc...).

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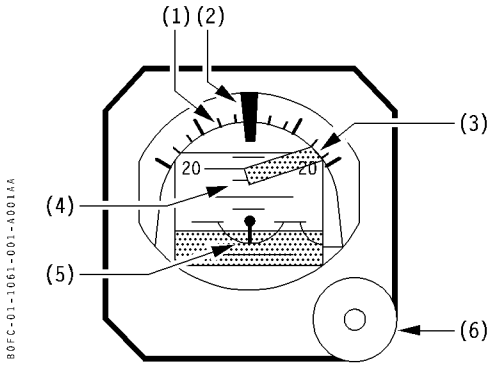
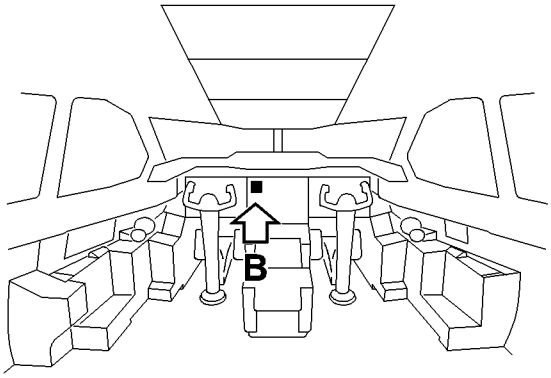
B. STANDBY ARTIFICIAL HORIZON





- The Standby Horizon is supplied anytime the DC ESS BUS is supplied (even on battery power only) and provides backup attitude reference in the event of loss PFD attitude reference.

(1) Bank Angle Scale

- The roll scale is graduated in 10° increments from 10° to 60°.

(2) Roll Pointer

- A pointer rolls with the aircraft and points at the bank angle on the bank angle scale.

(3) Flag

- A red flag is displayed in case of instrument failure or loss of electrical power supply.

(4) Pitch Scale

- The aircraft pitch attitude is indicated by reference to the aircraft symbol.

(5) Aircraft Reference

- The aircraft symbol is fixed.

(6) Caging Knob

- When pulled, the gyro is erected, leveling and centering the horizon.

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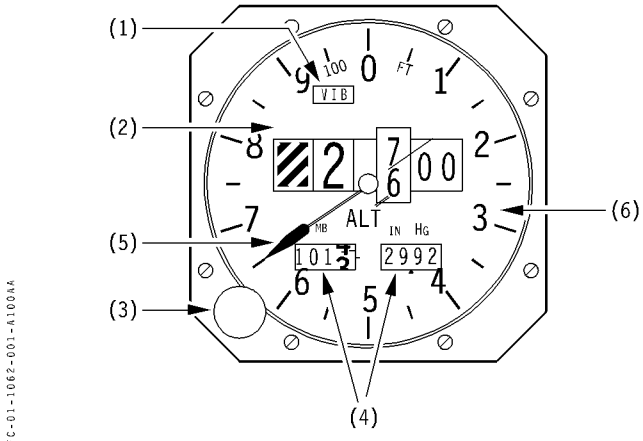
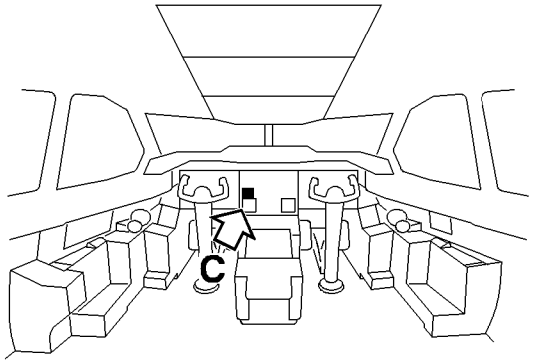
C. STANDBY ALTIMETER





80FC-01-1062-001-A100A

- The standby altimeter provides backup altimeter reference in case of failure of the Main Altimeter. No electrical power is required for its operation (except for the internal vibrator).
- It is supplied from the standby pitot-static system.
- An internal vibrator minimizes the effect of mechanical friction to ensure a smooth pointer movement.
- The vibrator operates only in flight.

(1) VIB Flag

- The amber VIB flag appears in case of failure of the internal vibrator, and when the aircraft is on ground.
- The standby altimeter can still be used, but altitude pointer movement can be jerky.

(2) Altitude Counter

- The digital counter indicates ten thousands, thousands and hundreds of feet.
- A white and black striped flag masks the ten thousands indication when below 10 000 ft.
- A red and white striped flag masks the ten thousands indication when altitude is negative.

(3) Baroset Knob

- Sets barometric pressure reference in the millibars (mb) and inches of mercury (inHg) windows.

(4) Baroset Windows

- Two windows indicate the barometric pressure reference set with the Baroset knob, one in millibars (745 to 1 050 mb) and the other in inches of mercury (22 to 31 inHg).

(5) Analog Altitude Pointer

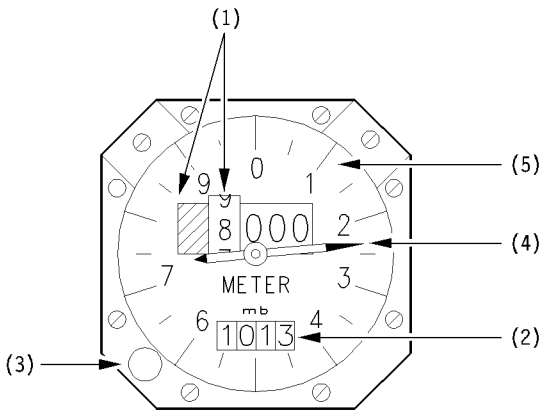
- One pointer revolution equals 1 000 ft of altitude change.

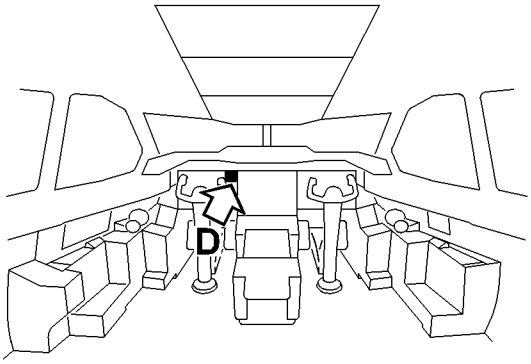
(6) Altitude Dial Scale

- The dial is graduated from 0 to 1 000 in 50 ft increments.
- The 100 ft graduations are numbered 0 to 1.

Mod : 3832

D. STANDBY METRIC ALTIMETER





B0FC-01-1062-002-A100AA

- The standby metric altimeter is supplied from the standby pitot-static system.

(1) Altitude Counter

- The digital counter indicates ten thousands and thousands of meters.
- A white and black striped flag masks the ten thousands indication when below 10 000 m.
- A red and white striped flag masks the ten thousands indication when altitude is negative.

(2) Baroset Windows

- The window indicate the barometric pressure reference set with the Baroset knob in millibars (870 to 1 050 mb).

(3) Baroset Knob

- Sets barometric pressure reference in millibars (mb).

(4) Analog Altitude Pointer

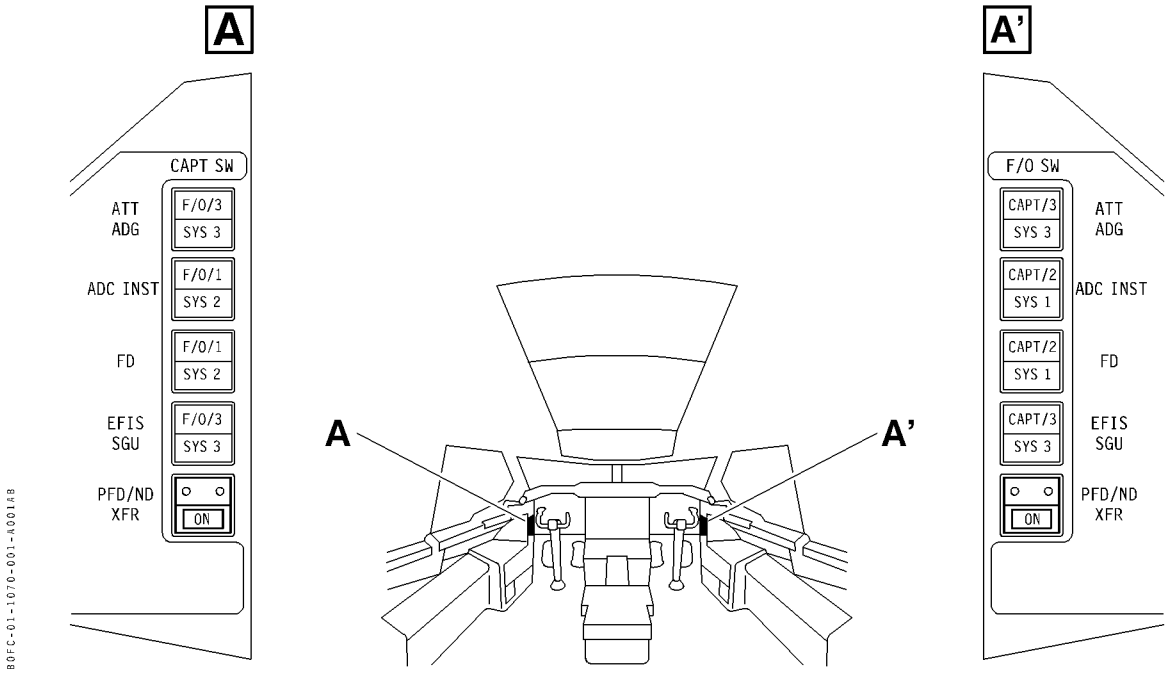
- One pointer revolution equals 1 000 m of altitude change.

(5) Altitude Dial Scale

- The dial is graduated from 0 to 1 000 in 50 m increments.
- The 100 m graduations are numbered 0 to 9.

Mod : 3221

CAPT AND F/O SWITCHING PANELS



- In case of loss of the primary data source, flight instruments can be switched to an alternate source (SYS 3) or share the data of the opposite primary source (SYS 2 for CAPT switching, SYS 1 for F/O switching).

R • The switching is performed by pressing the associated pushbutton switch on the affected side SWITCHING panel.

ATT HDG Pushbutton Switch

R • Enables to switch from the primary IRS source (IRS 1 for CAPT, IRS 2 for F/O) to standby IRS 3, for recovery of ATT and HDG data.

ADC INST Pushbutton Switch

R • Enables to share the other pilot's ADC and FAC
R data, for recovery of speed, altitude and speed limits information.

FD Pushbutton Switch

• Enables to share the other pilot's FCC, for recovery of the FD bars and guidance. R

EFIS SGU Pushbutton Switch

• Enables to switch from the primary SGU source (SGU 1 for CAPT, SGU 2 for F/O) to standby SGU 3, for recovery of PFD/ND displays. R

PFD/ND XFR Pushbutton Switch

• Enables to transfer the PFD display on the lower CRT and the ND display on the top CRT, for recovery of PFD or ND display in case of CRT failure, or for convenience. R R

STD or Mod : (4803 + 5884)

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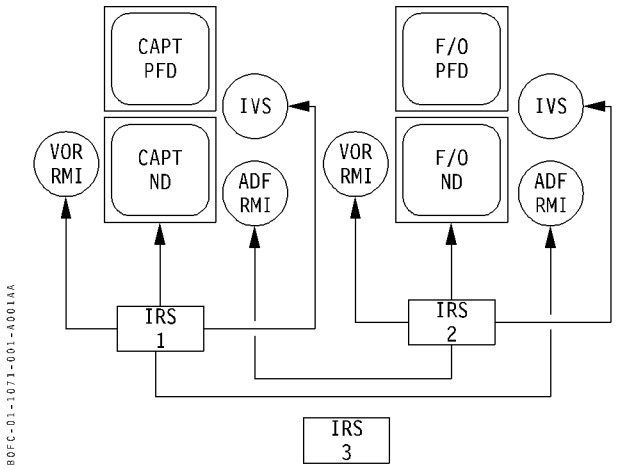
NORMAL OPERATION

- The IRS provides the flight instruments with inertial reference information and attitude.
- In the normal configuration IRS 1 supplies the CAPT's instruments, IRS 2 supplies the F/O's instruments.

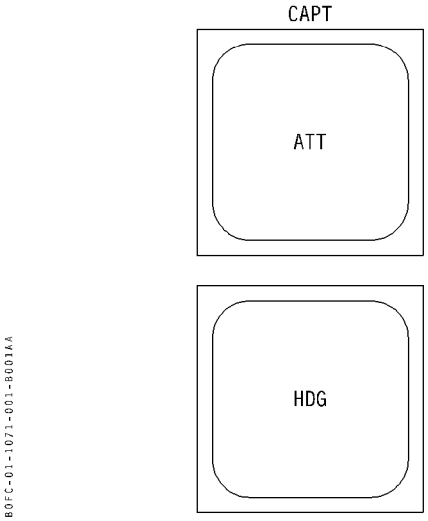
  IRS 3 is in standby and is available as an alternate source.



R • As illustrated above to enable cross-checking of
R heading references, each ADF RMMI displays the
R heading information from the opposite side.

IRS FAILURE

- The following example illustrates the loss of the IRS 1 :

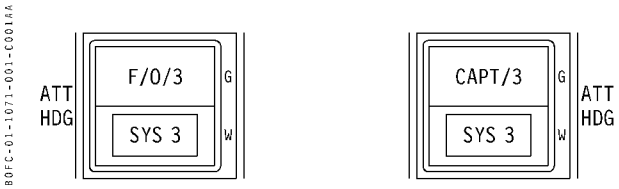


  – A red ATT message is displayed on CAPT PFD,
  – A red HDG message is displayed on CAPT ND.

Note : IRS failure also causes the loss of Inertial Vertical Speed (IVS) on affected VSI and of heading references on the associated VOR RMI.

IRS RECOVERY

- In case of IRS failure, the affected crew member can recover the attitude and heading data from the IRS3 by pressing the ATT HDG pushbutton on the SWITCHING panel :



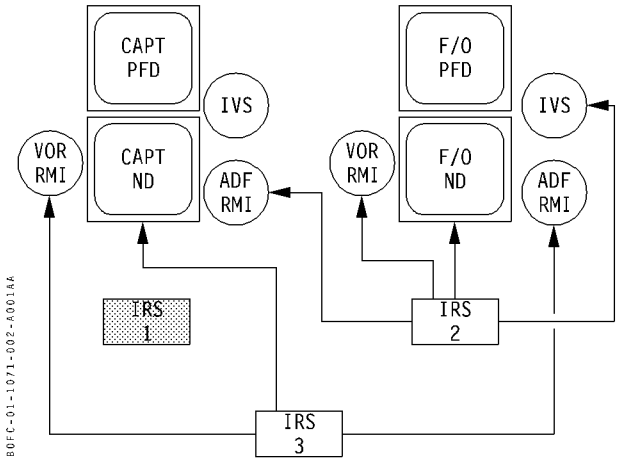
IRS SWITCHING PRIORITY

- The CAPT has priority over selection of IRS 3. Once the CAPT has selected IRS 3 by pressing his ATT HDG pushbutton switch, the F/O cannot select IRS 3.
- Likewise, if the F/O has selected IRS 3, and then the CAPT presses his own ATT HDG pushbutton switch, the CAPT will take over IRS 3, and the F/O's selection of IRS 3 will be cancelled.

IRS DATA RECOVERY

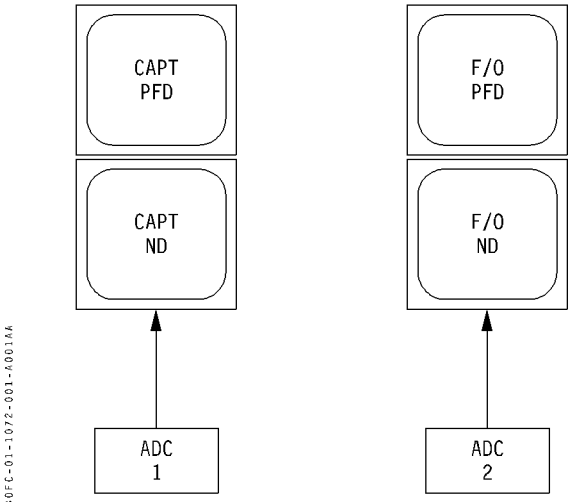
- To recover information from IRS 3, press CAPT ATT HDG pushbutton switch :
  - "SYS 3" illuminates on CAPT ATT HDG pushbutton switch to confirm that IRS 3 is in use.
  - "CAPT/3" illuminates on F/O ATT HDG pushbutton switch to notify the F/O that the CAPT is using IRS 3.
- IRS 3 now supplies the CAPT's flight instruments and F/O's ADF RMI.

Note : In this case CAPT, vertical speed indicator is supplied by the ADC only.



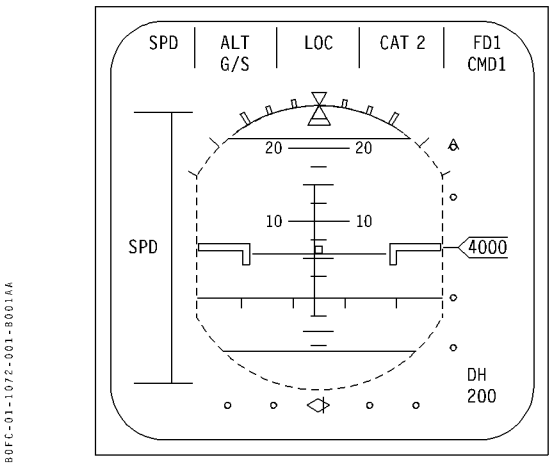
NORMAL OPERATION

- The Air Data Computers (ADC) provide the flight instruments with airspeed, altitude and vertical speed information.
- The Flight Augmentation Computers (FAC) provide the speed limits (VSS, VLS, F, S, Green Dot and VMAX) and speed trend for presentation on the PFD speed scale.
- In the normal configuration ADC 1 supplies the CAPT's instruments and ADC 2 supplies the F/O's instruments.

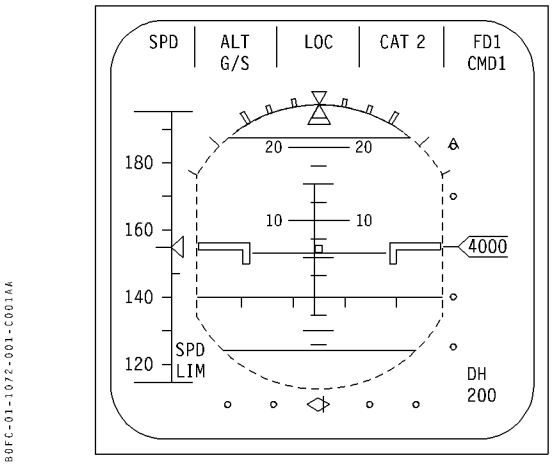


ADC FAILURE

- The following example illustrates the loss of the ADC 1 :
  - A red SPD message replaces speed scale on CAPT PFD.

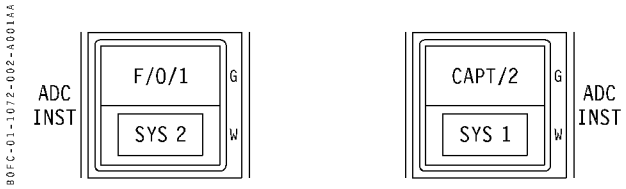


Note : FAC failure causes the loss of the speed limits and the speed trend on the PFD speed scale accompanied by a red SPD LIM message at the bottom of the speed scale.



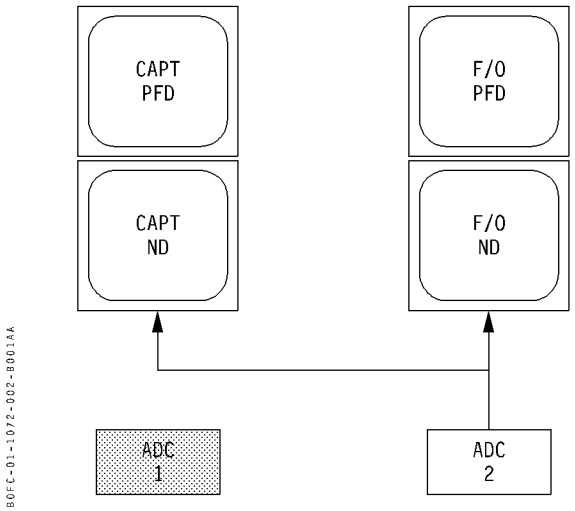
ADC DATA RECOVERY

- In case of ADC failure, the affected crew member can share the data from the opposite ADC by pressing the ADC INST pushbutton on the SWITCHING panel :



  - "SYS 2" illuminates on CAPT ADC INST pushbutton switch to confirm that ADC 2 and FAC 2 are in use .
  - "CAPT/2" illuminates on F/O ATT HDG pushbutton switch to notify the F/O that the CAPT is sharing F/O's ADC and FAC.

- ADC 2 now provides data to both pilots' EFIS.

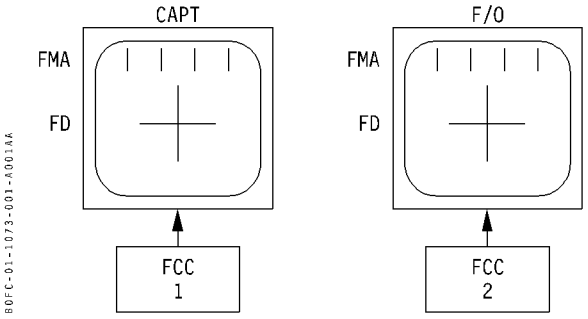


Note : Simultaneous cross supply (CAPT instruments from ADC 2/FAC 2 and F/O instruments from ADC 1/FAC 1) is not possible.

Note : In the above single-ADC configuration, the CAPT and F/O PFD speed scales reflect the same speed information, any speed cross-check must be performed against the standby airspeed indicator.

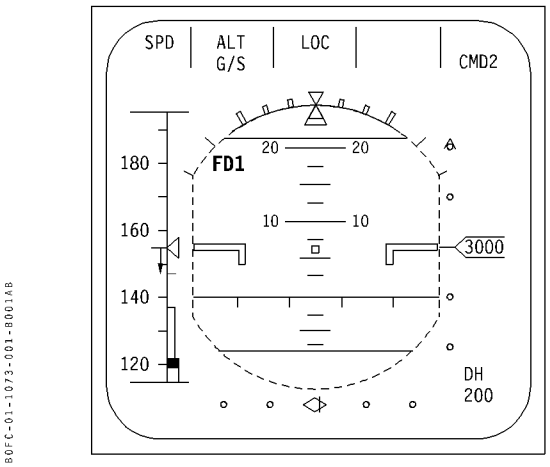
NORMAL OPERATION

- The Flight Control Computers (FCC) supply the Flight Director bars commands and autoflight system (AP/FD-A/THR) Flight Mode Annunciator (FMA) operating modes.
- In the normal configuration FCC 1 supplies the CAPT's FD and FMA and FCC 2 supplies the F/O FD and FMA.



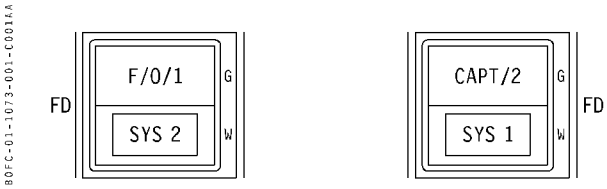
FD FAILURE

R
- The following example illustrates the loss of the FCC 1 (with an autopilot engaged in CMD) :
  - A red FD1 message is displayed on CAPT PFD.

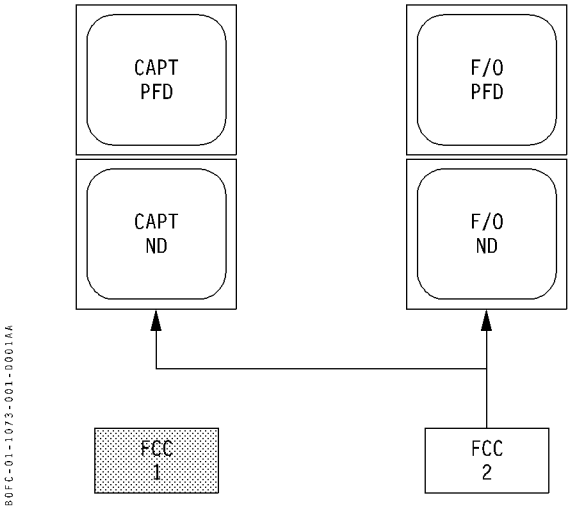
R


FD RECOVERY

- In case of FD failure, the affected crew member can share the data from the opposite FD receiver by pressing the FD pushbutton on the SWITCHING panel :



  - "SYS 2" illuminates on CAPT FD pushbutton switch to confirm that FD 2 is in use.
  - "CAPT/2" illuminates on F/O FD pushbutton switch to notify the F/O that the CAPT is sharing F/O's FCC.
- FCC 2 now provides data to both pilot PFD's.



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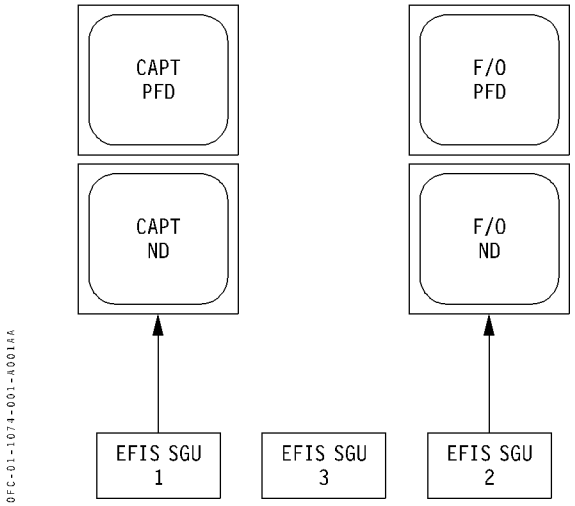
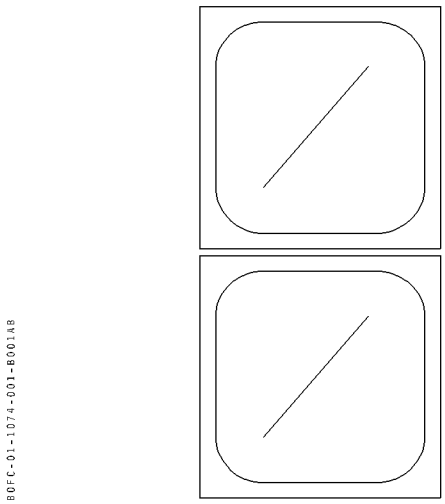
NORMAL OPERATION

- The EFIS Symbol Generator Units (SGU) generate the pictures which are presented on the PFD and ND.
- In the normal configuration EFIS SGU 1 supplies the CAPT's PFD and ND, EFIS SGU 2 supplies the F/O's PFD.
- SGU 3 is in standby and is available as an alternate source.



EFIS SGU FAILURE

- The following example illustrates the loss of the EFIS SGU 1 :
  - White diagonal lines are displayed on both Cathodic Ray Tubes (CRT).

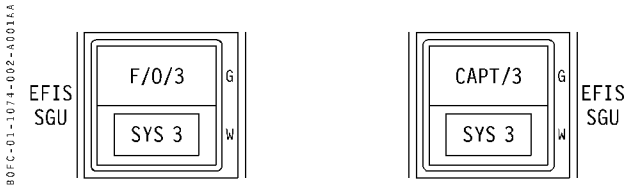


EFIS SGU SWITCHING PRIORITY

- The CAPT has priority over selection of EFIS SGU 3. Once the CAPT has selected EFIS SGU 3 by pressing his EFIS SGU pushbutton switch, the F/O cannot select EFIS SGU 3.
- Likewise, if the F/O has selected EFIS SGU 3, and then the CAPT presses his own EFIS SGU pushbutton switch, the CAPT will take over EFIS SGU 3, and the F/O's selection of SGU 3 will be cancelled.

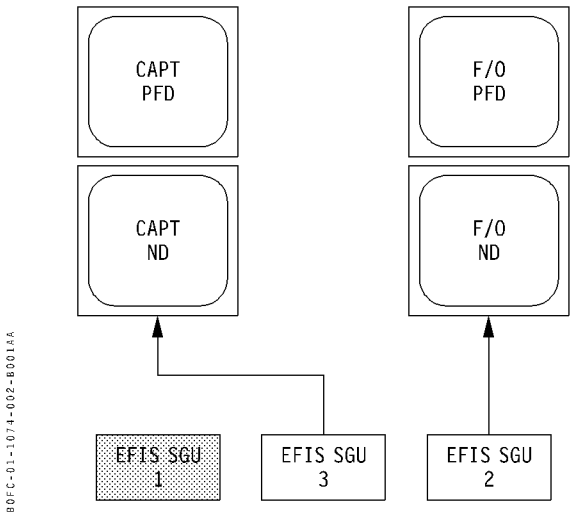
EFIS SGU RECOVERY

- In case of EFIS SGU failure, the affected crew member can share the data from the SGU3 by pressing the EFIS SGU pushbutton on the SWITCHING panel :



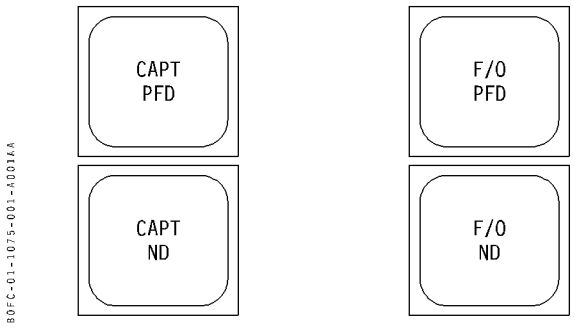
  - "SYS 3" illuminates on CAPT EFIS SGU pushbutton switch to confirm that SGU 3 is in use.
  - "CAPT/3" illuminates on F/O EFIS SGU pushbutton switch to notify the F/O that the CAPT is using SGU 3.

- EFIS SGU 3 now supplies the CAPT's EFIS.



NORMAL OPERATION

- In the normal configuration the PFD is displayed on the upper Cathodic Ray Tube (CRT) and the ND is displayed on the lower CRT.



R
R
R
- If desired, the PFD can be displayed on the lower CRT by pressing the PFD/ND XFR pushbutton switch.

CRT FAILURE

- The following example illustrates the loss of the CAPT's upper CRT :

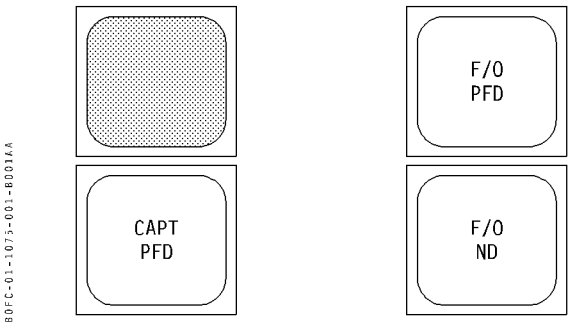
R
R
– the CAPT upper CRT is completely blank or fails to display data correctly.

R CRT RECOVERY

R
R
R
R
- The affected display (PFD or ND) can be presented on the remaining CRT by using the PFD/ND XFR pushbutton switch.

R
R
R
R
- The affected display can be also transfered to the other CRT by switching the affected display to OFF.

R
R
R
- The PFD is now displayed on the CAPT's lower CRT.



STD or Mod : (5846 + 11123)

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Not applicable

LEFT BLANK INTENTIONALLY

Not applicable

Not applicable

Not applicable

LEFT BLANK INTENTIONALLY

GENERAL

- The Ground Proximity Warning System (GPWS) includes :
  - one GPWS computer,
  - two GPWS-G/S warning light/pushbutton switches on the Captain and First Officer's instrument panels,
  - one GPWS FAULT light and a GPWS selector switch on the CAPT SWITCHING panel,
  - an audio warning system.
- Between 30 and 2 450 ft AGL, GPWS provides visual and audio synthetic voice warnings to alert the flight crew in case of hazardous flight path conditions which could result in a Controlled Flight Into Terrain (CFIT) event.
- Five warning modes are provided :
  - Mode 1 : excessive sink rate,
  - Mode 2 : excessive terrain closure rate,
  - Mode 3 : descent after take-off,
  - Mode 4 : inadvertent proximity to terrain,
  - Mode 5 : descent below ILS glide slope.

Note : Mode 5 is active only when a valid ILS glide slope signal is being received. Mode 5 warnings are inhibited for ILS "Back Course".

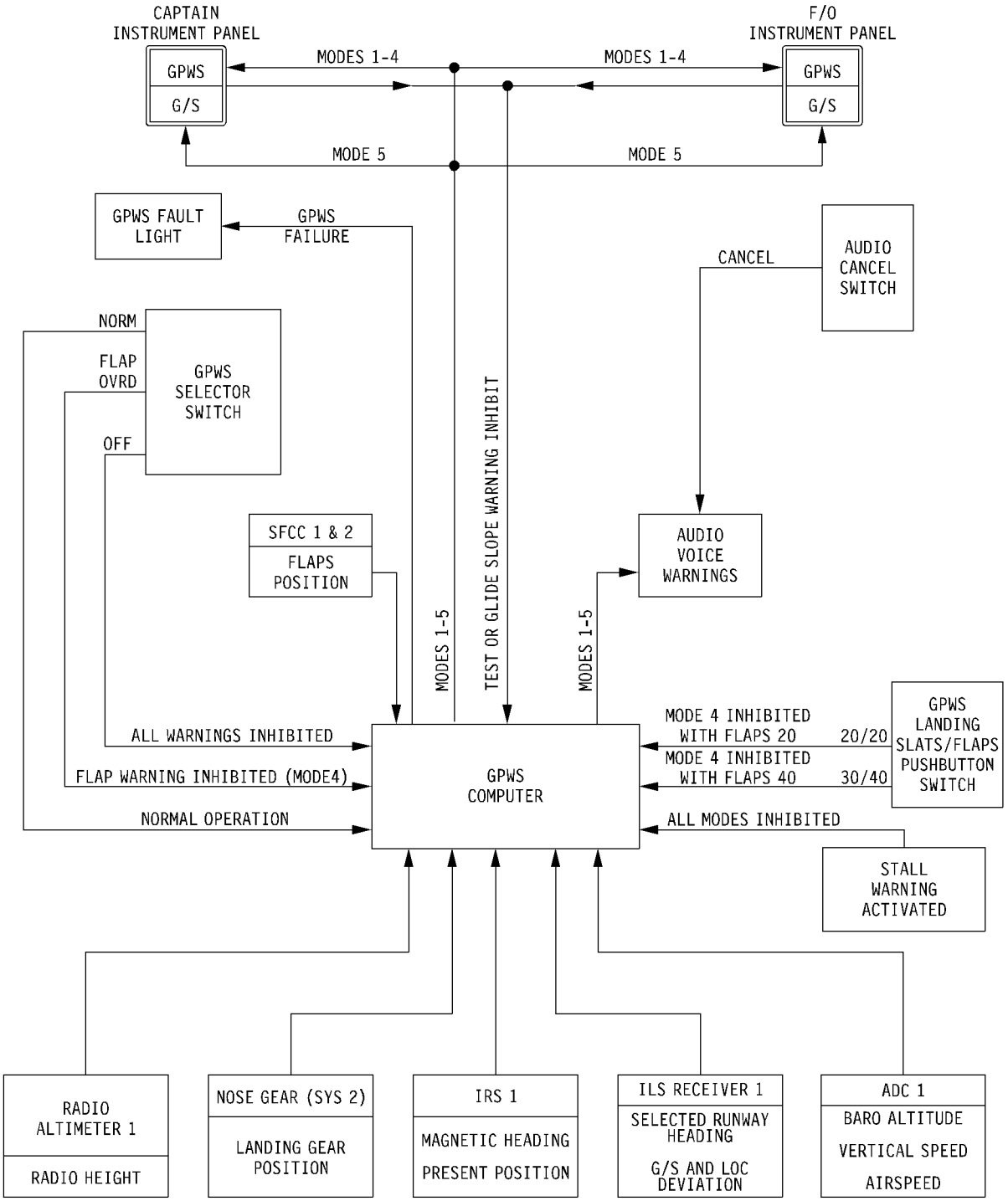
- Visual warnings (on Captain and F/O's GPWS-G/S warning lights) :
  - Modes 1 to 4 : red "GPWS" lights illuminate,
  - Mode 5 : amber "G/S" lights illuminate.
- Audio warnings : specific synthetic voice phrases are given for each individual mode.
- All GPWS audio warnings can be cancelled with the EMER AUDIO CANCEL switch.
- A 3-position (NORM - FLAP OVRD - OFF) GPWS selector switch is located on the Captain's instrument panel.
  - If landing with flaps 20 or less, selecting FLAP OVRD inhibits the "TOO LOW FLAPS" warnings (mode 4B).
  - If the GPWS fails, all warnings can be inhibited by selecting the switch to the OFF position.
- A GPWS LANDING FLAPS switch is used to inform the GPWS of the selected landing configuration.
- Illumination of the amber GPWS FAULT light on the CAPT SWITCHING panel indicates GPWS failure.
- GPWS can be tested on ground or in flight (above 1 000 ft RA) by pressing either the Captain or the F/O's GPWS-G/S pushbutton switch.
- GPWS is electrically supplied from the AC BUS 1.
- All GPWS warnings are inhibited if the stall warning is activated.

Note 1 : Several airports around the world have terrain located on their approach or departure flight path which penetrates the standard GPWS warning profiles. When operating to/from these airports, the IRS position is used to modify the warning profile and avoid nuisance warnings.

Note 2 : GPWS requires information from ADC 1, ILS 1, IRS 1, Radio Altimeter 1, SFCC 1 and SFCC 2, and the SYS 2 nose gear down lock sensor.

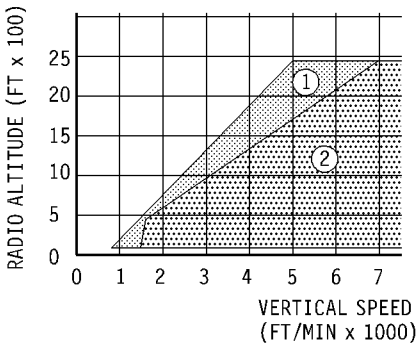
Mod : 5697

SYSTEM INTERFACE



Mod : 5697 + 6234

MODE 1:EXCESSIVE SINK RATE

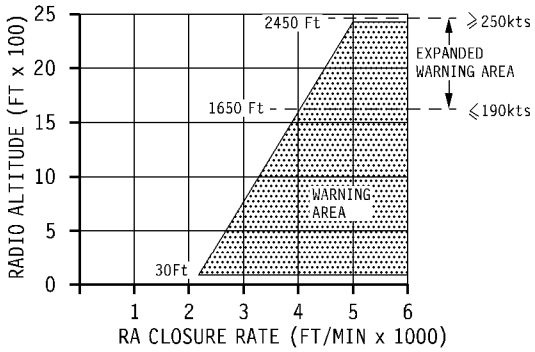


① "SINK RATE"

② "WHOOP WHOOP PULL UP"

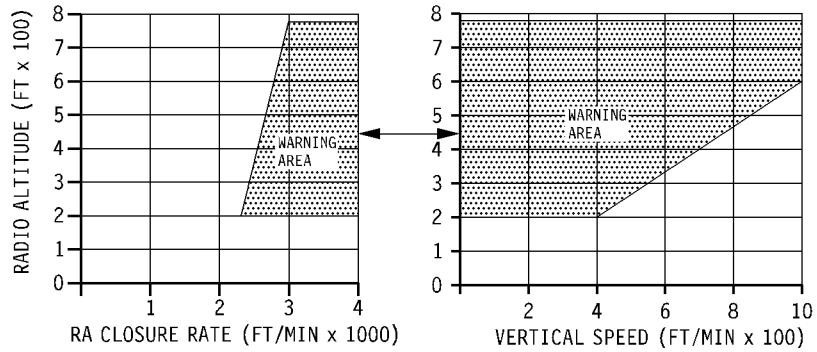
MODE 2:EXCESSIVE TERRAIN CLOSURE RATE

MODE 2A - FLAPS 20 OR LESS



R "TERRAIN" "TERRAIN"
THEN CONTINUOUS "WHOOP
WHOOP PULL UP" AS LONG AS
IN THE WARNING AREA AND A 300 FT
BARO ALTITUDE GAIN IS NOT OBTAINED.

MODE 2B - FLAPS 40°

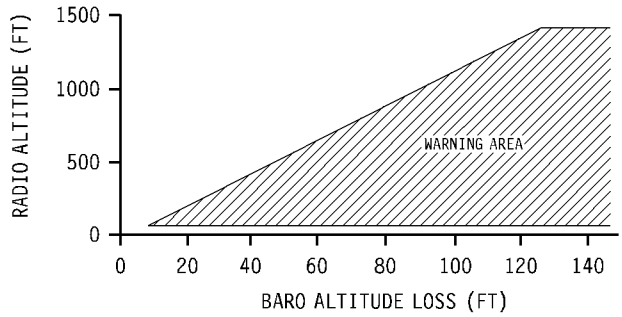


"TERRAIN" "TERRAIN"
THEN CONTINUOUS "WHOOP WHOOP PULL UP"
AS LONG AS IN WARNING AREA.

B0FC-01-1081-001-A001AA

STD or Mod : 5697

MODE 3:DESCENT AFTER TAKE-OFF



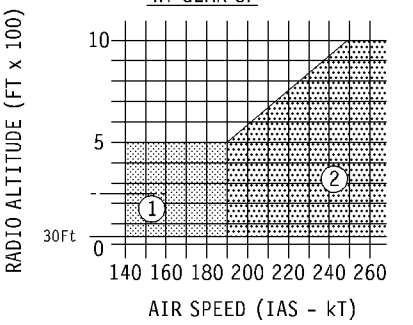
IF A DESCENT IS MADE DURING THE INITIAL TAKE-OFF CLIMB, OR DURING A GO AROUND A REPEATED ORAL ALERT IS GENERATED:

- "DON'T SINK" (GEAR UP) OR "DON'T SINK GEAR" (GEAR DOWN) THEN "TOO LOW"

MODE 4:INADVERTENT PROXIMITY TO TERRAIN

R R R R R R R

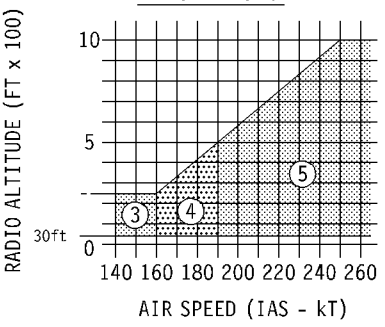
4A-GEAR UP



① "TOO LOW GEAR"

② "TOO LOW TERRAIN"

4B-GEAR DOWN



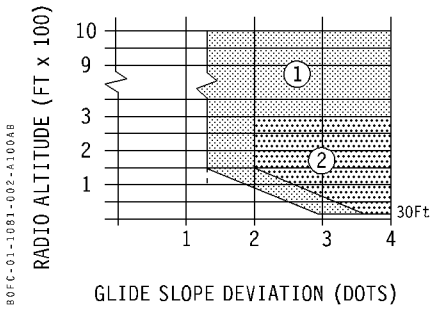
③ IF FLAPS LESS THAN 20, OR LESS THAN 40 (*) "TOO LOW FLAPS"

④ IF FLAPS LESS THAN 20, OR LESS THAN 40 (*) "TOO LOW TERRAIN"

⑤ "TOO LOW TERRAIN"

(*) DEPENDING ON THE GPWS LANDING SLATS/FLAPS SWITCH POSITION

MODE 5:DESCENT BELOW GLIDE SLOPE

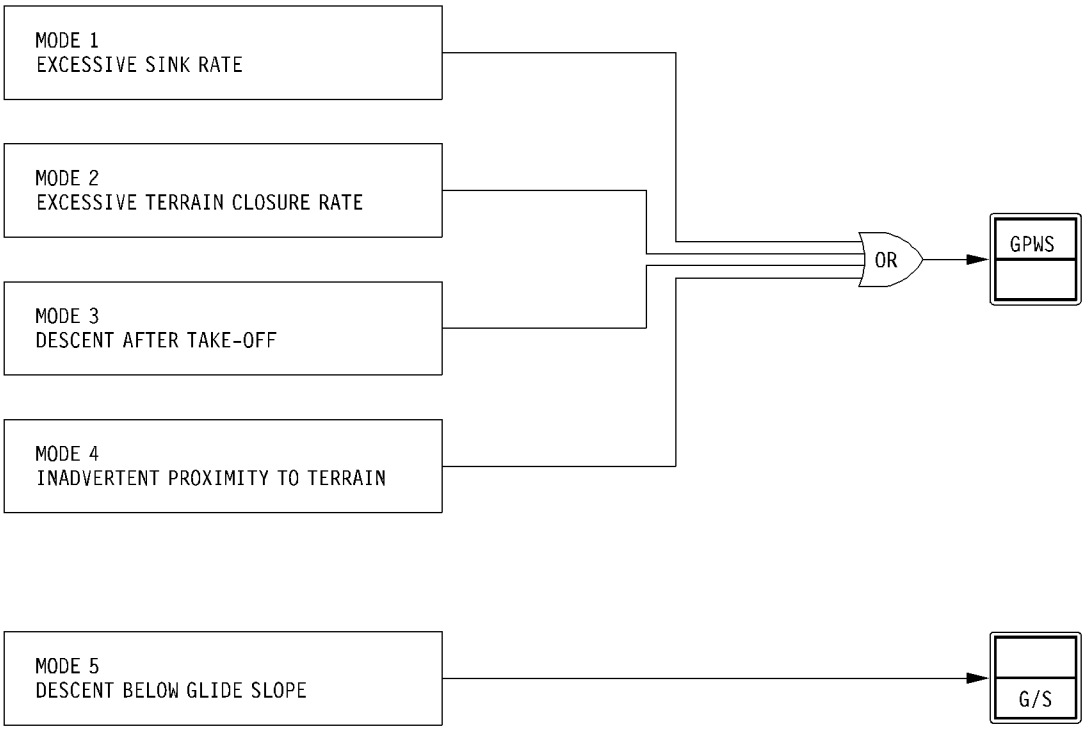


① "GLIDE SLOPE" SOFT ALERT

② "GLIDE SLOPE" HARD ALERT (INCREASED LEVEL)

80FC-01-1081-002-A100A8

Mod : 5697



R
R

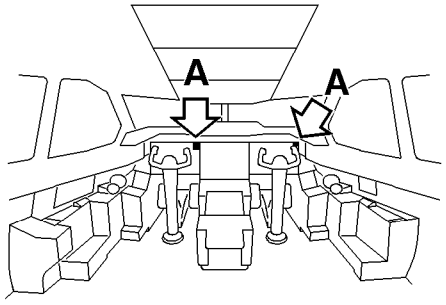
WARNING PRIORITIES

1 - WHOOP WHOOP PULL UP
2 - TERRAIN
3 - TOO LOW TERRAIN
4 - TOO LOW
5 - TOO LOW GEAR
6 - TOO LOW FLAPS
7 - SINK RATE
8 - DON'T SINK GEAR
9 - DON'T SINK
10 - GLIDE SLOPE

BOFC-01-1081-003-A001AA

STD or Mod : 5697

LEFT BLANK INTENTIONALLY



BGFC-01-1082-001-A001AA

A. GPWS-G/S Pushbutton Switches

BGFC-01-1082-001-B001AA

- Each of these two identical pushbutton switches on the Captain and F/O's instrument panels include a GPWS and G/S warning light.

■ **GPWS light (red)**

– Illuminates when any warnings for modes 1 through 4 are activated.

– The associated voice warning is simultaneously generated.

■ **G/S light (amber)**

– Illuminates when a below glide slope alert (mode 5) is activated.

– The associated "GLIDE SLOPE" voice warning is generated simultaneously.

■ **Pressed**

- **Pressed on Ground :**

– If pressed momentarily :

- The airborne self test warning (see "Pressed above 1 000 ft AGL" below) is generated.

– If pressed for more than 5 seconds the full GPWS self test is generated :

- Amber GPWS "FAULT" light illuminates on CAPT SWITCHING panel.
- On Captain and F/O's GPWS - G/S switches :
  - amber "G/S" warning light illuminates then extinguishes,
  - red "GPWS" warning light illuminates then extinguishes.
- During the self test sequence, all voice warnings are generated as follows :
  - all the warnings described in 1.10.81 p3, R
  - MINIMUM (not used).
- The GPWS amber "FAULT" light extinguishes.

- **Pressed between 1 000 - 30 ft AGL :**

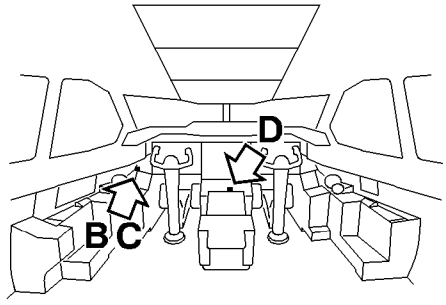
– Mode 5 glide slope warnings are inhibited.

- **Pressed above 1 000 ft AGL :**

– The airborne self test is generated :

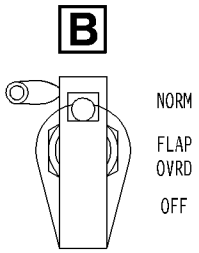
- Amber GPWS "FAULT" light illuminates on CAPT SWITCHING panel.
- Amber "G/S" warning light illuminates on Captain and F/O's GPWS - G/S switches, with one "GLIDE SLOPE" voice warning.
- Amber G/S warning light extinguishes.
- Red "GPWS" warning light illuminates on Captain and F/O's GPWS - G/S switches with one "WHOOP WHOOP - PULL UP" voice warning.
- All GPWS warning lights extinguish.

Note : "MINIMUM" is the mode 6 voice warning (descent below Decision Height) and is not used. Decision Height information is provided by the PFD Radio Altimeter display.



BOFC-01-1082-002-A110AA

B. GPWS Selector Switch



BOFC-01-1082-002-B110AA

- This switch is guarded and lockwired in the NORM position.

■ **NORM**

– All GPWS warnings are available.

■ **FLAP OVRD**

– This position can be selected if landing with less than full flaps.

– FLAP OVRD inhibits nuisance "TOO LOW FLAPS" warning (Mode 4) if an approach is intentionally flown with less than full flaps.

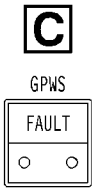
■ **OFF**

– Selected in case of GPWS malfunction.

– All warnings are inhibited.

– FAULT light illuminates.

C. GPWS Warning Light R



BOFC-01-1082-002-C110AA

- FAULT illuminates amber when a GPWS malfunction exists. R

- When illuminated, all GPWS warnings are inhibited.

D. GPWS LANDING SLATS/FLAPS Switch

BOFC-01-1082-002-D110AA

- When the landing gear shock absorbers are compressed, the swtich automatically trips down to the 30/40 position.

■ **20/20**

– The warnings in mode 4 are inhibited for flaps 20 or more.

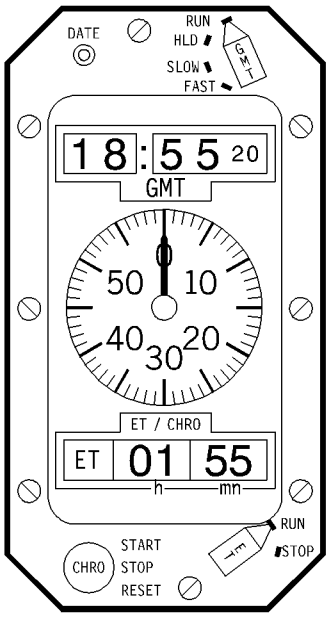
■ **30/40**

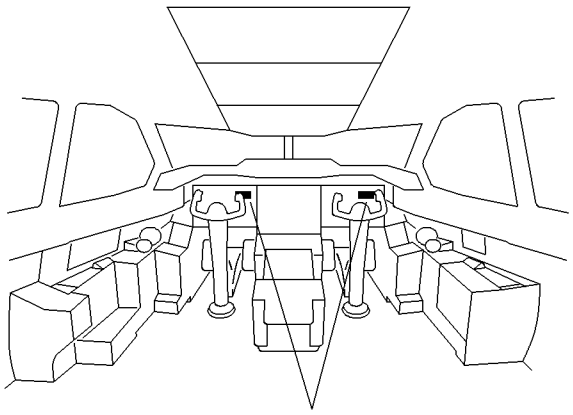
– The warnings in mode 4 are inhibited for flaps 40.

Mod : 5697

GENERAL

A



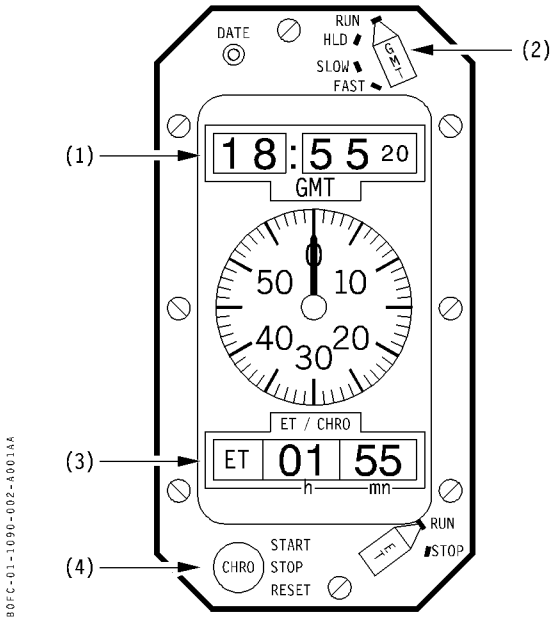


A

- A clock is available on each main instrument panel.
- Each of these two clocks has a remote pushbutton switch on the control wheel to operate the Stopwatch (CHRO) function.
- Captain's clock provides GMT data for FMC 1 and the F/O's clock provides GMT output for the Digital Flight Data Recorder and FMC 2.
- Each clock is supplied by two electrical power supply circuits, one of which is direct from the aircraft batteries to allow clocks continued operation when the aircraft is parked without any electrical power supply.

STD or FDX

OPERATIONAL DESCRIPTION



(1) GMT Window

- Displays hours, minutes and every 10 seconds.

(2) GMT Selector

- This 4-position switch is used to set GMT.

■ **FAST**

– Sets the hours.

– Sets GMT month if DATE pushbutton switch is pressed and held.

■ **SLOW**

– Set the minutes.

– Sets GMT day if DATE pushbutton switch is pressed and held.

■ **HLD (Hold)**

– Used to stop the GMT clock (for example to synchronize clock with GMT time reference).

■ **RUN**

– The GMT clock runs continuously.

– When the clock has been set, this is the normal position of this switch.

Note : To move out of the RUN position, the GMT selector must be pressed in before it can be turned.

(3) ET (Elapsed Time) Counter

- Displays hours and minutes elapsed since the Elapsed Time (ET) switch was placed in ET.

Note : When the stopwatch (CHRO) is in use, this counter is covered by the CHRO counter but Elapsed Time recording continues uninterrupted.

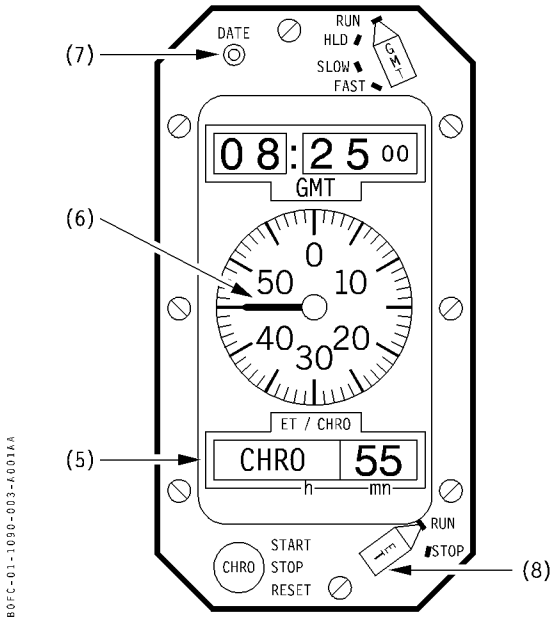
(4) CHRO (stopwatch) Pushbutton Switch

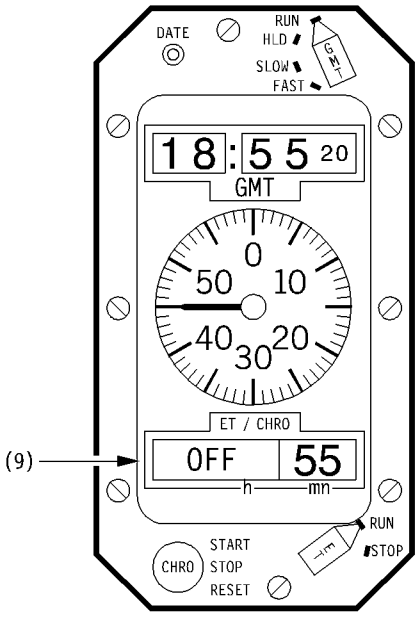
- When ET is displayed (as in (3) in the above clock illustration), the stopwatch is not running.
- Pressing the CHRO pushbutton switch (or the remote pushbutton switch on the control yoke) starts the stopwatch.
- A display of whole minutes elapsed since starting the stopwatch appears, masking the ET counter, and the sweep second hand indicates seconds (see (5) and (6) in the clock illustration on next page).

Note : While the stopwatch is running, the ET counter continues to run, but is simply masked by the CHRO display.

- A second press stops the stopwatch (see (9) in the clock illustration next page).
- A third press resets the stopwatch to zero as in the clock illustration above. The ET counter is uncovered.

OPERATIONAL DESCRIPTION (continued)





(5) CHRO (stopwatch) Counter

- When stopwatch is in use, "CHRO" flag is displayed with whole minutes elapsed since stopwatch was started (if ET switch is in RUN position, the ET counter is masked but still running).

(6) Stopwatch Sweep Second Hand

- When stopwatch is in use, the sweep second hand counts the seconds elapsed since the last whole minute.

(7) DATE Pushbutton Switch

- This pushbutton is held pressed and used with the GMT selector to set the GMT month and day.
  - GMT counter now displays the month in the left window and the day in the right one.
  - The GMT selector is then used to set the date as described in (2) above.

(8) ET Switch

- **STOP**
  - ET counter stops.
- **RUN**
  - ET counter is reset to zero and starts counting the Elapsed Time.

(9) OFF Flag

- In case of loss of electrical power supply, all indications are frozen and the OFF flag appears.
- When clock is repowered, all clock functions operate normally again.

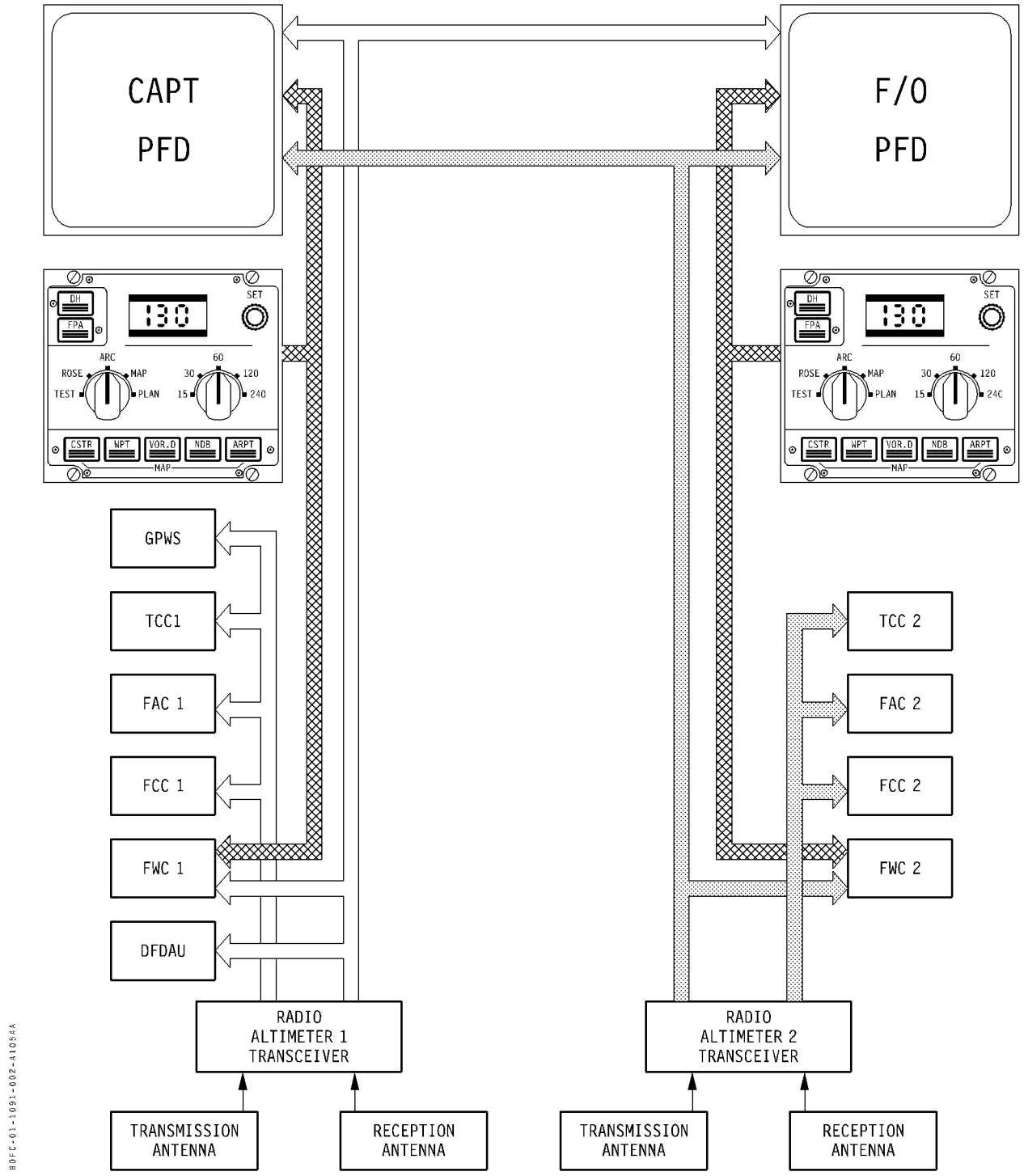
CLOCK SETTING TECHNIQUE

- A clock setting can be performed if required, for example in case of aircraft battery replacement or power loss.
  - With left hand press the DATE pushbutton switch. With right hand rotate GMT selector to FAST to set GMT month.
  - When the GMT month is set, rotate immediately the selector to SLOW to set GMT day.
  - When the GMT day is set, rotate immediately the selector to HOLD.
  - Release the DATE pushbutton switch.
  - Rotate the GMT selector to FAST, set GMT hour (24 hours format).
  - When GMT hour is set, immediately rotate the selector to SLOW until the GMT minutes are set.
  - Immediately rotate the selector to HLD and wait for GMT time reference (hack).
  - When GMT reference agrees with the time set, rotate the selector to RUN.

GENERAL

- Two Radio Altimeters are installed, and operate when below 2500 ft Radio Altitude (RA).
- The RA, which is displayed on each pilot's PFD, reflects the height of the main landing gear wheels above the ground (irrespective of the landing gear position).
  - Radio Altimeter 1 data are normally displayed on the CAPT's PFD. If Radio Altimeter 1 fails, the CAPT's PFD automatically displays data from Radio Altimeter 2.
  - Likewise, Radio Altimeter 2 data are normally displayed on the F/O's PFD. If Radio Altimeter 2 fails, the F/O's PFD automatically displays data from Radio Altimeter 1.
- The Radio Altimeters' antennae are located under the aft cargo compartment (see AIRCRAFT GENERAL chapter).
- RA information is displayed on the PFD (refer to section 1.10.23 PRIMARY FLIGHT DISPLAY – RADIO ALTITUDE).
- The RA Decision Height is set on the CAPT's and F/O's EFIS control panels (refer to section 1.10.30 – PRIMARY CONTROL PANEL description).
- The loss of one or both RA and the effect on aircraft systems is described in the individual description of each affected system.

SYSTEM ARRANGEMENT



Mod : S5063 or 6523 or (S5063 + 6523)

GENERAL

- The automatic call out system, integrated in the FWC, generates synthetic voice call outs when the Radio Altitude is below 400 ft.

DESCRIPTION

- The following automatic altitude call outs are provided :

Radio height (ft)	Call out
400	FOUR HUNDRED
300	THREE HUNDRED
200	TWO HUNDRED
100	ONE HUNDRED
50	FIFTY
40	FORTY
30	THIRTY
20	TWENTY
10	TEN
5	FIVE
DH + 100	HUNDRED ABOVE
DH	MINIMUM

- Call outs are inhibited during take-off.

  The system is activate only after an aircraft descent has been detected.

- After one of the above call outs have been given, if the next succeeding level is not passed within a certain time, the system announces the intermediate radio height. This time depends on the radio height :

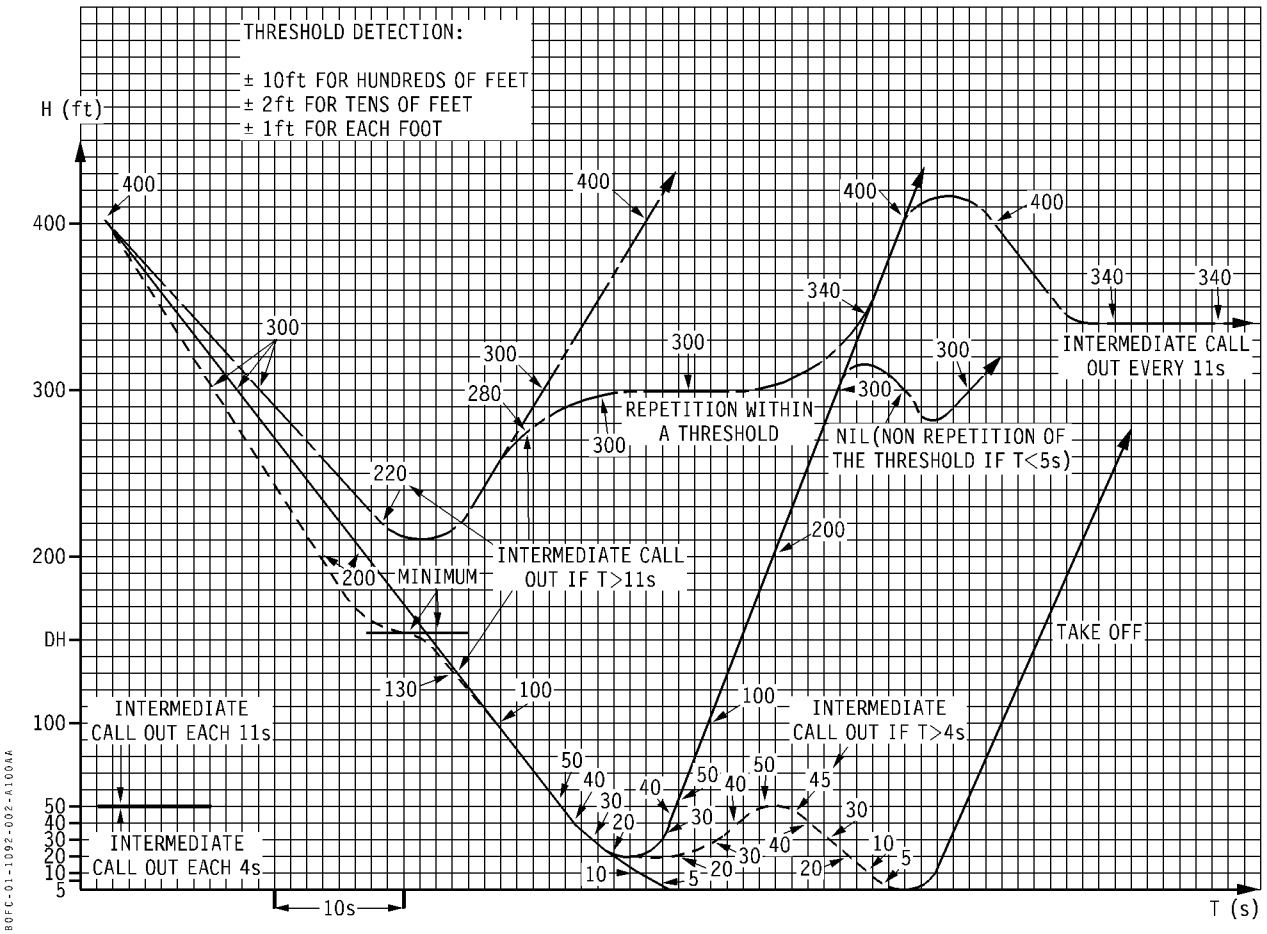
Radio Height	Time	Intermediate call out
Between 400 ft and 100 ft	11 s	radio height in 10 ft interval rounded to the lower.
Between 100 ft and 50 ft	11 s	radio height not rounded
Below 50 ft	4 s	radio height not rounded

- When reaching the Decision Height (DH) selected on the EFIS primary control panels, "MINIMUM" is announced.

Note : If two different DH are selected on the two EFIS primary control panels, "MINIMUM" will be announced twice.

Mod : (3732 + 6445) or (6119 + 6445)

CALL OUT CONFIGURATIONS



Mod : 3732 or 6119

STALL WARNING

R • A dual stall warning system, activated by the Flight Warning Computer (FWC), provides audio (Cricket) and stick shaker warnings in case of impending stall.

Note : A stick shaker is installed on each control column.

R • Stall warning activation depends on the AoA and slats configuration.

The stall warning is activated :

– If the AoA exceeds 10° in clean configuration,

or

– If the AoA exceeds 17.5° with slats extended.

• AoA is sensed by two electrically heated alpha probes (one on each side of the forward fuselage).

• Slats position is transmitted to the two FWC.

LEFT BLANK INTENTIONALLY

GENERAL

- The aircraft is equipped with a Cockpit Voice Recorder (CVR) and an Aircraft Integrated Data System, which are automatically supplied from the first engine start until five minutes after the last engine shutdown.
- With engines shut down the CVR and DFDR can be selected ON manually.

COCKPIT VOICE RECORDER (CVR)

- The CVR is designed to :
  - Record the last 30 minutes of cockpit conversation and aural warnings (closed-loop recording).
  - Record the following on four different channels:
    - Radio conversations (received and transmitted),
    - Communications and conversations between crew members,
    - Aural warnings,
    - Announcements made by crew members.
- The CVR system is made up of :
  - A recorder in a crashproof box (installed in the aft fuselage),
  - A microphone located at the base of the overhead panel,
  - A control panel on the overhead panel.

R The CVR system also uses the flight crew and the
R passenger address microphones.

- The CVR is supplied from the AC EMER BUS.

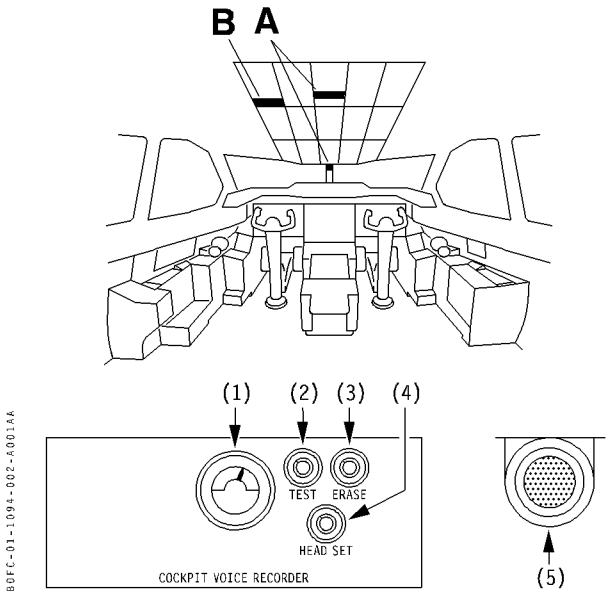
Note : One reason why batteries are selected OFF prior to the flight crew evacuation is to stop the CVR and prevent the erasure of potentially important data.

AIRCRAFT INTEGRATED DATA SYSTEM

- The Aircraft Integrated Data System records many flight parameters which are collected and converted by a Digital Flight Data Acquisition Unit (DFDAU).
- This data is recorded by a Digital Flight Data Recorder (DFDR), which is encased in a shock and heat-resistant enclosure.

  Its storage capacity is 25 hours.
- An AIDS EVENT pushbutton switch is provided to record special events.

A. COCKPIT VOICE RECORDER Panel



(1) Monitor Indicator

- For use during test only. Movement of the pointer in the white band indicates that all channels are operative.

(2) TEST Pushbutton Switch

- When pressed and held the test is activated.
  - The pointer moves in pulses to indicate that all channels are recording properly.
  - If a headset is plugged into the HEAD SET jack, the test may be heard as low frequency signal.

(3) ERASE Pushbutton Switch

- Allows fast erasing of tape recordings.
  - Landing gear struts must be compressed with parking brake set.
  - While erasing, a low frequency signal may be heard in the headset.

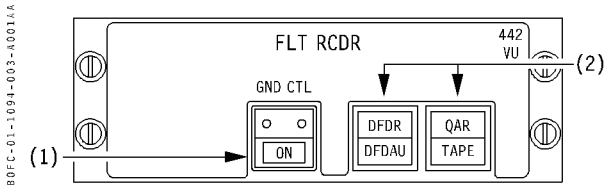
(4) HEAD SET Jack

- When a headset is plugged into the jack, the following can be heard :
  - Cockpit sounds picked up by the microphone,
  - Test tone when TEST pushbutton switch is pressed,
  - The erase tone when ERASE pushbutton switch is pressed.

(5) Area Microphone

- Picks up cockpit conversations and warning sounds.

B. FLT RCDR Panel



(1) GND CTL Pushbutton Switch

- The GND CTL pushbutton switch may be used when engines are shut down to select the CVR, DFDR and QAR (Quick Access Recorder) ON or off.

■ **Normal (pushbutton switch released-out)**

– CVR, DFDR and QAR are automatically powered from first engine start until five minutes after both engines are shutdown.

■ **ON (blue - pushbutton switch pressed-in)**

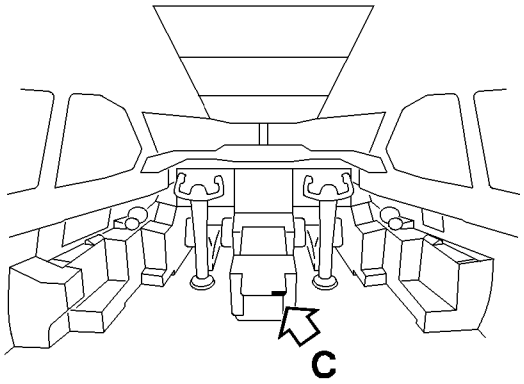
– The CVR, DFDR and QAR are powered.

– When the first engine is started, the ON light extinguishes.

(2) Fault Annunciator Lights

- Four amber annunciator lights are provided :
  – DFDAU (Digital Flight Data Acquisition Unit),
  – DFDR (Digital Flight Data Recorder),
  – QAR (Quick Access Recorder),
  – TAPE (tape supply low).
- Respective annunciator illuminates when a fault is detected in the corresponding unit or during test.
- DFDR illuminates when Aircraft Integrated Data System is not supplied.

C. AIDS EVENT Pushbutton Switch



- When the AIDS EVENT pushbutton switch is pressed, an Event Mark is recorded on the DFDR tape.

LEFT BLANK INTENTIONALLY

WEIGHT AND BALANCE SYSTEM is not installed.

LEFT BLANK INTENTIONALLY