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## DESCRIPTION

The Air Data and Inertial Reference System (ADIRS) supplies temperature and anemometric, barometric and inertial parameters to the EFIS system (PFD and ND) and to other user systems (FMGC, FADEC, PRIM, SEC, FWC, SFCC, ATC, GPWS, CMC, CPC).

The system includes :

- three identical ADIRU's (Air Data and Inertial Reference Units).

Each ADIRU is divided in two parts, either of which can work separately in case of failure in the other :

- the ADR (Air Data Reference) part which supplies baro metric altitude, airspeed, mach, angle of attack, temperature and overspeed warnings.
- the IR (Inertial Reference) part which supplies attitude, flight path vector, track, heading, accelerations, angular rates, ground speed and aircraft position.

Note : The ADIRU gives the true heading instead of magnetic heading :

- R                   – above 82.5° North
- R                   – above 73.5° North between 92.5° and 117.5° West (magnetic polar region)
- R                   – above 60.5° South

- one ADIRS control panel (ADIRS MSU) on the overhead panel for selection of modes (NAV, ATT, OFF) and indications of failures.

The IR is initialized through the FMGES.

- Two GPS receivers, which are connected to the IR part of the ADIRU's for GP/IR hybrid position calculation.

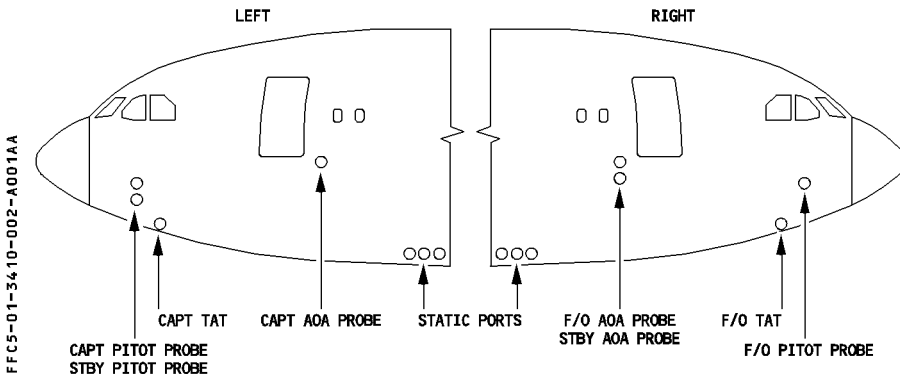
- four types of sensors :

- pitot probes (3)
- static pressure probes (STAT) (6)
- angle of attack sensors (AOA) (3)
- total air temperature probes (TAT) (2)

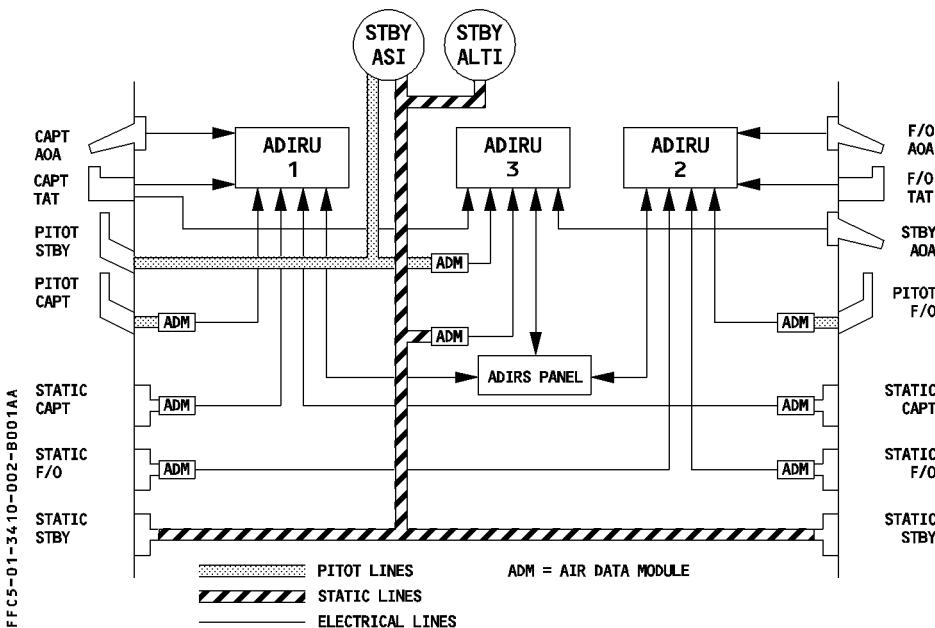
These sensors are electrically heated to prevent from icing up.

- eight ADMs (Air Data Modules) which convert pneumatic data from pitot and static probes into numerical data for the ADIRUs.
- a switching facility for selecting ADR3 or IR3 for instrument displays in case of ADIRU 1 or 2 failure.
- a MAG/TRUE pushbutton switch for polar navigation.
- AC BUS provides normal electrical supply. DC BUS provides a back up possibility through internal inverter.

**PROBES LOCATION**



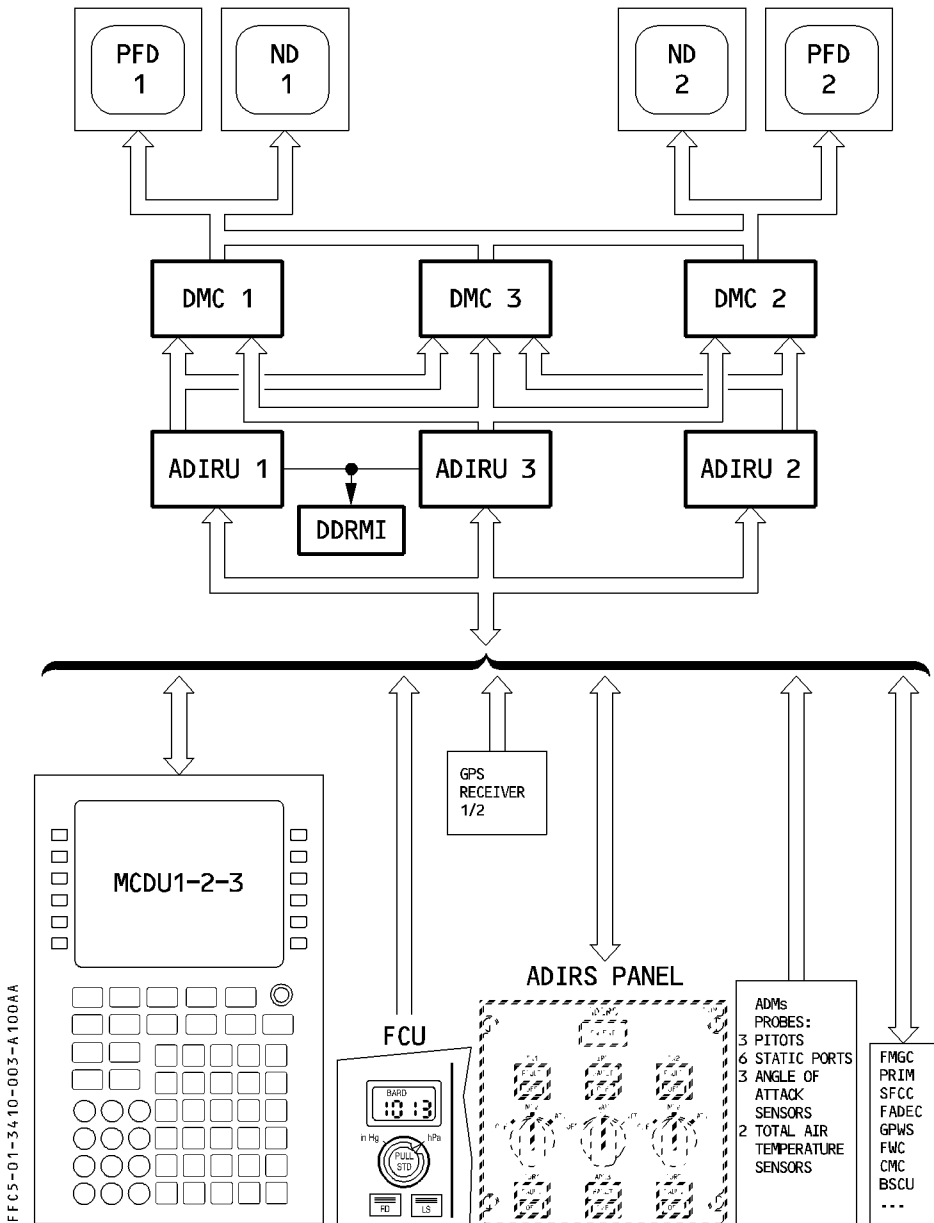
**PROBES SCHEMATIC**



*Note : ADIRU 1 is supplied by CAPT probes,  
 ADIRU 2 is supplied by F/O probes,  
 ADIRU 3 is supplied by STBY probes and CAPT TAT*

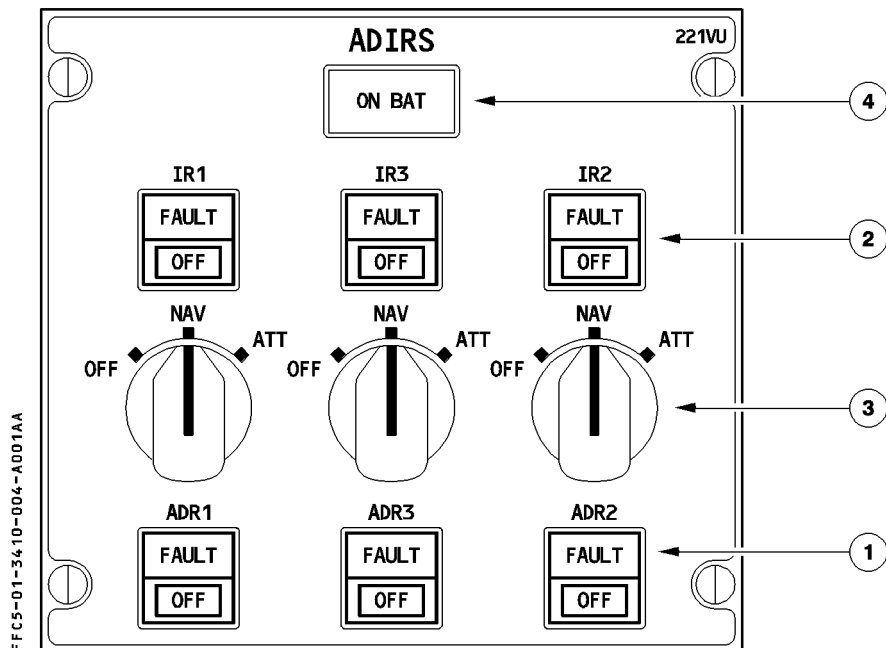
**ADIRS SCHEMATIC**

R



## CONTROLS AND INDICATORS

### OVERHEAD PANEL



R ① ADR 1 (2) (3) pb sw

OFF : Air data output disconnected.

R FAULT It : This amber light comes on with an ECAM caution if a fault is detected in the air data reference part.

R ② IR 1 (2) (3) pb sw

OFF : Inertial data output disconnected.

R FAULT It : This amber light comes on with an ECAM caution when a fault affects the respective IR.

R Steady : the respective IR is lost.

R Flashing : the attitude and heading information may be recovered in ATT mode.





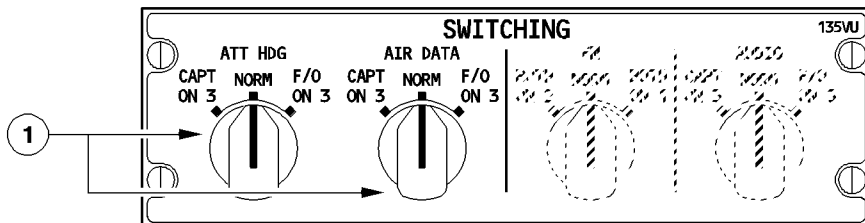
**LEFT INTENTIONALLY BLANK**





## PEDESTAL

FFC5-01-3410-007-R001AA



### ① ATT HDG and AIR DATA sel

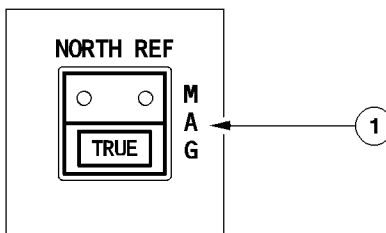
- NORM** : ADIRU 1 supplies data to PFD1, ND1, DDRMI and ATC 1.  
 ADIRU 2 supplies data to PFD2, ND2 and ATC2.
- CAPT ON 3** : ADR 3 or IR 3 replaces ADR 1 or IR 1.
- F/O ON 3** : ADR 3 or IR 3 replaces ADR 2 or IR 2.

## MAIN INSTRUMENTS PANEL

At high latitude above 82.5° North or 60.5° South (or entering the north magnetic polar region : latitude 73.5° N and longitude between 117.5° W and 92.5° W) the ADIRUs replace magnetic heading by true heading on EFIS and DDRMI.

- R In addition the GRID track appears on ND. When the aircraft is in close proximity to these regions (latitude above 82° North or 60° South or approaching the north polar region : 73° N and longitude between 90° W and 120° W) the ADIRU will trigger a message on ND "SELECT TRUE REF" requesting to change north reference.

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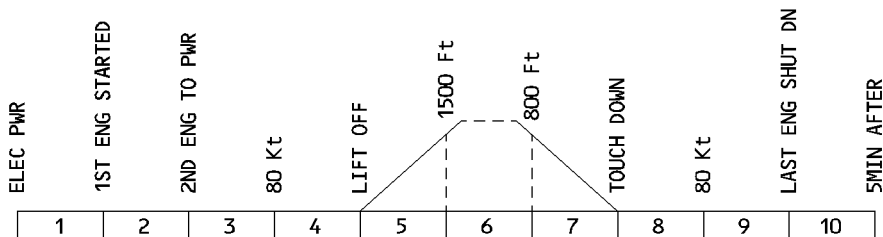
### ① NORTH REF pb sw

- TRUE (in)** : Pressing this pushbutton selects the true heading for instrument display. TRUE light comes on blue. The ND displays GRID track values if position is above 65° N or S.
- MAG (out)** : Magnetic heading is selected.



**WARNINGS AND CAUTIONS**

FFCS-01-34.10-008-A001AB



R

E/W D : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
<b>STALL WARNING (No ECAM message)</b> An aural stall warning is triggered when the AOA is greater than a predetermined angle This angle depends on – the Slats/Flap position – the Speed/Mach – the F/CTL law (normal, alternate/direct)	Cricket + STALL (synthetic voice)	MASTER WARN	NIL	NIL	NIL
<b>OVERSPEED</b> – VMO/MMO aircraft speed/mach greater than VMO + 4 kt/MMO + 0.006 – VLE aircraft speed greater than VLE + 4 kt with L/G not unlocked or L/G doors not closed – VFE aircraft speed greater than VFE + 4 kt with slats or/and flaps extended.	CRC				
ADR 1(2)(3) FAULT	SINGLE CHIME	MASTER CAUT	NIL	ADR FAULT It	1, 4, 8, 10
ADR 1+2 (1+3)(2+3) FAULT				IR FAULT It	1, 4, 5, 7, 8, 10
IR 1(2)(3) FAULT					1, 4, 8, 10
IR 1+2 (1+3)(2+3) FAULT				CHECK HDG (on ND and PFD)	4, 8
<b>HDG DISCREPANCY</b> difference between heading on CAPT and F/O displays greater than 5° in TRUE or than 7° in MAG	CHECK ATT (on PFD)				
<b>ATT DISCREPANCY</b> difference between roll or pitch angle displayed on CAPT and F/O PFD greater than 5°					
<b>ALTI DISCREPANCY</b> difference between altitude displayed on CAPT and F/O PFD greater than : – 500 ft if baro ref STD is selected – 250 ft if QNH is selected	CHECK ALT (on PFD)				

E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
EXTREME LATITUDE A/C enters in polar area, the crew must select true reference	SINGLE CHIME	MASTER CAUT	NIL	NIL	4, 5, 7, 8
BARO REF DISCREPANCY discrepancy between F/O and captain baro ref					3,4,8
IR NOT ALIGNED Problem detected during IR alignment					NIL
FM/IR POS DISAGREE discrepancy between a/c position computed by FMs and given by IRs					1, 2, 3, 4, 5, 7, 8, 9, 10

### **MEMO DISPLAY**

- “IRS IN ALIGN XXX” and “IR XXX IN ATT ALIGN” appear in green, during an IR alignment.
- “IRS IN ALIGN” :
  - Becomes amber, if engines are running
  - Flashes in green, if IRS alignment is faulty.
- “TRUE NORTH REF” appears in green, when the NORTH REF pushbutton is at TRUE. The message pulses for 10 seconds in Phase 1 or 2, or at slats’ extension.
- “ADIRS SWTG” appears in green, when either the AIR DATA or the ATT HDG selector is not in the NORM position.

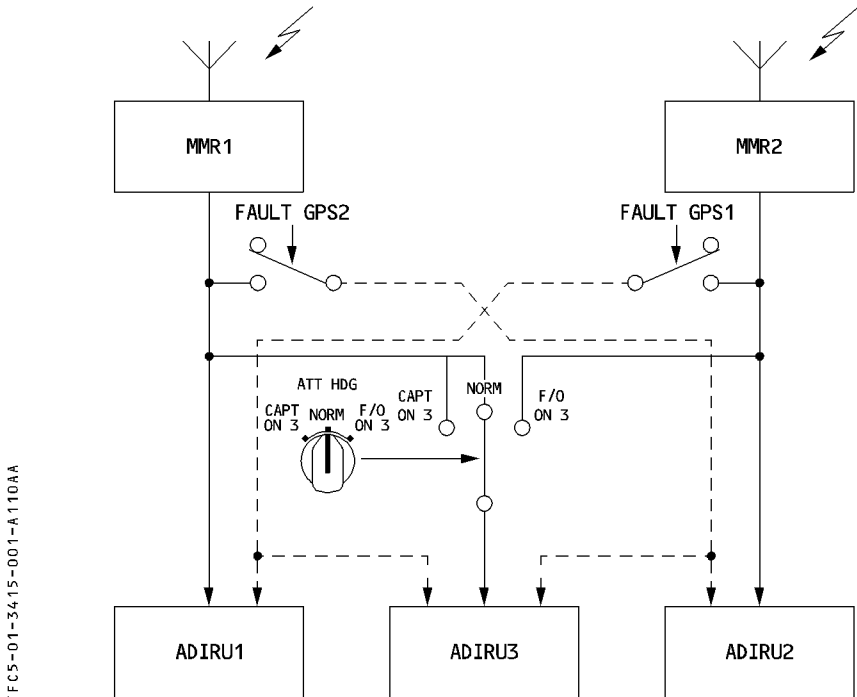
**DESCRIPTION**

The Global Positioning System (GPS) is a satellite based radio navigation aid. Worldwide 24 satellites broadcast accurate navigation data that the aircraft can use for the precise determination of its position.

The aircraft has two independent GPS receivers. Each GPS receiver is integrated in a modular avionics unit called MMR (Multi Mode Receiver) (GPS1 receiver in MMR1, GPS2 receiver in MMR2).

- R The MMR processes the data received and transfers them to the ADIRUs, which then perform a GP-IRS hybrid position calculation. The FMGCs use the hybrid position. The GPS MONITOR page on MCDU1 or MCDU2 can display pure GPS position, true track, ground speed, estimated position, accuracy level, and mode of operation for the information and use of the flight crew.

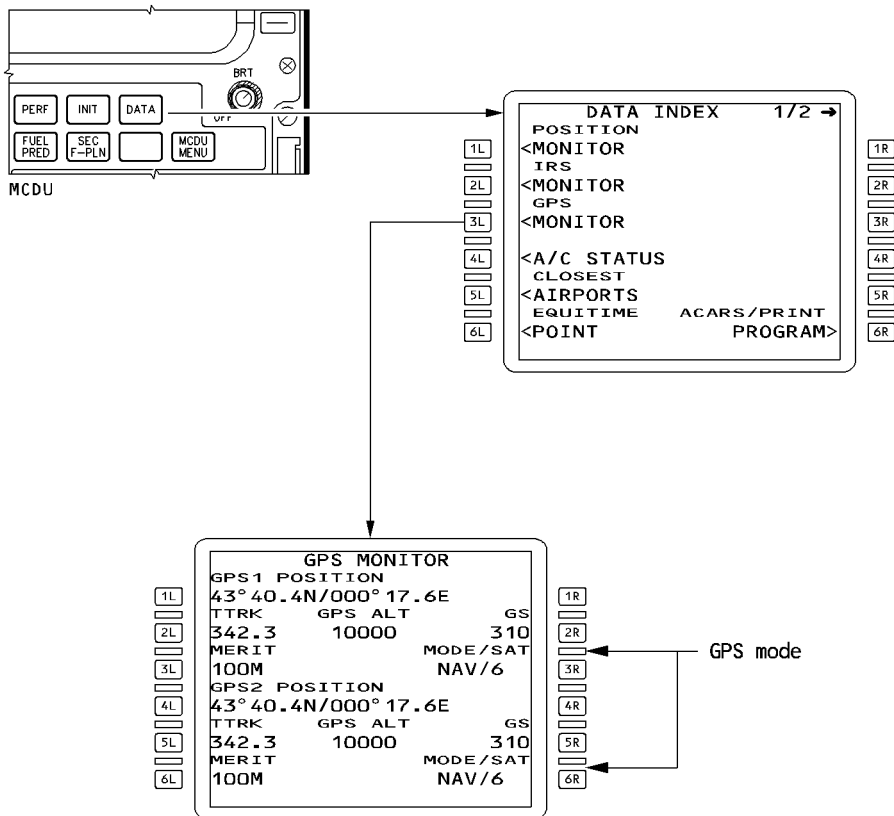
*Note* : Flight crew can use the MCDU NAVAID page to deselect the use of GPS data for calculating position. (See FCOM 4.03.20).



**NORMAL OPERATION**

In normal operation, the GPS receiver 1 supplies ADIRU 1 and ADIRU 3, the GPS receiver 2 supplies ADIRU 2.

The GPSSU operates in different modes which are indicated on the GPS MONITOR page :



FFCS-01-34.15-002-A120AA

**R** – **Initialization mode (INIT)**  
**R** When this mode is entered, the GPSSU hardware and software are initialized.

– **Acquisition mode (ACQ)**  
 The GPSSU enters in this mode after power up or during long periods of lost satellite signal. It remains in this mode until it is able to track at least four satellites, then transfers to NAV mode. To enter navigation mode more quickly, the GPSSU uses initial position, time and altitude from IRS.

- Navigation mode (NAV)**

R When the GPSSU tracks 4 or more satellites, it enters NAV mode and continually  
 R supplies data to the ADIRUs.
  
- Altitude Aiding (ALTAID)**

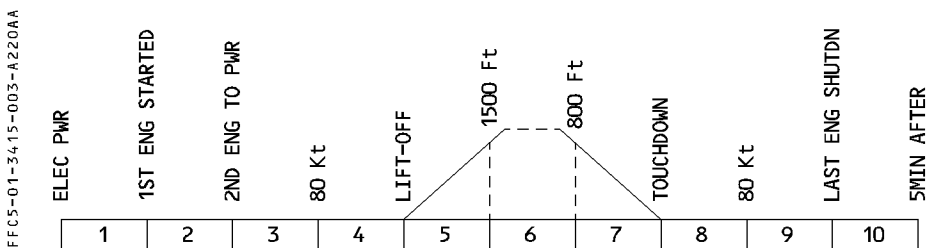
If the GPSSU can track at least four satellites, it uses the GPS altitude and the IR altitude to calculate an altitude bias.  
 If the number of satellites drops to three, the altitude bias is frozen and the GPSSU enters ALTAID mode using the IR altitude corrected with the altitude bias.  
 If, after 2 minutes, it has not acquired a fourth satellite, the GPSSU reverts to ACQ mode.
  
- Fault mode (FAULT)**

The fault mode is entered when a failure has been detected, which may prevent the GPSSU from transmitting data.

**OPERATION IN CASE OF FAILURE**

If one GPS receiver fails, the three ADIRUs automatically select the only operative GPS receiver. If ADIRU 1 fails, ADIRU 3 is supplied by GPSSU 1 and ADIRU 2 by GPSSU 2. In order to keep Side 1 and Side 2 segregation, in case ADIRU 2 fails, the ATT HDG selector has to be selected to F/O ON 3 so that ADIRU 3 will be supplied with GPSSU 2 data. If two ADIRUs fail, the remaining ADIRU is supplied by its own side GPS receiver.

**WARNINGS AND CAUTIONS**



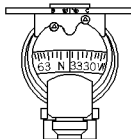
E / WD: FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
GPS 1 (2) FAULT	SINGLE CHIME	MASTER CAUTION	NIL	NIL	4, 5, 7, 8
FM/GPS POS DISAGREE (If GPS PRIMARY installed)					1, 3, 4, 10
GPS PRIMARY LOST (No ECAM warning) (If GPS PRIMARY installed)	TRIPLE CLICK During non ILS approach only	NIL		ND/MCDU message	2, 3, 4, 5, 8, 9, 10



## COMPASS

There is a compass located on top of the windshield center post.  
The deviation card is located above the compass.

FFCS-01-3420-001-A001AA

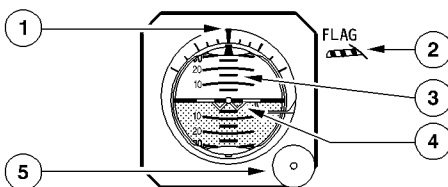


## HORIZON

The electric standby horizon normally obtains current from the DC ESS BUS. In the case of a total electrical failure, the horizon remains usable for 5 minutes.

- R Note : When leveling the wings, after performing a small turn of a small bank angle, the  
R displayed roll attitude may temporarily be incorrect by a few degrees.

FFCS-01-3420-001-B001AA



### ① Roll scale

The roll scale indicates the bank angle. It has bank angle graduations up to 60°. There is no rotation limit.

### ② Flag

The flag appears if the instrument fails or if power supply fails.

### ③ Pitch scale

The pitch scale indicates the pitch attitude. It can show pitch angle up to  $\pm 85^\circ$

### ④ Aircraft reference

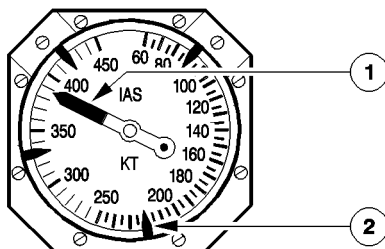
It is a fixed symbol which represent the aircraft.

⑤ Caging knob

R Flight crew pulls it out to erect the gyro, and level and center the horizon, (the airplane should be level during this procedure).

R **AIRSPEED INDICATOR**

FFCS-01-3420-002-A001AA



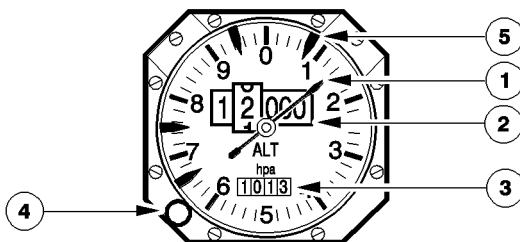
① Airspeed pointer

② Airspeed bugs (4)

R For marking of airspeed references.

R **ALTIMETER**

FFCS-01-3420-002-B001AA



① Altitude pointer

R ② Altitude counter (feet)

The very left drum is replaced :

- for altitude below 10 000 feet by white/black stripes
- for altitude below 0 feet (reference altitude) amber/black stripes.



R ③ Altimeter setting

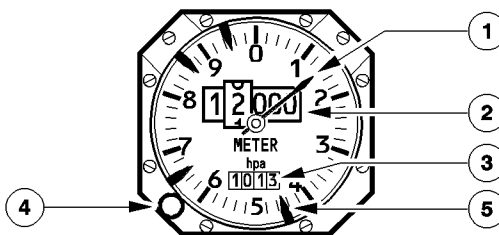
Display pressure setting in hPa.

R ④ Altimeter setting knob⑤ Altitude bugs (4)

R For marking of altitude references.

R **ALTIMETER (in meter)**

FFC5-01-3420-003-A100AA

① Altitude pointerR ② Altitude counter (meter)

The very left drum is replaced :

- for altitude below 10 000 m by white/black stripes
- for altitude below 0 m (reference altitude) by amber/black stripes

R ③ Altimeter setting

Display pressure setting in hPa.

R ④ Altimeter setting knob⑤ Altitude bugs (4)

R For marking of altitude references.

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## TUNING

The FMGC is the basic means for nav aids tuning.  
Three modes of tuning are available.

### AUTOMATIC TUNING

In normal operation, the FMGC tunes nav aids automatically, with each FMGC controlling its own receiver.

If one FMGC fails, the remaining one controls both sides receivers, after activation of the FM selector switch.

### MANUAL TUNING

The crew can use the MCDU to override the FMGCs' automatic selection and tuning of nav aids, and select a specific nav aid for visual display.

This does not affect the automatic function of the FMGC.

- R An entry on one MCDU is sent to both FMGC in dual mode, or to the remaining FMGC in
- R single mode.

### BACK UP TUNING

If both FMGCs fail, the flight crew can use the RMPs (Radio Management Panels 1 and 2) on the pedestal for back up tuning.

The CAPT RMP controls VOR 1 and ADF 1

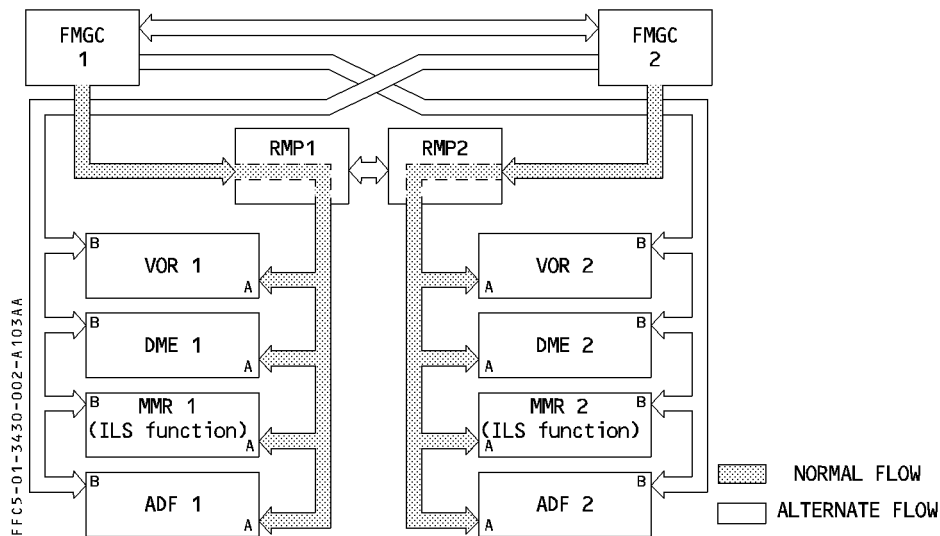
The F/O RMP controls VOR 2 and ADF 2

Each RMP controls both ILSs (provided NAV back up is selected on RMP 1 and RMP 2)

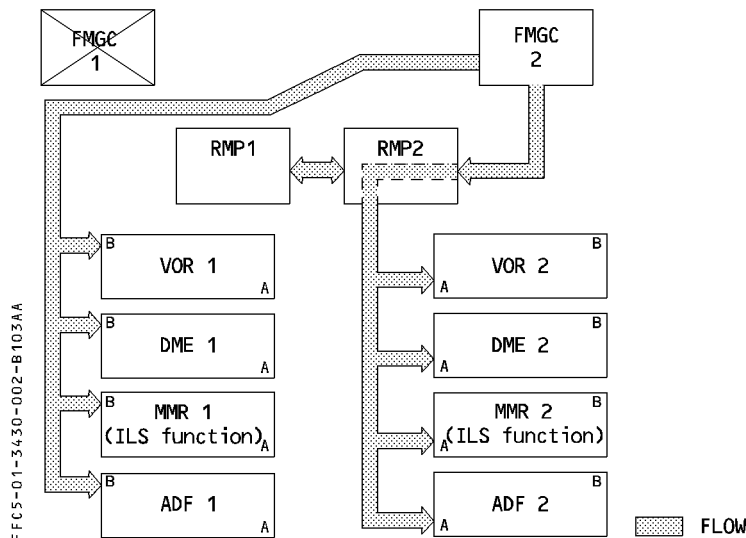
RMP 3 is not used for nav aids tuning.

**ARCHITECTURE**

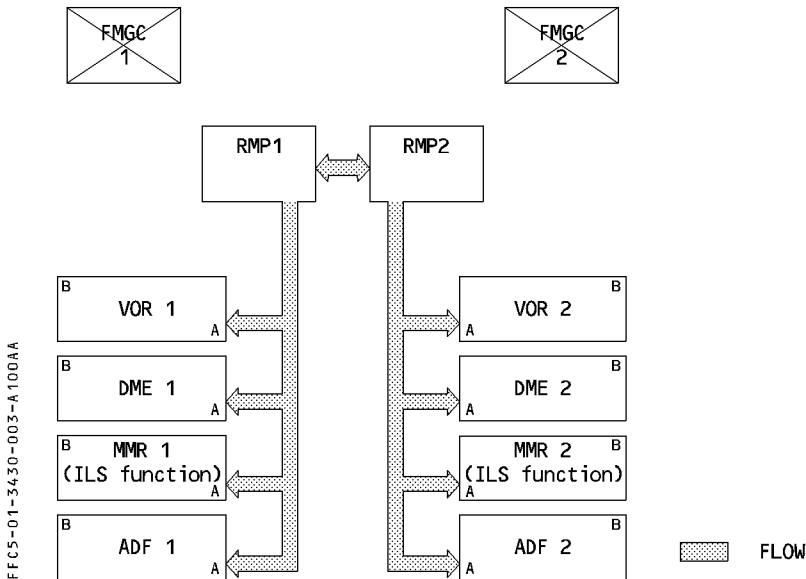
Normal operation :



FMGC 1 failure :



Backup tuning :





## NAVAIDS

### VOR

The aircraft has two VOR receivers.

(For tuning instructions, refer to the "TUNING" paragraph).

- The navigation displays (NDs) show VOR1 and VOR2 information in accordance with the position of the ADF/VOR selectors on the EFIS control panel (Refer to 1.31).
- The DDRMI on the center panel also displays VOR1 and VOR2 bearings if the heading signal is valid, in accordance with the ADF/VOR selector on the DDRMI.

### ILS

The aircraft has two ILS receivers. Each ILS receiver is integrated in a modular avionics unit called MMR (Multi Mode Receiver) (ILS1 receiver in MMR1, ILS2 receiver in MMR2).

(For tuning instructions, refer to the "TUNING" paragraph).

- PFD1 and ND2 display ILS1 information.
- PFD2 and ND1 display ILS2 information.
- R – The flight crew can display the ILS information on each PFD by pressing the LS pushbutton on the onside EFIS control panel (deviation scales and deviation indexes come on).
- R – The NDs display ILS information if the flight crew selects the ROSE LS mode on the EFIS control panel (Refer to 1.31).

### ADF

The aircraft has two ADF systems.

(For tuning instructions, refer to "TUNING" paragraph).

- The NDs display ADF1 and ADF2 information, depending on the position of the ADF/VOR selectors on the EFIS control panel. (See 1.31).
- The DDRMI also displays ADF1 and ADF2 bearings, depending on the position of the ADF/VOR selector (on the DDRMI).

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## DME

The aircraft has two DMEs.

The frequency set automatically on the DME corresponds to that set on the VOR or ILS.

Up to 5 ground stations are tuned by the FMGEC :

- Channel 1 is used for FMS radio position in VOR/DME mode
- Channel 2 and 3 for FMS radio position in DME/DME mode
- Channel 4 for VOR/DME display
- Channel 5 for ILS/DME display

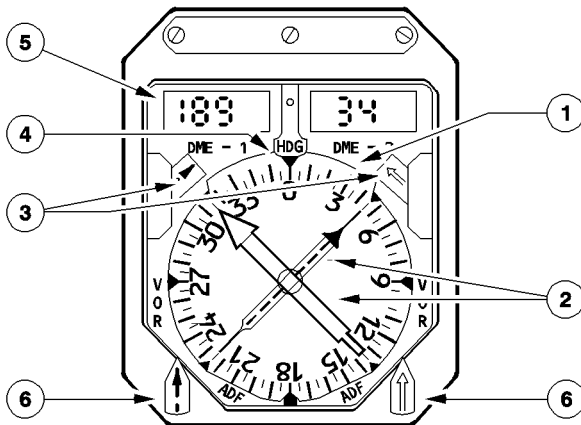
The NDs and the DDRMI can display the VOR-DME information .

- R The ILS-DME information is displayed on NDs, and PFDs when the flight crew has pressed the LS pushbutton on the EFIS control panel.

## MARKER BEACON

One marker beacon system is included in VOR receiver 1.

The PFD displays the outer, middle and inner marker signals. (Refer to 1.31).

**CONTROLS AND INDICATORS****DIGITAL DISTANCE AND RADIO MAGNETIC INDICATOR (DDRMI)**

FFCS-01-3430-006-A001AC

**① Compass card**

ADIRU 1 normally supplies the signal that positions the compass card (ADIRU 3 supplies it when selected by the ATT HDG SWITCHING selector).

Display the MAG or TRUE heading as selected by the NORTH REF pushbutton.

Above 82.5° north or 60.5° south or in the north magnetic polar region, TRUE heading is automatically selected.

**② Bearing pointers**

Indicate the magnetic bearing to the station received by VOR 1 or ADF 1 (dashed pointer) and VOR 2 or ADF 2 (double pointer).

**③ VOR/ADF 1 (2) flags**

The indicators display these flags if :

- the VOR or ADF receiver fails (VOR/ADF selector position indicates the failed receiver), or
- the RMI has an internal failure, or
- the heading signal from ADIRS is not valid, or
- the power supply fails.

Associated with the flag, the relevant pointer moves to the 3 o'clock position.

*Note :* In ELEC EMER configuration only ADF 1 or VOR 1 is available at a time, according to the position of the VOR 1/ADF 1 selector.



#### ④ HDG flag

Appears, associated with VOR/ADF flags display, when :

- R – the heading signal from the supplying ADIRS is not valid, or
- the RMI has an internal failure, or
- the power supply fails.

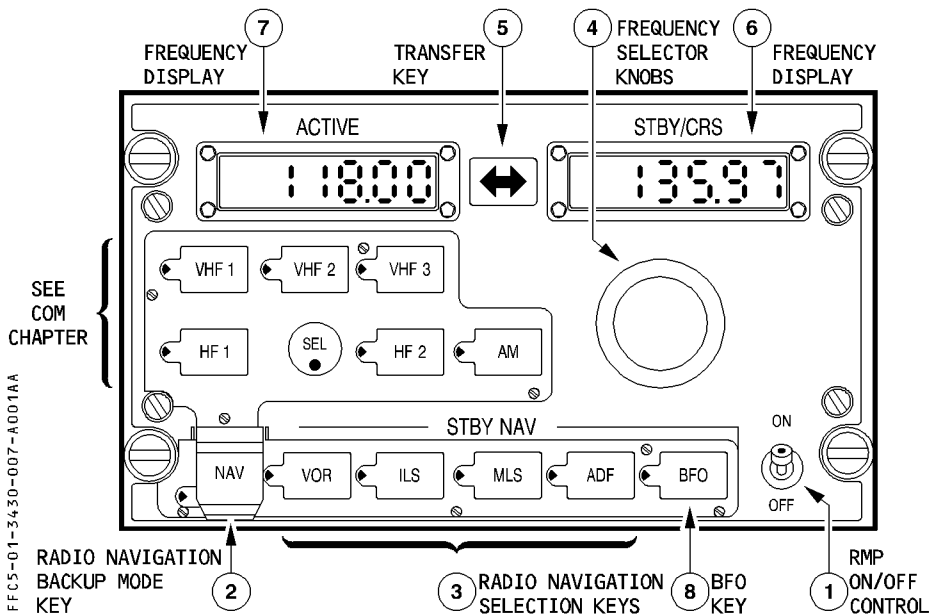
#### ⑤ DME 1 (2) counters

- R – The counters indicate distances in NM and 1/10 th at less than 20 NM. At less than 1 NM, 0 is shown.

#### ⑥ VOR/ADF selector

- VOR 1 or ADF 1 on single pointer.
- VOR 2 or ADF 2 on double pointer.

### RADIO MANAGEMENT PANEL (RMP)



#### ① ON/OFF sw

This switch controls the power supply to the panel.





## ② NAV key (transparent switchguard)

- Pressing this key engages the radio navigation backup mode. It takes control of the VOR, ILS, MLS and ADF receivers away from the FMGC and gives it to the RMP.
- The green monitor light comes on.
- Pressing the NAV key a second time returns control of the navigation radios to the FMGC.

*Note* : – The flight crew must select this backup tuning mode on both RMP1 and RMP2 if both FMGCs or both MCDUs fail. In the emergency electrical configuration, only RMP1 receives power.

- Pressing the NAV key on RMP3 (if installed) has no effect.
- In the NAV backup mode, the flight crew can select radio communication systems as it would in the normal mode.  
Setting one RMP to NAV backup mode removes nav aids tuning from both FMGCs.

## ③ STBY NAV keys

When the NAV key is on and the flight crew presses one of these STBY NAV keys, the ACTIVE window displays the frequency to which that receiver is tuned. The green monitor light on the selected key comes on, and the one on the previously selected STBY NAV or COM key goes out.

## ④ Rotating knob

Two concentric knobs allow the flight crew to preselect frequencies for communication radios and stand-by navigation systems and select courses for VOR and ILS. The desired frequency or course is set in the STBY/CRS window.

- setting frequency :  
The outer knob controls the most significant digits, the inner knob controls the least significant digits. A rate multiplier speeds up the tuning when the knob is rotated rapidly.
- setting course :  
Selected by inner knob only.

⑤ Transfer key

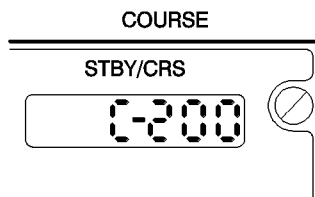
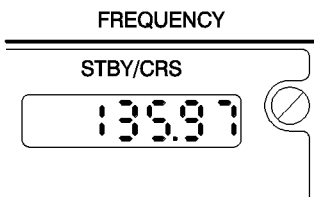
The flight crew presses this key to interchange ACTIVE and STBY frequencies. This action tunes the selected receiver to the new ACTIVE frequency.

⑥ STBY/CRS window

The flight crew can make the frequency displayed in this window become the active frequency by pressing the transfer key, or change it by rotating the tuning knob. If this window displays a course, then the ACTIVE window displays the associated frequency.

*Note : If the STBY/CRS window is displaying a course, then pressing the transfer key displays the active frequency in both windows.*

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R ⑦ ACTIVE window

This window displays the frequency of the selected navaid which is identified by a green monitor light on the selection key.

⑧ BFO key

Pressing this key activates the BFO (Beat Frequency Oscillator) if the ADF receiver is selected.

The green monitor light comes on.

R For most ADFs, with BFO activated, the audio identification is heard. However, there are  
 R some ADFs where the BFO must be deactivated, in order to hear the audio identification.

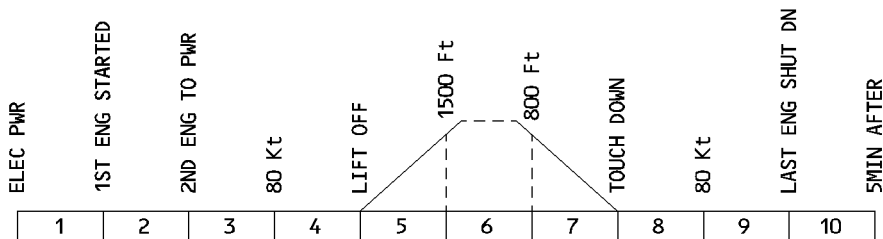


A340

SIMULATOR

### WARNINGS AND CAUTIONS

FFCS-01-3430-010-A001AB



R

E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
ILS 1 (2)(1+2) FAULT	SINGLE CHIME	MASTER CAUT	NIL	Flag on PFD and ND	3, 4, 5

**DESCRIPTION**

The aircraft has two radio altimeters which provide the height of main landing gear above ground.

Normally the CAPT PFD displays the RA1 height and the F/O PFD displays the RA2 height. If either radio altimeter fails, both PFDs display the height from the remaining one.

**INDICATIONS ON PFD**

(Refer to 1.31.40).

**AUTOMATIC CALLOUT**

FWC generates a synthetic voice for radio height announcement below 2500 feet. These announcements come through the cockpit loudspeakers even if the speakers are turned off.

**PREDETERMINED CALLOUTS**

The altitude callout uses the following predetermined threshold :

R

height (ft)	call out
2500	TWO THOUSAND FIVE HUNDRED or TWENTY FIVE HUNDRED
2000	TWO THOUSAND
1000	ONE THOUSAND
500	FIVE HUNDRED
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 (or MDA/MDH) + 100 DH (or MDA/MDH)	HUNDRED ABOVE MINIMUM

*Note : The reference altitude for callouts is the radio altitude for precision approaches (DH) and baro altitude (MDA/MDH) for non precision approaches.*

Pin programmings allow the operator to select the callouts needed.

If aircraft remains at a height that is in the detection zone for a height callout, the corresponding message is repeated at regular intervals.

**R INTERMEDIATE CALL OUT**

R If time between two consecutive predetermined call outs exceeds a certain threshold, the present height is repeated at regular intervals.

R The threshold is : 11 seconds above 50 feet

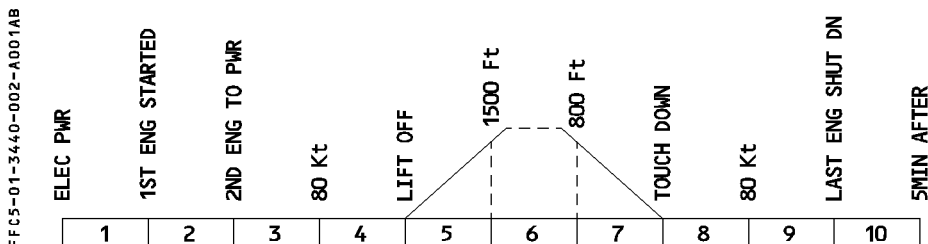
R 4 seconds below 50 feet

R The repeating interval is 4 seconds.

**R “RETARD” ANNOUNCEMENT**

R The loudspeaker announces “RETARD” at 20 feet or at 10 feet if autothrust is active

R and one autopilot is in LAND mode.

**WARNINGS AND CAUTIONS**

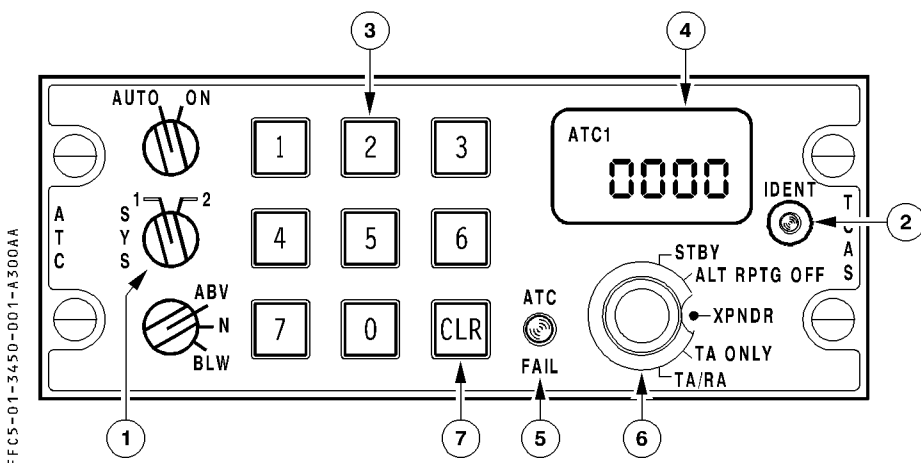
E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
RA 1 (2)(1+2) FAULT	SINGLE CHIME	MASTER CAUT	NIL	Flag on PFD	3, 4, 5, 8



## DESCRIPTION

- R The aircraft has two ATC transponders which are controlled by a dual control box on the center pedestal.  
Only the selected transponder operates.  
The associated ADR (1 for transponder 1, etc...) supplies the altitude for altitude reporting.
- R In case of a failure, ADR 3 can do this when selected by the AIR DATA SWITCHING selector.

## CONTROL PANEL



### ① XPNDR sel

- R This switch selects transponder 1 or 2.

### ② IDENT sw

- R The flight crew presses this button to send the aircraft identification signal.

**③** Pushbutton(s)

Set(s) the code that the ATC assigns.

**④** Code display

This window displays the selected code.

**⑤** ATC FAIL light

This light comes on, if the selected Transponder fails.

**⑥** Mode selector

STBY : The two ATC Transponders and the TCAS are electrically-supplied, but are not operating.

ALT RPTG OFF : No altitude data is transmitted.

XPNDR : – On ground : The selected ATC Transponder only operates in the selective aircraft interrogation mode of Mode S.

– In flight : The selected ATC Transponder operates.

Baro altitude data is transmitted.

ATC 1 uses ADR 1 or ADR 3. ATC 2 uses ADR 2 or ADR 3.

TCAS is on standby.

**⑦** CLR pushbutton

This pushbutton clears the code display.

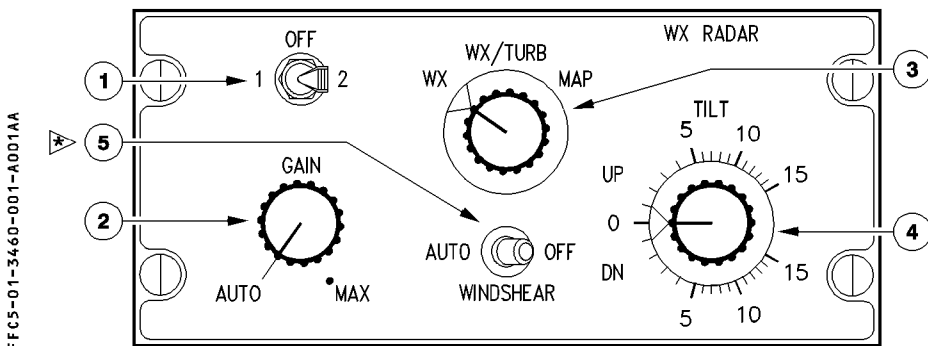
*Note : The previous code remains, until a new four-digit code is entered.*

**DESCRIPTION**

The aircraft has two weather radar systems. Only one transceiver is active. It can display the weather image on the ND in any mode except PLAN.

Each pilot may remove the weather image from his ND by setting the associated brightness control to the minimum (refer to 1.31).

R *Note* : Some aircraft may be fitted with one weather radar system only.

**CONTROL PANEL****① Transceiver 1-2 sel**

This switch allows to select one radar, or to turn both radars to off.

R *Note* : When one radar only is fitted on aircraft, no weather image will be displayed when switching on system 2.

**② GAIN knob**

This knob adjusts the sensitivity of the receiver in all modes. "AUTO" automatically adjusts the gain to the optimum setting.

**③ Mode sel**

**WX** : Weather mode : colors indicate the intensity of precipitation (black for the lowest intensity, green, amber and red indicating progressively higher intensities).

**WX/TURB** : The screen shows turbulence areas (in precipitation areas) in magenta (within 40 NM).

**MAP** : Radar operates in ground mapping mode : black indicates water, green, ground and amber, cities and mountains.





④ TILT knob

This knob controls the antenna tilt.


Zero represents the horizon as the ADIRS 1 sees it as follows :

- WS SYS 1 by ADIRS 1 (or 3 if selected)
- WS SYS 2 by ADIRS 2 (or 3 if selected)

Note : *Setting different scales on the ND reduces the sweep rate of each ND image.  
(8 seconds instead of 4 seconds)*

⑤ WINDSHEAR Sel ◀ (operative only if the windshear function is embodied)

- R AUTO : Windshear function is activated : Windshear areas will be detected by the  
R antenna scanning below 1500 feet RA even if transceiver selector (1) is set  
to OFF, and displayed on the ND.
- OFF : No windshear function.

AIRBUS TRAINING  <b>A340</b> SIMULATOR FLIGHT CREW OPERATING MANUAL	<b>NAVIGATION</b>		1.34.70	P 1
	GPWS		SEQ 110	REV 19

<b>DESCRIPTION</b>
--------------------

The Enhanced Ground Proximity Warning System (EGPWS) generates aural and visual warnings when one of the following conditions occurs at radio altitudes between 30 and 2450 feet for Modes 2, 4, 5, and between 10 and 2450 feet for Modes 1 and 3.

- Mode 1 : Excessive rate of descent.
- Mode 2 : Excessive terrain closure rate.
- Mode 3 : Altitude loss after takeoff, or go-around.
- Mode 4 : Unsafe terrain clearance, when not in landing configuration.
- Mode 5 : Excessive deviation below the glideslope.

In addition to the basic GPWS functions, the GPWS has an enhanced function (EGPWS) which provides, based on a worldwide terrain database :

- A Terrain Awareness Display (TAD), which predicts the terrain conflict, and displays the terrain on the ND.
  - A Terrain Clearance Floor (TCF), which improves the low terrain warning during landing.
- The cockpit loudspeakers broadcast, even if turned off, the aural warning or caution messages associated with each mode. The audio volume of these messages is not controlled by the loudspeaker volume knobs. (These knobs only allow volume adjustment for radio communication).

- R GPWS lights come on to give a visual warning for Modes 1 to 4, TAD, and TCF. For mode 5, the glideslope lights, on the Captain and First Officer instrument panels, come on.

*Note : A number of airports throughout the world have approaches or departures that are not entirely compatible with standard GPWS operation. These airports are identified in the envelope modulation database in such a way that when the GPWS recognizes such an airport, it modifies the profile to avoid nuisance warnings.*

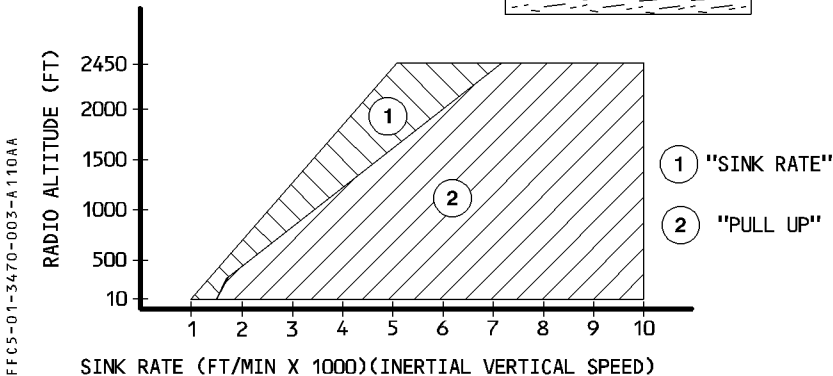
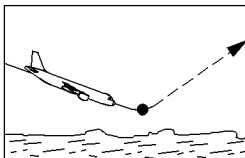
- R *This envelope uses the baro altitude in QNH or QFE reference, depending on a pin program (QFE is an option).*

- R *If the QFE option is installed, the Enhanced GPWS uses (for GPWS basic modes)*

- R *the QFE barometric reference altitude, independently of the selected barometric reference setting on the EFIS control panel.*



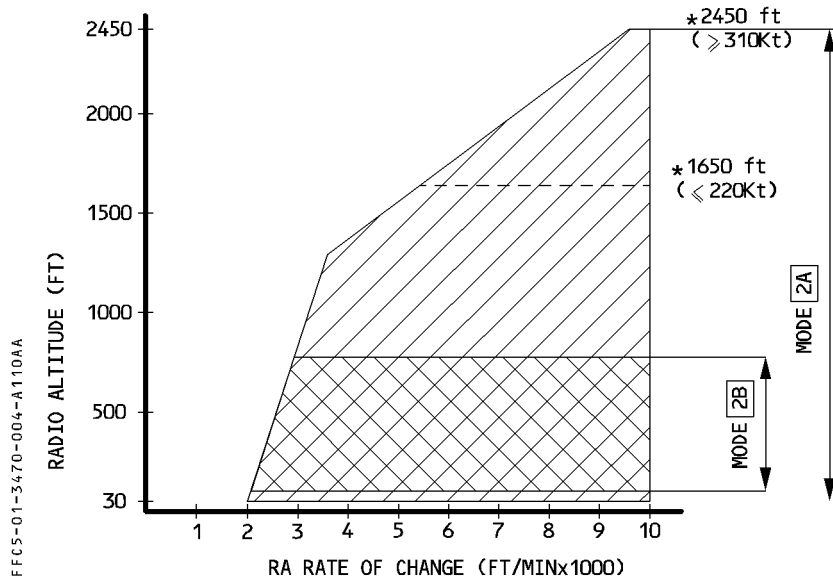
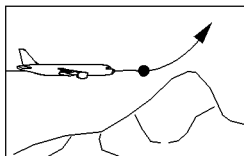
**MODE 1 : EXCESSIVE RATE OF DESCENT**



Mode 1 has two boundaries. Penetration of the first boundary generates the illumination of the GPWS lights and a repeated aural alert "SINK RATE". Penetration of the second boundary generates the repetitive "PULL UP".

The lower cut-off limit is 10 feet radio altitude.

The upper cut-off limit is 2450 feet radio altitude.

**MODE 2 : EXCESSIVE TERRAIN CLOSURE RATE**

**2A** — Flaps not in landing configuration and aircraft not on the glide slope beam. Penetration of the boundary lights up the GPWS lights and sounds the repeated aural alert: "TERRAIN".

After "TERRAIN" has sounded twice, the warning switches to "PULL UP", repeated continually until the aircraft leaves the warning envelope. After the aircraft leaves the boundary the GPWS lights stay on and the voice message "TERRAIN" persists. These alerts cease when the aircraft increases either the barometric or inertial altitude by 300 feet. If it enters another alert region during this altitude gain time, then the whole process begins again with a new reference altitude for the 300 feet altitude gain.

\* Upper cut-off limit varies from 1650 feet to 2450 feet radio altitude depending on speed (between 220 kt to 310 kt).

At certain airports, the upper boundary is limited to reduce the warning sensitivity and minimize the nuisance warnings.

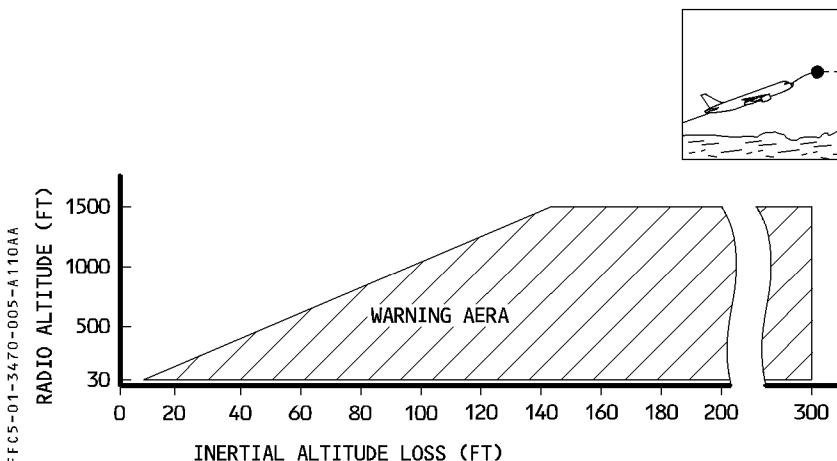


2B — Flaps in landing configuration.

Lowering the flaps to the landing position automatically switches GPWS to Mode 2B. In this case lower boundary varies between 200 feet to 600 feet depending on radio altitude rate of change. During ILS approach (glide slope deviation  $< \pm 2$  dots) the lower boundary is fixed at 30 feet.

When the aircraft enters the envelope, the alert is the same as for mode 2A. When gear and flaps are in the landing configuration, the voice message is "TERRAIN " and is not followed by "PULL UP" if the aircraft remains within the envelope.

### MODE 3 : ALTITUDE LOSS AFTER TAKEOFF



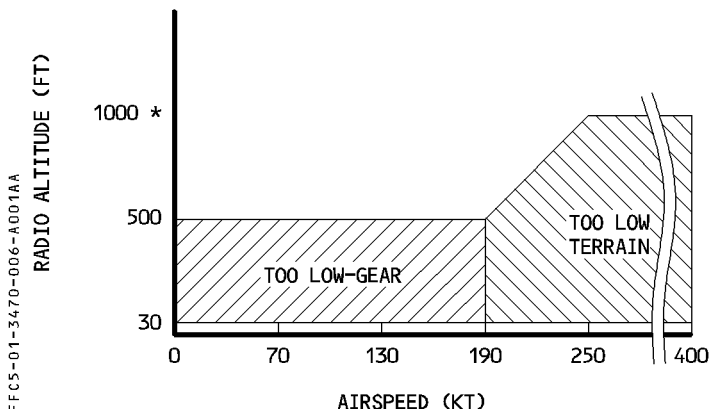
If the aircraft descends during the initial takeoff climb or during a go around, GPWS lights come on and the aural alert "DON'T SINK" sounds repeatedly.

The lower cut-off limit is 30 feet radio altitude.

Mode 3 is desensitized according to the time accumulated after departure and the radio altitude.

**MODE 4 : UNSAFE TERRAIN CLEARANCE WHEN NOT IN LANDING CONFIGURATION :**

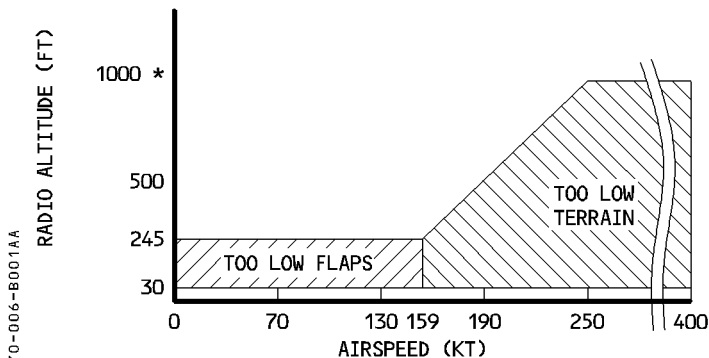
R 4A - Landing gear up :



Two aural warnings may be triggered, depending on the area : "TOO LOW-GEAR" or "TOO LOW-TERRAIN". In addition, the GPWS lights come on.

R  
R  
R

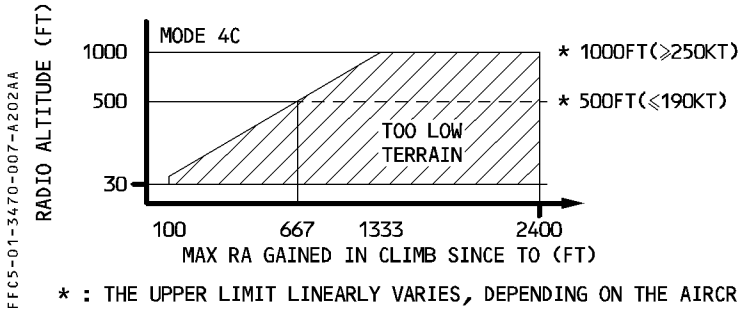
4B - Landing gear down, and flaps not in landing configuration.



- \* - OTHER MAXIMUMS ARE USED AT CERTAIN AIRPORTS TO MINIMIZE NUISANCE WARNINGS.
- THIS MAXIMUM IS ALSO REDUCED TO 800feet WHEN AN OVERFLIGHT IS DETECTED.

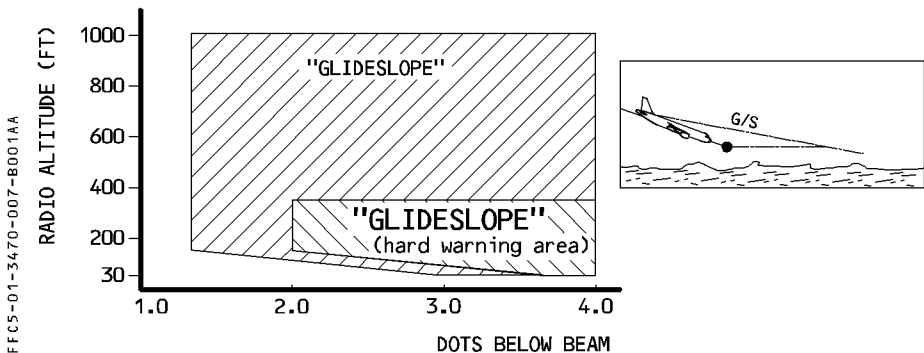
R Three aural warnings may be generated, depending on the area and the configuration :  
R "TOO LOW-GEAR", "TOO LOW-FLAPS" or "TOO LOW-TERRAIN". In addition, the GPWS  
R lights come on.

R 4 C – Landing gear up, or flaps not in landing configuration.



If the aircraft starts an inadvertent controlled flight into the ground during takeoff and climb, and penetrates the boundary, then the GPWS lights come on and the “TOO LOW TERRAIN” aural alert sounds repeatedly.

### MODE 5 : DESCENT BELOW GLIDESLOPE



R Note : Normally, the *GLIDESLOPE* alert is only triggered with the gear down. For a few airports, the gear down logic requirement is deleted, and other upper limits are used to increase the warning envelope.

In both areas, the alert is a repeated “GLIDESLOPE” aural messages, and both G/S lights come on. The loudness and the repetition rate of the aural message increase, when the aircraft enters the hard warning areas.

The mode is armed, when ILS1 receives a valid signal.

Pressing the GPWS-G/S pushbutton cancels the warning. This is temporary and the mode is automatically reactivated for a new envelope penetration.

The upper cut-off limit is 1000 feet radio altitude.

The lower cut-off limit is 30 feet radio altitude.



**EGPWS FUNCTIONS****TERRAIN AWARENESS AND DISPLAY**

The Terrain Awareness and Display (TAD) function computes a caution and a warning envelope ahead of the aircraft, according to the aircraft altitude, the nearest runway altitude, the range to the nearest runway threshold, the ground speed, and the turn rate. When the boundary of these envelopes conflicts with the terrain memorized in the database, the system generates the relevant alert :

Alert Level	Aural Warning	ND (refer to 1.31.45)	Local Warning
Warning	TERRAIN AHEAD, PULL UP	<ul style="list-style-type: none"> <li>– Automatic terrain display *</li> <li>– Solid red areas</li> <li>– TERR AHEAD (red)</li> </ul>	The pb light comes on on each pilot's instrument panel
Caution	TERRAIN AHEAD	<ul style="list-style-type: none"> <li>– Automatic terrain display *</li> <li>– Solid yellow areas</li> <li>– TERR AHEAD (amber)</li> </ul>	

- \* When the TERR ON ND switch is selected ON, the ND displays the terrain memorized in the database according to the aircraft position, when ARC or ROSE mode is selected. The terrain is displayed in various densities of green, yellow, red, or magenta, depending on the threat (see 1.31.45, INDICATIONS ON ND). When an alert is generated (either caution or warning) and TERR ON ND is not selected, the terrain is automatically displayed, and the ON light of the TERR ON ND pushbutton will come on.

Note : 1. When TERR ON ND is selected, the weather radar display image is not displayed, even if the weather radar is ON.

2. The relative height of the aircraft is computed by using the Captain's baro setting. Thus, the Terrain Awareness Display (TAD) does not protect against baro setting errors.

3. The TAD and Terrain Clearance Floor (TCF) functions operate using the FMS 1 position. Thus, the system does not protect against an FMS 1 position error.

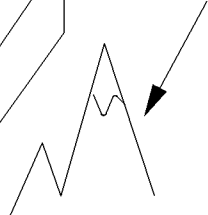
**TERRAIN CAUTION AND WARNING ENVELOPE BOUNDARIES**

FFCS-01-3470-009-A110AA



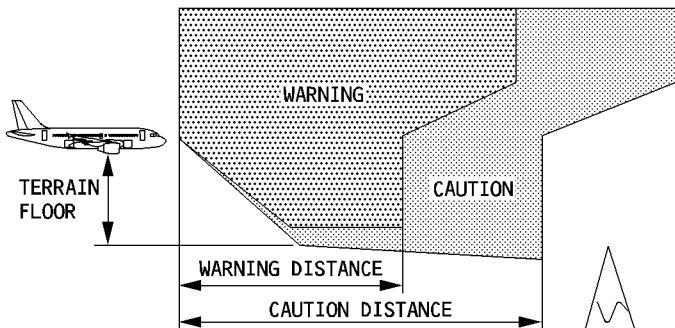
TERRAIN FROM THE TERRAIN DATABASE.

IF THE CAUTION OR WARNING ENVELOPE CONFLICTS WITH THE TERRAIN IN THE TERRAIN DATABASE, THEN A WARNING OR CAUTION IS TRIGGERED



**VERTICAL ENVELOPE**

R

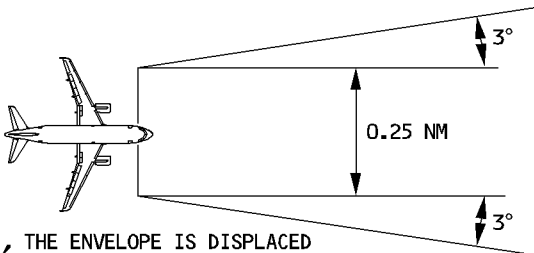


FFCS-01-3470-009-B110AA

TERRAIN FLOOR VARIES WITH DISTANCE AND ALTITUDE TO NEAREST AIRPORT. WARNING AND CAUTION DISTANCES VARY WITH GROUND SPEED AND TURN RATE. WARNING DISTANCE IS APPROX. 30 SECONDS. CAUTION DISTANCE IS APPROX. 60 SECONDS.

**HORIZONTAL ENVELOPE**

R

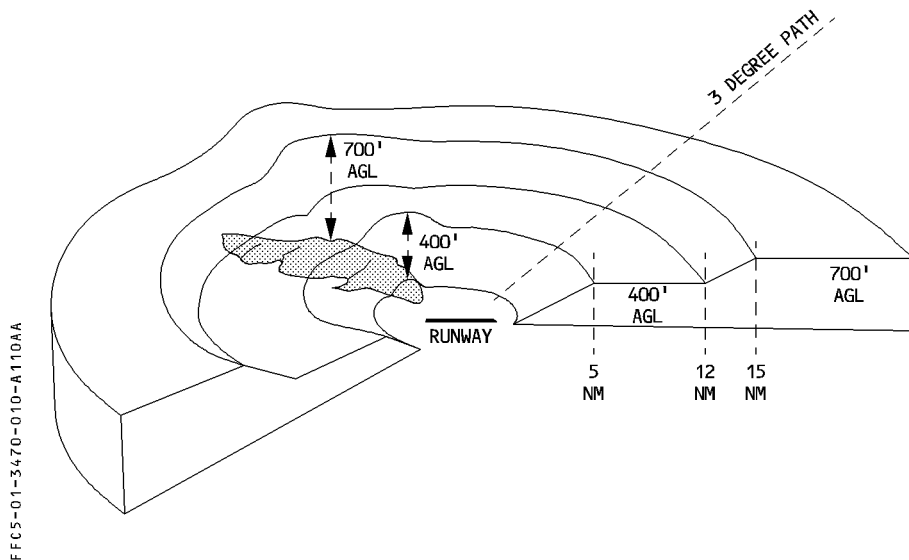


FFCS-01-3470-009-C110AB

DURING TURNS, THE ENVELOPE IS DISPLACED TO LOOK ALONG THE AIRCRAFT FLIGHT PATH.

**TERRAIN CLEARANCE FLOOR**

A terrain clearance floor envelope is stored in the database for each runway for which terrain data exist. The Terrain Clearance Floor (TCF) function warns of a premature descent below this floor, regardless of the aircraft's configuration.



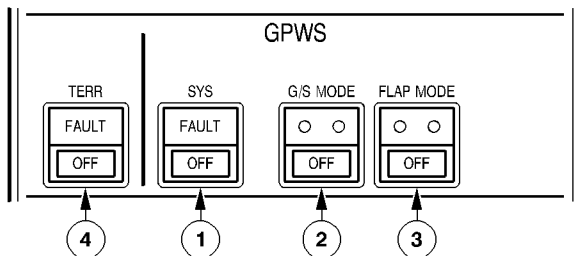
R If the airplane descends below this floor, a TOO LOW TERRAIN aural warning sounds, and the GPWS lights come on, on the glareshield.



## CONTROLS AND INDICATORS

### OVERHEAD PANEL

FFCS-01-3470-011-A110AA



#### ① SYS pb sw

OFF : All basic GPWS alerts (Mode 1 to 5) are inhibited.

FAULT It : This amber light comes on, along with an ECAM caution, if the basic GPWS mode 1 to 5 malfunction.

*Note : If ILS 1 fails, only mode 5 is inhibited. Consequently, the FAULT light does not come on and the GPWS FAULT warning is not triggered.*

#### ② G / S MODE pb sw

OFF : Glide slope mode (mode 5) is inhibited.

#### ③ FLAP MODE pb sw

OFF : Flap mode ("TOO LOW FLAPS" mode 4) is inhibited.

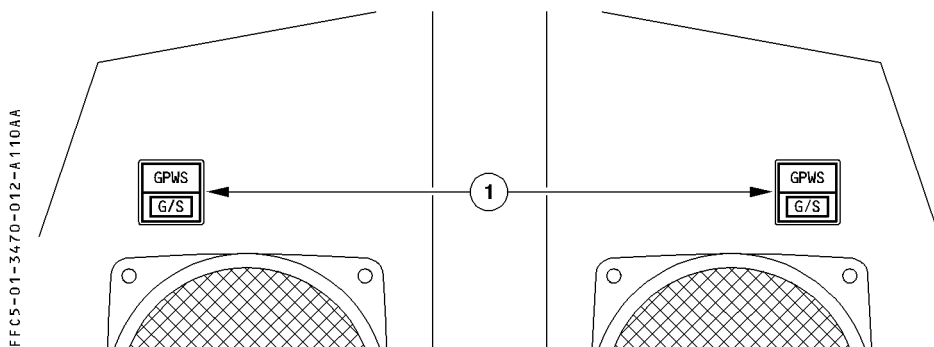
(To avoid nuisance warning in case of landing with reduced flaps setting).

Moreover if LDG CONF 3 is selected on MCDU the flap mode will be automatically inhibited when FLAPS 3 position is reached.

#### ④ TERR pb sw

OFF : Inhibits the Terrain Awareness Display (TAD) and Terrain Clearance Floor (TCF) modes, and does not affect the basic GPWS mode 1 to 5.

FAULT It : This amber light comes on, along with an ECAM caution, if the TAD or TCF mode fails.. The basic GPWS mode 1 to mode 5 are still operative if the SYS pushbutton switch lights OFF or FAULT are not illuminated.

**MAIN INSTRUMENTS PANEL****① GPWS – G/S pb**

**GPWS** : This red light comes on when any mode from 1 to 4 or TAD or TCF alert is activated. The corresponding aural warning sounds.

**G/S** : This amber light comes on when mode 5 is activated. The "GLIDE SLOPE" aural warning sounds.

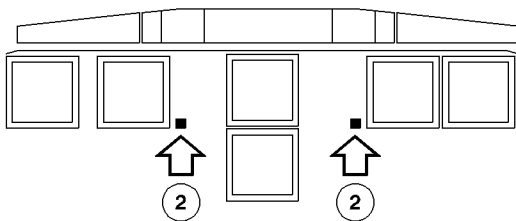
**Note** : 1. If the flight crew presses this button briefly when a glide slope warning is on, the G/S light goes out and the "GLIDE SLOPE" aural warning (soft or loud) stops.

2. The GPWS can be tested by pressing this pushbutton. If the pushbutton is pressed briefly, some of the aural warnings sound and pushbutton captions, related to the GPWS, come on. If the pushbutton is pressed continuously, then all the aural warnings sound.

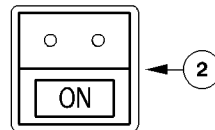


R

FFCS-01-3470-013-A110AA



TERR ON ND



## ② TERR ON ND pb

These pushbuttons are located on either side of the ECAM. Each pushbutton controls the onside terrain display.

ON : The terrain is displayed on the ND if :

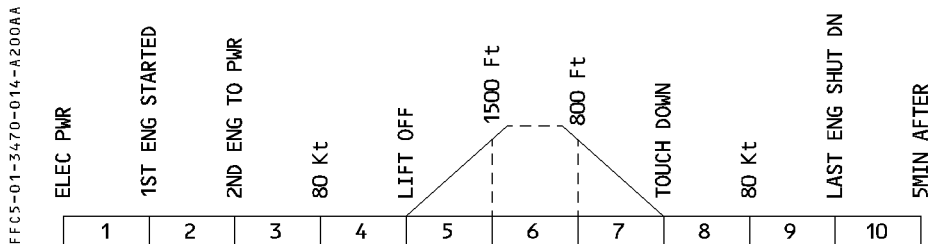
- R
- R
- TERR pushbutton is selected ON, and
  - TERR FAULT light is not on.

The ON light comes on.

OFF : The terrain data is not displayed on the ND.

Note : · If the Terrain Awareness Display (TAD) mode generates a caution or a warning while the TERR ON ND is not switched ON, the terrain is automatically displayed on the NDs (see EGPWS specific caution and warning due to TAD mode) and the ON light of the TERR ON ND pushbutton will come on.

- To differentiate between the terrain and the weather display, the terrain display sweeps from the center outward to both sides of the ND.

**WARNINGS AND CAUTIONS**

R

E / WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
GPWS FAULT	SINGLE CHIME	MASTER CAUT	NIL	GPWS SYS FAULT It	1, 3, 4, 5, 8
GPWS TERR DET FAULT The enhanced terrain detection function is inoperative. The basic GPWS mode 1 to 5 are still operative.				GPWS TERR FAULT It	1, 3, 4, 5 8,10

**MEMO DISPLAY**

- R GPWS FLP OFF is displayed in green when GPWS FLAP MODE pushbutton switch is OFF. TERR STBY appears in green when the aircraft position accuracy (provided by the FMS) is not sufficient to allow the enhanced TCF and TAD modes to operate. These modes are not available until the TERR STBY memo disappears. If selected, the terrain data display on ND is automatically deselected when the TERR STBY memo is triggered.”



## DESCRIPTION

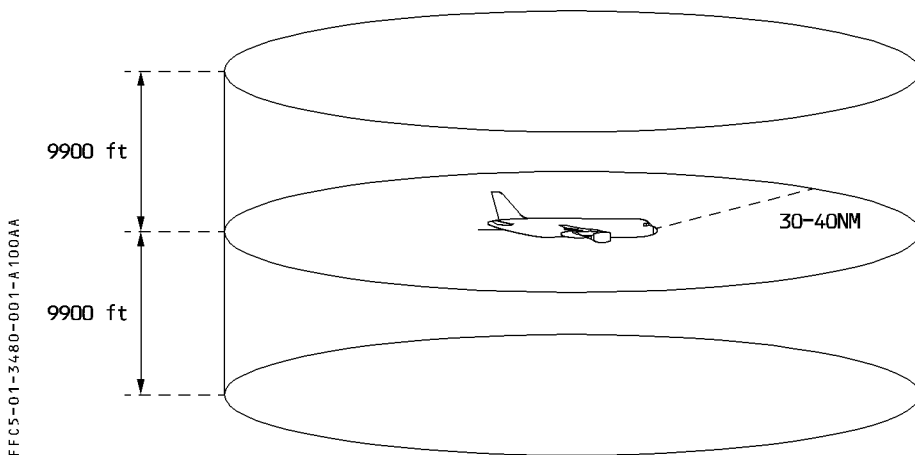
### GENERAL

The TCAS (Traffic alert and Collision Avoidance System) :

- Detects any aircraft equipped with a transponder, flying in its vicinity ;
- Displays potential and predicted collision targets ;
- Issues vertical orders to avoid conflict.

The TCAS is normally independent of the ground-based air traffic control system.

- R The TCAS detection capability is limited to intruders flying within a maximum range of  
 R 30-40 NM (depending on aircraft configuration and external conditions), and within a  
 R maximum altitude of 9 900 feet above and below the threatened aircraft.





**MAIN COMPONENTS**

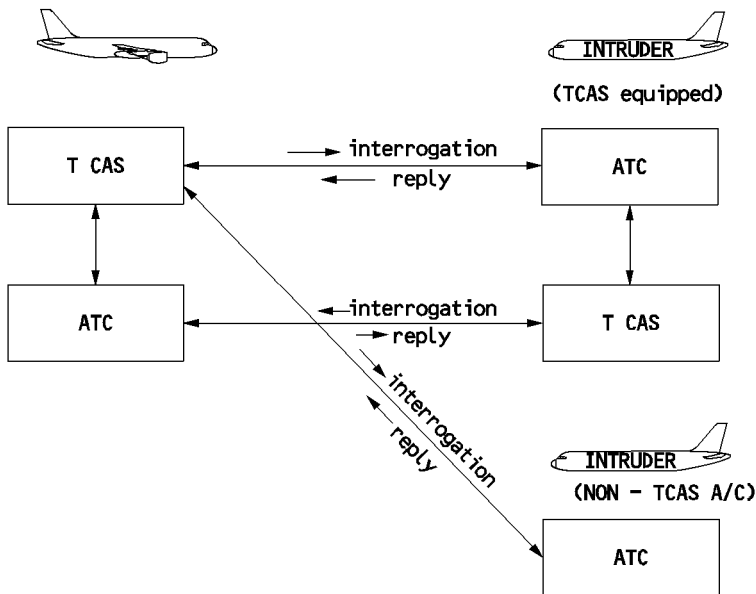
The system includes :

- a single channel TCAS computer
- two TCAS antennas
- two mode S ATC transponders, one active the other in standby.

These transponders allow :

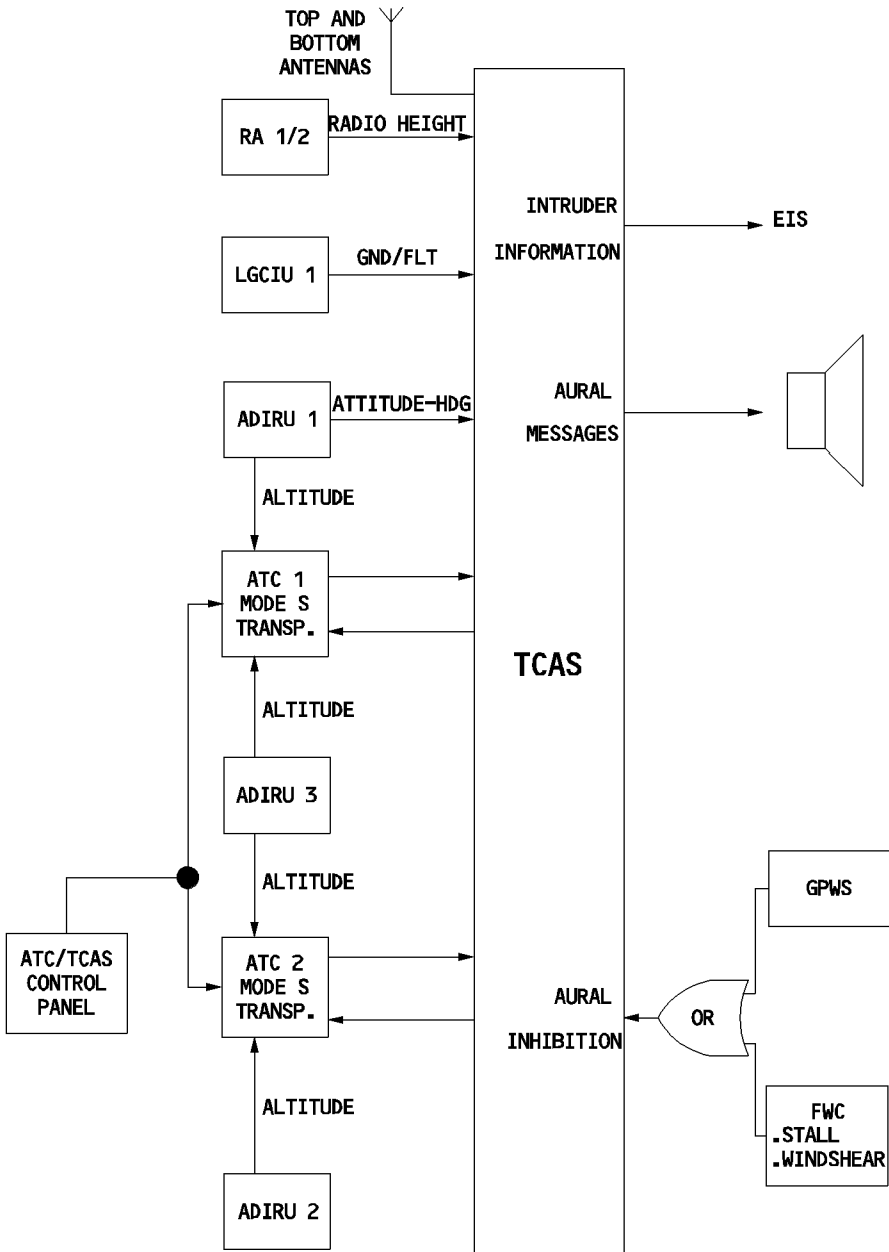
- interface between the ATC/TCAS control panel and the TCAS computer
- communication between the aircraft and intruders equipped with a TCAS system

- an ATC/TCAS control panel



FFCS-01-3480-002-A100AA

R



FFC5-01-3480-003-A100AC

**PRINCIPLE**

The TCAS interrogates transponder of intruders. From the transponder replies, the TCAS determines for each intruder:

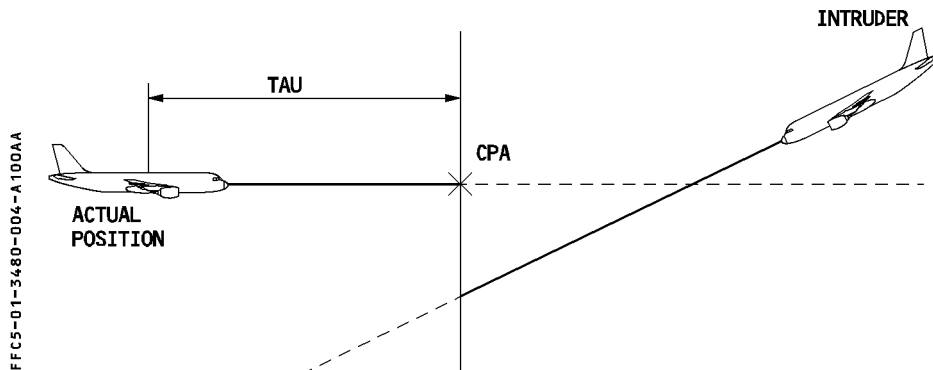
- its relative bearing
- its range and closure rate
- its relative altitude if available (ATC mode C or S).

Then the TCAS computes the intruder trajectory, the Closest Point of Approach (CPA) and the estimated time (TAU) before reaching the CPA.

Each time the relative position of the intruder presents a collision threat, aural and visual advisories are triggered.

TCAS optimizes vertical orders to ensure a sufficient trajectory separation and a minimal vertical speed variation considering all intruders.

R



## INTRUDER CLASSIFICATION

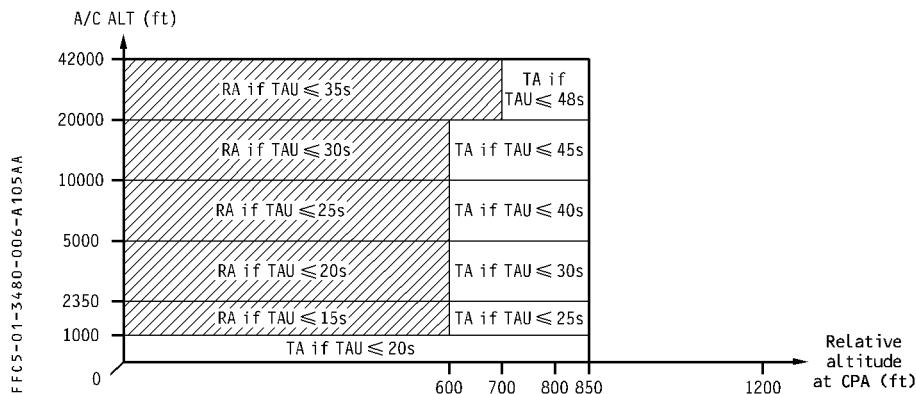
The intruders are classified in four levels :

LEVEL	INTRUDER POSITION	DISPLAYED INFORMATION
Proximate intruder	<ul style="list-style-type: none"> <li>– no collision threat</li> <li>– intruder in vicinity to aircraft (closer than 6 NM in lateral and <math>\pm 1\ 200</math> ft in vertical direction)</li> </ul>	<ul style="list-style-type: none"> <li>– ND : intruder position</li> </ul>
Traffic Advisory (TA)	<ul style="list-style-type: none"> <li>– potential collision threat</li> <li>– TAU is about 40 seconds</li> </ul>	<ul style="list-style-type: none"> <li>– ND : intruder position</li> <li>– Aural message</li> </ul>
Resolution Advisory (RA)	<ul style="list-style-type: none"> <li>– real collision threat</li> <li>– TAU is about 25 seconds</li> </ul>	<ul style="list-style-type: none"> <li>– ND : intruder position</li> <li>– Aural messages</li> <li>– PFD : vertical orders</li> <li>. Maintain actual V/S (Preventive Advisory)</li> <li>or</li> <li>. Modify V/S (Corrective Advisory)</li> </ul>
Other intruders	<ul style="list-style-type: none"> <li>– no collision threat</li> <li>– intruder within a range greater than 6 NM or above <math>\pm 1200</math> feet in vertical direction</li> <li>– any non proximate, TA, RA intruders within the surveillance envelope (lateral range : closer than 30 Nm vertical range : refer to 1-34-80 p 7)</li> </ul>	<ul style="list-style-type: none"> <li>– ND : intruder position</li> </ul>



## TA / RA THRESHOLDS

**FOR INFO**



## TCAS MODES

TCAS has 2 modes of operation :

**TA/RA** : Selected on the ATC/TCAS panel ; this mode allows the display of all intruders.


**TA** : Can be selected by :

- The crew, on the ATC/TCAS panel, in case of aircraft degraded performance (engine failure, landing gear extended), or when operating near closely-spaced parallel runways, or
- The special equipped ground stations, via ATC transponder uplink command, or
- Automatically, when the following priority messages are triggered :
  - Stall
  - GPWS messages.

Consequently :

- All RAs are inhibited and converted into TAs.
- The TA threshold is set to  $TAU \leq 20$  seconds, irrespective of the aircraft's altitude.
- No vertical speed advisories are indicated on the PFD.
- "TA ONLY" is displayed on the NDs.

In case priority messages are triggered, all TCAS aural messages are suppressed.

AIRBUS TRAINING  <b>A340</b> SIMULATOR FLIGHT CREW OPERATING MANUAL	<b>NAVIGATION</b>		1.34.80	P 7
	TCAS		SEQ 105	REV 14

### **ADVISORY INHIBITION**

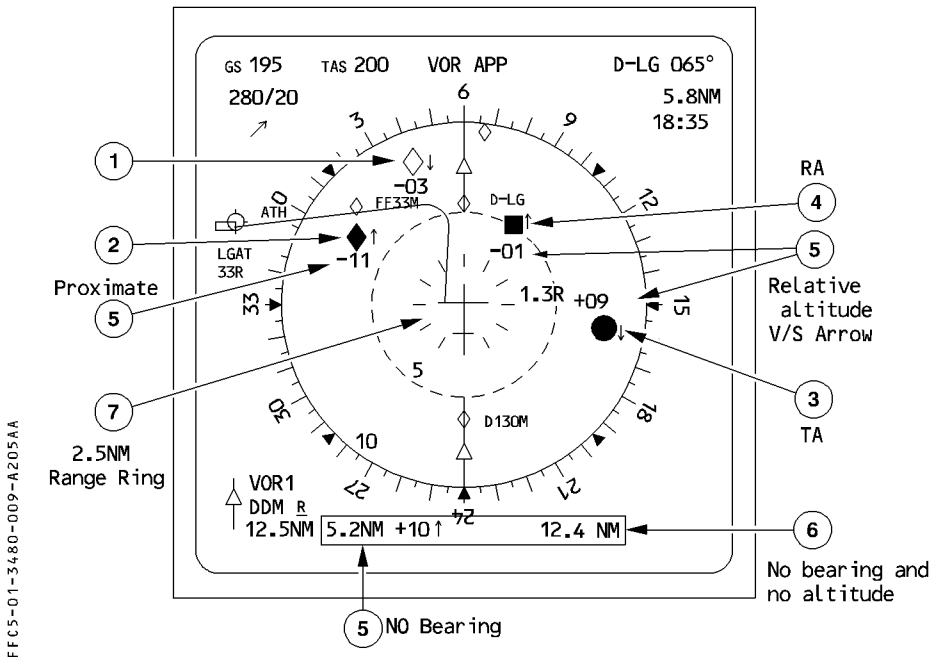
Some advisories are inhibited, depending on the aircraft altitude :

- All intruders flying below 380 feet AGL, when the own aircraft altitude is below 1700 feet AGL.
- R – All RA aural messages below 1100 feet AGL in climb, and 900 feet AGL in descent. In this case, the RAs are converted into TAs.
- R – “Descend” type advisory below 1200 feet AGL in climb, or 1000 feet AGL in descent.
- R – “Increase Descent” RA below 1650 feet AGL in climb, or 1450 feet AGL in descent.
- All TA aural messages below 500 feet AGL.



**ND INDICATIONS**

The traffic is displayed in all ROSE modes and ARC mode whatever NM range is selected. Only the eight most threatening intruders are displayed.

**① Other intruder**

Indicated by a white empty diamond.

**② Proximate intruder**

Indicated by a white filled diamond.

**③ TA intruder**

Indicated by an amber circle.

Associated with the "TRAFFIC-TRAFFIC" aural message.



**④** RA intruder

Indicated by a red square.

Associated with vertical orders displayed on the PFD and aural messages.

Note : *If the range of an intruder is not available, the intruder is not displayed.  
An intruder may be partially displayed when its range is out of scale.*

**⑤** Relative altitude/Vertical Speed arrow

Relative altitude : indicated in hundred of feet above or below the symbol depending on the intruder position.

Vertical speed arrow : displayed only if the intruder vertical speed is greater than  $\pm 500$  ft/min

Relative altitude and vertical speed arrow are displayed in the same color as the associated intruder symbol.

Note : *If the altitude of an intruder is not available, neither altitude nor vertical speed indications are displayed.*

**⑥** No Bearing Intruder

If the bearing of TA or RA intruder is not available the following data is presented in digital form at the bottom of the ND :

- range
- relative altitude and vertical speed arrow if available.

Displayed amber or red according to threat level.

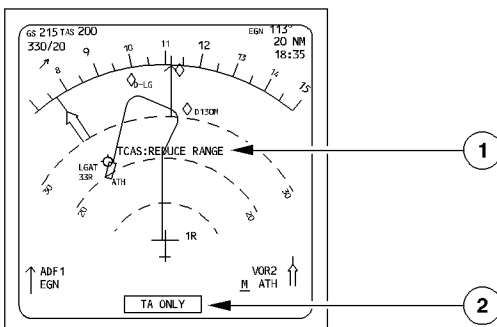
**⑦** Range Ring

A 2.5 NM white range ring is displayed when a 10 or 20 NM range is selected.



## TCAS MESSAGES

FFCS-01-34.80-011-A100AA



### ① Mode and range messages

The following messages may be displayed to get the pilot's attention :

**TCAS : REDUCE RANGE** : Displayed, when a TA or RA is detected, and the ND range is above 40 NM.

**TCAS : CHANGE MODE** : Displayed, when a TA or RA is detected, and the ND mode is PLAN.

It is displayed in amber or red, depending on the advisory level (TA or RA).

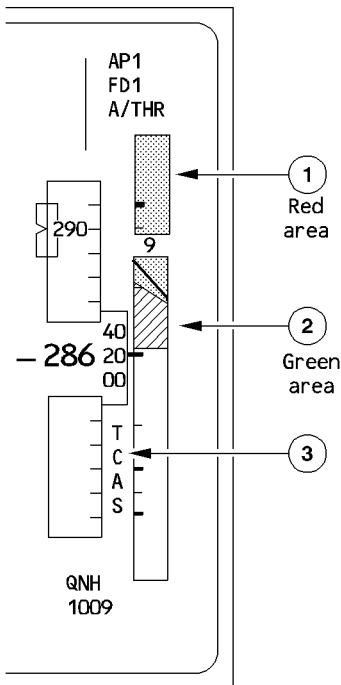
### ② TCAS operation messages

- R TCAS : It is displayed in red, in case of an internal TCAS failure. It flashes for 9 seconds, then remains steady.
- R TA ONLY : It is displayed in white, when selected by the crew.

**PFD INDICATIONS**

- R In case of RA detection, the PFD presents vertical orders on the vertical speed scale. The vertical speed scale back ground which is normally grey may be partially replaced by green and/or red areas.
- R and/or red areas.

Note : When TCAS information has to be displayed on the vertical speed scale, the grey background of the air speed and heading scales are removed.



① Red area

Indicates the vertical speed where risk of conflict is high.

② Green area

Indicates the recommended vertical speed range ("FLY TO" sector).

Note : – The aircraft can also fly in the grey vertical speed range without risk of conflict (preventive RA).

R

### ③ TCAS message

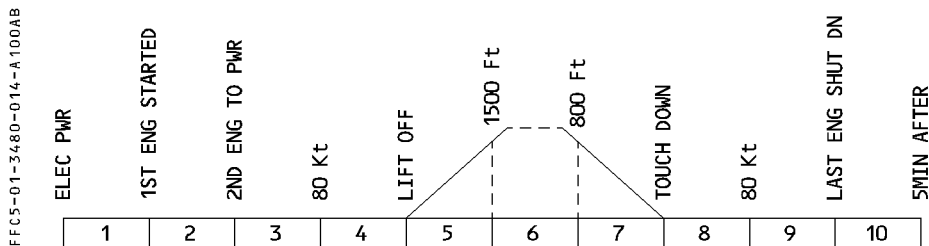
It appears in red, when the TCAS cannot provide RA data, or in case of a TCAS internal failure.

*Note : When within the red area, the vertical speed needle and digits change to red, but in a different pattern, so that it is possible to clearly distinguish them from the background.*

## AURAL MESSAGES

TA/RA detection is associated with the following messages :

- |   |  |
|---|--|
| <p>“TRAFFIC TRAFFIC”</p> <p>“CLIMB CLIMB”</p> <p>“CLIMB, CROSSING CLIMB” (twice)</p> <p>“INCREASE CLIMB” (twice)</p> <p>“DESCEND DESCEND”</p> <p>“DESCEND, CROSSING DESCEND” (twice)</p> <p>“INCREASE DESCEND” (twice)</p> <p>“ADJUST VERTICAL SPEED, ADJUST”</p> <p>R</p> <p>“CLIMB, CLIMB NOW” (twice)</p> <p>“DESCEND, DESCEND NOW” (twice)</p> <p>“MONITOR VERTICAL SPEED”</p> <p>“MAINTAIN VERTICAL SPEED, MAINTAIN”</p> <p>“MAINTAIN VERTICAL SPEED ...<br/>CROSSING MAINTAIN”</p> <p>“CLEAR OF CONFLICT”</p> | <p>: Only in case of TA detection.</p> <p>: Climb at the vertical speed indicated by the green area on the PFD.</p> <p>: Same as above. Indicates that you will cross through the intruder altitude.</p> <p>: Triggered after the CLIMB message, if the vertical speed is insufficient to achieve safe vertical separation.</p> <p>: Descend at the vertical speed indicated by the green area on the PFD.</p> <p>: Same as above. Indicates that you will cross through the intruder altitude.</p> <p>: Triggered after the DESCEND message, if the vertical speed is insufficient to achieve safe vertical separation.</p> <p>: Adjust the vertical speed to that indicated by the green area of the PFD, reducing climb vertical speed or descent vertical speed, as appropriate.</p> <p>: Triggered after the DESCEND message, if the intruder trajectory has changed.</p> <p>: Triggered after the CLIMB message, if the intruder trajectory has changed.</p> <p>: Ensure that vertical speed remains outside the red area. Triggered only once, in case of preventive RA.</p> <p>: Maintain the vertical speed indicated on the green area of the PFD.</p> <p>: Maintain the vertical speed indicated on the green area of the PFD. Indicates that you will cross through the intruder altitude.</p> <p>: The range increases, and separation is adequate. Return to assigned clearance.</p> |
|---|--|

**WARNINGS AND CAUTIONS**

E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLT PHASE INHIB
TCAS FAULT	NIL	NIL	NIL	Flag on PFD and ND	3, 4, 5, 7, 8

**MEMO DISPLAY**

TCAS STBY appears in green when :

- R – the crew selects TCAS STBY on ATC/TCAS panel, or
- R – both ATC or RA fail, or
- R – the crew turns OFF the ALT RPTG switch.

**BUS EQUIPMENT LIST****FOR INFO**

		NORM			EMER ELEC		
		AC	DC	DC BAT	AC ESS	DC ESS	HOT
ADIRU	ADIRU 1				X		HOT 1 (1)
	AOA RESOLVER 1				X (2)		
	ADIRU 2	AC2-3					HOT 2 (1) during 5 mn
	AOA RESOLVER 2	AC2-3					
	ADIRU 3	AC1-2			X (3)		HOT 2 (1)
	AOA RESOLVER 3	AC1-2			X (2)		
STBY INST	HORIZON					X	
	ALTIMETER					SHED	
	COMPASS					X	
NAVAIDS	VOR 1				X		
	VOR 2	AC2-3					
	MMR 1				X		
	MMR 2	AC2-3					
	ADF 1				X		
	ADF 2	AC2-3					
	DDRMI				X		
	DME 1	AC1-1					
DME 2	AC2-3						
RADIO ALTIMETER	RA 1	AC1-2					
	RA 2	AC2-3					
ATC	ATC 1				X		
	ATC 2	AC2-3					
GPWS		AC1-2					
WEATHER RADAR	WX 1	AC1-2					
	WX 2	AC2-3					
TCAS ◀		AC1-1					
PVI ◀		AC1-1					

(1) Backup supply.

(2) AOA1 resolver power supply is lost, and AOA3 resolver power supply is recovered, when AC1-2 is lost and AIR DATA CAPT ON 3 is selected.

(3) When AC1-2 is lost.