INTERFLUG
BETRIEB
VERKEHRSFLUG

Flugbetriebsdokumentation

Flugzeug-Handbuch A 310

FZH-310

Das FZH-310 /Teil 2 ist ein von Airbus Industrie genehmigter und in den Abschnitten

- 02 PROCEDURES & TECHNIQUES
- 03 NORMAL PROCEDURES

im Betriebsteil Flugbetrieb der INTERFLUG bearbeiteter Nachdruck des Teils 2 (PROCEDURES AND PERFORMANCE) des Original-FLIGHT CREW OPERATING MANUAL (FCOM) des Flugzeugtyps A310. Es unterliegt dem Änderungsdienst und ist nur für den internen Gebrauch bei INTERFLUG bestimmt.
Verbindlich ab 1.1.1990 für die Mitarbeiter des Betriebsteils Flugbetrieb.

Flugkapitän Materna
Betriebsteilleiter

Herausgeber: INTERFLUG - Technische Dokumentationsstelle
Berlin - Schönefeld

November 1989

Ordnungs-Nummer: OP-4/33

Ag/130/TD/15/89

- **FAULT**

R The light comes on amber to indicate the three
R positions overboard valve remains open after engine starting.

Illumination of the FAULT light is accompanied by ECAM activation.

R The FAULT light goes off when the OVBD VALVE P/B
R switch is selected OFF, provided the three positions overboard valve is closed.

(4) OVBD VALVE/INBD Annunciator

The double indication annunciator displays the path taken by the extraction airflow.

- **OVBD VALVE Flowbar On, (INBD Flowbar Off)**

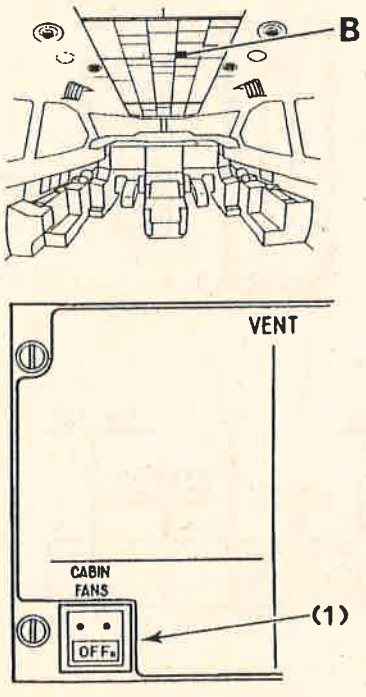
R The airflow goes directly overboard through the three
R positions overboard valve which is fully or partially open.

- **INBD Flowbar On (OVBD VALVE Flowbar Off)**

R The airflow goes directly in the cargo compartment through the inboard valve.

B. VENT PANEL

– Cabin Fan



(1) CABIN FANS Pushbutton Switch

Controls the activation of fans which allow a part of the cabin air to be recirculated.

- **On (P/B Switch Pressed-In)**

  The fans are running and the cabin air is recirculated.

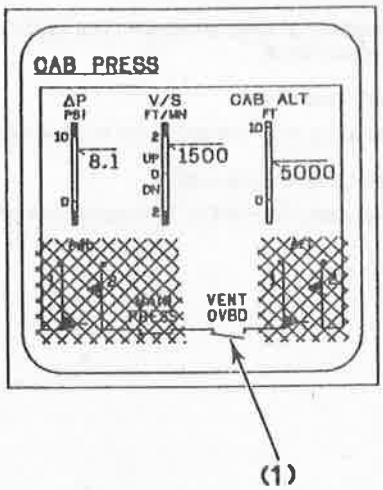
- **OFF/R (P/B Switch Released-out)**

  The fans are stopped. The OFF/R light comes on white.

Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AIR CONDITIONING / PRESSURIZATION / VENTILATION VENTILATION – ECAM	1.02.40 PAGE 6 REV 16 SEQ 030

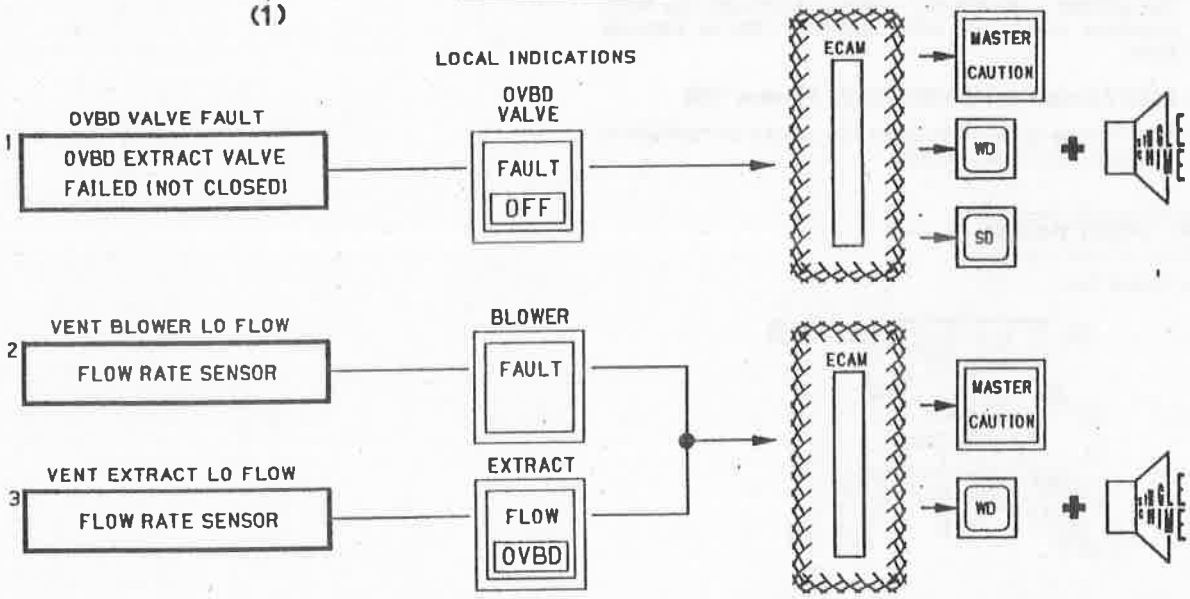
SYSTEM DISPLAY

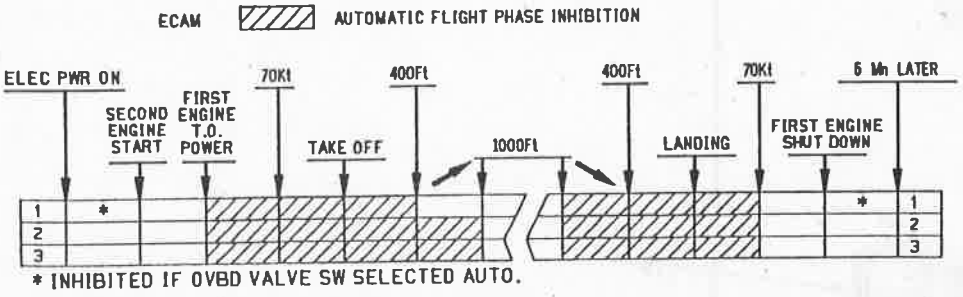


(1) VENT OVBD Indication

VENT OVBD	White	OVBD valve is fully closed
	Green	
VENT OVBD	White	OVBD valve is partially open
	Green	
VENT OVBD	White on ground amber in flight	OVBD valve is fully open
	Green on ground amber in flight	

WARNING LOGIC





PLN.FCO.B1.0240.006-AA.030

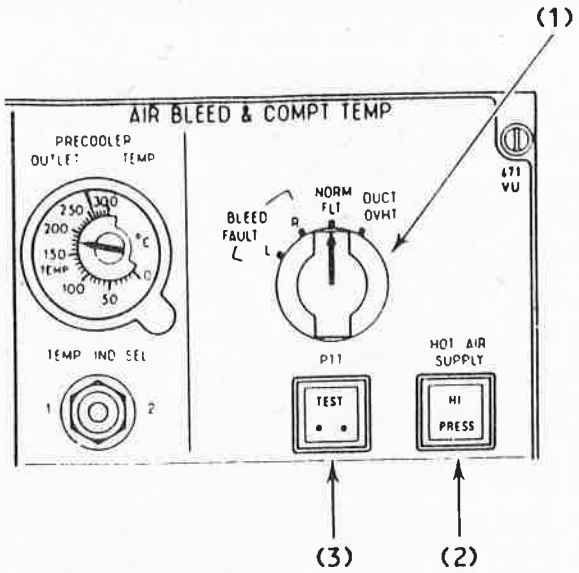
Mod. : 5051 + 5119

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL

AIR CONDITIONING / PRESSURIZATION / VENTILATION

MAINTENANCE PANEL – CONTROLS

A. AIR BLEED & COMPT TEMP PANEL



(1) AIR BLEED & COMPT TEMP Test Selector Switch

Connects the PTT P/B switch to the warning circuits for test of overheat warning and automatic closure of the hot air supply valve.

(2) HOT AIR SUPPLY memorized fault annunciator (MFA)

Comes on white, when the pressure in the hot air duct exceeds 12.5 PSI for one minute or more.

(3) PTT Pushbutton Switch

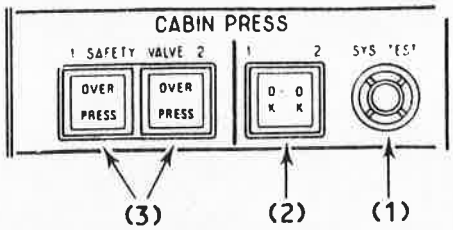
- **TEST**

  The light comes on white, when the test selector switch is not in NORM position.

- **Pressed and held**

  A simulated overheat signal is generated to test the selected overheat warning circuit. After test, systems must be reset.

B. CABIN PRESS PANEL



(1) SYS TEST Pushbutton Switch

The pressurization systems are tested one at a time as selected by the SYS 1 or SYS 2/PUSH TO SEL P/B switch on the CABIN PRESS panel.

When the P/B switch is pressed and held, the active system is tested:

- Respective OK light comes on white if:
  - Electrical circuit integrity of controller, valves and aircraft is satisfactory.
  - All warning (ECAM) are satisfactory.

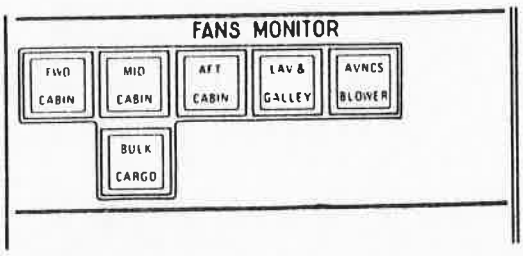
(2) SYS 1 / SYS 2 / OK Annunciator

The light of the active system comes on, when SYS TEST pushbutton switch is pressed, to indicate successful test.

(3) SAFETY VALVE OVER PRESS lights

The light comes on when the valve opens.

C. FANS MONITOR PANEL



All the memorized fault annunciators (MFAs) come on in case of functional failure of the corresponding fan, i.e: cabin recirculation fans, lavatory and galley fan, avionics blowers, bulk cargo fan.

Mod. : 3881 + 4000

Vers. : All

Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM CONTENTS	N 1.03.00 PAGE 1 MAR 83

Vers. : All Eng. : All

CONTENTS

TABLE OF CORRESPONDENCE BETWEEN « CODE » NUMBER AND MOD/MP NUMBER(S)

	EQUIVALENCE CODES	DESIGNATION
	0310A	STD or (Mod : 5051 + 6415)
	0310B	(MP S5063 + Mod : 4939) or (MP S5063 + Mod : 4939 + 5051 + 6415)
	0310C	MP S5063 or Mod : 6523
	0310D	(MP S5063 + Mod : 5051) or (Mod : 5051 + 6523)
	0320A	STD or (Mod : 5051 + 6415)
	0330A	STD or (Mod : 5051 + 6415)
	0340A	Mod : 5124 or 5616 or (5435 + 5616)
	0340B	STD or Mod : 5435
R	0340C	Mod : 7258 or (7171 + 7187)
	0350A	MP S5063 or (MP S5063 + Mod : 5051 + 6415)
	0350B	MP S5063 or Mod : 6523
	0350C	(Mod : 4939 + 6523) or (MP S5063 + Mod : 4939)
	0350D	(MP S5063 + Mod : 6036) or (Mod : 6036 + 6523)
	0350E	(MP S5063 + Mod : 5051) or (Mod : 5051 + 6523)
	0350F	STD or (Mod : 5051 + 6415)
	0350G	(MP S 5063 + Mod : 6036 + 6375) or (Mod : 6036 + 6375 + 6523)
R	0361A	STD or (Mod : 5051 + 6415)
R	0361B	MP S5063 or (MP S5063 + Mod : 5051 + 6415)
R	0361C	(Mod : 5051 + MP S5063) or (Mod : 5051 + 6523)
R	0362A	STD or (Mod : 5051 + 6415)
R	0362B	MP S5063 or (MP S5063 + Mod : 5051 + 6415)
	0362C	(MP S5063 + Mod : 5051) or (Mod : 5051 + 6523)
	0365A	Mod : 3791 or 5954 or (3791 + 5954)
	0365B	STD or Mod : 6789 or (Mod : 3791 + 6034) or (Mod : 3791 + 6662) or (Mod : 5954 + 6789) or (Mod : 3791 + 5954 + 6789) or (Mod : 3791 + 6034 + 6662) or (Mod : 3791 + 5954 + 6034 + 6662) or (Mod : 3791 + 5954 + 6034 + 6662 + 6789)

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM GENERAL INFORMATION DESCRIPTION	1.03.10 PAGE 1 REV 20 SEQ 020

The aircraft is provided with a digital AUTOMATIC FLIGHT SYSTEM (AFS) which controls the aircraft around the PITCH, ROLL and YAW axis. The AFS controls also the SPEED and the THRUST.

The AFS consists of four independent basic sub-systems which are :

- FLIGHT AUGMENTATION COMPUTER (FAC) system
- AUTOTHROTTLE (THRUST CONTROL COMPUTER –TCC – system)
- AUTOPILOT/FLIGHT DIRECTOR (FLIGHT CONTROL COMPUTER – FCC – system)
- FAULT ISOLATION and DETECTION SYSTEM (FIDS)

These systems are self monitored, which makes them FAIL PASSIVE (disengagement of the failed unit before it affects aircraft handling).

Duplication of systems and segregation of supply services make them FAIL OPERATIVE (after first failure the remaining system ensures continuation of operation).

– The FAC system consists of two identical units, each providing :
  - YAW DAMPER Function (03-20)
  - PITCH TRIM Function (03-30)
  - FLIGHT ENVELOPE PROTECTION function (03-40)

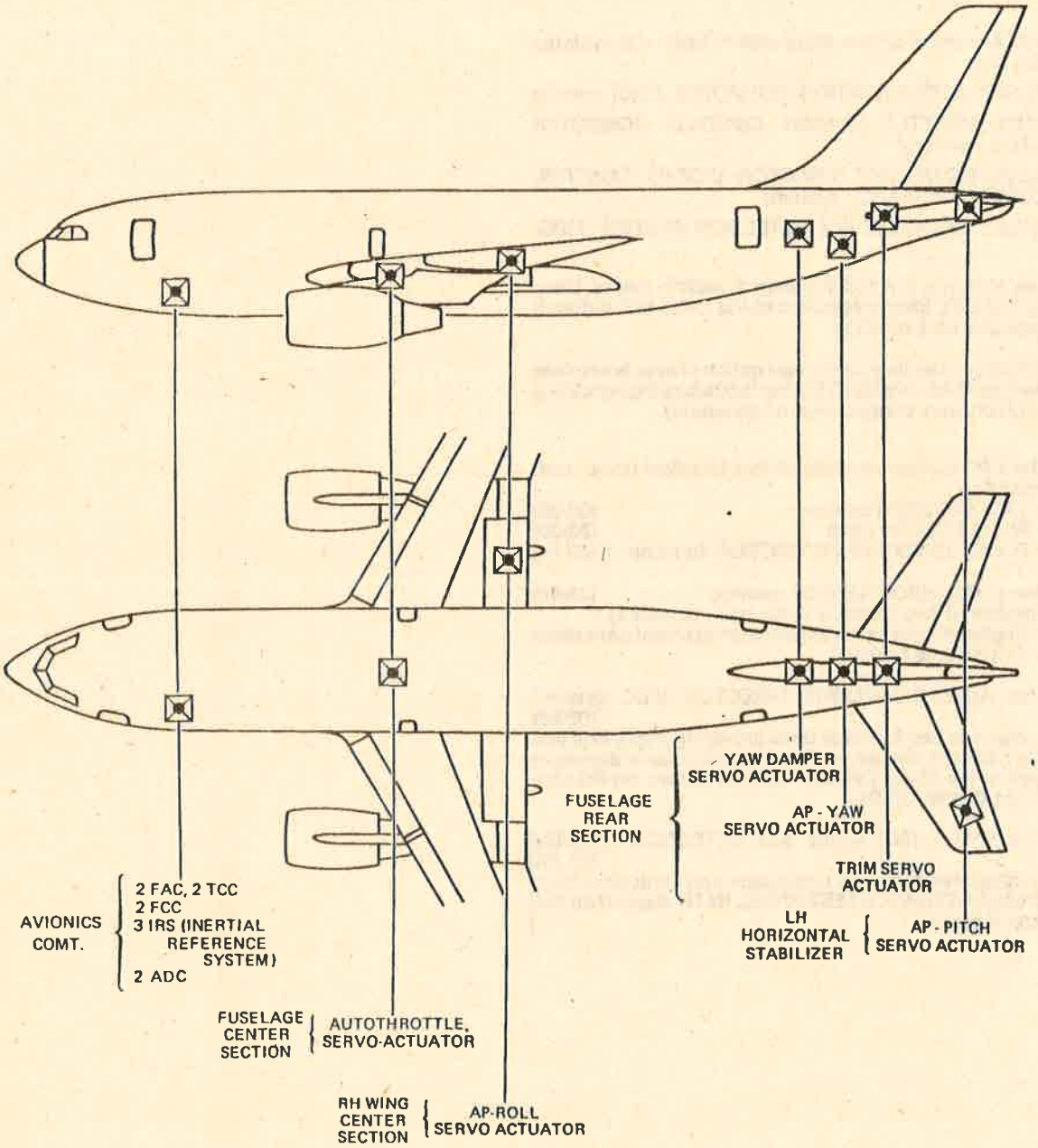
– The AUTOTHROTTLE (TCC system) (03-50) consists of two identical units, each providing :
  - Display of maximum engine management parameter
  - Autothrottle function

– The AUTOPILOT/FLIGHT DIRECTOR (FCC system) (03-60) comprises two identical units providing Pitch, Roll and Yaw control signals to the Autopilot servo-actuators and to the Flight Director command bars on Primary Flight Display (PFD).

– The FAULT ISOLATION and DETECTION SYSTEM (03-70) is integrated in all AFS computers and controlled from the MAINTENANCE TEST PANEL (MTP) located on the lateral panel.

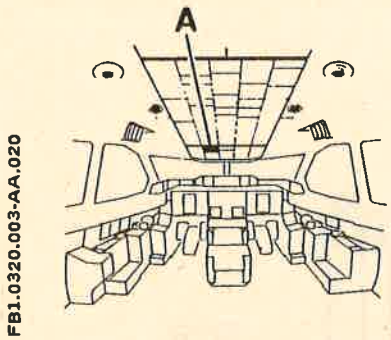
A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM GENERAL INFORMATION SCHEMATICS	1.03.10 PAGE 2 REV 20 SEQ 020

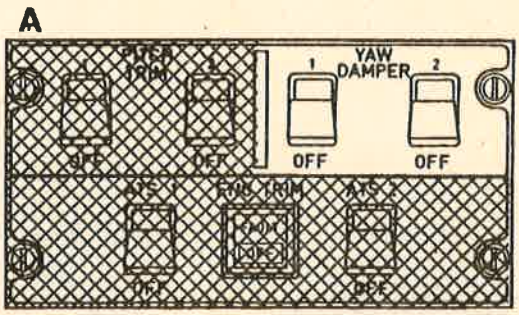
COMPUTER, SENSOR AND ACTUATOR LOCATION



R Code : 0310 C

A. YAW DAMPER levers





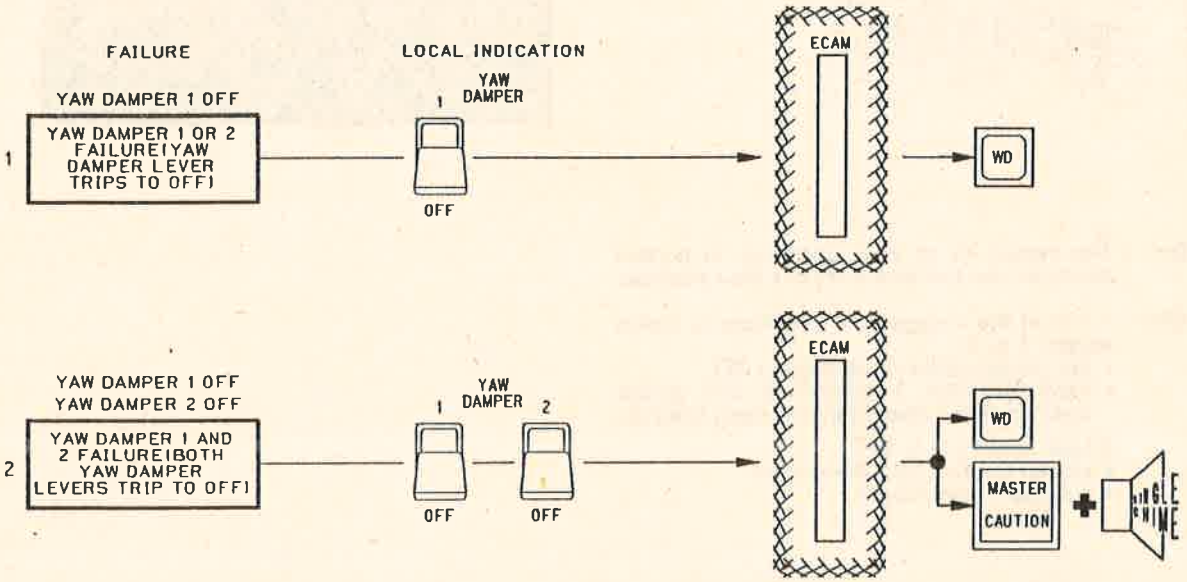
- **On** : The system (1 or 2) is operative. In normal operation the two levers are in « On » position.

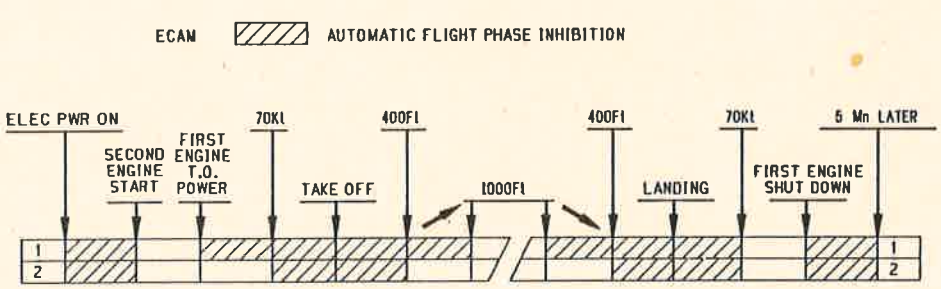
- **OFF** : if one of the engagement conditions is lost in system 1 or 2 :
  - the corresponding lever trips to OFF.
  - YAW DAMPER 1 (or/and 2) OFF amber warning illuminates on the Warning Display.

  If both levers trip to OFF :
  - Master Caution light illuminates
  - a single chime sounds.

Mod. : 5051

WARNING LOGIC



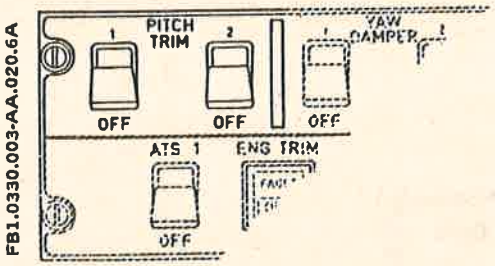


R OPS.FCO.B1.0320.004-00.020

Mod. : 5051

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM PITCH TRIM CONTROLS	1.03.30 PAGE 3 REV 19 SEQ 020

A. PITCH TRIM LEVERS

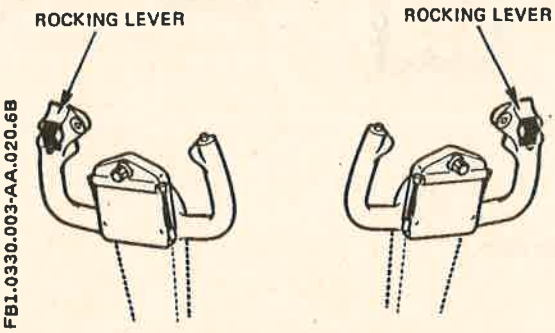


- On : The system (1 or 2) is operative. In normal operation the two levers are in the « On » position.

- OFF : If one of the engagement conditions is lost in system 1 or 2 :
  - the corresponding lever trips to OFF
  - PITCH TRIM 1 (or 2) OFF amber warning illuminates on the Warning Display.

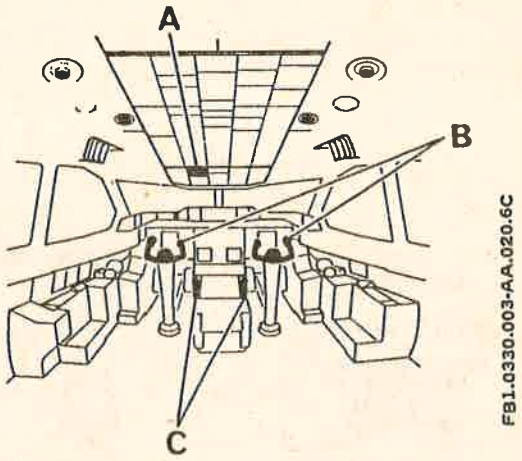
  If both levers trip to OFF :
  - Master Caution light illuminates.
  - a single chime sounds.

B. ROCKING LEVERS

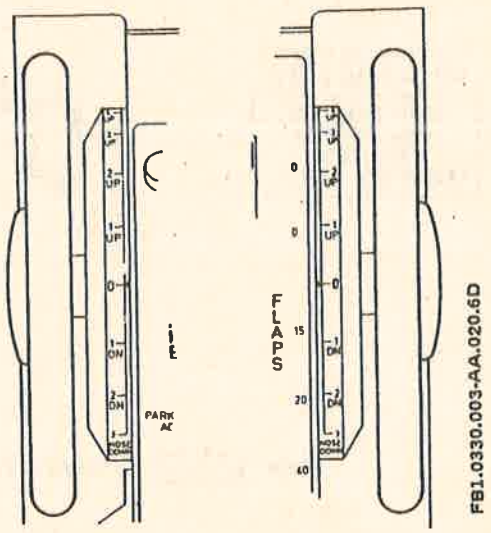


CAPT CONTROL WHEEL F/O CONTROL WHEEL

- Rocking levers are spring loaded to neutral.
- An upward or downward movement of the rocking levers, trim the aircraft nose down or nose up respectively.
- If the CM1 and CM2 rocking levers are operated simultaneously in opposition, trimming stops.
- Two outputs of opposite direction from the same rocking lever cause the disengagement of both trim systems (Protection against jamming of a rocking lever microswitch).



C. MANUAL PITCH TRIM CONTROL WHEEL

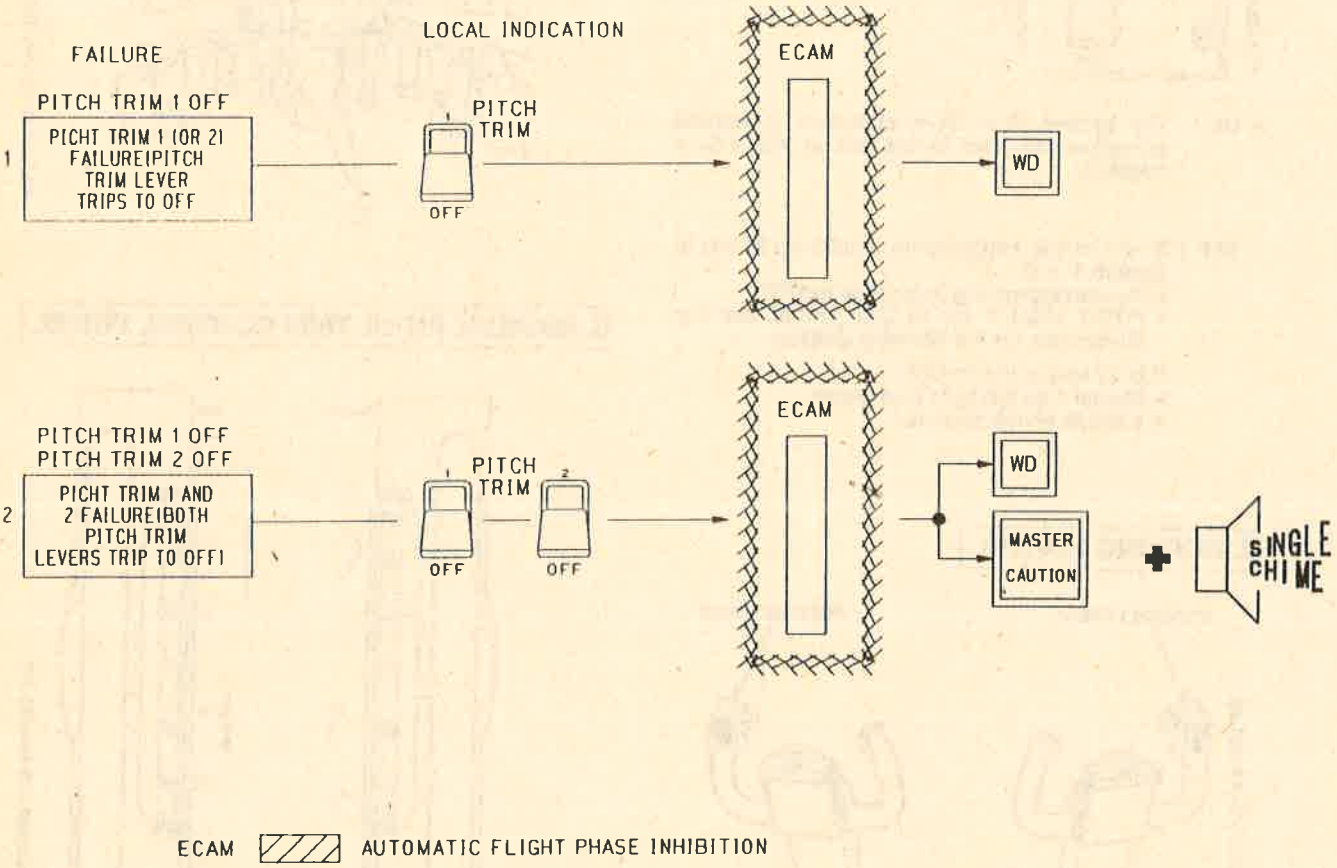


It mechanically controls the two hydraulic motors which actuate the stabilizer. When this TRIM wheel is used, it disengages both PITCH TRIM systems.

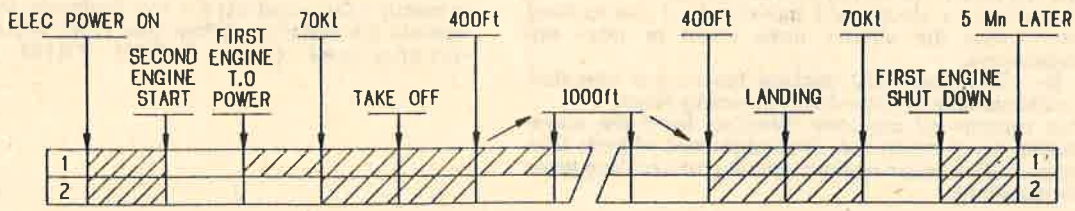
Mod. : 5051

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM PITCH TRIM ECAM	1.03.30 PAGE 4 REV 13 SEQ 620

WARNING LOGIC



ECAM ▨ AUTOMATIC FLIGHT PHASE INHIBITION



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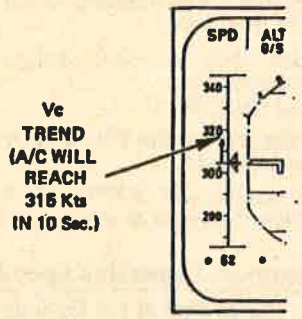
Mod. : 5051

Each FAC (FLIGHT AUGMENTATION COMPUTER) provides computation for the following functions :
- Vc TREND
- LIMIT SPEEDS
- MINIMUM SPEED FOR FLAPS OR SLATS RETRACTION
- ENGINE OUT OPERATING SPEED (IN CLEAN CONFIG.)
- ALPHA FLOOR AND WINDSHEAR PROTECTION.

1. Vc TREND (Acceleration of the A/C)

Vc TREND is represented on the PFD by a yellow arrow which indicates (by its direction) if the A/C accelerates or decelerates and (by its length) the speed the A/C would reach after 10 sec. if acceleration remained constant.

R This symbol appears only when greater than 2 KT and
R is removed when lower than 1 KT.
R In the event of FAC failure, this symbol is not displayed.



2. LIMIT SPEEDS

VLS (Lowest Selectable Speed).

VLS is the lower limit of the flight envelope.
It is defined as a margin with respect to stall (Vs).
VLS depends on A/C configuration and flight phase but is not G-load dependent.
The table below gives the different values of VLS.

	ALTITUDES LOWER THAN 25000 FT	ALTITUDES GREATER THAN 25000 FT
TAKE OFF* PHASE or TOUCH AND GO	VLS = 1.2 VS then 1.3 VS as soon as SLATS/FLAPS handle has been moved to retract or extend SLATS/FLAPS.	
LANDING* AND GO AROUND PHASES	VLS = 1.3 Vs	
CLEAN* CONFIG.	VLS = 1.3 Vs	VLS IS CALCULATED SO THAT THERE IS ROUGHLY 0.3 g MARGIN WITH RESPECT TO BUFFETING

* – Change from T/0 schedule (1.2 Vs) to landing schedule (1.3 Vs) is triggered by SLATS/FLAPS handle displacement (either retraction or extension).
– Change from landing to T/0 schedule is triggered by LDG GEAR shock absorber compression (A/C on ground).
– During a configuration change, VLS is progressively increased or decreased so that VLS corresponding to the new selected configuration will be displayed only when SLATS/FLAPS will be really at the new position.

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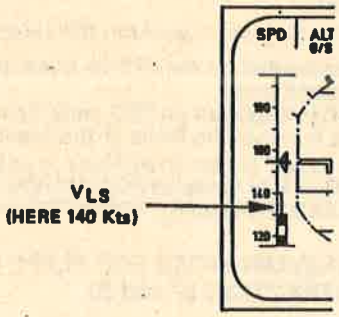


VLS is represented on the PFD by an amber strip along the speed scale. This symbol is displayed on PFD, only 5 sec after lift off and if VLS is within the limits of the speed scale.
It disappears at touch down.

Note : If a speed lower than VLS is selected in TCC (SPD/MACH mode) or FCC (LVL/CH, PROFILE, T/O, G/A Modes), TCC or FCC maintains VLS.

Vers. : All Eng. : All

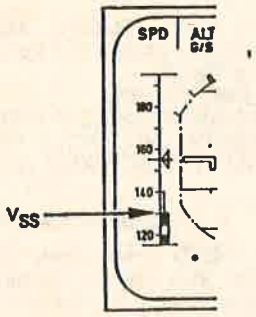
Vss (STICK SHAKER Speed)

Vss is the speed corresponding to the activation of the STICK SHAKER warning.

R Vss is equal to 1.138 V_s in clean configuration and 1.08 V_s in other configurations.
Vss is G-load dependent.

Vss is represented on the PFD by a red and black strip along the speed scale.

The symbol is displayed on PFD, only 5 s after lift off and if Vss is within the limits of the speed scale.



VMAX (Maximum Selectable Speed)

VMAX is the higher limit of the flight envelope.

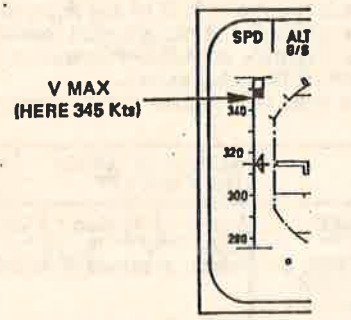
VMAX depends on the A/C configuration.

- VMAX = VMO (Maximum allowed speed) if SLATS and LANDING GEAR are retracted.
  VMO is calculated by the ADC and takes into account MMO.
- VMAX = VLE (Maximum speed, gear down) if SLATS are retracted and LANDING GEAR is extended.
- VMAX = VFE (Maximum speed, flaps extended) if SLATS are extended or if the S/F selector is not in the 0/0 position.

Note : VFE is computed upon the S/F selector position.

VMAX is represented on the PFD by a red and black strip along the speed scale.
This symbol is displayed on PFD, only 5 sec. after lift off and if VMAX is within the limits of the speed scale.

Note : if a speed higher than VMAX is selected in TCC (SPD/MACH mode) or FCC (LVL/CH, PROFILE T/O, GO AROUND modes), TCC or FCC maintains VMAX.



3. MINIMUM SPEED FOR FLAPS OR SLATS RETRACTION (F and S)

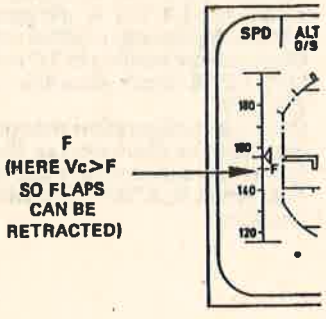
F (Minimum Speed for FLAPS Retraction)

F is equal to 1.25 VS of SLATS 15°/FLAPS 0° configuration.
F is not G-load dependent.

F is represented on the PFD by a green – F bug moving along the speed scale.

The symbol is displayed on PFD, only 5 sec after lift off and only in configuration 15°/15° or 20°/20° (SLAT/FLAP handle on 15°/15° or 20°/20° confirmed by the SLATS/FLAPS position).

e.g. : if after take off, the flaps are jammed and the S/F selector is set on 20/20, F for 30/40 config remain displayed.



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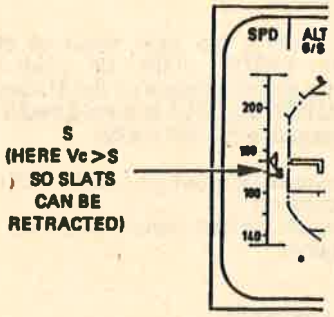
Mod. : 6354

S (Minimum Speed for SLATS Retraction)

S is equal to 1.25 Vs of the CLEAN configuration.
S is not G-load dependent.
S is represented on the PFD by a green - S bug moving along the speed scale.

The symbol is displayed on PFD, only 5 sec. after lift off and only in configuration 15°/0° (SLAT/FLAP handle on 15°/0°).



4 - « GREEN DOT » (Engine Out Operating Speed in CLEAN Configuration)

« GREEN DOT » speed is the BEST LIFT TO DRAG RATIO speed (or DRIFT DOWN speed) in CLEAN configuration.

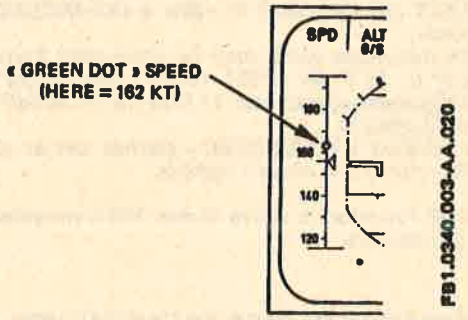
« GREEN DOT » speed is not G-load dependent.

Below 20 000 ft :
« GREEN DOT » speed is equal to 232 Kt at 132 tons ± 1Kt per ± 1 ton.

Above 20 000 ft :
It increases by 2 Kt per 1000 ft.

« GREEN DOT » speed is represented on the PFD by a green dot moving on the speed scale.

The symbol is displayed only in flight and only in CLEAN configuration (SLAT/FLAP handle on 0°/0°).



5. SPEED INDICATION IN CASE OF SLATS OR FLAPS JAMMING

Vc TREND and VMAX are not affected.
VLS, VSS « GREEN DOT », F and S are calculated by taking into account the previous SLATS and FLAPS position.

Code : 0340C

6. ALPHA FLOOR AND WINDSHEAR PROTECTION

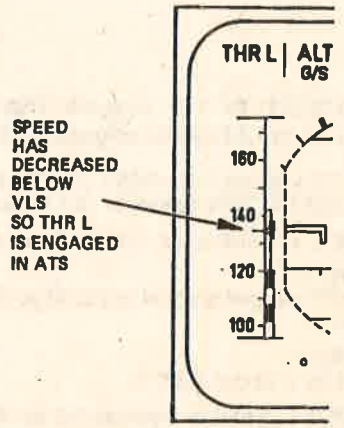
When the FAC detects a too high angle of attack it engages THRUST LATCH (THR L) (with thrust corresponding to the selected mode on the Thrust Rating Panel) in TCC, if AUTOTHROTTLE is armed and if A/THR function is not engaged with THR mode.

Angle of attack minimum value which causes THR L mode engagement, depends on :
- aircraft configuration (in fact, handle position).
- windshear detection.

Minimum value is :
- 8.5° in clean configuration
- 14.5° in 15°/0°, 15°/15° and 20°/20° configurations.
- 11.5° in 30°/40° configuration.

Note : In case windshear is detected, the angle of attack minimum value is decreased (only if SLATS are extended) to allow a GO-AROUND sooner.
The minimum value may be decreased from 14.5° to 10.5° (in 15°/0°, 15°/15°, and 20°/20° configurations) and from 11.5° to 7.5° (in 30°/40° configuration).
In addition « WINDSHEAR » flashes amber on PFD, above the aircraft symbol.

ALPHA FLOOR Function is active above 100 ft provided ATS is not declutched.



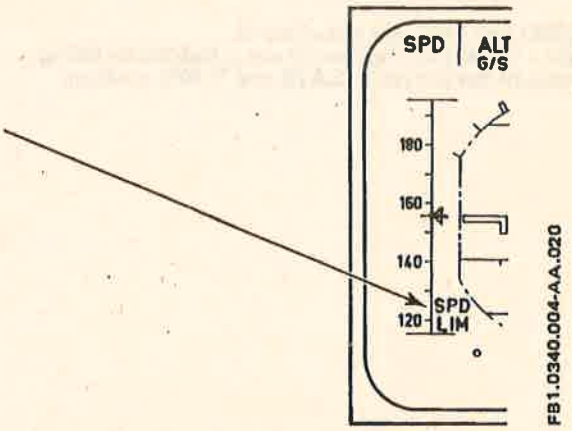
7. INDICATION IN CASE OF FAC FAILURE

PRELIMINARY NOTE : In normal conditions FAC 1 feeds PFD 1 and FAC 2 feeds PFD 2.

In case of a FAC failure, all the speeds calculated by this FAC (Vc TREND, VLS, VSS, VMAX, F, S, « GREEN DOT ») are no longer available so no longer displayed on the associated PFD. A red « SPD LIM », which first flashes for a few seconds, is displayed at the bottom of the speed scale.
In case of both FAC's failure « SPD LIM » appears on both PFD's.

Note : This warning is also displayed in case of :
- *SFCC failure (or SLAT/FLAP control lever position failure)*
- *ADC failure*
- *ANGLE OF ATTACK (α) PROBE failure*
- *IRS failure*

See table in following page.



Mod. : 7187

The following table summarizes the consequences of a peripheral equipment failure on the « FLIGHT ENVELOPE PROTECTION » function of the FAC system.

	CONDITION → / FAILURE ↓	SPEED LIMIT SENT TO EFIS	SPEED LIMIT SENT TO ATS and AP/FD	ALPHA FLOOR
	ADC 1 (or 2) failure	LOST ON SIDE 1 (or 2). « SPD LIM » flag.* SWITCHING POSSIBLE, flag disappears	LOST IN FAC 1 (or 2)	lost in FAC 1 (or 2) only IF SLATS OUT
	ADC 1 and 2 failure	LOST ON BOTH SIDES. « SPD LIM » flag.*	LOST IN BOTH FAC's (BOTH AP's and ATS LOST)	LOST ONLY IF SLATS OUT
R	IRS 1 (or 1 + 3) failure	LOST ON SIDE 1. « SPD LIM » flag. ADC SWITCHING NOT RECOMMENDED	NO EFFECT (FAC 2 used)	LOST IN FAC 1 (only IF SLATS OUT)
R	IRS 2 (or 2 + 3) failure	LOST ON SIDE 2. « SPD LIM » flag. ADC SWITCHING NOT RECOMMENDED	NO EFFECT (FAC 1 used)	LOST IN FAC 2 (only if SLATS OUT)
	IRS 3 failure	NO EFFECT	NO EFFECT	NO EFFECT
	IRS 1 + 2 failure	LOST ON BOTH SIDES. « SPD LIM » flag.	LOST IN BOTH FAC's (BOTH AP's and ATS LOST)	LOST ONLY IF SLATS OUT
	2 ALPHA PROBES failure	LOST ON BOTH SIDES. « SPD LIM » flag.	$V_{LS} = 0$ / $V_{MAX} = V_{MO} = 340$] IF LDG GEAR UP $V_{LS} = 0$ / $V_{MAX} = V_{LE} = 270$] IF LDG GEAR DOWN	LOST
	SFCC 1 (or 2) failure	LOST ON SIDE 1 (or 2). « SPD LIM » flag. SWITCHING NOT RECOMMENDED	NO EFFECT	NO EFFECT
	BOTH SFCC failure	LOST ON BOTH SIDES. « SPD LIM » flag.	$V_{LS} = 0$ / $V_{MAX} = V_{MO} = 340$] IF LDG GEAR UP $V_{LS} = 0$ / $V_{MAX} = V_{LE} = 270$] IF LDG GEAR DOWN	LOST
	RADIO ALTIMETER 1 (or 2) failure	NO EFFECT	NO EFFECT	LOST IN FAC 1 (or 2)
	BOTH R/A failure	NO EFFECT	NO EFFECT	LOST

* On PFD, only « SPD » flag is displayed.

R Code : 0340A

PURPOSE

The ATS (AUTOTHROTTLE SYSTEM) assures the following functions :
- Continuoulsy computes the THRUST LIMIT corresponding to the mode selected on TRP.
- Acquires and maintains the THRUST LIMIT calculated by the TCC (in THR L or THR mode) or the TARGET THRUST calculated by the FMC (in P THR mode).
- Acquires and maintains the SPEED or the MACH selected on FCU (in SPD/MACH mode) or calculated by the FMC (in P SPD or P MACH mode).
- Retracts the throttles to the idle position (in RETARD mode).

ATS COMMANDS COMPUTATION

Computations for ATS functions are made in two computers, the THRUST CONTROL COMPUTERS (TCC 1 and 2).
But TCC 2 is in standby.

Each TCC includes two computing channels (a command one and a monitor one) for safety reason.

Each TCC receives informations mainly from the FLIGHT CONTROL UNIT, the GO LEVERS, the ATS disconnect pushbuttons, the FLIGHT CONTROL COMPUTER, the FLIGHT MANAGEMENT COMPUTER, the engines, the RADIO ALTIMETER, the ADC, IRS, FAC. Then with all these data the TCC provides command signals to the ATS ACTUATOR.

CONNECTION WITH ENGINE CONTROLS

A single electric actuator installed in the autothrottle system actuates, through two coupling units, simultaneously the throttle levers and the ENGINE HMC (Hydro Mechanical Control). The throttle position is detected by two THROTTLE POSITION DETECTORS and transmitted to the TCC's.

The actuator responds to inputs from the TCC. Each coupling unit includes an electromagnetic clutch and a safety friction clutch.

The automatic operation may be overridden for each engine by applying a light load on the corresponding throttle lever. Load is detected by a DYNAMOMETRIC ROD (one on each throttle lever) which deactivates the electromagnetic clutch.

During the period of load application, the pilot manually adjusts the throttle lever. As soon as the load is released, the autothrottle resumes the control and maintains any possible difference between the two throttle lever settings.

Note : See DRAWING in next page.

ELECTRICAL POWER SUPPLY

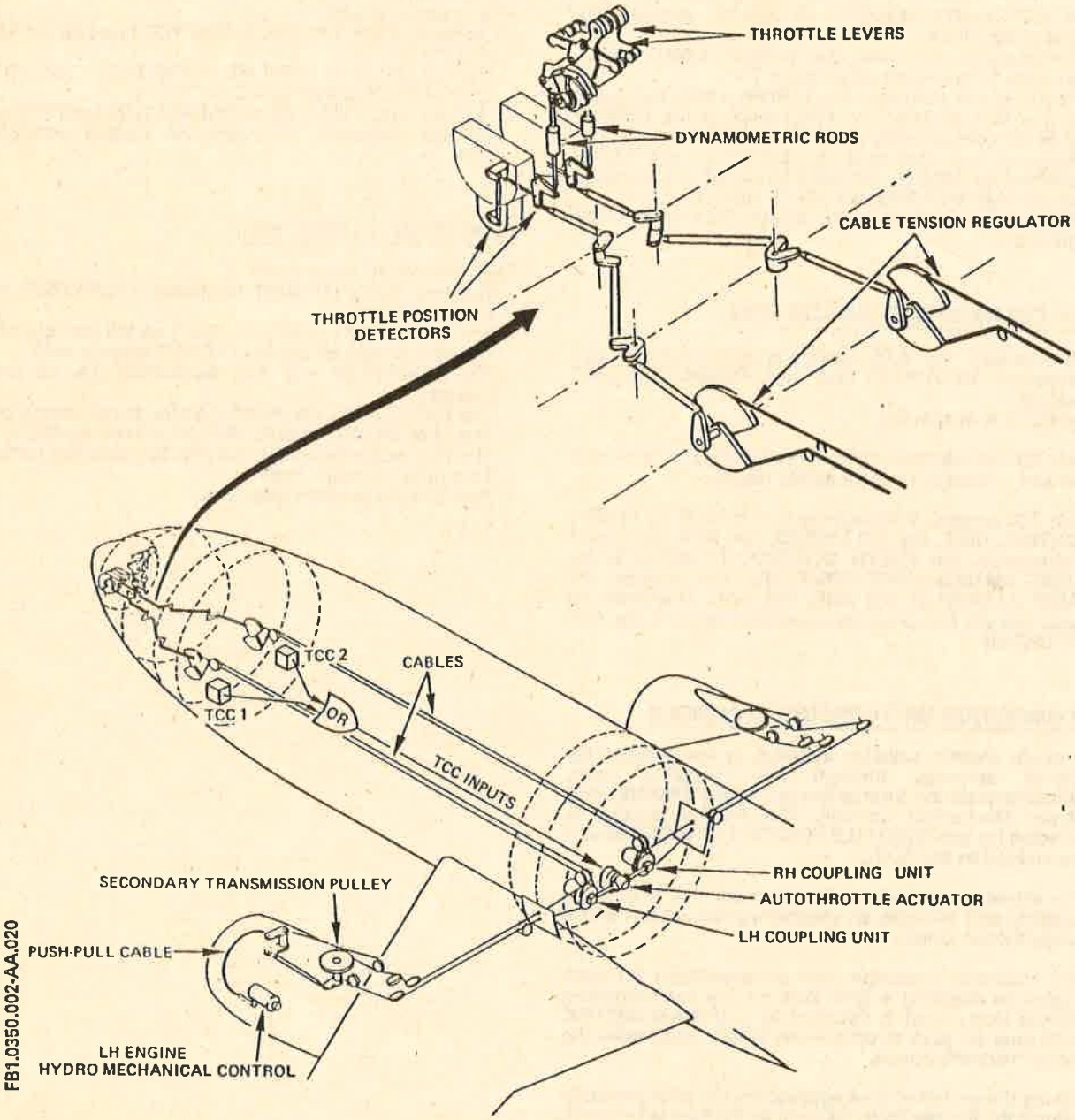
ATS is supplied with
- 28 Volt DC (28 V NORM BUSfor TCC 1 and 28 V ESS BUS for TCC 2)
- 115 Volt AC (115 V/400 HZ NORM BUS 1 for TCC 1, 115/400 HZ NORM BUS 2 for TCC 2)
- 26 Volt AC (26 V/400 HZ NORM BUS 1) for both TCC's, the dynamometric rods and the throttle position detector.

COMPONENT LOCATION

The ATS mainly comprises :
- The two TCC's (THRUST CONTROL COMPUTER) in electronic rack.
- The FCU (FLIGHT CONTROL UNIT) on the glareshield.
- The two arming levers (on FAC/ATS engage unit)
- The GO-LEVERS and ATS disconnect p.b. on the throttles
- The TRP (THRUST RATING PANEL) on the central panel
- The FMA (FLIGHT MODE ANNUNCIATOR) on PFD's.
- The ATS actuator associated with two coupling units
- Two dynamometric rods
- Two throttle position detectors.

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE GENERAL	1.03.50 PAGE 2 REV 20 SEQ 020

CONNECTION WITH ENGINE CONTROLS

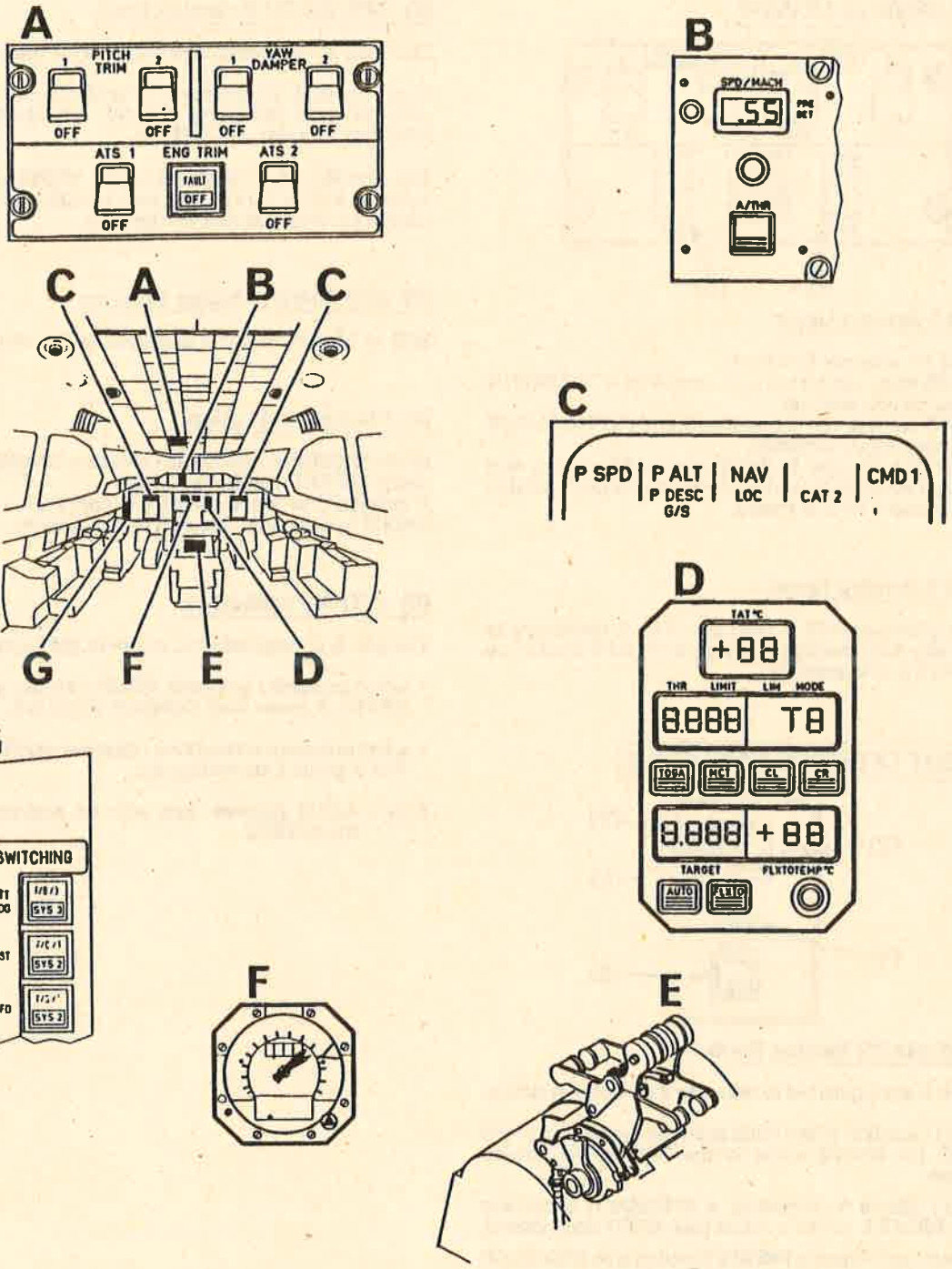


Note : ATS actuator simultaneously actuates, through the coupling units, THROTTLE LEVERS and ENGINE HYDRO MECHANICAL CONTROLS.

R Code : 0350 B

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE CONTROLS	1.03.50
		PAGE 3
		REV 20 SEQ 020

LOCATION OF CONTROLS



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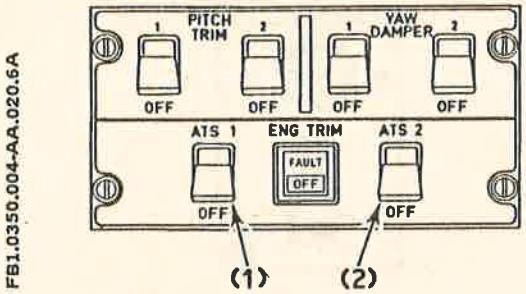
R Code : 0350B

A. ATS ARMING LEVERS



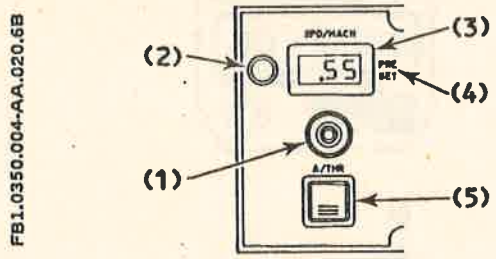
(1) ATS 1 Arming Lever

- On : ATS 1 channel is armed.
  ATS lever can be set to on only if all ATS ARMING conditions are met.
  ATS modes can be engaged and ALPHA FLOOR protection is available.
- OFF : ATS 1 channel is deactivated. ATS modes and ALPHA FLOOR protection are no longer available unless ATS 2 is armed.

(2) ATS 2 Arming Lever

Same functions as ATS 1. Only one ATS is necessary to have all the ATS functions. When both ATS levers are armed, ATS 2 is in standby.

B. FLIGHT CONTROL UNIT (FCU)



(1) SPD/MACH Setting Knob

The knob is springloaded to return to the neutral position.

- neutral : rotation of the knob changes the setting of the SPEED (or MACH) value in the SPD/MACH display window
- pulled : allows to introduce a SPD/MACH constraint when PROFILE mode is active (see AP/FD description).
- pressed : activates the PRESET function (see SPD/MACH mode in ATS and AP/FD description).
  A second press deactivates the PRESET.

(2) SPD/MACH Selecting Knob

The knob is springloaded to return to the neutral position.

When pressed, the display in SPD/MACH display window changes from SPEED to ACTUAL A/C MACH (or from MACH to ACTUAL A/C SPEED).

The new MACH or SPEED is hold if SPD/MACH mode is active in ATS or AP/FD. This new MACH or SPEED can of course be changed and will be hold.

(3) SPD/MACH Display Window

SPD or MACH setting is displayed in this window.

(4) PRESET Indication

When PRESET is activated (by pressing SPD/MACH setting knob) PRESET illuminates green.
It extinguishes when PRESET is deactivated or PRESET SPEED is taken into account by the system.

(5) A/THR Pushbutton

The p.b. is springloaded to return to the neutral position.

- when pressed : activates A/THR function (coupling to AP/FD). 3 green bars illuminate in the p.b.
- when pressed a second time : deactivates A/THR function. The 3 green bars extinguish.

Note : A/THR function can also be activated through GO-LEVERS.

C. FMA (FLIGHT MODE ANNUNCIATOR) DISPLAY (ON PFD)

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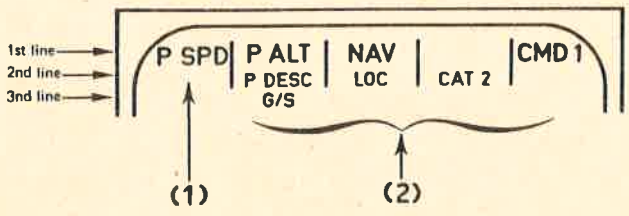

(1) Display For AUTOTHROTTLE

- The active mode in the ATS appears in GREEN in the FIRST line of the first window :
  - THR when SRS, LVL/CH or GO AROUND is active in AP/FD and provided A/THR function is active.
  - SPD or MACH when V/S, ALT, ALT* or LAND is active in AP/FD and provided A/THR function is active.
  - P THR, P SPD or P MACH when PROFILE (coupling of the FMS to the AP/FD) is active in AP/FD and provided A/THR function is active.
  - THR L (THRUST LATCH) when conditions for THR engagement are not met or when ALPHA FLOOR protection is activated.
- At DECLUTCH (at TAKE OFF) a BLUE « THR » illuminates in the SECOND line.
- In DESCENT (with LVL/CH mode) a BLUE « A/THR » illuminates in the SECOND line provided A/THR function is active.
- When neither A/THR function nor THR L mode active an AMBER « MAN THR » illuminates in the SECOND line, unless ATS is disarmed.

(2) Display For AP/FD

See AP/FD description

D. TRP (THRUST RATING PANEL)

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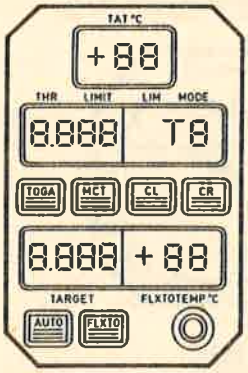

See description in THRUST LIMIT CALCULATION.

E. THROTTLE LEVERS

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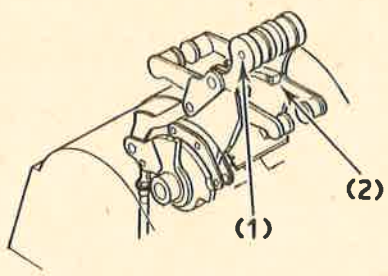


(1) ATS DISCONNECT Pushbutton

Pressing either p.b. disengages A/THR function or THR L mode.

MODE indication on FMA's extinguishes and MAN THR illuminates amber.

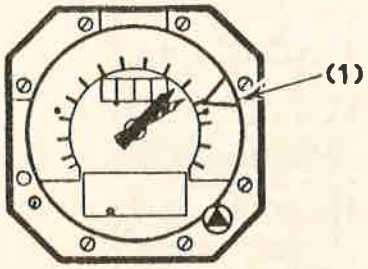
(2) GO LEVERS

Action on GO LEVERS engages

- either TAKE OFF or GO AROUND mode in AP/FD and A/THR function and THR mode in ATS.
- or THR L (THRUST LATCH) alone if conditions for TAKE OFF or GO AROUND engagement are not met.

Vers. : All Eng. : All

F. THRUST LIMIT INDICATION (ON THRUST INDICATORS)



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(1) THRUST LIMIT BUG

A THR LIMIT Bug (on N1 indicators for GE engines and on EPR indicators for PW engines) displays the THRUST LIMIT calculated by the TCC. This THRUST LIMIT function of the mode selected on TRP is also displayed on the TRP « THR LIMIT » window.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE THRUST LIMIT CALCULATION	N 1.03.50 PAGE 7 MAR 83

PROCESS OF CALCULATION

THR LIMIT CALCULATION is operative INDEPENDENTLY OF ATS ARMING.

N1 is the main parameter for engine management. THRUST-limit is calculated by the TCC from altitude, Mach, TAT, CAS (all provided by ADC 1 or 2) and air bleed informations.

Calculations are made for six modes : Take off (TO) and Go Around (GA) which are selected by a single pushbutton, Maximum Continuous Thrust (MCT), Maximum Climb (CL), Maximum Cruise (CR) and Flexible Take Off (FLX TO).

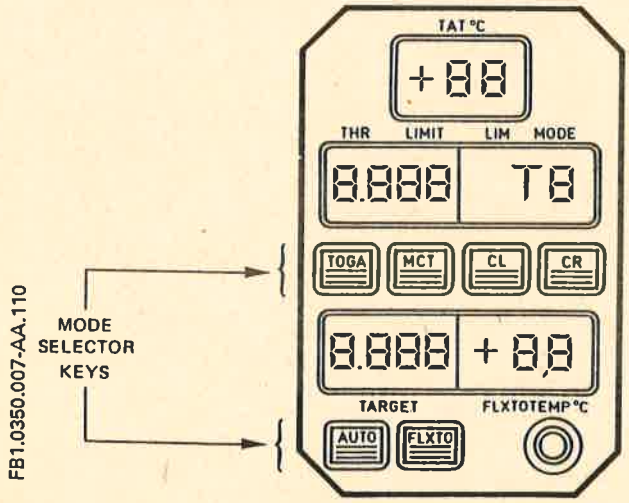
When AUTO mode is selected (AUTO can be manually selected on TRP or is automatically selected when PROFILE mode is engaged), the mode selection is automatically done by the FMC. But the TCC still calculates the corresponding THRUST-LIMIT.

Provided one of these modes is selected on the TRP (and regardless of ATS lever position), THRUST LIMIT is continuously computed and displayed on the TRP (on the THR LIMIT display window) and on the N1 indicators (by the movable N1 indexes).

This allows a comparison between actual engine rating and maximum rating.

Note : During approach GA is automatically selected upon SLATS extension but any other mode except TO or FLEX TO can be manually selected on the TRP.

THRUST LIMIT INDICATION ON THRUST RATING PANEL (TRP)



A mode is selected by pressing the corresponding key. Such an action causes illumination of three green bars in the key.

The keys are springloaded to return to the neutral position and a second action has no effect.

The mode selected by the pilot or by the FMC (when AUTO is selected) is displayed in the « LIM MODE » window.

Note : AUTO mode cannot be selected before THRUST REDUCTION ALTITUDE (1500 ft by default)

DISPLAY IN THE « THR LIMIT » WINDOW :

The limit thrust corresponding to the selected mode is displayed.

The only exception is when FLEX TO is selected. In this case MAX TO thrust is displayed in the THR LIMIT window and FLEX TO in the TARGET window.

DISPLAY IN THE « TARGET » WINDOW :

- If PROFILE mode is not engaged, the limit thrust displayed in the THR LIMIT window is recopied (except for FLEX TO as explained above) if THRUST mode (THR or THRL) is active in the ATS.
  Nothing is displayed if SPD/MACH mode is active in the ATS.
  I-L is displayed if throttles are on idle in descent with LVL/CH mode.
- If PROFILE is engaged, TARGET THRUST calculated by the FMC is displayed whatever the mode is (P THR or P SPD/P MACH)
  I-L is displayed if idle thrust is requested by the FMC.

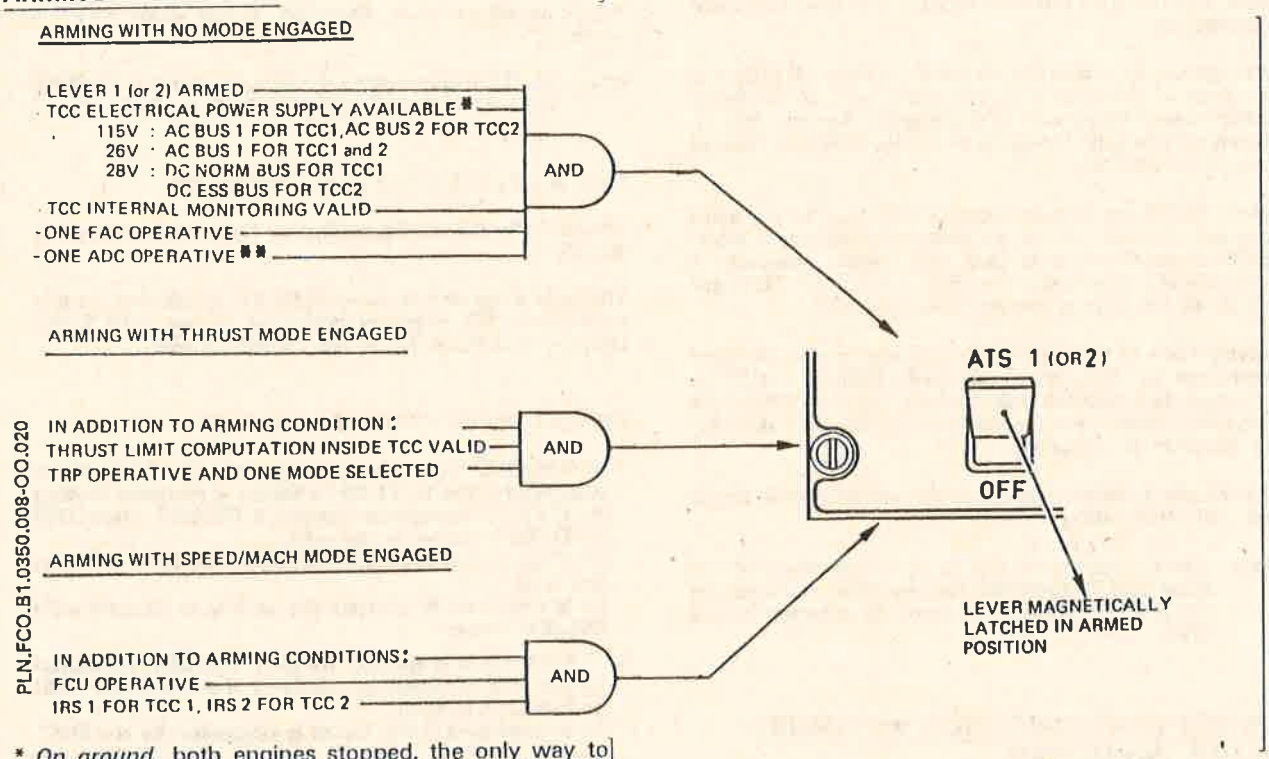
For detailed information concerning the TRP and the THRUST computation, refer to « POWER PLANT » chapter.

Vers. : All GE Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE ATS ARMING/DISARMING	1.03.50 PAGE 8 REV 20 SEQ 020

No mode can be engaged in ATS before at least one ATS lever has been armed.
When the two ATS levers are armed, ATS 2 is in standby.

ARMING CONDITIONS



* *On ground,* both engines stopped, the only way to supply electrical power to the AFS computers (FAC, FCC, TCC) is to arm at least one PITCH TRIM lever. So ATS can be armed only if at least one PITCH TRIM lever is armed.

** In normal use, ADC 1 feeds both TCC's. In case of ADC 1 failure, an automatic switching on ADC 2 is provided.

DISARMING

ATS 1 (or 2) is disarmed (ATS lever trips to OFF)
- Manually by setting the lever to OFF.
- Automatically if one of the arming conditions is lost.

If one ATS disarms, the other resumes control of the power.

Note : see ECAM WARNING LOGIC for the WARNING indications.

ATS RESPONSE TO PERIPHERAL FAILURE

The following table summarizes the consequences of a peripheral equipment failure on the autothrottle system according to its condition of engagement at the time of failure.

CONDITION → / FAILURE ↓	ATS armed SPD/M or P SPD/P MACH mode engaged	ATS armed THR L, THR or P THR mode engaged
ENGINE 1 or 2 failed	No effect	No effect
ENGINE GENERATOR 1 or 2 failed (electrical transient)	No effect	No effect
Engine TRIM 1 or 2 failed	No effect	No effect
ADC 1 failed	Both ATS disarms, but automatic switching on ADC 2 is provided. And so ATS can be rearmed then mode re-engaged.	
BOTH ADC's failed	Both ATS disarm. No rearming possible	
FAC 1 or 2 failed	No effect	
BOTH FAC's failed	Both ATS disarms. No rearming possible	
IRS 1 or 2 failed	ATS 1 (or 2) disarms. Rearming not possible Modes remain available through ATS 2 (or 1).	No effect
THR LIMIT COMPUTATION failed in TCC 1 (or 2)	No effect. Protection against excessive thrust setting is assured by TCC 2 (or 1).	ATS 1 (or 2) disarms. Rearming possible. Modes remain available through ATS 2 (or 1)
TRP failure	• Both ATS disarm if P SPD/P MACH active. Rearming possible but not mode re-engagement. • No effect if SPD/MACH active provided the knobs (on N 1 indicators) are pushed (auto). If these knobs are pulled to manually set the N 1 limit then : – Both ATS disarm if throttles angle is lower than 17 deg. – No effects if throttles angle is greater than 17 deg.	Both ATS disarm. Rearming possible but not mode re-engagement.
FCU failure	Both ATS disarms. Rearming possible but not mode re-engagement	
LOSS of both FD's and AP's	A/THR can be engaged but only on SPD/MACH mode if it is available	

Note : the only failures which affect RTAR mode are :
– the dual Radio Altimeter failure (only when this mode is engaged at 30 ft).
– the FCU failure
– the failures which cause A/THR disengagement

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE MODES ASSOCIATED TO A / THR	1.03.50 PAGE 10 REV 20 SEQ 020

1 – A/THR FUNCTION

A/THR function allows to couple ATS to AP/FD. This means that all the modes associated to A/THR function are automatically selected by the AP/FD, function of the active longitudinal mode in AP/FD.

The modes associated to A/THR are : THR, P THR, SPD, MACH, P SPD, P MACH, RTAR.
The only mode not associated to A/THR is THR L (THRUST LATCH).

Note : engagement of THR L disengages A/THR.

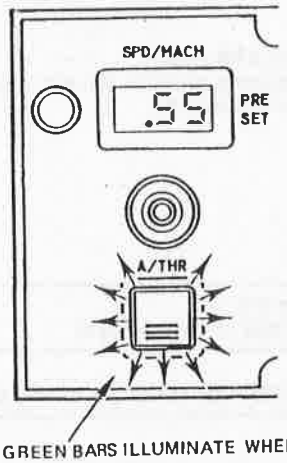
ENGAGEMENT

Provided :

- One ATS lever is armed (If the two are armed ATS 2 is in standby).
- the A/C is not in ALPHA FLOOR condition

A/THR function can be engaged in two different ways :

- by action on the GO LEVERS if this action engages TAKE OFF or GO AROUND mode in AP/FD (in this case THR mode and A/THR are engaged at the same time in ATS).
- on ground with both engines stopped or in flight if LAND TRACK mode is not active in AP/FD, by pressing the A/THR p.b. on FCU.



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3 GREEN BARS ILLUMINATE WHEN A/THR FUNCTION IS ACTIVE

DISENGAGEMENT

A/THR function will be disengaged (but both ATS levers will remain armed) :

- by a second action on the A/THR pushbutton provided LAND TRACK phase of LAND mode is not active.
- by pressing either ATS disconnect pushbutton
- at touchdown when both throttles are on idle position (5^{o}).
- if ground spoilers are deployed on one side
- if one engine is set to reverse thrust.
- when THR L mode is forced in ATS
- if both AP's and FD's are disengaged
- if MCT, CL or CR is selected on TRP when CAS is lower than 60 KTS
- on ground if SPD/MACH is active and one engine is started.

Note : If AFS is used during all the flight, THRUST IS AUTOMATICALLY CONTROLLED FROM TAKE OFF TO LANDING, since A/THR function is automatically engaged at take off by GO LEVERS and automatically disengaged at touch down.

WARNING

A/THR function non-engagement or disengagement (manual or due to a failure) is indicated by a MAN THR amber light which illuminates steady on the PFD's to indicate that the pilot must control the throttles.

This occurs for example during taxi (before take off) or at landing (after touch down)

MAN THR illuminates steady until the pilot engages A/THR function or THR L mode or set both ATS levers to OFF.

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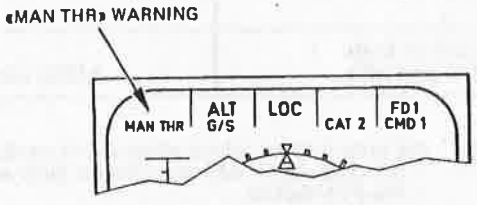


Note : 1. MAN THR warning also occurs when THR L mode is lost.
2. MAN THR warning appears, of course, at each time either ATS disconnect p.b (on throttles) is pressed since this causes A/THR or THR L loss.

4 – RTAR (RETARD) MODE

In this mode the ATS commands the throttle reduction on idle position.

Note : In all flight phases throttle reduction is limited to 5°.

ENGAGEMENT

RTAR mode can be engaged only if A/THR function is active.

RTAR mode is automatically engaged (green RTAR on FMA's) :
- when LVL/CH mode is engaged in descent (SPD or MACH engages in AP/FD)
- At 30 ft radio altitude if SPEED mode is active in the ATS and if one radio altimeter indicates a height lower than or equal to 30 ft. (SPD disengages when RETARD engages).

Note : when RETARD mode is engaged by LVL/CH mode, it is possible during throttles reduction to manually stop the throttles to obtain the desired thrust. RETARD mode is disengaged when throttles are stopped (manually or on idle position).

DISENGAGEMENT

- at each time A/THR function disengages
- when with LVL/CH in descent, throttle reduction is stopped (manually on any position or automatically on idle position). In this case A/THR illuminates blue on FMA's (A/THR function only armed).

OPERATION

For MODE SEQUENCING, see AP/FD MODE DESCRIPTION (LVL/CH and LAND modes).

In this mode, the ATS commands the capture and maintains the THRUST LIMIT corresponding to the mode selected on TRP (as for THR mode).

ENGAGEMENT

- THR L engagement (green THR L on FMA's) is possible only if ATS is armed (on overhead panel).
- THR L is engaged (this causes A/THR function disengagement) :
  - At each time either GO-LEVER is pressed and this action does not lead to THR engagement by the AP/FD.
    This occurs, for example, in APPROACH if SLATS are not extended (in this case GO AROUND mode does not engage in AP/FD and so THR mode cannot be engaged).
  - When ALPHA FLOOR protection is activated (see 03-40 chapter)
- Green THR L illuminates steady when THR L is engaged by ALPHA FLOOR condition.
  Green THR L flashes when THR L is engaged out of the ALPHA FLOOR conditions or when the A/C goes out of the ALPHA FLOOR conditions.

DISENGAGEMENT (ATS remains armed)

- by pressing ATS disconnect p.b.
- by engaging A/THR function (press on A/THR p.b.)
- when GROUND SPOILERS are deployed on one side
- if one engine is set to reverse thrust.

R

Note : When no mode is active in ATS a MAN THR amber warning appears on the FMA's.
MAN THR illuminates steady until the pilot engages THR L mode (or A/THR function) or set ATS lever to OFF.

OPERATION

For MODE SEQUENCING see AP/FD MODE DESCRIPTION (TAKE OFF, GO AROUND, modes).

THR L CONTROL DIAGRAM

See DIAGRAM facing THR and P THR modes description.

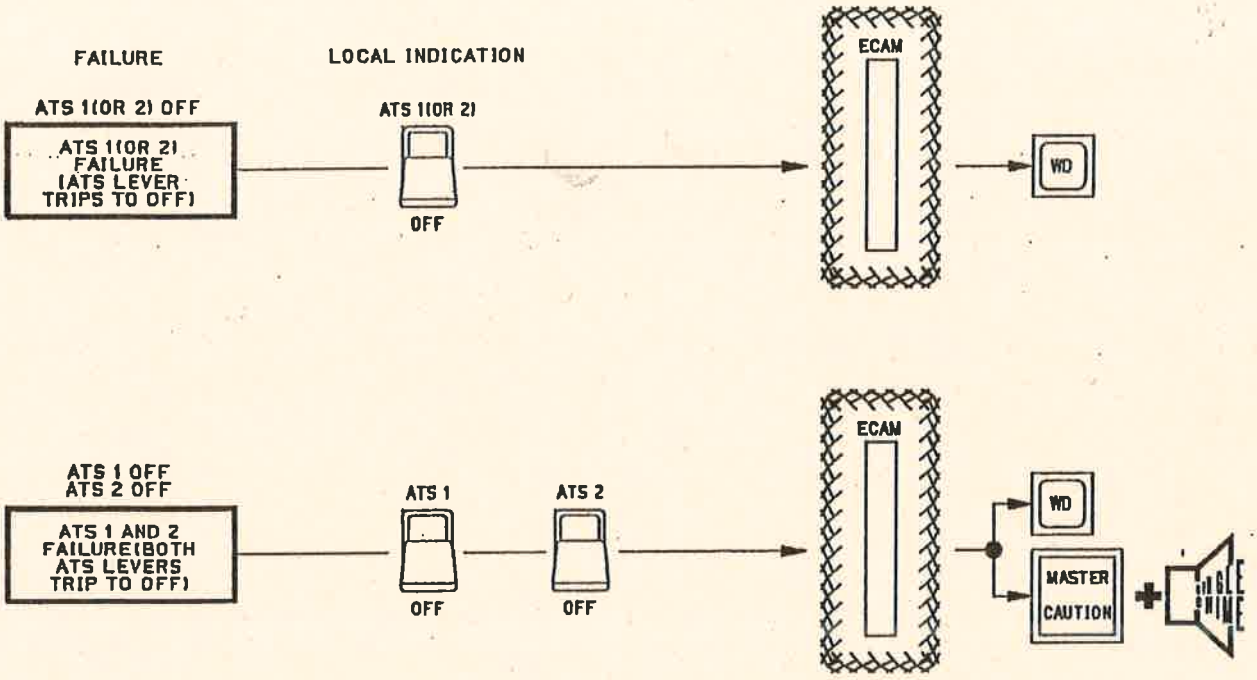
A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE DFA MODE	1.03.50 PAGE 15 REV 07 SEQ 001

DFA is not installed.

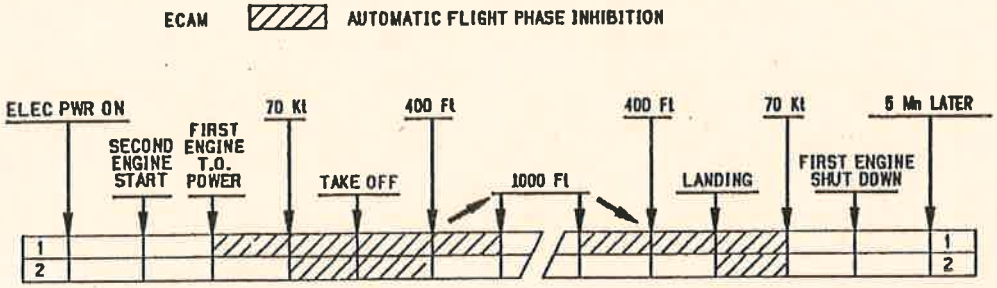
Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE ECAM	1.03.50 PAGE 16 REV 22 SEQ 040

WARNING LOGIC



R



OPS.FCO.B1.0350.016-AB.040

Code : 0350 E

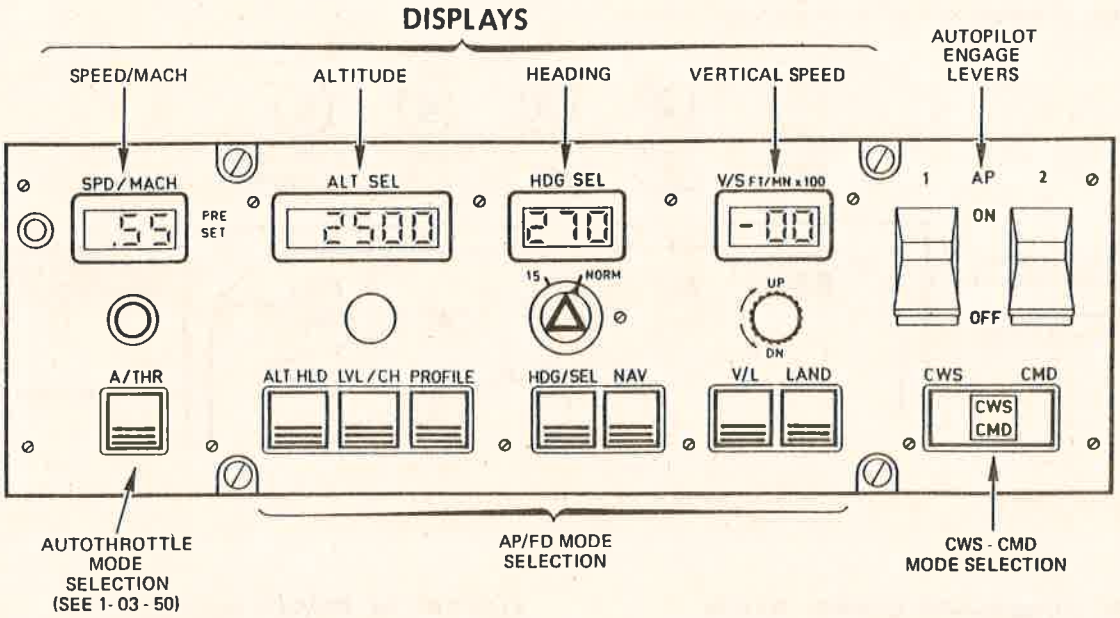
AP/FD MODE SELECTION

The different modes (longitudinal,. lateral or common) are selected through controls located on the FCU (Flight Control Unit).

The only exception is for TAKE OFF (SRS + RWY) and GO-AROUND which are selected through the GO-LEVERS located on the throttles.

Actions to select these modes are described in sub-chapters 03-65, 03-66, 03-67.

R
R
R



MODE SELECTION LOGIC

FD computations are common with those of the AP.

The selection of a mode is done in the same way if only the FD's are engaged or if the FD's and one or two AP's are all engaged.

Mode selection is based on the following principles :

- Any action on a mode pushbutton (on the FCU), if the engagement conditions are met, allows the engagement of the corresponding mode.
- Any second action on an illuminated mode pushbutton, disengages the modes.
  Moreover, if the mode is in active phase (and not in arming phase) this causes selection of V/S mode if the disengaged mode was a longitudinal mode, or HDG mode if the disengaged mode was a lateral mode.
- Pulling one of the 4 knobs (on the FCU), if the engagement conditions are met, allows the engagement of the corresponding mode. Theses knobs don't allow to disengage the corresponding modes.
- The loss of one mode engagement condition leads to the disengagement of the mode and in some cases the disconnection of the AP/FD (see mode description in 03-65, 03-66, 03-67).
- The AP, when engaged in CMD, engages in the modes selected with the corresponding FD.

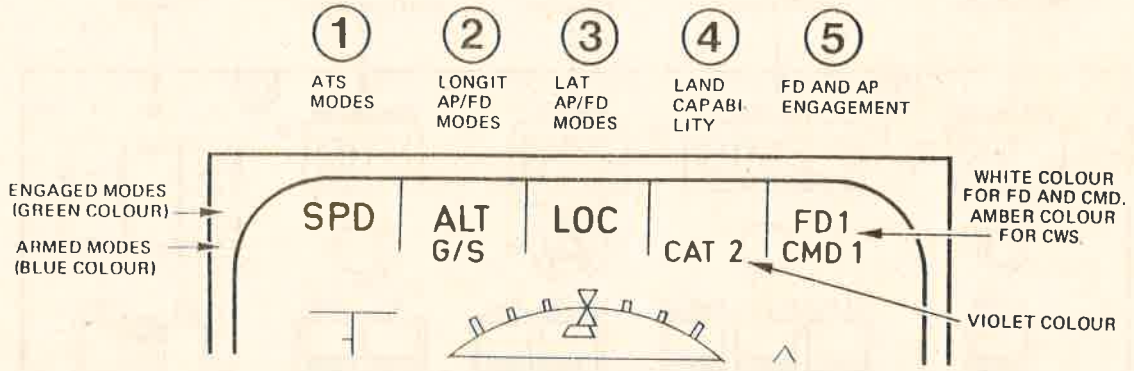
Note : In all modes, the FD BARS (if active) indicate the commands to be executed to follow the selected modes and references.

Vers. : All Eng. : All

AP/FD MODE ANNUNCIATION ON PFD

AP/FD engagement status and mode engagement are indicated on the FMA (FLIGHT MODE ANNUNCIATOR) which is integrated in the upper part of the PFD (PRIMARY FLIGHT DISPLAY)

The FMA is divided in 5 zones as described below :



AP/FD COMMANDS COMPUTATION

Computations for AP and FD functions are made by the same computer : the FCC (FLIGHT CONTROL COMPUTER). There are two FCC's (one for each AP/FD).

Each FCC includes two computing channels, a command one and a monitor one, for safety reason.

The FCC's receive information mainly from the Flight Control Unit (mode selection, references), the GO-LEVERS (mode selection), the disconnect pushbuttons (AP disconnection), the VOR, ILS, Altimeters, FMS (Flight Management System) and from other computers like ADC, IRS, FAC, TCC, etc.
Then with all these data the FCC's provide command signals to the FD bars (FD function) and to the flight control SERVO ACTUATORS (AP function).

ELECTRICAL POWER SUPPLY

The AP/FD system is electrically supplied with :
- 28 Volt DC which is the main supply :
  28 Volt DC ESS BUS supplies FCC 1 and FCU
  28 Volt DC NORM BUS supplies FCC 2 and FCU
- 26 Volt AC :
  26 Volt AC ESS BUS supplies FCC 1
  26 Volt AC BUS 2 supplies FCC 2

The AP/FD system is energized when one of the following conditions is met :
- one engine running
- one PITCH TRIM lever armed.
- for MAINTENANCE purpose if cockpit LAMP TEST or, through MTP, GROUND SCAN or AFS/LAND TEST is activated.

On ground, electrical power supply is automatically cut off 12.5 s after the last of the following conditions has occured :
- Both engines shut down
- Both PITCH TRIM levers set to OFF
- End of the MAINTENANCE tests mentionned above.

Note : when electrical power is cut off, the other levers (YAW DAMPER, ATS) trip.

Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR FD DESCRIPTION	1.03.62 PAGE 1 REV 08 SEQ 001

FUNCTION

The goal of the FD is to provide informations to the pilot (through the FD BARS on PFD's), to allow manual guidance of the A/C :

- in pitch axis, if a longitudinal mode has been engaged
- in roll axis, if a lateral mode has been engaged
- in yaw axis, if certain phases of TAKE OFF or LAND modes have been engaged.

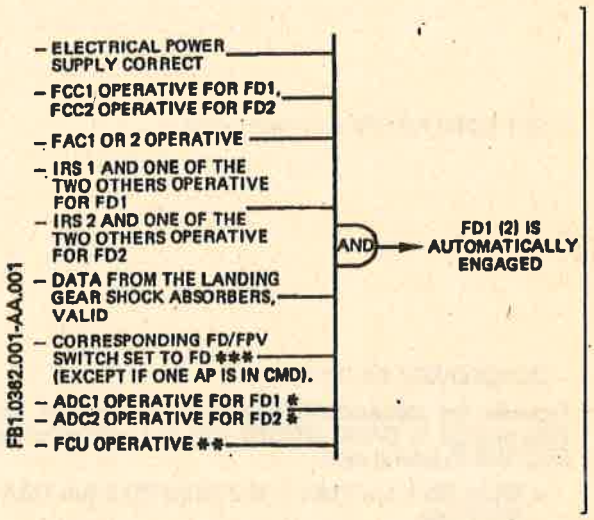
If the FD commands are followed, the FD BARS remain centered on the PFD.

One or two BARS can be out of view, depending on the selected modes.
In addition, the FD BARS can be moved out of view by setting the FD/FPV switch to OFF or FPV, (see FD/FPV SWITCH schematic).

If no AP is engaged in CMD, FMA and FD BARS on PFD 1 are associated with FD 1, FMA and FD BARS on PFD 2 are associated with FD 2.

If an AP is engaged in CMD, both FMA's are associated with this AP, but the FD BARS on the PFD's remain associated with the corresponding FD.
This means, for example, that in VOR MODE, when two different settings are selected on the two VOR control panels, the FD BARS are not centered on the side where no AP is engaged.

Note : FOR MODE DESCRIPTION (common to FD and AP in CMD), see 03-65, 03-66, 03-67.



ENGAGEMENT CONDITIONS

No pushbutton exists to engage or disengage the FD's.

The two FD's are independent. FD1 feeds PFD1 and FD2 feeds PFD2.

When the two FCC's are electrically energized and provided all the engagement conditions (here after listed) are met, the two FD's are automatically engaged in the basic modes :

- V/S (Vertical Speed) in pitch axis.
- HDG (Heading) in roll axis.

* not necessary after GLIDE CAPTURE phase.

** not necessary in GO AROUND or LAND TRACK modes.

*** If the FD/FPV switch is set to FPV and if one of the following modes :
- TAKE OFF (SRS + HDG or RWY)
- GO AROUND
- ALIGN phase of LAND mode
- ROLL OUT phase of LAND mode

is engaged, the FD BARS are automatically recovered on the PFD's.

Note : To these general engagement conditions, specific engagement conditions must be added depending on the selected modes. See mode description in 03-65, 03-66, 03-67.

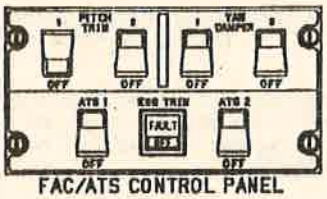
Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR FD DESCRIPTION	1.03.62 PAGE 2 REV 22 SEQ 110

ENGAGEMENT ANNUNCIATION

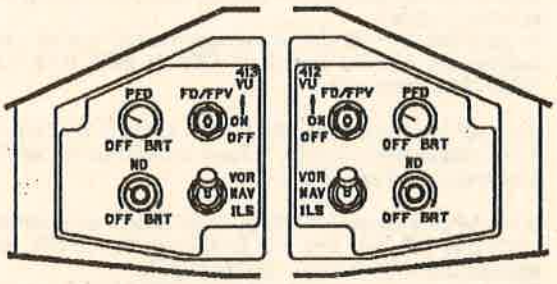
– ENGAGE ONE PITCH TRIM LEVER ON THE FAC/ATS CONTROL PANEL (to supply FCC's with electricity).

Note : FCC's are already supplied with electricity if at least one engine is operating.



FAC/ATS CONTROL PANEL

– SET BOTH FD/FPV switches to ON.

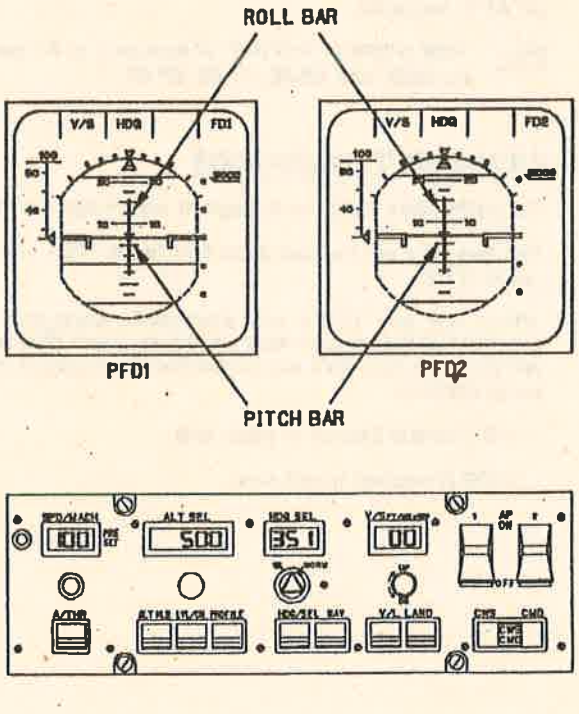


– CONSEQUENCES ON PFD's.

Provided the ENGAGEMENT CONDITIONS are met, both FD's engage in BASIC MODES (V/S in longitudinal axis and HDG in lateral axis).

- White FD 1 (on FMA 1) and white FD 2 (on FMA 2) illuminate.
- Green V/S and HDG illuminate on both FMA's.
- PITCH AND ROLL BARS come in view on both PFD's.

Notes : 1. As long as A/C is on ground and HDG mode is engaged, ROLL BAR is synchronized on A/C heading (ROLL BAR remains centered on PFD's).
YAW BAR appears only at TAKE OFF (with RWY mode) or at LANDING (in ALIGN and ROLL OUT phases of LAND mode).
At take off (at 30ft) if HDG replaces RWY mode, ROLL BAR is also synchronized on A/C heading at HDG engagement.
2. When a failure causes disengagement of both AP/FD's, the FD's reengage in basic modes after a delay but in this case the FD bars flash for 10 sec.



OPS.FCO.B1.0362.002–AA.110

– CONSEQUENCES ON FCU :

The reference display windows are initialized with present aircraft parameters (here 100 kt, 500 ft, 351°, 0 ft/mn).
In case of absent or invalid FCC data :
– 100 kt is displayed in SPD/MACH display window.
– 5000 ft is displayed in ALT display window.
– O° is displayed in HDG SEL display window.
– – – – is displayed in V/S display window.

Note : 100 kt is the minimum value for the SPD/MACH display window.

Code : 0362C

DISENGAGEMENT

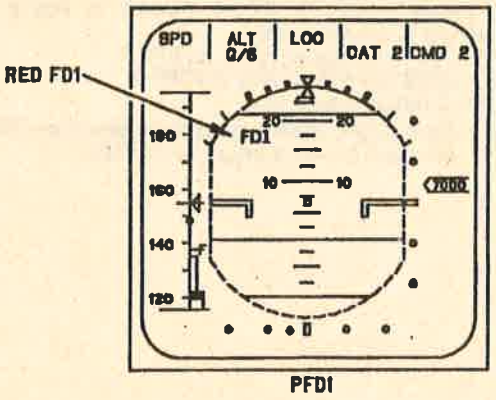
No pushbutton exists to engage or disengage the FD's.

However each pilot can clear the FD BARS on his PFD by means of his FD/FPV switch (see next paragraph).

If one engagement condition is no longer met for one FD, it disengages :

- The FD BARS on the corresponding PFD are set out of view.
- A FD 1 (or 2) red message appears on PFD 1 (or 2).
- The lights related to the FD extinguish on the corresponding FMA, unless an AP is engaged in CMD (as on the example).

In case of a single FD failure, the FD BARS can be recovered by pressing the FD switch, on the instrument switching panel. The remaining FD then feeds both PFD's. (see FD SWITCHING schematic).



FD/FPV SWITCH

(1) CAPT « FD/FPV » SWITCH

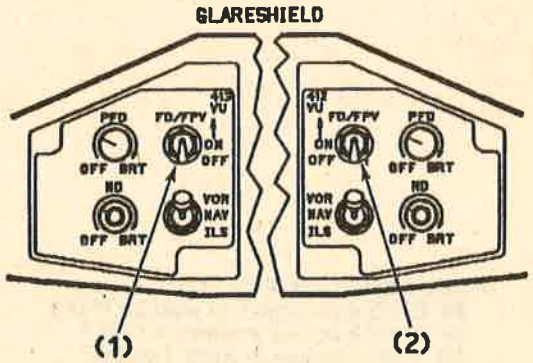
- **OFF (stable position) :**
  Both FD bars and FPV symbols are out of view on PFD1. If no AP is in CMD, FD1 is disengaged (AP/FD mode indications extinguish on FMA 1). But no failure message (red FD1 on PFD1) is displayed.
- **ON (stable position) :**
  either FD bars or FPV symbols are presented on PFD1.
- **Upper position (unstable) :**
  when the switch is set to the upper position, the display on PFD1 switches from FD bars to FPV symbols or from FPV symbols to FD bars.
  When FPV symbols are displayed and when no AP is in CMD, AP/FD mode indications disappear on FMA 1.

  Notes :

  1. FPV function and symbols are described with EFIS in FLIGHT INSTRUMENTS chapter.

  2. When the switch is set from OFF to ON, or at FCC's energization (if the switch is already ON), the FD bars are displayed.

  3. An automatic reversion to FD bars display on PFD's is done when TAKE OFF, GO AROUND or LAND mode (ALIGN or ROLL OUT phase) is engaged.



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(2) F/O « FD/FPV » SWITCH

Same function as CAPT FD/FPV SWITCH, but it applies to PFD2 and FD2.

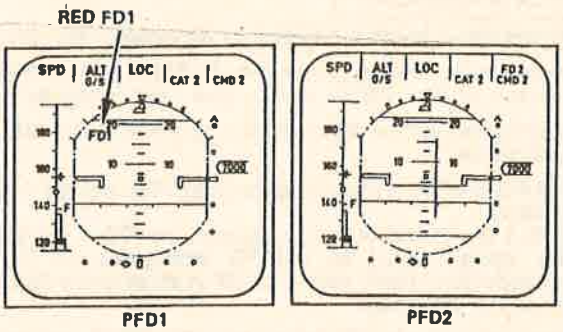
Mod. : 5051

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR FD DESCRIPTION	1.03.62 PAGE 4 REV 20 SEQ 001

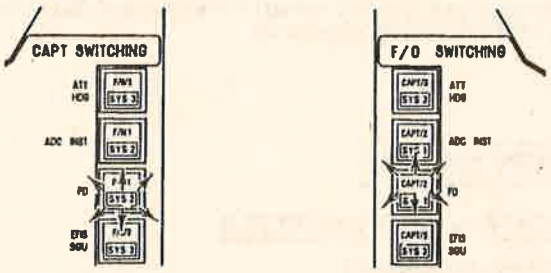
FD SWITCHING (case of FCC 1 failure)

- If a failure occurs in FCC 1 (failure in FCC 2 has symetrical consequences) :
  - FD1 red message appears on PFD 1.
  - FD BARS are out of view on PFD 1.
  - PFD 2 remains as it was.

  Note : Here AP/FD modes remain displayed on FMA 1 because an AP is engaged in CMD.



- By pressing CAPT FD SWITCH (1)
  - SYS 2 illuminates white on the CAPT FD SWITCH.
  - CAPT/2 illuminates green on the F/O FD SWITCH (2)

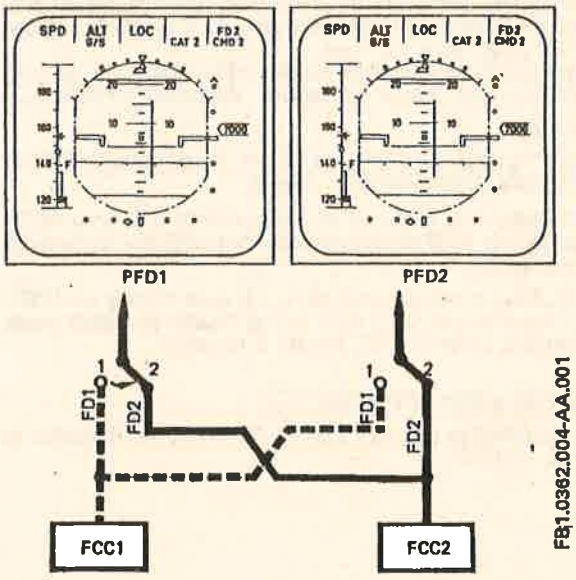


- FCC 2 then feeds PFD 1 (3)
  FD BARS come again in view on PFD 1.
  White FD 2 comes in view on FMA 1
  FD 1 red message is cleared on PFD 1.

Note : 1. It is always possible to come back to the original configuration by pressing a second time the CAPT FD SWITCH.

2. It is not possible to feed at the same time PFD 1 with FCC 2 and PFD 2 with FCC 1.

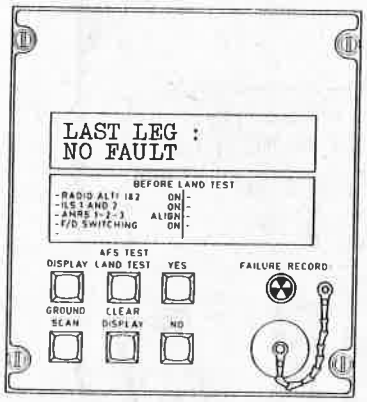
3. There is no priority between CAPT and F/O switch.



AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM FAULT ISOLATION AND DETECTION SYSTEM SCHEMATICS	R 1.03.70 PAGE 3 REV 08

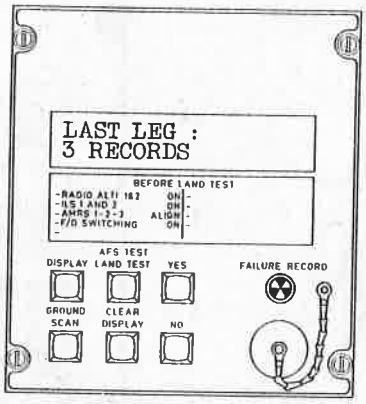
MESSAGES DISPLAYED WHEN PRESSING THE « DISPLAY » PUSHBUTTON (1)

EXAMPLE 1
(NO DETECTED FAILURE)



END

EXAMPLE 2
(3 FAILURES RECORDED)



1 FCC 1 FAILED

EVENTS ARE NUMBERED FROM 1 TO 30

2 COMPLEMENTARY TEST ON GROUND

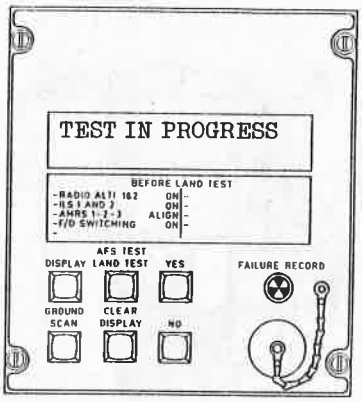
FAULTY LRU'S ASSOCIATED WITH 3RD EVENT ARE DISPLAYED IN PROBABILITY ORDER

3–1 FCC 2 FAILED

3–2 AP DISC PUSHBUTTON SW

END

EXAMPLE 3
(TEST IN PROGRESS)



AT THE END OF THE TEST NO MESSAGE IS DISPLAYED.

A SECOND ACTION ON THE DISPLAY P.B. IS NECESSARY TO DISPLAY THE FAILURES

OPS.FCO.B1.0370.003-OO.001

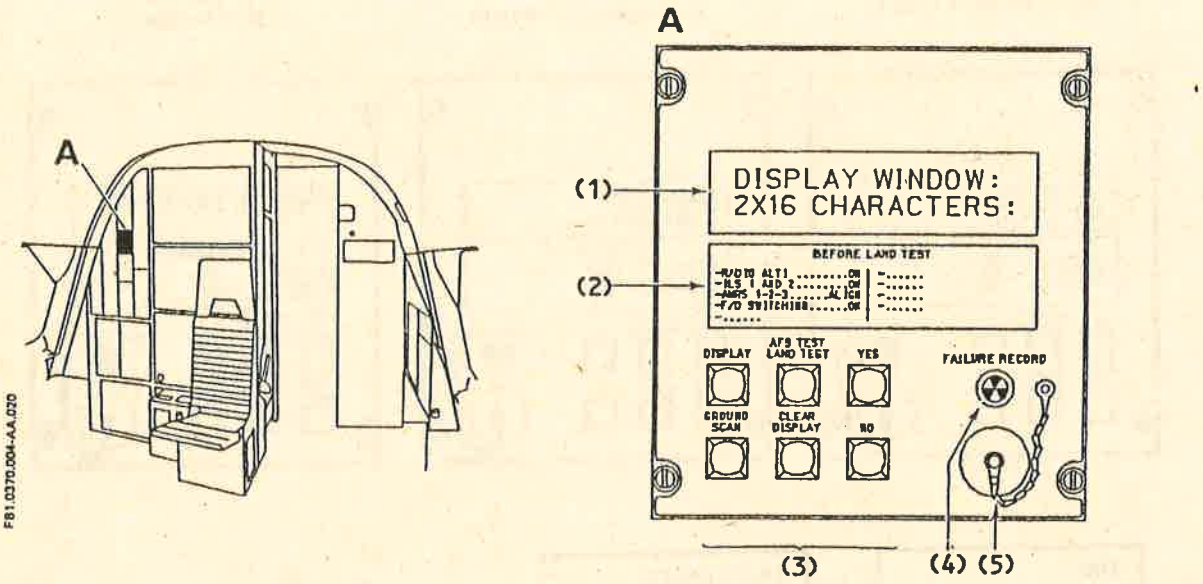
Notes : 1 – After the DISPLAY p.b. has been pressed, the messages are automatically displayed in cyclic form. Each message is displayed for three seconds. After END, there is no more displayed message.

2 – The MTP can memorize up to thirty events for the last six flights following the first-in, first-out method (the last memorized event erases the first memorized one).
Action on DISPLAY p.b. only will display the messages concerning the last flight.
Pressing at the same time DISPLAY, YES and NO p.b. will display the messages concerning the 6 previous flights.

Vers. : All

Eng. : All

A. MAINTENANCE TEST PANEL



(1) MTP DISPLAY WINDOW

Comprises two lines of sixteen alphanumeric characters.

(2) BEFORE LAND TEST Placard

Specifies the status of the peripheral systems required for the LAND TEST.

(3) MTP Keyboards

Six control pushbuttons allow to display on the DISPLAY WINDOW, the informations collected by the FIDS.

DISPLAY, AFS TEST/LAND TEST and GROUND SCAN pushbuttons allow to select the different functions of the FIDS.

YES, NO, CLEAR DISPLAY pushbuttons are used only on ground with AFS TEST/ LAND TEST or GROUND SCAN functions.

(4) FAILURE RECORD Magnetic Indicator

Indicates black and white when a failure has been recorded. Indicates black when no failure has been recorded.

(5) MTP Connector

Allows connection of a TEST SET to help maintenance personnel in complex trouble-shooting.

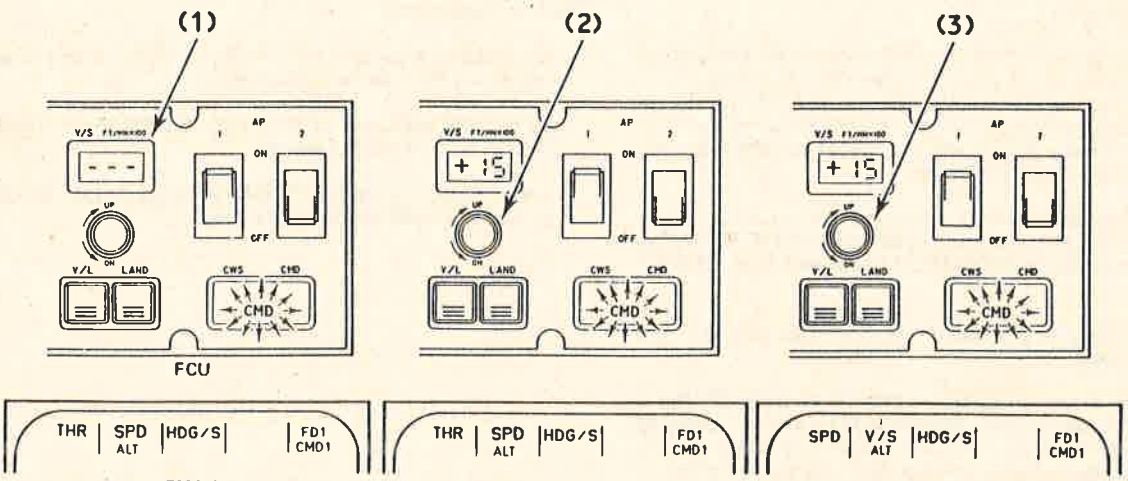
Mod. : 4803

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR LONGITUDINAL MODES	N 1.03.65 PAGE 3 MAR 83

V/S MODE (CONT'D)

OPERATION - ANNUNCIATION

- Before V/S engagement
  - dashes on the V/S display window (1).
  - A/C configuration is for example : one AP in CMD. LVL/CH mode engaged.
- Turning V/S knob (2) :
  - synchronizes V/S counter on A/C present V/S.
  - then allows to preselect a new V/S (here 1500 ft/min)
- When pulling the V/S knob (3) :
  - V/S mode engages on the preselected V/S.
  - green V/S illuminates on both FMA's.
  - ATS engages in SPD mode (if A/THR active). Green SPD illuminates on both FMA's.



Note : If V/S setting knob had not been turned, V/S mode would have engaged on present aircraft vertical speed.

Vers. : All Eng. : All

ALT MODE

Altitude (ALT) mode maintains the altitude existing at the time of engagement if vertical speed is null.
If vertical speed is not null, AP/FD first levels off the aircraft and then maintains the resulting altitude.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

ALT is engaged

- by pressing the ALT HLD pushbutton on FCU, provided LAND mode is not active in the TRACK phase.
  At the same time SPEED or MACH mode is automatically engaged in autothrottle (if A/THR active). ATS maintains the speed (or mach) selected on the SPD/MACH display window.
- by pulling SPD/MACH setting knob on FCU, when PROFILE mode is engaged in altitude hold (P ALT). This allows to enter a SPD/MACH constraint (see PROFILE mode).
- automatically at the end of the CAPTURE phase of the ALT* mode.

Note : This mode is available with FD as with AP. But if AP is engaged in CMD when FD is already engaged in ALT mode, the AP takes into account the altitude selected on the ALT display window.

That is to say :

If the difference between the A/C and the selected altitude is lower than 250 ft, the AP will capture and maintain the selected altitude.

If the difference between the A/C and the selected altitude is greater than 250 ft, the AP will level off the A/C and maintain the resulting altitude.

DISENGAGEMENT

ALT is disengaged

- by pressing a second time ALT p.b. (This causes basic mode – V/S – to be selected).
- by manual selection of V/S, LVL/CH, PROFILE, TAKE-OFF or GO AROUND mode.
- automatically when GLIDE CAPTURE or GLIDE TRACK phase of LAND mode is activated.

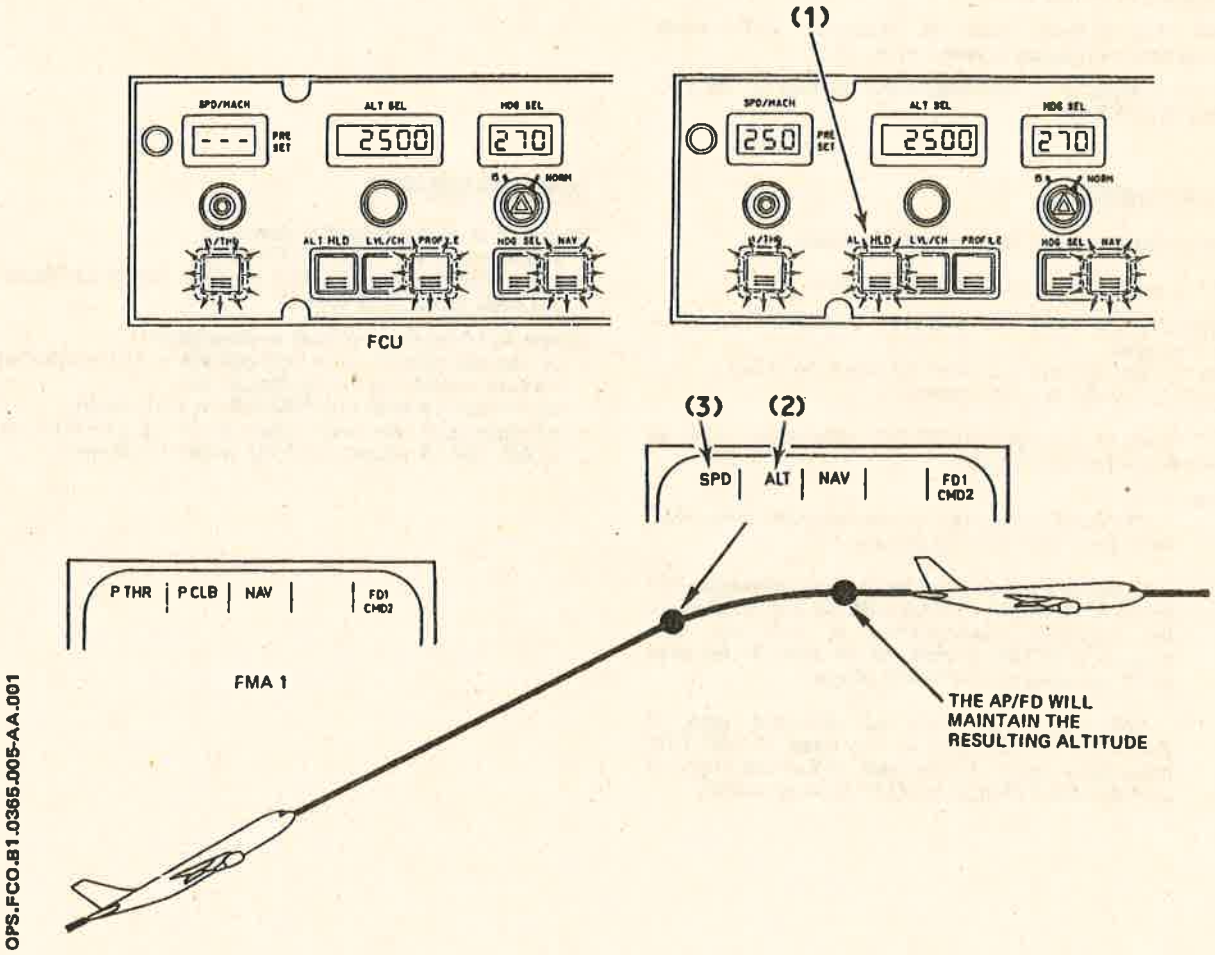
A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR LONGITUDINAL MODES	1.03.65 PAGE 5 JUL 83 SEQ 001

ALT MODE (CONT'D)

OPERATION – ANNUNCIATION

- Before ALT engagement, A/C configuration is for example :
  - AP in CMD.
  - PROFILE and NAV modes engaged.
  - Vertical speed not null.

- When ALT HLD p.b. is pressed (1)
  - ALT p.b. is lighted
  - PROFILE p.b. is extinguished
  - ALT illuminates green on both FMA (2).
  - ATS engages in SPD (or MACH). Green SPD (or MACH) illuminates on both FMA (3).
  - The AP/FD levels off the A/C.



ALT* MODE

Altitude acquire (ALT*) mode acquires the altitude selected on the ALT display window (on FCU).

This mode comprises two phases :

- An ARMING PHASE during which a support longitudinal mode (V/S, LVL/CH, TAKE-OFF or GO-AROUND) is used to converge towards the selected level.
- A CAPTURE PHASE which starts as soon as a given relation between the altitude deviation and the A/C vertical speed is achieved. When CAPTURE phase is initiated, autothrottle (if A/THR active) automatically engages in SPD/MACH.

When the desired level is reached, ALT mode automatically engages in place of ALT*.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

No pushbutton exists to engage this mode.

ALT* is armed (blue ALT on FMA's) when :

- V/S, LVL/CH, TAKE OFF (SRS) or GO AROUND mode is engaged
- and a new altitude has been selected on FCU.
- and FLAPS 40° are not selected

ALT* mode is engaged (CAPTURE phase) as soon as capture conditions are met.

Notes :

– CAPTURE phase can not be activated when ALT knob (on FCU) is being turned.

– Selected altitude may be changed (through ALT knob) in ARMING PHASE without any change on the engaged modes.Except if, with the new altitude CAPTURE conditions are met. In this case ALT engages in CAPTURE phase.*

– Selected altitude may be changed, also, in CAPTURE PHASE. But in this case, if CAPTURE conditions are no longer met, V/S mode engages and ARMING PHASE of ALT is re-activated.*

DISENGAGEMENT

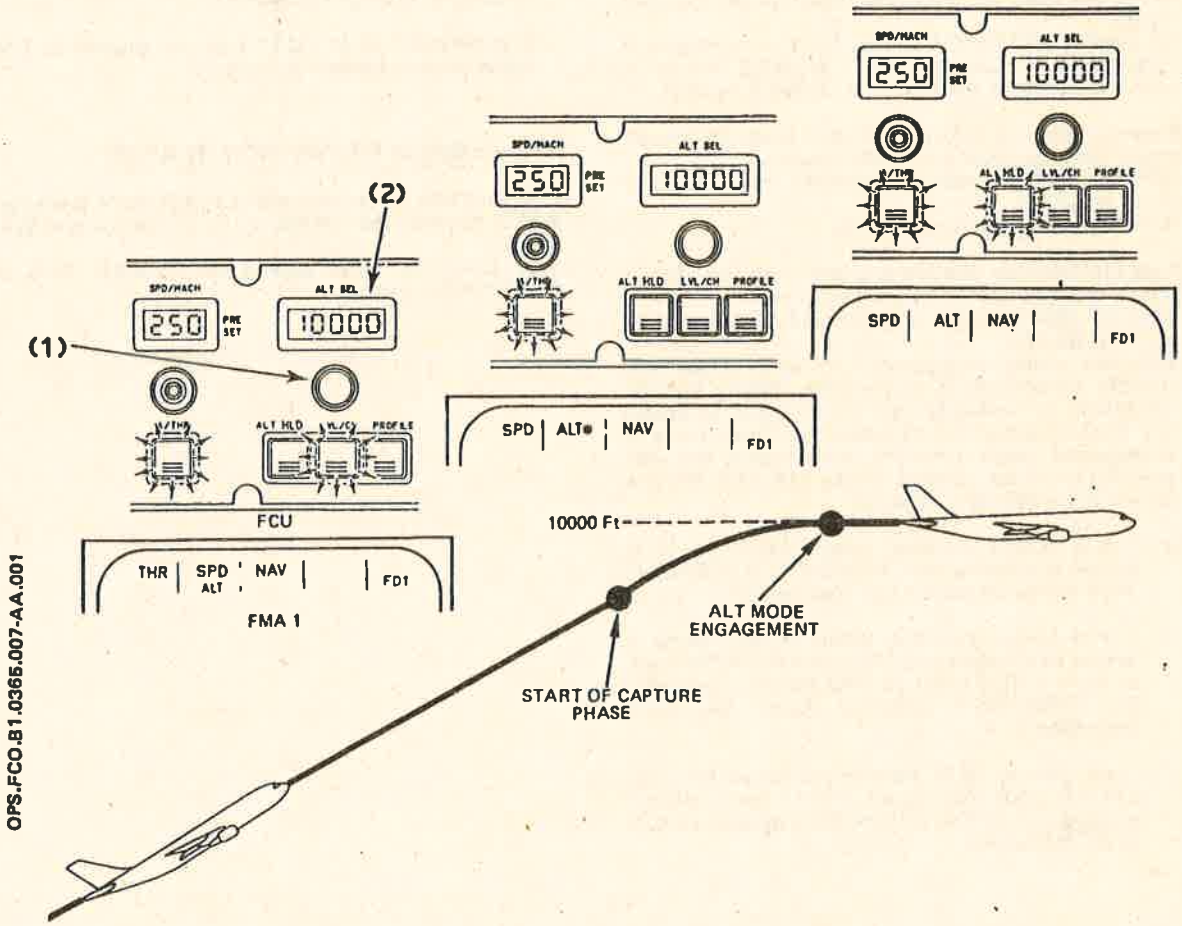
Blue ALT (arming phase) is disarmed
- by manual selection of ALT mode.
- automatically when PROFILE mode or GLIDE CAPTURE of LAND mode is activated.

Green ALT* (capture phase) is disengaged
- by manual selection of a new altitude on FCU such that capture conditions are no longer met.
- by manual selection of PROFILE, or ALT mode.
- automatically when ALT mode or GLIDE CAPTURE or GLIDE TRACK phase of LAND mode is activated.

ALT* MODE (CONT'D)

OPERATION – ANNUNCIATION

- ARMING PHASE
  A/C configuration is, for example :
  - LVL/CH mode engaged.
  - desired level (10 000 ft) selected by the mean of the ALT knob (1) and displayed on the ALT display window (2).
  - Blue ALT (ALT* armed) illuminated on FMA's.
- START of CAPTURE PHASE (which depends on the A/C V/S) :
  - Green ALT* illuminates on both FMA's.
  - ATS engages in SPD mode (if A/THR active) and green SPD illuminates on both FMA's.
  - LVL/CH p.b. is extinguished.
- When reaching the selected level :
  - ALT mode automatically engages.
  - Green ALT illuminates on both FMA's.
  - ALT HLD p.b. is lighted.



LEVEL CHANGE – LVL/CH – MODE

LVL/CH mode allows to perform a level change with a minimum of crew actions.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

- Provided a level different from the A/C present altitude has been selected on the FCU, LVL/CH mode is engaged :
  - by pressing LVL/CH p.b. on FCU, provided LAND mode is not active in TRACK phase.
  - by pulling ALT knob whatever the active vertical mode is, except PROFILE and TRACK phase of LAND mode.
  - by pulling SPD/MACH setting knob to introduce a SPD/MACH constraint when PROFILE mode is active in climb or descent (see PROFILE mode).
- When the selected altitude is higher than the aircraft altitude, engagement of LVL/CH causes :
  - SPD (or MACH) mode engagement and arming of ALT* in AP/FD
  - THR mode engagement in ATS.
- When the selected altitude is lower than the aircraft altitude, engagement of LVL/CH causes :
  - SPD (or MACH) mode engagement and arming of ALT* in AP/FD.
  - RETARD mode engagement in ATS (Automatic throttle retraction). It is possible, during throttle retraction, to manually stop the throttles to obtain the desired thrust. In all cases, RETARD mode is disengaged when throttles are stopped (on idle position or at the desired thrust) but ATS remains armed (blue A/THR on FMA's).

Notes : – It is always possible, when LVL/CH mode is active, to select a new SPD/MACH or ALTITUDE. They will be acquired and maintained.

– It is always possible, when LVL/CH mode is active, to change from SPD mode to MACH mode or from MACH mode to SPD mode by pressing the SPD/MACH selecting knob (see ATS description).

– As soon as ALT capture conditions are met, LVL/CH mode disengages. ALT* (capture phase) engages in AP/FD, SPD/MACH engages in ATS (if A/THR active).*

DISENGAGEMENT

LVL/CH is disengaged

- by pressing a second time LVL/CH p.b. on FCU (this causes basic mode – V/S – to be engaged)
- by manual selection of V/S, ALT, GO-AROUND, TAKE-OFF or PROFILE mode.
- automatically when ALT* (capture phase) or LAND (glide capture phase) is engaged.

SPD or MACH PROTECTION IN AP/FD

If VLS or VMAX is reached when LVL/CH mode is engaged, AP/FD controls the aircraft so as to not exceed VLS or VMAX.
This protection also applies to PROFILE, SRS and GO-AROUND mode.

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LEVEL CHANGE – LVL/CH – MODE (CONT'D)

OPERATION – ANNUNCIATION (case of a climb)

- Present A/C configuration

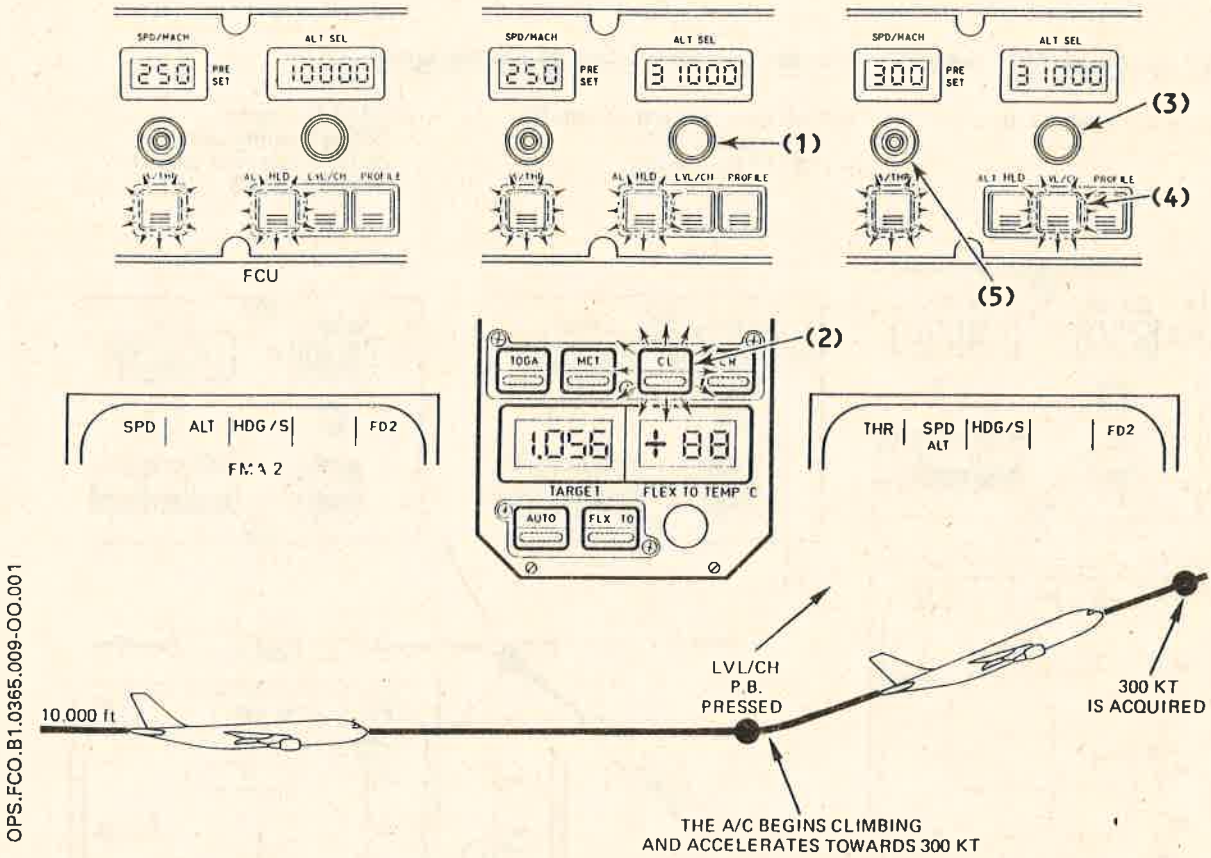
- Desired ALT (31 000ft here) is selected through ALT knob (1).
- Desired thrust (here CL) is selected on TRP (2).

Note : If AUTO mode has been selected, CL will be automatically engaged upon LVL/CH engagement.

- When pulling ALT knob (3)
  - LVL/CH p.b. is lighted (4).
  - ATS engages in THR mode (green THR on FMA's).
  - AP/FD engages in SPD mode (green SPD on FMA's) and armed ALT* mode (blue ALT on FMA's).

Note : LVL/CH can also be engaged by pressing the LVL/CH pushbutton.

- Desired climb SPD is selected by turning SPD/M setting knob (5).



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Vers. : All Eng. : All

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PRESET FUNCTION

This function allows, when a SPEED or a MACH is being maintained by the AP/FD or the ATS, to preselect a speed or a MACH which will be the new target SPEED or MACH when certain conditions are met.

Note : PRESET function is not available when PROFILE mode is active.

These conditions are :

- LVL/CH or ALT mode engagement.
- ALT* mode activation.
- Automatic SPD engagement when MACH mode was active and the PRESET SPD is reached (this case is encountered in descent).

R - Automatic MACH engagement when SPD mode was active and the PRESET MACH is reached (this case is encountered in climb).

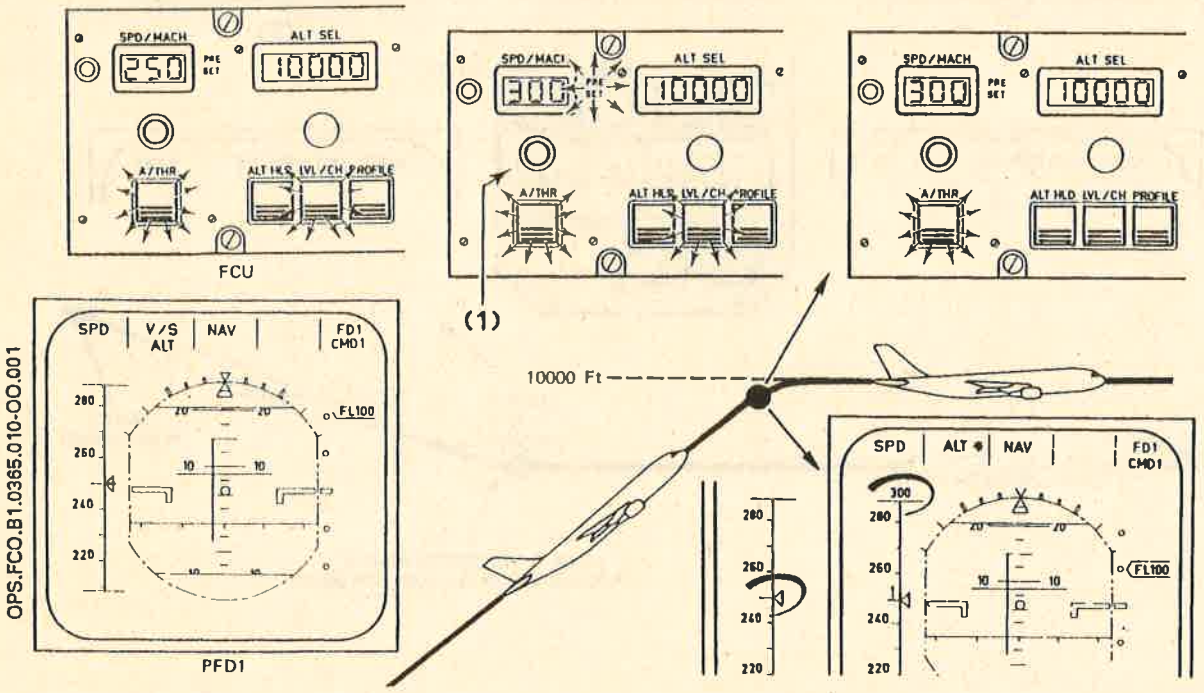
PRESET used with LVL/CH

PRESET may be used with LVL/CH :

- prior to take off to preselect initial climb speed when V2 is selected (this initial climb speed will be the new target at LVL/CH engagement).
- before initiating a climb or a descent to preselect a speed different from the one maintained at the present level. But the recommanded procedure is to adjust the speed after LVL/CH engagement as shown in LVL/CH mode.

PRESET used with ALT* activation (Similar sequence when ALT is engaged)

- Present A/C configuration
- Push then rotate the knob (1) to preset 300 KTS.
- PRESET illuminates
- At ALT* activation
  - PRESET extinguishes.
  - 300 kt is the new TARGET SPEED for ATS.



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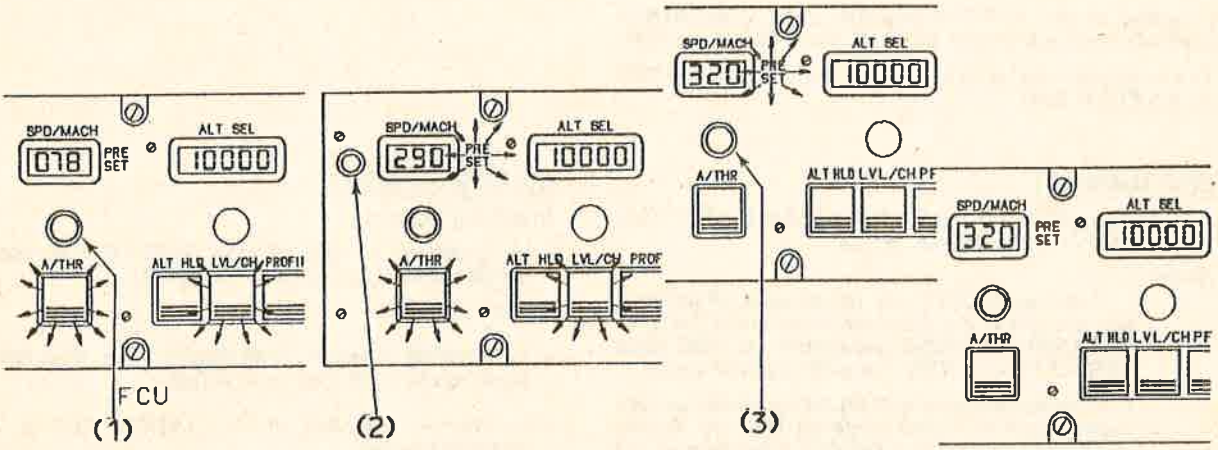
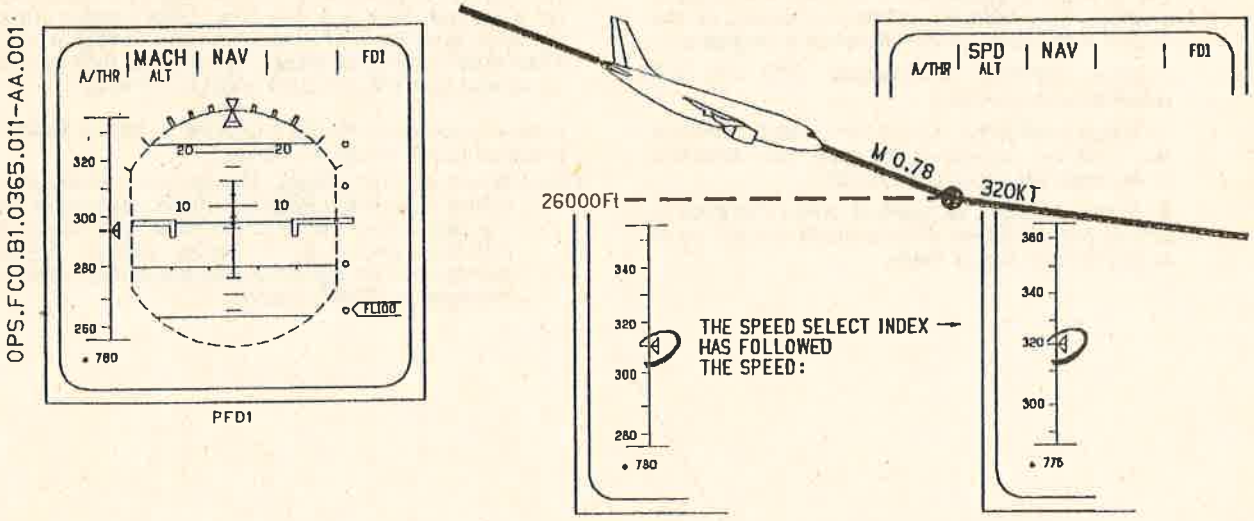
PRESET FUNCTION (CONT'D)

PRESET used when reaching a SPEED (case of a descent)

- Initial A/C configuration : LVL/CH (in descent) with MACH mode engaged.
- Push the knob (1) to engage PRESET.
- Push the knob (2), the actual A/C speed is displayed.
- Rotate the knob (3) to preselect the 320 KT speed.
- At 26 000 ft, 320 KT is reached. PRESET extinguishes. AP/FD engages in SPD mode and maintains 320 KT





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Note : A Similar procedure is used in climb to PRESET a MACH when the SPD mode is engaged.

PRESET DEACTIVATION

It is possible, at any time, to deactivate the PRESET function by simply pushing a second time the SPD/MACH setting knob.
In this case PRESET light extinguishes on FCU and the SPEED (or MACH) which is presently maintained by AP/FD or ATS is displayed again in the SPD/MACH display window.

PROFILE MODE

PROFILE mode allows to couple the FMS (Flight Management System) to the AP/FD and ATS.

The FMS, then, controls the VERTICAL NAVIGATION (through AP/FD) and the THRUST (through the ATS).

Coupling to the ATS is possible (through PROFILE mode) only if A/THR p.b. is armed (on FCU).

Coupling to the AP/FD is possible even if no ATS is available but coupling to the ATS alone is not possible.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

- by pressing PROFILE p.b. on FCU provided LAND mode is not active in the TRACK phase.

Notes :

1. Pressing PROFILE p.b. before take off will only arm the mode. It will remain armed until THRUST REDUCTION ALTITUDE (predetermined FMS value – 1500 FT above RWY – or pilot inserted value).

2. PROFILE engagement (in active phase) causes engagement of AUTO mode on TRP and display of TARGET thrust in « TARGET » window of the TRP (if PALT is active, the « TARGET » window is dashed). This TARGET will be maintained by the ATS if, in addition, A/THR function is engaged.

3. When PROFILE is engaged, SPD and V/S windows are dashed.

4. When in PROFILE, a level cannot be left without two positives actions of the crew (see selection of an upper or lower flight level).

5. If VLS or VMAX is reached when PROFILE is active, the AP/FD (or ATS) controls the A/C so as to not exceed VLS or VMAX.

DISENGAGEMENT

In arming phase :

- by pressing a second time PROFILE p.b. (active longitudinal mode remains engaged).

In active phase :

- by pressing a second time PROFILE p.b. (this causes basic mode – V/S – to be selected).

- by manual selection of V/S, LVL/CH, ALT or GO-AROUND mode.
  Turning the SPD/MACH or V/S setting knob allows to set a desired value (e.g. V/S constraint), starting from the value synchronized on the A/C present SPD or V/S. Then pulling the knob allows to enter the SPD or V/S constraint (see V/S and SPD constraint entry).

- automatically when GLIDE CAPTURE or GLIDE TRACK phase of LAND mode is activated.

Note : When a FMC (Flight Management Computer) failure is detected PROFILE mode disengages on the side where the FMC has failed. Moreover, if PROFILE mode is in active phase, AP/FD disengages. On the other side, the AP/FD remains engaged in PROFILE mode.

SEE « FMS USE » IN PROCEDURES AND TECHNIQUES FOR THE USE OF PROFILE (ENGAGEMENT, DISENGAGEMENT)

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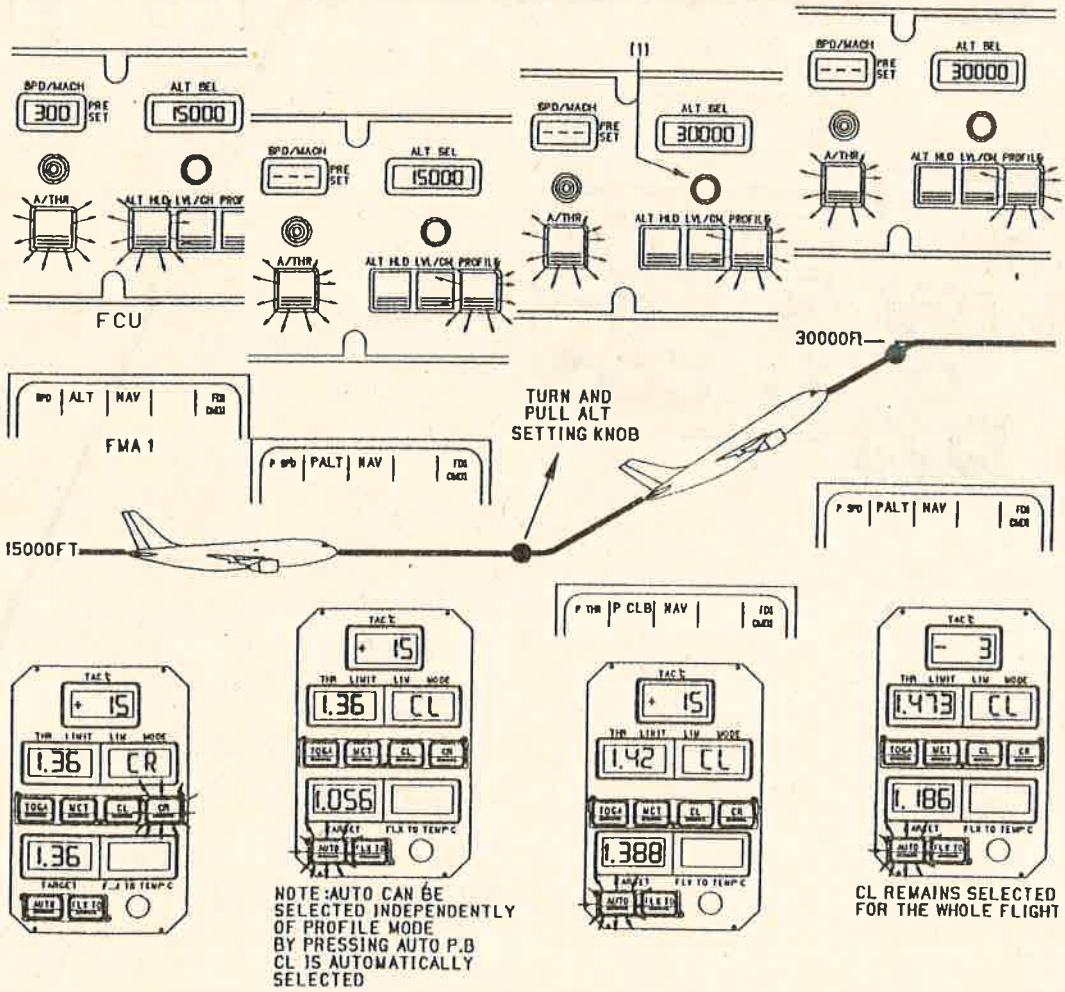
PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION DURING TAKE OFF

Described with TAKE OFF MODE in 1-03-67

OPERATION-ANNUNCIATION IN CRUISE (SELECTION OF AN UPPER FLIGHT LEVEL)

- Initial A/C configuration
- PROFILE engagement :
  - AP/FD goes to P ALT
  - ATS goes to P SPD
  - TRP goes to AUTO
  - SPD/MACH counter is dashed.
  - TRP TARGET window is dashed.
- Upper FL is selected through ALT setting knob (1).
  Then climb is *initiated* by *pulling this knob.*
  TARGET thrust is displayed in TARGET window.
- At new FL acquisition
  - AP/FD goes back to P ALT
  - ATS goes back to P SPD.
  - TRP TARGET window is dashed.



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R Code : 0365B

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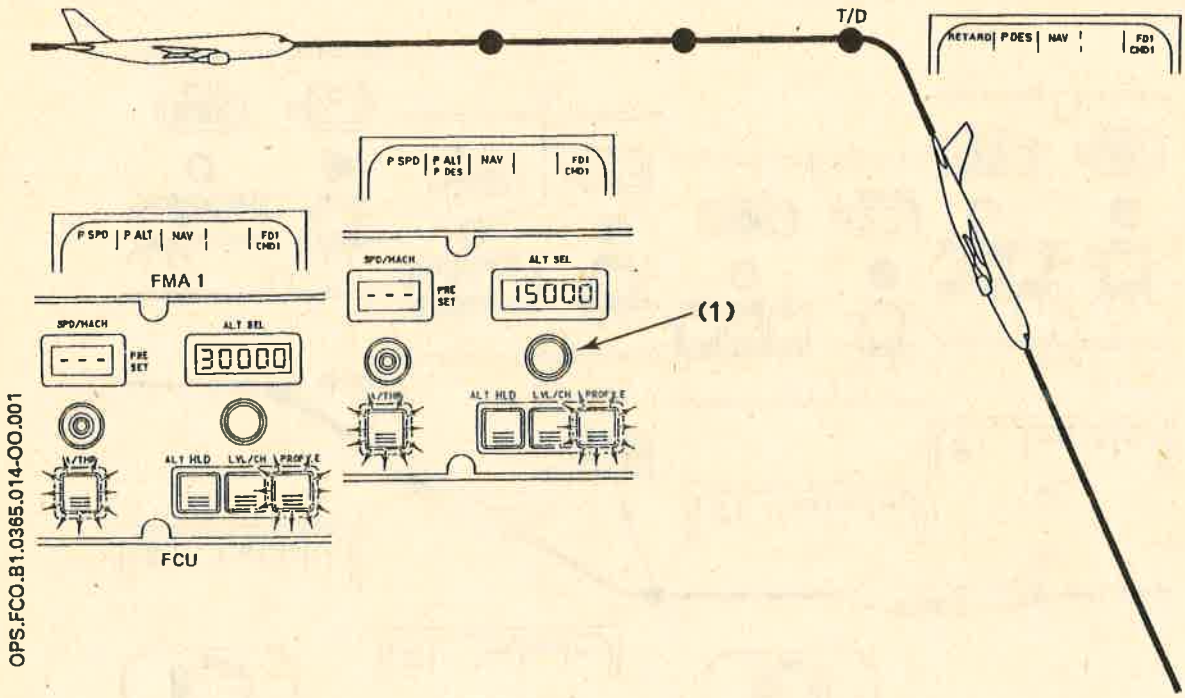
PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION IN CRUISE (SELECTION OF A LOWER FLIGHT LEVEL)

- Initial A/C configuration
- Lower FL is selected through ALT setting knob (1).

Pulling ALT knob initiates descent regardless of T/D computation. Green P DES and P THR then RETARD illuminate on PFD's.



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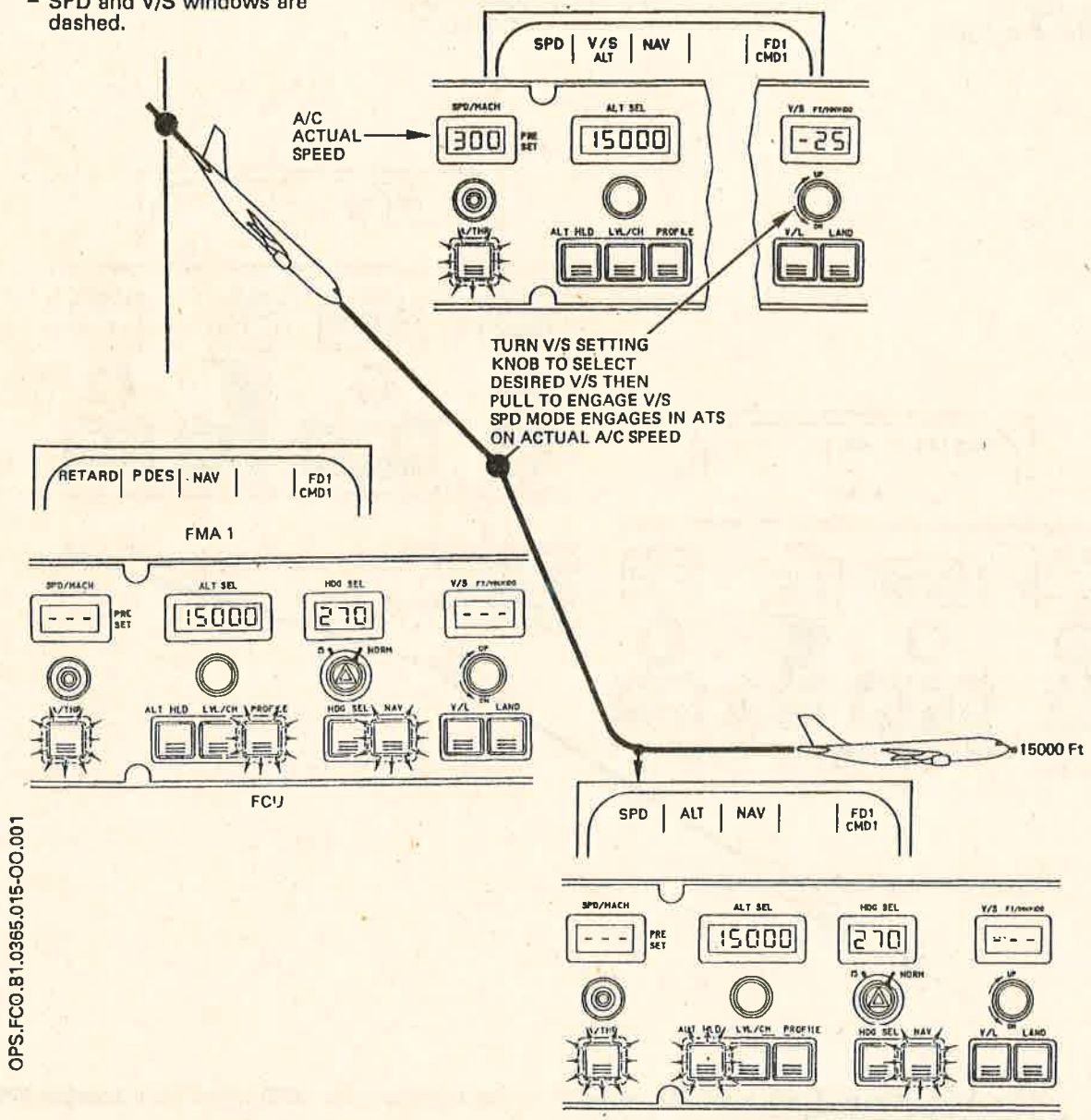
PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION TO INTRODUCE A V/S CONSTRAINT

- Initial A/C configuration :
  - PROFILE engaged
  - SPD and V/S windows are dashed.
- V/S constraint entry



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Note : 1. Another possibility to introduce a V/S constraint is to disengage PROFILE (V/S engages) and to set the desired V/S. But this is less easy and quick to perform.

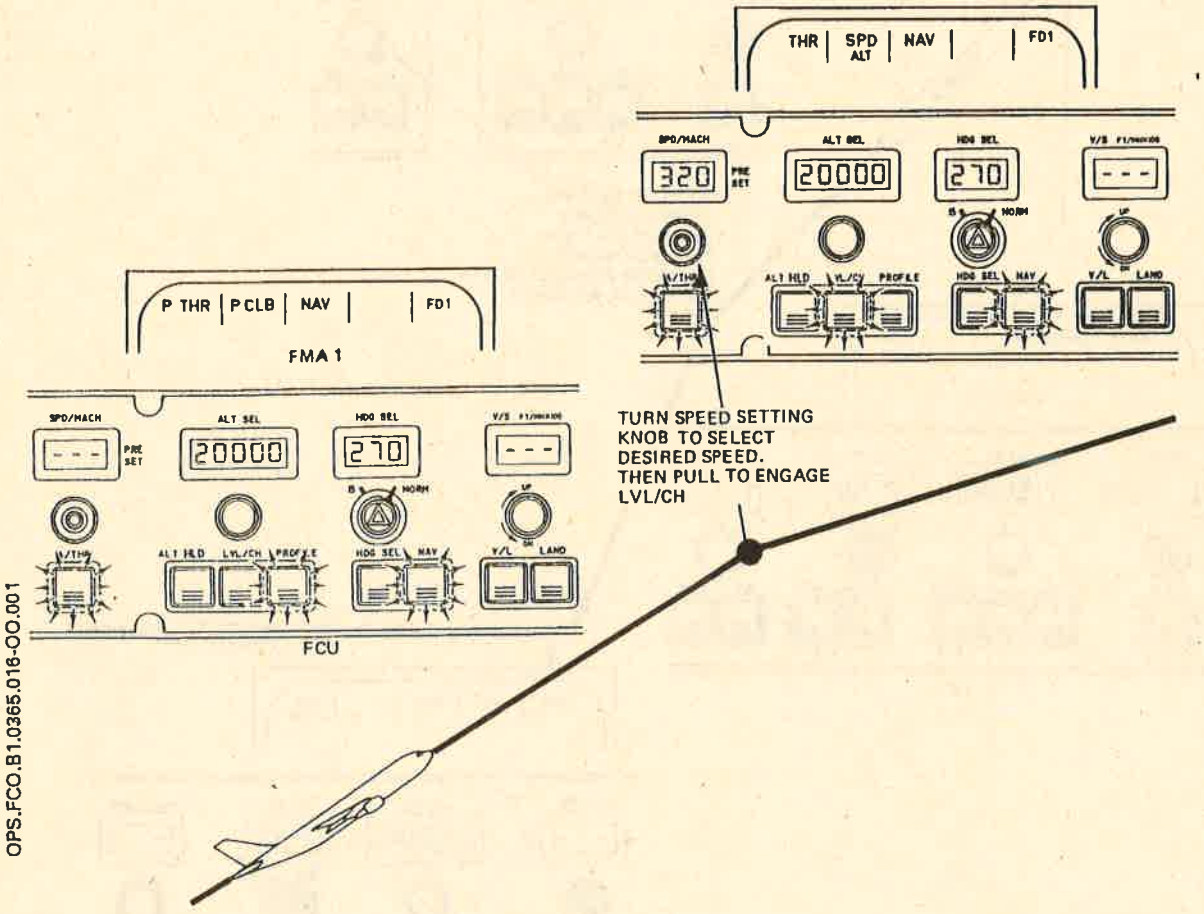
2. If, after having selected a vertical speed, V/S mode is not engaged, V/S window will be dashed again after 10 seconds

R Code : 0365B

PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION TO INTRODUCE A SPEED (OR MACH) CONSTRAINT

- A/C initial configuration :
  - PROFILE engaged.
- SPD constraint entry :
  - SPD in AP/FD .
  - THR in ATS



Notes :

1. *If the A/C is in level (P SPD and P ALT engaged) turning then pulling the SPD setting knob engages SPD (in ATS) and ALT (in AP/FD) modes.*
2. *Another possibility to introduce a SPD (or MACH) constraint is to engage LVL/CH (in climb or descent) or ALT (in level) then to select the desired SPEED. But this is less easy and quick to perform.*
3. *If after having selected a speed (or a mach), SPEED (or MACH) mode is not engaged, SPD/MACH window will be dashed again after 10 sec.*

R Code : 0365B

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LATERAL MODES

- HDG (BASIC MODE)
- HDG SEL
- NAV
- VOR/LOC.

Vers. : All Eng. : All

HDG MODE

Heading (HDG) is the BASIC LATERAL MODE of AP/FD.

It maintains the HDG at the time of engagement if bank angle is lower than 5°.
If bank angle is greater than 5°, AP/FD first brings the wings towards horizontal and then maintains the heading which exists when the bank angle decreases to 5°.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

HDG is engaged

- when FD's are engaged. This normally occurs when the AP/FD system is electrically energized on ground.
- by pressing an illuminated lateral mode pushbutton if this mode is in active phase (this lateral mode disengages and HDG engages)
- by pressing a second time LAND mode pushbutton (after LOC capture and before LAND TRACK phase only).
- if a longitudinal mode is engaged when LAND mode is active (after GLIDE CAPTURE phase and before LAND TRACK phase only).
- if an AP is engaged in CMD, when the associated FD is not operative (failure not affecting the AP or FD/FPV switch set to FPV or OFF position). In this case the other basic mode -V/S- is also engaged.
- in some conditions, when TAKE-OFF is engaged or disengaged or when GO-AROUND is disengaged (see these modes).

R - when a failure (in a non basic mode) causes
R disengagement of both AP/FD's. In this case, the FD's
R reengage in basic modes (V/S and HDG) after a delay
R and the FD BARS flash for 10 sec or less if a non basic
R mode is re-engaged.

DISENGAGEMENT

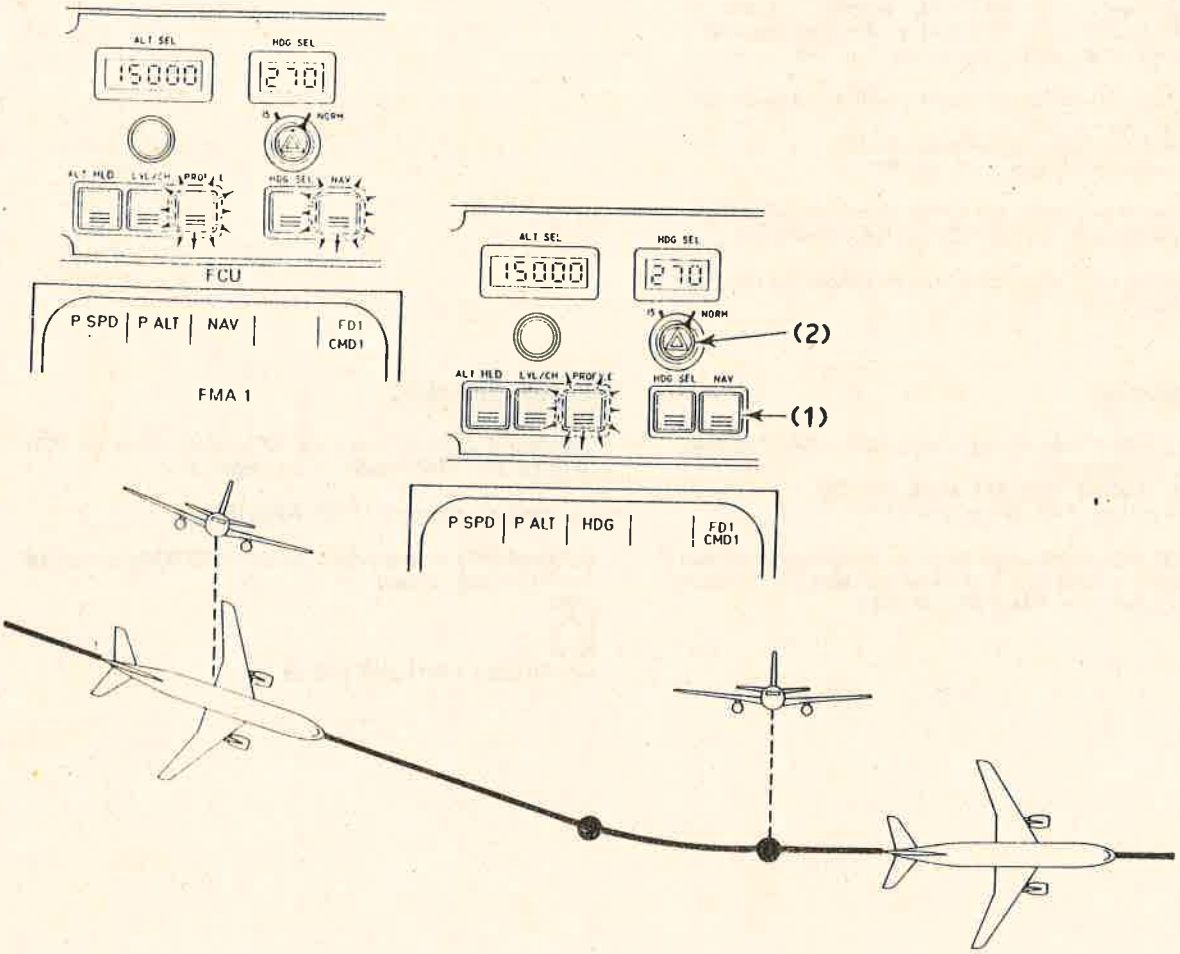
HDG is disengaged

- by manual selection of HDG SEL or GO-AROUND.
- automatically at activation of the CAPTURE phase of the following modes :
  VOR
  LOC
  NAV
  LAND (LOC CAPTURE phase)
- at take off if RWY mode is selected.

HDG MODE (CONT'D)

OPERATION – ANNUNCIATION

- Initial A/C configuration :
  - PROFILE and NAV modes engaged.
  - Bank angle greater than 5°.
- Press NAV p.b. (1) :
  - NAV is disengaged
  - HDG is engaged
  - NAV p.b. is extinguished
  - the A/C is wing levelled off.
- The HDG existing when the bank angle becomes lower than 5° is held.



Note : By pressing the HDG SEL knob (2), it is possible to synchronize the HDG SEL display window on the A/C heading (whatever the selected mode is, except HDG SEL mode)

Vers. : All

Eng. : All

HDG SEL MODE

Heading Selection (HDG SEL) mode acquires and maintains the heading selected on the FCU.

The HDG SEL knob is made of an inner and an outer knob. It has several functions.

The inner knob is a 3 position springloaded knob :
- neutral position : allows to select a heading
- when pulled : HDG SEL mode is engaged
- when pushed : the HDG SEL display window is synchronized on the A/C heading. But this possibility is inhibited when HDG SEL mode is active.

The outer knob allows to choose two different maximum bank angles during turn.
R - the NORM position corresponds to 25°
- the 15 position corresponds to 15°.

The position of this outer knob also limits the bank angle for VOR mode, but not for LOC or NAV mode.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

Provided LAND mode is not engaged in TRACK phase, HDG SEL is engaged :
- either by pulling HDG SEL knob on FCU.
- or by pressing HDG SEL p.b. on FCU.

Note : HDG SEL mode may have an arming phase (blue HDG/S on FMA's) if it is selected with RWY mode at take off (see TAKE OFF MODE).

DISENGAGEMENT

- pressing a second time HDG SEL pushbutton on FCU (this causes HDG mode to be engaged).
- by manual selection of GO-AROUND.
- automatically at activation of the CAPTURE phase of the following modes :
  VOR
  LOC
  NAV
  LAND (LOC CAPTURE phase).

Vers. : All Eng. : All

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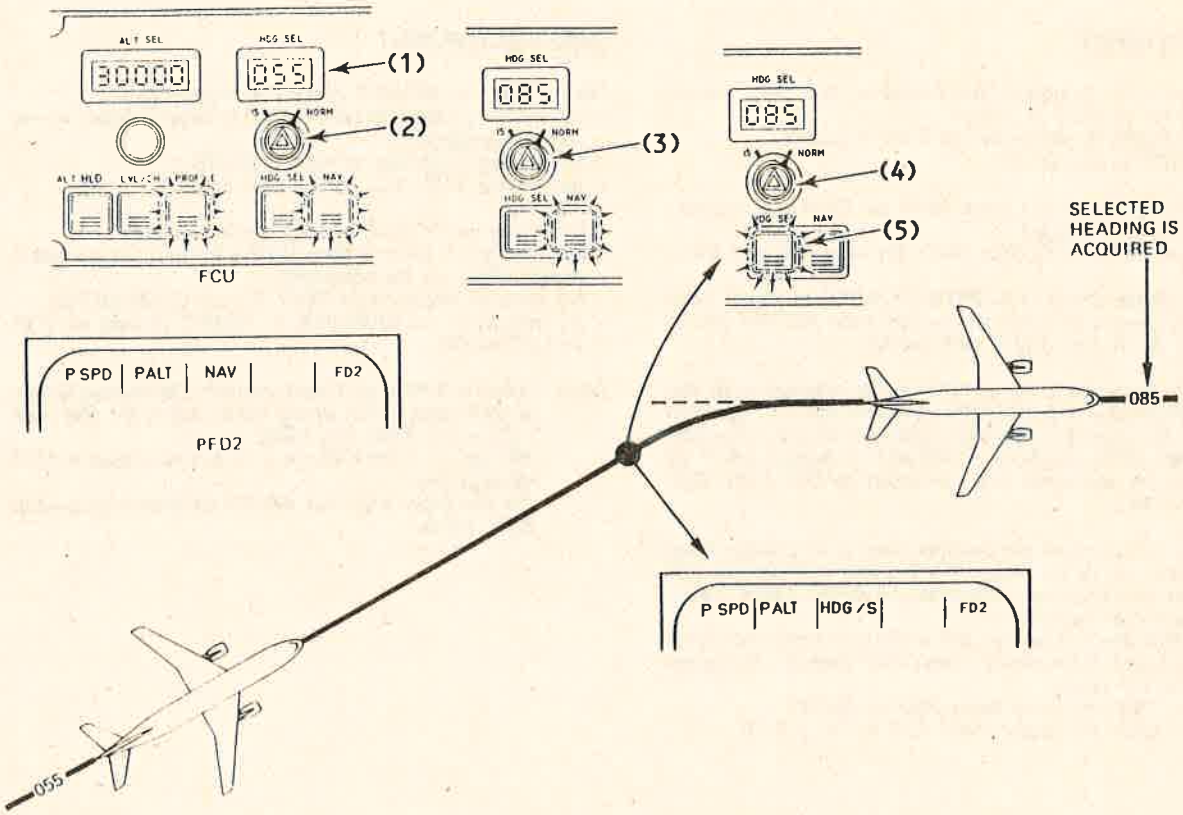
HDG SEL MODE (CONT'D)

OPERATION -ANNUNCIATION

- Initial A/C configuration :
  - PROFILE and NAV engaged.
  - Present A/C heading has been displayed on HDG SEL display window (1) by pressing HDG SEL knob (2)
- Desired heading is selected by turning HDG SEL knob (3)
- HDG SEL Mode is engaged by :
  - pulling HDG SEL knob (4)
  - or pressing HDG SEL p.b. (5)

  In both cases :
  - HDG SEL p.b. is lighted
  - green HDG/S is displayed on FMA's.



Note :

- *Before HDG SEL engagement, whatever the difference between A/C heading and selected heading is, the A/C will acquire the selected heading in such a way that the minimum turn will be done.*
- *If selected heading is modified after HDG SEL mode engagement, whatever the new selected value is, the A/C will turn towards the left if the HDG SEL knob has been rotated towards the left (and towards the right if the HDG SEL knob has been rotated towards the right), to acquire the new selected heading.*

Vers. : All Eng. : All

NAV MODE

NAV mode allows to couple the FMS (FLIGHT MANAGEMENT SYSTEM) to the AP/FD for the control of the HORIZONTAL NAVIGATION.

For further information on the FMS HORIZONTAL NAVIGATION see chapter 1.19.

NAV mode comprises two phases : ARMING and ACTIVE.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

NAV mode is engaged by pressing the NAV mode pushbutton on FCU provided :
- LAND mode is not active in TRACK phase.
- The FMS is operative.

During ARMING phase (blue NAV on FMA's) a support mode can be engaged.
These are HDG, HDG SEL, RWY (at take off) and VOR.

ACTIVE phase starts at CAPTURE POINT (see figure here besides), except at take off. In this case ACTIVE phase starts at 30 ft (see TAKE OFF mode).

Note : 1. Independently of NAV mode engagement, the flight plan stored in the FMS and the A/C position with regard to this flight plan are displayed on the ND (NAVIGATION DISPLAY) provided MAP or PLAN mode has been selected on EFIS CONTROL PANEL.

R *2. To capture the desired track or to change from*
R *one leg to the other, bank angle is limited to 25°*
R *in almost cases whatever the BANK LIMIT knob*
R *selector position is.*
R *This limit raises to 30° when tail wind increases*
R *ground turn radius. This limit linearly decreases*
R *to 15° when :*
R *– TAS increases from 350 to 450 KT*
R *– CAS decreases from 1.35 VS to 1.3 VS.*

DISENGAGEMENT

NAV mode (in ARMING phase) is disengaged :
- by pressing a second time NAV p.b. (lateral active mode remains engaged).
- by manual selection of GO-AROUND.
- by arming VOR, LOC, HDG SEL or LAND mode.

NAV mode (in ACTIVE phase) is disengaged :
- by pressing a second time NAV p.b. (this causes basic mode -HDG- to be selected).
- by manual selection of HDG SEL or GO-AROUND.
- by activation (in CAPTURE or TRACK phase) of VOR or LOC mode.

Note : when a FMC (Flight Management Computer) failure is detected, NAV mode disengages on the side where the FMC has failed.
Moreover, if NAV mode is in active phase AP/FD disengages.
On the other side the AP/FD remains engaged in NAV mode.

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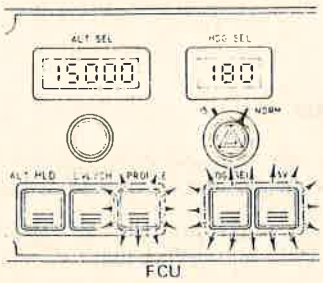
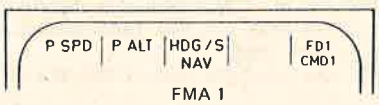
NAV MODE (CONT'D)

OPERATION-ANNUNCIATION

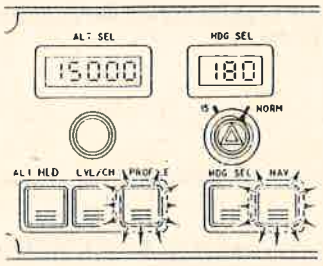
- Initial A/C configuration :
  - PROFILE and HDG SEL modes engaged.
  - NAV mode armed (blue NAV on FMA's) by having pressed NAV pb (1).

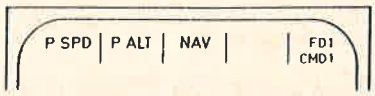


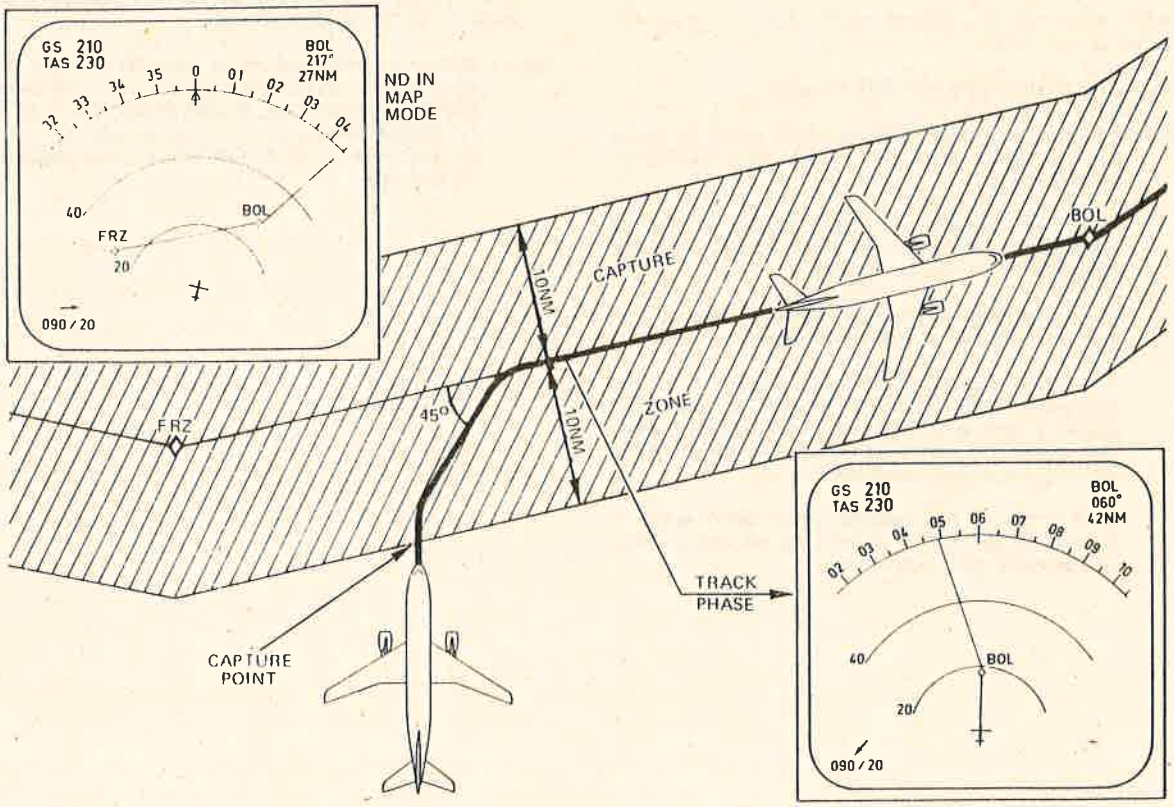


FMA 1

- At capture point
  - NAV mode engages in active phase
  - A/C will follow the Flight Plan defined in the FMS.







Vers. : All Eng. : All

VOR/LOC MODE

1. VOR MODE

This mode captures and maintains a selected VOR course.
VOR mode comprises three phases: ARMING, CAPTURE, TRACK.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

VOR mode is armed by pressing the V/L pushbutton on FCU provided :

R – Both VOR/NAV/ILS switches are on VOR position if
R the two FD's only are engaged
R or,
R at least, the VOR/NAV/ILS switch on the side where
R the AP is in CMD, is on VOR.

– A VOR frequency and a VOR COURSE have been selected on both VOR control panels.

– LAND mode (in any phase) or RWY mode (take off mode) is not active.

– No failure is detected on VOR receiver.

Notes : 1. Engagement of VOR and LOC mode is made by the same p.b. (V/L p.b.). See VOR/LOC selection logic.

2. When overflying VOR station (cone of confusion), the selected VOR course can be changed by as much as 30°.

3. In CAPTURE or TRACK phase, a new course can be selected. It will be captured.

4. Independently of VOR mode engagement, but provided VOR/NAV/ILS switch is on. VOR position, selected VOR radial and deviation from this radial are indicated on onside ND (if ROSE or ARC display is selected).

5. To capture the desired radial, bank angle is limited to 25° or 15° depending on the position of the HDG SEL outer knob.

DISENGAGEMENT

VOR mode (in ARMING phase) is disengaged :
- by pressing a second time V/L p.b. (lateral active mode remains engaged).
- by manual selection of GO-AROUND or TAKE-OFF
- by arming NAV, LOC or LAND mode.

VOR mode (in CAPTURE or TRACK phase) is disengaged :
- by pressing a second time V/L p.b. (this causes basic mode -HDG- to be selected).
- by manual selection of HDG SEL, GO-AROUND or TAKE-OFF.
- by activation of NAV mode (in ACTIVE phase) or LAND mode (in LOC capture phase).

Note : When a VOR failure is detected, VOR mode disengages on the side where the VOR receiver has failed. Moreover, if VOR mode is in CAPTURE or TRACK phase, AP/FD disengages.
On the other side the AP/FD remains engaged in VOR mode.

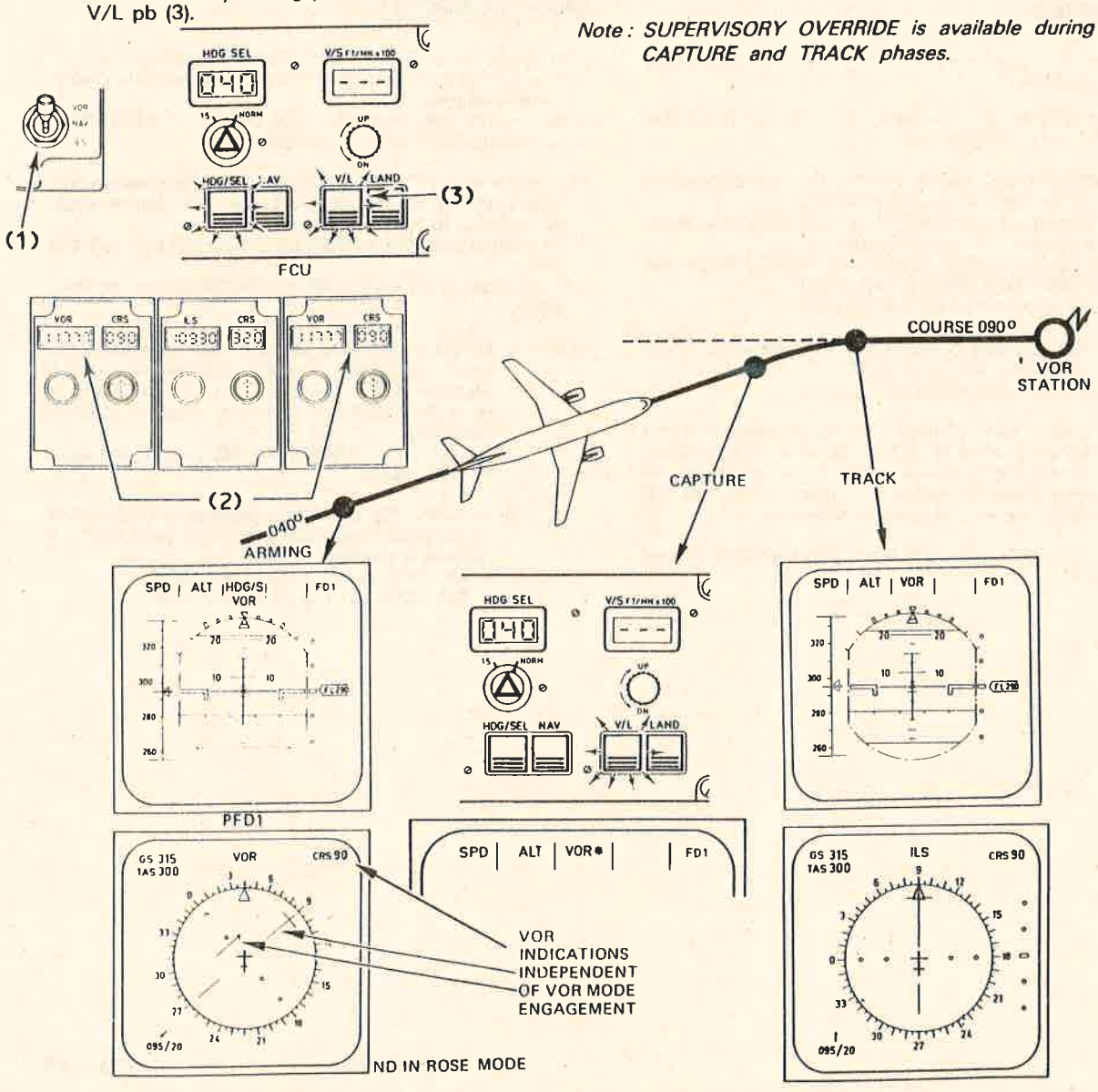
VOR/LOC MODE (CONT'D)

VOR MODE (CONT'D)

OPERATION-ANNUNCIATION

- Initial A/C configuration :
  - HDG SEL engaged
  - Both VOR/NAV/ILS switches on VOR (1)
  - VOR course and frequency selected on VOR CONTROL PANELS (2).
  - VOR armed by having pressed V/L pb (3).
- At CAPTURE point (depending on intercept angle)
  - green VOR * illuminates in place of green HDG/S on both FMA's.
  - HDG SEL p.b. is extinguished on FCU.
- TRACK phase
  - green VOR illuminates on both FMA's.
  - Deviation bar is centered on ND's and VOR index is centered on PFD's.

Note : SUPERVISORY OVERRIDE is available during CAPTURE and TRACK phases.



VOR/LOC MODE (CONT'D)

2. LOC MODE

It captures and maintains a LOCALIZER BEAM.

This mode is used in case of GLIDE BEAM MISSING or POOR QUALITY ILS.
It comprises three phases : ARMING, CAPTURE, TRACK.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

LOC mode is engaged by pressing the V/L pushbutton on FCU provided :

R – either VOR/NAV/ILS switch is on ILS position if the
R two FD's only are engaged
R or
R the VOR/NAV/ILS switch on the side corresponding
R to the AP in CMD is on ILS position.
– An ILS frequency and a RUNWAY COURSE have been selected on the ILS control panel.
– LAND mode (in TRACK phase) of GO AROUND (on roll axis) or TAKE OFF (SRS) is not engaged.
– No failure is detected on ILS receiver

Note : 1. Engagement of VOR and LOC mode is made by the same p.b. (V/L p.b.).
See VOR/LOC selection logic.

2. Independently of LOC mode engagement, but provided VOR/NAV/ILS switch is on ILS position, selected RWY course and deviation from this course are indicated on the onside PFD and ND (if ROSE or ARC display is selected).

3. To capture the LOC beam, bank angle is limited to 30°.

DISENGAGEMENT

LOC mode (in ARMING phase) is disengaged :
– by pressing a second time V/L p.b. (lateral active mode remains engaged) ;
– by manual selection of TAKE OFF or GO-AROUND ;
– by arming NAV or LAND mode.

LOC mode (in CAPTURE or TRACK phase) is disengaged :
– by pressing a second time V/L p.b. (this causes basic mode HDG to be selected) ;
– by manual selection of HDG SEL, GO-AROUND or TAKE OFF ;
– by activation (in CAPTURE or TRACK phase) of NAV mode.

Note : 1. When an ILS receiver failure is detected, LOC mode disengages on the side where the ILS receiver has failed. Moreover, if LOC mode is in CAPTURE or TRACK phase AP/FD disengages.
On the other side the AP/FD remains engaged in LOC mode.

2. In CAPTURE or TRACK phases, a LOCALIZER transmitter failure (no signal on both A/C ILS receivers) causes :
– The LOC scale to flash on PFD's
– The ROLL FD bar to flash PFD's.

VOR/LOC MODE (CONT'D)

LOC MODE (CONT'D)

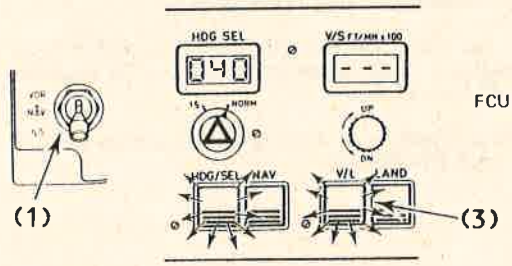
OPERATION - ANNUNCIATION

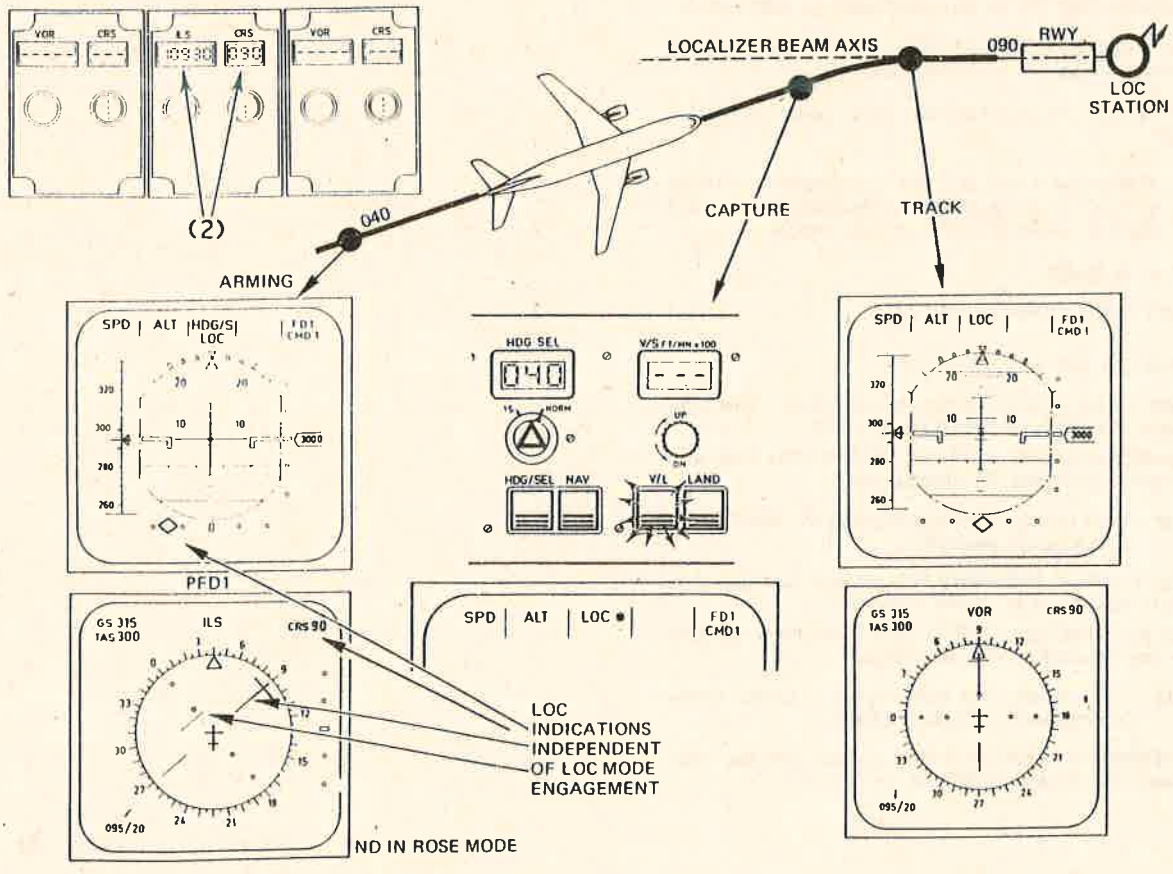
- Initial A/C configuration :
  - HDG SEL engaged
R - At least one VOR/NAV/ILS
R switch on ILS (1)
  - LOC course and frequency selected on ILS CONTROL PANEL (2).
  - LOC armed by having pressed V/L p.b. (3).

- At CAPTURE POINT (depending on intercept angle) :
  - green LOC * illuminates in place of HDG/S on both FMA's.
  - HDG SEL p.b. is extinguished on FCU.

- TRACK phase
  - green LOC illuminates on both FMA's.
  - Deviation bar is centered on ND's and LOC index is centered on PFD's.

Note : – Intercept angle must be lower than 115°.
– SUPERVISORY OVERRIDE is possible during CAPTURE phase when AP is in CMD.





VOR/LOC MODE (CONT'D)

3. VOR/LOC SELECTION LOGIC

Since the same pushbutton is used to engage VOR and LOC mode it is necessary to have a SELECTION LOGIC.

VOR or LOC engagement will depend on the position of the VOR/NAV/ILS switch and on the engaged FD's and AP's.

1) **The two FD's only are engaged and LAND mode is not armed or engaged ; or both AP's are engaged in CMD with GO AROUND mode :**

PRIORITY IS GIVEN TO LOC MODE

ACTION ON V/L p.b. ENGAGES :

- ***VOR mode*** if the two VOR/NAV/ILS switches are on VOR
  If on one side, VOR/NAV/ILS switch is on NAV, the corresponding FD is also engaged in VOR mode.

  If VOR mode being active, one VOR/NAV/ILS switch is set to ILS, the corresponding FD is disengaged.
- ***LOC mode*** if at least one VOR/NAV/ILS switch is on ILS.
  If on one side, VOR/NAV/ILS switch is on NAV, the corresponding FD is also engaged in LOC mode.

  If on one side, VOR/NAV/ILS switch is on VOR, the corresponding FD is disengaged.
- ***NOTHING*** if both VOR/NAV/ILS switches are on NAV.

Note : If both AP's are in CMD, engagement of VOR or LOC mode causes AP 2 disengagement ; but FD 2 engages in VOR or LOC mode.

2) **1 AP is in CMD :**

PRIORITY IS GIVEN TO THE AP.

ACTION ON V/L p.b. ENGAGES :

- ***VOR mode*** if VOR/NAV/ILS switch (on the side where the AP is in CMD) is on VOR.

R If on the other side, VOR/NAV/ILS switch is on ILS,
R the corresponding FD disengages.

Note : VOR mode does not engage if LAND mode is armed or engaged.

- ***LOC mode*** if VOR/NAV/ILS switch (on the side where the AP is in CMD) is on ILS.

R If on the other side, VOR/NAV/ILS switch is on VOR,
R the corresponding FD disengages.

Note : LOC mode does not engage if LAND mode is engaged in TRACK phase.

- ***NOTHING*** if VOR/NAV/ILS switch (on the side where the AP is in CMD) is on NAV.

3) **LAND mode is armed or engaged and both FD's are engaged or both AP's are in CMD :**

- VOR mode cannot be engaged
- LOC mode is engaged by action on V/L p.b. if at least one VOR/NAV/ILS switch is on ILS.

  If on both sides VOR/NAV/ILS switches are on ILS, AP 2 disengages but FD 2, AP 1 and FD1 engage in LOC mode.

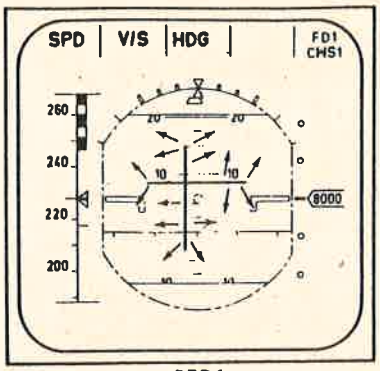
  If on one side, VOR/NAV/ILS switch is on VOR, the corresponding AP and FD disengage.

  If on one side, VOR/NAV/ILS switch is on NAV, the corresponding AP disengages but the FD engages in LOC mode.
- If LAND Mode is in TRACK phase, action on V/L p.b. HAS NO EFFECT.

FD BARS FLASHING

The FD bars flash in the following conditions, in order to alert the crew, in the event of inadvertent return to basic modes or during approach in the event of an ILS transmitter failure :

- return to basic mode engagement
- LAND mode disengagement
- loss of altitude capture condition during a new flight level setting when in altitude acquire mode.



PFD1

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CWS DESCRIPTION	1.03.63 PAGE 1 REV 20 SEQ 001

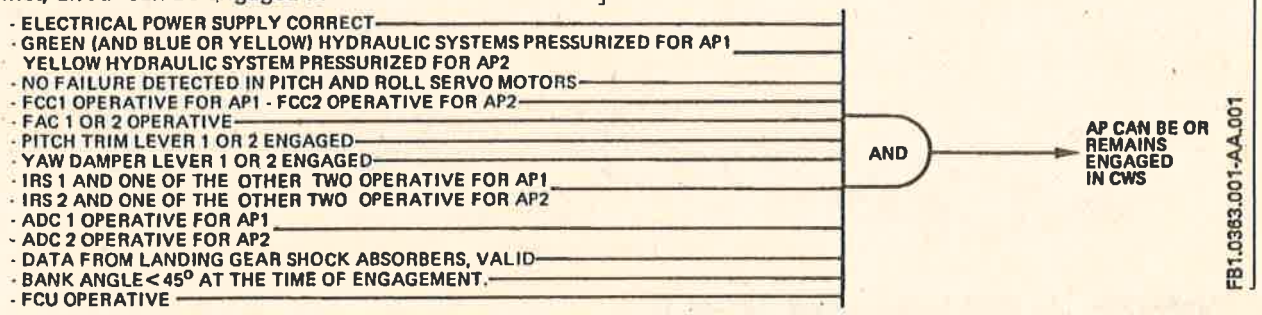
FUNCTION

When an AP is engaged in CWS (Control Wheel Steering) :

- The PITCH ATTITUDE and BANK ANGLE that the A/C had at engagement are maintained.
- The PITCH ATTITUDE and/or BANK ANGLE may be modified by simply applying a load (above a threshold) on one control wheel. This load is converted by the dynamometric rods into electrical signals sent to the FCC which then command the flight controls via the actuators.
- The AUTO TRIM function is inhibited :
  - on ground and in take-off until 5 sec after lift-off.
  - in flight, GEAR is down when an effort is detected on the control wheel.
  - in GO AROUND, for 5 sec, on a nose up order to avoid excessive attitude.
- The ELECTRIC TRIM is always available on ground or in flight.
- The Yaw axis can not be controlled by the CWS function.
- While an AP is engaged in CWS, any FD mode can be engaged. The FD works independently of the AP in CWS.

ENGAGEMENT CONDITIONS

Provided all engagement conditions (hereafter listed) are met, an AP can be engaged in CWS.



R It is not possible to engage two AP's in CWS.

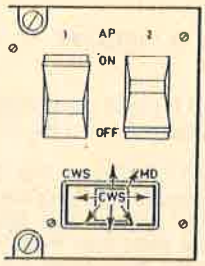
DISENGAGEMENT

Conditions of disengagement and warnings are similar to those of AP in CMD (see 03-64) except for AUTOLAND lights which do not flash below 200 ft.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CWS DESCRIPTION	R 1.03.63 PAGE 2 REV 10

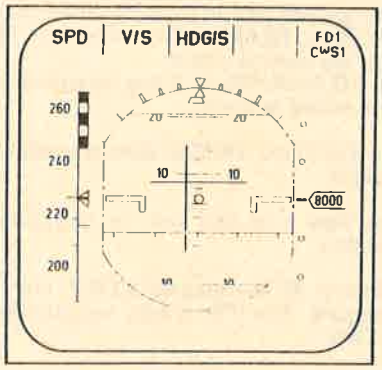
ENGAGEMENT ANNUNCIATION – OPERATION

- On ground : SET THE AP LEVER TO ON (1)
- In flight : SET THE AP LEVER TO ON (The AP engages in CMD) then PRESS THE CWS/CMD pb (2).

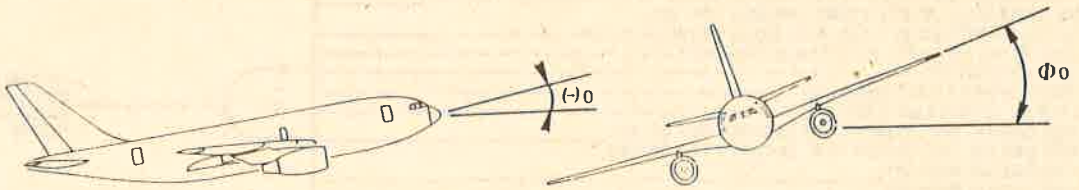


FCU

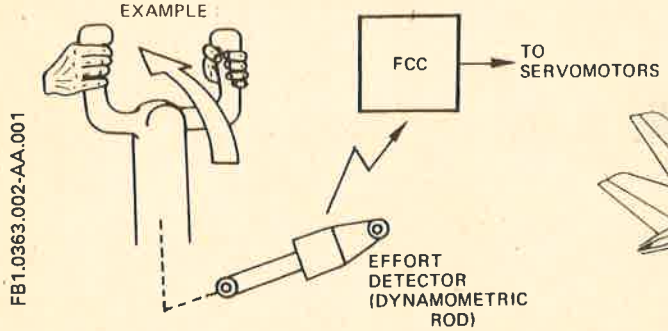
- Provided the ENGAGEMENT CONDITIONS are met :
  - CWS illuminates amber on FCU (on the CWS/CMD p.b.).
  - CWS 1 illuminates amber on both FMA's.
  - The FD's remain in the engaged modes.
  - Pitch attitude and bank angle at engagement are maintained.

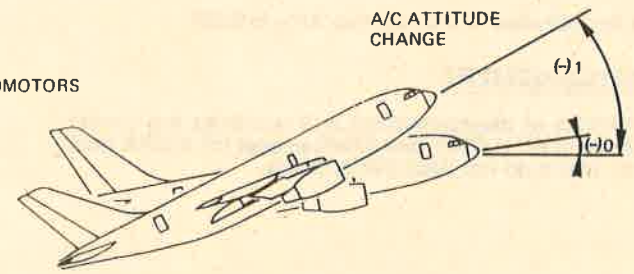


PFD 1



- OPERATION : The CWS function allows the pilot to change Pitch Attitude or Bank Angle.





WHEN THE PILOT RELEASES THE CONTROLS, THE AP MAINTAINS (-) 1 (THE NEW ATTITUDE)

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CMD DESCRIPTION	R 1.03.64 PAGE 1 REV 08

FUNCTION

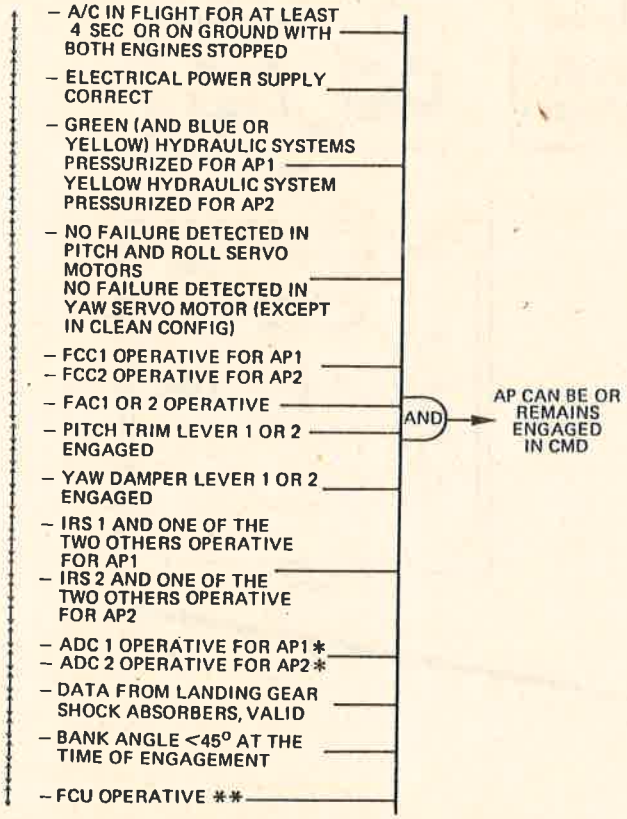
When an AP is engaged in CMD (COMMAND) the A/C is automatically controlled :

- in pitch axis, if a longitudinal mode has been engaged
- in roll axis, if a lateral mode has been engaged
- in yaw axis, as soon as SLATS are extended to at least 15° (SLATS/FLAPS handle on SLATS 15° position).

Note : FOR MODE DESCRIPTION (common to FD and AP in CMD), see 03-65, 03-66, 03-67.

ENGAGEMENT CONDITIONS

Provided the engagement conditions (hereafter listed) are met, an AP can be engaged in CMD.



*NOT NECESSARY AFTER GLIDE CAPTURE
**NOT NECESSARY IN GO AROUND OR LAND TRACK MODE

Note : To this general engagement conditions, specific engagement conditions must be added depending on the selected modes. See mode description in 03-65, 03-66, 03-67.

OPERATION

On ground the AP cannot be engaged in CMD if one or two engines are operating.

In flight the AP can be engaged in CMD only 4 sec after lift off :

- either by pressing the CWS/CMD p.b. if the AP is already engaged in CWS (this action is inhibited in LAND track phase).
- or by setting the AP lever to ON if no AP was previously engaged in CWS.

The AP engages in the modes which were previously active on the corresponding FD.

If the corresponding FD is not operative (failure not affecting the AP or FD/FPV switch set to FPV or OFF position) the AP engages in the basic modes: V/S (Vertical Speed) on pitch axis and HDG (Heading) on roll axis.

If AP engages in the basic modes :

- It maintains the A/C vertical speed and heading at the time of engagement. However if bank angle is greater than 5°, the AP first brings the wings towards horizontal and then maintains the heading obtained when the bank angle decreases to 5°.
- The V/S display window on FCU is synchronized on the A/C V/S at engagement.

Two AP's can never be engaged simultaneously in CMD, except if LAND or GO AROUND mode has been engaged. In this case AP 2 is in standby.
AP 2 will disconnect as soon as another mode is selected.

If LAND or GO AROUND mode is not engaged, the engagement of the second AP causes the disengagement of the first one.

AP cannot stay in CMD on ground with one or two engines operating except when the A/C lands with LAND mode engaged (disengagement of LAND mode causes both AP's disengagement).

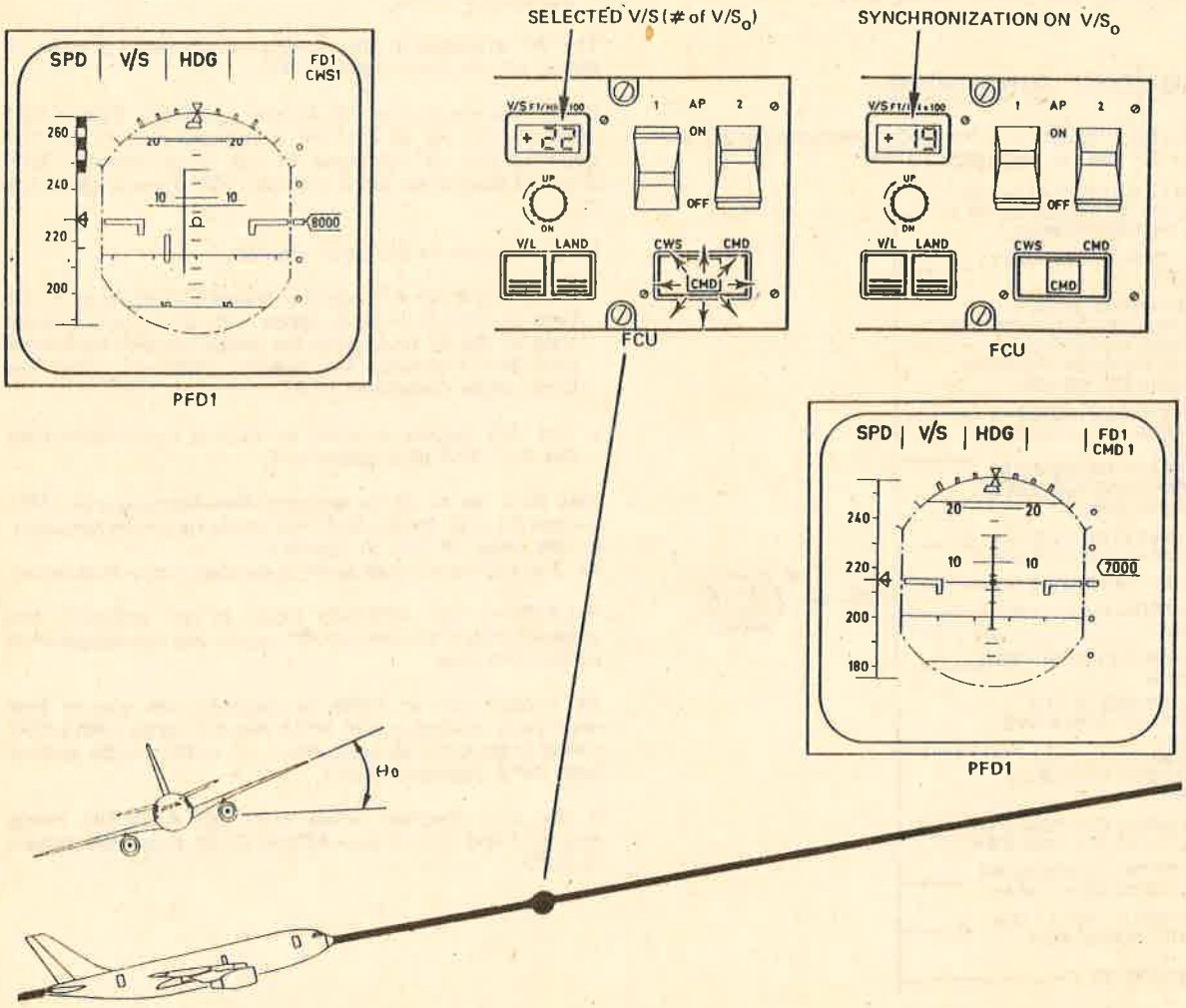
If the A/C touches down with GO AROUND mode engaged and one or two AP's in CMD, they also remain in CMD.

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CMD DESCRIPTION	R 1.03.64 PAGE 2 REV 06 JUL 83

ENGAGEMENT ANNUNCIATION (with FD previously in BASIC MODES and the AP engaged in CWS).

- Before AP engagement
  - Bank angle is Φ_o
  - Actual Vertical Speed is V/S_o
  - V/S and HDG modes are engaged with FD.
  - AP 1 is in CWS.
- When CWS/CMD p.b. is pressed (1)
  - CMD illuminates white on FCU (on CWS/CMD pb).
  - CMD 1 illuminates white on both FMA's.
  - AP holds V/So and V/S display window is synchronized on V/So.
  - If $\Phi_o < 5°$, AP holds the heading at engagement.
  - If $\Phi_o > 5°$, AP first levels the wings, then maintains the heading obtained when the bank angle decreases to 5°.
  - FD BARS are centered on both PFD's.



Notes :

1. If any other modes than BASIC MODES were selected with FD, the AP engages in these modes and takes into account the references selected on the FCU or VOR control panel or ILS control panel, etc..., and not the A/C references (such as V/So for V/S mode) at engagement.

2. In flight, if no AP is engaged in CWS, setting an AP lever to ON engages the AP in CMD (and not in CWS as on ground).

Vers. : All Eng. : All

DISENGAGEMENT

AP can be disconnected :

- intentionally
  - by setting the AP lever to OFF (which disconnects the respective AP)
  - by action on either AP disconnect pushbutton located on the control wheels (which disconnects both AP's if they were engaged)
  - when a force above a threshold is applied on the stick in pitch (except in LAND and GO AROUND modes).

- automatically
  if one of the engagement conditions is no longer met (which disengages the respective AP).

Intentional disconnection or automatic disconnection (when the lost engagement condition does not concern the FD) does not cause mode disengagement. Modes remain available with the FD.

Disconnection of the engaged AP (or of the two, if engaged) causes the red MASTER WARNING to be lit in front of each pilot and the flashing of a red AP OFF
R warning message on the left ECAM CRT. At the same
R time an aural warning (CAVALRY CHARGE) sounds.

In addition below 200 ft radio altitude, at the time of disengagement, a red AUTOLAND light flashes on the glareshield, in front of each pilot, if LAND mode is engaged in LAND TRACK phase.

AP OFF, CAVALRY CHARGE and AUTOLAND warnings will be cancelled by pressing either AP disconnect p.b.

AUTOMATIC COMPENSATION IN CASE OF ENGINE FAILURE

An automatic compensation (on YAW axis) is made by the AP when an engine fails if the following conditions are met :

- An AP is engaged in CMD
- SLATS are extented to at least 15°

In the other cases, use RUDDER TRIM to obtain stabilized straight and level flight.

Note : YAW DAMPER provides an additional compensation (on YAW axis) if an AP is engaged in CMD with SRS or GO AROUND modes.

AUTOMATIC RUDDER TRIM FUNCTION

An automatic rudder deflection is made by the AP to obtain and to maintain neutral position of the control wheel in lateral. This automatic rudder trim function is available in all modes if the following conditions are met :

- an AP is engaged in CMD
- SLATS are extended to at least 15°.

The automatic rudder trim order is reduced to zero within 10 seconds when the SLATS/FLAPS lever is moved out of the 15/0 position to the 0/0 position or if the AP is disengaged.

SUPERVISORY OVERRIDE FUNCTION (Lateral)

This function is available with an AP in CMD, in VOR mode and in capture phase of LOC and LAND modes.

During these phases, the pilot, by applying a load (above a threshold) on the control wheel, operates a control surface deflection proportional to the load applied. When the pilot releases his load, the AP guides again the aircraft along the flight path corresponding to the mode engaged. Outside these phases, the supervisory override function is not available. However, it is still possible to modify the aircraft attitude by applying a strong load in roll on the control wheel but this is not a normal operation when one AP is in CMD.

Mod. : 5051 + 5757 + 5953

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR LONGITUDINAL MODES	1.03.65 PAGE 1 JUL 83 | SEQ 001

LONGITUDINAL MODES

- V/S (BASIC MODE)
- ALT
- ALT*
- LVL/CH
- PRESET FUNCTION
- PROFILE

V/S MODE

Vertical Speed (V/S) is the BASIC LONGITUDINAL MODE of AP/FD.
It maintains the V/S at the time of engagement, and also, will acquire and maintain a new V/S when selected on the FCU.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

V/S is engaged

- when FD's are engaged. This normally occurs when the AP/FD system is electrically energized on ground.
- by pulling the V/S knob on FCU, provided LAND mode is not active in the track phase.
- by pressing an illuminated longitudinal mode pushbutton if this mode is in active phase (this longitudinal mode disengages and V/S engages).
- at AP engagement in CMD if the associated FD is not operative (failure not affecting the AP or FD/FPV switch set to FPV or OFF position). In this case the other basic mode – HDG – is also engaged.
- when, being in altitude capture phase (ALT* mode), a new altitude (causing loss of capture conditions) is set on the FCU.
- when a lateral mode is engaged after GLIDE CAPTURE phase and before LAND TRACK phase (LAND mode active).
- when a failure (in a non basic mode except pitch TAKE OFF and GO AROUND modes) causes disengagement of both AP/FD's. In this case, the FD's reengage in basic modes (V/S and HDG) after a delay and the FD BARS flash for 10 sec or less if a non basic mode is re-engaged.
  The FCC does not disengage from pitch TAKE OFF or GO AROUND modes when both AP/FD's go to OFF.

Note : In all cases, V/S mode engages on the preselected vertical speed set on the counter or on the present A/C vertical speed if the counter is dashed.

V/S mode engagement leads to SPD or MACH mode engagement in ATS (the counter will synchronize on the A/C speed if it was dashed, which is the case when PROFILE mode is engaged).

DISENGAGEMENT

V/S is disengaged

- by manual selection of ALT, LVL/CH, PROFILE, TAKE OFF or GO-AROUND mode
- automatically :
  when ALT* mode is activated.
  when GLIDE CAPT phase of LAND mode is activated.

SPEED PROTECTION

In V/S mode, the priority will be given to the vertical speed, against the speed.
If vertical speed is not compatible with selected speed, the speed will decrease or increase towards VLS or VMAX. But on reaching VLS + 5 KTS (when vertical speed is positive) or VMAX (when vertical speed is negative), the AP/FD will automatically change to LVL/CH mode with selected speed as reference.

The following table summarizes the consequences of a peripheral equipment failure on the « FLIGHT ENVELOPE PROTECTION » function of the FAC system.

	CONDITION → / FAILURE ↓	SPEED LIMIT SENT TO EFIS	SPEED LIMIT SENT TO ATS and AP/FD	ALPHA FLOOR
	ADC 1 (or 2) failure	LOST ON SIDE 1 (or 2). « SPD LIM » flag.* SWITCHING POSSIBLE, flag disappears	LOST IN FAC 1 (or 2)	lost in FAC 1 (or 2) only IF SLATS OUT
	ADC 1 and 2 failure	LOST ON BOTH SIDES. « SPD LIM » flag.*	LOST IN BOTH FAC's (BOTH AP's and ATS LOST)	LOST ONLY IF SLATS OUT
R	IRS 1 (or 1 + 3) failure	LOST ON SIDE 1. « SPD LIM » flag. ADC SWITCHING NOT RECOMMENDED	NO EFFECT (FAC 2 used)	LOST IN FAC 1 (only IF SLATS OUT)
R	IRS 2 (or 2 + 3) failure	LOST ON SIDE 2. « SPD LIM » flag. ADC SWITCHING NOT RECOMMENDED	NO EFFECT (FAC 1 used)	LOST IN FAC 2 (only if SLATS OUT)
	IRS 3 failure	NO EFFECT	NO EFFECT	NO EFFECT
	IRS 1 + 2 failure	LOST ON BOTH SIDES. « SPD LIM » flag.	LOST IN BOTH FAC's (BOTH AP's and ATS LOST)	LOST ONLY IF SLATS OUT
	2 ALPHA PROBES failure	LOST ON BOTH SIDES. « SPD LIM » flag.	$V_{LS} = 0$ / $V_{MAX} = V_{MO} = 340$] IF LDG GEAR UP $V_{LS} = 0$ / $V_{MAX} = V_{LE} = 270$] IF LDG GEAR DOWN	LOST
	SFCC 1 (or 2) failure	LOST ON SIDE 1 (or 2). « SPD LIM » flag. SWITCHING NOT RECOMMENDED	NO EFFECT	NO EFFECT
	BOTH SFCC failure	LOST ON BOTH SIDES. « SPD LIM » flag.	$V_{LS} = 0$ / $V_{MAX} = V_{MO} = 340$] IF LDG GEAR UP $V_{LS} = 0$ / $V_{MAX} = V_{LE} = 270$] IF LDG GEAR DOWN	LOST
	RADIO ALTIMETER 1 (or 2) failure	NO EFFECT	NO EFFECT	LOST IN FAC 1 (or 2)
	BOTH R/A failure	NO EFFECT	NO EFFECT	LOST

* On PFD, only « SPD » flag is displayed.

R Code : 0340A

PURPOSE

The ATS (AUTOTHROTTLE SYSTEM) assures the following functions :
- Continuoulsy computes the THRUST LIMIT corresponding to the mode selected on TRP.
- Acquires and maintains the THRUST LIMIT calculated by the TCC (in THR L or THR mode) or the TARGET THRUST calculated by the FMC (in P THR mode).
- Acquires and maintains the SPEED or the MACH selected on FCU (in SPD/MACH mode) or calculated by the FMC (in P SPD or P MACH mode).
- Retracts the throttles to the idle position (in RETARD mode).

ATS COMMANDS COMPUTATION

Computations for ATS functions are made in two computers, the THRUST CONTROL COMPUTERS (TCC 1 and 2).
But TCC 2 is in standby.

Each TCC includes two computing channels (a command one and a monitor one) for safety reason.

Each TCC receives informations mainly from the FLIGHT CONTROL UNIT, the GO LEVERS, the ATS disconnect pushbuttons, the FLIGHT CONTROL COMPUTER, the FLIGHT MANAGEMENT COMPUTER, the engines, the RADIO ALTIMETER, the ADC, IRS, FAC. Then with all these data the TCC provides command signals to the ATS ACTUATOR.

CONNECTION WITH ENGINE CONTROLS

A single electric actuator installed in the autothrottle system actuates, through two coupling units, simultaneously the throttle levers and the ENGINE HMC (Hydro Mechanical Control). The throttle position is detected by two THROTTLE POSITION DETECTORS and transmitted to the TCC's.

The actuator responds to inputs from the TCC. Each coupling unit includes an electromagnetic clutch and a safety friction clutch.

The automatic operation may be overridden for each engine by applying a light load on the corresponding throttle lever. Load is detected by a DYNAMOMETRIC ROD (one on each throttle lever) which deactivates the electromagnetic clutch.

During the period of load application, the pilot manually adjusts the throttle lever. As soon as the load is released, the autothrottle resumes the control and maintains any possible difference between the two throttle lever settings.

Note : See DRAWING in next page.

ELECTRICAL POWER SUPPLY

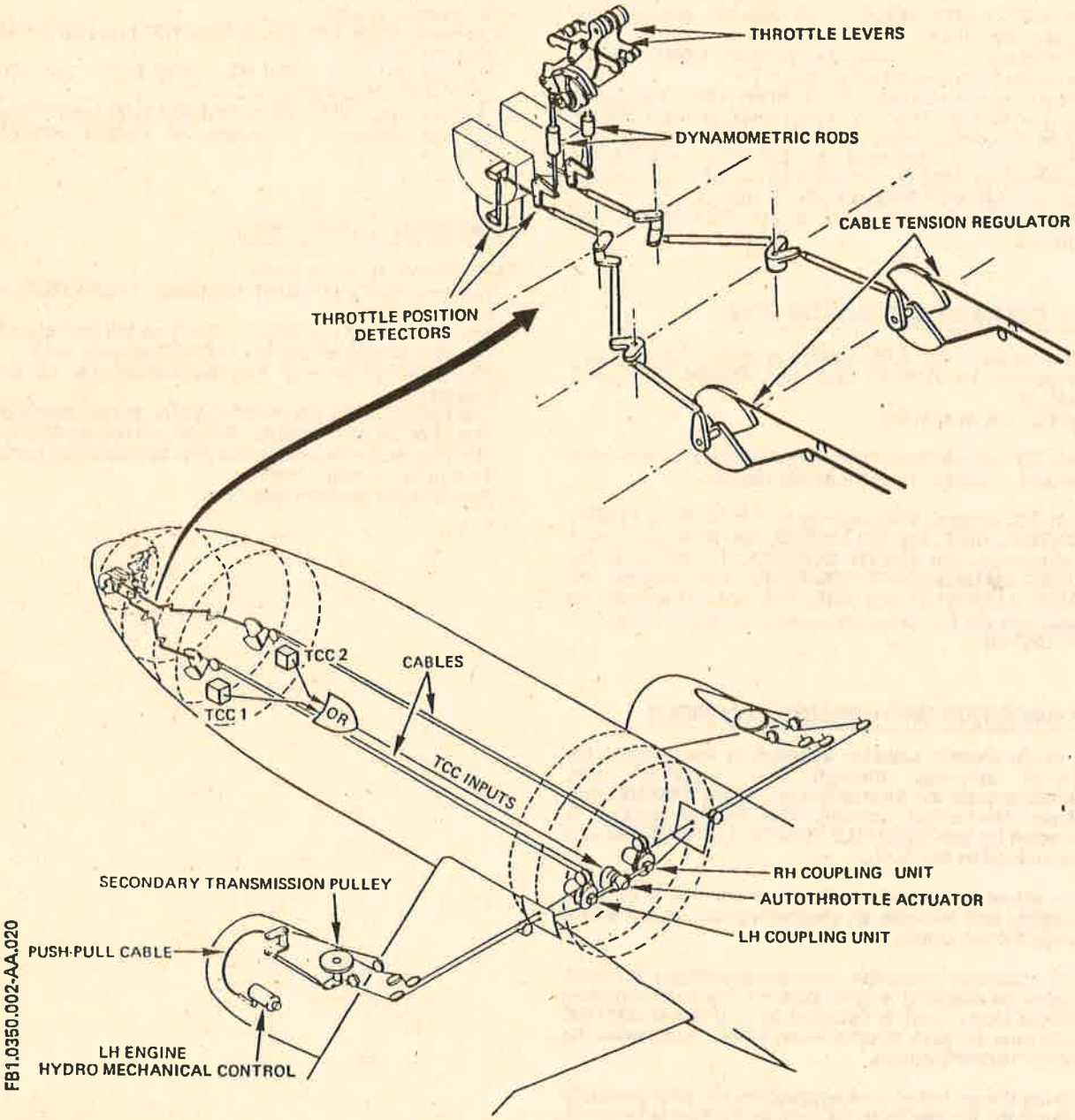
ATS is supplied with
- 28 Volt DC (28 V NORM BUSfor TCC 1 and 28 V ESS BUS for TCC 2)
- 115 Volt AC (115 V/400 HZ NORM BUS 1 for TCC 1, 115/400 HZ NORM BUS 2 for TCC 2)
- 26 Volt AC (26 V/400 HZ NORM BUS 1) for both TCC's, the dynamometric rods and the throttle position detector.

COMPONENT LOCATION

The ATS mainly comprises :
- The two TCC's (THRUST CONTROL COMPUTER) in electronic rack.
- The FCU (FLIGHT CONTROL UNIT) on the glareshield.
- The two arming levers (on FAC/ATS engage unit)
- The GO-LEVERS and ATS disconnect p.b. on the throttles
- The TRP (THRUST RATING PANEL) on the central panel
- The FMA (FLIGHT MODE ANNUNCIATOR) on PFD's.
- The ATS actuator associated with two coupling units
- Two dynamometric rods
- Two throttle position detectors.

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE GENERAL	1.03.50 PAGE 2 REV 20 SEQ 020

CONNECTION WITH ENGINE CONTROLS

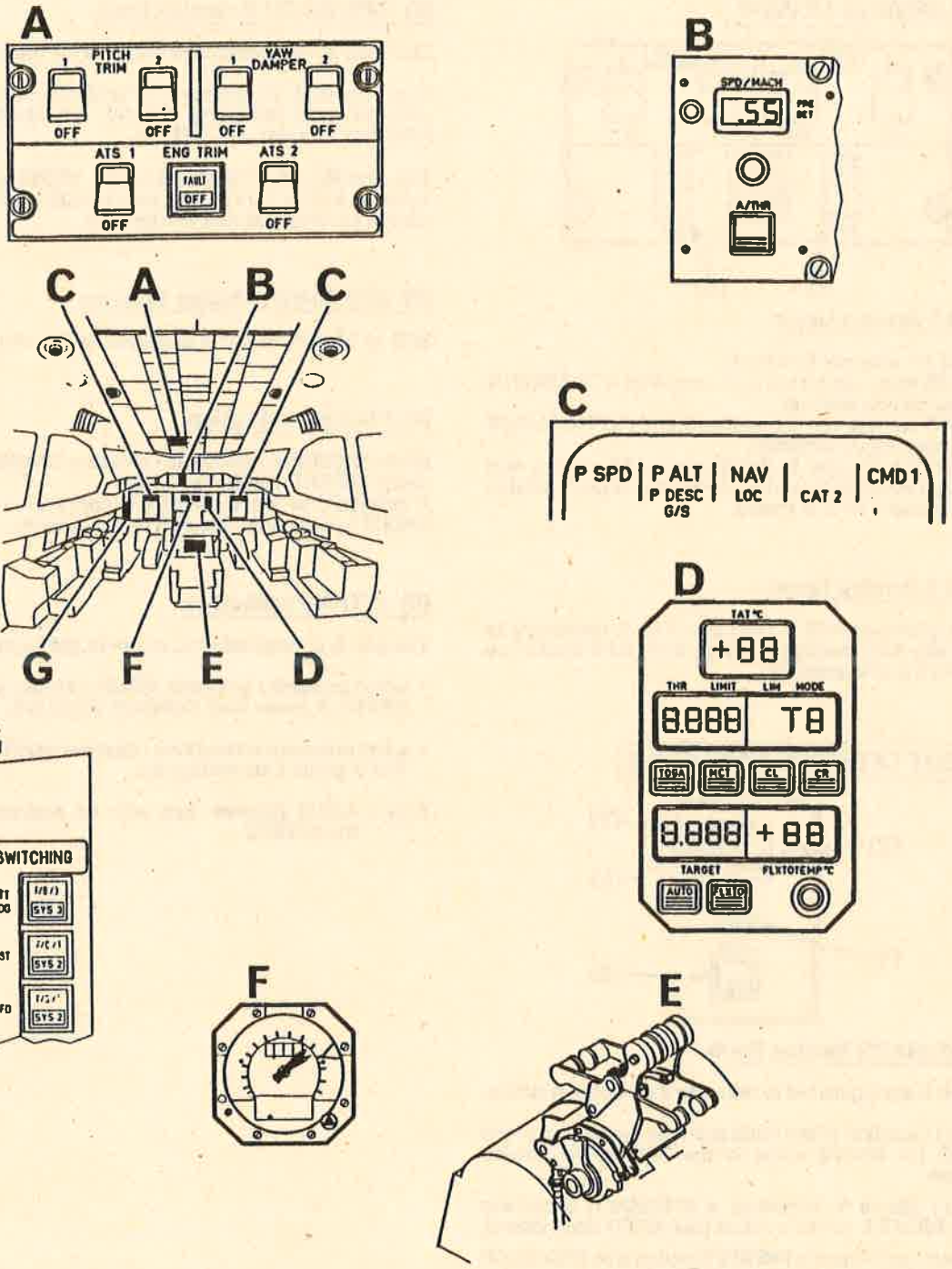


Note : ATS actuator simultaneously actuates, through the coupling units, THROTTLE LEVERS and ENGINE HYDRO MECHANICAL CONTROLS.

R Code : 0350 B

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE CONTROLS	1.03.50
		PAGE 3
		REV 20 SEQ 020

LOCATION OF CONTROLS



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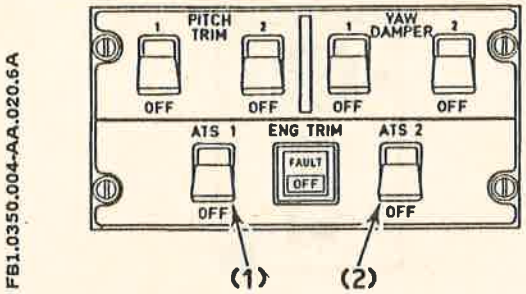
R Code : 0350B

A. ATS ARMING LEVERS



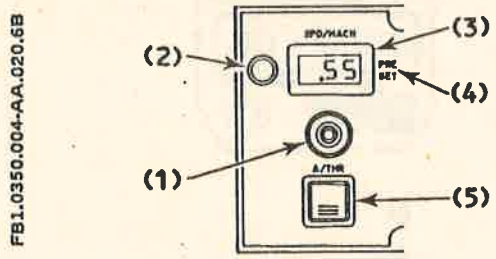
(1) ATS 1 Arming Lever

- On : ATS 1 channel is armed.
  ATS lever can be set to on only if all ATS ARMING conditions are met.
  ATS modes can be engaged and ALPHA FLOOR protection is available.
- OFF : ATS 1 channel is deactivated. ATS modes and ALPHA FLOOR protection are no longer available unless ATS 2 is armed.

(2) ATS 2 Arming Lever

Same functions as ATS 1. Only one ATS is necessary to have all the ATS functions. When both ATS levers are armed, ATS 2 is in standby.

B. FLIGHT CONTROL UNIT (FCU)



(1) SPD/MACH Setting Knob

The knob is springloaded to return to the neutral position.

- neutral : rotation of the knob changes the setting of the SPEED (or MACH) value in the SPD/MACH display window
- pulled : allows to introduce a SPD/MACH constraint when PROFILE mode is active (see AP/FD description).
- pressed : activates the PRESET function (see SPD/MACH mode in ATS and AP/FD description).
  A second press deactivates the PRESET.

(2) SPD/MACH Selecting Knob

The knob is springloaded to return to the neutral position.

When pressed, the display in SPD/MACH display window changes from SPEED to ACTUAL A/C MACH (or from MACH to ACTUAL A/C SPEED).

The new MACH or SPEED is hold if SPD/MACH mode is active in ATS or AP/FD. This new MACH or SPEED can of course be changed and will be hold.

(3) SPD/MACH Display Window

SPD or MACH setting is displayed in this window.

(4) PRESET Indication

When PRESET is activated (by pressing SPD/MACH setting knob) PRESET illuminates green.
It extinguishes when PRESET is deactivated or PRESET SPEED is taken into account by the system.

(5) A/THR Pushbutton

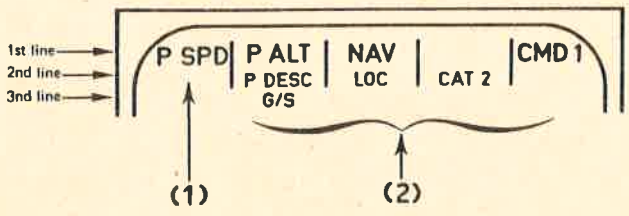
The p.b. is springloaded to return to the neutral position.

- when pressed : activates A/THR function (coupling to AP/FD). 3 green bars illuminate in the p.b.
- when pressed a second time : deactivates A/THR function. The 3 green bars extinguish.

Note : A/THR function can also be activated through GO-LEVERS.

C. FMA (FLIGHT MODE ANNUNCIATOR) DISPLAY (ON PFD)

FB1.0350.005-AA.001.6A



(1) Display For AUTOTHROTTLE

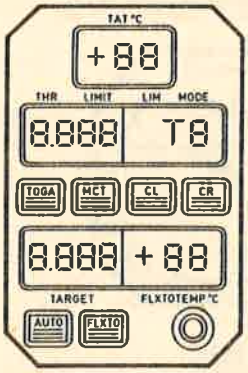
- The active mode in the ATS appears in GREEN in the FIRST line of the first window :
  - THR when SRS, LVL/CH or GO AROUND is active in AP/FD and provided A/THR function is active.
  - SPD or MACH when V/S, ALT, ALT* or LAND is active in AP/FD and provided A/THR function is active.
  - P THR, P SPD or P MACH when PROFILE (coupling of the FMS to the AP/FD) is active in AP/FD and provided A/THR function is active.
  - THR L (THRUST LATCH) when conditions for THR engagement are not met or when ALPHA FLOOR protection is activated.
- At DECLUTCH (at TAKE OFF) a BLUE « THR » illuminates in the SECOND line.
- In DESCENT (with LVL/CH mode) a BLUE « A/THR » illuminates in the SECOND line provided A/THR function is active.
- When neither A/THR function nor THR L mode active an AMBER « MAN THR » illuminates in the SECOND line, unless ATS is disarmed.

(2) Display For AP/FD

See AP/FD description

D. TRP (THRUST RATING PANEL)

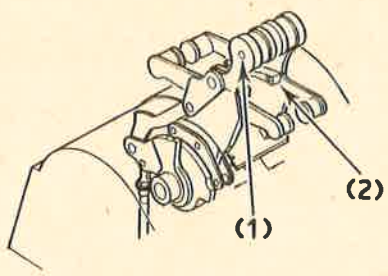
FB1.0350.005-AA.001.6B



See description in THRUST LIMIT CALCULATION.

E. THROTTLE LEVERS

FB1.0350.005-AA.001.6C



(1) ATS DISCONNECT Pushbutton

Pressing either p.b. disengages A/THR function or THR L mode.

MODE indication on FMA's extinguishes and MAN THR illuminates amber.

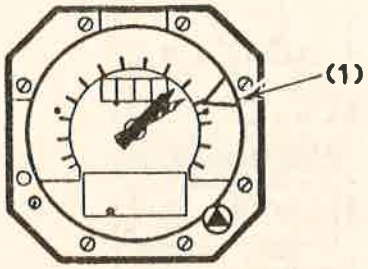
(2) GO LEVERS

Action on GO LEVERS engages

- either TAKE OFF or GO AROUND mode in AP/FD and A/THR function and THR mode in ATS.
- or THR L (THRUST LATCH) alone if conditions for TAKE OFF or GO AROUND engagement are not met.

Vers. : All Eng. : All

F. THRUST LIMIT INDICATION (ON THRUST INDICATORS)



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(1) THRUST LIMIT BUG

A THR LIMIT Bug (on N1 indicators for GE engines and on EPR indicators for PW engines) displays the THRUST LIMIT calculated by the TCC. This THRUST LIMIT function of the mode selected on TRP is also displayed on the TRP « THR LIMIT » window.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE THRUST LIMIT CALCULATION	N 1.03.50 PAGE 7 MAR 83

PROCESS OF CALCULATION

THR LIMIT CALCULATION is operative INDEPENDENTLY OF ATS ARMING.

N1 is the main parameter for engine management. THRUST-limit is calculated by the TCC from altitude, Mach, TAT, CAS (all provided by ADC 1 or 2) and air bleed informations.

Calculations are made for six modes : Take off (TO) and Go Around (GA) which are selected by a single pushbutton, Maximum Continuous Thrust (MCT), Maximum Climb (CL), Maximum Cruise (CR) and Flexible Take Off (FLX TO).

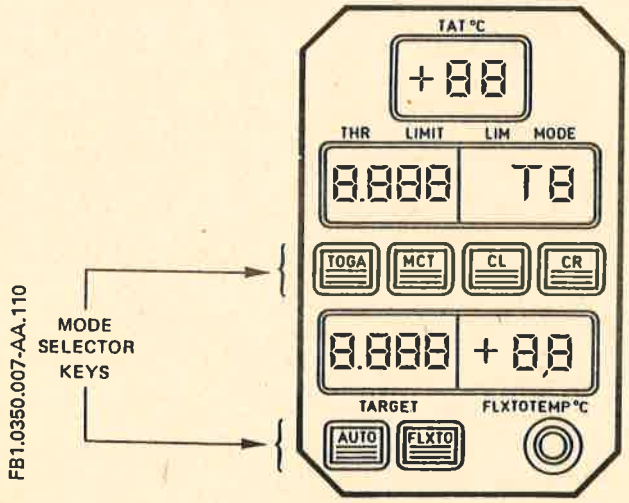
When AUTO mode is selected (AUTO can be manually selected on TRP or is automatically selected when PROFILE mode is engaged), the mode selection is automatically done by the FMC. But the TCC still calculates the corresponding THRUST-LIMIT.

Provided one of these modes is selected on the TRP (and regardless of ATS lever position), THRUST LIMIT is continuously computed and displayed on the TRP (on the THR LIMIT display window) and on the N1 indicators (by the movable N1 indexes).

This allows a comparison between actual engine rating and maximum rating.

Note : During approach GA is automatically selected upon SLATS extension but any other mode except TO or FLEX TO can be manually selected on the TRP.

THRUST LIMIT INDICATION ON THRUST RATING PANEL (TRP)



A mode is selected by pressing the corresponding key. Such an action causes illumination of three green bars in the key.

The keys are springloaded to return to the neutral position and a second action has no effect.

The mode selected by the pilot or by the FMC (when AUTO is selected) is displayed in the « LIM MODE » window.

Note : AUTO mode cannot be selected before THRUST REDUCTION ALTITUDE (1500 ft by default)

DISPLAY IN THE « THR LIMIT » WINDOW :

The limit thrust corresponding to the selected mode is displayed.

The only exception is when FLEX TO is selected. In this case MAX TO thrust is displayed in the THR LIMIT window and FLEX TO in the TARGET window.

DISPLAY IN THE « TARGET » WINDOW :

- If PROFILE mode is not engaged, the limit thrust displayed in the THR LIMIT window is recopied (except for FLEX TO as explained above) if THRUST mode (THR or THRL) is active in the ATS.
  Nothing is displayed if SPD/MACH mode is active in the ATS.
  I-L is displayed if throttles are on idle in descent with LVL/CH mode.
- If PROFILE is engaged, TARGET THRUST calculated by the FMC is displayed whatever the mode is (P THR or P SPD/P MACH)
  I-L is displayed if idle thrust is requested by the FMC.

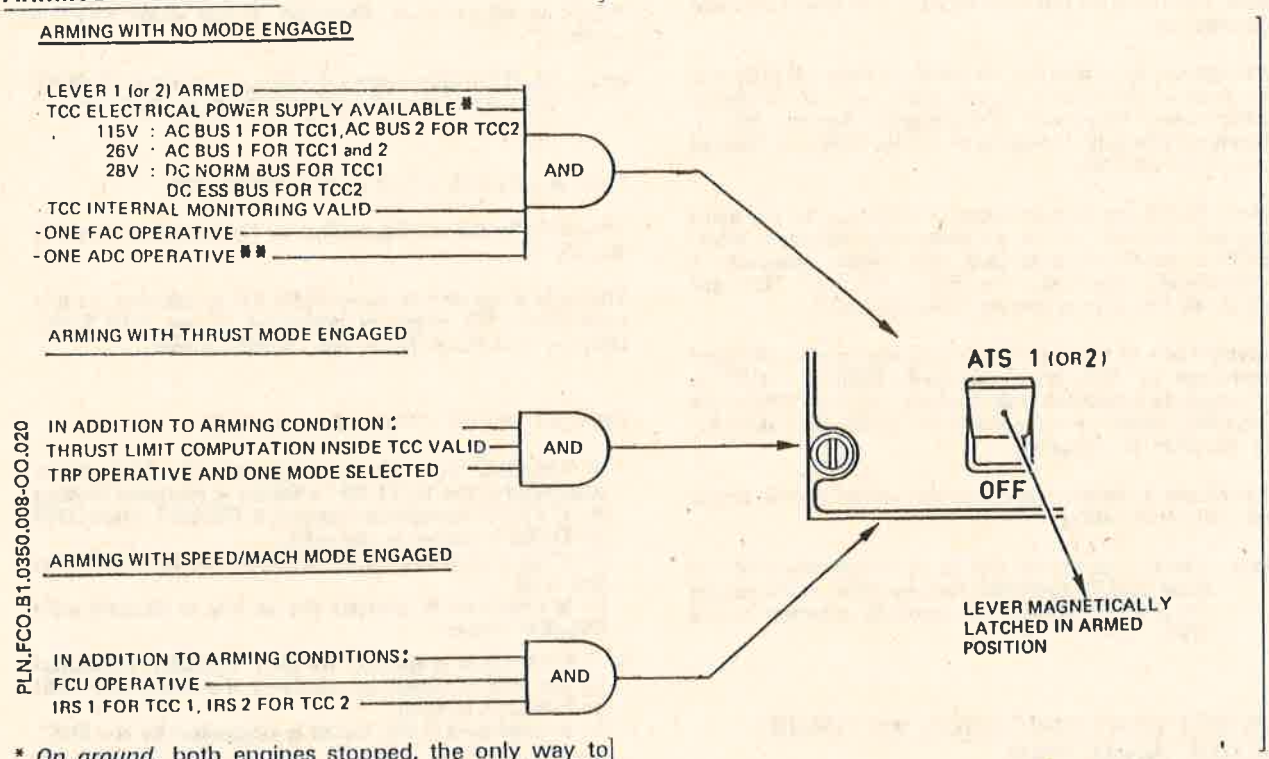
For detailed information concerning the TRP and the THRUST computation, refer to « POWER PLANT » chapter.

Vers. : All GE Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE ATS ARMING/DISARMING	1.03.50 PAGE 8 REV 20 SEQ 020

No mode can be engaged in ATS before at least one ATS lever has been armed.
When the two ATS levers are armed, ATS 2 is in standby.

ARMING CONDITIONS



* *On ground,* both engines stopped, the only way to supply electrical power to the AFS computers (FAC, FCC, TCC) is to arm at least one PITCH TRIM lever. So ATS can be armed only if at least one PITCH TRIM lever is armed.

** In normal use, ADC 1 feeds both TCC's. In case of ADC 1 failure, an automatic switching on ADC 2 is provided.

DISARMING

ATS 1 (or 2) is disarmed (ATS lever trips to OFF)
- Manually by setting the lever to OFF.
- Automatically if one of the arming conditions is lost.

If one ATS disarms, the other resumes control of the power.

Note : see ECAM WARNING LOGIC for the WARNING indications.

ATS RESPONSE TO PERIPHERAL FAILURE

The following table summarizes the consequences of a peripheral equipment failure on the autothrottle system according to its condition of engagement at the time of failure.

CONDITION → / FAILURE ↓	ATS armed SPD/M or P SPD/P MACH mode engaged	ATS armed THR L, THR or P THR mode engaged
ENGINE 1 or 2 failed	No effect	No effect
ENGINE GENERATOR 1 or 2 failed (electrical transient)	No effect	No effect
Engine TRIM 1 or 2 failed	No effect	No effect
ADC 1 failed	Both ATS disarms, but automatic switching on ADC 2 is provided. And so ATS can be rearmed then mode re-engaged.	
BOTH ADC's failed	Both ATS disarm. No rearming possible	
FAC 1 or 2 failed	No effect	
BOTH FAC's failed	Both ATS disarms. No rearming possible	
IRS 1 or 2 failed	ATS 1 (or 2) disarms. Rearming not possible Modes remain available through ATS 2 (or 1).	No effect
THR LIMIT COMPUTATION failed in TCC 1 (or 2)	No effect. Protection against excessive thrust setting is assured by TCC 2 (or 1).	ATS 1 (or 2) disarms. Rearming possible. Modes remain available through ATS 2 (or 1)
TRP failure	• Both ATS disarm if P SPD/P MACH active. Rearming possible but not mode re-engagement. • No effect if SPD/MACH active provided the knobs (on N 1 indicators) are pushed (auto). If these knobs are pulled to manually set the N 1 limit then : – Both ATS disarm if throttles angle is lower than 17 deg. – No effects if throttles angle is greater than 17 deg.	Both ATS disarm. Rearming possible but not mode re-engagement.
FCU failure	Both ATS disarms. Rearming possible but not mode re-engagement	
LOSS of both FD's and AP's	A/THR can be engaged but only on SPD/MACH mode if it is available	

Note : the only failures which affect RTAR mode are :
– the dual Radio Altimeter failure (only when this mode is engaged at 30 ft).
– the FCU failure
– the failures which cause A/THR disengagement

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE MODES ASSOCIATED TO A / THR	1.03.50 PAGE 10 REV 20 SEQ 020

1 – A/THR FUNCTION

A/THR function allows to couple ATS to AP/FD. This means that all the modes associated to A/THR function are automatically selected by the AP/FD, function of the active longitudinal mode in AP/FD.

The modes associated to A/THR are : THR, P THR, SPD, MACH, P SPD, P MACH, RTAR.
The only mode not associated to A/THR is THR L (THRUST LATCH).

Note : engagement of THR L disengages A/THR.

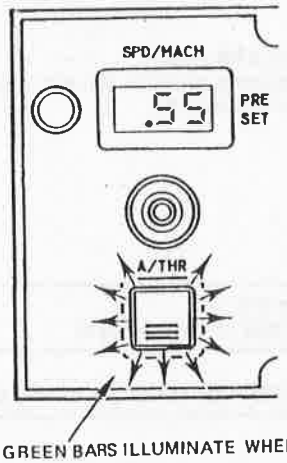
ENGAGEMENT

Provided :

- One ATS lever is armed (If the two are armed ATS 2 is in standby).
- the A/C is not in ALPHA FLOOR condition

A/THR function can be engaged in two different ways :

- by action on the GO LEVERS if this action engages TAKE OFF or GO AROUND mode in AP/FD (in this case THR mode and A/THR are engaged at the same time in ATS).
- on ground with both engines stopped or in flight if LAND TRACK mode is not active in AP/FD, by pressing the A/THR p.b. on FCU.



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3 GREEN BARS ILLUMINATE WHEN A/THR FUNCTION IS ACTIVE

DISENGAGEMENT

A/THR function will be disengaged (but both ATS levers will remain armed) :

- by a second action on the A/THR pushbutton provided LAND TRACK phase of LAND mode is not active.
- by pressing either ATS disconnect pushbutton
- at touchdown when both throttles are on idle position (5^{o}).
- if ground spoilers are deployed on one side
- if one engine is set to reverse thrust.
- when THR L mode is forced in ATS
- if both AP's and FD's are disengaged
- if MCT, CL or CR is selected on TRP when CAS is lower than 60 KTS
- on ground if SPD/MACH is active and one engine is started.

Note : If AFS is used during all the flight, THRUST IS AUTOMATICALLY CONTROLLED FROM TAKE OFF TO LANDING, since A/THR function is automatically engaged at take off by GO LEVERS and automatically disengaged at touch down.

WARNING

A/THR function non-engagement or disengagement (manual or due to a failure) is indicated by a MAN THR amber light which illuminates steady on the PFD's to indicate that the pilot must control the throttles.

This occurs for example during taxi (before take off) or at landing (after touch down)

MAN THR illuminates steady until the pilot engages A/THR function or THR L mode or set both ATS levers to OFF.

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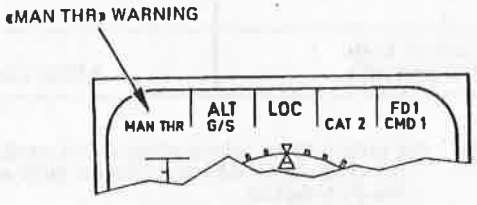


Note : 1. MAN THR warning also occurs when THR L mode is lost.
2. MAN THR warning appears, of course, at each time either ATS disconnect p.b (on throttles) is pressed since this causes A/THR or THR L loss.

4 – RTAR (RETARD) MODE

In this mode the ATS commands the throttle reduction on idle position.

Note : In all flight phases throttle reduction is limited to 5°.

ENGAGEMENT

RTAR mode can be engaged only if A/THR function is active.

RTAR mode is automatically engaged (green RTAR on FMA's) :
- when LVL/CH mode is engaged in descent (SPD or MACH engages in AP/FD)
- At 30 ft radio altitude if SPEED mode is active in the ATS and if one radio altimeter indicates a height lower than or equal to 30 ft. (SPD disengages when RETARD engages).

Note : when RETARD mode is engaged by LVL/CH mode, it is possible during throttles reduction to manually stop the throttles to obtain the desired thrust. RETARD mode is disengaged when throttles are stopped (manually or on idle position).

DISENGAGEMENT

- at each time A/THR function disengages
- when with LVL/CH in descent, throttle reduction is stopped (manually on any position or automatically on idle position). In this case A/THR illuminates blue on FMA's (A/THR function only armed).

OPERATION

For MODE SEQUENCING, see AP/FD MODE DESCRIPTION (LVL/CH and LAND modes).

In this mode, the ATS commands the capture and maintains the THRUST LIMIT corresponding to the mode selected on TRP (as for THR mode).

ENGAGEMENT

- THR L engagement (green THR L on FMA's) is possible only if ATS is armed (on overhead panel).
- THR L is engaged (this causes A/THR function disengagement) :
  - At each time either GO-LEVER is pressed and this action does not lead to THR engagement by the AP/FD.
    This occurs, for example, in APPROACH if SLATS are not extended (in this case GO AROUND mode does not engage in AP/FD and so THR mode cannot be engaged).
  - When ALPHA FLOOR protection is activated (see 03-40 chapter)
- Green THR L illuminates steady when THR L is engaged by ALPHA FLOOR condition.
  Green THR L flashes when THR L is engaged out of the ALPHA FLOOR conditions or when the A/C goes out of the ALPHA FLOOR conditions.

DISENGAGEMENT (ATS remains armed)

- by pressing ATS disconnect p.b.
- by engaging A/THR function (press on A/THR p.b.)
- when GROUND SPOILERS are deployed on one side
- if one engine is set to reverse thrust.

R

Note : When no mode is active in ATS a MAN THR amber warning appears on the FMA's.
MAN THR illuminates steady until the pilot engages THR L mode (or A/THR function) or set ATS lever to OFF.

OPERATION

For MODE SEQUENCING see AP/FD MODE DESCRIPTION (TAKE OFF, GO AROUND, modes).

THR L CONTROL DIAGRAM

See DIAGRAM facing THR and P THR modes description.

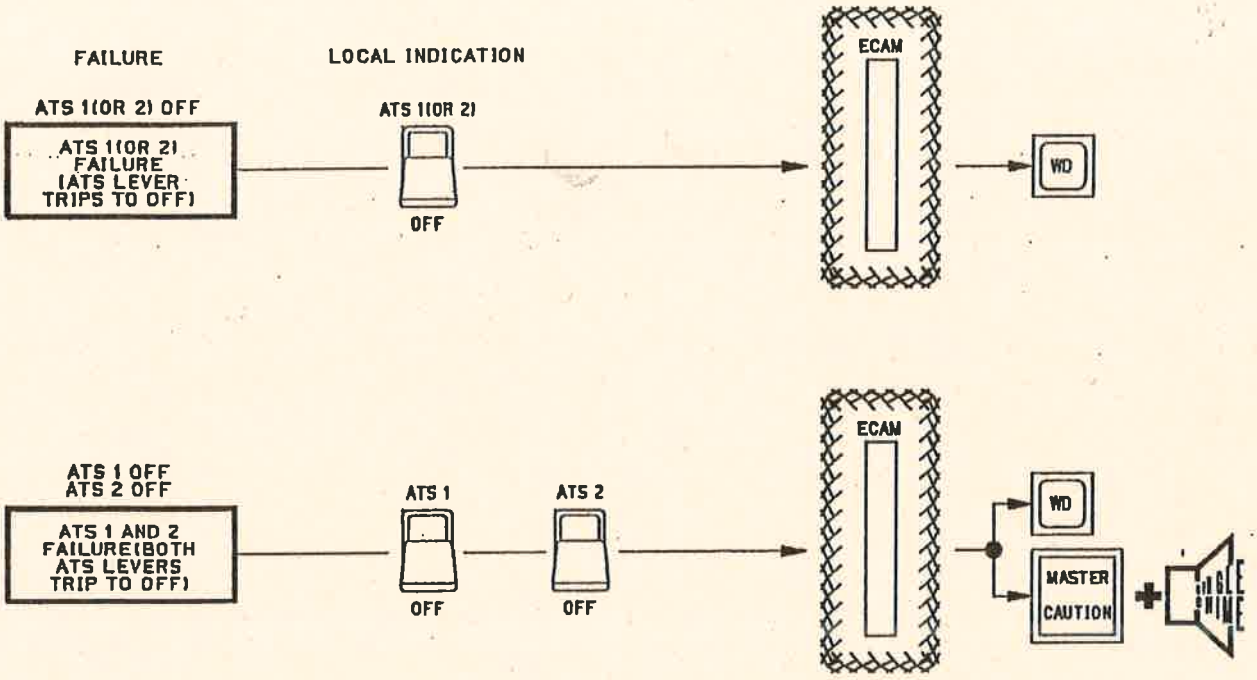
A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE DFA MODE	1.03.50 PAGE 15 REV 07 SEQ 001

DFA is not installed.

Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOTHROTTLE ECAM	1.03.50 PAGE 16 REV 22 SEQ 040

WARNING LOGIC



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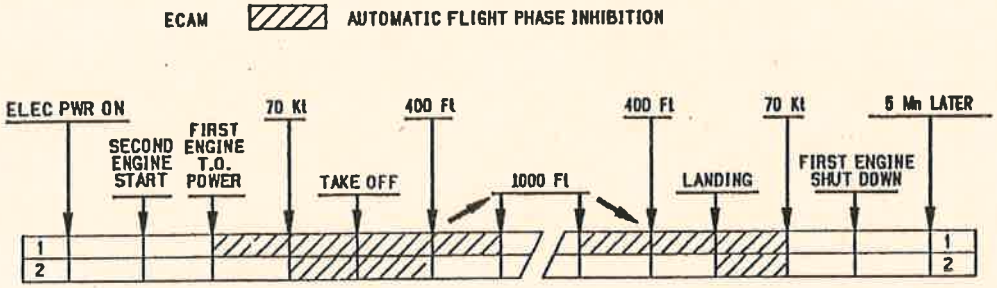

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Code : 0350 E

AP/FD MODE SELECTION

The different modes (longitudinal,. lateral or common) are selected through controls located on the FCU (Flight Control Unit).

The only exception is for TAKE OFF (SRS + RWY) and GO-AROUND which are selected through the GO-LEVERS located on the throttles.

Actions to select these modes are described in sub-chapters 03-65, 03-66, 03-67.

R
R
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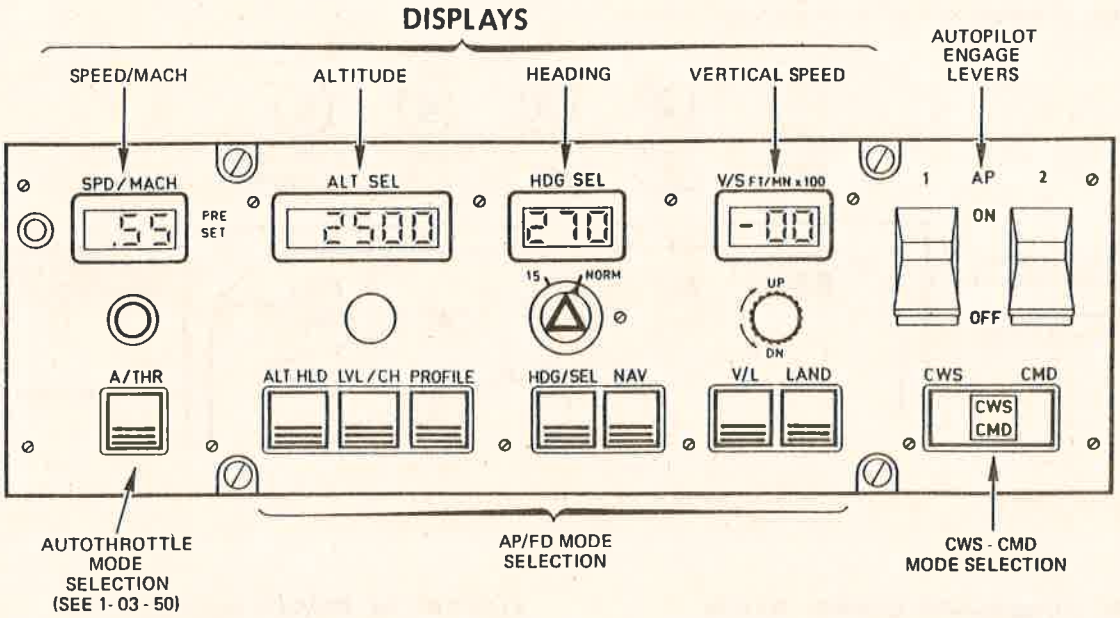


MODE SELECTION LOGIC

FD computations are common with those of the AP.

The selection of a mode is done in the same way if only the FD's are engaged or if the FD's and one or two AP's are all engaged.

Mode selection is based on the following principles :

- Any action on a mode pushbutton (on the FCU), if the engagement conditions are met, allows the engagement of the corresponding mode.
- Any second action on an illuminated mode pushbutton, disengages the modes.
  Moreover, if the mode is in active phase (and not in arming phase) this causes selection of V/S mode if the disengaged mode was a longitudinal mode, or HDG mode if the disengaged mode was a lateral mode.
- Pulling one of the 4 knobs (on the FCU), if the engagement conditions are met, allows the engagement of the corresponding mode. Theses knobs don't allow to disengage the corresponding modes.
- The loss of one mode engagement condition leads to the disengagement of the mode and in some cases the disconnection of the AP/FD (see mode description in 03-65, 03-66, 03-67).
- The AP, when engaged in CMD, engages in the modes selected with the corresponding FD.

Note : In all modes, the FD BARS (if active) indicate the commands to be executed to follow the selected modes and references.

Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR FD DESCRIPTION	1.03.62 PAGE 1 REV 08 SEQ 001

FUNCTION

The goal of the FD is to provide informations to the pilot (through the FD BARS on PFD's), to allow manual guidance of the A/C :

- in pitch axis, if a longitudinal mode has been engaged
- in roll axis, if a lateral mode has been engaged
- in yaw axis, if certain phases of TAKE OFF or LAND modes have been engaged.

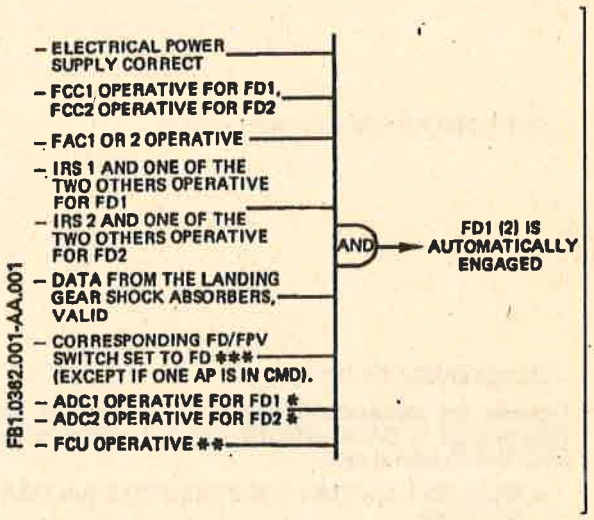
If the FD commands are followed, the FD BARS remain centered on the PFD.

One or two BARS can be out of view, depending on the selected modes.
In addition, the FD BARS can be moved out of view by setting the FD/FPV switch to OFF or FPV, (see FD/FPV SWITCH schematic).

If no AP is engaged in CMD, FMA and FD BARS on PFD 1 are associated with FD 1, FMA and FD BARS on PFD 2 are associated with FD 2.

If an AP is engaged in CMD, both FMA's are associated with this AP, but the FD BARS on the PFD's remain associated with the corresponding FD.
This means, for example, that in VOR MODE, when two different settings are selected on the two VOR control panels, the FD BARS are not centered on the side where no AP is engaged.

Note : FOR MODE DESCRIPTION (common to FD and AP in CMD), see 03-65, 03-66, 03-67.



ENGAGEMENT CONDITIONS

No pushbutton exists to engage or disengage the FD's.

The two FD's are independent. FD1 feeds PFD1 and FD2 feeds PFD2.

When the two FCC's are electrically energized and provided all the engagement conditions (here after listed) are met, the two FD's are automatically engaged in the basic modes :

- V/S (Vertical Speed) in pitch axis.
- HDG (Heading) in roll axis.

* not necessary after GLIDE CAPTURE phase.

** not necessary in GO AROUND or LAND TRACK modes.

*** If the FD/FPV switch is set to FPV and if one of the following modes :
- TAKE OFF (SRS + HDG or RWY)
- GO AROUND
- ALIGN phase of LAND mode
- ROLL OUT phase of LAND mode

is engaged, the FD BARS are automatically recovered on the PFD's.

Note : To these general engagement conditions, specific engagement conditions must be added depending on the selected modes. See mode description in 03-65, 03-66, 03-67.

Vers. : All Eng. : All

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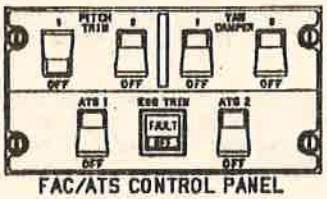
ENGAGEMENT ANNUNCIATION

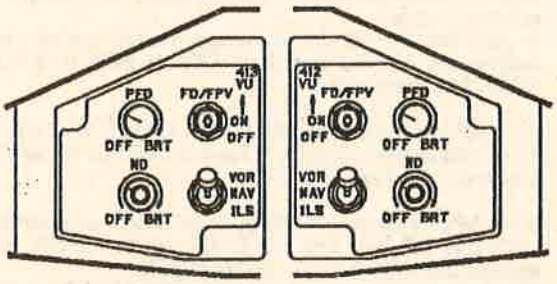
– ENGAGE ONE PITCH TRIM LEVER ON THE FAC/ATS CONTROL PANEL (to supply FCC's with electricity).

Note : FCC's are already supplied with electricity if at least one engine is operating.



FAC/ATS CONTROL PANEL

– SET BOTH FD/FPV switches to ON.

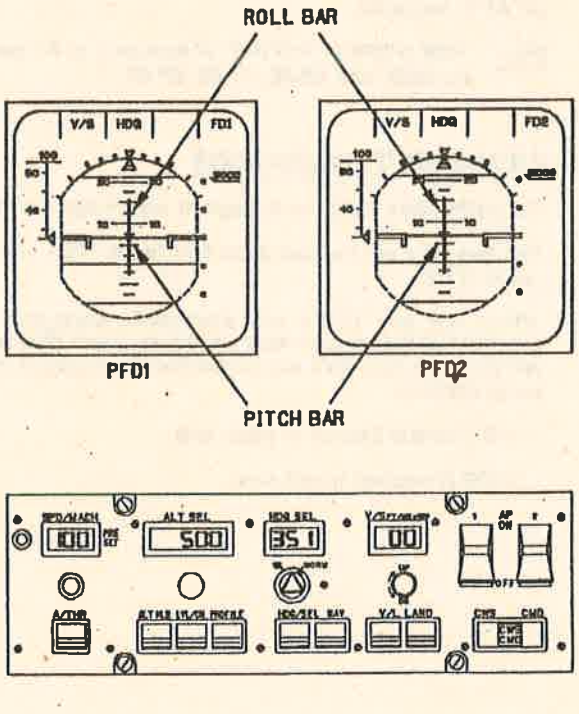


– CONSEQUENCES ON PFD's.

Provided the ENGAGEMENT CONDITIONS are met, both FD's engage in BASIC MODES (V/S in longitudinal axis and HDG in lateral axis).

- White FD 1 (on FMA 1) and white FD 2 (on FMA 2) illuminate.
- Green V/S and HDG illuminate on both FMA's.
- PITCH AND ROLL BARS come in view on both PFD's.

Notes : 1. As long as A/C is on ground and HDG mode is engaged, ROLL BAR is synchronized on A/C heading (ROLL BAR remains centered on PFD's).
YAW BAR appears only at TAKE OFF (with RWY mode) or at LANDING (in ALIGN and ROLL OUT phases of LAND mode).
At take off (at 30ft) if HDG replaces RWY mode, ROLL BAR is also synchronized on A/C heading at HDG engagement.
2. When a failure causes disengagement of both AP/FD's, the FD's reengage in basic modes after a delay but in this case the FD bars flash for 10 sec.



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– CONSEQUENCES ON FCU :

The reference display windows are initialized with present aircraft parameters (here 100 kt, 500 ft, 351°, 0 ft/mn).
In case of absent or invalid FCC data :
– 100 kt is displayed in SPD/MACH display window.
– 5000 ft is displayed in ALT display window.
– O° is displayed in HDG SEL display window.
– – – – is displayed in V/S display window.

Note : 100 kt is the minimum value for the SPD/MACH display window.

Code : 0362C

DISENGAGEMENT

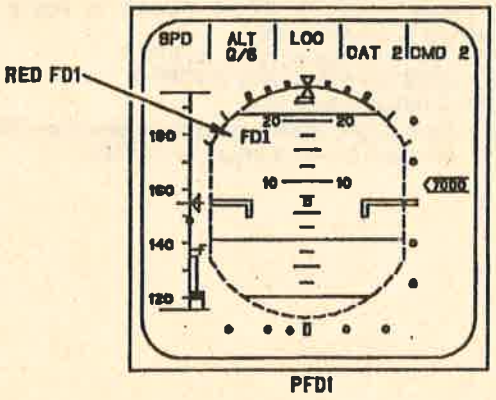
No pushbutton exists to engage or disengage the FD's.

However each pilot can clear the FD BARS on his PFD by means of his FD/FPV switch (see next paragraph).

If one engagement condition is no longer met for one FD, it disengages :

- The FD BARS on the corresponding PFD are set out of view.
- A FD 1 (or 2) red message appears on PFD 1 (or 2).
- The lights related to the FD extinguish on the corresponding FMA, unless an AP is engaged in CMD (as on the example).

In case of a single FD failure, the FD BARS can be recovered by pressing the FD switch, on the instrument switching panel. The remaining FD then feeds both PFD's. (see FD SWITCHING schematic).



FD/FPV SWITCH

(1) CAPT « FD/FPV » SWITCH

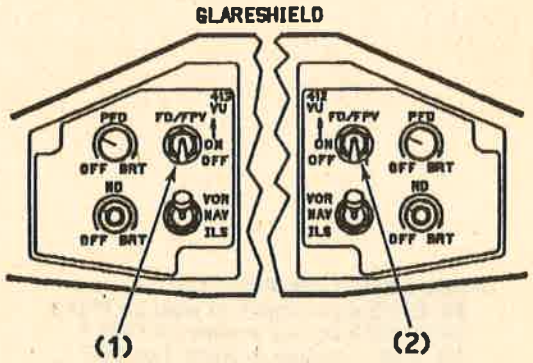
- **OFF (stable position) :**
  Both FD bars and FPV symbols are out of view on PFD1. If no AP is in CMD, FD1 is disengaged (AP/FD mode indications extinguish on FMA 1). But no failure message (red FD1 on PFD1) is displayed.
- **ON (stable position) :**
  either FD bars or FPV symbols are presented on PFD1.
- **Upper position (unstable) :**
  when the switch is set to the upper position, the display on PFD1 switches from FD bars to FPV symbols or from FPV symbols to FD bars.
  When FPV symbols are displayed and when no AP is in CMD, AP/FD mode indications disappear on FMA 1.

  Notes :

  1. FPV function and symbols are described with EFIS in FLIGHT INSTRUMENTS chapter.

  2. When the switch is set from OFF to ON, or at FCC's energization (if the switch is already ON), the FD bars are displayed.

  3. An automatic reversion to FD bars display on PFD's is done when TAKE OFF, GO AROUND or LAND mode (ALIGN or ROLL OUT phase) is engaged.



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(2) F/O « FD/FPV » SWITCH

Same function as CAPT FD/FPV SWITCH, but it applies to PFD2 and FD2.

Mod. : 5051

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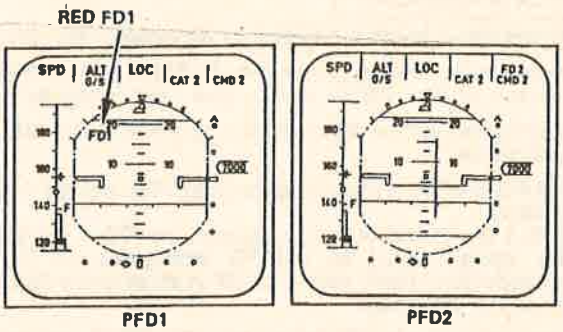
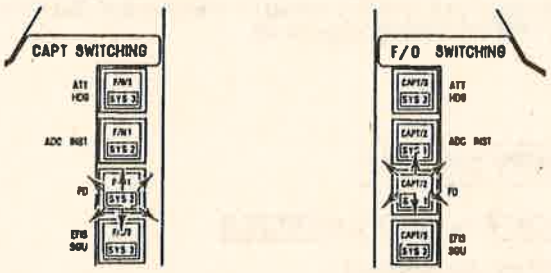
FD SWITCHING (case of FCC 1 failure)

- If a failure occurs in FCC 1 (failure in FCC 2 has symetrical consequences) :
  - FD1 red message appears on PFD 1.
  - FD BARS are out of view on PFD 1.
  - PFD 2 remains as it was.

  Note : Here AP/FD modes remain displayed on FMA 1 because an AP is engaged in CMD.



- By pressing CAPT FD SWITCH (1)
  - SYS 2 illuminates white on the CAPT FD SWITCH.
  - CAPT/2 illuminates green on the F/O FD SWITCH (2)

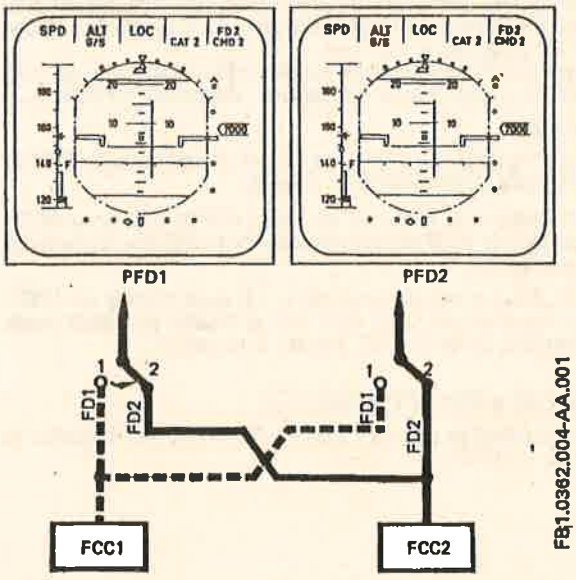


- FCC 2 then feeds PFD 1 (3)
  FD BARS come again in view on PFD 1.
  White FD 2 comes in view on FMA 1
  FD 1 red message is cleared on PFD 1.

Note : 1. It is always possible to come back to the original configuration by pressing a second time the CAPT FD SWITCH.

2. It is not possible to feed at the same time PFD 1 with FCC 2 and PFD 2 with FCC 1.

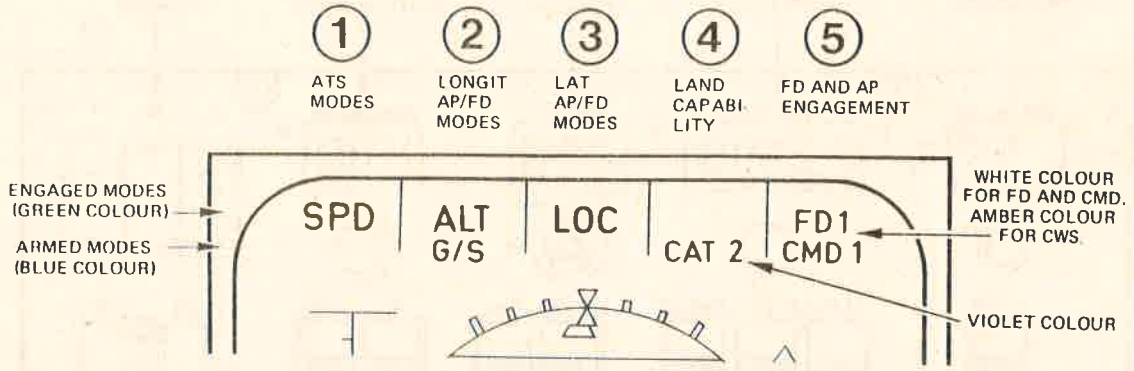
3. There is no priority between CAPT and F/O switch.



AP/FD MODE ANNUNCIATION ON PFD

AP/FD engagement status and mode engagement are indicated on the FMA (FLIGHT MODE ANNUNCIATOR) which is integrated in the upper part of the PFD (PRIMARY FLIGHT DISPLAY)

The FMA is divided in 5 zones as described below :



AP/FD COMMANDS COMPUTATION

Computations for AP and FD functions are made by the same computer : the FCC (FLIGHT CONTROL COMPUTER). There are two FCC's (one for each AP/FD).

Each FCC includes two computing channels, a command one and a monitor one, for safety reason.

The FCC's receive information mainly from the Flight Control Unit (mode selection, references), the GO-LEVERS (mode selection), the disconnect pushbuttons (AP disconnection), the VOR, ILS, Altimeters, FMS (Flight Management System) and from other computers like ADC, IRS, FAC, TCC, etc.
Then with all these data the FCC's provide command signals to the FD bars (FD function) and to the flight control SERVO ACTUATORS (AP function).

ELECTRICAL POWER SUPPLY

The AP/FD system is electrically supplied with :
- 28 Volt DC which is the main supply :
  28 Volt DC ESS BUS supplies FCC 1 and FCU
  28 Volt DC NORM BUS supplies FCC 2 and FCU
- 26 Volt AC :
  26 Volt AC ESS BUS supplies FCC 1
  26 Volt AC BUS 2 supplies FCC 2

The AP/FD system is energized when one of the following conditions is met :
- one engine running
- one PITCH TRIM lever armed.
- for MAINTENANCE purpose if cockpit LAMP TEST or, through MTP, GROUND SCAN or AFS/LAND TEST is activated.

On ground, electrical power supply is automatically cut off 12.5 s after the last of the following conditions has occured :
- Both engines shut down
- Both PITCH TRIM levers set to OFF
- End of the MAINTENANCE tests mentionned above.

Note : when electrical power is cut off, the other levers (YAW DAMPER, ATS) trip.

Vers. : All Eng. : All

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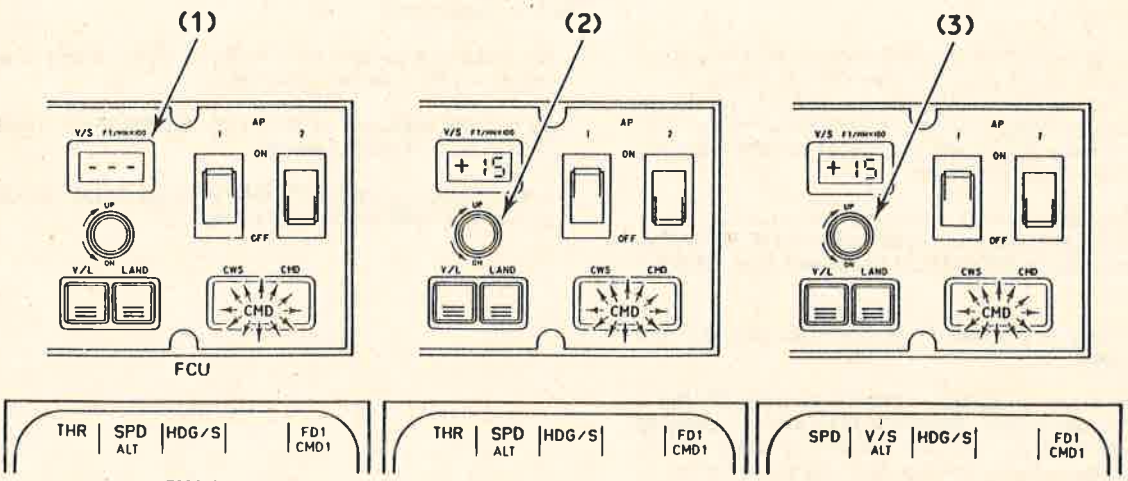
V/S MODE (CONT'D)

OPERATION - ANNUNCIATION

- Before V/S engagement
  - dashes on the V/S display window (1).
  - A/C configuration is for example : one AP in CMD. LVL/CH mode engaged.
- Turning V/S knob (2) :
  - synchronizes V/S counter on A/C present V/S.
  - then allows to preselect a new V/S (here 1500 ft/min)
- When pulling the V/S knob (3) :
  - V/S mode engages on the preselected V/S.
  - green V/S illuminates on both FMA's.
  - ATS engages in SPD mode (if A/THR active). Green SPD illuminates on both FMA's.



Note : If V/S setting knob had not been turned, V/S mode would have engaged on present aircraft vertical speed.

Vers. : All Eng. : All

ALT MODE

Altitude (ALT) mode maintains the altitude existing at the time of engagement if vertical speed is null.
If vertical speed is not null, AP/FD first levels off the aircraft and then maintains the resulting altitude.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

ALT is engaged

- by pressing the ALT HLD pushbutton on FCU, provided LAND mode is not active in the TRACK phase.
  At the same time SPEED or MACH mode is automatically engaged in autothrottle (if A/THR active). ATS maintains the speed (or mach) selected on the SPD/MACH display window.
- by pulling SPD/MACH setting knob on FCU, when PROFILE mode is engaged in altitude hold (P ALT). This allows to enter a SPD/MACH constraint (see PROFILE mode).
- automatically at the end of the CAPTURE phase of the ALT* mode.

Note : This mode is available with FD as with AP. But if AP is engaged in CMD when FD is already engaged in ALT mode, the AP takes into account the altitude selected on the ALT display window.

That is to say :

If the difference between the A/C and the selected altitude is lower than 250 ft, the AP will capture and maintain the selected altitude.

If the difference between the A/C and the selected altitude is greater than 250 ft, the AP will level off the A/C and maintain the resulting altitude.

DISENGAGEMENT

ALT is disengaged

- by pressing a second time ALT p.b. (This causes basic mode – V/S – to be selected).
- by manual selection of V/S, LVL/CH, PROFILE, TAKE-OFF or GO AROUND mode.
- automatically when GLIDE CAPTURE or GLIDE TRACK phase of LAND mode is activated.

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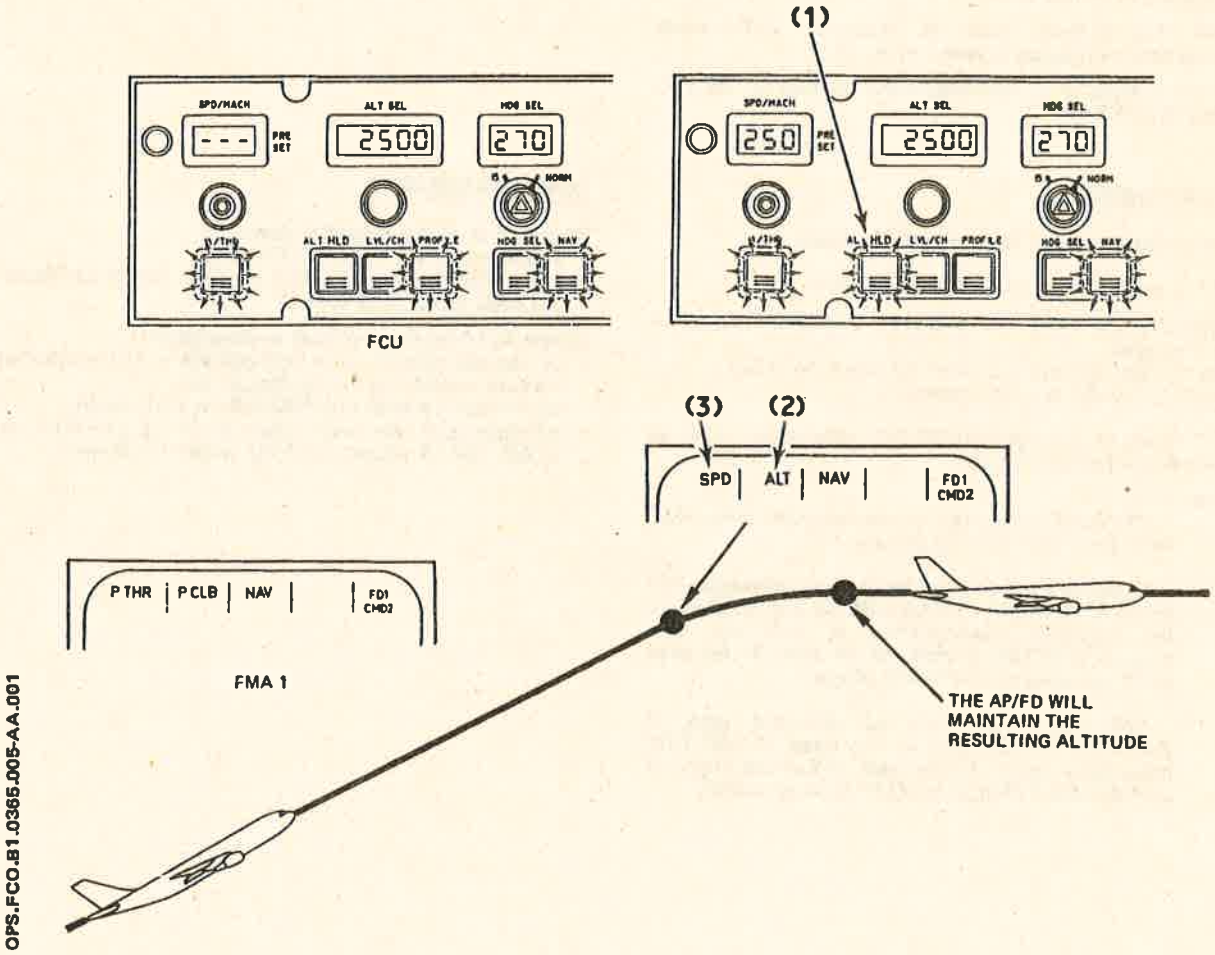
ALT MODE (CONT'D)

OPERATION – ANNUNCIATION

- Before ALT engagement, A/C configuration is for example :
  - AP in CMD.
  - PROFILE and NAV modes engaged.
  - Vertical speed not null.

- When ALT HLD p.b. is pressed (1)
  - ALT p.b. is lighted
  - PROFILE p.b. is extinguished
  - ALT illuminates green on both FMA (2).
  - ATS engages in SPD (or MACH). Green SPD (or MACH) illuminates on both FMA (3).
  - The AP/FD levels off the A/C.



ALT* MODE

Altitude acquire (ALT*) mode acquires the altitude selected on the ALT display window (on FCU).

This mode comprises two phases :

- An ARMING PHASE during which a support longitudinal mode (V/S, LVL/CH, TAKE-OFF or GO-AROUND) is used to converge towards the selected level.
- A CAPTURE PHASE which starts as soon as a given relation between the altitude deviation and the A/C vertical speed is achieved. When CAPTURE phase is initiated, autothrottle (if A/THR active) automatically engages in SPD/MACH.

When the desired level is reached, ALT mode automatically engages in place of ALT*.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

No pushbutton exists to engage this mode.

ALT* is armed (blue ALT on FMA's) when :

- V/S, LVL/CH, TAKE OFF (SRS) or GO AROUND mode is engaged
- and a new altitude has been selected on FCU.
- and FLAPS 40° are not selected

ALT* mode is engaged (CAPTURE phase) as soon as capture conditions are met.

Notes :

– CAPTURE phase can not be activated when ALT knob (on FCU) is being turned.

– Selected altitude may be changed (through ALT knob) in ARMING PHASE without any change on the engaged modes.Except if, with the new altitude CAPTURE conditions are met. In this case ALT engages in CAPTURE phase.*

– Selected altitude may be changed, also, in CAPTURE PHASE. But in this case, if CAPTURE conditions are no longer met, V/S mode engages and ARMING PHASE of ALT is re-activated.*

DISENGAGEMENT

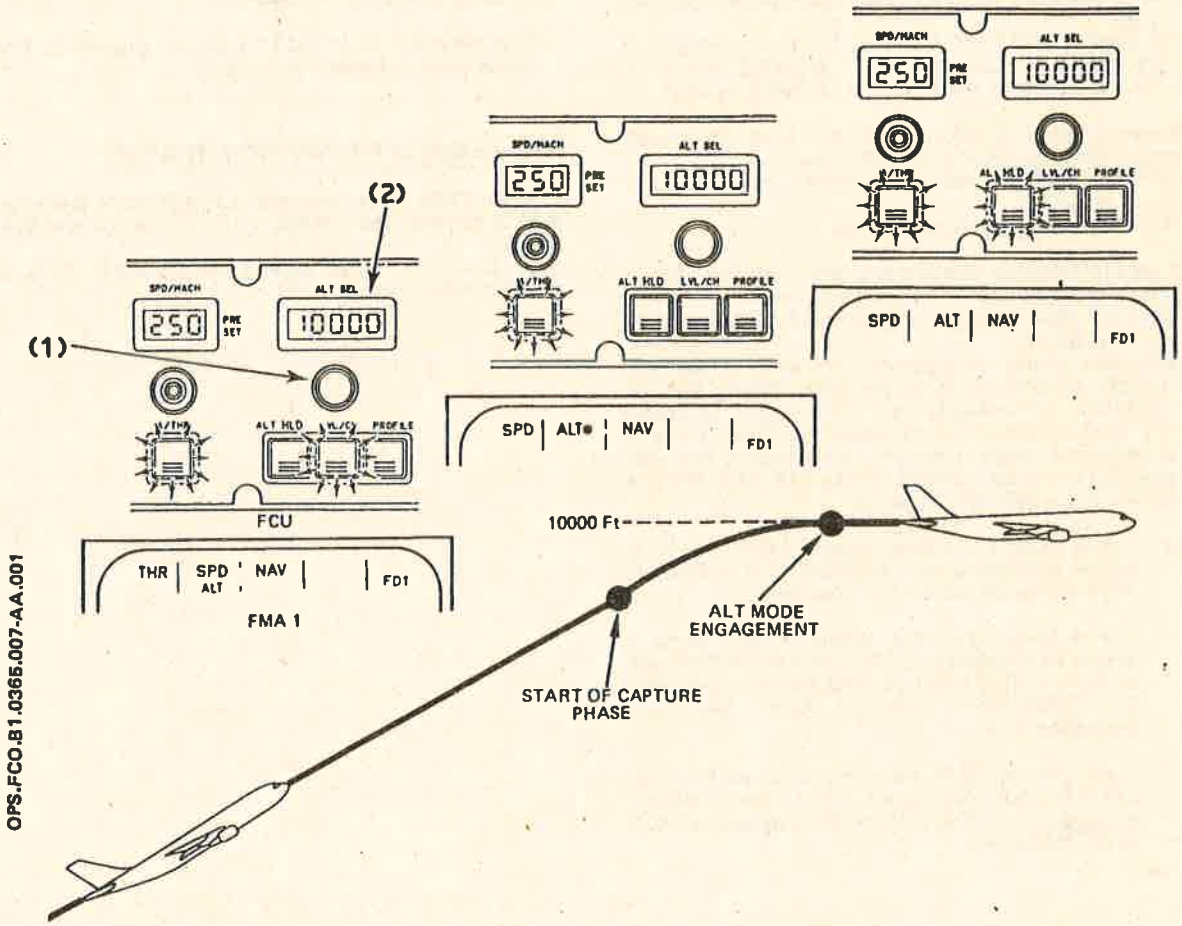
Blue ALT (arming phase) is disarmed
- by manual selection of ALT mode.
- automatically when PROFILE mode or GLIDE CAPTURE of LAND mode is activated.

Green ALT* (capture phase) is disengaged
- by manual selection of a new altitude on FCU such that capture conditions are no longer met.
- by manual selection of PROFILE, or ALT mode.
- automatically when ALT mode or GLIDE CAPTURE or GLIDE TRACK phase of LAND mode is activated.

ALT* MODE (CONT'D)

OPERATION – ANNUNCIATION

- ARMING PHASE
  A/C configuration is, for example :
  - LVL/CH mode engaged.
  - desired level (10 000 ft) selected by the mean of the ALT knob (1) and displayed on the ALT display window (2).
  - Blue ALT (ALT* armed) illuminated on FMA's.
- START of CAPTURE PHASE (which depends on the A/C V/S) :
  - Green ALT* illuminates on both FMA's.
  - ATS engages in SPD mode (if A/THR active) and green SPD illuminates on both FMA's.
  - LVL/CH p.b. is extinguished.
- When reaching the selected level :
  - ALT mode automatically engages.
  - Green ALT illuminates on both FMA's.
  - ALT HLD p.b. is lighted.



LEVEL CHANGE – LVL/CH – MODE

LVL/CH mode allows to perform a level change with a minimum of crew actions.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

- Provided a level different from the A/C present altitude has been selected on the FCU, LVL/CH mode is engaged :
  - by pressing LVL/CH p.b. on FCU, provided LAND mode is not active in TRACK phase.
  - by pulling ALT knob whatever the active vertical mode is, except PROFILE and TRACK phase of LAND mode.
  - by pulling SPD/MACH setting knob to introduce a SPD/MACH constraint when PROFILE mode is active in climb or descent (see PROFILE mode).
- When the selected altitude is higher than the aircraft altitude, engagement of LVL/CH causes :
  - SPD (or MACH) mode engagement and arming of ALT* in AP/FD
  - THR mode engagement in ATS.
- When the selected altitude is lower than the aircraft altitude, engagement of LVL/CH causes :
  - SPD (or MACH) mode engagement and arming of ALT* in AP/FD.
  - RETARD mode engagement in ATS (Automatic throttle retraction). It is possible, during throttle retraction, to manually stop the throttles to obtain the desired thrust. In all cases, RETARD mode is disengaged when throttles are stopped (on idle position or at the desired thrust) but ATS remains armed (blue A/THR on FMA's).

Notes : – It is always possible, when LVL/CH mode is active, to select a new SPD/MACH or ALTITUDE. They will be acquired and maintained.

– It is always possible, when LVL/CH mode is active, to change from SPD mode to MACH mode or from MACH mode to SPD mode by pressing the SPD/MACH selecting knob (see ATS description).

– As soon as ALT capture conditions are met, LVL/CH mode disengages. ALT* (capture phase) engages in AP/FD, SPD/MACH engages in ATS (if A/THR active).*

DISENGAGEMENT

LVL/CH is disengaged

- by pressing a second time LVL/CH p.b. on FCU (this causes basic mode – V/S – to be engaged)
- by manual selection of V/S, ALT, GO-AROUND, TAKE-OFF or PROFILE mode.
- automatically when ALT* (capture phase) or LAND (glide capture phase) is engaged.

SPD or MACH PROTECTION IN AP/FD

If VLS or VMAX is reached when LVL/CH mode is engaged, AP/FD controls the aircraft so as to not exceed VLS or VMAX.
This protection also applies to PROFILE, SRS and GO-AROUND mode.

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LEVEL CHANGE – LVL/CH – MODE (CONT'D)

OPERATION – ANNUNCIATION (case of a climb)

- Present A/C configuration

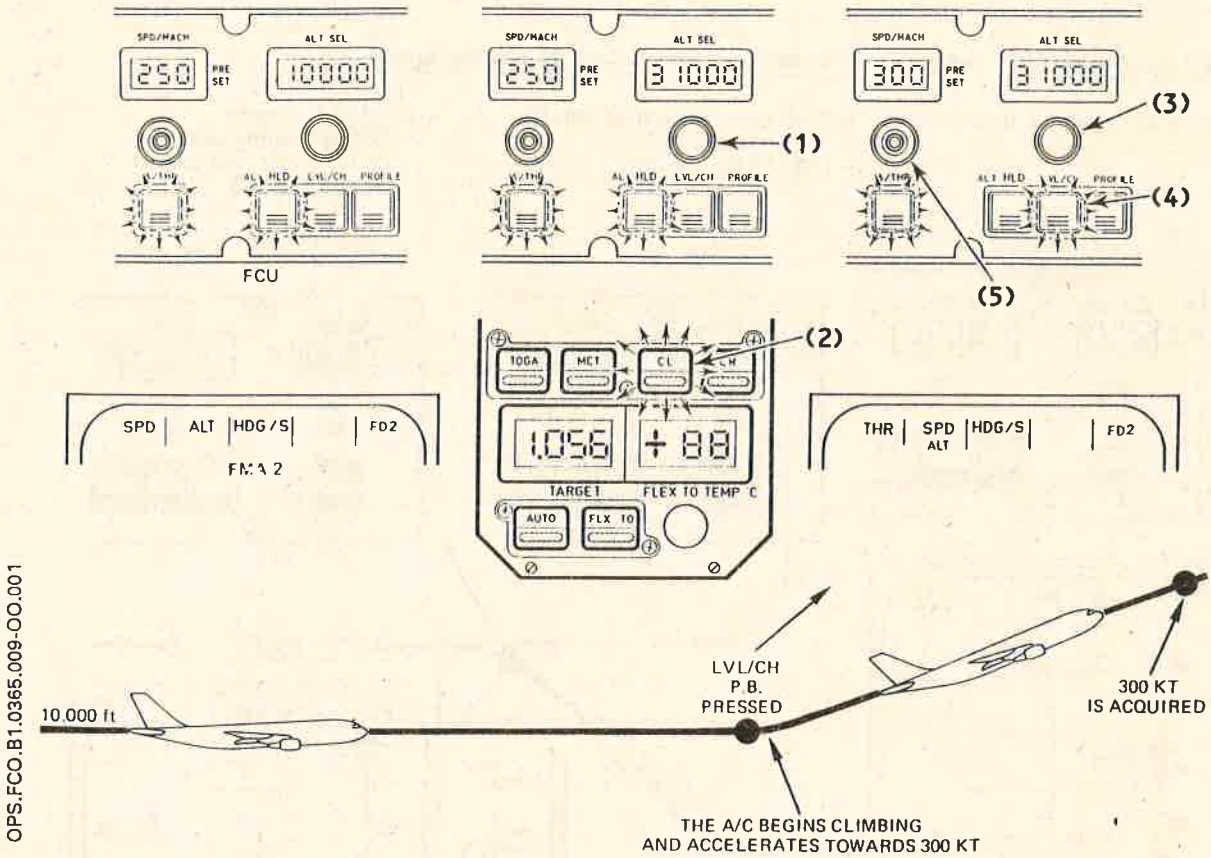
- Desired ALT (31 000ft here) is selected through ALT knob (1).
- Desired thrust (here CL) is selected on TRP (2).

Note : If AUTO mode has been selected, CL will be automatically engaged upon LVL/CH engagement.

- When pulling ALT knob (3)
  - LVL/CH p.b. is lighted (4).
  - ATS engages in THR mode (green THR on FMA's).
  - AP/FD engages in SPD mode (green SPD on FMA's) and armed ALT* mode (blue ALT on FMA's).

Note : LVL/CH can also be engaged by pressing the LVL/CH pushbutton.

- Desired climb SPD is selected by turning SPD/M setting knob (5).



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Vers. : All Eng. : All

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PRESET FUNCTION

This function allows, when a SPEED or a MACH is being maintained by the AP/FD or the ATS, to preselect a speed or a MACH which will be the new target SPEED or MACH when certain conditions are met.

Note : PRESET function is not available when PROFILE mode is active.

These conditions are :

- LVL/CH or ALT mode engagement.
- ALT* mode activation.
- Automatic SPD engagement when MACH mode was active and the PRESET SPD is reached (this case is encountered in descent).

R - Automatic MACH engagement when SPD mode was active and the PRESET MACH is reached (this case is encountered in climb).

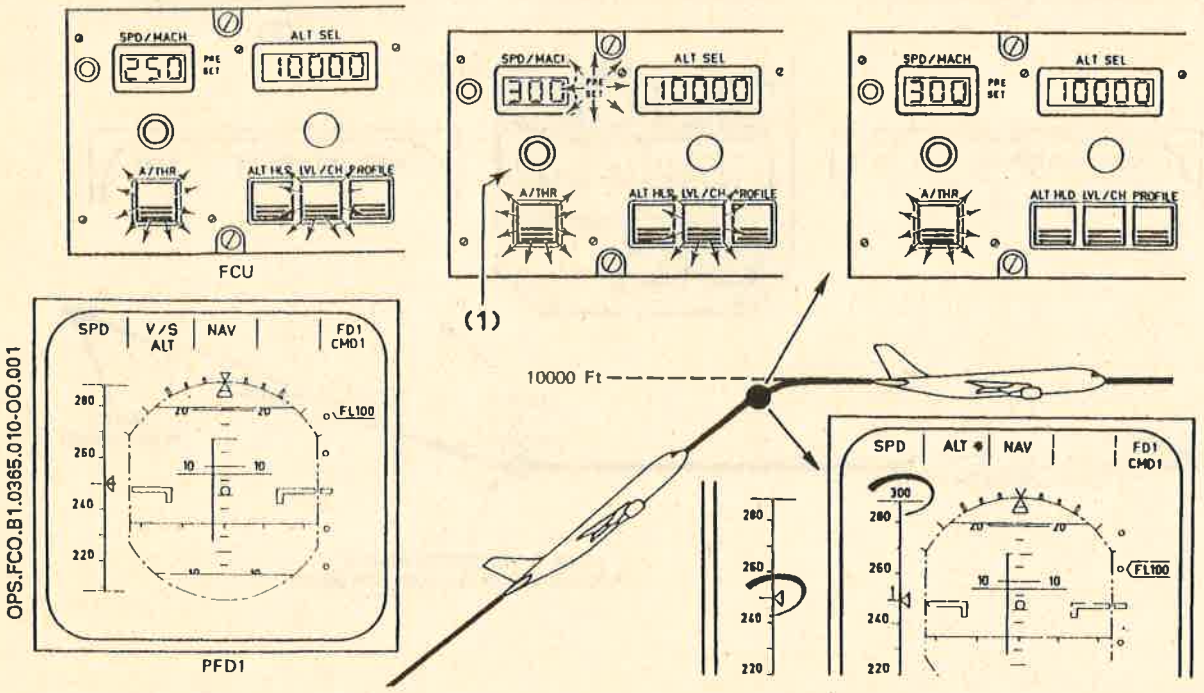
PRESET used with LVL/CH

PRESET may be used with LVL/CH :

- prior to take off to preselect initial climb speed when V2 is selected (this initial climb speed will be the new target at LVL/CH engagement).
- before initiating a climb or a descent to preselect a speed different from the one maintained at the present level. But the recommanded procedure is to adjust the speed after LVL/CH engagement as shown in LVL/CH mode.

PRESET used with ALT* activation (Similar sequence when ALT is engaged)

- Present A/C configuration
- Push then rotate the knob (1) to preset 300 KTS.
- PRESET illuminates
- At ALT* activation
  - PRESET extinguishes.
  - 300 kt is the new TARGET SPEED for ATS.



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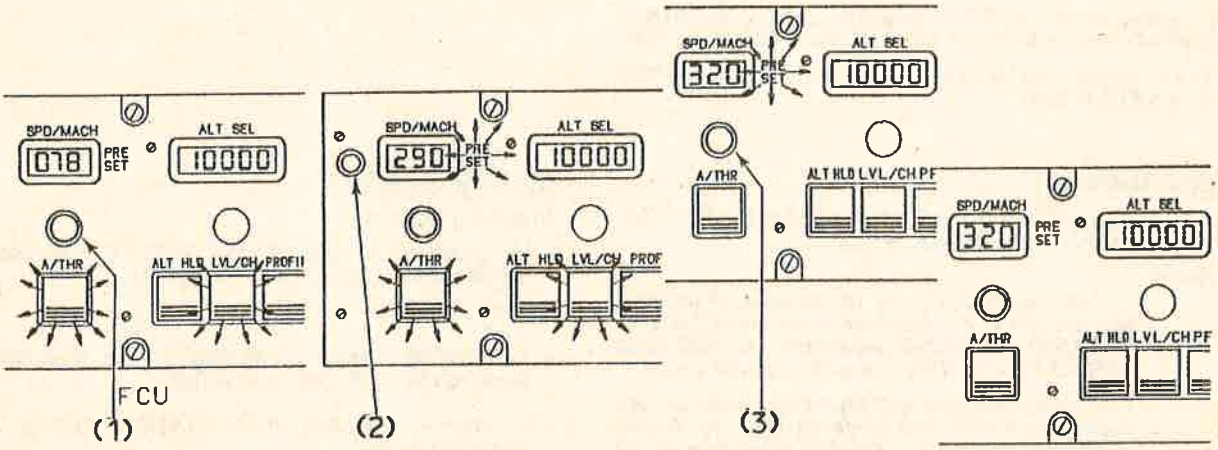
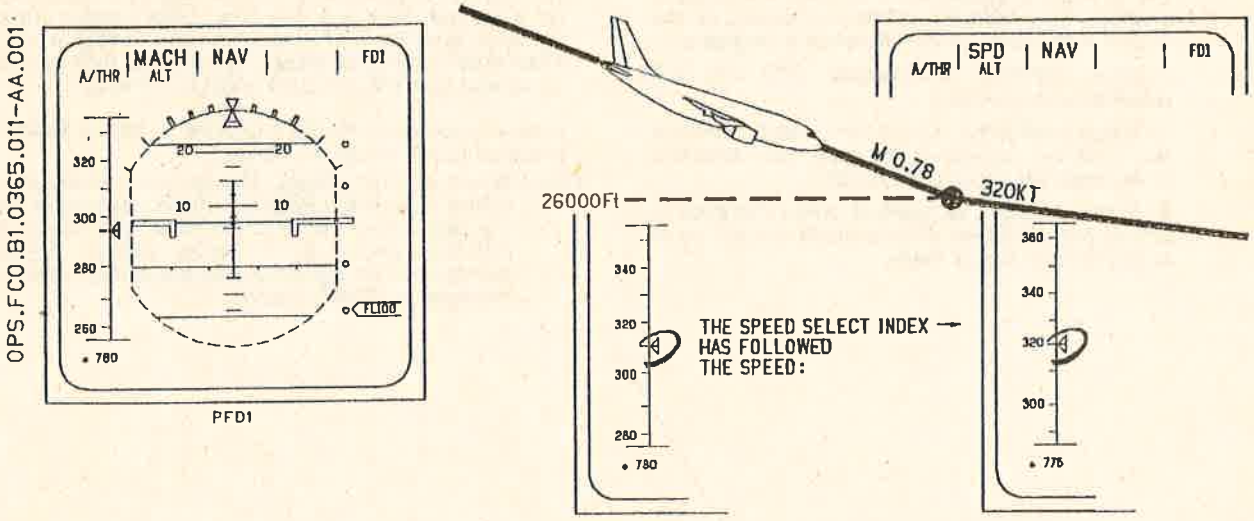
PRESET FUNCTION (CONT'D)

PRESET used when reaching a SPEED (case of a descent)

- Initial A/C configuration : LVL/CH (in descent) with MACH mode engaged.
- Push the knob (1) to engage PRESET.
- Push the knob (2), the actual A/C speed is displayed.
- Rotate the knob (3) to preselect the 320 KT speed.
- At 26 000 ft, 320 KT is reached. PRESET extinguishes. AP/FD engages in SPD mode and maintains 320 KT





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Note : A Similar procedure is used in climb to PRESET a MACH when the SPD mode is engaged.

PRESET DEACTIVATION

It is possible, at any time, to deactivate the PRESET function by simply pushing a second time the SPD/MACH setting knob.
In this case PRESET light extinguishes on FCU and the SPEED (or MACH) which is presently maintained by AP/FD or ATS is displayed again in the SPD/MACH display window.

PROFILE MODE

PROFILE mode allows to couple the FMS (Flight Management System) to the AP/FD and ATS.

The FMS, then, controls the VERTICAL NAVIGATION (through AP/FD) and the THRUST (through the ATS).

Coupling to the ATS is possible (through PROFILE mode) only if A/THR p.b. is armed (on FCU).

Coupling to the AP/FD is possible even if no ATS is available but coupling to the ATS alone is not possible.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

- by pressing PROFILE p.b. on FCU provided LAND mode is not active in the TRACK phase.

Notes :

1. Pressing PROFILE p.b. before take off will only arm the mode. It will remain armed until THRUST REDUCTION ALTITUDE (predetermined FMS value – 1500 FT above RWY – or pilot inserted value).

2. PROFILE engagement (in active phase) causes engagement of AUTO mode on TRP and display of TARGET thrust in « TARGET » window of the TRP (if PALT is active, the « TARGET » window is dashed). This TARGET will be maintained by the ATS if, in addition, A/THR function is engaged.

3. When PROFILE is engaged, SPD and V/S windows are dashed.

4. When in PROFILE, a level cannot be left without two positives actions of the crew (see selection of an upper or lower flight level).

5. If VLS or VMAX is reached when PROFILE is active, the AP/FD (or ATS) controls the A/C so as to not exceed VLS or VMAX.

DISENGAGEMENT

In arming phase :

- by pressing a second time PROFILE p.b. (active longitudinal mode remains engaged).

In active phase :

- by pressing a second time PROFILE p.b. (this causes basic mode – V/S – to be selected).

- by manual selection of V/S, LVL/CH, ALT or GO-AROUND mode.
  Turning the SPD/MACH or V/S setting knob allows to set a desired value (e.g. V/S constraint), starting from the value synchronized on the A/C present SPD or V/S. Then pulling the knob allows to enter the SPD or V/S constraint (see V/S and SPD constraint entry).

- automatically when GLIDE CAPTURE or GLIDE TRACK phase of LAND mode is activated.

Note : When a FMC (Flight Management Computer) failure is detected PROFILE mode disengages on the side where the FMC has failed. Moreover, if PROFILE mode is in active phase, AP/FD disengages. On the other side, the AP/FD remains engaged in PROFILE mode.

SEE « FMS USE » IN PROCEDURES AND TECHNIQUES FOR THE USE OF PROFILE (ENGAGEMENT, DISENGAGEMENT)

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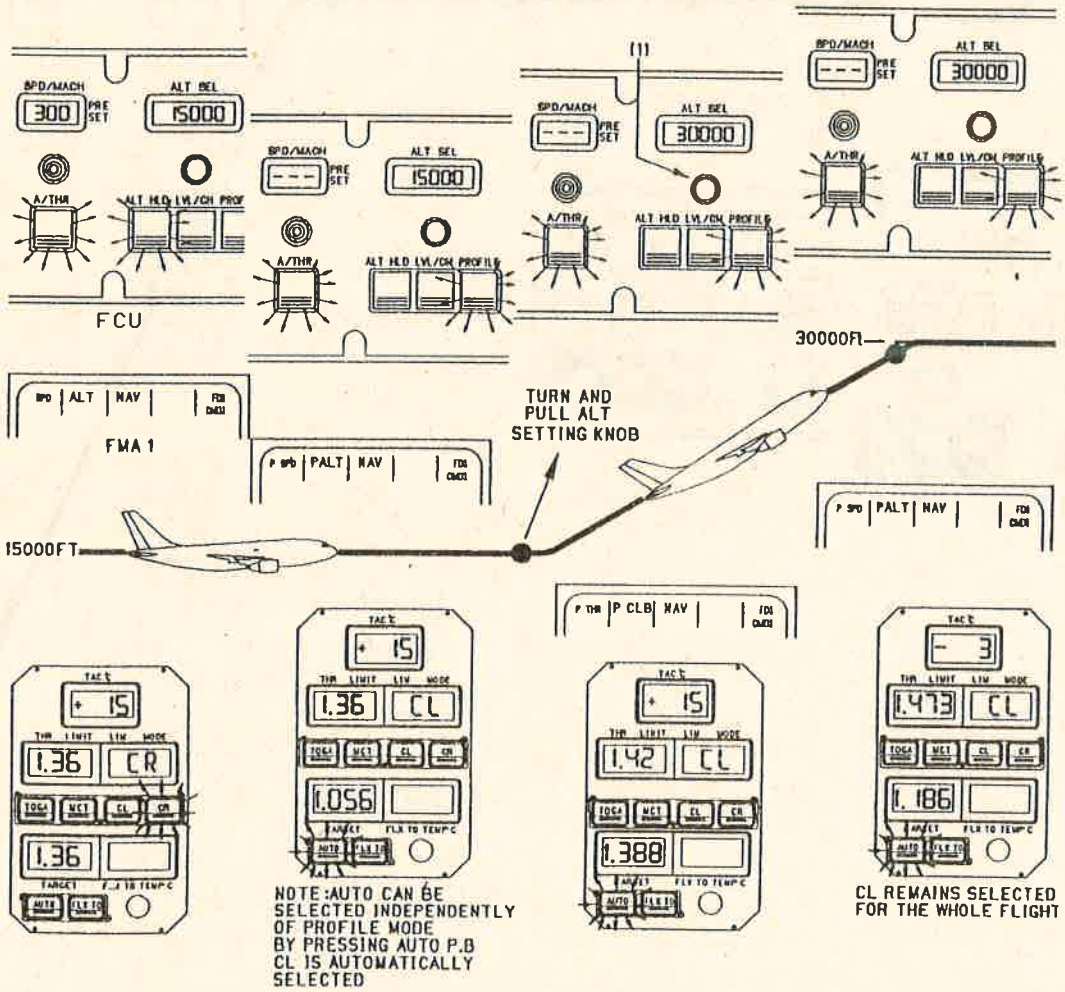
PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION DURING TAKE OFF

Described with TAKE OFF MODE in 1-03-67

OPERATION-ANNUNCIATION IN CRUISE (SELECTION OF AN UPPER FLIGHT LEVEL)

- Initial A/C configuration
- PROFILE engagement :
  - AP/FD goes to P ALT
  - ATS goes to P SPD
  - TRP goes to AUTO
  - SPD/MACH counter is dashed.
  - TRP TARGET window is dashed.
- Upper FL is selected through ALT setting knob (1).
  Then climb is *initiated* by *pulling this knob.*
  TARGET thrust is displayed in TARGET window.
- At new FL acquisition
  - AP/FD goes back to P ALT
  - ATS goes back to P SPD.
  - TRP TARGET window is dashed.



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R Code : 0365B

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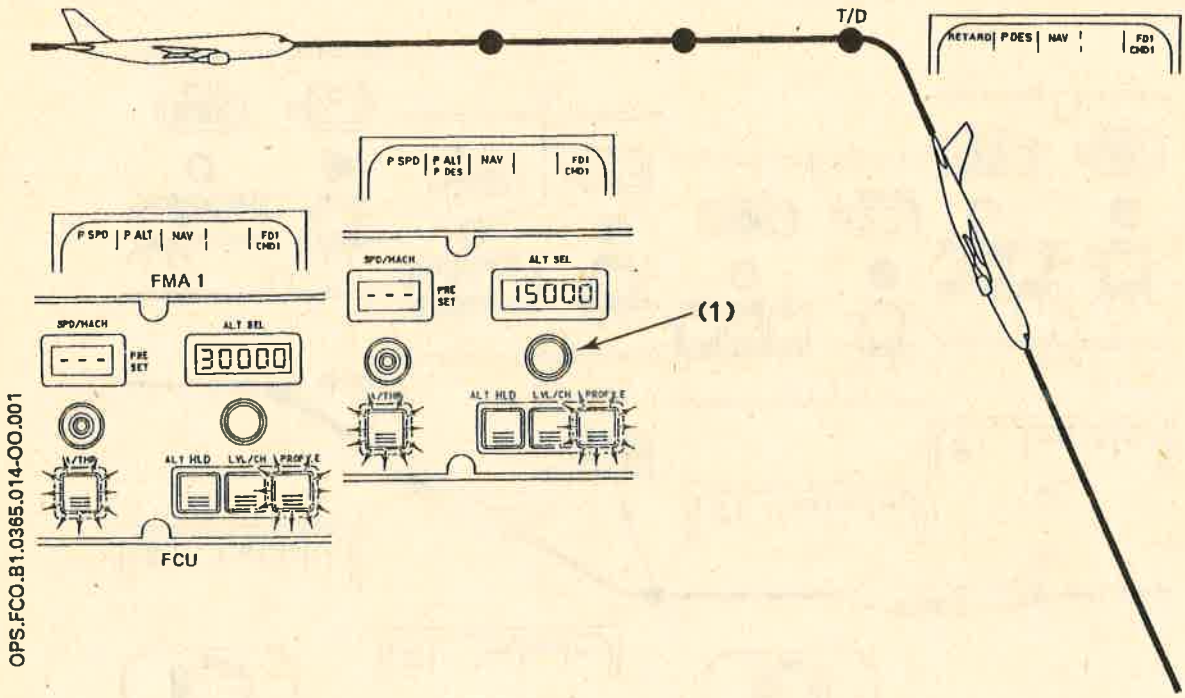
PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION IN CRUISE (SELECTION OF A LOWER FLIGHT LEVEL)

- Initial A/C configuration
- Lower FL is selected through ALT setting knob (1).

Pulling ALT knob initiates descent regardless of T/D computation. Green P DES and P THR then RETARD illuminate on PFD's.



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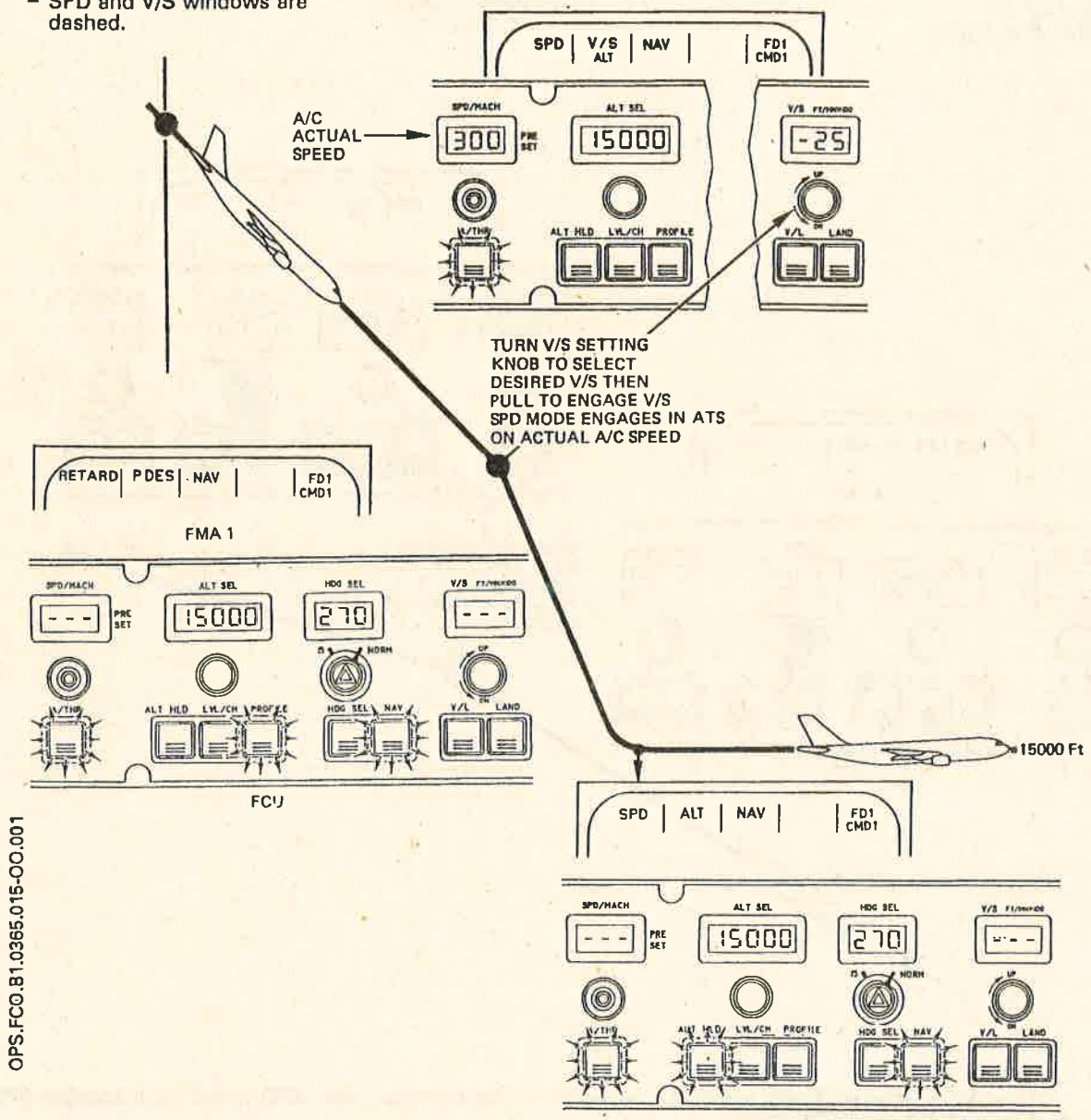
PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION TO INTRODUCE A V/S CONSTRAINT

- Initial A/C configuration :
  - PROFILE engaged
  - SPD and V/S windows are dashed.
- V/S constraint entry



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Note : 1. Another possibility to introduce a V/S constraint is to disengage PROFILE (V/S engages) and to set the desired V/S. But this is less easy and quick to perform.

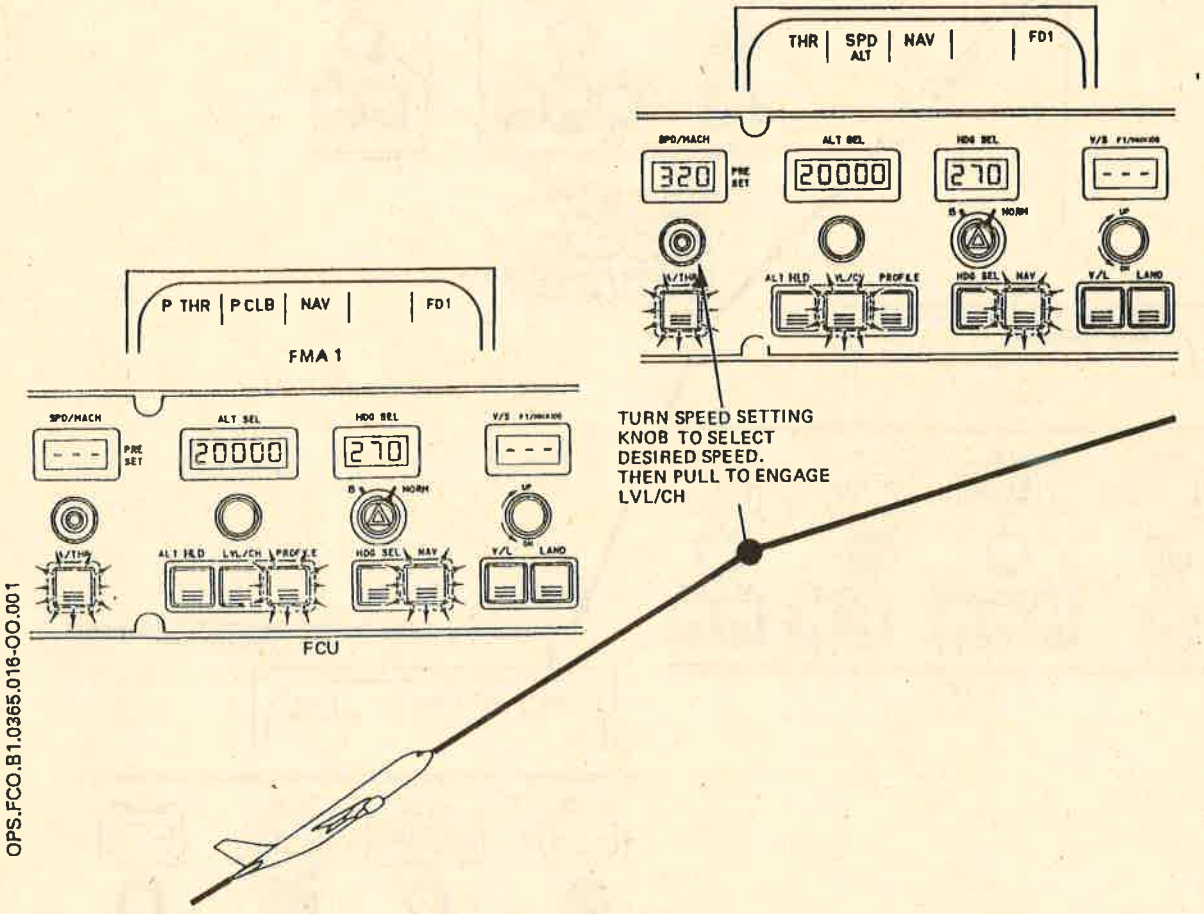
2. If, after having selected a vertical speed, V/S mode is not engaged, V/S window will be dashed again after 10 seconds

R Code : 0365B

PROFILE MODE (CONT'D)

OPERATION-ANNUNCIATION TO INTRODUCE A SPEED (OR MACH) CONSTRAINT

- A/C initial configuration :
  - PROFILE engaged.
- SPD constraint entry :
  - SPD in AP/FD .
  - THR in ATS



Notes :

1. *If the A/C is in level (P SPD and P ALT engaged) turning then pulling the SPD setting knob engages SPD (in ATS) and ALT (in AP/FD) modes.*
2. *Another possibility to introduce a SPD (or MACH) constraint is to engage LVL/CH (in climb or descent) or ALT (in level) then to select the desired SPEED. But this is less easy and quick to perform.*
3. *If after having selected a speed (or a mach), SPEED (or MACH) mode is not engaged, SPD/MACH window will be dashed again after 10 sec.*

R Code : 0365B

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LATERAL MODES

- HDG (BASIC MODE)
- HDG SEL
- NAV
- VOR/LOC.

Vers. : All Eng. : All

HDG MODE

Heading (HDG) is the BASIC LATERAL MODE of AP/FD.

It maintains the HDG at the time of engagement if bank angle is lower than 5°.
If bank angle is greater than 5°, AP/FD first brings the wings towards horizontal and then maintains the heading which exists when the bank angle decreases to 5°.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

HDG is engaged

- when FD's are engaged. This normally occurs when the AP/FD system is electrically energized on ground.
- by pressing an illuminated lateral mode pushbutton if this mode is in active phase (this lateral mode disengages and HDG engages)
- by pressing a second time LAND mode pushbutton (after LOC capture and before LAND TRACK phase only).
- if a longitudinal mode is engaged when LAND mode is active (after GLIDE CAPTURE phase and before LAND TRACK phase only).
- if an AP is engaged in CMD, when the associated FD is not operative (failure not affecting the AP or FD/FPV switch set to FPV or OFF position). In this case the other basic mode -V/S- is also engaged.
- in some conditions, when TAKE-OFF is engaged or disengaged or when GO-AROUND is disengaged (see these modes).

R - when a failure (in a non basic mode) causes
R disengagement of both AP/FD's. In this case, the FD's
R reengage in basic modes (V/S and HDG) after a delay
R and the FD BARS flash for 10 sec or less if a non basic
R mode is re-engaged.

DISENGAGEMENT

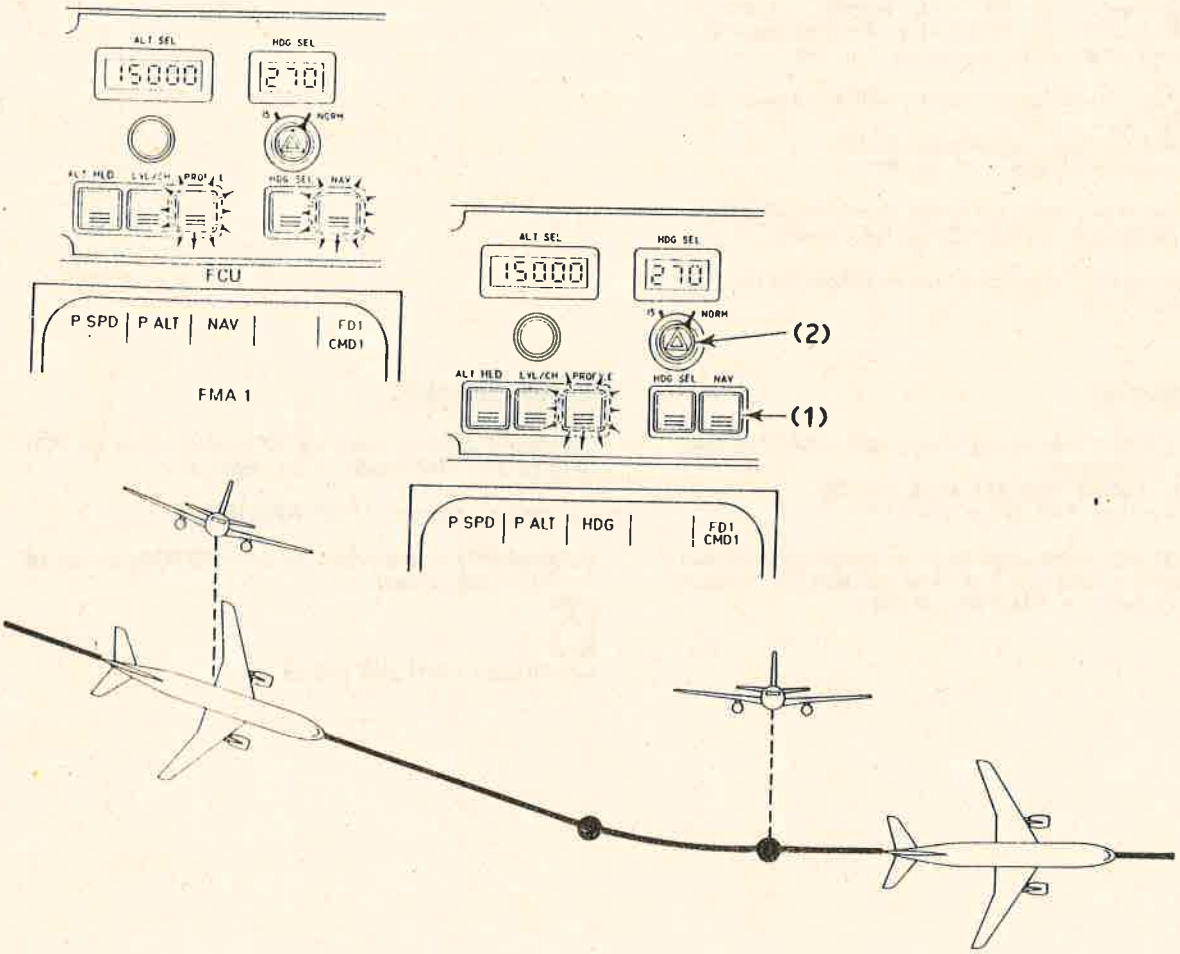
HDG is disengaged

- by manual selection of HDG SEL or GO-AROUND.
- automatically at activation of the CAPTURE phase of the following modes :
  VOR
  LOC
  NAV
  LAND (LOC CAPTURE phase)
- at take off if RWY mode is selected.

HDG MODE (CONT'D)

OPERATION – ANNUNCIATION

- Initial A/C configuration :
  - PROFILE and NAV modes engaged.
  - Bank angle greater than 5°.
- Press NAV p.b. (1) :
  - NAV is disengaged
  - HDG is engaged
  - NAV p.b. is extinguished
  - the A/C is wing levelled off.
- The HDG existing when the bank angle becomes lower than 5° is held.



Note : By pressing the HDG SEL knob (2), it is possible to synchronize the HDG SEL display window on the A/C heading (whatever the selected mode is, except HDG SEL mode)

Vers. : All

Eng. : All

HDG SEL MODE

Heading Selection (HDG SEL) mode acquires and maintains the heading selected on the FCU.

The HDG SEL knob is made of an inner and an outer knob. It has several functions.

The inner knob is a 3 position springloaded knob :
- neutral position : allows to select a heading
- when pulled : HDG SEL mode is engaged
- when pushed : the HDG SEL display window is synchronized on the A/C heading. But this possibility is inhibited when HDG SEL mode is active.

The outer knob allows to choose two different maximum bank angles during turn.
R - the NORM position corresponds to 25°
- the 15 position corresponds to 15°.

The position of this outer knob also limits the bank angle for VOR mode, but not for LOC or NAV mode.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

Provided LAND mode is not engaged in TRACK phase, HDG SEL is engaged :
- either by pulling HDG SEL knob on FCU.
- or by pressing HDG SEL p.b. on FCU.

Note : HDG SEL mode may have an arming phase (blue HDG/S on FMA's) if it is selected with RWY mode at take off (see TAKE OFF MODE).

DISENGAGEMENT

- pressing a second time HDG SEL pushbutton on FCU (this causes HDG mode to be engaged).
- by manual selection of GO-AROUND.
- automatically at activation of the CAPTURE phase of the following modes :
  VOR
  LOC
  NAV
  LAND (LOC CAPTURE phase).

Vers. : All Eng. : All

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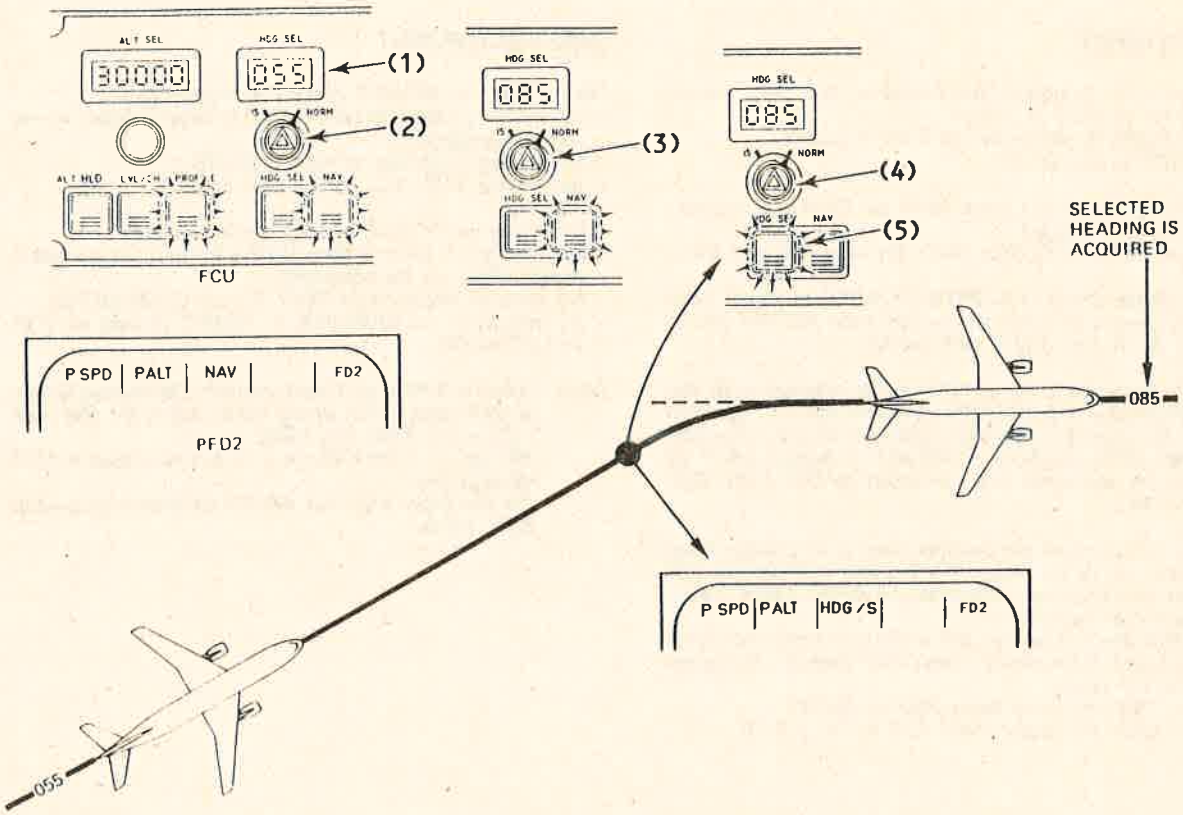
HDG SEL MODE (CONT'D)

OPERATION -ANNUNCIATION

- Initial A/C configuration :
  - PROFILE and NAV engaged.
  - Present A/C heading has been displayed on HDG SEL display window (1) by pressing HDG SEL knob (2)
- Desired heading is selected by turning HDG SEL knob (3)
- HDG SEL Mode is engaged by :
  - pulling HDG SEL knob (4)
  - or pressing HDG SEL p.b. (5)

  In both cases :
  - HDG SEL p.b. is lighted
  - green HDG/S is displayed on FMA's.



Note :

- *Before HDG SEL engagement, whatever the difference between A/C heading and selected heading is, the A/C will acquire the selected heading in such a way that the minimum turn will be done.*
- *If selected heading is modified after HDG SEL mode engagement, whatever the new selected value is, the A/C will turn towards the left if the HDG SEL knob has been rotated towards the left (and towards the right if the HDG SEL knob has been rotated towards the right), to acquire the new selected heading.*

Vers. : All Eng. : All

NAV MODE

NAV mode allows to couple the FMS (FLIGHT MANAGEMENT SYSTEM) to the AP/FD for the control of the HORIZONTAL NAVIGATION.

For further information on the FMS HORIZONTAL NAVIGATION see chapter 1.19.

NAV mode comprises two phases : ARMING and ACTIVE.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

NAV mode is engaged by pressing the NAV mode pushbutton on FCU provided :
- LAND mode is not active in TRACK phase.
- The FMS is operative.

During ARMING phase (blue NAV on FMA's) a support mode can be engaged.
These are HDG, HDG SEL, RWY (at take off) and VOR.

ACTIVE phase starts at CAPTURE POINT (see figure here besides), except at take off. In this case ACTIVE phase starts at 30 ft (see TAKE OFF mode).

Note : 1. Independently of NAV mode engagement, the flight plan stored in the FMS and the A/C position with regard to this flight plan are displayed on the ND (NAVIGATION DISPLAY) provided MAP or PLAN mode has been selected on EFIS CONTROL PANEL.

R *2. To capture the desired track or to change from*
R *one leg to the other, bank angle is limited to 25°*
R *in almost cases whatever the BANK LIMIT knob*
R *selector position is.*
R *This limit raises to 30° when tail wind increases*
R *ground turn radius. This limit linearly decreases*
R *to 15° when :*
R *– TAS increases from 350 to 450 KT*
R *– CAS decreases from 1.35 VS to 1.3 VS.*

DISENGAGEMENT

NAV mode (in ARMING phase) is disengaged :
- by pressing a second time NAV p.b. (lateral active mode remains engaged).
- by manual selection of GO-AROUND.
- by arming VOR, LOC, HDG SEL or LAND mode.

NAV mode (in ACTIVE phase) is disengaged :
- by pressing a second time NAV p.b. (this causes basic mode -HDG- to be selected).
- by manual selection of HDG SEL or GO-AROUND.
- by activation (in CAPTURE or TRACK phase) of VOR or LOC mode.

Note : when a FMC (Flight Management Computer) failure is detected, NAV mode disengages on the side where the FMC has failed.
Moreover, if NAV mode is in active phase AP/FD disengages.
On the other side the AP/FD remains engaged in NAV mode.

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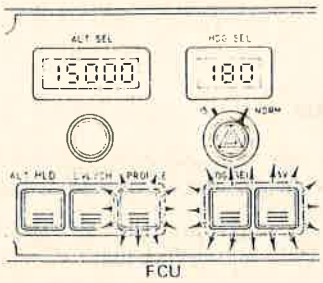
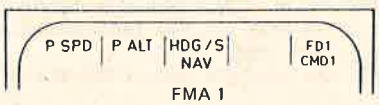
NAV MODE (CONT'D)

OPERATION-ANNUNCIATION

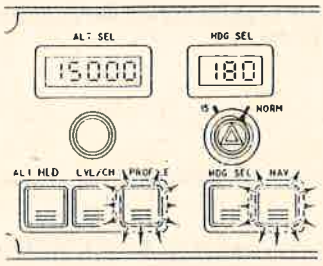
- Initial A/C configuration :
  - PROFILE and HDG SEL modes engaged.
  - NAV mode armed (blue NAV on FMA's) by having pressed NAV pb (1).

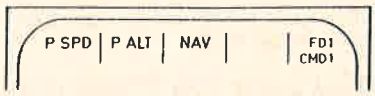


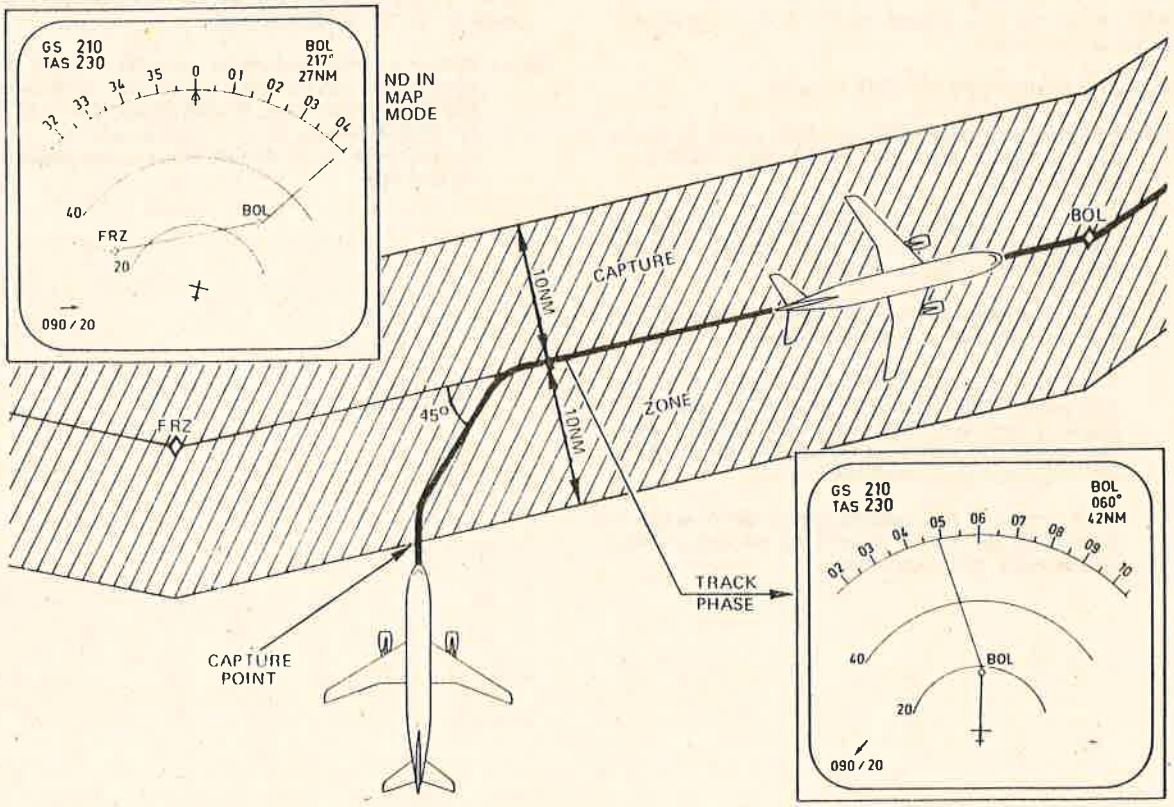


FMA 1

- At capture point
  - NAV mode engages in active phase
  - A/C will follow the Flight Plan defined in the FMS.







Vers. : All Eng. : All

VOR/LOC MODE

1. VOR MODE

This mode captures and maintains a selected VOR course.
VOR mode comprises three phases: ARMING, CAPTURE, TRACK.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

VOR mode is armed by pressing the V/L pushbutton on FCU provided :

R – Both VOR/NAV/ILS switches are on VOR position if
R the two FD's only are engaged
R or,
R at least, the VOR/NAV/ILS switch on the side where
R the AP is in CMD, is on VOR.

– A VOR frequency and a VOR COURSE have been selected on both VOR control panels.

– LAND mode (in any phase) or RWY mode (take off mode) is not active.

– No failure is detected on VOR receiver.

Notes : 1. Engagement of VOR and LOC mode is made by the same p.b. (V/L p.b.). See VOR/LOC selection logic.

2. When overflying VOR station (cone of confusion), the selected VOR course can be changed by as much as 30°.

3. In CAPTURE or TRACK phase, a new course can be selected. It will be captured.

4. Independently of VOR mode engagement, but provided VOR/NAV/ILS switch is on. VOR position, selected VOR radial and deviation from this radial are indicated on onside ND (if ROSE or ARC display is selected).

5. To capture the desired radial, bank angle is limited to 25° or 15° depending on the position of the HDG SEL outer knob.

DISENGAGEMENT

VOR mode (in ARMING phase) is disengaged :
- by pressing a second time V/L p.b. (lateral active mode remains engaged).
- by manual selection of GO-AROUND or TAKE-OFF
- by arming NAV, LOC or LAND mode.

VOR mode (in CAPTURE or TRACK phase) is disengaged :
- by pressing a second time V/L p.b. (this causes basic mode -HDG- to be selected).
- by manual selection of HDG SEL, GO-AROUND or TAKE-OFF.
- by activation of NAV mode (in ACTIVE phase) or LAND mode (in LOC capture phase).

Note : When a VOR failure is detected, VOR mode disengages on the side where the VOR receiver has failed. Moreover, if VOR mode is in CAPTURE or TRACK phase, AP/FD disengages.
On the other side the AP/FD remains engaged in VOR mode.

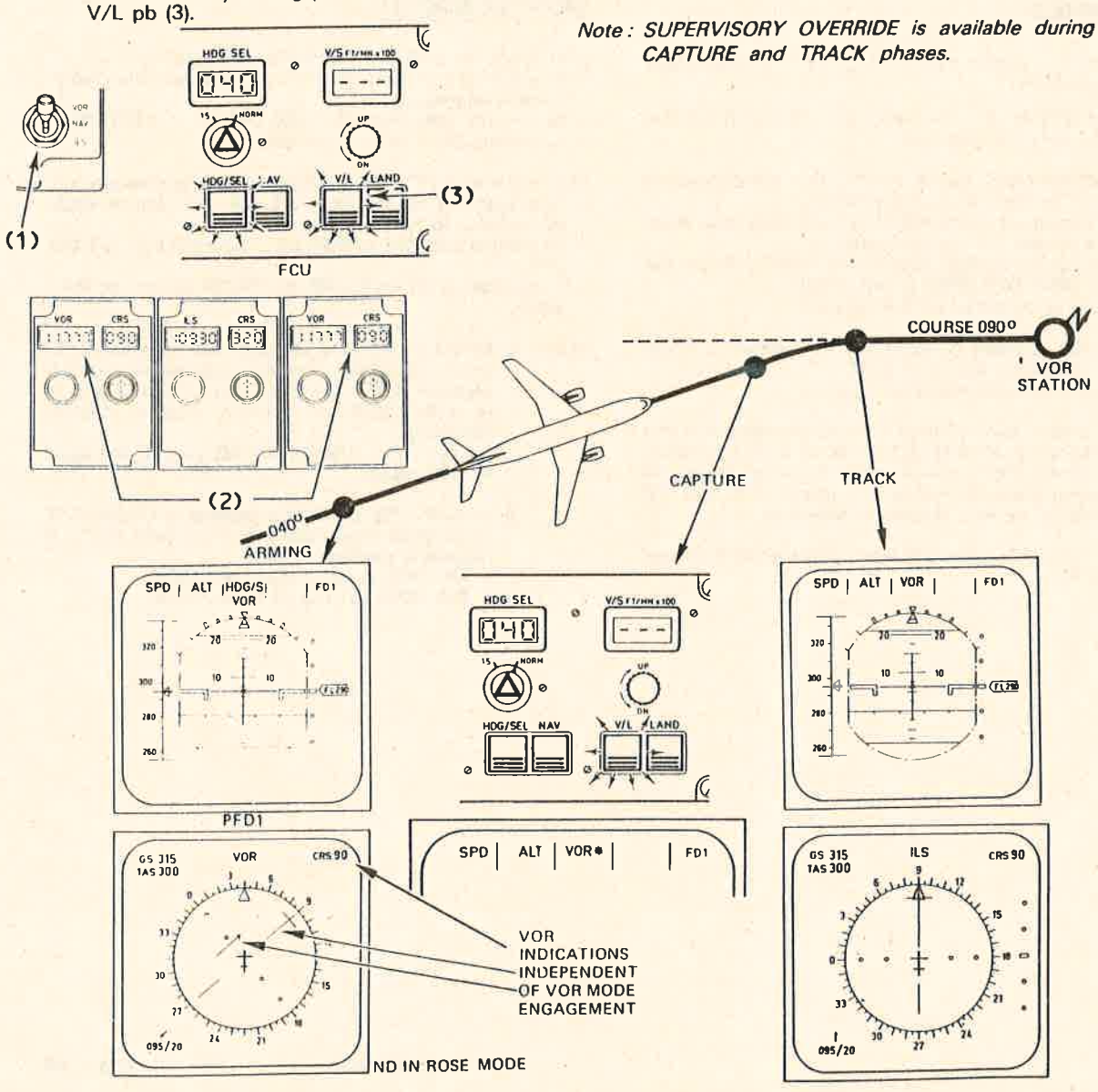
VOR/LOC MODE (CONT'D)

VOR MODE (CONT'D)

OPERATION-ANNUNCIATION

- Initial A/C configuration :
  - HDG SEL engaged
  - Both VOR/NAV/ILS switches on VOR (1)
  - VOR course and frequency selected on VOR CONTROL PANELS (2).
  - VOR armed by having pressed V/L pb (3).
- At CAPTURE point (depending on intercept angle)
  - green VOR * illuminates in place of green HDG/S on both FMA's.
  - HDG SEL p.b. is extinguished on FCU.
- TRACK phase
  - green VOR illuminates on both FMA's.
  - Deviation bar is centered on ND's and VOR index is centered on PFD's.

Note : SUPERVISORY OVERRIDE is available during CAPTURE and TRACK phases.



VOR/LOC MODE (CONT'D)

2. LOC MODE

It captures and maintains a LOCALIZER BEAM.

This mode is used in case of GLIDE BEAM MISSING or POOR QUALITY ILS.
It comprises three phases : ARMING, CAPTURE, TRACK.

The commands to be executed are indicated on the PFD by the ROLL BAR.

ENGAGEMENT

LOC mode is engaged by pressing the V/L pushbutton on FCU provided :

R – either VOR/NAV/ILS switch is on ILS position if the
R two FD's only are engaged
R or
R the VOR/NAV/ILS switch on the side corresponding
R to the AP in CMD is on ILS position.
– An ILS frequency and a RUNWAY COURSE have been selected on the ILS control panel.
– LAND mode (in TRACK phase) of GO AROUND (on roll axis) or TAKE OFF (SRS) is not engaged.
– No failure is detected on ILS receiver

Note : 1. Engagement of VOR and LOC mode is made by the same p.b. (V/L p.b.).
See VOR/LOC selection logic.

2. Independently of LOC mode engagement, but provided VOR/NAV/ILS switch is on ILS position, selected RWY course and deviation from this course are indicated on the onside PFD and ND (if ROSE or ARC display is selected).

3. To capture the LOC beam, bank angle is limited to 30°.

DISENGAGEMENT

LOC mode (in ARMING phase) is disengaged :
– by pressing a second time V/L p.b. (lateral active mode remains engaged) ;
– by manual selection of TAKE OFF or GO-AROUND ;
– by arming NAV or LAND mode.

LOC mode (in CAPTURE or TRACK phase) is disengaged :
– by pressing a second time V/L p.b. (this causes basic mode HDG to be selected) ;
– by manual selection of HDG SEL, GO-AROUND or TAKE OFF ;
– by activation (in CAPTURE or TRACK phase) of NAV mode.

Note : 1. When an ILS receiver failure is detected, LOC mode disengages on the side where the ILS receiver has failed. Moreover, if LOC mode is in CAPTURE or TRACK phase AP/FD disengages.
On the other side the AP/FD remains engaged in LOC mode.

2. In CAPTURE or TRACK phases, a LOCALIZER transmitter failure (no signal on both A/C ILS receivers) causes :
– The LOC scale to flash on PFD's
– The ROLL FD bar to flash PFD's.

VOR/LOC MODE (CONT'D)

LOC MODE (CONT'D)

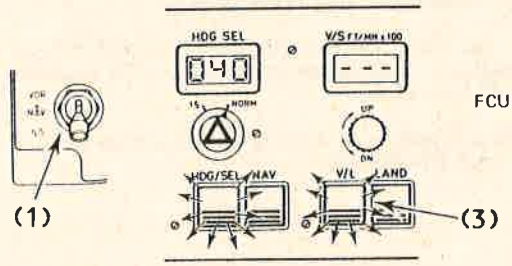
OPERATION - ANNUNCIATION

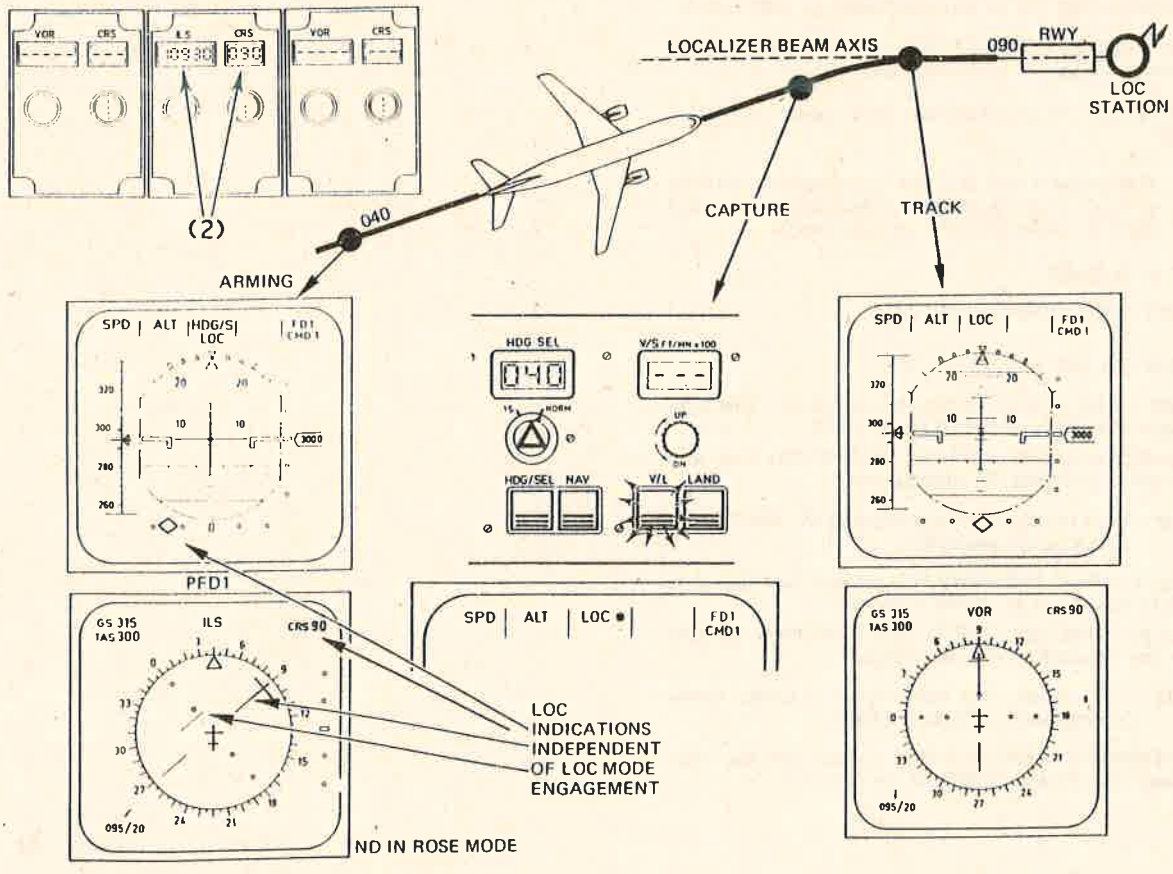
- Initial A/C configuration :
  - HDG SEL engaged
R - At least one VOR/NAV/ILS
R switch on ILS (1)
  - LOC course and frequency selected on ILS CONTROL PANEL (2).
  - LOC armed by having pressed V/L p.b. (3).

- At CAPTURE POINT (depending on intercept angle) :
  - green LOC * illuminates in place of HDG/S on both FMA's.
  - HDG SEL p.b. is extinguished on FCU.

- TRACK phase
  - green LOC illuminates on both FMA's.
  - Deviation bar is centered on ND's and LOC index is centered on PFD's.

Note : – Intercept angle must be lower than 115°.
– SUPERVISORY OVERRIDE is possible during CAPTURE phase when AP is in CMD.





VOR/LOC MODE (CONT'D)

3. VOR/LOC SELECTION LOGIC

Since the same pushbutton is used to engage VOR and LOC mode it is necessary to have a SELECTION LOGIC.

VOR or LOC engagement will depend on the position of the VOR/NAV/ILS switch and on the engaged FD's and AP's.

1) **The two FD's only are engaged and LAND mode is not armed or engaged ; or both AP's are engaged in CMD with GO AROUND mode :**

PRIORITY IS GIVEN TO LOC MODE

ACTION ON V/L p.b. ENGAGES :

- ***VOR mode*** if the two VOR/NAV/ILS switches are on VOR
  If on one side, VOR/NAV/ILS switch is on NAV, the corresponding FD is also engaged in VOR mode.

  If VOR mode being active, one VOR/NAV/ILS switch is set to ILS, the corresponding FD is disengaged.
- ***LOC mode*** if at least one VOR/NAV/ILS switch is on ILS.
  If on one side, VOR/NAV/ILS switch is on NAV, the corresponding FD is also engaged in LOC mode.

  If on one side, VOR/NAV/ILS switch is on VOR, the corresponding FD is disengaged.
- ***NOTHING*** if both VOR/NAV/ILS switches are on NAV.

Note : If both AP's are in CMD, engagement of VOR or LOC mode causes AP 2 disengagement ; but FD 2 engages in VOR or LOC mode.

2) **1 AP is in CMD :**

PRIORITY IS GIVEN TO THE AP.

ACTION ON V/L p.b. ENGAGES :

- ***VOR mode*** if VOR/NAV/ILS switch (on the side where the AP is in CMD) is on VOR.

R If on the other side, VOR/NAV/ILS switch is on ILS,
R the corresponding FD disengages.

Note : VOR mode does not engage if LAND mode is armed or engaged.

- ***LOC mode*** if VOR/NAV/ILS switch (on the side where the AP is in CMD) is on ILS.

R If on the other side, VOR/NAV/ILS switch is on VOR,
R the corresponding FD disengages.

Note : LOC mode does not engage if LAND mode is engaged in TRACK phase.

- ***NOTHING*** if VOR/NAV/ILS switch (on the side where the AP is in CMD) is on NAV.

3) **LAND mode is armed or engaged and both FD's are engaged or both AP's are in CMD :**

- VOR mode cannot be engaged
- LOC mode is engaged by action on V/L p.b. if at least one VOR/NAV/ILS switch is on ILS.

  If on both sides VOR/NAV/ILS switches are on ILS, AP 2 disengages but FD 2, AP 1 and FD1 engage in LOC mode.

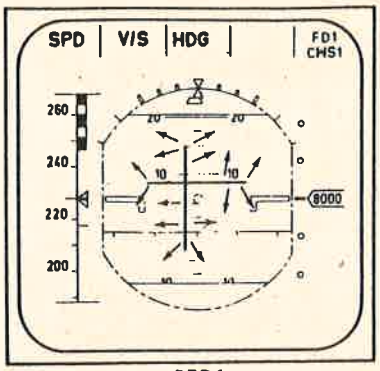
  If on one side, VOR/NAV/ILS switch is on VOR, the corresponding AP and FD disengage.

  If on one side, VOR/NAV/ILS switch is on NAV, the corresponding AP disengages but the FD engages in LOC mode.
- If LAND Mode is in TRACK phase, action on V/L p.b. HAS NO EFFECT.

FD BARS FLASHING

The FD bars flash in the following conditions, in order to alert the crew, in the event of inadvertent return to basic modes or during approach in the event of an ILS transmitter failure :

- return to basic mode engagement
- LAND mode disengagement
- loss of altitude capture condition during a new flight level setting when in altitude acquire mode.



PFD1

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CWS DESCRIPTION	1.03.63 PAGE 1 REV 20 SEQ 001

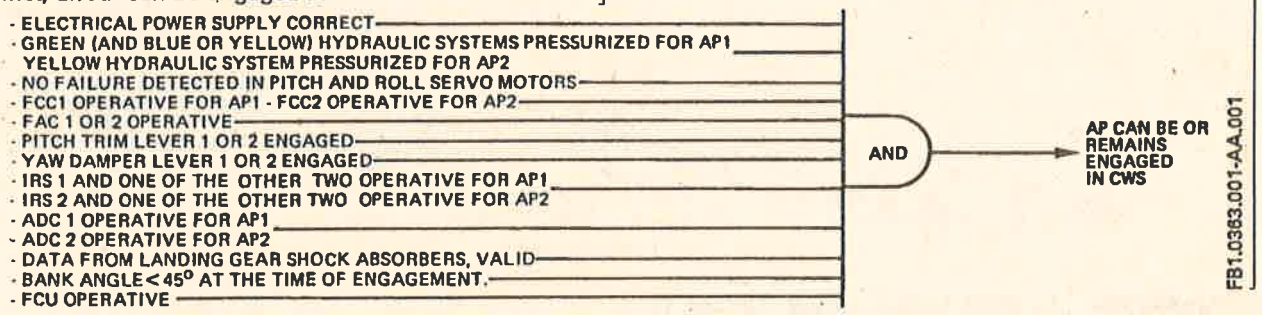
FUNCTION

When an AP is engaged in CWS (Control Wheel Steering) :

- The PITCH ATTITUDE and BANK ANGLE that the A/C had at engagement are maintained.
- The PITCH ATTITUDE and/or BANK ANGLE may be modified by simply applying a load (above a threshold) on one control wheel. This load is converted by the dynamometric rods into electrical signals sent to the FCC which then command the flight controls via the actuators.
- The AUTO TRIM function is inhibited :
  - on ground and in take-off until 5 sec after lift-off.
  - in flight, GEAR is down when an effort is detected on the control wheel.
  - in GO AROUND, for 5 sec, on a nose up order to avoid excessive attitude.
- The ELECTRIC TRIM is always available on ground or in flight.
- The Yaw axis can not be controlled by the CWS function.
- While an AP is engaged in CWS, any FD mode can be engaged. The FD works independently of the AP in CWS.

ENGAGEMENT CONDITIONS

Provided all engagement conditions (hereafter listed) are met, an AP can be engaged in CWS.



R It is not possible to engage two AP's in CWS.

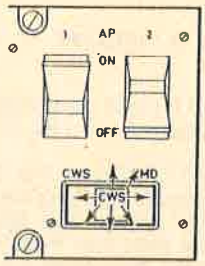
DISENGAGEMENT

Conditions of disengagement and warnings are similar to those of AP in CMD (see 03-64) except for AUTOLAND lights which do not flash below 200 ft.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CWS DESCRIPTION	R 1.03.63 PAGE 2 REV 10

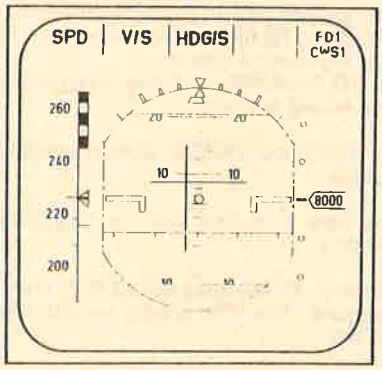
ENGAGEMENT ANNUNCIATION – OPERATION

- On ground : SET THE AP LEVER TO ON (1)
- In flight : SET THE AP LEVER TO ON (The AP engages in CMD) then PRESS THE CWS/CMD pb (2).

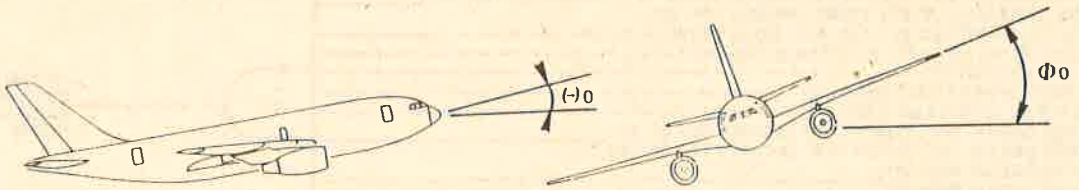


FCU

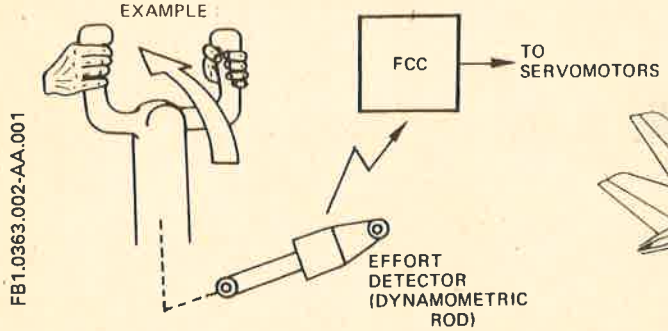
- Provided the ENGAGEMENT CONDITIONS are met :
  - CWS illuminates amber on FCU (on the CWS/CMD p.b.).
  - CWS 1 illuminates amber on both FMA's.
  - The FD's remain in the engaged modes.
  - Pitch attitude and bank angle at engagement are maintained.

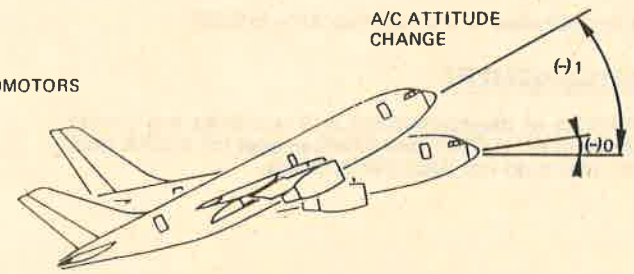


PFD 1



- OPERATION : The CWS function allows the pilot to change Pitch Attitude or Bank Angle.





WHEN THE PILOT RELEASES THE CONTROLS, THE AP MAINTAINS (-) 1 (THE NEW ATTITUDE)

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CMD DESCRIPTION	R 1.03.64 PAGE 1 REV 08

FUNCTION

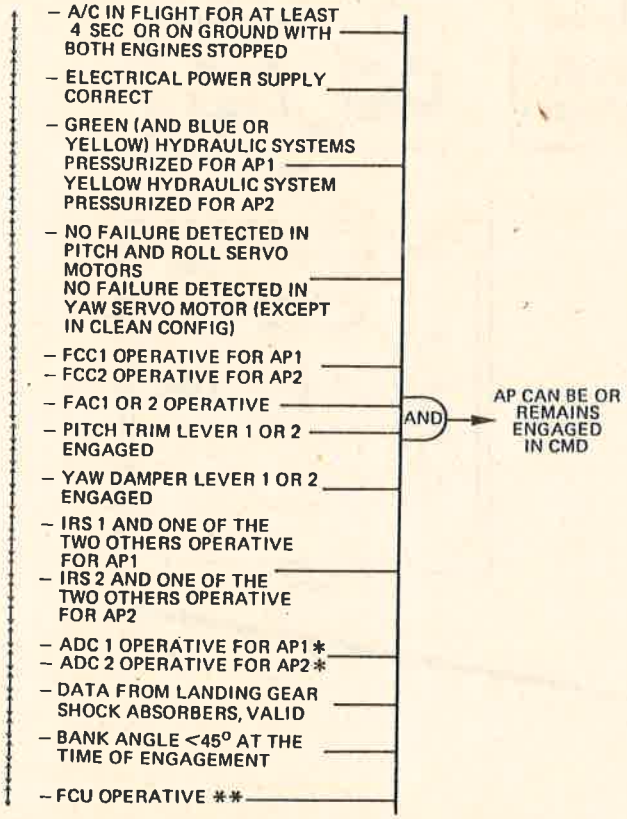
When an AP is engaged in CMD (COMMAND) the A/C is automatically controlled :

- in pitch axis, if a longitudinal mode has been engaged
- in roll axis, if a lateral mode has been engaged
- in yaw axis, as soon as SLATS are extended to at least 15° (SLATS/FLAPS handle on SLATS 15° position).

Note : FOR MODE DESCRIPTION (common to FD and AP in CMD), see 03-65, 03-66, 03-67.

ENGAGEMENT CONDITIONS

Provided the engagement conditions (hereafter listed) are met, an AP can be engaged in CMD.



*NOT NECESSARY AFTER GLIDE CAPTURE
**NOT NECESSARY IN GO AROUND OR LAND TRACK MODE

Note : To this general engagement conditions, specific engagement conditions must be added depending on the selected modes. See mode description in 03-65, 03-66, 03-67.

OPERATION

On ground the AP cannot be engaged in CMD if one or two engines are operating.

In flight the AP can be engaged in CMD only 4 sec after lift off :

- either by pressing the CWS/CMD p.b. if the AP is already engaged in CWS (this action is inhibited in LAND track phase).
- or by setting the AP lever to ON if no AP was previously engaged in CWS.

The AP engages in the modes which were previously active on the corresponding FD.

If the corresponding FD is not operative (failure not affecting the AP or FD/FPV switch set to FPV or OFF position) the AP engages in the basic modes: V/S (Vertical Speed) on pitch axis and HDG (Heading) on roll axis.

If AP engages in the basic modes :

- It maintains the A/C vertical speed and heading at the time of engagement. However if bank angle is greater than 5°, the AP first brings the wings towards horizontal and then maintains the heading obtained when the bank angle decreases to 5°.
- The V/S display window on FCU is synchronized on the A/C V/S at engagement.

Two AP's can never be engaged simultaneously in CMD, except if LAND or GO AROUND mode has been engaged. In this case AP 2 is in standby.
AP 2 will disconnect as soon as another mode is selected.

If LAND or GO AROUND mode is not engaged, the engagement of the second AP causes the disengagement of the first one.

AP cannot stay in CMD on ground with one or two engines operating except when the A/C lands with LAND mode engaged (disengagement of LAND mode causes both AP's disengagement).

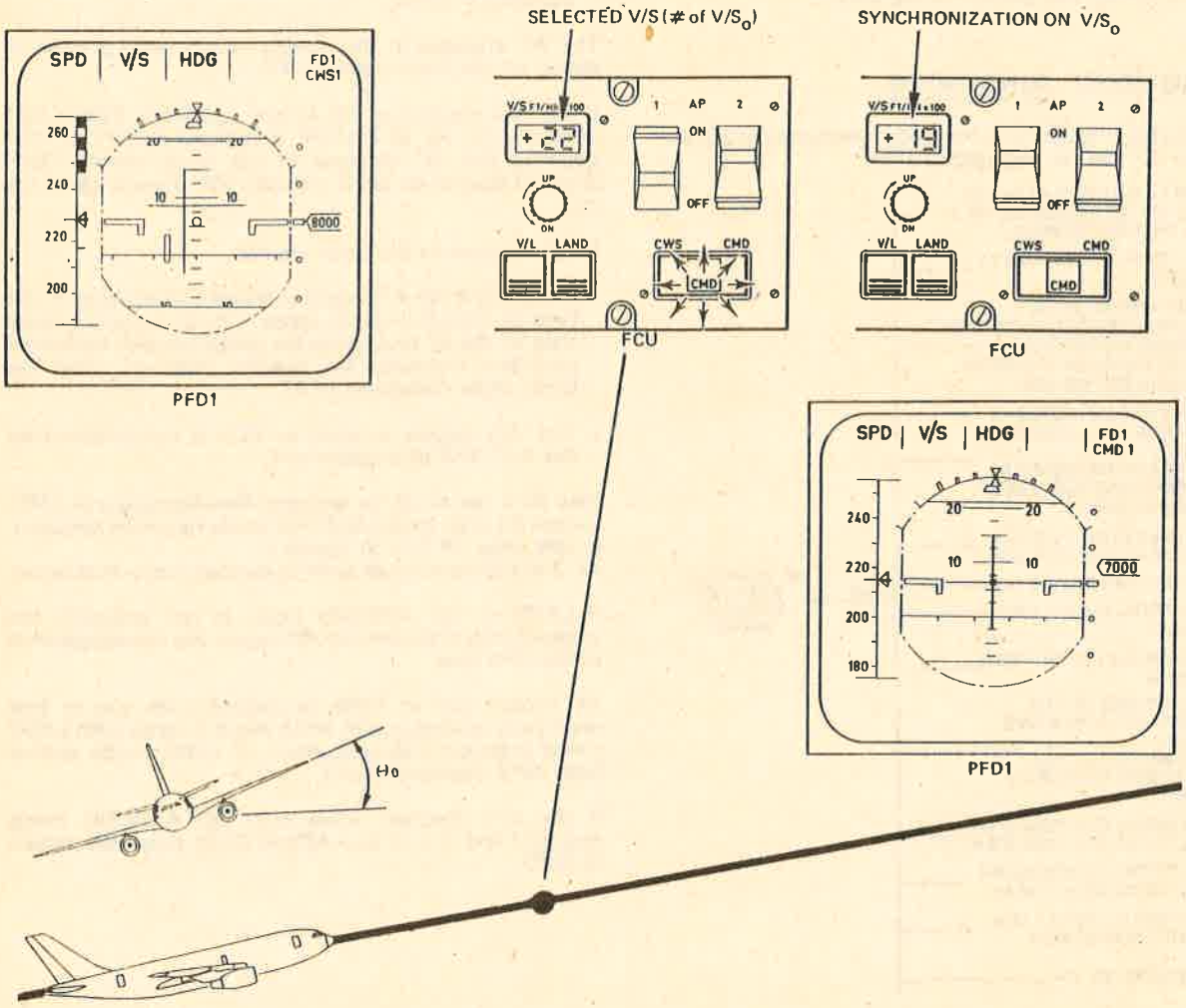
If the A/C touches down with GO AROUND mode engaged and one or two AP's in CMD, they also remain in CMD.

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR AP IN CMD DESCRIPTION	R 1.03.64 PAGE 2 REV 06 JUL 83

ENGAGEMENT ANNUNCIATION (with FD previously in BASIC MODES and the AP engaged in CWS).

- Before AP engagement
  - Bank angle is Φ_o
  - Actual Vertical Speed is V/S_o
  - V/S and HDG modes are engaged with FD.
  - AP 1 is in CWS.
- When CWS/CMD p.b. is pressed (1)
  - CMD illuminates white on FCU (on CWS/CMD pb).
  - CMD 1 illuminates white on both FMA's.
  - AP holds V/So and V/S display window is synchronized on V/So.
  - If $\Phi_o < 5°$, AP holds the heading at engagement.
  - If $\Phi_o > 5°$, AP first levels the wings, then maintains the heading obtained when the bank angle decreases to 5°.
  - FD BARS are centered on both PFD's.



Notes :

1. If any other modes than BASIC MODES were selected with FD, the AP engages in these modes and takes into account the references selected on the FCU or VOR control panel or ILS control panel, etc..., and not the A/C references (such as V/So for V/S mode) at engagement.

2. In flight, if no AP is engaged in CWS, setting an AP lever to ON engages the AP in CMD (and not in CWS as on ground).

Vers. : All Eng. : All

DISENGAGEMENT

AP can be disconnected :

- intentionally
  - by setting the AP lever to OFF (which disconnects the respective AP)
  - by action on either AP disconnect pushbutton located on the control wheels (which disconnects both AP's if they were engaged)
  - when a force above a threshold is applied on the stick in pitch (except in LAND and GO AROUND modes).

- automatically
  if one of the engagement conditions is no longer met (which disengages the respective AP).

Intentional disconnection or automatic disconnection (when the lost engagement condition does not concern the FD) does not cause mode disengagement. Modes remain available with the FD.

Disconnection of the engaged AP (or of the two, if engaged) causes the red MASTER WARNING to be lit in front of each pilot and the flashing of a red AP OFF
R warning message on the left ECAM CRT. At the same
R time an aural warning (CAVALRY CHARGE) sounds.

In addition below 200 ft radio altitude, at the time of disengagement, a red AUTOLAND light flashes on the glareshield, in front of each pilot, if LAND mode is engaged in LAND TRACK phase.

AP OFF, CAVALRY CHARGE and AUTOLAND warnings will be cancelled by pressing either AP disconnect p.b.

AUTOMATIC COMPENSATION IN CASE OF ENGINE FAILURE

An automatic compensation (on YAW axis) is made by the AP when an engine fails if the following conditions are met :

- An AP is engaged in CMD
- SLATS are extented to at least 15°

In the other cases, use RUDDER TRIM to obtain stabilized straight and level flight.

Note : YAW DAMPER provides an additional compensation (on YAW axis) if an AP is engaged in CMD with SRS or GO AROUND modes.

AUTOMATIC RUDDER TRIM FUNCTION

An automatic rudder deflection is made by the AP to obtain and to maintain neutral position of the control wheel in lateral. This automatic rudder trim function is available in all modes if the following conditions are met :

- an AP is engaged in CMD
- SLATS are extended to at least 15°.

The automatic rudder trim order is reduced to zero within 10 seconds when the SLATS/FLAPS lever is moved out of the 15/0 position to the 0/0 position or if the AP is disengaged.

SUPERVISORY OVERRIDE FUNCTION (Lateral)

This function is available with an AP in CMD, in VOR mode and in capture phase of LOC and LAND modes.

During these phases, the pilot, by applying a load (above a threshold) on the control wheel, operates a control surface deflection proportional to the load applied. When the pilot releases his load, the AP guides again the aircraft along the flight path corresponding to the mode engaged. Outside these phases, the supervisory override function is not available. However, it is still possible to modify the aircraft attitude by applying a strong load in roll on the control wheel but this is not a normal operation when one AP is in CMD.

Mod. : 5051 + 5757 + 5953

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR LONGITUDINAL MODES	1.03.65 PAGE 1 JUL 83 | SEQ 001

LONGITUDINAL MODES

- V/S (BASIC MODE)
- ALT
- ALT*
- LVL/CH
- PRESET FUNCTION
- PROFILE

V/S MODE

Vertical Speed (V/S) is the BASIC LONGITUDINAL MODE of AP/FD.
It maintains the V/S at the time of engagement, and also, will acquire and maintain a new V/S when selected on the FCU.

The commands to be executed are indicated on the PFD by the PITCH BAR.

ENGAGEMENT

V/S is engaged

- when FD's are engaged. This normally occurs when the AP/FD system is electrically energized on ground.
- by pulling the V/S knob on FCU, provided LAND mode is not active in the track phase.
- by pressing an illuminated longitudinal mode pushbutton if this mode is in active phase (this longitudinal mode disengages and V/S engages).
- at AP engagement in CMD if the associated FD is not operative (failure not affecting the AP or FD/FPV switch set to FPV or OFF position). In this case the other basic mode – HDG – is also engaged.
- when, being in altitude capture phase (ALT* mode), a new altitude (causing loss of capture conditions) is set on the FCU.
- when a lateral mode is engaged after GLIDE CAPTURE phase and before LAND TRACK phase (LAND mode active).
- when a failure (in a non basic mode except pitch TAKE OFF and GO AROUND modes) causes disengagement of both AP/FD's. In this case, the FD's reengage in basic modes (V/S and HDG) after a delay and the FD BARS flash for 10 sec or less if a non basic mode is re-engaged.
  The FCC does not disengage from pitch TAKE OFF or GO AROUND modes when both AP/FD's go to OFF.

Note : In all cases, V/S mode engages on the preselected vertical speed set on the counter or on the present A/C vertical speed if the counter is dashed.

V/S mode engagement leads to SPD or MACH mode engagement in ATS (the counter will synchronize on the A/C speed if it was dashed, which is the case when PROFILE mode is engaged).

DISENGAGEMENT

V/S is disengaged

- by manual selection of ALT, LVL/CH, PROFILE, TAKE OFF or GO-AROUND mode
- automatically :
  when ALT* mode is activated.
  when GLIDE CAPT phase of LAND mode is activated.

SPEED PROTECTION

In V/S mode, the priority will be given to the vertical speed, against the speed.
If vertical speed is not compatible with selected speed, the speed will decrease or increase towards VLS or VMAX. But on reaching VLS + 5 KTS (when vertical speed is positive) or VMAX (when vertical speed is negative), the AP/FD will automatically change to LVL/CH mode with selected speed as reference.

A310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR COMMON MODES	1.03.67 PAGE 1 JUL 83 | SEQ 001

COMMON MODES

- ASSOCIATION OF MODES AT TAKE OFF
- LAND
- GO AROUND

ASSOCIATION OF MODES AT TAKE OFF

TAKE OFF mode is available with FD's only or with FD's and an AP in CWS, but not with an AP in CMD.
However, 4 seconds after lift off, one AP can be engaged in CMD.
The **LONGITUDINAL MODE** used at TAKE OFF is **SRS** (SPEED REFERENCE SYSTEM) which acquires and maintains :
- The SPEED which is selected on FCU (V2) increased by 10 KT with two engines operating.
- V2 (or the A/C existing speed if it is greater than V2) in case of engine failure.

Note : – PITCH ATTITUDE is limited to 18°.
– In case a too high speed is selected on FCU, a 100 ft/min vertical speed is maintained at minimum.
– In case a too low speed is selected, VLS (see definition in 03-40) will be maintained at minimum.

When A/C capability is stressed by strong windshear conditions, an SRS survival strategy is adopted :
- selected speed increased by 10 kts is maintained with two engines operating (the highest of selected speed and A/C airspeed in case of engine failure) until vertical speed decreases down to zero,
- a slightly positive vertical speed is then commanded until airspeed decreases down to slightly above Vss,
- then airspeed is controlled slightly above Vss, trading altitude if high windshear intensity requires.

The **LATERAL MODE** used at TAKE OFF can be **RWY** (RUNWAY which allows to maintain the A/C on the LOC beam), **HDG SEL** or **HDG**.
The commands to be executed are indicated on the PFD by the PITCH BAR (for SRS mode), the YAW BAR (for RWY mode) and the ROLL BAR (for HDG or HDG SEL mode).

Note : With HDG mode engaged, ROLL BAR is not active on ground, it remains centered.

ENGAGEMENT

- **SRS** and **RWY** modes are engaged by action on either GO-LEVER provided :
  - SLATS are extended to at least 15°.
  - Main landing gear struts are compressed.
  - Runway ILS FREQUENCY and HEADING are selected (for RWY mode only)

Note : 1. This action also engages A/THR function and THR mode in ATS, provided TO or FLX TO has been selected on TRP.
2. This also causes an automatic reversion to FD BARS display on PFD's if FPV symbols were previously displayed.
3. RWY mode is not engaged when take off is performed backwards the localizer (aircraft heading different from RWY course by more than 40°).

- For **HDG** or **HDG SEL** mode see table here after.
  As a general rule HDG engages, upon action on either GO LEVER, if any lateral mode (except HDG SEL) has been engaged and the runway ILS frequency and HEADING have not been selected.
  HDG SEL, if previously engaged, remains engaged after action on either GO-LEVER if the runway ILS frequency and HEADING have not been selected.

The following 7 associations of modes are possible at take off depending on the selected lateral mode prior to action on GO-LEVERS.

	LATERAL MODE PRIOR TO ACTION ON GO LEVERS	MODES ENGAGED AFTER ACTION ON GO-LEVERS AND UP TO 30 FT	MODES ENGAGED ABOVE 30 FT
1	ANY LATERAL MODE EXCEPT HDG SEL or NAV	SRS + HDG	SRS + HDG
2	As in 1, but runway ILS FREQUENCY and HEADING are selected on ILS control panel	SRS + RWY	SRS + HDG
3	HDG SEL	SRS + HDG SEL	SRS + HDG SEL
4	NAV ARMED and any other lateral mode (except HDG SEL)	SRS + HDG + NAV ARMED	SRS + NAV
5	HDG SEL engaged, NAV armed	SRS + HDG SEL + NAV ARMED	SRS + NAV
6	Runway ILS FREQUENCY and HEADING selected on ILS C.P. HDG SEL engaged	SRS + RWY + HDG SEL ARMED	SRS + HDG SEL
7	As in 6 but NAV ARMED and any other lateral mode selected	SRS + RWY + NAV ARMED	SRS + NAV

DISENGAGEMENT

Association of modes at TAKE OFF can be disengaged axis by axis.

SRS is disengaged :
- At THRUST REDUCTION ALTITUDE (predetermined FMS value — 1500 ft above RUNWAY – or pilot entered value) if PROFILE mode has been armed.
- By manual selection of PROFILE (above THRUST REDUCTION ALTITUDE), V/S, ALT or LVL/CH mode.
- When CAPTURE phase of ALT* mode is activated.

The reference speed becomes the A/C speed at the time of SRS disengagement if this speed is higher than the previously selected speed except if PRESET was selected.

RWY is automatically disengaged at 30 ft.

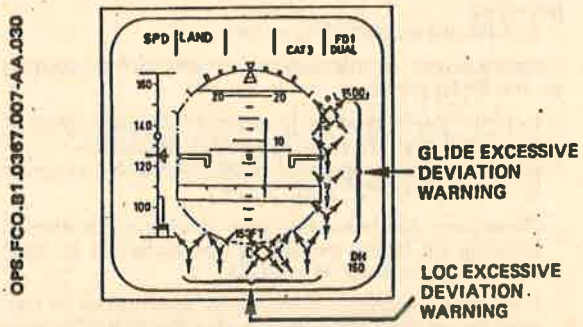
For **HDG, HDG SEL** or **NAV** see LATERAL MODES description is 03.66.

Mod. : 5757 + 6036 + 7187

LAND MODE (CONT'D)

WARNINGS LINKED TO LAND MODE

- **EXCESSIVE DEVIATION FROM LOC OR GLIDE BEAM**



These warnings can occur only if CAT 2, or CAT 3 capability illuminates on FMA's and LAND mode is engaged.

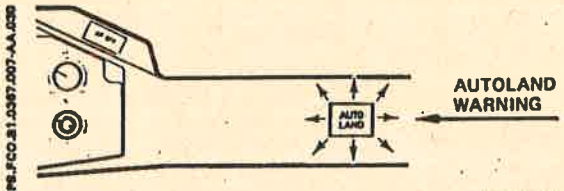
LOC excessive deviation warning (flashing of LOC index and scale on PFD's and of LOC scale and bar on ND's) occurs if :
- LOC DEVIATION is greater than 0.3 dot on PFD
- radio altitude is greater than 15 ft
- LOC TRACK phase of LAND mode has been initiated.

GLIDE excessive deviation warning (flashing of G/S index and scale on PFD's and ND's) occurs if :
- glide deviation is greater than 1 dot on PFD
- radio altitude is greater than 100 ft
- GLIDE TRACK phase of LAND mode active.

Note : 1. From LOC TRACK phase and whatever the capability is (CAT 1, CAT 2, CAT 3) the LOCALIZER (respectively GLIDE) transmitter failure (no signal on both A/C ILS receivers) causes :
- *The LOC (respectively GLIDE) scale to flash on PFD's*
- *The ROLL (respectively PITCH) FD BAR to flash on PFD's*
- *Below 200 FT, AUTOLAND warning.*

2. LOC and GLIDE EXCESSIVE DEVIATION WARNINGS can be tested by pressing one of the two AUTOLAND light p.b.

- **AUTOLAND**



AUTOLAND warning indicates that a take-over is required. It can occur only if Radio Altitude is lower than 200 ft ; CAT 2 or CAT 3 capability is available and LAND TRACK phase of LAND mode is active.

Provided these conditions are met, a red « AUTOLAND » light flashes on the glareshield, in front of each pilot if one of the following conditions occurs :
- GLIDE or LOC excessive deviation warning is activated.
- « AP OFF » warning is activated (both AP's are disconnected).
- A LONG FLARE is detected (A/C not on the ground 13.5 sec after the 50 ft height has been detected on the radio altimeter).
- A difference of 10 ft between radio altimeter 1 and 2 is detected during at least 1 sec.

Note : 1) AUTOLAND warning can be de-activated by :
- *either GO AROUND initiation*
- *or two successive actions on any AP instinctive disconnect push-button (first action disengages AP, second one clears « AP OFF » and « AUTOLAND » warnings).*

2) Both AUTOLAND warning lights can be tested by pressing one of the lights. This also tests the LOC and GLIDE EXCESSIVE DEVIATION WARNINGS (on PFD's).

- **DECREASE IN CAPABILITY**

In case of decrease of the landing capability (CAT 3 downgraded to CAT 2 or CAT 2 to CAT 1 or loss of CAT 1) a TRIPLE CLICK warning sounds in the cockpit.

GO-AROUND MODE

This mode allows to perform a go-around with a longitudinal and lateral guidance of the A/C. In addition it automatically engages THR mode in ATS.

GO-AROUND mode can be used with :

- one or two FD's engaged only.
- one or two FD's engaged and one AP in CWS.
- one or two AP's engaged in CMD.

The LONGITUDINAL MODE included in GO-AROUND mode is SRS (SPEED REFERENCE SYSTEM) which allows to acquire and maintain :

- the SPEED which is selected on FCU (VAPP) increased by 10 KT with two engines operating.
- VAPP (or the A/C existing speed if it is greater than VAPP) in case of engine failure.

Note :
- *PITCH ATTITUDE is limited to 18°.*
- *In case a too high speed is selected on FCU, a 100 ft/min vertical speed is maintained at minimum.*
- *In case a too low speed is selected, VLS (see definition in 03-40) will be maintained at minimum.*

When strong windshear conditions are encountered, an SRS survival strategy is adopted :

- selected speed increased by 10 kts is maintained with two engines operating (the highest of selected speed and A/C airspeed in case of engine failure) until vertical speed decreases down to zero.
- a slightly positive vertical speed is then commanded until airspeed decreases down to slightly above Vss,
- then airspeed is controlled slightly above Vss, the altitude being reduced while the windshear intensity remains high.

The LATERAL MODE included in GO-AROUND consists of levelling the wings, then of maintaining the wings horizontal.
The commands to be executed are indicated on the PFD by the PITCH BAR (in longitudinal) and the ROLL BAR (in lateral).

ENGAGEMENT

- GO-AROUND mode (and also A/THR function and THR mode in ATS) is engaged by action on either GO-LEVER provided :
  - SLATS are extended to at least 15°.
- Consequences of this action are different depending on the flight phase :
  - In flight (main landing gear strut released) AP(s) (if engaged) and FD's engage in GO-AROUND. AP(s) remain(s) engaged in CMD if A/C touches down after GO-AROUND engagement.
  - On ground (main landing gear strut compressed) at landing, go levers activation has no effect as long as, at least, one AP is in CMD.
  - If no AP is engaged, from touch down up to 30 sec. after touch down, FD's engage in GO AROUND mode when go levers are pressed. If the A/C has touched down for more than 30 sec., FD's engage in TAKE OFF mode (SRS + RWY or SRS + HDG) if slats are extended to at least 15°.

Note : 1. GA is automatically selected on TRP when SLATS are extended to at least 15°.
2. When GO-AROUND mode is engaged, an automatic reversion to FD BARS display is done on PFD's, if FPV symbols were previously displayed.

DISENGAGEMENT

Disengagement of GO-AROUND mode is possible only by engaging an other mode. If the two AP's were engaged, AP 2 (right side) will disengage.

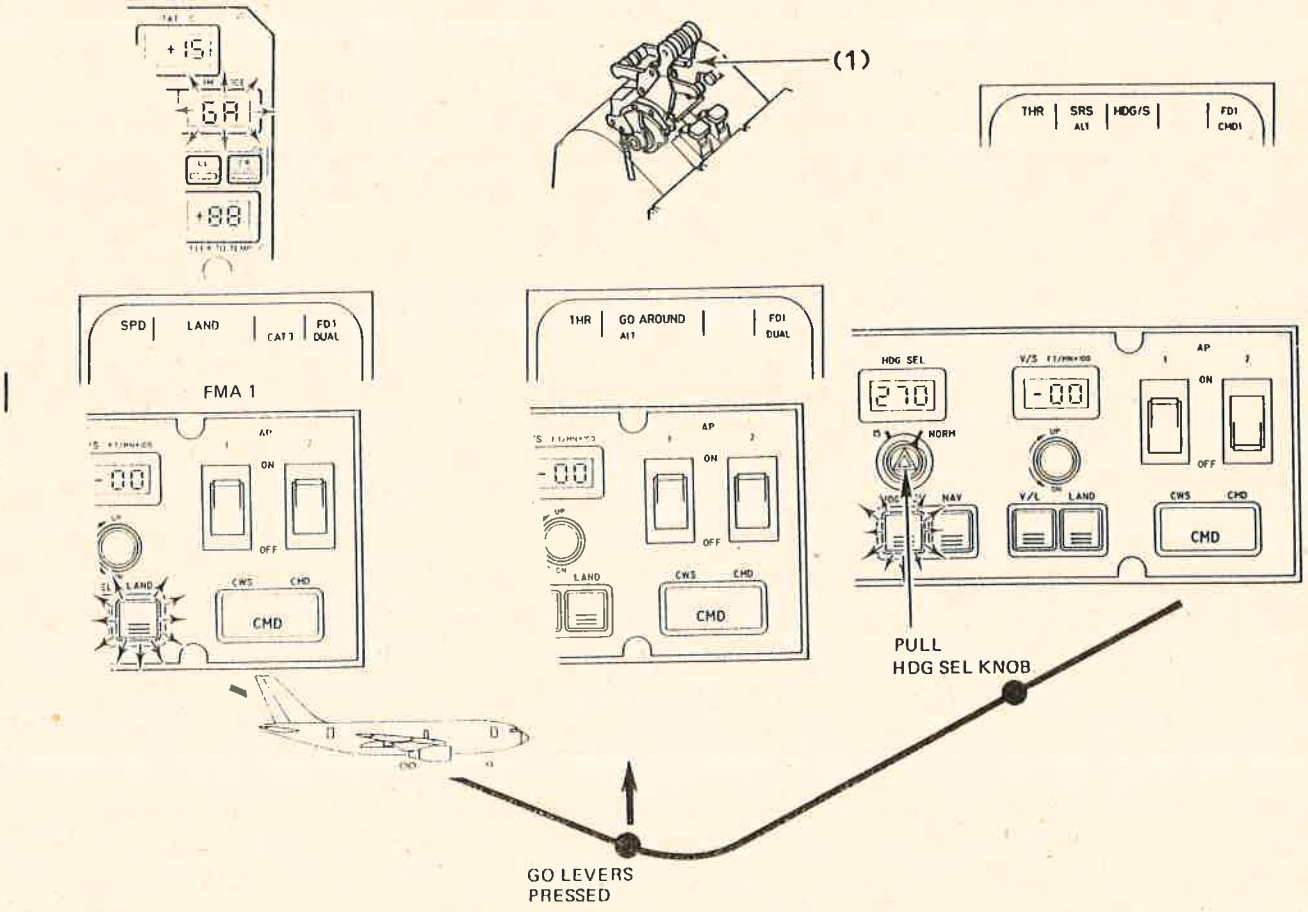
- When a longitudinal mode is engaged (V/S, ALT, LVL/CH, ALT* or PROFILE mode) :
  - GO-AROUND mode disengages.
  - HDG mode engages as lateral mode.
  - The ATS engages in the mode corresponding to the engaged longitudinal mode.
- When a lateral mode is engaged (HDG SEL, VOR CAPTURE or TRACK phase, NAV CAPTURE or TRACK phase) :
  - GO-AROUND mode disengages.
  - The longitudinal mode of GO-AROUND (SRS) remains active. SRS illuminates green on both FMA's.
  - THR remains engaged in ATS.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM AUTOPILOT / FLIGHT DIRECTOR COMMON MODES	R 1.03.67 PAGE 9/10 REV 07

GO-AROUND MODE (CONT'D)

OPERATION – ANNUNCIATION

- Initial A/C configuration
- Press either GO-LEVER (1):
  - AP engages in GO-AROUND
  - ATS engages in THR
  - ALT* is armed (blue ALT on FMA's)
- GO AROUND disengagement: for example by engaging HDG SEL
  - HDG SEL and SRS engage
  - AP 2 disconnects.



Vers. : All Eng. : All

The AFS flight line maintenance is based on the use of a FAULT ISOLATION and DETECTION SYSTEM (FIDS) integrated into the AFS computers (FAC's, FCC's, TCC's).

This FIDS is controlled from the MAINTENANCE TEST PANEL (MTP) which is located on the LATERAL PANEL in the cockpit.

FUNCTIONS

The AFS FIDS fulfils the following functions :

- FAULT ISOLATION

  The FIDS allows to detect on ground or in flight the faulty LINE REPLACEABLE UNITS (LRU) at each time an AFS subsystem (AP, ATS, PITCH TRIM, YAW DAMPER) disconnects or does not engage, or when the landing capability is downgraded.
  These LRU's, once isolated, can be easily replaced on ground by the maintenance personnel. The list of the faulty LRU's can be displayed on the MTP DISPLAY WINDOW (in flight or on ground) by pressing the DISPLAY pushbutton on the MTP.

- COMPLEX TROUBLE-SHOOTING

  This procedure is used on ground by QUALIFIED MAINTENANCE PERSONNEL in the event the FAULT ISOLATION function does not allow failure detection. Detailed informations, helping in trouble-shooting, can be displayed on the MTP DISPLAY WINDOW by pressing the GROUND SCAN pushbutton on the MTP. (This function is inhibited in flight).

- TEST AFTER REPLACEMENT OF A LRU

  It is performed by MAINTENANCE PERSONNEL, after replacement of a LRU.
  It is initiated (possible on ground only) by pressing the AFS TEST/LAND TEST pushbutton.

- LAND MODE TEST

  It is performed by MAINTENANCE PERSONNEL. It is initiated (possible on ground only) by pressing the AFS TEST/LAND TEST pushbutton.

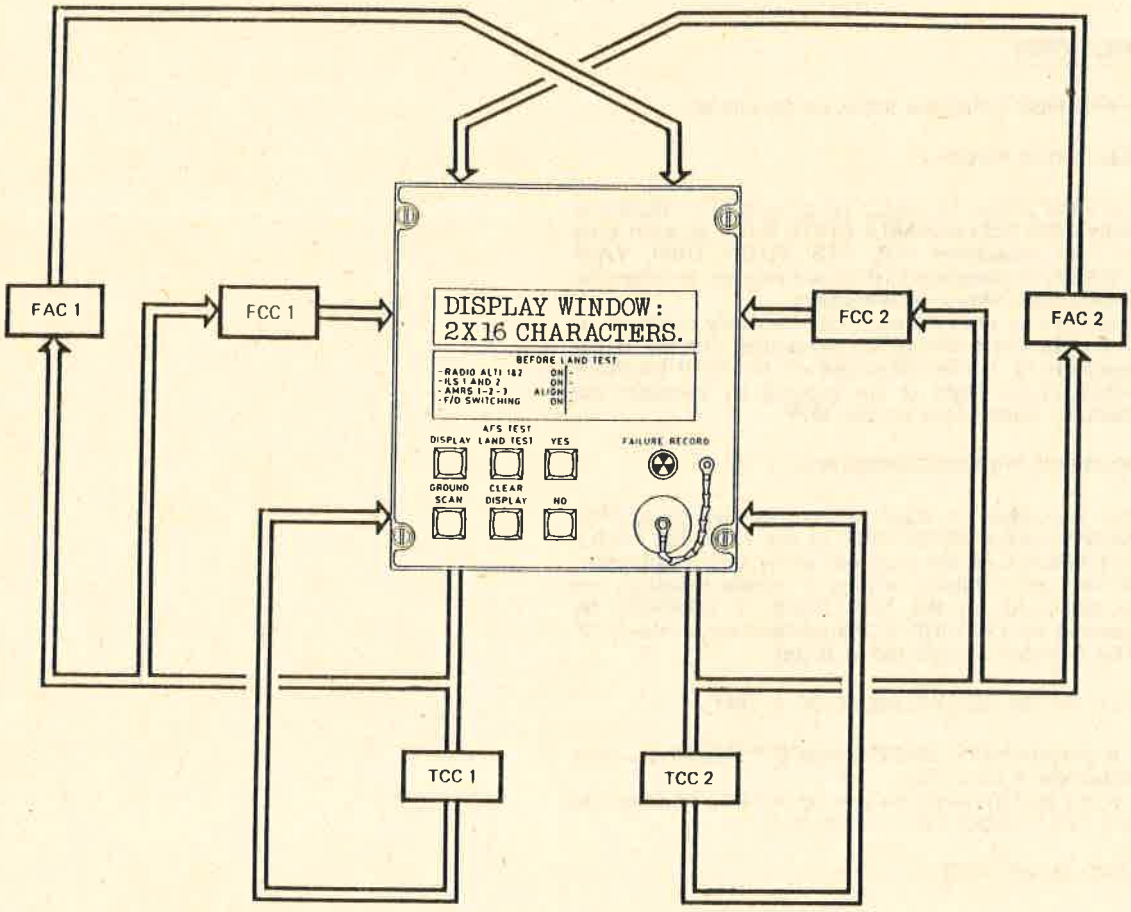
Note : Only FAULT ISOLATION function (DISPLAY pushbutton) may be used by the crew. The others are typically used by MAINTENANCE PERSONNEL.

POWER SUPPLY

The MTP is supplied with 28 Volts DC from NORMAL BUS.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM FAULT ISOLATION AND DETECTION SYSTEM SCHEMATICS	R 1.03.70 PAGE 2 REV 08

MTP INTERFACE WITH AFS COMPUTERS



The MTP receives and sends informations through data bus lines to all the AFS computers.

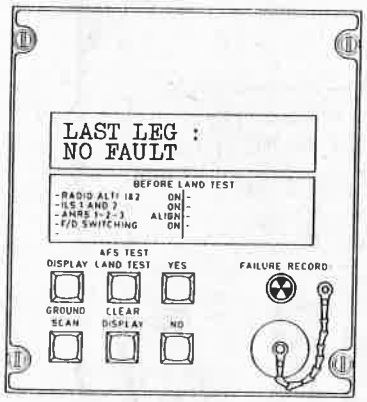
This allows the MTP to generate messages concerning the AFS and PERIPHERAL equipments status.

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUTOMATIC FLIGHT SYSTEM FAULT ISOLATION AND DETECTION SYSTEM SCHEMATICS	R 1.03.70 PAGE 3 REV 08

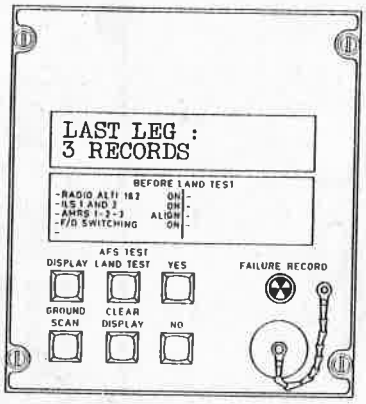
MESSAGES DISPLAYED WHEN PRESSING THE « DISPLAY » PUSHBUTTON (1)

EXAMPLE 1
(NO DETECTED FAILURE)



END

EXAMPLE 2
(3 FAILURES RECORDED)



1 FCC 1 FAILED

EVENTS ARE NUMBERED FROM 1 TO 30

2 COMPLEMENTARY TEST ON GROUND

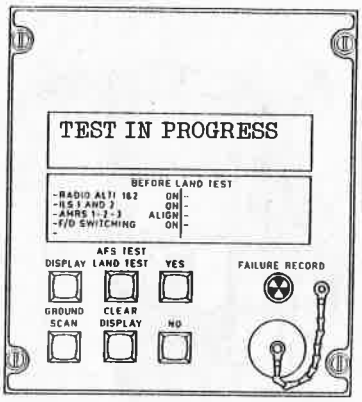
FAULTY LRU'S ASSOCIATED WITH 3RD EVENT ARE DISPLAYED IN PROBABILITY ORDER

3–1 FCC 2 FAILED

3–2 AP DISC PUSHBUTTON SW

END

EXAMPLE 3
(TEST IN PROGRESS)



AT THE END OF THE TEST NO MESSAGE IS DISPLAYED.

A SECOND ACTION ON THE DISPLAY P.B. IS NECESSARY TO DISPLAY THE FAILURES

OPS.FCO.B1.0370.003-OO.001

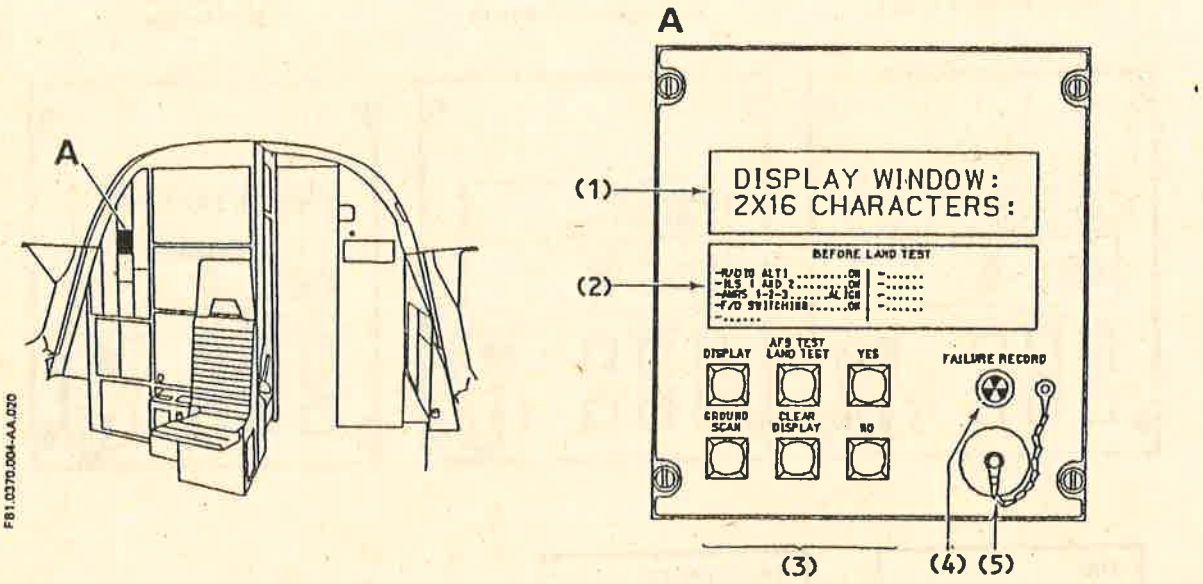
Notes : 1 – After the DISPLAY p.b. has been pressed, the messages are automatically displayed in cyclic form. Each message is displayed for three seconds. After END, there is no more displayed message.

2 – The MTP can memorize up to thirty events for the last six flights following the first-in, first-out method (the last memorized event erases the first memorized one).
Action on DISPLAY p.b. only will display the messages concerning the last flight.
Pressing at the same time DISPLAY, YES and NO p.b. will display the messages concerning the 6 previous flights.

Vers. : All

Eng. : All

A. MAINTENANCE TEST PANEL



(1) MTP DISPLAY WINDOW

Comprises two lines of sixteen alphanumeric characters.

(2) BEFORE LAND TEST Placard

Specifies the status of the peripheral systems required for the LAND TEST.

(3) MTP Keyboards

Six control pushbuttons allow to display on the DISPLAY WINDOW, the informations collected by the FIDS.

DISPLAY, AFS TEST/LAND TEST and GROUND SCAN pushbuttons allow to select the different functions of the FIDS.

YES, NO, CLEAR DISPLAY pushbuttons are used only on ground with AFS TEST/ LAND TEST or GROUND SCAN functions.

(4) FAILURE RECORD Magnetic Indicator

Indicates black and white when a failure has been recorded. Indicates black when no failure has been recorded.

(5) MTP Connector

Allows connection of a TEST SET to help maintenance personnel in complex trouble-shooting.

Mod. : 4803

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT	1.04.00
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TABLE OF CORRESPONDENCE BETWEEN « CODE » NUMBER AND MOD/MP NUMBER(S)

EQUIVALENCE CODES	DESIGNATION
0410A	Mods : 5917 or 6365
R 0410B	Mod : (5917 + 6299) or (6299 + 6365)
0480A	STD or (Mod : 5051 + 6415)

A310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT APU GENERAL DESCRIPTION	1.04.10 PAGE 1 REV 21 SEQ 050

GENERAL

The auxiliary power unit is a self-contained unit which makes the aircraft independent of external pneumatic and electrical power supply.

On ground :

Provide bleed air for starting the engines at altitude in the range – 1,000 ft to 8,000 ft and to supply the air conditioning system of the aircraft.
Provide electrical power to supply the aircraft network.

During Takeoff :

Supply of bleed air for air conditioning and wing anti-icing, in this way avoiding engine thrust reduction caused by use of engine bleed air, if optimum aircraft performance is required.

In Flight :

Provision of back-up power for :
- electrical system (below 41,000 ft)
- air conditioning (below 20,000 ft)
- wing anti-incing (below 20,000 ft).

For APU start and operation only electrical power (batteries, AC emer inverter), and fuel supply at positive pressure are required.

Under normal conditions APU starting is permitted throughout the operating speed range up to 41,000 ft pressure altitude.

APU starting on battery only, is permitted up to 20,000 ft.

The APU fuel consumption with bleed air extracted and generator under load may be averaged at 200 kg/h on ground. In flight consumption is lower than consumption on the ground.

APU RUNNING indication is displayed on the ECAM MEMO page.

APU ENGINE

The basic element of the APU is the gas turbine which delivers mechanical shaft power for driving the accessory gearbox and produces bleed air for engine starting and for pneumatic system supply.

It consists of three main components :

- The power section has a two-stage centrifugal compressor driven by a three-stage axial turbine governed to a constant speed by variation of fuel flow which is controlled by the fuel control unit (FCU) and the electronic control box (ECB).
- The load compressor has a single-stage centrifugal compressor directly driven by the power section and delivers bleed air to the aircraft pneumatic system, controlled by modulating inlet guide vanes.
- The accessory gearbox is directly driven by the power section and carries the fuel control unit, lubrication pumps, AC generator, cooling air fan and starter motor.

AIR INTAKE SYSTEM

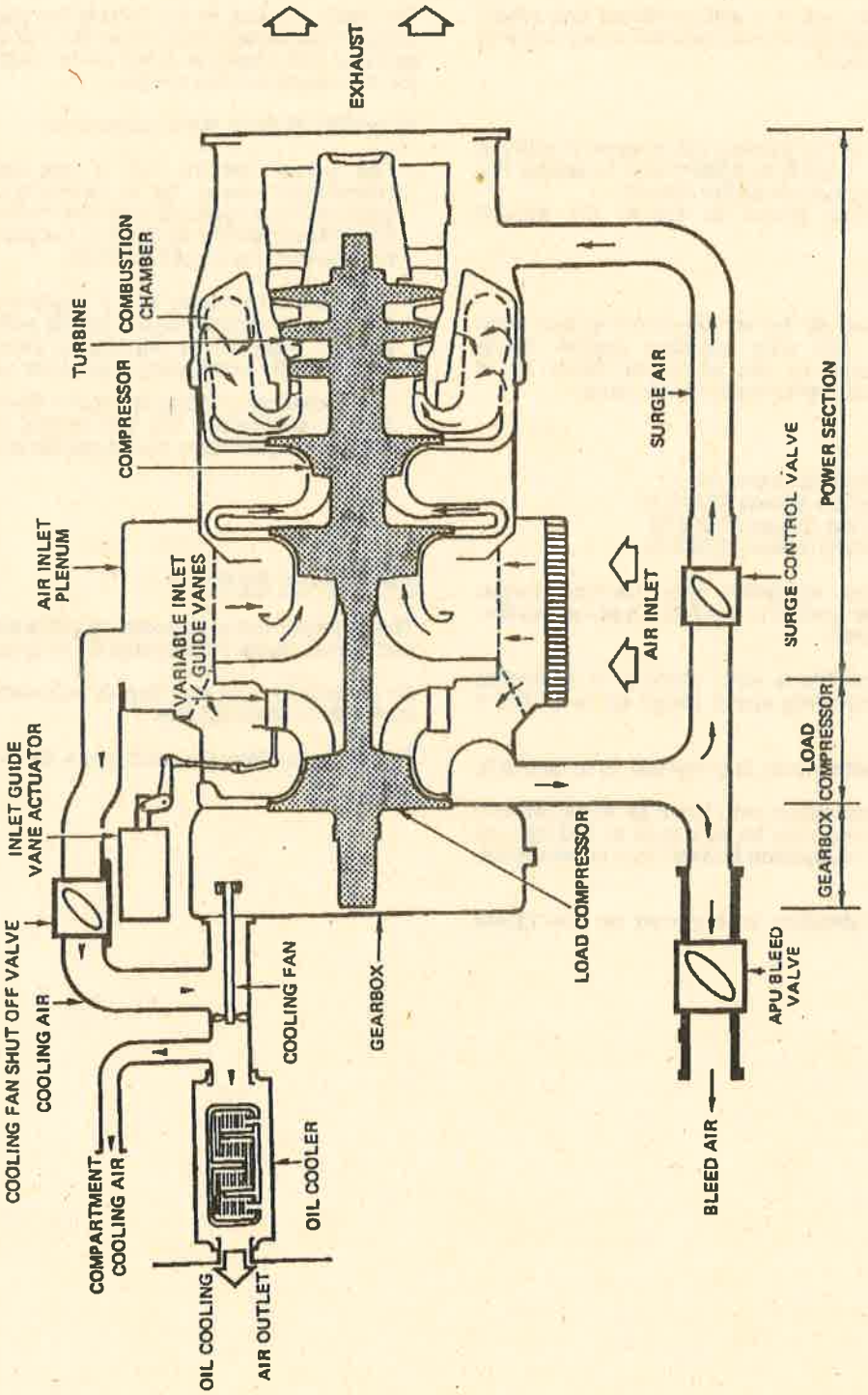
The air intake system, consisting of the air intake, diffuser and elbow, ducts the external air to compressor inlet.

An electrically operated flap, is automatically controlled by the APU MASTER SW.

The air intake flap is closed when the APU is not being used.

A310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT APU GENERAL SCHEMATICS	1.04.10 PAGE 2 REV 10 SEQ 001

APU ENGINE

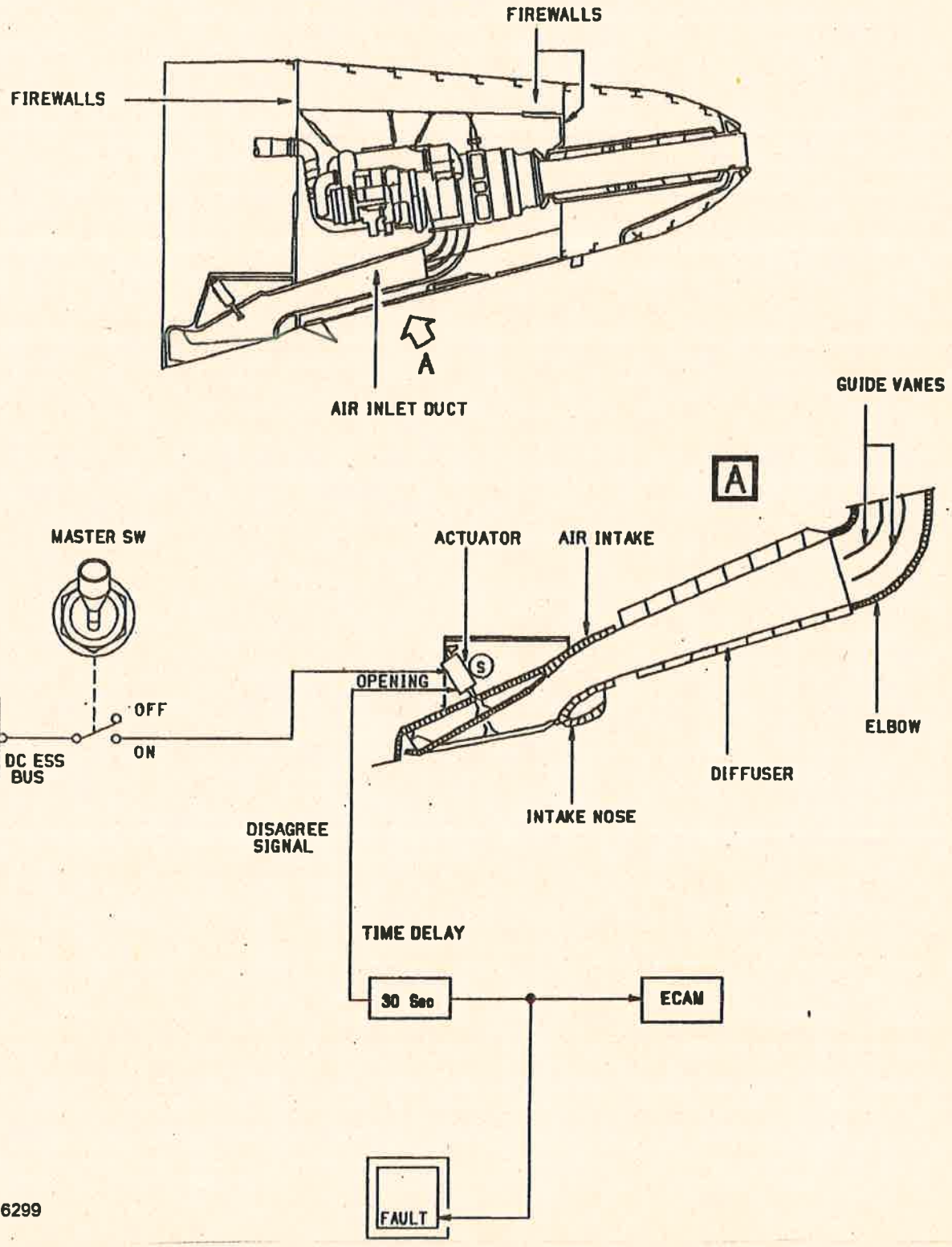


OPS.FCO.B1.0410.002-00.001

Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT APU GENERAL SCHEMATICS	1.04.10 PAGE 3/4 REV 16 SEQ 020

APU ENGINE – AIR INTAKE



OPS.FCO.B1.0410.003-AA.020

Mod. : 6299

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT FUEL SYSTEM DESCRIPTION	N 1.04.20 PAGE 1 MAR 83

GENERAL

Normal fuel supply for the APU is from the left wing tanks. To use fuel from the right wing tanks the crossfeed valve must be opened.

The required positive pressure for the APU is available via tank or APU fuel pump.

Fuel flow to the APU is controlled normally by the isolation valve. In case of fire, the fuel supply is interrupted by the fire shut-off valve additionally.

FUEL FEED

A Centrifugal LP pump, installed in the crossfeed line, is electrically supplied by the AC EMER BUS.

When the APU MASTER SW is selected to ON and:

- **FUEL PUMP** pushbutton switch is selected AUTO,

  The pump is activated automatically when the pressure in the supply line is below 22 PSI. When the tank pumps are operating, the APU pump will not operate since tank pump pressure output exceeds 22 PSI.

- **FUEL PUMP** pushbutton switch is OVRD,

  The pump is continuously in operation.

An isolation valve is installed downstream of the LP pump.When the APU is not in operation the valve is closed to prevent the fuel line from being pressurized.

A fire shut-off valve upstream of APU compartment firewall is controlled by the APU FIRE handle (overhead panel) and, on ground by the automatic APU fire extinguishing system. The valve position is indicated by the LP VALVES APU indication on the fuel panel.

The LO PR light in the FUEL PUMP pushbutton switch on the APU panel comes on when the pressure switch downstream the fire shut-off valve senses the fuel pressure below 6 PSI.

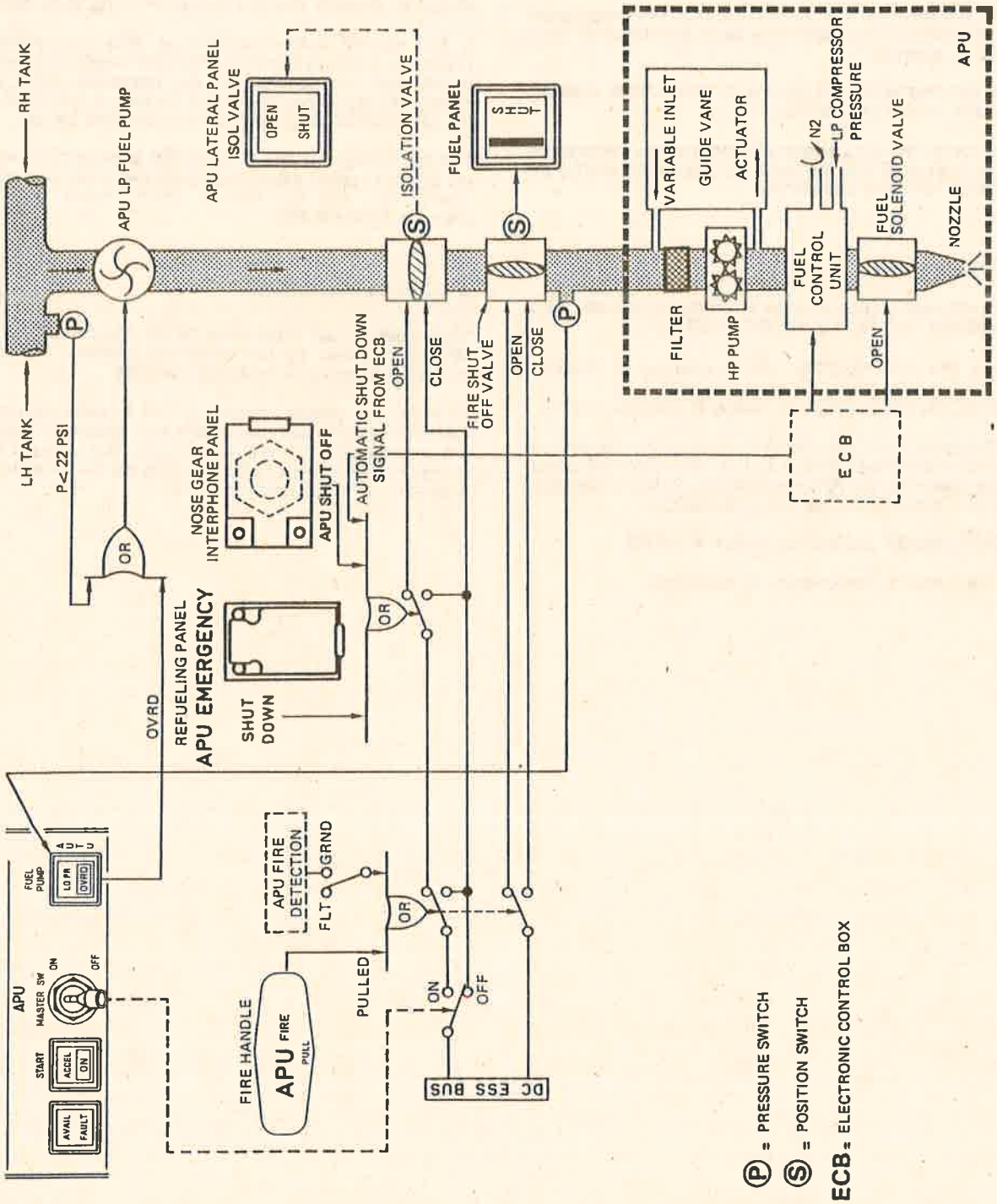
APU FUEL CONTROL

High pressure fuel is delivered to the fuel control by the HP pump driven by the accessory gearbox. The fuel control unit operates hydromechanically.

To allow the proper amount of fuel in each operating condition mechanical, pneumatic and electronic signals are processed by the fuel control unit. The metered fuel is injected into the combustor through two manifolds, each with nine atomizing nozzles.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT FUEL SYSTEM SCHEMATICS	R 1.04.20 PAGE 2 REV 08

FUEL SYSTEM



Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT OIL SYSTEM DESCRIPTION	R 1.04.30 PAGE 1 REV 08

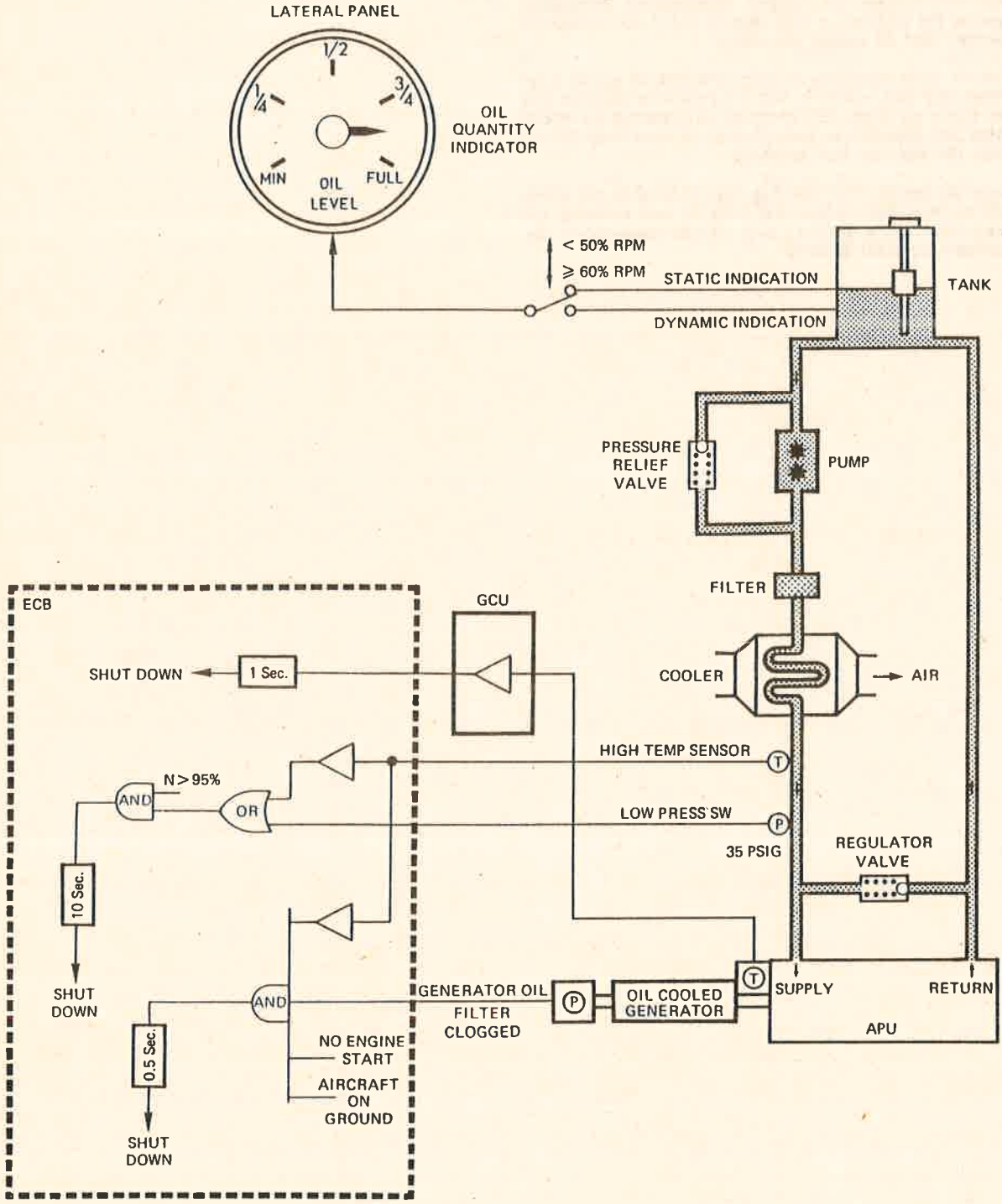
The APU utilizes an integral independent lubrication system for lubrication and cooling the APU, accessory gearbox and oil cooled generator.

The oil level indicating system consists of an oil level transmitter and indicator. The transmitter is installed into the sump oil level. The indicator is installed on lateral panel and provides an indication of oil level from MIN to FULL divided into four quarters.

Because, during APU running, the oil level in the sump will be less than when the APU is not running, the transmitter has a dynamic and a static operating mode, provided by à 60 % relay.

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT OIL SYSTEM SCHEMATICS	R 1.04.30 PAGE 2 REV 08

OIL SYSTEM



Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT AIRBLEED SYSTEM DESCRIPTION	R 1.04.40 PAGE 1 REV 08

The fully automatic bleed air system supplies and controls air bleed from the load compressor for the pneumatic system.

The APU bleed air system is separated from the aircraft pneumatic system by a bleed check valve and the APU load control valve, which is a shut-off butterfly valve, spring loaded normally closed when the APU is inoperative, pneumatically powered and controlled by the electronic control box and the APU bleed control switch.

The amount of air supplied by the APU, in accordance with aircraft system demand is determined by the inlet guide vanes position.

The position is in response to an electrical voltage signal from the electronic control box. For extensive bleed air demand during main engine start and wing de-icing the APU speed increases.

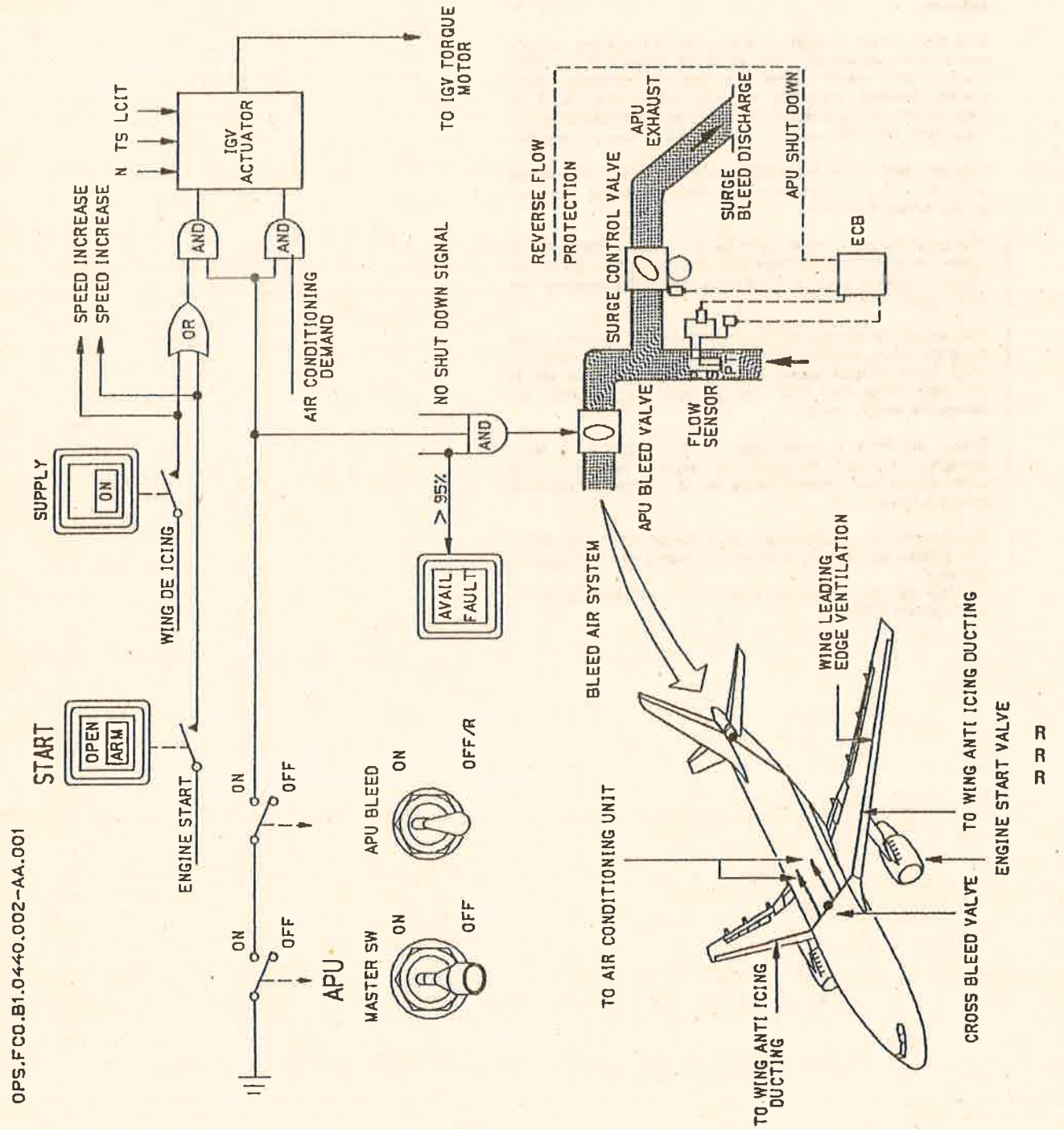
The speed is controlled by the electronic control box. A surge valve, installed between the compressor and the APU load control valve, ensures that sufficient air is diverted from the load compressor to maintain an adequate surge margin.

Surge air flow is discharged in the tailpipe. A load compressor inlet temperature sensor monitors the compressor inlet temperature as a means of sensing reverse flow.

An increase of temperature, as a result of reverse flow, will initiate an APU shut down to protect the unit against damage.
Additionally the bleed air system will be monitored via the system CRT.

A310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT AIRBLEED SYSTEM SCHEMATICS	1.04.40 PAGE 2 REV 19 SEQ 001

BLEED AIR SYSTEM



OPS.FCO.B1.0440.002-AA.001

A310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT STARTING DESCRIPTION	1.04.50 PAGE 1 REV 20 SEQ 020

After the MASTER switch is selected ON and the LO PR light in the FUEL PUMP pushbutton switch is off the start can be initiated by pressing the START pushbutton switch.

Then the automatic start sequence begins :

- The white ON light in the START pushbutton switch comes on.

R – The air intake flap opens.

R – The start output of the ECB energizes the starter motor

R – When 7 % rpm are reached
R • the blue integrated ACCEL light comes on
R • the ECB energizes the igniters, and initiates the fuel supply.

R – At 50 % rpm :
R • the starter motor is switching off
R • the START p/b switch drops out and the white ON R light goes off.

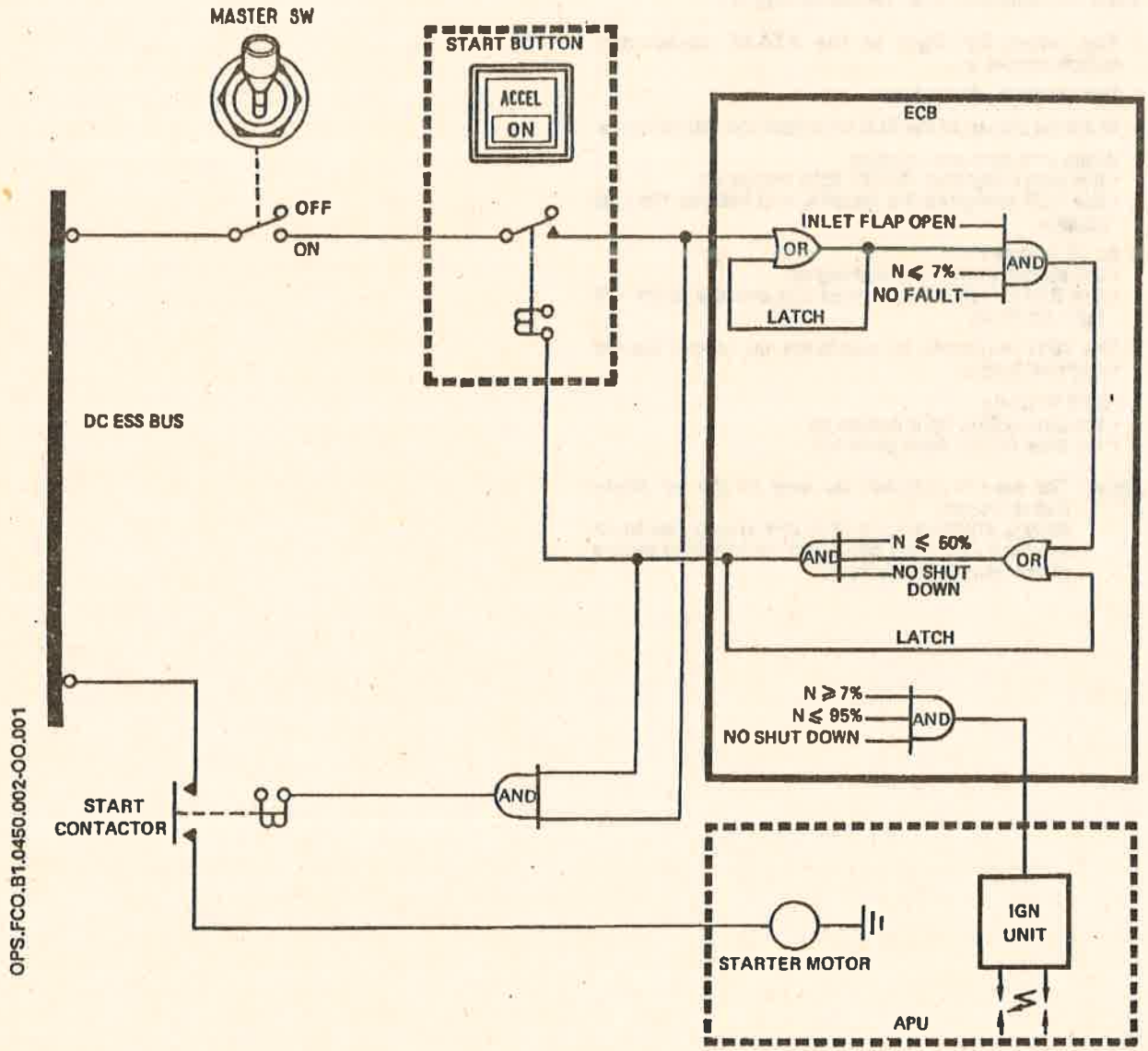
R – The APU continues to accelerate up to the normal R regulated speed.

R – At 95 % rpm :
R • the blue AVAIL light comes on
R • the blue ACCEL light goes off.

Note : The start is inhibited as long as the air intake flap is closed.
After a shutdown the MASTER switch has to be selected OFF then ON again for resetting before every new start attempts.

A310 FLIGHT CREW OPERATING MANUAL	AUXILIARY POWER UNIT STARTING SCHEMATICS	1.04.50 PAGE 2 REV 08 SEQ 001

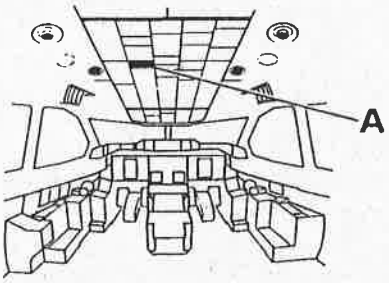
STARTING SYSTEM

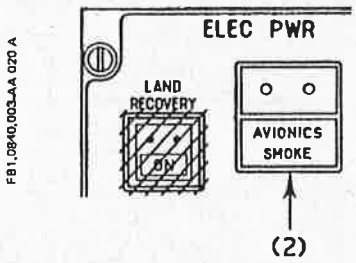


Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	FIRE PROTECTION ELECTRICAL CONTROLS	1.08.40 PAGE 3 REV 21 SEQ 020

A. SMOKE LIGHTS ON ELEC PWR PANEL





(1) (RESERVED)

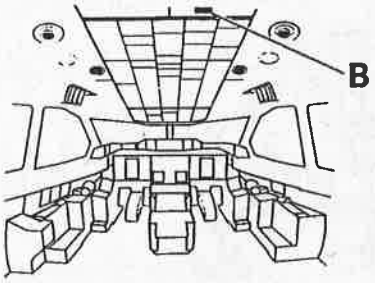
(2) AVIONICS SMOKE Light

The AVIONICS SMOKE light comes on red when smoke is detected in the ventilation duct from :

- Cockpit instrument panels
- Overhead panel
- Circuit breakers panel
- Weather radar transceiver
- Electronic racks
- IRS 2
- Underfloor area equipment

Illumination of the AVIONICS SMOKE light is accompanied by ECAM activation.

B. MINIMUM EQUIPMENT BAY, SMOKE



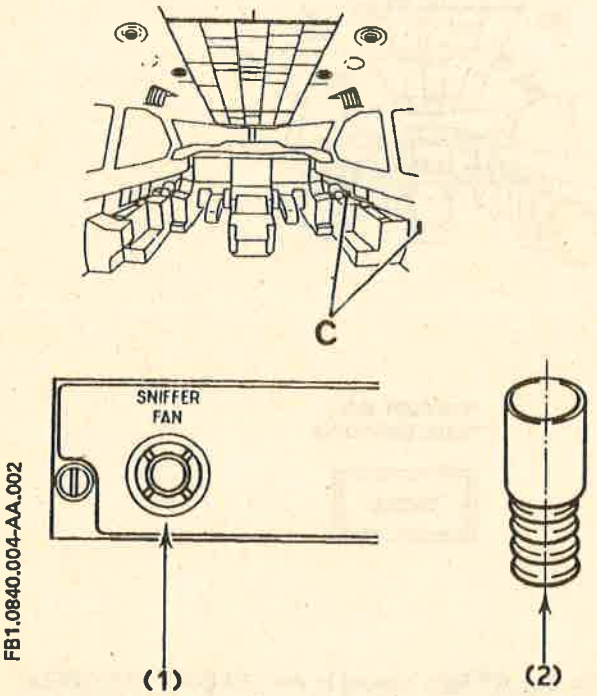
The SMOKE light located in the MIN EQPT BAY CIRCUIT BREAKERS section of the overhead circuit breaker panel comes on red when smoke is detected in the ventilation duct from the minimum equipment bay.

Illumination of the SMOKE light is accompanied by ECAM activation.

Mod. : 7483

A310 FLIGHT CREW OPERATING MANUAL	FIRE PROTECTION ELECTRICAL CONTROLS	1.08.40 PAGE 4 REV 08 SEQ 002

C. SNIFFER FAN CONTROLS



A fan located in the duct from the avionics compartment provides olfactory confirmation of smoke via a sniffer tube.

(1) SNIFFER FAN Pushbutton

- **Pressed and Held**

  The fan is activated and blows air through the sniffer duct.

- **Released**

  The fan is deactivated

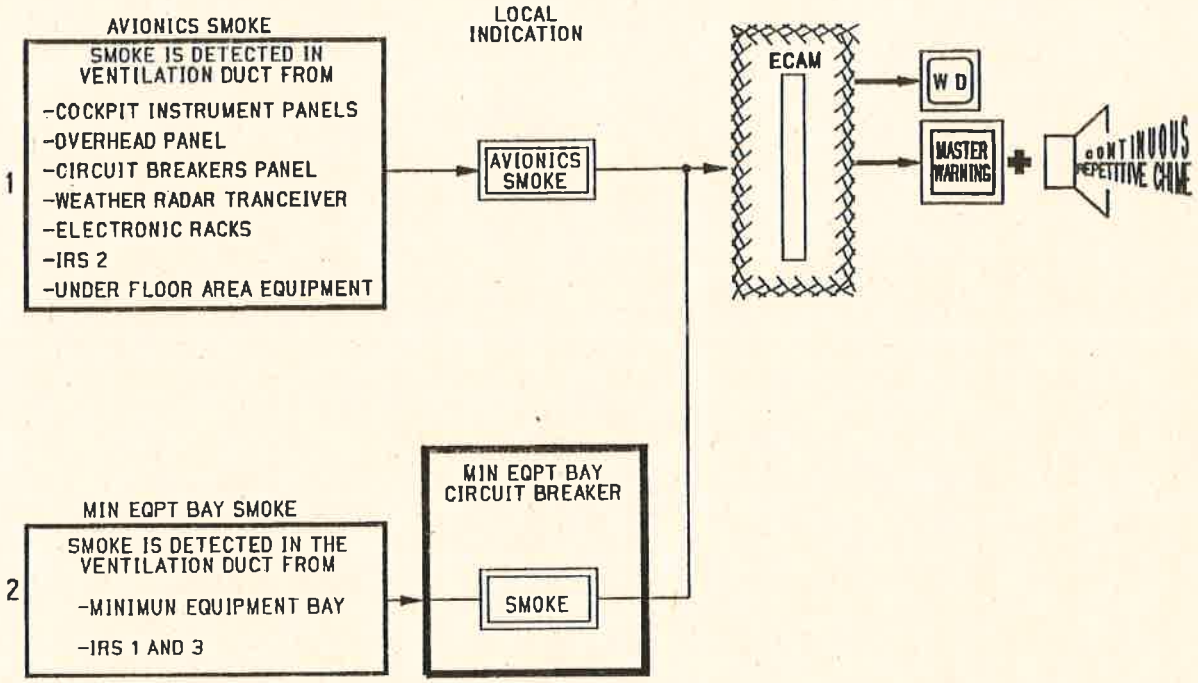
(2) Sniffer Tube

The movable tube is provided for olfactory confirmation of smoke in air from the avionics compartment, extracted by the sniffer fan.

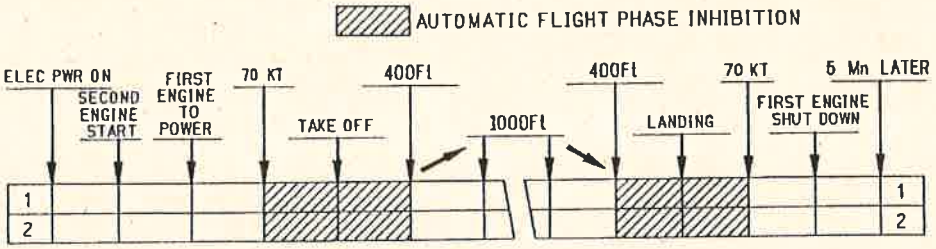
Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	FIRE PROTECTION ELECTRICAL ECAM-WARNING LOGIC	1.08.40 PAGE 5/6 REV 21 SEQ 100

SMOKE WARNINGS



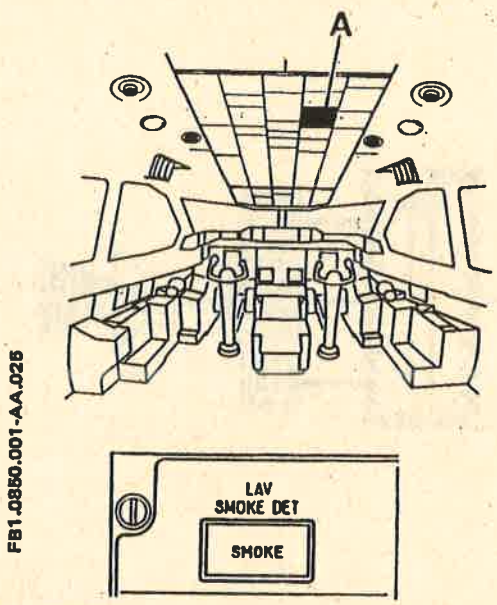
OPS.FCO.B1.0840.005-AB.100



Mod. : 5051 + 7483

A310 FLIGHT CREW OPERATING MANUAL	FIRE PROTECTION LAVATORY CONTROLS	1.08.50 PAGE 1 REV 22 SEQ 025

A. LAV SMOKE DET PANEL



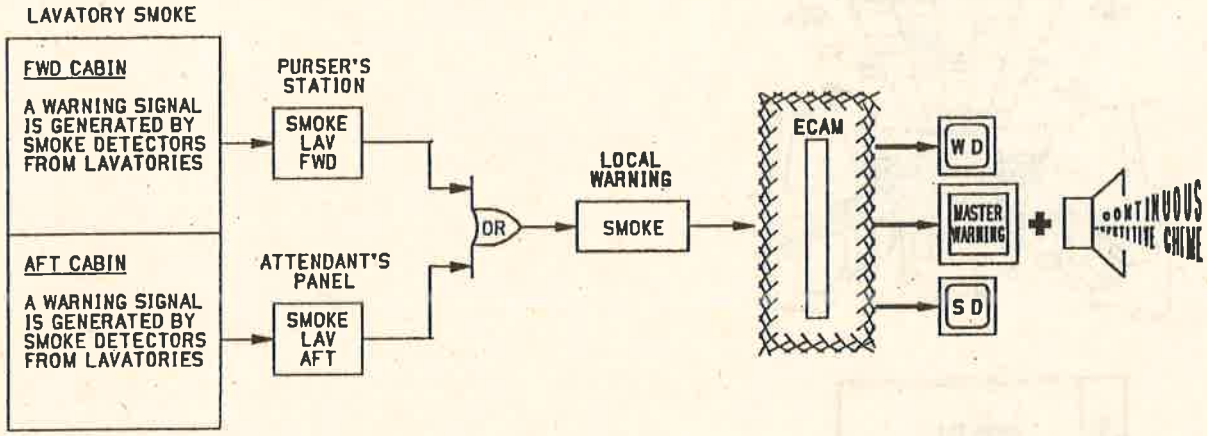
The SMOKE light comes on red to indicate smoke has been detected in the air extraction duct from one of the lavatories.

Illumination of the SMOKE light is accompanied by ECAM activation.

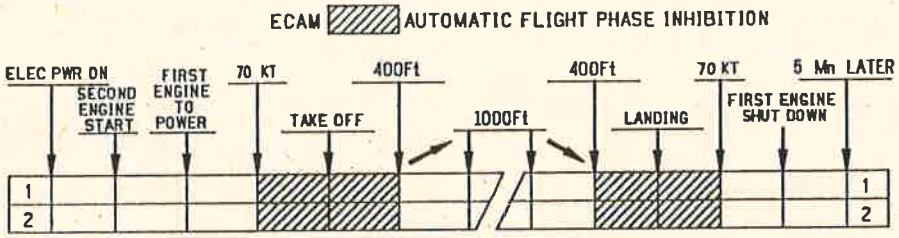
R Code : 0850A

A310 FLIGHT CREW OPERATING MANUAL	FIRE PROTECTION LAVATORY ECAM	1.08.50 PAGE 2 REV 22 SEQ 100

SMOKE WARNING



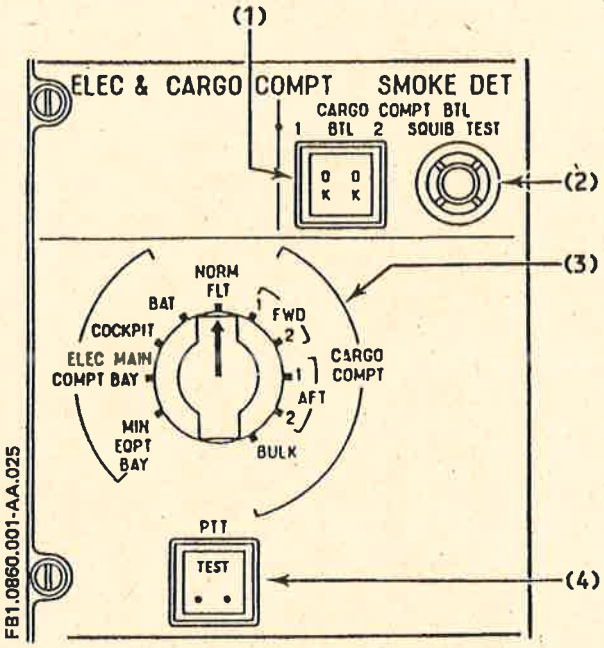
OPS.FCO.B1.0850.002-AA.100



R Code : 0850B

A310 FLIGHT CREW OPERATING MANUAL	FIRE PROTECTION MAINTENANCE PANEL CONTROLS	1.08.60 PAGE 1 REV 21 SEQ 025

A. ELEC and CARGO COMPT SMOKE DET PANEL



Controls the test of the electrical and cargo compartment smoke detection systems (detectors and circuit).

(1) BTL 1 (2) OK Lights

The lights BTL 1 and BTL 2 come on white, while SQUIB TEST pushbutton is pressed, when the corresponding squib in the bottle is operative.

(2) SQUIB TEST Pushbutton

When pressed and held the squibs in the discharge heads are tested simultaneously.

(3) Smoke Test Selector

Selects smoke detection system to be tested. 10 positions correspond to 10 smoke detectors.

. 6 in cargo compartments

. 4 in ventilation ducts from electrical bay.

The NORM FLT position deactivates the test functions, the TEST light in the PTT pushbutton is off.

(4) PTT Pushbutton

The pushbutton initiates the test of the selected smoke detection system.

- **Pressed and Held**

  The test sequence is activated. It is successful if :

  . Corresponding local SMOKE light comes on

  . MASTER WARNING light comes on associated with RC.

  Note : ISOL VALVE FAULT light comes on COMPT TEMP panel and must be reset after test.

- **Released**

  Test sequence is deactivated

- **TEST**

  The light comes on white when the smoke test selector is in any test position and not in NORM FLT position.

Mod. : 5051

LEFT INTENTIONALLY BLANK

LEFT INTENTIONALLY BLANK

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS	1.09.00
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R **TABLE OF CORRESPONDENCE BETWEEN « CODE » NUMBER AND MOD/MP NUMBER(S)**

EQUIVALENCE CODES	DESIGNATION
0920A	STD or (Mod. : 5051 + 6415)
0930A	STD or (Mod. : 5051 + 6415)
0940A	STD or (Mod. : 5051 + 6415)
0950A	STD or (Mod. : 5051 + 6415)
0960A	STD or (Mod. : 5051 + 6415)
0970A	STD or (Mod. : 5051 + 6415)
0980A	STD or (Mod. : 5051 + 6415)

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS GENERAL DESCRIPTION	R 1.09.10 PAGE 1 REV 08

The control of the aircraft is achieved by :

- the primary flight controls
- the secondary flight controls.

The primary flight controls ensure :

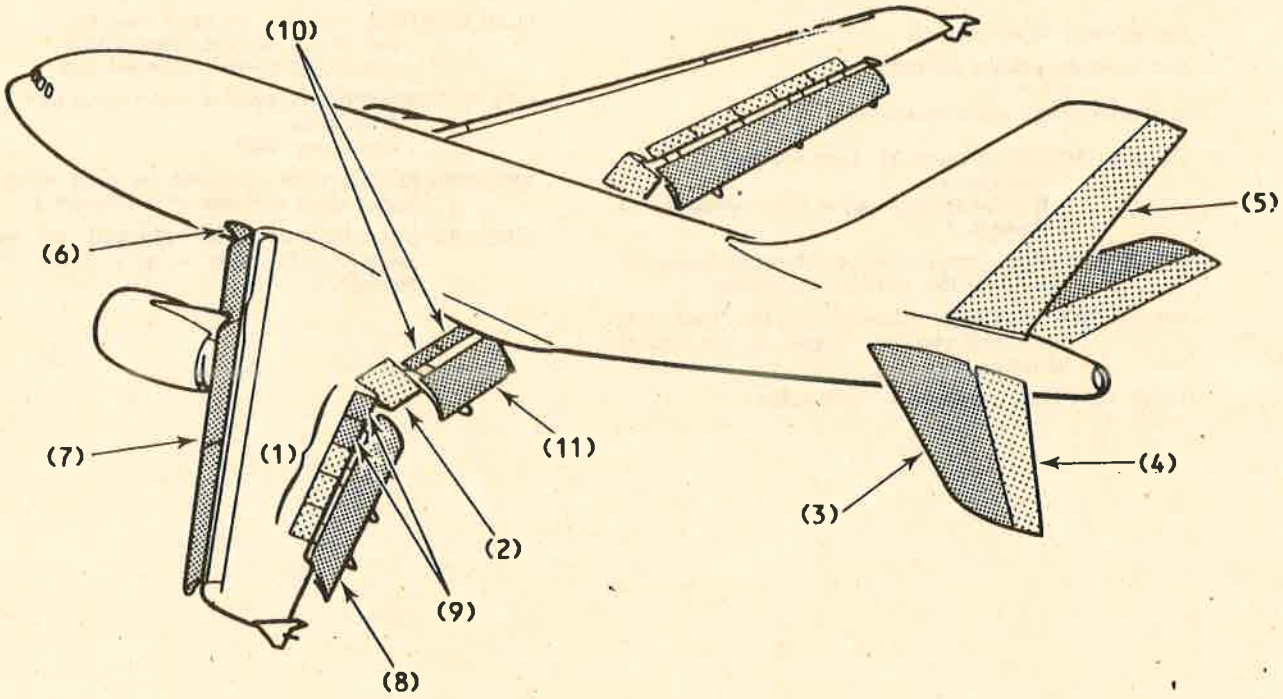
- ROLL CONTROL achieved on each wing by :
  . one aileron
  . five roll spoilers, upper wing surfaces n° 3 through 7.
- PITCH CONTROL achieved by two elevators hinged on the trimmable horizontal stabilizer.
- PITCH TRIM CONTROL achieved by the trimmable horizontal stabilizer hinged on the aircraft structure.
- YAW CONTROL achieved by one rudder.

The secondary flight controls ensure :

- FLAP CONTROL achieved on each wing by :
  . one double slotted inboard flap
  . one single slotted outboard flap
- LIFT AUGMENTING achieved on each wing by :
  . three slats
  . one kruger flap.
- SPEEDBRAKE CONTROL achieved on each wing by upper wing surfaces n° 1 through 4.
- GROUND SPOILER CONTROL achieved on each wing by all upper wing surfaces n° 1 through 7.

Vers. : All Eng. : All

AIRBUS INDUSTRIE A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS GENERAL SCHEMATICS	1.09.10 PAGE 2 REV 14 | SEQ 620



PRIMARY CONTROLS LOCATION

(1) ROLL SPOILERS

(2) AILERON

(3) TRIMMABLE HORIZONTAL STABILIZER

(4) ELEVATOR

(5) RUDDER

SECONDARY CONTROLS LOCATION

(6) KRUGER FLAP

(7) SLATS

(8) OUTER FLAP

(9) OUTER SPEEDBRAKES

(10) INNER SPEEDBRAKES

(11) INNER FLAP

Mod. : 4863

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SERVO CONTROLS DESCRIPTION	1.09.20 PAGE 1 REV 20 SEQ 001

All control surfaces are actuated by irreversible servo controls (in addition, on THS and slats/flaps motors there are pressure-off brakes).

Each one of them is supplied by one of the three independent hydraulic systems. The redundancy is such that with two systems failed, the remaining system provides safe aircraft control over the whole flight envelope.

The servo controls actuation is achieved by a mechanical linkage except for the roll spoilers, speedbrakes, yaw and roll trims, slats and flaps for which the control is made by electrical signalling.

The electrical autopilot orders are transmitted to the mechanical linkage by means of autopilot servo actuators. These orders can be overridden by the pilots.

Control Wheel Steering sensors permit the pilots to alter the autopilot pitch and roll commands.

In the event of control valve jamming in a servo control, an electrically controlled selector valve in the associated hydraulic system cuts off the hydraulic power supply to all the servo controls powered by this system.

Priority valves are installed upstream of the following components :

- blue system : slat power control unit (PCU) motor
- green system : flap, slat PCU motors and kruger actuator R
- yellow system : flap PCU and THS motors

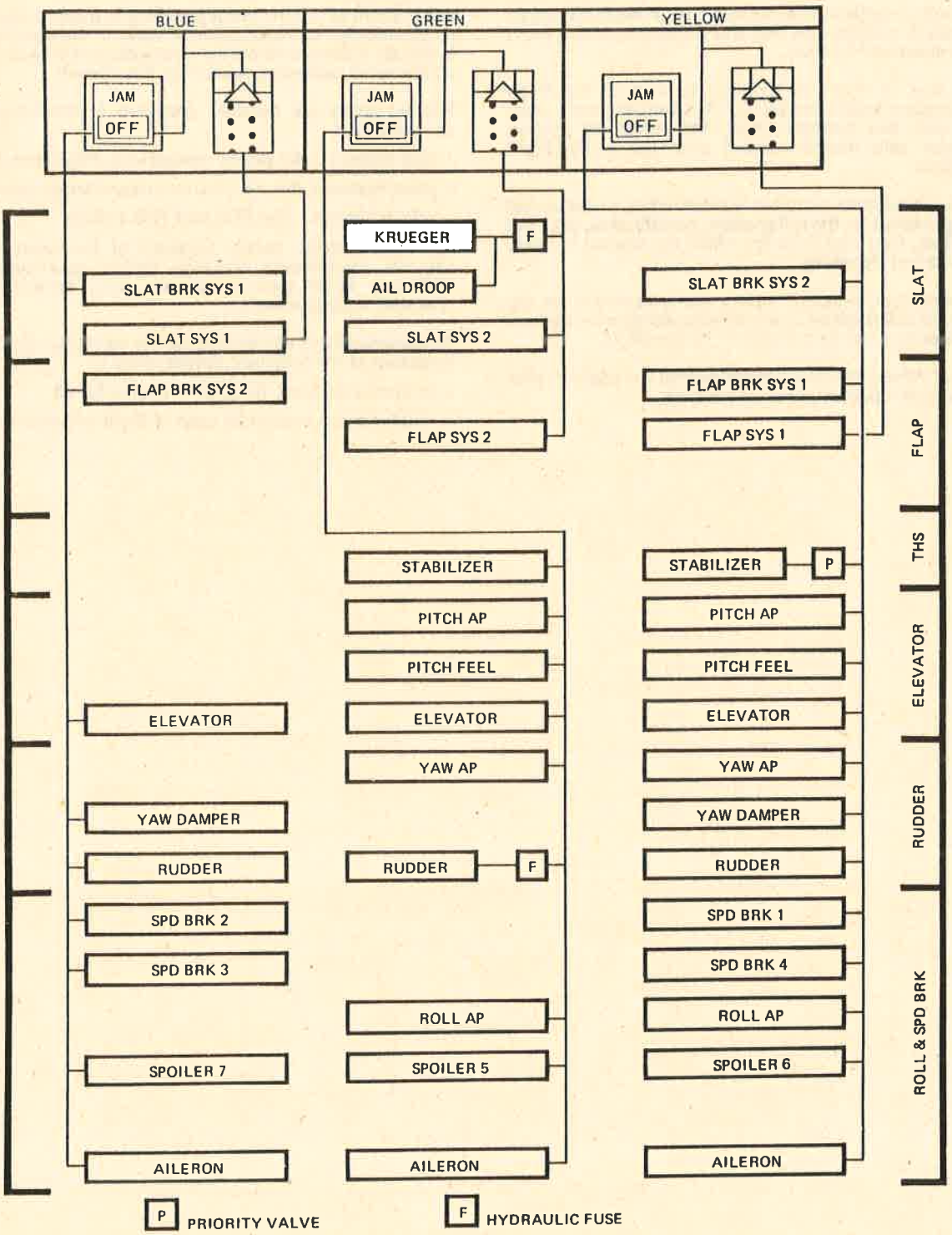
in order to avoid supply pressure of the main flight controls components dropping (below approximately 1885 psi) when various hydraulic user systems are operated simultaneously.

To preserve the green system, safety vaives are installed upstream of the following components :

- Kruger valve block (in case of engine burst)
- Rudder servo control (in case of flight collision).

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SERVO CONTROLS SCHEMATICS	N 1.09.20 PAGE 2 MAR 83

HYDRAULIC DISTRIBUTION



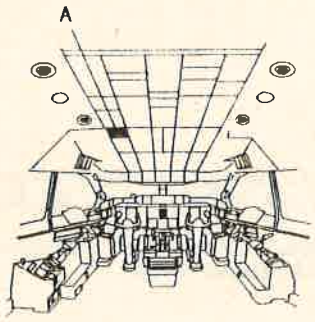
OPS.FCO.B1.0920.002-AA.001

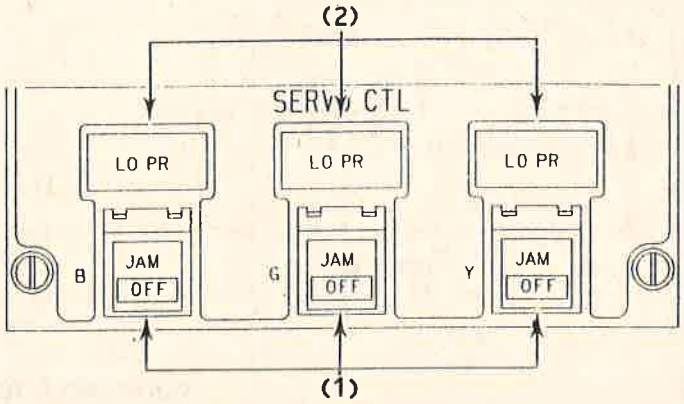
Vers. : All

Eng. : All

A. SERVO CTL PANEL

OPS.FCO.B1.0920.003-00.601





(1) SERVO CTL Pushbutton Switches

All these P/B switches are guarded.
These P/B switches control the servo shut-off valves for the individual hydraulic circuits BLUE, GREEN and YELLOW.

- **Normal**

  (P/B switch pressed-in): Hydraulic power is supplied to the corresponding users as soon as pressure is available in the corresponding hydraulic system (See Hydraulic Distribution).

- **OFF**

  (P/B switch released-out): The OFF light comes on white and the hydraulic power supply to the corresponding users is shut off.
  The associated JAM warning is inhibited and LO PR amber illumination confirms the OFF selection.

- **JAM**

  When a P/B switch is pressed-in, the associated JAM light comes on amber when a jamming is detected in the related hydraulic control valves of rudder, elevator, ailerons or trimmable horizontal stabilizer.
  Illumination of a JAM light is accompanied by ECAM activation. The jammed control is identified on the Warning Display.

R This jamming detection is inhibited as soon as one
R hydraulic system is not supplied.

(2) B, G, Y LO PR Lights

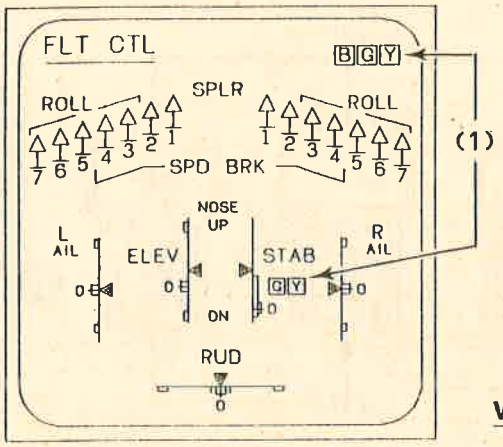
A light comes on amber when the flight control supply pressure in the corresponding hydraulic system has dropped (below 1450 psi) down-stream the servo control valve, or when the hydraulic supply has been shut off. Illumination of an amber LO PR light is accompanied by ECAM activation.

Notes: The SERVO CTL P/B switches positions and associated warnings are repeated on the ECAM hydraulic system page.

– To prevent inadvertent complete deactivation of servo controls, only two systems can be deactivated at a time by selection of SERVO CTL P/B switches to OFF.
When the third P/B switch is selected to OFF, all three systems are activated regardless of P/B switch setting.

Mod. : 5904

SYSTEM DISPLAY – FLT CTL PAGE

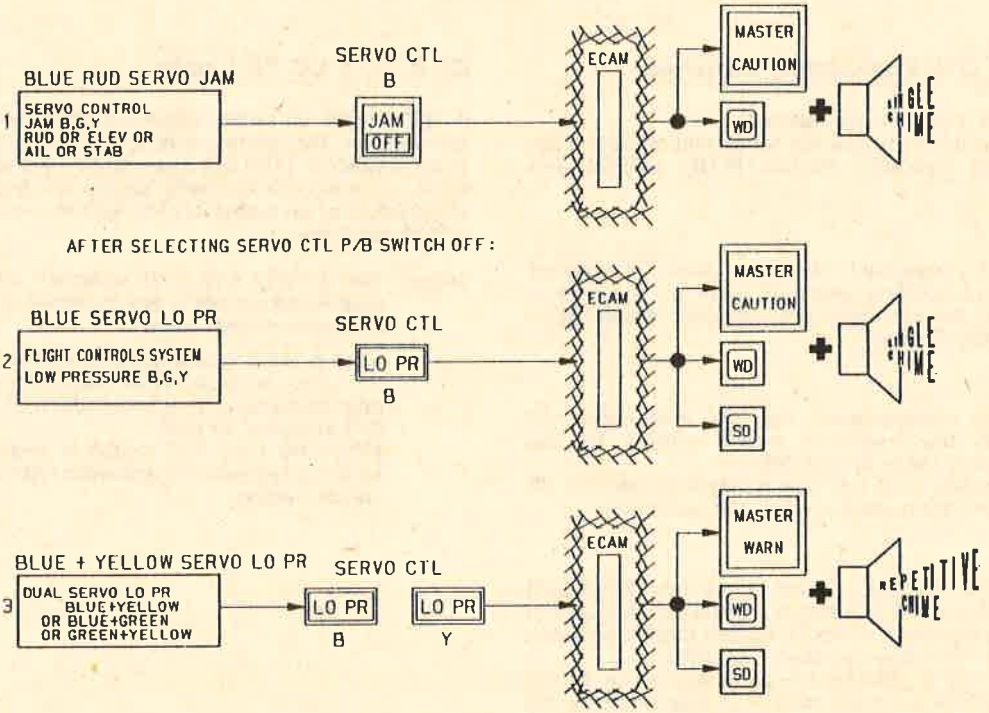


(1) B,G,Y Symbols

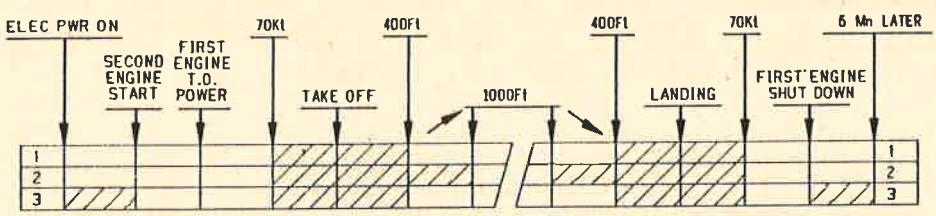
Each available system on the flight controls and trimmable horizontal stabilizer is indicated by a green symbol.

In case of servo control low pressure detection, the corresponding symbols become amber.

WARNING LOGIC



ECAM ▨ AUTOMATIC FLIGHT PHASE INHIBITION



R OPS.FCO.B1.0920.004-00.620

Mod. : 5051

The roll control surfaces on each wing are :

- one aileron powered by 3 servo controls
- 5 roll spoilers, each one powered by 1 servo control.

The spoiler system is supplied from two normal bus bars (28 V DC and 26 V AC). When the normal buses have been cut off, before landing, power is supplied again to two spoiler groups by pressing the LAND RECOVERY P/B switch on the overhead panel.

From the two interconnected control wheels, the roll inputs are transmitted to the ailerons by dual cable runs providing fail safe operation. In each wing the inputs are transmitted to a differential unit receiving additional inputs from :

- artificial feel unit
- aileron droop unit
- trim screw jack

In case of jamming in one control run, the interconnected spring strut can be compressed to permit operation of the other control run to the other wing. The pilot efforts required on the wheel is between 16 daN (34 lbs) and 40 daN (90 lbs). Spoilers control is still available but downgraded.

Each servo control linkage on the aileron includes a spring rod to protect it against a runaway if an input lever on one jack remains in the open position.

The artificial feel is provided by a spring loaded rod. The trim actuator is electrically signalled by a control on the center pedestal in the range of $\pm$ 7° of the aileron deflection. During cruise, the operational limit for aileron trim are $\pm$ 2°.

In order to improve the aerodynamic characteristics, a droop signal coming from the slats control system moves the ailerons downwards of 6.6° maximum when the slats are extended. R

The roll spoilers and speedbrakes are electrically signalled by two identical computers (EFCU-Electrical Flight Control Units) that elaborate the roll orders by processing the signals coming from the control wheels position transducers units.

Each computer is composed by two control units and two monitoring units. Each unit controls or monitors one group of surfaces. Each group is made of one or two pairs of servo controls (spoilers 2-3, spoilers 4-1, spoilers 6-7, spoilers 5).

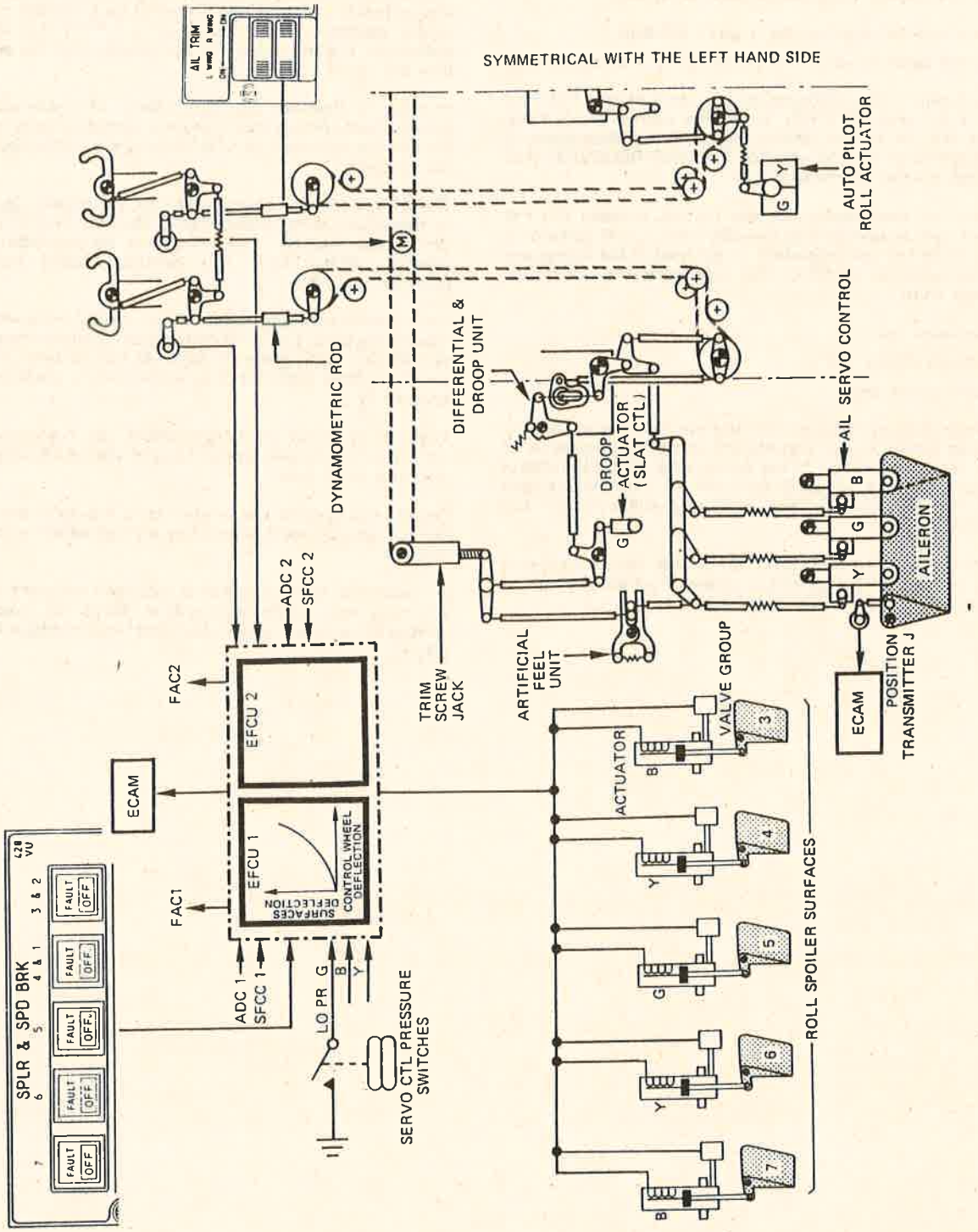
Thus, for a group of servo controls, the corresponding control unit is in one computer and the monitoring unit is in the other one.

For the roll spoilers the control laws are such that they are not usually used unless the control wheel is moved enough.

An autopilot servo actuator is mounted adjacent to the RH wing rear cable quadrant. It drives the complete control via a detent lever which can be overridden by the pilots.

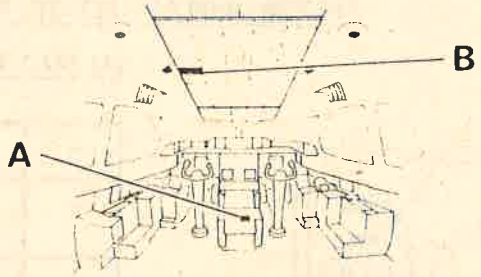
AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS ROLL CONTROL SCHEMATICS	R 1.09.30 PAGE 2 REV 08

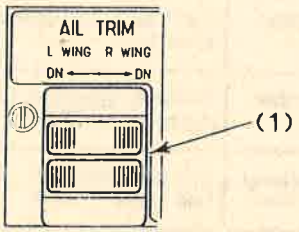
ROLL CONTROL

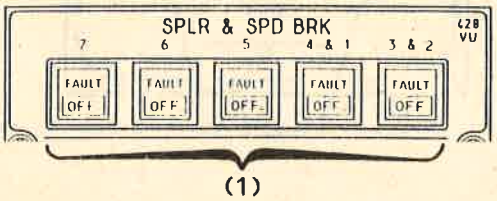


Vers. : All Eng. : All

A. AIL TRIM PANEL







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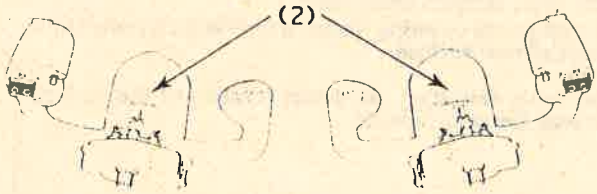


(1) AIL TRIM Switches

Ailerons trim control is electrically powered.

For safety purposes, both switches must be moved and held in the same direction (L WING or R WING) to energize the system. This action selects a constant speed displacement in the corresponding direction.

Full travel of about 7° of aileron in each direction is achieved at a speed of 0.4°/s.

(2) Aileron Trim Scales

A scale representing 14° aileron movement (7° in each direction) is engraved and painted on the top of each control column opposite a pointer painted on the control handwheel.

With the control handwheels released, the crew can thus read the actual aileron trim value.

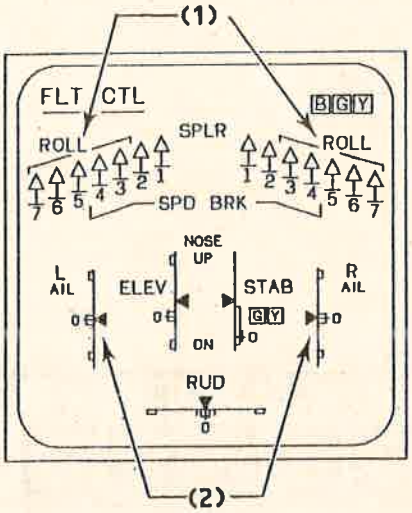
(1) SPLR & SPD BRK Pushbutton Switches

Each P/B switch is associated with one or two pairs of symmetrical upper wing surfaces.

- **On** (P/B switch pressed-in): The corresponding control system is activated. Each time a system is activated, or corresponding hydraulic system on, or the aircraft electrical network is energized, a 2s safety BITE test is triggered for the corresponding EFCU units (control and monitor).
- **OFF/R** (P/B switch released-out): The OFF/R light comes on white and the corresponding control system is deactivated. If hydraulic pressure is available, the actuators are automatically held in retracted position. The monitoring circuits are reset by this action. This indication is accompanied by ECAM activation.
- **FAULT**: When a P/B switch is pressed-in, the associated FAULT light comes on amber, if a failure is detected by the monitoring circuits which then deactivate the control system. Illumination of the FAULT light is accompanied by ECAM activation.

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS ROLL CONTROL ECAM	1.09.30 PAGE 4 REV 19 SEQ 020

SYSTEM DISPLAY – FLT CTL PAGE



(1) ROLL SPOILERS Position Indication

—	Green	Surface is retracted
—	Amber	Surface is retracted but a failure exists
▲	Green	Surface is deflected by more than 2°
▲ 4	Amber	Surface extended, failure detected by EFCU's
▲	Flashing Green	Surfaces extended, on ground, and speed ≥ 70 kt

R
R

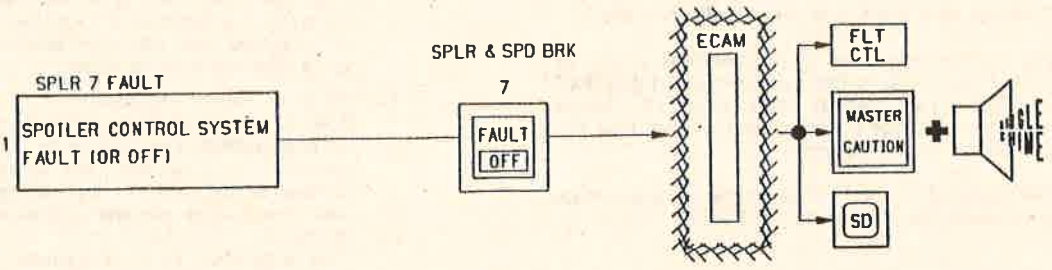
NOTE : Same indication is given on the WHEEL page.

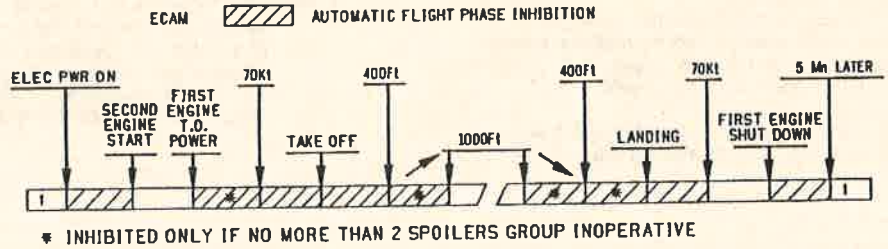
(2) AIL Position Indication

A white scale covering the full travel range is provided for each aileron surface.

An index indicating the actual position of the surfaces moves along each scale.

WARNING LOGIC





* INHIBITED ONLY IF NO MORE THAN 2 SPOILERS GROUP INOPERATIVE

PLN.FCO.B1.0930.004-00.020

Mod. : 5051

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS PITCH CONTROL DESCRIPTION	1.09.40 PAGE 1 REV 20 SEQ 030

The pitch control is achieved by two elevators hinged on the horizontal stabilizer, each actuated by three servo controls controlled by a dual mechanical linkage through dynamometric rods, cable runs, an artificial feel system linked to the cable run of the LH control column and load limiting rods.

In normal operation, the two elevators are controlled together.

Range of deflection is + 30°, − 15° when no AP is engaged and + 18°, − 9° otherwise.

In case of jamming in one control linkage during flight (take off excluded) pitch control is provided by THS (Trimmable Horizontal Stabilizer).

If jamming occurs at take off, two uncoupling bellcranks enable the elevator on the other side to be controlled by one or both pilots :

- first bellcrank installed downstream of the captain's control column which can be overridden by a pilot force of approximately 50 daN (112 lbs)
- second bellcrank installed between the two elevators.

A pitch uncoupling unit (locking rod plus solenoid) prevents accidental asymetrical deflection of the elevators during flight and allows uncoupling of the RH and LH control systems during take off (locked at speeds lower than 30 kt or higher than 195 Kt).

The artificial feel is provided by the associated action of :

- a double action spring loaded rod.
- a torsion bar driven by a variable gain mechanism which generates a variable stiffness in the control. The variable gain mechanism is actuated by either of two electrohydraulic actuators. Each actuator is controlled by an independent PITCH FEEL channel, each one included in a FLC (Feel and Limitation Computer).

Inputs are function of stabilizer position, airspeed, and mach number. In case of failure of two systems, the mechanism returns to the low speed position.

To warn in case of and to prevent too high angle of attack, pitch control is stiffened when angle of attack exceeds 17.5° with slats extended 15° or more.

In each run, downstream of the artificial feel system, a load limiting spring rod limits the efforts in the elevators control linkage.

A spring loaded rod on each servo control input avoids a runaway of the elevator in case of jamming of one input lever in the open position.

An autopilot actuator is mounted adjacent to the LH elevator. It drives the control via a detent lever which can be overridden by the pilots.

Pitch trim is provided by adjustment of the horizontal stabilizer from + 3° (nose down) to − 14° (nose up). It is actuated by a fail safe ball screw jack driven by two independent hydraulic motors supplied respectively by green and yellow systems and coupled by a differential gear through pressure-off brakes.

Horizontal stabilizer adjustment may be initiated :

- manually (AP disengaged) by trim wheels operation (mechanical mode) or by action of the control wheel rocking levers (electrical mode).
- automatically by AP trim, mach and Vc trim or alpha (angle of attack) trim function.

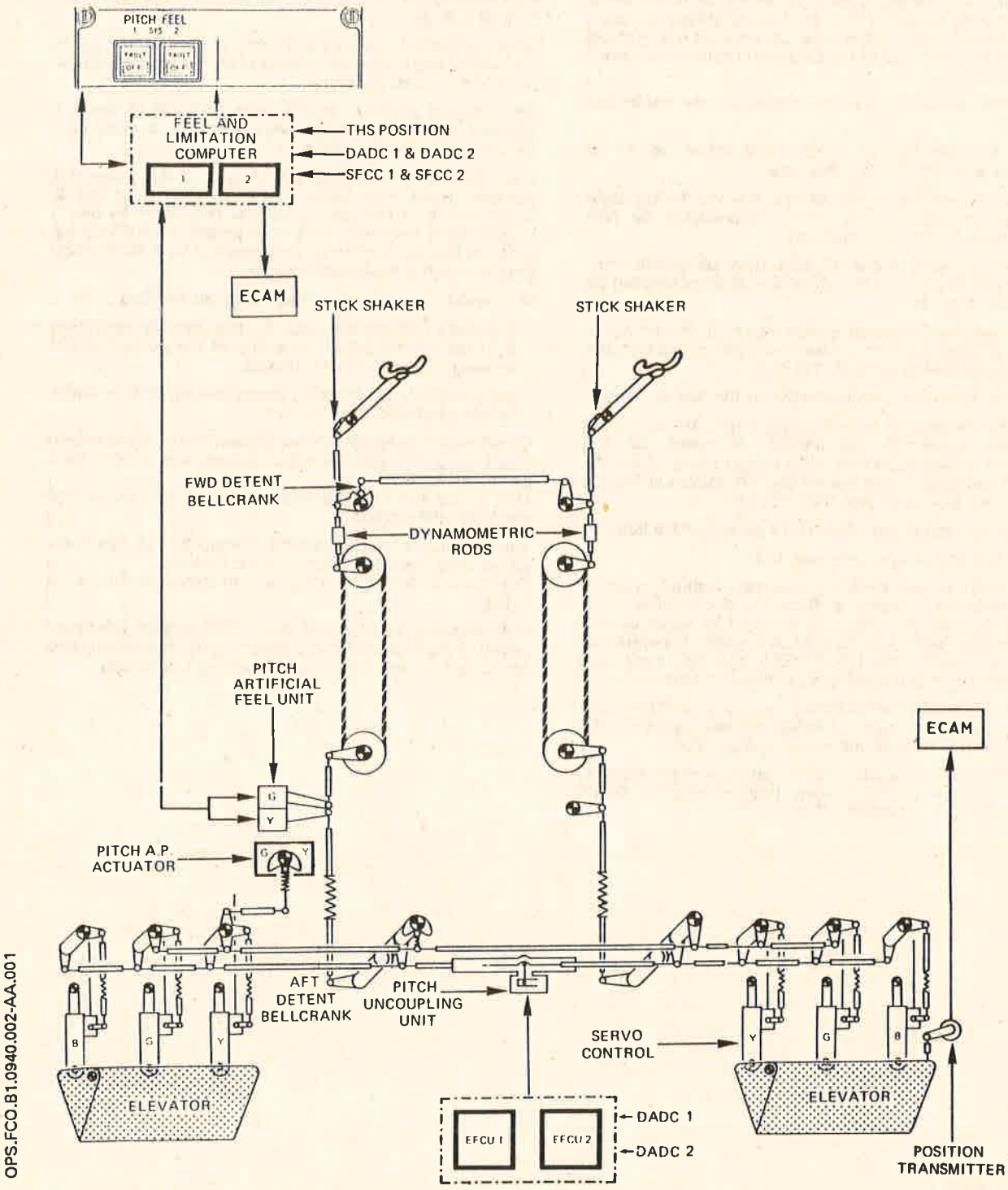
Electrical and automatic trim signals are processed in two FAC (Flight Augmentation Computers) and control two electrical motors.
Trim speed and trim authority depend on trim mode and aircraft configuration.

The motors drive the control linkage to the hydraulic valves which control the hydraulic motors.
The manual trim wheel run is connected to the same linkage.

Stall warning is provided by a stick shaker (electrical motor) which is installed on each control column, and controlled by the FWC (Flight Warning Computer).

Mod. : 5606

PITCH CONTROL

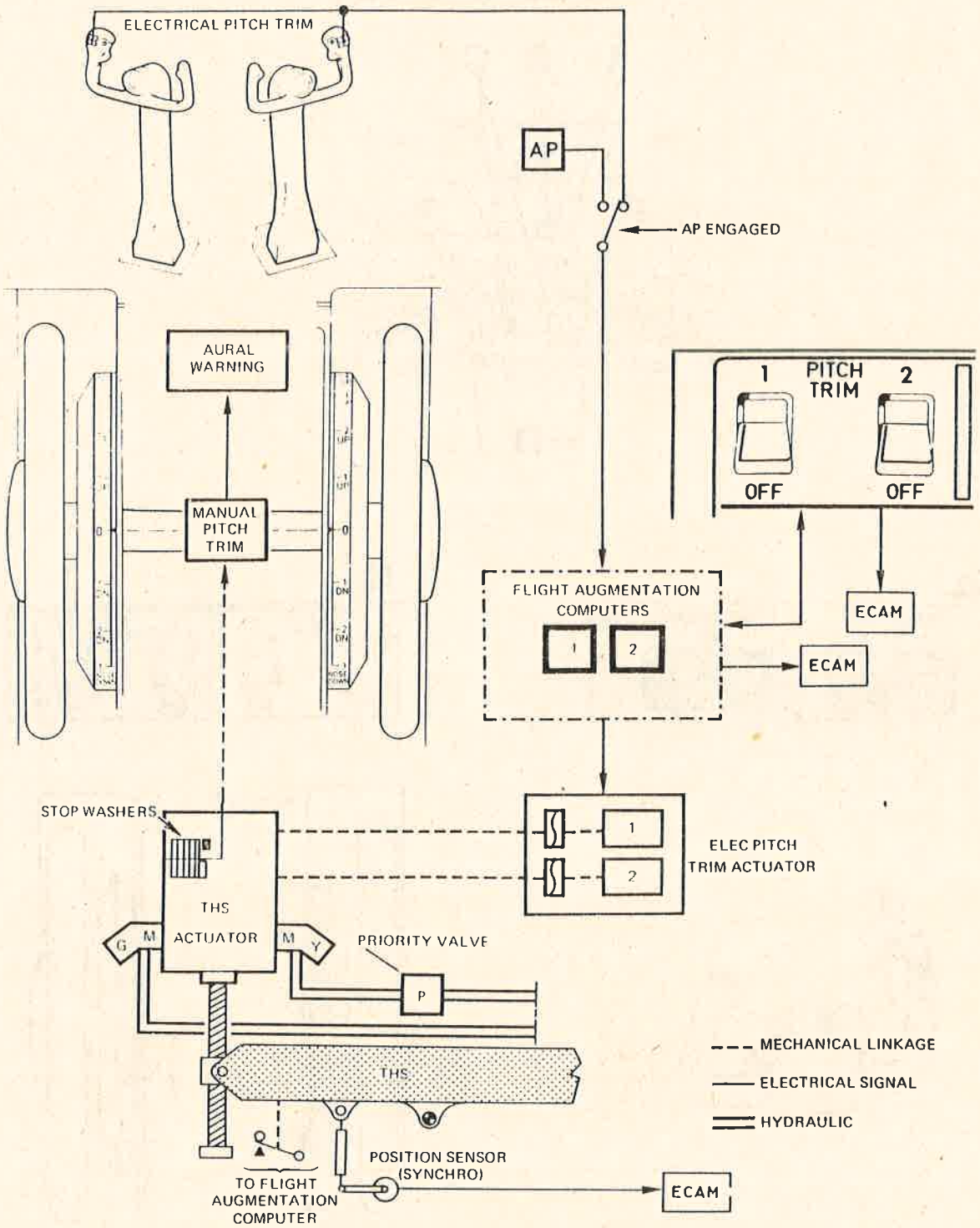


OPS.FCO.B1.0940.002-AA.001

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS PITCH CONTROL SCHEMATICS	R 1.09.40 PAGE 3 REV 08

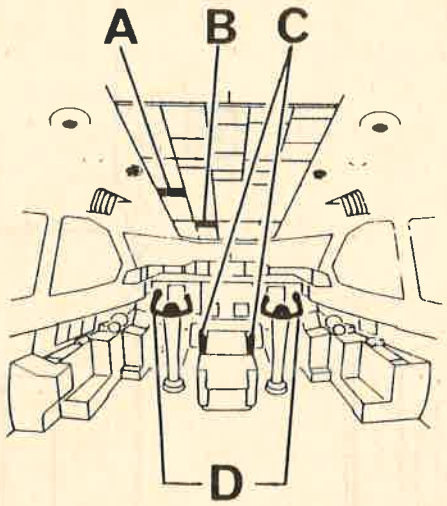
PITCH TRIM CONTROL



Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS PITCH CONTROL CONTROLS	1.09.40 PAGE 4 REV 14 SEQ 620

LOCATION OF CONTROLS



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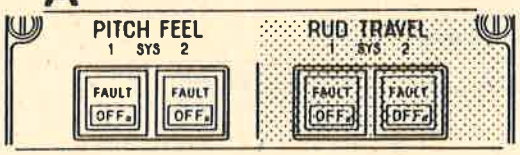

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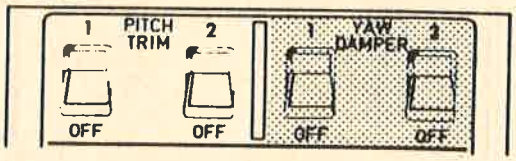

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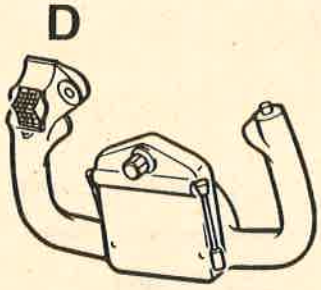

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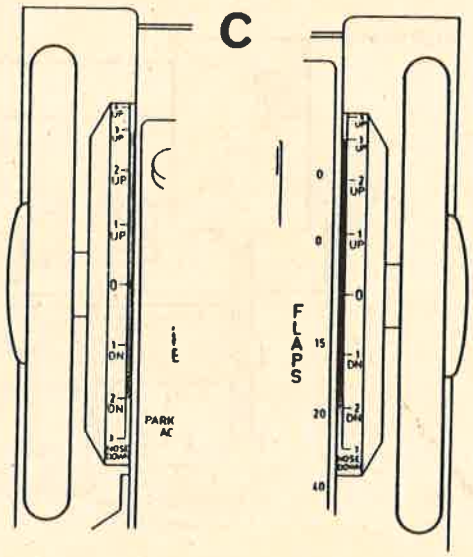
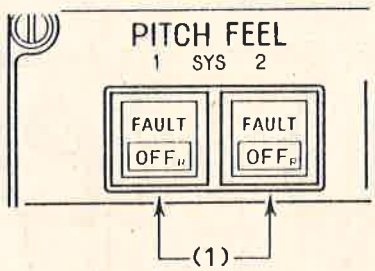


Mod. : 4801

A. PITCH FEEL CONTROL PANEL



(1) PITCH FEEL SYS 1 and 2 Pushbutton Switches

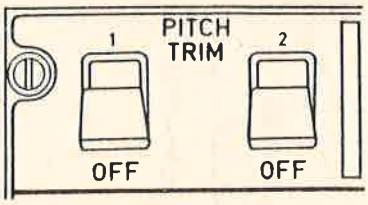
The P/B switches control the channels 1 and 2 of the Feel and Limitation Computers (FLC) for elevator control.

- **On** (P/B switch pressed-in) : The corresponding system is engaged. Both systems may be engaged simultaneously but only one is effectively operating.
  If one system fails, it is automatically deactivated and the other one continues to operate.
- **OFF/R** (P/B switch released-out) : The OFF/R light comes on white and the system involved is disengaged.
  The monitoring circuits are reset by this action.
  This indication is accompanied by ECAM activation.
- **FAULT** : When a P/B switch is pressed-in, the associated FAULT light comes on amber if a failure is detected in the corresponding system. Illumination of the amber FAULT light is accompanied by ECAM activation.

  Both FAULT lights remaining illuminated, when the P/B switches are released-out and the OFF/R lights are illuminated white, constitutes a pitch disagree warning (The artificial feel unit is operating in high speed configuration when flaps are extended 20° or more).

  Illumination of both FAULT lights is accompanied by ECAM activation.

B. PITCH TRIM 1 and 2 LEVERS



For description of electrical pitch trim, refer to Automatic Flight System.

- **1 (or 2)** : The lever is magnetically latched in the active position and the pitch trim 1 (or 2) is engaged. If a failure is detected, the corresponding PITCH TRIM lever trips to OFF.
- **OFF** : The respective pitch trim is disengaged.

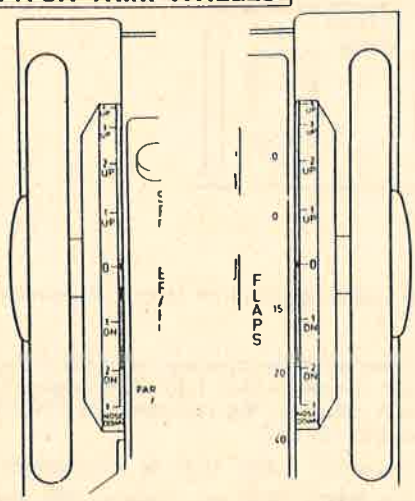
  . When one PITCH TRIM lever trips to OFF, the associated pitch trim system disengages and the ECAM is activated.

  . When both PITCH TRIM levers trip to OFF, all electrical control modes of the THS are lost and the ECAM is activated.

  Note : Pitch trim disengages and the levers trip to OFF, when trim reaches full nose up or full nose down position (mechanical stops).

R

C. PITCH TRIM WHEELS



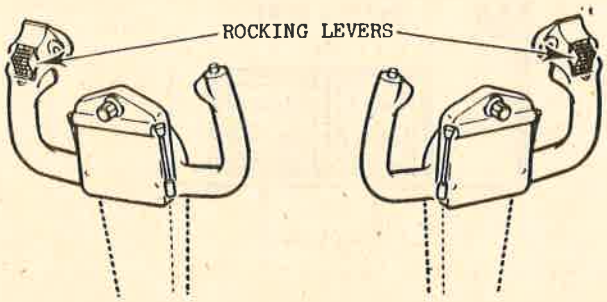
Both pitch trim wheels provide mechanical control of the Trimmable Horizontal Stabilizer (THS).

When a pitch trim control wheel is used to override the electrical command, it disengages the electric actuators and the PITCH TRIM levers trip to OFF.

The trim range is from 14° nose up to 3° nose down.

Trim position is indicated in degrees on a scale adjacent to each trim wheel which is painted green over the normal take off range (2° DN, 3° UP).

D. ROCKING LEVERS



On each control wheel, a rocking lever for pitch trim control is installed. Up or down movement of the rocking levers activates the two electric actuators which control the hydraulic motors for horizontal stabilizer adjustment providing that at least one PITCH TRIM system is engaged and AP is OFF or in CWS mode.

The rocking levers are spring loaded to neutral position.

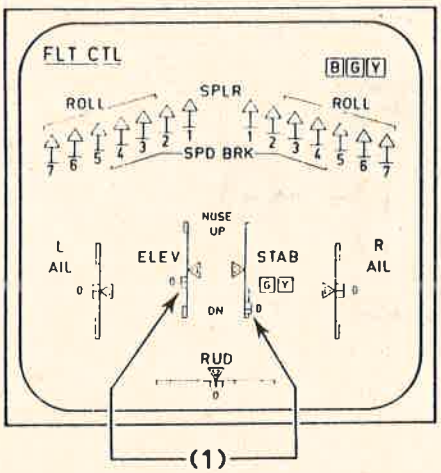
If both rocking levers are operated simultaneously, but in opposite position, trimming action stops.

If trimming by means of the rocking levers lasts for more than 1s, an aural warning, the « whooler » is activated.

Jamming of one of the microswitches activated by a rocking lever, resulting in a runaway, is overcome by selecting the same switch in opposite position. Trimming stops and the system disengages.

Note : The pitch trim rate is :
– 0.9°/s when the speed is below 200 kts.
– 0.17°/s when the speed is above 240 kts.
It varies linearly from 0.9°/s to 0.17°/s when the speed is between 200 and 240 kts.

SYSTEM DISPLAY - FLT CTL PAGE



(1) ELEV and STAB Position Indication

A white scale covering the full travel range is provided for elevator and trimmable horizontal stabilizer position.

An index indicating the actual position of the surfaces moves along each scale.

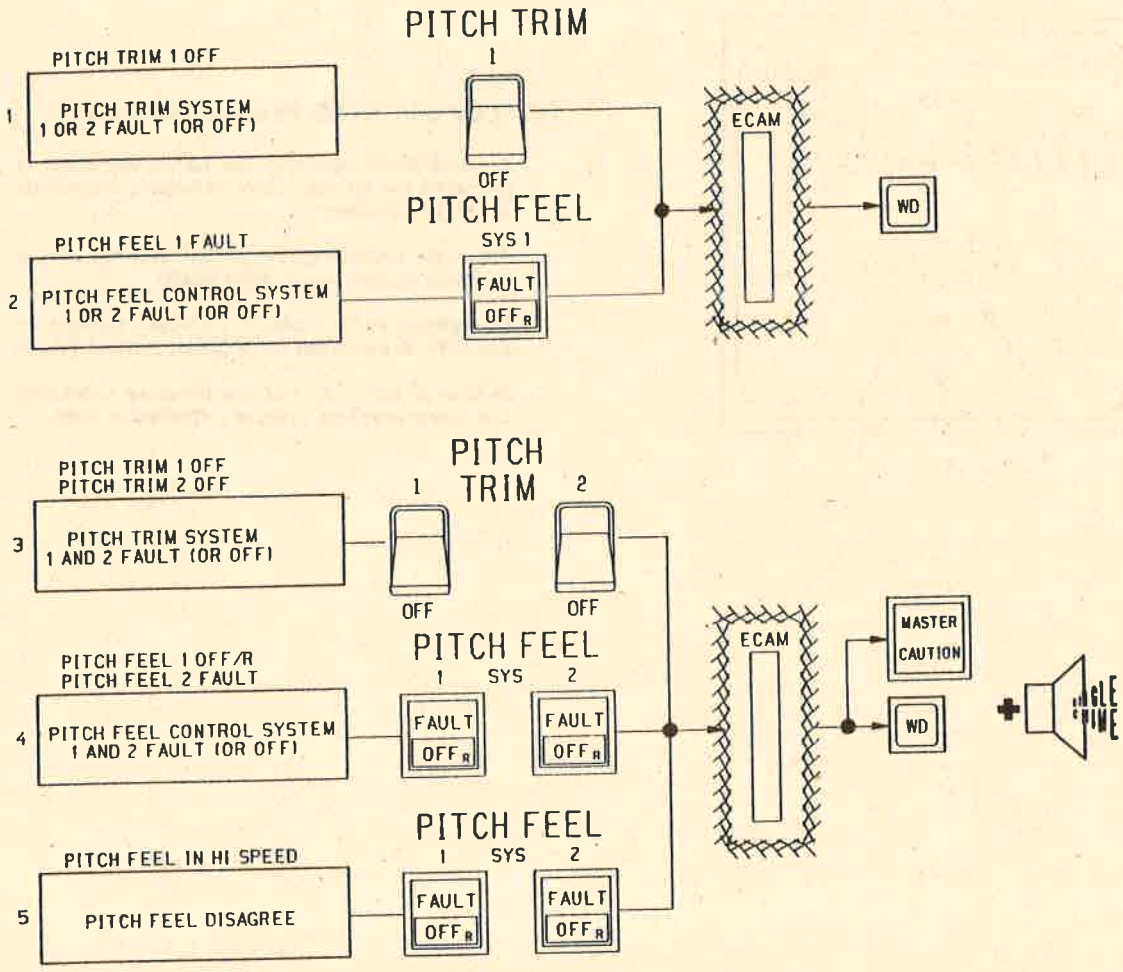
In addition each available hydraulic system on the THS is indicated by a green symbol (G, Y).

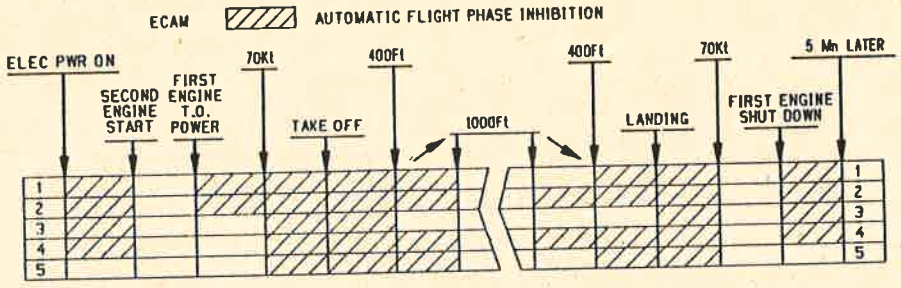
In case of servo control low pressure detection, the corresponding symbol becomes amber.

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS PITCH CONTROL ECAM	1.09.40 PAGE 8 REV 13 SEQ 620

WARNING LOGIC





Mod. : 5051

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS YAW CONTROL DESCRIPTION	1.09.50 PAGE 1 REV 19 SEQ 050

The rudder, operated by 3 servo controls mechanically controlled, receives pilot's inputs by a single cable run up to a spring loaded artificial feel unit connected to the trim screw jack.

From this point up to the servo controls the commands are transmitted by dual rigide linkage, receiving additional inputs from a rudder travel limiter, yaw damper and autopilot servoactuators.

The artificial feel is provided by a spring loaded rod.

R The trim actuator is electrically signalled. It is driven by
R an electrical motor. During cruise, the operational limit for rudder trim is ± 1.5°.

The rudder travel limiter reduces the pedals and rudder deflection from ± 30° at speed below 165 kt to ± 3.5° at 310 kt and above. The orders are delivered by two independent RUDDER TRAVEL channels, each one included in a digital computer (Feel and Limitation Computer) receiving inputs from the DADC's (Digital Air Data Computers) and the SFCC's (Slats Flaps Control Computers).

Each computer controls an electrical motor driving a common electromechanical actuator coupled to a variable stop lever.
Only one channel is normally active. The other is in standby.

A spring loaded rod positions the variable stop lever in the low speed position in case of dual failure.

An autopilot servo actuator is mounted adjacent to the artificial feel unit upstream of the variable stop lever. It drives the complete control via a detent lever which can be overridden by the pilot.

Yaw damper commands are transmitted via a differential unit cancelling a feedback to the pedals.

A spring loaded rod on each servo control input avoids a runaway of the rudder in case of jamming of one input lever in the open position.

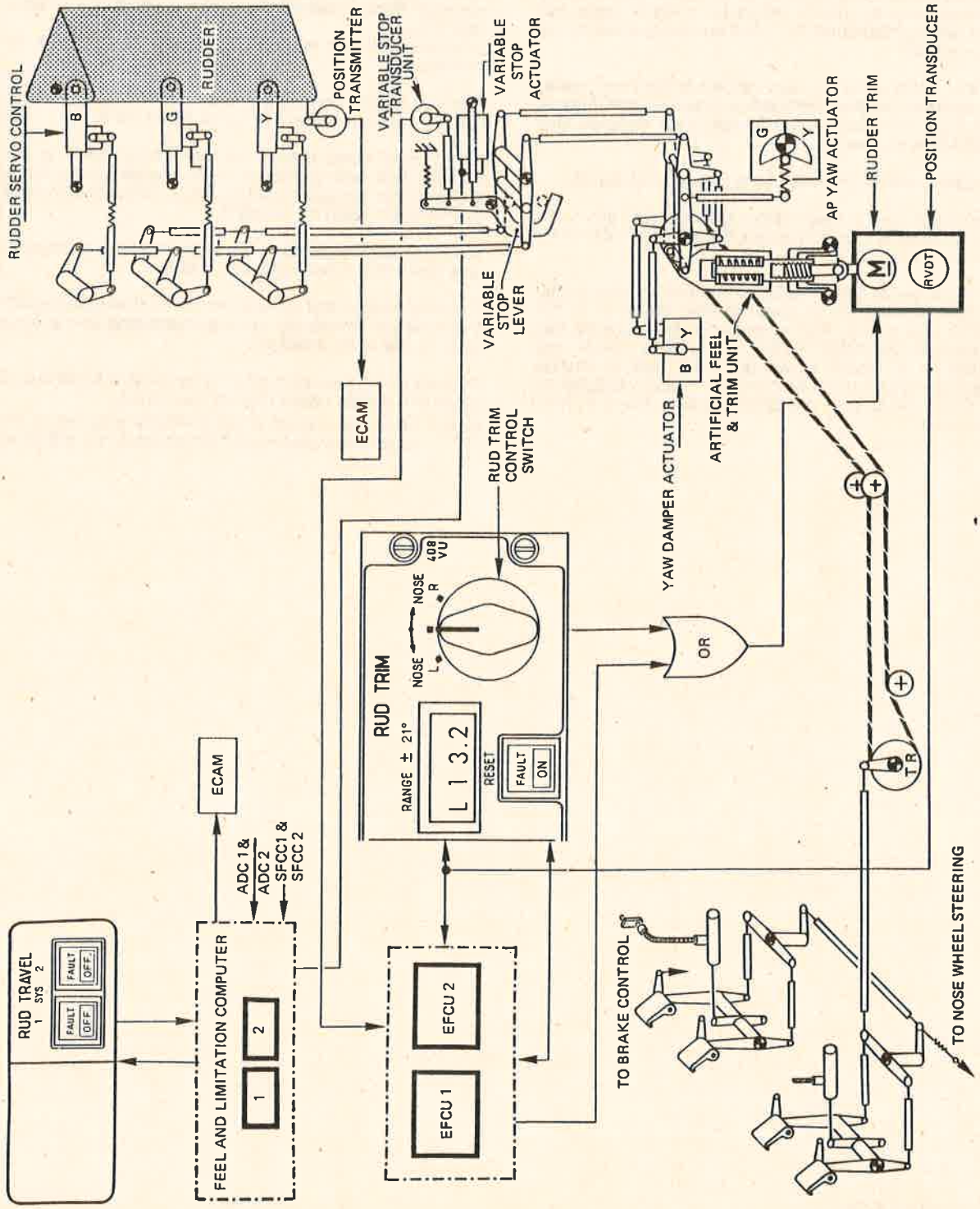
To each pedal, levers are attached to provide brake inputs when the pedals rotate around their pivots.

Note : The yaw control is hydraulically coupled to the nose wheel steering when this system is activated.

Mod. : 4744 + 5408

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS YAW CONTROL SCHEMATIC	R 1.09.50 PAGE 2 REV 08

YAW CONTROL

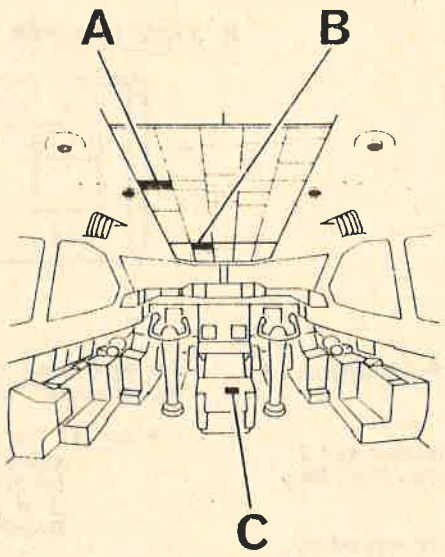


OPS.FCO.B1.0950.002-AA.001

Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS YAW CONTROL CONTROLS	N 1.09.50 PAGE 3 MAR 83

LOCATION OF CONTROLS



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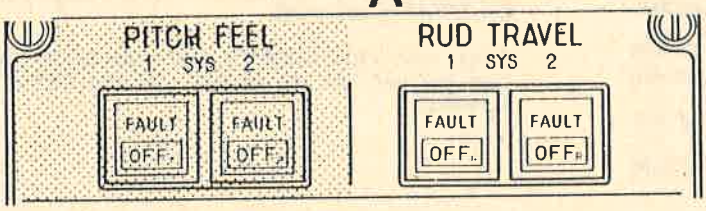

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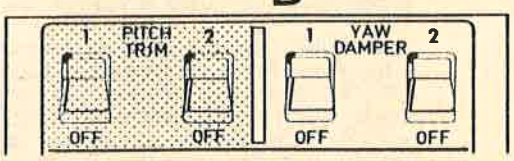

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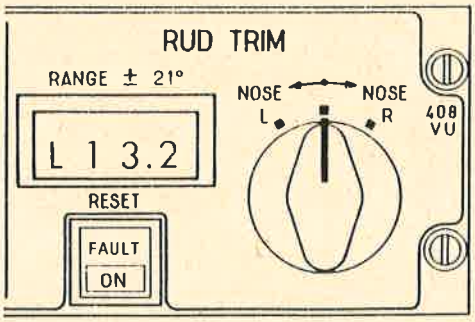
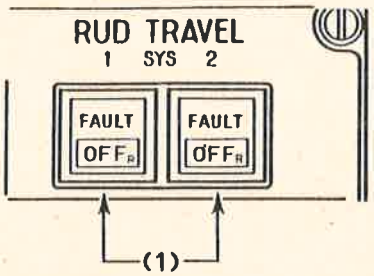


Vers. : All Eng. : All

A. RUD TRAVEL CONTROL PANEL



(1) RUD TRAVEL SYS 1 and 2 Pushbutton Switches

The P/B switches control the channels 1 and 2 of the Feel and Limitation Computers (FLC) for rudder travel limiting.

- **On** (P/B switch pressed-in): The corresponding system is engaged. Both systems may be engaged simultaneously but only system 1 is effectively active.
  If system 1 fails, it is automatically deactivated and system 2 becomes active.

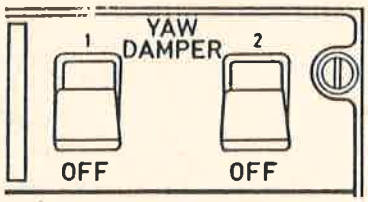
- **OFF/R** (P/B switch released-out): The OFF/R light comes on white and the system involved is disengaged.
  The monitoring circuits are reset by this action.
  This indication is accompanied by ECAM activation.

- **FAULT**: When a P/B switch is pressed-in, its FAULT light comes on amber if a failure is detected in the respective system.
  Illumination of the amber FAULT light is accompanied by ECAM activation.

  Both FAULT lights remaining illuminated, when the switches are released-out and the OFF/R lights are illuminated white, constitutes a rudder disagree warning (The variable stop lever is not in low speed position with flaps extended 20° or more).

  Illumination of both FAULT lights is accompanied by ECAM activation.

B. YAW DAMPER 1 and 2 LEVERS



For description of electrical yaw damper, refer to Automatic Flight System.

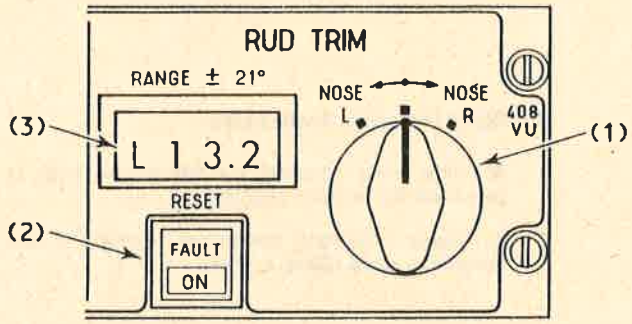
- **1 (or 2)**: The lever is magnetically latched in active position and the yaw damper 1 (or 2) is engaged.
  If a failure is detected, the YAW DAMPER 1 (or 2) lever trips to OFF.

- **OFF**: The respective yaw damper is disengaged.

When one YAW DAMPER lever trips to OFF, the associated yaw damper system disengages and the ECAM is activated.

When both YAW DAMPER levers trip to OFF, the yaw damper function is lost and the ECAM is activated.

C. RUD TRIM PANEL



(1) RUD TRIM Rotary Selector

Rudder trim control is electrically powered.
The rotary selector is springloaded to the neutral (center) position.
The direction of rudder trim travel depends on direction of rotary selector (NOSE L or NOSE R).

Full authority of rudder trim is about 21° in each direction.

(2) RESET Pushbutton Switch

R It allows initiation of an automatic sequence controlled by the EFCU's to position the rudder trim at 0° ± 0.2°.

- **ON (P/B switch pressed-in)**

  The ON light comes on white. The switch is latched during the reset action and will release out automatically when reset is achieved.

- **Normal (P/B switch released-out)**

  Automatically or manually, the reset action is stopped and the ON light goes off.

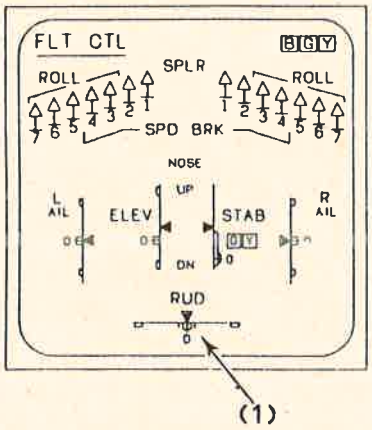
- **FAULT**

  The light comes on amber if a failure of the reset function is detected or if the actuator position transducer fails.

(3) RUD TRIM Position Indicator

A digital indicator displays rudder trim direction (L or R) and value (0° to 21°).

SYSTEM DISPLAY - FLT CTL PAGE

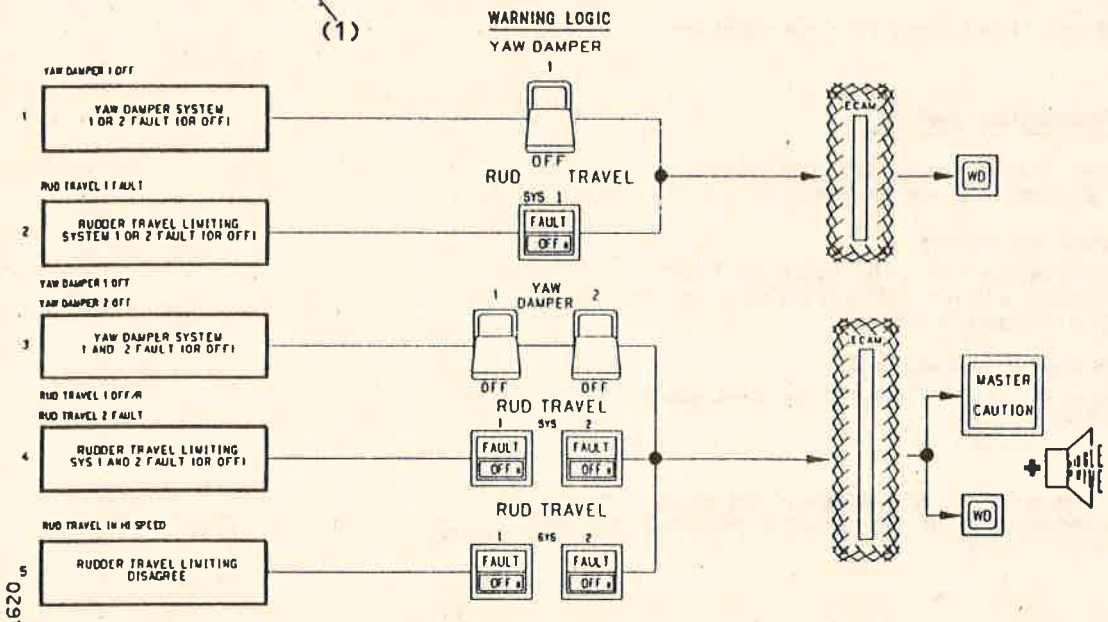


(1) RUD Position Indication

A white scale covering the full travel range is provided for rudder position.

An index indicating the actual position of the surface moves along a scale.

WARNING LOGIC



PLN.FCO.BI.0950.006-00.620

Mod. : 5051

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SLATS AND FLAPS DESCRIPTION	1.09.60 PAGE 1 REV 11

A single control lever located on the center pedestal permits slats and flaps control. The lever has five gated positions. It is not possible to select an intermediate position (If the lever is held in between gates the system drives to the last demanded position and after 10 sec all the slats and flaps FAULT warnings illuminate).

The slats and flaps are electrically signalled by two identical digital computers (Slats Flaps Control Computers). Each one is composed of one slats control channel and one flaps control channel.

Each hydraulic motor of slats and flaps power control units is controlled by consolidated orders simultaneously elaborated by two lanes in the involved channel.

To elaborate these orders, the computers receive :

- command sensor unit signals
- Power Control Unit position
- torque shaft wing tip position
- DADC signals
- shock absorbers position
- vanes and KRUGER position
- PCU (Power Control Unit) pressure switches signals.

SLATS

Each wing has three retractable slats.
The inner one is guided by three tracks and the center and outer slats are guided by four tracks.
Each movable section is actuated by two reversible recirculating ball screwjacks.

The power is supplied to the ball screwjacks by a torque shaft driven by a power control unit and protected by a system torque limiter for each wing.
Each ball screwjack has also its own torque limiter.
All these torque limiters include a latched lock-out indicator and in case of overload of a jack in the torque shaft system, they will freeze the system until a reverse selection is attempted.

In case of mechanical failure, there are pressure-on wing tip brakes located between the last two tracks on each wing. They are activated if a failure is detected by both control channels (asymmetry, overspeed or symetrical runaway). They cannot be released in flight (non volatile latches in the computers). Each brake is supplied by blue and yellow hydraulic circuits.

The power control unit consists of two independant hydraulic motors coupled to a differential mechanical system through pressure-off brakes that realise the system irreversibility. The two motors are supplied by different hydraulic circuits (green and blue).

As soon as an order is given, the corresponding computer of each motor sends signals to deliver the pressure to the motor, releases the involved pressure-off brake and controls the sense and speed of movement. When the selected position is reached, the systems are de-energized, applying the pressure-off brakes and stopping the movement.

In case of hydraulic failure, the corresponding motor remains locked by his brake and the operating speed of the slats is reduced by half due to the differential mechanism of the power unit gearbox. However, full torque is still available.
Four slats positions can be selected (0°, 15°, 20°, 30°) by the five positions control lever.

In addition, to obtain better aerodynamic characteristics, one KRUGER flap is provided on each wing and is located between the inner slat and the fuselage.
The KRUGER flaps are extended when the slats flaps control lever is moved from position 1 to 2 and remain extended for all other selected positions.
When slats 0° position is selected, the KRUGER flaps folds up under the leading edge.

Each KRUGER flap and AIL droop actuator is powered by an hydraulic jack supplied by the green circuit via an electrohydraulic selector controlled by the slats control system.

The KRUGER jacks are mechanically locked in retracted position and hydraulically locked in extended position. At speeds higher than 60 kt, and if the angle of attack is higher than 9°, the complete retraction of slats below 15° and KRUGER flaps, is automatically inhibited (alpha lock function).

FLAPS

Each wing has two flaps sections.
The inner ones are double slotted fowler type (with an extending leading edge vane) and the outer ones are single slotted fowler type (with no vane).

Each inner flap is guided by two tracks fitted with ball screwjacks and each outer flap is guided by three tracks fitted with ball screwjacks except for the central track.

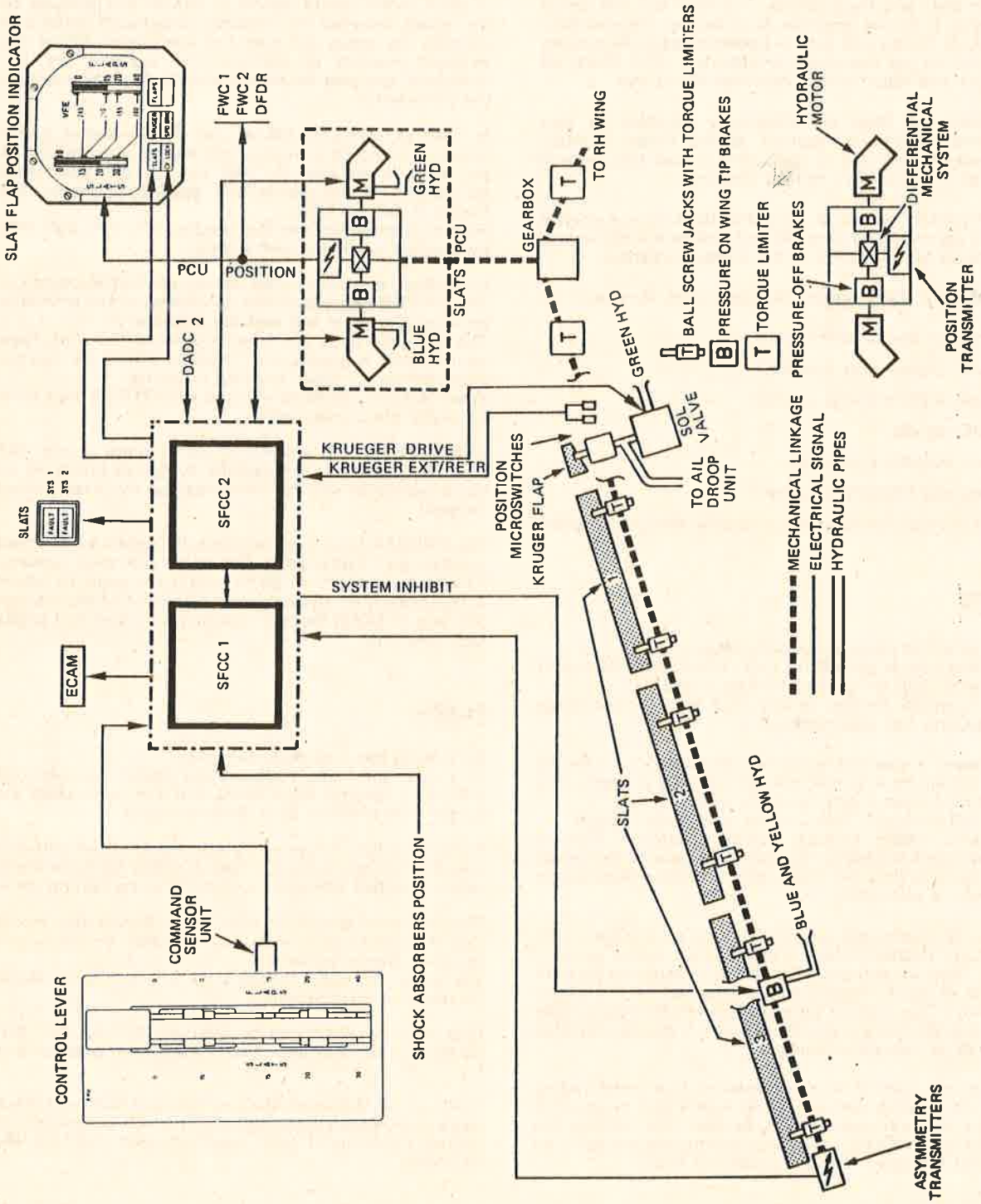
The flaps drive system is similar to the slats system except that the power unit motors are supplied by yellow and green hydraulic systems.
The vanes and outer central track jamming is monitored by mean of microswitches.

Four flaps positions can be selected (0°, 15°, 20°, 40°) by moving the slat flap control lever from position 2 to 5.

Furthermore, between the inboard and outboard flaps, there is an aileron droop signal unit which commands the aileron to droop of 6.6° maximum with KRUGER flap extension.

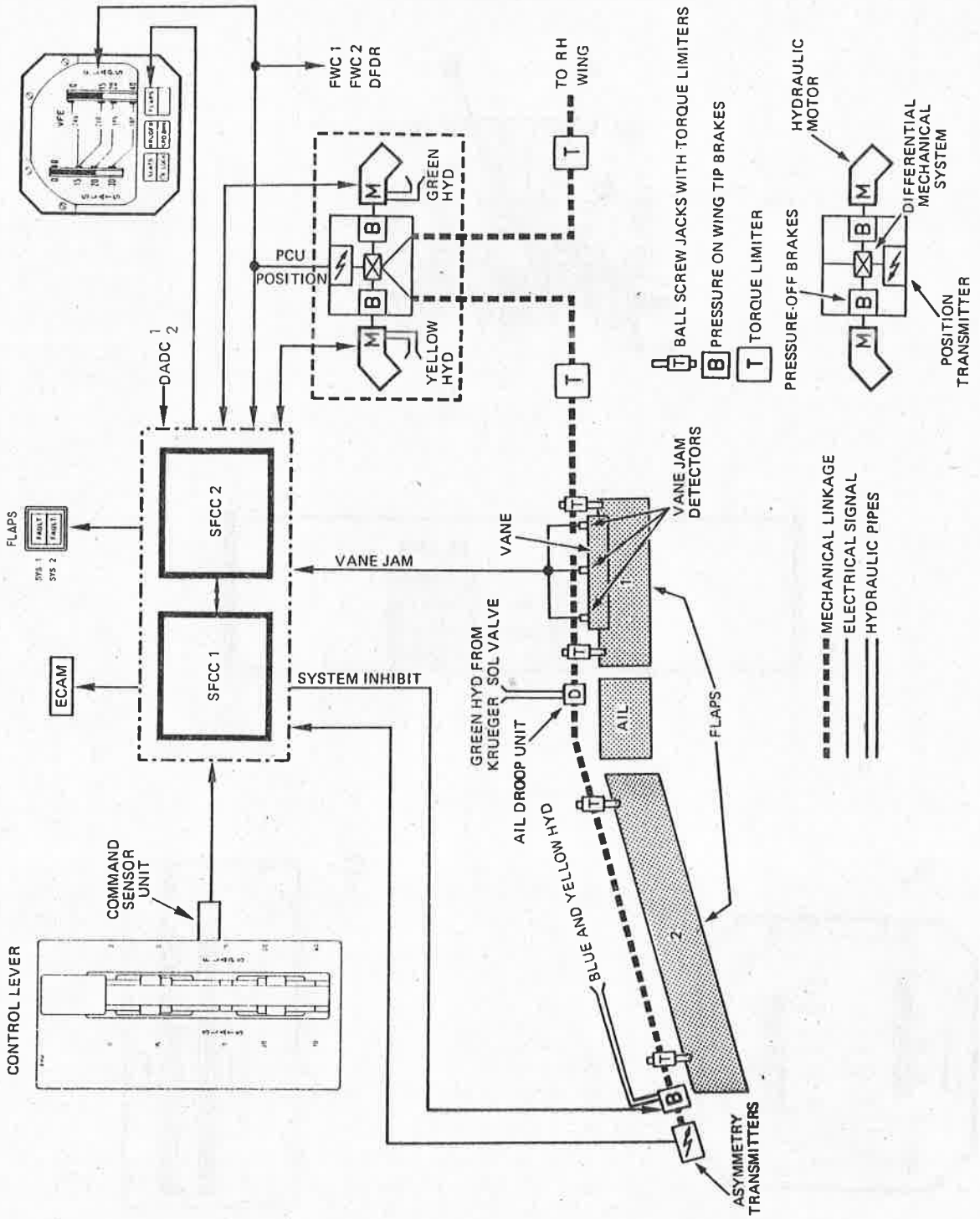
R
R
R

SLATS CONTROL



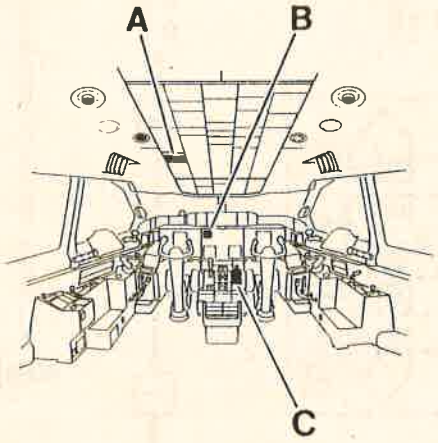
AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SLATS AND FLAPS SCHEMATICS	1.09.60 PAGE 3 REV 14 SEQ 601

FLAPS CONTROL



AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SLATS AND FLAPS CONTROLS	1.09.60 PAGE 4 REV 14 SEQ 601

LOCATION OF CONTROLS



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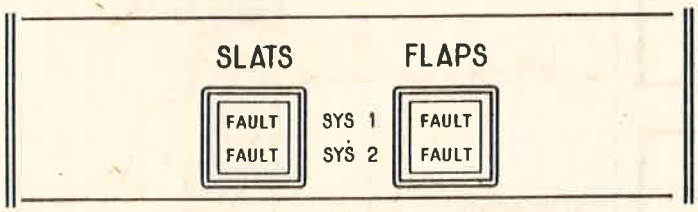

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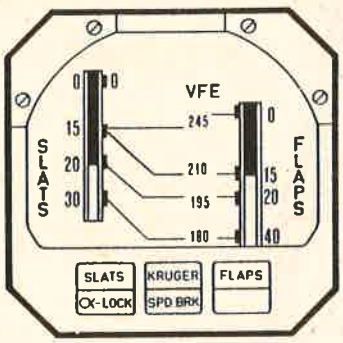

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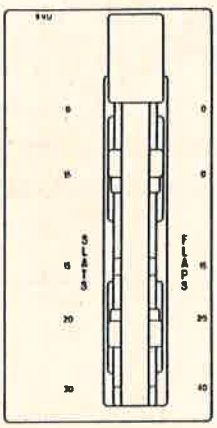
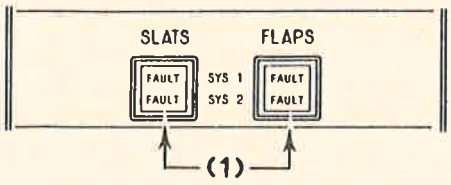


R
R
R

A. SLATS and FLAPS CONTROL PANEL



(1) SLATS (or FLAPS) SYS 1 and 2 FAULT Lights

Each light comes on amber when the associated hydraulic motor is inoperable.

Both SLATS (or FLAPS) FAULT lights will come on simultaneously if the slats (or flaps) stop due to a system or vane jam. In both cases, a reverse selection is possible. If system or vane jam is released, the system will move to the command position.

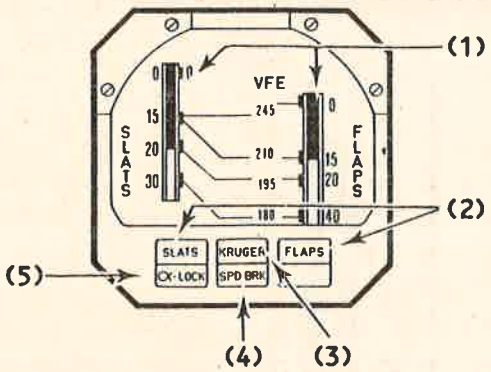
Both SLATS (or FLAPS) FAULT lights and the associated amber SLATS (or FLAPS) lights on the Slat Flap Position Indicator will come on simultaneously if a mechenical failure is detected.

In this case, the system is locked by the wing tip brakes and there is no possibility of recovery in flight.

Note : If a SFCC is not installed, the two associated FAULT light (one SLATS FAULT light and one FLAPS FAULT light) will come on.

Illumination of these lights is associated with ECAM.

B. SLATS / FLAPS POSITION INDICATOR



(1) SLATS/FLAPS Position Indicator Strips

Slats and flaps position is shown by white strips moving up and down associated scales. The corresponding VFE (speed limit) is placarded opposite each normal position (indicated by a round number).

(2) SLATS and FLAPS Lights

Come on amber when the wing tip brakes of the associated system are locked. Illumination of these lights is accompanied by both amber FAULT lights of the corresponding channels on the control panel, and ECAM activation.

(3) KRUGER Light

Comes on amber if either KRUGER flap is not in correct position 10s after a movement command.
Illumination of KRUGER light is accompanied by ECAM activation.

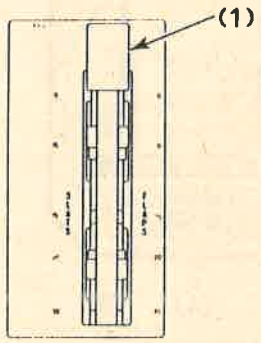
(4) SPD BRK Light

The light comes on blue when the speedbrake control lever is not in RET position.

(5) α-LOCK Light

Flashes blue when the slats α lock function is activated (inhibition of complete slats and KRUGER flap retraction at high angle of attack).

C. SLATS and FLAPS CONTROLS



(1) Slats and Flaps Control Lever

The lever controls simultaneously the operations of slats, flaps and KRUGER flaps.

Five gated positions correspond to the following configurations.

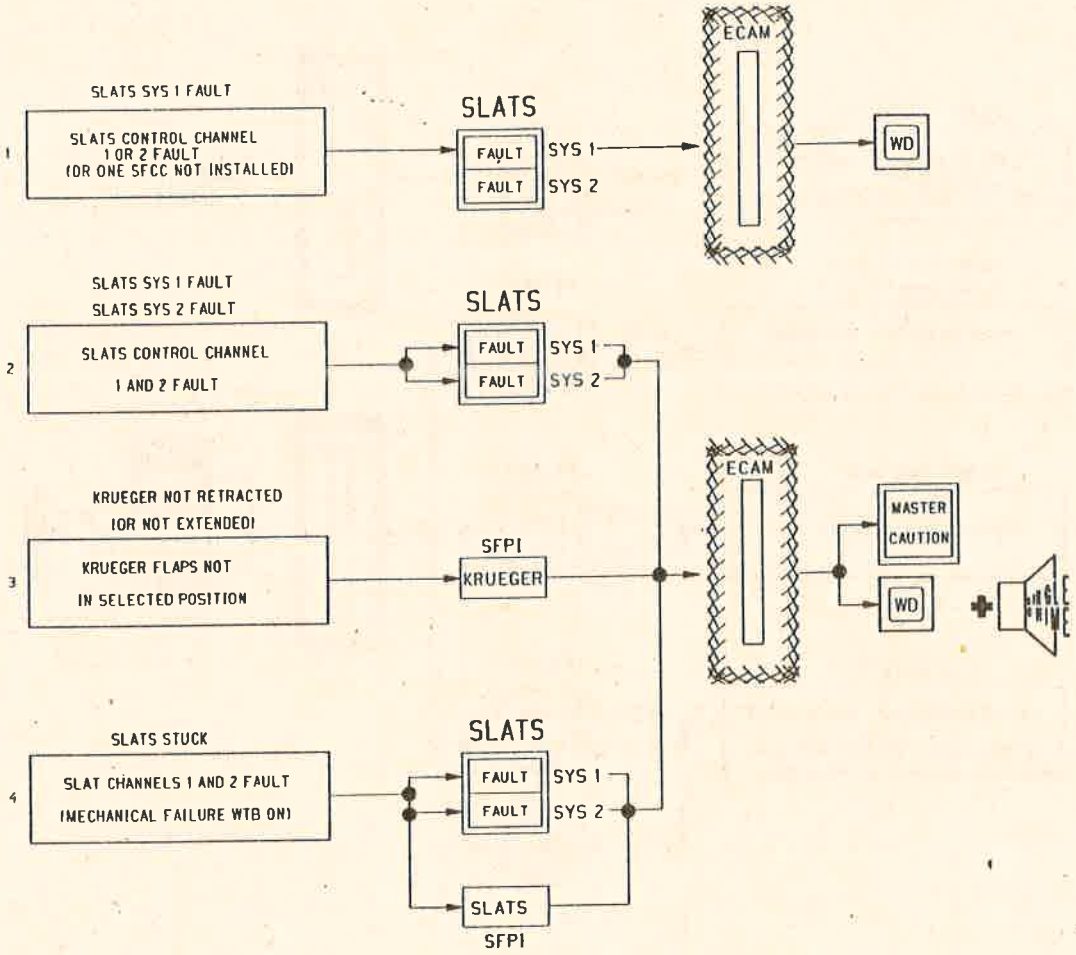
Position Sequence	SLATS (outer, center)	SLATS (inner)	FLAPS (outer)	FLAPS (inner)	KRUGER
1(0/0)	0°	0°	0°	0°	Retracted
2(15/0)	17°	16°	0°	0°	Extended
3(15/15)	17°	16°	8°	15°	Extended
4(20/20)	21°	20°	16°	22.1°	Extended
5(30/40)	25.4°	24°	31.5°	41°	Extended
( ): Number indicated on the SFPI					

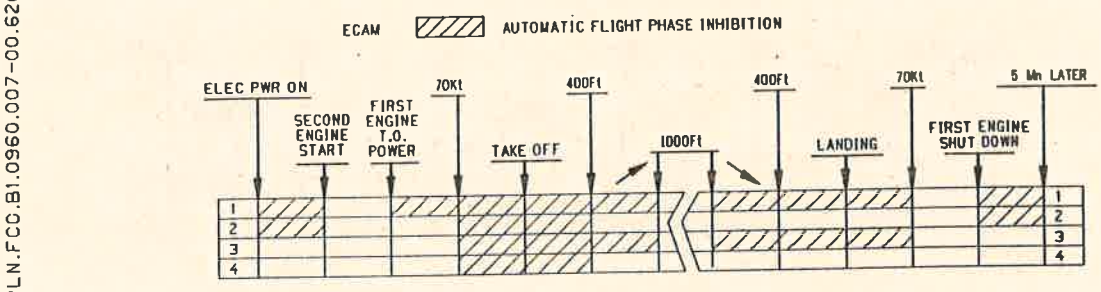
Before selection of any position, the slats/flaps control lever must be pulled up. A baulk is provided for positions 2 and 4 to prevent the lever moving straight through.

Note: All slats and flaps FAULT lights will illuminate if control lever remains between two gated positions (after 10s).

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SLATS AND FLAPS ECAM	1.09.60 PAGE 7 REV 13 SEQ 620

WARNING LOGIC





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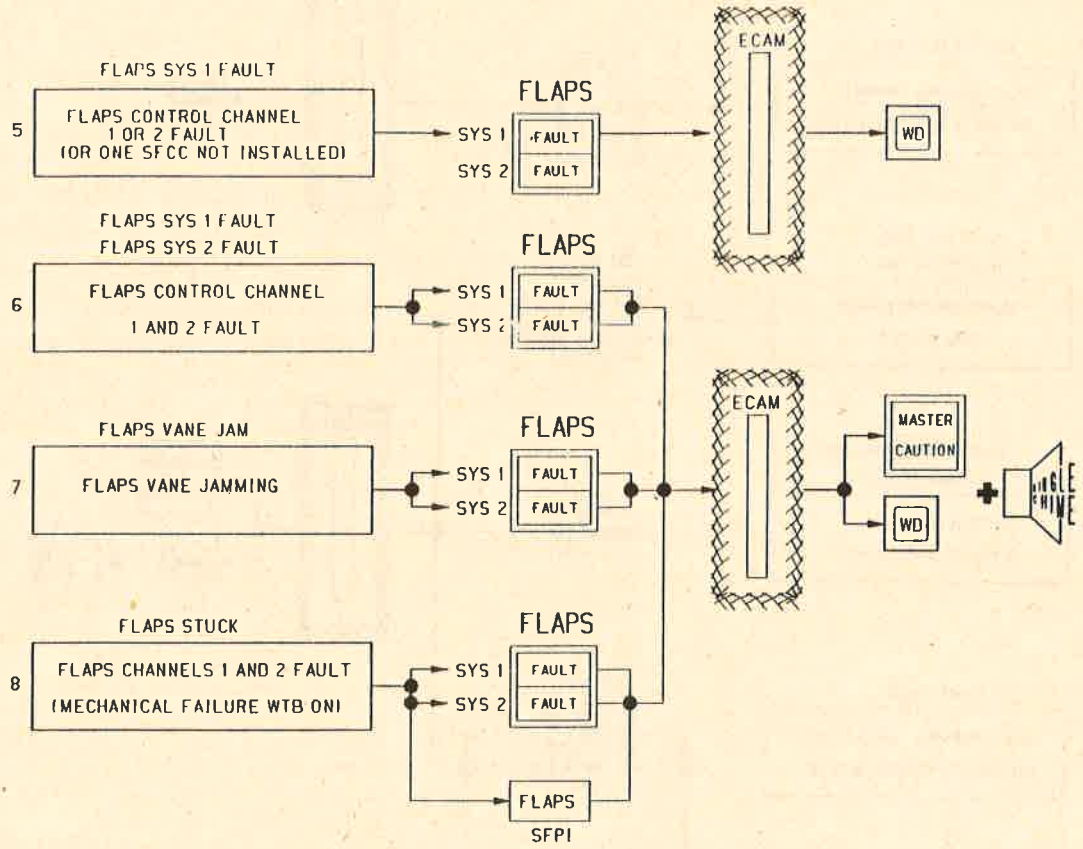
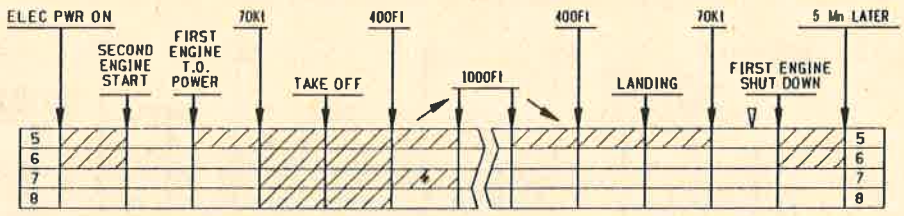
Mod. : 5051

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SLATS AND FLAPS ECAM	1.09.60 PAGE 8 REV 13 SEQ 620

WARNING LOGIC (Cont'd)



ECAM AUTOMATIC FLIGHT PHASE INHIBITION



* INHIBIT ONLY DURING EXTENSION

PLN.FCO.B1.0960.008-00.620

Mod. : 5051

SPEEDBRAKES

There are two inner and two outer speedbrakes located on the upper surface of each wing.
The outer speedbrakes are also used as roll spoilers.

They are selected by a lever situated on the center pedestal. Eleven positions can be selected from RET (retracted) to FULL (fully extended) position.

R Maximum deflection is :
R – 45° for outer airbrakes
R – 20° for inner airbrakes

Each speedbrake element is powered by one servo control which receives pressure from an electro-hydraulic valve group controlled by the corresponding units of the EFCU'S (Electrical Flight Control Units) also used for roll spoilers control.

« SPEED BRAKES EXTENDED » indication is given on the ECAM MEMO page.

GROUND SPOILERS

R Speedbrakes and roll spoilers surfaces are used on the ground as ground spoilers. Deflection angles become 50° for all surfaces.

They are automatically extended when :
– they are selected.
– the aircraft is on the ground.

The ground spoilers are selected when the two following conditions are fulfilled :
– SPEED BRAKE control lever pulled upwards (when it is in RET position) or thrust reverser selected on one engine
and
– both engine throttle levers in idle position. R

Ground spoilers will remain extended during bounces as long as both throttles are in the idle position and the SPEED BRAKE control lever is pulled up. R R

Ground spoiler retraction after landing is achieved :
– either by pressing the SPEED BRAKE control lever down (preselection cancellation),
– or by moving one throttle lever out of the idle position.

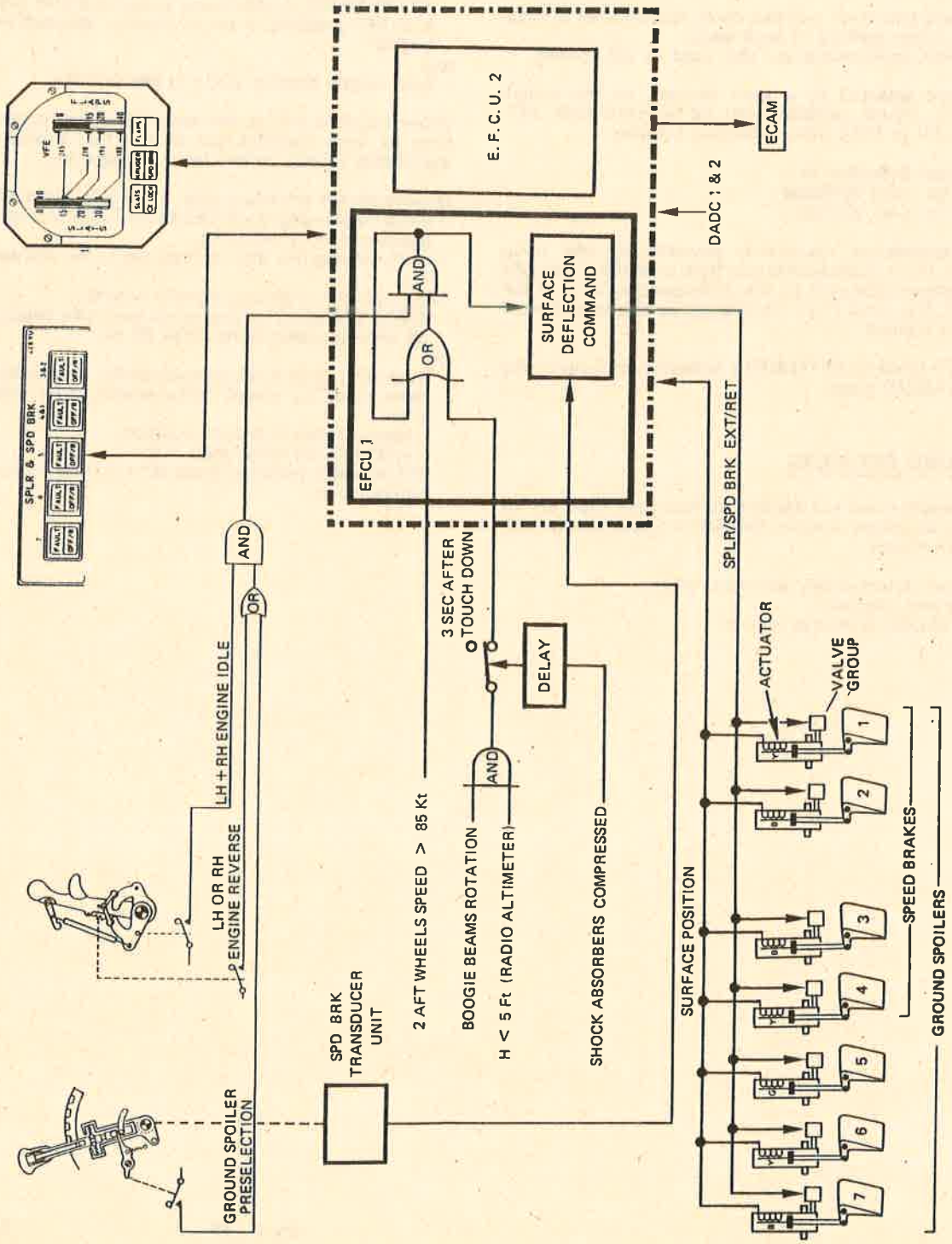
The « aircraft on ground signal » is sent : R
– during take-off or landing when two main landing gear aft wheels speed higher than 85 kt R R R
or
– at landing, only if the ground spoiler preselection has been made by speed brake control lever selection, when : R R R
. boogie beam in ground position, R
. radio altitude lower than 5 ft R
This signal is inhibited 3 sec after first shock absorber compression. R R

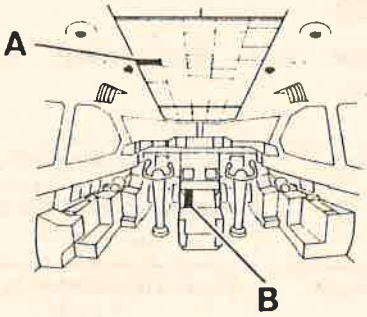
Vers. : All Eng. : All

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SPEEDBRAKES AND GROUND SPOILERS SCHEMATIC	1.09.70 PAGE 2 REV 14 SEQ 601

R
R
R

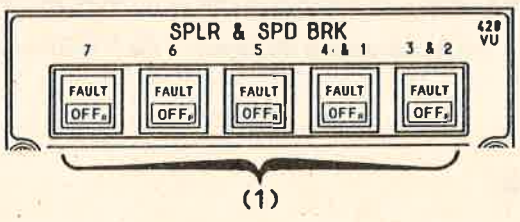
SPEEDBRAKES AND GROUND SPOILERS CONTROL





A. SPLR & SPD BRK CONTROL PANEL

FB1.0970.003-AA.001



(1) SPLR & SPD BRK Pushbutton Switches

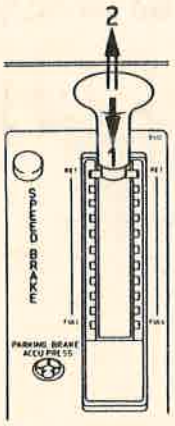
Each P/B switch is associated with one or two pairs of symmetrical upper wing surfaces.

- On (P/B switch pressed-in): The corresponding control system is activated. Each time a system is activated, or corresponding hydraulic system on, or the aircraft electrical network is energized, a 2s safety BITE test is triggered for the corresponding EFCU units (control and minotor).

- OFF/R (P/B switch released-out): The OFF/R light comes on white and the corresponding control system is deactivated. If hydraulic pressure is available, the actuators are automatically held in retracted position.
  The monitoring circuits are reset by this action.
  This indication is accompanied by ECAM activation.

- FAULT: When a P/B switch is pressed-in, the associated FAULT light comes on amber, if a failure is detected by the monitoring circuits which then deactivate the control system.
  Illumination of the FAULT light is accompanied by ECAM activation.

B. SPEEDBRAKE LEVER



The lever controls:
- the position of the speedbrake surfaces eleven positions from retracted (RET) to fully extended (FULL).

- manual preselection of the ground spoiler function.

. Speedbrake selection (1)

To select the speedbrake surfaces to the required position, the pilot must press on the top of the lever and move it to the corresponding notch.

The control lever cannot be moved as long as the ground spoiler function is preselected.

. Ground spoiler operation (2)

To arm the ground spoiler function, the control lever must be lifted when in retracted position (RET).

When the control lever is lifted or reverse thrust is selected on one engine, all the roll spoiler and speedbrake surfaces will extend if all the other logic conditions are achieved:

- both engine throttle control levers at idle position

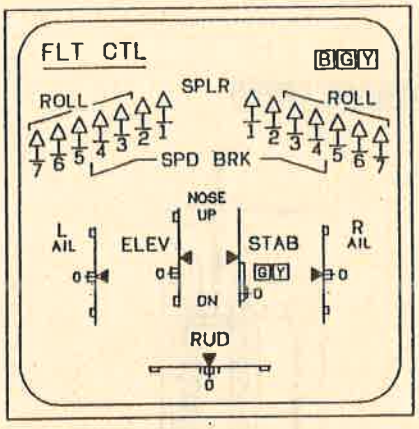
- aircraft on ground logic fulfilled:
  . aft wheels speed higher than 85 kt.
  . or bogie beams movement (valided by a logic).

Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS SPEEDBRAKES AND GROUND SPOILERS ECAM	1.09.70 PAGE 4 REV 19 SEQ 020

SYSTEM DISPLAY – FLT CTL PAGE

(1) SPD BRK and GND SPLR Position Indication



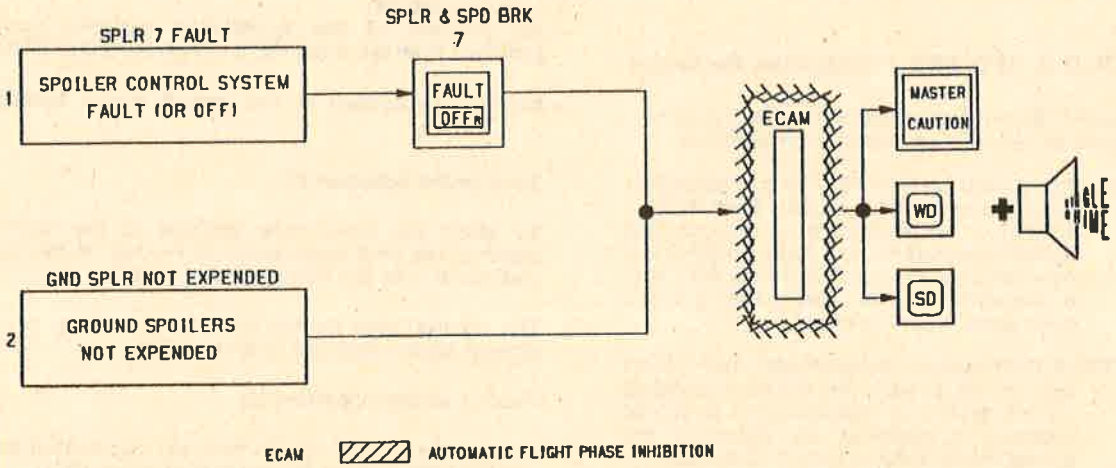
(1)

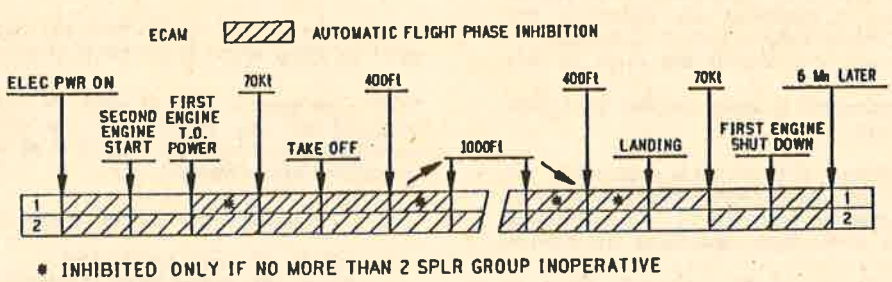
—	Green	Surface is retracted
—	Amber	Surface is retracted but a failure exists
1	Green	Surface is deflected by more than 2°
4	Amber	Surface extended, failure detected by EFCU's
1	Flashing Green	Surfaces extended on ground, and speed ⩾ 70 kt

R
R

Note : Same indication is displayed on the WHEEL page.

WARNING LOGIC





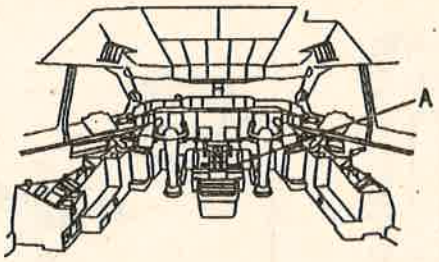
* INHIBITED ONLY IF NO MORE THAN 2 SPLR GROUP INOPERATIVE

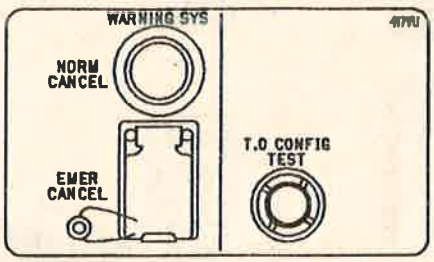
OPS.FCO.B1.0970.004-00.020

Mod. : 5051

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS TAKE OFF CONFIGURATION TEST CONTROLS	1.09.80 PAGE 1 REV 22 SEQ 100

A. T.O CONFIG TEST PUSHBUTTON





T.O CONFIG TEST pushbutton is pressed and held to activate take off configuration test.

R If the aircraft is at Take off configuration, the test will
R activate «NORM for T.O.» message on ECAM.

This test will activate the appropriate warnings if the aircraft is not at take-off configuration, during phases 1 and 2 (from ELEC PWR ON to first engine take-off power).

The warnings are cancelled when the pushbutton is released.

Flight Controls conditions for warning and resultant warnings are :

- HORIZONTAL STABILIZER is not in Take Off Configuration (> 3.5° UP or > 2.3° DN)
  MASTER WARNING light comes on with associated CRC and ECAM activation.
- SLATS or FLAPS are not in Take Off Configuration (not at 15° or 20°). KRUGER position is not monitored.
  MASTER WARNING light comes on with associated CRC and ECAM activation.
- SPEEDBRAKES or GROUND SPOILERS are extended.
  In this case, illumination of the blue SPD BRK light on SFPI is accompanied by MASTER WARNING light with associated CRC and ECAM activation.

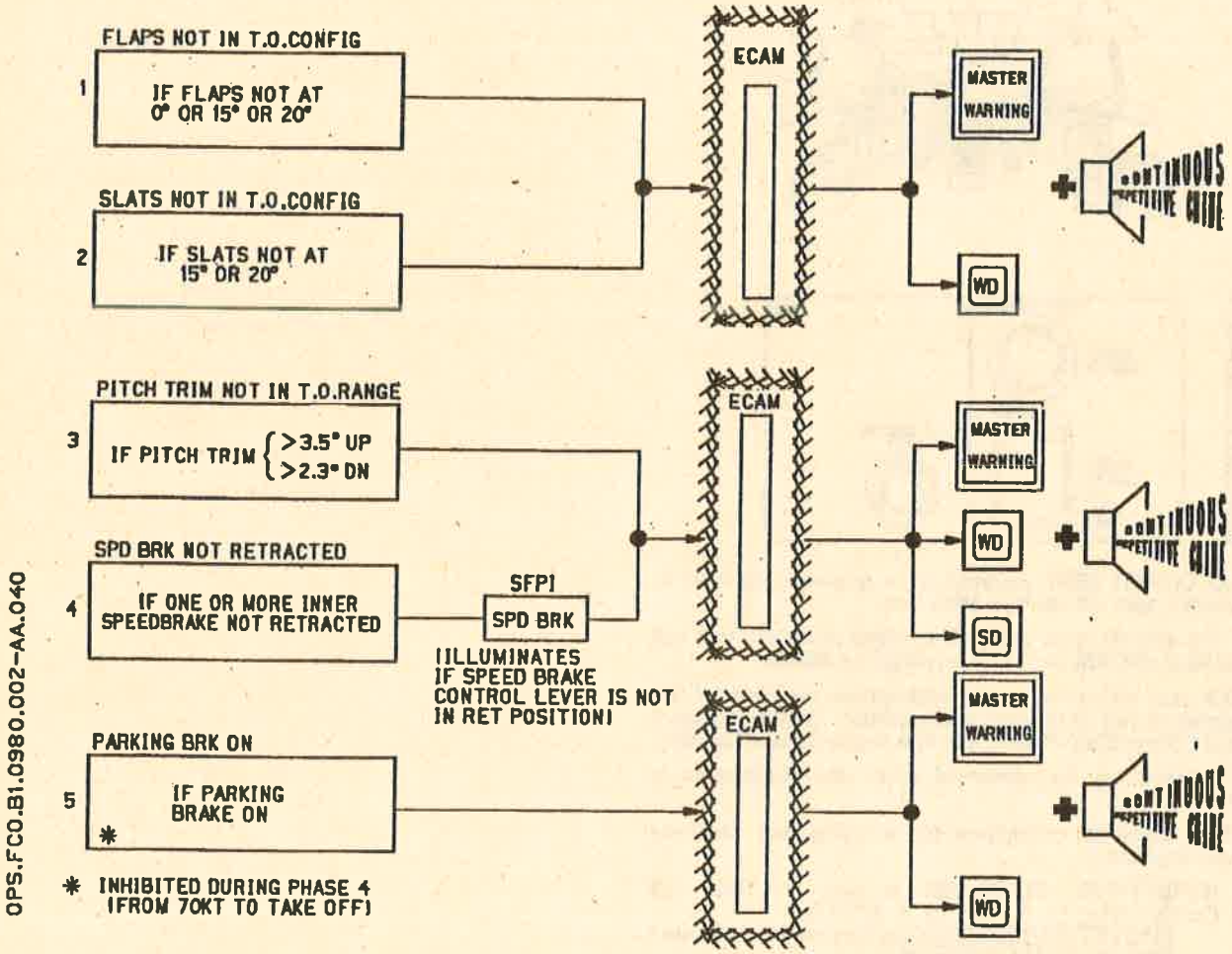
Pressing T.O CONFIG TEST pushbutton also activates appropriate warnings for the following systems :
- DOORS (when not closed)
- LANDING GEAR (brake temperature)
- PROBE HEAT (Standby or CAPT or F/O probes heat off)

Mod. : 4801 + 5051

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT CONTROLS TAKE OFF CONFIGURATION TEST / TAKE OFF WARNING ECAM	1.09.80 PAGE 2 REV 19 SEQ 040

WARNING LOGIC

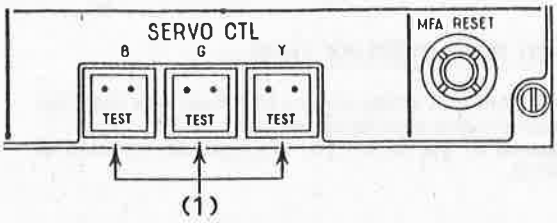
During phases 3 and 4 (from first engine take-off power to take-off)



Conditions 1,2,3 and 4 can also be tested during phases 1 and2 (from ELEC PWR ON to first engine take-off power) by pressing T.O CONFIG TEST pushbutton.

Mod. : 4801 + 5051

A. SERVO CTL TEST PANEL



Only used on ground to test the jamming detection microswitches, with pressure of the respective circuit shut off.

(1) B, G, Y TEST Pushbutton Switches

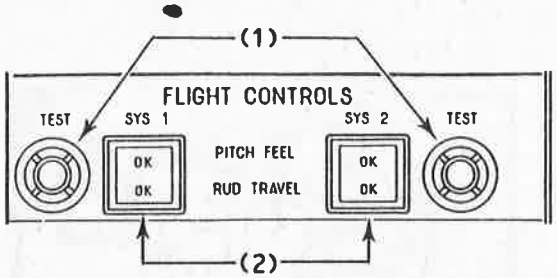
After selecting the related SERVO CTL P/B switch to OFF (on overhead panel), the TEST P/B switch for the respective circuit is magnetically latched when pressed-in and the TEST light comes on white.

For jamming detection test, the control involved must be moved rapidly.
Successful test is indicated by flashing of JAM light in the related SERVO CTL P/B switch.
If not successful, the fault isolation procedure must be done on the face of the jamming detection control box.

After selecting the SERVO CTL P/B switch to normal, the TEST P/B switch is automatically released-out and the TEST light goes off.

B. FLIGHT CONTROLS TEST PANEL

- PITCH FEEL & RUD TRAVEL Test.



(1) TEST Pushbuttons

The pushbuttons control the test of PITCH FEEL and RUD TRAVEL electrical systems and warning systems continuity.

The test is possible only if PITCH FEEL and RUD TRAVEL systems are engaged on the control panel (overhead panel).

Left pushbutton tests pitch feel and rudder travel system 1.
Right pushbutton tests pitch feel and rudder travel system 2.

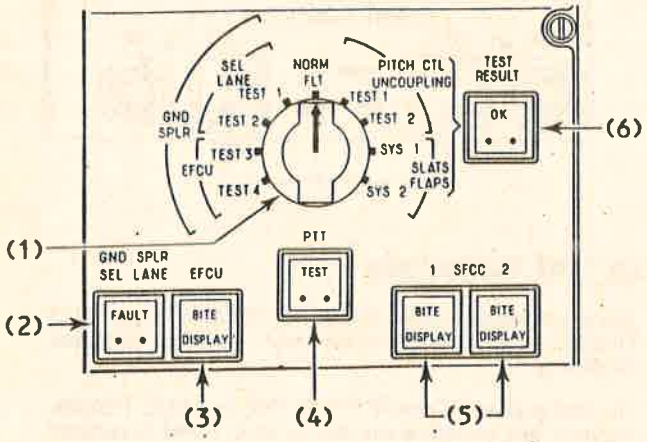
When a TEST pushbutton is pressed and held, the associated system must disengage and its FAULT light comes on amber.

Successful test is indicated by white OK lights illumination :
- upper lights for PITCH FEEL SYS 1 and 2.
- lower lights for RUD TRAVEL SYS 1 and 2.

(2) OK Lights

These lights illuminate white, as long as the TEST pushbutton is pressed and held, to indicate asuccessful test.

C. FLIGHT CONTROLS TEST PANEL (Cont'd)



(1) Test Selector

- **NORM FLT**

  Normal operating position, test circuits disconnected, warnings cancelled.

- **GND SPLR**

  Checks that no undue condition is permanently achieved in the ground spoilers logic for the EFCU involved when the TEST P/B switch is pressed-in :

  . SEL LANE TEST 1 and 2 positions check the integrity of selection lanes aircraft wirings.

  . EFCU TEST 3 and 4 positions check the integrity of each EFCU logic.
  The corresponding FAULT lights on the SPLR & SPD BRK panel will go off.
  This test requires all hydraulic power to be cut off to all flight controls to have the FAULT lights illuminated before test.

- **PITCH CTL UNCOUPLING**

  Tests periodically, on ground, the electrical circuits of the pitch uncoupling unit.

  . TEST 1 checks that the uncoupling unit rod is in the locked position.

  . TEST 2 checks that the uncoupling unit moves to the unlocking position, when the control solenoïd is energized.

- **SLATS/FLAPS**

  Commands a BITE sequence for the relevant SFCC (SYS 1 or SYS 2) when the TEST P/B switch is pressed-in.

(2) GND SPLR SEL LANE FAULT Light

This light comes on white when a fault has been detected in TEST 1 or TEST 2 positions of the test selector.

(3) EFCU BITE DISPLAY Light

This light comes on white when a fault has been detected by the continuous monitoring of each EFCU.
More details of the failure are displayed of the face of the EFCU's.

(4) PTT Pushbutton Switch

This P/B switch activates the test of the system selected by the test selector. A TEST indication is integrated into the P/B switch.

- **PTT**

  When pressed-in and held, the selected system is tested.

- **TEST**

  The light comes on white when the test selector is set to a system test position. It is extinguished when the test selector is in NORM FLT position.

(5) SFCC 1 & 2 BITE DISPLAY Lights

These lights come on white when a fault has been detected by the continuous monitoring of the SFCC's, even if the failure does not require crew action (no FAULT indication on the overhead panel). More details of the failure are displayed on the face of the SFCC's.

(6) TEST RESULT OK Light

This light comes on white when test is successful.

Note : These lights (OK, FAULT, BITE DISPLAY) will illuminate providing that the ANN LTS switch is in READ position during the test.

A310 FLIGHT CREW OPERATING MANUAL	TEMPORARY REVISION N° 48	1.11.00
		PAGE 0
		MAY 89

SUBJECT : 2nd ACT description.

Please insert in volume 1 and update the list of temporary revisions.

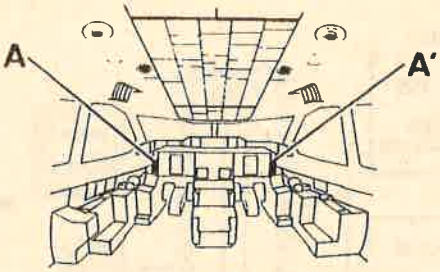
TR N° 48 page 1 of 16 at the beginning of chapter 1.11.
TR N° 48 page 2 of 16 facing 1.11.30 page 1/2
TR N° 48 page 3 of 16 facing 1.11.40 page 1
TR N° 48 page 4 of 16 facing 1.11.40 page 2
TR N° 48 page 5 of 16 facing 1.11.40 page 6A
TR N° 48 page 6 of 16 facing 1.11.40 page 6B
TR N° 48 page 7 of 16 facing 1.11.40 page 8
TR N° 48 page 8 of 16 facing 1.11.40 page 9
TR N° 48 page 9 of 16 facing 1.11.40 page 11/12
TR N° 48 page 10 of 16 facing 1.11.50 page 1
TR N° 48 page 11 of 16 facing 1.11.50 page 3/4
TR N° 48 page 12 of 16 facing 1.11.60 page 1
TR N° 48 page 13 of 16 facing 1.11.60 page 2
TR N° 48 page 14 of 16 facing 1.11.60 page 3
TR N° 48 page 15 of 16 facing 1.11.60 page 4
TR N° 48 page 16 of 16 facing 1.11.70 page 10

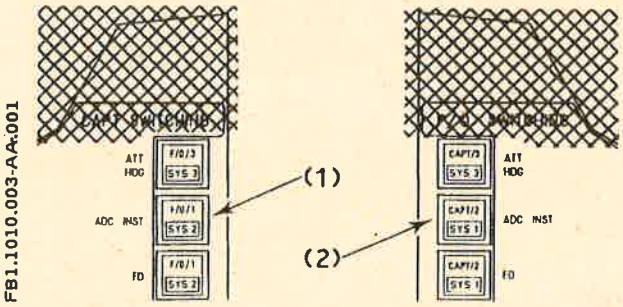
Do not remove this temporary revision until instructed to do so by either the « list of Temporary Revisions » of a normal revision or a Temporary Revision superseding this one.

TABLE OF CORRESPONDENCE BETWEEN « CODE » NUMBER AND MOD/MP NUMBER(S)

	EQUIVALENCE CODES	DESIGNATION
	1010A	STD or (Mod : 5051 + 6415)
	1010B	MP S5063 or Mod. : 6523
	1020A	STD or Mod. : 4803
	1020B	STD or (Mod : 5051 + 6415)
	1020C	MP S5063 or Mod : 6523
	1030A	STD or (Mod : 5051 + 6415)
R	1030B	Mod : 7258 or (7171 + 7187)
	1040A	STD or (Mod : 5051 + 6415)
	1050A	Mod : 3221 or 6505
	1070A	STD or (Mod : 3503 + 4663)

A and A' CAPT and F/O SWITCHING Panels





FB1.1010.003-AA-001

The P/B switches control the ADC data supply for CAPT and F/O flight instruments : PFD, ND, altimeter and VSI. In case of one ADC failure, data supply from the other ADC can be established. Both sets of instruments are then fed by one ADC.

These P/B switches also control FAC data supply for EFIS SGU'S.

CAPT and F/O P/B switches have two integrated indications to reflect the switching status.

(1) CAPT ADC INST Pushbutton Switch

- **Normal (P/B switch released-out).**

  CAPT instruments are supplied by ADC 1.
  CAPT PFD is supplied by FAC 1.

- **SYS 2 (P/B switch pressed-in).**

  SYS 2 light comes on white, CAPT instruments are supplied by ADC 2. CAPT PFD is supplied by FAC 2.

- **F/O/1.**

  The light comes on green to indicate that the F/O has selected instruments supply by ADC 1 and PFD supply by FAC 1 due to ADC 2 or FAC 2 supply failure.
  CAPT cannot select ADC 2/FAC 2. R

(2) F/O ADC INST Pushbutton Switch

- **Normal (P/B switch released-out).**

  F/O instruments are supplied by ADC 2.
  F/O PFD is supplied by FAC 2.

- **SYS 1 (P/B switch pressed-in).**

  SYS 1 light comes on white, F/O instruments are supplied by ADC 1.
  F/O PFD is supplied by FAC 1.

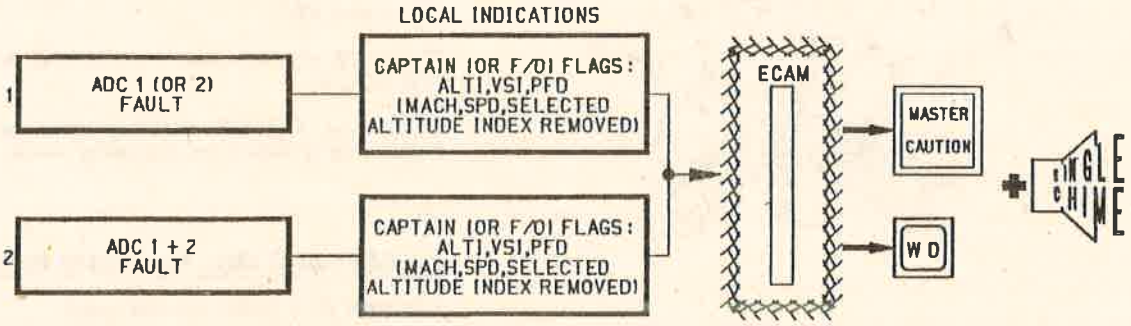
- **CAPT/2.**

  The light comes on green to indicate that the CAPT has selected instrument supply by ADC 2 and PFD supply by FAC 2 due to ADC 1 or FAC 1 supply failure.
  F/O cannot select ADC 1/FAC 1. R

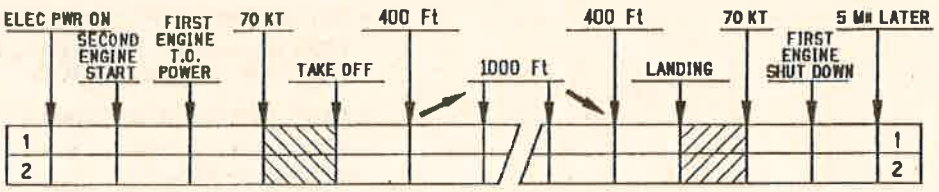
Note : Simultaneous cross supply (CAPT instruments from ADC 2/FAC 2 and F/O instruments from ADC 1/FAC 1) is not possible.

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS AIR DATA SYSTEM ECAM	1.10.10 PAGE 4 REV 13 SEQ 020

WARNING LOGIC



ECAM ▨ AUTOMATIC FLIGHT PHASE INHIBITION



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Mod. : 5051

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS EFIS – GENERAL DESCRIPTION	1.10.20 PAGE 1 REV 20 SEQ 001

ELECTRONIC FLIGHT INSTRUMENT SYSTEM (EFIS)

The Electronic Flight Instrument System (EFIS) presents to the flight crew on four CRT instruments the data needed :

- to control the aircraft by means of two Primary Flight Displays (PFD)
- to navigate by means of two Navigation Displays (ND).

The EFIS includes the following components :

- Three identical Symbol Generator Units (SGU) located in the avionics compartment.
- Two identical PFD and two identical ND located on the main instrument panels.
- Two identical control panels and two complementary control panels set on the glareshield.
- CAPT and F/O SWITCHING panels located on either side of the main instruments panels.
- One test panel located on lateral panel.

The information presented on the two Display Units is received from SGU's.

- SGU1 drives the Captain's PFD and ND
- SGU2 drives the First Officer's PFD and ND
- SGU3 is in standby to drive either the Captain's or the First Officer's PFD and ND.

The System Architecture allows the following possibilities of reconfiguration in case of a component failure :

- SGU3 can replace either SGU1 or SGU2.
  Crew action consists of pressing EFIS SGU P/B switch to select SYS3.
  Captain's selection has priority.
- A transfer control allows the exchange of the PFD and ND images.
- Some input sensors are reconfigured automatically and some by crew action.

The EFIS power supply is as follows :

- AC BUS 1 supplies SGU 3
- AC BUS 2 supplies SGU 2, F/O PFD, F/O ND, F/O control panel
- AC ESS BUS supplies CAPT ND
- AC EMERG BUS supplies SGU 1, CAPT PFD, CAPT control panel
- DC NORM BUS supplies F/O instrument switching
- DC ESS BUS supplies CAPT instrument switching

Input to the SGU's for PFD and ND displays are as follows :

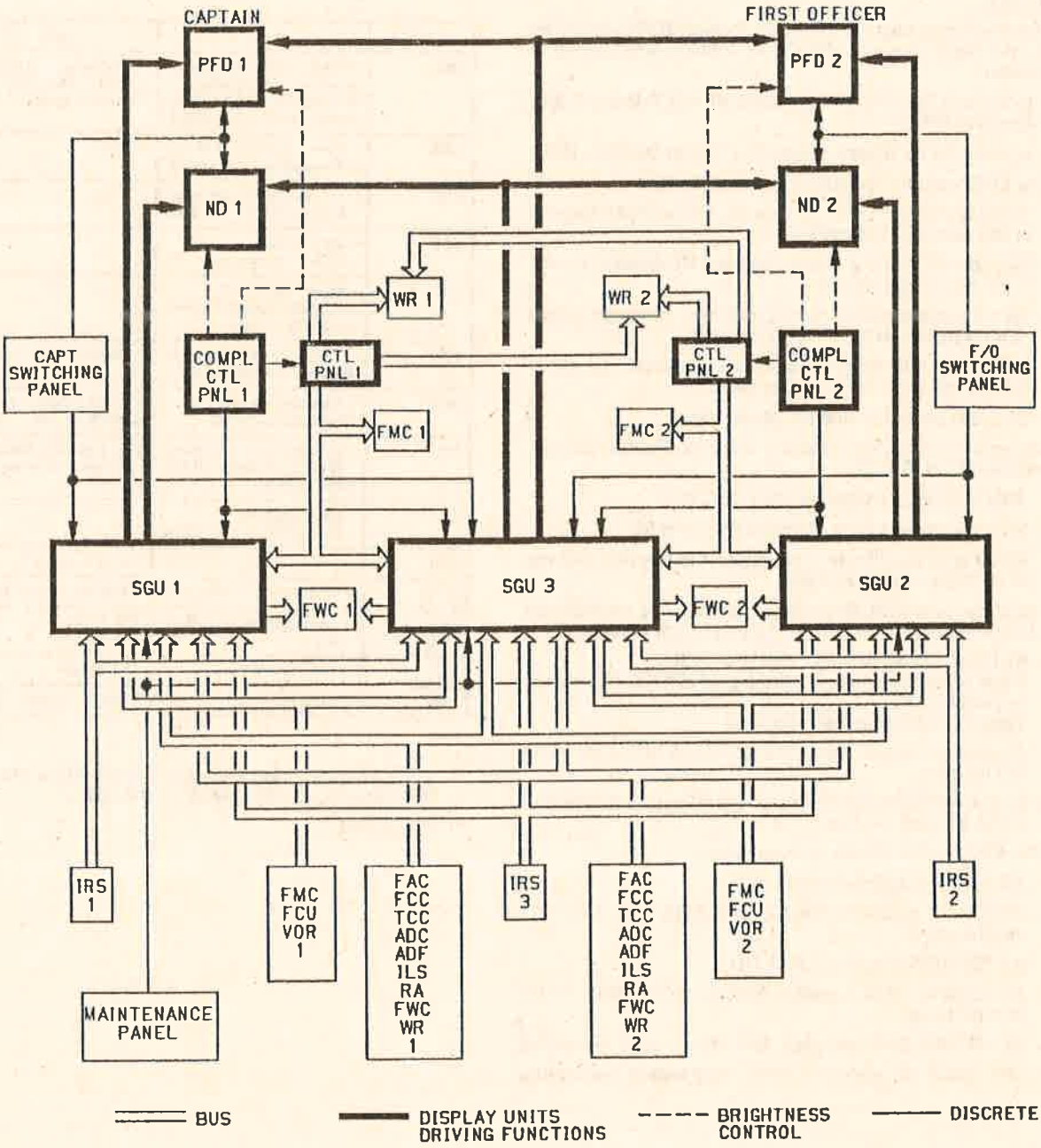
SYST.	PFD	ND
IRS	– Pitch – Roll – Magnetic heading – Transversal acceleration – Flight path vector (drift and slope)	– Magnetic heading – Wind* – Magnetic track – Ground speed
ADC	– Baro altitude – Mach – Computed airspeed	– TAS
FCC	– AP modes – Capabilities – Engagements – FD bars	
TCC	– ATS modes – DFA messages **	R
FAC	– Vss – Vls – F – S – Green dot speed – Speed tendency – Vmax	
FCU	– Selected speed – Selected altitude – Selected heading	– Selected heading
VOR	– Selected course (Flight path target)	– Selected course – VOR deviation – TO FROM
ILS	– G/S and LOC deviations – Runway heading (flight path target)	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 target slope – DH	WR range
WR		WR Image
FMC	– DME ILS – V1	– Flight plan – Wind*

* A pin programming allows either the IRS wind or the FMC wind to be displayed on the ND's.

** If installed R

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS EFIS – GENERAL SCHEMATICS	1.10.20 PAGE 2 REV 20 SEQ 020

SYSTEM BLOCK DIAGRAM



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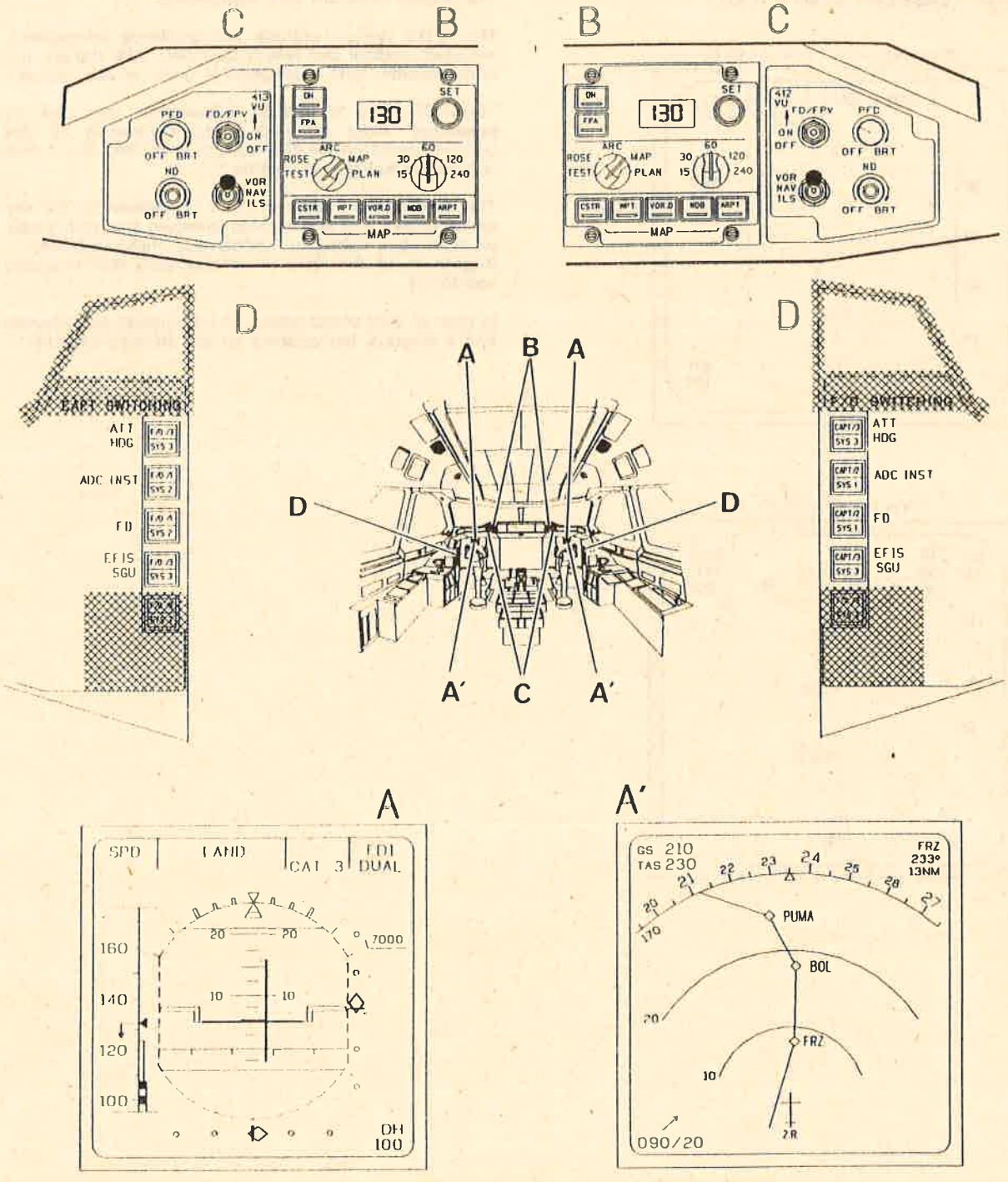
R Code : 1020C

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS EFIS – GENERAL CONTROLS	1.10.20 PAGE 3 REV 13 | SEQ 601

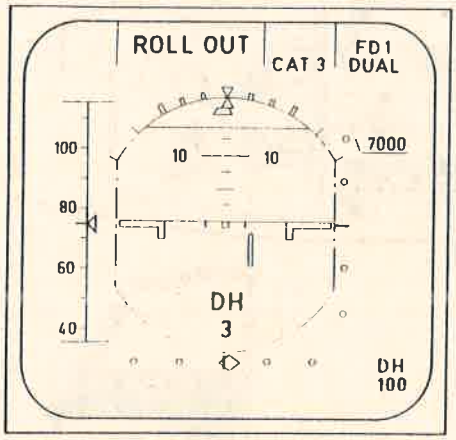
LOCATION OF CONTROLS



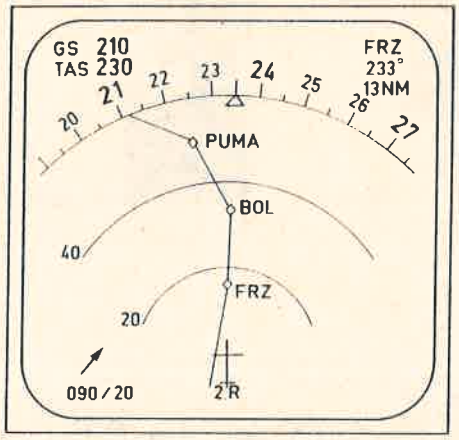
AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS EFIS – GENERAL CONTROLS	R 1.10.20 PAGE 4 REV 07

A & A'. DISPLAY UNITS (DU)

PRIMARY FLIGHT DISPLAY (PFD)



NAVIGATION DISPLAY (ND)



The display units are CRT instruments.

The PFD's display attitude and guidance information, airspeed, vertical and lateral deviation, AFS modes and radio altitude. PFD description is given in this chapter. R R R

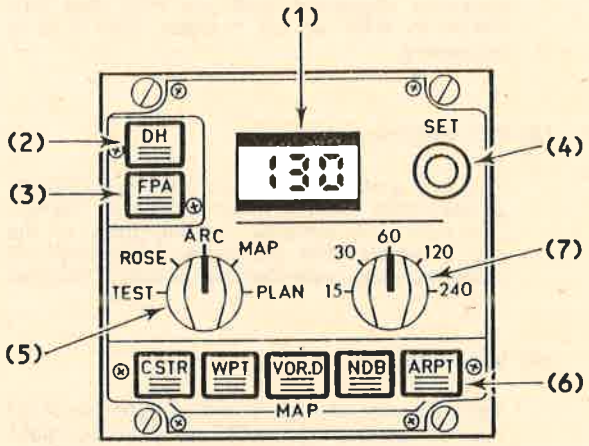
The ND's give navigation information that can be presented under different forms depending on the selected mode on the EFIS control panel. ND description is given in Navigation chapter. R

The seven colors used on DU's in addition to the sky which is blue and earth which is brown are : red, green, white, amber, light blue, yellow and magenta (violet). Brightness of the DU's is automatically and manually controlled. R R

In case of SGU or DU failure, all information are removed and a diagonal bar appears on the affected screens. R R

Vers. : All Eng. : All

B. EFIS CONTROL PANEL



– PFD Control –

(1) Display Window

The display presents either Decision Height in ft or Flight Path Angle in degrees, according to the selected pushbutton.

(2) DH Pushbutton

The Decision Height can be pre-set by pressing this pushbutton. The selected pushbutton is marked by a lighted dash. Another press cancels this selection and set the display to : – – –

(3) FPA Pushbutton

The Flight Path Angle can be pre-set by pressing this pushbutton. The selected pushbutton is marked by a lighted dash. Another press cancels this selection and set the display to : – – –

(4) SET Knob

This knob permits DH or FPA to be set to the desired value.
When DH is selected, the value is adjustable in increments
R of 5 ft from – 5 ft to 995 ft.
When FPA is selected, the value is adjustable in increments of 0.1° from – 9.9° tc + 9.9°.
For both cases the initial value at power on is 0.

– ND control –

(5) Mode Rotary Selector

The selector permits the display mode of the ND to be set for :
TEST, ROSE, ARC, MAP or PLAN

(6) MAP, PLAN Options (See FMS Chapter)

In MAP or PLAN mode, following options can be activated by one of the five pushbuttons :

- CSTR (constraints)
- WPT (waypoints)
- VOR.D (VOR.DME)
- NDB (Non Directional Beacon)
- ARPT (Airports)

Pressing of one pushbutton activates the indicated function, illuminates the bar within the pushbutton and cancels the other functions.

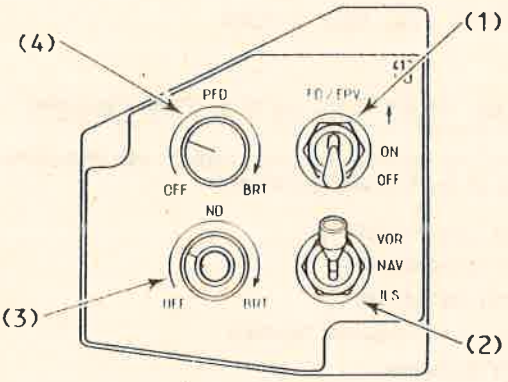
Another push cancels the function and extinguishes the bar.

When the Mode Rotary Selector is turned to ARC position, an option selection is kept but not active (bar extinguished). Turning the Mode Rotary Selector back to MAP or PLAN position reactivates the previously selected option (bar illuminated).

(7) Range Rotary Selector

In ARC, MAP or PLAN mode the crew can select any of the five ranges : 15, 30, 60, 120 or 240 NM. This is the viewing distance of the ND.

C. COMPLEMENTARY EFIS CONTROL PANEL



(1) Guidance Selection Switch

R This three position switch selects either Flight Director cross bars or Flight Path Vector symbols on the PFD.

- OFF position (stable) : FD cross bars and FPV R symbols are out of view.
- ON position (stable) : The PFD presents either the cross bars or the flight path vector symbols.
- The upper position is unstable. When activated this position switches the display from FD bars to FPV symbols or from FPV symbols to FD bars.

When switched from OFF to ON position the FD bars R are presented.

In ON position, an automatic reversion to FD is provided when TAKE-OFF, GO AROUND or LAND (ALIGN or ROLL OUT phase) is engaged in AP/FD.

(2) VOR-NAV-ILS Switch

This switch selects the mode of flight path R deviation displayed both on PFD and ND. When in NAV or ILS position, the VOR is R autotuned.

(3) ND Brightness

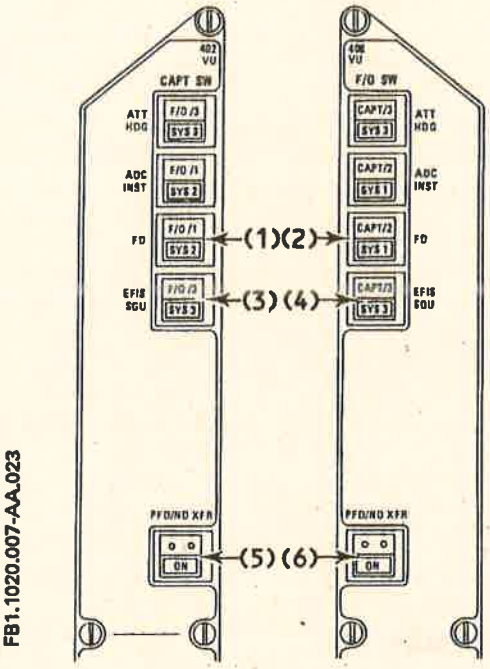
The outer potentiometer controls the brightness R of the raster shading (radar image) on the ND. The inner one controls the brightness of the R stroke writing. The ND image is switched off when the inner potentiometer is in OFF position. R

(4) PFD Brightness

This potentiometer controls the brightness of the R PFD. When switched to OFF position, the image R is then automatically transfered to the ND. R

Note : The display brightness depends on the R *ambient brightness and is not a linear* R *function of the potentiometer setting.* R

D. CAPT and F/O SW PANELS



FB1.1020.007-AA.023

(1) CAPT FD Pushbutton Switch

- **Normal (P/B switch released-out).**
  CAPT PFD displays FD1 command bars.
- **SYS 2 (P/B switch pressed-in).**
  SYS 2 light comes on white. CAPT PFD displays FD2 command bars.
- **F/0/1.**
  The light comes on green when FD1 commands has been selected by F/O. R

(2) F/O FD Pushbutton Switch

- **Normal (P/B switch released-out).**
  F/O PFD displays FD2 command bars.
- **SYS 1 (P/B switch pressed-in).**
  SYS 1 light comes on white. F/O PFD displays FD1 command bars.
- **CAPT/2.**
  The light comes on green, when FD2 commands has been selected by CAPT. R
  Note : Simultaneous cross supply (CAPT PFD from FD2 and F/O PFD from FD1) is not possible.

(3) CAPT EFIS-SGU Pushbutton Switch

- **Normal (P/B switch released-out).**
  CAPT PFD and ND are supplied by SGU 1.
- **SYS 3 (P/B switch pressed-in).**
  SYS 3 light comes on white, CAPT PFD and ND are supplied by SGU 3.
- **F/O/3.**
  The light comes on green to indicate that the F/O has selected instrument supply by SGU 3 due to SGU 2 supply failure.
  Note : The CAPT EFIS SGU P/B switch has priority and cancels previous selection.

(4) F/O EFIS-SGU Pushbutton Switch

- **Normal (P/B switch released-out).**
  F/O PFD and ND are supplied by SGU 2.
- **SYS 3 (P/B switch pressed-in).**
  SYS 3 light comes on white, F/O PFD and ND are supplied by SGU 3.
- **CAPT/3.**
  The light comes on green to indicate that the CAPT has selected instrument supply by SGU 3 due to SGU 1 supply failure.
  Note : When CAPT/3 light is illuminated, the F/O cannot select SYS 3.

(5) CAPT PFD/ND XFR Pushbutton Switch

When pressed-in, ON illuminates white and the PFD and ND displays are inverted. In case of failure of a DU, the picture of the failed one can be presented on the other DU.

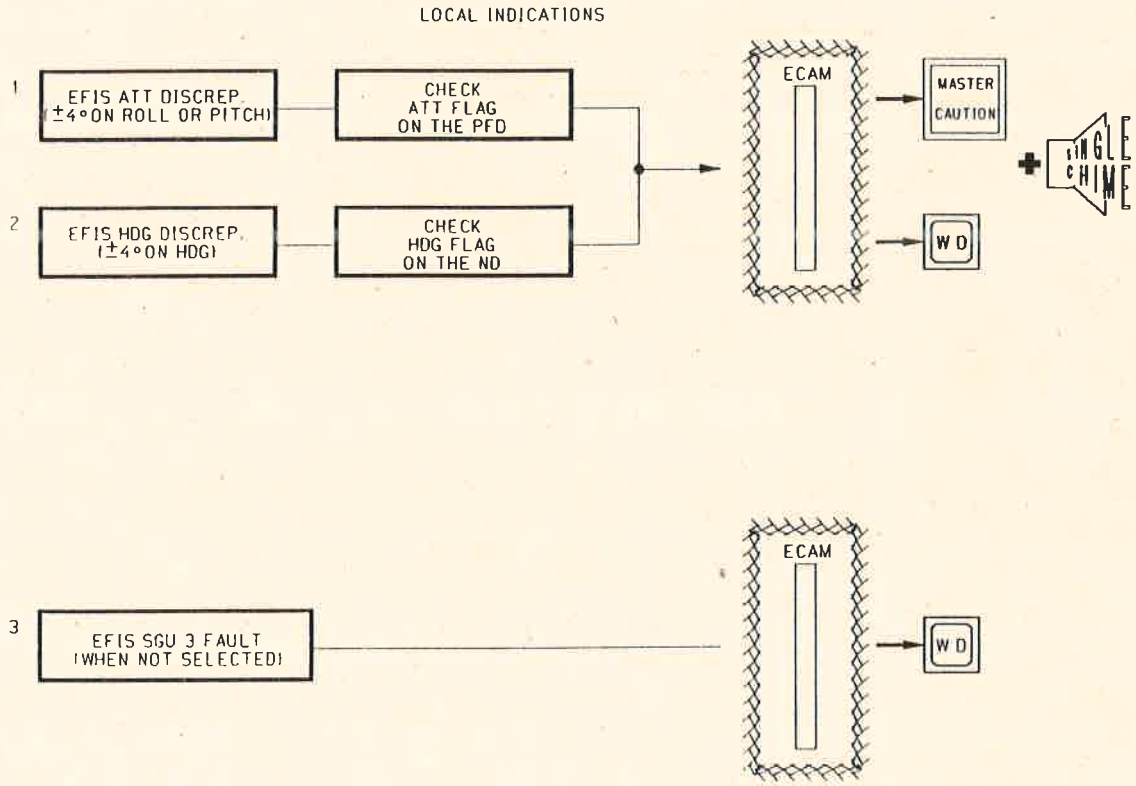
(6) F/O PFD/ND XFR Pushbutton Switch

Same effects as for CAPT PFD/ND XFR P/B switch.

Mod. : 4803

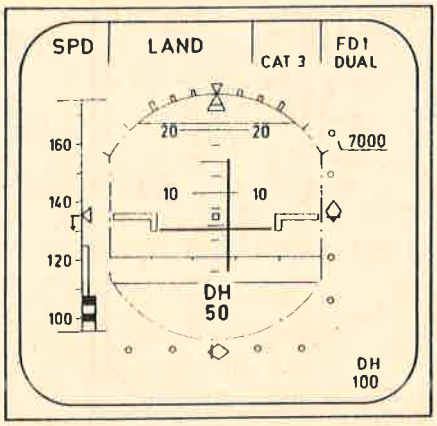
LEFT BLANK INTENTIONALLY

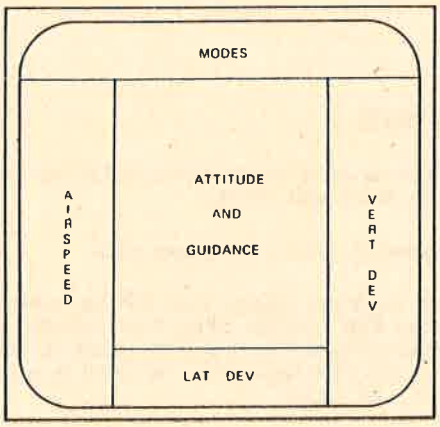
WARNING LOGIC



Mod. : 5051

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS PRIMARY FLIGHT DISPLAY DESCRIPTION	R 1.10.30 PAGE 1 REV 07





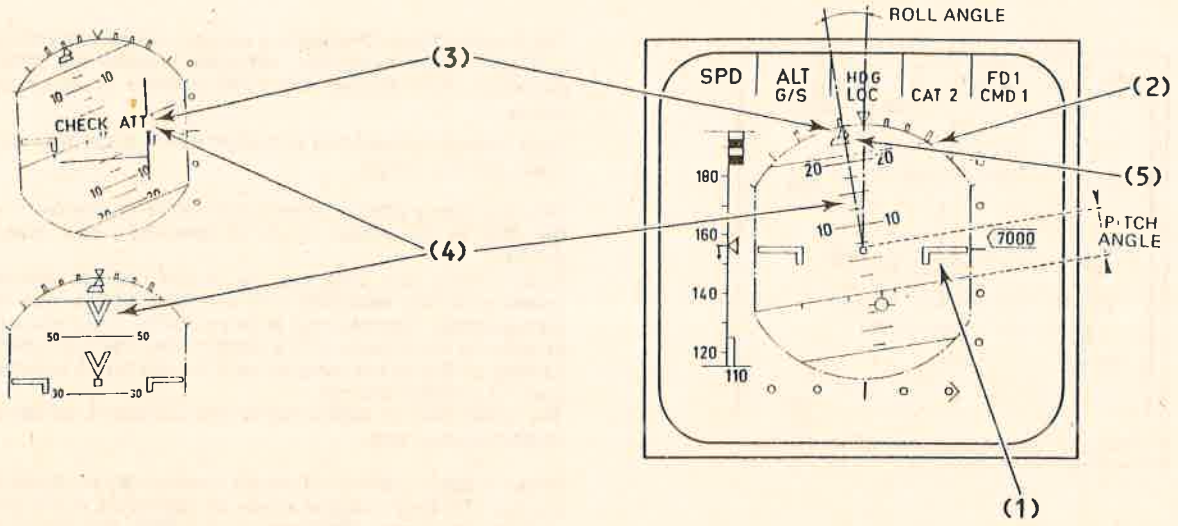
The Primary Flight Display is a display unit giving attitude and guidance information, airspeed, vertical and lateral deviation, AFS modes and radio altitude in separated zones. R R

Each item of information is always displayed at the same place on the image.

When a failure affects information which is displayed on the PFD in the actual mode of operation, this item is deleted. R
Some items are replaced by a red failure warning message which indicates clearly which information has disappeared. The message flashes during a few seconds in order to draw the crew's attention, then remains visible as long as the failure lasts or until the system is switched over to another source.
The failed item of equipment is also indicated on the left ECAM display unit. R

When a failure affects information which is not displayed on the PFD in the actual mode of operation, there is no warning message displayed on the PFD, but the failed item is indicated on the left ECAM display unit. R R

Vers. : All Eng. : All



The aircraft pitch and roll attitudes are indicated in the center part of the image by a sphere which looks like a conventional ADI.

The displacement of the horizon line with respect to the aircraft symbol indicates pitch and roll angles. The sky zone is colored blue, the earth zone is colored brown.

ROLL

(1) Fixed Aircraft Symbol

Black, outlined in yellow.

(2) Roll scale

White scale graduated at 0-10-20-30-45-60° of bank.

(3) Roll Index

Yellow index turns in relation to the roll angle along the roll scale.

When roll becomes greater than 45° all the PFD displays other than attitude, speed and heading are erased. The image returns to normal when the roll angle becomes lower than 40° again.

In case of roll data failure, the whole sphere is erased and is replaced by a red ATT flag which first flashes for a few seconds.

In case of attitude information discrepancy a red CHECK ATT flag appears on both PFD's.

PITCH

(4) Pitch scale

The pitch scale is white. Graduation is in 2.5° increments between 20° down and 30° up.

Red V's appear in case of excessive pitch.

When pitch becomes greater than 25° (or lower than – 13°), all the PFD displays other than attitude, mach speed and heading are erased. The image returns to normal when the pitch angle becomes lower than 22° (or greater than – 10°) again.

In case of pitch data failure, the whole sphere is erased and is replaced by a red ATT flag which first flashes for a few seconds.
In case of attitude information discrepancy a red CHECK ATT flag appears on both PFD's.

CROSS TRACK ACCELERATION

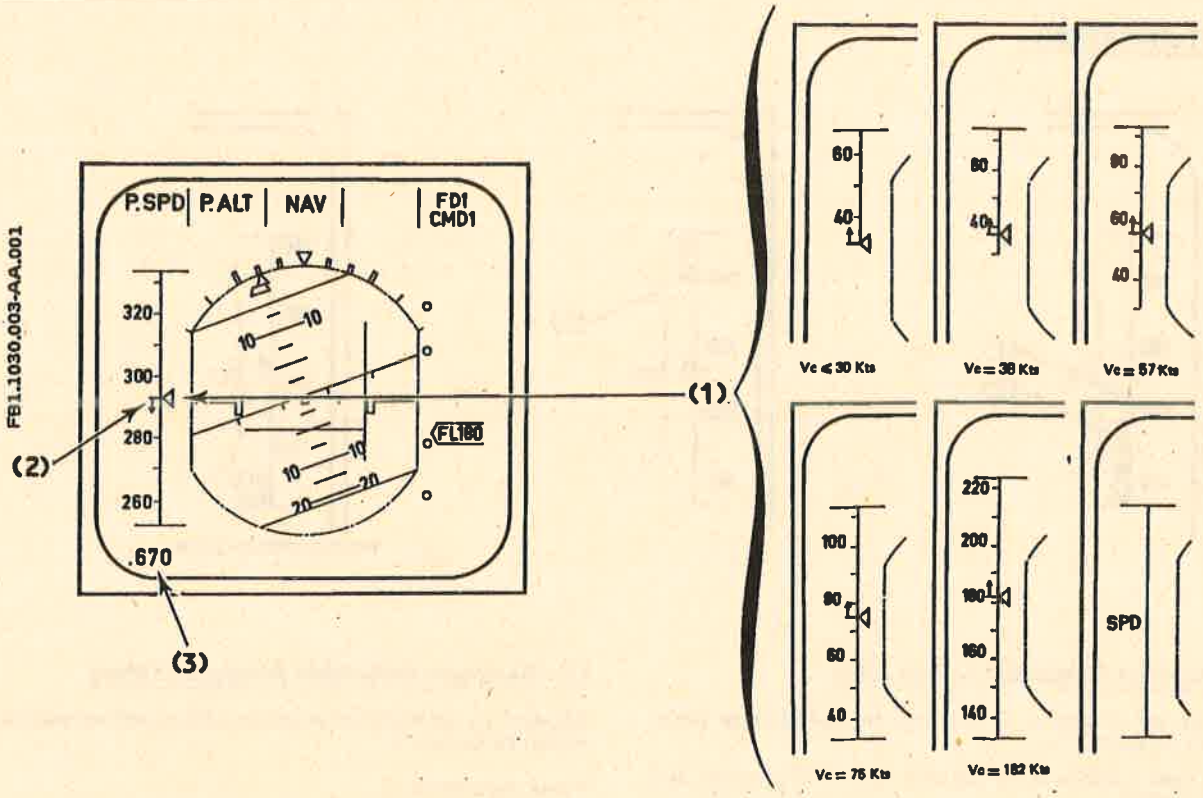
(5) Side slip Index R

A yellow trapezoidal index moving below the roll index indicates the side slip. R

1 cm = 0.2 g. The side slip index is against its stop at 0.3 g and remains immobilized in the position which corresponds to this value. If the side slip information is lost, the index is removed. R R

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS PRIMARY FLIGHT DISPLAY AIRSPEED INFORMATION	1.10.30 PAGE 3 REV 19 SEQ 001

COMPUTED AIRSPEED – SPEED TREND – MACH NUMBER



(1) Actual Airspeed Symbol and Scale

The airspeed is indicated by a white scale moving in front of a fixed yellow symbol. The scale is graduated with marks every 10 kt and numerical values every 20 kt with a displayed range of 80 kt.

The scale is fixed for a speed below 30 kt. In this case, only half a scale is displayed. The second half of the scale will be displayed progressively as the speed becomes greater than 30 kt. In case of speed information failure, all the symbols displayed on the scale are removed, the scale turns red and a red SPD flag which first flashes for a few seconds, appears. In this case, the airspeed information is obtained by switching over to the other ADC.

(2) Speed Trend

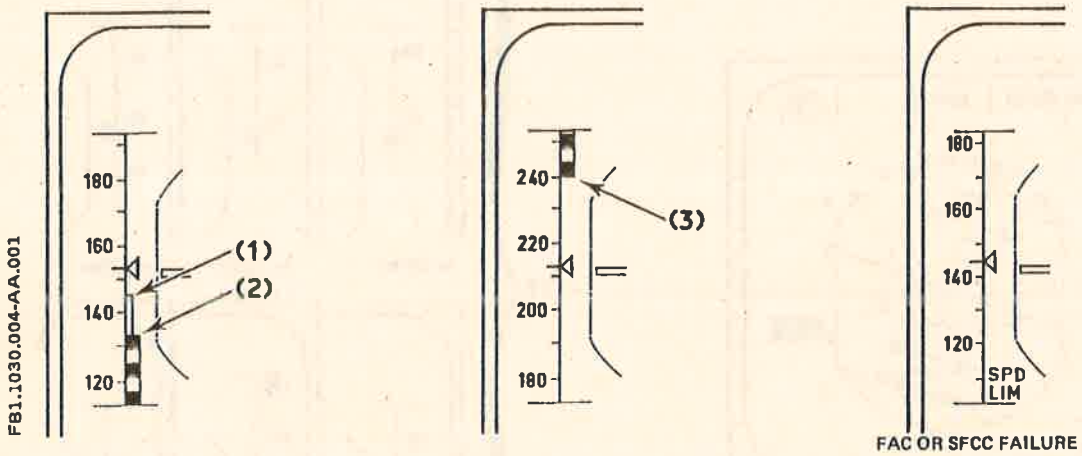
The airspeed tendency (acceleration or deceleration) is indicated by a yellow pointer starting from the speed symbol. The limit of the vector gives the airspeed value which will be attained in 10 seconds if the acceleration remains constant. This vector appears only when greater than 2 kt and is removed when lower than 1 kt.
In the event of a FAC failure, this vector is removed.

(3) Mach Number

Mach number appears (white) when exceeding .5 M. It disappears when below .45 M and is replaced by – – –. In case of mach failure, a red MACH flag, which first flashes for a few seconds, is displayed. R

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS PRIMARY FLIGHT DISPLAY AIRSPEED INFORMATION	1.10.30 PAGE 4 REV 21 SEQ 001

LIMIT AIRSPEEDS



(1) Lowest Selectable Speed (VLS)

Shown by an amber strip along the speed scale when within its limits (*).

This speed depends on altitude and configuration and represents :

. 1.2 Vs at take off and for touch and go

. 1.3 Vs in all other cases (as soon as flaps or slats are extended or retracted one step). During a configuration change, VLS display is progressively changed taking into account the actual configuration.

. At altitude above 25,000 ft and with slats retracted, VLS represents a margin of .3 g with respect to buffeting.

VLS information is inhibited from touch down up to 5 seconds after lift-off.

(2) Stick Shaker Speed (Vss)

Shown by a red and black strip along the speed scale when within its limits (*).

R Vss is equal to 1.138 Vs in clean configuration, and 1.08 Vs in other configurations.

Vss information is inhibited from touch down up to 5 seconds after lift-off.

(3) Maximum Selectable Airspeed (Vmax)

Shown by a red and black strip along the speed scale when within its limits (*).

Vmax represents :

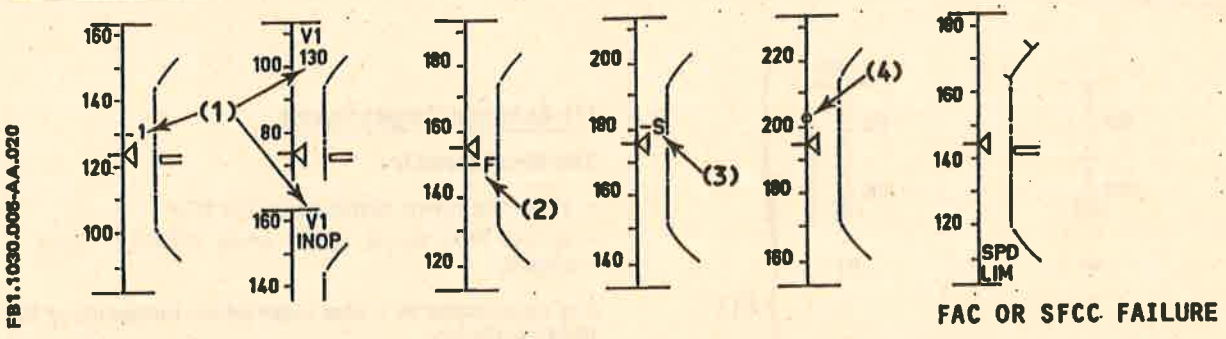
. VMO in clean configuration with landing gear up (VMO is calculated by the ADC and takes into account MMO).

. VLE for slats retracted and landing gear down.

. VFE when slats or flaps are extended.

(*) In case of FAC or SFCC failure these limit speeds are no longer available there fore no longer displayed. A red SPD LIM flag, which first flashes for a few seconds, is displayed.

MANEUVER SPEEDS



(1) Decision Speed : – 1 (V1)

It is loaded by the FMC CDU and is displayed in the form of a blue symbol – 1 moving along the speed scale. When out of indication range, it is digitally shown on the upper part of the scale. It is removed after take off. In case of failure a V1 INOP red flag, which first flashes for a few seconds, replaces the digital value.

(2) Minimum Flap Retraction Speed : –F

It corresponds to 1.25 Vs of slats 15° flaps 0° configuration and is represented by a green– F symbol moving along the speed scale.
The latter is not displayed when out of indication range.
The flaps can be retracted when the airspeed is greater than F, i.e. when – F symbol lies below speed symbol.
– F symbol is displayed only 5 seconds after lift-off and only in 15°/15° or 20°/20° configuration (SLAT/FLAP handle on 15°/15 or 20°/20°).

(3) Minimum Slat Retraction Speed : –S

It corresponds to 1.25 Vs of clean configuration and is represented by a green – S symbol moving along the speed scale. The latter is not displayed when out of indication range.
The slats can be retracted when the airspeed is greater than S, i.e. when – S symbol lies below speed symbol.
– S symbol is displayed only 5 seconds after lift-off and only in 15°/0° configuration(SLAT/FLAP handle on 15°).

(4) Engine Out Operating Speed in Clean configuration : o (Green dot).

Shown by a green dot moving along the speed scale. It represents the best lift to drag ratio speed in clean configuration (DRIFT DOWN speed).

Below 20,000 ft :
« green dot » corresponds to 232 kt at 132 tons ± 1kt per ± 1 ton.

Above 20,000 ft :
It increases by 2kt per 1000 ft.

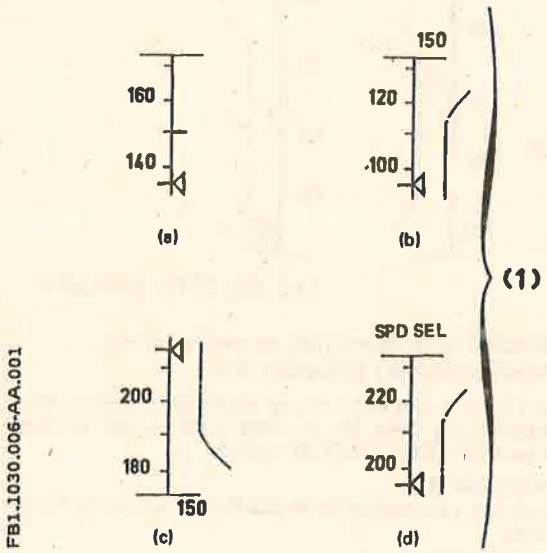
The green dot is displayed in flight and in clean configuration only (SLAT/FLAP handle on0°/0°)

Note : All the speeds (except V1) are computed by the FAC. In case of FAC or SFCC failure the corresponding symbols (– F, – S, o) are removed. A SPD LIM red flag, which first flashes for a few seconds, is displayed.

Code : 1030B

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS PRIMARY FLIGHT DISPLAY AIRSPEED INFORMATION	1.10.30 PAGE 6 REV 07 SEQ 001

TARGET SPEED



(1) Selected Target Speed

The target speed is :

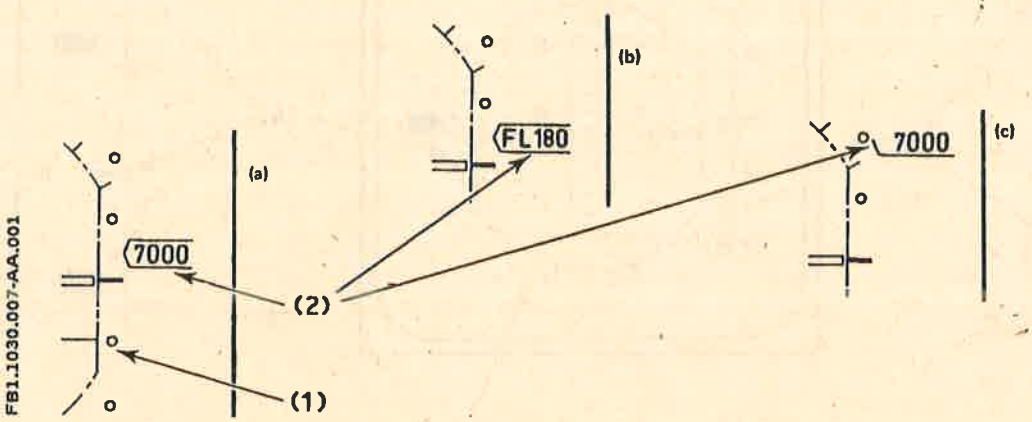
- either the speed displayed on the FCU
- or the FMC target speed when PROFILE mode is engaged.

It is represented by a blue index which moves along the speed scale (a).
When out of the indication range, it is digitally shown either above (b) or below the speed scale (c).
In case of failure, a red SPD SEL flag flashes for a few seconds above the scale then remains fixed (d).

Vers. : All Eng. : All

A310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS PRIMARY FLIGHT DISPLAY TRAJECTORY DEVIATION	1.10.30 PAGE 7 REV 19 SEQ 001

ALTITUDE DEVIATION



(1) Altitude Deviation Scale

The white vertical deviation scale displays an altitude error with respect to the altitude selected on the FCU. One dot represents a height of 500 ft. The maximum deviation displayed is ± 1 000 ft.

R

(2) Selected Altitude Index

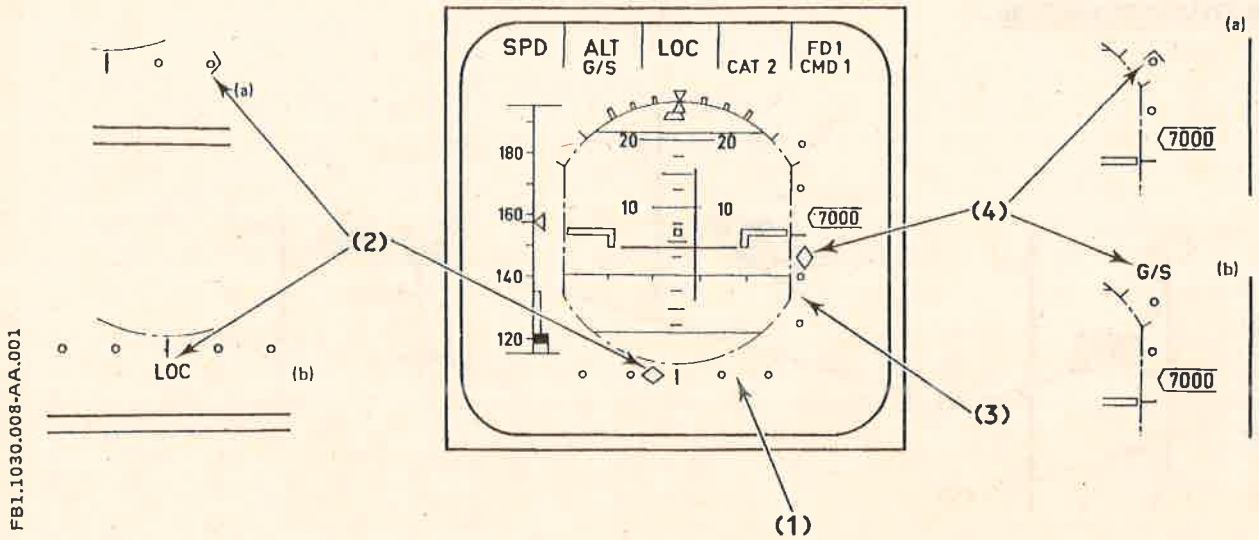
The altitude selected on FCU is indicated in blue in the white mobile index.

The indication in the box is either :

- Altitude in ft (a) if the baro knob of the altimeter is set for corrected altitude.
- Flight level (b) if the baro knob of the altimeter is set on standard.

When the deviation is out of display range, the index is against stop and only half of it is represented (c).

In case of failure of the aircraft altitude information the index is removed.



LATERAL DEVIATION (ILS MODE)

(1) Lateral Deviation Scale (white)

The lateral deviation scale presents a normal LOC deviation. The maximum deviation displayed is ± 150 μ A. (≃ 350 ft at runway threshold).

(2) Localizer Index

A localizer index is displayed when localizer signal is received.

At the maximum deviation only half a box is displayed (a).

- In case of localizer receiver failure, the index is removed and a red LOC flag which first flashes for a few seconds, is displayed under the scale (b).
- In LAND mode, in case of excessive LOC beam deviation (.3 dot), the index and the scale flash.
- If LOC transmitter fails when LOC mode (LOC mode alone or LAND mode) is in capture or track phase, the roll FD bar and the lateral deviation scale flash and the localizer index is cleared on both PFD's. R

VERTICAL DEVIATION (ILS MODE)

(3) Vertical Deviation Scale (white)

In addition to altitude error, the vertical deviation scale presents a normal glide slope deviation. A two-dot glide slope deviation represents 150 μA. (.72° for a 3° glide slope).

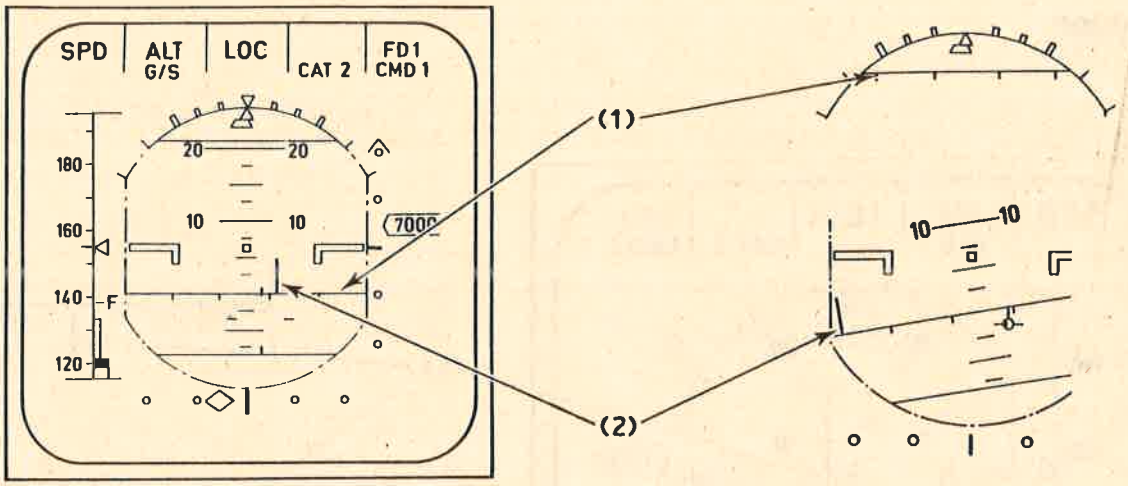
(4) Glide Slope Index

A glide slope index is displayed when glide signal is received.

At the maximum deviation only half a box is displayed (a).

- In case of glide slope receiver failure, the index is removed and a red G/S flag which first flashes for a few seconds, is displayed on the top of the scale (b).
- In LAND mode, in case of excessive GLIDE beam deviation (1 dot), the index and the scale flash.
- If GLIDE transmitter fails when LAND mode is in GLIDE capture of track phase, the pitch FD bar and the vertical deviation scale flash and the glide slope index is cleared on both PFD's. R

AIRBUS INDUSTRIE A 310 FLIGHT CREW OPERATING MANUAL	FLIGHT INSTRUMENTS PRIMARY FLIGHT DISPLAY HEADING	R 1.10.30 PAGE 9 REV 07



(1) Heading Scale

A white heading scale graduated in 10° increments is provided on the horizon line.

R In case of great nose up attitudes, the horizon line disappears, but the graduations remain
R visible on the base of the display.
R In case of great nose down attitudes, the horizon
R line disappears, but the graduations remain
R visible at the top of the display.

(2) Selected Heading

In FPV mode (FPV/FD selector switch on complementary control panel in FPV position) the selected heading, symbolized by a blue vertical line moves on the heading scale. It represents the heading displayed on the FCU. R R

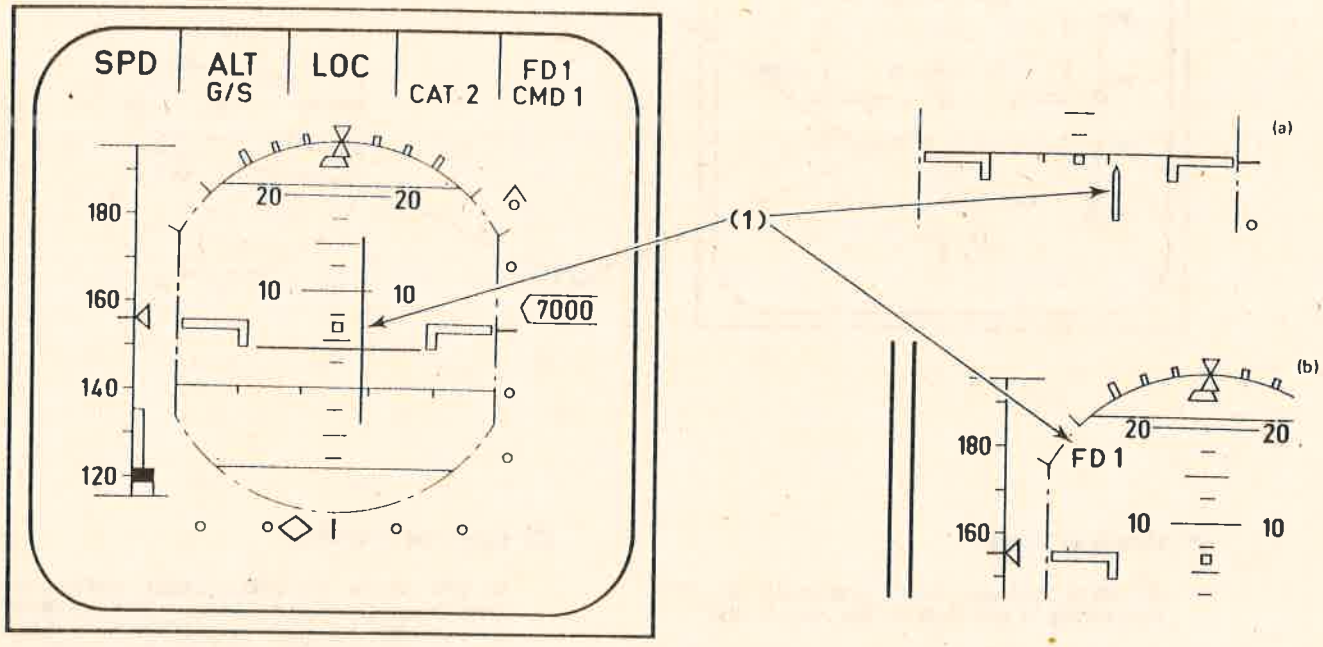
When the selected value is out of display range, the symbol remains against the stop on the corresponding side. R

In case of heading information failure, heading scale and heading symbol are removed.

Vers. : All Eng. : All

The guidance selection switch (on complementary EFIS control panel) allows to display FD (Flight Director) or FPV (Flight Path Vector) mode steering.

FD MODE



(1) FD Command Bars

When FD is selected, green pitch and roll command bars are displayed.

In ground configuration, the vertical bar is replaced by a specific symbol (yaw bar) which moves below the aircraft symbol (a). It appears at take off (RWY mode) and at landing (ALIGN and ROLL OUT phases of LAND mode). R R

In case of FD failure the command bars are removed and a red FD1 (or FD2 depending on FD engaged) flag, which first flashes for a few seconds, is displayed (b). R

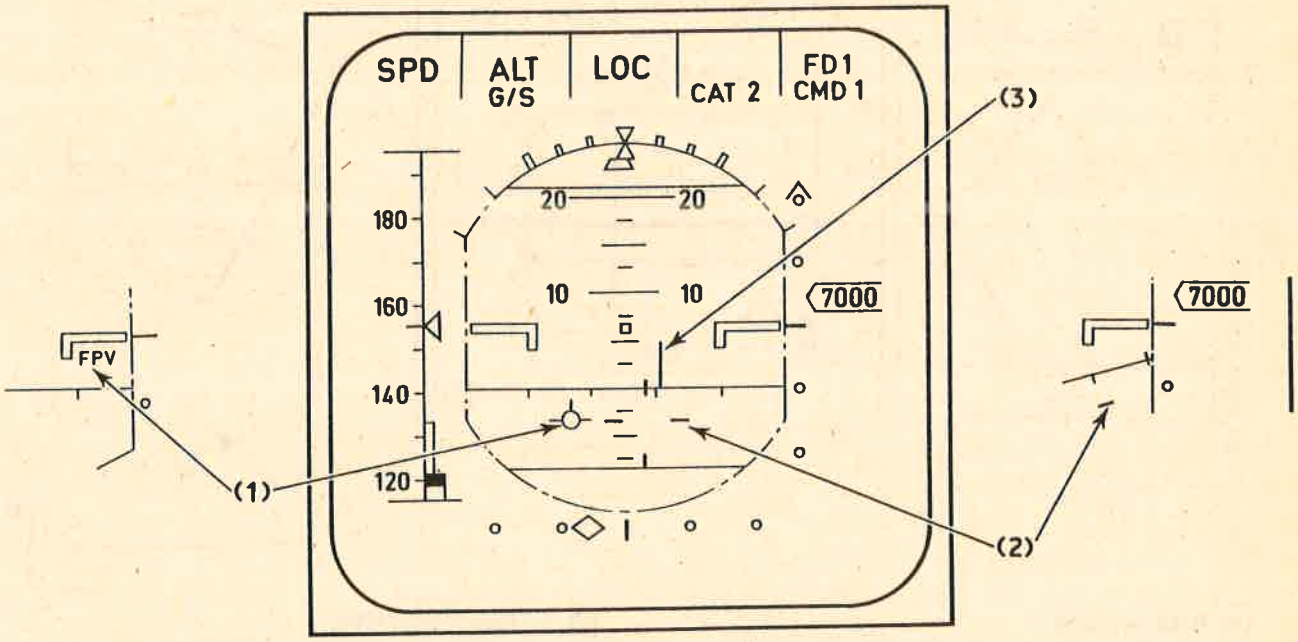
When the AP/FD reverts inadvertently to the basic modes, the FD bars flash for 5 seconds. R R

Vers. : All

Eng. : All

FPV MODE

R The Flight Path Vector is a new way for checking the aircraft trajectory : it must be considered as « augmented
R crew data » and, as such, does not replace the Flight
R Director.
R



FB1.1030.011-AA.001

(1) Flight Path Vector

It provides display of the aircraft trajectory in path and slope.

- The lateral deviation with respect to the aircraft symbol represents the drift
- The vertical deviation with respect to the horizon line represents the slope followed.
  (The Flight Path Vector is above, on or below the horizon line when the aircraft is in climbing configuration, in level flight or in descent configuration).

The pitch graduations serve as slope graduations.
In case of failure, the Flight Path Vector is erased and a red FPV flag which first flashes for a few seconds, is displayed below the aircraft symbol.

(2) Flight Path Target

It shows the selected trajectory in path and slope, whenever FPA is selected on EFIS control panel. R
Its position with respect to the heading scale indicates :

- VOR selected course, when in VOR mode
- the runway axis (QFU) when ih ILS mode

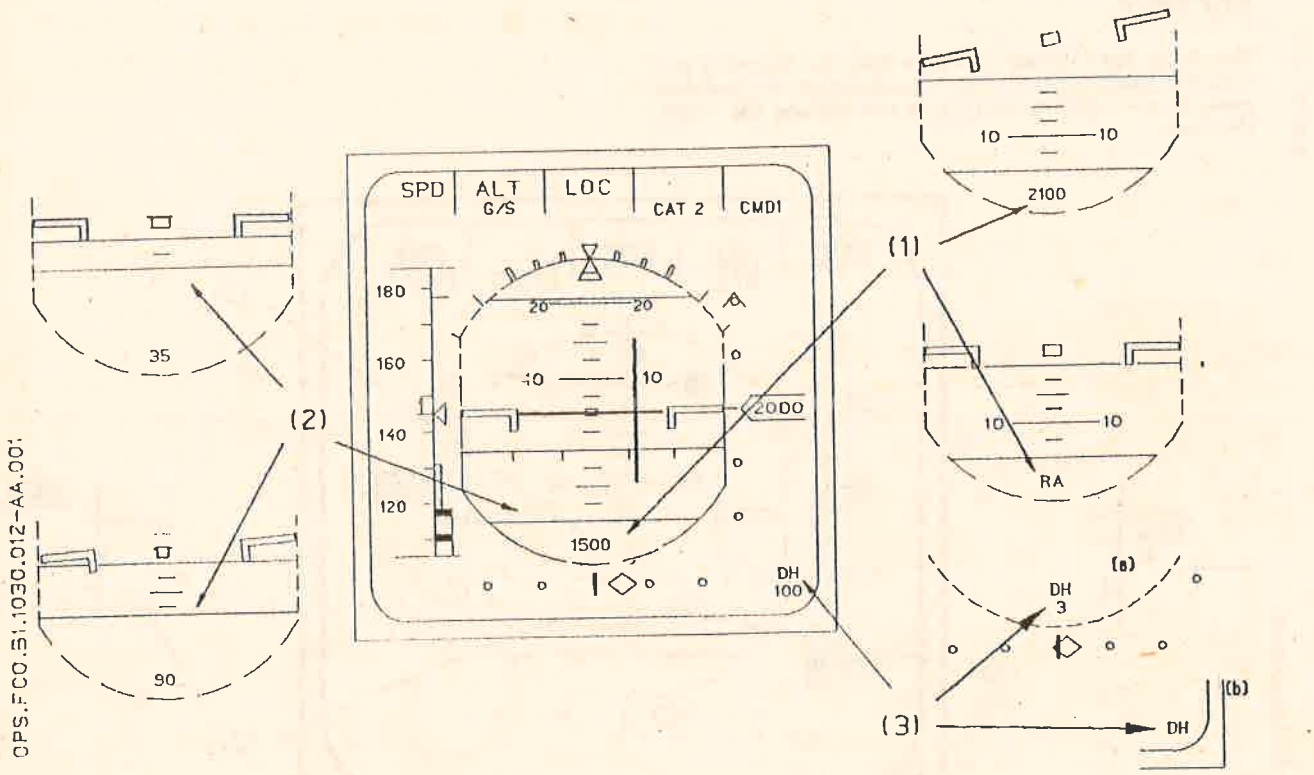
The vertical deviation with respect to the horizon line represents the slope selected on the EFIS control panel. The pitch graduations serve as slope graduations.

If the course selected is out of display range, half of the target is presented against stop.

(3) Selected Heading

See Heading information.

Vers. : All Eng. : All



(1) Radio Height

Ground height is shown in digital form below 2 500 ft.

The dimension and color of the digits vary according to the height :
H ≥ 1 000 ft : 4 mm green digits
H < 1 000 ft : 5 mm green digits (amber when H ≤ DH + 100 ft)

The variation step also depends on the altitude :
H > 50 ft : 10 ft increments
5 ≤ H ≤ 50 ft : 5 ft increments
H < 5 ft : 1 ft increments

In case of failure of both radio altimeters and if slats are extended, a RA red flag, which first flashes for a few seconds, is displayed in place of radio height.

(2) Analog Radio Height

During final approach the white lower line moves up towards the horizon line, erasing the graduations of the pitch scale.
The distance between the two lines is proportional to the ground height (5 ft/mm).

(3) Decision Height (DH)

DH as selected on the EFIS control panel is displayed in blue when the radio height is below 2 500 ft.
When the radio height is lower than the decision height, an amber DH message, which first flashes for a few seconds, is displayed above radio height (a).
In case of failure, DH information is removed and a red DH flag is displayed (b). R R