27.00 CONTENTS

	FLIGHT CONTROLS	1.27.10	P 1
A320 SIMULATOR FLIGHT CREW OPERATING MANUAL	DESCRIPTION	SEQ 001	REV 34

AIRBUS TRAINING

GENERAL

The fly-by-wire system was designed and certified to render the new generation of aircraft even more safe, cost effective, and pleasant to fly.

BASIC PRINCIPLE

Flight control surfaces are all :
— Electrically-controlled, and
— Hydraulically-activated.
The stabilizer and rudder can also be mechanically-controlled.
Pilots use sidesticks to fly the aircraft in pitch and roll (and in yaw, indirectly, through turn coordination).
Computers interpret pilot input and move the flight control surfaces, as necessary, to follow their orders.

R However, when in normal law, regardless of the pilot's input, the computers will prevent
R excessive maneuvers and exceedance of the safe envelope in pitch and roll axis.
R However, as on conventional aircraft, the rudder has no such protection.
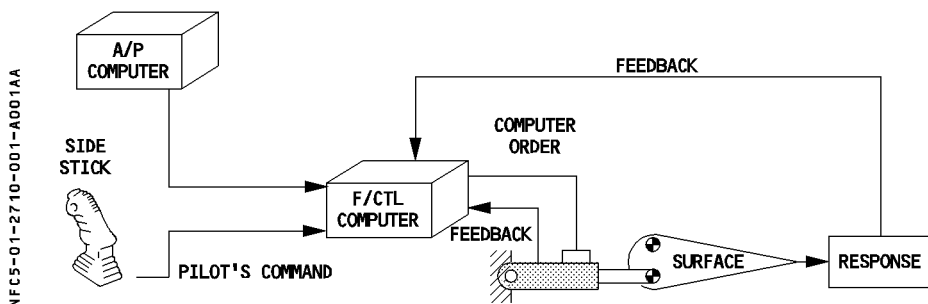
CONTROL SURFACES

The flight controls are electrically or mechanically controlled as follows :

Pitch axis

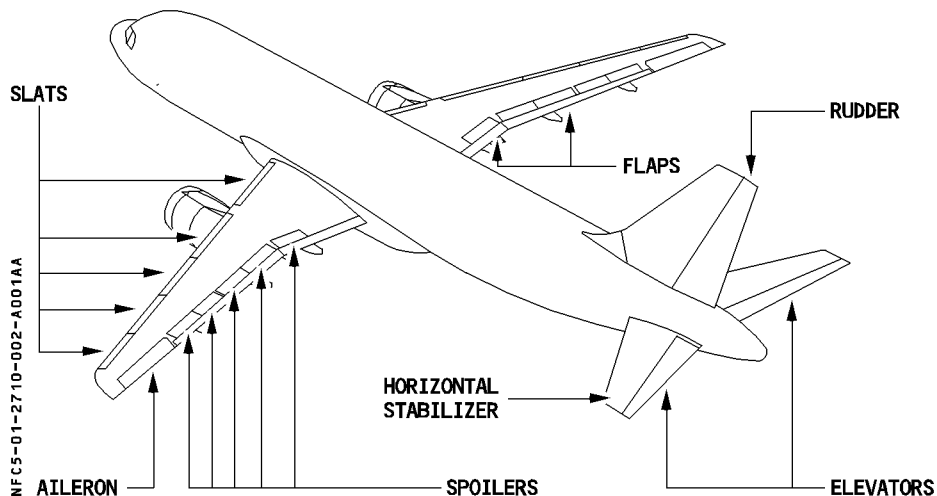|		
Elevator	=	Electrical
Stabilizer	=	Electrical for normal or alternate control. Mechanical for manual trim control

Roll axis

Ailerons	=	Electrical
Spoilers	=	Electrical

Yaw axis

Rudder	=	Mechanical, however control for yaw damping, turn coordination and trim is electrical.

Speed brakes

Speed brakes	=	Electrical

Note : All surfaces are hydraulically actuated.

COCKPIT CONTROLS

— Each pilot has a sidestick controller with which to exercise manual control of pitch and roll. These are on their respective lateral consoles.
  The two sidestick controllers are not coupled mechanically, and they send separate sets of signals to the flight control computers.
— Two pairs of pedals, which are rigidly interconnected, give the pilot mechanical control of the rudder.
— The pilots control speed brakes with a lever on the center pedestal.
— The pilots use mechanically interconnected handwheels on each side of the center pedestal to control the trimmable horizontal stabilizer.
— The pilots use a single switch on the center pedestal to set the rudder trim.
— There is no manual switch for trimming the ailerons.

COMPUTERS

Seven flight control computers process pilot and autopilot inputs according to normal, alternate, or direct flight control laws.
The computers are :

2 ELACs
(Elevator Aileron Computer)
For : Normal elevator and stabilizer control.
      Aileron control.

3 SECs
(Spoilers Elevator Computer)
For : Spoilers control.
      Standby elevator and stabilizer control.

2 FACs
(Flight Augmentation Computer)
For : Electrical rudder control.

In addition 2 FCDC
Flight Control Data Concentrators (FCDC) acquire data from the ELACs and SECs and send it to the electronic instrument system (EIS) and the centralized fault display system (CFDS).

ARCHITECTURE

GENERAL ARCHITECTURE

FOR INFO

Arrows indicate the control reconfiguration priorities

G B Y indicates the hydraulic power source (green, blue, or yellow) for each servo control.

NFC5-01-2710-005-A100AA

PITCH CONTROL

R Two elevators and the Trimmable Horizontal Stabilizer (THS) control the aircraft in pitch. The maximum elevator deflection is 30° nose up, and 17° nose down. The maximum THS deflection is 13.5° nose up, and 4° nose down.
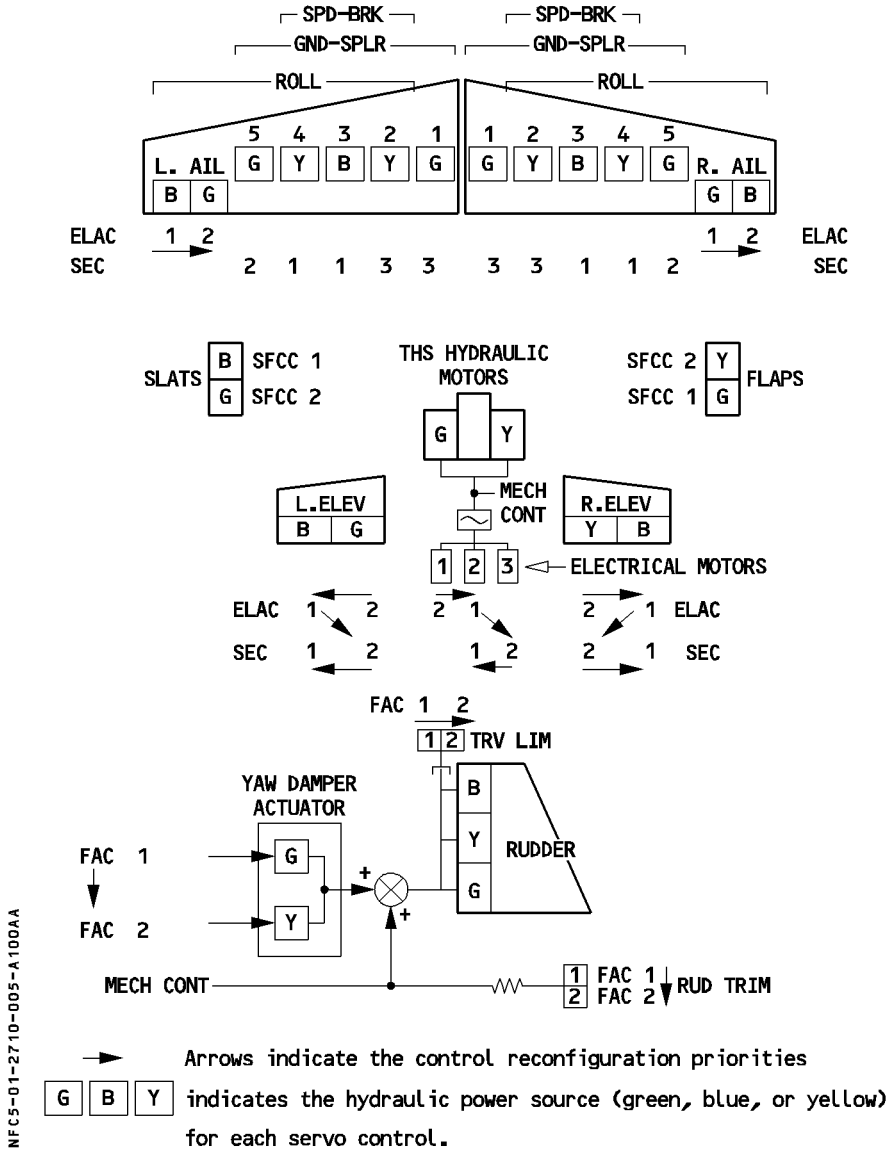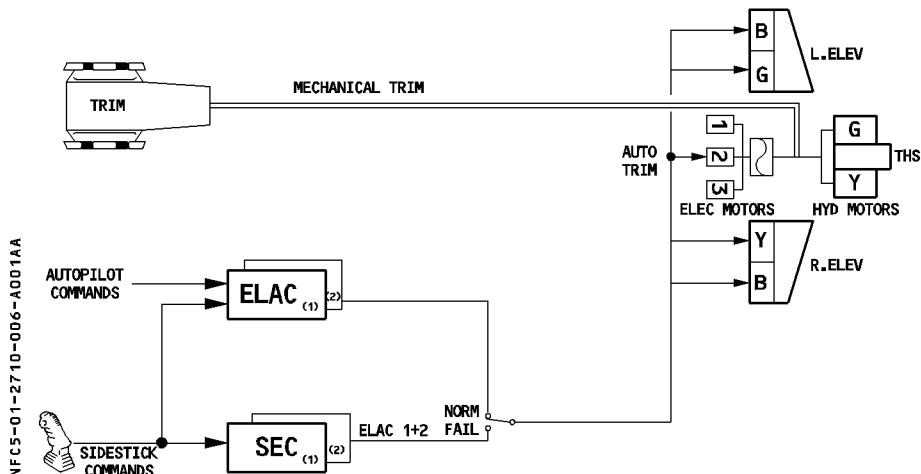
ELECTRICAL CONTROL

— In normal operations, ELAC2 controls the elevators and the horizontal stabilizer, and the green and yellow hydraulic jacks drive the left and right elevator surfaces respectively. The THS is driven by N° 1 of three electric motors.
— If a failure occurs in ELAC2, or in the associated hydraulic systems, or with the hydraulic jacks, the system shifts pitch control to ELAC1. ELAC1 then controls the elevators via the blue hydraulic jacks and controls the THS via the N° 2 electric motor.
— If neither ELAC1 nor ELAC2 is available, the system shifts pitch control either to SEC1 or to SEC2, (depending on the status of the associated circuits), and to THS motor N° 2 or N° 3.
Page 8, below, describes how the actuators are reconfigured in case of failure.

MECHANICAL CONTROL

Mechanical control of the THS is available from the pitch trim wheel at any time, if either the green or yellow hydraulic system is functioning.
Mechanical control from the pitch trim wheel has priority over electrical control.
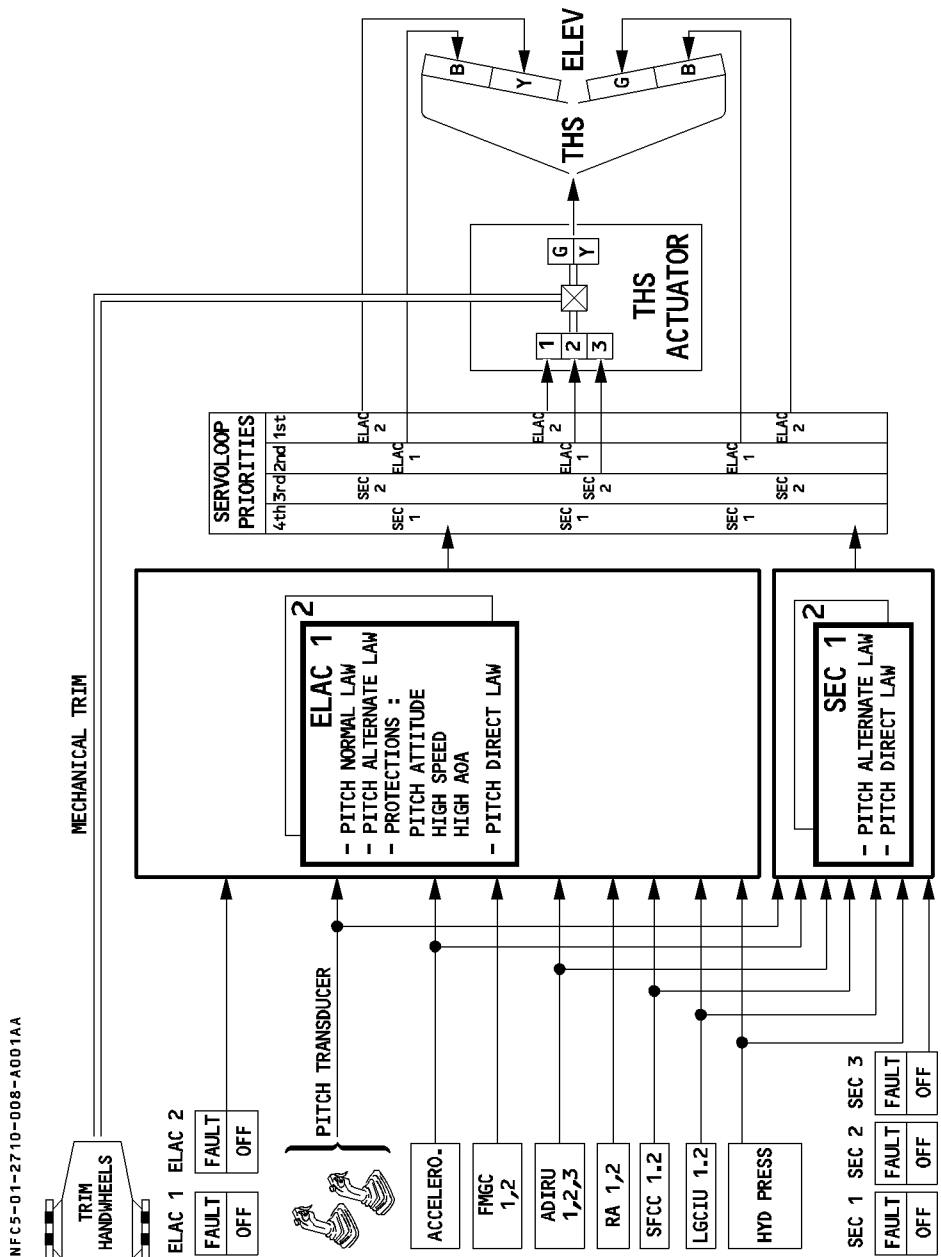
ACTUATION

Elevators
— Two electrically-controlled hydraulic servojacks drive each elevator.
  Each servojack has three control modes :
  . Active   : The jack position is electrically-controlled.
  . Damping   : The jack follows surface movement.
  . Centering : The jack is hydraulically retained in the neutral position.
— In normal operation :
  · One jack is in active mode.
  · The other jack is in damping mode.
  · Some maneuvers cause the second jack to become active.
— If the active servojack fails, the damped one becomes active, and the failed jack is automatically switched to the damping mode.
R — If neither jack is being controlled electrically, both are automatically switched to
R   centering mode.
R   If neither jack is being controlled hydraulically, both are automatically switched to
R   damping mode.
— If one elevator fails, the deflection of the remaining elevator is limited in order to avoid putting excessive asymmetric loads on the horizontal tailplane or rear fuselage.

Stabilizer
— A screwjack, driven by two hydraulic motors, drives the stabilizer.
— The two hydraulic motors are controlled by :
  · One of three electric motors, or
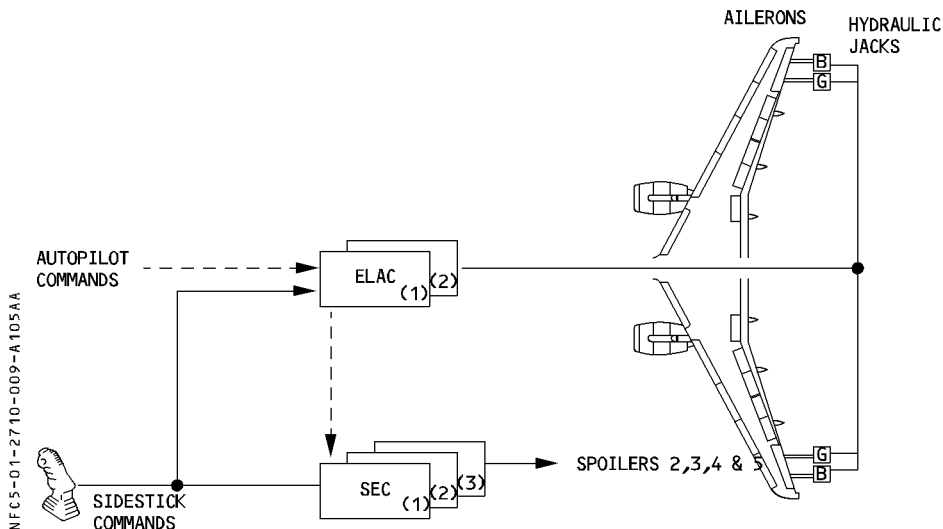 · The mechanical trim wheel.

PITCH CONTROL – SCHEMATIC

FOR INFO

NFC5-01-2710-008-A001AA

ROLL CONTROL

One aileron and four spoilers on each wing control the aircraft about the roll axis.
The maximum deflection of the ailerons is 25°.
The ailerons extend 5° down when the flaps are extended (aileron droop).
The maximum deflection of the spoilers is 35°.

ELECTRIC CONTROL

— The ELAC 1 normally controls the ailerons.
    If ELAC1 fails, the system automatically transfers aileron control to ELAC2.
    If both ELACs fail, the ailerons revert to the damping mode.
— SEC3 controls the N° 2 spoilers, SEC1 the N° 3 and 4 spoilers, and SEC2 the N° 5
    spoilers.
    If a SEC fails, the spoilers it controls are automatically retracted.

ACTUATION

Ailerons
Each aileron has two electrically controlled hydraulic servojacks.
One of these servojacks per aileron operates at a time.
Each servojack has two control modes :
Active   : Jack position is controlled electrically
Damping : Jack follows surface movement.

The system automatically selects damping mode, if both ELACs fail or in the event of blue and green hydraulic low pressure.

Spoilers

A servojack positions each spoiler. Each servojack receives hydraulic power from either the green, yellow, or blue hydraulic system, controlled by the SEC1, 2 or 3 (as shown on page 5).

The system automatically retracts the spoilers to their zero position, if it detects a fault or loses electrical control.

If the system loses hydraulic pressure, the spoiler retains the deflection it had at the time of the loss, or a lesser deflection if aerodynamic forces push it down.

R   When a spoiler surface on one wing fails, the symmetric one on the other wing is inhibited.

SPEEDBRAKES AND GROUND SPOILERS

SPEEDBRAKE CONTROL

The pilot controls the speedbrakes with the speed brake lever.
The speedbrakes are actually spoilers 2, 3 and 4.
Speedbrake extension is inhibited if :
− SEC1 and SEC3 both have faults.
− An elevator (L or R) has a fault (in this case only spoilers 3 and 4 are inhibited).
− Angle-of-attack protection is active.
− Flaps are in configuration FULL.
− Thrust levers above MCT position
− Alpha floor activation
If an inhibition occurs when the speedbrakes are extended, they retract automatically and stay retracted until the inhibition condition disappears and the pilots reset the lever. (The speedbrakes can be extended again 10 seconds or more after the lever is reset).
When a speedbrake surface on one wing fails, the symmetric one on the other wing is inhibited.

Note : *1. For maintenance purposes, the speedbrake lever will extend the N° 1 surfaces when the aircraft is stopped on the ground, whatever the slat/flap configuration.*
2. When the aircraft is flying faster than 315 knots or Mach 0.75 with the autopilot engaged, the speedbrake retraction rate is reduced (Retraction from FULL to in takes about 25 seconds).

FOR INFO

The maximum speedbrake deflection in manual flight is :
40° for spoilers 3 and 4
20° for spoiler 2.
The maximum speedbrake deflection with the autopilot engaged is :
25° for spoilers 3 and 4
12.5° for spoilers 2.
The maximum speedbrake deflection with the autopilot engaged is achieved with half speedbrake lever deflection.
For these surfaces (which perform both roll and speedbrake functions) the roll function has priority. When the sum of a roll order and a simultaneous speedbrake order on one surface is greater than the maximum deflection available in flight, the same surface on the other wing is retracted until the difference between the two surfaces is equal to the roll order.

GROUND SPOILER CONTROL

Spoilers 1 to 5 act as ground spoilers.
When a ground spoiler surface on one wing fails, the symmetric one on the other wing is inhibited.

Arming
The pilot arms the ground spoilers by pulling the speedbrake control lever up into the armed position.

Full extension
The ground spoilers automatically extend during rejected takeoff, at a speed greater than 72 knots, or at landing when both main landing gears have touched down, when :

R · Ground spoilers are armed and all thrust levers are at or near idle, or
· Reverse is selected on at least one engine (other thrust lever at or near idle), if ground
R spoilers were not armed.

> Note : · In autoland, the ground spoilers fully extend at half speed one second after both main landing gear touch down.
> R · The spoiler roll function is inhibited when spoilers are used for the ground spoiler
> R function.

Partial extension
The ground spoilers partially extend (10°) when reverse is selected on at least one engine (other engine at idle), and one main landing gear strut is compressed. This partial extension, by decreasing the lift, eases the compression of the second main landing gear strut, and consequently leads to full ground spoiler extension.

Retraction
The ground spoilers retract :
· After landing, or after a rejected takeoff, when the ground spoilers are disarmed.

> Note : If ground spoilers are not armed, they extend at the reverse selection and retract when idle is selected.

· During a touch and go, when at least one thrust lever is advanced above 20°.

> Note : After an aircraft bounce, the ground spoilers remain extended with the thrust levers at idle.

FOR INFO

R The landing gear touchdown condition is triggered for both main landing gear, either when
R their wheel speed is greater than 72 knots, or when their landing gear struts are
R compressed and the radio altitude is very low (RA < 6 feet).
R For the ground spoiler logic, idle signifies :
R Thrust lever position < 4° or < 15° when below 10 ft
R

ROLL CONTROL – SCHEMATIC

FOR INFO

YAW CONTROL

One rudder surface controls yaw.

ELECTRICAL RUDDER CONTROL

The yaw damping and turn coordination functions are automatic.
The ELACs compute yaw orders for coordinating turns and damping yaw oscillations, and transmit them to the FACs.
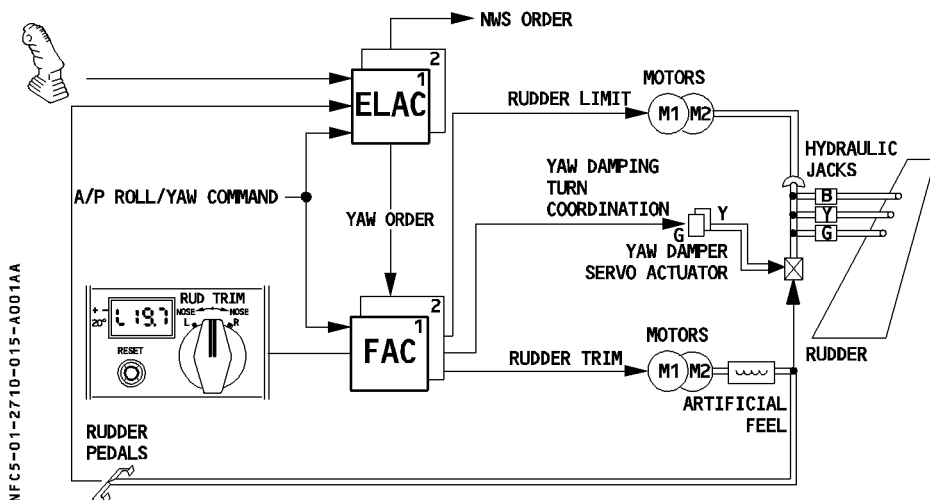
MECHANICAL RUDDER CONTROL

The pilots can use conventional rudder pedals to control the rudder.

RUDDER ACTUATION

Three independent hydraulic servojacks, operating in parallel, actuate the rudder. In automatic operation (yaw damping, turn coordination) a green servo actuator drives all three servojacks. A yellow servo actuator remains synchronized and takes over if there is a failure.
There is no feedback to the rudder pedals from the yaw damping and turn coordination functions.

RUDDER TRAVEL LIMIT

The deflection of the rudder and the pedals is limited as a function of speed.
Each channel of the limiter is controlled and monitored by its associated FAC. If both FACs fail, maximum deflection is available when the slats are extended.
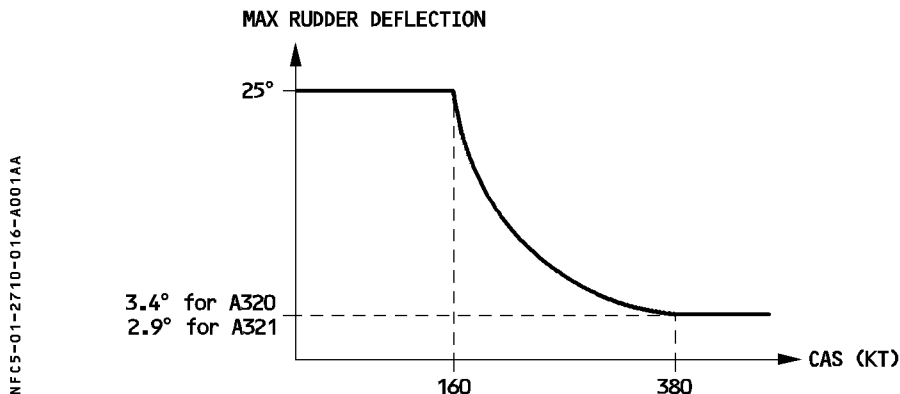
RUDDER TRIM

The two electric motors that position the artificial feel unit also trim the rudder. In normal operation, motor N° 1, controlled by FAC1, drives the trim, and FAC2 with motor N° 2 remains synchronized as back-up.
In manual flight, the pilot can apply rudder trim with the rotary RUD TRIM switch on the pedestal.
— Maximum deflection is ± 20°.
— Rudder trim speed is one degree per second.
— In addition to limitation by TLU, if rudder trim is applied, maximum rudder deflection may be reduced in the opposite direction.
The pilot can use a button on the RUD TRIM panel to reset the rudder trim to zero.

R   *Note : With the autopilot engaged, the FMGC computes the rudder trim orders. The rudder trim rotary switch and the rudder trim reset pushbutton are not active.*

YAW CONTROL – SCHEMATIC

FOR INFO
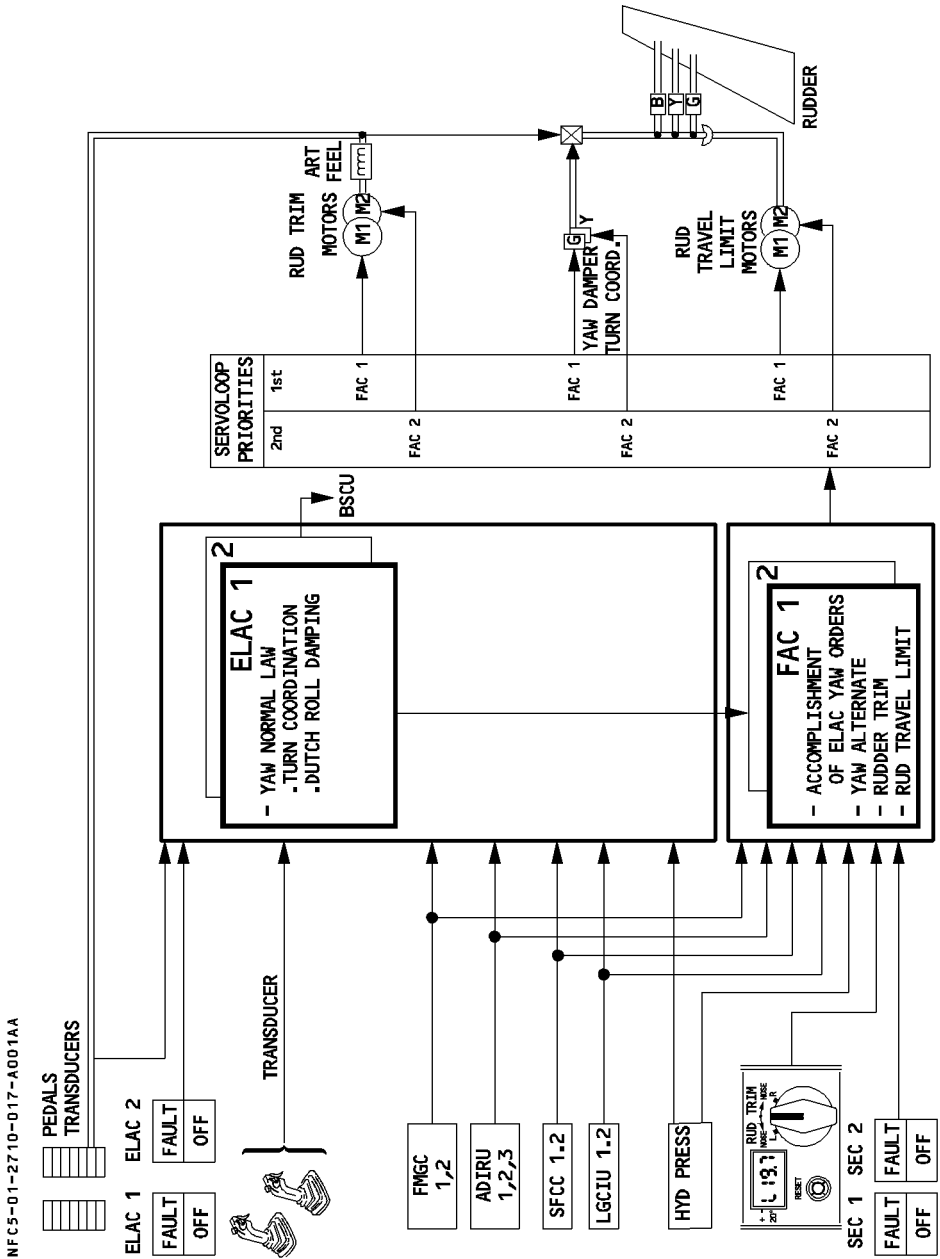
GENERAL

Flight control normal law covers :
— three-axis control
— flight envelope protection
— alleviation of maneuver loads
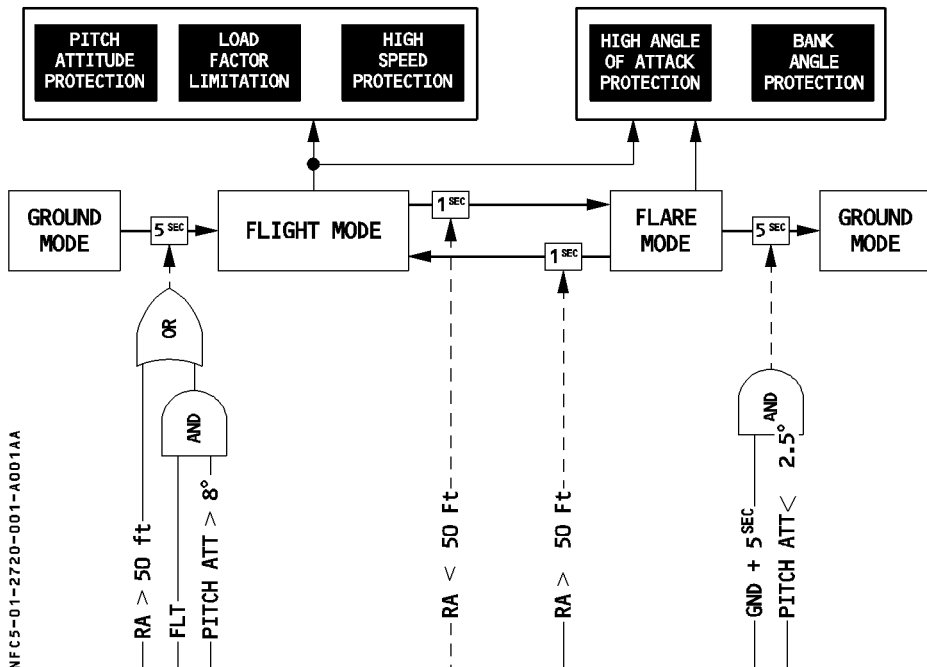
PITCH CONTROL

GROUND MODE

Ground mode is active when the aircraft is on the ground. It is a direct relationship between sidestick deflection and elevator deflection, without auto trim.

It automatically sets the trimmable horizontal stabilizer (THS) at 0° (inside the green band). A setting that the pilot enters manually to adjust for CG has priority for takeoff.

When the aircraft reaches 70 knots during the takeoff roll, the system reduces the maximum up elevator deflection from 30° to 20°, and the aircraft performs the rotation maneuver in direct law.

As soon as the aircraft becomes airborne, the system blends in the flight mode.

The reverse process occurs after touchdown.

FLIGHT MODE

The normal-law flight mode is a load-factor-demand mode with automatic trim and protection throughout the flight envelope.

Following normal law, the sidestick controllers set the elevator and THS to maintain load factor proportional to stick deflection and independent of speed.

With the sidestick at neutral, wings level, the system maintains 1 g in pitch (corrected for pitch attitude), and there is no need for the pilot to trim by changing speed or configuration. Pitch trim is automatic both in manual mode and when the autopilot is engaged. In normal turns (up to 33° of bank) the pilot does not have to make any pitch corrections once the turn is established.

The flight mode is active from takeoff to landing, and follows the logic shown schematically on page 1, above.

Automatic pitch trim freezes in the following situations :
— The pilot enters a manual trim order.
— The radio altitude is below 50 feet (100 feet with autopilot engaged).
— The load factor goes below 0.5 g.
— The aircraft is under high-speed or high-Mach protection (except when there is fault in one of the elevators).

When angle-of-attack protection is active, the THS setting is limited between the setting at the aircraft's entry into this protection and 3.5° nose down. (Neither the pilot nor the system can apply additional nose-up trim).

Similarly, when the load factor is higher than 1.25 g or when the aircraft exceeds 33° of bank, the THS setting is limited to values between the actual setting and 3.5° nose down.

Control with autopilot engaged
— The ELACs and SECs limit what the autopilot can order.
— The pilot has to overcome a restraining force in order to move the sidestick when the autopilot is engaged. If he overcomes this force and does move the sidestick, he disconnects the autopilot.
R — The pilot can also disconnect the autopilot by pushing on the rudder pedals (10° out of trim), or by moving the pitch trim wheel beyond a certain threshold.
— All protections of normal laws remain effective.

FLARE MODE

The flight mode changes to flare mode when the aircraft passes 50 feet RA as it descends to land.
The system memorizes the attitude at 50 feet, and that attitude becomes the initial reference for pitch attitude control.
As the aircraft descends through 30 feet, the system begins to reduce the pitch attitude, reducing it to 2° nose down over a period of 8 seconds. This means that it takes gentle nose-up action by the pilot to flare the aircraft.

PROTECTIONS

The normal law protects the aircraft throughout the flight envelope, as follows :
— load factor limitation
— pitch attitude protection
— high-angle-of-attack (AOA) protection
— high-speed protection.
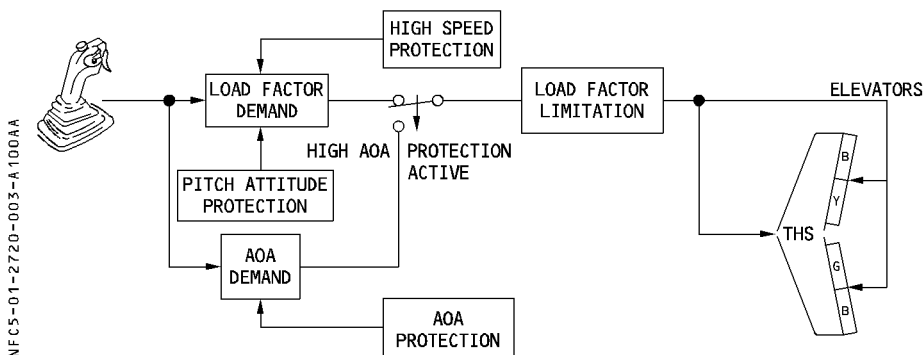
LOAD FACTOR LIMITATION

The load factor is automatically limited to :
+ 2.5 g to − 1 g for clean configuration.
+ 2 g to 0 for other configurations.

PITCH ATTITUDE PROTECTION

Pitch attitude is limited to :
— 30° nose up in conf 0 to 3 (progressively reduced to 25° at low speed).
— 25° nose up in conf FULL (progressively reduced to 20° at low speed).
— 15° nose down (indicated by green symbols "=" on the PFD's pitch scale).
The flight director bars disappear from the PFD when the pitch attitude exceeds 25° up or 13° down. They return to the display when the pitch angle returns to the region between 22° up and 10° down.

HIGH ANGLE OF ATTACK PROTECTION

Under normal law, when the angle of attack becomes greater than αprot, the system switches elevator control from normal mode to a protection mode, in which the angle of attack is proportional to sidestick deflection. That is, in the αprot range, from α prot to αmax, the sidestick commands α directly. However, the angle of attack will not exceed αmax, even if the pilot gently pulls the sidestick all the way back. If the pilot releases the sidestick, the angle of attack returns to αprot and stays there.

This protection against stall and windshear has priority over all other protections. The autopilot disconnects at α prot $+ 1°$.
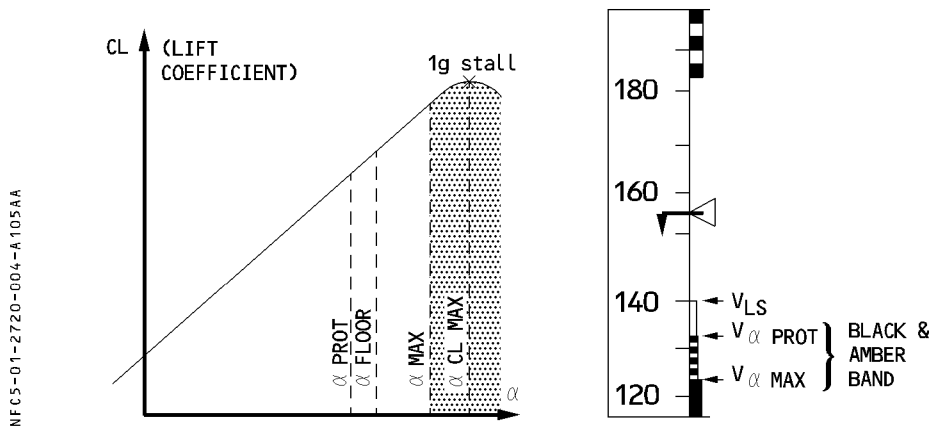
$V\alpha$ prot, $V\alpha$ floor, $V\alpha$ max vary according to the weight and the configuration.
To deactivate the angle of attack protection, the pilot must push the sidestick :
— More than 8° forward, or
— More than 0.5° forward for at least 0.5 seconds, when $\alpha < \alpha$ max.
In addition, below 200 feet, the angle of attack protection is also deactivated, when :
— Sidestick deflection is less than half nose-up, and
— Actual α is less than α prot $- 2°$.

Note : 1. At takeoff, αprot is equal to αmax for 5 seconds.
       2. αfloor is activated through the A/THR system, when :
          — α is greater than α floor (9.5° in configuration 0; 15° in configuration 1, 2; 14° in configuration 3 ; 13° in configuration FULL), or
          — Sidestick deflection is greater than 14° nose up, with either the pitch attitude or the angle of attack protection active.
          The αfloor function is available from lift-off to 100 feet RA before landing.

HIGH-SPEED PROTECTION

The aircraft automatically recovers following a high speed upset. Depending on the flight conditions (high acceleration, low pitch attitude), the High Speed Protection is activated at/or above VMO/MMO.

R When it is activated, the pitch trim is frozen. Positive spiral static stability is introduced to
R 0° bank angle (instead of 33° in normal law), so that with the sidestick released, the aircraft
R always returns to a bank angle of 0°. The bank angle limit is reduced from 67° to 45°.

As the speed increases above VMO/MMO, the sidestick nose-down authority is progressively reduced, and a permanent nose-up order is applied to aid recovery to normal flight conditions.

The High Speed Protection is deactivated when the aircraft speed decreases below VMO/MMO, where the usual normal control laws are recovered.

The autopilot disconnects when high speed protection goes active.

High speed protection symbol:
Two green bars at VMO + 6

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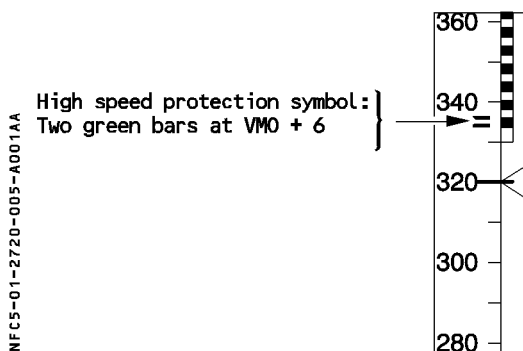
Note : The ECAM displays an "O/SPEED" warning at VMO + 4 knots and MMO + 0.006.

LOW ENERGY WARNING ◁

The low energy warning is computed by the FAC, see 1.22.40.

LATERAL CONTROL

NORMAL LAW

When the aircraft is on the ground (in "on ground" mode), the sidestick commands the aileron and roll spoiler surface deflection. The amount of control surface deflection that results from a given amount of sidestick deflection depends upon aircraft speed. The pedals control rudder deflection through a direct mechanical linkage.

When the aircraft is in the "in flight" mode, normal law combines control of the ailerons, spoilers (except N° 1 spoilers), and rudder (for turn coordination) in the sidestick. While the system thereby gives the pilot control of the roll and heading, it also limits the roll rate and bank angle, coordinates the turns, and damps the dutch roll.

The roll rate requested by the pilot during flight is proportional to the sidestick deflection, with a maximum rate of 15° per second when the sidestick is at the stop.

When the aircraft is in "flare" mode, the lateral control is the same as in "in flight" mode.
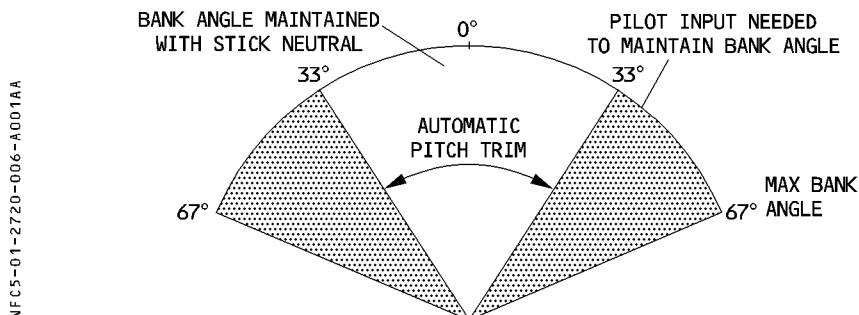
BANK ANGLE PROTECTION

R Inside the normal flight envelope, the system maintains positive spiral static stability for bank angles above 33°. If the pilot releases the sidestick at a bank angle greater than 33°, the bank angle automatically reduces to 33°. Up to 33°, the system holds the roll attitude constant when the sidestick is at neutral. If the pilot holds full lateral sidestick deflection, the bank angle goes to 67° (indicated by a pair of green bar lines "=" on the PFD) and no further.

If the angle-of-attack protection or high speed protection is operative, the bank angle goes to 45° and no further, if the pilot holds full lateral sidestick deflection. If high speed
R protection is operative, the system maintains positive spiral static stability from a bank angle of 0°, so that with the sidestick released, the aircraft always returns to a bank angle of 0°.

When bank angle protection is active, auto trim is inoperative.

If the bank angle exceeds 45°, the autopilot disconnects and the FD bars disappear. The FD bars return when the bank angle decreases to less than 40°.

BANK ANGLE MAINTAINED WITH STICK NEUTRAL — 0° — PILOT INPUT NEEDED TO MAINTAIN BANK ANGLE — 33° — 33° — AUTOMATIC PITCH TRIM — 67° — 67° MAX BANK ANGLE

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LEFT INTENTIONALLY BLANK

SIDESLIP TARGET

If one engine fails, the FAC modifies the sideslip indication slightly to show the pilot how much rudder to use to get the best climb performance (ailerons to neutral and spoilers retracted).

In takeoff configuration (1,2,3) when the FAC detects asymmetric thrust (35 % N1) and at least one engine is above 80% N1, the slideslip indication on the PFD changes from yellow lo blue.

ROLL INDEX

SIDESLIP TARGET (blue)

BANK ANGLE
LIMITATION (67°)

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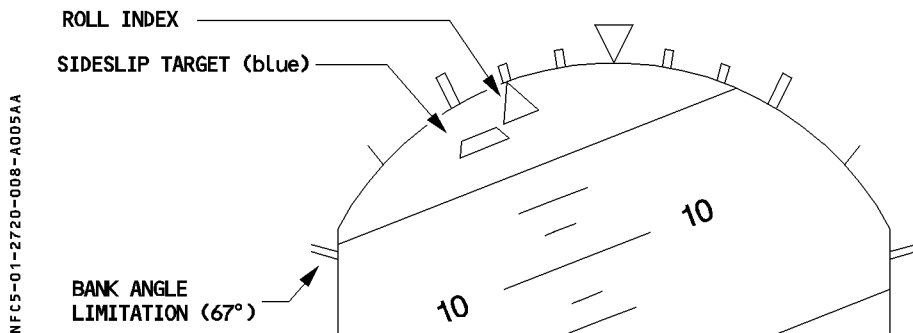
The pilot's response is normal and instinctive : zero the slip indication by applying the right amount of rudder to get the best climb performance.

GENERAL

Depending on the failures occuring to the flight control system, or on its peripherals, there are 3 levels of reconfiguration :
— Alternate law
 They are two levels of alternate law : with and without reduced protections.
— Direct law
— Mechanical

FLIGHT CONTROLS LAW RECONFIGURATION

PITCH NORMAL
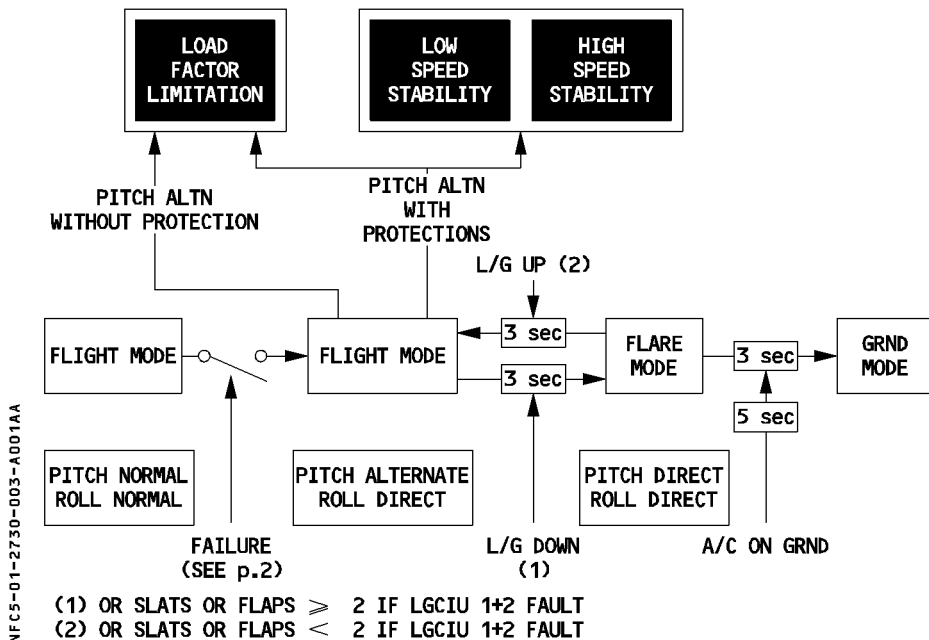ROLL NORMAL
YAW NORMAL

TRIPLE IR FAIL.

RADIO ALTIMETERS FAIL WHEN L/G DOWN OR IN CONF 2 IF BOTH LGCIU'S FAILED
→ DIRECT / DIRECT / ALT

DOUBLE (2nd NOT SELF DETECTED) IR FAILURE
→ DIRECT / DIRECT / MECHANICAL

ELEC FAIL BAT ONLY
→ DIRECT / DIRECT / MECHANICAL

DOUBLE SELF DETECTED ADR FAILURE.
DOUBLE (2nd NOT SELF DETECTED) ADR FAILURE (ALPHA DISAGREE).
DOUBLE ELAC FAILURE.
SIDESTICK FAULT.
DOUBLE AILERON FAILURE.
LOSS OF ALL SPOILERS.
THS JAMMED.
TRIPLE SEC FAILURE.
ELAC 2 + BLUE HYD FAILURE.
ELAC 1 + GREEN HYD FAILURE.
ELAC 1 + YELLOW HYD FAILURE.
ONE ELEVATOR FAILURE.
DOUBLE SELF DETECTED IR FAILURE.

DOUBLE FAC FAIL
DOUBLE HYD FAIL (Y+G)
YAW DAMPER FAIL
→ ALT (REDUCED PROT) / DIRECT / MECHANICAL

→ ALT (REDUCED PROT) / DIRECT / ALT

EMER ELEC FROM RAT (AFTER FAC 1 RESET)

CREW ACTION: IDENTIFICATION OF FAILED IR, ELAC 1+2 RESET

DOUBLE (2nd NOT SELF DETECTED V CAS OR M DISAGREE).
TRIPLE ADR. FAILURE.
DOUBLE SFCC SLAT CHANNEL FAILURE.
DOUBLE HYD FAILURE (B+G).
→ ALT (NO PROTECTION) / DIRECT / ALT

PITCH ALT (NO PROTECTION)
ROLL DIRECT
YAW ALT

NFC5-01-2730-002-A103AA

ALTERNATE LAW

NFC5-01-2730-003-A001AA

(1) OR SLATS OR FLAPS $\geqslant$ 2 IF LGCIU 1+2 FAULT
(2) OR SLATS OR FLAPS $<$ 2 IF LGCIU 1+2 FAULT

PITCH CONTROL

GROUND MODE

Under alternate law the ground mode becomes active on the ground five seconds after touchdown.
It is identical to the ground mode of the normal law.

FLIGHT MODE

In flight, the alternate law pitch mode follows a load-factor demand law much as the normal law pitch mode does, but it has less built-in protection (reduced protections).

FLARE MORE

In pitch alternate law the flight mode changes to the flare mode when the pilot selects landing gear down. The flare mode is a direct stick-to-elevator relationship.
(See DIRECT LAW).

LATERAL CONTROL

When the aircraft flying in pitch alternate law, lateral control follows the roll direct law associated with yaw alternate or mechanical.

ROLL DIRECT LAW

See page 6.

YAW ALTERNATE LAW

Only the yaw damping function is available. Damper authority is limited to ± 5° of rudder deflection.

REDUCED PROTECTIONS

LOAD FACTOR LIMITATION

The load factor limitation is similar to that under normal law.

PITCH ATTITUDE PROTECTION

There is no pitch attitude protection. Amber Xs replace the green double bars "=" on the PFD.
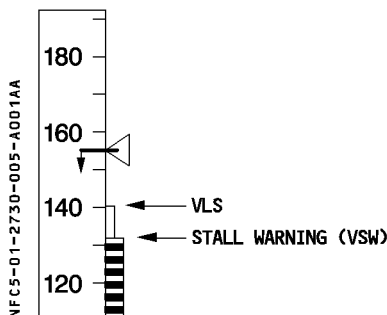
R **LOW SPEED STABILITY**

An artificial low speed stability replaces the normal angle-of-attack protection. It is available for all slat/flap configurations, and the low speed stability is active from about 5 knots up to about 10 knots above stall warning speed, depending on the aircraft's gross weight and slats/flaps configuration.

A gentle progressive nose down signal is introduced, which tends to keep the speed from falling below these values.

The system also injects bank-angle compensation, so that operation effectively maintains a constant angle of attack.

In addition, audio stall warnings (crickets + "STALL" synthetic voice message) is activated at an appropriate margin from the stall condition.

The PFD speed scale is modified to show a black/red barber pole below the stall warning. The α floor protection is inoperative.

R **HIGH SPEED STABILITY**

Above VMO or MMO, a nose up demand is introduced to avoid an excessive increase in speed. The pilot can override this demand.

In addition, the aural overspeed warning (VMO + 4 or MMO + 0.006) remains available.

BANK ANGLE PROTECTION

Not provided.

Note : _The AP will disconnect, if speed exceeds VMO/MMO, or if the bank angle exceeds 45°._

ALTERNATE LAW WITHOUT REDUCED PROTECTION

This is identical to alternate law except that it does not include the low-speed stability or the high-speed stability. It includes only the load factor limitation.

DIRECT LAW

PITCH CONTROL

The pitch direct law is a direct stick-to-elevator relationship (elevator deflection is proportional to stick deflection).
In all configurations the maximum elevator deflection varies as a function of CG.
It is a compromise between adequate controllability with the CG forward, and not-too-sensitive control with the CG aft.
There is no automatic trim : the pilot must trim manually.
The PFD displays in amber the message "USE MAN PITCH TRIM".
No protections are operative.
The α floor function is inoperative.
Overspeed and stall warnings are available as for alternate law.

LATERAL CONTROL

When flying in "direct law", the roll direct law associated with mechanical yaw control governs lateral control.

ROLL DIRECT LAW

The roll direct law is a direct stick-to-surface-position relationship. System gains are set automatically to correspond to slat/flap configuration.
With the aircraft in the clean configuration, the maximum roll rate is about 30° per second. With slats extended, it is about 25° per second.
To limit roll rate, the roll direct law uses only ailerons and spoilers N° 4 and 5.
If spoiler N° 4 has failed, spoiler N°3 replaces it.
If the ailerons have failed, all roll spoilers become active.

YAW MECHANICAL CONTROL

The pilot controls yaw with the rudder pedals.
The yaw damping and turn coordination functions are lost.

ABNORMAL ATTITUDE LAWS

The system applies an abnormal-attitude law in pitch and roll if the aircraft exceeds any of these limits in flight.
— Pitch attitude > 50° nose up or 30° nose down
— Bank angle > 125°
— Angle of attack > 30° or < − 10° (− 15° for A319 and A321)
— Speed > 440 knots or < 60 knots
— Mach > 0.91 or < 0.1
The law in pitch is the alternate law with no protection except load-factor protection and without auto trim. In roll it is a full-authority direct law with a yaw mechanical.
When the aircraft has recovered from its abnormal attitude, the flight control laws in effect are :
— in pitch : alternate law without protection with autotrim.
— in roll : full authority direct law with yaw alternate law.
There is no reversion to the direct law when the pilot extends the landing gear.

MECHANICAL BACK-UP

PITCH

Mechanical back-up permits the pilot to control the aircraft during a temporary complete loss of electrical power.
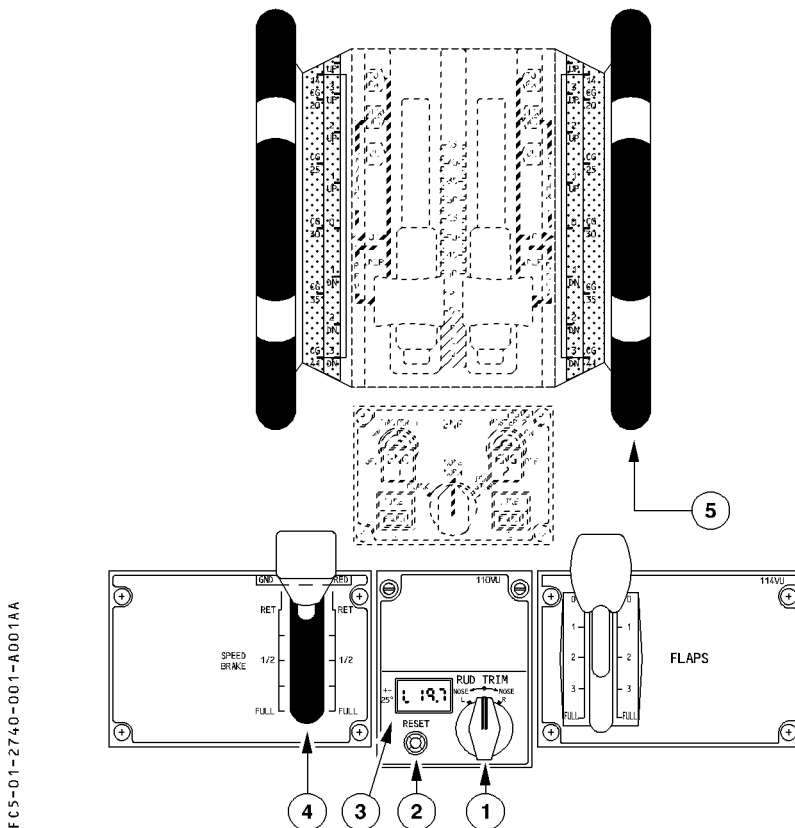He does this in pitch by applying trim manually to the THS.
The PFDs display "MAN PITCH TRIM ONLY" in red.

LATERAL

The pilot uses the rudder pedals as the mechanical back-up to control the aircraft laterally.

PEDESTAL

NFC5-01-2740-001-A001AA

① RUD TRIM Rotary Switch

Controls the rudder trim actuator, which moves the neutral point of the artificial feel by the equivalent of one degree of rudder travel per second.

Note : The rudder trim rotary switch has no effect, when the autopilot is engaged.

② RESET Pushbutton

R   By pushing the RESET pushbutton, the zero trim position is ordered at 1.5° / second.

Note : The RESET pushbutton is not active, when the autopilot is engaged.

③ Position Indicator

Displays the rudder trim direction (L or R) and value (0 to 20°).

④ SPEEDBRAKE lever

The lever controls :
— The position of the speedbrake surfaces.
  To set speedbrake surfaces to a required position, the lever has to be pushed down and set to the required position. A "hardpoint" is provided at "½" SPEEDBRAKE position.
— The manual preselection of the ground spoilers.
  To arm the ground spoilers, the lever must be pulled up when in the RET position. When the lever is armed (or reverse thrust is selected), all spoiler's surfaces will automatically extend at landing, or in case of a rejected takeoff.

⑤ PITCH TRIM wheel

Both pitch trim wheels provide mechanical control of the THS and have priority over electrical control. A pilot action on the pitch trim wheel disconnects the autopilot.

Note : Crew action on the pitch trim wheel does not disconnect the ELACs (micro-switches, actuated by the override mechanism, ensure that the computers remain synchronized with the manually-selected position).

R The THS is manually-controlled on ground for the THS setting, before takeoff and in flight,
R when in direct law.
R — Before takeoff, the pilot sets the THS to the angular value, determined as a function
R   of the aircraft CG, using the CG scale on the wheel. The relationship between the
R   aircraft CG and the THS setting shown on the trim wheel is only applicable for takeoff.
R   The limits of the THS normal setting range for takeoff are indicated by a green band
R   on the pitch trim wheel.
R — In flight, when in direct law, the pilot uses the THS conventionally to fly in trim. In
R   flight, the aircraft pitch trim setting depends on aircraft CG, weight, altitude and
R   speed. Consequently, the relation between the aircraft CG, and the THS setting
R   displayed on the pitch trim wheel, does not apply in flight.
R Following nosewheel touchdown, as the pitch attitude becomes less than 2.5° for more
R than 5 seconds, pitch trim is automatically reset to zero.

Note : This function is inoperative, when the green or yellow hydraulic system is not pressurized.

LATERAL CONSOLES

SIDESTICKS

Each pilot has on his lateral console a sidestick he can use to control pitch and roll manually. Each sidestick is springloaded to neutral.

When the autopilot is engaged, a solenoid-operated detent locks both sidesticks in the neutral position. If the pilot applies a force above a given threshold (5 daN in pitch, 3.5 daN in roll) the stick becomes free and the autopilot disengages.

The hand grip has two switches :
— Autopilot disconnect and sidestick takeover pushbutton.
— Push-to-talk button.

NFC5-01-2740-003-A200AA

NEUTRAL

RADIO

TAKE OVER PB
(A/P DISCONNECTION OR TAKE OVER
FROM OPPOSITE SIDESTICK)
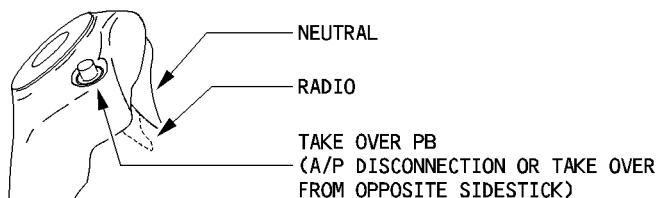
Sidestick priority logic
— When only one pilot operates the sidestick, it sends his control signals to the computers.
— When the pilots move both side stick simultaneously in the same or opposite direction and neither takes priority, the system adds the signals of both pilots algebraically. The total is limited to the signal that would result from the maximum deflection of a single sidestick.

R
R
R
Note : *In the event of simultaneous input on both sidesticks (2° deflection off the neutral position in any direction) the two green SIDE STICK PRIORITY lights on the glareshield come on and "DUAL INPUT" voice message is activated.*

A pilot can deactivate the other stick and take full control by pressing and keeping pressed his priority takeover pushbutton. For latching the priority condition, it is recommended to press the takeover push button for more than 40 seconds. This allows the pilot to release his takeover push button without losing priority. However, a pilot can at any time reactivate a deactivated stick by momentarily pressing the takeover push button on either stick. If both pilots press their takeover pushbuttons, the pilot that presses last gets priority.

Note : *If an autopilot is engaged, the first action on a takeover pushbutton disengages it.*

In a priority situation

— A red light comes on in front of the pilot whose stick is deactivated.
— A green light comes on in front of the pilot who has taken control, if the other stick is not in the neutral position (to indicate a potential and unwanted control demand).

Note : *If the aircraft is on the ground and commencing its takeoff run and one stick is deactivated, this triggers the takeoff "CONFIG" warning.*

GLARESHIELD

NFC5-01-2740-004-A100AA
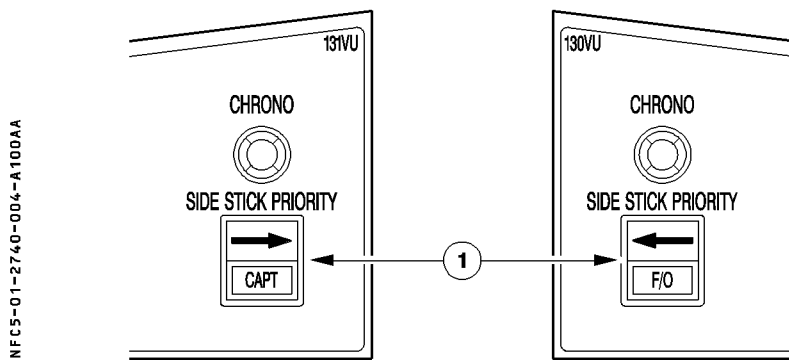
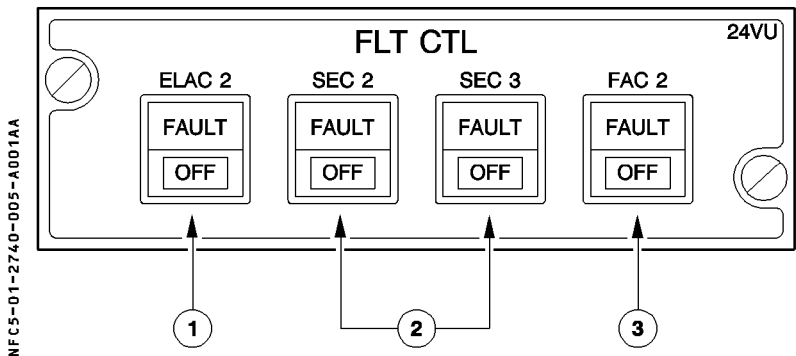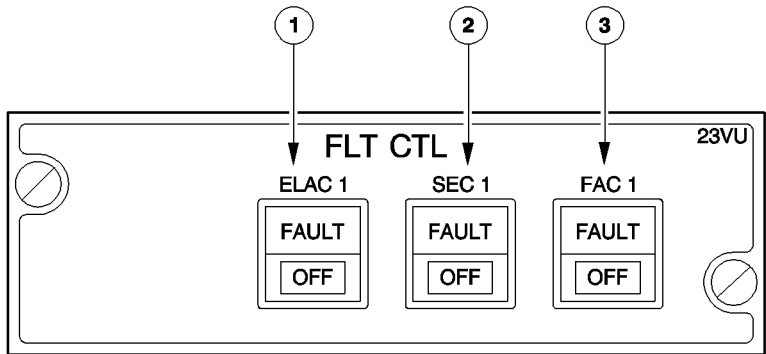(1) SIDE STICK PRIORITY lt

Red arrow light :
— comes on in front of the pilot losing authority.
— goes out if he has recovered his authority
  · if the other pilot releases his TAKEOVER pushbutton prior the priority condition is latched.
  or
  · If he has used his takeover push button to cancel a latched priority situation.
  Sidestick priority audio : A "PRIORITY LEFT" or "PRIORITY RIGHT" audio voice message is given each time priority is taken.
Green CAPT and F/O lights :
— Both lights flash when the pilots move both sidesticks simultaneously and neither takes priority.
— When a pilot has taken priority by pressing the takeover pushbutton and the other pilot's sidestick is not at neutral, the light in front of the pilot with priority lights up. It goes out when the other pilot returns his stick to the neutral position.

OVERHEAD PANEL

FLT CTL   23VU

1 → ELAC 1   2 → SEC 1   3 → FAC 1

FAULT FAULT FAULT
OFF   OFF   OFF

FLT CTL   24VU

ELAC 2   SEC 2   SEC 3   FAC 2

FAULT FAULT FAULT FAULT
OFF   OFF   OFF   OFF

1   2   3

NFC5-01-2740-005-A001AA

(1) ELAC 1(2) pushbutton

Controls the Elevator and Aileron Control (ELAC) Computer 1(2).

ON   : ELAC 1(2) performs the following functions :
- Normal pitch and roll
- Alternate pitch
- Direct pitch and roll
- Abnormal attitude
- Aileron droop
- Acquisition of autopilot orders.

OFF   : The corresponding computer is not active. Switching it OFF, then ON, resets the computer.

FAULT : Comes on amber, along with an ECAM caution :
- When a failure is detected
- During ELAC power-up test (eight seconds).

> *Note : The ELAC power-up test occurs when electrical power is turned on, or after the occurrence of an electrical transient lasting longer than 25 milliseconds.*

The FAULT light goes off, when the pilot selects OFF, or at the end of the ELAC power-up test, if its results are satisfactory.

(2) SEC 1(2)(3) pushbutton

Controls the spoiler and elevator (SEC) computers 1(2)(3).

ON   : SEC 1(2)(3) performs the following functions :
- Normal roll (by controlling the spoilers)
- Speedbrakes and ground spoilers
- Alternate pitch (SEC 1 and SEC 2 only)
- Direct pitch (SEC 1 and SEC 2 only)
- Direct roll
- Abnormal attitude.

OFF   : The corresponding computer is not active. Switching it OFF, then on, resets the computer.

FAULT : Comes on amber, along with an ECAM caution, when a failure is detected. The FAULT light goes off, when the pilot selects OFF.

③ <u>FAC 1(2) pb sw</u>

Controls the flight augmentation computer (FAC) 1(2).

ON   : Both FACs perform the following functions :
           — Normal roll (coordinating turns and damping dutch roll)
           — Rudder trim
           — Rudder travel limit
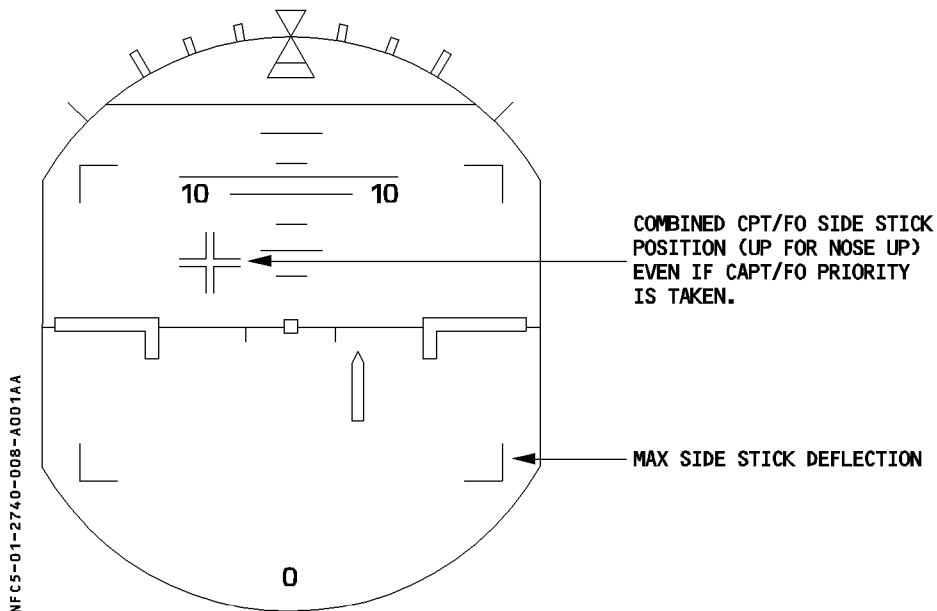   — Alternate yaw

OFF   : The corresponding computer is not active. Switching it OFF and then ON resets the computer.

FAULT : Lights up in amber, along with a caution on ECAM, when a failure is detected. The FAULT light goes out when the pilot selects OFF.

SIDE STICK INDICATIONS ON PFD

On the ground, after the first engine start, sidestick position indications appear white on both PFDs.
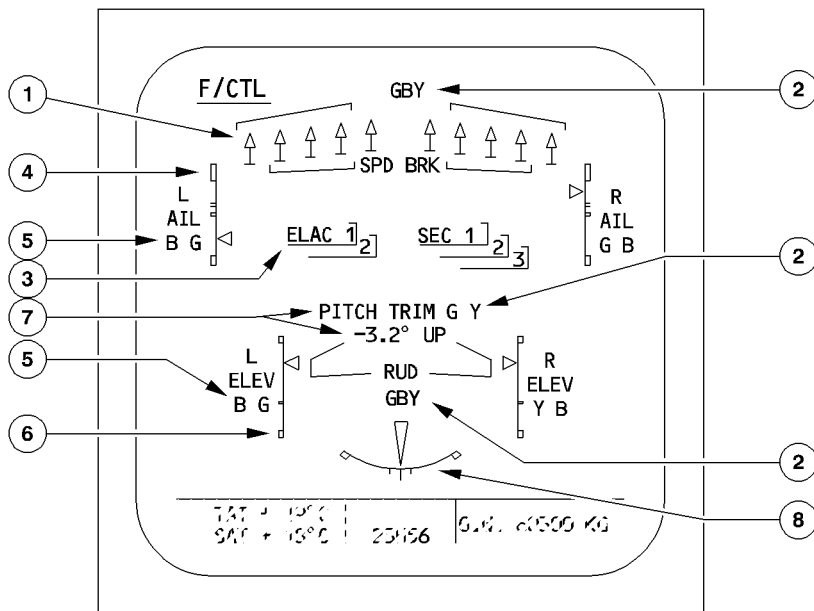The indications disappear when the aircraft goes from the ground into flight.

COMBINED CPT/FO SIDE STICK POSITION (UP FOR NOSE UP) EVEN IF CAPT/FO PRIORITY IS TAKEN.

MAX SIDE STICK DEFLECTION

NFC5-01-2740-008-A001AA

ECAM F/CTL PAGE

R

(1) Spoilers/speed brakes indication

↑ (green) : SPOILER DEFLECTED BY MORE THAN 2.5° (GREEN)

— : SPOILER RETRACTED (GREEN)

↑ (amber) : SPOILER FAULT DEFLECTED (AMBER)

1 : SPOILER FAULT RETRACTED (AMBER)

(2) Hydraulic system pressure indication

Normally green. Changes to amber if pressure in the hydraulic system gets low.

(3) ELAC/SEC indication

Normally green. Changes to amber if there is a failure in the ELAC or the SEC, or if ELAC or SEC pushbutton is off, or if both flight control data concentrators (FCDCs) fail.
The surrounding box is normally grey. It changes to amber if the ELAC or SEC indication does.

④ Aileron position indication

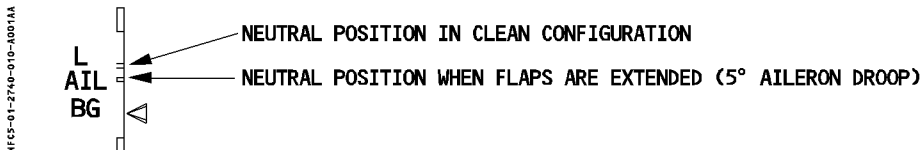White scale and green index. It changes to amber, when neither (green nor blue) servojack is available.

L
AIL
BG

→ NEUTRAL POSITION IN CLEAN CONFIGURATION
→ NEUTRAL POSITION WHEN FLAPS ARE EXTENDED (5° AILERON DROOP)

⑤ Aileron and elevator actuator indication

"G" and "B" are normally displayed in green.
The color changes to amber, in case of a green or blue hydraulic system low pressure.
The partial box also changes to amber, if the associated computer or actuator fails.

⑥ Elevator position indication

White scale and green index. The index changes to amber, when both associated actuators are not available.

⑦ Pitch trim position indication

The pitch trim numbers are in green. They change to amber, if the hydraulic pressure gets low in the green and yellow systems.
The "PITCH TRIM" legend is in white. It changes to amber, if there is a pitch trim jam.

⑧ Yaw control indications
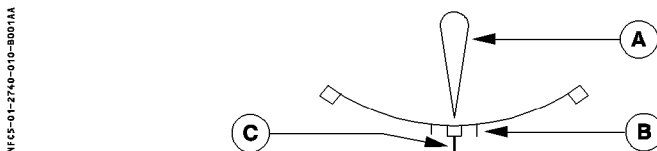
Ⓐ Rudder position indication
It is normally in green. The rudder symbol becomes amber, if the blue, green, and yellow hydraulic pressures are low.

Ⓑ Rudder travel limiter
Indication of high-speed position.

Ⓒ Rudder trim position
It is normally in blue. It changes to amber, if the rudder trim reset fails.

ECAM WHEEL PAGE

NFC5-01-2740-011-A100AA

① **SPOILERS/SPEED BRAKES INDICATION**

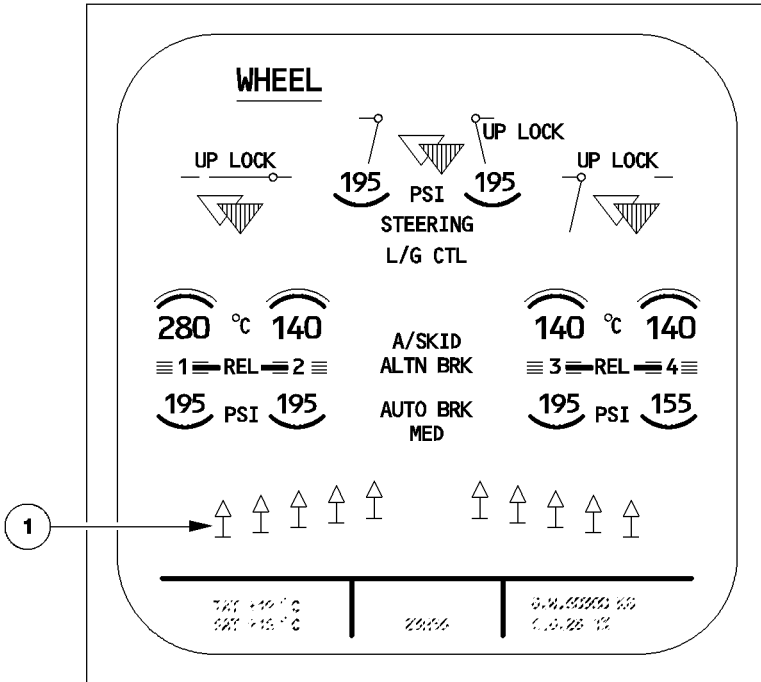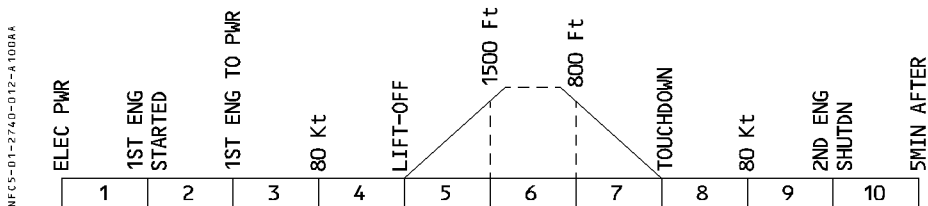These indications are the same as those displayed on the FLT CTL page.

WARNINGS AND CAUTIONS

NFCS-01-2740-012-A100AA

	ELEC PWR	1ST ENG STARTED	1ST ENG TO PWR	80 Kt	LIFT-OFF	1500 Ft	800 Ft	TOUCHDOWN	80 Kt	2ND ENG SHUTDN	5MIN AFTER
	1	2	3	4	5	6		7	8	9	10

E / WD: FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
CONFIG . SLATS/FLAPS NOT IN T.O CONFIG, or . SPD BRK NOT RETRACTED, or . PITCH TRIM NOT IN TO RANGE, or . RUD TRIM NOT IN T.O RANGE A/C not in TO configuration when thrust levers are set at TO, or Flex TO, or when pressing TO CONFIG. pb.	CRC	MASTER WARN	NIL / F/CTL	NIL / NIL	5, 6, 7, 8
CONFIG R (L) SIDESTICK FAULT (BY TAKE OVER) L or R sidestick is inoperative (takeover pb pressed more than 30 sec) when thrust levers are set at TO, or Flex TO, or when pressing TO CONFIG pb.			NIL	Red * SIDESTICK PRIORITY lt	
L +R ELEV FAULT Loss of both elevators.	SINGLE CHIME	MASTER CAUT	F/CTL	PFD message	NIL
L (R) SIDESTICK FAULT Transducers, on pitch or roll axis, are failed on one sidestick.				NIL	
ELAC 1 (2) FAULT Failure of ELAC				FAULT lt on ELAC pb	3, 4, 5, 7, 8
ELAC 1 (2) FAULT One sidestick transducer fault.				NIL	
SEC 1 (2) (3) FAULT Failure of one SEC.				FAULT lt on SEC pb	3, 4, 5
FCDC 1 + 2 FAULT Failure of both FCDCs.				NIL	4, 5, 7
DIRECT LAW Direct laws are active.				PFD message	4, 5, 7, 8
ALTN LAW Alternate laws are active.				NIL	
IR DISAGREE Disagree between two IRs, with the third one failed.			NIL	PFD message	3, 4, 5, 7
DUAL INPUT Both sidesticks are moved simultaneously.	Synthetic voice repeated every 5 seconds	NIL		SIDESTICK Priority light	NIL

* The red SIDESTICK PRIORITY light comes on, as soon as the sidestick becomes inoperative.

E / WD: FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
ADR DISAGREE One ADR is faulty, or has been rejected by the ELAC, and there is a speed or angle-of-attack disagree between the two remaining ADRs.			NIL	FAULT lts on ELAC pbs	3, 4, 5, 7
GND SPLR FAULT Loss of ground spoiler function in SEC 1 + 3 or 1 + 2 or 2 + 3 or 1 + 2 + 3.			F/CTL		3, 4, 5
SPD BRK DISAGREE Position disagree between surfaces and lever position.					
SPD BRK FAULT Spd brake lever transducers to SEC 1 and 3 failed.	SINGLE CHIME	MASTER CAUTION			
SPD BRK STILL OUT Speed brake out with at least one engine not at idle.			NIL		1, 2, 3, 4, 5, 8, 9, 10
STABILIZER JAM Jamming of stabilizer					4, 5
L (R) ELEV FAULT Loss of both servojacks on one elevator or activation of elevator flutter protection in ELAC.					
L (R) AIL FAULT Loss of both servojacks on one aileron.				NIL	
SPLR FAULT Loss of one or more spoilers.					3, 4, 5, 7
ELAC 1 PITCH FAULT Failure of pitch channel in ELAC 1.			F/CTL		3, 4, 5, 7, 8
ELAC 2 PITCH FAULT Failure of pitch channel in ELAC 2, or loss of one or both ELAC 2 rudder pedal transducers.					
GND SPLR 1 + 2 (3 + 4) Gnd splr channel failed in SEC 3 (1).					3, 4, 5
ELEV SERVO FAULT Loss of one servojack on one elevator.	NIL	NIL			
SPD BRK 2 (3 + 4) FAULT Spd brake lever transducers to SEC 3 (1) failed.					3, 4, 5, 7, 8
AIL SERVO FAULT Loss of one servojack on one aileron, or loss of one or both ELAC 1 rudder pedal transducers.					
FCDC 1 (2) FAULT			NIL		
SIDESTICK PRIORITY Failure in a sidestick priority logic circuit.					3, 4, 5, 6, 7, 8, 9

MEMO DISPLAY

— "SPEED BRK" memo display logic :
  · When the speedbrakes are extended in Flight Phases 2, 3, 4, and 5, the SPEED BRK memo flashes in amber.
  · When the speedbrakes are extended in Flight Phases 6 and 7, the SPEED BRK memo is displayed in green. It flashes in amber, after 50 seconds, if at least one engine is above idle.
— "GND SPLRS ARMED" appears in green, if the ground spoilers are armed.

DESCRIPTION

GENERAL

Each wing has the following lift augmentation devices :
— two flap surfaces
— five slat surfaces.
These surfaces are electrically controlled and hydraulically operated.
The pilot extends slats and flaps by moving the FLAPS lever on the center pedestal.
It has five positions.

MAIN COMPONENTS

The slat and flap systems are similar, comprising :
— Two slat flap control computers (SFCCs), each containing one slat channel and one flap channel.
— A power control unit (PCU) consisting of two independent hydraulic motors coupled by a differential gearbox.
    The motors use green and blue hydraulic power for the slats and yellow and green power for the flaps.
    Pressure-off brakes (POBs) lock the transmission when the slat or flap surfaces have reached the selected position or if hydraulic power fails.
— Five slat surfaces and two flap surfaces per wing.
— An assymetry position pick-off unit (APPU) that measures the assymetry between the left and right wings.
— A flap disconnect detection system, which detects attachment failure and inhibits flap operation in order to prevent further damage. A sensor detects the failure by measuring excessive differential movement between the inner and the outer flaps.
— Wingtip brakes (WTBs), activated in case of assymetry, mechanism overspeed, symmetrical runaway, or uncommanded movement of the surfaces. They cannot be released in flight.
    They use blue and green hydraulic power for the slats and for the right wing flaps, and blue and yellow hydraulic power for the left wing flaps.
— Feedback position pick-off units (FPPUs) that feed back position information to the SFCCs.
— An indication position pick-off unit (IPPU) that sends position data to the ECAM.

Note : If the flap wingtip brakes are on, the pilot can still operate the slats, and if the slat wingtip brakes are on, he can still operate the flaps.
    If one SFCC is inoperative, slats and flaps both operate at half speed.
    If one hydraulic system is inoperative, the corresponding surfaces (slats or flaps) operate at half speed.

ARCHITECTURE
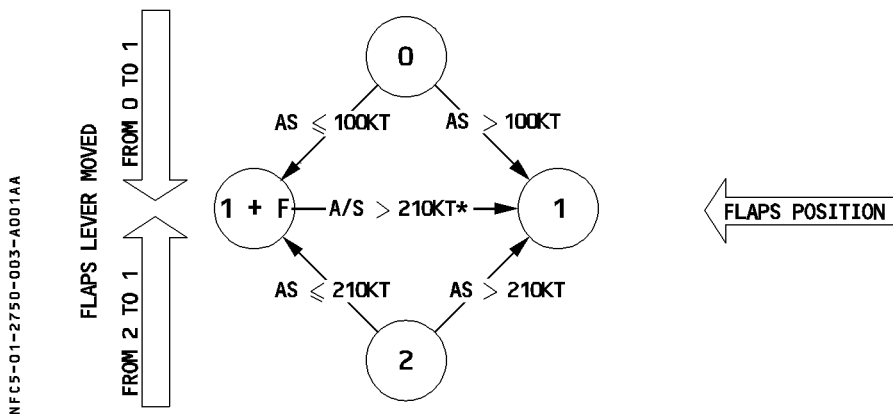

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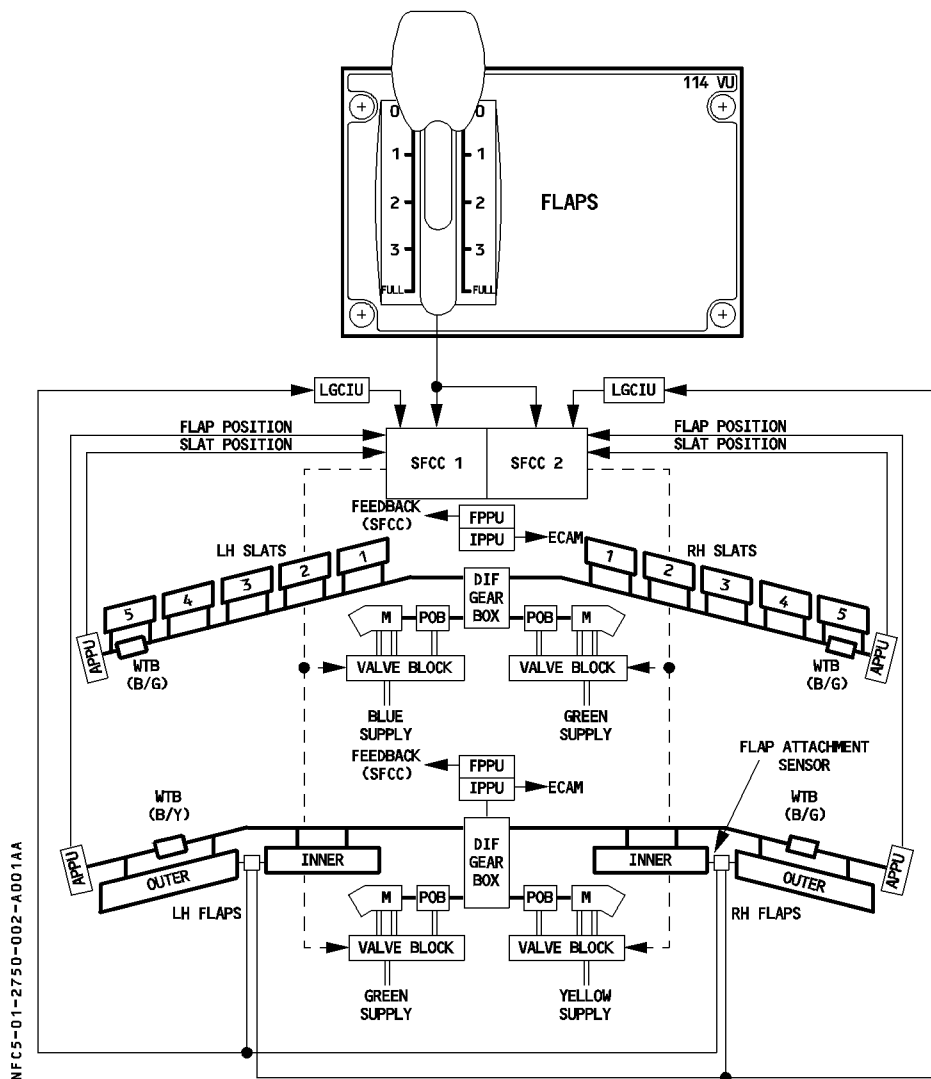
CONFIGURATIONS

The FLAPS lever has five positions : 0, 1, 2, 3 and FULL.
Two configurations correspond to position 1 : Configuration 1 and Configuration 1 + F.
The pilot selects these as follows :

* When Configuration 1 + F is selected, the flaps retract to 0° automatically at 210
R knots (before the airspeed reaches VFE).

ALPHA/SPEED LOCK FUNCTION (SLATS)

This function inhibits slat retraction at high angles of attack and low speeds.
The SFCCs use corrected angle-of-attack (alpha) or airspeed information from the air data inertial reference units (ADIRUs) to key the inhibition of slat retraction.
If alpha exceeds 8.6° or the airspeed falls below 148 knots, retraction from position 1 to position 0 is inhibited.
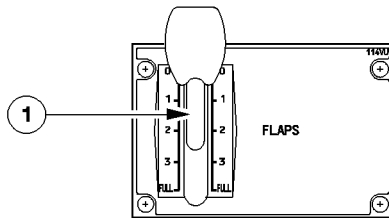The inhibition is removed when alpha falls below 7.6° or when the speed exceeds 154 knots.
This function is not active if :
— Alpha exceeds 8.6° or the airspeed falls below 148 knots after the pilot has moved the lever to 0.
— The aircraft is on the ground with its speed less than 60 knots.

CONTROLS AND INDICATORS

PEDESTAL

① FLAPS lever

The FLAPS lever selects simultaneous operation of the slats and flaps.
The five lever positions correspond to the following surface positions :

Position	SLATS	FLAPS	Indications on ECAM			
0	0	0			CRUISE	HOLD
1	18	0	1			
		10	1 + F	TAKEOFF		
2	22	15	2			APPR
3	22	20	3		LDG	
FULL	27	35	FULL			

Before selecting any position, the pilot must pull the lever out of the detent. Balks at positions 1 and 3 prevent the pilot from calling for excessive flap/slat travel with a single action.

Note : The pilot cannot select an intermediate lever position.

Takeoff in configuration 1 :
1 + F (18°/10°) is selected. If the pilot does not select configuration 0 after takeoff, the flaps retract automatically at 210 knots.

Takeoff or go-around in configuration 2 or 3 :
If the pilot selects configuration 1, he gets 1 + F (18°/10°) if airspeed is under 210 knots. If the pilot does not select configuration 0 after takeoff, the flaps retract automatically at 210 knots.
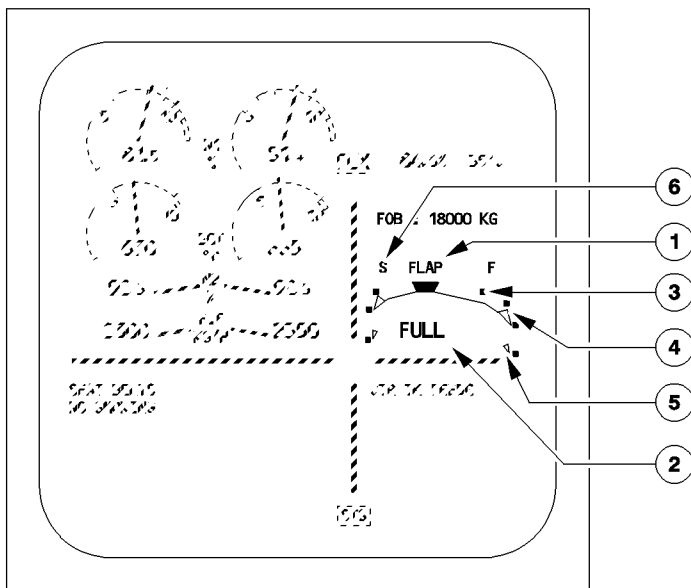
Configuration 0 to configuration 1 in flight :
Configuration 1 (18°/0°) is selected.

Note : After flap retraction, configuration 1 + F is no longer available until the airspeed is 100 knots or less, unless configuration 2, 3, or FULL has been selected previously.

ECAM UPPER DISPLAY

(1) FLAP indication

The "FLAP" legend appears when the slats or the flaps are not fully retracted.
— The legend is white when the slats and flaps are in the selected position.
— The legend is cyan when the slats and flaps are in transit.
— The legend is amber if :
  · Both relevant hydraulic systems go down (except on the ground with engines stopped).
  · The wingtip brakes are on.
  · There is a fault in the slats or flaps.

(2) Flap lever position

The legend "0," "1 + F," "1," "2," "3," or "FULL" appears.
— The legend is green when the slats and flaps are in the selected position. "0" is not displayed when the aircraft attains the clean configuration.
— The legend is cyan when the slats and flaps are in transit.
  The legend "S (F) LOCKED" appears in amber, associated with an ECAM caution, when the wingtip brakes are applied or when the system detects a non-alignment between two flaps.
  The legend "A-LOCK" pulses in cyan when the slat alpha/speed-lock function is active.

③ Position indexes

These white points indicate that the slats and flaps are in a selectable position. They do not appear when the aircraft is in the clean configuration.

④ Slat and flap position

These green triangles indicate the actual position of the slats and flaps.
They change to amber if :
— Both relevant hydraulic systems go down, unless the aircraft is on the ground with both engines stopped.
— The wingtip brakes are on.
— There is a fault in the slats or flaps.

⑤ Selected surface position

These blue triangles indicate the position the pilot has selected.
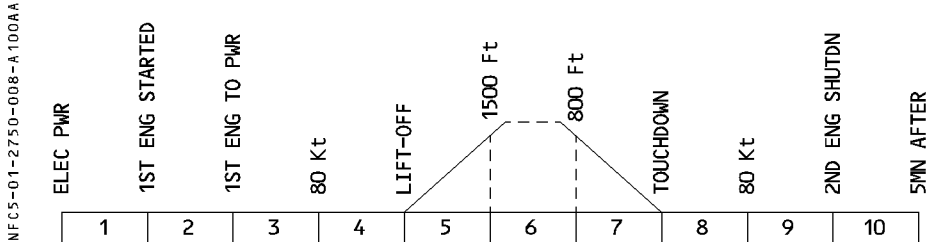(With the current standard display management computer, the blue triangles may disappear before the slats and flaps are all completely in the selected position).

⑥ S and F indications

The "S" and "F" normally appear in green. They become amber if :
— Both relevant hydraulic systems go down, unless the aircraft is on the ground with both engines stopped.
— The wingtip brakes are on.
— There is a fault in the slats or flaps.

AIRBUS TRAINING

A320

SIMULATOR

FLIGHT CREW OPERATING MANUAL

FLIGHT CONTROLS

FLAPS AND SLATS

1.27.50   P 8

SEQ 100   REV 37

WARNINGS AND CAUTIONS

E/WD : FAILURE TITLE conditions	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNING	FLT PHASE INHIB
CONFIG SLATS (FLAPS) NOT IN TO CONFIG Slats or flaps are not in takeoff configuration, when thrust levers are set at TO, or FLEX TO, or when pressing the TO CONFIG pb.	CRC	MASTER WARN	NIL	NIL	5, 6 * 7, 8
FLAP LVR NOT ZERO Slats or flaps were unintentionally selected in cruise.					1, 2, 3, 4, 5, 7, 8, 9, 10
SLATS (FLAPS) FAULT Failure of both slat or flap channels.	SINGLE CHIME	MASTER CAUT			4, 5, 8
SLATS (FLAPS) LOCKED Slats or flaps' wing tip brakes applied, or non alignment detected between 2 flaps.					
SLATS SYS 1 (2) FAULT Failure of slat channel in one SFCC.	NIL	NIL			3, 4, 5, 7, 8
FLAP SYS 1 (2) FAULT Failure of flap channel in one SFCC.					
SLAT (FLAP) TIP BRK FAULT Failure of one wing tip brake on slats or flaps, or failure of one wing tip brake solenoid on slats, or flaps.					
FLAPS ATTACH SENSOR Failure of flap attachment's failure detection sensor.					

* The warning is automatically recalled by pressing the TO CONFIG pushbutton.

BUS EQUIPMENT LIST

			NORM		EMER ELEC		
			AC	DC	AC ESS	DC ESS	HOT
COMPUTERS	MAIN FLT CTL	ELAC 1				X	HOT 1 (1)
		ELAC 2		DC2			HOT 2 (1)
		SEC 1				X	HOT 1 (1)
		SEC 2		DC2			
		SEC 3		DC2			
		FAC 1			X	SHED	
		FAC 2	AC2	DC2			
		FCDC 1				SHED	
		FCDC 2		DC2			
	FLAPS SLATS	SFCC 1 slats				X	
		SFCC 1 flaps				X	
		SFCC 2 slats		DC2			
		SFCC 2 flaps		DC2			
PITCH TRIM		MOTOR 1		DC2			HOT 2 (1)
		MOTOR 2				X	
		MOTOR 3		DC2			
RUDDER TRIM		MOTOR 1				X	
		MOTOR 2		DC2			
		INDIC		DC2			
RUDDER TRAVEL LIMIT		MOTOR 1				X	
		MOTOR 2		DC2			

(1) standby supply