

Reference to Figure 11 Auto Flight System Overview

ATA 22 AUTO FLIGHT

22-00 AUTO FLIGHT-GENERAL

DESCRIPTION

General

The auto-flight system is made up of the following sub-systems:

- **FMGS (Flight Management and Guidance System)**

The FMGS performs the functions given below:

- **AP (Auto Pilot)**,
- **FD (Flight Director)**,
- **A/THR (Autothrust)** and
- flight management which includes:
 - navigation,
 - performance and
 - processing of displays.

- **FAC (Flight Augmentation)**

The FAC performs the functions given below:

- yaw damper,
- rudder travel limiting,
- monitoring of the flight envelope,
- computations of maneuvering speed,
- yaw autopilot order using power loops of yaw damper and rudder trim and
- only FAC 1 for BITE function of the AFS.

System Description

The AFS/FMS includes four computers. Two FACs and two FMGCs located in the aft electronics rack 80VU.

The actuators associated with the FAC are directly connected to the flight controls.

All the controls and displays are in the cockpit:

- on the glareshield,
- overhead panel,
- maintenance panel and
- center pedestal.

The system buses which transfer the digital information of the ARINC specification 429 perform:

- interconnections between the computers,
- connections between the computers, control units and sensors.

Architecture of AFS

The AFS comprises two sub-systems:

- Flight Augmentation Computer system
- Flight Management and Guidance Computer system.

These sub-systems include the computers, actuators, control units and associated peripherals.

There are no servo actuators for the autopilot and the autothrust functions.

The FMGS system sends the surface deflection commands for the autopilot function to:

- ELAC 1 and ELAC 2 for pitch and roll commands
- FAC 1 and FAC 2 for yaw commands.

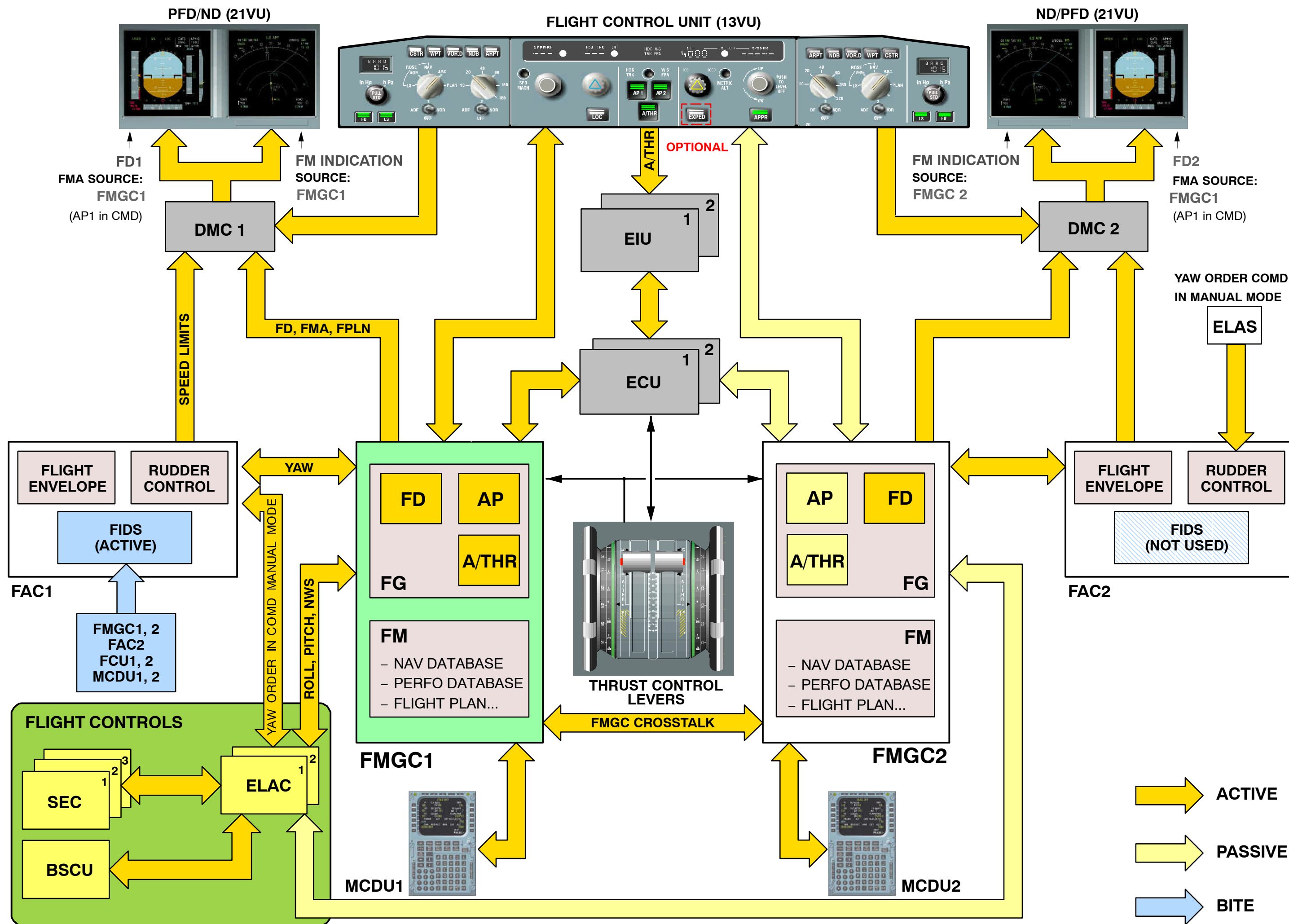
The system (FMGS) sends the thrust command for the autothrust function to:

- ECU 1/EEC 1 (to set the thrust command on the engine 1)
- ECU 2/EEC 2 (to set the thrust command on the engine 2).

The side stick controllers and the throttle control levers do not move when the autopilot and the A/THR are engaged.

Controls and Indicating

- Controls
 - FAC pushbutton switches on FLT CTL panels 23VU and 24VU,
 - FCU (**F**light **C**ontrol **U**nit) on the glareshield,
 - MCDU (**M**ultipurpose **C**ontrol and **D**isplay **U**nits)
 - takeover and priority pushbutton switches and
 - A/THR instinctive disconnect pushbutton switches.
- Indicating and Warnings
 - Primary Flight Display (CAPT and F/O PFDs),
 - Navigation Display (CAPT and F/O NDs),
 - upper and lower display units of the ECAM system,
 - rudder trim indicator on the RUD TRIM panel on the center pedestal and
 - MASTER WARN, MASTER CAUT and AUTO LAND lights.



Reference to Figure 12 FAC Functional Operation Schematic

22–60 FLIGHT AUGMENTATION (FAC)

FAC FUNCTIONAL OPERATION

General

The Flight Augmentation Computer (FAC) fulfills the functions given below:

- Yaw Damper

The yaw damper function ensures:

- In manual control, the accomplishment of the yaw orders from the elevator aileron computer (ELAC) (stabilization and manual turn coordination). It also provides a yaw–damping degraded law in the event of ELAC failure (alternate law).
 - In automatic control, the accomplishment of the autopilot orders from the Flight Management and Guidance Computer (FMGC) for:
 - Turn coordination (ILS approach mode and roll out).
 - Guidance (align and roll out).
- It also ensures in automatic flight:
- Engine failure recovery.
 - Yaw stability.
 - Turn coordination (cruise).

- Rudder Trim

The rudder trim function ensures:

- In manual control:
 - The accomplishment of the pilot trim orders from the manual trim control (control and reset)
- In automatic control:
 - The accomplishment of the autopilot orders (autotrim on the yaw axis)
 - The generation and the accomplishment of the engine failure recovery function.

- Rudder Travel Limiting

The rudder travel limiting function ensures:

- The limitation of the rudder travel as a function of a predetermined law
- The return to low speed limitation in case of loss of function as soon as the slats are extended.

- Calculation of Characteristic Speeds and Protection of Flight Envelope

The FAC generates, independently of the engage status of the pushbutton switches, different functions necessary to:

- The control of the speed scale on the PFDs
- The adaptation of gains for the FMGC and ELAC
- The distribution of signals necessary to the FMGC control laws

- The flight envelope protection in automatic flight (speed limits for the FMGC, alpha floor for the autothrust)
- The display of the rudder trim order and the rudder travel limiter position if available
- The windshear detection (option activated by pin program)
- The low energy detection (option activated by pin program).

- Maintenance

The Centralized Fault–Display System (CFDS) has two modes of operation:

- Normal mode

In this mode, the system FIDS (BITE concentrator) stores all the analysis results of the various BITE. It may perform a crosscheck to determine the faulty LRU. It transmits the reference of the LRUs which have failed during the current flight to the Centralized Fault–Display Interface–unit (CFDIU).

- Menu mode

In this mode it is possible to activate the various AFS tests and to display maintenance snapshots.

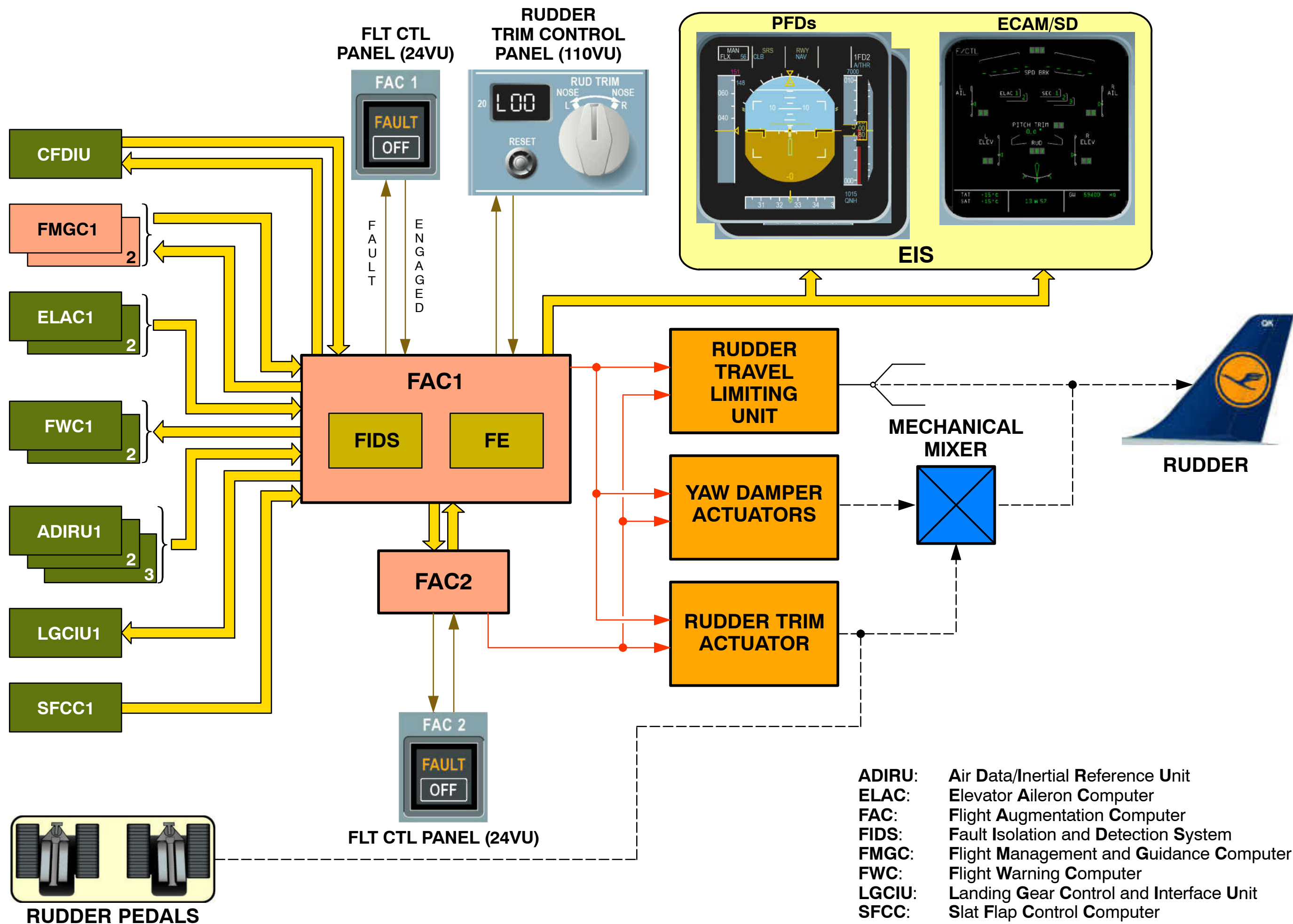


Figure 12 FAC Functional Operation Schematic

Reference to Figure 13 FCU Panel Description and Peripherals

22-81 FLIGHT CONTROL UNIT

FCU FUNCTIONAL OPERATION

General

The Flight Control Unit (FCU) comprises the auto flight control section and the EFIS control sections. It is located on the glareshield.

The FCU consists of two identical computers totally independent.

The computers (SIDE 1 and SIDE 2) have separate power supplies.

Each side is associated with the controls on the front panel of the unit.

The display is common to both sides, whereas the signals are routed via separate paths.

Operational Use

Engagement of system and selection of modes

The FCU enables the engagement of the AP and the selection of modes through three control panels:

- the left and right side panels for the selection of modes on Capt PFD, ND and on F/O PFD, ND respectively
- the center panel for the engagement of AP and A/THR and the selection of the AP/FD modes.

The FCU also enables the selection of reference parameters:

- heading/track
- vertical speed/flight path angle
- speed/Mach
- altitude.

The operating mode of the AP is in MANUAL CONTROL when the references are selected on the FCU. The AP is in AUTO CONTROL when the flight management system defines these references.

In auto control:

- the corresponding reference is shown by a dashed line on the FCU (for altitude, a value is always shown).
- an indicator light comes on near the corresponding reference display on the FCU.

To selection a parameter in manual control mode, you pull and turn the corresponding selector knob on the FCU.

To revert to the auto control mode, you push the corresponding selector knob.

Operational rule

The AP/FD or the autothrust system always maintain speed.

Modification of altitude requires two actions:

- select new altitude
- pull the altitude selector knob (for immediate acquisition of value) or push the selector knob (for acquisition according to flight plan).
Pulling a selector knob always leads to an immediate acquisition and hold of the corresponding parameter.

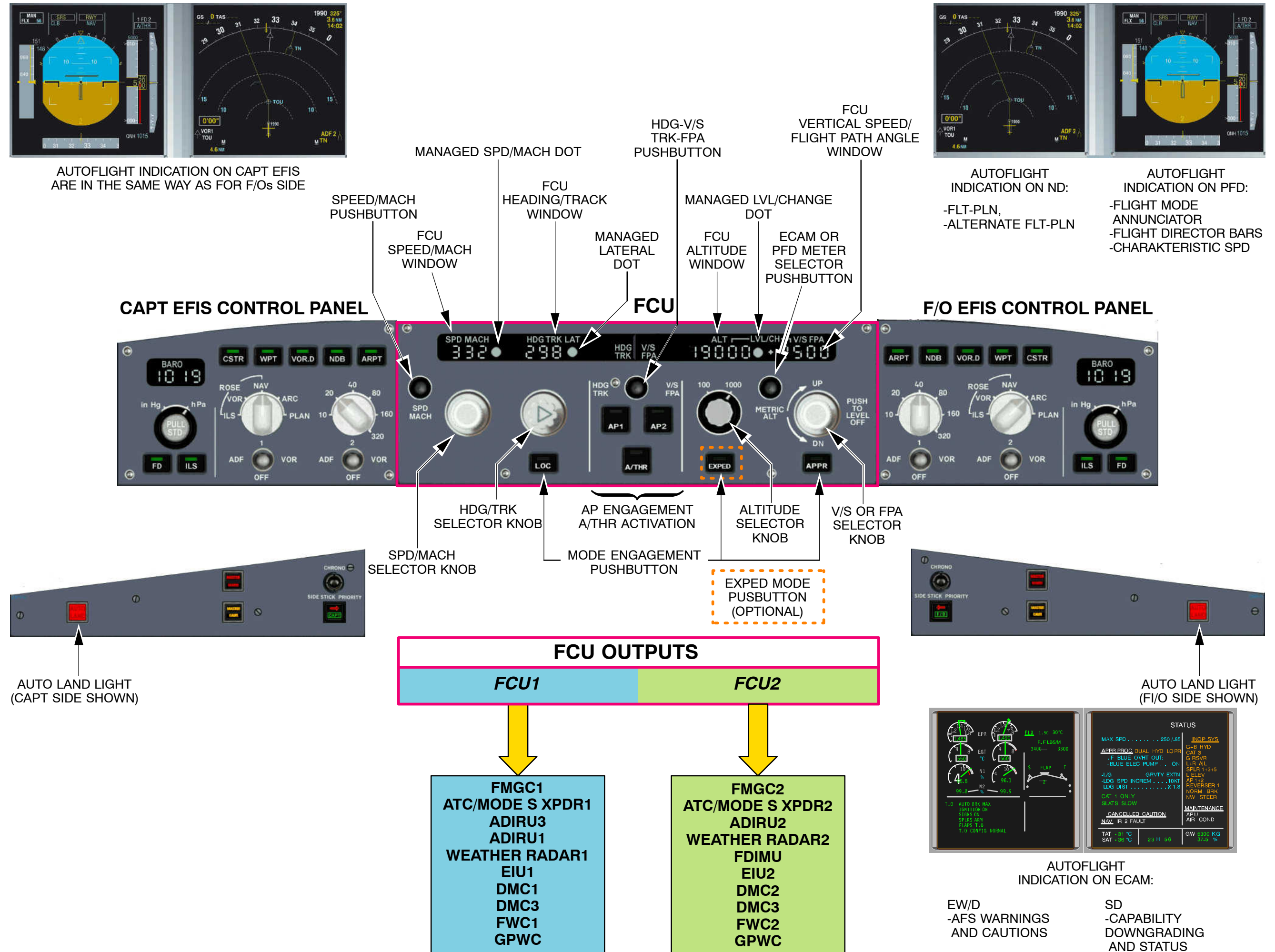


Figure 13 FCU Panel Description and Peripherals