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GENERAL

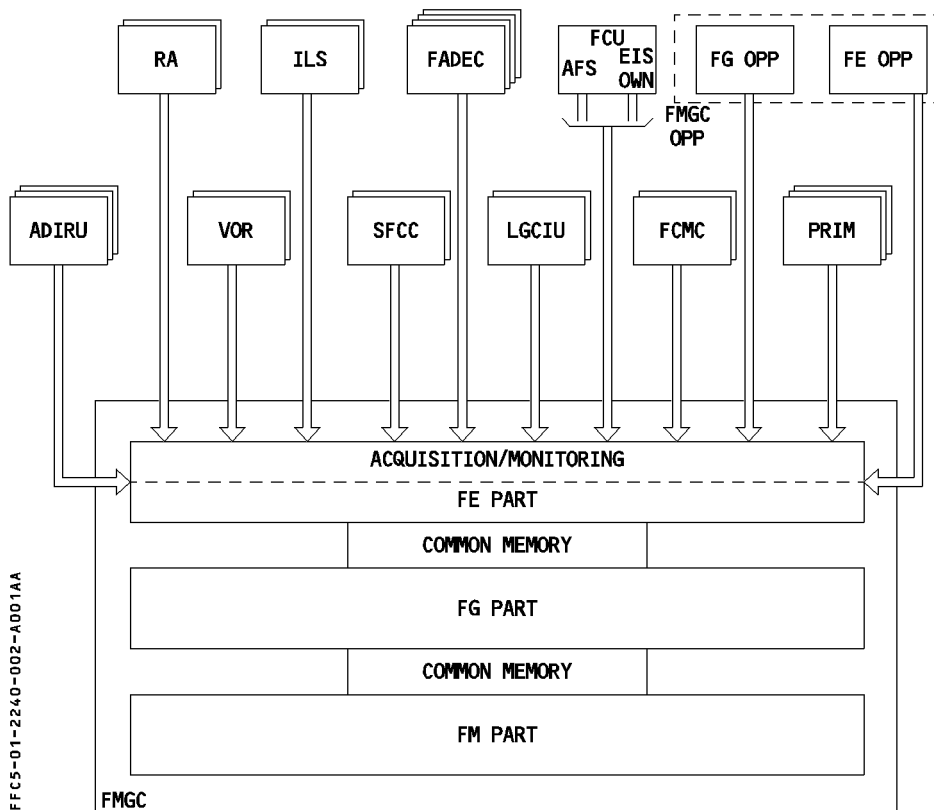
The Flight Envelope (FE) part of the FMGS performs the following functions :

- acquisition and monitoring of parameters used by FE and FG parts
- characteristic speeds computation
- back-up weight and CG computation
- aft CG monitoring
- windshear detection

ACQUISITION/MONITORING

Acquisition and monitoring of buses common to FM, FG or FE are performed by the FE. Only ARINC buses specific to the FM part are acquired by the FM itself.

Dialogue between FM, FG and FE is achieved through common memories.



The FE function generates the following information :

- flight/ground conditions (LGCIU/SFCC)
- flap/slat configuration (SFCC)
- engine configuration (FADEC)
- ADR/IR parameters after filtering and consolidation (used by the control laws).

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CHARACTERISTIC SPEEDS COMPUTATION

FE part computes the characteristic speeds and sends them to :

- the FG which uses them as limits for guidance modes
- the EFIS for display on the PFD speed scale

The following speeds are computed :

Minimum speeds

– VLS

(Refer to 3.04.10)

– Manoeuvring speeds F, S, O (Green Dot)

(Refer to 3.04.10)

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WEIGHT AND CENTER OF GRAVITY COMPUTATION

The FMGC uses the weight and center of gravity from the FCMC (Fuel Computer) when available.

The GW and CG computed by the FE part are used :

- as back-up in case of dual FCMC failure.
- to trigger the aft CG caution and warning signals (independently of the FCMC).

FE Weight computation (back up)

- When the aircraft is below 14625 feet and 255 knots :
 $GW = f(\alpha, CAS, N1/EPR \text{ actual}, CG \text{ from FE part}, \text{altitude})$
- When the aircraft is above 14625 feet or 255 knots :
 $GW = TOGW - WFU$
 TOGW : takeoff gross weight
 WFU : weight fuel used acquired from FADECs.

FE Center of gravity computation (back up/aft cg warning)

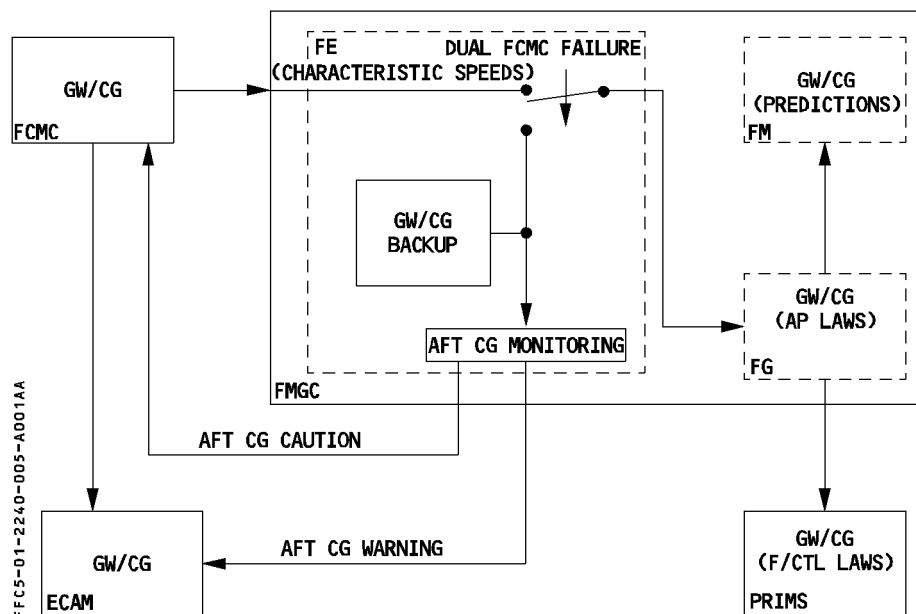
The CG is computed from the position of the horizontal stabilizer and is function of the N1/EPR, V_c , ALT, MACH and GW from FE part.

AFT CG MONITORING

The flight envelope uses only its own computed gross weight (GW) and center of gravity (CG) to trigger the aft CG signals.

The current CG is compared to the aft CG limit computed from the GW.

If the CG > CG limit –1 %, an aft CG caution signal is sent to the FCMCs. The target CG is then shifted forward by 1.5 % (only one time). If the CG becomes higher than the CG limit the aft CG warning signal is sent to the FWCs which trigger a red warning.



Note : AFT CG monitoring is available above 20 000 ft if the aircraft is in clean configuration with speed brakes retracted.

WINDSHEAR DETECTION

A windshear detection signal is generated whenever the aircraft encounters a windshear and the predicted energy level falls below a predetermined safe minimum energy threshold (reactive windshear detection).

Note : The energy threshold is expressed as an angle of attack threshold α_0 .

The aircraft predicted energy level is $\alpha + \Delta\alpha$ where :

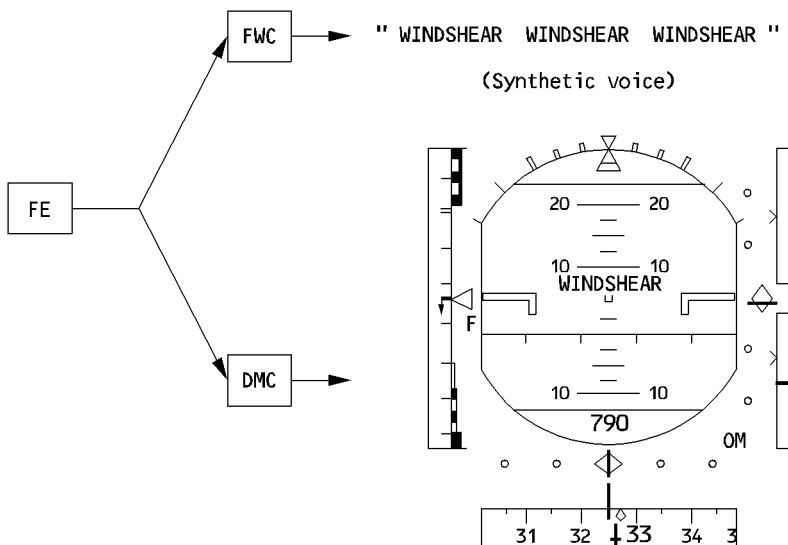
- α is the current angle of attack
 - $\Delta\alpha$ is the equivalent AOA computed from measured vertical drafts and longitudinal shears.
- If $\alpha + \Delta\alpha > \alpha_0$ the windshear conditions are detected.

The windshear detection function is provided in takeoff and approach phase under the following conditions :

- At takeoff, from lift off up to 1300 feet
- At landing from 1300 feet to 50 feet.
- With at least CONF 1 selected.

The warning consists of :

- a visual "WINDSHEAR" red message displayed on both PFDs for a minimum of 15 seconds.
- an aural synthetic voice announcing "WINDSHEAR" three times.



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