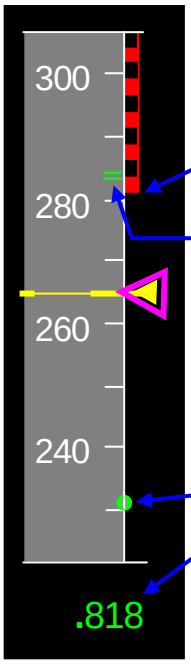
Airbus PFD Speed Indications – Descent & Arrival

Cruise at high level – Clean



High Speed Protection

Indicates the speed (VMO + 4 kt or MMO + 0.006) at which an overspeed warning will occur and High Speed Protection becomes active.

The ***actual*** configuration is used for the overspeed warning.

This symbol is not displayed in pitch alternate or direct law because the protection is not available. Also only displayed when clean.

VMAX

The lower end of a red and black strip along the speed scale defines this speed.

It is the lowest of the following:

- VMO or the speed corresponding to MMO,
- VLE, or
- VFE

The display of VMAX is linked to the position of the ***LG Handle*** (VLE) and/or the ***Flap Lever*** (VFE), ***not*** the actual configuration.

Green Dot

(Engine-out operating speed in clean configuration).

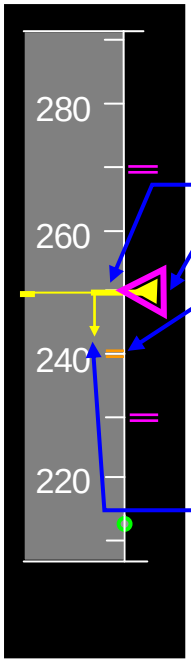
Green Dot appears when the Flap Lever is at 0 (zero). It shows the speed corresponding to the best lift-to-drag ratio.

GD will ***never*** be less than VLS (or α Prot if it is greater than VLS). GD is "pushed up" by VLS (or α Prot).

Mach Number

This is displayed when it is greater than 0.5 and the LS pushbutton is not selected on the EFIS control panel.

Descent – Clean



Actual Airspeed Reference Line and Scale

A white scale on a grey background moves in front of a fixed yellow reference line next to a yellow triangle to show airspeed. The minimum airspeed indication is 30 knots.

VFE NEXT

This symbol shows the VFE corresponding to the next ***Flap Lever*** position.

It appears when the aircraft altitude is below 20,000 feet (which is why at high level in the above diagram it is not displayed).

This diagram is for an A330 (VFE Next (F1) of 240 Kts).

Speed Trend

This pointer starts at the speed symbol. The tip shows the speed the aircraft will reach in 10 seconds if its acceleration remains constant. The pointer appears only when it is greater than 2 knots and disappears when it is less than 1 knot. It also disappears if the FMGCs fail.

Target Airspeed (magenta or blue)

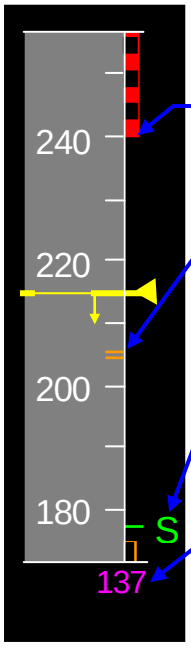
This symbol gives the target airspeed or the airspeed corresponding to the target Mach number.

The target airspeed is the airspeed computed by FMGC in Managed Speed mode (magenta) or selected manually on the FCU for Selected Speed mode (blue).

When the target speed is off the speed scale, its value is displayed as numbers below or above the speed scale in the appropriate colour (see next diagram).

If Managed Speed is set ***and*** DES Mode is engaged a magenta Managed Speed target range is displayed on the PFD. This is normally ± 20 Kts either side of the Managed Speed target.

Flap 1



VMAX (VFE)

VMAX (in this case VFE 240 Kts for an A330) is displayed as soon as the Flap Lever is selected to F1.

VFE NEXT

This symbol shows the VFE corresponding to the next Flap Lever position (in this case F2).

Minimum Slat Retraction Speed

Represented by a green letter S. It appears when the Flap Lever is in position 1.

Target Airspeed (magenta or blue)

The Approach Phase has been activated and Managed Speed is now 137 Kts (VAPP). As the target speed is off the speed scale, its value is displayed as numbers below the speed scale (in magenta as Managed Speed has been set).

Managed Speed will remain a constant VAPP (137 Kts) unless VAPP (Target) is modified through the use of G/S Mini.

Flap Speed Display

VFE and VFE Next change as soon as the Flap Lever is selected to a new position.

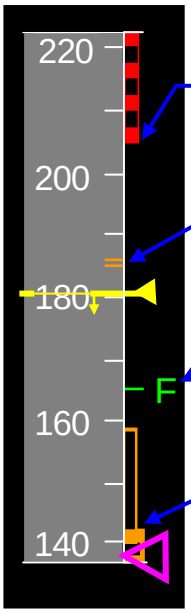
When the Flap Lever, in this particular case, is selected to F1:

- VMAX (VFE) jumps to the previous VFE Next (240 Kts in this case),
- VFE Next jumps to the new VFE Next for F2 (205 Kts), and
- The appropriate Characteristic Speed is displayed (in this case S speed). Only one Characteristic Speed at a time is displayed.

This process reoccurs at each new Flap Lever selection.

Airbus PFD Speed Indications – Descent & Arrival

Flap 2 (selected but Flap position ≤ 1)



VMAX (VFE)

VMAX (VFE) of 205 Kts is displayed as soon as the Flap Lever is selected to F2.

VFE NEXT

This symbol shows the VFE corresponding to the next Flap Lever position (in this case F3 – 186 Kts).

Minimum Flap Retraction Speed

This is a green letter F. It appears when the Flap Lever is in position 2 or 3.

Minimum Speeds

VLS and α Prot are now appearing (see below).

Notice how the available IAS useable (between VLS and VMAX) is decreasing with each increasing Flap selection.

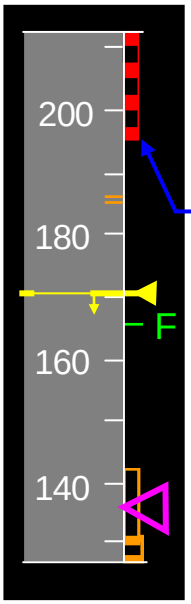
VFE F2 Display

When the Flap Lever is selected to F2 the Slats move from S1 to S2. The Flaps move from F0 towards F2. While the Flaps are less than F1, VFE is 205 Kts (which is the VFE for Config 1*).

As soon as the Flaps get greater than F1 the VFE jumps immediately to 196 Kts (VFE for Config 2). See the next diagram.

It is permitted to select F2 when below VFE Next F1* of 205 Kts, but greater than VFE F2 of 196 Kts (FCTM). If the speed is greater than 196 Kts when the Flaps travel reach F1* ***F RELIEF*** will flash in green on the EW/D and the Flaps will stop at F1* until the speed becomes less than 196 Kts when the Flaps will automatically resume travelling to F2.

Flap 2 (selected but Flap position > 1)



VMAX (VFE)

VMAX (VFE) of 196 Kts is displayed as soon as the Flaps travel to greater than F1* to F2 (the one time that VFE is displayed according to the actual configuration).

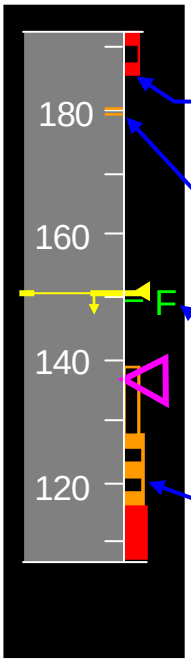
VFE Display

The only changes on the speed tape between the previous diagram and this one is that VMAX (VFE) has jumped from 205 Kts to 196 Kts after the Flaps had travelled to greater than F1*.

VFE Next and F Speed remains the same.

VLS and α Prot have decreased with the extra Flap now extended (Flaps at 2).

Flap 3



VMAX (VFE)

VMAX (VFE) of 186 Kts is displayed as soon as the Flap Lever is selected to F3.

VFE NEXT

This symbol shows the VFE corresponding to the next Flap Lever position (in this case Full – 180 Kts).

Minimum Flap Retraction Speed

This is a green letter F. It appears when the Flap Lever is in position 2 or 3. Notice how F Speed has decreased with the Flaps now at F3.

Minimum Speeds

VLS, α Prot and α Max are now appearing and have decreased due to the extra Flaps now extended (F3).

F3 Display

If you decide to do a Config 3 landing, you select Config 3 on the MCDU PERF APPR page.

This results in:

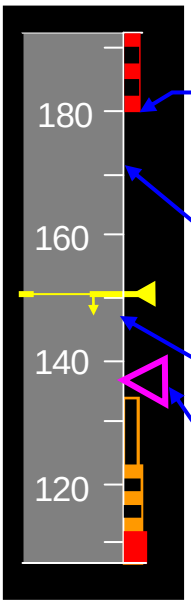
- VLS Config 3 being used to display VLS on the MCDU (up to 3 Kts greater than VLS Config Full for the A330 depending on AUW),
- VAPP Config 3 being used to display VAPP on the PFD and MCDU,
- The ECAM Landing Memo displaying FLAPS green when F3 selected, and
- F Speed being displayed on the PFD as the Flap Lever is at F3.

In Managed Speed with the Approach Phase activated, VAPP will be the A/THR commanded speed even though F Speed is still displayed (and in most normal cases is greater than VAPP).

VAPP Target (which is a G/S Mini derived display indication) is still available.

Airbus PFD Speed Indications – Descent & Arrival

Flap Full



VMAX (VFE)

VMAX (VFE) of 180 Kts is displayed as soon as the Flap Lever is selected to Full.

VFE NEXT

No VFE Next displayed (as Full is all you're going to get).

Minimum Flap Retraction Speed

No F Speed is displayed at Full.

Target Airspeed (magenta or blue)

VAPP is 137 Kts (Managed Speed).

VAPP Display

VAPP is a Managed Speed function computed by the ***FMGC***. VAPP can also be manually entered on the PERF APPR page.

The ***FM*** computes this approach speed, using the formula: VAPP = VLS + 1/3 of the headwind component (1/3 of the headwind component is limited to 5 knots as a minimum and 15 knots as a maximum).

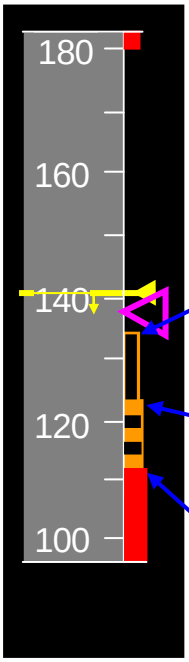
It will change depending on whether Config 3 or Config Full is selected on the MCDU PERF APPR page.

It will be displayed as the highest of either:

- VAPP, or
- VAPP Target (which is a G/S Mini derived display indication).

Sometimes the VAPP displayed on the PFD is less than the PFD displayed VLS + 5 Kts on the speed tape. This is because the VLS displayed is computed by the FE and the VAPP displayed is computed by the FM and there is sometimes a slight mismatch (usually a few knots only).

Flap Full, almost on speed



Minimum Selectable Speed (VLS)

The top of the amber strip along the speed scale indicates VLS. It represents the lowest selectable speed providing an appropriate margin to the stall speed.

VLS information is inhibited from touchdown until 1 second after liftoff.

With A/THR active, VLS is the lowest speed that you can select. If you select a speed less than VLS, when VLS is reached the A/THR will increase thrust to maintain at least VLS.

Alpha Protection Speed (α Prot)

The top of a black and amber strip along the speed scale indicates this speed. It represents the speed corresponding to the angle of attack at which alpha protection becomes active.

It is displayed when in pitch normal law.

Alpha Max Speed (α Max)

The top of a red strip along the speed scale indicates this speed. It represents the speed corresponding to the maximum angle of attack that the aircraft can attain in pitch normal law.

It is displayed when in pitch normal law.

Speed Display

These speeds are all dependant on the ***actual*** configuration of the aircraft.

All of the following speeds (except GD, S and F Speeds) that are displayed on the PFD, change if the shape of the wing changes (i.e. Slats, Flaps or S/B selected):

- VLS, GD, S and F Speed (Characteristic Speeds) and are all computed by the ***FE***.
- α PROT and α MAX and are computed by the ***PRIM*** based on aerodynamic data.

VLS is ***not*** AoA dependant and will only change with a configuration change. VLS will also increase with S/B extended.

α PROT and α MAX (as their names suggest) ***are*** AoA dependant and will increase with increased AoA (e.g. in turbulence and G loading, including turns).

α PROT can increase such that it is greater than VLS (in which case VLS will be covered on the display and not visible by α PROT).

CHARACTERISTIC SPEEDS

The Characteristic Speeds (VLS, F, S and Green Dot) are displayed on the PFD speed scale and are computed by the ***Flight Envelope (FE)*** computer.

VLS, F, S and Green Dot are also displayed on the MCDU PERF TAKE OFF, APPR and GO-AROUND pages. The speeds displayed on these pages are computed by the ***FMGC (FM)***.

VLS

VLS is the lowest selectable speed. VLS is represented by the top of an amber strip on the airspeed scale on the PFD.

It is equal to:

- 1.13 VS at take-off,
- 1.18 VS when the flaps are retracted, and
- 1.23 VS when in the clean configuration. It remains at 1.23 VS until landing.

Airbus PFD Speed Indications – Descent & Arrival

VLS is corrected for Mach effect to maintain a 0.3g buffet margin. In addition, VLS is increased when the speed brakes are extended.

At take-off, until retraction of one step of flaps, VLS is equal to or greater than the lower of V2/1.05 and 1.05 VMCA. In all other phases of flight, VLS is equal to or greater than VMCL. In the case of two engines inoperative on the same wing, as soon as the slats are extended, VLS on the PFD is ≥ VMCL-2. VLS on the MCDU is ***not*** modified.

F Speed

- At take-off, F speed is the minimum speed at which the flaps may be retracted.
- On approach, F speed is the target speed when the aircraft is in CONF 2 or 3.

It is represented by "F" on the PFD speed scale when the Flap Lever is in the F2 or F3 position. F Speed is not displayed when the Flap Lever is in the Full position.

- It is equal to approximately 1.18 VS of CONF 1+F for take-off. It is limited to a minimum of VMCL+5 kt.
- For approach in CONF 2, it is increased by (A333: 14%) (A343: 18%) (A346: 22%). It is limited to a minimum of VMCL+15 kt and to a maximum of VFE CONF 3 – 2 kt.
- For approach in CONF 3, it is increased by (A333: 4%) (A343: 7%) (A346: 12%). It is limited to a minimum of VMCL+10 kt and to a maximum of VFE CONF FULL - 2 kt.

S Speed

- At take-off, S speed is the minimum speed at which the slats may be retracted.
- On approach, S speed is the target speed when the aircraft is in CONF 1.

It is represented by "S" on the PFD speed scale when the Flap Lever is in the F1 position.

- It is equal to approximately 1.21 VS of clean configuration. It is limited to VFE CONF 1* - 2 kt for approach.

Green Dot

- Green Dot corresponds to the engine-out operating speed in clean configuration.
- It provides the speed for the best lift/drag ratio and corresponds to the final take-off speed.

It is represented by a green dot on the PFD speed scale when the Flap Lever is in the F0 (zero) position. A formula to derive Green Dot for A333/A343 only (there is no formula for A346) is shown below:

- 0.6 x weight (tonnes) + (A333: 107 kt) (A343: 115 kt) below 20,000 ft
- Add 1 kt per 1000 ft above 20,000 ft
- Subtract 10 kt with one engine out. (A346: Green dot speed is not modified with one engine inoperative).