SRT / SRAE SOFTWARE DOCUMENTATION SUPER-USER

5. SPEED LIMITERS

chapter 5

Release : 2.0

REVISIONS DOCUMENT

Release	Author	Date	Modifications
1.0	M.Mersier	01/05/2004	• Creation (SRA)
2.0	M.Mersier	09/15/2006	• Update (SRT/SRAE)

5.1   Limiter 1

Limiter 1 is used by default when the switch is "OFF" or not used (for switch configuration see Client_Configuratio.doc §3.4) There are two sets of identical parameters; one for ignition, the other one for injection.

5.1.1   Ignition Limiter 1

A value of absolute limit (**EE.Lim.Lim1_all**) which cannot be overruled by any other map, but may be reduced by a delta as a function of gear position, and preceded by "soft-cut" limiter bands.

5.1.2   Injection Limiter 1

The set of parameters applicable to the injection limiter limit (**EE.Lim.Lim1_inj**) is similar to the set used for the ignition limiter (with its own specific absolute limiter, delta f(gear) and "soft cut" limiter bands).

5.2   Limiter 2

The set of parameters applicable to Limiter 2 (**EE.Lim.Lim2_all** and **EE.Lim.Lim2_inj**) is similar to the set used for Limiter 1, changing only the absolute limiters (delta f(gear) and "soft cut" limiter bands are the same).

Note that it can be practical to use the second limiter as a hardware "kill switch", by setting its values to 1 RPM.

5.3   Pre-Limiters

An offset (**EE.Lim.DeltaLim**) from the absolute limiter may be specified as a function of gear position.

5.4   Soft limiter

The soft limiter band (value function of the gear position) is sub-divided in 4 identical RPM bands with progressive cutting strength, and is directly expressed in RPM.
This band of RPM defines, for each gear, the "soft" limiter level (progressive cut of 20%, 40%, 60%, 80% of the cylinders, on a rotating pattern, to avoid always cutting the same cylinders).

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The width of this band, defining the beginning of the soft limiter, can be specified separately for the ignition cut (**EE.Lim.BandeAll1**) and the injection cut (**EE.Lim.BandeInj1**).

5.5 Upshift Limiter

When the upshift conditions are detected (flag **FD.Plus.UpshiftCut** is **ON** : see § Upshift Management in Other_Strategies.doc for details) The engine speed limiter is calculated and applied, and will act on ignition, injection or both.

5.5.1 Cut mode

The cut application of the upshift limiter can be selected by the map **EE.Plus.Cx_coup**

Value	Description
00	No Cut
01	Ignition Cut Only
02	Injection Cut Only
03	Ignition and Injection Cut

5.5.2 Limiter

The value of the engine speed limiter is calculated from the engine speed at the start of upshift, as follows :

$$\text{Limiter}\ \text{Upshift} = \text{FD.Plus.re}\ \text{gime\_up} * \frac{\text{EE.Plus.Kr}\ \text{evlim}\ ,f\,(\,\text{RapBv}\ )}{256}$$

Where:
- **FD.Plus.regime_up** : Engine speed at the start of upshift in RPM.
- **EE.Plus.Krevlim** : Coefficient of reduction of engine speed in % from the engine speed at the start of the upshift used for the engine speed limiter as a function of gear position.

This limiter replaces the absolute limiter during upshift. The band of soft cut stays active below this limiter.

5.6 Fault limiter

In case of :
- Electrical default on the both throttles or the both pedals
- Or coherency default between the both throttles or the both pedals
- Or fault diagnostic from HBridge driver

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- Or a fault from drive by ware Control Loop Diagnostic (DEFAUTERREUR1/2)

The ignition limiter **FD.Lim.lim_all** become the lower value between **EE.Pmot.LimAllPmot** and **FD.Lim.lim_all** determined by the previous limiters.

The injection limiter **FD.Lim.lim_inj** become the lower value between **EE.Pmot.LimInjPmot** and **FD.Lim.lim_inj** determined by the previous limiters.

5.7 Turbo Start Limiter

When the Turbo Start conditions are detected and If turbo function is activated (flag **FD.Tbo.Depart** is **ON** : see § Start Engine Limiter Switch in Turbo.doc for details) the engine speed limiter is determined and applied, and will act on ignition and injection.

5.7.1 Limiter

The value of the engine speed limiter is determined from the start limiter rotator position as follows (see § Start Engine Limiter Switch in Turbo.doc for details).

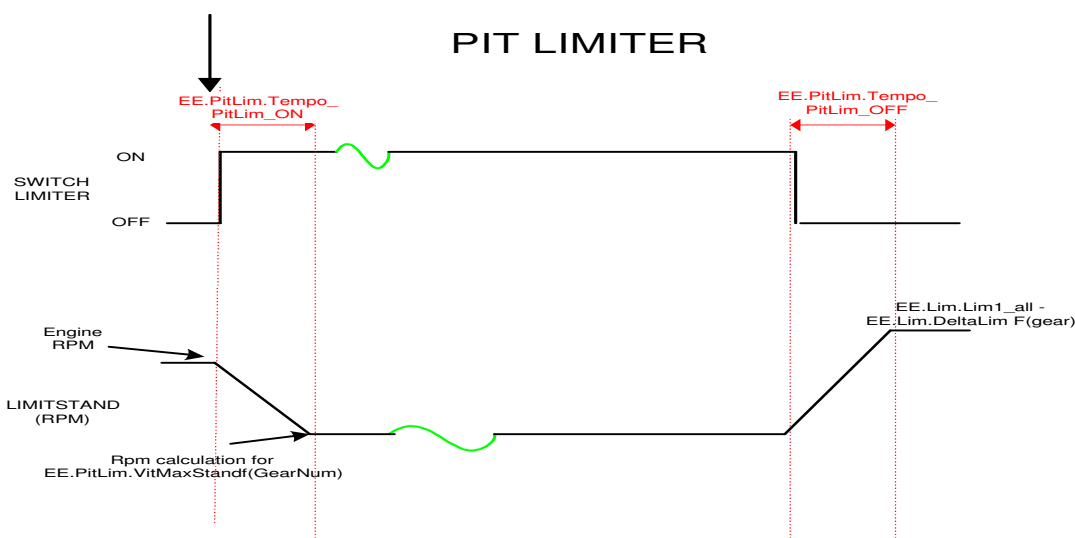$$FD.Tbo.RegLimBangDep = EE.Tbo.tab\_LimBangDep[FD.Acq.RotacLimDep] - prelim$$

Where:
- **EE.Tbo.tab_LimBangDep**: Engine speed limiter f(start limiter rotator position).
- **Prelim** : Prelimiter defined at § 5.3.

This limiter replaces the absolute limiter during upshift. The band of soft cut stays active below this limiter.

5.8   PIT LIMITER.

5.8.1   Pit Limiter Diagram

5.8.2   Pit Limiter Management.

When **FD.SW.PitLim.State** is activated and **FD.Lim.Vit1000tr** > 0

$$Lim\_Stand = (EE.PitLim.VitMaxStand * 1000)/(FD.Lim.Vit1000tr)$$

Where:
- **FD.Lim.Vit1000tr** is the Speed vehicle to 1000 rpm as a function of the gear position (1, 2, ... X). interpolated in the table **EE.PitLim.TabVit1000tr**[RapBV] only when **FD.SW.PitLim.State is ON** .

During **EE.PitLim.Tempo_Pitlim_On**

$$Lim\_Stand = ((FD.Vrs.Regime - Lim\_Stand) * Tempo\_Pitlim\_On)$$
$$/ EE.PitLim.Tempo\_Pitlim\_On$$

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Where:
- **FD.Vrs.Regime** is the engine RPM.
- **EE.PitLim.Tempo_Pitlim_On** :Map temporisation for decrease the limiter when the pit limiter is activated.
- **Tempo_Pitlim_On** : temporisation counter decrease each 5 mSec.

When **FD.SW.PitLim.State** is desactivated and during **EE.PitLim.Tempo_Pitlim_off**

$$Lim\_Stand = (EE.PitLim.VitMaxStand * 1000)/(FD.Lim.Vit1000tr)$$

$$tmpOffAll = ((limAllCarto - prelim - lim\_stand) * (EE.PitLim.Tempo\_Pitlim\_Off - Tempo\_Pitlim\_Off)) / EE.PitLim.Tempo\_Pitlim\_Off$$

$$tmpOffInj = ((limInjCarto - prelim - lim\_stand) * (EE.PitLim.Tempo\_Pitlim\_Off - Tempo\_Pitlim\_Off)) / EE.PitLim.Tempo\_Pitlim\_Off$$

$$lim\_All = tmpOffAll + lim\_stand$$
$$lim\_Inj = tmpOffInj + lim\_stand$$

Where:
- **LimAllCarto** is the Ignition limiter selected (Limiter1 or Limiter2 cf § 5.1) .
- **Prelim** is prelimiter (cf § 5.3)
- **EE.PitLim.Tempo_Pitlim_Off** : Map temporisation for increase the limiter when the pit limiter is desactivated.
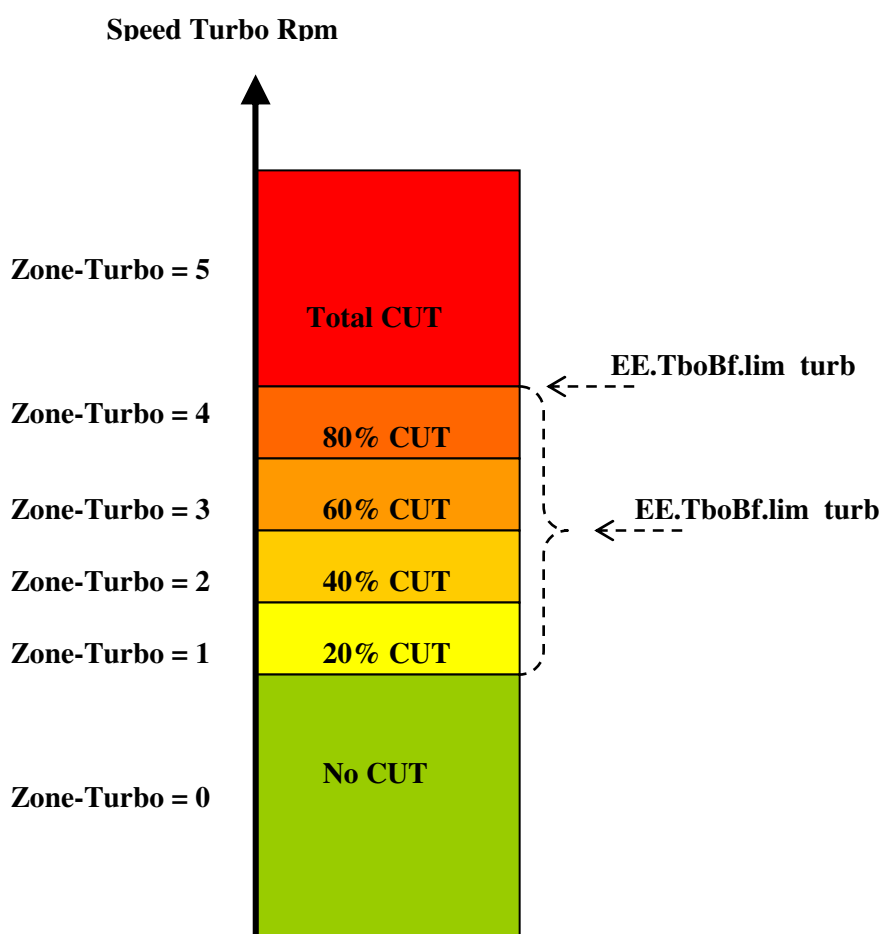- **Tempo_Pitlim_Off** : temporisation counter decrease each 5 mSec.

5.8.3 Pit Limiter Selection.

The cut application of the pit limiter can be selected by the map **EE.PitLim.CxCoup**

Value	Description
00	No Cut
01	Ignition Cut Only
02	Injection Cut Only
03	Ignition and Injection Cut

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5.9   Limiter for speed turbo protection

If turbo function is activated, a speed turbo protection is activated. When the speed turbo is greater than **EE.TboBf.lim_turbo** rpm, an absolute limiter is applied on ignition and injection, under this threshold and in the band **EE.TboBf.bande_lim_turbo**,   a proportional limiter is calculated as follow :

Speed Turbo Rpm

Zone-Turbo = 5	Total CUT
Zone-Turbo = 4	80% CUT
Zone-Turbo = 3	60% CUT
Zone-Turbo = 2	40% CUT
Zone-Turbo = 1	20% CUT
Zone-Turbo = 0	No CUT

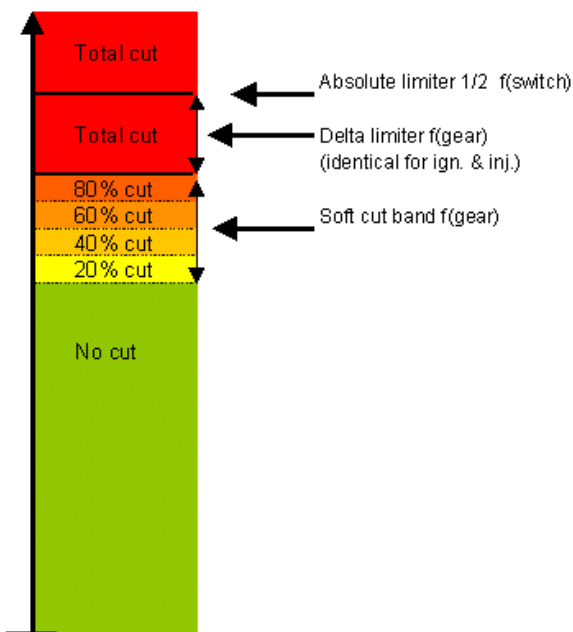**EE.TboBf.lim turb**

EE.TboBf.lim turb
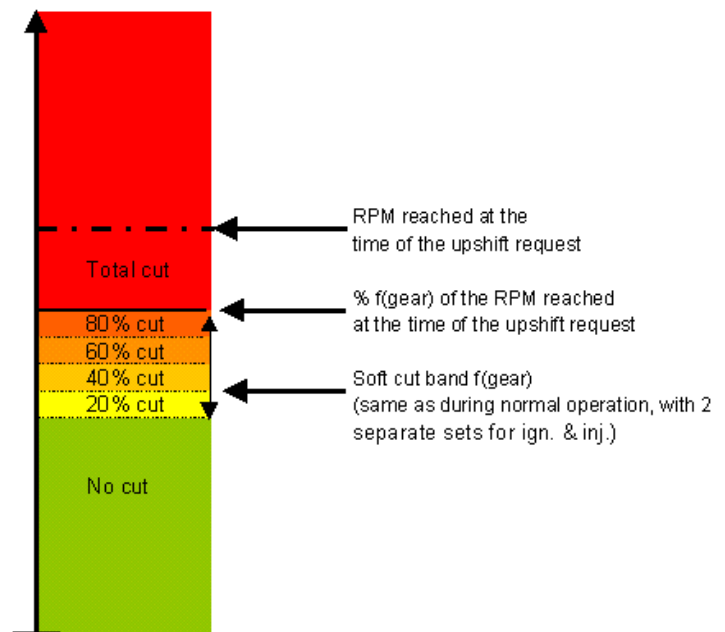
5.10 Limiter Application

The result of the calculation is applied as follows:

During normal operation, 2 independant sets of limiter values for ignition and injection

Engine speed (RPM)

Total cut — Absolute limiter 1/2 f(switch)

Total cut — Delta limiter f(gear) (identical for ign. & inj.)

80 % cut
60 % cut — Soft cut band f(gear)
40 % cut
20 % cut

No cut

During upshift, only 1 set of RPM % values for the specific upshift limiter (cutting can be done on ign. or inj. or both)

Engine speed (RPM)

— RPM reached at the time of the upshift request

Total cut

80 % cut — % f(gear) of the RPM reached at the time of the upshift request

60 % cut
40 % cut — Soft cut band f(gear) (same as during normal operation, with 2 separate sets for ign. & inj.)
20 % cut

No cut

Independently for Injection & Ignition (during normal operation, excepting upshift):
- Hard limiter RPM threshold (total cut) = Absolute limiter (1 or 2 f(switch)) – Delta limiter f(gear)
- Soft limiter RPM threshold (beginning of the first band) = Hard limiter (above) – Soft limiter Band size f(gear)

During Upshift: the Soft limiter bands are still valid, but the Delta limiter is ignored and the absolute limiter is replaced by a percentage of the RPM reached at the moment of the upshift request.
This percentage is function of the gear position (and cannot exceed 100% *of course*).
The limiter during upshift can be either cutting ignition or injection or both.

If speed turbo protection is activated , the max value of cut between turbo limiter and normal limiter is applied for injection and ignition

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