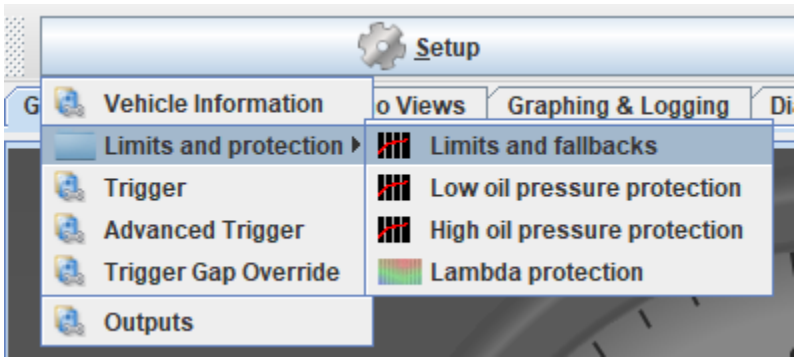
Limits and Protections (Setup Menu)



Limits and Protection (Base Engine Menu)

The **“Limits and Protection”** submenu under **“Setup”** includes essential settings for protecting the engine by setting operational limits. This section is crucial for safeguarding the engine against conditions that could lead to damage. The available options are:

1. Limits and Fallbacks

- This setting allows users to define **maximum operational limits** for various engine parameters, such as **RPM, boost pressure, and temperature.**
- When limits are reached, fallback strategies (like reducing power or triggering a safe mode) are activated to prevent damage.

  Example: Setting an RPM limit to ensure the engine doesn’t exceed a specified threshold, which can prevent mechanical failure.

2. Oil Pressure Protection

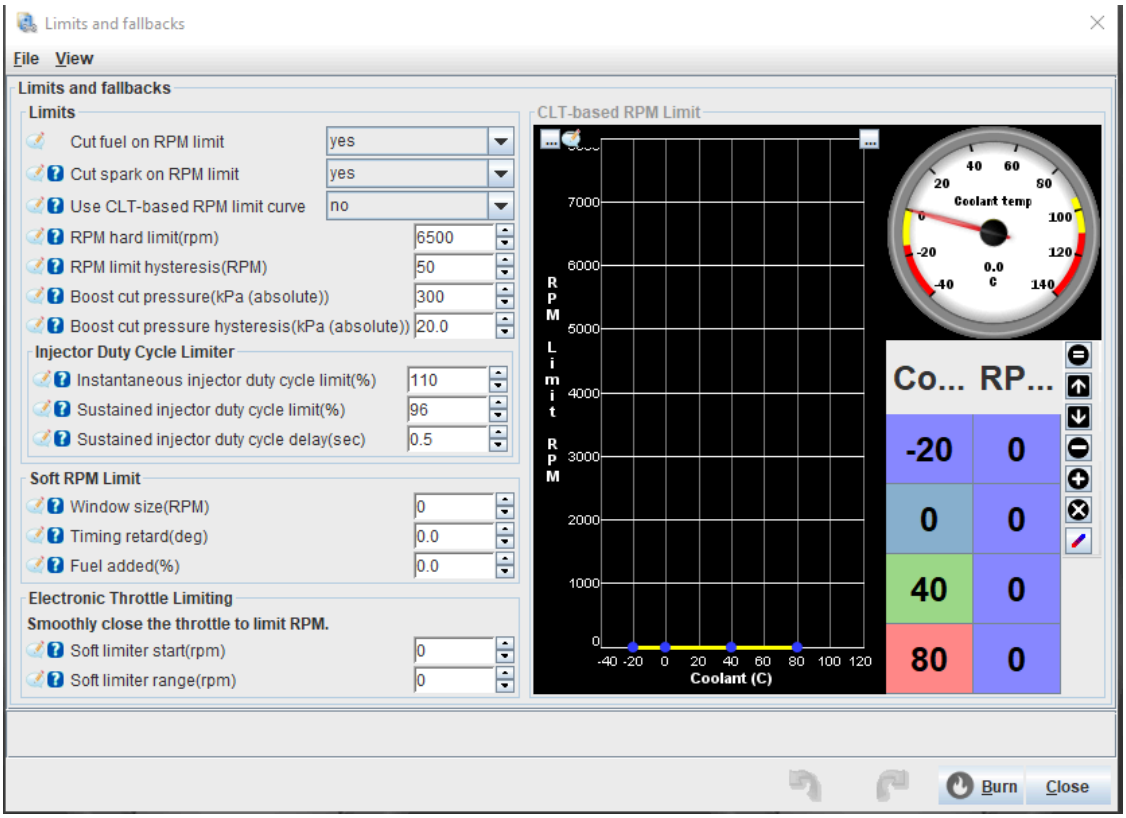
- Monitors oil pressure levels to protect the engine from insufficient lubrication, which can cause severe damage. This is typically not used on Harleys as they operate with an Oil Pressure Switch as opposed to an oil pressure sensor.

3. Lambda Protection

- This feature monitors air-fuel ratios (AFR) to ensure the engine operates within safe combustion parameters.
- If AFR deviates from the safe range (either too lean or too rich), it can trigger corrective actions.
- **Tip:** Lambda protection is essential for turbocharged or high-performance engines that require precise fuel control to avoid detonation or poor performance.

Limits and Fallbacks

Main Options



1. Cut fuel on RPM limit:

When enabled, this option cuts the fuel supply when the RPM limit is reached. Cutting fuel provides a smoother limiting action; however, it may lead to slightly higher combustion chamber temperatures since unburned fuel is not present to cool the combustion process.

2. Cut spark on RPM limit:

When selected, this option cuts the spark to limit RPM. Cutting spark can produce flames from the exhaust due to unburned fuel igniting in the exhaust system. Additionally, this unburned fuel can help cool the combustion chamber, which may be beneficial in high-performance applications.

3. Use CLT-based RPM limit curve:

Setting this to "yes" enables the RPM limit to vary with coolant temperature (CLT), utilizing the control panel on the right. This feature allows you to set different RPM limits based on the engine's coolant temperature, providing a temperature-dependent RPM control.

RPM Limits

- **RPM hard limit (RPM)**: The maximum RPM before cut actions (fuel or spark) are triggered.

- **RPM limit hysteresis (RPM):** Sets a buffer below the RPM hard limit, helping avoid rapid cycling of cut actions by defining a range within which RPM must drop before cut actions are re-enabled.

Boost Cut Limits:

- **Boost cut pressure (kPa absolute):**
  Specifies the absolute maximum boost pressure allowed before triggering a cut.
- **Boost cut pressure hysteresis (kPa absolute):**
  Defines a pressure range below the cut limit at which boost can resume, providing smoother control over boost cut actions.

Injector Duty Cycle Limiter

- **Instantaneous injector duty cycle limit (%):**
  This sets an immediate limit on injector duty cycle. If this threshold is reached, the system will immediately cut the injectors to prevent excessive fuel delivery.
- **Sustained injector duty cycle limit (%) & Sustained injector duty cycle delay(seconds):**
  This limit allows injectors to operate up to the specified duty cycle percentage for a short period (as defined by the delay). After this delay, if the duty cycle remains above the limit, it will trigger a cut. This setting helps balance performance by allowing temporary high fuel demands while protecting the injectors from prolonged stress.

Soft RPM Limit

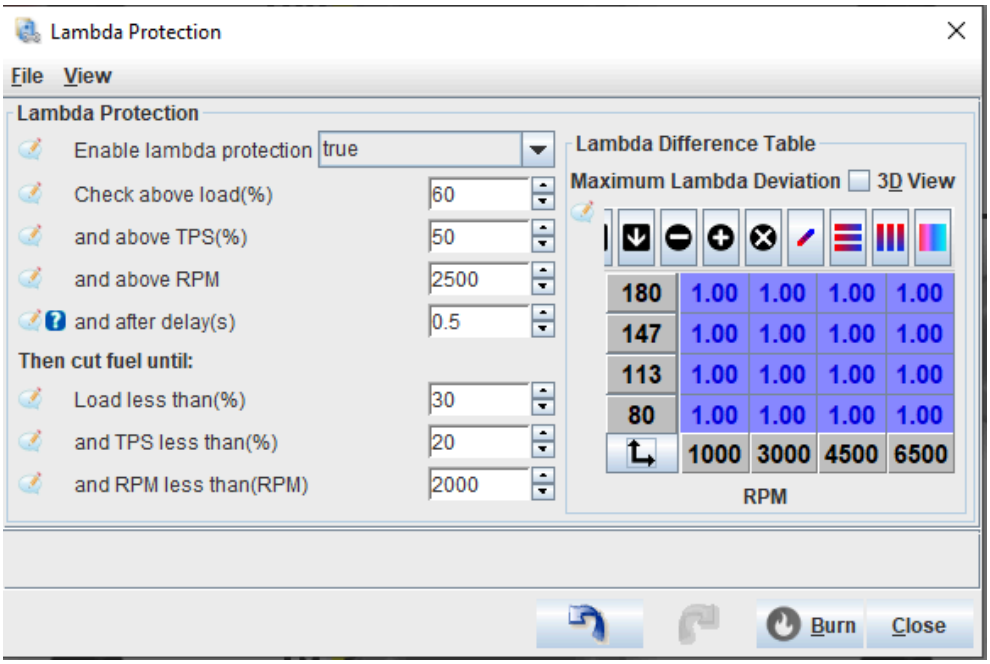
- **Window size (RPM), Timing retard (degrees), and Fuel added (%):** These options allow you to create a "soft" limiter that gradually engages, rather than abruptly cutting fuel or spark. This can help prevent sudden drops in power, making the limiter response smoother.

Electronic Throttle Limiting

- **Soft limiter start RPM and Soft limiter range (RPM):**
  Gradually closes the throttle as the RPM approaches the limit, helping to provide a smooth limiter response for electronically controlled throttles.

This section provides fine-tuned control over RPM, pressure, and throttle limits, with options for different limiter styles that balance performance and protection. For instance, using spark cut can add a visual effect with exhaust flames, while fuel cut keeps the action smooth and consistent.

Lambda Protection



The **Lambda Protection** window enables protection based on the Lambda values, which help in monitoring air-fuel ratio (AFR) deviations and ensuring safe engine operation under specific conditions. Here's a breakdown of the options:

Settings:

- **Enable lambda protection:** Allows you to toggle Lambda Protection on or off.
- **Check above load (%):** The system will check Lambda values only when the engine load exceeds this percentage threshold.
- **and above TPS (%):** Lambda values will only be monitored if the throttle position sensor (TPS) exceeds this percentage.
- **and above RPM:** Lambda protection activates only when the RPM is above this specified threshold.
- **and after delay (s)**: Sets a delay time (in seconds) before Lambda Protection engages after the above conditions are met.

Cut Fuel Until:

This section determines the conditions under which fuel will be cut when Lambda Protection is active.

- **Load less than (%):** Fuel will be cut until engine load drops below this percentage.
- **and TPS less than (%):** Fuel cut will continue until the TPS is below this percentage.

- **and RPM less than (RPM):** Fuel cut remains active until the RPM falls below this threshold.

Lambda Difference Table:

The Lambda Difference Table (right side of the window) allows you to set a maximum allowable deviation in Lambda values.

- **Y-axis represents Load.**
- **X-axis represents RPM.**
- **Z-axis values represent Lambda values (not AFR)**.

This table helps define the Lambda deviation limits under various engine loads and RPMs, enabling finer control over protection levels based on actual engine performance conditions.