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1. Progressive Shift (General Overview)

The progressive shift feature is designed to limit the engine speed to encourage the driver to up-shift early which in turn improves fuel economy. The engine speed limit set by the feature increases as the engine load increases. This can be useful for pulling grades or accelerating up to the speed of traffic.

Programmable parameters within the engine control module (ECM) provide progressive shift related options that can be adjusted to suit the customer’s needs.

This document will address unique progressive shift functionality for MaxxForce® 11L and 13L engines.

To set up the progressive shift feature it is recommended that you use one of the example settings, referenced in the “Parameter Setup” section, and then modify only the specific parameters that will help meet your vehicle application.

1.1. Feature Codes

N/A

2. Definitions/Acronyms

The following terms are referenced in this document:

- **ECM** – Engine Control Module
- **GDP** – Gear Down Protection
- **PS** – Progressive Shift

3. Description and Operation

3.1. Operation

This feature has programmable engine speed limit parameters optimized for each transmission gear to encourage the use of the higher gears during cruise control and low engine load operations.

NOTE: The customer programmable parameters speed limits can be set low to emphasize fuel economy or high to improve engine performance.

Progressive Shift helps the vehicle reach the top gear sooner, which results in fuel savings. These benefits are best realized during level or city driving operations. The engine progressively increases the speed limits with higher engine loads, such as while ascending steep grades.

Refer to the graph discussion in the [Parameter Setup](#) section for more information.

3.2. Feature Interaction

The progressive shift feature interacts with the following engine features:

NOTE: In general, the lowest engine speed limit of Progressive Shift, Gear Down Protection, Cruise Control, and Vehicle Speed Limiter (AKA Road Speed Limiting) will be followed.

- **Cruise Control** – If the progressive shift engine speed limit is lower than the engine speed that would be produced at a cruise control set speed in a given gear ratio, then progressive shift will be the limiter. If however, progressive shift results in a higher engine speed limit than the cruise control set speed would result in, then cruise control will be the target. Cruise control resume speed may not be attained if progressive shift is limiting engine speed for the current gear.
- **Gear Down Protection** – When in the high gear range, progressive shift will limit engine speeds unless overridden by lower speeds set by gear down protection.
- **Vehicle Speed Limiter** – When in the high gear range, progressive shift will limit engine speeds unless overridden by lower speeds set by the vehicle speed limiter.

4. Programmable Parameters

4.1. Required Parameters

The following programmable parameters are required for progressive shift. These parameters should be programmed to encourage drivers to up-shift to the next highest gear to help maintain the engine’s most efficient speed range for fuel economy.

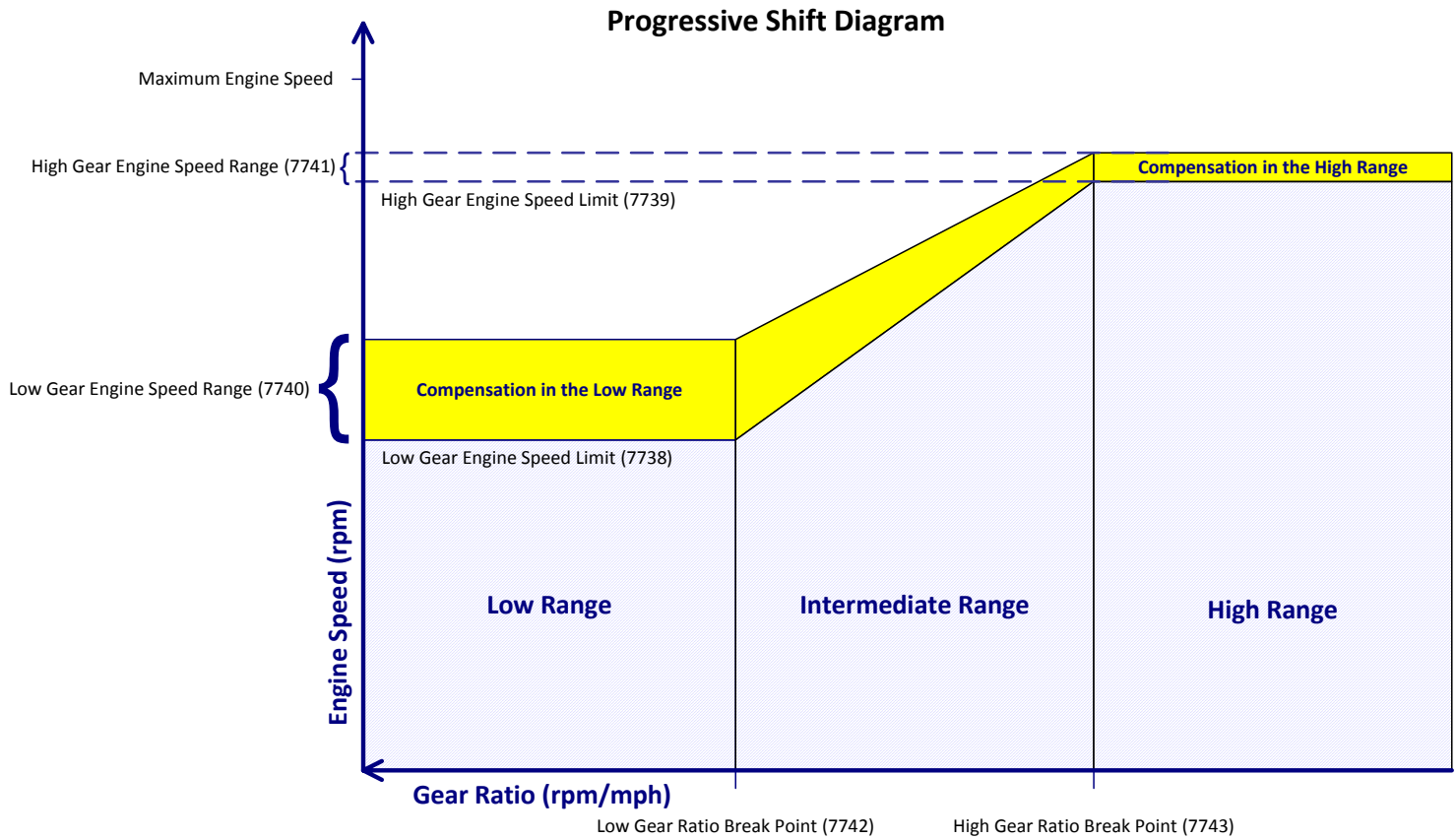
Parameters indicated as “Customer Programmable” can be adjusted differently than the production assembly plant setting to meet the customer’s needs. If the parameter is indicated as non-customer programmable, the parameter setting is preset from the factory and can’t be changed without authorization.

Parameter Name	Description	Possible Values	Customer Programmable?	Recommended Setting
PS Enable (7744)	This parameter enables or disables the progressive shift feature in the engine.	0: Disabled 1: Enabled	YES	Customer Chosen
PTP Enable (7722)	This parameter must be enabled for progressive shift and gear down protection to operate.	0: Disable 1: Enable	YES	Must be set to 1.
PS Low Gear Engine Speed Limit (7738)	This parameter sets the maximum engine speed allowed at low load when the current gear ratio is greater than the programmed “PS Low Gear Ratio Break Point” (7742) parameter value. This parameter must be set to a value less than the “PS High Gear Engine Speed Limit” (7739) parameter setting.	1,000 – 2,000 rpm	YES	Refer to the examples in the “Parameter Setup” section for more information.
PS Low Gear Engine Speed Range (7740)	This parameter sets the range of engine speed added to the “PS Low Gear Engine Speed Limit” (7738) parameter value when the current gear ratio is greater than the programmed “PS Low Gear Ratio Break Point” (7742) parameter value. At 100% engine load this value will be added to the “PS Low Gear Engine Speed Limit” (7738) parameter value.	100 - 1000 rpm	YES	Refer to the examples in the “Parameter Setup” section for more information.

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<p>PS High Gear Engine Speed Limit (7739)</p>	<p>This parameter sets the maximum engine speed allowed at low load when the current gear ratio is less than the programmed “PS High Gear Ratio Break Point” (7743) parameter setting.</p> <p>This parameter must be set to a value greater than the “PS Low Gear Engine Speed Limit” (7738) parameter setting.</p>	<p>Can be set between the parameter (7738) setting and 2200 RPM</p>	<p>YES</p>	<p>Refer to the examples in the “Parameter Setup” section for more information.</p>
<p>PS High Gear Engine Speed Range (7741)</p>	<p>This parameter sets the range of engine speed added to the “PS High Gear Engine Speed Limit” (7739) parameter setting when the current gear ratio is less than the programmed “PS High Gear Ratio Break Point” (7743) parameter setting.</p> <p>At 100% engine load this value will be added to the “PS High Gear Engine Speed Limit” (7739) parameter setting.</p>	<p>100 – 1000 RPM</p>	<p>YES</p>	<p>Refer to the examples in the “Parameter Setup” section for more information.</p>
<p>PS Low Gear Ratio Break Point (7742)</p>	<p>This parameter sets the gear ratio above which the “PS Low Gear Engine Speed Limit” (7738) parameter and the “PS Low Gear Engine Speed Range” (7740) are used.</p> <p>This parameter must be set to a value higher than the “PS High Gear Ratio Break Point” (7743) parameter setting.</p>	<p>0.5 – 20</p>	<p>YES</p>	<p>A ratio that corresponds to 3rd, 4th, OR 5th gear is recommended.</p> <p>For example, if 5th gear is chosen, a value of 4.00 would be appropriate for a 10-speed manual transmission.</p> <p>Larger values equate to a lower gear number. For example: If a value of 8.00 is entered, gears with a ratio > 8.00 are considered Low Gears.</p>
<p>PS High Gear Ratio Break Point (7743)</p>	<p>This parameter sets the gear ratio below which the “PS High Gear Engine Speed Limit” (7739) and the “PS High Gear Engine Speed Range” (7741) are used.</p> <p>This parameter must be set to a value less than the “PS Low Gear Ratio Break Point” (7742) parameter setting.</p>	<p>0.5 – 20</p>	<p>YES</p>	<p>A ratio that corresponds to 5th, 6th, OR 7th gear is recommended.</p> <p>For example, if 6th gear is chosen, a value of 2.60 would be appropriate for a 10-speed manual transmission.</p> <p>Smaller values equate to a higher gear number. For example: If a value of 2.50 is entered, gears with a ratio < 2.50 are considered High Gears.</p>

5. Parameter Setup



Graph Discussion (observe the graph)

Progressive Shift consists of 3 gear regions: a high gear region, a low gear region, and an intermediate region. The gear ratio break point parameter settings determine what range the gears fall within.

For example, If the “Low Gear Ratio Break Point” (7742) parameter is programmed to 3.72 (5th gear) AND the “High Gear Ratio Break Point” (7743) parameter is programmed to 1.00 (9th gear) then gears 1-5 would fall within the “Low Range”, gears 6-9 would fall within the “Intermediate Range”, and 10th gear would fall in the “High Range”.

Engine speed limits (7738 & 7739) must be programmed for the high and low gear regions. The engine speed limits in the “Intermediate Range” are calculated automatically. In this region the engine speed limit compensation will fall somewhere between the “Low Range” compensation and the “High Range” compensation depending on the current gear and the current engine load and the parameter settings.

The initial engine speed limits are applied at low engine loads. The amount of compensated engine speed increase allowed when operating under heavy load is controlled by the engine speed range parameters for the high and low gear regions (7740 & 7741). This range value is the maximum engine

speed increased that is added to the engine speed limit for the appropriate gear region when operating at 100% engine load.

Refer to the next section for specific examples regarding how to configure the parameters for progressive shift.

5.1. Possible Progressive Shift Applications

This section describes only a few possible feature applications and how the programmable parameters can be effectively configured for each application. This is not a comprehensive list, and does not include all possible applications that an owner/operator might encounter.

Please review the description and operation section and the programmable parameters for a better understanding of how the various engine parameters might be best configured for your vehicle.

(Example A) – Customer desires to maximize fuel economy due to light vehicle loads (flat terrain).

In this example, let’s assume that the customer desires to maximize fuel economy since the vehicle is lightly loaded.

Adjust parameters as follows:

Progressive Shift Programmable Parameter Setup for Example A:		
Parameter	Value	Units
PS Enable (7744)	1	Enabled/Disabled
PTP Enable (7722)	1	Enabled/Disabled
PS Low Gear Engine Speed Limit (7738)	1400	Rpm
PS Low Gear Engine Speed Range (7740)	200	Rpm
PS High Gear Engine Speed Limit (7739)	1500	Rpm
PS High Gear Engine Speed Range (7741)	200	Rpm
PS Low Gear Ratio Break Point (7742)	Set to a ratio that corresponds to 3rd, 4th, OR 5th gear.	Gear ratio value
PS High Gear Ratio Break Point (7743)	Set to a ratio that corresponds to 5th, 6th, OR 7th gear.	Gear ratio value

(Example B) – Customer desires to maximize fuel economy due to light vehicle loads (flat terrain) with Multi-Torque.

In this example, let’s assume that the customer desires to maximize fuel economy since the vehicle is lightly loaded.

Adjust parameters as follows:

Progressive Shift Programmable Parameter Setup for Example B:		
Parameter	Value	Units
PS Enable (7744)	1	Enabled/Disabled
PTP Enable (7722)	1	Enabled/Disabled
PS Low Gear Engine Speed Limit (7738)	1400	Rpm
PS Low Gear Engine Speed Range (7740)	220	Rpm
PS High Gear Engine Speed Limit (7739)	1500	Rpm
PS High Gear Engine Speed Range (7741)	220	Rpm
PS Low Gear Ratio Break Point (7742)	Set to a ratio that corresponds to 3rd, 4th, OR 5th gear.	Gear ratio value
PS High Gear Ratio Break Point (7743)	Set to a ratio that corresponds to 5th, 6th, OR 7th gear.	Gear ratio value

(Example C) – Customer desires to maximize fuel economy due to medium vehicle loads (rolling hills).

In this example, let’s assume that the customer desires to maximize fuel economy since the vehicle is moderately loaded while running rolling hills.

Adjust parameters as follows:

Progressive Shift Programmable Parameter Setup for Example C:		
Parameter	Value	Units
PS Enable (7744)	1	Enabled/Disabled
PTP Enable (7722)	1	Enabled/Disabled
PS Low Gear Engine Speed Limit (7738)	1400	Rpm
PS Low Gear Engine Speed Range (7740)	250	Rpm
PS High Gear Engine Speed Limit (7739)	1500	Rpm
PS High Gear Engine Speed Range (7741)	300	Rpm
PS Low Gear Ratio Break Point (7742)	Set to a ratio that corresponds to 3rd, 4th, OR 5th gear.	Gear ratio value
PS High Gear Ratio Break Point (7743)	Set to a ratio that corresponds to 5th, 6th, OR 7th gear.	Gear ratio value

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(Example D) – Customer desires to maximize fuel economy due to medium vehicle loads (rolling hills) with Multi-Torque

In this example, let’s assume that the customer desires to maximize fuel economy since the vehicle is moderately loaded while running rolling hills.

Adjust parameters as follows:

Progressive Shift Programmable Parameter Setup for Example D:		
Parameter	Value	Units
PS Enable (7744)	1	Enabled/Disabled
PTP Enable (7722)	1	Enabled/Disabled
PS Low Gear Engine Speed Limit (7738)	1400	Rpm
PS Low Gear Engine Speed Range (7740)	275	Rpm
PS High Gear Engine Speed Limit (7739)	1500	Rpm
PS High Gear Engine Speed Range (7741)	325	Rpm
PS Low Gear Ratio Break Point (7742)	Set to a ratio that corresponds to 3rd, 4th, OR 5th gear.	Gear ratio value
PS High Gear Ratio Break Point (7743)	Set to a ratio that corresponds to 5th, 6th, OR 7th gear.	Gear ratio value

(Example E) – Customer desires to maintain engine performance due to heavy vehicle loads (mountainous terrain).

In this example, let’s assume that the customer desires to maintain engine performance under heavy vehicle loads or due to extreme conditions such as driving through mountainous regions.

Adjust parameters as follows:

Progressive Shift Programmable Parameter Setup for Example E:		
Parameter	Value	Units
PS Enable (7744)	1	Enabled/Disabled
PTP Enable (7722)	1	Enabled/Disabled
PS Low Gear Engine Speed Limit (7738)	1400	Rpm

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PS Low Gear Engine Speed Range (7740)	300	Rpm
PS High Gear Engine Speed Limit (7739)	1600	Rpm
PS High Gear Engine Speed Range (7741)	300	Rpm
PS Low Gear Ratio Break Point (7742)	Set to a ratio that corresponds to 3rd, 4th, OR 5th gear.	Gear ratio value
PS High Gear Ratio Break Point (7743)	Set to a ratio that corresponds to 5th, 6th, OR 7th gear.	Gear ratio value

(Example F) – Customer desires to maintain engine performance due to heavy vehicle loads (mountainous terrain) with Multi-Torque

In this example, let's assume that the customer desires to maintain engine performance under heavy vehicle loads or due to extreme conditions such as driving through mountainous regions.

Adjust parameters as follows:

Progressive Shift Programmable Parameter Setup for Example F:		
Parameter	Value	Units
PS Enable (7744)	1	Enabled/Disabled
PTP Enable (7722)	1	Enabled/Disabled
PS Low Gear Engine Speed Limit (7738)	1500	rpm
PS Low Gear Engine Speed Range (7740)	275	Rpm
PS High Gear Engine Speed Limit (7739)	1600	Rpm
PS High Gear Engine Speed Range (7741)	325	Rpm
PS Low Gear Ratio Break Point (7742)	Set to a ratio that corresponds to 3rd, 4th, OR 5th gear.	Gear ratio value
PS High Gear Ratio Break Point (7743)	Set to a ratio that corresponds to 5th, 6th, OR 7th gear.	Gear ratio value

6. Frequently Asked Questions

Q: How can I set up the progressive shift feature to maximize fuel economy?

A: Refer to the examples in the [Possible Progressive Shift Applications](#) section for more information.