

International[®] S13 Integrated (2023)

Overview: *Progressive Shift*

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General Overview: Progressive Shift

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 ascending grades or accelerating to the speed of traffic.

This document will address unique Progressive Shift functionality for the S13.

Description and Operation

NOTE: Refer to the vehicle operation and maintenance manual, as well as the S13 engine operation and maintenance manual, for additional information on operation and indications.

The Progressive Shift feature limits engine speed based on the currently engaged gear. Customer programmable parameters allow for optimal engine speeds for each transmission gear. This feature encourages the driver to shift gears sooner; operating the engine at a lower RPM more often resulting in a fuel economy improvement. These benefits are best realized if the Up-Shift Indicator feature is enabled for a visual indication of the Progressive Shift operation.

The Progressive Shift feature has the ability to identify engine load and progressively increases engine speed limits with higher engine loads. This feature also recognizes neutral conditions and allows the engine to rev the full RPM range when in neutral.

Customer programmable speed limit parameters can be set low to emphasize fuel economy or high to improve engine performance.

Operation

- Progressive Shift feature will be activated when the Progressive Shift Enable parameter is set to “Enabled”.
- To take full advantage of the Progressive Shift feature it is recommended that the Up-Shift Indicator feature be enabled. See the Up-Shift Indicator feature for the enabling parameter.
- The transmission gear table and matching gear ratio table are pre-populated from the factory and should not be modified. Use them only for reference when selecting Progressive Shift gear ranges.

Feature Interaction

The Progressive Shift feature interacts with the following engine features:

- **Cruise Control** - The Progressive Shift feature and/or cruise control feature will be the limiter for engine speed whichever has the lowest set speed. Cruise control resume speed may not be attained if Progressive Shift is limiting engine speed for the current gear.
- **Gear Down Protection (GDP)** - The Progressive Shift feature will limit engine speeds when in high gear range, unless overridden by lowest speeds set by Gear Down Protection.

- **Vehicle Speed Limiter** - The Progressive Shift feature will limit the engine speeds when in high gear range, unless overridden by a lowest speed set by the vehicle speed limiter.

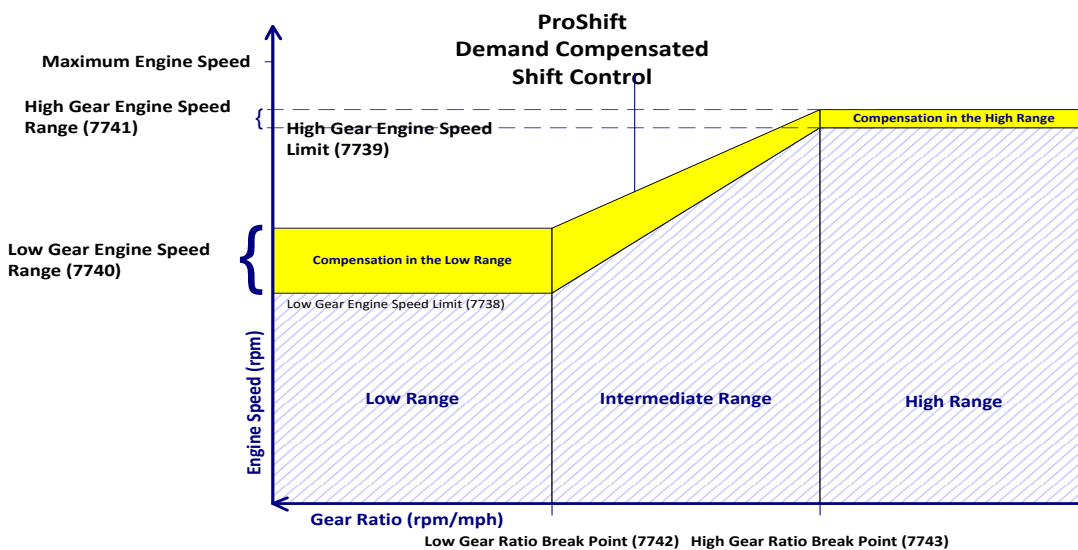
In general, the lowest engine speed limit of Progressive Shift, Gear Down Protection, Cruise Control or Vehicle Speed Limiter will be followed.

Programmable 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 cannot be changed without authorization.

Progressive Shift Diagram



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 (B10A 006) parameter is programmed to 3.72 (5th gear) AND the High Gear Ratio Break Point (B10A 007) parameter is programmed to 1.00 (9th gear) then gears 1-4 would fall within the “Low Range”, gears 6-8 would fall within the “Intermediate Range”, and 9 - 10th gear would fall in the “High Range”.

Engine speed limits (B10A 002) & (B10A 003) must be programmed for the high and low gear range. The engine speed limits in the “Intermediate Range” are calculated automatically. In this region, the engine speed limit will fall somewhere between the Low Range and the High Range depending on current gear and engine load settings.

The initial engine speed limits are applied at low engine loads. The engine speed range parameters for the high and low gear regions (B10A 004) & (B10A 005) control the engine speed increase allowed under heavy loads. This range value is the maximum engine speed increase that is added to the engine speed limit for the gear range when operating at 100% engine load.

Refer to the Parameter Setup section for specific examples regarding how to configure the parameters for Progressive Shift.

Parameter Value	Description	Possible Values	Cust Pgrm	Recommended Settings
Progressive Shift Enable (PSE) (B10A 000)	Enables or disables the Progressive Shift feature in the engine.	0: Disabled 1: Enabled	YES	Customer chosen
Low Gear Engine Speed Limit (LGESE) (B10A 002)	Sets the maximum engine speed allowed at low load when the current gear ratio is greater than the programmed Low Gear Ratio Break Point (B10A 006) parameter value. This parameter must be set to a value less than the High Gear Engine Speed Limit (HGESE) (B10A 003) parameter setting.	0 to 3000 RPM	YES	Refer to the examples in the "Parameter Setup" section for more information.
High Gear Engine Speed Limit (HGESE) (B10A 003)	Sets the maximum engine speed allowed at low load when the current gear ratio is less than the programmed High Gear Ratio Break Point (B10A 007) parameter setting. This parameter must be set to a value greater than the Low Gear Engine Speed Limit (LGESE) (B10A 002) parameter setting.	0 to 3000 RPM	YES	Refer to the examples in the "Parameter Setup" section for more information.
Low Gear Engine Speed Limit Range (LGESELR) (B10A 004)	Sets the range of Engine speed added to the Low Gear Engine Speed Limit (LGESE) (B10A 002) parameter value when the current gear ratio is greater than the programmed Low Gear Ratio Break Point (B10A 006) parameter value. At 100% engine load this value will be added to the Low Gear Engine Speed Limit (LGESE) (B10A 002) parameter value.	0 TO 3000 RPM	YES	Refer to the examples in the "Parameter Setup" section for more information.
High Gear Engine Speed Limit Range (HGESELR) (B10A 005)	Sets the range of engine speed added to the High Gear Engine Speed Limit (HGESE) (B10A 003) (parameter setting when the current gear ratio is less than the programmed High Gear Ratio Break Point (B10A 007) parameter setting. At 100% engine load this value will be added to the High Gear Engine Speed Limit (HGESE) (B10A 003) parameter setting.	0 TO 3000 RPM	YES	Refer to the examples in the "Parameter Setup" section for more information.
Low Gear Ratio LES Break Point (LGRHESBP) (B10A 006)	Sets the gear ratio above which the Low Gear Engine Speed Limit (LGESE) (B10A 002) parameter and the Low Gear Engine Speed Range" (B10A 004) are used. This parameter must be set to a value higher than the "High Gear Ratio Break Point (B10A 007) parameter setting.	0 TO 78	YES	A ratio that corresponds to 3rd, 4th, or 5th gear is recommended. For example, if 5th gear is chosen, a value of 4.00 would be appropriate for a 10-speed manual transmission. 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.

Parameter Value	Description	Possible Values	Cust Pgrm	Recommended Settings
High Gear Ratio HES Break Point (HGRHESBP) (B10A 007)	Sets the gear ratio below which the High Gear Engine Speed Limit(B10A 002) and the High Gear Engine Speed Range (B10A 005) is used. This parameter must be set to a value less than the Low Gear Ratio Break Point (B10A 006) parameter setting.	0 TO 78	YES	A ratio that corresponds to 5th, 6th, or 7th gear is recommended. For example, if 6th gear is chosen, a value of 2.60 would be appropriate for a 10-speed manual transmission. 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.
Minimum Gear Ratio for Progressive Shifting (MGRPS) (B10A 001)	Sets the minimum Gear Ratio where Progressive shifting will enable.	0 TO 100	YES	Needs to match actual transmission ratio top gear minus 1.
Minimum Gear Number for Progressive Shifting (MGNPS) (B10A 008)	Sets the minimum Gear number where Progressive shifting will enable.	0 TO 100	YES	This is the lowest gear number when PS is enabled, typically 2nd

Parameter Setup

Selecting Progressive Shift Gear Ranges

Select gear ratio break points that are sequential. Do not make the High Gear Ratio Break Point a numerically larger value than the Low Gear Ratio Break Point. Break points may be spread apart. The Progressive Shift feature will interpolate an in-between engine speed limit for any gears found in-between the breakpoints. Any gear may be selected for break points however, selecting the break point at or near the hi/low range split is typical

Low Gear Ratio Break Point

This Navistar Engine Diagnostics parameter represents a gear ratio. Any transmission gear with a numerically higher ratio than this break point will be limited to the Low Gear Engine Speed Limit (LGESL) (B10A 002).

- For a 10spd, typically this value would be set to the gear ratio for 5th gear
- For a 13spd, the gear ratio for 5th gear would likely be used
- For an 18spd, the gear ratio for 10th gear would be typical

High Gear Ratio Break Point

This Navistar Engine Diagnostics parameter represents a gear ratio. Any transmission gear with a numerically lower ratio will be limited to the High Gear Engine Speed Limit (HGESL) (B10A 003).

- For a 10spd, typically this value would be set to the gear ratio for 6th gear

Selecting Progressive Shift Engine Speed Limits

Low Gear Engine Speed Limit

This Navistar Engine Diagnostics parameter represents an engine RPM. The engine speed will be limited to this value when the transmission is engaged in a low range gear, typically 2nd through 5th gears on a 10spd.

- Typical values are 1600 to 1700 RPM
- Lower values are better for fuel economy but are also more intrusive upon driving styles
- 1st gear is defaulted OFF for Progressive Shift allowing the full RPM range when in 1st gear or creeper gears. Any transmission gear with a ratio numerically higher than 11.3:1 will not be subject to Progressive Shift RPM limits

High Gear Engine Speed Limit

This Navistar Engine Diagnostics parameter represents an engine RPM. The engine speed will be limited to this value when the transmission is engaged in the higher gears, typically 6th through 10th on a 10spd.

- Typical values are 1700 to 1800 RPM
- Lower values are again more intrusive upon driving styles, but better for fuel economy
- Vehicles running on mountainous terrain may require higher values than vehicles on flat terrain
- Vehicles running frequently with very heavy loads may also require higher values than lightly loaded vehicles

Selecting Progressive Shift Extended Range Load Based Engine Speed Ranges

The use of the load based RPM extender is optional. It can be set to 0 RPM for either or both high and low gear ranges. Since the extended range is load based, it will only allow the extra RPM when heavy fueling is present. This makes the Progressive Shift feature more intrusive upon driving styles and does tend to train the driver into shifting sooner.

Low Gear Engine Speed Range

This Navistar Engine Diagnostics parameter represents an engine RPM “adder”. The Low Gear Engine Speed Limit (LGESE) (B10A 002) will be increased by this amount when the engine is running at high load conditions.

- Typical values are 0 to 300 RPM
- Lower values are better for 18spd transmissions (i.e. 50-150 RPM). Higher values are better for 10spd and 13spd transmissions (200-300 RPM). This is because an 18spd transmission can split any low gear.

High Gear Engine Speed Range

This Navistar Engine Diagnostics parameter represents an engine RPM “adder”. The High Gear Engine Speed Limit (HGESE) (B10A 003) will be increased by this amount when the engine is running at high load conditions.

- Typical values are 0 to 300 RPM
- Lower values are better for 13spd and 18spd transmissions (i.e. 50-150 RPM). Higher values are better for 10spd transmissions (200-300 RPM). This is because 13spd and 18spd transmission can split any low gear.

Progressive Shift Set up Examples

To set up the Progressive Shift feature it is recommended that you use one of the example settings, and then modify only the specific parameters that will help meet your vehicle application.

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.

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

Adjust parameters as follows:

Parameter	Value	Units
PS Enable (B10A 000)	1	Enabled/Disabled
Low Gear Engine Speed Limit (LGESE) (B10A 002)	1400	RPM
Low Gear Engine Speed Range (B10A 004)	200	RPM
High Gear Engine Speed Limit (HGESE) (B10A 003)	1500	RPM
High Gear Engine Speed Range (B10A 005)	200	RPM

Parameter	Value	Units
Low Gear Ratio Break Point (B10A 006)	Set to a ratio that corresponds to 3 rd , 4 th , or 5 th gear	Gear Ratio Value
High Gear Ratio Break Point (B10A 007)	Set to a ratio that corresponds to 5 th , 6 th , or 7 th gear	Gear Ratio Value

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

Adjust parameters as follows:

Parameter	Value	Units
PS Enable (B10A 000)	1	Enabled/Disabled
Low Gear Engine Speed Limit (LGESL) (B10A 002)	1400	RPM
Low Gear Engine Speed Range (B10A 004)	220	RPM
High Gear Engine Speed Limit (HGESL) (B10A 003)	1500	RPM
High Gear Engine Speed Range (B10A 005)	220	RPM
Low Gear Ratio Break Point (B10A 006)	Set to a ratio that corresponds to 3 rd , 4 th , or 5 th gear	Gear Ratio Value
High Gear Ratio Break Point (B10A 007)	Set to a ratio that corresponds to 5 th , 6 th , or 7 th gear	Gear Ratio Value

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

Adjust parameters as follows:

Parameter	Value	Units
PS Enable (B10A 000)	1	Enabled/Disabled
Low Gear Engine Speed Limit (LGESL)	1400	RPM

Parameter	Value	Units
(B10A 002)		
Low Gear Engine Speed Range (B10A 004)	250	RPM
High Gear Engine Speed Limit (HGESL) (B10A 003)	1500	RPM
High Gear Engine Speed Range (B10A 005)	300	RPM
Low Gear Ratio Break Point (B10A 006)	Set to a ratio that corresponds to 3 rd , 4 th , or 5 th gear	Gear Ratio Value
High Gear Ratio Break Point (B10A 007)	Set to a ratio that corresponds to 5 th , 6 th , or 7 th gear	Gear Ratio Value

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

Adjust parameters as follows:

Parameter	Value	Units
PS Enable (B10A 000)	1	Enabled/Disabled
Low Gear Engine Speed Limit (B10A 002)	1400	RPM
Low Gear Engine Speed Range (B10A 004)	275	RPM
High Gear Engine Speed Limit (HGESL) (B10A 003)	1500	RPM
High Gear Engine Speed Range (B10A 005)	325	RPM
Low Gear Ratio Break Point (B10A 006)	Set to a ratio that corresponds to 3 rd , 4 th , or 5 th gear	Gear Ratio Value
High Gear Ratio Break Point(B10A 007)	Set to a ratio that corresponds to 5 th , 6 th , or 7 th gear	Gear Ratio Value

Example E - Customer desires to maintain engine performance due to heavy vehicle loads in mountainous terrain.

Adjust parameters as follows:

Parameter	Value	Units
PS Enable (B10A 000)	1	Enabled/Disabled
Low Gear Engine Speed Limit (LGESL) (B10A 002)	1400	RPM
Low Gear Engine Speed Range (B10A 004)	300	RPM
High Gear Engine Speed Limit (HGESL) (B10A 003)	1600	RPM
High Gear Engine Speed Range (B10A 005)	300	RPM
Low Gear Ratio Break Point (B10A 006)	Set to a ratio that corresponds to 3 rd , 4 th , or 5 th gear	Gear Ratio Value
High Gear Ratio Break Point (B10A 007)	Set to a ratio that corresponds to 5 th , 6 th , or 7 th gear	Gear Ratio Value

Example F - Customer desires to maintain engine performance due to heavy vehicle loads in mountainous terrain.

Adjust parameters as follows:

Parameter	Value	Units
PS Enable (B10A 000)	1	Enabled/Disabled
Low Gear Engine Speed Limit (LGESL) (B10A 002)	1500	RPM
Low Gear Engine Speed Range (B10A 004)	275	RPM
High Gear Engine Speed Limit (HGESL) (B10A 003)	1600	RPM
High Gear Engine Speed Range (B10A 005)	325	RPM
Low Gear Ratio Break Point (B10A 006)	Set to a ratio that corresponds to 3 rd , 4 th , or 5 th gear	Gear Ratio Value
High Gear Ratio Break Point (B10A 007)	Set to a ratio that corresponds to 5 th , 6 th , or 7 th gear	Gear Ratio Value

Frequently Asked Questions

How can I set up the Progressive Shift feature to maximize fuel economy?

Refer to the examples in the Possible Progressive Shift Applications section for more information.

Definitions/Acronyms

The following terms are referenced in this document:

Acronym	Definition
GDP	Gear Down Protection
PS	Progressive Shift
PIM	Powertrain Interface Module