Programming Cat® Electronic Truck Engines

May 2005

CATERPILLAR®

Contents

Introduction

Introduction

By the early 1980's, it had become evident that new engine technologies would have to be brought to bear if Caterpillar, or any other diesel engine manufacturer, was to prosper in the rapidly evolving market environment. A combination of increased government regulation, prompted by legitimate environmental concerns, stronger competition and more demanding market expectations dictated totally new approaches to diesel engine design.

In order to meet these challenges, Caterpillar embarked on an ambitious development program to create totally new diesel engines. That program resulted in the 3176 and the 3406B PEEC. Since 1987, the use of electronics on Caterpillar On-Highway Engines © has grown Engine models such as the C-10, C-12, C15, C-16, and 3126E have been introduced. Most recently, the model year 2004 electronic engine line includes the C7, C9, C11, C13, and C15 with ACERT © Technology (Cat manufactures a wide variety of electronic engines for applications as varied as locomotives and very large earth movers. This booklet covers On-Highway Engines only).

Today, electronics do much more than control the combustion process to meet ever-toughening emission standards and customer fuel economy expectations. They allow the engine to talk to and coordinate with driveline components. They allow monitoring and control of driving habits to meet business objectives. Remote programming and monitoring ability allows real time fleet control from an office location. In today's changing economic environment, a fleet manager must juggle economy and driver satisfaction. Caterpillar electronically controlled engines allow a fleet manager to spec a driveline free from the usual compromises and then program the engines to reflect desired driving habits. In addition, the Driver Reward feature allows the manager to automatically reward drivers who meet preset fleet objectives.

Incorporation of the latest, most powerful ECM, ADEM2000, has equipped Caterpillar On-Highway Engines with numerous electronic features. This book outlines Caterpillar electronic features that have the ability to change the way fleets operate. It is now possible to program fleet truck engines and sit back and let the electronics take over.

What's New

A lot has changed with Caterpillar's on-highway engine technology since the last revision of this book in January 2000. Perhaps the biggest change in Cat's on-highway engine technology has been the introduction and perfection of ACERT © Technology. This book essentially picks up where the January 2000 revision left off, covering all on-highway engines from 2001 to 2005. The Recommendations, Advantages, and Disadvantages sections have all been updated to reflect the most current line of Caterpillar on-highway engines as well. What follows is a brief list of the major additions and changes that have been made to this book.

- ✔ All of the electronic parameters have been modified to reflect programming requirements for on-highway engines from 2001 up to 2005 including all necessary ACERT© Technology considerations.
- ✔ An Input Selection section had been added to provide information on all available selection options.
- ✔ The Output Selection section has been expanded to include more available outputs.
- ✔ Information on Gear Fast/Run Slow and Gear Fast/Run Super Slow has been added.
- ✔ Design Pro has replaced Truck Engine Pro.
- ✔ Cat Messenger has been referenced along with Cat ID, since although Messenger is the newer device, both are in use today.
- ✔ Driver Reward information has been added.
- ✔ A section on Improving Fuel Economy has been added to provide helpful trip preparation, driving, and spec'ing recommendations for trucks powered with Caterpillar on-highway engines with ACERT© Technology.

Understanding the Electronic Controls

This booklet is to aid you in choosing appropriate programmable values. Some features fall into a "non-programmable" or "programmable only by your authorized Cat dealer" category. While you may not need to be concerned about programming these parameters, we have included them in this booklet so you can have a greater understanding of the Caterpillar electronic system.

Cat electronic truck engines offer a wide range of features, these include but are not limited to:

- ✔ Maximum Vehicle Speed Limiting
- ✔ Maximum Engine RPM Limiting
- ✔ Progressive Shift prompts
- ✔ Idle-Shutdown Timer
- ✔ Wide variety of Cruise Control features
- ✔ Retarder control
- ✔ Dedicated PTO control features
- ✔ Engine Monitoring System
- ✔ Engine Diagnostics w/fault logging including "snapshot" recording
- ✔ Numerous Trip Recording options
- ✔ Powertrain (J1922 or J1939) Interface
- ✔ ATA (J1587) Data Link
- ✔ Cooling fan control including A/C high pressure

Not all of these features fall into the "customer programmable" category. Some features, like the ATA Data Link, have to do with the way the engine electronics are integrated into the truck and drive train electronics. Another example is the setting for tachometer calibration, which comes preset from the truck factory and should not be changed. (In fact, most features come with a preset value from the factory.)

Other features, like password protection, can only be set by a customer.

In short, the programmable features fall into two basic categories:

Factory specified parameters and features which include both;

1 – **Caterpillar Standard Features**

2 – **Truck Manufacturers' (OEM) Standard Features**

Customer specified parameters and specifications which include both;

1 – **OEM Databook Features** (the ones chosen as the truck is spec'd and ordered)

2 – **Optional Programmable Features** (parameters unique to the application and normally set after the truck is delivered)

Customer programmable features with a icon in the title bar can be locked for additional security. (See Customer Parameter Lockout, page 159 for details.)

Note: Since the introduction of the 3176B and 3406E engines in 1993, Caterpillar has continued to add and enhance the features available to both the Fleet Owner and the Owner Operator. These additions and enhancements are made by changing the software in the Personality Module, which is in the Electronic Control Module (ECM) on the engine. New Personality Module Software can be installed by an authorized Caterpillar dealer. Throughout this booklet references are made to software release dates to define when a particular feature became available. Listed below are the dates of the major Personality Module Software updates.

Name	Date
NOV00	November 2000
OCT01	October 2001
JAN02	January 2002
OCT02	October 2002
MAR03	March 2003
MAR04	March 2004

These dates may or may not correspond to model year changes.

Factory Specified Parameters and Features

Each new engine will come with several features set at factory default settings. Some of these, like the oil sump capacity, are set at the engine factory. Others, like the tachometer calibration, are set by the truck manufacturer. All of these default settings fall into one of three categories.

1 – A specific value required by the engine or truck electronics for proper operation (example - oil sump capacity, tachometer calibration)

2 – A standard value set for convenience (example - PTO Ramp Rate is set at 50 rpm/sec)

3 – A value set at the upper limit of the possible range to ensure that the specific feature does not take effect until reset by the customer (example - Vehicle Speed Limiting is set at 127 mph)

Customer Programmable Parameters and Specifications

Determining Parameters and Specifications
On the following pages you will see a explanation of each electronic parameter. Along with the explanations are helpful recommendations and in some cases, split chart examples to help in specification development. Another aid in determining Parameters and Specifications is Cat® Design Pro (See page 173).

Customer specified parameters are divided into two sections; **OEM Data Book Programmable Features** are used to spec and order a truck and the **Optional Programmable Features** are used to customize the engine for your operation.

Some OEM Data Book Programmable Features covered are: (see page 13 for complete listing)

- ❑ Vehicle Speed Limit (VSL)
- ❑ Cruise Control Parameters
- ❑ Engine/Gear Parameters
- ❑ PTO/Fast Idle Features
- ❑ Idle Shutdown Timer
- ❑ Retarder Control
- ❑ Tamper Resistance
- ❑ Password Protection
- ❑ Engine Monitoring System

Optional Programmable Specifications covered include, bit are not limited to: (see page 13 for complete listing)

- ❑ Vehicle ID (required for Caterpillar fleet management software)
- ❑ Dedicated PTO Features
- ❑ Fuel Usage Correction Factor (ECM vs measured)
- ❑ Oil Capacity Adjustment for Maintenance Indicator
- ❑ Customer Specified PM Interval for Maintenance Indicator
- ❑ Programmable Low Idle RPM

Feature Comparison by Model

Feature	C-10 C-12 C-15 C-16	3126E	HD ACERT	MR ACERT
Vehicle ID	▯	▯	▯	▯
Vehicle Speed Calibration	▯	▯	▯	▯
Vehicle Speed Limit	▯	▯	▯	▯
VSL Protection	▯	▯	▯	▯
Tachometer Calibration	▯	▯	▯	▯
Soft Vehicle Speed Limit	▯	▯	▯	▯
Two-Speed Range Axle Ratio	▯	▯	▯	▯
Low Cruise Control Set Speed Limit	▯	▯	▯	▯
High Cruise Control Set Speed Limit	▯	▯	▯	▯
Engine Retarder	▯	▯	▯	▯
Engine Retarder Delay	▯		▯	
Engine Retarder Minimum Vehicle Speed Limit Type	▯		▯	
Engine Retarder Minimum Vechile Speed	▯		▯	
Smart Idle Parameters	▯	▯	▯	▯
Auto Retarder in Cruise	▯	▯	▯	▯
Auto Retarder in Cruise Increment	▯	▯	▯	▯
Cruise/Idle/PTO Switch Configuration	▯	▯	▯	▯
Soft Cruise Control	▯	▯	▯	▯
Idle Vehicle Speed Limit	▯	▯	▯	▯
Idle rpm Limit	▯	▯	▯	▯
Idle/PTO rpm Ramp Rate	▯	▯	▯	▯
Idle/PTO rpm Bump Rate	▯	▯	▯	▯
Fast Idle Engine rpm #1		▯		▯
Fast Idle Engine rpm #2		▯		▯
Warm Up Mode Idle Speed		▯		▯
PTO Configuration	▯	▯	▯	▯
PTO Top Engine Limit	▯	▯	▯	▯
PTO Engine rpm Set Speed	▯	▯	▯	▯
PTO to Set Speed	▯	▯	▯	▯
PTO Cab Throttle rpm Limit	▯	▯	▯	▯
PTO Vehicle Speed Limit	▯	▯	▯	▯
Torque Limit	▯	▯	▯	▯
PTO Shutdown Timer	▯	▯	▯	▯

Feature Comparison by Model

Feature	C-10 C-12 C-15 C-16	3126E	HD ACERT	MR ACERT
PTO Activates Cooling Fan	▯	▯	▯	▯
Lower Gears Engine rpm	▯	▯	▯	▯
Lower Gears Turn Off Speed	▯	▯	▯	▯
Intermediate Gears Engine rpm Limit	▯	▯	▯	▯
Intermediate Gears Turn Off Speed	▯	▯	▯	▯
Gear Down Protection rpm Limit	▯	▯	▯	▯
Gear Down Protection Turn On Speed	▯	▯	▯	▯
Low Idle Engine rpm	▯	▯	▯	▯
Top Engine Limit	▯	▯	▯	▯
Top Engine Limit with Droop (only available PM MAR03 and older)	▯		▯	
Transmission Style	▯	▯	▯	▯
Eaton Top 2 Override with Cruise Switch	▯		▯	
Eaton Top 2 Gear Ratios	▯		▯	
AT/MT/HT Part Throttle Shift Speed		▯		▯
Governor Type (excludes C-10, C-12, C-15, C-16 PM OCT01)	▯	▯	▯	▯
Idle Shutdown Timer	▯	▯	▯	▯
Allow Idle Shutdown Override	▯	▯	▯	▯
Minimum Idle Shutdown Outside Temp	▯	▯	▯	▯
Maximum Idle Shutdown Outside Temp	▯	▯	▯	▯
A/C Pressure Switch Fan-On Time	▯	▯	▯	▯
Fan with Engine Retarder in High Mode	▯	▯	▯	▯
Exhaust Brake Configuration		▯		▯
Engine Monitoring Mode	▯	▯	▯	▯
Coolant Level Sensor	▯	▯	▯	▯
Coolant Temperature Derate	▯		▯	
Engine Oil Pressure Sensor		▯		▯
Oil Level Switch Installation Status (GMT560 with 3126 & C9 only)		▯		▯
Primary Fuel Tank Capacity (GMT560 with 3126 & C9 only)		▯		▯
Secondary Fuel Tank Capacity (GMT560 with 3126 & C9 only)		▯		▯
Maintenance Indicator Mode	▯	▯	▯	▯
PM1 Interval	▯	▯	▯	▯
Engine Oil Capacity	▯	▯	▯	▯

Feature Comparison by Model

Feature	C-10 C-12 C-15 C-16	3126E	HD ACERT	MR ACERT
PM1 Reset (Dash Access)	□	□	□	□ □
Fleet Trip Reset (Dash Access)	□		□	
Theft Deterrent	□	□	□	□
Theft Deterrent Password	□	□	□	□
Quick Stop Rate	□	□	□	□
Customer Parameters (Dash Access)		□		□
State Selection (Dash Access)	□		□	
Fuel Correction Factor	□		□	
Change Fuel Correction Factor (Dash Access)	□		□	

Data Book and Optional Parameters

OEM Data Book

Optional

Optional (cont.) **Page**

Identification Parameters

	Factory	Databook	Optional
• Vehicle ID			✔

Vehicle ID

Description:
The Vehicle ID parameter allows the truck or fleet owner to electronically identify the vehicle with a unique set of characters. The Vehicle ID can be up to 17 characters long.

The Vehicle ID is required when using the optional Fleet Information Software (FIS).

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range	Default
17 Alpha-Numeric Charactores	Blank

Advantages:
Fleet Information Software offers many unique advantages to any fleet that uses Cat electronic engines. Assigning a Vehicle ID allows you to track the engine and vehicle performance using FIS. For complete details about Caterpillar's Fleet Information Software contact your local Cat dealer.

Disadvantages:
None

Recommendations:
- ✔ Caterpillar recommends using the Vehicle ID feature for all applications where the owner or operator expects to generate vehicle specific reports.
- ✔ The Vehicle ID is often entered as the Vehicle Identification Number (VIN).

Vehicle Speed Parameters

	Factory	Databook	Optional
• Vehicle Speed Calibration.....		✔	
• Vehicle Speed Calibration (J1939 Trans)		✔	
• Vehicle Speed Calibration (J1939 ABS)		✔	
• Vehicle Speed Limit		✔	
• VSL Protection		✔	
• Tachometer Calibration		✔	
• Soft Vehicle Speed Limit			✔
• Two-Speed Axle Range Ratio		✔	
• Multi-Torque Ratios		✔	

Vehicle Speed Calibration

Description:
The value (Pulses per Mile, PPM) of this parameter is used by the ECM to convert the vehicle speed signal into miles per hour (or kilometers per hour). The value is calculated using tire revolutions per mile, rear axle ratio and the number of teeth on the transmission chopper wheel. This parameter is programmed by the OEM.

$$PPM = M \times R_a \times N$$

Example: 31,200 = 502 x 3.90 x 16

M = Tire revolutions per mile. This information is available from the tire manufacturer.
R_a = Rear Axle Ratio. This is typically found on the housing of the rear axle, or on the specification sheet for the vehicle
N = Number of chopper teeth on the transmission drive shaft where the magnetic pickup is mounted. The value is typically 16, but may be 11.

Available:
All electronically controlled on-highway engines

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C9 GM	4000 PPM (2485 ppkm)	384000 PPM (238080 ppkm)	32000 PPM (19884 ppkm)
3126E, C7, C9 OTHER	4000 PPM (2485 ppkm)	384000 PPM (238080 ppkm)	Not Programmed
C-10, C-12, C-15, C-16	4000 PPM (2485 ppkm)	150000 PPM (93226 ppkm)	14000 PPM (8696 ppkm)
C11, C13, C15	4000 PPM (2485 ppkm)	150000 PPM (93226 ppkm)	Not Programmed

Advantages:
Proper calculation of the Vehicle Speed Calibration parameter is essential for proper cruise control and speedometer (if controlled by the ECM) operation, and accurate Fleet and Driver Trip Data.

Disadvantages:
Miscalculation of the Vehicle Speed Calibration parameter will cause all values calculated by the ECM using the Vehicle Speed value to be in error (e.g. vehicle miles, fuel economy, etc.). **Precise calculation is critical to provide accurate calculated values from the ECM.**

Recommendations:

✔ Let the OEM calculate and program Vehicle Speed Calibration parameter based on the truck specs.

✔ Recalculate and program the Vehicle Speed Calibration parameter if any changes are made to the driveline components, such as a different rear axle ratio or a tire size change.

Vehicle Speed Calibration (J1939-Trans)

Description:
By setting the Vehicle Speed Input parameter to the J1939-Trans option, the ECM will be calibrated to receive vehicle speed information over the J1939 datalink. The Vehicle Speed Cal (J1939-Trans) parameter value represents the Transmission Output Shaft revolutions per mile, and is used with the output shaft speed signal (received over the J1939 datalink) to calculate vehicle speed.

When the ECM is configured to receive Vehicle Speed information from an Electronic Transmission Control Unit via the J1939 datalink, the attached transmission must be capable of supporting the J1939 ETC1 Broadcast Message that provides the transmission output shaft speed.

OEM Responsibilities:

- Determine if the transmission is capable of supporting the required ETC1 message protocol.
- Determine the parameter value to be programmed for a given chassis by one of the methods listed below.

Parameter Calculation Methods:

Method 1

Vehicle Speed Cal (J1939-Trans) =
Transmission Output Shaft revolutions per mile

Method 2

Vehicle Speed Cal (J1939-Trans) =

$$\frac{\text{Transmission Speed Sensor pulse per mile}}{\text{Number of teeth on the output shaft chopper wheel}}$$

Method 3

Vehicle Speed Cal (J1939-Trans) =
Tire revolutions per mile x Axle ratio

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9, C-10, C-12, C-15, C-16, C11, C13, C15	0 revs per mile (0 rev per km)	65000 revs per mile (43000 revs per km)	Not Programmed

Description:
By setting the Vehicle Speed Input parameter to the J1939-ABS option, the ECM will be calibrated to receive vehicle speed information using Antilock Brake System (ABS) wheel speed over the J1939 datalink. The Vehicle Speed Cal (J1939-ABS) parameter value represents the ratio of actual tire revolutions per mile divided by assumed ABS tire revolutions per mile, and is used with the wheel speed signal (received over the J1939 datalink) to calculate vehicle speed.

It is important to note that if this calibration method is to be used, the ABS must be able to support the J1939 High Resolution Wheel Speed Broadcast Message, which provides wheel speed from the two rear wheels. In addition to the wheel speed, the ABS will also transmit the actual revolutions per mile, which should be divided by the assumed ABS tire revolutions per mile to obtain the Vehicle Speed Cal (J1939-ABS) parameter.

OEM Responsibilities:

- Determine if the ABS can support the required message protocol mentioned above.
- It is recommended that the OEM program the Vehicle Speed Calibration parameter.

Parameter Calculation Method:

$$\text{Vehicle Speed Cal} = \frac{\text{Actual Tire Revolutions Per Mile}}{\text{Assumed ABS Tire Revolutions Per Mile}}$$

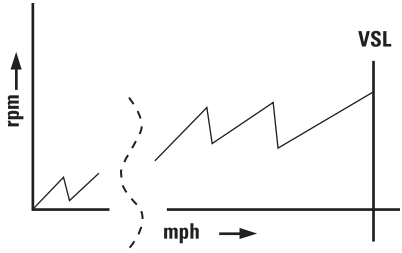
Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9, C-10, C-12, C-15, C-16, C11, C13, C15	0	6.550	Not Programmed

Vehicle Speed Limit (VSL)

Description:
Vehicle speed limiting sets the maximum speed of the truck. Vehicle Speed Limiting cuts off the fuel to the injectors when the truck exceeds the programmed speed. With the release of NOV95 Personality Module Software, VSL can be exceeded using cruise control if the High Cruise Control (HCC) Set Limit parameter is programmed higher than the Vehicle Speed Limit parameter (See page 32).



Available:
All electronically controlled on-highway engines covered in this handbook. The ability to program HCC Set Limit above VSL is available on heavy duty engines only.

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9 GM	30 MPH (48 km/h)	75 MPH (121 km/h)	75 MPH (121 km/h)
3126E, C7, C9 Other	30 MPH (48 km/h)	127 MPH (204 km/h)	127 MPH (204 km/h)
C-10, C-12, C-15, C-16, C11, C13, C15	30 MPH (48 km/h)	127 MPH (204 km/h)	127 MPH (204 km/h)

Advantages:
Using the VSL feature allows you to “gear fast - run slow” to optimize the balance between fuel economy and performance or simply specify for the best fuel economy. Setting VSL allows the truck operator to consistently operate the engine and truck at fuel efficient and safe vehicle speeds. Without VSL, most trucks can be capable of very high vehicle speeds, due to GFRS/GFRSS spec’ing methods.

Disadvantages:
VSL can be a hard limit that allows no fuel until the

vehicle slows to a speed below the programmed limit. This makes the common practice of "running at hills" very difficult. Soft VSL (See page 26) may alleviate this problem if the driver expects to operate at or above VSL on downhill runs.

Recommendations:

✔ Gearing for best fuel economy.

Engine	RPM	MPH	Note
3126E	2000	60	GCW < 50,000 lbs
	2200	60	GCW= 50,000+ lbs
C-10	1600	65	Linehaul applications with 80,000 lbs or less
C-12	1550	65	9,10,or 15 speed single overdrive transmission
	1450-1500	65	13 or 18 speed dual overdrive transmission
C-15 C-16	1550	65	410 hp and below
	1500	65	435 hp and above
C7	2000	60	50,000 GCW or less
	2200	60	Provides more startability or load speed performance
C9	1650	65	60,000 GCW or less
C11	1450	65	60,000 GCW or less
C13	1450	65	80,000 GCW or less
C15	1400	65	Less than 1750 lb-ft
	1325	65	1750 lb-ft and above

✔ If engine RPM at Vehicle Speed Limit is less than or equal to Peak Toque RPM + 100, select another axle ratio or transmission to increase engine RPM. Otherwise driveability may be adversely affected. Use Design Pro to check for gradeability at cruise speed to ensure it is 1.0% or greater. Also, use Design Pro to check for gradeability at peak torque to ensure it is 1.8% (1.5% minimum).

VSL Protection

Description:
This tamper -resistant feature is a programmed engine RPM limit that the engine will not exceed if the ECM should lose the vehicle speed signal. In other words, if the vehicle speed signal is lost the truck will not exceed the Vehicle Speed Limit (VSL). The VSL Protection parameter should be set high enough that the vehicle can limp home, but low enough that it will not be capable of exceeding the VSL.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	1000RPM	TEL RPM	TEL RPM
3126E GM	1700 RPM	1700 RPM	1700 RPM
3126E Other C7, C9	1700 RPM	TEL RPM	TEL RPM

Advantages:
The tamper resistance feature helps deter those who may be tempted to try and circumvent the vehicle speed signal. If the ECM were to lose the vehicle speed signal for any reason, the engine rpm would be limited to the programmed RPM value of the VSL Protection parameter.

Disadvantages:
None

Recommendations:
✔ Caterpillar recommends electronic engines be protected by setting this feature to an RPM value equal to:

$$\text{VSL Protection (rpm)} = \frac{VSL \times R_a \times R_t \times M}{60}$$

where;
VSL = Vehicle Speed Limit
R_a = Rear Axle Ratio
R_t = Transmission Ratio in the highest gear
M = Tire revolutions per mile

Description:
Programmed by the OEM, this parameter is used by the ECM to convert the engine speed signal into revolutions per minute for a tachometer.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	12.0 PPR	500.0 PPR	113.0 PPR
3126E GM, C7, C9 GM 530/540	2.0 PPR	500.0 PPR	17.5 PPR
C7, C9 GM T560	2.0 PPR	500.0 PPR	2.0 PPR
3126 Other	2.0 PPR	500.0 PPR	134.0 PPR

Advantages:
By using the ECM Output to drive the in-dash tachometer the need for a separate sensor for the tachometer is eliminated.

Recommendations:
✔ For most applications the factory default is correct.

✔ For ECM driven tachometer applications the in-dash tachometer must be set to the same pulses per revolution (PPR) setting as the ECM.

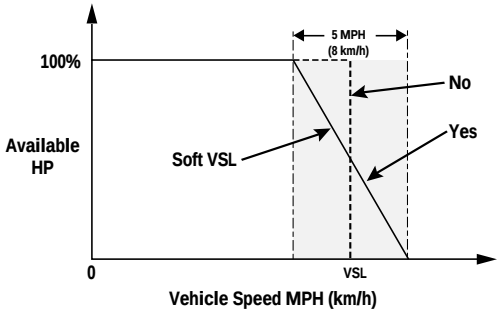
✔ To verify that the ECM is driving the tachometer, perform the tachometer special test in Cat ET. When running the special test, the tachometer reading should sweep to approximately 1500 rpm. If not, use the following calculation to correct the Tachometer Calibration parameter value.

$$\frac{\textbf{PPR}}{\textbf{Tach}} = \frac{\textbf{X}}{\textbf{1500}}$$

PPR	=current Tachometer Calibration value
Tach	=value displayed on the tachometer during the test
X	=the desired Tachometer Calibration value
1500	=value that should be displayed on the tachometer during the test

Soft Vehicle Speed Limit

Description:
Both Vehicle Speed Limiting (VSL) and Soft Vehicle Speed Limiting (Soft VSL) set the maximum speed of the truck. Vehicle Speed Limiting cuts off the fuel to the injectors when the truck exceeds the VSL programmed mile per hour value. When you choose Soft VSL, fuel delivery is modulated when VSL is reached. When the truck reaches the programmed VSL value, the fuel is not abruptly cut off. Instead, it is gradually reduced. Soft VSL may allow the truck to exceed VSL by a maximum of 2.5 MPH (4 km/h), when the truck is using less than 50% of the available engine horsepower.



Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range	Default
No Yes	No

Advantages:
Using Soft VSL feature not only allows you to "gear fast – run slow" to optimize a balance between fuel economy and performance or simply specify for the best fuel economy, but also allows the driver to "run at hills" by "warming" the turbo at the bottom of the hill. This means that there is enough fuel to keep moderate boost levels even though fuel delivery is tapered off by Soft VSL.

Disadvantages:
Not setting VSL allows the truck operator to "run fast"

and as a result get poor fuel economy. Also, some drivers may not like driving with Soft VSL enabled. Some common complaints are that there seems to be lower power and the truck may not feel like it can hold a constant speed. However, these effects are due to the modulated fuel delivery, and once a driver gets used to them, will still result in the advantages listed previously. This perceived power loss can be even more noticeable on trucks that are spec'ed near minimum gradeability requirements.

Recommendations:

✔ Do not use Soft VSL unless you expect the truck to operate at or above VSL in uneven or flat terrain.

Two-Speed Range Axle Ratio

Description:
This parameter must be programmed when a Two-Speed Axle On/Off Switch is used by the ECM in order to adjust the vehicle speed calibration. When a two-speed axle is used, the change in gear ratios from the high speed range to the low speed range alters the calibration of the Vehicle Speed Limit and Vehicle Speed Calibration, which require a calibration adjustment to ensure the ECM-driven speedometer and ECM-stored information correctly reflect the actual vehicle speed.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range				Cat Default
	Minimum		Maximum		
	Low Speed Range	High Speed Range	Low Speed Range	High Speed Range	
3126E, C7, C9	0.00	0.00	19.99	9.99	0.00
C-10, C-12, C-15, C-16, C11, C13, C15	1.00	1.00	19.99	9.99	1.00

Advantages:
Proper calculation of the Low Speed Range Axle Ratio and High Speed Range Axle Ratio parameters is essential for proper cruise control and speedometer (if controlled by the ECM) operation, and accurate fleet and driver trip data.

Disadvantages:
None

Recommendations:
- ✔ Let the OEM calculate the Low Speed Range Axle Ratio and High Speed Range Axle Ratio parameters based on the truck specifications.
- ✔ Recalculate and program the Low Speed Range Axle Ratio and High Speed Range Axle Ratio parameters if any changes are made to the rear axle ratios. **Note that repairing or replacing the rearend with the same axle ratio will not cause a problem or require any recalculation for this parameter.**

Cruise Control Parameters

	Factory	Databook	Optional
• Low Cruise Control Speed Set Limit		✔	
• High Cruise Control Speed Set Limit		✔	
• Engine Retarder		✔	
• Engine Retarder Delay			✔
• Engine Retarder Minimum VSL Type			✔
• Engine Retarder Minimum Vehicle Speed			✔
• Smart Idle Parameters	✔		
• Auto Retarder In Cruise			✔
• Auto Retarder In Cruise Increment			✔
• Cruise/Idle/PTO Switch Configuration	✔		
• Soft Cruise Control		✔	

Description:
Cruise control allows the comfort and convenience of automotive type cruise control, complete with "bump" speed settings ("Bump Cruise" allows the operator to change the vehicle speed in 1 MPH (1.6 km/h) increments by "bumping" the Accel or Decel switch). While in cruise mode, the ECM monitors and maintains vehicle speed at a set value. Additionally, the use of an engine retarder while the cruise control is "On" has three programmable modes to match your braking method. The retarder can also be programmed to automatically turn on when the truck exceeds the cruise set speed while going down hill.

Advantages:
Using cruise control can reduce driver fatigue and improve fuel economy when used correctly. Caterpillar's SoftCruise speed control can provide a smoother ride and additional fuel economy. The SoftCruise feature is most beneficial in rolling terrain.

Disadvantages:
Cruise control offers few disadvantages. If the Low Cruise Control setting is set too low it may allow drivers to operate the cruise in slower city traffic which may

not be desirable. However, if Low Cruise Control is set too high the driver will not be able to use it when climbing long grades.

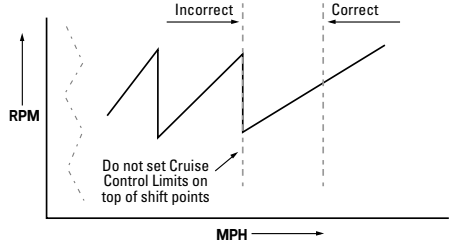
Using the standard cruise (by setting Caterpillar's SoftCruise speed control to "off") can cause the driver to sense uneven fueling - rapid fuel on/fuel off. This may discourage the use of cruise control and negatively effect fuel economy and driver comfort.

Recommendations:

✔ Use cruise control by setting both the upper and lower cruise control speed limits (HCC and LCC).

✔ Set the HCC at the highest speed you intend the vehicle to cruise. This may be above the Vehicle Speed Limit parameter setting.

✔ Do not set the cruise control limit right on top of a shift point. Driveability may be adversely affected. Check your settings against a split chart for your driveline.



✔ To take full advantage of SoftCruise, set the High Cruise (HCC) parameter to at least 3 mph below the Vehicle Speed Limit Parameter (VSL).

Example: VSL = 65, HCC = 62 or less

✔ On the other hand, to encourage the use of cruise control, set HCC to 3 mph above the recommended VSL. This will result in the truck being operated in cruise, with the HCC speed reached by "bumping" up the cruise.

Description:
Low Cruise Control Set Speed Limit (LCC) sets the minimum vehicle speed for which cruise control may be activated.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E GM	30 MPH (48 km/h)	75 MPH (121 km/h)	30 MPH (48 km/h)
3126E Other	15 MPH (24 km/h)	127 MPH (204 km/h)	127 MPH (204 km/h)
C7, C9 GM	25 MPH (40 km/h)	75 MPH (121 km/h)	25 MPH (40 km/h)
C7, C9 Other	15 MPH (24 km/h)	127 MPH (204 km/h)	127 MPH (204 km/h)
C-10, C-12, C-15, C-16, C11, C13, C15	15 MPH (24 km/h)	127 MPH (204 km/h)	127 MPH (204 km/h)

Advantages:
Programming of this parameter can restrict the use of cruise control to those places where it is proper.

Disadvantages:
If the Low Cruise Control Speed Set Limit is set too low it may allow drivers to operate the cruise in slower city traffic, which may not be desirable. However, if LCC is set too high, the driver will not be able to use it when climbing long grades.

Recommendations:
✔ A typical value for Low Cruise Control Set Limit is 20 MPH (32 km/h).

High Cruise Control Speed Set Limit

Description:
High Cruise Control Speed Set Limit sets the maximum vehicle speed for which cruise control may be used. If the driver attempts to set a vehicle speed higher than the programmed value of High Cruise Control Speed Set Limit, the programmed value will become the cruise set speed.

It is possible to program High Cruise Control Speed Set above the programmed Vehicle Speed Limit. However, the driver can only attain speeds higher than VSL by using the ACCEL switch and "bumping" up the vehicle speed.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9 GM	30 MPH (48 km/h)	75 MPH (121 km/h)	75 MPH (121 km/h)
3126E, C7, C9 Other	20 MPH (32 km/h)	127 MPH (204 km/h)	127 MPH (204 km/h)
C-10, C-12, C-15, C-16, C11, C13, C15	30 MPH (48 km/h)	127 MPH (204 km/h)	127 MPH (204 km/h)

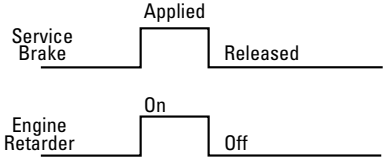
Advantages:
Using cruise control can reduce driver fatigue and improve fuel economy. Fleets may want to set HCC above VSL to encourage use of cruise control.

Disadvantages (possible):
If High Cruise Control Speed Set is programmed to a value above the Vehicle Speed Limit (VSL) the truck most likely will be driven at higher speeds, therefore reducing fuel economy.

Recommendations:
- ✔ Set the High Cruise Control Speed Set Limit at the highest speed you intend the vehicle to cruise.
- ✔ Set the High Cruise Control Speed Set Limit 3 to 5 MPH (5 to 13 km/h) below the Vehicle Speed Limit (VSL). This allows the driver to "run at hills" in rolling terrain and allows some reserve speed for passing.
- ✔ If increased security is needed, this parameter can be "locked" using the Customer Parameter Lockout (See page 159).

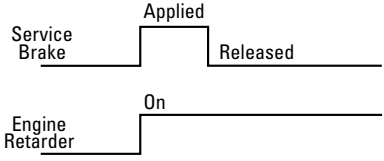
Description:
When the driver is operating an engine retarder with the cruise control switch "On" and steps on the service brake, two customer selectable modes of operation are available, Coast and Latch. One additional Manual mode is available, which does not require the cruise switch to be in the "On" position and operates like a retarder on a mechanically governed engine.

Coast Mode:



Coast Mode engages the engine retarder when the driver presses (applies) the service brake pedal. When the pedal is released, the retarder disengages.

Latch Mode:



Latch Mode engages the retarder when the driver presses (applies) the service brake. The driver can then release the service brake and the retarder will remain engaged until another input, such as depressing the throttle or clutch, engine RPM drops below 800 RPM, or the retarder is turned off, is supplied.

Manual Mode does not require the Cruise Control Switch to be in the "On" position. In Manual Mode the engine retarder will activate anytime the Retarder Switch is "On", engine RPM is above 800 RPM and the engine is not being fueled.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range	Default
3126E, C7, C9, C-10, C-12, C-15, C-16, C11, C13, C15	Coast Latch Manual	Manual

Advantages:
The Coast and Latch settings of the Engine Retarder Mode can offer increased driver comfort and reduce driver fatigue.

Disadvantages:
None

Recommendations:
✔ This is a driver preference feature. Program to the setting the driver prefers.

Engine Retarder Delay 

Description:
The Engine Retarder Delay parameter provides a programmable delay to assist shifting of some European transmissions. The delay occurs after the basic retarder conditions have been met.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	0 seconds	3 seconds	0 seconds

Advantages:
Allows the use of a wider range of transmissions.

Disadvantages:
None

Recommendations:
✔ Engine Retarder Delay should be programmed to zero except when required by the transmission.

Engine Retarder Minimum VSL Type

Description:
Engine Retarder Minimum Vehicle Speed Limit Type defines how the Engine Retarder Minimum Vehicle Speed parameter will be used.

If the Engine Retarder Minimum Vehicle Speed Limit Type is programmed to the "soft" setting, the engine retarder will remain ON below the value programmed in the Engine Retarder Minimum Vehicle Speed until the normal engine retarder turn-off parameters are met.

If the Engine Retarder Minimum Vehicle Speed Limit Type is programmed to the "hard" setting, the engine retarder will turn off when the value programmed in the Engine Retarder Minimum Vehicle Speed is reached.

In both cases the engine retarder will remain off until vehicle speed is higher than the programmed value of the Engine Retarder Minimum Vehicle Speed and the retarder has been re-engaged.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Engine	Range	Cat Default
C-10, C-12, C-15, C-16, C11, C13, C15	Soft Limit Hard Limit	Hard Limit

Advantages:
Provides flexibility for driver comfort while complying to local restrictions.

Disadvantages:
None

Recommendations:
✔ This is a driver preference feature. Program to the setting the driver prefers.

Description:
Engine Retarder Minimum Vehicle Speed is similar to Low Cruise Control Speed Set Limit. Engine Retarder Minimum Vehicle Speed sets the minimum vehicle speed at which retarder operation is allowed. This parameter affects both the Engine Retarder Solenoids and any auxiliary brake. Setting the Engine Retarder Minimum Vehicle Speed to 0 (Zero) disables this feature.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	0 MPH (0 km/h)	127 MPH (204 km/h)	0 MPH (0 km/h)

Advantages:
The Engine Retarder Minimum Vehicle Speed parameter turns the engine retarder off, at or below the programmed speed. This parameter can also be used to prevent excessive use of the engine retarder at low speeds.

Disadvantages:
If the engine retarder is engaged and the truck slows to the value of the Engine Retarder Minimum Vehicle Speed the retarder will turn off.

Recommendations:
- ✔ Be sure to observe all federal, state, and local ordinances regarding the use of the engine retarder when setting the Engine Retarder Minimum Vehicle Speed parameter.

Smart Idle Parameters

Description:
This parameter is used to determine the voltage trip point below which the Battery Monitor and Engine Speed Control System will automatically elevate engine idle in order to maintain ideal battery system voltage. The engine idle will only be increased if the vehicle is stopped and the transmission is out of gear. If these conditions are not met, the engine idle will not be adjusted.

The engine idle will be increased to 1000 RPM, or will be increased by an amount less than 1000 RPM if the Idle RPM Limit parameter is programmed less than 1000 RPM (see page 47).

Note:
This feature requires the installation of a Neutral Switch on J1/P1 terminal-62 (Input #12). Engine speed will only be elevated when the transmission is in neutral.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

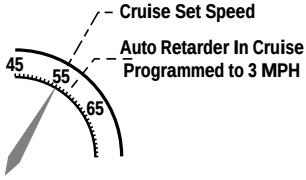
Range		Cat Default
Minimum	Maximum	
0 volts	25.5 volts	0 volts

Advantages:
Promotes additional battery life.

Disadvantages:
Slight effect on fuel economy if the engine idle is elevated too often.

Recommendations:
- ✔ Set to 12.2 V for a 12 V system, and 24.5 V for a 24 V system.

Description:
Auto Retarder in Cruise determines the miles per hour (km/h) value above the cruise set speed that the engine retarder will turn On. The Retarder switch must be in the On position and cruise control set, for this feature to operate. Programming the Auto Retarder in Cruise parameter to 0 (zero) will disable the feature. This parameter works in conjunction with the Auto Retarder in Cruise Increment parameter. The initial braking level (Low or Hi) of retarding is dependent on the value of the Auto Retarder in Cruise Increment parameter.



Example: The cruise speed is set at 55 MPH and Auto Retarder in Cruise parameter is programmed to 3 MPH. When the truck accelerates to 58 MPH, by going down hill, the retarder will activate.

Available:
All electronically programmed on-highway engines

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	0 MPH (0 km/h)	10 MPH (16 km/h)	0 MPH (0 km/h)
C7, C9	3 MPH (5 km/h)	10 MPH (16 km/h)	0 MPH (0 km/h)

Advantages:
Auto Retarder in Cruise can increase driver comfort and reduce driver fatigue while maintaining the desired road speed.

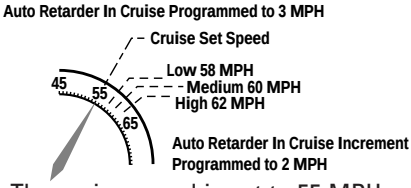
Note: The maximum Retarder level is determined by the Retarder Level switch position.

Disadvantages:
Programming this parameter to a speed that is too low can result in a degraded fuel economy. See Recommendations and the Auto Retarder in Cruise Increment parameter discussion to avoid this effect.

Recommendations:

✔ If Auto Retarder in Cruise is desired, program the parameter to 3 – 5 MPH (5 – 8 km/h) to take advantage of SoftCruise. The minimum setting with Soft Cruise is 3 MPH due to the fact that Soft Cruise requires 2.5 MPH to work correctly.

Description:
The Auto Retarder in Cruise Increment parameter works in conjunction with the Auto Retarder in Cruise parameter and controls the retarder level. It requires that Auto Retarder in Cruise parameter to be programmed to a value other than 0 (Zero).



Example: The cruise speed is set to 55 MPH and Auto Retarder in Cruise parameter is programmed to 3 MPH and Auto Retarder in Cruise Increment is programmed to 2 MPH. When the truck accelerates to 58 MPH, by going down hill, the Low retarder level will activate. If the truck continues to accelerate, Medium level retarding would activate at 60 MPH. High level of retarding will activate if the truck reaches 62 MPH.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	0 MPH (0 km/h)	5 MPH (8 km/h)	2 MPH (3 km/h)

Advantages:
Auto Retarder in Cruise Increment allows the driver to customize the Auto Retarder in Cruise feature to match his/her driving style.

The Auto Retarder in Cruise feature provides drivers who are "graded" for incentive purposes, an automatic method to control the amount of time above VSL.

Disadvantages:
Programming the Auto Retarder in Cruise Increment parameter too tightly can result in a degraded fuel economy. For instance, if it is set to zero, and the Auto Retarder in Cruise parameter is set to 1 MPH, then all six cylinders will retard when the vehicle exceeds cruising speed by just 1 MPH. This can result in less desirable fuel economy.

Recommendations:

- ✔ Program the Auto Retarder in Cruise Increment to 2 MPH. This will allow for all three levels of braking to be used for smoother decel on moderate grades

- ✔ If High level of retarding is required, program the Auto Retarder in Cruise Increment to 0 (Zero). If this is done, Soft Cruise should not be used (see page 44 for details on Soft Cruise), since it requires 2.5 MPH to work properly.

- ✔ Set the Auto Retarder in Cruise Increment parameter to the preference of the driver, bearing in mind the potentially negative affect on fuel economy if the increment is set too tightly.

Description:
Generally there are two accepted combinations of cruise control switches. The specific combination of switches is a driver convenience feature.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

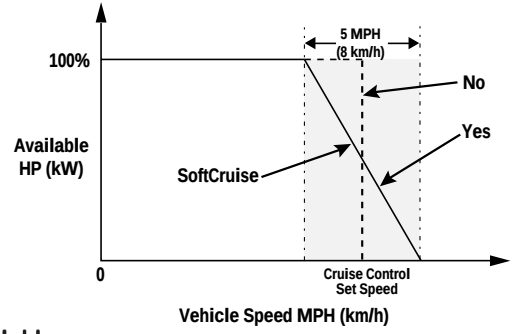
Engine	Range	Default
3126E, C7, C9 GM C-10, C-12, C-15, C-16, C11, C13, C15	Set/Accel-Resume/-Decel Set/Decel-Resume/Accel	Set/Accel-Resume/Decel
3126E, C7, C9 Other		Set/Decel-Resume/Accel

Advantages:
The switch setting can be changed to meet driver preferences.

Disadvantages:
None

Recommendations:
✔ None, this feature should be changed based on driver preference.

Description:
The Caterpillar SoftCruise speed control feature provides a small "soft" window centered around the cruise set speed. With SoftCruise "On", the ECM will modulate fuel delivery for a more efficient, smoother cruise control. SoftCruise reduces the abrupt on/off fuel cycling that is common with some diesel engine cruise controls. It allows the truck to increase speed slightly above the cruise set speed while going down hill (no-load) to "warm up" the turbocharger. This provides quick boost and improved engine response on the next hill.



Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range	Default
3126E, C7, C9, C-10, C-12, C-15, C-16, C11, C13, C15	Yes No	Yes

Advantages:
SoftCruise speed control can provide a smoother ride and improved fuel economy. The SoftCruise feature is most beneficial in rolling terrain.

Disadvantages:
Like Soft VSL, SoftCruise Control may allow the vehicle speed to fall 2.5 mph below the VSL before full fuel is demanded by the governor. This can lead to a perceived (not an actual) loss of power.

Recommendations:
✔ Set to customer's preference.

Idle Parameters

Formerly - Old PTO
PTO Governor Parameters

	Factory	Databook	Optional
• Idle Vehicle Speed Limit		✔	
• Idle RPM Limit		✔	
• Idle/PTO RPM Ramp Rate	✔		
• Idle/PTO Bump RPM	✔		
• Fast Idle RPM #1 & #2			✔
• Warm Up Mode Idle Speed ...		✔	

Idle Vehicle Speed Limit

FORMERLY - IDLE/PTO VEHICLE SPEED LIMIT OR
PTO/EXTENDED IDLE VEHICLE SPEED LIMIT OR
PTO MODE VEHICLE SPEED LIMIT

Description:
Idle Vehicle Speed Limit is the maximum vehicle speed allowed when the engine is in the Idle Mode. (Idle Mode is entered if the engine RPM is set by the cruise control Set/Resume switch, when the cruise control On/Off switch is in the On position.) If the value programmed in the Idle Vehicle Speed Limit parameter is exceeded, the set engine rpm will not be maintained.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range		Cat Default
Minimum	Maximum	
1 MPH (2 km/h)	15 MPH (24 km/h)	1 MPH (2 km/h)

Advantages:
None

Disadvantages:
None

Recommendations:
- ✔ For non-PTO operations where overnight idling is the primary usage of this feature, set the Idle/PTO Vehicle Speed Limit to 2 MPH.

- ✔ For PTO Operation use the Dedicated PTO feature and related parameters (see page 52)

Idle RPM Limit

FORMERLY - PTO/EXTENDED IDLE ENGINE RPM LIMIT OR PTO MODE ENGINE RPM LIMIT

Description:
Idle RPM Limit is the maximum engine rpm in the idle mode. Idle mode occurs if the engine rpm is set using the cruise control On/Off switch and the Set/Resume switch. The actual upper limit of this parameter is determined by the programmed Top Engine Limit. The lower limit is determined by the programmed Low Idle Engine rpm.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9	700 RPM	TEL RPM	TEL RPM
C-10, C-12, C-15, C-16, C11, C13, C15	600 RPM	TEL RPM	TEL RPM

Advantages:
Being able to electronically control engine rpm offers more precise control than a hand throttle. The ability to limit maximum engine rpm in the Idle mode saves fuel and prevents unnecessary engine wear.

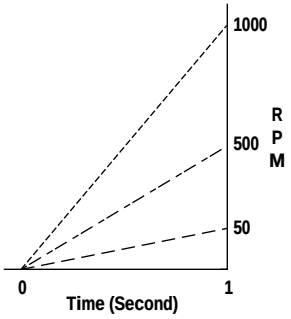
Disadvantages:
None

Recommendations:
✔ For non-PTO operations where overnight idling is the primary usage of this feature, set the Idle/PTO RPM Limit between 900 and 1100 rpm based on climatic conditions.

Idle/PTO RPM Ramp Rate

FORMERLY - PTO ENGINE RPM RAMP RATE

Description:
The Idle/PTO Ramp Rate parameter defines how many rpm the engine will change in one second when in Idle Mode or Dedicated PTO Mode. This parameter determines Accel, Decel and Resume Idle or PTO Engine rpm rates of increase/decrease. Notice that the parameter applies to both idle control (rpm set using cruise control On/Off and Set/Resume switches) and PTO control (rpm set using PTO On/Off and Set/Resume switches)



Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range		Cat Default
Minimum	Maximum	
5 RPM/sec	1000 RPM/sec	50 RPM/sec

Advantages:
Setting the Idle/PTO Ramp Rate can help reduce work cycle time by reducing the time it takes to get the engine up to the preferred RPM.

Disadvantages:
Setting an Idle/PTO Ramp Rate too high could accelerate the failure of some PTO attachments.

Recommendations:
✔ This programmable feature is application dependent and should be programmed based on customer specific requirements.

Idle/PTO Bump RPM

Description:
The Idle/PTO RPM Bump determines the rpm increment/decrement when the Accel/Decel switches are briefly “bumped”. It applies to both Dedicated PTO and Idle modes of operation.

Available:
All electronically controlled engines covered in this handbook

Range:

Range		Cat Default
Minimum	Maximum	
5 RPM	500 RPM	20 RPM

Advantages:
Setting the Idle/PTO RPM Bump can help reduce work cycle time by reducing the time it takes to get the engine up to the preferred RPM.

Disadvantages:
None

Recommendations:
✔ This programmable feature is application dependent and should be programmed based on customer specific requirements.

Fast Idle Engine RPM #1 & #2

Description:
With the installation of a momentary contact Fast Idle switch, the driver can toggle the switch and the engine will go immediately to a preset RPM value.

The available RPM values are stored as the Fast Idle Engine RPM #1 or Fast Idle Engine RPM #2 parameters. The ranges for these two parameters are listed below. The engine will increase from the programmed Low Idle to the Fast Idle Engine RPM #1 value when the Fast Idle switch is first pressed and released. The second time the Fast Idle switch is pressed and released, the engine will increase to the Fast Idle Engine RPM #2 value. After pressing the Fast Idle switch a third time, the engine will return to low idle, and Fast Idle will be disabled.

The difference between the Fast Idle Engine RPM #1 and #2 parameters is that the #1 parameter can be overridden by the operator, whereas the #2 parameter cannot be overridden beyond the programmed value. To override the Fast Idle Engine RPM #1 parameter, the operator should press the accelerator pedal until the desired rpm is reached, and then depress the Fast Idle Enable switch. This rpm will then be the Fast Idle Engine RPM #1 value as long as the ECM is powered.

Available:
3126E, C7, and C9 medium duty engines

Range:

Fast Idle Engine RPM #	Range		Cat Default
	Minimum	Maximum	
1	700 RPM	TEL RPM	1000 RPM
2	700 RPM	TEL RPM	0 RPM

Advantages:
Setting the Fast Idle Engine RPM can help reduce work cycle time by reducing the time it takes to get the engine up to the preferred RPM.

Recommendations:
✔ This programmable feature is application dependent and should be programmed based on customer specific requirements.

Warm Up Mode Idle Speed

Description:
The Warm Up Mode Idle Speed parameter determines engine speed while the engine is in the warm up mode. The Warm Up Mode Idle Speed parameter will be activated when the sum of coolant temperature and intake manifold air temperature is less than 86 ° F (30 ° C).

While the engine is in the warm up mode, the engine will return to low idle if either the service brake or the clutch pedal is depressed, an automatic transmission is put in gear, or the ECM detects vehicle speed. After returning to low idle, the engine can then return to Warm Up Mode Idle Speed if the sum of coolant temperature and intake manifold temperature 86 ° F (30 ° C) as mentioned above.

Note:
Heavy duty warm up speed is non-programmable and is fixed at 1000 rpm.

Available:
Medium duty on-highway engines

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9	700 rpm	1400 rpm	1000 rpm

Advantages:
This parameter allows the driver a flexible rpm range for the Warm Up Mode Idle Speed depending upon the specific application.

Disadvantages:
None

Dedicated PTO Parameters

The Dedicated PTO Parameters require JAN95 or newer Personality Module Software, therefore Dedicated PTO Parameters apply to all engine models covered in this handbook. For further detail on the latest PTO Installation and Setup refer to the PTO Application and Installation guide RENR1282. Contact your authorized Caterpillar dealer to order this publication.

Anytime the Dedicated PTO circuit is Active, both the length of time and the fuel used will be stored in the Trip Data Information in the ECM (See the Trip Data Section pages 160-165).

	Factory	Databook	Optional
• PTO Configuration			✔
• PTO Top Engine Limit			✔
• PTO Engine RPM Set Speed			✔
• PTO to Set Speed			✔
• PTO Cab Throttle RPM Limit			✔
• PTO Kickout Vehicle Speed Limit			✔
• Torque Limit			✔
• PTO Shutdown Time			✔
• PTO Shutdown Timer Maximum RPM			✔
• PTO Activates Cooling Fan			✔

Description:
The PTO Configuration parameter defines the features that are available for dedicated PTO applications and the input signals that the ECM monitors while in PTO mode. The PTO Configuration parameter has 4 programmable options:

- **OFF** indicates the application does not use dedicated PTO
- **Cab Switches** indicates that the Cruise Control Set/Resume Switch, in the cab, is being used for control of Dedicated PTO function .
- **Remote Switches** indicates that control of the Dedicated PTO function is outside the cab.
- **Remote Throttle** indicates that a Remote Throttle is being used as part of the Dedicated PTO operation.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Ra
0 Cab Sv Remote Remote

Advantages:
The PTO Configuration parameter allows the engine to be easily customized to the many PTO application, and reduces the number of mechanical components required.

Disadvantages:
None

Recommendations:
- ✔ For the most recent information on PTO installation and setup, refer to the PTO Application and Installation Guide RENR1282.
- ✔ If Dedicated PTO is used, all Dedicated PTO parameters must be programmed for proper operation.

PTO Top Engine Limit

Description:
If the engine has been wired to work in the dedicated PTO mode, the PTO Top Engine Limit parameter can be programmed to a value up to the maximum rpm of the engine. This parameter is only in effect when the engine is in the Dedicated PTO mode. The value programmed can exceed the programmed Top Engine Limit RPM (see page 69).

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	600 RPM	TEL RPM	TEL RPM
3126E, C7, C9 PM MAR03 and Earlier	700 RPM	TEL RPM	TEL RPM
C7,C9 PM MAR04 and Later	Low Idle RPM	TEL RPM	TEL RPM

Advantages:
PTO Top Engine Limit allows the flexibility to work in PTO applications where additional RPM above the engine Top Engine Limit RPM is required, or where RPM must be limited to prevent damage to the PTO device.

Disadvantages:
None

Recommendations:
✔ Refer to RENR1282 for specific details.

Description:
PTO Engine RPM Set Speed is the engine RPM the engine will proceed to when the PTO On/Off circuit is On and the Cruise/PTO Set switch is toggled. If the PTO to Set Speed parameter (see page 56) is programmed to Yes, the engine will go to the PTO Engine RPM Set Speed whenever the PTO On/Off circuit is On. PTO Configuration must be programmed to Cab Switches or Remote Switches before this parameter can be programmed.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range		Cat Default
Minimum	Maximum	
Low Idle RPM	PTO TEL	0 RPM

Advantages:
Allows the flexibility to go to a specific engine rpm every time when in Dedicated PTO operation.

Disadvantages:
None

Recommendations:
✔ Refer to RENR1282 for further details.

PTO to Set Speed

Description:
When the PTO to Set Speed parameter is programmed to Yes, the engine rpm will go directly to the value programmed in the PTO Engine RPM Set Speed parameter (see page 55) when Dedicated PTO is On . PTO Configuration must be programmed to Cab Switches or Remote Switches before this parameter can be programmed.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Advantages:
By automatically going to a programmed engine RPM every time Dedicated PTO is engaged, cycle time can be reduced and precise control of engine rpm is possible for specialized PTO applications.

Disadvantages:
None

Recommendations:
- ✔ Set the PTO to Set Speed Parameter to YES if the application requires the engine to go to a specified RPM every time the Dedicated PTO feature is On.
- ✔ For further details, refer to RENR1282.

PTO Cab Throttle RPM Limit

(Also knows as “PTO Cab Controls RPM Limit”)

Description:
The PTO Cab Throttle RPM Limit parameter determines the engine rpm limit of the Cab Throttle Position Sensor when the PTO Configuration parameter is programmed to Cab Switches and the engine is in the Dedicated PTO mode.

- If Programmed to **Low Idle**, the Cab Throttle Position Sensor is ignored.
- If programmed to **TEL**, the engine will operate to the programmed Top Engine Limit rpm.
- If Programmed to **PTO TEL**, the engine will operate to the programmed PTO Top Engine Limit rpm.

If PTO Configuration is programmed to Remote Switches or Remote Throttle, the ECM will always ignore the Cab Throttle Position Sensor when the engine is in the Dedicated PTO mode.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range
Low Idle TEL PTO TEL

Advantages:
Prevents the use of the cab throttle to override PTO settings and overspeeding the PTO device.

Disadvantages:
None

Recommendations:
✔Refer to RENR1282 for more specific details.

PTO Kickout Vehicle Speed Limit

Description:
Similar in operation to Vehicle Speed Limit, but it only applies when the engine is in Dedicated PTO Mode. PTO mode is entered if the PTO On/Off circuit is On. If the PTO Vehicle Speed limit is exceeded, the engine will "kick out" of the Dedicated PTO mode and no longer maintain the set engine rpm.

Available:
All electronically controlled on-highway engines covered in this handbook

*Note: For model year 2001 HD engines this parameter was referred to as "PTO Vehicle Speed Limit", the name was changed for HD engines afterwards.

Range:

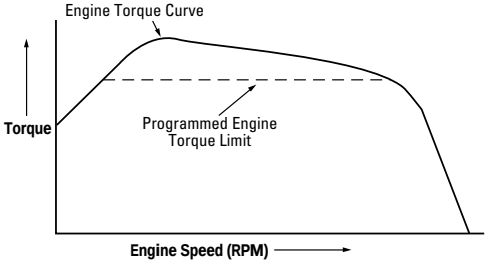
Range		Cat Default
Minimum	Maximum	
1 MPH (2 km/h)	127 MPH (204 km/h)	1 MPH (2 km/h)

Advantages:
Some Dedicated PTO applications use transmission driven PTO's. In some cases the vehicle is required to travel at speeds in excess of the 15 MPH limit. That was not possible with the combined Idle/PTO Vehicle Speed Limit parameter. The customer now has the flexibility to limit vehicle speed in both Idle and Dedicated PTO operation.

Disadvantages:
None

Recommendations:
✔ Refer to RENR1282 for more specific details

Description:
The Torque Limit parameter defines the maximum torque output of the engine during Dedicated PTO operation. The maximum value is the Rated Torque of the engine. If the Torque Limit is Programmed to a value higher than the rated torque of the engine, the torque limit is ignored.



Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	200 lb ft (270 Nm)	2500 lb ft * (3389 Nm)	2500 lb ft (3400 Nm)
3126E, C7, C9	100 lb ft (135 Nm)	2000 lb ft * (2700 Nm)	2000 lb ft (2700 Nm)

* Actual Maximum is based on engine rating

Advantages:
By programming a Torque Limit the ECM can help prevent damage to engine driven PTO devices due to over-torque from the engine.

Disadvantages:
None

Recommendations:
✔ Refer to RENR1282 for additional information.

PTO Shutdown Time

Description:
Similar in function to the Idle Shutdown Timer, the PTO Shutdown Timer will shutdown the engine when the engine has been in the Dedicated PTO Mode for the programmed time.

Note: When the PTO Timer times out the engine will shutdown, regardless of load.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range		Cat Default
Minimum	Maximum	
3 Minutes	1440 Minutes	0 Minutes

Advantages:
The PTO Shutdown Timer can limit unnecessary PTO time, save fuel and reduce engine wear.

Disadvantages:
When the engine shuts down as a result of the PTO Shutdown Timer the truck's dash remains "hot". To avoid draining the batteries the ignition key must be switched to the "off" position after the engine shuts down.

Recommendations:
✔ For additional information, refer to RENR1282.

Description:
PTO Shutdown Timer Maximum RPM can be used to reset the PTO Shutdown Timer. Programming this parameter to 2120 rpm disables this feature and will not allow the PTO Shutdown Timer to be overridden by increasing engine rpm. If programmed to a value below 2120 rpm, the timer will be reset whenever engine RPM exceeds this programmed value.

Available:
All heavy-duty on-highway engines covered in this handbook

Range:

Minimum	Maximum	Default
600 rpm	2120 rpm	2120 rpm

PTO Activates Cooling Fan

Description:
If the ECM is being used to run the engine cooling fan circuit, this parameter can be programmed to have the cooling fan cycle normally (based on Coolant Temperature or Inlet Air Temperature or A/C High Pressure) or run continuously when in the Dedicated PTO Mode.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range	Default
Normal Continuous	Normal

Advantages:
Some applications require the fan to be on continuously during PTO operation. This can be accomplished without additional wiring by programming this parameter.

Disadvantages:
If the application does not require continuous fan operation but the ECM is programmed to Continuous mode, excessive fuel may be consumed, increasing overall cost of operation.

Recommendations:
✔ Refer to RENR1282 for additional information.

Engine/Gear Parameters

FORMERLY - PROGRESSIVE SHIFT PARAMETERS

	Factory	Databook	Optional
• Lower Gears Engine RPM Limit		✔	
• Lower Gears Turn Off Speed		✔	
• Intermediate Gears Engine RPM Limit		✔	
• Intermediate Gears Turn Off Speed		✔	
• Gear Down Protection RPM Limit		✔	
• Gear Down Protection Turn On Speed		✔	
• Top Engine Limit		✔	
• Top Engine Limit with Droop			✔
• Low Idle Engine RPM			✔
• Transmission Style	✔		
• Eaton Top 2 Override with Cruise Switch		✔	
• Eaton Top 2 Gear Ratios	✔		
• GFRS/GFRSS			
• AT/MT/HT Part Throttle Shift Speed	✔		
• Governor Type		✔	

Lower Gears Engine RPM Limit

FORMERLY - LOW GEARS #1 ENGINE RPM LIMIT

Lower Gears Turn Off Speed

FORMERLY - LOW GEARS #1 TURN OFF SPEED

Intermediate Gears Engine RPM Limit

FORMERLY - LOW GEARS #2 ENGINE RPM LIMIT

Intermediate Gears Turn Off Speed

FORMERLY - LOW GEARS #2 TURN OFF SPEED

Description:

Lower Gears Engine RPM Limit and Intermediate Gears Engine RPM Limit are meant to approximate ideal progressive shifting. Lower Gear Engine RPM Limiting should be used in conjunction with Intermediate Gears Engine RPM Limiting. However, you can choose to use only Lower Gears Engine RPM Limit if that is best suited to your operation.

Both Lower and Intermediate Gears RPM Limiting have "soft" rpm limits. This means if you are in a heavily loaded condition or starting on an especially steep grade and do not want to shift until the engine reaches higher rpm, the limit will not stop you. If not heavily loaded, it simply slows the acceleration rate of the engine when you pass the programmed setting, prompting the driver to shift for the most "normal" operations.

The maximum engine acceleration rate above the Lower Gears Engine RPM Limit is 33 rpm/sec and 25 rpm/sec for Intermediate Gears Engine RPM Limiting.

The engine can accelerate all the way to your programmed Top Engine limit (TEL) when necessary and will not be noticed by most drivers if properly programmed to fit your application.

Once the Lower Gears Engine RPM Limit has been determined, the Lower Gears Turn Off Speed is selected as the mean vehicle speed between where the Lower Gears Engine RPM Limit intersects the line of gear to be limited and the line of the next highest gear. Next, Intermediate Gear Engine RPM Limit and Intermediate Gears Turn Off Speed are selected in much the same way. The values for all four parameters are automatically calculated when using Cat® Design Pro.

Available:

All electronically controlled on-highway engines covered in this handbook

Range:
Lower Gears Engine RPM Limit

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	1100 RPM	TEL	TEL
3126E, C7, C9	1500 RPM	TEL	TEL

Lower Gears Turn Off Speed

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	3 MPH (5 km/h)	30 MPH (48 km/h)	3 MPH (5 km/h)
3126E, C7, C9	1 MPH (2 km/h)	15 MPH (24 km/h)	1 MPH (2 km/h)

Intermediate Gears Engine RPM Limit

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	1100 RPM	TEL	TEL
3126E, C7, C0	1500 RPM	TEL	TEL

Intermediate Gears Turn Off Speed

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	5 MPH (8 km/h)	50MPH (80 km/h)	5 MPH (8 km/h)
3126E, C7, C9	10 MPH (16 km/h)	50MPH (80 km/h)	10 MPH (16 km/h)

Advantages:
Lower Gears Engine RPM Limiting and Intermediate Gears Engine RPM Limiting improve fuel economy by promoting progressive shifting. Needlessly “winding up” the engine to higher rpms before up shifting wastes both fuel and time while failing to take advantage of Caterpillar’s exceptional low rpm torque.

Disadvantages:
This setting provides minimal fuel savings for long haul operations unless the driver stops frequently and regularly tries to “wind it up”.

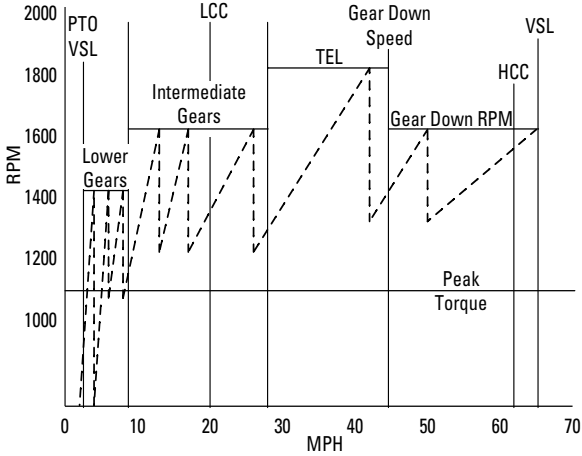
Recommendations:

Lower Gears Limit

✔ Set the Lower Gears Limit no lower than Peak Torque rpm + 200 rpm. Properly setting this parameter requires a close look at many factors, including engine rating, terrain and application.

For example, heavy-duty engines are typically set at the following:

1200 rpm + 200 rpm = 1400 rpm



Note how Lower Gears and Intermediate Gears setting fit in the total spec, especially in respect to Top Engine Limiting (stair step effect).

A similar graph would apply to mid-range engines.

Intermediate Gears Limit

✔ Set the Intermediate Gears Limit halfway between the Lower Gears RPM Limit and Top Engine Limit.

For example, the C-15 is typically set to the following:
Lower Gears Limit = 1400 rpm
Top Engine Limit = 2120 rpm
Intermediate Gears Limit = 1760 rpm

Lower Gears and Intermediate Gears Limits

✔ Use Cat® Design Pro program to determine the most effective setting for your application.

Note: Turn Off Speeds are automatically calculated in the Cat® Design Pro computer program. Cat® Design Pro is the easiest tool to use to build an effective spec.

Gear Down Protection RPM Limit

FORMERLY - HIGH GEARS ENGINE RPM LIMIT

Gear Down Protection Turn On Speed

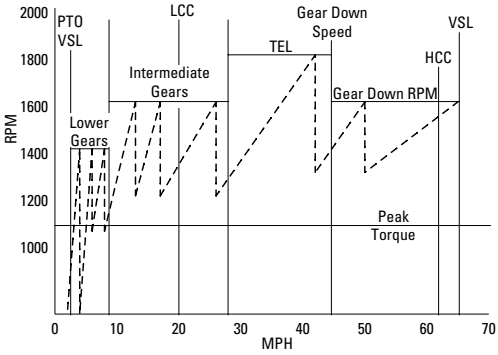
FORMERLY - HIGH GEARS TURN ON SPEED

Description:

Gear Down Protection allows you to set an engine rpm limit for the higher gears that ensures cruising speed can only be reached in top gear.

Gear Down Protection has two parameters to specify. The first is the Gear Down Protection Turn On Speed. This is the point, in either mph or km/h, where the RPM limit first takes effect. In the illustration below the Gear Down Protection Turn On Speed is set at 45 MPH. The second parameter is the Gear Down Protection RPM Limit. It is set at 1600 rpm in the illustration.

With some driveline combinations cruising speed can only be reached while in the transmission's top gear; the Gear Down Protection RPM Limit would not have to be set for these trucks.



It is important to note that although Low/Intermediate Gears parameters are "soft" limits, Gear Down Protection is actually a "hard" limit.

Available:

All electronically controlled on-highway engines covered in this handbook

Range:

Gear Down Protection RPM Limit

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	1300 RPM	TEL	TEL
3126E, C7, C9	1700 RPM	TEL	TEL

Gear Down Protection Turn On Speed

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9 (Other) C-10, C-12, C-15, C-16, C11, C13, C15	30 MPH (48 km/h)	127MPH (204 km/h)	127MPH (204 km/h)
3126E, C7, C9 (GM)	30 MPH (48 km/h)	75MPH (121 km/h)	75MPH (121 km/h)

Advantages:
Gear Down Protection helps ensure that the truck is run in the correct (highest possible) gear at cruising speed. Properly setting these parameters will keep the engine in the most fuel efficient rpm range to achieve the best fuel economy at cruising speed.

Disadvantages (possible):
Some driveline combination can allow a driver to reach cruising speed in more than one gear even with this feature properly set. However, gear down protection is still moderately effective in these situations and should be used.

If the Gear Down Protection RPM Limit is set too low, the driver may have to wait too long to downshift when climbing steep grades with heavy loads. This may cause the driver to drop two transmission gears, when one would have been adequate.

Recommendations:
- ✔ Set the Gear Down Protection RPM Limit such that highway cruising speeds can only be reached in top gear (Use Cat® Design Pro).
- ✔ Set Gear Down Protection RPM Limit high enough that engine rpm does not drop below peak torque plus 100 rpm during upshift.
- ✔ Set the Gear Down Protection Turn On Speed well below the cruise speed. As with all electronic shift strategies, do not set “gear-on” speeds on top of shift points.

Top Engine Limiting (TEL)

Description:
Top Engine Limit (TEL) sets the maximum engine rpm value.

Available:
All electronically controlled engines covered in this handbook.

Important Note:
Due to EPA emissions regulations, the ability to program TEL has been removed as of 1999. Therefore, **no** engines in this handbook offer the ability to program TEL.

Low Idle Engine RPM

Description:
The programmable Low Idle Engine RPM feature sets the minimum engine speed according to driver preferences.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	600 RPM	750 RPM	600 RPM
3126E, C7, C9	700 RPM	800 RPM	700 RPM

Advantages:
The ability to specify the low idle rpm can be very helpful if a different low idle rpm is needed, either to suit unique operating conditions or if there is resonant vibration at a specific rpm (mirrors, rattles, etc.). Lower idle rpm in conjunction with the proper load starting technique (“no throttle” starts) also reduces clutch wear.

Disadvantages:
Idling at higher speed increases fuel consumption and engine wear. Every effort should be made to stay as low as possible.

Recommendations:
✔ This adjustment is rarely required and should be done on a case by case basis.

Description:
This parameter allows the ECM to work with automatic transmissions that require additional inputs to the ECM.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range	Cat Default
C-10, C-12, C-15, C-16, C11, C13, C15	Manual Automatic Option 1, Automatic Option 2, Automatic Option 3, Automatic Option 4, Eaton Top 2	Manual (PM OCT01 and older) Manual Option 1 (PM JAN02 and newer)
3126E, C7, C9 (GM)	Automatic Option 1, Automatic Option 2, Automatic Option 3, Automatic Option 4, AT/MT/HT Option 1, AT/MT/HT Option 2, AT/MT/HT Option 3, AT/MT/HT Option 4, Manual Option 1, Manual Option 2	Manual Option 2 (GMT560) Universal (GM530/540)
3126E C7, C9 (Other)	Manual Automatic Option 1, Automatic Option 2, Automatic Option 3, Automatic Option 4, AT/MT/HT Option 1, AT/MT/HT Option 2, AT/MT/HT Option 3, AT/MT/HT Option 4	Manual Option 1

Advantages:
This parameter allows the engine and transmission to work together for proper operation.

Disadvantages:
None

Recommendations:
✔ This parameter will be programmed by the truck manufacturer and should not be changed unless the type of transmission is changed.

Description:
The Eaton Top 2 Override with Cruise Switch parameter is programmed as either Yes or No. When programmed to Yes, this parameter disables the top 2 mode when the cruise switch is OFF and the transmission is not yet in the top 2 gears. When the cruise switch is in the ON position, the top 2 mode is enabled. If the cruise switch is in the OFF position while in one of the top 2 gears, the ECM will go into a hold mode where the transmission will not be shifted from the currently selected gear.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Engine	Range	Default
C-10, C-12, C-15, C-16, C11, C13, C15	Yes/No	No

Note: This feature is unavailable when the Transmission Style parameter is not programmed to Eaton Top 2.

Advantages:
The Eaton Top 2 Override with Cruise Switch parameter gives the operator more control over the transmission shifting in vehicles which are equipped with Eaton Top 2 transmissions.

Disadvantages:
Extra consideration should be made when cresting a hill to avoid the top 2 feature from downshifting prior to cresting a hill. See recommendations below for further details.

Recommendations:
✔ The hold mode mentioned above is typically used when cresting the top of a hill. Good driving habits suggest lugging the engine back up to 200 rpm below peak torque in the current gear if cresting a hill is possible within a short period of time.

In order to do this, the operator must override the automatic top 2 shifting to hold the transmission in top gear. If not, the top 2 feature will perform a downshift prior to cresting the top of the hill.

Description:
The Top Gear Ratio parameter refers to the Eaton Top 2 Gear Ratios that are used by the ECM to decide when to energize the Shift and Lockout solenoid outputs (required for the Eaton Top 2 feature) when shifting between the top two gears in vehicles equipped with Eaton Top 2 transmissions. These parameters are Top Gear Ratio, Top Gear Minus One Ratio, and Top Gear Minus Two Ratio. These parameters have no effect if the Transmission Style parameter is not programmed to Eaton Top 2, however they must be correctly programmed if it is programmed to Eaton Top 2.

Top Gear Ratio
This ratio identifies the highest gear ratio for an Eaton Top 2 Transmission. The programmable range is shown in the table below. Note that for Gear Fast Run Slow (GFRS) ratings the default value should be 0.731.

Top Gear Minus One Ratio
This ratio identifies the second highest gear ratio for an Eaton Top 2 Transmission. The programmable range is shown in the table below. Note that for Gear Fast Run Slow (GFRS) ratings, the default value should be 0.856.

Top Gear Minus Two Ratio
This ratio identifies the third highest gear ratio for an Eaton Top 2 Transmission. The programmable range is shown in the table below. Note that for Gear Fast Run Slow (GFRS) ratings, the default value should be 1.00.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Engine	Minimum	Maximum	Default
C-10, C-12, C-15, C-16, C11, C13, C15	0.000	3.750	0.000

Note: The XX appearing in the transmission model number refers to (x) 100=Nominal Torque Capacity. For example, RTLO-14613A has a Nominal Torque capacity of 14 (x) 100 or 1400 lb ft. The transmission model designation and other transmission identification information are stamped on the transmission tag on the lower left side near the front of the transmission.

Advantages:
When properly programmed, these parameters allow the Eaton Top 2 Transmission to effectively control automatic shifting in the top 2 gears.

Disadvantages:
None

Recommendations:
- ✔ These parameters must be precisely programmed to three decimal places to ensure proper operation of the Eaton Top 2 transmission and the engine in the top 2 gears. Not programming this parameter precisely may result in a 253-11 Check Transmission Customer Parameters diagnostic code.

Description:
Gear Fast/Run Slow (GFRS) and Gear Fast/Run Super Slow (GFRSS) are specing methods to promote improved fuel economy through lower engine speed and faster gearing. GFRS/GFRSS only applies for a multi-torque rating allowing at least a 1750 lb-ft upper torque value. In addition, the Eaton-Fuller RTOC-16909A Convertible 9(10) - Top 2 transmission must be used (see Eaton Top 2 details on page 72-74).

GFRS/GFRSS is applicable for van, reefer, and tanker applications, with a GCW of 80,000 lbs. The following table matches axle ratios with the appropriate drive axle tires revolutions per mile, specifically for the GFRSS designation. A GFRS table is not included, however, the only difference is an increased engine rpm.

While GFRS/GFRSS is not an electronically-programmable parameter, it has been included in this handbook to supplement the Eaton Top 2 transmission programming section on page 72-74. The results of employing GFRS/GFRSS can be seen by entering appropriate data into Cat Design Pro.

Available:
C-15, C-16, C13, C15 heavy duty engines
(Provided sufficient torque is available - see recommendation below)

Range:

Axle Ratio	Drive Axle Tires Revolutions/Mile
1300 - 1350 RPM @ 65 MPH	
3.21	513 to 531
3.25	506 to 525
3.36	490 to 508
3.42	481 to 499
3.55	464 to 480
3.58	460 to 476

Recommendations:

- ✔ Caterpillar recommends that the engine have at least 1650 lb-ft of torque available for GFRS
- ✔ Caterpillar recommends that the engine have at least 1750 lb-ft of torque available for GFRSS

Description:
The AT/MT/HT Part Throttle Shift Speed parameter provides the ability to change the shifting characteristics in vehicles equipped with non-data link capable Allison transmissions. The Allison AT/MT/HT (nonelectronic) transmissions require an input from the engine ECM to regulate transmission shifting. The ECM monitors accelerator pedal position, engine speed, load, and cruise control status to determine if the transmission should use closed throttle or full throttle shift modulation.

Programming the Transmission Style parameter to one of the AT/MT/HT options activates ECM Output #7 (J1/P1:20) to control a shift interface relay connected to the transmission. The ECM can then energize the output when the transmission should use full throttle modulation (performance mode) or disable the output when the transmission should use closed throttle modulation (economy mode).

Available:
3126E, C7, and C9 medium duty engines

Range:

Alternatives	Default
Low (80% Enable/ 65% Disable) Medium (70% Enabl/ 55% Disable)	High (60% Enable/ 45% Disable)

Advantages:
This parameter provides additional control over shifting characteristics of the non-data link capable Allison transmissions. This additional control enables a driver to optimize the transmission's behavior depending upon the specific application.

Disadvantages:
None

Description:
Caterpillar offers three governor options, selectable with the Governor Type parameter. These three options are the Full Range Governor, and two types of the Min/Max Governor.

Full Range Governor
This governor type allows the engine to maintain engine speed for a given throttle position. The Full Range Governor is capable of injecting the maximum amount of fuel for a given desired engine speed.

The Full Range Governor is very sensitive to changes in engine speed, **and is therefore not the preferred governor type for vehicles using automatic transmissions.** For example, if the ECM wants to maintain 1500 rpm, the governor will try to maintain the desired speed. When an automatic transmission performs an upshift, the actual engine speed will fall below the desired engine speed of 1500 rpm. The Full Range Governor would then inject a large amount of fuel in an attempt to increase the engine speed back up to the desired engine speed of 1500 rpm. This causes undesirable, harsh shifting with an automatic transmission.

Min/Max Governor
The Min/Max Governor, however, is well-suited for vehicles with automatic transmissions. The Min/Max governor will only control engine speed when at the minimum (low idle) or maximum (top engine limit) allowed engine speed. When in between these two extremes, the engine will produce the power proportional to the throttle position. This results in smoother shifting with automatic/automated transmissions.

The Min/Max Governor optimizes automatic transmission shift quality and power modulation, allowing the operator to adjust the engine power output to match typical vehicle operating conditions. The engine speed will vary to find a vehicle load level which will match the engine power output specified by the throttle. If the throttle is commanding more power than the vehicle load will offer, the engine will accelerate to the top engine limit. This makes it very difficult to maintain a constant engine speed when the vehicle is parked. Slightly depressing the throttle pedal with the vehicle parked will cause the engine to go to the top engine limit, which may be undesirable

for applications that require precise engine speed control while parked. This problem can be solved by the third governor type.

Min/Max Governor with Speed Control
The Min/Max Governor with Speed Control offers the best combination of the Full Range Governor and the Min/Max Governor. It provides smooth shifting with automatic/automated transmissions while driving, and precise engine speed control when the vehicle is parked.

Available:
All electronically controlled on-highway engines covered in this handbook
(Note: Excludes C-10, C-12, C-15, C-16 PM OCT01)

Range:

Engine	Range	Default
3126E, C7, C9 (PM MAR03 and before) C-10, C-12, C-15, C-16 (PM JAN02 - PM OCT02)	Min/Max	Full Range
3126E, C7, C9 (PM MAR 04 and after) C11, C13, C15	Min/Max with Speed Control, Min/Max	Full Range

Advantages:
The Governor Type parameter allows the operator to customize engine speed control by specifying the appropriate governor for the selected transmission type. When the Governor Type is properly set as recommended below, optimum engine speed control is achieved.

Disadvantages:
None

Recommendations:
- ✔ The Full Range Governor is recommended for vehicles with manual transmissions.
- ✔ The Min/Max Governor is recommended for vehicles with automatic/automated transmissions.
- ✔ The Min/Max Governor with Speed Control is recommended for all automatic/automated transmission-equipped vehicles with that require precise engine speed control when parked.

Timer Parameters

	Factory	Databook	Optional
• Idle Shutdown Timer		✔	
• Allow Idle Shutdown Override			✔
• Min. Idle Shutdown Temperature			✔
• Max. Idle Shutdown Temperature			✔
• A/C Switch Fan On Time	✔		
• Fan w/Engine Retarder in High Mode			✔

Description:
The Idle Shutdown Timer is designed to shut down the engine after a specified idle period. For the shutdown to occur, certain conditions must be met for the entire time-out period. These conditions include: no load on the engine, cold mode inactive and vehicle speed must be 0 (zero) mph.

If these conditions are met, then 90 seconds before the customer specified idle time is reached, the check engine light will start flashing at a rapid rate. If either the brake or clutch pedals are depressed during this final 90 seconds when the lamp is flashing, the idle shutdown timer will be disabled, if the Idle Shutdown Override parameter is programmed to Yes (see page 83). This allows the driver to override the idle shut-down timer if necessary to keep the truck idling.

If the idle shutdown timer is overridden, the ECM will log the override as a Logged Event. These Logged Events can be viewed with a service tool.

If the timer is set to 0 (zero), the Idle Shutdown feature is turned off.

If the truck/engine is wired for PTO use, the Idle Shutdown Timer will not be active when PTO mode is active. In this case PTO shutdown time would be used for the shutdown time. It is important that the engine/truck be wired for PTO, since if it is not, the engine could shutdown after the idle shutdown time while in PTO mode

Available:
All electronically controlled on-highway engines covered in this handbook.

Range:

Range		Cat Default
Minimum	Maximum	
3 Minutes	1440 Minutes	0 Minutes

Advantages:
The idle shutdown timer has several advantages. One is that it encourages drivers to shut the engine off before leaving the truck for an extended period of time.

The other advantages include the ability to limit unnecessary idle time, save fuel and reduce engine wear.

Disadvantages:
When the engine shuts down as a result of the Idle Shutdown Timer the truck's dash remains "hot". To avoid draining the batteries the ignition key must be switched to the "off" position after the engine shuts down.

Recommendations:
- ✔ Caterpillar recommends that this parameter be set in the 3 to 5 minute range for most operation.

- ✔ Check with the truck manufacturer as to the availability of the optional wiring to shut the trucks electrical system off after an Idle Shutdown event.

Allow Idle Shutdown Override

Description:

The Allow Idle Shutdown Override parameter determines whether the clutch or service brake can be used to override the Idle Shutdown Timer during the last 90 seconds of timing. The Idle Shutdown Timer parameter must be programmed to a value other than 0 (zero). The Allow Idle Shutdown Override parameter has three different settings.

Yes - Allows the driver to override the Idle Shutdown Timer during the last 90 seconds of timing. (If the driver does override the timer an Idle Shutdown Override Event will be logged in the ECM memory)

No - The driver can **not** override the Idle Shutdown Timer during the last 90 seconds of timing. In other words, the truck will always shutdown. (When the engine does shutdown at the end of the Idle Shutdown Time period an Idle Shutdown Occurrence event will be logged in the ECM memory).

Outside Temperature Based - If the truck has the optional Outside Air Temperature Sensor installed (see authorized Cat Dealer or truck OEM for part number) and the Minimum and Maximum Idle Shutdown Outside Temperature parameters are properly programmed (see page 85), then Idle Shutdown will be based on the Outside Air Temperature.

Available:

All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E, C7, C9	No	Yes
C-10, C-12, C-15, C-16, C11, C13, C15	No, Outside Temp. Based, J1587 Outside Temp. Based	Yes

Advantages:
By programming the Allow Idle Shutdown Override parameter to No, it is guaranteed that the truck will shutdown at the programmed time. This can increase fuel economy and decrease engine wear.

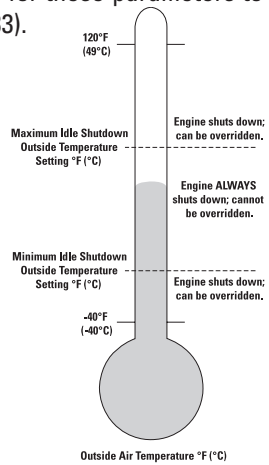
The Outside Temperature Based setting allows the flexibility of a defined temperature range where the engine will always shutdown along with temperature ranges where the driver can override the shutdown, allowing the use of air conditioning or heating.

Disadvantages:
None

Recommendations:
- ✔ Caterpillar recommends setting this parameter to No for most applications when the driver is not required to sleep in the truck.

- ✔ Caterpillar recommends the installation of the optional temperature sensor and setting this parameter to Outside Temperature Based for applications when the driver is required to sleep in the truck. Refer to Special Instruction SEHS9920 for installation details.

Description:
The Minimum and Maximum Idle Shutdown Temperature settings allow the flexibility of a defined temperature range where the engine will always shutdown along with temperature ranges where the driver can override the shutdown, allowing the use of air conditioning or heating. The Allow Idle Shutdown Override parameter must be programmed to "Outside Temperature Based" for these parameters to be programmed (See page 83).



Available:
All on-highway engines covered in this handbook.

Range:

Range		Cat Default
Minimum	Maximum	
-40°F (-40°C)	120°F (49°C)	120°F (49°C)

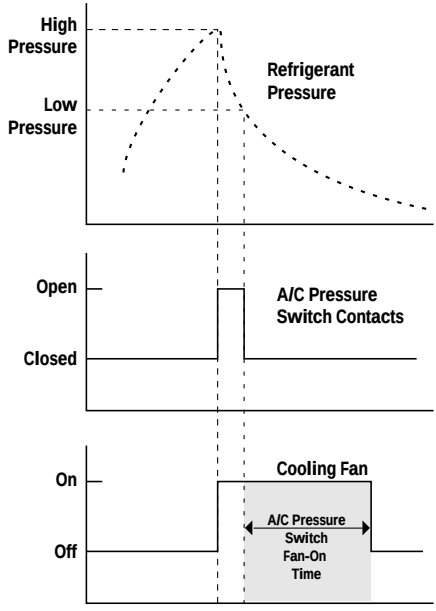
Advantages:
The Outside Temperature Based Shutdown saves fuel by allowing idle only when necessary for driver comfort.

Disadvantages:
If the Idle Shutdown time is programmed for a long time (more than an hour) and the temperature drops in to the "Always Shutdown" range the engine would shutdown and could wake the driver.

Recommendations:
- ✔ Program the Minimum setting to a value where it would be necessary to use the heater to be comfortable and the Maximum setting to a value where it would be necessary to use the air conditioner to be comfortable.

A/C Pressure Switch Fan-On Time

Description:
If the truck has a normally closed A/C High Pressure switch installed and connected to the ECM, and the ECM is wired to run the cooling fan, then the A/C Pressure Switch Fan-On Time can be programmed to prevent excessive cycling of the cooling fan clutch. This parameter has no effect on any other Cooling Fan-On condition, only when the cooling fan is turned on by high A/C Pressure. Programming the A/C Pressure Switch Fan-On Time to 0 (zero) disables this feature and the ECM will not monitor this input.



Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range		Cat Default
Minimum	Maximum	
0 Seconds	600 Seconds	0 Seconds

Advantages:
The A/C Pressure Switch Fan-On Time can reduce the amount of fan cycling and increase fan clutch life.

Recommendations:
✔ Caterpillar recommends a setting of 60 to 120 seconds with C-135 refrigerant.

Fan with Engine Retarder in High Mode

Description:
The Fan with Engine Retarder in High Mode parameter determines if the Cooling Fan will turn On when the Engine Retarder has been active in the High mode for at least 2 seconds (JUN95 or newer Personality Module Software, for JAN95 or earlier Personality Module Software the Engine Retarder had to be active in the High mode for 10 seconds). The truck must be wired so that the ECM is controlling the cooling fan operation and the engine must have a retarder installed for this feature to function.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range
Yes No

Advantages:
The Cooling Fan can add additional retarding horsepower.

Disadvantages:
None

Recommendations:
✔ This programmable feature is application dependent and should be programmed based on customer specific requirements.

Exhaust Brake Parameters

	Factory	Databook	Optional
• Exhaust Brake Configuration		✔	

Description:
The Exhaust Brake Configuration parameter determines the functionality of the exhaust brake. This parameter can be programmed to one of the following options: None, Warm Up Device Only, Exhaust Brake Only, or Exhaust Brake & Warm Up Device.

The exhaust brake can be used to apply a parasitic load to the engine in order to aid engine warm up to achieve normal operating temperature quicker. To use this feature, the Exhaust Brake Configuration parameter must be set to either Warm Up Device Only or Exhaust Brake and Warm Up Device. Also, the Warm Up Mode Idle Speed parameter must be programmed to an engine speed between 700 rpm and 1400 rpm. If these preceding conditions are met, then the engine will ramp up to the programmed Warm Up Mode Idle Speed parameter value when the intake air temperature is below 50 degrees Fahrenheit and the coolant temperature is below 160 degrees Fahrenheit.

Available:
3126E, C7, and C9 medium duty engines

Range:

Engine	Alternatives	Default
3126E, C7, C9 Other	None, Warm Up Only, Exhaust Brake & Warm Up	Exhaust Brake Only
C7, C9 (PM MAR04 and after) GMT560	Warm Up Only, Exhaust Brake & Warm Up, Exhaust Brake Only	None

Advantages:
This parameter allows an operator to use the installed exhaust brake on his/her vehicle to act as an exhaust brake, a warm up device to help the engine achieve operating temperature quicker, or a combination of the two. This allows flexibility in the use of the exhaust brake depending upon the specific application.

Disadvantages:
None

Engine Monitoring Parameters

	Factory	Databook	Optional
• Engine Monitoring Mode		✔	
• Engine Monitoring Lamps		✔	
• Coolant Level Sensor		✔	
• Coolant Temperature Derate			✔
• Engine Oil Pressure Sensor			✔
• Oil Level Switch Installation Status			✔
• Primary Fuel Tank Capacity			✔
• Secondary Fuel Tank Capacity			✔

Description:
The Engine Monitoring System provides built-in engine monitoring that can detect abnormal oil pressure, high intake manifold air temperature, high coolant temperature and if an optional Coolant Level Sensor is installed, coolant level. Typically, an additional Warning lamp is installed in the dash for driver notification. The Engine Monitoring System can be programmed to one of four different settings:

Off - Monitoring System is Off
Warning - The Warning Lamp on the dash turns On
Derate - The Warning Lamp on the dash turns On and engine power is reduced
Shutdown - The Warning Lamp on the dash turns On, engine power is reduced, then the engine shuts down.

Engine	Monitoring		
	Oil Pressure	High Coolant Temperature	Low Coolant Level
3126E, C7, C9	Optional	□	Optional
C-10, C-12, C15, C-16, C11, C13, C15	□	□	Optional

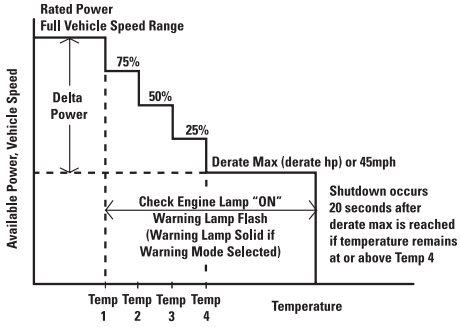
Abnormal Oil Pressure - Engine oil pressure is monitored for all rpm and loads. For example, this can help prevent excessive damage if the engine is started without oil or if the oil pressure is too low during a heavy pull. Power and speed (engine rpm) are limited during the derate period following the warning if the Derate or Shutdown settings are programmed. If the low oil pressure condition persists, the engine will shutdown if the Shutdown setting is active.

High Coolant Temperature - Engine coolant temperature is monitored to provide gradual power reductions as the coolant temperature increases above the acceptable limits if the Engine Monitoring Mode is programmed to Derate or Shutdown. The driver can downshift to increase rpm and coolant flow in this mode. If the high coolant temperature condition persists, and the Engine Monitoring Mode parameter is programmed to Shutdown, the engine will shutdown.

Example: Coolant Temperature Derate/ Shutdown

Rated Hp = 400 Hp

Delta Hp = 240 Hp = 400 Hp - 160 Hp



As Coolant temperature rises to 217°F (103°C) the engine is derated by 25% of the Delta Hp. In this example 240 Hp x .25 = 60 Hp. The driver would have 340 Hp available. If the driver reacted by downshifting, for example, and the temperature did not rise, the power would stay at this level.

However, if the coolant temperature continued to increase, to 219°F (104°C) the driver would lose another 25% or 60 Hp and have 280 Hp in this example.

If the temperature continues to rise to 223°F (106°C) the maximum derate would occur. In this example 100% of the Delta Hp or 240 Hp. The truck would be limited to 160 Hp or 45 MPH (72.5 km/h) which ever occurs first.

If Shutdown has been selected as the Engine Monitoring Mode, and the temperature remained above 223°F (106°C) the engine would shutdown 20 seconds after the maximum derate had been reached. (Shutdown Mode is not available for BrakeSaver equipped engines.)

Low Coolant Level - Coolant level is monitored if an OEM sensor is installed and the coolant level option is activated (See page 95). To avoid "false alarms" a warning delay or "debounce" period prevents the system from warning the driver if the coolant level fluctuates rapidly, such as it could while traversing bumpy terrain. Vehicle speed is limited during the derate period following the warning if Derate or Shutdown settings are programmed. If the low coolant level persists the engine will shutdown if the Shutdown mode has been selected.

High Inlet Manifold Air Temperature - While this feature is part of the monitoring system **it will not affect operation of the engine other than the normal power loss you would experience without a monitoring system.** The driver will simply be alerted and a fault logged as it is when any one of the monitored conditions exceeds acceptable limits.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range	Default
Off Warning Derate Shutdown	Warning*

*Default setting is "Derate" for C7,C9 model year 2003 for GMT560

Advantages:
If a monitored engine fault should occur, such as low oil pressure, high coolant temperature, low coolant level, and the engine monitoring system is in one of its active modes, the engine electronics can warn the driver, derate or even shutdown the engine, depending upon how the system has been programmed. The additional expense of "add-on" systems can be avoided by using the Caterpillar system.

Disadvantages:
None

Recommendations:
- ✔ Use the setting which best matches your requirements, however, Caterpillar recommends using the Shutdown mode for most applications.
- ✔ If another monitoring system is used, set the Caterpillar system to Off to avoid interaction with the installed system.
- ✔ When specing your truck ask that the coolant level sensor be installed and activated. This may be an additional cost option, but less than the cost of another monitoring system.

Engine Monitoring Lamps

Description:
This parameter determines the lamp requirements for the Engine Monitoring System. When programmed to the Warning Lamp option, one lamp connected to J1/P1:29, is used to indicate potentially damaging engine conditions.

When programmed to Option 1, up to three discrete lamp outputs are available to indicate specific engine problems. Option 1 configures J1/P1:29 for connection of a Low Oil Pressure Warning Lamp, J1/P1:31 for connection of a High Coolant Temperature Warning Lamp. J1/P1:30 may used to connect a Low Coolant Level Warning Lamp if the Coolant Level Sensor is programmed to other "No". If the Coolant Level Sensor parameter is programmed to No, then J1/P1:30 can be used to connect a PTO Switch On Lamp.

For GMT530 trucks, this parameter may be programmed to High Coolant Temp Warning Lamp. The optional setting configures the ECM to provide an indication when engine coolant temperature is abnormally high. This circuit is used to interface the GM Vehicle Shutdown System. When programmed to the High Coolant Temp Warning Lamp setting, J1/P1:29 is not available for use as a Warning Lamp for the Caterpillar Engine Monitoring System.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E GM	High coolant temp warning lamp	Warning lamp
3126E Other C7/C9 GMT560	NA	NA
C7/C9 GM530/540	High coolant temp warning lamp	Warning lamp
HD C7/C9 Other	Option 1	Warning Lamp

Description:
If the OEM has installed Coolant Level sensor, this parameter must be programmed to Yes to enable the Coolant Level Monitoring function.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E	4-Pin, 2-Pin Switch (Not available for all OEMs)	None
C7/C9 GM530/540	4-Pin	None
C7/C9 GMT560	4-Pin, None	2-Pin Switch
C-10, C-12, C-15, C-16 Before PM OCT02	4-Pin	None
C-10, C-12, C-15, C-16 PM OCT02 and After C11, C13, C15	4-Pin 2-Wire Float Sensor	None

Advantages:
Coolant level sensing can reduce the chance of engine damage caused by loss of coolant.

Disadvantages:
Programming this parameter to Yes when there is no coolant level sensor installed can cause false logging of coolant level faults.

Recommendations:
✔ Cat recommends programming to Yes if the OEM has installed a Coolant Level Sensor.

Coolant Temperature Derate

Description:
The Coolant Temperature Derate parameter allows the OEM the ability to derate the engine based on coolant temperature. Specifically, the engine power is derated by 3% at 103 degrees Celsius and 6% at 104 degrees Celsius. This helps to prevent the engine coolant from over heating during high engine load conditions.

Available:
C11,C13, C15 heavy duty engines

Range:

Range	Default
Enabled	Disabled

Advantages:
By programming the Coolant Temperature Derate parameter to Enabled, the coolant temperature can be kept from over heating in the event of high engine load conditions.

Description:
The oil pressure sensor is standard on all heavy duty on-highway engines and is an integral part of the engine monitoring system. However, the Engine Oil Pressure Sensor is optional on medium duty engines and is not required for engine monitoring.

Medium duty engines have a HEUI (Hydraulically actuated Electronically controlled Unit Injector) fuel system that uses high pressure oil to inject fuel. If the engine oil pressure is too low, the fuel system cannot supply fuel to the engine. Therefore, by the design of the fuel system, it is impossible to run the engine without sufficient engine oil pressure.

The optional Engine Oil Pressure Sensor is typically used to provide oil pressure information to a vehicle instrument cluster equipped with an oil pressure gauge.

Available:
3126E, C7, C9 medium duty engines

Range:

Engine	Alternatives	Default
GM530/540	None	None
GMT560	None	Installed
Other	Installed	None

Advantages:
This parameter provides the operator with engine oil pressure information via a vehicle instrument cluster oil pressure gauge, enabling the operator to more closely monitor the engine oil pressure status.

Disadvantages:
None

Oil Level Switch Installation Status

Description:
The Oil Level Switch Installation Status parameter is only available on medium duty on-highway engines when the Truck Manufacturer parameter is programmed to GM and the Truck Model parameter is programmed to GMT-560.

This parameter configures the ECM to monitor a normally-opened OEM-installed oil level switch mounted in the oil pan and wired to the ECM's engine connector (J2). Proper oil level keeps this switch closed, but if the oil level is too low, the switch will be opened. The ECM reads the status of the switch on each power-up. If three sequential engine starts show an open switch, low oil level is indicated.

Available:
3126E, C7, C9 medium duty engines (GMT560 only)

Range:

Range	Default
Enabled	Disabled

Advantages:
This parameter enables the operator of a GMT-560 truck with a medium duty engine the ability to more closely monitor the engine oil level via an OEM-installed oil level switch.

Disadvantages:
None

Primary Fuel Tank Capacity 

Description:
The Primary Fuel Tank Capacity parameter is programmed to determine the size of the primary fuel tank in gallons. This parameter is only applicable to GMT560 trucks.

Available:
3126E, C7, C9 medium duty engines (GMT560 only)

Range:

Range	Default
25, 35, None	50

Secondary Fuel Tank Capacity

Description:
The Secondary Fuel Tank Capacity parameter is programmed to determine the size of the secondary fuel tank in gallons. This parameter is only applicable to GMT560 trucks.

Available:
3126E, C7, C9 medium-duty engines (GMT560 only)

Range:

Range	Default
25, 35, 50	None

Maintenance Parameters

	Factory	Databook	Optional
• Maintenance Indicator Mode			✔
• PM1 Interval			✔
• Engine Oil Capacity	✔		

Maintenance Indicator Mode

Description:
The Maintenance Indicator will send a signal via the datalink to either a service tool, optional Cat ID or Cat Messenger, some OEM installed electronic dash displays or the Fleet Information Software program indicating that maintenance will be due in 3,000 miles or less. This allows for the convenient scheduling of service.

The preferred way for the ECM to calculate when the next preventive maintenance (PM) is due is to compare the actual amount of fuel used by the engine, to the engine oil capacity. (This method is based on the fact that engine oil additives will become depleted over time based on the amount of fuel burned and oil capacity)

The customer has the option of setting a specific hour or mileage (km) Preventive Maintenance (PM) Interval. This is done by programming the Maintenance Indicator Mode to one of four options:

Manual - Distance – Fixed number of Miles (km)
Manual - Hours – Fixed number of Hours
Automatic - Distance – ECM Calculated Miles (km)
Automatic - Hours – ECM Calculated Hours

If either Manual mode is selected, the PM1 Interval (see page 102) parameter must be programmed to the desired distance or hours. If either Automatic mode is selected, the Engine Oil Capacity (see page 105) parameter must be programmed to the oil capacity.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range	Default
Off Manual-Distance Manual-Hours Automatic-Distance Automatic-Hours	Off

Note: For GMT560 PM OCT01 and newer, Default is "Automatic Distance"

Advantages:
This feature allows the customer to take advantage of the built-in "maintenance due" reminder feature of the engine electronics while maintaining PM intervals tailored to specific operation. For instance, an extended oil change interval may have been developed with the careful use of Scheduled Oil Sampling. The ECM can then be programmed to the extended interval.

Disadvantages:
The customer specified PM interval may not be the optimum maintenance interval. Maintenance intervals based on older technology engines may be too short and can raise the total cost of ownership.

Recommendations:
✔ For most on-highway applications use of the Automatic-Distance mode is the most effective means to mange preventative maintenance.

PM1 Interval

Description:
If the Maintenance Indicator Mode (see page 102) parameter has been programmed for either manual mode; Manual-Distance or Manual - Hours, then the PM1 Interval parameter must be programmed to the desired miles or hours.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:
Manual - Distance

Range		Cat Default
Minimum	Maximum	
5000 Miles (8050 km)	35000 Miles (56325 km)	15000 Miles (24140 km)

Manual - Hours

Engine	Range		Cat Default
	Minimum	Maximum	
C-10, C-12, C-15, C-16, C11, C13, C15	100 Hours	750 Hours	300 Hours
3126E, C7, C9	100 Hours	750 Hours	250 Hours

Advantages:
By using either manual mode the owner will be notified of an upcoming PM interval based on his/her standard interval.

Disadvantages:
The customer specified PM interval may not be the optimum maintenance interval. Maintenance intervals based on older technology engines may be too short and can raise the total cost of ownership.

Recommendations:
✔ Contact your authorized dealer for help in creating customized PM intervals.

Description:
If the Maintenance Indicator Mode parameter has been programmed for either automatic mode; Automatic-Distance or Automatic - Hours, then the Engine Oil Capacity parameter must be programmed to the proper amount of oil in the engine.

If a device that increase oil capacity, like a remote mounted bypass filter, is added the ECM could be recommending oil changes more often than warranted unless the new oil capacity is programmed into the ECM.

With the amount of oil programmed, the ECM can then calculate when the next Preventive Maintenance (PM) is due is to compare the actual amount of fuel used to the engine oil capacity. (This method is based on the fact that engine oil additives will become depleted over time based on the amount of fuel burned and oil capacity.)

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range		
Minimum	Maximum	Cat Default
20 Quarts (19 Liters)	60 Quarts (57 Liters)	See table on following page

Range	Default
3126E, C7, C9	33 Quarts (31 Liters)
3126E, C7, C9 GM	22 Quarts (21 Liters)
C-10, C-12, C11, C13*	36 Quarts (34 Liters)
C11, C13 Deep-Standard Oil Sump	42 Quarts (40 Liters)
C-15, C-16, C15	40 Quarts (38 Liters)
C-15, C-16, C15 w/Rear Sump BrakeSaver	40 Quarts (38 Liters)
C-15, C-16, C15 w/Front Sump BrakeSaver	40 Quarts** (38 Liters)

* C11 & C13 shallow oil sump

**C-15 & C-16 w/Front Sump BrakeSaver engines should be programmed to 52 quarts (49 liters).

Advantages:
Additional oil capacity may be added to an engine after it is installed in the truck and the user can continue to effectively use the Maintenance Indicator by simply adjusting the oil sump capacity parameter.

Disadvantages:
None

Recommendations:
- ✔ In most cases, the factory default value is correct. This default value would only need to be changed if additional oil capacity was added to the engine.
- ✔ Caterpillar recommends this correction be made with the help of an authorized dealer.

Trip Parameters/Cat ID (Messenger) Access

	Factory	Databook	Optional
• Fuel Correction Factor			✔
Cat ID (Messenger) Access Parameters			
• Change Fuel Correction Factor			✔
• PM1 Reset			✔
• Fleet Trip Reset			✔
• Customer Parameters			✔
• State Selection			✔
• Quick Stop Rate			✔
• Theft Deterrent			✔
• Theft Deterrent Password			✔

Fuel Correction Factor

Description:
The Fuel Correction Factor parameter allows an owner to correct for fuel rate measurement variations. Incorrectly setting this parameter can cause the reporting of incorrect fuel consumption data. This correction factor is calculated by comparing the amount of fuel burned to the ECM reported value. A percentage (+/-) is then entered into the ECM using the service tool or Fleet Information Software.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Range		Cat Default
Minimum	Maximum	
-63.5%	63.5%	0

Advantages:
The Fuel Correction Factor parameter allows the customer to “fine tune” the ECM to insure that it is accurately calculating the fuel consumption rate. It is important that the fuel rate be accurately recorded since it is used for calculations such as fuel mileage and PM.

Disadvantages:
None

Recommendations:
- ✔ Caterpillar recommends that the Fuel Correction Factor be used only if there is a consistent and well documented need. At that time Caterpillar recommends that is only be done by an authorized dealer.

Note: This feature should not be confused with the fuel temperature power correction feature of the ECM. The ECM measures the fuel temperature and automatically adjusts the fuel rate to compensate for hot fuel.

If the Fuel Correction Factor is changed, it will not change the data currently stored in the ECM. It will only change data collected after the change.

Example:

$$\text{New FCF} = \left((100 + \text{Old FCF}) \times \frac{\text{ECM - Tank}}{\text{Tank}}\right) + \text{Old FCF}$$

New FCF = New Fuel Correction Factor
Old FCF = Old Fuel Correction Factor (the value currently programmed in the Fuel Correction Factor parameter)
ECM = Fuel Mileage as calculated by the ECM
Tank = Actual Fuel Mileage as calculated using pump receipts

$$\text{New FCF} = \left((100 + (-2.5)) \times \frac{7.0 - 7.1}{7.1}\right) + (-2.5)$$

$$\text{New FCF} = \left(\quad 97.5 \quad \right) \times \quad -0.0141 \quad \Big) + (-2.5)$$

$$\text{New FCF} = \left(\qquad\qquad -1.3748 \qquad\qquad \right) + (-2.5)$$

The -3.8748 is rounded off the nearest 0.5%.

The New Fuel Correction Factor is -4.0%

Description:
The Change Fuel Correction Factor parameter allows the Fuel Correction Factor parameter to be programmed from the Caterpillar Driver Information Display (Cat ID) or Cat Messenger. A properly installed Cat ID or Cat Messenger is required.

Options are:
No - Can not change Fuel Correction Factor from Cat ID or Cat Messenger
Yes - May change Fuel Correction Factor from Cat ID or Cat Messenger

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Range	Default
No Yes	No

Advantages:
An owner-operator may want driver access to this parameter, a fleet operation may not.

Disadvantages:
Unnecessary changing of the Fuel Correction Factor could adversely affect the data stored in the ECM.

Recommendations:
✔ Set the Dash Display Access to Change the Fuel Correction parameter to No. This will eliminate the possibility of inadvertent changing of the Fuel Correction Factor parameter.

✔ Contact your authorized dealer for help in programming the Fuel Correction Factor.

Description:
This parameter allows the reset of the PM1 Maintenance via the Caterpillar Driver Information Display (Cat ID) or Cat Messenger. A properly installed Cat ID or Cat Messenger is required and the Maintenance Indicator Mode parameter must be programmed to either of the Manual or Automatic Modes.

Options are:
No - Can not reset Maintenance Indicator from Cat ID or Cat Messenger
Yes - May reset Maintenance Indicator from Cat ID or Cat Messenger

Available:
All electronically-controlled engines covered in this handbook

Range:

Range	Default
No Yes	No

Advantages:
For those who have a Caterpillar Driver Information Display or Cat Messenger and are using one of the Maintenance Indicator Modes this feature allows the resetting of the Maintenance Indicator without a service tool.

Disadvantages:
If the PM is accidently reset from the Dash Display, the oil change interval could be exceeded.

Recommendations:
✔ Program this parameter to No unless this feature is desired by the driver or fleet owner.

✔ This programmable feature is application dependant and should be programmed based on customer specific requirements.

Description:
This parameter allows the driver to reset of the Fleet Trip Segment (see page 162) of the Trip Data via the Caterpillar Driver Information Display (Cat ID) or Cat Messenger. A properly installed Cat ID or Cat Messenger is required.

Options are:
No - Can not reset Fleet Trip Data from Cat ID or Cat Messenger
Yes - May reset Fleet Trip Data from Cat ID or Cat Messenger

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Range	Default
No Yes	No

Advantages:
An owner-operator may want the ability to reset the Fleet Trip Data, as well as the Driver Trip data from the Dash Display.

Disadvantages:
Resetting of the Fleet Trip at an improper time could have an adverse effect on the data collected by Fleet Information Software for the fleet manager.

Recommendations:
✔ Set the Dash Display Access to Reset the Fleet Trip Data to No, unless this feature is desired.

✔ This programmable feature is application depended and should be programmed based on customer specific requirements.

Description:
The Dash Display Access Parameter - Customer Parameters is a medium duty feature only. It allows the operator to change the following customer programmable parameters via a Caterpillar dash display:

- **Soft Cruise Control**
- **Fast Idle RPM #1**
- **Fast Idle RPM #2**
- **Low Idle Engine RPM**

Available:
3126E, C7, C9 medium duty engines

Range:

Alternatives	Default
Yes	No

Advantages:
Programming this parameter to Yes allows the operator the ability to change the customer parameters listed above easily from the cab of the truck.

Disadvantages:
None

Description:
The ECM has the capability of recording state-specific totals including distance traveled, fuel burned, and percent idle time. The Dash Display Access Parameter - State Selection is a heavy duty feature that enables the State Line Crossing feature. The state can be easily selected from a Caterpillar dash display.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Alternatives	Default
No	Yes

Advantages:
Programming this parameter to Yes allows the operator to easily select the current state from a Caterpillar dash display, this enabling him/her to keep track of state-specific totals listed above.

Disadvantages:
For the state-specific totals to be accurate, the state must be selected manually by the driver via the Caterpillar dash display upon crossing a state line. If the state is not selected near the state line, the totals will be inaccurate.

Quick Stop Rate

Description:
The Quick Stop Rate parameter value is the threshold at which a Quick Stop Event (Date, time and snapshot) will be logged in the ECM memory. The ECM monitors the rate of change of vehicle speed. If the rate of change is greater than or equal to the value programmed into the Quick Stop Rate parameter a Quick Stop Event will be logged. Quick Stop Rate value is application sensitive, light loads may require a higher value and heavy loads a smaller value. If the Quick Stop Rate parameter is programmed to 0 (zero) the feature is disabled and no Quick Stop Events will be logged.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range		Cat Default
	Minimum	Maximum	
3126E, C7, C9	0 MPH/Sec (0 km/h/Sec)	128 MPH/Sec (205km/h/Sec)	0
C-10, C-12, C-15, C-16, C11, C13, C15	0 MPH/Sec (0 km/h/Sec)	15 MPH/Sec (24 km/h/Sec)	0

Advantages:
All ECM recorded vehicle and engine conditions can be replayed for 44 seconds before and 15 seconds after the Quick Stop Event. This data may provide valuable information on drivetrain component wear.

Disadvantages:
None

Recommendations:
✔ Program a value of 7 MPH/Sec as a starting point.

Theft Deterrent

Description:
When used with the Theft Deterrent Password parameter (see page 117), the Theft Deterrent system prevents the engine from starting unless the password has been entered via the Caterpillar Driver Information Display (Cat ID) or Cat Messenger.

Before the operator can use the Theft Deterrent feature of the Cat ID or Cat Messenger, the system must be turned On. To turn the Theft Deterrent system On, a service tool must be used to program the Theft Deterrent parameter to Yes.

No -
Theft Deterrent capability turned Off

Yes -
Theft Deterrent capability turned On

Auto Enable -
Operator **must** enter a password to start, regardless of how engine was shut-off

Once the Theft Deterrent parameter has been turned On, the operator must enter the password **before** the engine shuts off or the key is turned to the off position. The engine will not restart without reentering the password. For further detail on Cat ID or Cat Messenger operation, including the Theft Deterrent feature refer to the Operation and Maintenance Manual.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Alternatives	Default
Yes, Auto-Enable	No

Advantages:
The Theft Deterrent can be an effective method to control unauthorized operation of the vehicle.

Disadvantages:
If the password is forgotten, the truck will be out of service. The password can be obtained using a service tool.

Recommendations:
✔ Caterpillar recommends the use of the Theft Deterrent feature.

Description:
The Theft Deterrent password is required if the Theft Deterrent parameter (see previous page) is programmed to Yes. This password is then required to restart the engine if the Theft Deterrent feature has been enabled before the engine was shutdown. If the Theft Deterrent Password is lost or forgotten a service tool is required to start the engine.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range	Default
Four Characters A thru Z, 0 thru 9	0000 (All Zeros)

Advantages:
The Theft Deterrent can be an effective method to control unauthorized operation of the vehicle.

Disadvantages:
If the password is forgotten, the truck will be out of service. The password can be obtained using a service tool.

Recommendations:
- ✔ Caterpillar recommends using the Theft Deterrent System.
- ✔ With a choice of all alphanumeric characters a password can be selected that is easily remembered.

Input Selection

- Transmission Neutral Switch
- Exhaust Brake Switch
- Torque Limit Switch
- Ignore Brake/Clutch Switch
- Two-Speed Axle Switch
- Diagnostic Enable Switch
- PTO On/Off Switch
- PTO Engine Shutdown Switch
- PTO Engine RPM Set Speed Input A
- PTO Engine RPM Set Speed Input B
- Remote PTO Set Switch
- Remote PTO Resume Switch
- Cruise Control On/Off Switch
- Cruise Control Set/Resume Switch
- Cruise Control Pause Switch
- A/C High Pressure Switch
- A/C Fan Request Switch
- Vehicle Speed Input
- Fan Override Switch
- Service Brake Pedal Position Switch #1
- Clutch Pedal Position Switch
- Accelerator Pedal Position Switch
- Starting Aid On/Off Switch
- Retarder Off/Low/Med/High Switch

Note that Input Selections are not designated as Factory, OEM Databook, or Optional. These selections are all, in effect, optional, but are typically set at the factory. However, after the vehicle is shipped, various inputs can be added either by the customer or OEM. The Input Selections section has been added for completeness due to its direct relation with the parameters discussed in this handbook.

Transmission Neutral Switch

Description:
The Transmission Neutral Switch parameter determines how the ECM will receive status information from the neutral switch. The factory default setting listed below configures the ECM to monitor pin 62 of the Vehicle Harness Connector for a hardwired neutral switch circuit connection. However, the ECM can also be configured to receive the neutral switch status via the J1939 datalink, if the transmission ECU is capable of supporting the required broadcast message protocol. When the Transmission Style parameter is programmed to Automatic Option 3 or Automatic Option 4, the programming expects a neutral switch input. If the Transmission Neutral Switch parameter is programmed to None, then the ECM will assume the transmission is in gear at all times.

Available:
3126E, C7, C9, C11, C13, C15

Range:

Alternatives	Default
J1939, None	J1/P1:62*

*Note: For heavy duty engines PM MAR04 and after, Default is "None" and Alternatives are "J1939, J1/P1:62"

Recommendations:
✔ Program this parameter as specified by the application and transmission

Exhaust Brake Switch

Description:
The Exhaust Brake Switch parameter is used to determine the nature of the Exhaust Brake Switch connection to the ECM. See recommendations below for appropriate parameter programming based on switch connection.

Available:
3126E, C7, C9 medium-duty engines

Range:

Alternatives	Default
J1/P1:16, J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster	None

Recommendations:
- ✔ If the Exhaust Brake Switch is installed in the ECM Exhaust Brake Output circuit to disable the brake by opening the output circuit, the Exhaust Brake Switch parameter should be programmed to None.
- ✔ If the Exhaust Brake Switch is connected to the dedicated ECM Exhaust Brake Switch Input, then the Exhaust Brake Switch parameter should be programmed to one of the Alternatives.

Description:
The Torque Limit Switch parameter is programmed to select the input connection for the programmable torque limit. The Torque Limit Switch should only be used for temporary PTO equipment protection, and should not be used continuously. Please refer to the Torque Limit parameter, discussed in detail on page 59.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1/P1:23, J1/P1:7*	None

*Note: J1/P1:23 only applicable for 3126E, C7, C9 medium-duty engines

Advantages:
Programming this parameter allows the operator the ability to make use of the Torque Limit parameter's ability to limit torque in PTO applications and protect PTO equipment when necessary.

Disadvantages:
None

Recommendations:
✔ The Torque Limit Switch should only be used to temporarily protect PTO equipment and should not be used continuously.

Ignore Brake/Clutch Switch

Description:
The Ignore Brake/Clutch Switch parameter is available for applications that require mobile use of the vehicle with a set engine rpm that does not require the Brake or Clutch switch to disengage the engine rpm set speed. This parameter is specifically used with PTO applications so that the PTO mode can ignore the Brake switch and Clutch switch and not kickout of PTO mode if either of the switches is activated. This parameter must be programmed to one of the Alternatives to activate this feature.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1/P1:47, J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	None

*Note: J1939 alternatives only available for PM JAN02 heavy-duty engines (C-10, C-12, C-15, C-16).

Advantages:
Programming the Ignore Brake/Clutch Switch parameter allows PTO mode to continue even if the Brake switch or Clutch switch has been activated.

Disadvantages:
None

Description:
The Two Speed Axle Switch parameter is available for vehicles equipped with a two speed axle. When a two speed axle is used, the change in gear ratio from the main drive axle ratio to the two speed axle ratio alters the calibration of the vehicle speed signal. Programming this parameter to one of the Alternatives allows the switch to be used. When the switch is in the ON position, the ECM can then automatically adjust the vehicle speed calibration. This ensures that the speedometer is driven by the ECM and that the ECM stored information correctly reflects the actual vehicle speed.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1/P1:6, J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	None

*Note: J1939 alternatives available PM JAN02 and after on heavy-duty engines

Diagnostic Enable Switch

Description:
The Diagnostic Enable Switch can be used by an operator or technician to prompt for diagnostic flash codes. The input can be programmed to be hard wired to the ECM or connected via the J1939 data link.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1/P1:46, J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	None

*Note: J1939 alternatives NOT available on PM OCT01 heavy-duty engines (C-10, C-12, C-15, C-16)

Description:
The PTO On/Off Switch parameter is available to specify the PTO On/Off Switch connection to the ECM. The switch itself can only be used when the PTO Configuration parameter is set to Cab Switches, Remote Switches, or Remote Throttle.

Available:
C7, C9 medium-duty engines (PM MAR04 and after)

Range:

Alternatives	Default
J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster	J1/P1:56

Advantages:
When programmed properly, this parameter allows the use of the PTO On/Off Switch to control PTO operation.

Disadvantages:
None

Recommendations:
✔ If J1939 sources are not available on the vehicle, make sure that the PTO On/Off Switch parameter is not programmed to one of the J1939 Alternatives. Even if the PTO Configuration parameter is set to Off, this will result in a diagnostic code event

PTO Engine Shutdown Switch

Description:
The PTO Engine Shutdown Switch can be used to shut the engine down while in PTO mode with no vehicle speed present. This is an emergency feature, and therefore the ECM will log an Emergency PTO Shutdown Event.

Available:
3126E, C7, C9 medium-duty engines

Range:

Alternatives	Default
J1/P1:23, J1/P1:7	None

Advantages:
The PTO Engine Shutdown Switch parameter allows an emergency engine shutdown while in PTO mode provided there is no vehicle speed present.

Disadvantages:
None

PTO Engine RPM Set Speed Input A

Description:
The PTO Engine RPM Set Speed Input A switch is used to control the engine speed during PTO operation. Specifically, this parameter is set to set engine speed to the engine speed specified by the PTO Engine RPM Set Speed A parameter. For the PTO Engine RPM Set Speed Input A to work properly, the PTO Configuration parameter must be programmed to Cab Switches, Remote Switches, or Remote Throttle, and the PTO Engine RPM Set Speed A parameter must be set to a valid engine speed.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E, C7, C9 (PM MAR03 and before)	J1/P1:46	None
3126E, C7, C9 (PM MAR04 and after)	J1/P1:46, J1939 Cab Controller, J1939 Body Controller, J1939 Instrument Cluster	None
C-10, C-12, C-15, C-16 (PM OCT01 and before)	J1/P1:6, J1/P1:46, J1/P1:58, J1/P1:60	None
C-10, C-12, C-15, C-16 (PM JAN02 and after) C11, C13, C15	J1/P1:6, J1/P1:46, J1/P1:58, J1/P1:60, J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster	None

Advantages:
This parameter allows the operator to adjust the engine speed to the speed specified by the PTO Engine RPM Set Speed A parameter.

Disadvantages:
None

PTO Engine RPM Set Speed Input B

Description:
The PTO Engine RPM Set Speed Input B switch is used to control the engine speed during PTO operation. Specifically, this parameter is set to set engine speed to the engine speed specified by the PTO Engine RPM Set Speed B parameter. For the PTO Engine RPM Set Speed Input B to work properly, the PTO Configuration parameter must be programmed to Cab Switches, Remote Switches, or Remote Throttle, and the PTO Engine RPM Set Speed B parameter must be set to a valid engine speed.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E, C7, C9	J1/P1:7, J1/P1:23	None
C-10, C-12, C-15, C-16, C11, C13, C15	J1/P1:6, J1/P1:46, J1/P1:58, J1/P1:60	None

Advantages:
This parameter allows the operator to adjust the engine speed to the speed specified by the PTO Engine RPM Set Speed B parameter.

Disadvantages:
None

Remote PTO Set Switch

Description:
The Remote PTO Set Switch parameter is programmed to tell the ECM how the Remote PTO Set Switch is connected. Note that the Remote PTO Set Switch can only be used when the PTO Configuration parameter is programmed to Remote Switches or Remote Throttle.

Available:
C7, C9 (PM MAR 04 and after), C-10, C-12, C-15, C-16, C11, C13, C15

Range:

Alternatives	Default
None J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	J1/P1:58

*Note: J1939 alternatives NOT available on PM OCT01 heavy duty engines (C-10, C-12, C-15, C-16)

Recommendations:
- ✔ Make sure that the vehicle has a J1939 datalink if the Remote PTO Set Switch parameter is programmed to one of the J1939 sources. Even if the PTO Configuration parameter is programmed to Off, an engine diagnostic code will occur if the Remote PTO Set Switch is programmed to a nonexistent J1939 source.

Remote PTO Resume Switch

Description:
The Remote PTO Resume Switch parameter is programmed to tell the ECM how the Remote PTO Resume Switch is connected. Note that the Remote PTO Resume Switch can only be used when the PTO Configuration parameter is programmed to Remote Switches or Remote Throttle.

Available:
C7, C9 (PM MAR 04 and after), C-10, C-12, C-15, C-16, C11, C13, C15

Range:

Alternatives	Default
None J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	J1/P1:60

*Note: J1939 alternatives NOT available on PM OCT01 heavy duty engines (C-10, C-12, C-15, C-16)

Recommendations:
- ✔ Make sure that the vehicle has a J1939 datalink if the Remote PTO Set Switch parameter is programmed to one of the J1939 sources. Even if the PTO Configuration parameter is programmed to Off, an engine diagnostic code will occur if the Remote PTO Set Switch is programmed to a nonexistent J1939 source.

Description:
The Cruise Control On/Off Switch input parameter identifies the Cruise Control On/Off Switch connection to the ECM. The switch itself is used to enable cruise control when the vehicle is moving, or to control engine idle rpm when the vehicle is stationary.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	J1/P1:59

*Note: J1939 alternatives NOT available on PM OCT01 heavy duty engines (C-10, C-12, C-15, C-16)

Recommendations:
✔ Make sure that the J1939 data link is available if this parameter is programmed to one of the J1939 source Alternatives. Failure to do so will result in a diagnostic code.

Cruise Control Set/Resume Switch

Description:
The Cruise Control Set/Resume Switch parameter is programmed to identify the Cruise Control Set/Resume Switch connection to the ECM. The switch itself is used in conjunction with the Cruise Control On/Off Switch to control cruise control operation when the vehicle is moving, to adjust engine idle rpm when the vehicle is stationary, to adjust engine rpm when the PTO Configuration parameter is set to Cab Switches, and to enable diagnostic flash codes on the Check Engine Lamp.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E, C7, C9 (PM MAR04 and after)	J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	J1/P1:35 & 33
3126E, C7, C9 (PM MAR03 and before) C-10, C-12, C-15, C-16, C11, C13, C15	J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	J1/P1:35 & 44

*Note: J1939 alternatives NOT available on PM OCT01 heavy duty engines (C-10, C-12, C-15, C-16)

Recommendations:
✔ Make sure that the J1939 data link is available if this parameter is programmed to one of the J1939 source Alternatives. Failure to do so will result in a diagnostic code.

Description:
The Cruise Control Pause Switch parameter is programmed to identify the Cruise Control Pause Switch connection to the ECM. If this parameter is programmed to J1939 Body Controller, Instrument Cluster, or Cab Controller, the Cruise Control Pause Switch will act like the service brake or clutch switch by causing the PTO mode to kickout. If in the On position, the switch will prevent the engine from entering PTO mode, and there is no programmable parameter for ignoring this switch.

Available:
3126E, C7, C9
C-10, C-12, C-15, C-16 (PM JAN02 and after)
C11, C13, C15

Range:

Alternatives	Default
J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster	None

Recommendations:
✔ Make sure that the vehicle is equipped with a J1939 data link if programming this parameter to one of the J1939 source Alternatives. Failure to do so will generate a diagnostic code.

A/C High Pressure Switch

Description:
The A/C High Pressure Switch parameter identifies the A/C High Pressure Switch connection to the ECM. By programming this parameter to the Default value listed below, the ECM is able to respond to the normally closed A/C High Pressure Switch. This switch will open when the refrigerant pressure exceeds the desired limit.

Available:
3126E, C7, C9 medium-duty engines

Range:

Alternatives	Default
None	J1/P1:41

A/C Fan Request Switch

Description:
The A/C Fan Request Switch parameter is programmed to identify the A/C Fan Request Switch connection to the ECM. Programming this parameter may be used to activate the Cooling Fan whenever the air conditioning compressor clutch is engaged.

Available:
3126E, C7, C9 medium-duty engines (GMT560 only)

Range:

Alternatives	Default
J1/P1:41	J1/P1:62

Vehicle Speed Input

Description:
The ECM has an input circuit that can be used to connect a hardwired vehicle speed sensor producing a differential input signal, or a single ended signal from an electronic control. To make use of this feature, the Vehicle Speed Input parameter must be programmed to the Default option listed below. The ECM can also be configured to receive vehicle speed information from an Electronic Transmission Control Unit via the J1939 datalink, provided that the transmission is capable of supporting the J1939 ETC1 Broadcast Message protocol. Note that if this method is to be used, the J1939 Trans option must be selected as well.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1939 Trans J1939 ABS*	J1/P1:32 & 33**

*Note: J1939 ABS alternative not available on PM OCT01 heavy-duty engines (C-10, C-12, C-15, C-16)
**Note: Default value is “None” for C7 and C9 medium-duty engines (PM MAR04 and after)

Description:
The Fan Override Switch parameter is programmed to identify the Fan Override Switch connection to the ECM. This parameter can be programmed to one of the available hard wired options or J1939 datalink source inputs. The switch itself allows the operator to turn on the cooling fan at any time, resulting in improved retarding/braking and engine cooling.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E, C7, C9	J1939 Cab Controller, J1939 Body Controller, J1939 Instrument Cluster	None
C-10, C-12, C-15, C-16, C11, C13, C15	J1/P1:6, J1/P1:7, J1/P1:46, J1/P1:47, J1939 Cab Controller, J1939 Body Controller, J1939 Instrument Cluster*	None

*Note: J1939 alternatives NOT available on PM OCT01 heavy-duty engines (C-10, C-12, C-15, C-16)

Advantages:
When programmed to one of the input Alternatives, this parameter allows the use of the Fan Override Switch, which results in improved engine retarding/braking and engine cooling.

Service Brake Pedal Position Switch #1

Description:
The Service Brake Pedal Position Switch #1 parameter is programmed to identify the Service Brake Pedal connection to the ECM. The switch itself is used to communicate the Service Brake Pedal's position, which can affect Cruise, Idle, PTO, and Idle Shutdown operation. When the Service Brake Pedal is depressed it will deactivate either Cruise Control, Idle, or PTO (depending on PTO programming). Changing the pedal position (depressing a released pedal or releasing a depressed pedal) in the last 90 seconds while the Idle Shutdown Timer is counting will override the Idle Shutdown Timer if the Customer Parameter Allow Idle Shutdown Override is programmed to Yes.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1939 Cab Controller, J1939 Body Controller, J1939 Instrument Cluster*	J1/P1:45

*Note: J1939 alternatives NOT available on PM OCT01 heavy-duty engines (C-10, C-12, C-15, C-16)

Description:
The Clutch Pedal Position Switch parameter is programmed to identify the Clutch Pedal Position Switch connection to the ECM. The Clutch Pedal Position Switch is required if a manual transmission is installed or if an automated transmission that uses a clutch is installed. The switch will communicate the Clutch Pedal position to the ECM to control Cruise Control, Cab PTO, and Idle Shutdown. If the Clutch Pedal is depressed the cruise control or Cab PTO will be deactivated. A change in the Clutch Pedal position (depressing a released pedal or releasing a depressed pedal) in the last 90 seconds while the Idle Shutdown timer is counting will override the Idle Shutdown Timer, provided that the ECM is programmed to allow the Idle Shutdown Override.

Available:
All electronically programmable on-highway engines covered in this handbook

Range:

Alternatives	Default
J1939 Cab Controller, J1939 Body Controller, J1939 Instrument Cluster*	J1/P1:22

*Note: J1939 alternatives NOT available on PM OCT01 heavy-duty engines (C-10, C-12, C-15, C-16)

Starting Aid On/Off Switch

Description:
The Starting Aid On/Off Switch parameter is programmed to identify the type of connection the Starting Aid On/Off Switch has with the ECM. The Starting Aid On/Off Switch is used to allow the operator to enable or disable the ECM controlled Starting Aid Output. If the switch is in the On position, the ECM will automatically enable the Starting Aid Output when conditions require the use of a starting aid. When the switch is in the Off position, the Starting Aid system will not function.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Alternatives	Default
J1/P1:6, J1/P1:7, J1/P1:46, J1/P1:47	None

Description:
The Retarder Off/Low/Med/High Switch parameter identifies how the Retarder Off/Low/Med/High Switch is connected to the ECM. The switch itself controls the operation of the Engine Retarder Solenoids. If the switch is to be hardwired to the ECM, the Low/High Input should be wired to the ECM connector J1/P1 terminal 23, and the Med/High Input to J1/P1 terminal 40.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Alternatives	Default
J1939 Body Controller, J1939 Cab Controller, J1939 Instrument Cluster*	J1/P1:23 & 40

*Note: J1939 alternatives NOT available on PM OCT01 heavy-duty engines (C-10, C-12, C-15, C-16)

Output Selection

- Fast Idle Enabled Lamp
- Wait to Start Lamp
- Fan Control Type
- Change Oil Lamp
- PTO Active Configuration Output
- PTO Switch On Lamp
- Engine Running Output
- Starting Aid Output
- Engine Shutdown Output
- Auxiliary Brake
- Air Inlet Shutoff Control Relay

Note that the Output Selections listed are not designated as Factory, OEM Databook, or Optional. Output selection connections are all options that are specified at the factory. However, if features are added outside the factory, output selections can be specified at that time. This section is included for completeness due to its direct relation to the parameters discussed in this handbook.

Fast Idle Enabled Lamp

Description:
The Fast Idle Enabled Lamp parameter is available to indicate to the driver when the Fast Idle #1 or Fast Idle #2 operations are active. This parameter is programmed as shown below, but requires that a momentary Fast Idle Switch is installed and the Fast Idle #1 parameter is programmed to a valid speed above low idle.

Available:
3126E, C7, C9 medium-duty engines

Range:

Alternatives	Default
J1/P1:21, None	J1/P1:31

Wait to Start Lamp

Description:
The Wait to Start Lamp parameter is programmed to configure the ECM to either turn on output J1/P1:31 or to send a message over the J1939 datalink to turn on the attached lamp when the inlet air heater is on and the engine is not running. This feature is different from the Inlet Air Heater Lamp that will turn on whenever the Inlet Air Heater is operating (with or without engine speed).

Available:
3126E, C7, C9 medium-duty engines

Range:

Alternatives	Default
J1/P1:31, J1939*	None

*PM MAR04 and after

Fan Control Type

Description:
The Fan Control Type parameter determines if the ECM is used to operate the engine cooling fan.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Alternative	Default
3126E, C7, C9 PM MAR03 and before	On/Off Variable Speed Option S	None
C7, C9 PM MAR04 and after	On/Off PWM On/Off DC Variable Speed Option S	None
C-10, C-12, C-15, C-16, C11, C13, C15 PM MAR03 and before	On/Off Three Speed Fan	None
C-10, C-12, C-15, C-16, C11, C13, C15 PM MAR04 and after	On/Off PWM, On/Off DC, Three Speed Fan PWM, Three Speed Fan DC, Variable Speed Fan Option S (variable ratings)	None

Advantages:
When the engine ECM controls the engine cooling fan there is no need for second set of coolant temperature sensors. Engine ECM fan control also provides additional features, such as, Fan with Engine Retarder in High Mode.

Disadvantages:
None

Recommendations:
✔ This parameter must be programmed based on the truck fan installation.

Change Oil Lamp

Description:
The Change Oil Lamp parameter is used to turn on the Change Oil Lamp when, according to programmed maintenance parameters, the engine is in need of an oil change. The Change Oil Lamp parameter must be programmed to the Default setting listed below in order for this feature to work.

Available:
3126E, C7, C9 medium-duty engines

Range:

Alternatives	Default
None	J1/P1:30

PTO Active Output Configuration

Description:
The PTO Active Output Configuration parameter is activated whenever the engine is actively in PTO mode.

Available:
C7, C9 medium-duty engines

Range:

PM	Alternatives	Default
PM MAR03	J1/P1:19	None
PM MAR04	None	J1/P1:19

PTO Switch On Lamp

Description:
The PTO Switch On Lamp parameter is used to enable a lamp output when programmed to the Default value listed below. This lamp is enabled whenever the PTO switch is closed, but is not available when the Warning Lamp parameter is programmed to Option 1.

Available:
3126E, C7, C9 medium-duty engines

Range:

Alternatives	Default
None	J1/P1:30

Advantages:
This parameter provides enables a lamp that will notify the truck operator when the engine is in PTO mode.

Description:
The Engine Running Output is used to allow the ECM to drive a solenoid or relay to prevent the starter from being engaged while the engine is running. The Engine Running Output enables when the engine speed reaches 50 rpm below the programmed Low Idle rpm, and then disables when the engine speed falls 100 rpm below the programmed Low Idle rpm.

Available:
All on-highway engines covered in this handbook (not available to all OEMs)

Range:

Engine	Alternatives	Default
3126E, C7, C9	J1/P1:31	None
C-10, C-12, C-15, C-16, C11, C13, C15	J1/P1:10, J1/P1:12, J1/P1:13	None

Advantages:
Programming this parameter prevents unnecessary wear on the starter.

Starting Aid Output

Description:
The Starting Aid Output parameter is programmed to specify the type of control used for the Starting Aid Output. The output can be either automatically controlled by the ECM, or a manual switch can be installed and connected to the ECM for operator control, as specified below.

Available:
3126E, C7, C9 (before PM MAR04), C-10, C-12, C-15, C-16, C11, C13, C15

Range:

Engine	Alternatives	Default
3126E, C7, C9 (before PM MAR04)	Automatic	Off
C-10, C-12, C-15, C-16, C11, C13, C15	J1/P1:10, J1/P1:12, J1/P1:13	None

Engine Shutdown Output

Description:
The Engine Shutdown Output parameter is used to specify the ECM output pin for the Engine Shutdown Output. This feature is used to shutdown the vehicle electrical system after the idle timer has expired. The Engine Shutdown Output comes on after the engine has been running for more than 3 seconds, and then turns off when the engine rpm is at least 100 rpm below low idle for more than 3 seconds.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Alternatives	Default
J1/P1:10, J1/P1:12, J1/P1:13	None

Auxiliary Brake

Description:
The Auxiliary Brake parameter is programmed to identify the connection of the auxiliary brake relay to the ECM. This feature is used in conjunction with an aftermarket braking device installed on the vehicle. However, operation of the auxiliary brake and relay is inhibited during undesirable engine operating conditions (such as while the engine injectors are being fueled).

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Range:

Alternatives	Default
J1/P1:12	None

Air Inlet Shutoff Control Relay

Description:
The Air Inlet Shutoff Control Relay parameter is used to identify the Air Inlet Shutoff Control Relay to the ECM. Programming this parameter will enable the ECM to control the relay via the J2/P2:13 connection specified below.

The Air Inlet Shutoff device is used to prevent the engine from over-speeding due to ingesting combustible gas present in the ambient air. This feature shuts off the inlet air to the engine by closing a spring-loaded flap on the air inlet when the conditions are met to energize the relay. These conditions are zero vehicle speed, battery voltage on the Neutral Switch input, throttle at minimum, and engine speed over 2500 rpm.

Available:
C11, C13, C15 PM MAR04 and after (specific ratings only)

Range:

Alternatives	Default
None	J2/P2:13

Advantages:
Programming this parameter to the Alternative listed above will give over-speed protection to an Air Inlet Shutoff-equipped engine.

Disadvantages:
If the Air Inlet Shutoff Relay is energized too long, serious damage to the relay can occur.

Recommendations:
- ✔ Only allow the Air Inlet Shutoff Relay to be energized for between 1 and 2 seconds to prevent damage to the relay.

Customer Passwords

	Factory	Databook	Optional
• Password #1		✔	
• Password #2		✔	

Description:
To protect the engine against unauthorized reprogramming once the parameters are set, the customer can specify either one or two passwords to control access to the parameters stored in the electronic control module (ECM). However, the use of passwords is not required for Cat electronic engines to operate. Both passwords can be up to eight alphanumeric characters in length.

Once these passwords are programmed, they are required to gain access to the customer specified parameters. No one can change the pre-programmed Cruise Control parameter for instance, even if they were to have access to a service tool, without also knowing the correct password(s).

If the password is misplaced or forgotten the customer will have to contact either his Caterpillar dealer or authorized truck dealer to view the passwords. This requires a higher level of security called a factory password.

Available:
All Electronically Controlled Engines

Range:

Advantages:
Programming in a password or words help make the customer's electronics specifications more secure and resistant to tampering.

Disadvantages:
If the password(s) is(are) forgotten, arrangements must be made with an authorized dealer to obtain a factory password.

Recommendations:
- ✔ Caterpillar recommends that electronic engines be protected by passwords and that those passwords be kept secure.

Data Link Parameters

Factory  Databook  Optional 

- Powertrain Data Link .....✔

Description:
The Powertrain Data Link parameter determines if or how the ECM will communicate to a powertrain device, such as a wheel-slip or anti-lock brake control. Different datalinks are used by the various controls depending on the manufacturer of the powertrain device.

The standard ECM for midrange engines (3126E, C7, & C9) communicates with the J1939 data link. C-10, C-12, C-15, C-16 heavy duty engines with PM OCT01 and older can communicate with either J1922 or J1939, depending upon how it is programmed. With the JAN02 PM, the J1922 standard was no longer supported, therefore all of the most current on-highway engines support J1939 data link communication only.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Engine	Alternatives	Default
3126E, C7, C9 GM	None	J1939
3126E, C7, C9 Other	J1939	None
C-10, C-12, C-15, C-16 (PM OCT01 and older)	J1922, J1939, J1922 & J1939	Off
C-10, C-12, C-15, C-16 (PM JAN02 and newer) C11, C13, C15	None	J1939

Advantages:
The Powertrain Data Link parameter allows the ECM to work with the various "Industry Standard" datalinks available on powertrain devices today.

Disadvantages:
None

Recommendations:
✔ This parameter should be programmed to the datalink necessary to communicate with the powertrain device(s) installed on the truck.

Special Parameters

	Factory	Databook	Optional
• Customer Parameter Lockout	✔		✔

Customer Parameter Lockout

Description:
If a security level higher than a customer password(s) (see page 154) is required, either by the customer or local laws, the following parameters can be "locked out".

- Vehicle Speed Limit
- Vehicle Speed Calibration
- High Cruise Control Speed Set Limit
- Top Engine Limit
- Soft Vehicle Speed Limit
- A/C Pressure Switch Fan-On Time
- Driver Reward Enable
- Engine Monitoring Lamps
- Engine Retarder Delay
- Fan Control Type
- High Speed Range Axle Ratio
- Low Speed Range Axle Ratio
- Multi-Torque Ratio
- Top Gear Minus One Ratio
- Top Gear Minus Two Ratio
- Top Gear Ratio
- Transmission Style
- Vehicle Overspeed Protection

These parameters have been labeled throughout this book with the icon in the title bar.

Available:
All electronically controlled on-highway engines covered in this handbook

Range:

Range	Default
Unlocked Locked	Unlocked

Advantages:
The ability to lock certain critical parameters to comply with either local laws or customer requests.

Disadvantages:
None

Recommendations:
✔ Lock only those parameters that either required by local laws or customer request.

Trip Data

Various totals are stored in the ECM memory on on-highway engines. This data is called **Trip Data**. This data is divided into three major categories; Current Totals, Fleet Trip and Driver Trip. The ECM also uses this data to create Histograms that show engine operation and driving habits. The ECM can also be individually programmed to record data based on various parameters, as requested by an owner or fleet, by using the Custom Data feature.

The Trip Data can be viewed various ways:

Cat ID (Cat Messenger) Dash Display - The Cat ID or Cat Messenger can view the Current Totals, Fleet Trip and Driver Trip data.

Fleet Information Software (FIS) - Can view, analyze and create custom reports of all the Trip Data (See page 169).

ECAP & ET - These Service Tools can view all the various Trip Data.

Current Totals

Description:
The ECM calculates and stores lifetime information.

This information includes:
- Total Engine Hours - Engine Running Hours
- Total Distance
- Total Fuel Used - Including Idle and PTO Fuel Used
- PTO Hours
- PTO Fuel
- Idle Hours
- Idle Fuel
- Engine Load Factor

This information is available through the service tools, FIS and Cat Driver Information Display (Cat ID)/Cat Messenger.

If an ECM needs to be replaced, the Current Totals can be programmed into the replacement ECM.

Available:
All electronically controlled on-highway engines covered in this handbook

Fleet Trip Totals

Description:
The ECM can store certain information in a Fleet Trip Total. The length of this data is user dependent. The Fleet Trip Reset can be performed by a service tool, Fleet Information Software (FIS) or the Caterpillar Driver Information Display Cat ID or Cat Messenger, if programmed to do so (see page 107).

This information includes:

- Hours
- Fuel Used
- Fuel Economy
- Max. Engine Speed
- Idle Hours
- Idle Fuel
- % Idle Hours
- Distance
- Average Load Factor
- Average Vehicle Speed
- Max. Vehicle Speed
- PTO Hours
- PTO Fuel
- % PTO Hours

Available:
All electronically controlled on-highway engines covered in this handbook

Driver Trip Totals

Description:
The ECM can store certain information in a Driver Trip Total. The length of this data is user dependent. The Driver Trip Reset can be performed by a service tool, Fleet Information Software (FIS) or the Caterpillar Driver Information Display (Cat ID)/Cat Messenger.

This information includes:

- Hours
- Fuel Used
- Fuel Economy
- Max. Engine Speed
- Idle Hours
- Idle Fuel
- % Idle Hours
- Distance
- Average Load Factor
- Average Vehicle Speed
- Max. Vehicle Speed
- PTO Hours
- PTO Fuel
- % PTO Hours

Since this data can be reset by the driver at anytime, it can be a subset of the Fleet Trip Totals.

An example can be the Fleet Trip and Driver Trip data could be reset at the same time at the beginning of the trip. The driver could then manually record the Driver Trip Data when he/she reached their first destination. After recording the data, the driver would reset the Driver Trip Data and proceed on with the next leg of the trip, manually recording and resetting after each leg. Upon arriving back at home base the driver would have the various segments written down and the ECM would have the data for the entire trip stored in the Fleet Trip Data. An evaluation could then be made, using the overall Fleet Trip Totals and the various Driver Trip Totals of each leg.

Available:
C-10, C-12, C-15, C-16, C11, C13, & C15 heavy duty engines

Histograms

Description:
The ECM records the amount of time that the truck has been operated at various RPM and MPH. This time information is stored in "buckets". The RPM buckets are 100 RPM segments. The MPH are in 5 MPH segments. This information is displayed on the service tool or Fleet Information Software (FIS) as a bar chart called a histogram. FIS also displays a 3 dimensional histogram to evaluate engine operation and driver effectiveness.

The histogram time period is the same as the Fleet Trip data.

Available:
All electronically controlled on-highway engines covered in this handbook

Description:
The ECM provides 5 user definable Custom Data Reports. These can be programmed using a service tool or Fleet Information Software (FIS). Custom Data is part of the Fleet Trip Data. When the Fleet Trip Data is reset the Custom Data is also reset.

The basic program is:

Sum **(column 1)** For **(column 2)** Between **(column 3)** And **(column 3)** And **(column 2)** Between **(column 3)** and **(column3)**.

Column 1	Column 2	Column 3
Engine Hours or Miles (kilometers) or Gallons (Liters) or Ocurrences (number of times and event has occured)	RPM	0 - 3,000
	MPH (km/h)	0 - 127 (0 - 205)
	gallons/hr (liters/hr)	0 - 40 (0 - 150)
	Percent Load	0 - 100
	Coolant Temp. °F (°C)	0 - 248 (0 - 120)
	Oil Pressure psi (kPa)	0 - 100 (0 - 689)
	Fuel Temperature °F (°C)	0 - 248 (0 - 120)
	Intake Manifold Air Temp °F (°C)	0 - 248 (0 - 120)
	Cruise Control	Active/ Not Active
	PTO Control	Active/Not Active
	Engine Brake Solenoids	Active/Not Active
	Percent Throttle	0 - 100
	Service Brakes	On/Off

Example:
To find the number of gallons of fuel used when the truck was traveling between 55 and 65 MPH.

Sum **Gallons** for **MPH** between **55** and **65**

This would store the number of gallons of fuel used during the current Fleet Trip Segment when the truck was traveling between 55 and 65 MPH.

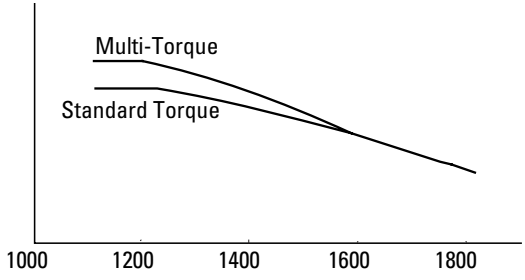
Available:
All electronically controlled on-highway engines covered in this handbook

Miscellaneous Information

- Multi-Torque Ratings
- Multi-Torque Ratios
- Triggering Snapshots
- Cat ID (Cat Messenger)
- Fleet Information Software (FIS)
- Cat® Design Pro

Multi-Torque Ratings

Description:
Multi-Torque is an optional engine rating that provides two different torque or power curves for a single rating. The engine operates on the "standard torque" curve in the lower gears and on the "multi-torque" curve in the top 4 gears. The number of gears in which multi-torque is operational depends on the drivetrain component specification. 100 lb. ft. of additional torque is typical at peak torque when operating in the "multi-torque" mode. See the Engine Performance Manual for the exact amount of increased torque.



The ECM determines when the vehicle is in the top gears by calculating the ratio of engine speed to vehicle speed. If the ratio is greater than 71.5, the engine will operate with the standard torque curve.

Available:
C-10, C-12, C-15, C-16, C11, C13, C15 heavy duty engines

Advantages:
With the additional torque the truck can crest the hill without shifting. This can increase fuel economy, reduce wear and increase driver satisfaction.

Description:
This parameter is used to select the desired Multi-Torque trip point. Multi-Torque ratings allow the engine to provide additional torque or additional horsepower and torque when the transmission is operating in higher gears. The trip point is determined by a ratio of engine speed versus vehicle speed. The three programmable options represent the different trip point values listed below:

Pre-PM MAR04
MT-4: Turn on ratio is 71.5 rpm/mph & below (Top 4 Gears)
MT-2: Turn on ratio is 37.6 rpm/mph & below (Top 2 Gears)
MT-1: Turn on ratio is 27.9 rpm/mph & below (Top 1 Gear)

PM MAR04 and After
MT-C: Turn on ratio is 38 rpm/mph & below (Top 4 Gears)
MT-B: Turn on ratio is 33 rpm/mph & below (Top 2 Gears)
MT-A: Turn on ratio is 27.9 rpm/mph & below (Top 1 Gear)

NOTE: This feature is not used with standard engine ratings, it is only available for Multi-Torque ratings.

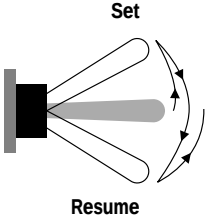
Available:
Heavy duty electronically controlled on-highway engines covered in this handbook

Range:

Engine	Range	Default
Heavy Duty Pre-PM MAR04	MT-2, MT-1	MT-4
Heavy Duty PM MAR04 & After	MT-B, MT-C	MT-A

Triggering Snapshots

Description:
The Engine ECM saves certain information for use in troubleshooting any time a fault code is logged. There is also a method to manually trigger snapshots using the Set/Resume cruise control switch. By toggling the switch from the "center-off" position, up to the Set position and down to the Resume position and back to the "center-off" position (or vice-versa) within a one second time period, a snapshot of the engine parameters will be taken. Only the 4 most recent manually triggered snapshots can be stored at anytime.



Available:
All electronically controlled on-highway engines covered in this handbook

Advantages:
The driver who is experiencing an intermittent problem can aid in the troubleshooting of the problem by taking a "snapshot" when experiencing the problem. A snapshot records 13 seconds of engine data, 9 seconds before the trigger and 4 seconds after the trigger. This snapshot information can then be viewed by a technician using a service tool.

Disadvantages:
None

Description:
The Cat Messenger has replaced the Caterpillar Information Display (ID), but existing Cat IDs are still in use today. The Cat Messenger or Cat ID is a cab mounted display device. It can be ordered as an option from the truck manufacturer or retro fitted in any appropriately equipped on-highway vehicle. It can display a wide variety of information; Diagnostic Data, Engine Operating Information, Vehicle Trip Information, Trip Information and is an integral part of the Theft Deterrent system. Cat Messenger or Cat ID can display the information in both English and Metric units as well as in English , Spanish or French Languages.

For a complete description of the Caterpillar Messenger or the Caterpillar Information Display (ID), refer to the Operation and Maintenance Manual for your engine.

Available:
All electronically controlled on-highway engines covered in this handbook

Fleet Information Software

Description:
The Caterpillar Fleet Information Software is a platform for extraction, analysis and historical file storage of information generated for Caterpillar truck engines. Additional information is available in Product News LEXT4442.

Available:
All electronically controlled on-highway engines covered in this handbook

Advantages:
The Caterpillar Fleet Information Software was developed to assist fleet managers in monitoring and improving the overall performance of their fleet. This is accomplished through analysis of daily, weekly and annual performance of vehicles and drivers. In addition to providing a platform for extraction, analysis and historical file storage of information generated by truck engines, the Fleet Information Software can also be used to upload information and various parameters into the engine's electronic control module (ECM). The PC Windows (3.1) based application is menu driven and focuses on the following major categories:
Information Download - Three quick, straightforward and reliable methods for downloading are provided. All engine electronic control module Trip data is downloaded and reset automatically.
Information Upload - Information such as maintenance parameters, custom report definitions, Vehicle ID, and fuel correction factor, may be modified using FIS, and automatically uploaded to the ECM during the next generation of data.
Information Analysis - FIS offers the user a flexible tool for analyzing data from one to an entire fleet of engines. Data may be sorted by specific driver, vehicle, route, state or province. Sorted data can be used for generating a wide variety of reports.
Customer Parameter Cross-Checking - FIS records the Customer Programmable features of each truck and then verifies that those parameters have not been changed.

Important Note:
FIS is in the process of being revitalized to a web-based software system. This "next generation" FIS will feature additional reports in the form of service packages, effortless updates, and improved capabilities. Look for the new FIS in 2006.

Cat Design Pro

Formerly Cat Truck Engine Pro, Cat Design Pro features improved navigation tools, updated options, step-by-step spec'ing instructions, International units of measure, redesigned route simulations, and real-time, current engine information including legacy support back to 2001.

The secret to a "good" truck spec is through analysis of a customer's performance requirements and the correct selection of driveline components to maximize performance and fuel economy. Cat Design Pro is a Web-based software program that provides the ability to compare performance of specific driveline component combinations. It also includes an industry-exclusive route simulation program where selected specifications can be run on more than 30,000 miles of U.S. and Canadian interstate routes to more accurately evaluate vehicle performance.

- Route Simulation
- Compare up to 4 different driveline specifications at one time
- Operational Analysis providing life cycle costs
- Dealer Locator
- Presentation Generation
- Proposal Generation
- Specification Summaries

For more information order LEDT3882 from the Caterpillar Literature System

Packed with the latest enhancements in spec'ing software, Design Pro accomplishes much more than its predecessors. Design Pro is an inexpensive investment to ensure that new vehicles are spec'ed properly, and that your customers receive the accurate balance between fuel economy and performance for their unique applications.

Experience spec'ing on a whole new level by ordering Cat Design Pro today. For details or to see a demo of Design Pro on-line, contact your Cat Truck Engine Account Manager.

Driver Reward

The Driver Reward feature is used to reward drivers for staying within the operating limits set forth by the fleet manager. This results in improved fuel economy for the fleet, as well as performance incentive for drivers. The following five parameters are monitored and recorded by the ECM to be used in Driver Reward calculations:

- Average Engine Speed
- Average Vehicle Speed
- Average Upshift RPM
- Average Throttle Demand
- Average Percent Idle Time

The fleet manager can prioritize these objectives by assigning a weight to each, adding up to a total of 100% for all five. An objective can be effectively "turned off" by weighting it with "0". Rewards can then be assigned to drivers in the form of increased Vehicle Speed Limits. In addition, the averaging time period over which the five objectives are calculated can be tailored to a specific fleet's needs. Once the desired objectives are set, the engine electronics take over and manage the program.

The Driver Reward feature can reduce the variability of a fleet's fuel economy by placing a more strict Vehicle Speed Limit value on drivers who do not meet fleet performance objectives. Increased vehicle speed for high-performance drivers will help with driver retention, while reducing the Vehicle Speed Limit for poor drivers will improve overall fleet fuel economy.

The Driver Reward feature can be activated using Caterpillar Electronic Technician (ET) or Caterpillar Pocket Tec. In addition, the necessary parameters, such as the objectives weighting discussed above, and the VSL bonuses for drivers, can be programmed using ET.

Additional information detailing Driver Reward programming will be released in the near future.

Improving Fuel Economy

- Trip Preparation Tips
- Driving Tips
- Spec'ing Recommendations

Trip Preparation

Achieving improved fuel economy begins even before the engine is started. Trip preparation is fundamental to ensuring efficient fuel economy once your vehicle is on the road. The following are Caterpillar recommendations for trip preparation that are sure to bring about improved fuel economy.

Check Tire Pressure

Improperly inflated tires can drastically reduce fuel economy as well as diminish the life expectancy of the tires themselves.

Limit "Warm - Up" Time:

Excessive idling wastes fuel, adds contaminates to the oil, and adds carbons to the combustion chamber of your engine. Allow the engine to warm up during the normal walk-around inspection. The engine will approach operating temperature while driving at low rpm and low power as you begin your trip.

Avoid Rapid Starts:

Rapid starts burn excessive fuel because the engine is winding to high a high rpm. Instead, utilize the progressive shifting technique (outlined on the following page).

Keep Vehicle Speed Down:
Fuel economy drops by 0.10 mpg for every 1 mph over 55 mph.

Cruise in Top Gear:
For maximum fuel economy, utilize the following shift parameters:

1. Operate highest gear possible/do not run one gear down
2. Keep the engine below 1500 rpm
3. Downshift around 1100 rpm
4. Use progressive shifting techniques
   -Upshift around 1400-1500 rpm in upper gears
   -Upshift around 1100-1300 rpm in lower gears

Use Cruise Control Whenever Possible:
Using cruise control helps maintain average speed and good fuel economy.

Avoid Downshifting too Early When Climbing Grades
Caterpillar engines allow you to "lug the engine" (i.e. operate at 1000-1200 rpm), as long as the engine maintains road speed while climbing a grade in the 1000-1200 rpm range. In this situation, there is no need to downshift.

Do Not Run with "Fan On" Unless Required
The fan draws horsepower and reduces fuel economy. Under normal operating conditions, leave the fan switch in the automatic mode while driving, which allows the fan to activate only when needed.

Stay Alert to Changing Road Conditions
Anticipate possible slowdowns and stops, and coast in gear to improve overall fuel economy.

Eliminate Idle Time
Caterpillar engines with ACERT© Technology do not require long cool-down periods. Therefore, do not idle for long periods of time.

-If the vehicle is to parked for more than 5 minutes, shut it down
-If idling for heating or cooling, idle between 800-1000 rpm

Please note that a reduction in idle time from 50% to 25% can improve mpg by 2-4%

Operating Caterpillar Engines with ACERT© Technology

The following recommendations are designed to optimize fuel economy, performance, and engine life while operating Caterpillar engines with ACERT Technology. In order to appreciate the full benefits of these recommendations, it is also critical that the truck be properly spec'd for maximum fuel economy and optimal engine performance. Please refer to the Caterpillar Pure Power Spec brochure (lit. #LEDT3408) for the recommended spec'ing requirements. For quick reference, see the chart below.

High Horsepower Line Haul	
Pre-10/02	**ACERT**
550 hp/1850 lb-ft	550 hp/1850 lb-ft
RTLO 18913A	RTLO 18913A
3.55:1	3.36:1
285/75R24.5	285/75R24.5
75 mph @ 1629 rpm	75 mph @ 1542 rpm
Gradeability @ cruise - 1.27	Gradeability @ cruise - 1.21
65 mph @ 1412 rpm	65 mph @ 1337 rpm
Gradeability @ cruise - 1.73	Gradeability @ cruise - 1.56
Startability 1st - 27.77	Startability 1st - 25.73

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