

# Troubleshooting

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## **C11, C13 and C15 On-highway Engines**

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KCA1-Up (Engine)  
KCB1-Up (Engine)  
BXS1-Up (Engine)



## Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

**Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.**

**Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintenance and repair information.**

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "DANGER", "WARNING" or "CAUTION". The Safety Alert "WARNING" label is shown below.



The meaning of this safety alert symbol is as follows:

**Attention! Become Alert! Your Safety is Involved.**

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

Operations that may cause product damage are identified by "NOTICE" labels on the product and in this publication.

**Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that the product will not be damaged or be made unsafe by the operation, lubrication, maintenance or repair procedures that you choose.**

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Caterpillar dealers have the most current information available.



**When replacement parts are required for this product Caterpillar recommends using Caterpillar replacement parts or parts with equivalent specifications including, but not limited to, physical dimensions, type, strength and material.**

**Failure to heed this warning can lead to premature failures, product damage, personal injury or death.**

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# Troubleshooting Section

## Electronic Troubleshooting

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### System Overview

**SMCS Code:** 1900

### System Operation

These truck engines were designed for electronic control. A solenoid on each injector controls the amount of fuel that is delivered by the injector. An Engine Control Module (ECM) sends a signal to each injector solenoid in order to provide complete control of the engine.

### Electronic Controls

The electronic system consists of the Engine Control Module (ECM), the engine sensors and the vehicle interface. The ECM is the computer. The personality module is the software for the computer. The personality module contains the operating maps. The operating maps define the following characteristics of the engine:

- Horsepower
- Torque curves
- RPM
- Other characteristics

### Engine Governor

The electronic controls that are on the engine serve as the engine governor.

The electronic controls determine the timing and the amount of fuel that is delivered to the cylinders. These decisions are based on the actual conditions and the desired conditions at any given time.

The governor uses the accelerator pedal position sensor to determine the desired engine speed. The governor compares the desired engine speed to the actual engine speed. The actual engine speed is determined through the primary engine speed/timing sensor. If the desired engine speed is greater than the actual engine speed, the governor injects more fuel in order to increase engine speed.

The desired engine speed is typically determined by one of the following conditions:

- The position of the accelerator pedal
- The desired vehicle speed in cruise control
- The desired engine rpm in PTO control

### Timing Considerations

Once the governor has determined the amount of fuel that is required, the governor must determine the timing of the fuel injection. Fuel injection timing is determined by the ECM after considering input from the following components:

- Coolant temperature sensor
- Intake manifold air temperature sensor
- Atmospheric pressure sensor
- Boost pressure sensor

At start-up, the ECM determines the top center position of the number 1 cylinder from the signal for the secondary engine speed/timing sensor. After start-up, the ECM determines the top center position of the number 1 cylinder from the primary engine speed/timing sensor. The ECM decides when fuel injection should occur relative to the top center position and the ECM provides the signal to the injector at the desired time. The ECM adjusts timing for the best engine performance, the best fuel economy and the best control of white smoke. Actual timing cannot be viewed with the electronic service tool, and Desired Timing cannot be viewed with the electronic service tool.

### Fuel Injection

The ECM controls the amount of fuel that is injected by varying the signals to the injectors. The injectors will pump fuel only if the injector solenoid is energized. The ECM sends a high voltage signal to the solenoid. This high voltage signal energizes the solenoid. By controlling the timing and the duration of the high voltage signal, the ECM can control injection timing and the ECM can control the amount of fuel that is injected.

The personality module inside the ECM sets certain limits on the amount of fuel that can be injected. The “FRC Fuel Limit” is a limit that is based on the boost pressure. The “FRC Fuel Limit” is used to control the air/fuel ratio for control of emissions. When the ECM senses a higher boost pressure, the ECM increases the “FRC Fuel Limit”. A higher boost pressure indicates that there is more air in the cylinder. When the ECM increases the “FRC Fuel Limit”, the ECM allows more fuel into the cylinder.

The Rated Fuel Limit is a limit that is based on the power rating of the engine and engine rpm. The Rated Fuel Limit is similar to the rack stops and the torque spring on a mechanically governed engine. The Rated Fuel Limit provides the power curves and the torque curves for a specific engine family and a specific engine rating. All of these limits are determined at the factory. These limits are in the personality module and these limits cannot be changed.

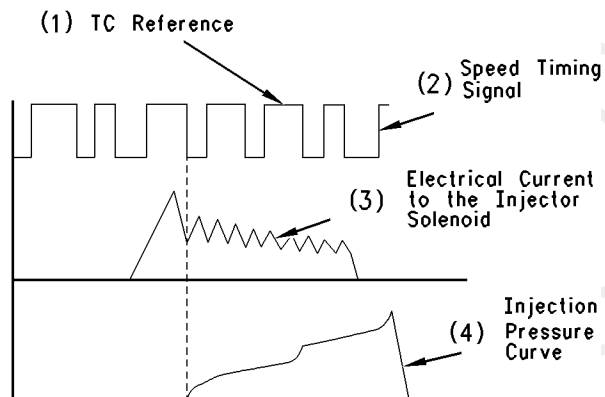


Illustration 1

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- (1) TC reference
- (2) Speed-timing signal
- (3) Electrical current to injector solenoid
- (4) Injection pressure curve

**Note:** The signals and the timing of Illustration 1 are not to scale.

## Customer Parameters And Engine Speed Governing

A unique feature with electronic engines is customer specified parameters. These parameters allow the vehicle owner to fine tune the ECM for engine operation. Fine tuning the ECM for engine operation allows the vehicle owner to accommodate the typical usage of the vehicle and the power train of the vehicle.

Many of the customer parameters provide additional restrictions on the actions that will be performed by the ECM in response to the driver's input. For example, the “PTO Top Engine Limit” is an engine rpm limit. The “PTO Top Engine Limit” is an engine rpm limit that is used by the ECM as a cutoff for the fuel. The ECM will not fuel the injectors above this rpm.

Some parameters are intended to notify the driver of potential engine damage (Engine Monitoring Parameters). Some parameters enhance fuel economy (“Vehicle Speed”, “Cruise Control”, “Engine/Gear Speed Limit” Parameter and “Idle Shutdown” Parameters). Other parameters are used to enhance the engine installation into the vehicle. Other parameters are also used to provide engine operating information to the truck engine owner.

## Engine Monitoring

Caterpillar provides a factory installed engine monitoring system. The Caterpillar engine monitoring system monitors engine oil pressure, coolant temperature, intake manifold air temperature, and coolant level (optional device). Optional devices are OEM installed.

The oil pressure, intake manifold air temperature, and coolant temperature sensors are standard on all engines. The vehicle OEM installs the coolant level sensor and the associated harness. The coolant level sensor is the only optional component of Caterpillar engine monitoring. Coolant level is selected through a customer programmable parameter.

Caterpillar engine monitoring can be programmed to three different modes. These three modes of programming are the following modes: WARNING, DERATE, and SHUTDOWN. The coolant temperature sensor, the oil pressure sensor and the coolant level sensor (optional device) will operate in the engine monitoring mode that is selected.

For example, if DERATE mode was selected, the engine will derate engine power and vehicle speed. The engine will derate engine power and vehicle speed if the coolant temperature sensor, the oil pressure sensor or the coolant level sensor detects conditions that exceed acceptable limits.

An excessive intake manifold air temperature will not derate the engine. Also, an excessive intake manifold air temperature will not shut down the engine.

## Caterpillar Engine Monitoring

### WARNING Operation

If the system is programmed to WARNING, the ECM causes the warning lamp to turn on. This will also cause the check engine lamp to flash because of the active diagnostic code. The flashing check engine lamp indicates that a problem has been detected by the engine monitoring system. No further action by the ECM or action by the engine occurs if the ECM is programmed to WARNING.

If the problem is due to one of the following conditions, the ECM will cause the Warning lamp to turn ON and the ECM will cause the check engine lamp to flash:

- Low coolant level
- High coolant temperature
- High intake manifold air temperature
- Low oil pressure

### DERATE Operation

If the system is programmed to DERATE, the ECM causes the warning lamp to turn ON. The warning lamp does not flash. Also, the ECM begins flashing the check engine lamp. The flashing check engine lamp indicates that a problem has been detected by the engine monitoring system.

This response is identical to the response when the system is in the WARNING mode.

The DERATE mode alters the engine performance when any of the following conditions exist:

- Oil pressure becomes very low oil pressure.
- Coolant level becomes very low coolant level.
- Coolant temperature becomes high coolant temperature.
- Coolant temperature becomes very high coolant temperature.

Whenever the warning lamp is flashing, the ECM is limiting or derating the engine.

The ECM limits the maximum vehicle speed and the ECM reduces the available power when any of the following conditions exist:

- High coolant temperature
- Very high coolant temperature

- Very low coolant level

If the ECM detects very low oil pressure, the ECM limits the following parameters:

- Maximum vehicle speed
- Available power
- Engine rpm

This derating of engine performance is provided in order to get the driver's attention so the driver can take action in order to avoid engine damage.

### SHUTDOWN Operation

If the system is programmed to SHUTDOWN, the ECM takes all the action that is indicated for the DERATE mode and the ECM will eventually shut down the engine under some conditions.

The SHUTDOWN mode will shut down the engine when any of the following conditions exist:

- Oil pressure becomes very Low oil pressure.
- Coolant level becomes very Low coolant level.
- Coolant temperature becomes very high coolant temperature.

### Monitoring Fuel Temperature

The fuel temperature sensor monitors the fuel temperature. The fuel rate that is calculated by the ECM is adjusted in order to compensate for changes in fuel temperature. The fuel rate is also adjusted for constant power. The sensor is also used to warn the operator of excessive fuel temperature with a diagnostic event code because excessive fuel temperatures can adversely affect engine performance. The electronic service tool can be used to temporarily disable the adjustment of fuel temperature. This could be necessary for testing a vehicle on a dynamometer with fuel temperature compensation.

### Other ECM Functions Of Performance

The ECM also provides enhanced control of the engine for vehicle functions such as retarding the engine and controlling the cooling fan. Refer to Troubleshooting, "Component Diagram" for supplemental information about the systems that can be monitored by the ECM in order to provide enhanced vehicle performance, fuel economy and convenience for the driver.



## Self-Diagnostics

The electronic system has the ability to diagnose problems. When a problem is detected, a diagnostic code is generated and the check engine/diagnostic lamp may be turned ON. In most cases, the code is also stored in permanent memory or logged in the Engine Control Module (ECM).

When diagnostic codes occur, the diagnostic codes are called active diagnostic codes. Active diagnostic codes indicate that a problem of some kind currently exists. Active diagnostic codes should always be serviced before any other work is performed. If a truck is brought in with an active code, find the code in this manual and proceed to diagnose the cause.

Diagnostic codes that are stored in memory are called logged diagnostic codes. Logged diagnostic codes do not necessarily indicate that something needs to be repaired. The problem may have been temporary, or the problem may have been repaired since the problem was logged. Logged diagnostic codes are instead meant to be an indication of probable causes for intermittent problems.

Diagnostic codes that identify operating conditions outside the normal operating range are called events. Event codes are not typically an indication of an electronic system problem.

Some of the diagnostic codes require passwords to be cleared from memory. Diagnostic codes that do not require passwords to be cleared from memory are automatically deleted after 100 hours of engine operation.

## Engine Snapshot Data

Whenever most diagnostic codes occur, the ECM records the time in engine hours of the occurrence. Also, the ECM records the operating parameters of the engine for 9.6 seconds before the diagnostic code and 3.4 seconds after the diagnostic code. The operating parameters of the engine that are recorded are similar to the operating parameters of the engine that are displayed in the status screens of the electronic service tool. Not all of the status screens or parameters are recorded. The engine snapshot can also be triggered from the cruise control Set/Resume switch. In order to trigger the engine snapshot from the cruise control Set/Resume switch, quickly toggle the switch to the Set position. Then, quickly toggle the switch to the Resume position. You can also toggle the cruise control Set/Resume switch from the Resume position to the Set position. The engine snapshot can also be triggered from the electronic service tool.

## Effect Of Diagnostic Codes On Engine Performance

The discussion on engine monitoring mentions that the check engine lamp flashes when a specific condition exists. When the ECM detects the engine problem, the ECM generates an active diagnostic code. Also, the ECM logs the diagnostic code in order to indicate the time of the problem's occurrence. The ECM also logs the number of occurrences of the problem. There are two types of diagnostic codes. There are fault codes and event codes.

### Diagnostic Fault Codes

Diagnostic fault codes are provided in order to indicate that an electrical problem or an electronic problem has been detected by the ECM. In some cases, the engine performance can be affected when the condition that is causing the code exists. More frequently, the driver cannot detect any difference in the engine performance.

If the check engine lamp is flashing and the driver indicates that a performance problem occurs, the diagnostic code may indicate the cause of the problem. The problem should be corrected.

If the driver does not indicate a problem with the engine performance and a diagnostic code is logged by the ECM, the situation indicates that the ECM detected an abnormal condition, but the abnormal condition did not affect engine performance.

In this situation, the system has no faults except when either of the following conditions exist:

- There are several occurrences of the diagnostic code in a very short period of time.
- The ECM is indicating an active code at the present time.

### Diagnostic Event Codes

Diagnostic event codes are used to indicate that some operational problem has been detected in the engine or in the truck by the ECM. Usually, this does not indicate an electronic malfunction.

The ECM also provides an ECM date/time clock that is used to time stamp the following diagnostic event codes:

- 84-00 Vehicle Overspeed Warning
- 84-14 Quick Stop Occurrence
- 100-11 Very Low Oil Pressure

- 105-11 Very High Intake Manifold Air Temperature
- 110-11 Very High Coolant Temperature
- 111-11 Very Low Coolant Level
- 190-00 Engine Overspeed Warning

Refer to Troubleshooting, “Diagnostic Codes” for a listing of all of the diagnostic codes.

## ECM Lifetime Totals

The ECM maintains total data of the engine for the following parameters:

- “Total Time” (Engine Hours)
- “Total Distance”
- “PTO Time” and “PTO Fuel”
- “Idle Time” and “Idle Fuel”
- “Average Load Factor”(Engine)
- “Total Fuel”
- “Total Max Fuel”

The “total time” is the engine’s operating hours. The engine hours do not include operating time when the ECM is powered ON but the engine is not running.

“Total Distance” data requires a vehicle speed sensor or an electronic vehicle speed source to be connected to the ECM. The same sensor is used for ECM vehicle speed. Distance can be displayed in miles or kilometers.

“PTO Time” and “PTO Fuel” are logged if the engine RPM is set with the cruise switch and when the engine is operating under a load. Also, the “PTO Time” and the “PTO Fuel” are logged when the PTO On/Off switch is in the ON position and vehicle speed is within the range of the “PTO Vehicle Speed Limit” parameter.

“Idle Time” and “Idle Fuel” can include operating time when all of the following conditions are met:

- When engine speed is set by using the cruise switches and the vehicle speed is within the range of the “Idle Vehicle Speed Limit” parameter.
- The engine is not operating under a load.

Fuel information can be displayed in US Gallons or liters.

“Total Fuel” is the total amount of fuel that is consumed by the engine during operation.

“Total Max Fuel” is the maximum amount of fuel that could have been consumed by the engine during operation.

“Average Load Factor” provides relative engine operating information. “Average Load Factor” compares actual engine operation information to the maximum engine operation that is available. “Average Load Factor” is determined by using “Total Max Fuel”, “Idle Fuel”, and “Total Fuel”. All of these parameters are available by using the electronic service tool. These parameters are available within the menu for “Current Totals”.

## Trip Data That Is Stored In The ECM

The trip data allows the tracking of engine operation by the vehicle owner over intervals that are defined by the vehicle owner. Two types of trip data are stored in the ECM, Driver Trip Data and Fleet Trip Data. All of the trip data is stored in memory and the trip data is maintained through the unswitched battery lines when the key switch is OFF. An internal battery will maintain this information while the unswitched battery lines are disconnected.

### Driver Trip Data

Driver trip data is known as the driver trip segment. The driver trip segment includes data for the following parameters:

- Total Time
- Driving Time
- Distance
- Fuel
- Overall Fuel Economy
- Driving Fuel Economy
- Idle Time
- Idle Fuel
- Percent Idle Time
- PTO Time
- PTO Fuel
- Percent PTO Time
- Average Load Factor

- Average Vehicle Speed
- Average Driving Speed
- Maximum Vehicle Speed
- Maximum Engine Speed
- Start Time
- End Time
- Start Odometer
- End Odometer

A driver trip segment can be reset by using the electronic service tool or a Caterpillar Messenger Driver Information Display.

When the data is reset, the ECM stores the current totals at the time of the reset. This data is used as the starting point for the driver trip data. The electronic service tool or the Messenger accesses this starting point and the current totals from the ECM in order to calculate the data for the driver trip segment. Resetting the driver trip segment does not require passwords.

### Fleet Trip Data

Fleet trip data includes a fleet trip segment, histograms, and custom data. The fleet trip segment records the same parameters as the driver trip segment except that the fleet trip segment can be reset independently of the driver trip segment.

Three histograms are available. One histogram records engine hours versus the engine speed. The second histogram records engine hours versus vehicle speed. The third histogram records engine hours versus engine speed and vehicle speed.

The electronic service tool calculates the percentage of time that is spent in each of the engine rpm or vehicle speed ranges. Custom data is available. Custom data allows the recording of engine parameters that are specified by the vehicle owner. The ECM records the custom data.

A reset of the fleet trip data which includes the fleet trip segment, the histograms, and the custom data can be done in several ways. The following tools can be used to reset the fleet trip data:

- Caterpillar Electronic Technician (Cat ET)
- Caterpillar Fleet Information Software (FIS)
- Caterpillar Messenger Driver Information Display

When the data is reset, the ECM records the current totals at the time of the reset. These totals are used as the starting point for the fleet trip. The following tools access the recorded starting point:

- Cat ET
- Caterpillar Fleet Information Software (FIS)
- Messenger

The tool then subtracts the recorded starting point from the current totals in the ECM in order to calculate the fleet trip data. Resetting the fleet trip data requires customer passwords if the passwords are programmed.

### Fleet Trip Custom Data

Fleet trip custom data is part of the fleet trip segment. Fleet trip custom data allows the owner of the vehicle to set five customized methods of recording data for the vehicle. Refer to Illustration 2 for the basic program.

---

SUM\_\_<sup>1</sup> WHEN \_\_<sup>2</sup> IS BETWEEN\_\_<sup>3</sup>  
AND\_\_<sup>4</sup> AND WHEN \_\_<sup>5</sup>  
IS BETWEEN\_\_<sup>6</sup> AND\_\_<sup>7</sup>

---

Illustration 2  
Basic Program

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The following list defines the options for variable 1 of the basic program:

- "Engine Hours"
- "Distance Traveled"
- "Fuel Burned"
- "Occurrences"

Refer to the following list for information regarding the options that are available for variable 2 and variable 5.

Variables 3, 4, 6, and 7 define the minimum range and the maximum range of variables 2 and 5.

- Engine RPM
- Vehicle Speed

- Fuel Rate
- Load Factor
- Coolant Temperature
- Oil Pressure
- Fuel Temperature
- Intake Manifold Air Temperature
- Cruise
- PTO
- Engine Retarder
- Throttle Position
- Brake

Refer to the example of a custom data program, as shown below.

**“Fuel Burned when Fuel Temperature is between 7° and 67° C (45° and 120° F) and Vehicle Speed is between 87 and 137 km/h (55 and 85 mph)”**

The custom data programs are protected by customer passwords. The programs are stored in permanent memory. The programs are not reset when the fleet trip segment is reset, but the data that is recorded for the trip is reset.

### Fuel Correction Factor

A Fuel Correction Factor is available for fine tuning the calculations for fuel consumption. The Fuel Correction Factor is protected by customer passwords. The Fuel Correction Factor enhances the accuracy of the calculation for fuel consumption. Altering the Fuel Correction Factor does not affect data that is already stored in the ECM. Altering the Fuel Correction Factor only affects data that is stored in the ECM after the Fuel Correction Factor is entered.

**Note:** The Fuel Correction Factor should be adjusted from data that has been recorded for a long time, data from the fuel tank and recorded data in the ECM.

### Quick Stop Rate

A customer parameter is available in order to record the quick stop occurrences. The parameter determines the rate of change in vehicle speed that is used by the ECM in order to record a quick stop event code and a quick stop snapshot. Refer to Troubleshooting, “ECM Snapshot”.

### Maintenance Indicator Data

The ECM records the current totals when a reset occurs for the following three levels of maintenance:

- PM1
- PM2
- Cooling System Clean/Flush

The ECM uses the previous point of maintenance in order to calculate the timing of the next scheduled maintenance work.

The maintenance indicator mode is programmable to hours or distance. The PM1 maintenance is programmable to the Off, Automatic Distance, Automatic Hours, Manual Distance, or Manual Hours setting.

If the PM1 is programmed to the automatic mode, the ECM calculates the next point of maintenance by considering the history of the vehicle's operation from the previous maintenance interval. If the vehicle has a history of poor fuel economy the maintenance indicator parameter will occur sooner than a vehicle with better fuel economy.

The ECM also uses the engine oil capacity. A larger engine oil capacity provides a longer maintenance interval. The engine oil capacity is programmed into the ECM in liters or quarts. If the PM1 is programmed to the manual mode, the owner can program the ECM in the owner's specific maintenance interval. The maintenance interval can be programmed to the owner's specific interval that is based on mileage or time. The interval for the PM2 and the interval for the cooling system Clean/Flush are established by the factory.

### Messenger

The Caterpillar Messenger Driver Information Display is available to provide engine operating information to the driver. The Driver Trip Segment, the Fleet Trip Segment, and the Maintenance Indicator data can be viewed. However, the Fleet Trip Histograms and the Custom Data cannot be viewed from the display.

Messenger provides the ability to enter an ID code for a driver in order to divide the fleet trip segment for two drivers. If the driver enters the information regarding the state of travel, the fleet trip segment can be tagged by the state of travel.

Messenger can be used in order to tag portions of the fleet trip segment into two ID codes. Messenger can also be used in order to tag portions of the fleet trip segment into the state of travel. The ID code and the information regarding the state of travel cannot be viewed from the display. Only the Caterpillar Fleet Information Software (FIS) can view this information. The ability to reset any of these parameters is dependent on customer parameters in the ECM.

Messenger will also display engine operating parameters such as engine rpm, coolant temperature, boost pressure and many other parameters.

Messenger will also display engine diagnostic codes. Messenger will also display a brief text description of the diagnostic codes.

An available feature on Messenger is the theft deterrent. The theft deterrent allows the driver to input a password prior to shutdown. The theft deterrent will prevent the engine from restarting until the password is successfully entered. Messenger must have the version of software that is capable of supporting this feature.

An "Auto-Enable" option is available as a Theft Deterrent. If this option is selected, the theft deterrent will automatically be activated when the engine is shut down. The driver must input the correct password in order to start the engine.

"Secure Idle" is another Theft Deterrent. This allows the driver to bring the engine to an idle condition. The driver then enters the password. The engine will remain at low idle until the password is re-entered. If the engine is shutdown, a password will be required to go above low idle after start-up.

## **Fleet Information Software (FIS)**

The Caterpillar Fleet Information Software (FIS) is another method that can be used to review the trip information. The entire fleet trip segment, which includes the following elements of data can be accessed with the Caterpillar FIS:

- Histograms
- Custom Data
- Information that is tagged by the ID code
- Information that is tagged by the state of travel

Maintenance Indicator information can be retrieved with the Caterpillar FIS.

When the Caterpillar FIS downloads the information, the Caterpillar FIS also resets the ECM in order to prepare the ECM for the next trip. The information can be downloaded to a computer with the Caterpillar FIS program, or the information can be downloaded to an Argo Mobile Data Tool (MDT). The Argo Mobile Data Tool (MDT) is then connected to a computer in order to download the information.

## **Driver Reward Feature**

The driver reward feature automatically adjusts the VSL as a reward to the driver for operating a truck in a manner that meets the truck engine owner's specifications. Several parameters are monitored in order to evaluate a driver's operating technique. Weighting factors are applied to the parameters that reflect the operating techniques that are desired and the operating techniques that are expected. If the operating techniques meet the owner's specifications or the operating techniques exceed the owner's specifications, the VSL is automatically increased as a reward. The VSL will decrease when the operating techniques do not meet the owner's specifications.

Messenger can be used to monitor parameters that affect the driver reward, which allows the driver to adjust the operating techniques, as required.

## **"Wireless Communication Enable"**

The "Wireless Communication Enable" parameter in the ECM allows the ECM to communicate through the SAE J1587 Data Link with certain systems of communication. Programming this parameter requires factory passwords.

With this system, the customer can remotely change the following parameters with the Caterpillar FIS:

- Fuel Correction Factor
- Custom Data
- Maintenance Indicator Data

With this system, the customer can remotely extract the following information from the ECM:

- Current Totals
- Reports on Custom Data
- Fleet Trip Data
- Economy Model
- Maintenance Information

- Settings for Customer Parameters

The reports are processed for the owner of the fleet with the Caterpillar FIS. The frequency and the timing of the downloading of the information can be at set intervals or the downloading of the information can be done manually.

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## Glossary

**SMCS Code:** 1900

**Note:** This glossary contains definitions of terminology for all of Caterpillar On-Highway Truck Engines. Some of the terms are only applicable to certain engines.

**A/C High Pressure Switch** – The A/C high pressure switch senses refrigerant pressure in the air conditioning system. The A/C high pressure switch opens the electrical contacts and the A/C high pressure switch closes the electrical contacts. The opening and closing of the electrical contacts depends on the pressure in the system. The electrical contacts control the cooling fan. This switch may be connected to the ECM in some applications.

**Accelerator Pedal Position** – The accelerator pedal position is the interpretation by the ECM of the signal from the accelerator pedal position sensor.

**Accelerator Pedal Position Sensor** – The accelerator pedal position sensor is an electronic sensor that is connected to the accelerator pedal. The accelerator pedal position sensor sends a Pulse Width Modulated signal to the ECM.

**ACERT** – Advanced Combustion Emissions Reduction Technology

**Active Diagnostic Code** – An active diagnostic code describes a condition that is currently present in order to alert the driver or the service technician of an abnormal parameter of engine operation. Refer to a Diagnostic Fault Code.

**Aftermarket Device** – An aftermarket device is a device or an accessory that is installed by the customer after the vehicle is delivered.

**Air-To-Air Aftercooler** – An air-to-air aftercooler is a device that is used on turbocharged engines in order to cool inlet air that has undergone compression. The inlet air is cooled after the inlet air passes through the turbocharger. The inlet air is passed through an aftercooler (heat exchanger) that uses ambient air for cooling. The inlet air that has been cooled advances to the inlet manifold.

**Alternating Current (AC)** – Alternating current is an electric current that reverses direction at a regular interval that is reoccurring.

**American Wire Gauge (AWG)** – AWG is a measure of the diameter of electrical wire. AWG is also a measure of the current carrying capacity of electrical wire. When the AWG number is smaller, the diameter of the wire is larger. When the AWG number is larger, the diameter of the wire is smaller.

**Analog Sensors** – Analog sensors produce a DC output signal. The sensors detect changes in temperature or pressure. The change is converted by the sensor to an electrical signal.

**Analog Sensor Return** – The common line (ground) for the analog sensor from the ECM is used as a ground for the analog sensors.

**Analog Sensor Supply** – The +5 volt supply from the ECM provides power to the analog sensors.

**Anti-Lock Brake System (ABS)** – An anti-lock brake system is a brake system that attempts to reduce a skid during brake operation. A power train electronic control can turn off the engine retarder, if necessary. Also, a power train electronic control can signal the engine ECM to deactivate the engine retarder.

**ATA Data Link (American Trucking Association)** – The ATA data link is a two wire electrical connection for communication with other microprocessor based devices. These devices are compatible with Standards for the American Trucking Association and Standards for the SAE (J1587 and J1708) such as trip recorders, electronic dashboards, power train controls, and maintenance systems. The data link is also the serial communication medium that is used for programming and troubleshooting Caterpillar truck engines.

**Atmospheric Pressure Sensor** – The atmospheric pressure sensor measures barometric pressure. The sensor sends a signal to the Engine Control Module (ECM). The signal is used in engine control and in engine operation.

**Auxiliary Pressure Sensor** – This sensor is an additional pressure sensor that is installed by the engine owner.

**Auxiliary Retarder Relay** – The brakes' solenoids are driven by an OEM installed relay, which is driven by the ECM.

**Auxiliary Temperature Sensor** – This sensor is an additional temperature sensor that is installed by the engine owner.

**Before Top Center (BTC)** – BTC is the 180 degrees of crankshaft rotation before the piston reaches the top center position in the normal direction of rotation.

**Boost** – The difference between the turbocharger outlet pressure and the atmospheric pressure is commonly referred to as boost.

**Boost Pressure Sensor** – The boost pressure sensor measures inlet manifold air pressure. The boost pressure sensor sends a signal to the ECM.

**Bypass Circuit** – A bypass circuit is a circuit that is used as a substitute circuit for an existing circuit. A bypass circuit is typically used as a test circuit.

**Calibration** – Calibration is an electronic adjustment of a sensor signal.

**Camshaft Position Sensor** – Refer to Secondary Engine Speed/Timing Sensor.

**Caterpillar Driver Information Display (CAT ID)** – The Caterpillar Driver Information Display is a digital readout of the performance parameters of the vehicle and performance parameters that are monitored by the ECM.

**Caterpillar Electronic Technician (Cat ET)** – Cat ET is an electronic service tool that uses a software program to run on a personal computer (PC). Cat ET is used to service Caterpillar products. This program has replaced the ECAP tool.

**Caterpillar Engine Monitoring** – Caterpillar Engine Monitoring is the part of the Caterpillar electronic engine control that monitors coolant temperature, oil pressure, intake manifold air temperature and coolant level. The monitoring alerts the operator of detected problems. Coolant temperature, intake manifold air temperature, and oil pressure sensors are supplied by Caterpillar and monitored by the ECM. The coolant level sensor is installed by the vehicle OEM but still monitored by the ECM. Aftermarket engine monitoring systems do not interface with the Caterpillar electronic engine control.

**Check Engine Lamp** – The check engine lamp is sometimes referred to as the diagnostic lamp. The check engine lamp is used to alert the operator of the presence of an active event. The lamp then flashes a diagnostic code.

**Clutch Pedal Position Switch** – The switch is typically supplied and installed by the OEM. This switch is typically a limit switch that is mounted near the clutch pedal. The switch is usually adjustable. This switch is in the normally closed position when the clutch pedal is released. Depressing the clutch pedal will open the circuit.

**Code** – Refer to the Diagnostic Fault Code and the Diagnostic Event Code.

**Cold Mode** – Cold mode is a mode for cold starting and for cold engine operation that includes timing that is retarded and low idle that is raised. This mode is used for engine protection, reduced smoke emissions and faster warm up time.

**Communication Adapter Tool** – The communication adapter provides a communication link between the ECM and Cat ET.

**Control Area Network (CAN) Data Link** – The CAN Data Link is a serial communications port that is used for communication with other microprocessor based devices. This is also referred to as the J1939 Data Link.

**Coolant Level Sensor** – This OEM installed sensor detects the absence or presence of coolant at the probe. The sensor then sends a signal to the ECM.

**Coolant Temperature Sensor** – This sensor detects the engine coolant temperature for Cold Mode operation and the Caterpillar Engine Monitoring. The Caterpillar Engine Monitoring must be enabled for the coolant temperature sensor to be used for monitoring purposes.

**Cooling Fan Override Switch** – This switch overrides control of the cooling fan relay so the cooling fan operates continuously. This switch is supplied and installed by the OEM.

**Cooling Fan Relay** – This relay is controlled by the ECM which uses information from the coolant temperature sensor, the engine retarder and the air conditioning high pressure switch. The air conditioning high pressure switch is not always installed. The relay and the air conditioning high pressure switch is supplied and installed by the OEM.

**Crankshaft Position Sensor** – Refer to Primary Engine Speed/Timing Sensor.

**Cruise Control Range** – The cruise control range is the speed range that is monitored by the cruise control. This speed range is typically the anticipated speed range on the open road. The cruise control range can be programmed with the low cruise limit and the high cruise limit.

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