SEBU8860-02 (en-us)
August 2016

Operation and Maintenance Manual

Tire Monitoring System

ELK 2001-6000 (Machine Control & Guidance Products)

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, including human factors that can affect safety. 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 verify that you are authorized to perform this work, and 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.

⚠ WARNING

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.

A non-exhaustive list of 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. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. 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 you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

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. Cat dealers have the most current information available.

⚠ WARNING

When replacement parts are required for this product Caterpillar recommends using Cat replacement parts.

Failure to follow this warning may lead to premature failures, product damage, personal injury or death.

In the United States, the maintenance, replacement, or repair of the emission control devices and systems may be performed by any repair establishment or individual of the owner's choosing.

Table of Contents

Foreword

Literature Information

This manual should be stored in the operator's compartment in the literature holder or seat back literature storage area.

This manual contains safety information, operation instructions, and maintenance recommendations.

Some photographs or illustrations in this publication show details or attachments that can be different from your product.

Continuing improvement and advancement of product design might have caused changes to your product which are not included in this publication. Read, study and keep this manual with the product.

Whenever a question arises regarding your product, or this publication, please consult your Cat dealer for the latest available information.

Safety

The safety section lists basic safety precautions. In addition, this section identifies the text and locations of warning signs and labels used on the machine.

Operation

The operation section is a reference for the new operator and a refresher for the experienced operator. This section includes a discussion of gauges, switches, product controls, attachment controls, and programming information.

Photographs and illustrations guide the operator through correct procedures of checking, starting, operating and stopping the product.

Operating techniques outlined in this publication are basic. Skill and techniques develop as the operator gains knowledge of the product and its capabilities.

Maintenance

The maintenance section is a guide to equipment care.

Safety Section

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Safety Messages

SMCS Code: 4203; 7490

Safety Messages

WARNING

Do not operate or work on this machine unless you have read and understand the instructions and warnings in the Operation and Maintenance manuals. Failure to follow the instructions or heed the warnings could result in injury or death. Contact your authorized dealer for replacement manuals. Proper care is your responsibility.

Operation

Clear all personnel from the machine and from the area.

Clear all obstacles from the path of the machine. Beware of hazards (wires, ditches, etc.).

Be sure that all windows are clean.

Secure the doors and the windows.

If the machine is equipped with rear view mirrors, then adjust the mirrors according to the specifications of the Operation and Maintenance Manual.

Make sure that the horn, the travel alarm (if equipped), and all other warning devices are working properly.

Fasten the seat belt securely.

Warm up the engine and the hydraulic oil before operating the machine.

Only operate the machine while you are in a seat.

The seat belt must be fastened while you operate the machine. Only operate the controls while the engine is running.

While you operate the machine slowly in an open area, check for proper operation of all controls and all protective devices. Before you move the machine, make sure that no one will be endangered. The machine can tip when you cross ditches, ridges, or other unexpected obstructions.

Do not allow riders on the machine unless the machine has the following equipment:

- Additional seat
- Additional seat belt
- Rollover Protective Structure (ROPS)

Note any needed repairs during machine operation. Report any needed repairs.

Avoid any conditions that can lead to tipping the machine. The machine can tip when you work on hills, on banks and on slopes. Also, the machine can tip when you cross ditches, ridges, or other unexpected obstructions.

Avoid operating the machine across the slope. When possible, operate the machine up the slopes and down the slopes.

Maintain control of the machine.

Do not overload the machine beyond the machine capacity.

Be sure that the hitches and the towing devices are adequate.

Never straddle a wire cable. Never allow other personnel to straddle a wire cable.

Before you maneuver the machine, make sure that no personnel are between the machine and the trailing equipment.

Always keep the “Rollover Protective Structure” (ROPS) installed during machine operation.

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Safety Messages

SMCS Code: 4203; 7490

Safety Messages

WARNING

Do not operate or work on this machine unless you have read and understand the instructions and warnings in the Operation and Maintenance manuals. Failure to follow the instructions or heed the warnings could result in injury or death. Contact your authorized dealer for replacement manuals. Proper care is your responsibility.

Operation

Clear all personnel from the machine and from the area.

Clear all obstacles from the path of the machine. Beware of hazards (wires, ditches, and so forth).

Be sure that all windows are clean.

Secure the doors and the windows.

If the machine is equipped with rear view mirrors, then adjust the mirrors according to the specifications of the Operation and Maintenance Manual.

Make sure that the horn, the travel alarm (if equipped), and all other warning devices are working properly.

Fasten the seat belt securely.

Warm up the engine and the hydraulic oil before operating the machine.

Only operate the machine when you are in a seat.

The seat belt must be fastened when you are operating the machine. Only operate the controls when the engine is running.

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Maintain control of the machine.

Do not overload the machine beyond the machine capacity.

Be sure that the hitches and the towing devices are adequate.

Never straddle a wire cable. Never allow other personnel to straddle a wire cable.

Before you maneuver the machine, make sure that no personnel are between the machine and the trailing equipment.

Always keep the “Rollover Protective Structure” (ROPS) installed during machine operation.

Product Information Section

Identification Information

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Regulatory Compliance

SMCS Code: 4203; 7490

FCC Notice

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and 2. This device must accept any interference received, including interference that may cause undesired operation. This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/tv technician for help

Changes or modifications to this device without the express approval may void the users authority to use this device.

Industry Canada Notice to Users

Operation is subject to the following two conditions:

- This device may not cause interference
- This device must accept any interference, including interference that may cause undesired operation of the device. Refer to RSS-GEN 7.1.5.

Industry Thailand Notice to Users

This telecommunication equipment conforms to technical standard NTC TS 1010–2550.

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General Information

SMCS Code: 4203; 7490

System Information

The part number for the system covered in this publication is 434 - 4542 Tire Monitor Gp.

For installation instructions of the 434 - 4542 Tire Monitor Gp , refer to Special Instruction, REHS9135.

System Overview

The Tire Monitoring System constantly monitors the pressure and temperature of each tire on the machine. The constant monitoring provides real-time information of the status of each tire. The information is displayed through the Messenger display.

The Tire Monitoring System has the following features:

- Monitor the pressure and temperature of each tire.
- Monitor Active and Logged Events
- Axle configuration information
- Sensor installation status

Tire Maintenance

Proper tire maintenance is critically important for reducing tire operating expense. When properly maintained and inflated, tires will provide proper vehicle handling and operation with maximum tire lifetime.

Tire Monitoring System Maintenance

Inspect all clamps, guards, clips, and straps for proper installation. Attach electrical wiring to hoses and tubes that contain flammable fluids or combustible fluids should be avoided. Keep wiring and electrical connections free of debris.

Electrical wires should be checked daily. If any of the following conditions exist, parts must be replaced before the machine is operated.

- Fraying
- Signs of abrasion or wear
- Cracking
- Discoloration
- Cuts on insulation
- Other damage

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Declaration of Conformity

SMCS Code: 4203; 7490

European Union EU Declaration of Conformity

Table 1

CATERPILLAR ®
EU Declaration of Conformity

The undersigned, representing	And the authorized representative established within the Community
CATERPILLAR INC	**CATERPILLAR INC**
100 N.E. Adams Street	Robert B Andrews
Peoria, IL 61629	EAME / CIS Regional Compliance Manager
USA	Product Compliance & Support PD&GT Division
	Tel: +44 1455 826769/ Mob: +44 7979 700710
	Email: Andrews_Rober_Bt@cat.com
	Caterpillar (UK) LTD
	Peckleton Lane,
	Desford, Leicestershire LE99JT

hereby declares that the product:

Brand: Tire Monitoring System	
Model: ELK 2001–6000	Part Number: 434 - 4542

is in conformity with essential requirements of the following EU Directives

2014/53/EU	Radio Equipment Directive
2014/35//EU	Low Voltage Directive
2014/30/EU	Electromagnetic Compatibility (ECM) Directive

(continued)

(Table 1, contd)

as is verified by compliance with the following standards:

EN 13309:2010	ISO 13766:2006
ETSI EN 300 200–1 V2 4.1 (2012–05)	ETSI EN 300 200– 2 V2 4.1 (2012–05)
ETSI EN 300 200–1 V2 4.1 (2000–09)	EN ETSI 01 489–1(2002–08)
EN 60950–2000	EN ISO 14982:2009

Done at:
Caterpillar Inc.,
100 N.E. Adams Street,
Peoria, Illinois 61629, USA

Signature

Date:
May 19, 2016

Name / Position
Beth Friling / Product Manager

Illustration 1 g06100148

Operation Section

Operation

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Basic Operation

SMCS Code: 4203; 7490

The Messenger display can be used to view information regarding the pressure and temperature of each tire. Only check the tires when the machine is stopped and in a safe location. Never check the status of a tire when the machine is in motion.

The following parameters can be viewed through the Messenger display.

- Tire temperature
- Tire pressure

The following parameters can be changed through the Messenger display.

- Installation status for all tires
- Configuration for a two axle four tire system or a two axle six tire system.

Note: Independent software will allow for configuration of a three axle six tire system.

Messenger Display Operation

The main menu of the Messenger display contains information on:

- Settings for contrast, brightness, language, and units
- Service parameters and system information
- Active and logged diagnostic events
- Configuration parameters

The Messenger Display flow chart below shows the user how and where to find specific information for the Tire Monitoring system.

Note: Combination language files are available on SIS web.

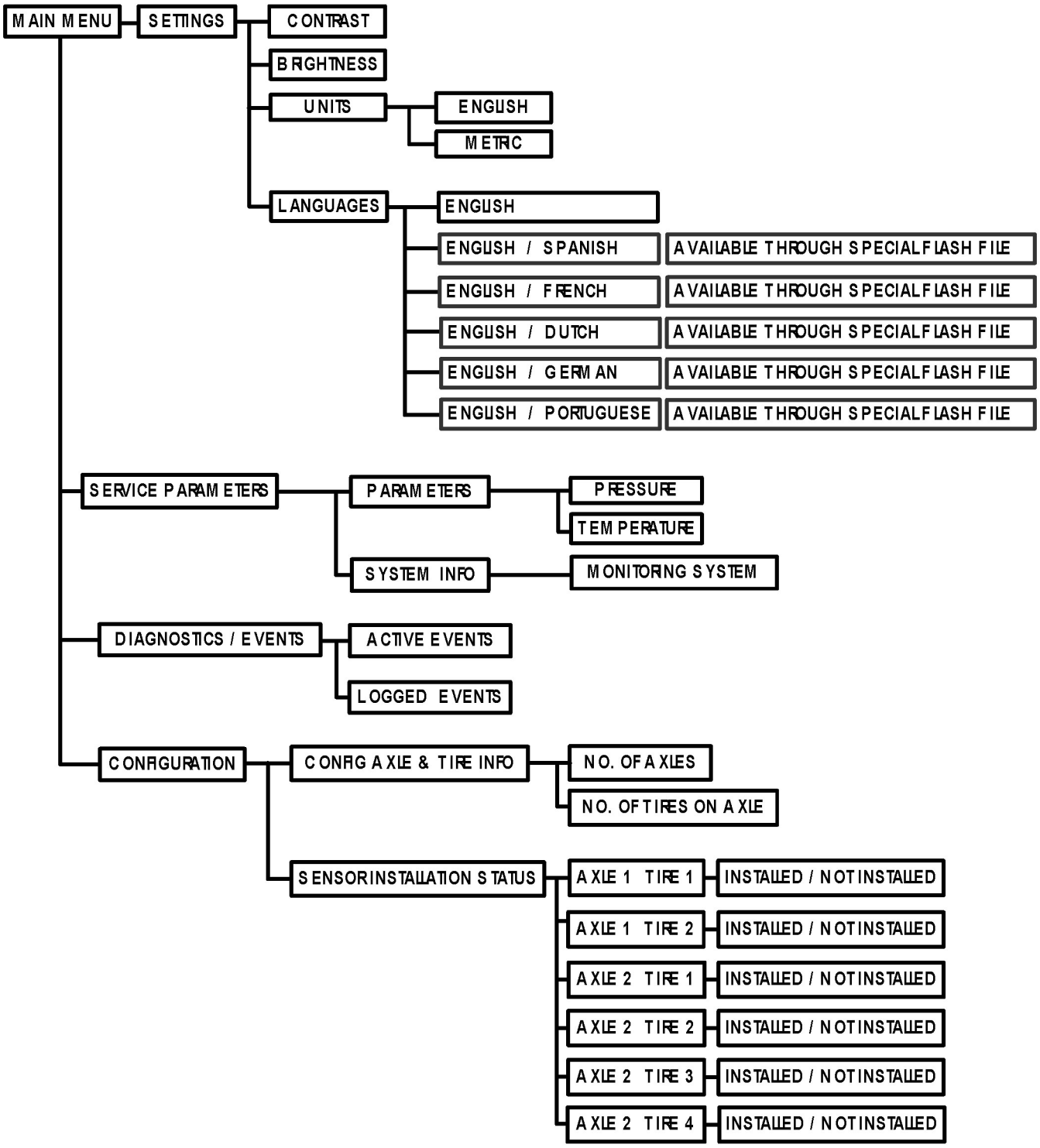

Illustration 2 g06097759

Annunciation Warning

Illustration 3 g06065379

When a warning is active, the graphical display will indicate which tire is producing the warning and the reason for the warning through a flashing pop-up message, or annunciation. Refer to Illustration 3 for a view of the warning and message. Pressing the “OK” button will temporarily snooze the warning. Refer to Table 2 for warning types and snooze times.

Note: If the pressure is not being updated, the display will show “*****” for pressure.

Table 2

Warning / Annunciation Type	Snooze Time
Over Pressure	2 minutes
Under Pressure	20 minutes
Extreme Under Pressure	2 minutes
High Temperature	2 minutes
Tire Sensor Low Battery	1 hour

Warning Icons

Basic Symbol – This symbol is on the Messenger display to indicate that the system is operating normally.

Pressure Symbol – This symbol is accompanied with a pop-up message on the display when tire pressures are out of the desired range.

Failure/Malfunction Symbol – This symbol is accompanied with a pop-up message on the display when a tire failure or malfunction has occurred.

Temperature Symbol – This symbol is accompanied with a pop-up message on the display when tire temperatures are out of the desired range.

Sensor Identification Number Symbol – This symbol identifies the identification number of the sensor currently being displayed.

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Warning Operation

SMCS Code: 4203; 7490

Configuring Thresholds for Events

Responding to the events and diagnostics that are provided by the system is important. There are some values that are configurable by the service technician at the time of installation using the Caterpillar Electronic Technician (CAT ET). These configurable values are percentages of an optimum pressure or temperature value and are used by the warning system as thresholds. If temperature compensation is enabled, the system calculates the proper inflation pressure of the tire based on the operating temperature and the pressure of the tire when the tire is cold. The default settings for the pressure events can be configured, and events set to be temperature compensated.

The system supports the following events:

- Least Severe High Pressure (Level 1)
- Least Severe Low Pressure (Level 1)
- Moderately Severe Low Pressure (Level 2)

- High Temperature (Level 1)

Least Severe High/Low (Level 1) Pressure Events

The least severe high/low pressure events are the first warnings when a tire is under or over inflated. When a tire pressure lags or exceeds the threshold from the optimum inflation pressure, a pop-up message on the Tire Monitoring System display, advises the operator to “Service Soon” . If temperature compensation is enabled, it permits the system to provide the temperature compensated least severe high/low pressure events. If temperature compensation is disabled, the least severe pressure events use gauge pressure to trigger events.

Moderately Severe Low Pressure (Level 2) Pressure Events

The moderately severe low-pressure events are the second warning of and under inflated tire. Moderately severe low-pressure events warn the operator when a tire pressure falls below the Cold Inflation Pressure (CIP) threshold.

The moderately severe low-pressure events warn the operator if a tire pressure lags the threshold from the optimum inflation pressure. A pop-up message on the Tire Monitoring System display advises the operator to “Slow Down, Reduce Load” .

High Temperature (Level 1) Alert

The high temperature alert warns the driver when a tires temperature exceeds 90° C (194° F). A high tire temperature is typically caused by under inflation. The system will usually provide a pressure deviation alert and a critical low-pressure alert well before a high temperature alert. If triggered, the high temperature alert may be an indication of an alternative problem, such as a dragging brake, bearing failure, or some other condition.

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Event Codes

SMCS Code: 4203; 7490

Event codes alert the operator or the technician that an abnormal operating condition exists in one of the machine systems.

When the tire pressure monitoring ECM activates an event code, the operator or the technician will be alerted by the Messenger display. Most active events will be logged by the ECM. Some events are active only. Active only events are not logged. The events that are active and the events that are logged can be viewed with the following equipment:

- Messenger display
- Caterpillar Electronic Technician (Cat ET)

Warning Levels

The ECM will assign a warning level to an active event code. Event codes are one of two levels. The level is according to the severity of the abnormal condition. Each warning level requires a specific response from the operator. The warning levels and the required operator response are listed below.

Warning Level 1

Warning level 1 alerts the operator that a machine system requires attention. The operator should check that the involved system condition or the operator should perform maintenance on the involved system at the earliest possible time.

Warning Level 2

Warning Level 2 requires changing the operation of the machine or performing a maintenance procedure. Failure to correct a Level 2 warning may result in damage to the components that are involved in the system.

Indications and System Response

The Tire Monitoring System display will alert the operator when an event code is active. Event codes are activated in one of two warning levels according to the severity of the condition. All warnings are seen as flashing pop ups on the Messenger display. The levels of severity are indicated alongside the event code.

Caterpillar Electronic Technician (Cat ET) Service Tool

When an abnormal operating condition of the system occurs, the status screen on the Cat ET indicates that there is an active event.

Event codes are displayed on Cat ET in the following format:

EXXXX Description of the code

The “E” means that the code is an event code. The “XXXX” is a numeric identifier. The numeric identifier is followed by a description of the code.

Active event codes are listed in ascending numerical order. The code with the lowest number is listed first. The active event code is removed from the list when the condition is no longer present.

Logged Event Codes

Some event codes are logged in the memory of the ECM. Some event codes are active only. The logged event codes are listed in chronological order. The most recent code is listed first.

A logged code is cleared from memory when the service technician manually clears the code.

Note: Always clear logged event codes after investigating and correcting the problem which generated the code.

Diagnostic Indicators

Event codes alert the operator or the technician that an abnormal operating condition exists in one of the machine systems. When the Tire Monitoring System ECM activates an event code, the operator or the technician will be alerted by the Tire Monitoring System display. The events that are active and the events that are logged can be viewed with the following equipment Tire Monitoring System display or Caterpillar Electronic Technician (Cat ET).

Table 3

Alarm	DTC SPN - FMI	Event/Diagnostic	EID - WCI or CID-FMI	Tire Monitoring System Display Message
First Level Low Pressure	241–18	Low Tire Pressure	EID 1205 to 1210 (6 Tires) and 1338 and 1339 (LR and RR) for 4 Tire EIDs WCI 1	WCI 1 “Service Soon”
Second Level Low Pressure	241–1	Low Tire Pressure	EID 1205 to 1210 (6 Tires) and 1338 and 1339 (LR and RR) for 4 Tire EIDs WCI 2	WCI 2 “Slow Down, Reduce Speed”
First Level High Pressure	241–16	High Tire Pressure	EID 1211 to 1216 (6 Tires) and 1340 and 1341 (LR and RR) for 4 Tire EIDs WCI 1	WCI 1 “Service Soon”

(continued)

(Table 3, contd)

High Temperature	242–16	High Tire Temperature	EID 1268 to 1273 (6 Tires) and 1342 and 1343 (LR and RR) for 4 Tire EIDs WCI 1	WCI 1 “Service Soon”
Sensor Fault (not communicating)	929–12	Tire Pressure / Temperature Sensor	CID 3474 to 3479 (6 Tire) and 3744 and 3745 (LR and RR) for 4 Tire FMI 09 Abnormal Update Rate	Abnormal Update Rate
Sensor Battery Low Alert	1697–4	Tire Pressure / Temperature Sensor	CID 3474 to 3479 (6 Tire) and 3745 and 3746 (LR and RR) for 4 Tire FMI 04 Voltage Below Normal	Voltage Below Normal
Tire Monitoring Module Loss of Communications Annunciation	Generated by Tire Monitoring System display with TMM communications loss for 180 seconds using DM1 message	Tire Monitoring Module	CID 3473 FMI 9	Abnormal Update Rate
Tire Monitoring Module Wrong Software Versions	Generated by Tire Monitoring System display control by checking TMM software versions	Tire Monitoring Module	CID 3473 FMI 2	Data Erratic Intermittent or Incorrect WCI

(continued)

(Table 3, contd)

Tire Monitoring Module EEPROM Fault (Checksum Error) or Permanent MAP Protocol Failure	929–31 Or internally generated by Tire Monitoring System display control	Tire Monitoring Module	CID 3473 FMI 12	Bad Device or Component
Tire Monitoring Module Temporary Loss of MAP Protocol	Generated by Tire Monitoring System display control by timeout check	Tire Monitoring Module	CID 3473 FMI 14	Special Instruction

Diagnostic Display Examples

All active diagnostics / events can be viewed under the “Diagnostics” screen of the “Main Menu” . Use up and down arrows to traverse the list. Highlight the selected event in active diagnostics screen select “OK” button to see the detail screen.

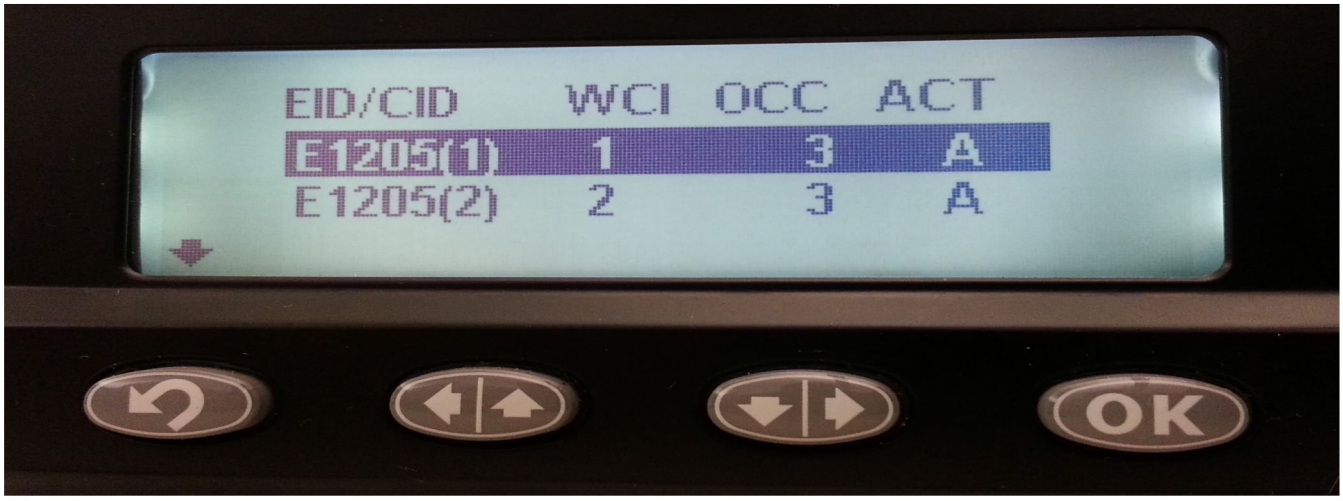

Illustration 4 g06065674
List of Active events

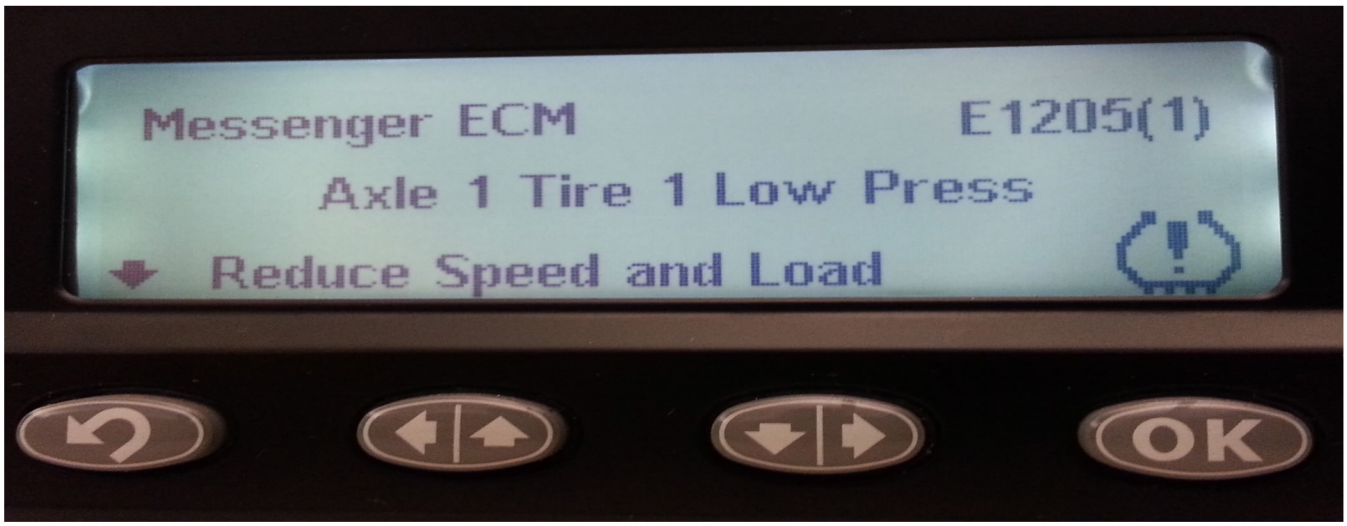

Illustration 5 g06065680

Low Tire Pressure Left Front Tire WCI 1 Detail Screen

Index

Product and Dealer Information

Note: For product identification plate locations, see the section “Product Identification Information” in the Operation and Maintenance Manual.

Delivery Date: _____

Product Information

Model: _____

Product Identification Number: _____

Engine Serial Number: _____

Transmission Serial Number: _____

Generator Serial Number: _____

Attachment Serial Numbers: _____

Attachment Information: _____

Customer Equipment Number: _____

Dealer Equipment Number: _____

Dealer Information

Name: _____ Branch: _____

Address: _____

_____

_____

	Dealer Contact	Phone Number	Hours
Sales:	_____	_____	_____
Parts:	_____	_____	_____
Service:	_____	_____	_____