

Draft

Tire Monitor System Reference
Manual

GENII

Draft

Note; Prior to issue this manual to be examined and approved by;

Engineering
Marketing
Customer Service

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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.

Introduction

Purpose of Manual







This manual is intended for use by service personnel and dealers. It contains detailed information on operation, installation and service of the SmarTire Pressure Monitoring Systems (GEN-II).

About Tire Monitoring Systems

The SmarTire System consists of a receiver and optional programmable Multifunction Display, which are conveniently mounted within easy view and reach of the driver. Wheel mounted sensor/transmitters inside each tire measure contained air pressure and temperature and transmit this data to the receiver. The receiver or Multifunction Display displays the location and/or value of any detected abnormal tire pressure or temperature, alerting the driver at preset limits.

The Multifunction Display also provides convenient fingertip access to viewing the pressure, temperature and pressure deviation of each tire.

Tire Monitoring Components

Valve mount transmitter	Strap mount transmitter	Receiver with mounting bracket	Multi-function display
			
Power Adaptor (Gooseneck)		Receiver Power Cable	
			

Feature Summary

Feature	Function of
Low pressure alert	Receiver
Low pressure warning	Receiver and multi-function display
Pressure deviation alert	Multi-function display
High temperature warning	Multi-function display
Battery voltage	Multi-function display
Temperature compensation factor (slope)	Multi-function display
Transmitter ID learn mode	Multi-function display

System Scope of Use and Warnings

The SmarTire™ System and Tire Maintenance

This system is a sensing device designed to identify and display tire operating data and activate an alert or warning when pressure or temperature irregularities are detected. It is the responsibility of the driver to react promptly and with discretion to alerts and warnings. Abnormal tire inflation pressures should be corrected at the earliest opportunity.

System Installation and Usage

Use of the SmarTire™ system requires that it has been properly installed and programmed by qualified personnel according to SmarTire Systems Inc. documentation.

This includes the Owner's Manual and any supplementary installation instructions included with system components.

THIS SYSTEM IS SUITABLE FOR USE IN PASSENGER AND LIGHT TRUCK TIRES UP TO MAXIMUM COLD INFLATION PRESSURE OF 85 PSI..

Use of Chemicals

Temporary resealing or reinflation products containing internal sealers or propellants in any tire/wheel assembly may adversely affect the operation of Sensor Modules. Use of these chemicals can damage the pressure sensor and may nullify any manufacturer's warranty, expressed or implied.

Power Connection

If your Display Module is connected to an unkeyed cigarette lighter socket unplug it when you park the vehicle for extended periods of time (more than three days) to avoid draining the battery. On a keyed circuit you will see the key lights turn off and the information screen clear when the ignition switch is turned off.

Warnings

1. When an alert or warning conditions is detected, reduce vehicle speed to an appropriate safe level and proceed to a safe stopping location or facility where the tire can be inspected and serviced.
2. The *pressure deviation alert* indicates that the pressure has dropped a set amount below the required pressure.
3. The *low pressure alert* occurring shortly after a pressure status alert indicates that a rapid pressure loss is taking place.
4. The *low pressure warning* indicates that the pressure has dropped to a level considered critical to the tire's ability to support and/or provide directional control to the vehicle.

5. The *high temperature warning* indicates that the contained air temperature has exceeded the selected maximum. A tire temperature buildup can be caused by a number of factors including severe under inflation, hard sustained braking, vehicle overload and sustained high speeds.

SmarTire Product Overview

The Tire Monitoring Systems are sold in several configurations and options. Below is a table outlining the available kits, upgrades and spare components.

Product List

Product	Product Stock Code	Description
A	060.1004	Pressure Alert System – 4 wheels – Multi fit Strap Mount Transmitters
H	060.1002	Pressure Alert System – 2 wheels – Multi fit Strap Mount Transmitters
B	060.2004	Pressure Alert System – 4 wheels - Valve Transmitters (valves not included)
I	060.2002	Pressure Alert System – 2 wheels – Multi fit Valve Mount Transmitters
D	061.4000	Pressure Alert Full Function Display (LCD-I)
E	061.4001	Pressure Alert Full Function Remote Display (LCD-R)
C	061.3000	Pressure Alert Flexible Power Adaptor
F	061.1002	Pressure Alert Transmitter Kit – 2 - Multi-fit Strap Mount Transmitters
G	061.2002	Pressure Alert Transmitter Kit – 2 - Valve Transmitters (valves not included)
	063.2000	Pressure Alert 2 Valve Kit – A
	063.2001	Pressure Alert 2 Valve Kit – B
	063.2002	Pressure Alert 2 Valve Kit – C
	063.2003	Pressure Alert 2 Valve Kit – D

Tire Monitor System Kit Component Table

Kit Description			Kit Components																	
Product Type Short Code			Base receiver	Receiver Cable Kit	Transmitter, Strap Mount	Transmitter, Valve Mount	LCD Multi-function Display Type I	LCD Multi-function Display Type R	Flexible Power Adaptor	Strap	Document Kit Basic	Document Kit, LCD	Installation Kit	Package Type A	Package Type B		Valve - A	Valve - B	Valve - C	Valve - C
	Kit Stock Code	Kit Description	200.0059	069.0002	200.0064	200.0065	200.0060	200.0068	200.0066	264.0115	700.0000	700.0001	069.0001	276.0041	276.0042					
A	060.1004	Pressure Alert System – 4 wheels – Multi fit Strap Mount Transmitters	1	1	4					4	1			1						
H	060.1002	Pressure Alert System – 2 wheels – Multi fit Strap Mount Transmitters	1	1	2					2	1			1						
B	060.2004	Pressure Alert System – 4 wheels - Valve Transmitters (valves not incl.)	1	1		4									1					
I	060.2002	Pressure Alert System – 2 wheels – Multi fit Valve Mount Transmitters	1	1		2									1					
D	061.4000	Pressure Alert Full Function Display (LCD-I)					1					1			1					
E	061.4001	Pressure Alert Full Function Remote Display (LCD-R)						1				1			1					
C	061.3000	Pressure Alert Flexible Power Adaptor							1						1					
F	061.1002	Pressure Alert Transmitter Kit – 2 - Multi-fit Strap Mount Transmitters			2					2	1									
G	061.2002	Pressure Alert Transmitter Kit – 2 - Valve Transmitters (valves not included)				2														
	063.2000	Pressure Alert 2 Valve Kit – A															2			
	063.2001	Pressure Alert 2 Valve Kit – B																2		
	063.2002	Pressure Alert 2 Valve Kit – C																	2	
	063.2003	Pressure Alert 2 Valve Kit – D																		2

System Descriptions

Pressure Alert Systems – 2 and 4 wheels – Multi-fit Strap Mount Transmitters

Kit # 060.1004 (4 wheel) **Product A**
Kit # 060.1002 (2 wheel) **Product H**

Overview

These kits contain a base receiver, two or four strap mounted transmitters, installation hardware and documentation for use on tires with a pressure up to 83 PSI (gauge).

The transmitters transmit pressure and temperature data when the vehicle attains a speed of 10 kph. Tire pressure and temperature are checked every six seconds and data is transmitted every 5 minutes.







The receiver annunciates a pressure loss incident at two severity levels. The initial warning occurs when the pressure has dropped a set amount below the required pressure. A second warning occurs when the pressure has dropped to a level considered critical to the support of the vehicle. The affected tire is identified with a colour coded indicator on the receiver, corresponding to the same colour code on the valve of the respective tire.

An optional serial port can send transmitter data to another customer device.

To install the system use a supplied strap to mount the transmitter on the lowest part of the wheel well near the valve. Plug the receiver into the cigarette lighter plug with the supplied cable.

Bill of Materials

Component Images

Receiver	Transmitter
 A black, rectangular receiver unit with a curved top and a series of four indicator lights on the front panel.	 A small, grey, rectangular transmitter unit with a curved top and a small opening on the side.
Receiver cable and adaptor	Strap for mounting transmitters
 A coiled black cable with a car cigarette lighter adaptor and a small black plastic component.	 A black, flexible strap with a buckle, used for mounting transmitters.
Receiver with mounting bracket and suction cups	Transmitter mounted on wheel
 The receiver unit mounted on a black plastic bracket with two suction cups for attachment.	 A close-up view of a transmitter unit mounted on a tire, showing the tire tread and the wheel rim.

Pressure Alert Systems – 2 and 4 wheels – Multi-fit Valve Mount Transmitters

Kit # 060.2004 (4 wheel) Product B

Kit # 060.2002 (2 wheel) Product I

Overview

These kits contain a base receiver, two or four valve mounted transmitters, installation hardware and documentation for use on tires with a pressure up to 83 PSI (gauge).

The transmitters transmit pressure and temperature data when the vehicle attains a speed of 10 kph. Tire pressure and temperature are checked every six seconds and data is transmitted every 5 minutes.

The receiver annunciates a pressure loss incident at two severity levels. The initial warning occurs when the pressure has dropped a set amount below the required pressure. A second warning occurs when the pressure has dropped to a level considered critical to the support of the vehicle. The affected tire is identified with a colour coded indicator on the receiver, corresponding to the same colour code on the valve of the respective tire.

An optional serial port can send transmitter data to another customer device.




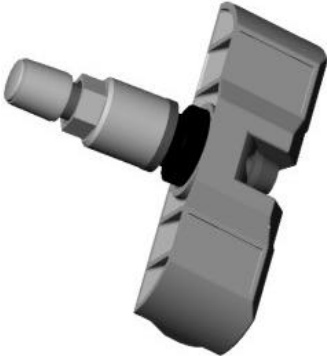


To install the system attach a transmitter to a suitable valve and mount in the valve hole. Plug the receiver into the cigarette lighter plug with the supplied cable.

Note: Valves are not included with the kit.

Bill of Materials

Component Images

NOTE: Valve not included in kit

Receiver	Transmitter
 A black, rectangular receiver unit with a curved top and a small display or indicator on the front.	 A grey, rectangular transmitter unit with a central circular opening.
Receiver cable and adaptor	Transmitter mounted with valve
 A coiled grey cable with a car cigarette lighter plug and a small black adaptor.	 A grey transmitter unit with a valve stem attached to its side.
Receiver with mounting bracket and suction cups	Transmitter mounted on wheel
 A black receiver unit mounted on a grey plastic bracket with two suction cups.	 A close-up view of a transmitter unit mounted on the inner rim of a silver wheel.

Pressure Alert Full Function Display

Kit # 061.4000 LCD-I

Kit # 061.4001 LCD-R

Overview





The full function display is used with any existing system to extend the functionality of the basic tire pressure monitoring system up to 20 tire positions. It provides a digital pressure and temperature readout as well as diagnostic data such as transmitter battery life for each tire. The user can also set his own pressure warning levels and adjust other parameters to suit a particular tire.

Two models of the LCD exist, differing by their method of connecting to the base receiver. The LCD-I clips onto the front of the receiver, while LCD-R is connected via a 6 ft. interconnecting cable.

To install, remove the basic receiver bezel. Clip the LCD-I unit onto the front of the base receiver (or connect the cable in the case of the LCD-R).

Bill of Materials

Component Images

LCD-I	LCD-R
	
LCD-I mounted with receiver	LCD-R with cable to receiver
	

Pressure Alert Flexible Power Adaptor

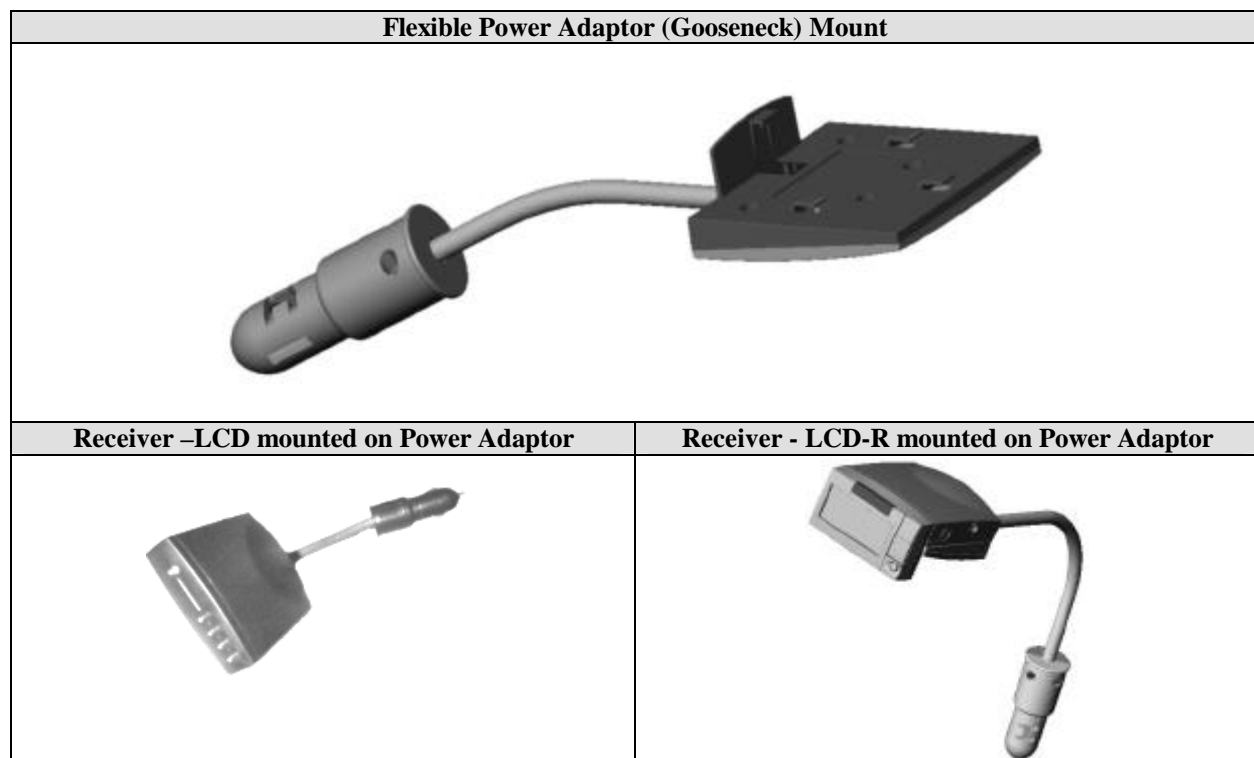
Kit # 061.3000

Overview

A flexible power adaptor is plugged into the cigarette lighter socket and the receiver is mounted on it so that it can be positioned by the driver for the best viewing position.

Bill of Materials

Component Image



Pressure Alert Transmitter Kit – 2 - Multi-fit Strap Mount Transmitters

Kit # 061.1002



Overview

This kit consists of two strap-mount transmitters and installation hardware and instructions for installation. It is intended to expand an existing installation.

Note: If this kit increases the total number of transmitters on a vehicle to greater than four, then the full function display must also be installed to view all tire positions.

Bill of Materials

Component Image

Strap-mount transmitter	Strap
	

Pressure Alert Transmitter Kit – 2 - Multi-fit Valve Mount Transmitters

Kit # 061.2002

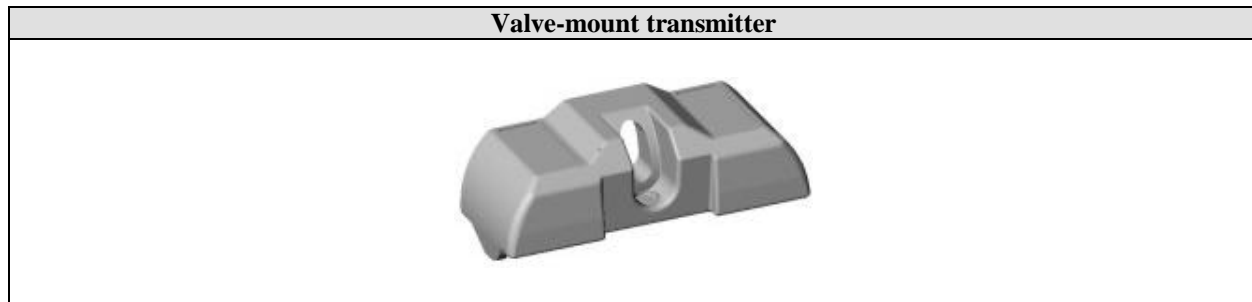
Overview

This kit consists of two strap-mount transmitters and installation hardware and instructions for installation.

Note: If this kit increases the total number of transmitters on a vehicle to greater than four, then the full function display must also be installed to view all tire positions.

Bill of Materials

Component Image







Pressure Alert Valve Kits

Overview

These kits consist of two alligator valves of differing length for use with valve-mount transmitter kits.

Component Image




Pressure Alert 2 Valve Kit – A	Kit stock code 063.2000
	
Pressure Alert 2 Valve Kit – B	Kit stock code 063.2001
	
Pressure Alert 2 Valve Kit – C	Kit stock code 063.2002
	
Pressure Alert 2 Valve Kit – D	Kit stock code 063.2003
	

Receiver

Operation

Ensure the receiver is plugged in. After power is applied the lights flash red, green, then amber. They continue to flash amber until signals are received from the tire transmitters which transmit pressure data shortly after the vehicle starts to move (at speeds greater than 10kph).. Then all will turn off except the system light (left most light).

The receiver is preset to initiate warnings at two levels of tire pressure. Typical settings are 24 PSI to initiate a **Low Pressure Alert** and 18 PSI to initiate a **Low Pressure Warning**. Check your kit documentation for the settings for your receiver.

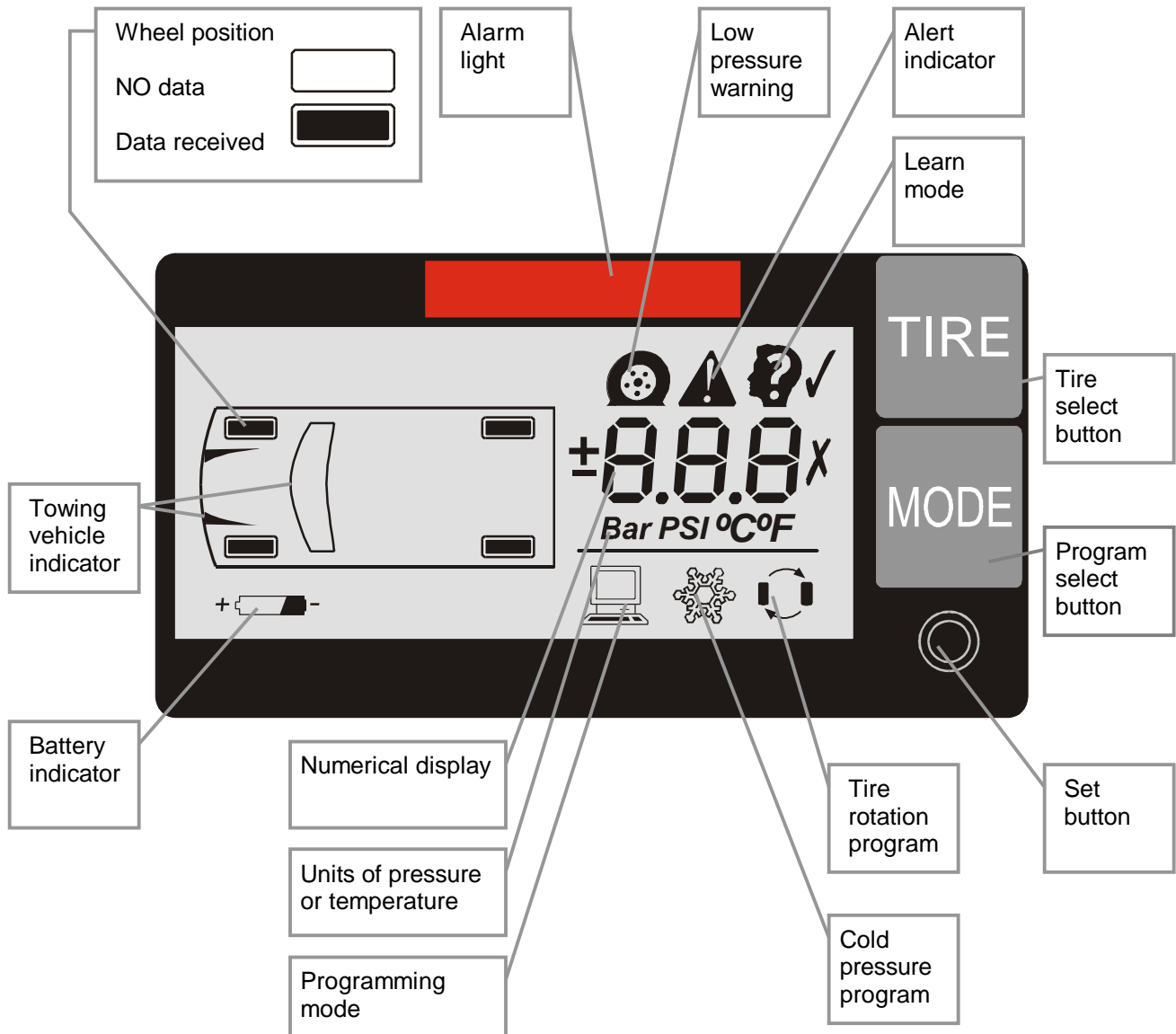
	<p>When transmissions are received amber tire lights turn off one at a time and finally system led turns green and stays on steady.</p>
	<p>System light is on green. Normal condition with no alerts on any tire.</p>
	<p>On Low Pressure Alert, there is a long beep, the tire light turns red and stays red.</p> <p>On Low Pressure Warning, the receiver beeps five times, with accompanying red light. Then red light flashes. After one minute receiver beeps five times. Continues until tire condition is corrected. Then light turns off.</p>

Programming the Receiver
























The factory settings for Low Pressure Alert and Low Pressure Warning can be changed with the multi-function display. When a new transmitter is installed its ID must be programmed into the receiver for it to be able to receive data. This is done with the Learn Mode of the multi-function display.

Multi-function Display (MFD)

Controls and Display



ICON Summary Table

Name	Icon	Description
Battery Indicator		Diagnostic mode, used to display battery voltage for a selected sensor
Battery Text (“bat”)		Diagnostic mode, used to display battery voltage for a selected sensor
Check Mark		
Cold Pressure Setting		Programming Mode, Cold Pressure Setting
No data received		No data has been received (pressure, temperature or battery voltage)
Error Code (1)		Sensor fault detected
Error Code (2)		EEPROM fault
Error Code (3)		Oscillator fault
Alert		Display when a pressure alert has been detected. Used in programming pressure alert limit.
Low Pressure Warning		Display when a pressure warning has been detected. Used in programming pressure warning limit.
Numeric Display		Displays numerical value of pressure, temperature and other functions.
Pressure Deviation		When on indicates that the numerical value of the display is a pressure deviation.
Pressure Units		Pounds per square inch, Bars
Programming Mode		LCD unit is in programming mode.
Sensor Alarm		Sensor alarm is detected.
Slope		During programming mode, setting of slope
Temperature Units		Celsius or Fahrenheit degrees are selected
Tire ID Learn		Inner part flashes during ID learn mode
Tire Position Programmed		Tire position programmed, no data received
Tire Position Signal Received		Programmed tire position has received pressure data. (Inner part is on steady)
Tire Rotation		Programming mode, tire rotation mode
Towing vehicle indicator		At least one of the 10 towing vehicle sensors has transmitted
X Mark		

Multi-function Display Operation Modes

The Multi-function display extends the functionality of the basic tire monitoring system from four to twenty wheel positions. Digital readouts for pressure, temperature and temperature-compensated pressure alerts are provided for each wheel position.

The MFD is required when the receiver must be programmed to accept the new ID number of a replacement transmitter (Learn Mode) and to change the alert settings in the receiver.

Mode Summary

Stand-By mode	System wheel data status and configuration
Regular mode	View condition of a selected tire
Programming mode	Program cold pressure, tire rotation, (3) alert settings, units
Diagnostic modes	Slope, battery voltage, learn mode
Hidden Programming mode	Set receiver low pressure alert threshold

Power Stages

The MFD has an energy saving feature that turns lights on to full intensity only when required to display alert conditions or program the unit. The unit automatically switches to lower power stages when no data transmissions or control activity is detected.

Active stage Back light is on, LEDs (alarm light and button lights) at full intensity. Entered when any button is pressed or a valid packet is received in low-power stage.

Half-power stage Back light is off, LEDs (alarm light and button lights) dimmed
Default stage after power-up. This stage is entered when no button is pressed in 5 minutes

Low-power stage All lights are off (will activate when a button is pressed or transmission received). Entered when no valid data packet is received in 20 minutes.

In stand-by mode the MFD will be in one of the three power stages. In all other modes the MFD will be in the active power stage.

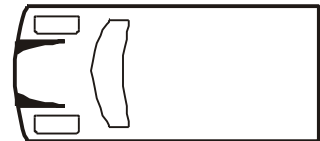
Stand-By Mode

The stand-by mode is the state of the multi-function display showing the system status, i.e. whether or not data has been received from installed transmitters. The screen is blank if no data has been received from any transmitter. A button must be pressed in this mode to enter the other modes. Specific data for a selected wheel position is obtained in the regular mode.

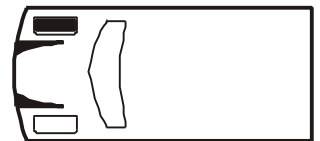
No data has been received from any installed transmitter.



The outline of an axle is displayed if at least a tire of that axle has a pressure or temperature transmission.



The tire with pressure or temperature data received is filled in. The outline of a tire with sensor fault flashes. If at least one of the ten tires of the towing vehicle has a transmission, the louver and the windshield are shown.



Regular Mode

This mode displays the specific pressure, temperature and alert condition of a selected wheel position. The display can be set to show pressure in PSI or BAR and temperature in °C or °F. Icons indicate the type of alert or warning.

From Stand-By mode press the TIRE button to enter the regular mode. Press the TIRE button to cycle through the tires. Press the MODE button to cycle through the pressure, temperature, and pressure deviation readings for a selected tire.

The alarm light will turn on if a tire with pressure or temperature problem is selected, and the appropriate warning icons are displayed. Press the SET button or the TIRE and MODE buttons together to go back to Stand-By mode. If no button is pressed in 5 minutes, the system will go back to Stand-By mode.

A wheel position that has not transmitted data cannot be selected even if it was previously programmed to accept a transmitter. The tire outline flashes when a sensor fault was detected.

Programming Modes

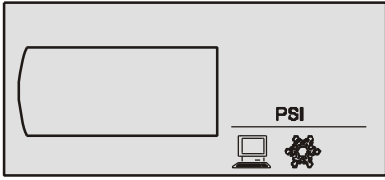
Standard Operating Settings – Level 1

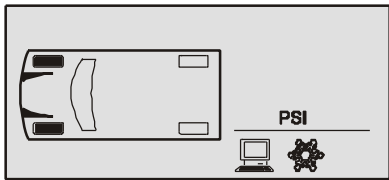
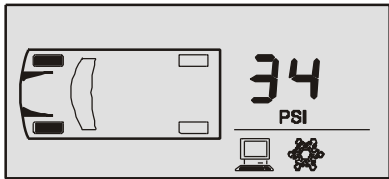
- Cold Pressure
- Tire Rotation
- Low Pressure Warning
- Pressure Deviation
- Temperature Alert
- Units Selection

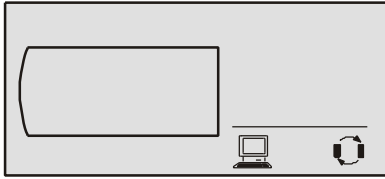


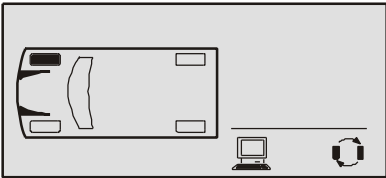
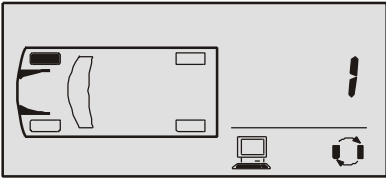
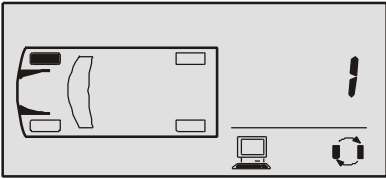

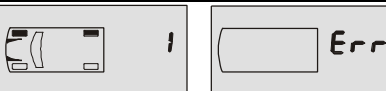
To Enter Programming Mode

1. Enter Standby mode
2. Press Set button
3. Cold Pressure Program mode is entered
4. Use MODE button to scroll the possible settings.
5. Press Set button to get back into Standby mode.

<p>Cold Inflation Pressure</p>	
<p>This function changes the cold inflation pressure for each axle.</p>	

	<p>To choose this mode press the TIRE button when the pressure unit and the snowflake icon are displayed.</p>
	<p>Press the TIRE button to scroll to the desired axle. The tires of the selected axle are filled in.</p> <p>Press the MODE button to view the current value.</p> <p>Press the TIRE or MODE button to increase and decrease the value respectively. Minimum is 5 PSI and maximum is 92 PSI.</p>
	<p>When the desired value is set, press the SET button to save and return to the axle selection menu. Scroll to a different axle using the TIRE button again, or press the SET button to exit this mode.</p>

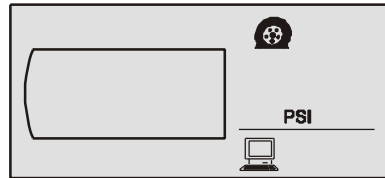
<p>Tire Rotation</p>	
<p>After a tire rotation the receiver needs to be reconfigured to accept existing tire ID numbers from the new locations. The color code on the transmitter and valve correspond to a sensor number.</p>	

	<p>To choose this mode press the TIRE button when the tire rotation icon is displayed</p>
	<p>The tire outline indicates the installed sensors. The selected tire location is filled-in. Use the TIRE button to scroll to the desired tire location.</p>
	<p>Press the MODE button to select it for editing. A number representing each sensor is shown (e.g. a 2 corresponds to sensor #2). Press the TIRE or MODE button to increase or decrease the value respectively.</p>
	<p>Press the SET button when the number representing the desired sensor is achieved. This returns the display to the tire selection menu. Scroll to a different tire location and edit the sensor numbers. When all the changes are done, press the SET button to save and exit this mode.</p>
	<p>If more than one tire location contain the same sensor number, the display will prompt an error with the conflicting tires filled in and the associated sensor number.</p>
<p>(ID 1 programmed in two locations)</p>	<p>Press SET to return the tire selection menu and make necessary corrections.</p>

NOTE:

After removing a sensor from the system using the Learn mode (see Diagnostic Modes below), the sensor numbers may be changed.

Low-Pressure Warning



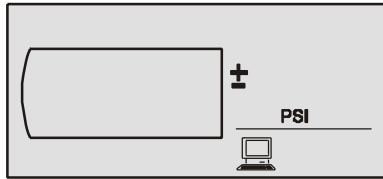
This function changes the low-pressure warning threshold for each axle.

A screenshot of the system's display. On the left, there is a top-down diagram of a car with four tires. The front-left tire is filled in. On the right, there is a flat tire icon, the text 'PSI', and a small laptop icon at the bottom.	<p>To choose this mode press the TIRE button when the flat tire icon and the pressure unit are displayed.</p> <p>The tires of the selected axle are filled in. Use the TIRE button to scroll to the desired axle.</p>
A screenshot of the system's display. On the left, there is a top-down diagram of a car with four tires. The front-left tire is filled in. On the right, there is a flat tire icon, the number '20', the text 'PSI', and a small laptop icon at the bottom.	<p>Press the MODE button to select the axle. The current value is shown. Press the TIRE or MODE button to increase or decrease the value respectively. Lowest is 5 PSI. Highest is 92 PSI. Hold a button down to scroll the values rapidly.</p>
	<p>When the desired value is set, press the SET button to save and return to the axle selection menu. Scroll to a different axle using the TIRE button again, or press the SET button to exit this mode.</p>

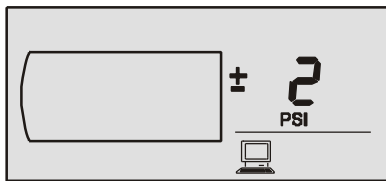
NOTE:

If this value is changed to exceed the low-pressure alert threshold, the alert threshold value will be adjusted so that the warning threshold value is not greater than the alert threshold value.

Pressure Deviation Alert

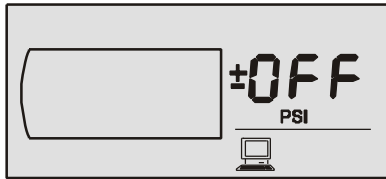


This function sets the pressure deviation alert threshold for all tires.



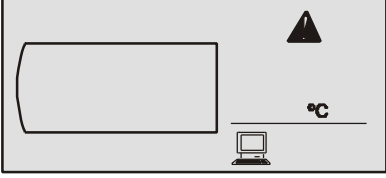
To choose this mode press the TIRE button when the +/- icon and the pressure unit are displayed.

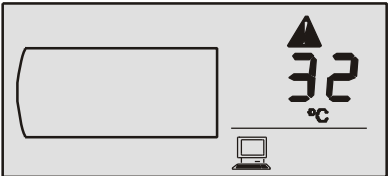
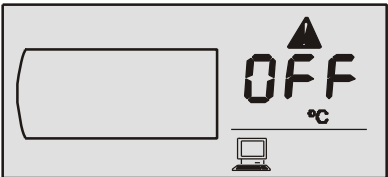
Press the TIRE button to display the current value. Press the TIRE or MODE buttons to increase or decrease the value respectively.

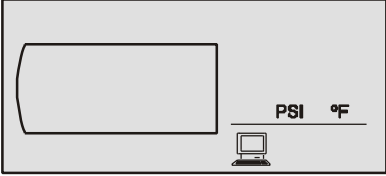


Press the MODE button until the display shows OFF to disable this feature.

Press the SET button to save the value.

High Temperature Alert	
<p>Change or turn off the high-temperature alert threshold in this mode.</p>	

	<p>To choose this mode press the TIRE button when the alert icon and the temperature unit are displayed. The current value of High Temperature Alert is displayed. Press the TIRE or MODE button to increase or decrease the value respectively. The minimum level is 86° F.</p>
	<p>Press the MODE button until the display reads OFF to disable this feature</p>
<p>Press the SET button to save the selected value.</p>	

Units	
<p>Use this mode to select the combination of pressure and temperature units.</p>	

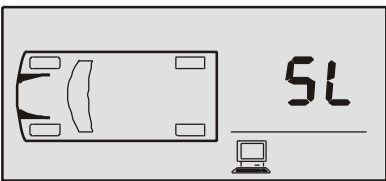
To choose this mode press the TIRE button when both the temperature and pressure units are displayed.

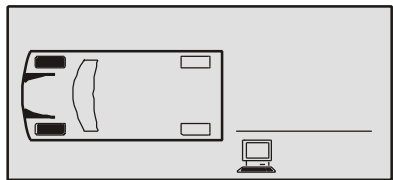
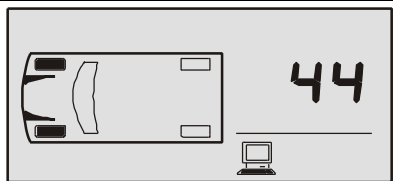
Use the TIRE or MODE button to scroll through the four combinations of unit settings. Press the SET button to save and exit this mode.

Diagnostic Modes - Level 2

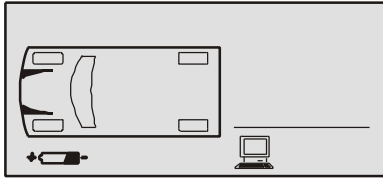
The following modes are found under the Diagnostic menu, which are accessed by holding the SET button in Stand-By mode or Programming menu for 5 seconds. The MODE button is used to scroll through each diagnostic mode.

- Slope (SL)
- Transmitter battery voltage (diagnostic function)
- Learn mode (set tire ID)

Slope		<p>Use this mode to change the slope value used to calculate the required pressure for each axle in this mode.</p>
--------------	--	--

	<p>To choose this mode press the TIRE button when “SL” is displayed.</p> <p>Press the TIRE button to select an axle.</p>
	<p>Press the MODE button to display the current value of slope for the selected axle.</p> <p>Press TIRE and MODE buttons to increase and decrease the value respectively. The minimum value is 10 and the maximum is 160.</p>
	<p>Press the SET button to save the value.</p> <p>Press the TIRE button to select another axle for programming.</p>

Battery Condition



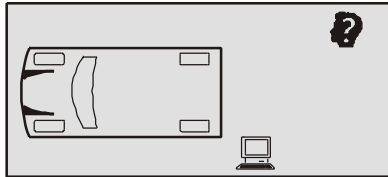
Use this mode to check the battery voltage level for each transmitter.

	<p>To view the transmitter battery voltage for a specific wheel location press the TIRE button to scroll to each location.</p>
	<p>If there is no voltage data received for a transmitter “---“ is displayed.</p>
<p>Press the SET button to exit this mode.</p>	

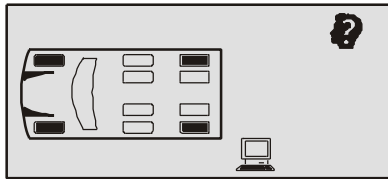
Learn



This mode is used to add or remove transmitters from the system.



Press the MODE button to select the learn mode icon. The currently installed positions are indicated with the tire outlines.



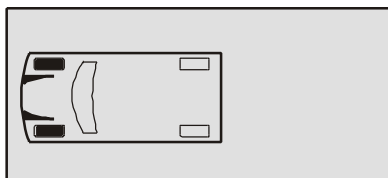
Press the TIRE button to display the ten possible wheel positions for the towing vehicle. The currently installed transmitter positions are now indicated with a filled in tire indicator.

The outline of the wheel position to be programmed will flash.

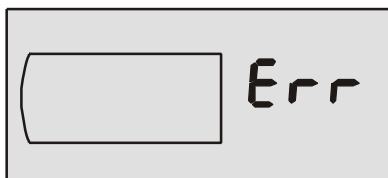
Use the TIRE button to scroll to the desired position.

To **add** a new transmitter ID at the selected position provoke a transmission from the transmitter. A beeper chirp and rapid flashing of the alarm light indicate a valid packet was received. The new ID is stored.

To **remove** the transmitter of the selected tire location press the MODE button.



If more than one tire location contains the same sensor ID, the display will prompt an error with the conflicting tires filled in.



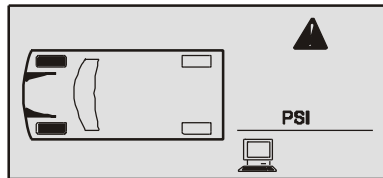
If no error is found, the tire map and the sensor type flags in the custom vehicle profile is updated. This operation is logged to the black box. All the fault flags and diagnostic counters stored in the EEPROM will be cleared. The system will reset and go to Stand-By mode.

WARNING:

Make sure that no transmitter other than the desired one has transmitted before moving on to the next tire location or exiting this mode.

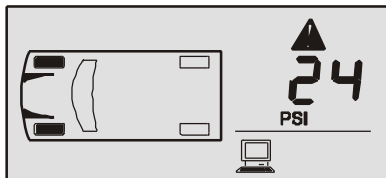
Hidden Programming Mode – Level 3

Low Pressure Alert



This mode sets the Low Pressure Alert and is used only by the receiver.

Hold the SET button for 10 seconds. The screen will show the diagnostic menu after 5 seconds. Another 5 seconds later, the warning icon and the pressure unit are displayed



Use the TIRE button to scroll to the desired axle. The tires of the selected axle are filled in.

Press the MODE button to display the current value of the selected axle. Press the TIRE or MODE button to increase or decrease the value respectively. The lowest value is determined by the setting of the Low Pressure Warning. The highest is 92 PSI.

When the desired value is set, press the SET button to save and return to the axle selection menu.

Scroll to a different axle using the TIRE button or press the SET button to exit this mode.

Checking Tire Conditions

Startup

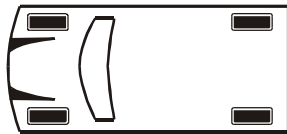
When power is applied a single beep accompanies all ICONS and lights turning on. Then screen blanks and only button lights stay on green.

Vehicle motion initiates data transmission from the wheel transmitters. The MFD windshield symbol (and louver) turn on, followed by each of the tire position icons. The windshield symbol indicates that data is coming from the towing vehicle transmitters.



Standby mode

Display after power up with no transmissions yet received.



Standby mode

This vehicle display indicates that transmissions have been received from all four transmitters of the *towing* vehicle.



Standby mode

This vehicle display indicates that transmissions have been received from both transmitters of the *towed* vehicle.

Detecting Abnormal Tire Pressure

The MFD alerts the driver of abnormal tire pressure with a Pressure Deviation Alert or a Low Pressure Warning.

Understanding Temperature Compensated Pressure Readings

An important feature of the SmarTire (MFD) system is that pressure alerts are initiated from a temperature compensated pressure calculation rather than on the actual pressure read by the sensor.

The reference pressure, or “cold pressure” is the air pressure inside the tire inflated at room temperature (18° C) to the tire manufacturer’s recommendation. A tire that heats up, for example to 28° C, will increase the air temperature inside the tire, resulting in increased air pressure. For example a normal or “required” pressure at 18° C may be 34 PSI and a normal pressure at 28° C may be 36 PSI. Both pressure readings are correct at their respective temperatures.

The amount of deviation from the required pressure (at any temperature) can be read by using the Pressure Deviation mode of the MFD. If at any time you are uncertain that the Actual Pressure reading on the display indicates the correct tire pressure, switch to the Pressure Deviation (+-) readout. A blank display indicates that the reading on the display is the correct one. Any (+) or (-) value indicates the tire pressure is incorrect by that value.

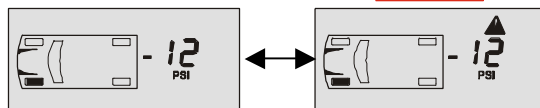
The Pressure Deviation Alert is temperature compensated.
The Low Pressure Warning is not temperature compensated.

Pressure Deviation Alert



PSI | Bar

The **Pressure Deviation Alert** is initiated when the actual pressure of a tire deviates by more than the amount programmed for the vehicle. For example this will occur if the MFD is set for +/- 2 PSI and the actual pressure drops to 24 PSI (from the required pressure of 34 PSI).



Alternating display

The MFD issues one beep. The alarm light and alert icon flash on and off. The digital readout displays the amount of deviation (-12 PSI) from required pressure. Press any button to stop the flashing and leave the alarm light on.

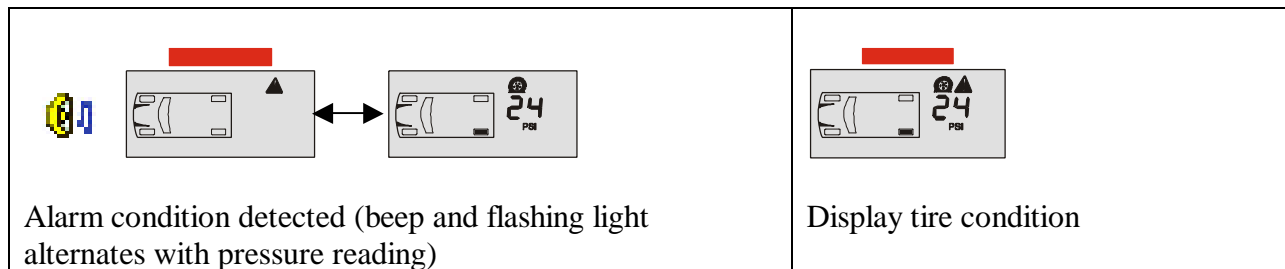
Low Pressure Warning



PSI | Bar

A **Low Pressure Warning** is initiated when the actual pressure drops below the value programmed for the wheel on that axle. For example if the setting is 26 PSI for the rear axle and an actual pressure of 24 PSI is detected, the MFD will initiate a Low Pressure Warning.

The beeper turns on and off continuously and the alarm light flashes. Press a button to stop the beeping and flashing. The display reverts to standby with the alarm light on continuously. Press the tire button to find the affected tire. The flat tire icon, the alert icon, PSI, the pressure reading and alarm light will all be on.



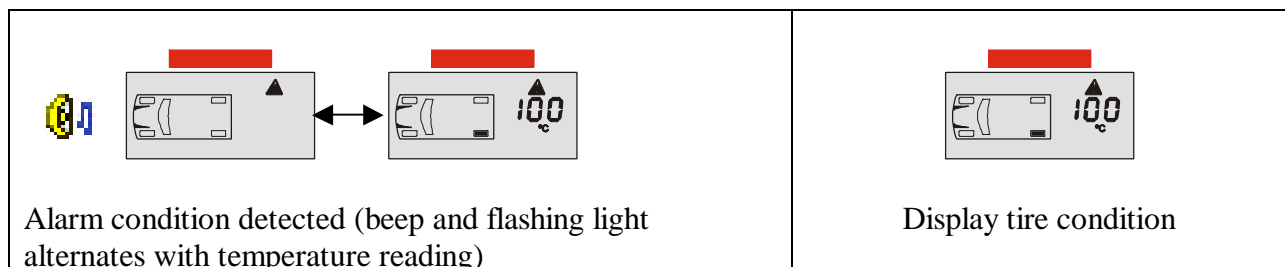
Detecting Excessive Tire Air Temperature

High Temperature Warning



°C | °F

The MFD reads the temperature value sent by the wheel transmitters and compares it to a programmed setting. If the actual temperature exceeds this setting the High Temperature Alert is initiated.



Installation

Valve Mount Transmitter

Procedure Overview

1. Deflate and demount the tire.
2. Verify that the wheel can accept a valve mount transmitter
3. Install the transmitter.
4. Mount the tire and inflate to the proper pressure.

Alligator Valve Selection Process and Verification of Proper Assembly Fit

Internal Visual Inspection of the Wheel or Rim

- 1. Confirm location of drop-center:**
 - Is it nearer to front or back side of the wheel? –
 - If near front, use the strap mount sensor.
 - If near back, continue.
- 2. Confirm location of the valve:**
 - Is it beside the drop-center well, but at no more than a 10-degree angle? –
 - If more than 10-degrees, use the strap mount sensor.
 - If close, then continue.
- 3. Confirm diameter of valve hole in the wheel:**
 - Is it 0.453” (11.6MM)?
 - [The only next closest standard sizes are 0.327” (8.38MM) and 0.625” (16.03MM)] –
 - If smaller/larger, use the strap mount sensor.
 - If confirmed 0.453” (11.6MM) diameter, then continue.
- 4. Confirm available clearance for the valve attachment nut:**
 - Is there 0.625” (16MM) diameter?
 - [This clearance is adequate in most cases, but there are some wheels in the market where we have found the anchor nut and washer to be 0.060” (1.5MM) too large.] –
 - If less, then use the strap mount sensor.
 - If more, then continue.

5. Confirm maximum rim thickness at valve clamping area:

- Is it 0.156" (4MM)?
- [Normally not a problem with a 0.453" diameter valve hole] –
- If greater, then use the strap mount sensor.
- If less, then continue.

6. Confirm depth of the drop-center well near the valve hole:

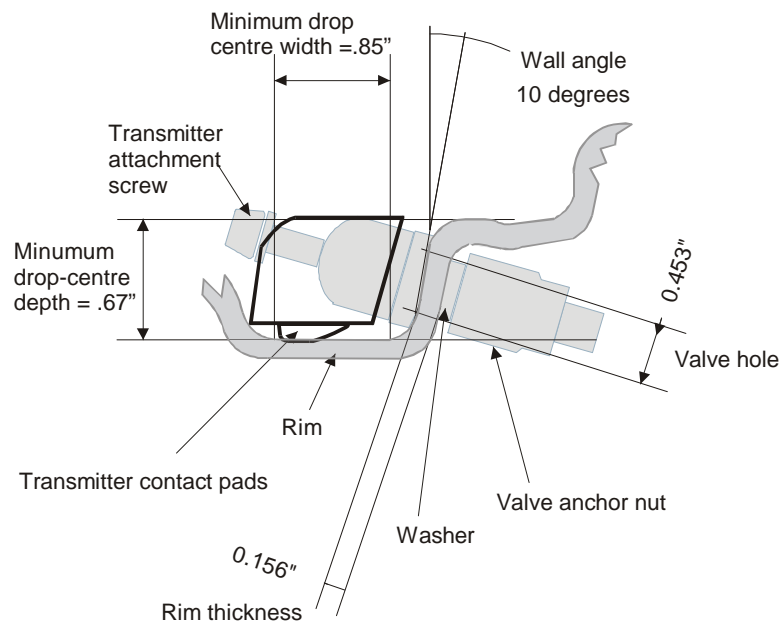
- Is it 0.67" (17.3MM) below the humps of the bead seats?
- If shallower/deeper, then consider using the strap mount sensor.
- If OK, then continue.

7. Confirm width of the flat base of the drop-center well:

- Is it at least 0.85" (22MM)?
- If less, then installation of either the valve or strap mount sensor may not be possible.
- If OK, then continue.

8. Confirm relative position of the valve grommet-sealing surface of the valve hole of the adjacent side or top edge of the drop-center well:

- Is valve hole recessed 0.25" (6MM)?
- If recessed considerably more, then use the strap mount sensor.
- If essentially flush or less, then continue.

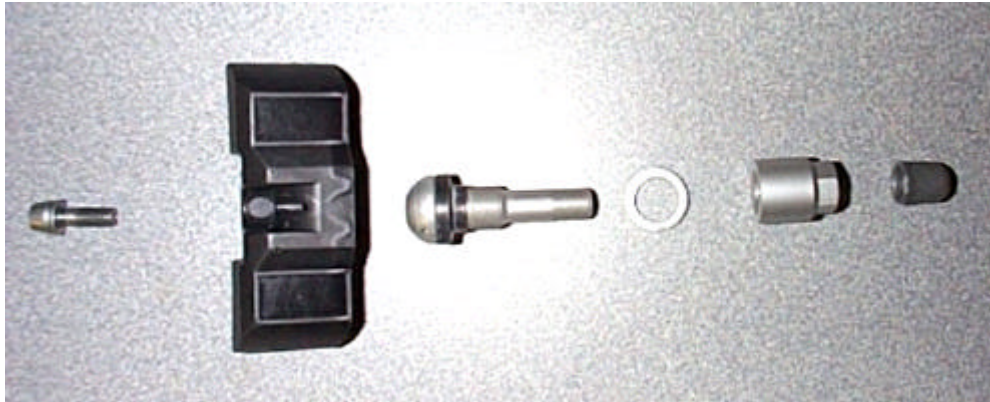


Alligator Valve Selection and Fit Verification

1. Start by using the valve assembly with longest of the three bases (Alligator #59.0054)
2. Remove the sensor attachment screw and install the valve body (into valve hole from the front side), washer and nut. Finger-tighten the nut until grommet is evenly seated. Make sure the fit of the valve body/grommet and the clearance of the washer/nut with respect to wheel.
3. Place the sensor's spherical mounting surface against the matching surface of the valve. Pivot the sensor housing toward the bottom of the drop-center well until both contact pads rest on the wheel. Confirm that the sensor's only contact with the wheel is at the two contact pads. Note the clearance between the sensor housing and the side of the drop-center well, including the bottom radius. This space should be approximately 0.080" (2MM).
 - If clearance is greater than 0.25" (6MM), consider using a valve with a shorter base.
 - If the clearance is between 0.25" and 0.44" (6.7MM and 11.3MM), switch to the valve assembly with the next shorter base (Alligator #59.0044).
 - If the clearance is greater than 0.44" (11.3MM), then utilize the valve assembly with the shortest base (Alligator #59.0034).
 - If no additional valve selections are available, then use the strap mount sensor.
4. Repeat the above procedure to verify housing clearance at both the top and bottom of the drop-center well.
5. Check the position of the valve attachment hole in the base of the valve body relative to the housing adjustment slot:
 - Is hole completely visible with the housing firmly seated against both the wheel and valve?
 - If the hole is not completely visible, then use the strap mount sensor.
 - If the hole is completely visible with some adjustment remaining, then continue.
6. Tighten valve anchor nut to a torque value of 36 in.-lb. (4+/-0.05Nm).
 - [Note: It is very important to tighten the valve anchor nut to the defined torque value prior to tightening the sensor attachment]
7. Assemble sensor housing and attachment screw onto the base of the valve. Before tightening, hold sensor housing snugly against both the valve and the bottom of the wheel's drop-center well. Tighten the sensor attachment screw to a torque of 36 in.-lb. (4+/-0.05Nm). Visually confirm that clearance remains between the top and bottom corners of the sensor housing and the wheel surface.

8. Finally, clearance between the sensor body and the side of the wheel's drop-center well should be at least 0.040" (1MM), and the housing contact pads at each end of the sensor housing are seated against the base of the drop-center well.
9. Install appropriate colored washer onto valve stem if required.

Transmitter and Valve Components



Transmitter/Valve Assembly on Wheel



Strap Mount Transmitter

Process Overview

1. Ascertain that the wheel can accept a strap mount transmitter.
2. Deflate and demount the tire.
3. Install the transmitter
4. Mount the tire.
5. Inflate the tire to the proper pressure.


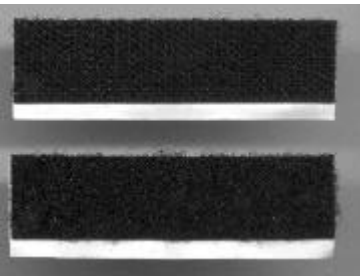


Base Receiver Installation

The receiver needs an electrical connection to the vehicle 12 volt power and it needs to be attached somewhere within view of the driver. The power connection may be made with the power cable supplied with every receiver or by using the gooseneck power adapter.

The only consideration to watch for is that the receiver turns on when the vehicle is started. When the receiver turns off the last pressure indications are not saved. New data must be received from the wheel transmitters, i.e. the vehicle must be driven for 5 or more minutes to get fresh data from all tires.



A bracket with suction cups supplied are intended for the receiver to be mounted on the windshield in front of the driver. Two Velcro pads supplier enable the receiver to be attached in other locations convenient to the driver.

Bracket and suction cup method	Velcro pads
	

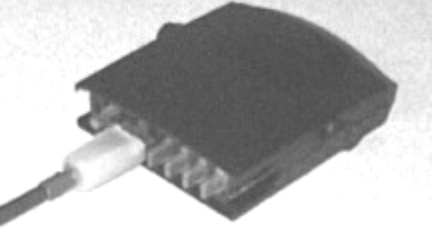
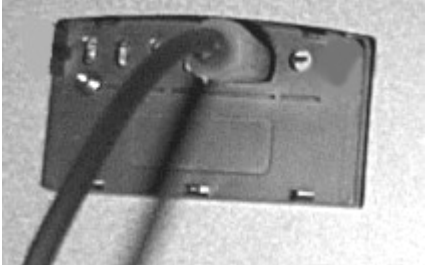
LCD unit Installation

The LCD unit comes in two models, one which integrates into the base receiver by clipping to its front panel and other type which is connected remotely to the receiver via a 6' cable.

To install the either LCD type, first remove the front bezel of the base receiver. Plug the LCD-I type in place of the bezel.

Remove bezel from receiver	Clip LCD-I onto front of receiver
	

For the remote version plug one end of the cable into the exposed connector on the base receiver and the other end into the back of the LCD-R type. Observe proper polarity.

Receiver cable end plug	LCD cable end connection
	

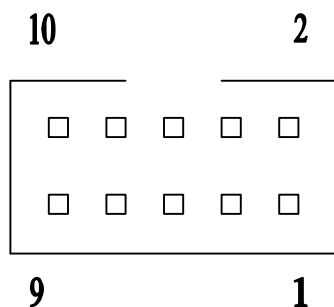
Power Shoe Installation

- Plug the power shoe connector into the cigarette lighter or an auxiliary plug in the vehicle.
- Remove the battery cover from the back of the receiver.
- Push the receiver onto the power adaptor.
- Adjust the power adaptor flexible arm to a convenient viewing angle.

Connection to External Systems

Interface; IPC to RS232

GEN II BATTERY CONNECTOR PIN DESIGNATIONS



Battery connector as seen from the rear of PCB.

PIN #	DESIGNATIONS
1	Open collector output (P2-4) - Diagnostic
2	E-I2C-CLK Communication (Clock)
3	Open collector output (P2-2) – Pressure alert
4	E-I2C-DAT Communication (Data)
5	No Connection
6	No Connection
7	Vin (supply voltage)
8	Ground
9	Battery pack input (4.5V)
10	Ground

Note:

- All open collector outputs can drive up to 50 mA max.
- Communication lines are level shift protected.
- Vin (supply voltage) 8.5Vdc to 26 Vdc max.
- Battery pack is comprised of 3 – 1.5V AA batteries (4.5Vdc)
- Connector used on Receiver PCB: SAMTEC:TML-105-02-G-D-RA
- Mating connector for above: SAMTEC:SMS-105-01-G-D

Technical Specifications

Base Receiver

Power Consumption	125 ma. maximum during alert
Operating Temperature Range	-40° F to 185° F (-40° C to 85° C)
Storage Temperature Range	-40° F to 185° F (-40° C to 85° C)
Frequency	433.92 MHZ \pm 75 kHz
Size	2.85" H x 3.08" D x .87" W
Weight	67 gm
Operating Humidity	100 % non condensing
Number of indicators	One multi-colored LED for each tire

LCD Full Function Display

Power Consumption	60 ma. maximum during alert (with receiver)
Operating Temperature Range	-20° F to 185° F (-40° C to 85° C)
Storage Temperature Range	-20° F to 185° F (-40° C to 85° C)
Size	2.8" W x .74" D x .164" H
Weight	43 gm.
Operating Humidity	100 % non condensing
Number of indicators	Full function 3-digit LCD display

Power Shoe

To be determined

Battery Pack

System under design

Transmitters – Strap Mount

Battery Life (Projected)	8.5 Years (normal vehicle use)
Operating temperature range	-40° F to 185° F (-40° C to 85° C)
Storage temperature Range	-40° F to 185° F (-40° C to 85° C)
Operating humidity	100%
Data transmitted	Pressure, temperature, battery voltage
Data transmission rate	Every 4 to 6 minutes (more frequently during a pressure loss incident)
Weight	To be determined
Size	To be determined
Frequency	433.92 Mhz
Pressure Range	90 PSI absolute (75 PSI gauge)
Pressure accuracy	+/- 2 PSI
Temperature accuracy	+/- 3 °C
Start-stop mode	Vehicle motion greater than 10kph
Method of mounting	Strap around the drop center of wheel

Transmitters – Valve Mount

Battery Life (Projected)	8.5 Years (normal vehicle use)
Operating temperature range	-40° F to 185° F (-40° C to 85° C)
Storage temperature Range	-40° F to 185° F (-40° C to 85° C)
Operating humidity	100%
Data transmitted	Pressure, temperature, battery voltage
Data transmission rate	Every 4 to 6 minutes (more frequently during a pressure loss incident)
Pressure Range	90 PSI absolute (75 PSI gauge)
Weight	23 gm. (without valve which is 20 gm.)
Size	To be determined
Frequency	433.92 Mhz
Pressure accuracy	+/- 2 PSI
Temperature accuracy	+/- 3 °C
Start-stop mode	Vehicle motion greater than 10kph
Method of mounting	Mounted on valve

Service and Warranty

Replacing a Transmitter – Valve and Strap Mount

1. Remove the existing transmitter
2. Install the new transmitter using the installation procedure in this manual.
3. Set the multi-function display into learn mode.
4. Spin the tire to provoke transmission.
5. Verify the system functions properly.

Replacing a Receiver

1. Unplug the existing receiver
2. Plug in a multi-function display and set into learn mode
3. Spin each tire in sequence to allow the new receiver to learn the ID codes of the transmitters.
4. Verify the system functions properly.

Replacing a Full Function Display

1. Remove power.
2. Unplug the existing display.
3. Plug in the new one in its place.

SmarTire Service Policy – Handling Returned Materials

To return any materials to SmarTire, call SmarTire Service at 1-800- to receive a Returned Material Authorization number (RMA). Follow instructions given by the service department for packaging and shipping the product back.

Note: *Shipments by air required the use of SmarTire approved shielding material to prevent radio transmissions in the aircraft.*

Limited Warranty (US)

NOTE: This warranty statement is currently under revision.

This Warranty covers substantial manufacturer's defects in workmanship and materials. It does not cover any unit that is damaged beyond normal usage, was not properly installed, was subjected to chemical contact, or other acts or omissions not sanctioned by the Owner's Manual.

All components are covered for three (3) years and 50,000 miles following the date of installation or five (5) years from date of manufacture, whichever comes first.

The SmarTire™ Warranty will be honored by any authorized SmarTire™ dealer. The owner is required to provide dated proof of purchase. The authorized dealer will determine if there is a warrantable condition associated with materials and/or manufacturing workmanship. If a warrantable condition exists, the component will be replaced free of charge, shipping prepaid. The owner is responsible for any labor and installation charges.

A completed Warranty Claim Form must be sent, postage prepaid, with the defective unit to SmarTire.

The Warranty does not include any further obligation whatsoever, including but not limited to actual installation of the replacement unit on the customer's vehicle.

All other Warranties express or implied, are disclaimed. All collateral agreements, which purport to modify this Limited Warranty, are of no effect. The absolute limit of liability is the purchase price of the unit. SmarTire Systems Inc. is not liable for any direct, consequential, indirect or punitive damages of any kind.

SOME STATES DO NOT ALLOW LIMITATIONS ON THE VALIDITY OR LENGTH OF IMPLIED WARRANTIES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

THIS WARRANTY GIVES YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY HAVE OTHER RIGHTS WHICH VARY FROM STATE TO STATE.

Warranty (Canada)

NOTE: This warranty statement is currently under revision.

This Warranty covers substantial manufacturer's defects in workmanship and materials. It does not cover any unit that is damaged beyond normal usage, was not properly installed, was subjected to chemical contact, or other acts or omissions not sanctioned by the Owner's Manual.

All components are covered for three (3) years and 80,000 kilometers following the date of installation or five (5) years from date of manufacture, whichever comes first.

The SmarTire™ Warranty will be honored by any authorized SmarTire™ dealer. The owner is required to provide dated proof of purchase. The authorized dealer will determine if there is a warrantable condition associated with materials and/or manufacturing workmanship. If a warrantable condition exists, the component will be replaced free of charge, shipping prepaid, if within the applicable warranty period. The owner is responsible for any labor and installation charges.

This notice must be sent, postage prepaid, with the defective unit to SmarTire Systems Inc. 13151 Vanier Place, Suite 150, Richmond, British Columbia, CANADA, V6V 2J1. Phone 1-604-276-9884.

The Warranty does not include any further obligation whatsoever, including but not limited to actual installation of the replacement unit on the customer's vehicle.

ALL OTHER WARRANTIES AND CONDITIONS, EXPRESS OR IMPLIED, INCLUDING WARRANTIES AND CONDITIONS FOR MERCHANTABILITY, DURABILITY OR FITNESS FOR PURPOSE, ARE DISCLAIMED. ALL COLLATERAL AGREEMENTS WHICH MODIFY THIS SOLE WARRANTY ARE OF NO EFFECT. SMARTIRE SYSTEMS INC. IS NOT LIABLE FOR ANY DIRECT, CONSEQUENTIAL, INDIRECT OR PUNITIVE DAMAGES. THE ABSOLUTE LIMIT TO LIABILITY IS THE PURCHASE PRICE OF THE UNIT.

Regulatory Requirements

FCC Identification

See notice at beginning of manual.

European Requirements

To be determined on a country by country procedure.