Tire Pressure Monitoring System
User's Manual

1. Introduction

The major components of the TPMS are: one sensor per tire, a rechargeable battery operated monitor, and a signal booster. Each sensor is installed in the tire and continuously monitors the tire pressure and temperature, and transmits the readings wirelessly via RF signals to the monitor, which displays the tire information on its LCD screen. Upon detection of abnormal tire conditions the sensor immediately issues a warning signal. The monitor receives the signal and displays tire alarm status and, if necessary, issues an audible alert and turns on the status lamp on the monitor.

2. The Monitor

The monitor is the interface between the TPMS and the user. The monitor LCD screen has a graphical representation of the vehicle with individual tire icons. It also displays temperature and pressure readings and shows tire status icons when something happens

There is a SMA connector on the left edge for external antenna connection. A status LED is located on the upper right side of the monitor. Below the status LED there are three buttons: **SET**, **CTRL**, and **MODE**:

- *Press the **SET** button will call up the next tire pressure and temperature readings in succession from vehicle left to right and front axle to rear, with a darken tire icon on the vehicle graphic*

indicating the associated tire location. If there is a trailer then the trailer screen will be displayed after the truck screen.
- *Press the **CTRL** button will turn on/off the LCD backlight*
- *Press and hold the **MODE** button for 3 seconds will get into the programming mode; press the **MODE** button again before mode selection will return to normal operation. Programming instructions will be described in a later section.*

2.1 Charge The Monitor Battery

The monitor has a rechargeable battery that can be safely charged with the included vehicle auxiliary power adapter, plugging into the USB connector on the backside of the monitor. A battery icon showed on the screen indicates the charging activity, and will be removed when the battery is fully charged. The monitor can also be charged though a standard mini-USB cord connecting to a digital device such as a laptop computer. The monitor can only take on maximum power input of **5.5 volt DC**. An AC-to-DC power conversion charger is available for ordering.
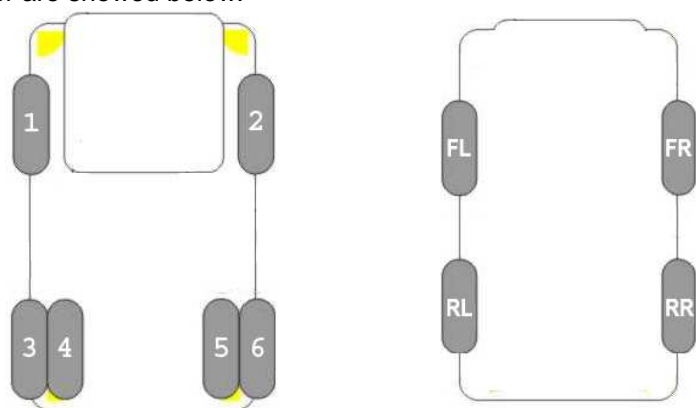
2.2 Turn On/Off The Monitor

The monitor can be turned on/off with the Battery Switch on the backside. **When the monitor turns on it will show all icons for 2 seconds, clear all warnings and tire information, and then display "- -" for the pressure and temperature readings. When the vehicle is moving new tire readings will appear after a few minutes, or could be up to an hour when parked.**

Notes: the sensors can detect whether the vehicle is in motion and will send out heartbeat signals every 3 to 5 minutes when moving; for a stationary vehicle the signal transmission slows down to once every hour for conserving sensor battery power. Nevertheless when abnormal tire situation occurs the sensor will send out warning signals immediately regardless the vehicle is moving or parked.
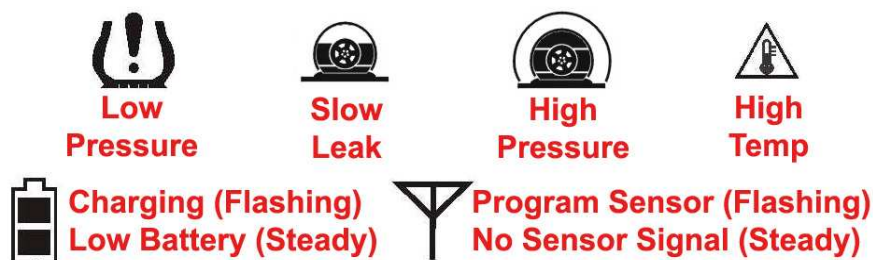
3. Operation

After installation, the system operates automatically and continuously. When monitor power is on and receives tire sensor signals, the display will show the current tire pressure and temperature. When on external power, normally the **green** light is on. Otherwise a **red** light indicates abnormal situations with the showing of corresponding tire indicator(s) and the warning icon(s). **Green** light will be off when on battery power.

The order of tire information display for a 6-tire truck and a 4-tire trailer are showed below:

Upon detection of abnormal tire pressure and/or temperature the monitor will display one or more of the following warnings and turn on the red light. For severe warnings (low pressure and rapid pressure change) the system will also sound an 8-second alarm.

Low Pressure	**Slow Leak**
High Pressure	**High Temp**

Charging (Flashing)
Low Battery (Steady)

Program Sensor (Flashing)
No Sensor Signal (Steady)

- A warning will continue to be displayed until the cause of the warning is corrected, then the warning will be cleared automatically.
- When multiple warnings occurred, the higher priority warning, such as a low pressure alarm, will be displayed first.
- *Press SET for 3 seconds will clear all the warnings on screen.*
- If the abnormal situation persists, however, warnings will be displayed again later even after the display was cleared.

4. Display Parameters Set Up

4.1 Set Up Individual Parameters

The monitor supports user setup of certain display parameters.

The user can adjust the warning threshold for tire pressure and temperature, and calibrate the pressure reading:

- Press and hold down the **MODE** button - after 3 seconds the monitor screen flashes.
- Press the **CTRL** button enters into the *Parameter Set Up* mode
- The first screen is for setting up the Low Pressure warning threshold for the steer axle, indicates by two darken tire icons on the front axle of the vehicle graphic.
- While in a setup screen, the **SET** button is used to change the setting. Each **SET** button pressing increment the setting by one unit. When setting reaches the maximum value it will wrap around back to the minimum. Pressing and holding down **SET** advances the setting rapidly.
- While in a setup screen, pressing the **CTRL** button brings the setup mode to the next screen. While in the last, pressing **CTRL** exits the Setup Mode and saves the new settings for all screens.
- The order of the setup screens is:
  ° Tractor steer axle low pressure warning threshold
  ° Tractor drive axle low pressure warning threshold
  ° Tractor tag axle low pressure warning threshold (if any)
  ° Trailer first axle low pressure warning threshold (if any)
  ° Trailer second & third axle low pressure warning threshold (if any)
  ° High pressure warning threshold for all tractor tires
  ° High pressure warning threshold for all trailer tires (if any)
  ° High temperature warning threshold for all tires
  ° PSI or Bar selection
  ° ℉ or ℃ selection
  ° Pressure reading calibration for all tires - can be set to a value within the range of -9 to 9 PSI, allowing adjustment to the pressure reading for reconcile with a reference gauge.

Notes:
While the TPMS provides sufficiently accurate tire pressure measurements, some user might prefer to use manual gauge readings as points of reference. In the event that there is a discrepancy between gauge and TPMS readings, user may adjust the Pressure Reading Calibration value for reconciling the measurements differences. A negative Calibration value subtracts from the TPMS readings while a positive value adds to it. Thus if on the average TPMS readings are 2 PSI higher than the gauge, a Calibration value of -2 would bring the TPMS readings down to the gauge level, so that when the user sees a pressure reading on the display he or she would know it is close to the gauge measurement. After adjusting the Calibration value its effect is applicable to new

measurements, so the display will show the reconciled readings when receiving fresh sensor signals, such as while the vehicle is moving.

4.2 Auto-Setup Low / High Tire Pressure Warning Thresholds

After sensor installation the abnormal tire pressure warning thresholds should be set up in accordance to the normal cold tire pressure of the vehicle. The Monitor has an automatic *Set Alarm* ("SA") mode to make setting up the warning thresholds much simpler.

To enter the *Set Alarm* mode from the Monitor, press the CTRL button for three seconds, then the monitor will show a screen with "**SA**" on it.

When in "**SA**" mode, press the CTRL button once will trigger the monitor to set up the warning thresholds for all axles according to the current tire pressure, as follows:

- *The low pressure warning threshold for an axle will be set to 12% below the average of all tires on that axle*, e.g., a steering axle with pressure of 80 PSI and 84 PSI for the two tires (i.e., average 82 PSI) will be set to having a LP warning threshold of 72 PSI.
- *The high pressure warning threshold for the vehicle will be set to 30% above the highest average pressure of all axles*, e.g., a 3-axle motorhome with average axle tire pressure of 80, 90, and 100 PSI, respectively, will be set to having a HP warning threshold of 130 PSI
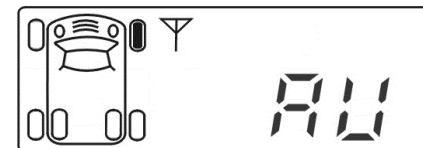
After pressing the CTRL button on the "**SA**" screen, the monitor will set up the warning thresholds for all axles (provide that the tires have normal pressure) and then exit to normal operation automatically.

5. Sensor Programming

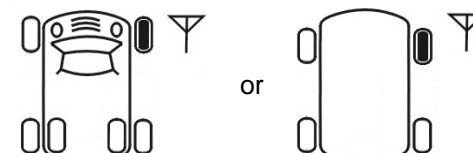There are two sensor programming screens here: automatic tire setup and manual tire setup.
- Press and hold down the **MODE** button - after 3 seconds the monitor screen flashes.
- Press the **SET** button enters into the *Sensor Programming* mode - automatic tire setup screen

Automatic Tractor Tire Setup Screen:

- Press the **SET** button again switches to the manual tire setup screen

Manual Tractor or Trailer Tire Setup Screen: or

5.1 Retrain System for All Tires

After sensor replacement, tire change, or tire rotation the system must be retrained to display the correct tire locations, as follows:

Manual Tire Setup Steps -
- Call up the Manual Tire Setup screen as described above, and then press the **CTRL** button; the No. 1 tire indicator starts blinking:
- Case 1: Sensors are yet not installed
  - Install a sensor on the #1 tire valve stem and wait one minute, or until the display picked up the signal – indicated by moving the blinking icon to the next tire - then install sensor on the #2 tire stem.
  - Repeat above until all sensor were installed and programmed; the system will beep and exit the setup mode automatically.
- Case 2: Sensors were already installed
  - Release 3 PSI or more of air from the No. 1 tire. This triggers its sensor to send out a signal. Upon receiving the signal, the system sets up this tire as the No. 1 tire location. The system then moves on to the No. 2 tire.
  - Repeat above step for the remaining tires (The setup order must always be from tire No. 1 to No. 2, …, to the last tire). After successfully retraining the last tire the system exits the setup mode automatically.
  - Refill tires to the proper air pressure.
  - Pressing the **SET** button will skip the current tire and move the blinking icon to the next tire; skipping the last tire will cause the system to exit the setup mode.

Automatic Tire Setup Steps –

- Sort Sensors in ascending order based on the last 5 digits of its ID on the label.
- Case 1: Sensors are yet not installed
  - Call up the Automatic Tire Setup screen, and then press the **CTRL** button; the No. 1 tire indicator starts blinking.
  - Put the sorted sensors on tire valve stems in accordance to tire location mapping (i.e., sensor with smallest ID goes to tire No. 1, ...); it is not necessary to wait in-between sensor installations.
  - The system will pickup all the sensor signals and assigned to respective tires based on the sensor-tire mapping scheme described below. System will exit the setup mode automatically upon completion.
- Case 2: Sensors were already installed in sorted order
  - Put the system in Auto-Setup mode
  - Drive the vehicle - the system would pick up the signals and will associate each sensor to a particular tire location automatically, based on the ID-tire mapping scheme. The system will exit the setup mode after completion.

Notes:

The sensor-tire association is based on the unique sensor ID: sensor with a smaller ID value (of the last 5 digits; ID is printed on the sensor label) will be assigned to the lowest numbered tire location available. This feature is specifically developed for the external valve stem mounted sensors, which can be readily installed to tires in accordance to their respective ID number. The Auto-Setup feature enables the sensor installation and setup to be completed in a few short minutes.

5.2 Retrain System for Some Tires

- To retrain system for tire rotation or replacement with less than all the tires, get into the Manual Tire Setup screen as described above, press the **SET** button to move the blinking icon to the desire tire location, and then release the associated tire air as described earlier to set it up.
- Note that each skipped tire will retain its previous sensor assignment, and this sensor will not be accepted for assignment to another tire location.
- Press the **CTRL** button for 3 seconds on the blinking tire icon will clear its sensor assignment.
- If there are more tire setup then press the **SET** button again for moving the blinking icon to the next desire tire location, and then repeat set up procedure.
- Press the **SET** button passing the last tire icon to exit the setup and save the new setting.

6. Enable/Disable Trailer Monitoring

Tire-Safeguard supports Trailer tire pressure monitoring. A truck-trailer TPMS display will first show the truck screen and then the trailer screen. The user may press the SET button to retrieve individual tire status. After the monitor not receiving any trailer tire sensor signal for over 2 hours, the trailer screen will be removed from the display; the trailer screen will be brought back once the trailer signals are received.

The missing trailer screen can be manually enabled or disabled by:
- Press CTRL for three seconds, the SA screen comes up.
- Press SET to find the trailer screen with tires for enabling or without tire for disabling the display.
- Press CTRL again to accept the setting and exit.