



Loose Wheel Sensors Inc.  
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# Loose Wheel Systems Inc.

## Installation and Reference Manual

June2022 Version 1.5

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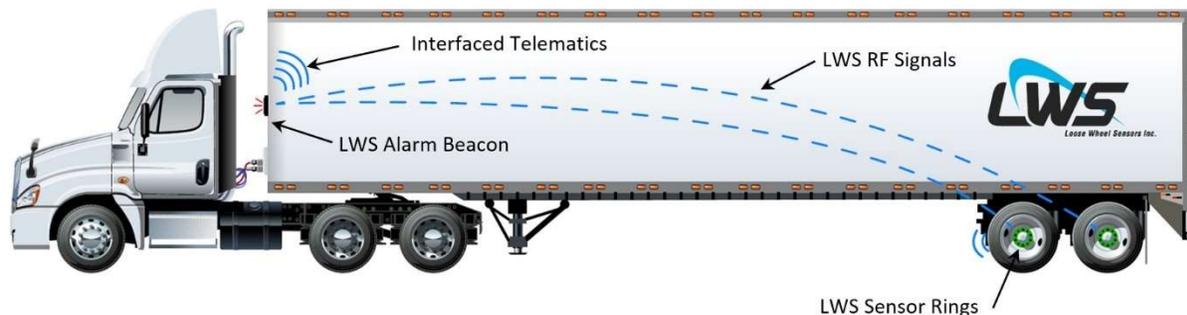
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## 1 LWS OVERVIEW

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The Loose Wheel Sensor system is a real-time early-stage warning system that **monitors the wheel stud clamping force holding wheels in place and the wheel hub temperature**. This patented technology helps drivers and fleet maintenance take a proactive maintenance role leading to safer roadways for everyone and helps manage risk and costs.

LWS's Sensor Rings monitor and send RF status messages to the LWS Alarm Beacon indicating wheel and stud identification, stud clamping condition, hub temperature, and sensor ring battery condition. The LWS Alarm Beacon provides drivers with visual notification (see Section 5 Beacon Light Codes) of both safe operating conditions and warnings of emerging issues.



The LWS system can also be integrated with compatible telematics systems to send immediate warnings to remote staff/systems (maintenance, dispatch, etc.).

For additional technical information please visit [www.lwshub.com](http://www.lwshub.com).

## 2 INSTALLATION CAUTION

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Read and understand this installation and reference guide before beginning the installation process.

Follow these steps in the sequence given. Failure to follow these installation and testing steps can lead to incorrect functioning of the system.

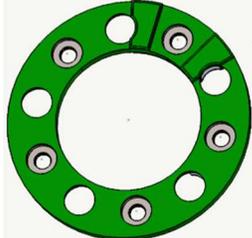
The LWS Sensor system must be installed by a qualified service technician trained to service rims/wheels and wheel ends.

Truck/trailer wheels are not required to be removed for installation.

A second person will be required when initializing and testing the installed LWS Sensors Rings and Alarm Beacon.

### 3 LWS SENSOR SYSTEM COMPONENTS

The LWS system contains the following components (per trailer):

1 – LWS Alarm Beacon	LWS Gasket Rings – one for each LWS Sensor Ring	LWS Sensor Rings – one for each wheel	Decal for Alarm Beacon Codes
			

For installation the following tools and additional parts are needed:

- Power lug nut wrench and a calibrated torque wrench
- Lubrication for studs and lug nuts
- 5 in 1 Wheel End Components Inspection Gauge to check studs and lug nuts
- Magnet for pairing LWS Sensor Rings and Alarm Beacon
- Wiring (18 gauge) to connect beacon to trailer's 7-way connector.
- Stainless steel screws (1" x #10) to mount the alarm beacon to the trailer.

## 4 LWS SYSTEM INSTALLATION

### 4.1 INSTALL LWS SENSOR RINGS ON WHEELS

Wheels do not need to be removed from truck/trailer to install the LWS Sensor Rings.

Repeat these steps for each LWS Sensor Ring being installed.

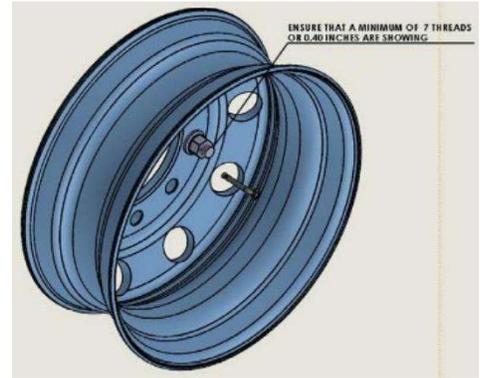
The LWS Sensor Ring uses 5 lug nuts from each wheel.

These 5 stud/lug nut locations are the LWS system monitored studs.

Figure 1 - LWS Sensor Rings Installed on Dual Axle Trailer



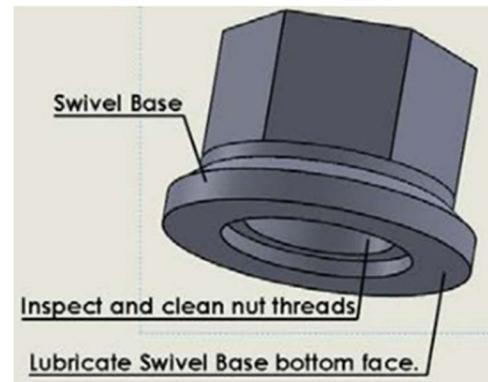
1. Before removing lug nuts check that 7 stud threads (or 0.40 inches) are showing beyond the top of the lug nut. This will ensure full thread engagement once the LWS Sensor Ring is installed.  
  
Remove every second lug nut (5 in total).



2. It is recommended that all studs and nuts are inspected with a 5 in 1 Wheel End Components Inspection Gauge. Replace studs and nuts if warranted.  
  
NOTE: Best practice is to ensure that all 10 fasteners are inspected.



3. Inspect each removed nut for corrosion and damage. Check that the two-part swivel base is in good order. Replace all faulty lug nuts. Clean lug nuts by removing corrosion and debris.  
  
Lubricate bottom face of lug nut with grease.  
  
**\*\*\*Warning: This is an important step to avoid torque from damaging the sensor \*\*\***  
  
Clean the 5 exposed studs with a wire brush and clean rim face. Apply one drop of lubricant to each stud



4. Note: It is recommended best practice at this stage to inspect, clean and/or replace and lubricate as necessary all other wheel studs and lug nuts and ensure that all are torqued to specification.

5. Place the isolation gasket ring onto the rim.

**Note: The smaller gasket stud holes must be placed over the exposed studs with the removed lug nuts.**

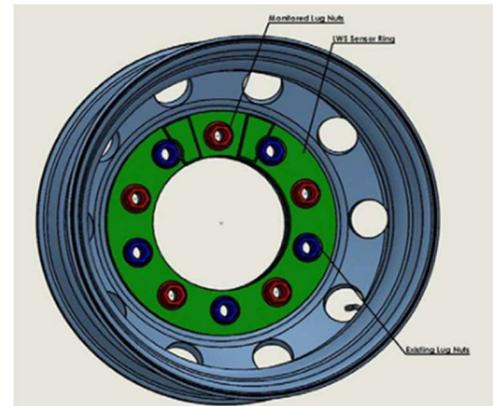
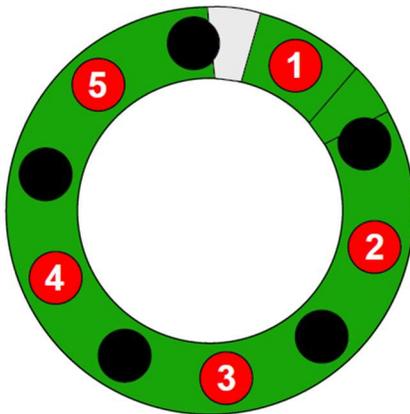
These smaller gasket studs holes must align with the monitored lug nut locations on the sensor rings (step 6).



6. Install the LWS Sensor Ring onto the Rim and (tighten) *torque* the lug nuts to 500 ft-lbs.

Note the positioning of the 5 lug nuts in the diagram below. The LWS Sensor Rings and Beacon are programmed to recognize the lug nut locations in the sequence as shown. The location of lug nut 1 is between the two raised compartments on the sensor ring. Each subsequent lug nut (2, 3, 4, & 5) is located in a clockwise manner around the ring.

Remember to add lubricant to the stud and the bottom face of the lug nut before installing and torquing the lug nuts.



## 4.2 INSTALL THE LWS ALARM BEACON

Install the LWS Alarm Beacon on the front of the trailer behind the driver so that it is visible from the driver's sideview mirror.

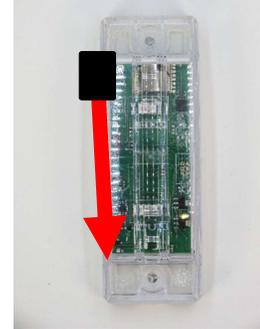
The LWS Alarm Beacon receives its operating power from the trailer's 7-way connector.



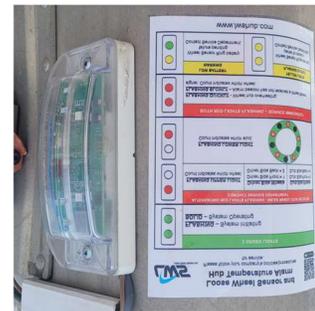
*Figure 2 LWS Beacon installed on front of trailer.*

<ol style="list-style-type: none"> <li>1. Attach the black power wire from the LWS Alarm Beacon to the blue wire on the trailer's 7-way connector. White wire is the ground wire. Brown wire is the interface wire for compatible telematics systems (see Section 6.3)</li> </ol>	
<ol style="list-style-type: none"> <li>2. Check that the beacon is receiving power. A solid green light will be visible on the front bottom left hand side of the beacon.</li> </ol>	
<ol style="list-style-type: none"> <li>3. Position and mount the LWS Alarm Beacon to the trailer behind the driver so that it is visible from the driver's sideview mirror. Mount the beacon using #10 screws with maximum torque of 25 inch lbs. Note the label on the back of the beacon indicates "this way up" for positioning. Connect the white ground wire. Ensure that all wires are secured and not dangling loosely.</li> </ol>	

4. Slide/swipe a magnet lengthwise along the clear plastic side of the beacon to clear the memory and reset. This needs to be done twice within 3 seconds. The beacon's two LED's will initially show solid red, and then will start flashing yellow - which indicates the beacon is ready to be paired with the wheel sensors.



5. Peel and stick the LWS Beacon Code label to the trailer beside the beacon.



### 4.3 PAIR EACH LWS SENSOR RING WITH THE LWS ALARM BEACON

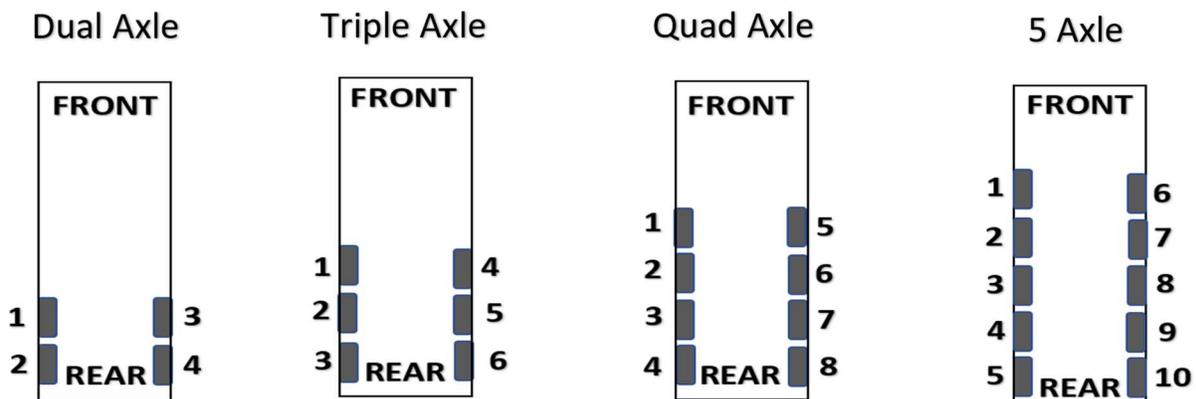
The LWS Alarm Beacon recognizes each LWS Sensor Ring's location by specific wheel number. In this step the LWS Alarm Beacon will be paired/synchronized with each installed LWS Sensor Ring in order for the beacon to receive RF signals.

Power to the LWS Alarm Beacon needs to be on during this step.

**CAUTION! THIS PAIRING MUST BE DONE IN SEQUENCE...WHEEL SENSOR 1, WHEEL SENSOR 2, WHEEL SENSOR 3, WHEEL SENSOR 4, ETC. FAILURE TO PAIR IN SEQUENCE WILL RESULT IN THE BEACON SIGNALLING A WARNING FOR THE WRONG WHEEL LOCATION.**

LWS sensor rings are paired/synchronized sequentially (1, 2, 3, etc) from front to back, starting with the driver side wheels and then progressing to the curbside wheels (front to back). The first sensor ring position (number 1) is always the first wheel closest to the driver on the driver side. All other sensor rings follow sequentially as shown below.

#### LWS Sensor Ring Locations



**CAUTION! WHEN REMOVING LWS SENSOR RINGS TO SERVICE WHEELS/TIRES THE LWS SENSOR RINGS MUST BE REINSTALLED TO THE SAME WHEEL LOCATION TO MAINTAIN PAIRING ACCURACY WITH THE LWS ALARM BEACON.**

<p>1. Have an assistant stand by the beacon to confirm when the LWS Sensor Ring is paired. As each ring is paired the two LWS Beacon lights will flash red. The number of times the lights flash red indicates the wheel position which has just been paired.</p>	
<p>2. Starting with Wheel number 1 wave a magnet over the sensor ring and observe a red LED light-up on the ring compartment. Within 2 to 3 seconds the assistant should see the beacon lights flash red once. The LWS Beacon is now paired with and recognizes signals that are specific to LWS Sensor Ring 1 and wheel 1.</p> <p>It is recommended that numbered decals be placed on LWS Sensor Rings identifying the ring/wheel number.</p>	
<p>3. Repeat this pairing process (step 2) for each of the remaining wheels/rings <b>in sequence</b> (2, 3 &amp; 4). The number of red-light flashes counted represents the specific wheel/ring paired with the beacon.</p>	
<p>4. Once all wheels are paired with the LWS Beacon the system will begin to cycle through and scan each wheel and each monitored stud/lug nut. The LWS beacon lights will be flashing green during this time.</p> <p>Once this cycle is complete and each wheel sensor has sent a radio message to the beacon, the two beacon lights will turn solid green. See note below.</p> <p>This cycle could take 3 to 5 minutes. When the LWS Beacon shows two solid green lights, the system is now operational, and all monitored wheels are clamped with a threshold torque.</p>	

### 4.3.1 TROUBLESHOOTING

**NOTE:** The LWS Alarm Beacon will only display two solid green lights when all sensor rings are paired, and the beacon is reading that all monitored studs/lug nuts are providing the proper clamping forces to keep the wheel in place.

If the beacon is not displaying two solid green lights and instead is displaying alternating red flashing lights this indicates that insufficient clamping force is present in one or more wheels. A count of the beacon's upper red light indicates which specific wheel, and a count of the bottom red light indicates which specific stud. One of two conditions is causing this:

- **Condition One** – The lug nuts may not have been properly installed and tightened to the specified torque. Do not try to compensate by over-torquing. The service technician should

remove the lug nut, ensure the stud and nut are properly cleaned and lubricated and then replace and (tighten) torque to required specification. Repower the alarm beacon. Wave a magnet over the sensor ring compartment to send an updated status message to the beacon<sup>1</sup>. If the beacon lights turn solid green (within one minute) the system is ready.

- **Condition Two** – This condition will only exist if actions taken for Condition One do not resolve the issue (alternating red flashing lights remain). The condition of the stud and/or lug nut may be deteriorated to the point where the fasteners do not provide sufficient clamping force to hold the wheel in place. The service technician will need to replace the stud and/or nut. Do not attempt to compensate by over-torquing beyond specifications.

Note that during the initial installation these conditions may emerge in more than one wheel where the LWS Sensor Rings are installed...meaning when one wheel/stud combination warning is corrected another wheel/stud combination warning may appear until all are resolved. When the LWS Alarm Beacon is displaying two solid green lights all monitored studs are providing the appropriate clamping force and the system is fully operational.

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<sup>1</sup> When the alarm beacon is repowered, the system begins to scan all monitored wheels and stud/nut locations. This could take 3 – 5 minutes. This time-period can be shortened to less than one minute by waving a magnet over the wheel sensor compartment.

#### 4.4 TESTING THE INSTALLATION

Post installation testing is done only after all installation steps have been completed and the LWS Alarm Beacon displays two solid green lights. For this test a fault (weak/loose stud) is created to verify that the LWS Alarm Beacon does receive a signal from the LWS Sensor Ring and correctly identifies the specific wheel and lug nut sending this signal. Follow these steps for this testing process.

1. Have an assistant stand by the beacon to watch for the change in the LWS Alarm Beacon lights (from two solid green lights to alternating flashing red lights).
2. The service technician should loosen one of the monitored lug nuts.
3. Within a few (up to 12) seconds the assistant should see the two solid green lights change to alternating flashing red lights.
4. The assistant should count the number of flashes occurring in the upper light and the number of flashes occurring in the bottom light. This count identifies which wheel and stud was loosened. For example, Wheel 1 Stud 4.
5. The assistant and service tech should then confirm that the LWS Alarm beacon correctly identified the wheel and stud. If they do not match the pairing needs to redone.
6. The service technician should then retighten the lug nut and torque to the correct specifications. Repower the system. Wave a magnet over the sensor ring to send a status message to the alarm beacon <sup>2</sup> . The LWS Alarm Beacon should display two solid green lights within one minute.
7. Repeat this test process for the other wheels equipped with LWS Sensor Rings.
8. When the LWS Alarm Beacon displays two solid green lights all monitored studs are providing the appropriate threshold clamping force and the system is fully operational.

<sup>2</sup> When the alarm beacon is repowered, the system begins to scan all monitored wheels and stud/nut locations. This could take 3 – 5 minutes. This time-period can be shortened to less than one minute by waving a magnet over the wheel sensor compartment.

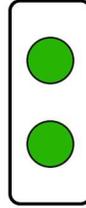
## 5 LWS ALARM BEACON CODES

**Start Up:** Green LEDs will flash slowly following a power connection as the system initializes. Once all monitored wheel studs have been located (1 – 5 minutes) the green LEDs will become solid indicating that all monitored wheels stud are providing appropriate clamping force and the system is operational.



### Two Green Lights Flashing

Beacon is initializing and scanning for an “OK” signal from each monitored wheel stud.



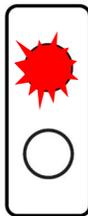
### Two Solid Green Lights

All stud sensors have been detected and all studs are connected, safe and ready. System is operating.

## LWS ALARM BEACON WARNINGS

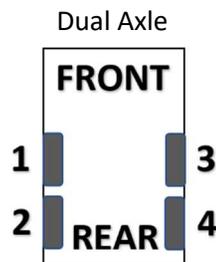
### Alternating Upper and Lower Red Lights Flashing

Weak Wheel Stud Detected. Contact Service Department.



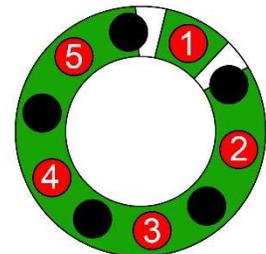
### Upper Red Light Flashing

Count indicates which wheel



### Lower Red Light Flashing

Count indicates which wheel stud



See Section 4.3 for wheel locations



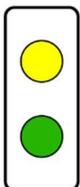
### Two Red Lights Flashing Quickly

High Hub Temperature Detected  
(Temperature has reached 175° F)  
Service Immediately.



### Two Red Lights Flashing Slowly

The beacon is not receiving a signal from a wheel sensor. Count indicates which wheel.  
Service Immediately



### Upper Yellow Light /

### Lower Green Light

Wheel sensor ring battery failure pending.  
Contact Service Department



### Two Yellow Lights Flashing Quickly

Wheel Sensors Rings are not paired/synced to Alarm Beacon  
Contact Service Department

## 6 ADDITIONAL INFORMATION

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### 6.1 REMOVAL AND REINSTALLTION OF LWS SENSOR RINGS

LWS Sensor Rings will need to be removed for wheel-end maintenance/repair, including tire rotation. Service technicians must ensure that the paired LWS Sensor Rings are reinstalled in the same wheel locations as originally installed. I.e., LWS Sensor Ring 1 and wheel location 1, LWS Sensor Ring 2 and wheel location 2, etc. It is important to ensure that the LWS sensor ring's monitored stud locations align with the smaller stud holes on the gasket when replaced. To replace the gasket and sensor ring follow these steps:

1. Before replacing the LWS gasket and sensor ring replace every second lug nut of the 10 exposed studs. Total of 5 lugs replaced.
2. Place the gasket onto the wheel rim ensuring that the smaller stud gasket holes are placed over the 5 remaining exposed studs.
3. Replace the LWS sensor ring over the gasket ring aligning the ring's monitored stud locations with the 5 remaining exposed studs.
4. Replace the 5 remaining lug nuts and tighten to the required torque.

Provided that the sensor rings are reinstalled to their original wheel location they **do not need** to be repaired/resynched with the alarm beacon. This information has been stored in the alarm beacon's memory.

**CAUTION! FAILURE TO REINSTALL SENSOR RINGS TO THEIR ORIGINAL LOCATION WILL RESULT IN THE BEACON SIGNALLING A WARNING FOR THE WRONG WHEEL LOCATION.**

After all sensor rings have been properly reinstalled to their original location the system needs to be repowered. The system will scan all monitored wheel and lug/nuts to be scanned and send status messages to the alarm beacon. When this cycle completes. the LWS Alarm Beacon will be displaying two solid green lights indicating that all monitored studs are providing the appropriate clamping force and the system is fully operational. See Section 4.3.1 if the beacon does not display two solid green lights.

It is recommended that the service technician conduct the Section 4.4 Testing process for all sensor rings to verify that the sensor rings have been reinstalled in the correct locations, appropriate clamping forces exist, and the system is operational.

Note: Should the need arise to re-pair/re-synch all LWS Sensor Rings with the Alarm Beacon sliding a magnet down the side of the beacon twice within 3 seconds will clear the beacon's programming (Section 4.2, Step 4). The entire pairing/synching procedure for all sensor rings can now be redone (Sections 4.3 and 5.0).

## 6.2 LWS SENSOR RING BATTERY REPLACEMENT

Each LWS Sensor Ring is powered by a custom battery module which is field replaceable. The estimated battery life is 4 years at 70° F ambient temperature. LWS Sensor Ring batteries can be ordered by contacting Loose Wheel Sensors Inc. at 1-866-447-6445 or [info@lwshub.com](mailto:info@lwshub.com).

The LWS Alarm Beacon will signal a low battery level warning (beacon's upper light will be yellow and the lower light will remain green). The system will continue to function safely for approximately 30 days beyond this detection.

There are two protruding compartments on the face of the of the LWS Sensor Ring. The larger compartment houses the custom battery, and the smaller compartment houses the circuit board.

Follow these steps to replace the LWS Sensor Ring battery:

1. Identify which LWS Sensor Ring needs a battery replacement by waving a magnet over the sensor ring. If the battery is completely drained, the alarm beacon lights will not flash. If the battery is "low" (as indicated by the beacon showing yellow/green lights), when each wheel sensor is triggered by the magnet, the alarm beacon will respond by flashing red indicating that this is the wheel which has the low battery. Note an assistant may be required to help with this step.
2. Remove the LWS Sensor Ring from the wheel.
3. Remove the metal plate (4 screws) from the backside of the sensor ring located directly behind the compartments.
4. Unplug the old battery and plug-in the new battery.
5. Replace the metal plate (4 screws).
6. Re-install the LWS Sensor Ring onto the wheel.
7. Repower the LWS system. Wave the magnet over the sensor ring. The LED on the sensor compartment should turn red. A status message is sent the alarm beacon. The alarm beacon will change from two flashing green lights to two solid green lights.

Note: The sensor ring does not need to be repaired/re-synched with the Alarm Beacon. This information has been stored in the alarm beacon's memory. The ring must be re-installed on the same wheel location.

## 6.3 TELEMATICS INTERFACE

The LWS system can also be interfaced with compatible telematic/tracking systems to send real-time digital text notifications to fleet maintenance, dispatch, etc. when events occur. Please call us at 877-447-6445 and we will work with your technical staff to help establish this interface.

#### 6.4 **ENHANCE COMPANY'S SAFETY MANAGEMENT PROGRAM**

The LWS system is a safety management tool and as such its use and operation needs to be incorporated into the company's safety policies and procedures. Clearly defined and written policies and procedures inform and provide direction to employees of what actions are to be taken for different situations. This includes (not intended to be an all-inclusive list):

- Ensuring that drivers, service technicians, and others as appropriate are educated with the LWS system and its operation.
- Incorporating the LWS system into pre-trip inspection policies and procedures.
- Defining what service actions need to be taken if the LWS Alarm Beacon provides a warning during system start-up/initialization and during transit.

## 7 WARRANTY INFORMATION

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### **LOOSE WHEEL SENSORS INC. (“LWSI”) WARRANTY**

#### **ONE-YEAR LIMITED WARRANTY**

Loose Wheel Systems Inc. warrants this product to be free from defects in workmanship and materials, under normal use and conditions for a period of one (1) year from the original invoice date. LWSI will replace or repair, at its sole option, the defective Product returned to us, or to one of our dealers by its original purchaser.

This Limited Warranty does not apply to normal wear and tear and does not cover repair or replacement if the Product is damaged by tampering, misuse, accident, abuse, neglect, improper installation, misapplication, alteration of any kind, disaster, acts of God, defects due to repairs or modifications made by anyone other than LWSI or an authorized service representative of LWSI, or reception problems caused by signal conditions or antenna systems outside the LWSI Product.

LWSI does not accept liability for incidental or consequential damages, or for any third-party claims for damages against the retail purchaser of this product. Some states or provinces do not allow the exclusion or limitation of incidental or consequential damages, so this may not apply to you.

We reserve the right to specify that items be returned to the original warehouse for inspection or be inspected by our representative in the field

This warranty gives you specific legal rights, and you may also have other rights which vary from province to province or state to state. LWSI’s responsibility for defects in materials and workmanship shall be limited to repair and/or replacement as set forth in this warranty. All express and implied warranties, including but not limited to, any implied warranties and warranties of merchantability or fitness for a particular purpose are disclaimed.

Please keep your sales receipt, product serial numbers and proof of coverage in a safe place. You may be asked to provide a copy of these if there is any question as to your product's eligibility for service coverage under this warranty. If you need service, first refer to the “Installation and Reference Guide” available at [www.lwshub.com](http://www.lwshub.com). After checking this guide additional help can be found by first calling your LWSI dealer and then, if necessary, by calling Loose Wheel Sensors Inc., 1-866-447-6445 (toll-free), from anywhere in Canada and the U.S.A.