

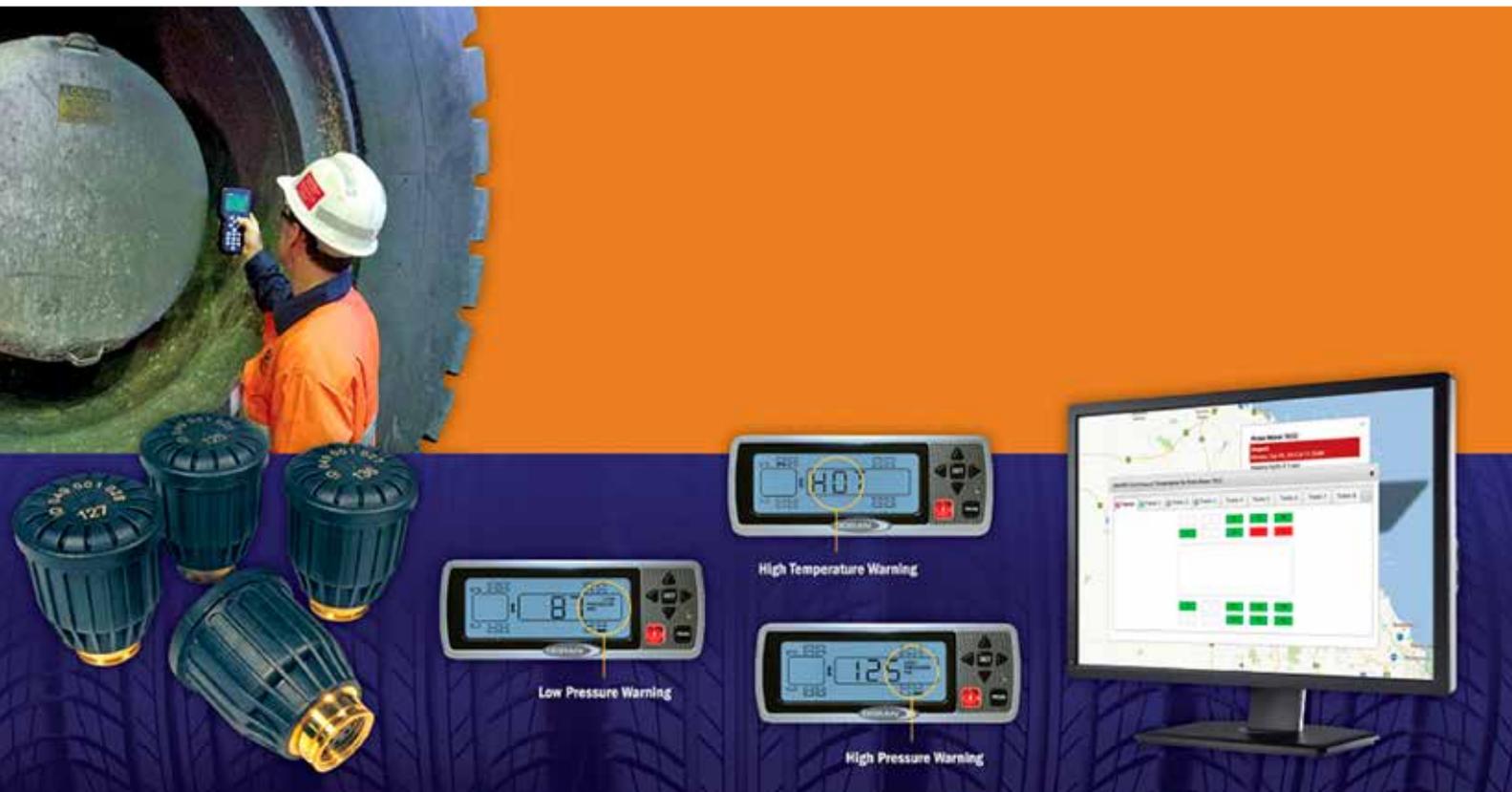
**TYRE MONITORING SYSTEMS
SAVE TYRES, FUEL, EQUIPMENT
DAMAGE... AND LIVES!**



| L | S | M |
TECHNOLOGIES

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Tyre Monitoring Systems (TM Systems) are quickly becoming a “mandatory” Industry Safety Control measure for all vehicles using pneumatic tyres as Authorities and Industry Standards / Guidelines call for such technology be utilised to mitigate vehicle accidents subjected to Tyre Blow outs, Roll-overs, Wheel Offs, Tyre Fires, etc.



It is interesting to note that TMS systems are mandatory for all domestic passenger vehicles and trucks (USA) in the USA, EU, Korea, China and Japan?

Tyre related accidents and fatalities involving vehicles utilised in such industries as Mining, On / Off Road Transport, Quarrying, Forklift / Materials Handling, Mobile Cranes, Light Vehicles, Distribution Trucks, Port Operations, etc have highlighted the importance of (virtual continuous) monitoring of Tyre Pressures and Temperatures with Tyre Monitoring Systems (TMS systems), to aid in mitigating potential tyre related vehicular accidents / incidents.



Figure 1: DTruck Tyre Fire- major Asset loss

Mandating of Tyre Monitoring Systems for Industry

Over the years there has been numerous tyre related incidents which some have sadly resulted in fatalities.

Some examples of changes that are occurring in Industry:

- A [Coroner Report of a tyre explosion fatality \(October 2014\)](#) acknowledged that Industry can also gain significant cost- downs / ROI with the use of TMSystems and recommended that industry investigate and implement within two years (in 2014), remote, or wireless, tyre pressure sensing equipment to allow operators to monitor tyre pressures from within the cabin of the truck- this deadline was October 2016.
- Department of Mining and Petroleum Safety Resources has updated their [Guidelines on Tyre Safety for Earth-moving Machinery](#) to include TMSystems to be installed- not just for Mining Equipment- but also other rubber mounted vehicles.
- [OTSI \(Office of Transport Safety Investigations\)](#) recently released their investigative report into [Bus Fires in NSW 2016](#) stating 43% of Bus Fires were confined to the Wheel Well.
- [NHTSA \(National Highway Traffic Safety Administration- USA\) Motorcoach Fire Safety Report- Nov 2015](#)- cited that the “causes for wheel fires are primarily dragging brakes, failed bearings, underinflated tyres”. They also recommend the implementation of TMSystems.
- [Truck Crash Data Analysis March 2012](#)- NSW Centre for Road Safety report that >22% of Transport Truck crashes are related to tyres / tyre failures.
- [NTI \(National Transport Insurance\) Major Accident Investigation Report – 2015](#) report that 33% of truck fires are related to wheels and tyres.



By implementing **TMSystem Technologies**, Vehicle Operators are able to dramatically **reduce** maintenance costs, **extend** tyre service life, **reduce** fuel consumption, **improve** braking / handling and control - and of course - **less downtime**.

Advantages of TMSystems

As anyone involved with managing wheels and tyres knows, maintaining the correct tyre inflation pressures is critical for a safe operation and prolonged tyre life.

By implementing TMSystem Technologies, Mining, Heavy Haulage, On-road Transport and many other Vehicle Operators are able to not only improve safety in their operational and maintenance tasks, but also dramatically reduce maintenance costs, extend tyre service life, reduce fuel consumption, improve braking / handling and control- and of course- less downtime. Some specific advantages in utilising TMSystems are:

- **Tyre Service Life / Fuel Economy:** Maintaining optimum set- point pressures mean tyres last longer and reduce fuel consumption.
- **Increased Safety:** Avoids catastrophic tyre failure, tyre fires (locked brakes / bearing failures, tyre under-inflation) and potential accidents.
- **Braking / Traction / Control:** Are all dramatically improved in both dry and especially in wet conditions if tyres are maintained at correct inflation set- points.
- **Cost downs / Productivity / Tyre Checks:** Checking and recording of only 100 tyres in a small fleet would take >6 hours of labour and associated productivity loss- compared to targeting only those tyres that need attention (re- pressurising).
- **Equipment Damage Control:** Catastrophic tyre failure / roll-overs, etc.
- **Lightning Strikes / Tyre fires / Pyrolysis & Explosions:** Specifically, within the Mining / Earthmoving Industries, if the TMSystems is still operating after an electrical storm a Telemetry System will display Tyre Temperatures / Pressures remotely allowing faster / safer back-to work Productivity.
- **Insurance Costs:** Reduced damage and accidents means less claims and lower Insurance costs.



Figure 2: Tyre Contact Pattern- 100% Pressure Set- point

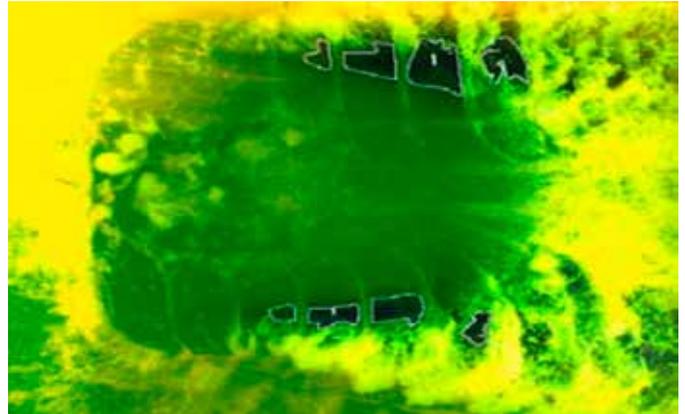


Figure 3: Tyre Contact Pattern 10% Pressure loss

What components make up a TMSystem

Basically, a TMSystem consists of:

- **In-Cabin Display:** This provides the Operator with information about the tyre condition (pressure / temperature), as well as provides audible / visual warnings / alerts, should there be an exception in the base- line settings.
- **Tyre Sensors:** Are placed onto the Tyres and constantly monitor the Air Pressure and Tyre/ Wheel Temperature. Data is provided directly to the In-Cabin Display (or via a Transceiver / Antenna) using RF communication between the Sensors and the Monitor.
- **Telemetry Data:** Where installed, tyre data can also be sent via telemetry to a web based portal that stores the data / tyre condition and provides remote analysis, management and event recording.

Are there differences in TMSystem Technologies?

Yes- there is a dramatic difference in available TMSystem Technology utilised for domestic vehicles vs that utilised for Industrial applications. Robustness, fit-for- purpose and heavy duty components are required to ensure reliability and longevity of the TMSystem.

Some aspects to consider in selecting a TMSystem are:

Internal Sensors: These are mounted internally to the Rim or vulcanised to the inside of the Tyre and have the following disadvantages.

- Are difficult and time consuming to install, as they require the Tyre to be removed. Similarly, they are costly to replace if they fail as the vehicle must return to the workshop.
- Reliability and strength of RF signals are low as the Sensor data must pass through the Tyre wall.
- If the Sensor fails, then vehicle must return to the workshop, the wheel / tyre removed and the new Sensor installed and programmed into the TMSystem. Depending on the Industry / vehicle this could take between a few 3 hours to a day to complete. Not only is this a costly process but loss of production / meeting schedules (eg Refuse vehicles, Public transport, etc).
- Normally when replacing Internal Sensors,

re-programming can only be completed by the supplier and not the end- user operational / maintenance personnel.

- Are usually restricted because of their design, are not compatible to larger tyres (large valve bore) - that is, they cannot be easily used or transferred between different types of vehicle assets.

External Sensors: These are mounted directly onto the Air Valve Stem and have many advantages over Internal Sensors:

- Consist of only 2 x Sensor types with the only difference being the thread for Large Bore Air Valves (eg Earthmoving / Dump Trucks) and Standard Bore Air Valves (eg Buses, Light Vehicles, Trucks).
- As the only Sensor difference is the thread size (large / standard bore valve stems), they can be quickly, easily and safely transferred and so used on any type of pneumatic tyre across all vehicle assets.
- They simply screw onto the Air Valve Stem thread and so are installed (and replaced) safely and quickly. No special skills are required, can be replaced / re programmed in the field within few minutes with virtually no loss of vehicle productivity.

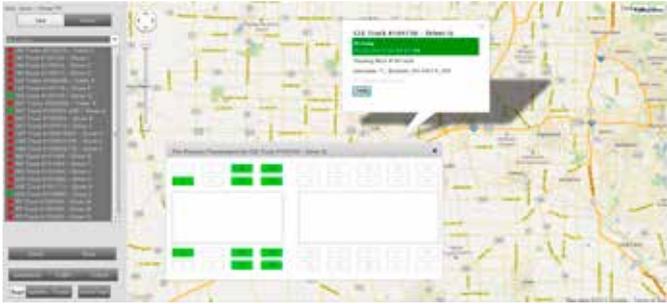


Figure 4: Remote Telemetry Data acquisition, reporting, management, etc



Figure 5: Heavy Duty Sensors / fully Potted are essential for low maintenance / replacement

Tyre Sensor Technology: There are many different manufactures of Sensors and they certainly vary in quality, robustness and capabilities.

Some aspects to consider in selection of a TMSystem:

- Ensure that the Sensors are designed to encapsulate the electronics in a single piece Sensor Housing- a minimum of IP69K. If the Sensor battery can be exchanged- that is the Sensor can be opened- then it can be subjected ingress and failure.
- Sensors that can be opened to have their battery replaced cannot be certified for use on Dangerous Goods vehicles that may be exposed to volatile operating environments.
- Sensors should be at a minimum tested and certified to SAE J2848 Standards Tyre Pressure Monitoring Systems- Medium and Heavy-Duty Highway Vehicles.
- The selected TMSystem should have the capability to can be transferred and utilised on any vehicles in your fleet. This will mean common spare parts and familiarisation.

Simple to Program: Industrial TM Systems should provide for quick and simple re- programming with an external Tool or via the Operator In- Cabin Display. Consideration should be given to on- going maintenance, the need for special skills, time to complete Sensor replacement / programming.

Warranties: If the supplier states they provide a fit- for- purpose TMSystem technology then they should also substantiate this with respective warranties of > 3- 5 years.

Technical Support: This goes without saying- the supplier should provide extensive orientation / training of your personnel, detailed documentation such as manuals, layout drawings, etc.

Integration / Telemetry / Web Based Portal: The TMSystem supplier should provide a Telematics / Web Based Portal solution so that live tyre condition data is acquired for compliance, analysis, recording and SMS / email alerts. Alternatively, the TMSystem should be able to fully integration into any Fleet Management System using commonly used vehicle communication protocols such as RS232, J1939.

What Tyre conditions should a TMSystem Monitor

A TMSystem should provide the Operator with information / warning / alerts such as:

- **Normal:** All tyre positions are communicating properly and tyres are inflated to within 12.5% of programmed baseline pressure.
- **FastLeak™ Alarm:** triggered when the pressure drops 31.0 Kpa within 16 seconds regardless of the baseline tyre pressure.
- **Under Pressure Level I Low Pressure Alarm:** initiated when a 12.5% drop from the tyre pressure occurs.
- **Extreme Under Pressure Level II Low Pressure**

Alarm: activated with a 25% drop from the tyre pressure.

- **High Pressure Alarm:** warns when there's a 25% increase over the programmed baseline tyre pressure.
- **High Temperature Alarm:** The Tread of a tyre can delineate from the Case at temperatures >120 degC and so an alert should be activated when the tyre / rim reaches a temperature of >80°C.
- **Lost Signal Alarm:** indicates a temporary interruption of RF signal reception, or it continual condition persists, the tyre Sensor is missing or battery depleted- indicating replacement.



LSM Technologies primary objectives are to be proactive in offering >decade of experience, expertise, research and OH&S mitigation control technology / services.

Through working with Industry OH&S Professionals / Regulators and our Clients to meet Australian / International Standards compliance and Reduce Risk, we also provide extensive ROI in extend Component Service Life and enhanced Productivity.

LSM Technologies as an industry champion committed to the on- going development of OH&S Technologies / Systems to continually improving our client's objectives of enhanced Safety (Health), Equipment Damage Control and Productivity.

For further information please contact us or visit www.lsm.com.au

