TADIRAN BATTERIES

Trailer tracking takes a powerful turn

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TRACMILE™ hubodometers combine wheel-powered energy harvesting with an industrial-grade rechargeable lithium-ion cell to track wheel-derived mileage and provide GPS location context and cellular connectivity, enabling greater data intelligence in managing unpowered trailers and other towable assets.

Trailer tracking isn't just about where an asset is – it's about how it's used and empowering teams with actionable data intelligence that drives smarter operational and financial decisions.

As fleets adopt mileage-based maintenance and billing, GPS-derived distance alone can be influenced by reporting cadence, coverage gaps, yard movement, and route-reconstruction assumptions. TRACMILE™ hubodometers address this limitation by measuring mileage at the wheel and using GPS as complementary location and trip context. This distinction is particularly useful when a trailer moves independently of the tractor or spends time in yards where short movements may be difficult to reconstruct from periodic location reports.

Tracking trailers with greater precision

Built around the principle that trailer mileage is best measured at the wheel, TRACMILE™ combines hub-mounted revolution counting, GPS visibility, and an innovative power management system, all controlled by a Cloud-based platform. The device captures forward and reverse wheel movement, including low-speed yard activity, while providing last reported location, trip history, and configurable alerts. Authorized users have 24/7 access to this data through mobile and web applications using Verizon 4G LTE Cat-M1 connectivity.



Fully assembled TRACMILE™ wheel-end device featuring six-coil electromagnetic harvesting assembly with industrial grade recharageable Li-ion battery.

Low-power wheel counting operates independently of the higher-power GPS and cellular functions. The device periodically wakes, hourly by default, with configurable and event-driven behavior, to obtain location information, process data, and communicate with the cloud before returning to an energy-saving state. Reports and alerts are generated according to configured schedules and event rules, with wireless connectivity subject to available energy and cellular coverage.

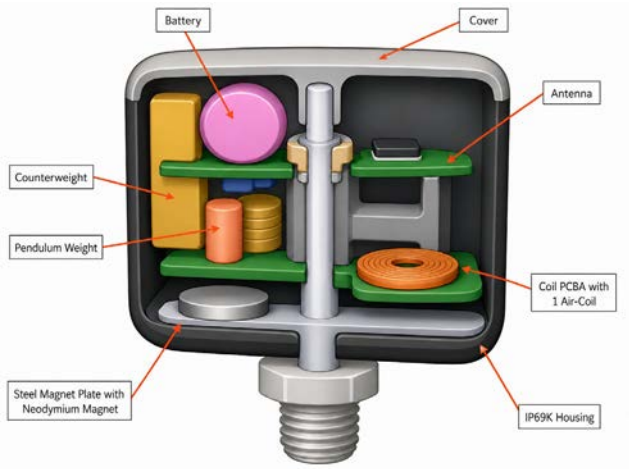
As an end-to-end system, TRACMILE™ combines wheel-end hardware, authenticated Cloud services, and mobile and web applications. QR-code-based commissioning

associates each device with a specific trailer or towable asset, while organization-based access controls allow authorized users to manage assets and review device status.

The interface presents map views, trailer-specific mileage, trip history, utilization patterns, reporting tools, and configurable alerts. Wheel-derived mileage is retained locally between transmissions, so cellular coverage gaps may delay visibility without interrupting the underlying mileage record. This data permits highly accurate mileage-based maintenance scheduling, per-mile billing, utilization analysis, and monitoring for unexpected movement or tamper events.

Smart system architecture

The cloud platform and embedded firmware are designed to support deployment in harsh wheel-end environments. By harvesting energy from wheel rotation and then storing it in an industrial grade rechargeable Li-ion cell, TRACMILE™ can operate without trailer wiring or routine battery replacement.



TRACMILE hubodometer cutaway view showing internal energy harvesting, battery, stabilization, and electronics architecture.

Trailer-specific mileage is calculated from bidirectional wheel-revolution counts adjusted for the configured tire size. GPS location and timestamps provide complementary information about asset movement, usage, and status. These two information sources serve different purposes: wheel revolutions establish the mileage record; while GPS helps place movement in time and location. Combining wheel and location information gives fleet managers more context than either measurement provides on its own.

Wheel-revolution counting operates independently of the communication schedule, and cumulative mileage is retained through normal power transitions. Controlled firmware-update capabilities allow the system to evolve as fleet requirements change.

An innovative power management solution

TRACMILE™ is self-powered through contactless electromagnetic energy harvesting at the wheel. Because wheel speed and operating conditions vary, the generated energy is conditioned and regulated before being used to power the electronics or stored in a Tadiran TLI-1520A industrial-grade rechargeable lithium-ion cell. The Li-ion cell buffers intermittent harvested energy and supports higher-current GPS and LTE communication events, including operation at low temperatures within specified charging limits.

TRACMILE™ spends most of its time in an ultra-low-power state to support wheel measurement and device housekeeping. Higher-power functions such as GPS and cellular

communication are enabled when needed. During prolonged inactivity, the system can transition to a lower-leakage state to conserve stored energy.

Protection and power-management circuits keep the battery and downstream electronics within defined operating limits as harvested voltage changes with wheel speed. Battery monitoring and duty cycling help preserve energy for periodic sensing and communication. This energy-buffering approach is important for trailers that may alternate between frequent travel and long periods of inactivity.



Tadiran TLI-1520A rechargeable Li-ion batteries can power TRACMILE™ devices for up to 25 years and 5,000 full charge cycles, able to be recharged and discharged at extremely cold temperatures.

Choosing the right battery

The rechargeable Li-ion cell serves as a buffer to supply power when harvested energy is not immediately available, including during stationary periods and higher-current GPS or cellular activity. The battery selection criteria needed to account for intermittent charging, brief power-intensive events, and a wide range of ambient conditions.

An industrial-grade Tadiran TLI-1520A rechargeable lithium-ion cell was selected for its cycle capability, high-current pulse response, low self-discharge, and wide operating-temperature range. Tadiran rates the cell to last for up to 5,000 full charge/discharge cycles under specified test conditions. Actual battery operating life may vary depending on the application load profile, charging strategy, and operating environment. The following battery characteristics were particularly important to TRACMILE™:

- Calendar and cycle life: Long cycle capability and low capacity loss support a lower total cost of ownership by reducing the need for routine battery replacement.
- High-pulse capability: GPS and cellular modems require brief high-current pulses. The selected cell can support these loads without the large voltage drop that may occur with cells not designed for pulse demand.
- Low self-discharge: Towable assets can remain stationary for extended periods with little or no energy being harvested. The TLI-1520A has a specified annual self-discharge rate below 5%, helping preserve stored energy between movement events.
- Efficient charge acceptance: Unlike a continuously powered system, this application produces intermittent, variable-speed energy that must be conditioned and stored efficiently.
- Temperature performance: Towable assets may experience severe seasonal temperature cycling. The TLI-1520A charges and discharges from -40°C to +85°C when operated within temperature-dependent charging-current limits, surpassing TRACMILE's specified operating range of -30°C to +75°C.

Robust design for a lower long-term cost of ownership

An unpowered trailer may remain parked through weeks of winter cold and then return to service in summer heat. Throughout each duty cycle, the rechargeable cell must retain

energy while the wheel is still, accept intermittent energy when movement resumes, and supply brief current pulses for GPS and cellular communication. Routine battery replacement across a fleet would add service time and cost, making the choice of cell critical to TRACMILE's design.

Cold temperatures can temporarily reduce available capacity and increase internal resistance, while prolonged heat can accelerate capacity loss and self-discharge. Tadiran TLI-1520A cells were selected for their combination of low self-discharge, high-pulse capability, and wide operating-temperature range, subject to the cell's specified charging-current limits. In addition, the battery's compact size enables rechargeable energy to be stored within the hubodometer's small footprint.

The rechargeable cell works with the wheel-motion energy harvester and power-management electronics to replenish the cell during travel while also providing a buffer of energy between movement events while eliminating the need for routine battery replacement. The battery and electronics are housed in a sealed wheel-end enclosure, with service intervals variable depending on usage, reporting settings, temperature, and the energy harvested over time.

Conclusion

Wheel-end measurement may sound simple, but delivering connected mileage from an unpowered trailer requires a sophisticated combination of low-power sensing, wheel-driven energy harvesting, and energy storage that can bridge periods of inactivity and power brief GPS and cellular transmissions. Tadiran's industrial-grade TLI-1520A rechargeable lithium-ion cell is a key part of that architecture, combining low self-discharge, high-pulse capability, and a wide operating-temperature range into a compact package. This complex solution provides fleet management with the enhanced data intelligence required to improve maintenance, billing, and asset utilization.