

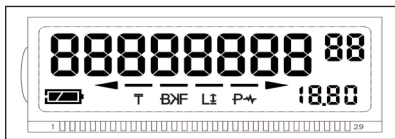
# Tesla 4 TR - AMR/AMI Register



## Description

**Applications:** The Tesla 4 TR (AMR / AMI - RF Transceiver Register) is a solid-state encoder with no mechanical numerical wheels. It is equipped with an integrated 1-Watt transceiver contained entirely inside the hermetically sealed enclosure. Tesla 4 TR is ideal in harsh meter pit environments with its standard external antenna. It is designed for use with all RG3 meters and to retrofit most other manufactures' meters (Badger, Neptune, Sensus, Hersey, Master Meter, etc.). Tesla 4 TR provides 2-way wireless connectivity with RG3 Automated Meter Reading Systems Software (AMRSS) AMR/AMI technology solutions which eliminates the need for physical access to the meter after installation.

**Operating Characteristics:** The digital reading transmitted by Tesla 4 TR integrated 1-Watt transceiver is retrieved directly from the register's internal magnetic sensor coupled to the wetted magnet through the meter body. Tesla 4 TR magnetic sensors are always on and always watching. This technology provides real time reads and eliminates interpretation of odometer wheels by means of LED, optical character recognition, or electromechanical contacts that could wear out. The Tesla 4 TR solution provides superior long-term performance and the most accurate counting solution available.



**LCD:** Tesla 4 TR is equipped with a large LCD for easy reading at a distance of 6 feet. The LCD provides a 10-digit programmable meter read and a 6 segment leak detector indicator with flow direction arrows. Flow rate, water movement, battery status, tamper, backflow, leak warning, and transmission indicator are shown on the LCD as appropriate. At 20% battery life remaining, the battery status indicator begins to flash on and off. Status indicators are sent as part of the AMR/AMI extended message. The LCD is always active and requires no tools for visual reading.

**Transmission Indicator:** The transmission indicator illuminates when Tesla 4 TR conducts RF activity, allowing the operator to visually confirm transmission has been sent.



## Specifications

Encoder Type	Straight reading, permanently sealed, electronic LCD absolute encoder with field programmable integrated 1-Watt RF transceiver for AMR/AMI applications.
Encoder Display	10-digit LCD totalizer, 6 segment leak detector, flow direction arrows, rate of flow, battery status, leak alarm, and back-flow alarm
Unit of Measure	U.S. gallons, Imperial gallons, cubic feet, cubic meters, and liters
Flow Rate	Units of Measure per Minute
Numerals	7.44 mm (.293") high and 7.24 mm (.285 wide)
Humidity	0 to 100% condensing
Weight	238 grams or 8.5 oz
Temperature	-40° to 185°F (-40° to 85°C)
Status Indicators	Electronic and visual icons for: Totalizer, flow rate, back-flow, leak, battery indicator (including 20% battery life alarm)
Signal Output	1-Watt RF Transmission
Signal Type	Unlicensed Frequency (902 MHz-928 MHz)
Battery	D cell lithium thionyl chloride battery with capacitor, fully encapsulated within Tesla 4 TR housing
Battery Life	25 Years (calculated)
Warranty	20 Years (Prorated)



**Water Movement Indicator:** Six segments illuminate in succession ending in an arrow to demonstrate directionality and to simulate water flow. The water movement indicator activates immediately upon water movement. Cessation of segment movement demonstrates that water movement has stopped within the past 20 seconds. After 20 seconds all segments disappear.

**Flow Rate:** Flow rate is clearly displayed in the applicable unit of measurement and updated every 10 seconds. If the unit of measure is gallons, for example on a residential meter, displayed flow rates range from 1/10th gpm to 1,999 gpm.

**Backflow:** The backflow indicator is activated after 4 units of backflow and remains illuminated for 30 days. A backflow flag is sent with the extended RF message, as long as the indicator is activated.

**Tamper:** Tamper is activated when no usage has occurred in the past 30 days. The tamper remains until usage occurs. A no-flow flag is sent with the extended RF message as long as the indicator is activated.

**Battery Status:** Tesla 4 TR uses a D cell lithium thionyl chloride battery with capacitor to provide a true 25 year battery profile. Unlike mesh systems that transmit multiple times for every read and bubble up systems that guesstimate battery profile by estimated usage over the life of the product, Tesla 4 TR adjusts the battery status indicator based on actual usage to provide the most accurate and up to date information to the utility. When the battery reaches 20%, the battery status icon on the LCD begins to flash on and off. Battery status is sent with the extended RF message each time Tesla 4 TR is read.

**Last Read Protection:** At 20% battery life remaining, a visual indicator on the LCD and a transmitted flag let the utility know the battery status. When 5% battery life remains, transceiver functionality is discontinued and all remaining power is diverted to counting and visual read display. Although the Tesla 4 TR will no longer transmit information, this gives the utility several billing cycles to retrieve the current read and replace the register. The new register can be field programmed with the old register's reading before replacement.

**Leak Detection:** Leak monitoring is constant. As a standard, the leak flag is triggered after 48 hours of continuous water movement. The leak flag will turn off if no water movement occurs for a period of 1 hour to ensure that the utility is not wasting resources addressing a leak that was in reality high usage.

Dimensions

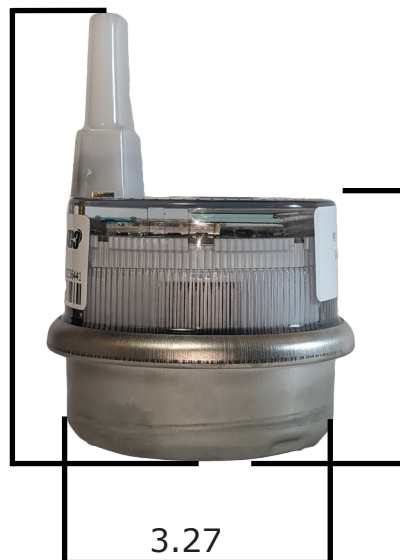


Actual Size LCD



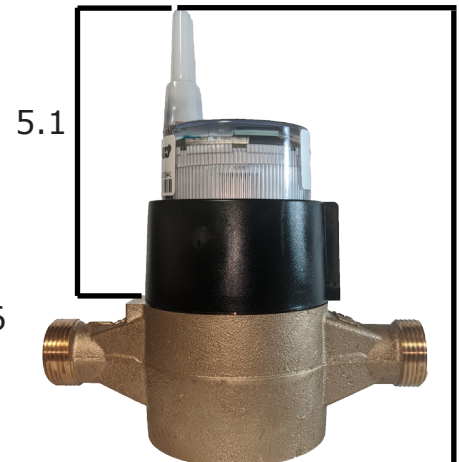
7.5

4.8



3.27

2.76



5.1

7.53

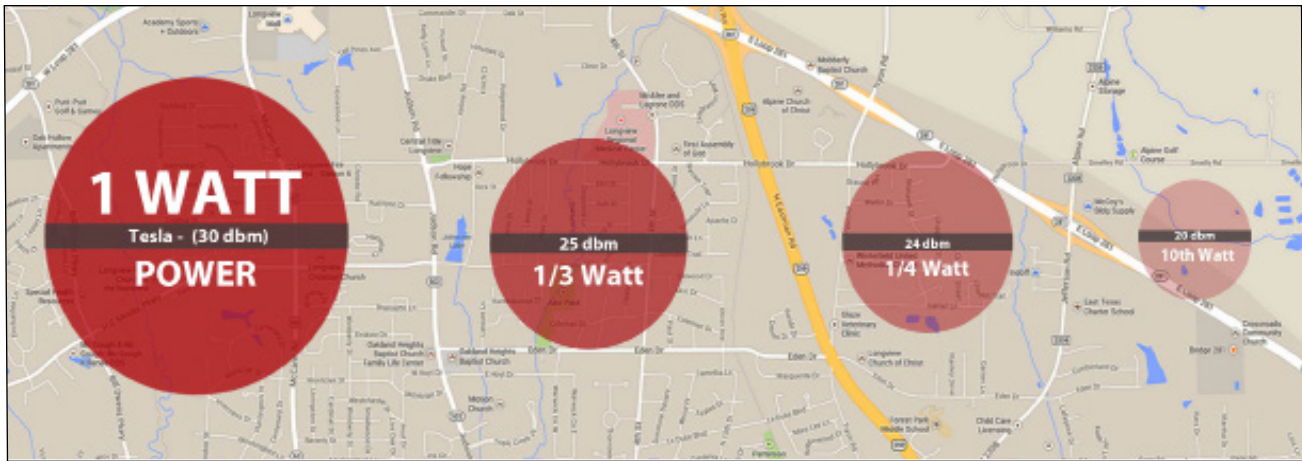


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**Leak Counter:** The leak counter indicates the number of days a leak has been occurring. The information is transmitted every time Tesla 4 TR is read. This enables the utility to provide warning to the customer and then respond accordingly if the customer has not resolved the issue. The leak counter resets after 10 days of non-continuous use.

**Time Sync for Water Loss Identification:** Every time Tesla 4 TR reads, it syncs time with the reading device. Tesla 4 TR time sync is a 2-Way transmission function and can only be accomplished with true 2-way communication. This feature is important because water loss identification through metering requires the comparison of water volumes recorded by customer and mainline meters over a specific period of time to the water volumes discharged from the treatment facilities or the volume passing through system zone meters over this same period of time. Distribution leak detection requires time synchronization to avoid "clock drift", a phenomena where two clocks do not run at the exact speed and after a period of time, "drift apart". By syncing time with the reading device, Tesla 4 TR avoids clock drift completely and delivers the most accurate leak detection possible.

**Transmission:** Tesla 4 TR technology starts where the rest of the industry's most advanced solutions top out. Tesla 4 TR has full time 2-way communication and also offers one-way communication redundancy. All functions are accomplished through streamlined 2-way communication utilizing the FCC approved unlicensed 902-928 MHz band. To ensure transmission success, Tesla 4 TR employs Cyclic Redundancy Checks (CRC), Spread Spectrum Frequency Hopping Modulation, and Channel Coding.



**\*Rule of Thumb: 6dbm gain = twice the distance of Transmission**

**Transmission Power:** Tesla 4 TR transmits at a full 1-watt. Unlike 1-way bubble up technologies that throw hundreds of thousands of wasted transmissions and large amounts of unnecessary energy into the atmosphere each month, Tesla 4 TR's extremely efficient 1 watt power is environmentally friendly. Although Tesla 4 TR has 10 times the transmission power of other leading AMR/AMI technologies, the total monthly output of electromagnetic radiation is at least 10,000 times less than comparable technologies, or roughly 5% of the amount emitted by the average cell phone each month in the US.

**Transmission Read Options:** From the factory, any Tesla 4 TR can be read as an AMR drive-by system, an AMI fixed network system (if network infrastructure is present), or as a hybrid system. No additional programming, switching modes, or contact with the register is necessary.

**Drive-By (AMR) Read:** Tesla 4 TR transmits its associated meter number, current read, number of digits transmitted, unit of measurement, battery status, leak counter, and backflow, tamper, and leak flags as applicable. Individual meters can be read alone or all meters can be read at once.

**Fixed (AMI) Read:** Each day the Tesla 4 TR transmits 24 top of the hour time synced reads.





**Hybrid:** Every Tesla 4 TR is AMI ready with no programming or power mode changes required. Adding infrastructure is all that is required to read Tesla 4 TR through an AMI network. Extended meter pit antenna is necessary for AMI applications.

**Resolution for 5/8" to 4" Meter Applications:** "Absolute" 10-digit meter reading on the LCD with precise visual readings down to the hundredths of a gallon or thousandths of a cubic foot/meter. Electronic output includes 8-digit remote meter reading. 1 to 8 digits can be communicated for billing.

**Resolution for 6" through 12" Meter Applications:** "Absolute" 9-digit meter reading on LCD with precise visual readings down to the whole unit. Electronic output includes 8-digit remote meter reading. 1 to 8 digits can be communicated for billing.

**Factory Programming:** When combined with an RG3 meter, Tesla 4 TR is factory programmed with a reading of 1 gallon and associated to its companion meter's serial number, type, and size. Factory programmed Tesla 4 TR register/meter combinations are ready for installation upon delivery just like a direct read meter with no additional operations needed.

**Construction:** Tesla 4 TR shroud assembly is constructed from engineered polycarbonate with a hermetically sealed stainless steel bottom. The enclosure is UV-resistant, weatherproof, and fully encapsulated to withstand harsh environments and to protect the solid state electronics. External antenna screw terminal pins are molded into the engineered polycarbonate lens and back sealed with a potting compound eliminating any opportunity for moisture intrusion at the connections making Tesla 4 TR suitable for installation in all environments, including continuously submerged water meter pits. Electronic circuitry is gold plated to provide increased corrosion resistance before it is encapsulated by high quality endothermic potting material that diminishes the expansion and contraction related to temperature extremes. Electronics are designed to provide immunity to electrical surges. Tesla 4 TR uses magnetically driven thermoplastic floating gears to minimize friction and provide long, reliable life. Tesla 4 TR counting mechanisms are permanently active magnetic sensors. The power source is an internal lithium battery with capacitor that is independently encapsulated in potting for redundant protection against moisture and provides 25 years of life.

**Precision Counting:** Tesla 4 TR uses magnetic sensors that detect changes and disturbances in the magnetic field of the wetted meter magnet like flux, strength, and direction. This precision technology allows Tesla 4 TR to accurately count with resolutions that far exceed the flow capabilities of any water, while remaining sensitive enough to count down to the thousandths of a gallon.

**Antenna:** Tesla 4 TR standard antenna build includes an external antenna to ensure strong and reliable transmission in flooded pit environments. An optional breakaway antenna that mounts in, or under, the meter pit lid is also available to provide a 1 watt transmission from the meter pit lid. The breakaway antenna inductively couples to the standard build antenna and allows the breakaway antenna to be pulled, or separated, from the standard build antenna without harming either. If the breakaway antenna has been removed, the standard build integral antenna continues to provide a full 1 watt transmission from the meter. The breakaway antenna can be snapped back in place to provide a full 1 watt transmission at the meter lid. Standard breakaway antenna lengths provided are 5 feet for small meters and 22 feet for large meters.

**Watchdog:** All mechanical and electronic devices are subject to the effects of their environment. Tesla 4 TR is equipped with an internal watchdog that reboots the electronics if faced with an external interference such as a close proximity lightning strike or other uncontrollable event.

**Electrical:** Tesla 4 TR electronic circuitry is gold plated and designed to provide immunity to electrical surges and transients per IEC801-2, IEC801-4 Severity Level 4.

**Data Log / Consumption:** Tesla 4 TR retains 120 days of hourly data. Whether Tesla 4 TR is being utilized in a drive by AMR system, an AMI network, or as a hybrid system, consumption data can be wirelessly extracted at the meter site.

#### Tesla 4 TR can Retro-Fit to the Following Manufactures Meters :



Hersey Meters

