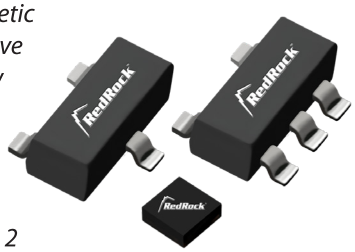
# HOW TO OVERCOME BATTERY LIFE ANXIETY WHEN USING ACTIVE MAGNETIC SENSORS




*When switching from passive magnetic sensors such as reed switches to active sensors such as the Coto Technology RedRock® TMR sensors, a common concern is battery life in battery-powered applications. RedRock® sensors are available with many different sampling rates, from 2 Hz up to 10,000 Hz. Idle and active modes (so-called "Sleep" and "Wake" modes respectively) provide this feature, which allows users to tailor their sampling rate choice to their particular application. The sensor's averaged current draw increases with sampling rate, from an incredibly low 50nA current for a 2 Hz sensor operating from a 3.0 V power supply.*

To help alleviate concerns about battery consumption, consider the following charts showing the expected battery life for various common primary battery types when used to run the lowest-power RedRock® sensor. We compare with typical sensors from other technologies: Anisotropic Magnetoresistive (AMR), Giant Magnetoresistive (GMR), and Hall sensors, which also economize on power consumption by using active mode/idle mode sampling. We have assumed the following typical average power consumptions (Table 1) for each type when powered from a 3.0 V supply. This data represents a wide selection of manufacturer's products with similar price points as Coto Technology's RedRock® sensor.

**Table 1: Typical magnetic sensor average power consumption**

| SENSOR TYPE | TYPICAL AVERAGE CURRENT CONSUMPTION (nA) |
|---|---|
| RedRock® TMR | 50 |
| Hall | 5000 |
| AMR | 1000 |
| GMR | 400 |

Of course we can't account for other current draws that will be-present in a user's circuit design, but we can figure the incremental life that a particular combination of RedRock® sensor and battery will account for. To start, here's a list of some common batteries (Table 2), their nominal voltages, and typical manufacturers' capacity specifications in milliamp-hours (mAh).

For the commonly-used lithium coin cell batteries, the expected life, due solely to the current draw of the various selected sensors running with a 3.0 V supply, is shown in Figure 1. Note that the manufacturers' battery capacity estimates are assumed to be accurate for both continuous mode and pulsed applications. Operation is presumed to be at room temperature. For batteries with nominal voltage less than 3.0 V, we've assumed the use of two batteries in series. Note that this does NOT double the mAh capacity.

Figure 1 also shows a horizontal dotted line corresponding to the battery manufacturers' typical stated shelf life. So for example, an RR122 sensor operating at 2 Hz with a CR2032 coin cell would run for about 500 years (!), far exceeding the battery's ten year-shelf life. In all figures, if the bar is higher than the red dotted line, then the incremental battery life exceeds the shelf life and so the current draw of the RedRock® sensor or other sensor types can be ignored. Similar charts are shown in Figure 1 for alkaline, zinc/air, and silver oxide primary batteries.

In the case of zinc/air batteries, the shelf life is based on how long the batteries are useful after air activation. Most manufacturers state about 20 weeks (0.38 years).

**Table 2: Primary battery capacities**

| TYPE | BATTERY | NOMINAL VOLTAGE | CAPACITY mAh |
|---|---|---|---|
| Lithium | CR2032 | 3.0 | 240 |
| Lithium | CR2025 | 3.0 | 150 |
| Lithium | CR1620 | 3.0 | 75 |
| Lithium | CR1220 | 3.0 | 36 |
| Lithium | CR1025 | 3.0 | 30 |
| Alkaline | AA | 1.5 | 2400 |
| Alkaline | AAA | 1.5 | 1000 |
| Alkaline | D | 9.0 | 500 |
| Zinc/Air | PR70 | 1.4 | 100 |
| Zinc/Air | PR41 | 1.4 | 180 |
| Zinc/Air | PR48 | 1.4 | 310 |
| Zinc/Air | PR44 | 1.4 | 650 |
| Silver Oxide | SR44 | 1.6 | 165 |
| Silver Oxide | SR66 | 1.6 | 25 |
| Silver Oxide | SR43 | 1.6 | 120 |
| Silver Oxide | SR60 | 1.6 | 18 |

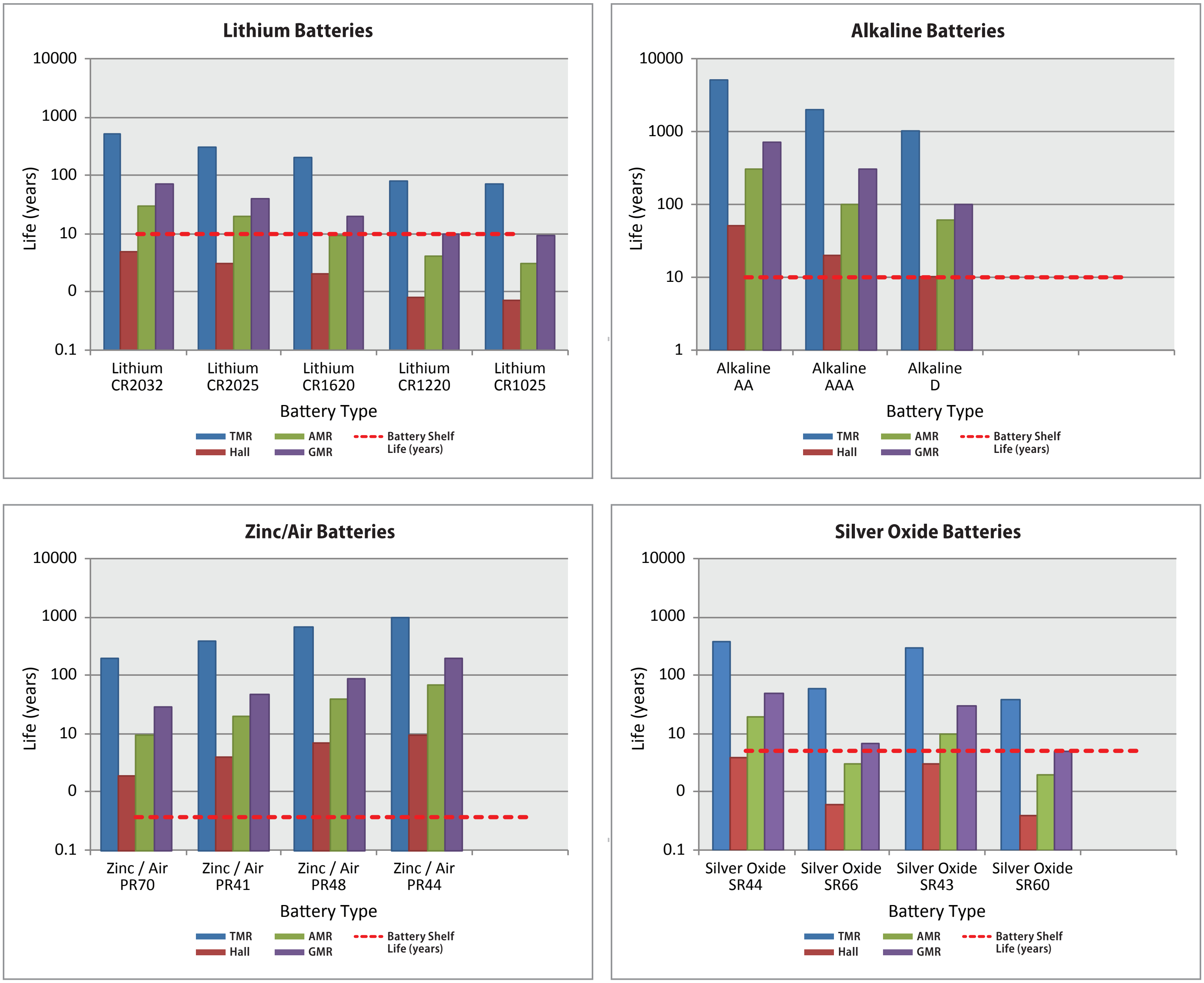



**Figure 1 Equivalent battery life in years based on battery capacity and average current draw for each sensor type.**

## Conclusion

In most cases, the current consumption of a RedRock® TMR sensor can be neglected when figuring the incremental effects on the battery life of an electronic device. Except for cases where the designer is forced into using a very high speed sampling sensor and a very low capacity battery, incremental battery consumption caused by the sensor will be negligible. The charts presented in this report should aid with rational choices of battery and sensor type when designing battery-powered electronic devices.

For further information, including advice on battery types not included in this report, please contact: **redrock@cotorelay.com** or visit **www.cotorelay.com**.

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