

The End of the Battery-Powered Light Switch?

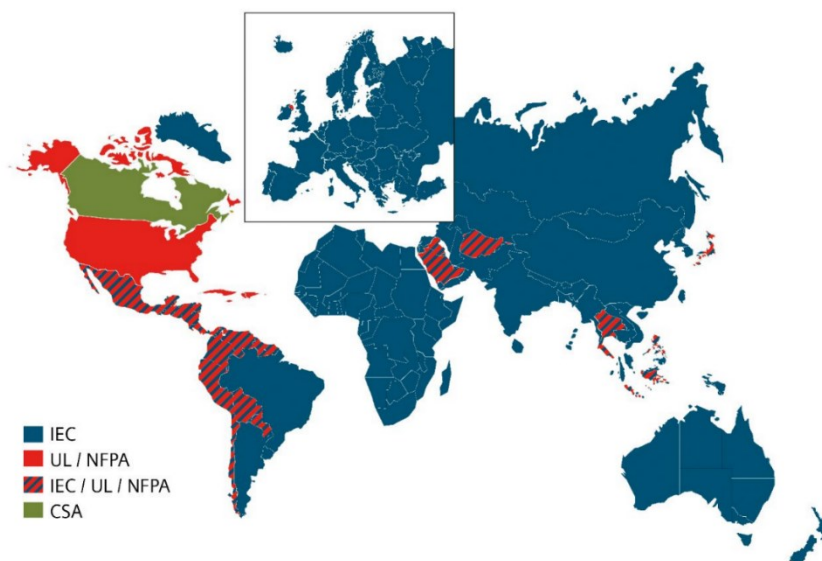
NFPA 70 - 2023 NEC Specification: New US Requirements for Wall-Mounted Devices

Energy Harvesting-Powered Light Switches - the Only Solution for Compliant Wireless Light Switches

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Adopted in all 50 states, the **NFPA 70 - National Electrical Code (NEC)** is the **US benchmark for safe electrical design, installation, and inspection to protect people and property from electrical hazards in residential, commercial and industrial settings**. First published in 1897, and initially stemming from the high risk of fire hazard in the early days of electrification and the need for effective fire insurance criteria, this set of safety standards and guidelines informs the electrician and outlines standardised procedures for safe installation, operation and maintenance in keeping with fire insurance requirements. It is recognized by the American Standards Institute (ANSI) as an American National Standard and is published by the National Fire Protection Association (NFPA). The NEC codes are generally used throughout the United States and updated every 3 years, and are comparable with other international standards (e.g. with the German DIN VDE 0100 norm).

To all intents and purposes, the NEC is the US licensed electrician's bible - setting standards for work carried out professionally as well as work done by individuals on a DIY basis. Infringement (e.g. through DIY installation of uncompliant devices by the home owner) comes with potential negative consequences on e.g. liability or insurance cover in the event of damage or injury. However, it's important to note that the NEC codes are not Federal Law and are not directly enforceable by the federal government. Instead, they are adopted by state and local governments which then enforce compliance through building codes and inspections. Therefore, the exact requirements and enforcement mechanisms can vary depending on the location.



Source: Siemens (UL = Underwriters Laboratory aka UL Solutions / NFPA = National Fire Protection Association)

In the 2023 NEC, additional measures were added to ensure safety if a battery fails in a switch or wall-mounted control device. To quote the exact NEC text:

“210.70 Lighting Outlets Required. Lighting outlets shall be installed where specified in 210.70(A), (B), and (C). The switch or wall-mounted control device shall not rely exclusively on a battery unless a means is provided for automatically energizing the lighting outlets upon battery failure.”

Section 210.70 applies primarily to dwelling spaces (i.e. habitable rooms, kitchens, bathrooms, toilets, laundry areas, basements, attics, utility areas and garages) as well as hospitality facilities such as hotel guest rooms/suites, student accommodation and the like.

The failure of a battery in a wall-mounted control device serving required lighting outlets should not result in the inability to safely egress a habitable room, guest room, attic, basement, or similar when necessary. Having utility power present, but no way to energize the lights in a room because of a bad battery in a wireless light switch, creates a hazard for the occupants.

In practice, this prescribes that any wall-mounted switch or other control device (e.g. for room lighting) be permanently connected to a constant power supply in order to guarantee functionality from a safety point of view - even if the switch is principally battery-powered, and governs an appliance wirelessly.



Source: Michaela Brestakova, EnOcean Alliance 2023

Somewhat paradoxically, this means that extra wiring is effectively required despite the widely acknowledged fact that wiring inherently constitutes a potential fire hazard in itself. According to the NFPA:

“Electrical distribution or lighting equipment is the third leading cause of home fires, and the fourth leading cause of home fire deaths. Conditions that make these fires possible can occur long before a fire presents – largely as a result of wiring being installed or repaired incorrectly, or when receptacles, power strips or cords are overloaded, etc.”

In practice, the implementation of new the NEC requirements makes the vast majority of today’s battery-powered wireless switches employing for example Bluetooth®, Zigbee®, Z-Wave®, LoRa® or proprietary wireless technology obsolete, due to the physical lack of provision for back-up (AC) power in these devices.

But... what if the switch generated its own power?

No problem: EnOcean wireless switches and sensors do just that! No wiring, no batteries, no limits - and an open door to a world of exciting new opportunities for sustainable smart solutions enhancing safety, security and comfort. At much lower installation and operating costs!

This is the smart way to comply with the new NEC requirements, with many additional advantages - including lower fire risks through less cabling (since bad wiring often constitutes a serious fire hazard in itself) and a reduced carbon footprint thanks to the reduced use of natural resources.

- Self-powered, sustainable, proven and widely deployed technology
- No need for back-up batteries or mains/cable power to guarantee functionality
- No need to pull expensive power cables.
- Complete flexibility in placement on virtually any surface, even glass
- Easy, clean and unobtrusive restructuring of existing spaces, with power cables only necessary in horizontal surfaces. No noise, no dirt - and business as usual.
- No need to purchase, stockpile, install, replace and dispose of expensive batteries.

EnOcean based switches and sensors don't rely on cables or batteries to gain energy, they "harvest" it out of thin air. More precisely, they derive their energy from the environment. The combination of miniaturized energy harvesters and ultra-low power wireless technology creates maintenance-free solutions for use in all types of buildings, from smart homes to industrial applications, as well as for the Internet of Things (IoT).

Energy from Motion

The mere push of a button can generate enough energy to send a reliable signal to turn lights on, or household appliances off. Energy harvesting makes it possible. A tiny electro-mechanical kinetic energy converter inside the battery-free switch modules uses this small movement to generate enough energy to send a radio telegram command to a matched receiver module, e.g. in a lightbulb socket. Energy harvesting switches don't look or feel different from conventional models, from simple on/off or up/down switches to sliding and rotary controls for controlling light intensity and colour, heating, cooling, sun-shading, security or home entertainment systems. Installed in minutes on any surface by a simple "peel & stick" method, they are ready for immediate use and many years of maintenance-free operation.



Energy Harvesting Module
eco200 Powering Millions of Light Switches
Source: EnOcean GmbH



Energy Harvesting Powered Wireless Light Switches
Source: Illumra

Energy production the sustainable way

But there's more. A full suite of thousands of fully interoperable, self-powered wireless switches and sensors for building monitoring and control are available and have already been installed in millions of smart homes & all types of buildings throughout the world. EnOcean-based sensors also harvest energy from room light, temperature differences or magnetic fields. For the past 20 years EnOcean Alliance members have been supplying energy-harvesting solutions for wireless EnOcean® technologies and more recently also for Bluetooth® and Zigbee® technologies. Batteries and wires are redundant. Our technology consumes as few resources as possible - making homes, buildings and installations safer, more secure, more comfortable and more energy-efficient. Less copper and PVC in the walls and greatly reduced power consumption enhance sustainability.

The EnOcean radio standard

The EnOcean radio norm is internationally standardized as ISO/IEC 14543-3-10 and is similar to wireless standards such as Wi-Fi® and Bluetooth®. It is especially optimized for wireless solutions with particularly low energy consumption, which are covered by energy harvesting power. The minimum telegram length sent is only about one millisecond at a data rate of 125kbit/s. The telegrams are repeated several times within 40 milliseconds avoiding collisions of telegrams and numerous switches, and many sensors can be operated in parallel without any problems. Each EnOcean radio module has a 32-bit unique identification number. The radio range is up to 1000 ft in open spaces and about 100 ft in buildings. These radio waves can easily penetrate walls and offer robust transmission power. At the same time, the high-frequency radiation is 100 times lower than in classic wired solutions.

The EnOcean Alliance

As creator and promoter of this global standard, the EnOcean Alliance features an interoperable ecosystem based on the open EnOcean wireless standard encompassing more than 5,000 products on offer from over 400 vendor members worldwide. Founded in 2008, the EnOcean Alliance is an international association of leading companies in the building and IT industries, with global headquarters in California. This open, non-profit organization is committed to enabling and promoting interoperable eco-systems for Smart Homes, Smart Buildings and Smart Spaces based on the maintenance-free radio standard (ISO/IEC 14543-3-10/11).