

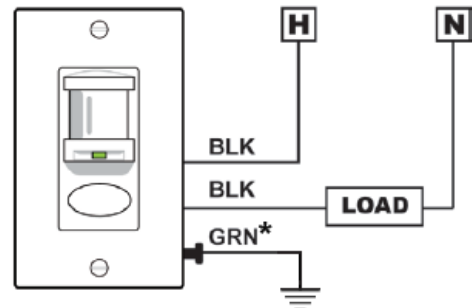
# Impact of NEC 2011 Section 404.2(C) on Application of Occupancy Sensors

Dave Behnke  
Director of Engineering – Sensor Switch

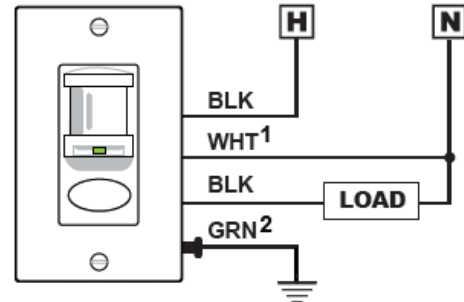
The 2011 edition of the National Electric Code introduced a new provision, 404.2.C, requiring a grounded circuit conductor (neutral) be provided at all switch locations, with two exceptions. The exceptions to when a grounded circuit conductor is required are (1) when sufficiently sized conduit is used so that if the grounded circuit conductor were added the conduit would meet NEC code, or (2) when cables assemblies feeding the switch box are open through a framing cavity at the top, bottom, or same floor level, or through an unfinished floor, wall or ceiling.

As explained in the 2011 NEC handbook, many lighting control devices require standby operating current, and because a grounded circuit conductor was previously unavailable at the switch location, the equipment grounding conductor was utilized. This is permitted in a number of UL standards, including UL773A, *Standard for Safety of Non-Industrial Photoelectric Switches for Lighting Control*, as long as the standby current is less than 0.5mA. All Sensor Switch sensors in the WSD and WSD 2P series, including dual technology sensors, comply with UL773A, and require less than 0.5mA of standby current, regardless of connection to the grounded circuit conductor or equipment grounding conductor.

Using occupancy sensors to manage lighting loads has become a standard for code-compliant lighting control. With the introduction of provision 404.2.C and subsequent availability of a grounded circuit conductor at the switch location, the equipment grounding conductor can maintain isolation from the line voltage control circuitry that is the origination point for the standby current. In this case, the equipment grounding conductor is used only as a safety ground.



\* Standby current running through equipment grounding conductor

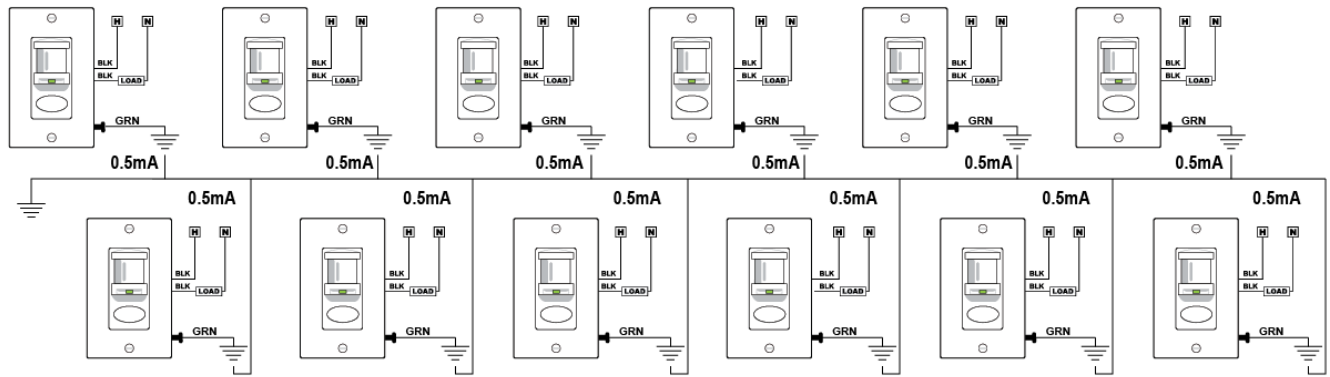


<sup>1</sup> Standby current running through grounded circuit conductor

<sup>2</sup> Safety ground isolated from line voltage control circuitry



An Acuity Brands Company

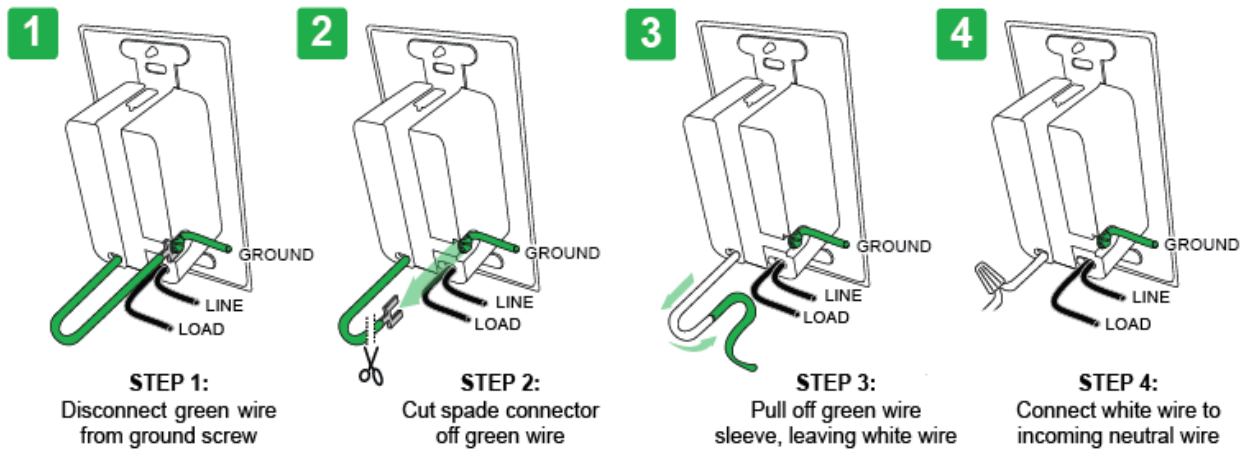


= **6mA** current through equipment grounding conductor. Enough current to trip a GFCI.

The isolation of the equipment grounding conductor from the grounded circuit conductor is one reason why a neutral referenced occupancy sensor is the preferred choice for certain customers. Another reason neutral referenced occupancy sensors are used is because many occupancy sensors that use ultrasonic technology cannot operate at less than 0.5mA, and as a result, require a grounded conductor circuit to operate within the guidelines of NEC and UL. The final disadvantage of sensors using the equipment grounding conductor is the potential “stack-up” issue. The “stack-up” issue is the result of having multiple devices installed on the same circuit, and the additive effect of the standby current. This can come into play when the devices are installed on a circuit with a ground fault circuit interrupter, which are required to trip at 5mA, per UL.

While the 2011 edition of the National Electric Code requires a grounded circuit conductor at all switch locations, it does not disallow the use of a lighting control device that instead uses the equipment grounding conductor for standby current, as allowed in UL773A. This leaves the decision up to individual states and jurisdictions as to whether or not the use of the grounded circuit conductor is required. It also has yet to be seen of the impact on the retrofit market, where in many applications, running a neutral to the switch location is impractical. This leads to two separate needs in the marketplace when specifying wall switch occupancy sensors- either a sensor that uses the grounded circuit conductor or the equipment grounding conductor. In many cases, it may be hard to distinguish which type of sensor is required prior to installation, resulting in the wrong type of sensor being ordered.

To combat this confusion, Sensor Switch has implemented a patent pending solution that allows a single sensor to meet the needs of NEC 2011 projects requiring the use of the grounded circuit conductor, as well as fit the needs of the retrofit market where only the equipment grounding conductor is available. As a commonly stocked item, having one sensor for both requirements will result in reduced inventory, faster delivery, few returns, and the best support for the contractor customer. This will also avoid the risk to the contractor if a local inspector does not allow the use of the equipment grounding conductor.



This new sensor, WSD NGX, allows for quick conversion of product for use in all applications of renovation and new construction covered by NEC 2011. In a matter of seconds, the installer can convert the sensor from the more common use of powering through the equipment grounding conductor to powering through the grounded circuit conductor.

*Celebrating its 25th year in 2012, Sensor Switch designs and manufactures occupancy sensors and daylight controllers in its Wallingford, CT facility.*



900 Northrop Road  
 Wallingford, CT, 06492  
 1-800-PASSIVE  
[www.sensorswitch.com](http://www.sensorswitch.com)