# Relay Dimming

# App Note 100

## What is and what isn't Relay Dimming?

When you read about relay dimming and "sending messages using the power line" one of your first thoughts may be that this is some form of power line carrier or PLC protocol. Various automation systems have used PLC for many decades starting with X10, followed by Spread Spectrum, CeBus, Insteon, UPB and IPC. While there have been many improvements over the years for this and similar technologies, all these methods suffer from noise on the power line that can mask or create false signals, or signal attenuation that can obliterate those signals.

Simply put, **Relay Dimming** is not any form of PLC
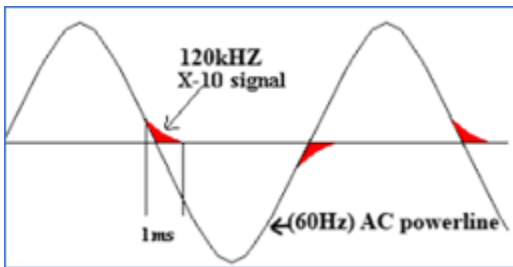


The oldest power line signal protocol is X10 and uses the 60hz sine wave of the power line as a carrier for the insertion of a message at selected points. The image on the left shows this graphically.

X10 method imposes a small 5VPP 120KHZ oscillated signal onto the powerline.
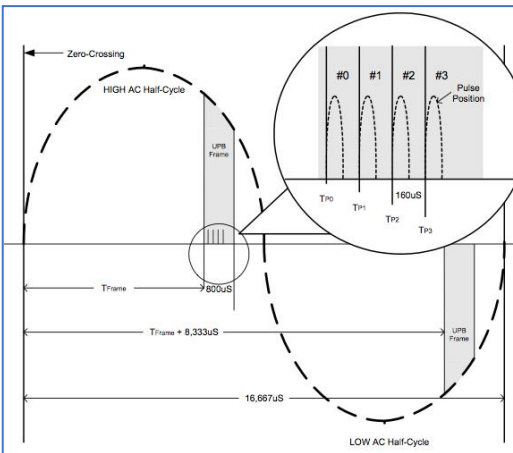


A modern method that uses the power line, developed by PCS, is called UPB and uses Pulse Position Modulation. UPB messages transmit digitally encoded information over the power line as a series of precisely timed electrical pulses.
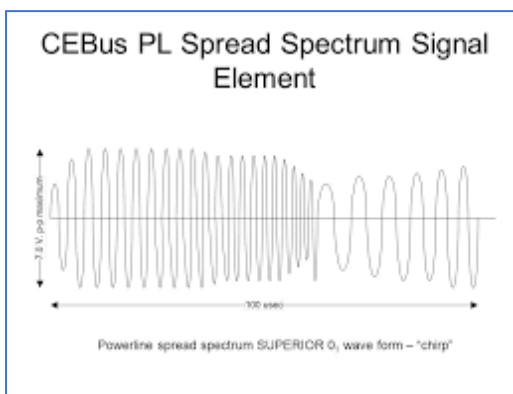


Another method that was developed as an attempt for X10 to address attenuation and noise issues was CEBus spread-spectrum.

All these methods use a signal that "comes along with" the 60hz power line. All these methods use some form of extra transmitter. Again, this is <u>not</u> **Relay Dimming**. Relay Dimming does not use a transmitter circuit. It ONLY uses the power relay that controls the power to the fixture circuit.

The **Relay Dimming** method works differently. The "marks" or "clicks" are put on the load line going from the relay switch to the fixtures controlled by that relay switch. A portion of the 60hz power line sine wave is removed from the fixture for a brief amount of time to make a "mark". For LED office space troffer fixture applications ½ of a whole cycle is removed by a relay "click". Some number of power line cycles later a second mark is made on the power line. The number of cycles between these two marks is the message. The receiving module uses a patented method of evaluating the power line to identify these marks. The method used by the receiving module is very tolerant of power line aberrations.
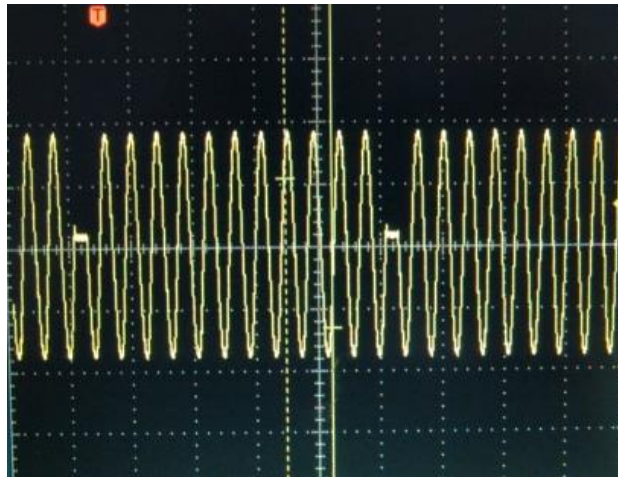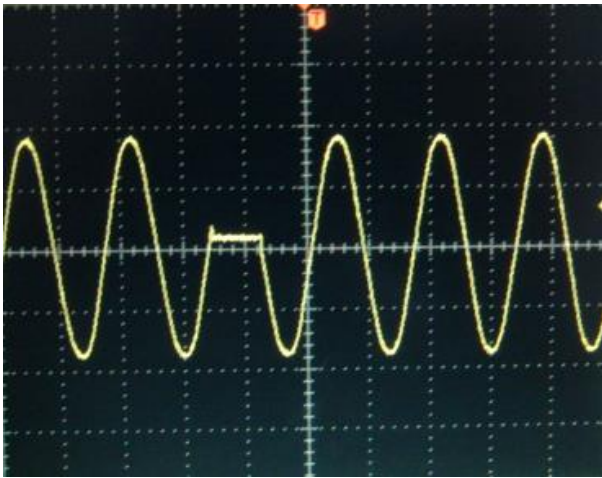


It is impossible for this signal method to go backwards into the circuits of the building. The relay load line goes ONLY to the fixtures on the load line (red wire). It is impossible for anything in the building to attenuate the missing ½ cycles. When the relay is open it is OPEN. It is only a simple mechanical power relay. The same relay type that has been used in all occupancy sensors and relay type switches for the past 20 years.

Photo #1 shows ½ positive cycle missing and Photo #2 shows an actual ON message formed by 2 clicks spaced 12 cycles apart.

There is no power line "method" that could be less expensive and so reliable. The method is limited to only the fixtures on one circuit. Relay Dimming is very simple and accomplishes one simple function – dimming LED fixtures without having to run the two 0-10V wires from the wall switch or occupancy sensor. Very Simple, Very Reliable, and Very Valuable.

Because the power line is a regular 60hz sine wave, making a mark by removing part of the cycle is very immune to noise or other factors. What **Relay Dimming** does is, in effect to, for a very brief period, turn the power off and then back on. Noise and signal attenuation are not factors in **Relay Dimming**.

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## Is the fixture affected by the Relay Dimming method?

No. By removing such a small part of the power the LED drivers don't even notice it. We have tested with fixtures from Phillips, Acuity/Lithonia, and Columbia/Hubbell and they show no effect from these power line marks. At this point we have tested with these major manufacturers but we expect that any LED fixture with a 0-10V driver can use **Relay Dimming**.

##end##

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