Different Types of Light Dimming

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In the old days, light dimming is through a variable resistor. As the nob is turning, the amount of resistant will vary which makes the current delivered to the load vary. Therefore, the voltage drop caused by the resistive nob will decrease the load voltage and dim the light down. The disadvantage of this is its inefficiency, it doesn’t save any energy since the applied voltage and current are the same between the dimming load and non-dimming load. Current must travel through a resistive nob so the energy is wasted as heat from the resistive nob. It can also be potentially dangerous since it creates a lot of heat.

Incandescent Dimming (Also referred to as 2-Wire Forward Phase Dimming)

The use of incandescent dimming can reduce energy consumption and increase lamp life. Since incandescent lights uses resistive filaments, it can be dimmed by most electronic dimmers. Typical incandescent dimmers such as Lutron DV-600P. These dimmers use a silicon device, usually an SCR or a Triac, to turn the AC waveform on part way through its cycle. By varying the point at which the waveform turns on, we can alter the amount of power delivered to the lamp. Incandescent dimmers cannot be used to dim low voltage loads, but magnetic low voltage dimmer or electric low voltage dimmer can be used

to dim incandescent loads.

Benefits of Incandescent Dimming:

- Incandescent compatible LED Drivers/lamps work with most 2-wire forward phase dimmers making them perfect for many retrofit applications.
- Some LED Drivers are specially designed to eliminate the problems associated with using 2-wire forward phase dimmers with LED fixtures including flicker, ghosting, pop on, drop out, etc.
- 2-wire forward phase dimmers are the least expensive and have the most installations in the marketplace. In many cases, these dimmers are less expensive than electronic low voltage dimmers or 0–10V dimmers.
- Generally, provide smooth dimming down to 10% depending upon the dimmer’s limitations.

Drawbacks of Incandescent Dimming:

- 2-wire forward phase dimmers should not be used with ELV drivers because doing so could cause any of the following malfunctions: dimmer buzz, lamp flicker, interaction between circuits or radio frequency interference (RFI).
- At times, noticeable noise in a forward phase dimming system can be observed as the filaments of the lamps are being dimmed. When the power is turned on to the lamp part way through the waveform cycle, the filament expands very rapidly, and then as the voltage ramps back down again the filament cools. This rapid cycle of expansion and contraction leads to “Lamp Sing” (an audible hum that can be objectionable).

Magnetic Low Voltage Dimming

Modern dimmers chop up the sine wave and turn off the circuit whenever the voltage switches polarity and turn it back on. The amount of time it turns off will dictate how bright the light will be. If the dimmer is set on a lower light, then the turn off time will be longer. If it’s on a brighter setting, then the turn off time will be shorter. It usually has a very smooth turn off period.

Magnetic transformers step down the 120 VAC line voltage into 12 VAC or 24 VAC. It uses copper winding around a steel core to produce magnetic flux. It’s usually rated as Volt-Amp because it’s heavily inductive and produces reactive power; which we need to take it into account for on the rating. Dimmers with magnetic low voltage transformers use the technology known as “leading edge”, it’s often used with inductive loads such as motors.

Drawbacks of MLV Dimming:

- Typical incandescent dimmers cannot be used to dim low-voltage lighting systems, nor they can be used to dim fluorescent lights. DO NOT USE REGULAR INCANDESCENT DIMMER ON LOW VOLTAGE DIMMING. It produces a small amount of DC voltage which may harm the magnetic transformer.

Electric Low Voltage Dimming

(Also referred to as Reverse Phase Dimming)

Electric transformers step down the 120 VAC voltage to 12 VAC or 24 VAC using electronic circuitry. It’s usually very small compare to magnetic transformers. They tend to have capacitive input which leads the current, and will require a trailing edge waveform for dimming. It’s very smooth to turn on but requires a Neutral wire connection.

Benefits of ELV Dimming:

- ELV dimming drivers are generally widely tested and approved by dimmer manufacturers for LED loads.
- Generally, 2-wire reverse phase dimmers work better on LED Drivers than most 2-wire forward phase dimmers. The reason is that most LED Drivers use Electronic Low Voltage (ELV) Transformers. These transformers are generally capacitive type loads which work much better when controlled by Reverse Phase dimmers.
- Allows smooth dimming down to 5% depending upon the dimmer’s limitations.

Drawbacks of ELV Dimming:

- 2-wire reverse phase dimmers can be more expensive than forward phase incandescent or magnetic low voltage style dimmers.
- Smaller install base could mean replacing incompatible dimmers on retrofit projects.
- 2-wire reverse phase drivers should not be used with forward phase dimmers because doing so could cause any of the following malfunctions: dimmer buzz, lamp

flicker, interaction between circuits or radio frequency interference (RFI).
- 2-wire reverse phase dimmers require a neutral wire. This can result in having to pull additional wire on remodel projects.
- Some architectural loads (e.g., linear fluorescent) perform better when dimmed with ELV dimmers. However, it is very important to refer to the luminaire manufacturer's datasheet to verify compatibility of forward or reverse phase dimming.

0-10 V Dimming Also Referred to as 4-Wire Dimming)

Low voltage 0-10 V dimming are usually used on LED or fluorescent lights. It uses low voltage 0-10 VDC signal connected to each LED power supply or fluorescent ballast. 0 V would be the minimum brightness and 10 V would be the maximum brightness. Its most common applications would be LED lighting fixture with 0-10 V dimming input. It usually requires a power pack providing DC power to the 0-10 V dimmer.

Benefits of 0-10V Dimming:

- Use existing 0–10V systems in retrofit applications.
- Large 0–10V install base in commercial applications due to IEC standards.
- Allows smooth dimming down to 5% depending upon the dimmer's limitations.
- Compatible with many daylight harvesting controls, occupancy sensors, and building automation.

Drawbacks of 0-10 V Dimming:

- Some manufacturers do not follow the IES standard. This leads to LED Drivers and lamps that claim 0–10V compatibility but drop out or pop on, or dim backwards with the lowest output at the top and the highest output at the bottom. Also, a function of correct pairing of LED Driver and LED load.
- The control signal is a small analog voltage and long wire runs can cause a signal level drop that can produce different light levels from different drivers on the same control circuit.

Digital Dimming (Also Known as Dali)

With digital dimming, the driver receives a digital signal which tells it how to respond. The advantage of digital dimming is that fixtures are addressable. You can also have many more different levels of light output when using digital dimming. Light fixtures require a Dali Driver and were more common among fluorescent fixtures.

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