APP-008: Using 0-10 volt DC signals for light dimming

This document is general information only. Always refer to local electrical codes for acceptable installations.

The main focus of this document is LED lighting fixtures, but the information applies to 0-10 volt fluorescent fixtures as well. We will refer to the device controlling the 0-10 volt signal as the *control* and the device under control as the *driver*.

There are two lighting control standards that use 0-10 volt control signals: **current sourcing** and **current sinking**. Phason controls do both standards; they automatically source or sink depending on what the device needs. Brief descriptions are below, but you can refer to Wikipedia for additional information.

Current sourcing

In current sourcing, the control sends voltage to the driver. The idea is that at 10 V the light should be at 100% of its potential output, while at 0 V it should be at 0% or its minimum.

Current sinking

Current sinking is the most common standard. In current sinking, 10 V DC is provided by the driver and the control reduces the V returned to the light. When the control returns 10 V to the driver, the light should be at 100% of its potential output. When the control returns 0 V to the driver, the light should be at 0% or its minimum.

Control range

The control range for many drivers is from 1-10 V, where 1 volt gives the minimum light output and 10 V the maximum. Some drivers stop light output when the voltage is at or below 0.5 V, but many remain at minimum output even at 0 V. In this case, the AC needs to be disconnected to stop light output. Phason lighting controls have a "follower" or "disconnect relay" feature to deal with this scenario.

It is important to note that maximum light output is at 10 V and minimum is typically at 1 V; there is no defined output for the range between those values. Different models of drivers can have different output characteristics. For example, driver model ABC might have a light output of 40% at 4 V, while model XYZ has an output of 30%. When installing fixtures at a site, make sure all fixtures are the same or compatible models.

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How many fixtures can the control operate?

The driver sources current out of the positive connection of the 0-10 V control connection. You need to know the maximum current the driver will source when the control is at 0 V. The value is typically 1 mA or less. A control can operate multiple fixtures, up to its maximum rated limit.

For example, maximum current rating of the **AutoFlex Variable DC Module** (VDC-4) is 100 mA per output. If the fixture sources a maximum current of 2 mA, the maximum number of fixtures that can be connected to the VDC-4 output is 50.

$$100 \div 2 = 50$$

Other considerations

LED lights tend to be low wattage devices. What is often missed is that they can have a high inrush current. This is a concern when it comes to the AC line relay or switch. The inrush current is often 50 to 100 times the steady state current. Give careful consideration to the inrush capability of the relay or switch that will supply the AC to the led fixtures.

Typically the colors used for the 0-10 V wires are gray for negative (–) and violet for positive (+). It is very important to connect the positive and negative wires to the indicated + and – terminals on the control. Reversed polarity can damage the control.

Use twisted pair wires for the 0-10 V control signal to reduce electrical noise pickup.

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