WattStopper®

TechBulletin

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Controls Compatible with Industry Standard Ballasts and LED Drivers

IEC Standard 60929 Annex E Specifies Control Protocol to Insure Interoperability

Topic: 0-10 VDC Sinking Control Dimming Protocol **Issue:** # TB183 **Date:** October 10, 2011

WattStopper's 0-10 VDC dimming controls, including selected DLM room controllers, wallbox dimmers and daylighting controllers, use an industry standard control protocol in order to control compatible ballasts and other devices such as LED drivers. This bulletin reviews how this low voltage "sinking" control method was developed, how it works and how it differs from 0-10 VDC "sourcing" control.

Background

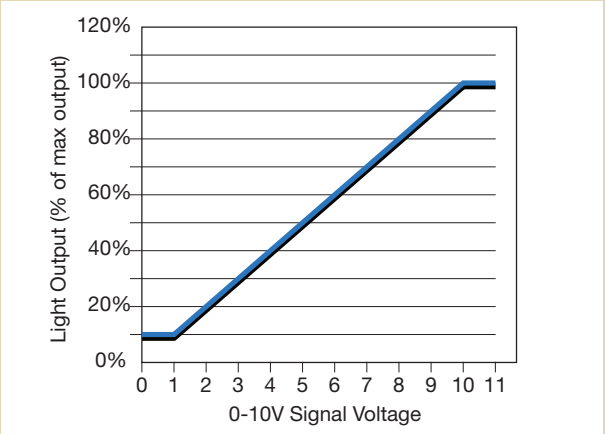
In the 1980s, the Advance Transformer Company developed a method that enabled low voltage control of the company's dimming ballasts. The technique requires the ballast to generate its own control voltage signal. A "controller" can then modulate the ballast's signal by "sinking," or drawing off, some of the power, which in turn changes the output of the ballast. If no controller is present, the ballast will operate at full light output. This 0-10 VDC control method was later adopted by the International Electrotechnical Commission (IEC) as part of a standard for ballasts, and technical specifications appear in IEC Standard 60929 Annex E.

The IEC analog protocol is sometimes confused with another 0-10 VDC protocol, ANSI E1.3-2001 (R2011) Entertainment Technology – Lighting Control Systems – 0 to 10V Analog Control Specification, but the two protocols are not compatible. The fundamental difference between the standards lies in which product supplies the control voltage: the controller or the device under control (e.g. ballast, LED driver, dimmer, etc.). The entertainment technology protocol requires that the controller generate, or "source" the low voltage signal.

When specifying 0-10 VDC controls, be sure that both the controller and the lighting load, or other device that is being controlled, utilize the same control protocol.

Dimming control using 0-10 VDC sinking

At its highest control level, the controller does not sink any of the control voltage, so the ballast input measures a full 10 volts resulting in 100% light output. For lower light levels, the controller reduces the voltage to the ballast input by sinking some of the power to ground. At an input voltage of 1 volt or less, the ballast should maintain its minimum light level, which is typically 10%, 5% or 1% output, depending on the ballast specification. Whether or not the low end of the dimming range (e.g. less than 2



This graph represents the ideal ballast or LED driver output in response to a controller, from the minimum dimming level to full.

Check with the ballast or driver manufacturer to confirm product specifications:

- Products should maintain maximum output at any control signal level ≥ 10 volts
- Product should maintain minimum output at any control signal level ≤ 1 volt
- Products should source no more than 2mA of control current: controllers can drive more ballasts if the ballasts source less current
- It is helpful to know what the maximum signal voltage will be on the 0-10 V control leads when no controller is connected

Note: If the ballast or driver causes the lamp or LED to flicker at the low end, adjusting the low trim (if available) on the controller may solve the problem.

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volts) is useable is also ballast specific.

To turn a 0-10 volt dimming ballast Off, the controller must activate a relay to switch the line voltage supply to the ballast. Some controllers (such as WattStopper's LMRC-210 and -310 series room controllers) include both low voltage and line voltage control components to provide both dimming and On/Off functionality. Other controllers (such as WattStopper's LS-301 Dimming Photosensor) contain only low voltage components, and work with a power pack to coordinate the On/Off switching.

The IEC standard requires that the ballast source no more than 2mA of control current, but the typical dimming ballast generates less than this: approximately .5mA. The amount of control current supplied by the ballast has a direct relationship to the number of ballasts a controller can drive. For example, the LMRC-210 and -310 series room controllers are designed to sink up to 100mA of control current per channel. This means that each output can drive at least 50 ballasts that meet the IEC standard.

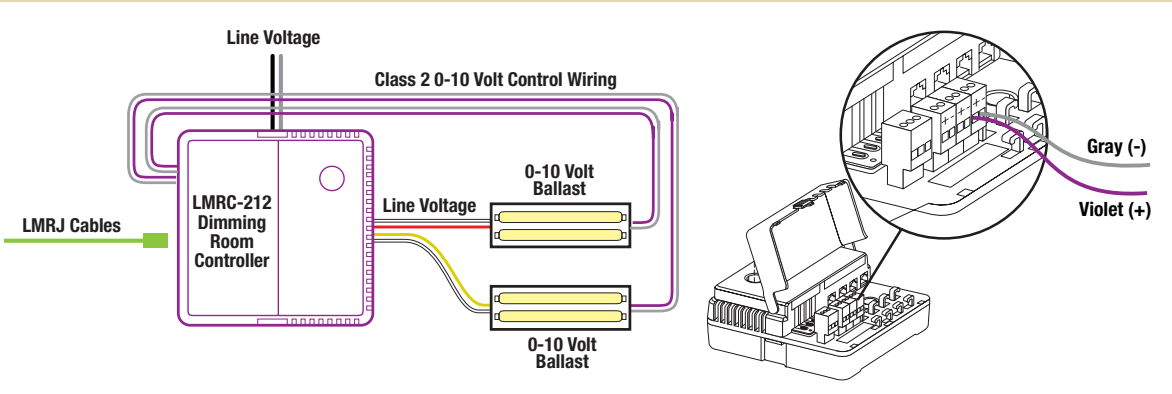
Beyond ballasts

Recently, manufacturers have incorporated 0-10 VDC sinking control into new products, including LED drivers, to ensure that their products will respond to the many controllers available in the marketplace. However, not all the new products follow the standard to the letter.

Product compatibility

Some controllers rely on the 0-10 VDC control signal to power their own electronics, and this may affect their control range (e.g. limit control to range such as 2-8 VDC.)

WattStopper's 0-10 VDC controllers use a separate power supply and provide full range control. They are compatible with many ballasts and other lighting products, and are intended to be compatible with any product that conforms to IEC Standard 60929 Annex E.



Run two low voltage conductors from the controller to the 0-10 VDC dimming ballast for light level control. If there are additional channels of dimming control, run additional pairs of wiring. Run line voltage wiring between each relay that will provide On/Off switching and the ballasts that will be controlled together. Follow NEC requirements for separation of Class 1 and Class 2 wiring. In this example, the LMRC-212 is wired to control two separate channels of dimming ballasts. The relays for On/Off control are integral to the room controller.

Wire leads or terminal labels for 0-10 VDC sinking control products are typically gray (-) and violet (+). It is important to maintain polarity when connecting control wiring.

