

Lighting Control for Noise-Sensitive Applications

MRI rooms, sound studios, and other noise-sensitive applications require very low-noise environments to preserve the integrity of the data collection in the room. Electrical noise created by alternating current line-voltage is of particular concern, even more so when that line-voltage is dimmed with a traditional phase-control signal. A better method of delivering power to the lights in a noise-sensitive application is to provide a direct-current, or DC signal. Lutron has DC dimming solutions for both incandescent and LED load types.

LED Loads

For LED loads, Lutron recommends the Hi-lume® 1% L3D or LTE LED Driver with Constant Current Reduction (CCR) output. Lutron does **NOT** recommend the use of Pulse Width Modulation (PWM) output drivers. The 1% L3D or LTE LED driver is controllable with either a Lutron® EcoSystem®, Lutron® 3-wire, or Lutron® forward-phase control. The 1% L3D or LTE LED driver is mounted outside of the room and sends a direct-current signal to the LED load inside the room, through a recommended filter for enhanced noise filtering. The use of a filter does not negatively impact dimming performance. Refer to the Hi-lume® 1% EcoSystem™/3-Wire L3D Driver specification submittal (Lutron® P/N 369325) or the Hi-lume® 1% 2-Wire LED Driver specification submittal (Lutron® P/N 369543) for more information.

If using Lutron® controls with LED drivers by others, consult the driver or fixture manufacturer for filtering recommendations. In all cases it is recommended to keep Lutron® dimming controls outside of the noise sensitive room.

What is Constant Current Reduction (CCR)?

In a CCR LED Driver, the output current flows continuously at a set amount for a given light level. Since the amount of light output is proportional to the current flowing through the LED, the current is reduced to reduce the brightness of the LED. See Lutron® Application Note #360 for more information on the differences between CCR and PWM dimming of LEDs at <http://www.lutron.com/TechnicalDocumentLibrary/048360.pdf>

What about 0-10 V_{DC} Controls?

If using Lutron 0–10 V_{DC} controls to control 0–10 V_{DC} fixtures in a noise-sensitive application, Lutron recommends keeping all 0–10 V_{DC} controls outside of the noise-sensitive area. Furthermore, consult with the 0–10 V_{DC} driver or fixture manufacturer for filtering recommendations for the noise-sensitive application.

LED Loads *(continued)*

Important Design considerations:

- Lutron does **NOT** recommend the use of PWM output models of the 1% L3D or LTE LED driver for noise-sensitive applications. These models dim the lights with a pulsed current output, which could create unwanted noise in a noise-sensitive application.
- Lutron recommends the use of LCR059 series of EMI filters (www.lcr-inc.com/pdf/mri-shielded-pdf/LCR059SeriesInstallationInstructions.pdf) for use with the 1% L3D or LTE LED driver. The LCR059 sits on the output side of the driver, between the driver and the load.
- Lutron recommends using higher current, ≥ 500 mA, output models of the 1% L3D or LTE LED driver. The use of a filter causes some minor reduction in the current delivered to the load, which may be significant for currents below 500 mA. Consult the Lutron® System Sales Engineering team for applications requiring lower currents. Any load that is compatible with a 1% L3D or LTE CCR driver that is ≥ 500 mA can also be used with the LCR059 filter.
- Keep in mind the maximum lead length from the driver to the LED load.

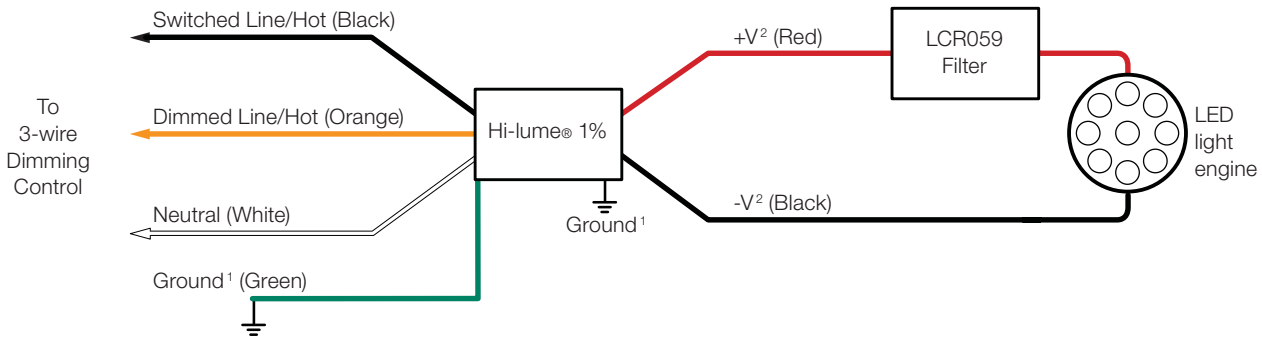
Maximum Driver-to-LED Light Engine Wire Length for Constant-Current Drivers:

Wire Gauge	Maximum Lead Length		
	200 mA to 700 mA	710 mA to 1.50 A	1.51 A to 2.10 A
18 AWG (0.75 mm ²)	30 ft (9 m)	15 ft (4.5 m)	10 ft (3 m)
16 AWG (1.5 mm ²)	35 ft (10.5 m)	25 ft (7.5 m)	15 ft (4.5 m)
14 AWG (2.5 mm ²)	50 ft (15 m)	40 ft (12 m)	25 ft (7.5 m)
12 AWG (4.0 mm ²)	100 ft (30 m)	60 ft (18 m)	40 ft (12 m)

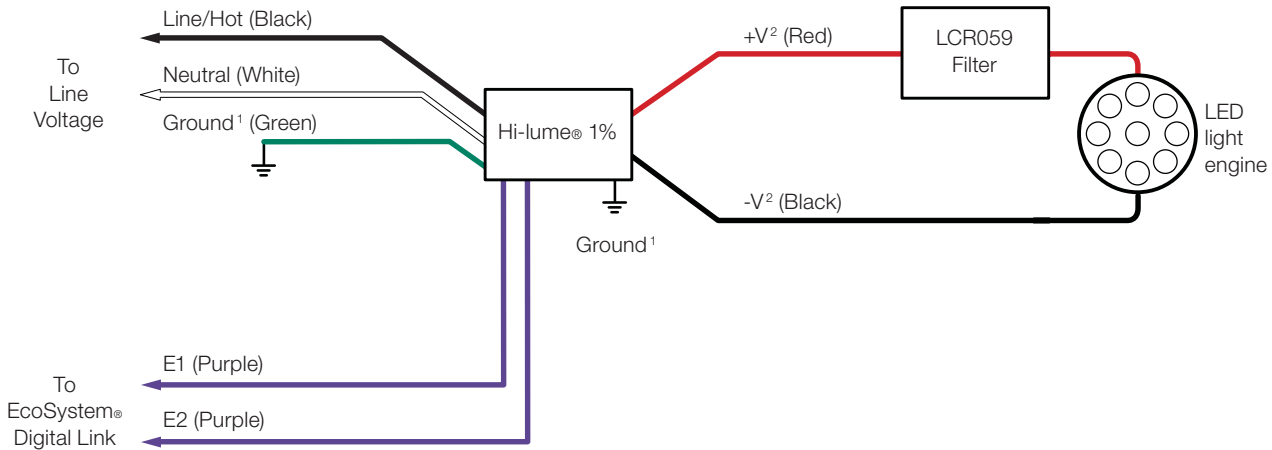
LED Wiring Overview

Note: Colors shown correspond to the terminal blocks on the driver.

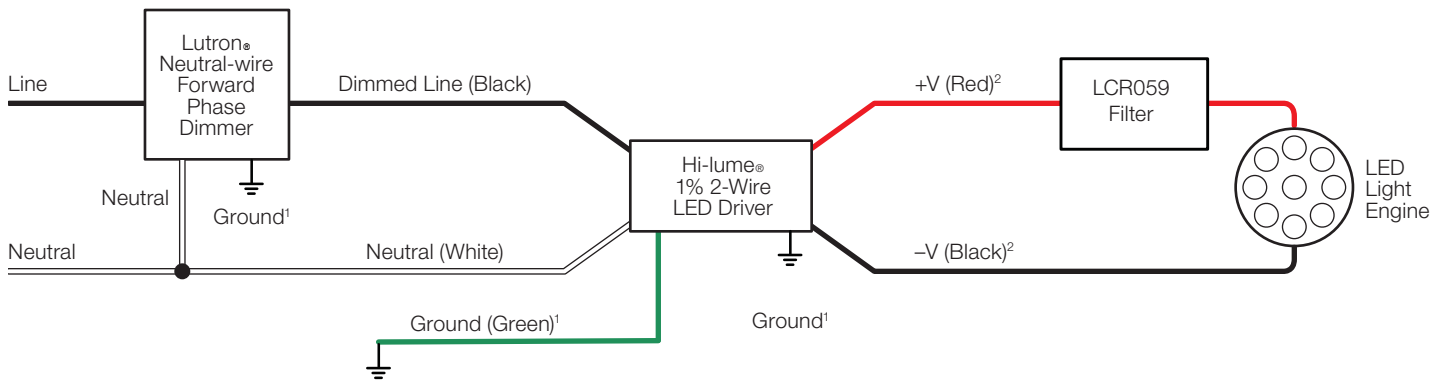
Wiring Diagram for 3-Wire Control



Wiring Diagram for EcoSystem® Digital Control



Controls Requiring Neutral



¹ Ground wire connection available on K-case models only. Fixture and driver case must be grounded in accordance with local and national electrical codes.
² For maximum driver-to-LED light engine wire length, see the **Maximum Driver-to-LED Light Engine Wire Length for Constant-Current Drivers** chart on page 3 of this document.

Incandescent Loads

For incandescent loads, Lutron recommends the DCI dimming panel (available for GRAFIK® 4000 and Quantum® systems). The DCI dimming panel is powered by 120 V~ and can power up to 3600 W of incandescent loads. The DCI dimming panel is mounted outside of the room and sends a direct-current signal to the incandescent lights in the room, through a filter designed specifically for the DCI panel to enhance noise filtering. The use of a filter does not negatively impact dimming performance. Refer to the DCI Dimming Panels specification submittal (Lutron® P/N 369645) for more information.

Important design considerations

- All power supplied into a noise-sensitive room must be fed through facility filters.
- Lutron® DCI Panel solutions also require the following UL® listed filter to be installed:

FIL-COIL COMPANY, INC.

P/N FC-2249

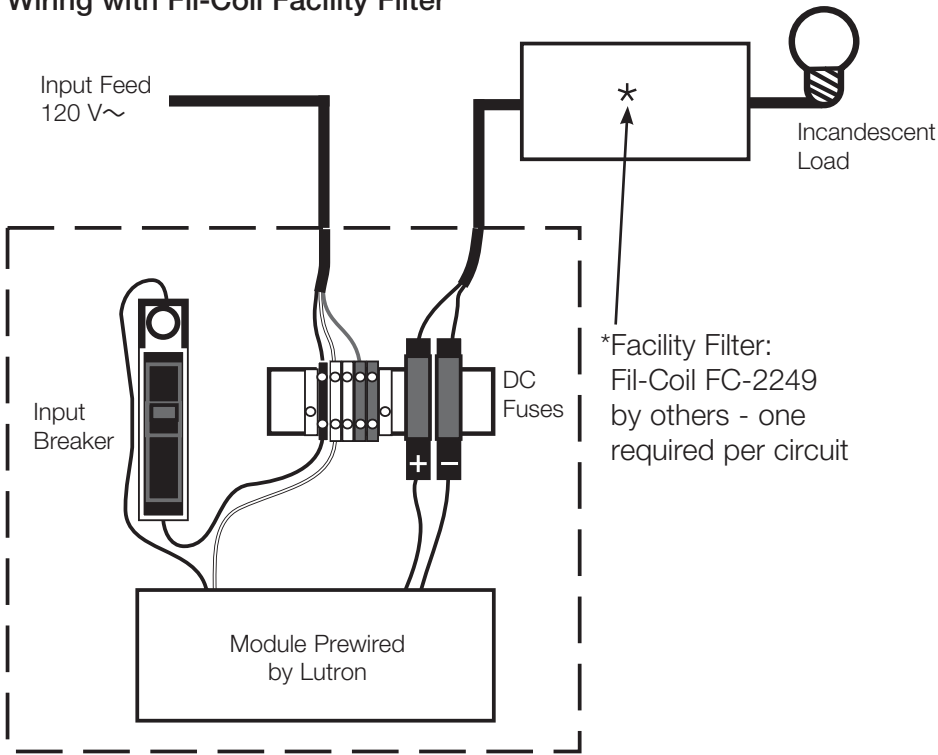
631.467.5328

Note: This is a custom filter designed specifically for DCI Panels. Other filters are not permitted unless each DCI circuit is supplied by a separate 120:120, 3.0 kVA isolation transformer (one transformer is required for each power input).

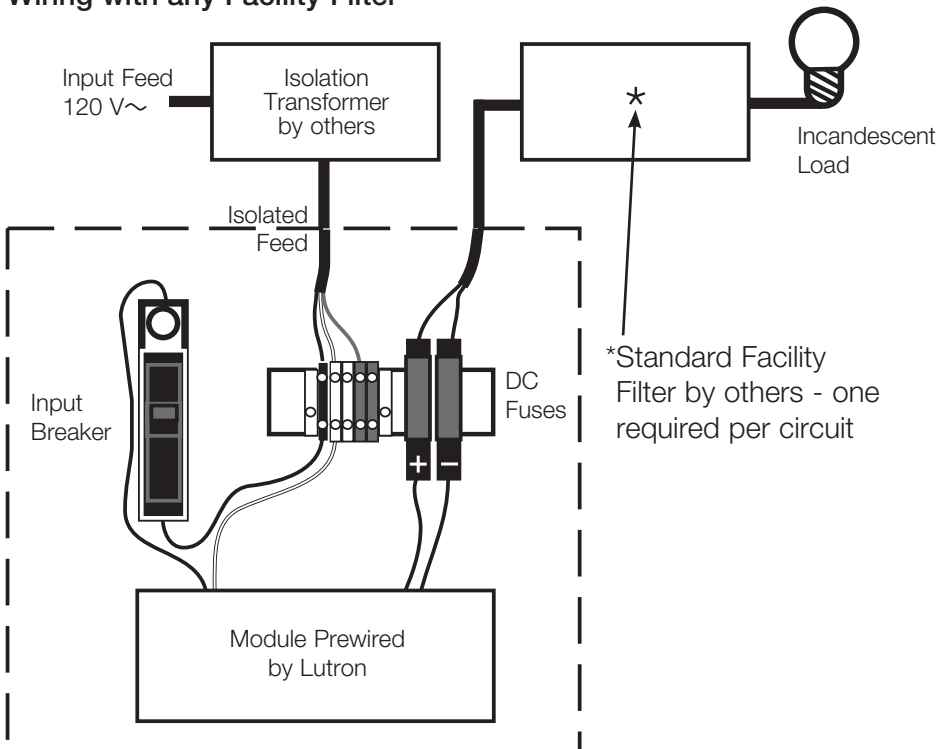
- All Controls and Dimming Panels must be mounted outside the room, away from the influence of large magnetic fields (especially true in the case of an MRI room).

DCI Wiring Overview

Wiring with Fil-Coil Facility Filter



Wiring with any Facility Filter



Lutron makes no guarantee for the total noise level in the room or the ability of the LED light engine to withstand the magnetic fields present in an MRI room. It is recommended to consult with the fixture manufacturer during the design phase of a project.

Lutron suggests mounting any phase-control dimming or digital communication (EcoSystem®, QS Link) wires at least 6 feet away from equipment that is sensitive to radio frequency interference.

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