

DIMMING FACTS FOR LED PRODUCTS



Introduction

Liton offers five dimmable driver options for its product lines: incandescent, electronic low voltage, magnetic low voltage, Hi-Lume and 0-10V. The following pages will help to explain the uses, benefits and limitations of each dimming system. Not all dimming options are available for all products. Please consult our website at: www.liton.com for available options.

LED Dimming Driver Terminology:

Efficacy:	The efficacy or efficiency of a lighting fixture is the amount of light (lumens) per unit of energy (watts). Lm/watts = efficacy
ELV – type dimmer:	An electronic low voltage dimmer used with electronic low voltage LED drivers. Also known as a trailing-edge dimmer.
MLV – type dimmer:	A magnetic low voltage dimmer used with magnetic low voltage drivers
Ghosting:	When an LED lighting fixture continues to glow in the off position. This is usually due to mismatched driver and dimmer technology, ex: incandescent dimmer paired with an electronic low voltage driver.
Leading-edge Dimmer:	A dimmer that was designed to work with Incandescent lamps. Older dimmers of this type were not designed to work with LED lamps and problems with flicker, pop-on and ghosting due to residual voltage have been observed. Newer designs have been specially designed to eliminate these problems.
LED Driver:	An electrical device that converts line voltage power to a power level that low voltage LEDs can use, much like a low voltage transformer converts line voltage power (120VAC) to low voltage (12VDC) so that it can be used with 12V MR16 lamps.
LED Dimmable Driver:	An LED driver that provides the correct power to the LEDs so that it can function and also allows the lumen output to be dimmed to create mood, ambience or to save energy.
Light Emitting Diode (LED):	A low voltage semiconductor device that emits light when electrical current is passed through it.
Pulse Width Modulation (PWM):	A method most LED drivers use to regulate the amount of power to the LED. PWM turns LEDs on and off at high frequency, reducing the total ON time to achieve a desired dimming level without visible flicker.
Reverse Phase Dimmers:	Also known as ‘Trailing-edge’ were designed to work with most electronic (ELV) and 3-wire CFL dimmers
Trailing-edge Dimmer:	A type of dimmer that was designed for use with most electronic low voltage (ELV) and 3-wire CFL dimmers.
Standard Phase Dimmers:	Also known as ‘Leading-edge’ were designed for use with Incandescent products.

Qualified Partners:



Incandescent Dimming Driver Option

History

Incandescent Dimmers were designed for use with Incandescent (120V) lighting fixtures that use A19 bulbs and PAR type lamps. They are the least expensive and most widely installed dimmers in the marketplace. They are also known as **Leading Edge Dimmers** or **Triac Dimmers**.

Where Used?

LITON offers 2-wire incandescent compatible drivers in many of its 4", 5" and 6" General Purpose Recessed Housings and its 2", 3" and 4" Mini-Arc Recessed Housings and are specified as "-DIN" when ordering. Please see specification sheets for further details.

Synonymous Terms:

Incandescent, Leading Edge, 2-Wire and Triac Dimmers, Forward Phase.

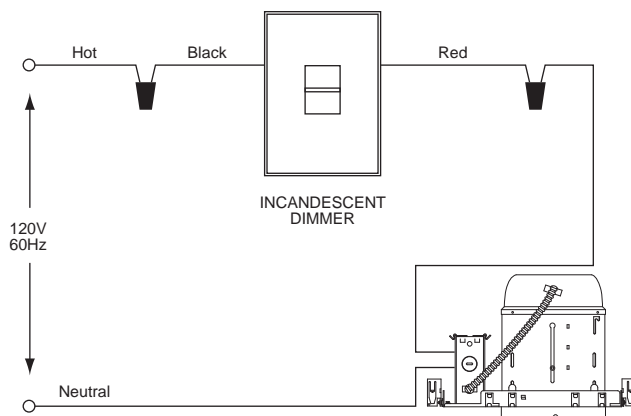
Benefits

- Incandescent LED drivers work with most 2-wire incandescent dimmers making them perfect for many retrofit applications.
- Liton's incandescent drivers are specially designed to eliminate the problems associated with using incandescent dimmers with LED fixtures including flicker and ghost imaging in power off mode.
- Incandescent dimmers are the least expensive and have the most installations in the marketplace.

Limitations

- Incandescent dimmers should not be used with ELV or MLV drivers because doing so could cause any of the following malfunctions: dimmer buzz, lamp flicker, interaction between circuits or radio frequency interference (RFI).

Incandescent Dimmer Wiring Diagram



Partial list of factory tested, compatible incandescent dimmers:

Manufacturer	Style	Model
Lutron	Skylark	S600PR
Lutron	Diva	DVSCCL-153P
Lutron	Diva	DV600PR
Leviton	Illumatech	IP106 (600W)
Hunt	Simplicity	PS-LED-PC

Electronic Low Voltage (ELV) Dimming

History

Electronic Low Voltage (ELV) Dimmers were originally designed to control Electronic Low Voltage Transformers used in low voltage (12V) MR16 type fixtures. ELV dimmers and transformers are more expensive but offer quieter operation, better control and tend to last longer than Magnetic Low Voltage Transformers (MLV). Also referred to as **Reverse Phase** Dimmers.

Where Used

ELV Dimming Option is used in LITON General Purpose Recessed Housings and is specified as “DLV” when ordering. Please see specification sheets for further details.

Synonymous Terms:

Electronic Low Voltage, ELV, Trailing Edge and Reverse Phase

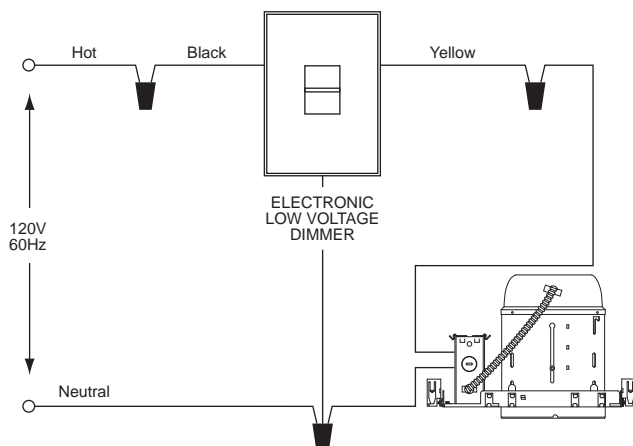
Benefits

- ELV dimming drivers from Liton are the LED driver most widely tested and approved by dimmer manufacturers (see list).
- Works better on LEDs than most magnetic low voltage (MLV) drivers.
- Allows smooth dimming down to 5% depending upon the dimmer's limitations.

Limitations

- ELV wall dimmers can be more expensive than incandescent or magnetic low voltage dimmers.
- Smaller install base could mean replacing incompatible dimmers on retrofit projects.
- ELV drivers should not be used with incandescent dimmers because doing so could cause any of the following malfunctions: dimmer buzz, lamp flicker, interaction between circuits or radio frequency interference (RFI).
- All ELV drivers and dimmers are 3-wire, requiring a neutral wire. This can result in having to pull additional wire on remodel projects.

Electronic Low Voltage (ELV) Dimmer Wiring Diagram



Examples of ELV dimmers:

(See next page for a more comprehensive list):

Manufacturer	Style	Model
Lutron	Skylark	SELV-300P
Lutron	Diva	DVELV-300P
Lutron	Maestro	MAELV-600
Lutron	Nova	NTELV-600
Lutron	Vierti	VTELV-600
Leviton	Surslide	6615-POW
LiteTouch	Inverse Phase	08-2140-01
LiteTouch	8-Channel	6615-POW

**(ELV) Factory Qualified Dimmers for
Under Cabinet “LULED” Series, Track Lighting “LTD8” Series
and Recessed Lighting “LHLD” 4", 5" & 6" Series**



Series	Model	Power	Avg. Price	# Units per Dimmer
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LUTRON® (Qualified LED Partner)

Lyneo® LX				
Single Pole	LXELV-600PL	600W	SELV-300P	1 - 13
3-Way	LXELV-603PL	600W		
Faendra®				
Single Pole	FAELV-500M	600W	SELV-300P	1 - 11
Skylark				
Single Pole	SELV-300P	300W	\$45 - \$55	1 - 7
3-Way	SELV-303P	300W	\$45 - \$55	1 - 7
Diva				
Single Pole	DVELV-300P	300W	\$80 - \$100	1 - 7
3-Way	DVELV-303P	300W	\$80 - \$100	1 - 7
Maestro				
Single Pole	MAELV-600	600W	\$110 - \$150	1 - 3
Nova				
Single Pole	NELV-450	450W	\$80 - \$85	1 - 10
Single Pole	NTELV-600	600W	\$150 - \$200	1 - 14
Vierti™				
Single Pole/Multi Location	VTELV-600	600W	\$180 - \$200	1 - 14
Lutron Interfaces				
Grafik Eye®	ELVI-1000		\$130 - \$180	2
Grafik Eye®	PHPM-PA Power Module			1 unit min.
HomeWorks®	HW-RPM-4A**			1 unit min.
RadioRA 2	RRD-6XA**			4 units min.
Commercial Systems	LP-RPM-4A**			1 - 27
**Low end trim adjustment needed				

CRESTRON (Certified Partner)

iLux® Universal Dimmer	CLS-EXP-DIMU	600W	SELV-300P	1 - 13
Low Voltage Dimmer	CLX-1DELV4	600W		
Universal Dimmer	DIN-1DIMU4			

VANTAGE

Electronic Dimmer 120V	EDIMMOD	600W	SELV-300P	1 unit min.
Electronic Load Dimmer 120V	ELDS4-DIN	600W		1 unit min.

LEVITON

Surslide		600W		
Single Pole	6615-POW	600W	\$20 - \$30	1 - 14
3-Way	6615-POW		\$20 - \$30	1 - 14
Vizia		600W		
Single Pole	VZE06-1LZ	600W	\$90 - \$150	1 - 14
3-Way	VZE06-1LZ		\$120 - \$180	1 - 14
Acenti		400W		
Single Pole	ATEO-1LW	400W	\$75 - \$100	1 - 9
3-Way	ATEO-1LW		\$75 - \$100	1 - 9
Illumatech		300W		
Single Pole	IPE04	300W	\$40 - \$70	1 - 7
3-Way	IPE04		\$40 - \$70	1 - 7

WattStopper

Miro				
Single Pole	DCD267*	600W	\$35 - \$45	1 - 13



Unison Dimmer Module	ELV10	0W		
Unison Dimmer Module	D20	154W		

LiteTouch.

120V Inverse Phase	08-2140-01	480W		
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Magnetic Low Voltage (MLV) Dimming

History

Magnetic Low Voltage (MLV) Dimmers were designed to control Magnetic Low Voltage Transformers used in low voltage lighting fixtures.

Where Used?

MLV Dimming can be used in LITON Linkaled products and come standard on all LD522 drivers.

Synonymous Terms:

Magnetic Low Voltage, MLV

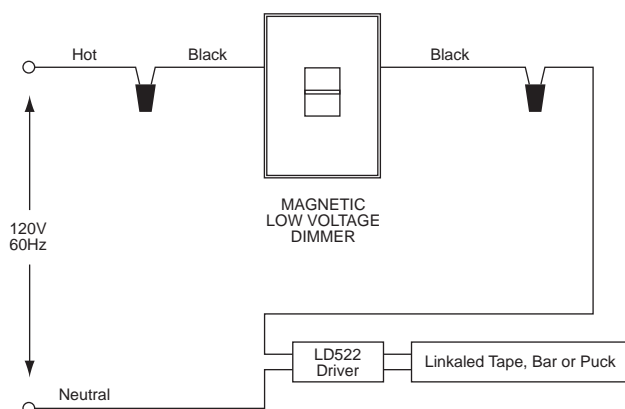
Benefits

- Liton's magnetic low voltage (MLV) drivers are specially designed to function with most magnetic low voltage dimmers.
- Allows smooth dimming down to 10% depending upon the dimmer's limitations.
- All MLV drivers and dimmers are 2-wire and do not require an additional neutral wire.
- MLV dimmers are less expensive than electronic low voltage dimmers or 0-10V dimmers.

Limitations

- MLV wall dimmers can be more expensive than incandescent dimmers
- MLV drivers should not be used with incandescent dimmers because doing so could cause any of the following malfunctions: dimmer buzz, lamp flicker, interaction between circuits or radio frequency interference (RFI).

Magnetic Low Voltage (MLV) Dimmer Wiring Diagram



Examples of MLV dimmers:

(See next page for a more comprehensive list):

Manufacturer	Style	Model
Lutron	Nova	NTLV-1000
Lutron	Diva	DVLV-103P
Lutron	Skylark	SLV-603P
Lutron	Illumatech	IPM06-1LZ



Factory Tested (MLV) Dimmers for Linkaled Products

Series	Model		
LUTRON® (Qualified LED Partner)			
Ariadni®	Single Pole 3-Way	AYLV-600P AYLV-603P	AYLV-600P-S AYLV-600P-S AYLV-600P-CSA AYLV-603P-CSA
Vareo®	Single Pole/Multi Location	V-600 V-1000-S VETN-1000-S VETS-R VETS-1000-SL	V-600-S VETN-1000 VETS-1000-S VETS-A-SL VETS-1000-SL-S V-1000 VETS-1000 VETS-1000-CSA VETS-R-S VETS-A-SL-S
Nova®	Single Pole Single Pole / 3-Way 3-Way 4-Way	NTLV-600 NTLV-1000 NTLV-1500 NTLV-603P NTLV-1003P NTLV-1503P NTLV-2003P NTLV-603P-CSA NTLV-1503P-CSA	NTLV-600-S NTLV-1000--S NTLV-1500-S NTLV-603P-S NTLV-1003P-S NTLV-1503P-S NTLV-2003P-S NTLV-1003P-CSA NT-1PS NT-1PS-S NT-1PS-CSA NT-3PS NT-3PS-S NT-3PS-CSA NT-4PS- NT-4PS-S NT-4PS-CSA
Ceana®	Single Pole 3-Way	CNLV-600P CNLV-603P	
Diva®	3-Way Single Pole 3-Way 4-Way	DVLV-603P DVLV-603P-S DVLV-103P DVLV-103P-S DVLV-10P DVLV-10P-S DVLV-600P SC-1PS SC-3PSNL	DVSVCLV-603P DVLV-603PH-S DVSVCLV-103P DVLV-103PH-S DVSVCLV-10P DVLV10PH-S DVSVCLV-600P SC-1PSNL SC-4PS DVLV-603P-CSA DVSVCLV-603P-L DVLV-103P-CSA DVSVCLV-103P-L DVLV-10P-CSA DVSVCLV-10P-L SC-3PS SC-4PSNL
Glyder®	Single Pole	GLV-600	GLV-600-CSA
Lyneo®	Single Pole 3-Way	LXLV-600PL LXLV-603PL	LXLV-10PL LXLV-103PL
Nova T®	Single Pole	NTLV-600 NTLV-1000	NTLV-600-277 NTLV-1000-277 NTLV-1500
Skylark®	Single Pole 3-Way	SLV-600P SLV-603P	SLV-600P-CSA SLV-603P-CSA SLV-600PH-CSA SLV-603PH-CSA
LEVITON®			
IllumaTech®	Single Pole / 3-Way Single Pole / 3-Way	IPM06-1LZ IPM10-1LZ	IPM06-1LX
Mural™	Single Pole / 3-Way Single Pole / 3-Way	MDM06-1LI MDM10-1LI	MDM06-1LW MDM10-1LW MDM06-1LA MDM10-1LA
SureSlide®	Single Pole / 3-Way	6613-PLT	6613-PLI 6613-PLW 6613-PLA
ToggleTouch™	Single Pole / 3-Way Single Pole / 3-Way	TGM10-1LI TGM10-1LT	TGM10-1LA
Vizia®	Single Pole / 3-Way	VPM06-1LZ	

0-10V Dimming Driver Option

History

0-10V Dimmers have been used in commercial applications for fluorescent lighting and occupancy and daylight sensor systems for years and are now becoming popular with LED products. One reason this standard is widely established is that it is defined in the IEC standard number 60929 Annex E, making it acceptable to most engineers.

Where Used?

LITON offers 0-10V drivers in its 5" and 6" General Purpose Recessed Housings, Architectural Recessed Housings, 24V Linkaled products and are specified as "-D10" when ordering. Please see specification sheets for further details.

Synonymous Terms:

0-10V, Fluorescent Dimming, 5-Wire Dimming.

Benefits

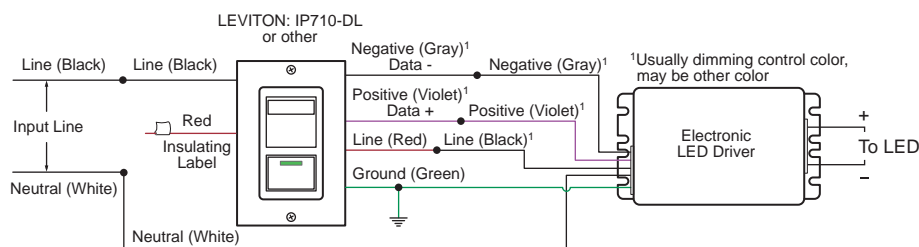
- Use existing 0-10V systems in retrofit applications.
- Liton's -D10 LED Driver is compatible with most 0-10V control systems.
- Large 0-10V install base in commercial applications due to IEC standards.
- Allows smooth dimming down to 5% depending upon the dimmer's limitations.
- Compatible with many daylight harvesting controls.

Limitations

- 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.
- 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.

0-10V Dimmer Wiring Diagram

-D10: 0-10V Fluorescent Dimming



Example 1:

Manufacturer	Style
Leviton	IP710-DLX
Lutron	NTFTV-WH*
Lightolier	V2000FAMU
Synergy	Mark VII ISD 120/277 WH-M10
*requires separate power pack, not supplied	

More Examples of 0-10V Dimming Systems:

Manufacturer	Style
Douglas Lighting	ALC3-BCM
Douglas Lighting	WPN-5821/5822/5721
Douglas Lighting	WWS-1301/1302

Manufacturer	Style
Hunt Dimming	PS-010-120V & PS-010-3W-120V
Hunt Dimming	PS-010-277V & PS-0101-3W-277V
Hunt Dimming	PS-LED-010-120V, PS-LED-010-3W-120V
Hunt Dimming	PS-LED-010-277V, PS-LED-010-3W-277V

Manufacturer	Style
Leviton	a-2000
Leviton	IP710
Leviton	Renior II (w/ 0-10V Setting)

Manufacturer	Style
Lehigh Electrical Co., Inc.	Collage Impress Touch Master
Lehigh Electrical Co., Inc.	CT500 LCD Touch
Lehigh Electrical Co., Inc.	DX2, DX2 277
Lehigh Electrical Co., Inc.	Single Set

Manufacturer	Style
Lutron	DVTV, DVSC TV
Lutron	NFTV
Lutron	NTFTV

Manufacturer	Style
Wattstopper, Inc.	ADF-120277

Lutron Hi-Lume Dimming Option

History

Lutron originally developed its Hi-Lume 1% Dimming ballast for use with fluorescent and compact fluorescent dimmer controls. It is a 3-wire system that has a separate line voltage wire that carries the phase control signal separate from the power wires. Hi-Lume drivers dim down to 1% of initial lumens, are more precise and more immune to electrical noise.

Where Used?

LITON offers Hi-Lume drivers in many of its General Purpose, Mini-Arc and Architectural LED products and are specified as “-DHL” when ordering.

Synonymous Terms:

Hi-Lume, 3-Wire

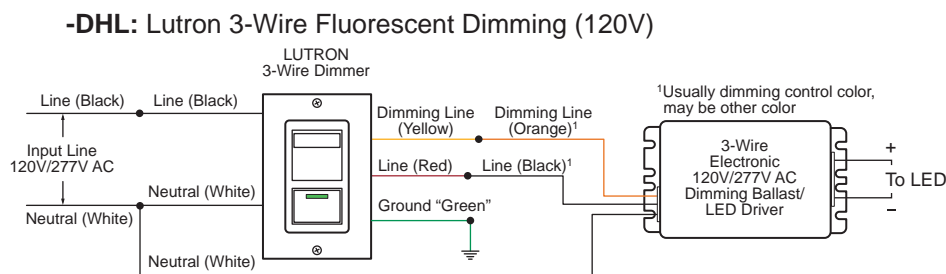
Benefits

- Allows smooth, continuous dimming down to 1% of initial lumens depending on dimming control limitations.
- Lutron’s Hi-Lume LED driver is compatible with more Lutron dimmers than any other brand and also compatible with their EcoSystem control system.
- Backed by Lutron’s 5-year Limited Warranty.

Limitations

- Compatible Lutron wall dimmers can be more expensive than electronic low voltage, incandescent or magnetic low voltage dimmers.
- All Lutron Hi-Lume drivers and compatible dimmers are 3-wire, requiring a neutral wire. This could necessitate pulling additional wire.
- The “-DHL” option should not be used with incandescent dimmers because doing so could cause any of the following malfunctions: dimmer buzz, lamp flicker, interaction between circuits or radio frequency interference (RFI).

-DHL Wiring Diagram



Partial list of factory tested, compatible dimmers:
(See next page for the Lutron Compatibility Report Card)

Manufacturer	Style	Model
Lutron	NovaT	NTF-10-277
Lutron	Skylark	SF-12P-277
Lutron	Vierti	VTF6A

Qualified Hi-Lume® Dimmers
For fixtures using the Lutron Hi-Lume® A-Series LED Driver



Product Family	Part Number		Fixtures per Control*		Measured light output range
	120V	277V	120V	277V	
NovaT®	NTF-10	NTF-10-277	1 - 41	1 - 44	100% - 1%
	NTF-103P	NTF-103P-277	1 - 20	1 - 33	100% - 1%
Nova®	NF-10	NF-10-277	1 - 41	1 - 44	100% - 1%
	NF103P	NF130P-277	1 - 20	1 - 33	100% - 1%
Vareo®	VF10		1 - 20	-	100% - 1%
Skylark®	SF-10P	SF-12P-277	1 - 20	1 - 33	100% - 1%
	SF-103P	SF-12P-277-3	1 - 20	1 - 33	100% - 1%
Diva®	DVF-103P	DVF-103P-277	1 - 20	1 - 33	100% - 1%
	DVSCF-103P	DVSCF-103P-277	1 - 20	1 - 33	100% - 1%
Ariadni®	AYF-103P	AYF-103P-277	1 - 20	1 - 44	100% - 1%
Vierti®	VTF-6A		1 - 15	1 - 33	100% - 1%
Maestro®	MAF-6AM	MAF-6AM-277	1 - 15	1 - 33	100% - 1%
	MSCF-6AM	MSCF-6AM-277	1 - 15	1 - 33	100% - 1%
Maestro Wireless®	MRF2-F6AN-DV		1 - 15	1 - 33	100% - 1%
RadioTouch®	RTA-RX-F		1 - 41	1 - 88	100% - 1%
Spacer System®	SPSF-6A	SPSF-6A-277	1 - 15	1 - 33	100% - 1%
	SPSF-6AM	SPSF-6AM-277	1 - 15	1 - 33	100% - 1%
Lyneo® Lx	LXF-103PL	LXF-103PL-277	1 - 20	1 - 33	100% - 1%
RadioRA® 2	RRD-F6AN-DV		1 - 15	1 - 33	100% - 1%
HomeWorks® QS	HQRD-F6AN-DV		1 - 15	1 - 33	100% - 1%
Interfaces**	PHPM-3F	PHPM-3F-DV	1 - 41	1 - 88	100% - 1%
	GRX-FDBI-16A		1 - 41	1 - 88	100% - 1%
PowPak™ dimming module with EcoSystem	RMJ-ECO32-DV-B		32 per EcoSystem link		100% - 1%
PowPak™ dimming module with EcoSystem	QSN-1ECO-S, QSN-2ECO-S		63 per EcoSystem link		100% - 1%
PowPak™ dimming module with EcoSystem	QSG_P120		64 per EcoSystem link		100% - 1%
Quantum®	Various		64 per EcoSystem link		100% - 1%

* Fixtures per control assumes a 40W fixture. Number of fixtures may be higher if wattages is less than 40W and may be lower if ganged. See control specification submittal sheet for details.

** For use with 3-wire controls or Commercial Systems, RadioRA Systems, or Home Systems applications.

**DIMMING FACTS
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