

PHILIPS
dynalite 

Networked Controls

LED Dimming
control and load
compatibility

1.0 Introduction:

1.1 About Philips Dynalite

Philips Dynalite is a highly specialized company whose principal occupation is to provide 'cutting edge' solutions for lighting control. Our achievements have been recognized worldwide and Philips Dynalite is generally the system of choice for projects involving integration with third-party vendor's equipment and for large-scale applications.

Philips Dynalite's philosophy is to provide the best solution possible for each and every project. This is the key to our success. Our considerable investment in Research & Development ensures that we remain at the forefront of our industry. Our position as a world leader in lighting management systems for the future is sustained through our total commitment to innovation.

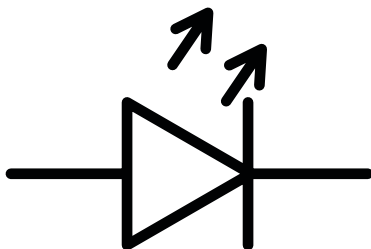
LEDs are quickly becoming the lamp of choice for many projects around the world due to their high efficiency and expected life span. This emerging technology has brought many new challenges to the lighting control market as LED lamps have different requirements and response characteristics from previous generations of lighting lamps.

This document was created to better describe how a Philips Dynalite lighting control system can be used to better manage LED lighting within any project.

1.2 What are LED lamps?

LED - Light Emitting Diode are electronic devices that produce light when an electrical current is applied. Unlike incandescent lamps, LEDs don't use heat to produce light which make them much more efficient and have a longer operational life expectancy.

A single lamp may consist of multiple LEDs to produce the right level of light output. All LEDs require supply at the correct DC voltage and current levels, this device is commonly called a driver. Mains rated LED fittings have a driver built into the lamp, ensuring that the LEDs receive the right current and voltage supply for correct operation.



Electronic symbol for LED

2.0 Dimming LEDs

2.1 LED lamps

Not all LED lamps are dimmable, only lamps that have been specifically designed by the manufacturer as dimmable may be dimmed. Attempting to dim a non-dimmable LED lamp or using an incompatible dimming method will result in undesirable behaviour or complete lamp failure. Dimmable lamps may only be compatible with certain dimming techniques. This paper only discusses Leading edge and Trailing edge dimmable techniques but there are many other methods that can be used such as DALI, 1-10, DMX and PWM, if compatible to the LED lamp type.

2.2 Why dim LED lamps

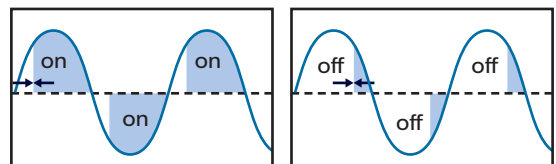
As with any area in which artificial lighting is used, people like to adjust the lighting level to meet their needs and create a more comfortable environment. Allowing the occupants of an area to reduce the lighting level can help reduce glare when there is excessive lighting levels. By reducing eye strain in office or school areas, occupants are more comfortable and better able to focus on the task at hand, allowing for them to be more productive.

When dimming LED lamps, their power consumption is also reduced, producing further running cost savings. A dimmed LED lamp also produces less heat which will help increase their operation life and protects the investment an end-user has made into their LED lamps.

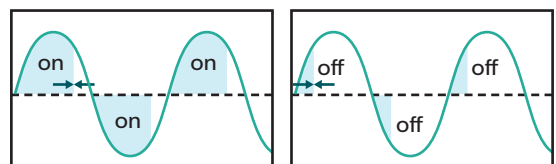
2.3 Mains Dimming techniques

Dimming of lighting through modifying the mains supply is a very common practice and has been used in lighting control for many years. All AC mains supply comes in the form of a sine wave, this wave is then modified to reduce the total output power. There are two types of mains dimming techniques - Leading Edge (LE) and Trailing Edge (TE).

Leading Edge dimming is the most established technique in the lighting control industry. In the example on the right, the dimming system stops natural sine wave from rising and only at the required time will it turn on the circuit and allow the supply to flow.



Trailing Edge dimming is relatively new style in comparison to Leading Edge and is more compatible with electronic lighting loads. As TE is more suited to electronic load types, it is more compatible with LED loads. The dimming effect is achieved by letting the sine wave naturally rise and then removing the supply at the required time to produce the dimmed result.



3.0 Challenges with LED dimming

3.1 LED dimming

When dimmed, LED lamps may become susceptible to a temporary or permanent flickering. Care in selecting the right lighting controller for the desired LED lamp is important so the risk of LED flickering can be reduced. Sources of LED lamp flicker can come from a range of different locations and often at the same time, for example:

- Mains supply instability
- Noise on the mains supply or dimming system (e.g. mains control tones, harmonic distortion, switching transients, etc)
- Dimming system not loaded correctly
- Too many or too few LED lamps are being used per lighting control channel
- LED driver design
- Dimmer level set too low

3.2 LED dimming response

LED lamps have very different response to dimming than previous generations of lighting lamps. It is important to remember that the pre-set scenes of a lighting control system will need to be adjusted if a project has upgraded to LED lamps.

LED lamps could also have a very different dimming curve to previous generations of lighting lamps. A lighting control system will need to compensate for LED dimming site effects such as:

Dead travel. This is when adjusting the dimmer channel output seems to have no relative effect to the LED lamp light output.

Popping on a LED lamp may require a minimum level before it is able to start producing light. For some lamps this might be as high as 10%-15%.

3.3 Overcoming LED dimming challenges.











To help apply an LED lighting solution to any project, Philips Dynalite has developed a range of products and useful tools for the correct selection of lighting controllers for LED lamps.

Correcting the load - Leading edge style dimmers, LEDs don't provide enough draw current for correct operation. This can produce a constant flicker and is sometimes called incorrect latching. To provide the right kind of load, an active load device (DMAL120FR) can be connected at any point of the lighting group.

Load compatibility table - Designing a correctly loaded lighting control system is now more important than ever as LED lamps require the right selection of controllers. Sections 4 and 5 covers the compatibility of the different load controllers Philips Dynalite has available and how best to load them.




Not all leading edge styles of dimming are compatible with LED lamps. Where a DMAL120FR was required to provide corrected loading, it is shown on chart 4.

4.0 Mains rated LED compatibility table

Type #																				
Leading Edge Dimmers	%	No:	%	No:	%	No:	%	No:	%	No:	%	No:	%	No:	%	No:	%	No:	%	No:
DDLE801			1-100%	1-10	1-100	1-6	1-100	1-25					1-100	1-15	1-100	1-18				
DDLE802					5-100	1-8	1-100	2-30	1-95	2-12			1-95	2-12	1-100	1-15			10-95	2-5
DDLE802 + DMAL120FR	1-100	2-13			5-100	1-8	1-100	2-30	1-95	2-12	1-100	2-13	1-95	2-12	1-100	1-15	10-95	1-8	10-95	2-5
DDMC802 + DDLM102					5-100	1-8	1-100	2-30	1-95	2-12			1-95	2-12	1-100	1-15			10-95	2-5
DDMC802 + DDLM102 + DMAL120FR	1-100	2-13			5-100	1-8	1-100	2-30	1-95	2-12	1-100	2-13	1-95	2-12	1-100	1-15	10-95	1-8	10-95	2-5
DDMC802GL + DGLM402					5-100	1-8	1-100	2-30	1-95	2-12			1-95	2-12	1-100	1-15			10-95	2-5
DDMC802GL + DGLM402 + DMAL120FR	1-100	2-13			5-100	1-8	1-100	2-30	1-95	2-12	1-100	2-13	1-95	2-12	1-100	1-15	10-95	1-8	10-95	2-5
DDMC802 + DDLM104					5-100	1-15	1-100												10-95	2-10
DDMC802 + DDLM104 + DMAL120FR	1-100	1-26			5-100	1-15	1-100	3-32	1-95	1-23	1-100	1-26	1-95	1-23	1-100	1-30	10-95	1-15	10-95	2-10
DDMC802GL + DGLM105					5-100	1-19			1-95	1-27			1-95	1-27	1-100	1-30	10-95	1-15	10-95	2-10
DDMC802GL + DGLM105 + DMAL120FR	1-100	2-33			5-100	1-19	1-100	1-36	1-95	1-27	1-100	2-33	1-95	1-27	1-100	1-38	10-95	1-19	10-95	2-12
DLE1203									1-95	1-13			1-95	1-13						
DLE1203 + DMAL120FR					5-100	1-12	1-100	1-36	1-95	1-13			1-95	1-13	1-100	1-23	10-95	1-12	10-95	1-8
DLE405									1-95	1-28			1-95	1-28					10-95	1-12
DLE405 + DMAL120FR					5-100	1-19	1-100	1-38	1-95	1-28			1-95	1-28	1-100	1-38	10-95	1-19	10-95	1-12
DLE1205									1-95	3-28			1-95	3-28						
DLE1205 + DMAL120FR	1-100	1-33			5-100	1-19	1-100	1-40	1-95	3-28	1-100	1-33	1-95	3-28	1-100	1-38	10-95	1-19	10-95	1-12
DLE410									1-95	2-53			1-95	2-53						
DLE410 + DMAL120FR	1-100	2-66					1-100	1-65	1-95	2-53	1-100	2-66	1-95	2-53	1-100	1-76	10-95	1-38	10-95	2-25
DMC810GL									1-95	2-53			1-95	2-53						
DMC810GL + DMAL120FR	1-100	2-66					1-100	1-65	1-95	2-53	1-100	2-66	1-95	2-53	1-100	1-76	10-95	1-38	10-95	2-25
DLE1210GL									1-95	2-53			1-95	2-53						
DLE1210GL + DMAL120FR	1-100	2-66					1-100	1-65	1-95	2-53	1-100	2-66	1-95	2-53	1-100	1-76	10-95	1-38	10-95	2-25
DLE1210									1-95	2-53			1-95	2-53						
DLE1210 + DMAL120FR	1-100	2-66			5-100	1-38	1-100	1-82	1-95	2-53	1-100	2-66	1-95	2-53	1-100	1-76	10-95	1-38	10-95	2-25
DLE120-S					5-100	1-38			1-95	2-53*			1-95	2-53*						
DLE120-S + DMAL120FR	1-100	2-66*			5-100	1-38	1-100	1-82*	1-95	2-53*	1-100	2-66*	1-95	2-53*	1-100	1-76*	10-95	1-38*	10-95	2-25*
DLE220-S					5-100	1-38			1-95	2-53*			1-95	2-53*						
DLE220-S + DMAL120FR	1-100	2-66*			5-100	1-38	1-100	1-82*	1-95	2-53*	1-100	2-66*	1-95	2-53*	1-100	1-76*	10-95	1-38*	10-95	2-25*
DLE1220GL-S					5-100	1-38			1-95	2-53*			1-95	2-53*						
DLE1220GL-S + DMAL120FR	1-100	2-66*			5-100	1-38	1-100	1-82*	1-95	2-53*	1-100	2-66*	1-95	2-53*	1-100	1-76*	10-95	1-38*	10-95	2-25*
Trailing Edge Dimmers	%	No:			%	No:	%	No:	%	No:	%	No:	%	No:	%	No:	%	No:	%	No:
DDTM102 standard dimming curve					5-100	1-15			1-95	1-14			1-95	1-14						
Edited LED dimming Curve	1-100	1-26					15-100	1-48			1-100	1-26			1-100	1-24				
DGTM402 standard dimming curve					5-100	1-15			1-95	1-14			1-95	1-14						
Edited LED dimming Curve	1-100	1-26					25-100	1-38			1-100	1-26			1-100	1-24				
DGTM105 standard dimming curve					5-100	1-28			1-95	1-22			1-95	1-22						
Edited LED dimming Curve	1-100	1-40					25-100	1-53			1-100	1-40			1-100	1-36				
DTE310 DTE1210 standard dimming curve					5-100	1-48			1-95	1-48			1-95	1-48						
Edited LED dimming Curve	1-100	1-48					25-100	1-140			1-100	1-48			1-100	1-81				
DGLEDM401 standard dimming curve					5-100	1-15			1-95	1-14			1-95	1-14						
Edited LED dimming Curve	1-100	1-26					1-100	1-38			1-100	1-26			1-100	1-24				





- Dimmable, with x to y lamps up to a max of 10% of the max dimmer load
- The majority of configurations show undesirable dimming behavior
- Configuration not tested

5.0 Low voltage LED and transformer

	 PHILIPS MASTER LEDSpot MR16 Dim 7W 12VAC Osram ET-REDBACK 60VA/230-240 (20-60W)				 PHILIPS MASTER LEDSpot MR16 Dim 7W 12VAC Philips ET-S 60VA 220-240V				 PHILIPS MASTER LEDSpot MR16 Dim 10W 12VAC Osram ET-REDBACK 60VA/230-240 (20-60W)			
	Dimming range	Number of lamps per transformer	Number of transformers per channel	Max number of lamps per channel	Dimming range	Number of lamps per transformer	Number of transformers per channel	Max number of lamps per channel	Dimming range	Number of lamps per transformer	Number of transformers per channel	Max number of lamps per channel
Leading edge dimmers												
DDLE802 & DGLM402	10%-100%	1-2	2-6	12	10%-100%	1-2	2-6	12	10%-100%	1-2	2-4	8
DGLM402	10%-100%	1-2	2-6	12	10%-100%	1-2	2-6	12	10%-100%	1-2	2-4	8
DDL104	10%-100%	1-2	2-13	26	10%-100%	1-2	2-13	26	15%-100%	1-2	2-9	18
DGLM105	10%-100%	1-2	2-16	32	10%-100%	1-2	2-16	32	15%-100%	1-2	6-11	22
DLE1203	10%-100%	1-2	2-9	18	10%-100%	1-2	2-9	18	15%-100%	1-2	2-7	14
DLE405	10%-100%	1-2	2-16	32	10%-100%	1-2	2-16	32	15%-100%	1-2	2-11	22
DLE1205	10%-100%	1-2	3-16	32	10%-100%	1-2	3-16	32	15%-100%	1-2	3-11	22
DLE410	10%-100%	1-2	5-32	64	10%-100%	1-2	5-32	64	15%-100%	1-2	5-23	46
DMC810GL	10%-100%	1-2	5-32	64	10%-100%	1-2	5-32	64	15%-100%	1-2	5-23	46
DLE1210GL	10%-100%	1-2	5-32	64	10%-100%	1-2	5-32	64	15%-100%	1-2	5-23	46
DLE1210	10%-100%	1-2	5-32	64	10%-100%	1-2	5-32	64	15%-100%	1-2	3-23	46
DLE120-S	10%-100%	1-2	5-32*	64*	10%-100%	1-2	5-32*	64*	15%-100%	1-2	2-23*	46*
DLE220-S	10%-100%	1-2	5-32*	64*	10%-100%	1-2	5-32*	64*	15%-100%	1-2	5-23*	46*
DLE1220GL-S	10%-100%	1-2	5-32*	64*	10%-100%	1-2	5-32*	64*	15%-100%	1-2	5-23*	46*
Trailing edge dimmers												
DDTM102	10%-100%	1-2	1-13	26	5%-100%	1-2	1-13	26	10%-100%	1-2	1-9	18
DGTM402	10%-100%	1-2	1-13	26	5%-100%	1-2	1-13	26	10%-100%	1-2	1-9	18
DGTM105	7%-100%	1-2	1-25	50	5%-100%	1-2	1-25	50	10%-100%	1-2	1-17	34
DTE310 DTE1210	7%-100%	1-2	1-41	82	7%-100%	1-2	1-41	82	10%-100%	1-2	1-29	58
DGLEDM401	20%-100%	1-2	1-13	26	20%-100%	1-2	1-13	26	20%-100%	1-2	1-9	18

- Dimmable, with x to y lamps up to a max of 10% of the max dimmer load
- The majority of configurations show undesirable dimming behavior
- Configuration not tested

5.0 Low voltage LED and transformer continued

 PHILIPS MASTER LEDSpot MR16 Dim 10W 12VAC Philips ET-S 60VA 220-240V				 Philips MR16 7W GU5.3 12V AC 12D 715mA 4000K Philips ET-S 15 LED 220-240V				 PHILIPS AR111 (10W)** Philips ET-S 60VA 220-240V				 PHILIPS AR111 (15W) Philips ET-S 60VA 220-240V			
Dimming range	Number of lamps per transformer	Number of transformers per channel	Max number of lamps per channel	Dimming range	Number of lamps per transformer	Number of transformers per channel	Max number of lamps per channel	Dimming range	Number of lamps per transformer	Number of transformers per channel	Max number of lamps per channel	Dimming range	Number of lamps per transformer	Number of transformers per channel	Max number of lamps per channel

Leading edge dimmers															
DDLE801					1-100%	1-2	13	13							
DDLE802 & DGLM402	15%-100%	1-2	2-4	8				15%-100%	1-2	2-4	8	5%-100%	1	5-5	5
DGLM402	15%-100%	1-2	2-4	8				15%-100%	1-2	2-4	8	5%-100%	1	5-5	5
DDLMI04	15%-100%	1-2	2-9	18				15%-100%	1-2	2-9	18	5%-100%	1	5-11	11
DGLMI05	15%-100%	1-2	6-11	22				15%-100%	1-2	6-11	22	5%-100%	1	5-14	14
DLE1203	15%-100%	1-2	2-7	14				15%-100%	1-2	2-7	14	5%-100%	1	1-8	8
DLE405	15%-100%	1-2	2-11	22				15%-100%	1-2	2-11	22	5%-100%	1	5-14	14
DLE1205	15%-100%	1-2	3-11	22				15%-100%	1-2	3-11	22				
DLE410	15%-100%	1-2	5-23	46				15%-100%	1-2	5-23	46				
DMC810GL	15%-100%	1-2	5-23	46				15%-100%	1-2	5-23	46	5%-100%	1	2-28	28
DLE1210GL	15%-100%	1-2	5-23	46				15%-100%	1-2	5-23	46	5%-100%	1	2-28	28
DLE1210	15%-100%	1-2	3-23	46				15%-100%	1-2	3-23	46	5%-100%	1	2-28	28
DLE120-S	15%-100%	1-2	2-23*	46*				15%-100%	1-2	2-23*	46*	5%-100%	1	1-56	56
DLE220-S	15%-100%	1-2	5-23*	46*				15%-100%	1-2	5-23*	46*	5%-100%	1	2-56	56
DLE1220GL-S	15%-100%	1-2	5-23*	46*				15%-100%	1-2	5-23*	46*	5%-100%	1	1-56	56
Trailing edge dimmers															
DDTM102	7%-100%	1-2	1-9	18				5%-100%	1-2	1-9	18	5%-100%	1	1-11	11
DGTM402	7%-100%	1-2	1-9	18				5%-100%	1-2	1-9	18	5%-100%	1	1-11	11
DGTM105	7%-100%	1-2	1-17	34				5%-100%	1-2	1-17	34	5%-100%	1	1-20	20
DTE310 DTE1210	5%-100%	1-2	1-29	58				7%-100%	1-2	1-29	58	7%-100%	1	1-35	35
DGLEDM401	20%-100%	1-2	1-9	18				20%-100%	1-2	1-9	18	20%-100%	1	1-5	5

- Dimmable, with x to y lamps up to a max of 10% of the max dimmer load
- The majority of configurations show undesirable dimming behavior
- Configuration not tested

6.0 Conclusions

Despite the many challenges that LED control presents, the running cost benefits make it a worthwhile goal.

Philips Dyalite is committed to continuous testing different LED types with all of its load controller options to provide the best and most up-to-date information possible. If there is an LED that has not been tested that you would like to use on an upcoming project, please send a request to the following email address. dynalite.info@philips.com

6.1 Testing notes

All percentages shown are from the Philips Dyalite commissioning software, dimmers channel output level.

Local mains quality may affect dimming performance as it may change at different periods during a day and also over time due to variable levels and types of loads on site and in nearby buildings. No assurance can be provided about these factors, so a general recommendation is to perform a test on site prior to installing the LED lamps.

Before re-lamping a project site from incandescent fittings to LED fittings it is highly recommended that a test be performed on a single lighting group. To conduct a comprehensive test all lamps on an existing light group should be changed over to the nominated LED fittings which are going to be used and observed over a 48 hour period to determine if there are any site related issues regarding lamp performance.

Local project supply noise or main instability were not factored into testing. All tests were conducted on stable mains supply.

Philips Dyalite does not accept any liability arising from the recommendations and test results presented in this report. They are for indicative purposes only and subject to changes in lamp and dimmer design, with no notification provided.



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