

PHILIPS

sense **and** simplicity

Dimming & MASTER LEDlamps

March, 2010

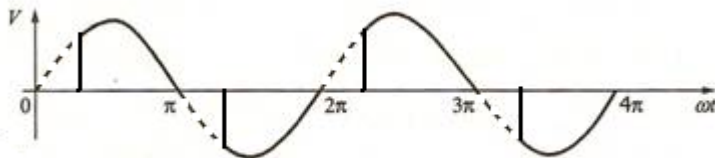
Background

- Recently, there have been increased number of requests for clarity and information on dimming of our MASTER LEDlamps and the boundary conditions associated with such dimming.
- There has also been substantial “knowledge” gained on this subject as a result of continuous testing & development AND as a result of discussions with leading dimmer manufacturers.
- This document attempts to distill currently available information on the subject of dimming of MASTER LEDlamps (ONLY 230V lamps) in a simple and user-friendly format to serve as a reference document.
- Further feedback on customer experiences with lamp-dimmer combinations is very much welcome , esp. in the unlikely instance of a negative experience when lamps-dimmer are used within the suggested boundary conditions.

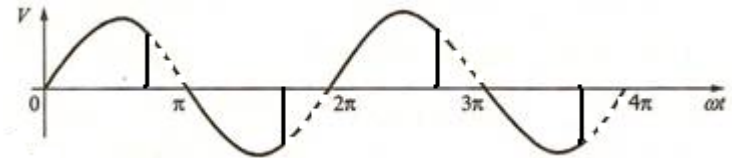
Mainstream dimmers :

Phase Cut Dimmers(leading & trailing edge)

- The technology used by the mainstream dimmers on the market is called phase cutting technology which works by “cutting off” part of the mains voltage to vary the RMS voltage fed to the lamp.
- The brightness of the lamp can thus be controlled by increasing or decreasing the RMS voltage and thereby the power supplied to the lamp
- There are two ways to cut off the mains voltage: either at the beginning of the sine wave or towards the end of it. A dimmer where such “cutting off” is done at the beginning is called a **leading edge dimmer** and a dimmer where the “cutting off” is done towards the end of the sine wave is called a **trailing edge dimmer**.



Leading Edge Dimmer



Trailing Edge Dimmer

Mainstream dimmers:

Compatible load(R/C/L dimmer) – An alternative classification

- Dimmers are also sometimes categorized by their compatibility with load(s) types
- There are three popular types of traditional lighting loads dimmers are designed to compatible with :



R type load: GLS, HV Halogen



L type load: LV Halogen with magnetic transformer



C type load: LV Halogen with electronic transformer

- Using this classification, we have:
 - *R dimmer which can be compatible with R type load*
 - *RC dimmer which can be compatible with R type and C type load*
 - *RL dimmer which can be compatible with R type and L type load*
 - *RLC dimmer which can be compatible with all three types load*

Mainstream dimmers:

Phase cut vs. Compatible load – Where is the connect?

- The linkage between leading/trailing edge dimmer and R/C/L dimmer can be found in table below:

Leading edge dimmer	R dimmer
	RL dimmer
	RLC dimmer
Trailing edge dimmer	RC dimmer
	RLC dimmer

Remark: RLC is universal dimmer

Dimmer compatibility:

- Philips offers a range of dimmer-compatible LED lamps, with specially designed electronics so that the lamp works on most common dimmers
 - Given the vast diversity in dimmer types and dimmer quality, a 100% compatibility cannot be guaranteed
 - Dimmer compatibility issues can include flickering lamps at certain dim level, audible noise(hum), higher light output at low dim level.
- Philips LED lamps are tested on more than 30 reference dimmers available globally, and performed well with most of them.
 - Our lamp can work well with most of **R, RL dimmers**, but not RC,RLC dimmers nor any dimmers with neon/LED light indicator

Dimmer load capability:

- An evaluation is currently still in progress with key dimmer manufacturers on how to define the **maximum LED lamp load** for a dimmer.
- Meanwhile, based on internal test results so far, Philips suggests the following (conservative) rule to define what the maximum LED lamps load can be:

Maximum total LED lamps power $\leq 1/10^{\text{th}}$ of dimmer's maximum rated power

For eg. For a dimmer which maximum rated power is 500Watt, the recommended maximum LED lamps load power should $\leq 50\text{Watt}$, which equal to around 7pcs of 7W dimmable LED lamps.

Special dimmers:

Apart from the phase cutting (mainstream) dimmers, there are also few types of special dimmers available in the market:

- Sinus dimmers:
 - Adjust the amplitude of the AC mains voltage
 - Used in theatre lighting
- 1-10 V dimming interface:
 - Analog means of driving a dimming input on an electronic driver
- DALI:
 - Digital communication for professional (office) lighting
- DMX512 (+RDM):
 - High speed communication bus for dynamic (entertainment) lighting
- Wireless remote controls:
 - Based on IR (infra-red) or RF (radio frequency)
 - Many protocols (e.g. RC5, Zigbee, Z-wave, ...)

Our dimmable LED lamps are **not compatible** with all above special dimmers !!!

