theben
energy saving comfort

The best way to switch and dim LED lighting
LED compatible solutions from Theben

LED – Energy saving with a bright future
and little quirks

LED sales have grown rapidly over recent years. Thanks to the improvements in the degree of efficiency and colour rendering index, there is almost no area of lighting technologies where they are not present: as retrofit versions, they are a welcomed alternative to unpopular energy saving lamps. Being illuminated strips and surfaces, they snuggle against every surface and thus allow completely new possibilities for light design. Even the first high-performance devices such as stage and studio spotlights are already available as LED version.

However, not every bulb can be easily replaced by an LED retrofit lamp. This may lead to some issues with existing installations, even with straight forward switching. The reason for this is the short but extremely high starting currents. They can be more than a thousand times the rated output. Contacts could burn-through or fuse as a result.

The challenge of LED's and how to deal with it

The difficulties with such everyday tasks such as switching or dimming surprises. There is as yet no standard for LED lamps and as such can lead to difficulties with switching and dimming some LED lamps.

There is general guidelines for LED lamps that apply, from the version of socket base, to Lumins output and Wattage consumption. However other factors are not. As apposed to a classic lamp with a simple spiral wound, LED lamps include a lot of electronics for control. Every manufacturer can decide the layout of this themselves. The manufacturer of switching and dimming devices currently do not have any indications as to which electrics it controls and as to how the lamp behaves. The respective standards currently only exist as a draft.

No standards available? Then we will test it ourselves!

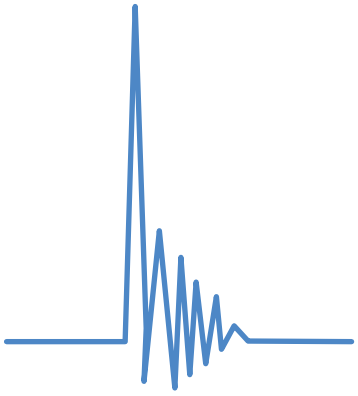
If special switching loads for LED lamps and discharge lamps are not specified on a product, one must assume that the product has not been approved for this. However, the specifications for LED loads are not always helpful. Which switching currents does the device manufacturer assume? These may differ from lamp to lamp. You should also be careful when adding. Several LEDs with low rated output may have higher switching currents in the sum than one single LED with the respective total output.

In order to be able to specify the load specifications for switching devices and dimmers, Theben conducts ongoing measurements on all conventional retrofit lamps. During these tests, the switching devices run through at least 40,000 switching cycles. This allows us to make reliable statements for the switchable loads.

LED – Contact Killer
Low consumption when used, wasteful when switched on

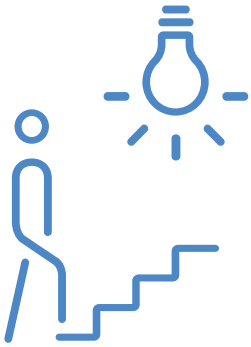
A simple scenario: in the staircases of a large residential building, the building management replaces the light bulbs with LED retrofit lamps. A specialist measures and verifies the prescribed brightness. The potential for savings is promising: next to the more favourable energy consumption, the long service live should also ensure for less maintenance costs.

But suddenly the staircase light time switch fails. An examination had shown scorched or fused contacts: the devices were obviously overloaded although the rated output of the installation was reduced significantly.



Hard work for the contacts
Capacitive switching loads

How can an LED lamp that only has a few Watt rated output destroy a switching contact that has been dimensioned for a multiple thereof? Upon closer inspection, the answer is found in the switching currents: in light bulbs, the typical switching currents of the cold spiral coil cause a tenfold of the respective rated current. With LED lamps and energy-saving lamps with their capacitive characteristics, one finds switching current pulses in the µs range that could be a thousand-fold and more of the rated current.
A measurement in our test laboratory authorised by the VDE has shown, that in a most unfavourable case, a switching current of 19 A with a 1.8 W LED lamp is the 1706-fold of the rated output!



Caution step!
Switch-off warning

At this position, you are also informed about problems with the switch-off warning (flashing twice or similar according to DIN 18015-2): the flashing is not reliably visible as the switch-off from the electric ballast or condensers of the LEDs is buffered. Switching several times also loads the service live of the device additionally.

How to switch LED lamps
With the right contacts at the right time

10 A–10 AX
230 V~

Two contacts for all switching cases:
Tungsten pre-contact

High currents require special contacts. Next to silver tin oxide ($AgSnO_2$), Theben uses a combination of two contacts that close after one-another: the tungsten pre-contact. The leading contact comprise high-Ohm and highly-resistant tungsten. It captures the starting current and limits it at the same time. The low-Ohm main contact remains unloaded from the switching peaks in such a manner. Theben uses these relays in the digital time switches TR 609 top2 S and SELEKTA 175 top2 as well as with the performance motion sensors theLuxa P and the presence detector theRonda P.

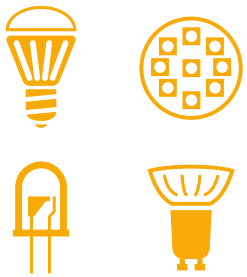
Switching precisely at a point:
zero-cross switching

Switching devices that are designed for a C load generally deal with the switching currents in a better manner. In doing so, Theben uses a particularly efficient solution, such as a so-called zero-cross switching. This calculates the zero crossing of the sinus curve of the alternating voltage. At this moment, the switch-on current is minimum when switching. That protects the relay contact and extends its service life, even at nominally high switching loads. Almost all of the devices of the top2 series, the motion detector theLuxa S and the presence detector PlanoCentro are equipped with it.

Environmentally aware and switching safely:
Cadmium-free contacts

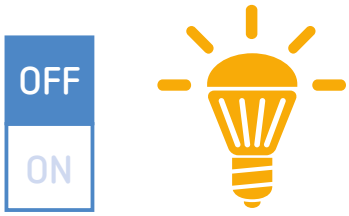
Cadmium oxide was thought to have been the ideal contact material for high switching currents. In the meantime, it is forbidden according to the RoHS guideline - where there are exceptions for electrical switching contacts. Theben had already changed to the environmentally friendly $AgSnO_2$ material at the turn of the millennium. These offer comparably good, in some cases even better contact and switching properties such as higher burn-off resistance, increased resistance against electric wear and a significantly reduced inclination to material migration during direct current operation.

Dimming LEDs?
Not something that should be taken for granted!



Dimmable or not?
The right choice is decisive

Not every LED lamp is dimmable. Even with those suitable versions, the dimming characteristics differ significantly and depending on the manufacturer. The LEDs flicker frequently and cannot be dimmed linear and harmonically as the electronic ballasts required react with great differences to the phase control and phase alignment. This is why some manufacturers only explicitly allow one of the methods.



Continuous light reluctance
Residual currents are sufficient

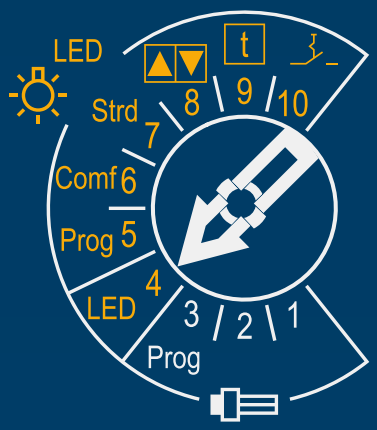
Another problem is caused by the interference suppression capacitors of the dimmer. Continuous very low residual currents run through them. These are sufficient to supply LED lamps with one to two Watt rated output. Then they no longer go out completely. A similar effect can be caused by long parallel positioned lines.

Dimmer meets lamp
The right choice is decisive

For infinitely variable control, not only the LED lamp has to be dimmable, but the dimmer must also be LED capable. Theben has developed several solutions for this purpose:

- Presets for different LED lamps
- Dimmer curves that can be reloaded via the ETS

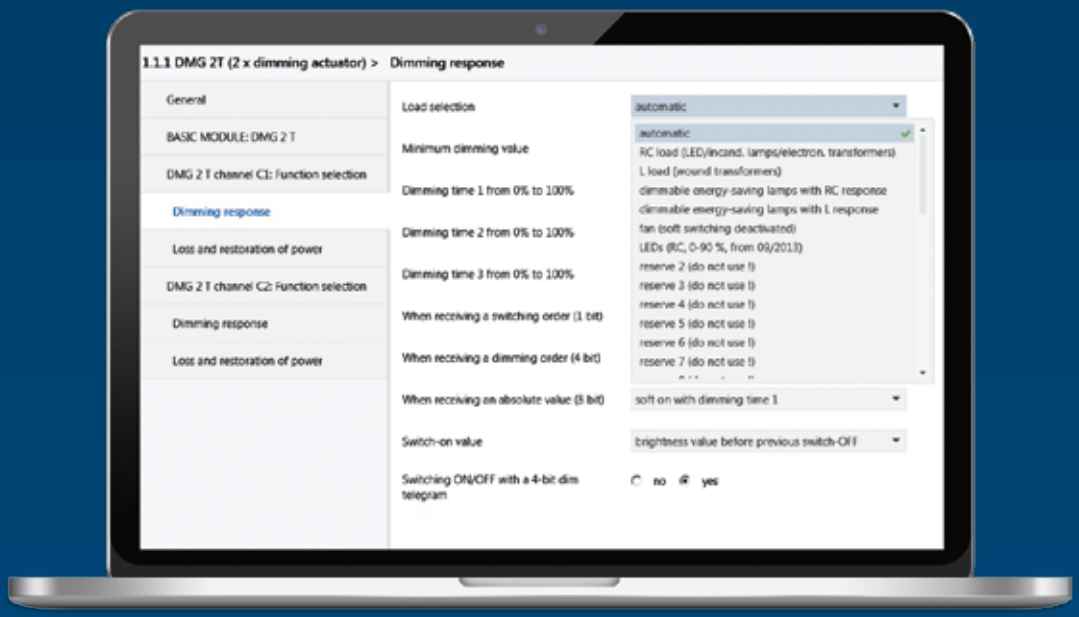
Dimming LEDs!
Theben can



A matter of setting
Select presets

LED compatible switching devices from Theben, such as the universal dimmer DIMAX 534 plus, offer additional setting options for a perfect adaptation to this technology.

A minimum brightness for LED lamps with low Wattage can be set using potentiometers and rotary switches. Even the type of control, phase control or phase alignment control can be selected. This practically allows all dimmable LED lamps of renowned manufacturers to be controlled reliably.



Up to date with KNX
Reloading dimming curves

The KNX universal dimming actuator from Theben goes one step further: in the programming software ETS, various dimming curves are stored, which correct the dimming response appropriately depending on the lamp used, thus ensuring smooth stepless dimming.

Another advantage of the Theben KNX dimming actuators is that new dimming curves can be imported via ETS as new lighting developments come along. This ensure that your investment and the future is protected.

Reliable, high-performance, accurate to the second
Time switches and staircase light time switches

From the light bulb to the LED lamp: with features such as zero-cross switching or tungsten pre-contact, Theben offers compact self-sufficient devices for every application from simple time switches to astronomical time switch with weekly program.

Here you will only find one product selection. Further products such as dimming switch, or similar, can be found at www. theben.de/en

Digital time switch with weekly program

Most digital time switches with a width of 1 module[1] are equipped with a tungsten pre-contact that protects the switching relay and takes over the capacitive switching load.

Astronomical digital time switch with weekly program

Digital time switches from a width of 2 modules[2] are equipped with a zero-cross switching to avoid wear and tear of relay contact and light source, i.e. prolongs service life of light source.

Staircase light time switch ELPA

For more than 10 years, electronic staircase light time switches from Theben have already been equipped with a zero-cross switching[3].

TR 609 top2 S

- Tungsten pre-contact
- LED switching capacity: < 2 W: 50 W, > 2 W: 600 W
- Max. switch-on peak. 800 A/ 200 µs
- 1 channel
- External input (push buttons and switches)
- Holiday / random program for presence simulation
- Pulse / cycle program
- High operating accuracy thanks to integrated temperature compensation

SELEKTA 174 top3

- Zero-cross switching
- LED switching capacity: < 2 W: 50 W, > 2 W: 600 W
- 2 channels
- Max. switch-on peak. 800 A/ 200 µs
- Global position input
- Offset function (+/- 120 minutes)
- 3 special programs with date function
- High operating accuracy thanks to integrated temperature compensation

ELPA 6 plus

- Zero-cross switching
- LED switching capacity: < 2 W: 55 W, 2-8 W: 500 W, > 8 W: 500 W
- Switch-off warning optimised for LED lamps
- Multi-function device with choice of 10 functions
- Extended function activated via long button press
- Continuous light
- Push button input with electronic overload protection
- Automatic 3 or 4-way conductor detection

[1] Does not apply: TR 608 top2 S
[2] The time switches with an operating voltage of 12 – 24 V do not have a zero-cross switching.
[3] Applies for: ELPA 3, ELPA 7, ELPA 8 and ELPA 9.

Fully automatic, versatile and adjustable device
Motion detector

Motion detectors from Theben are robust reliable stand-alone solutions that ensure a safe and economical lighting. Thanks to zero-cross switching or tungsten pre-contact, this proven and tested technology can be designed with even more reliability using LED lamps.

Motion detector theLuxa S

All theLuxa S versions are equipped with a zero-cross switching to avoid wear and tear of relay contact and light source, i.e. prolongs service life of light source.

Motion detector theLuxa P

All theLuxa P versions are equipped with a tungsten pre-contact that protects the switching relay and takes over the capacitive switching load.

Motion detector theMova P (not illustrated)

All theMova P versions are equipped with a tungsten pre-contact that protects the switching relay and takes over the capacitive switching load.

theLuxa S150/ S180

- Zero-cross switching
- LED switching capacity: < 2 W: 25 W, 2-8 W: 90 W, > 8 W: 100 W
- Detection angle 150°, 180° Creep under protection
- Detection area up to 12 m
- Adjustable brightness switching value and time delay
- Mixed light measurement suitable for the control of LEDs, fluorescent, incandescent and halogen lamps
- Teach-in of the current brightness switching value
- Impulse, test function

theLuxa P220/ P300

- Tungsten pre-contact
- LED switching capacity: < 2 W: 60 W, 2-8 W: 180 W, > 8 W: 200 W
- Max. switch-on peak. 800 A/ 200 µs
- Detection angle 220°, 300° Creep under protection
- Detection area up to 16 m
- For wall and ceiling installation
- Mixed light measurement suitable for the control of LEDs, fluorescent, incandescent and halogen lamps
- Adjustable brightness switching value and time delay
- Remote operation possible

theMova P360-100 UP

- Tungsten pre-contact
- Switching capacity (only with 230 V): 2300 W, 1150 VA
- LED switching capacity: < 2 W: 60 W, > 2 W: 180 W
- Max. switch-on peak. 800 A/ 200 µs
- Round detection area 360°, up to Ø 24 m (452 m^2)
- Mixed light measurement suitable for the control of LEDs, fluorescent, incandescent and halogen lamps
- Operation as fully automatic device
- Remote operation possible

Elegant, precise, configurable
Presence detector

Presence detector for professional requirements: the Theben devices will meet the most demanding private and commercial requirements. With a zero-cross switching or tungsten pre-contact, they can be combined with any lighting concept, from halogen spots to LED systems.

Presence detector theRonda P

All theRonda P versions are equipped with a tungsten pre-contact that protects the switching relay and takes over the capacitive switching load.

Presence detector thePrema E

All thePrema S and P versions are equipped with a high-performance relay.

Presence detector PlanoCentro (not illustrated)

All PlanoCentro versions are equipped with a crossover switching to avoid wear and tear of relay contact and light source, i.e. prolongs service life of light source.

theRonda P360-100/ 101

- Tungsten pre-contact
- Switching capacity (only with 230 V): 2300 W, 1150 VA
- LED switching capacity: < 2 W: 60 W, > 2-8 W: 180 W
- Max. switch-on peak. 800 A/ 200 µs
- Power consumption: 0.1 W
- Circular detection area 360°, up to Ø 24 m (452 m²)
- Mixed light measurement suitable for the control of LEDs, fluorescent, incandescent and halogen lamps
- Operation as fully or semi-automatic (absence detection)

thePrema P360-100 E/101 E

- Switching capacity (only with 230 V): 2300 W, 1150 VA
- LED switching capacity: < 2 W: 60 W, > 2-8 W: 180 W
- Max. switch-on peak. 800 A/ 200 µs
- Power consumption: 0.1 W
- Square detection area 360° (9 x 9 m)*
- Mixed light measurement suitable for the control of LEDs, fluorescent, incandescent and halogen lamps
- Operation as fully or semi-automatic (absence detection)

PlanoCentro 101-EWH

- Zero-cross switching
- Switching capacity: 2300 W, 1150 VA
- LED switching capacity: < 2 W: 60 W, > 2-8 W: 180 W
- Max. switch-on peak. 800 A/ 200 µs
- Power consumption: 0.4 W
- Square detection area 360° (9 x 9 m)*
- Mixed light measurement suitable for the control of LEDs, fluorescent, incandescent and halogen lamps
- Operation as fully or semi-automatic (absence detection)

* At installation height of 3 m

Stepless, flicker-free, expandable
Dimmer and KNX dimming actuators

Universal dimmer
All DIMAX plus versions have presets for the optimum LED control.

KNX MIX2 dimming actuators
Basic and extension module
In the KNX programming software ETS, various dimming curves are stored, which correct the dimming response appropriately depending on the lamp used, thus ensuring stepless dimming. New dimming curves – e.g. for future lamps – can be imported via ETS, thus ensuring your investments are well-protected.

KNX dimming booster
DMB 1 T KNX (not illustrated)
- 1 channel dimming booster
- For the output extension of the basic and expansion module of the universal dimming actuators by 300 W for each channel. Output of up to 2000 W/VA possible via max. 4 boosters

DIMAX 534 plus
- Universal dimmer for R, L and C loads with automatic load recognition
- 400 W dimming output
- Adjustable minimum brightness (required for LEDS and ESL)
- Use of the 1-channel dimming boosters 1 T KNX dimming booster can increase dimming output by 300 W/VA
- Up to 3 light scenarios can be triggered over separate entries

DMG 2 T KNX and DME 2 T KNX
- 2-way universal dimming actuators MIX2, basic and extension module
- For dimming dimmable LED lamps, low voltage and high voltage halogen lamps as well as incandescent lamps
- Also suitable for dimming dimmable compact fluorescent lamps via different dimming curves
- LED switching status indicator for each channel
- Dimming output: 400 W/VA per channel or 1 x 800 W/VA in parallel operation
- Use of the 1-channel dimming boosters 1 T KNX dimming booster can increase dimming output by 300 W/VA. Output of up to 2000 W/VA possible via max. 4 boosters
- Automatic load detection (can be deactivated)
- For R, L and C-loads
- Dimming range 0–100 %

KNX FIX2 dimming actuator
DM 4 T KNX (not illustrated)
- 4 way universal dimming actuator FIX2
- For dimming dimmable LED lamps, low voltage and high voltage halogen lamps as well as incandescent lamps
- Different dimming curves
- Dimming output: 400 W/VA per channel or 1 x 800 W/VA in parallel operation
- Performance upgrade up to 2000 W/VA by max. 4 boosters possible

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