



theben

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

Building Automation since 1921.

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

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.



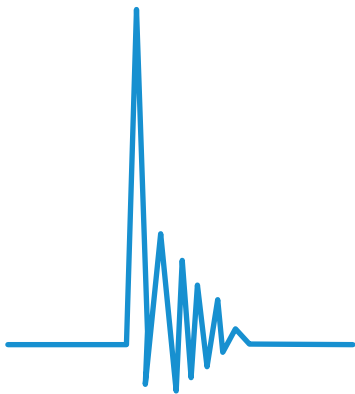
There is general guidelines for LED lamps that apply, from the version of socket base, to Lumens output and Wattage consumption. However other factors are not. As apposed to a classic lamp with a simple spiral wound, LED lamps include a lot of electronics for control. Every manufacturer can decide the 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 corresponding IEC standard is IEC 60669-2-1:2021.

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 life 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 2427-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 life of the device additionally.

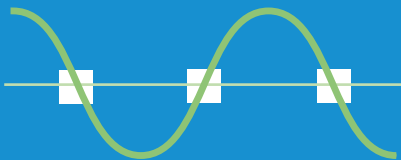
How to switch LED lamps With the right contacts at the right time



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, in almost all KNX devices as well as with the performance motion sensors theLuxa P, theMova P and presence detectors thePrema, theRonda UP, theRonda P and thePassa.



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/top3 series and the motion detectors theLuxa S are equipped with it.

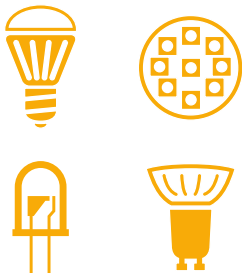


Environmentally aware and switching safely: Cadmium-free contacts

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.



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 can afterglow. A similar effect can be caused by long parallel positioned lines.

In such cases, for example, our compensation module (item no. 9070825) can remedy the situation.

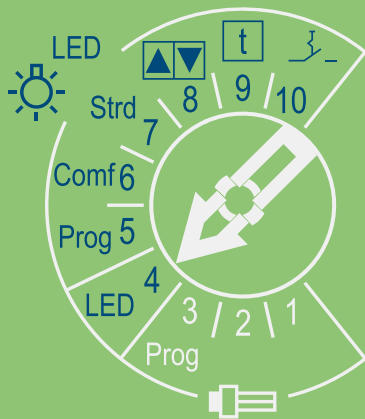


Dimmer meets lamp The right choice is decisive

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.

In addition, dimming curves can also be adjusted manually to each lamp. 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.

Digital time switch with weekly program

Most digital time switches with a width of 1 module¹ are equipped with a tungsten pre-contact that protects the switching relay and takes over the capacitive switching load.

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

Astronomical digital time switch with weekly program

Digital time switches from a width of 2 modules² 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.

SELEKTA 170 top3

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

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 switching³.

ELPA 6 plus

- Zero-cross switching
- LED switching capacity: < 2 W: 55 W, > 2 W: 600 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

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

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, incan-
descent 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 installa-
tion
- Mixed light measurement
suitable for the control of
LEDs, fluorescent, incandes-
cent 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 m²)
- Mixed light measurement
suitable for the control of
LEDs, fluorescent, incan-
descent and halogen lamps
- Operation as fully auto-
matic device
- Remote operation possible



Original size only 13.5 mm flat!

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.

- Switching capacity (only with 230 V): 2300 W, 1150 VA
- LED switching capacity: < 2 W: 60 W, > 2 W: 600 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)*
- Operation as fully or semi-automatic
- Installation height: 2–15 m

Presence detector LUXA 103

are the versatile device family for efficient lighting and HVAC control both indoors and outdoors. Perfect for high LED switching loads.

- Switching capacity: 2300 W
- LED switching capacity: 400 W
- Max. switch-on peak max. 500 A/200 µs
- Power consumption: < 0,5 W
- Circular detection area 360°, up to Ø 12 m (113 m²)
- Operation as fully or semi-automatic
- Installation height: 2,5–3,5 m
- IP 54 for outdoor use

Presence detector thePassa P (not illustrated)

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

- Switching capacity: 2300 W, 1150 VA
- LED switching capacity: < 2 W: 60 W, > 2 W: 600 W
- Max. switch-on peak 800 A/200 µs
- Power consumption: 0,1 W
- Detection area 360° (30 x 4,5 m)*
- Mixed light measurement suitable for the control of LEDs, fluorescent, incandescent and halogen lamps
- Operation as fully or semi-automatic
- Installation height: 2–15 m

Here you will only find one product selection. Further motion and presence detectors, also with DALI or KNX interface, can be found at www.theben.de/en

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



Universal dimmer

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

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 booster DMB 1 T KNX can increase dimming output by 300 W/VA
- Up to 3 light scenarios can be triggered over separate entries

DIMAX 545 plus P

- Universal dimmer for R, L and C loads with automatic load recognition
- 250 W dimming output
- Operation by button or app via Bluetooth Low Energy
- Adjustable dimming response
- Adjustable staircase light function
- App for Android and iOS
- Time functions, astro functions, night interruption – all functions can be combined with the dimming functions

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 booster DMB 1 T KNX 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)

KNX FIX dimming actuator DM 4-2 T KNX

- 4-way universal dimming actuator FIX1
- For dimming dimmable LED retrofit lamps, low voltage and high voltage halogen lamps as well as incandescent lamps
- Different dimming curves
- Dimming output: 200 W/VA per channel or 1 x 400 W/VA in parallel operation (C1+C2 or C3+C4)
- Also available as 8-way dimming actuator: DM 8-2 T KNX

KNX RF dimming actuator DU 1 S RF KNX

- 1-way wireless flush-mounted dimming actuator KNX KNX RF1.R
- For dimming dimmable LED retrofit lamps, low voltage and high voltage halogen lamps as well as incandescent lamps
- Dimming output 250 W/VA
- 2 binary inputs for floating contacts such as buttons, switches, temperature sensor (I2)
- Secure communication via support from "KNX Data Secure"

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Subject to technical changes
and improvements.

