2.4.5 Controlling brightness

There are a number of applications where it is practical to not only be able to switch a lighting installation or individual groups of luminaires on and off, but also to control their brightness. This means that the lighting can be adjusted to suit the use of the space and the ambient conditions; there is also a consider-able saving in energy due to the virtually loss-free leading edge dimmers. The ways and means of controlling brightness largely depends on the type of light source installed.

2.4.5.1 Incandescent lamps and halogen lamps

Conventional incandescent lamps and halogen lamps for mains voltage are the easiest light sources to dim. Simple leading edge dimmers are all that are required to control the brightness of these sources.

Incandescent lamps can be dimmed almost 100 per cent. A slight reduction in operating current results in considerable changes in the characteristics of the light source; the luminous flux reduces dramatically, lamp life increases considerably and there is a colour shift to the warmer colours of the spectrum. As we are familiar with this gradual changing of colour temperature through natural phenomena (sunset, a fire burning out), we find the change of luminous colour pleasant when incandescent lamps are dimmed.

2.4.5.2 Low-voltage halogen lamps

Low-voltage halogen lamps behave in a similar way to conventional incandescent lamps when dimmed. The reciprocal interaction of dimmer and transformer means that these control gear components are subject to increased stress. Conventional dimmers can, therefore, not be applied in this case. Special dimmers for low-voltage installations are required. The transformers used must also be approved as compatible with dimming gear and equipped with fuses that are designed to cope with the high starting current. Dimming is basically effected by controlling mains voltage. Conventional dimmers can sometimes be used together with electronic transformers, some makes still require specially adapted dimmers.

2.4.5.3 Fluorescent lamps

The brightness of fluorescent lamps can also be controlled, but the dimming behaviour of fluorescent lamps is considerably different to that of incandescent lamps.

At this stage it should be noted that there is a virtual linear correlation of lamp current and luminous flux. Whereas the luminous flux of an incandescent lamp is reduced to approx. 50 % at a decrease in lamp current of 10 %, to attain this level of dimming in fluorescent lamps the lamp current also has to be reduced by 50 %. Fluorescent lamps do not change their luminous colour when dimmed.

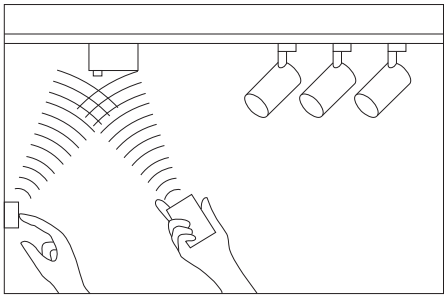
Special dimmers are required to control the brightness of fluorescent lamps. Some fluorescent lamp dimmers do not allow dimming to low illuminance levels, however. This must be taken into account in lecture halls, for example, where especially low dimming levels are required when slides and videos are shown.

Much of the dimming equipment available for fluorescent lamps requires an additional fourth conductor for the heating of the electrodes. Such systems cannot be used for fluorescent lamps that are operated on power tracks, as standard tracks only have three circuits.

During the dimming process the cables between the dimmer and the luminaire are subject to a considerable load of idle current that cannot be compensated, since the installation can only be compensated from outside the dimmed circuit. This idle current must be taken into account when dimensioning cables and control gear.

Controlling the brightness of fluorescent lamps can be effected in different ways, depending on the type of lamp, ballast and dimmer used.

26 mm lamps operated on inductive ballasts require a heating transformer with an electronic starter. Special electronic ballasts can also be used for controlling the brightness of 26 mm fluorescent lamps. They usually have to be supplied together with suitable dimmers, or they can be operated with all other kinds of dimmers designed for use with fluorescent lamps. In addition, each fixture has to be equipped with a special filter choke or a conventional ballast designed to function as a filter choke. Some of these means of controlling brightness require a three-wire connection, which makes them suitable for application with track systems. When electronic ballasts are used there are none of the disturbing flicker effects that can occur when dimming at mains frequency.
The way the dimming of 38 mm lamps operated on inductive ballasts was formerly effected is no longer of any real significance. It required special lamps with ignition aids and heating transformers for the permanent heating of the lamp electrodes.



Track system with 3-channel remote control. The receiver can be controlled via a manual device or a wall-mounted unit.

2.4.5.4 Compact fluorescent lamps

Compact fluorescent lamps with a two-pin base (integral starter) cannot be dimmed. Lamp types with four-pin bases are dimmed in the same way as conventional 26 mm fluorescent lamps.

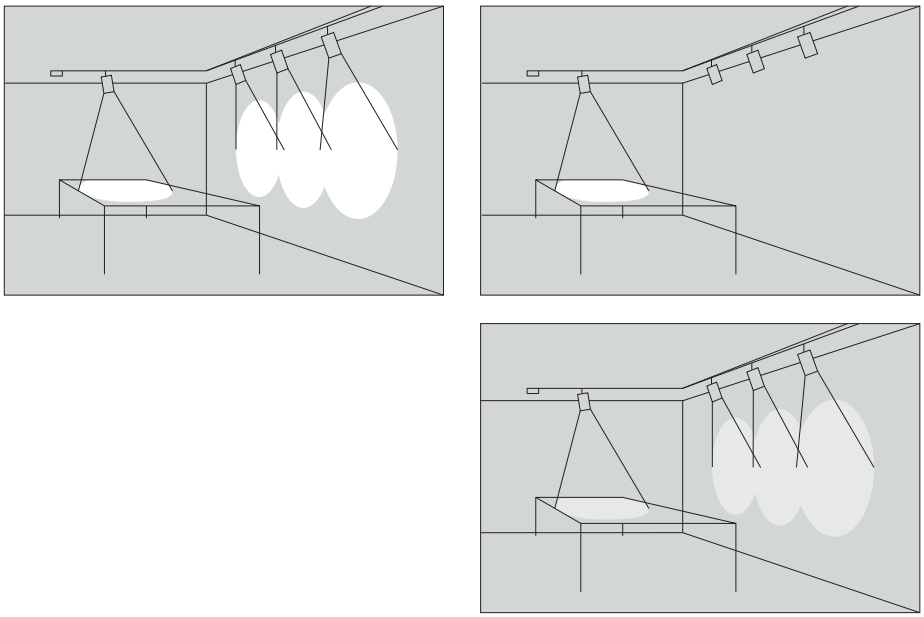
2.4.5.5 Other discharge lamps

As a rule high-pressure discharge lamps and low-pressure sodium lamps are not dimmed, because it cannot be guaranteed that the lamps will continue to burn consistently and dimming has a deteriorating effect on the properties of the lamp.

2.4.6 Remote control

Remote control systems provide the opportunity to control individual luminaires or circuits with the aid of a remote control unit. Receivers have to be installed in the fixtures, lighting installations or distributor boxes; these receivers switch or dim the fixtures they are connected to through an infrared signal. By coding signals it is possible to address a number of fixtures or circuits separately. Remote control systems can be used to control the lighting from any position within a space using a hand-held controller.
The great advantage of such systems is the fact that an individual circuit can be subdivided into several, separately controllable units.
There are special receivers available for operation on tracks. These receivers can control all the track circuits. This means that – especially in the case of old buildings with only one circuit available per room – it is possible to install differentiated lighting into a room easily and economically.

Example of the remote control of a three-circuit track system by switching and dimming of individual circuits.



2.4.7 Lighting control systems

The task of a lighting installation is to create optimum visual conditions for any particular situation. Good lighting must enable the users of the space to perform the necessary visual tasks and move safely from room to room. Furthermore, it should also take into consideration the aesthetic and psychological effects of the lighting, i.e. provide an aid for orientation, accentuate architectural structures and support the architectural statement. One only has to consider the simplest of lighting tasks to understand that the requirements cannot be fulfilled by one lighting concept alone. The lighting has to be adjusted to meet the changing conditions in the environment – the conditions for night lighting are different from the supplementary lighting required during the day. The requirements of a lighting installation are substantially different when it comes to the uses of the space, e.g. the change of

Diagram showing a programmable lighting control system. Preset panels (1) installed in the respective space allows pre-programmed light scenes to be called up. The switching and dimming sequences for the specific light scenes are programmed and saved in the central control unit (2). Various dimming modules allow the dimming of incandescent lamps (3), low-voltage halogen lamps (4) and fluorescent lamps (5).