

# COMMON COMMERCIAL DIMMING SYSTEMS

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There are a wide range of dimming systems available for commercial lighting systems offering differing benefits, here we explore the most commonly used systems, the purpose they fulfil and potential pitfalls to be aware of.

## Phase Cut

Phase Cut dimming is the most simple of the commonly available dimming systems and is generally not suitable for large scale commercial applications. Phase Cut dimming operates by cutting part of the waveform of an alternating current power supply reducing the voltage to the luminaire. This allows the luminaire to be dimmed via the mains cabling only and does not require additional cabling to carry a dimming signal to the luminaire unlike the other systems explored here. It is the lowest cost of the common commercial dimming systems and the simplest to install with the limited cabling requirements, however comes with a number of downsides which make it unsuitable for large scale professional dimmable installations.

These include relatively poor energy efficiency and a tendency to cause an audible hum which is not suitable in many applications. Phase cut dimming is generally confined to low cost products which are installed in small quantities, for example fire rated downlights.

### Typical Wiring:

L	Live
E	Earth
N	Neutral

Dimming is enabled through the mains wiring.

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## Switch Dimming

Switch dimming uses a single dedicated live feed to control the output of the luminaire from a retractive wall switch. Switch Dimming is the simplest and lowest cost professional dimming system where limited control is required. Installation is simple with only a single dimming wire required to control the luminaire output. A single brief press of the retractive switch will turn the luminaires on or off and if the switch is held the luminaires will dim up or down with alternate presses.

Despite the simplicity of switch dim systems there are some points of concern which must be noted. There is no standardisation between driver manufactures as to how switch dim systems operate, so different brands of switch dim drivers might dim at different rates, or switch on or off by different methods, for example some might instantly switch off where others might fade to off. Because of this it is crucial not to mix driver types on the same switch dim circuit as the differing dim rates will cause the luminaires to go out of synchronisation as soon as they are controlled, should this occur the only solution is to replace luminaires with ones with a common driver manufacturer which can be very costly.

Many of the latest generations of DALI drivers offer compatibility with numerous dimming systems including switch dimming and it is not uncommon to see DALI luminaires used on switch dim installations where customers have been unsure of the dimming type at the time of order placement and therefore ordered DALI on the assumption it will be compatible with multiple dimming types including switch dim. This practice carries a high risk of mismatched driver types as manufacturers producing DALI luminaires do not always standardise on a single driver manufacturer.

Even where a single driver manufacturer is used switch dim installations do sometimes go out of synchronisation, should this occur it is easily resolved by holding the retractive switch down for approximately 30 seconds, the luminaires will all dim then rise to full output to indicate that they have all been reset and synchronised.

### Typical Wiring:

L	Live
E	Earth
N	Neutral
SD	Switch Dim Live

A neutral connection is required for the switch dim terminals at the luminaire however this is usually commoned with mains neutral.

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## DSI Digital Serial Interface

DSI Digital Serial Interface uses a digital signal to dim luminaires. This dimming protocol was developed specifically by Tridonic so is only supported by their drivers. DSI dimming was launched in the early days of DALI to give a lower cost digital dimming system without the addressable functionality that DALI offers, however over time the cost of DALI drivers dropped sufficiently that DALI is commonly used on dimming systems where addressing is not required. Because of this DSI is now rarely used however Tridonic continue to support this format in their DALI driver ranges should it be needed.

DSI dimming requires two wires to send the digital dimming signal from the control device to the luminaire however unlike DALI, DSI dimming is polarity sensitive so requires the dimming wires to be terminated to the correct terminals.

### Typical Wiring:

L	Live
E	Earth
N	Neutral
D1	DSI 1
D2	DSI 2

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## DALI Digital Addressable Lighting Interface

DALI Digital Addressable Lighting Interface has sufficient complexity to require an article in its own right, this is intended as a brief overview to understand the differences between DALI and other dimming systems described here, but does not explore any of the complexities and peripheral devices required to control a fully addressed DALI system.

DALI is an internationally recognised dimming and addressable system that is capable of providing centralised control and management of all devices on a lighting installation. All DALI devices contain a chip which enables it to be addressed and become visible on a network. With the correct peripheral devices and software it is then possible to view all of the devices on the network allowing their status to be monitored for information such as energy consumption, failures and faults. Emergency testing can also be automated and test results and failures reported. Commissioning is needed when these systems are installed to ensure that the centralised system knows the location of each device that has been installed. Should a device fail it will automatically recommission itself, however this will only occur with a single device, if multiple devices on the network are replaced simultaneously they must be recommissioned. This addressing extends to every device on the system, not only luminaires but also control devices such as switches and sensors allowing luminaires and controls to be grouped and changed without the need to adjust wiring.

DALI is also commonly used as a basic dimming protocol where sensors or switches need to be used for local control of luminaires without the centralised reporting features being enabled. The DALI standard has recently been updated to DALI 2 and the vast majority of drivers sold on the market now are compliant with this new standard, DALI 2 drivers should be backwards compatible with DALI control devices but where using DALI 2 control devices it is important to ensure that the driver is also manufactured to this latest standard. DALI requires two dedicated wires to send the digital dimming and device information around the network, unlike DSI these are not polarity sensitive and the terminals are labelled accordingly.

### Typical Wiring:

L	Live
E	Earth
N	Neutral
DA	DALI
DA	DALI

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## DT8 DALI Type 8

DT8 DALI Type 8 is a DALI type used specifically to control Tunable White luminaires. Tunable White luminaires typically contain two circuits of LEDs of differing colour temperatures, one warm white and one cool white, which are operated together at differing outputs mixing their light output to produce different colour temperatures. Tunable White luminaires therefore require a driver with two channels which adjust simultaneously to change the colour temperature of the light whilst maintaining the same light output. DALI Type 8 enables this functionality from a single driver and therefore single DALI address simplifying the installation, commissioning and infrastructure required to operate Tunable White systems.

As with other DALI systems DALI Type 8 requires two dedicated wires to send the information between the control devices and the luminaire and is not polarity sensitive.

### Typical Wiring:

L	Live
E	Earth
N	Neutral
DA	DALI
DA	DALI

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## Corridor Function

Corridor Function is an option on many DALI enabled drivers to allow simple on / off mains switching sensors to control the driver so it will only operate at a dimmed level during periods of absence. Rather than incurring the expense of having to use a DALI enabled sensor, corridor function allows the luminaire to come to 100% output during periods of occupancy and to drop to 10% during periods of absence with only a switched live input, this is ideal for applications such as corridors where there is no natural daylight where luminaires need to remain on constantly, but during periods of absence the corridor is still lit to a low light level for safety.

This enables significant energy savings to be made in these applications without the need for more costly DALI sensors. The wiring for Corridor Function is similar to a Switch Dimming luminaire with a single dedicated control wire carrying the switched live output from the sensor to the luminaire.

### Typical Wiring:

L	Live
E	Earth
N	Neutral
CF	Corridor Function

A neutral connection is required for the corridor function terminals at the luminaire however this is usually commoned with mains neutral.

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## Wireless Control

Wireless Control is a broad term that can encompass a number of different system types ranging from local control with wireless sensors or switches controlling groups of luminaires to wireless central reporting systems that replicate DALI to manage lighting installations across large projects providing reports on failures, emergency testing and centralised control. Wireless systems have become increasingly popular over recent years as they enable the installation of versatile control solutions but do not require the additional wires needed to send data and dimming signals between luminaires, control devices and the reporting computer, therefore enabling controls to be integrated on a site without the need to rewire.

### Typical Wiring:

L	Live
E	Earth
N	Neutral

Dimming and data information is transmitted wirelessly.

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## Others

There are a broad range of other controls solutions on the market for specialised applications. DMX, KNX and RDM are a few examples among many others that may be used in specialised lighting applications such as colour changing RGBW luminaires or for stage and performance lighting, however this article is focused on the common dimming systems used in commercial applications for general lighting.