Basic Knowledge Required for the Successful Installation of LED Strips

The installation of a LED strip is quite simple, but there are some particularities to be considered to ensure that the result lives up to your expectations.

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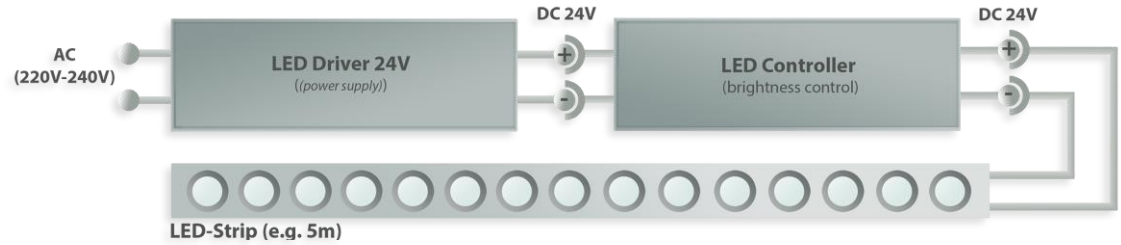
Hi-Line Lighting Ltd
+44(0)20 3322 9192
support@hiline-lighting.com

How to connect a LED strip? *(Circuit diagram of LED strips – LED Driver – LED Controller)*

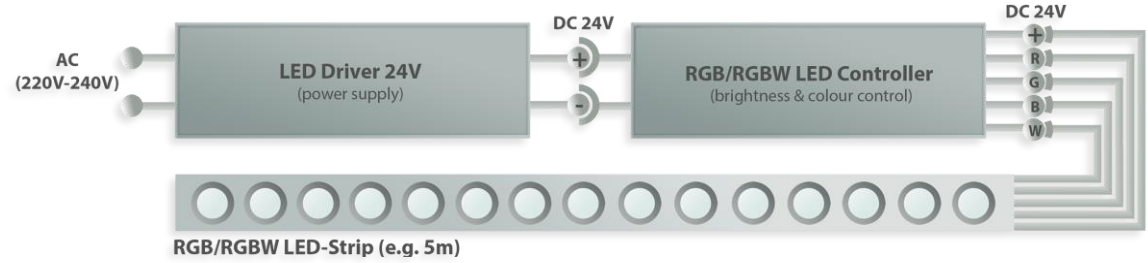
The following circuit diagrams show the basic equipment required for a successful LED strip installation.

The LED Driver is a special switched-mode power supply necessary to operate a LED strip.

Brightness adjustment of the LED strip: The brightness of a LED strip can be adjusted by combining a LED Driver with a LED Controller. As the brightness is being adjusted via the LED Controller it is not necessary to for the LED Driver to be dimmable.



Colour adjustment: Same as for the brightness adjustment, the LED Driver needs to be combined with a suitable RGB/RGBW LED Controller in order to adjust the colour of a RGB or RGBW LED strip.



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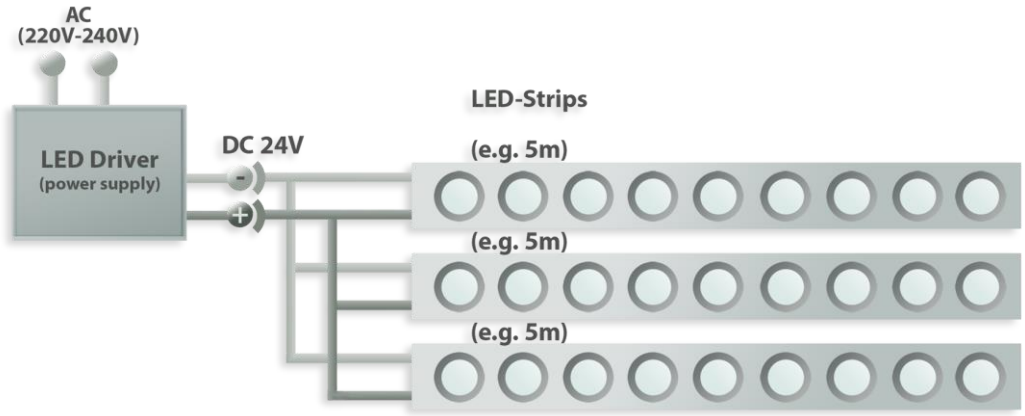
For a **"wireless" brightness and colour adjustment** an RGB/RGBW Remote Control will be additionally required.

1. What is the maximum length of a LED strip?

a. Maximum length of a LED strip with an 8-10mm wide circuit board (PCB)

When installing LED strips, which exceed the length of 5-6m, it can occur that the brightness of the LEDs decreases towards the end of the LED strip. This effect can be also visible through a colour shift (white light becomes pink, etc.). The reason for this is that the LED strips have a high electrical resistance, which gradually diminishes the voltage and leads to a brightness reduction.

If, for example, a 10m long LED strip is being supplied with 24V through the power supply it can be that only 15V arrive at the end of the LED strip due to the voltage drop caused by the electrical resistance. Therefore, to avoid the reduction in brightness, it is necessary to divide the LED strip and connect the resulting segments in parallel. For that several power connections points will be required.



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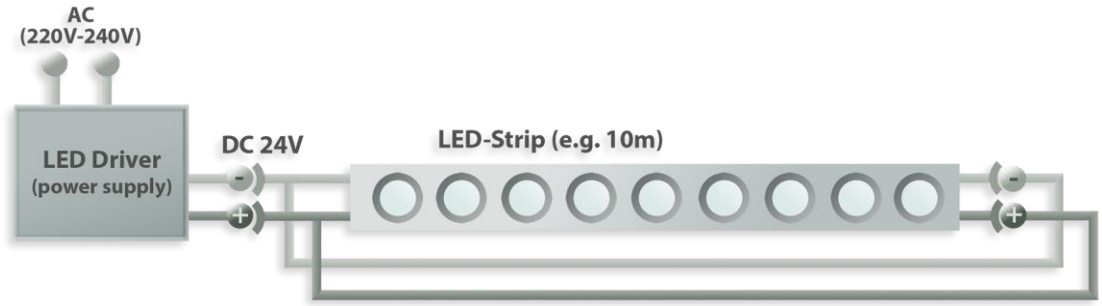
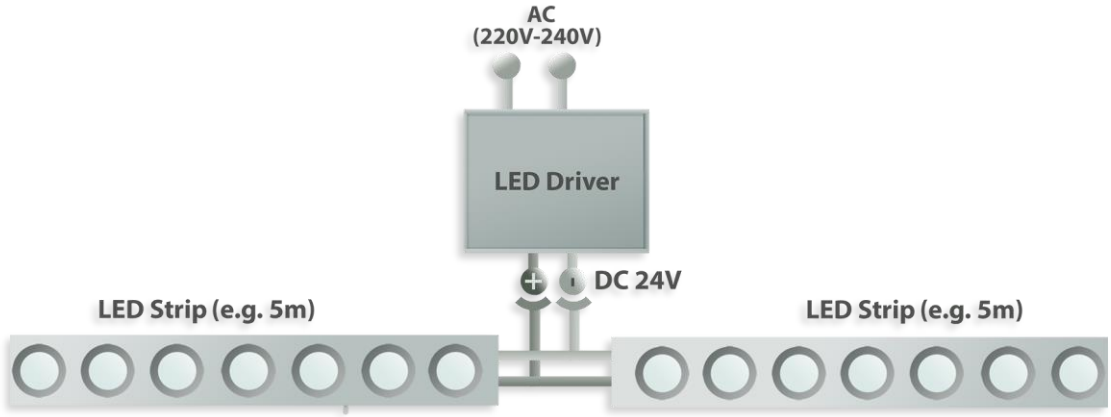
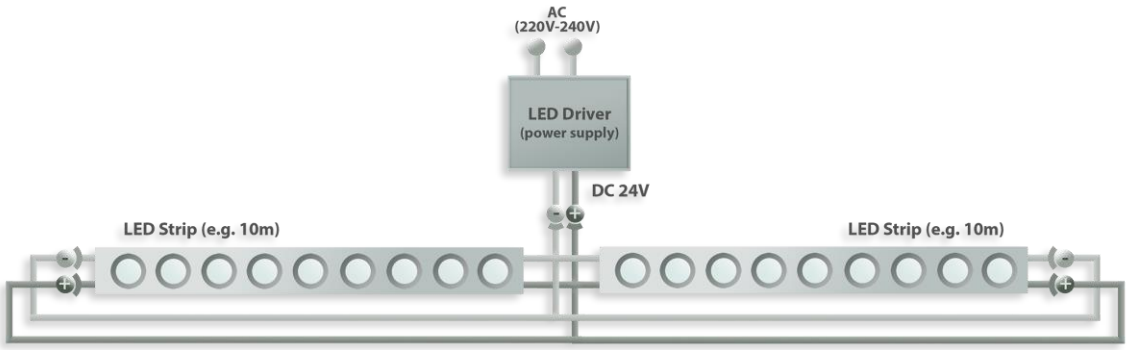
Should a LED strip of e.g. 10m be required it would make sense to supply the LED strip with power from both sides for the above-mentioned reasons.



Alternatively, a 10m long LED strip can also be supplied with power in the middle, leaving 5 meters of LED strip on each side.



For a 20-meter long installation it is necessary to connect the 24V DC supply from both ends (ring) **and** in the middle of the run.



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To reduce time and effort, please perform a test run first and adjust depending on the outcome.

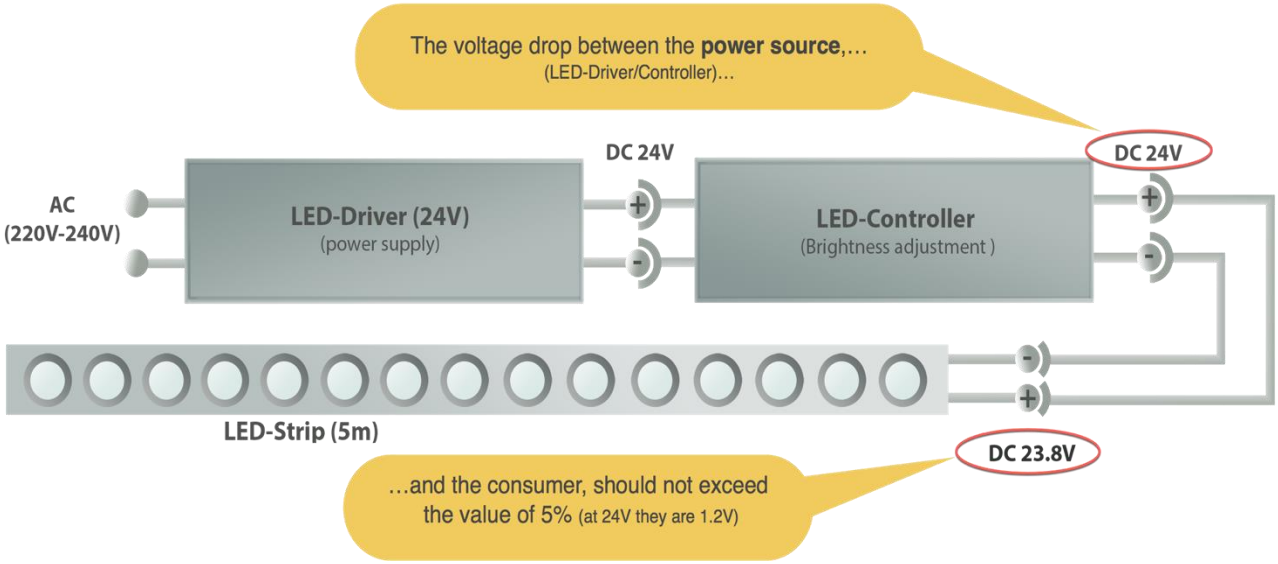
b. Maximum length of a LED strip with an 12mm wide circuit board (PCB)/2oz

Here the same applies as for the above-mentioned LED strips with the difference that the LED strip can be up to 10m long. Nevertheless, it would be advisable not to exceed the maximum length of 5m-6m and if possible to connect the LED strip in parallel.

2. How to calculate the required cable cross-section area of the power supply cable?

In a Direct Current (DC) circuit the right **cross-section area of the power supply cable** is a critical factor and is **used to describe the size of a wire** (in square mm).

„The higher the current and the longer the cable, the bigger the cable cross-section area has to be **to ensure that the resulting voltage drop remains as low as possible.** "



The steps listed below must be followed in order to calculate the cross-section area of the power supply cable. Please note that the following LED strip will be used as an example in the explanations below.

Cool White LED strip with **5m** length
with a power of **14.4W/m** and
a voltage of **24V**

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Step 1: Calculate the **total power consumption** of the LED strip by multiplying the power per meter by the length of the LED strip as follows in the example below:

14.4(W/m) x 5(m) = 72(W)

The result shows that a 5m long LED strip with a power of 14.4W/m has a **total power consumption** of 72W.

Step 2: Calculate the **maximum amperage** of the LED strip by dividing the total power consumption by the voltage as follows:

72(W) / 24(V) = 3(A)*

For the above mentioned LED strip with 24V the **maximum amperage** is 3A.

Step 3: Calculate the required **cross-section area of the power supply cable** by applying the formula below and round up the result to the next highest standardized cable cross-section area (=size of the cable).

$$\frac{\textbf{2 x cable length in m x amperage(A)*}}{\textbf{56 x 0.05 x voltage of LED strip (V)}}$$

maximum permissible voltage drop

Standardized cable cross-section in mm^2:

0.5 – 0.75 – 1.0 – 1.5 – 2.5 – 4.0 – 6.0 – 10 – 25 – 35 – 50 – 70 – 95

If we follow the example above assuming that our cable length from LED Driver to LED strip is 4m, the calculation will look as below:

$$\frac{\textbf{2 x 4m x 3(A)}}{\textbf{56 x 0.05 x 24(V)}} = \frac{\textbf{24}}{\textbf{67.2}} = \textbf{0.36mm}^2$$

$0.36mm^2$ rounded up to the next standardized cable cross-section area would result in $0.5mm^2$, i.e. a cable with a $0.5mm^2$ cross-section will be required for the LED strip in our example.

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Additional explanation of the formula components:

- ***The cable length from LED Driver/Controller to the LED strip***
  It is necessary to determine the double cable length as the current has to flow from the LED Driver/Controller to the LED strip and back.

- ***The maximum amperage (current flow) of the LED strip***
  In order to calculate the amperage, the ***total power consumption*** *of the LED strip needs to be determined and divided by the voltage of the LED strip as shown in Step 1 and 2.*

- ***The constant 56*** *= conductance of copper*

- ***The maximum permissible voltage drop*** *in a power supply cable is 5%. In order to get to these 5% required by the formula the voltage of the LED strip needs to be multiplied by 0.05. Therefore, for a LED strip with 24V, the maximum voltage drop amounts to 1.2V (i.e. 5% of 24V or 0.05x24V).*

3. How to choose a suitable LED Driver for a LED strip? How to calculate the required power of the LED Driver or power supply?

The LED Driver is a special switched-mode power supply used to operate of a LED strip.

Step 1: Determine the length of the LED strip and calculate the **total power consumption** of the LED strip by multiplying the power by the length of the LED strip as follows in the example below:

5(m) x 14.4(W/m) = 72(W)

The result shows that a 5m long LED strip with a power of 14.4W/m has a **total power consumption** of 72W.

Step 2: It is advisable though, not to operate the power supply to its full capacity, as this will lead to a warming of the power supply and consequently to a higher wear and tear of the material. It is therefore common practice to **add an additional 20% buffer to the total power consumption** in order to increase the life span of the power supply.

That results in:

72W x 1.2 (20%) = 86.4W

The above-mentioned example shows that the LED power supply should have a minimum power of 86.4W for 24V DC. As no power supply is available with this exact wattage, the next highest wattage should be chosen. A power supply of 100W is available for 24V DC in the Hi-line online shop.

Please note that a power supply with a higher wattage will not damage the LED strip, as it uses only the power it needs. Therefore, the LED strip given in the example, receives a maximum of 86.4W, although the LED Driver/power supply could deliver 100W.