

## LED modules connected in series

### Advice on the applicability of the Low Voltage Directive

There are LED modules on the market that are designed for connection in series.

According to Article 1, the Low Voltage Directive 2014/35/EU applies for "electrical equipment designed for use with a voltage rating of between 50 and 1 000 V for alternating current and between 75 and 1 500 V for direct current". At the same time it remains unclear what "voltage rating" in the sense of the Directive means if, for instance, an LED module with a rated voltage of 12 V is designed for operation of ten LED modules in series where an operating voltage of 120 V occurs.

For the intended series connection, the outer insulation of the single LED modules must feature the creepage distances and clearances for the voltages that occur when connected in series (see also EN 62031:2015<sup>1</sup>, 7.1, item k). Because the principal elements of the safety objectives according to Annex I of the LVD require, among others, a sufficient insulation and because the safety can only be assessed if the operating voltage is taken into account, the Fachverband Licht of the ZVEI and the VDE Prüf- und Zertifizierungsinstitut are of the opinion, that the operating voltage of the series connection is to be understood as the "voltage rating" in the sense of the Directive.

For the above example of a 12 V LED module, this means: The series connection of ten LED modules as specified by the manufacturer results in an operating voltage of 120 V. This value lies within the voltage boundaries of the Low Voltage Directive 2014/35/EU. Therefore, this LED modules shall comply with the LVD and shall carry a CE marking according to this Directive.

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<sup>1</sup> The DE version refers to DIN EN 62031:2013