

LED module

The present invention relates to an LED module (light-emitting diode module) for insertion into a luminaire, wherein the LED module comprises a plurality of LEDs (light-emitting diodes) and has terminals that can be inserted into sockets of the luminaire in order to replace conventional lighting means.

An LED module of this kind is known, for example, from DE 299 00 320 U1, in which an LED lamp with an outer geometry that is essentially consistent with a fluorescent bulb is disclosed. The LED lamp has an electrical terminal on each of its end sides in the longitudinal direction, wherein these terminals can be inserted into customary plug-in sockets for fluorescent bulbs. A plurality of LEDs are arranged as light sources in rows on a printed circuit board, and the printed circuit board furthermore has reverse voltage protection in the form of a diode in order to prevent current flowing through the LEDs in the wrong direction. Because the electrical supply for a fluorescent bulb is fundamentally different from that for LEDs, a cable set is furthermore provided with which the ballast provided for the fluorescent bulb can be bridged so that the bulb can be connected directly to the on-board voltage source of a vehicle, which means to a direct current source.

Known from DE 10 2004 044 166 B4 is an explosion-protected luminaire with LEDs as light sources, wherein a plurality of LEDs are permanently arranged on a lighting means carrier strip and a plurality of lighting means carrier strips are mounted in parallel on a lighting means carrier. This device, however, is not suitable for operation with fluorescent bulbs.

The object of the invention is consequently to provide an LED module for insertion into a luminaire in order to replace conventional lighting means and with which the light output can be improved.

This is achieved as a result of the LED module having at least two terminals, whereby the two terminals can be inserted into two different sockets of the luminaire for a lighting means at the same time. Advantageously, it can be possible for one of the two terminals to be inserted into one socket of the luminaire for a lighting means while it is possible for the other of the two terminals to be inserted into another socket of the light for an additional lighting means at the same time so that the LED module replaces two separate lighting means. The LED module consequently has at least two terminals, each of which can be inserted into at least two different sockets of the luminaire at the same time as a replacement for at least two separate lighting means. Due to the fact that the LED module does not replace just a single lighting means, it is possible to use as space for the LED module design both the space of the at least two replaced

lighting means and also the interspace normally provided between conventional lighting means. In a multitude of conventional luminaires, a plurality of conventional lighting means are provided, whereby interspaces are present between the lighting means that principally allow heat dissipation from the individual lighting means. LEDs, however, are very small punctiform light sources, of which a multitude must be provided for this reason. Consequently, improved light yield can be achieved by means of the teaching of the invention because then LEDs in the framework of the LED module can also be provided in the areas between the replaced conventional lighting means.

If such an LED module replaces a lighting means, such as a fluorescent lamp, it is possible that the LED module to replace this lighting means is supported in such a manner that it is rotatable relative to the sockets between a release position and a locking position. I. e., the LED module, with its contacting, is inserted between or into the sockets and then twisted by means of twisting the LED module or at least its contacting, i.e., its terminals, between the release and locking position. In the release position the LED module can be removed from the base body or inserted into it. In the locking position the LED module is localised on the base body.

In the case of an LED module to replace two lighting means, which in particular are otherwise arranged parallel to each other in the base body, as a rule there is no twisting of the LED module. Instead, however, it is possible to twist the sockets or holders in the base body in order in this way to release or mount the LED module. It is thereby possible that the corresponding sockets of the luminaire have an insertion channel that serves to insert the terminals or contacting, as the case may be, of the LED module. In this case each of the sockets and in particular the insertion channel is allocated a latching or locking mechanism. As already explained, in addition to or as an alternative to the latching or locking mechanism, twisting of the socket can take place in order to mount the LED module or allow removal via the insertion channel.

In this connection, it is likewise conceivable that the LED module has a locking mechanism allocated to its terminals or contacting, by means of which the module can be mounted on the base body after the terminals have been inserted into the socket or into the holder on the base body.

On the whole, an insertion of the LED module into the base body and particularly a mounting of the terminals to the holders for an electrical connection can be carried out in a simple manner,

whereby the LED module can be simultaneously mounted on the base body by means of such an insertion.

The assembly of such an LED module into a luminaire furthermore is easier because it is not necessary to insert a plurality of LED modules and instead a plurality of conventional lighting means can be replaced by just one LED module. This accelerates both the replacement of conventional lighting means with an LED module as well as the replacement of LED modules in a luminaire.

In the context of the teaching of the present invention, conventional lighting means are principally fluorescent lamps, but furthermore also incandescent bulbs, halogen bulbs and fluorescent tubes. The term "terminal" refers to the totality of a terminal, consequently for example the two male contacts on one side of a fluorescent lamp or the mounting socket of an incandescent bulb.

The terminals can advantageously be inserted into sockets for fluorescent bulbs. For this purpose, the terminal is formed in a manner consistent with a terminal on one side of a fluorescent bulb, namely principally as two male contacts that are separated from each other. The LED module principally is used as a replacement for standard fluorescent bulbs with 18W to 58W output.

In a preferred embodiment, at least two terminals are provided on one side of the LED module, and in each case at least two corresponding terminals on the opposite side of the LED module. The corresponding terminals are principally provided at the corresponding position on the particular opposite side of the LED module. This means the corresponding terminals are arranged in the LED module such that they are symmetric to one of the centred symmetry planes parallel to the opposite sides.

The LED module principally has a length that is greater than its height and width, whereby the terminals are provided on the lengthwise end sides. A plurality of parallel fluorescent lamps can consequently be replaced by the LED module, principally two parallel fluorescent lamps. The LED module is furthermore preferably at least twice as wide as it is high.

In an advantageous embodiment the terminals are used to mount the LED module in the luminaire. The terminals consequently not only assure an electrical supply, they also localise and hold the LED module in its position in the lamp.

Additional mounting means can alternatively or additionally be provided on the LED module and/or on the corresponding luminaire, in order that the LED module can additionally or exclusively be mounted in the luminaire.

In an embodiment, only some of the terminals are designed to be current-carrying. Because the LED module replaces a plurality of lighting means, it is not performance dependent on the energy supply of each lighting means. It is consequently sufficient if the power is supplied over only one terminal. Alternatively, one terminal can also constitute a positive pole of a direct voltage and the other terminal can constitute the negative pole of a direct voltage.

In an embodiment each terminal has two male contacts that are inserted into a corresponding socket of the luminaire. This makes it possible for conventional fluorescent lamps to be replaced by the LED module.

The terminals are advantageously arranged on two opposite end sides in the LED module's longitudinal direction, each at the same level and the same distance to the centre in the latitudinal direction of the LED module.

In an embodiment the terminals can be twisted relative to the LED module in order to allow the terminals to be mounted in the sockets of the luminaire. This means that after the LED module has been inserted into the luminaire, the twistable terminal is twisted automatically or by means of a manual action, as a result of which the LED module is mounted.

In order to avoid in a simple way an incorrect insertion of the LED module, or to allow an arrangement of the LED module in both directions within the luminaire, a rectifier mechanism, particularly with allocated safety circuit, is allocated to at least one terminal of the LED module. Due to the rectifier mechanism, it is guaranteed that incorrect insertion of the LED module is not possible, because both insertion directions are possible due to the rectification.

In this connection, the safety circuit can, for example, prevent excessively high voltage peaks or the like.

Rectifier mechanisms and safety circuits can advantageously be encapsulated.

In order to be able to allocate the corresponding terminals or also male contacts to the LED modules in a simple manner, pin housings can be arranged at the ends of the LED modules for the provision of the terminals and in particular of the male contacts.

In an embodiment, the LED module with its terminals is designed to be inserted into a total of four sockets in order in this way to replace two fluorescent bulbs, arranged in parallel and socketed on two sides. The arrangement of two parallel fluorescent bulbs is customary in many luminaires, as a result of which an LED module of that kind can be used in a number of ways. Moreover an LED module of that kind is simple to insert, because it is only necessary to insert the four terminals into the corresponding sockets at the same time, which allows simple assembly.

The LED module is advantageously characterised in such a way that it can be inserted into the luminaire with the correct orientation. This can be achieved, for example, by the correct orientation being indicated with an arrow or a marking. On the other hand, however, a geometric confining element, for example, in the form of a projection, can be provided that prevents incorrect insertion of the LED module.

The LED module can comprise an electronic ballast in order to supply the LEDs. Conventional lighting means are often operated with alternating voltage that is either provided directly by the power supply grid, such as for incandescent bulbs, for example, or that is supplied by a ballast, such as for fluorescent lamps, for example. Supplying LEDs, however, requires a relatively constant direct voltage. An electronic ballast that adapts the provided electric supply in such a way that LEDs can be operated can consequently be provided in the LED module. The LED module can consequently be inserted directly into a luminaire that actually provides unsuitable voltage for LED elements. In particular, the electronic ballast can convert a supply voltage of an electronic ballast for fluorescent bulbs into a suitable direct current supply for the LED module.

The electronic ballast is advantageously designed to provide a supply voltage with the correct polarity for the LEDs regardless of the orientation in which the LED module is inserted into the luminaire. This is particularly necessary for applications in which the supply voltage has already been converted to direct voltage and the electronic ballast in the LED module only ensures a further adjustment or a safeguarding of the current flow in the correct direction for the LEDs. In particular, this can be achieved by providing a diode.

The present invention furthermore relates to a luminaire with an LED module according to the invention and described in the preceding, whereby the luminaire and/or the LED module is explosion-protected. In particular, an explosion-protected LED module can be achieved by means of suitable encapsulation of the light-emitting diodes and any electronic ballast that may be provided, so that it is possible neither for an ignition spark to be generated nor for an ignition temperature to be reached that would ignite an explosive gas that possibly surrounds the LED

module. The luminaire can alternatively or additionally also be explosion-protected in itself. In particular, this can be achieved if the luminaire has a cover and a base body, which are both used to enclose the LED module in such a way that explosive gas cannot penetrate into the LED module and if furthermore the electric supply and the electric terminals of the luminaire are likewise executed such as to be explosion-protected.

In particular, the luminaire and/or the LED module can be formed with ignition protection type Ex-e, Ex-d or Ex-m.

In an embodiment, the lamp comprises a base body with sockets for conventional lighting means, into which the LED module is inserted, and a transparent or translucent cover that is placed onto the base body and that covers the LED module. The cover allows the light to be distributed, preferably in interaction with a reflector of the base body or of the LED module. The cover furthermore offers access for replacement of the LED module with another LED module or with conventional lighting means, such as fluorescent lamps, for example.

A plurality of LEDs are advantageously arranged in row in the longitudinal direction of the LED module. At least two parallel rows of LEDs can thereby be provided in the longitudinal direction of the LED module, whereby more than two parallel rows of LEDs can be also provided as the width of the LED module increases, in particular more than three, more than five or more than ten parallel rows of LEDs.

A plurality of LEDs can be arranged in the longitudinal direction on a printed circuit board in the LED module. This allows a simpler provision and simpler activation of a plurality of LEDs.

Advantageously, the LEDs radiate in the LED module at least to some extent in the direction of a reflector, which reflects and scatters the light of the LEDs so that the light field of the lamp is uniformly developed. The reflector can be a part of the luminaire or a part of the LED module.

The inventive task definition can also be solved by means of the provision of a luminaire that has on the one hand sockets for conventional lighting means, such as fluorescent lamps or incandescent bulbs, for example, and on the other hand at least one socket for an LED module that is inserted as a replacement for the conventional lighting means.

In particular, the sockets for the conventional lighting means can be equipped with no ballast or with a ballast other than the ballast that is provided for operation of the LED module.

In another embodiment, the LED module can have an electronic ballast so that the sockets of the conventional lighting means and the socket of the LED module can be operated with the same electric supply.

In particular, the sockets for the plurality of conventional lighting means and the at least one socket for the LED module are arranged in such a way that after replacement of the conventional lighting means, the LED module is arranged at least partially in the area of each replaced conventional lighting means. In order to be able to hold the LED module securely in the luminaire, the corresponding sockets of the luminaire can have a locking mechanism for locking the terminals or male contacts inserted into the socket. For example, a twist lock, a latching mechanism or the like is such a locking mechanism.

In the following, an advantageous embodiment of the invention is explained in more detail using the figures represented in the enclosed drawings.

Shown are:

Figure 1 A schematic isometric view of a luminaire with two fluorescent lamps and with removed cover according to the state of the art;

Figure 2 A schematic isometric view of a luminaire with an LED module according to the invention and with removed cover;

Figure 3 A schematic isometric view of a luminaire and an LED module provided for the same and according to the invention compared to conventional fluorescent lamps; and

Figure 4 A schematic diagram of an LED module with rectifier mechanism.

Figure 1 shows a conventional, explosion-protected luminaire 1 that has a base body 2, which is provided during operation with a transparent or translucent cover, which is not shown. The base body 2 has explosion-proof electric supply terminals 3, 4 to which corresponding supply lines can be connected. Provided in the base body 2 is a preliminary electronic controller which is not separately shown, which provides a supply voltage which is suitable for at least the operation of the fluorescent lamps 5.

Two fluorescent lamps 5 are arranged in parallel in the longitudinal direction L of the base body 2. In order to mount and localise the fluorescent lamps 5, mounting flanges 6 and 7 that project downwards are provided in the area of the two lengthwise ends of the base body 2. On each of the mounting flanges 6, 7 are provided two sockets, each of which is aligned in the direction of

the centre in the longitudinal direction of the luminaire 1. The term socket thereby does not in any way refer only to a projecting element for holding the ends of the fluorescent lamps 5, but rather just as much to recessed areas into which the terminals 8 (see Figure 3) of the fluorescent lamp 5 can be inserted.

The luminaire 1 has a length in the longitudinal direction L that is greater than the height in the height direction H and width in the latitudinal direction B.

Figure 2 shows an explosion-protected luminaire 1 without cover with structurally identical base body 2, which, however, is provided with an LED module 9 instead of with fluorescent lamps 5. The LED module 9 has a length that roughly corresponds to the length of the fluorescent lamps 5, wherein particularly the terminals 10, 13 and 11, 12 have the same spacing as the terminals 8 of the fluorescent lamps. The LED module 9 advantageously has a height that is slightly higher than the diameter of the fluorescent lamp 5, and a width such that at least the terminals 10, 11 can be inserted on one end side of the LED module into the sockets for the terminals of the fluorescent lamps in the mounting flange 6, 7 of the base body 2.

A multitude of LEDs 14 are arranged on a printed circuit board 15 in the longitudinal direction within the LED module 9. In the present embodiment, only the LEDs on a printed circuit board are visible in Figure 2, whereby further LEDs are arranged symmetrically to these on the other side in the latitudinal direction B. Moreover an additional LED row can be arranged between the two previously described rows of LEDs.

The LEDs 14 are supplied with a direct voltage which is advantageously produced by an electronic ballast which is provided in the LED module 9. In this way, the LED module 9 can be inserted into the base body 2 of a conventional luminaire 1, which provides a supply voltage for a fluorescent lamp by means of an electronic ballast.

The LEDs 14 are largely surrounded above and to the side by a reflector 16 or by a plurality of reflectors 16 which direct the light downwards in the direction of the opening of the base body 2 and furthermore scatter the light generated in a punctiform manner by the LEDs 14. In this way light distribution similar to that achieved by conventional fluorescent lamps 5 can be achieved with the LED module 9.

Figure 3 again shows a luminaire 1 that has a base body 2 whereby a cover 17 is arranged on the base body 2. When this cover 17 is removed from the base body 2, either the shown LED module 9 or the fluorescent lamps 5 can be inserted into the base body 2, before the cover 17 is closed again. The type of lighting means of the luminaire 1 can thereby be changed at any time,

without it being necessary to modify the base body 2 of the luminaire 1. This is particularly advantageous for the use in explosion-proof luminaires 1, because in this case a replacement of a ballast in the base body 2 or the like would require recertification or a new safety acceptance test which would be expensive and complex in the event the luminaire 1 were to be used in the industrial environment. The LED module 9 can moreover be fashioned in such a way that it is suitable for replacing the fluorescent lamps 5 in already existing luminaires 1. Luminaires 1 that have already been installed in the industrial area can thereby be upgraded so that they have LEDs instead of fluorescent lamps as lighting means.

In addition, in the event of re-designs of the base body 2, mounting mechanisms that additionally mount the LED module 9 to the terminals 10, 11, 12, 13 in the base body 2 can be provided. Furthermore, a preliminary control device can be provided for re-designed base bodies 2 that is suitable for the operation of both fluorescent lamps and LEDs so that no additional preliminary electronic controller has to be provided in the LED module 9.

The terminals 10, 11 are provided on the end side 18 in the longitudinal direction of the LED module 9 and the terminals 12, 13 are provided on the opposite end side 19 in the longitudinal direction. Each of the terminals 10, 11, 12, 13 has two male contacts 20, 20, as shown for terminal 10, which have geometry and spacing essentially consistent with that of the male contacts 21, 21 of a fluorescent lamp 5. The male contacts 20, 20 of the LED module are used only to some extent for a power supply of the LEDs, and the other male contacts can also be provided only for mounting the LED module 9.

Figure 4 shows a schematic diagram of an LED module 9 in which essentially the two printed circuit boards with LEDs 14, also refer to Figure 2, are arranged in parallel next to each other. A positive pole is on one end of each printed circuit board and a negative pole is on the other end. Arranged on the ends of the LED module are pin housings 22, 23, which hold ready the corresponding terminals 10, 11, 12, 13 or the associated male contacts. Arranged between the terminals and the respective printed circuit boards on at least one end of the LED module 9 are rectifier mechanisms 24 and 25. These preferably contain a safety circuit.

Because of the rectifier mechanisms, a reversed insertion of the LED module into the corresponding sockets of the luminaire, see Figure 2, is also possible without damage to the LEDs resulting due to incorrect voltage polarities. I. e., due to the rectifier mechanisms 24, 25 it is ensured that each of the corresponding positive poles of the respective printed circuit board with LEDs receives a positive voltage and the corresponding negative pole receives a negative voltage.

According to the invention consequently an LED module is proposed that can completely replace already existing fluorescent bulb solutions without it being necessary to change wiring or the mechanical system, see for example socket and holder, of the corresponding luminaire. The electrical or electronic ballast of the luminaire is thereby used to activate the corresponding LEDs. By means of additional mechanisms of the LED module, there is also the possibility that the module can be inserted into the luminaire twisted by 180° and that it can also be operated in this position. I. e., there is direction-independent operation both electrically and mechanically.

As a rule, an LED module replaces two customary fluorescent bulbs.

It is also possible that, for example, a plurality of printed circuit boards with LEDs are arranged one behind the other, likewise in a corresponding additional parallel arrangement, so that for example in each case two printed circuit boards with LEDs can be arranged behind one another and parallel to one another in one LED module. This also applies analogously for more than two printed circuit boards.

Claims

1. LED module (9) for insertion into a luminaire (1), wherein the LED module (9) comprises a plurality of LEDs (14), and has terminals (10, 11, 12, 13) that can be inserted into sockets of the luminaire (1) in order to replace at least one conventional lighting means (5),
characterised in that
the LED module (9) has at least two terminals (10, 11, 12, 13), wherein in each case one of the two terminals (10, 11, 12, 13) can be inserted into a socket of the luminaire (1) for a lighting means (5).
2. LED module according to Claim 1, wherein one of the two terminals (10, 11, 12, 13) can be inserted into a socket of the luminaire (1) for a lighting means (5) and the other of the two terminals (10, 11, 12, 13) can be simultaneously inserted into another socket of the luminaire (1) for an additional lighting means (5), so that the LED module (9) replaces two separate lighting means (5).
3. LED module according to one of the preceding claims, wherein the terminals can be inserted into sockets for fluorescent bulbs (5).
4. LED module according to one of the preceding claims, wherein at least two terminals (10, 11) are provided on one side of the LED module (9), and in each case at least two corresponding terminals (12, 13) are provided on the opposite side of the LED module (9).
5. LED module according to one of the preceding claims, wherein the LED module (9) has a length that is greater than the height and width, and wherein the terminals (10, 11, 12, 13) are provided on the end sides (18, 19) in the longitudinal direction.
6. LED module according to one of the preceding claims, wherein the terminals (10, 11, 12, 13) are used to mount the LED module (9) in the luminaire (1).
7. LED module according to one of the preceding claims, wherein only some of the terminals (10, 11, 12, 13) are designed to be current-carrying.
8. LED module according to one of the preceding claims, wherein each terminal (10, 11, 12, 13) has two male contacts that can be inserted into a corresponding socket of the luminaire (1).

9. LED module according to one of the preceding claims, wherein the terminals (10, 11, 12, 13) are arranged on two opposite end sides (18, 19) in the longitudinal direction of the LED module (9), each at the same height and the same distance to the centre in the latitudinal direction of the LED module (9).
10. LED module according to one of the preceding claims, wherein the terminals (10, 11, 12, 13) can be twisted with respect to the LED module (9) in order to allow the terminals (10, 11, 12, 13) to be mounted in the sockets of the luminaire.
11. LED module according to one of the preceding claims, wherein the LED module (9) with its terminals is designed to be inserted into a total of four sockets in order in this way to replace two fluorescent bulbs (9), which are arranged in parallel and socketed on two-sides.
12. LED module according to one of the preceding claims, wherein the LED module (9) is characterised in that it can be inserted into the luminaire (1) with the correct orientation.
13. LED module according to one of the preceding claims, wherein the LED module (9) comprises an electronic ballast in order to supply the LEDs (14).
14. LED module according to one of the preceding claims, wherein the electronic ballast is designed to provide a supply voltage in the correct polarity for the LEDs (14), regardless of the orientation with which the LED module (9) is inserted into the luminaire.
15. LED module according to one of the preceding claims, wherein a rectifier mechanism (24, 25), particularly with safety circuit, is allocated to at least one terminal (10, 11, 12, 13).
16. LED module according to one of the preceding claims, wherein pin housings (22, 23) with terminals (10, 11, 12, 13) and particularly with male contacts (20) are arranged on ends of the LED modules (9).
17. Luminaire (1) with LED module (9) according to one of the preceding claims, wherein the luminaire (1) and/or the LED module (9) is formed in an explosion-protected manner.
18. Luminaire according to Claim 16, wherein each socket has a locking mechanism to lock the terminals (10, 11, 12, 13) inserted in the socket and particularly to lock the male contacts.

19. Luminaire according to one of the preceding claims, wherein an LED module (9) to replace a lighting means is supported such that it can be rotated relative to the sockets between a release position and a locking position.
20. Luminaire according to one of the preceding claims, wherein the LED module (9) has locking mechanisms allocated to its terminals (10, 11, 12, 13).
21. Luminaire according to one of the preceding claims, wherein an insertion channel, for use in sliding in the terminals of the LED modules, and a latching or locking mechanism are allocated to each socket or to each holder.