



Electronic ballast or operating device for illumination means having programmable or configurable control unit

- 5 The present invention relates to the field of operating devices for illumination means, wherein external control information for programming or configuring the behavior of the electronic ballast or operating device can be delivered to a control unit, and can be stored in a
10 memory associated with the control unit.

- Electronic ballasts (EVGs) for operating lamps, in particular gas discharge lamps, are already well known. Ballasts of the latest generation are thereby not only
15 capable of precisely monitoring the operating behavior of a lamp to be operated and ensuring a fault-free lamp operation, but beyond this also have a data or communication connection, via which they can communicate with other ballasts or with central control devices.
20 Through this there is for example the possibility to send to the ballast brightness commands for the controlled lamps. Beyond this, the sent data can also generally influence the operating behavior of the ballast, for example indicate the average power to be delivered to the
25 gas discharge lamp or to determine the pre-heating duration before an ignition of the lamp.

- Along with these ballasts just described, which are configured for extensive data communication, there are
30 however often put to use also simply configured ballasts which are exclusively provided for operating the associated lamp in accordance with a predetermined scheme. The operating behavior of these ballasts is



already largely fixed during production and can subsequently not be influenced or only slightly influenced. In particular such ballasts are not configured to communicate, or at least to receive data,
5 via corresponding data or communication connections with other participants of an illumination system or with a central control device.

In order, even with these more simple ballasts, to open
10 up the possibility of being able to influence the operating behavior still at least to a certain degree at a later time point, that is after production, it is known to provide such ballasts with a configuration input. At this configuration input there can then be connected
15 passive configuration elements such as e.g. resistances or the like, which through their physical characteristics influence a certain function of the ballast. For example it is known, through the size of an external resistance connected to the configuration input, to set the power
20 which is delivered from the ballast to the lamp, or to determine the duration of the pre-heating phase before an ignition of the gas discharge lamp.

Through the arrangement of an additional configuration
25 input, however, the outlay for production of the electronic ballast is in turn increased. Further, the possibilities for influencing the operating behavior of the ballast with the aid of such a configuration input are limited. Beyond this, it is to be considered that
30 usually electronic ballasts are fully enclosed in a housing, which solely has the terminals for current supply of the ballast and the terminals for the lamp. With these very compact configurations, supplementary

terminals or inputs are not provided, for which reason a subsequent influencing of the operating behavior is not possible.

5 The problems referred to above relate not only to electronic ballasts for gas discharge lamps but general operating devices for illumination means. Also in the case of other illumination means such as e.g. incandescent lamps, halogen lamps or LEDs, it is often
10 desired or even necessary to be able to subsequently influence the operating behavior of the device (or to be able to subsequently correct, centrally and without disassembly, a subsequently recognized failure in the software of the operating device). A particularly
15 important application example is thereby the employment of LEDs or LED modules, since these light sources for realizing a precise color output must be calibrated after their production, which as a rule is effected through the transfer of appropriate configuration data.

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Correspondingly, the object of the present invention is to indicate a new type of possibility of influencing the operating behavior of an electronic ballast or an operating device for illumination means. In particular
25 the possibility is intended to be opened to deliver external control information for programming or configuring the operating behavior, in a manner which is as simple as possible to the control unit, associated with the operating device, without it being necessary for
30 this to associate additional terminals or inputs.

This object is achieved by means of the features of the independent claims. The dependent claims further develop

the central concept of the invention in particularly advantageous manner.

It is a concept of the present invention to use as
5 programming inputs, via which the external control
information can be delivered to a control unit arranged
in the ballast or operating device, the main terminals
for current supply of the ballast or operating device
and/or the output terminals, which generally are provided
10 for the purpose of delivering to a lamp an appropriate
operating voltage, for which purpose the mains and output
terminals are internally connected with the control unit.
In accordance with the solution according to the
invention there is thus needed no additional
15 configuration input or data input, since the already
present terminals of the ballast or operating device are
employed for data reception. There arises through this in
very simple manner the possibility of transmitting data
to the control unit, which can be stored in a memory
20 associated with the control unit, whereby the data then
influences the operating behavior of the ballast or
operating device, for example setting certain operating
parameters or defining operational processes.

25 The internal connection between the mains terminals
and/or output terminals serving as programming input with
the control unit can for example be effected via
connection lines which include a resistive voltage
divider. Alternatively thereto, the connection could
30 however also be effected magnetically, capacitatively,
optically or by means of a wireless connection.

In accordance with a preferred configuration of the present invention there is involved in the case of the memory for storing the externally delivered control information a non-volatile memory. The control unit has
5 at least a logic circuit, for example a microprocessor, which is connected with the memory.

The transfer of the control information is preferably effected in a time period in which the ballast or
10 operating devices is inactive, insofar as the lamp is not supplied with current in this time period. After conclusion of the transfer of the control information the lamp can then be ignited in the usual manner and operated, whereby the operating behavior is determined by
15 means of the previously delivered control information.

For transmitting the control information there is provided in accordance with the invention a programming device which is configured for the purpose of being
20 connected to the mains terminal and/or output terminals of the ballast or operating device, in order to transfer the control information to the control unit arranged in the ballast or operating device. Preferably there is hereby involved a portable programming device, which can
25 be taken by a user to the already installed ballast/operating devices.

The present invention correspondingly relates also to an illumination arrangement of larger scale, which has at
30 least one luminaire with an electronic ballast for operation of a lamp or has a operating device for illumination means and a programming device, which is configured in the above-described manner for the purpose

of transferring control information to the ballast or operating device and thereby influencing its operating behavior.

5 The subsequent transfer of control information is otherwise also of advantage since through this a lamp operating within a desired power window can be ensured. Often ballasts deviate, after their production, from the predetermined desired power, which is due to tolerances
10 in the components used which are unavoidable. By means of a subsequent influencing for example of the intermediate circuit voltage or the operating frequency of the supply voltage delivered to the load circuit with the lamp, such component tolerances can be taken into account and
15 deviations in the output power corrected. Particularly important in this context is also the subsequent calibration of semiconductor light sources such as e.g. LED modules, in order through this to ensure a precise color provision.

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Below, the invention will be described in more detail with reference to the accompanying drawings. The single Figure 1 thereby shows as exemplary embodiment an electronic ballast configured in accordance with the
25 invention for operating a gas discharge lamp. The ballast is thereby only an example for an illumination means operating device.

The ballast 1 in accordance with the invention is only
30 reproduced schematically in Figure 1 with the components significant for the lamp operation, since the present invention can fundamentally find employment with all kinds of electronic ballasts for operating lamps.

Illustrated components are a rectifier 2, connected with the input terminals 5 of the ballast 1, for rectifying the supply a.c. voltage present at the terminals 5, and
5 an inverter 3 which transforms the d.c. voltage received from the rectifier 2 into a high frequency a.c. voltage and passes this on as output voltage to output terminals 6 of the ballast 1, at which in turn the lamp LA to be operated by the ballast 1 is connected. The further
10 components, that are usually provided in electronic ballast, for example diverse elements for harmonics filtering or a smoothing circuit for transforming the rectified supply a.c. voltage into a d.c. voltage of particular level, are not illustrated, since they are
15 already known in their function and for the present invention are not further of significance.

Further it is to be remarked that the present invention is also not restricted to employment in the case of
20 electronic ballasts, but instead can be put to use in general with operating devices for arbitrary illumination means.

A significant component of the electronic ballast 1 with
25 regard to the present invention is a control unit 4 to which commands can be delivered from the outside and which controls the operation of the operating device in accordance with available commands and desired values.

30 In the illustrated example, the control unit controls the inverter 3 and therewith the operating voltage for the lamp LA provided by the inverter 3. The control unit 4 for this purpose generates appropriate control

information and transfers this to the inverter 3, which for example may have a half-bridge arrangement of two controllable switches. By means of an appropriate influencing of the switching frequencies the lamp - which
5 may in particular be a gas discharge lamp - can be operated in desired manner, in particular initially pre-heated, ignited and supplied with a predetermined power.

Corresponding information which influences the behavior
10 of the control unit 4, and thus of the ballast 1 overall, is contained in a memory 4a, which may be functionally connected with the control unit or - as illustrated - is a component of the control unit 4. This memory is preferably a non-volatile memory. The control unit 4 in
15 turn contains preferably a microprocessor μC which can access the memory 4a and is responsible for the generation of the appropriate control signals for controlling the inverter 3.

20 It is to be noted that instead of the microprocessor μC , also other logical circuits can be put to use, which assume the necessary control tasks.

The operating behavior of the illustrated electronic
25 ballast 1 can be altered or adapted in that the information contained in the memory 4a is altered or updated. To date it was known to provide for this purpose an additional control input at the ballast 1, which was connected with the control unit 4 or the memory 4a and
30 via which then appropriate data could be transmitted to the control unit 4.

In accordance with the present invention, however, this additional input is now omitted. Instead, there are employed as programming input already present terminals of the ballast 1. In the illustrated exemplary embodiment in particular the output terminals 6 are used, which are connected via corresponding connection lines, and a voltage divider of two resistances R_1 and R_2 , with the control unit 4. As is illustrated in Figure 1, there is now the possibility of connecting to the output terminals 6 of the ballast 1 an external programming device 10, which transmits corresponding control information V_{prog} to the control device 4. The connection may thereby be effected directly at the output of the inverter 3; it would, however, also be conceivable to connect the programming device 10 to the coil contacts of the lamp LA.

Instead of the illustrated connection between the output terminals 6 and the control unit 4 by means of the illustrated connection lines and the resistive voltage divider it could also be provided to realize the connection by means of a magnetic, capacitative or optical coupling. Further it would also be conceivable to transfer internally the control information from the output terminals 6 to the control unit 4 by means of a radio connection.

The external programming device 10 is in particular configured to be portable and can be provided for the purpose of being connected to various ballasts of an illumination system, in order to configure or program the devices subsequently.

The control information transmitted from the external programming device 10 is stored in memory 4a of the control unit 4 and determines the operating behavior of the ballast 1. In particular the data may contain
5 information with regard to the power delivered from the ballast 1 to the lamp LA. Thereby there is the possibility of externally predetermining a desired power of operating frequency at which the lamp LA is to be operated. Through this there arises in particular the
10 possibility of subsequently compensating for component tolerances occurring during production of the ballast, and therewith ensuring that all lamps are operated at the necessary or optimal power. A further possibility consists, through the external control information, of
15 influencing the pre-heating of the lamps or adapting the power to a newly connected lamp type.

A further important field of application of the present invention is in the control of LEDs or LED modules. Such
20 semiconductor light sources must as a rule still be calibrated after their assembly, in order to ensure a light emission of the desired color. This is particularly important in the case of LEDs since the power with which the LEDs are operated has direct effect on the color of
25 the emitted light. With an operating device for operation of LEDs in accordance with the present invention, there is now the possibility of carrying out the necessarily calibration in simple manner after production of the LED module. The necessary operating data can be transferred
30 in accordance with the invention in simple manner to the operating device.

The substantial advantage of the solution in accordance with the invention consists in that no additional programming or configuration input is necessary, but instead the already present terminals of the operating
5 device 1, which are usually configured as clamping contacts, are used.

Thereby there arises, alternatively or additionally to the illustrated configuration, in which the output
10 terminals 6 of the ballast 1 are used as programming input, also the possibility - illustrated by broken lines - to use the input terminals 5, to which usually the supply a.c. voltage for the ballast 1 is applied, as programming input. The advantage of the illustrated
15 variant, in which the output terminals 6 are employed as programming input, consists in that in this case the ballast 1 can at the same time be supplied with current in the normal manner.

20 If, in contrast, the input terminals 5 are used as programming input, it must be ensured that the current necessary for operation of the control unit and/or writing the memory 4a remains available. This could for example be effected in that the programming device in
25 this case makes available the necessary energy. Also the use of an internal battery or accumulator battery in the ballast or operating device would be conceivable. In both cases the operating device could also be programmed in an offline condition or with mains switched off.

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During the programming, the voltage supply need solely be sufficient to be able to operate the electronics (control unit, memory etc.). However in this programming mode, no

power is given to the connected illumination means, so that the supply voltage may be lower than in the case of actual operation. The supply voltage may in programming mode also be a d.c. voltage instead of the a.c. voltage
5 usual for illumination means operation.

It is also conceivable that the programming commands are modulated onto a supply voltage. In order to be able to exceed the narrow modulation level limits in the case of
10 so-called power line technology, the control unit is functionally separated from the mains. For example it is generally ensured by means of filtering that also high modulation levels applied at the mains terminals cannot radiate back into the mains supply.

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The transmission of the external control information is effected preferably in a period of time in which the lamp LA is not in operation. Only after the transfer has been completed can a lamp start then be carried out and the
20 lamp operated under the conditions which were determined by means of the transferred control information.

The present invention thus permits, in simple manner, subsequently, i.e. after the production of the ballast or
25 operating device, to have influence on its operating behavior. For this purpose no additional programming input need be provided, so that the ballast or operating device can be enclosed in the housing in the previously known manner. Thus, also for programming, for example in
30 the case of a software alteration or fault correction, no disassembly of the device is necessary. If appropriate, software alterations can be carried out even centrally.

New Claims

1. Operating device for illumination means, having

- mains terminals (5) for connecting the operating device to a current supply,
- output terminals (6) for connecting illumination means to the ballast (1) or operating device and
- a control unit (4) for controlling and/or regulating the operation of illumination means connected to the output terminals,

wherein external control information (Vprog) for programming or configuring the operating behavior of the operating device can be delivered to the control unit (4) via a programming input, and can be stored in a memory (4a) associated with the control unit (4)

characterized in that

the programming input is formed by means of the mains terminals (5) and/or the output terminals (6) of the operating device (2), wherein at least in the case of the use of the mains terminals (5) as programming input, the control unit (4) is functionally separated from the mains.

2. Operating device according to claim 1,

characterized in that,

the mains terminals (5) and/or output terminals (6) forming the programming input are connected with the control unit (4) via connection lines.

3. Operating device according to claim 2,

characterized in that,

the connection lines have a voltage divider (R1, R2).

4. Operating device according to claim 1,
5 characterized in that,
the mains terminals (5) and/or output terminals (6)
forming the programming input are coupled with the
control unit (4) magnetically.
- 10 5. Operating device according to claim 1,
characterized in that,
the mains terminals (5) and/or output terminals (6)
forming the programming input are coupled with the
control unit (4) capacitatively.
- 15 6. Operating device according to claim 1,
characterized in that,
the mains terminals (5) and/or output terminals (6)
forming the programming input are coupled with the
20 control unit (4) optically.
7. Operating device according to claim 1,
characterized in that,
the mains terminals (5) and/or output terminals (6)
25 forming the programming input are coupled with the
control unit (4) via a radio connection.
8. Operating device according to any preceding claim,
characterized in that,
30 the memory (4a) for storing the externally delivered
control information is a non-volatile memory.
9. Operating device according to claim 8,

characterized in that,
the control unit (4) has a logic circuit, in
particular a microprocessor (μ C), which is connected
with the memory (4a).

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10. Operating device according to any preceding
claim,

characterized in that,
the ballast (1) or operating device is surrounded by
a housing, whereby the mains terminals (5) and the
output terminals (6) are formed by means of clamping
contacts.

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11. Operating device according to any preceding
claim,

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characterized in that,
an external programming device (10) can be connected
for the transfer of the control information to the
coil contacts of the lamp (LA) or light source, or
to the mains terminals (5) of the ballast (1) or
operating device.

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12. Operating device according to any of claims 1 to
10,

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characterized in that,
an external programming device (10) can be connected
for the transfer of the control information to an
inverter (3) of the ballast (1) or operating device,
for generation of a supply a.c. voltage for the lamp
(LA) or light source.

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13. Operating device according to claim 11 or 12,
characterized in that,

the external programming device (10) during the transfer of the external control information (Vprog) at the same time forms a current supply source for the ballast (1) or operating device.

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14. Operating device according to any of claims 1 to 12,

characterized in that,

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the ballast (1) or operating device has a battery or an accumulator battery for current supply during the transfer of the external control information (Vprog).

15. Operating device according to any preceding claim,

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characterized in that,

the external control information determines the output power of the ballast (1) or operating device

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16. Programming device (10) for programming or configuring the operating behavior of an electronic ballast (1) for the operation of a lamp (LA) or an operating device for light sources,

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wherein the programming device (10) is provided for connection with mains terminals (5) and/or output terminals (6) of the ballast (1) or operating device, in order to transfer control information (Vprog) to a control unit (4) provided in the ballast (1) or operating device and

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wherein at least in the case of the use of the mains terminals (5) as programming input, the control unit (4) is functionally separated from the mains.

17. Programming device (10) according to claim 16,
characterized in that,
this is portable.

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18. Illumination system, having

a) at least one luminaire having an electronic ballast (1) for operating a lamp (LA) or an operating device for illumination means, which has

- 10 - mains terminals (5) for connection of the ballast (1) or operating device to a current supply source,
- output terminals (6) for connecting a lamp (LA) or light source to the ballast (1) or operating device, and
- 15 - a control unit (4) for control and/or regulation of an operating voltage delivered to the lamp (LA) or light source via the output terminals (6), and
- 20 - b) a programming device (10) for programming or configuring the operating behavior of the electronic ballast (1) or operating device, wherein the programming device (10) is provided for connection with the mains terminals (5) and/or the output terminals (6) of the ballast (1) or operating device, in order to transfer external control information (Vprog) to the control unit (4), wherein at least in the case of the use of the mains terminals (5) as programming input, the control unit (4) is
- 25 functionally separated from the mains.
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19. Method of programming or configuring the operating behavior of an operating device for illumination means, wherein the operating device has

- mains terminals (5) for connection of the operating device to a current supply source,
 - output terminals (6) for connection of illumination means to the operating device, and
 - a control unit (4) for the control and/or regulation of the operation of the illumination means connected via the output terminals (6),
- and wherein the programming or configuring is effected by means of external control information (Vprog) which is delivered to the control unit (4),

characterized in that the mains terminals (5) and/or the output terminals (6) of the operating device are used as programming input, wherein at least in the case of the use of the mains terminals (5) as programming input, the control unit (4) is functionally separated from the mains.

20. Method according to claim 19, characterized in that,

the transfer of the control information is effected in a configuration phase, in which the lamp (LA) or light source connected to the operating device is not operated.

21. Method according to claim 19, characterized in that,

the transfer of the control information is effected in a phase in which the operating device is

separated from a general current supply or the general current supply is switched off.

22. Method according to any of claims 19 to 21,
5 characterized in that,
the external control information (Vprog) is
transferred by means of an external programming
device (10).
- 10 23. Method according to claim 21 and 22,
characterized in that,
the external programming device (10), during the
transfer of the external control information
(Vprog), at the same time forms a current supply
15 source for the operating device.
24. Method according to any of claims 20 to 23,
characterized in that,
the power of the operating device is determined by
20 the external control information.
25. Method according to any of claims 20 to 24,
characterized in that,
during the programming, the operating device is
25 supplied with a reduced supply voltage.
26. Method according to any of claims 20 to 24,
characterized in that,
during the programming, the operating device is
30 supplied with a d.c. supply voltage.
27. Method according to any of claims 20 to 26,
characterized in that,

during the programming via the mains terminals, the operating device is functionally separated from the mains, in such a way that programming commands cannot be radiated back to the mains.