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(54)   **Device and method for controlling lighting control system**

(57)   A remote control and method for controlling a lighting control system, the remote control being adapted to both control the lighting connected to the lighting control system and to program the lighting of the lighting control system using wireless transmission. The remote control for controlling the lighting control system comprises two operation modes having differing transmission power of the remote signals.
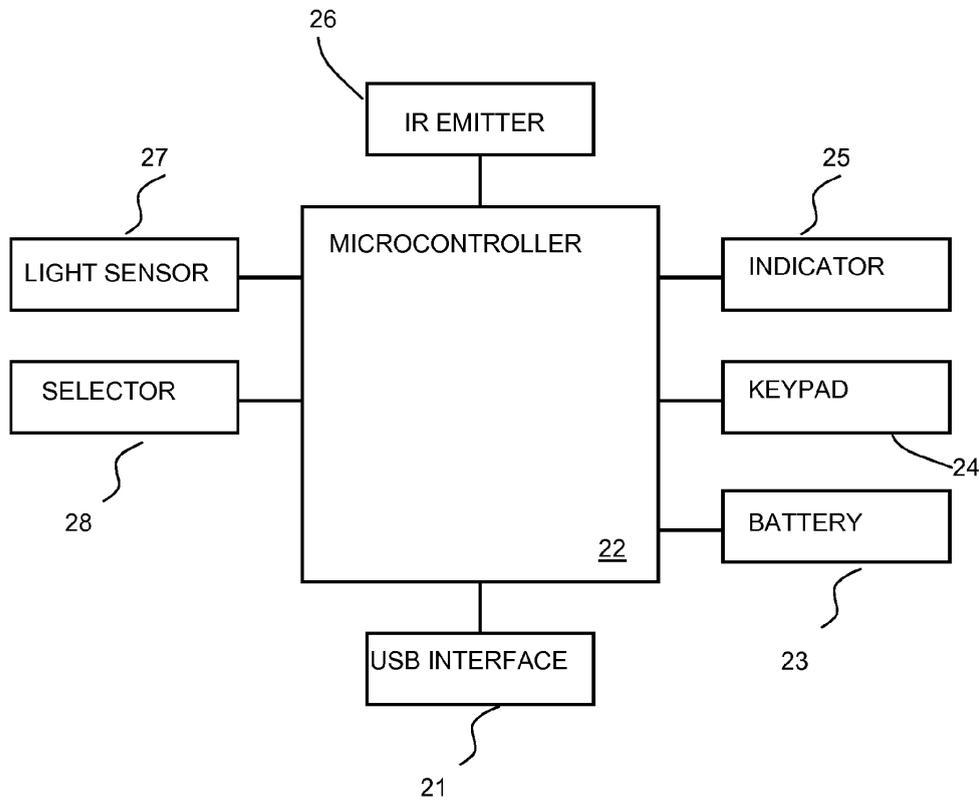
FIG 2

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to controlling lighting systems, and more particularly to controlling lighting systems remotely.

BACKGROUND OF THE INVENTION

[0002] It is known to create scenes and program settings for a lighting control system, such as a lighting system for a single room or a whole building. Typically, this is done using a computer connected to the lighting system. During installation and commissioning, the scenes and settings are programmed by a technician. The scenes and settings for the lighting system can also be reprogrammed or new scenes added at a later stage, if needed. Normal end users can control the lights (select scenes, turn on/off, dim up/down) using a variety of control means, such as push buttons installed on the walls, touch panels, or portable remote controls. Scene selection and control can also be performed without input from the users, for example by using timers or motion detectors.

[0003] In order to connect a computer to a lighting control system, special connecting equipment, such as routers, is needed. All the components of the lighting system then need to be connected to the connecting equipment, or the computer needs to be connected to several pieces of connecting equipment to program all the components of the lighting system. In some cases, connecting equipment is only needed for this purpose.

[0004] Instead of a networked computer, the settings can also be transferred using a portable remote control normally used by users to control the lighting. When a scene or set of settings has been created on a computer, the remote control can be connected to the computer, for example, and the settings are downloaded to the remote control. The lighting control system has local control intelligence that also acts as a receiver for the remote control, often in conjunction with a multisensor, which may include PIR (passive infrared), IR (infrared) and photo sensors, for example.

[0005] When the scenes or settings of a lighting control system are adjusted by remote control in e.g. open office environment, there is a risk that neighbouring lighting control systems are unintentionally adjusted. Sometimes address switches, or additional sensors (point & shoot), are used to deactivate selected lighting control systems before the programming. This means that each of the controlled groups needs to be separately deactivated for the programming to be successful. These additional measures used during the programming of the lighting control systems lead to higher costs and higher complexity of the system.

BRIEF DESCRIPTION OF THE INVENTION

[0006] An object of the present invention is thus to provide a method and a device implementing the method so as to solve the above problem. The object of the invention is achieved by a method and a device which are characterized by what is stated in the independent claims. The preferred embodiments of the invention are disclosed in the dependent claims.

[0007] The invention is based on the idea of using a device having at least two operation modes for remotely controlling and programming the lighting control system. One of the operation modes is a higher power mode, the other operation mode being a lower power mode. The operation modes send remote control signals of differing power levels, a higher power level being used mainly for controlling the lighting system and a lower power level for programming the lighting system.

[0008] An advantage of the method and device of the invention is that with the use of differing power levels the programmer of the control system can be sure that only the intended lighting control system is programmed. The power level used for programming individual lighting control systems is considerably lower than the power level used for controlling the lighting.

[0009] The installed lighting control system does not require any modifications or additions for programming of the system since the device for remotely controlling the lighting control system, i.e. the remote control is modified for that purpose. The modification of the device instead of an installed control system is a cost effective solution that makes the programming easier and less time consuming.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] In the following the invention will be described in greater detail by means of preferred embodiments with reference to the attached drawings, in which

Figure 1 shows an example of an environment with lighting control networks;
Figure 2 shows a simplified block diagram of a remote control; and
Figure 3 shows an example of a circuit inside the remote control for selecting a higher or a lower transmission power.

DETAILED DESCRIPTION OF THE INVENTION

[0011] In the following, the environment and the prior art structures of the lighting control system are described first, followed by the description of the device and method of the invention.

[0012] Figure 1 shows a simplified lay-out of an open space office having multiple luminaires 1A, 1 B, 1C, 2A, 2B, 2C, 3A, 3B, 3C, 3D, 4A, 4B, 4C, 4D, 5A, 5B, 5C. Each group of luminaires 1, 2, 3, 4, 5 forms an independ-

ent lighting control network with control connections connecting the luminaires of a group.

[0013]   Each network comprises a local control unit, which comprises for example PIR, photocell and infrared control, shown as a cross inside a luminaire 1A, 2A, 3A, 4A, 5A for controlling the lighting units connected to it. A local control unit controls the lighting units connected to it based on PIR and photocell information and input from the infrared remote control. The settings for the lighting units vary in different locations of the room. Therefore, when scenes (e.g. daytime, evening, cleaning, all lights off) are created, the settings for one and the same scene may be different in different parts of the room.

[0014]   Other application environments are listed below and use the same basic set-up as described above, yet they may differ in terms of their actual application settings (such as timing, fade levels, light levels).

- classroom
- single cell office
- corridor link (when multiple corridor sections are linked together to function as one combined application)
- corridor hold (when offices and corridors are linked together to act as one combined application)
- meeting room

[0015]   When uploading the settings to one local lighting control unit, the settings of the other control units must not be changed.

[0016]   The remote control is normally used to select or modify a scene by selecting, for example, a number corresponding to the desired scene, or to dim/brighten the lights by pressing, for example, up/down buttons of the remote control. Here the term "scene" refers to a preferred light setting for a particular lighting usage, such as daytime, evening or cleaning event.

[0017]   It is often desirable to change the scene of all the local lighting networks in the room at the same time, so that the transmission power of the remote control should be sufficient to be received by all the local control units in the room without being specifically pointed to each of them.

[0018]   The remote control can also be used to upload special settings to a local lighting control system using a special programming function on the remote control. If desired, this action may be repeated by pointing it to another local lighting control system and zapping (copy & paste) the same special settings again, thus reducing the overall time for the repeat programming action. Optical indicators on the remote control indicate to the user whether the action is being performed or whether it is completed.

[0019]   In the programming of the remote control, a desired scene or lighting control settings are created using a computer and a special computer program, defining parameters including but not limited to:

- Scenes (preset light levels) → relative target light level in %
- Constant light → maintains a combined light level (daylight + artificial) constant at a specified target light level, and adapts for any variations in the lighting environment
- Fixed light → keeps the light level fixed at a specified target light level, ignores any variations in the lighting environment
- Target level → a desired light level for a particular event
- Offset → this is a relative value (%) to which a light output of the system has to track the main target output level (either up or down)
- PIR walk in test (start /resume/stop) → a test to activate the lighting system outputs at a full output level (variable time in hours)
- Burn-in test (start/stop) → accelerated motion detector test (variable time in seconds)
- DALI → primary lighting control system output
- DALI 2 → secondary lighting control system output
- Fade time → the time for the above light outputs to change from an existing lighting status to a new lighting status
- Presence / absence check → enabled / disabled
- Presence detection occupancy timeout → timing (hours, minutes and seconds)
- Presence detection transition level → relative level (%)
- Presence detection transition timeout → timing (hours, minutes and seconds)
- Presence detection pass on → enabled / disabled
- Programming pass on → enabled / disabled
- Application modes → 6 physical application modes and 1 virtual application mode to hold any of the above listed parameter settings

[0020]   Once the scene is created it is copied to the remote control. The remote control is connected to a USB port of the computer, for example, and the scene parameters are downloaded to the remote control.

[0021]   When the scene settings have been copied to the remote control, the remote control can be disconnected from the computer.

[0022]   The uploading of the settings to the local control unit is initiated by a programming function key or a specific sequence of keys, for example. According to the present invention, the remote control comprises at least two operation modes. In a programming mode, i.e. a lower power operation mode, the transmission power used to transmit the settings is lower than the power in the control mode, i.e. the higher power mode, so that only the local control unit closest to the remote control receives the settings. The higher power mode is used to transmit normal control commands.

[0023]   The computer program can also be used to program the remote control, for example, to define the remote control to upload the settings using the higher trans-

mission power. This may be used, for instance, when the scene settings for all the local lighting networks are identical for a certain scene. Thus the higher power mode may also be used in connection with programming the lighting control systems.

[0024] The programming function of the remote control is normally disabled, but an expert user may enable it (e.g. by pushing a switch hidden under the cover of a battery compartment for over 5 seconds). This prevents the normal users from accidentally changing the settings of their lighting system.

[0025] When the programming function of the remote control is enabled, the remote control can be used for transferring settings to the lighting control system, i.e. programming the lighting control system. During the programming the remote control is changed to a low transmission power mode in a typical situation. Thus depending on how the remote control is programmed, it may operate in the lower power mode or the higher power mode.

[0026] The remote control may further comprise a third operation mode having a differing transmission power level. This operation mode is taken into use when the operating voltage of the remote control is provided by the USB interface.

[0027] Figure 2 shows a simplified block diagram of the remote control of the invention. The settings are received via a USB interface 21 and stored in a memory readable by a microcontroller 22. When the pushbuttons of a keypad 24 to transmit the settings are pressed, the microcontroller 22 controls the power selector 28 so that a transmitter 26 transmits the settings and control operations using the selected operation mode, i.e. the higher power level or the lower power level. The remote control is powered by a battery 23 and it may also comprise an indicator 25, such as a LED or a display, for displaying feedback on the operations carried out, for example. The remote control may also include a light sensor 27 for receiving information on the surrounding lighting level.

[0028] Figure 3 shows an example of a circuit structure for implementing a change in the operation mode. The circuit comprises two IR light emitting diodes V6, V7 with their respective series resistors R10, R11. IR LEDs V6, V7 are used for transmitting the desired information from the remote control to one or multiple local control units in the lighting control system (Figure 1, 1A, 2A,3A, 4A, 5A).

[0029] The circuit of Figure 3 comprises two inputs TX_ Low and TX_High. These inputs are connected preferably to a microcontroller or similar equipment which outputs the control data. Input TX-High is the input through which the control from the microcontroller is supplied when the higher transmission power level is required.

[0030] When input TX_High is high, both transistors V4 and V5 are biased conductive with resistances R9, R12 and R13. Transistor V4 conducts and draws one end of the series connection of resistors R2 and R5 to 0V and biases transistor V2 so that current from voltage

VCC flows through it. The current through transistor V2 flows via resistor R8 and via the IR LEDs V6, V7, thus producing UV radiation according to the pulse fed to the input TX_High.

[0031] At the same time as transistor V4 is controlled conductive, transistor V5 is also brought to a conducting state with input TX_high. The current through transistor V5 flows through resistors R3 and R6, which in turn make transistor V3 conduct. The voltage of the battery V_BAT of the remote control is connected to the emitter of transistor V3, and current from the battery can now flow through transistor V3 to the IR LEDs.

[0032] When a lower transmission power is required, the microcontroller uses input TX_Low for outputting IR commands from the IR LEDs V6, V7. When the input TX_Low is changed to a low state, transistor V1 is switched on with the resistors R1 and R4. Current can then flow from VCC through transistor V1 and resistor R7 to the IR light emitting diodes V6, V7. Resistor R7 has considerably higher resistance than resistor R8. Due to the higher resistance of R7, the current through the IR LEDs is considerably smaller. The transmission power is proportional to the current through the LEDs V6, V7 and the ratio of the resistances of resistors R7 and R8 can be for example in the range of 20.

[0033] The operating voltage VCC is generated either from the voltage of a battery or from an outside power source. This outside power source is preferably led to the remote controller via an USB interface through which the remote control is connected to a computer. Thus the computer produces voltage that is modified to be suitable for the remote control. Once the remote control is without the battery, a third transmission power level is obtained. The current path from V_BAT through transistor V3 is absent when there is no battery connected to the remote control and the current to the IR transmitters is led only from the current path V2-R8 when TX_High is controlled.

[0034] It should be understood that the circuit structure shown in Figure 3 is an example of a circuit for implementing the different transmission power levels. The implementation of the circuit may be different and also the inputs to the circuit from the microcontroller may vary.

[0035] It will be obvious to a person skilled in the art that, as the technology advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

Claims

1. A remote control for controlling a lighting control system, the remote control being adapted to both control lighting connected to the lighting control system and to program the lighting of the lighting control system using wireless transmission, **characterized in that** the remote control for controlling the lighting control

system comprises at least two operation modes having differing transmission power levels for the remote signals.

2. A remote control according to claim 1, **characterized in that** an operation mode having a higher transmission power is used for controlling the lighting.

3. A remote control according to claim 1 or 2, **characterized in that** an operation mode having a lower transmission power is used for programming the lighting.

4. A remote control according to claim 1, 2 or 3, **characterized in that** the lighting control system comprises multiple lighting control networks (1, 2, 3, 4, 5), each network comprising a local control unit and at least one luminaire (1A, 1 B, 1C, 2A, 2B, 2C, 3A, 3B, 3C, 3D, 4A, 4B, 4C, 4D, 5A, 5B, 5C), and the operation mode having the higher transmission power is used for programming the lighting when the same programming information is intended for multiple local control units.

5. A remote control according to any one of the previous claims 1 to 4, **characterized in that** the remote control comprises
an infrared transmitter (26; V6, V7) for transmitting remote signals,
and
a microcontroller (22) for controlling the operation of the transmitter (26; V6, V7) such that the transmitted signals are either transmitted with the higher transmission power or with the lower transmission power.

6. A remote control according to claim 5, **characterized in that** the remote control comprises a circuit responsive to output from the microcontroller (22) for providing a required transmission power level.

7. A remote control according to claim 6, **characterized in that** the circuit comprises two current paths (V1-R7, V2-R8) which lead a current to a transmitter (V6, V7), the current paths being adapted to be selected depending on the required transmission power level.

8. A remote control according to claim 7, **characterized in that** the current paths (V1-R7, V2-R8) have differing resistances such that when a higher transmission power is required, current to the transmitter is led through a lower resistance (R8) and when a lower transmission power is required, current to the transmitter is led through a higher resistance (R7).

9. A remote control according to claims 7 or 8, **characterized in that** the remote control further comprises a third current path (V3) which is adapted to lead current to the transmitter when the remote control comprises a battery for powering the operations when the higher transmission power is required.

10. A remote control according to claims 7, 8 or 9, **characterized in that** the voltage for the current paths having differing resistances is supplied by an operating voltage (VCC) of the remote control, the operating voltage being generated either from the battery or from an outside voltage source, such as an USB interface.

11. A method of controlling a lighting control system by a remote control, the remote control being adapted to both control lighting connected to the lighting control system and to program the lighting of the lighting control system using wireless transmission, **characterized by** the method comprising
providing with the remote control for controlling the lighting control system remote signals having differing transmission powers.
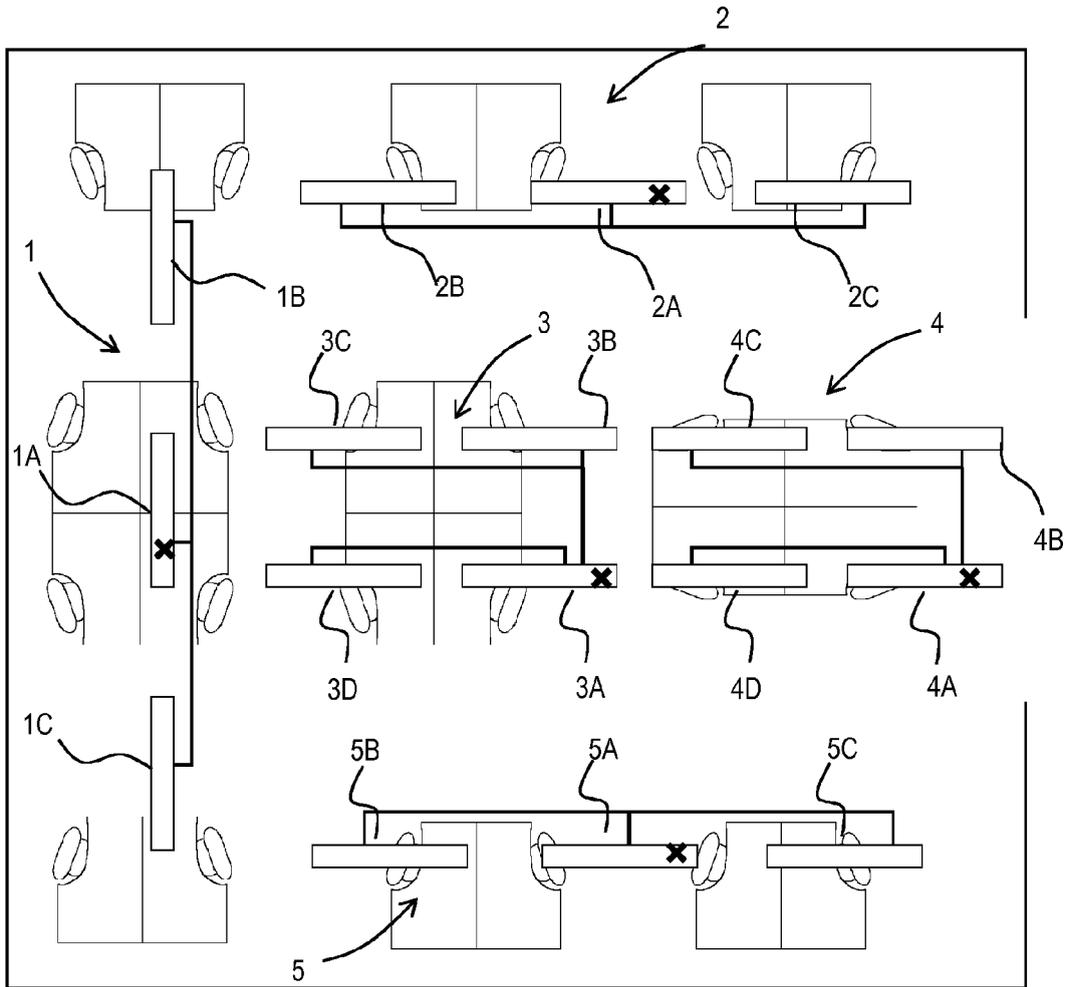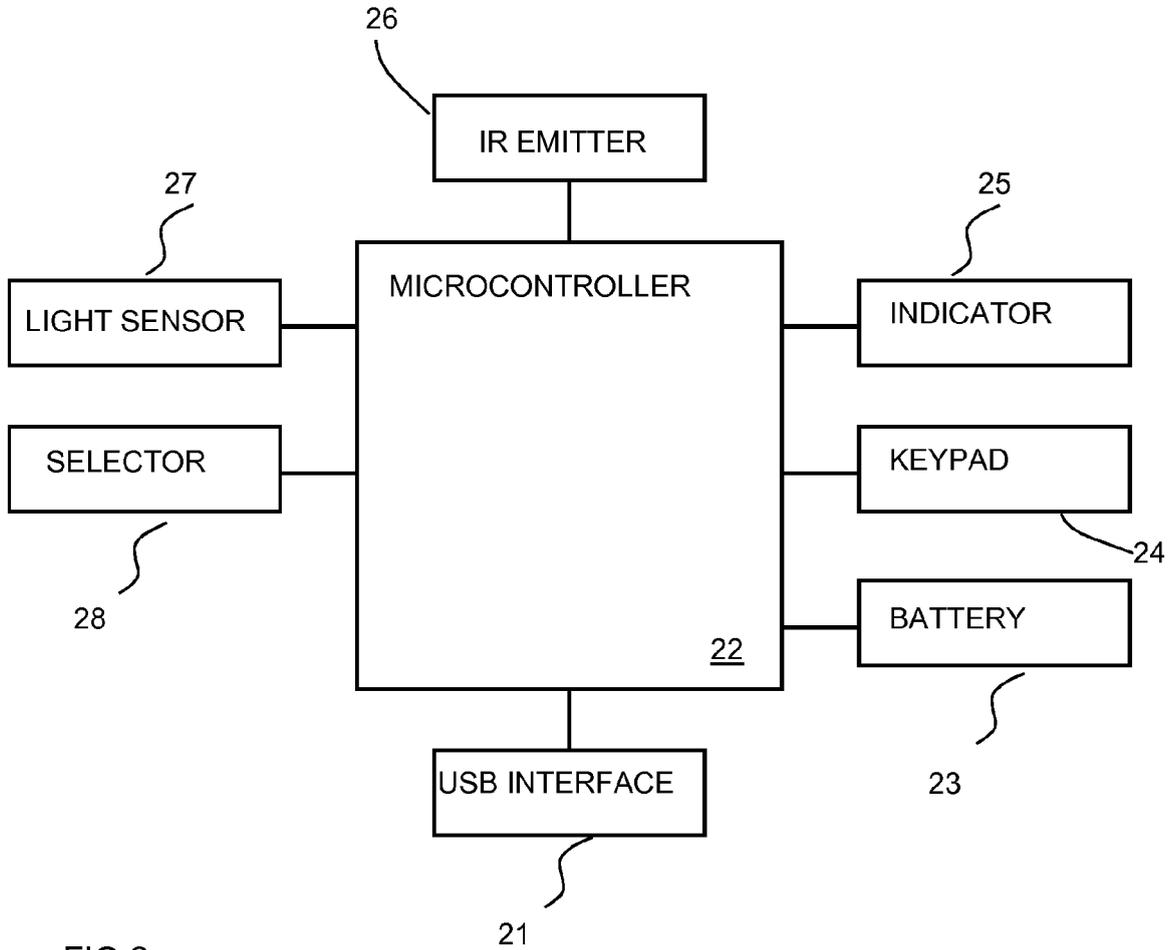
FIG 1

26

IR EMITTER

27

LIGHT SENSOR

MICROCONTROLLER

25

INDICATOR

SELECTOR

KEYPAD

24

28

22

BATTERY

23

USB INTERFACE

21

FIG 2

FIG 3

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EUROPEAN SEARCH REPORT

Application Number

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 June 2011	Brosa, Anna-Maria

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ANNEX TO THE EUROPEAN SEARCH REPORT
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