

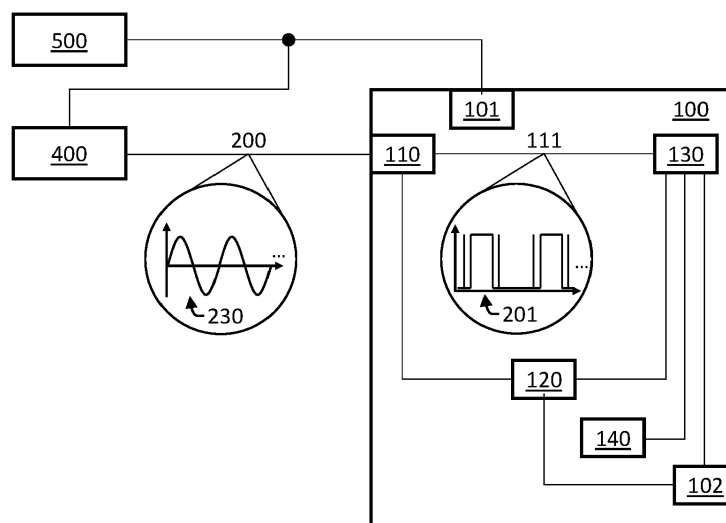
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gence (130) via an internal communication (111), wherein the internal intelligence (130) is configured to evaluate, based on the interface signal (200) retrieved via the internal communication (111), whether the detected interface signal (200) is a specific-bus signal (210), which is characteristic of a connected specific-bus communication device (300), or an other control signal. Furthermore the internal intelligence (130) is configured to detect a conflict when an other control signal is evaluated and the bus power supply unit (120) is active, and upon detection of the conflict, to initiate an output of a signal and/or to deactivate the bus power supply unit (120).



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Description

[0001] The invention relates to a control device with an integrated bus power supply unit that is configured to supply power via an interface of the control device to a specific-bus when active, whereas the control device is designed to detect undesirable operating conditions and is configured to react to them, and a lighting system comprising at least one luminaire and such a control device.

[0002] Such control devices are usually placed in between a luminaire and an external communication device, whereas on the one hand, these control devices have the function of so to speak translating received control signals to the luminaires, and on the other hand, if they are connected to a specific-bus (e.g. a digital addressable lighting interface, DALI, bus) on the input side, to supply this specific-bus with specific-bus power so that communication via this bus is possible.

[0003] This is unproblematic if a specific-bus device is actually connected to the interface, which also communicates via specific-bus signals. This is especially true in a scenario where the specific-bus has relatively low voltage values (e.g. for the DALI bus: ~ 14 VDC), whereby the supply voltage signal of this specific-bus can be fed via the integrated bus power supply unit of the control device as mentioned above, thus enabling the transmission of communication signals via the specific-bus.

[0004] However, such control devices are also possibly connected via their interface to another external communication device that is not a specific-bus device, for example to a so-called mains communication devices (e.g. a switchDIM device), which modulate communication signals to a mains power signal and then transfer this modified mains power signal as an interface signal to the interface of the control device. However, this is problematic in scenarios where a relatively high voltage signal (e.g. 230 VAC in the German power grid) is applied to the interface, where the bus power supply unit is also connected to. If the bus power supply unit (which usually is designed for the previously mentioned lower voltage signals) is active at the same time, the transmitted communication signals may be distorted or other problems may occur, such as undesired heat generation of the control device, which in turn may cause damage to components of the control device, at least in the long term.

[0005] Therefore, currently known control devices are delivered with the bus power supply unit switched off by default, so that when the device is put into operation, an installer - depending on whether the interface of the control device is indeed connected to a corresponding specific-bus - has to manually set whether the bus power supply unit should be activated or remain deactivated. Thus, the installation process for such known control devices is extremely time-consuming, and once a control device has been installed, it cannot easily be integrated into another system without taking into account the respective setting with regard to the bus power supply unit. Furthermore, if the setting is not made correctly, this

would result in communication problems, excessive heat generation, and thus increased (unnecessary) energy consumption and potential damage to components of the control device.

[0006] Thus, the currently known control devices were found to be disadvantageous in terms of installation effort, and potentially unfavourable energy consumption and operational safety. The invention is concerned with the task of providing a control devices with a conflict detection to ease installation and improve operational safety.

[0007] According to the invention the control device comprises an interface for connecting to an external communication; a bus power supply unit that is configured to supply power to a specific-bus via the interface when active; and an internal intelligence, which is configured to control at least the bus power supply unit. Hereby the interface is connected to an external communication device, which is a specific-bus communication device or an other communication device. Furthermore, the interface is adapted to detect an interface signal at the interface, wherein the interface signal is provided to the internal intelligence via an internal communication. The internal intelligence is configured to evaluate, based on the interface signal retrieved via the internal communication, whether the detected interface signal is a specific-bus signal, which is characteristic of a connected specific-bus communication device, or an other control signal. Moreover, the internal intelligence is configured:

- to detect a conflict when an other communication signal is evaluated and the bus power supply unit is active, and
- upon detection of the conflict, to initiate an output of a signal and/or to deactivate the bus power supply unit.

[0008] The provided control device is thus able to detect by itself whether a conflict is present and is further adapted to indicate and/or resolve such a conflict by itself. In this respect, the installation of such a control device in a lighting system is considerably facilitated for a user (e.g. an installer), since he or she now automatically receives feedback of an undesired setting of the control device and/or such an undesired setting is automatically corrected by the control device. To detect such a conflict, the internal intelligence of the control device evaluates the signal present at the interface and also takes into account the status of the bus power supply unit.

[0009] Furthermore, the lighting system itself is provided, comprising at least one luminaire and an embodiment of a control device presented herein. Hereby at least one of the at least one luminaire is coupled to the control device, wherein the lighting system further comprises an external communication device coupled to the interface of the control device.

[0010] Thereby, the control device receives control or communication signals, which are output by the external

communication device, whereby the luminaires connected to the control device (or the at least one connected luminaire) are potentially controlled accordingly on the basis of these communication signals. In addition, the control device can also supply a special bus with power, although this is only reasonable if the external communication device is a special bus device, so that no miscommunications or other errors are provoked. Hereby, the presence of such a special bus device is detected by the control device by means of analysis of the signal present at the interface. In this respect, the control device and thus the lighting system is designed to provide a simple and secure communication between the components of the lighting system and to react to respective scenarios, such as a change of the external communication device.

[0011] In an optional embodiment of the control device the interface is further adapted to extract a communication signal from the detected interface signal, wherein the communication signal is provided to the internal intelligence via the internal communication. Hereby the internal intelligence is configured to evaluate, based on the communication signal retrieved via the internal communication, whether the detected interface signal is a specific-bus signal or an other control signal. This has the advantage that the internal intelligence now directly receives the communication part of the interface signal for analysis, which enables a fast and accurate analysis of the signal by comparing it for example with known communication protocols. Preferably, relevant communication protocols can be stored in the control device, which are accessible to the internal intelligence for comparison with the present communication signal. Characteristics such as voltage characteristics, frequencies, spikes or peaks, etc. can be stored in these communication protocols, whereby at least parts of the stored characteristics are then compared with the signal that is actually present.

[0012] Further optionally, the internal intelligence is further designed:

- to comprehend the communication signal;
- and preferably when a specific-bus signal is evaluated, to put a response message on the interface signal via the interface.

[0013] This ensures that the communication signal received from the control device is understood and correctly implemented, whereby it is conceivable that the control device controls a luminaire coupled to the control device accordingly, or components of the control device (for example the bus power supply unit, the interface, etc.) or the control device itself behave according to the information contained. Preferably, the internal intelligence is designed for this purpose - i.e. the control of corresponding components or connected devices. The further preferred optional implementation also ensures that the control device can communicate with other devices of the specific-bus system and, for example, output confirmation signals

or status information to the devices coupled to the specific-bus.

[0014] Optionally the evaluation by the internal intelligence that is based on the respective signal (interface signal or therefrom extracted communication signal) retrieved via the internal communication whether the detected interface signal is a specific-bus signal or an other control signal, is performed by analysing the voltage characteristics of the respective retrieved signal (interface signal or therefrom extracted communication signal). By analysing the voltage characteristics, it is possible to determine the present signal type in a simple but reliable and thus efficient way, as already briefly discussed above.

[0015] Further optionally the other communication device is a mains communication device, wherein the other control signal is a mains communication protocol signal, which is characteristic of a connected mains communication device. Hereby the internal intelligence is preferably configured:

- to detect a conflict when a mains communication protocol signal is evaluated and the bus power supply unit is active, and
- upon detection of the conflict, to initiate an output of a signal and/or to deactivate the bus power supply unit.

[0016] With such a mains communication device, a communication signal can be generated in a simple and easy way, by modulating an additional communication signal on top of the existing mains power signal. The control device is configured to be able to receive such a mains communication signal at the interface and to analyse it accordingly. Such a mains communication signal does not represent a specific-bus signal and is therefore recognized by the control device as a conflict, provided that the bus power supply unit is also active at the same time.

[0017] Further optionally in any of the herein presented embodiments, the signal potentially output upon detection of the conflict signals a user (e.g. an installer) to deactivate the bus power supply unit of the control device or to change the connected external communication device to a specific-bus communication device. This ensures that the user is given a concrete signal to resolve the conflict, so that the conflict state is resolved as quickly and effectively as possible.

[0018] Further optionally the control device further comprises a signalling unit for outputting the signal (i.e. the signal potentially output upon detection of a conflict), whereas preferably the signal is an optical signal and/or an audio signal, whereas further preferred the optical signal is in the spectrum visible to humans and/or the audio signal is in the spectrum audible to humans, and whereas preferably the signal is generated by the internal intelligence driving an LED of the control device and/or by the internal intelligence driving a loudspeaker of the control

device. By means of such a signalling unit a particularly simple and concrete possibility for the generation and/or presentation of a corresponding signal is given. Preferably, this signalling unit is controlled by the internal intelligence.

[0019] Further optionally the internal intelligence is further configured - upon detection of the conflict - to deactivate the whole control device after causing the control device to output the signal. This configuration of the control device is particularly simple but effective in preventing future damage, for example due to thermal or electronic overload of individual components, while also eliminating the energy consumption caused by such a conflict. Since the shutdown is only initiated after the signal has been issued, the user also receives all relevant information so that he or she can resolve the conflict.

[0020] Further optionally the bus power supply unit is active per default. This facilitates installation of the device, as the implementation of the control device within an lighting system using the specific-bus is preferred. Thus, only in scenarios where the control device is not implemented in such a system with the specific-bus the bus power supply unit is to be deactivated.

[0021] Further optionally the bus power supply unit is also designed to supply power to a further bus, which preferably is a DALI bus, to which at least one luminaire is connected. Hereby it is conceivable that the bus power supply unit comprises a further bus power supply unit. In the alternative the further bus power supply unit and the bus power supply unit are separated. With the implementation of a power supply to the further bus various lighting scenarios and lighting systems are achievable. For example both stand-alone systems / island systems (such as a single floor lamp) and large interconnected lighting systems are possible with the such configured control device.

[0022] Further optionally the internal intelligence is integrated in the bus power supply unit. With this configuration, the internal intelligence is now positioned particularly advantageously so that communication between the interface, bus power supply unit and internal intelligence is particularly fast. This ensures that the interface signal (respectively the communication signal) is analysed particularly quickly and directly by the internal intelligence, so that conflict situations can be reacted to particularly fast, which in turn leads to the quickest possible elimination of the conflict. This prevents damage and counteracts a waste of energy.

[0023] Further optionally the internal intelligence is a controller, whereas preferably the internal intelligence is implemented as a microcontroller, whereby the evaluation of the respective signal retrieved via the internal communication (i.e. the interface signal or the communication signal), the detection of a conflict, and the corresponding generation of control commands will be realized primarily by a corresponding software function. This allows the analysis of the retrieved signal to be subsequently adapted by reprogramming or updates, whereby a particularly

large number of comparisons can also be carried out in a particularly short time. Alternatively or supplementary to this implementation the internal intelligence is at least partly realized as a corresponding hardware circuit. This has particular advantages in terms of component costs.

[0024] Further optionally the control device further comprises an input mains power supply device which is externally connected to mains power. This supplies the components of the control device with power so that safe operation is possible. For special applications, however, it is also conceivable that the power supply is provided by an accumulator or similar.

[0025] Further optionally components of the control device, such as the interface the bus power supply unit, the internal intelligence, are integrated within one housing of the control device. The integrated design makes the control device particularly easy to transport, assemble and install within a system, while the components are also protected by the common housing. The distances between the components can also be reduced, resulting in advantages in terms of communication speed and compactness of the device.

[0026] Further optionally with regard to the lighting system, comprising at least one luminaire and an embodiment of the control device presented herein, the at least one luminaire is coupled to the control device via a luminaire communication interface. This simplifies installation of the lighting system, while also improving control of the luminaire(s) by the control device. In particular, it is conceivable that several luminaires are connected to this luminaire communication interface, and the control device, or more precisely: the internal intelligence, can communicate with the individual luminaires in a targeted manner.

[0027] Further optionally if the external communication device is a mains communication device, the external communication device is further connected to mains power, whereas further preferred the mains communication device is a communication device which modulates a respective communication signal upon a mains power signal, whereas further preferred the mains communication device is a switch device. This allows a particularly simple but efficient communication or command generation as an alternative to the specific-bus.

[0028] Further optionally if the external communication device is a specific-bus device, the bus power supply unit supplies power to the specific-bus to which the specific-bus device is connected, wherein preferably the bus power supply unit supplies power to a further bus to which at least one of the at least one lights is connected. This makes it particularly easy to generate a specific-bus system as part of the lighting system, with communication secured by the power supply of the bus power supply unit of the control device.

[0029] Further optionally the lighting system further comprises multiple luminaires and further control devices, which each are coupled with different luminaires.

[0030] Here, in particular, it can be provided that at

least a few of the further control devices also have a bus power supply unit, so that a large number of devices can be interconnected, while the communication channel of the specific-bus is still reliably maintained by the bus power supply units.

[0031] In case the specific-bus is a DALI bus, for example, a system with 64 communication participants (specific-bus device(s), control device, further control device(s); and/or luminaires or the like) would have about four bus power supply units to ensure a secure connection - thus per bus power supply device about 16 participants are possible. In other embodiments, however, far more or fewer participants per bus power supply device are feasible.

[0032] The invention is explained in detail below with reference to examples of embodiments and with reference to the drawing. The figures show:

Figure 1 Exemplary schematic illustration of an embodiment of a control device according to the invention with its components;

Figure 2A Exemplary sketch representation of an embodiment of a lighting system according to the invention, comprising an exemplary embodiment of the control device, a specific-bus device, a mains power supply, and at least one luminaire coupled to the control device;

Figure 2B Exemplary sketch representation of an embodiment of a lighting system according to the invention, comprising an exemplary embodiment of the control device, a mains communication device, a mains power supply, and at least one luminaire coupled to the control device;

Figure 3A Exemplary sketch representation of an exemplary embodiment of the control device according to the invention, which is connected to a specific-bus device and a mains power supply, exemplary showing the connections between the components of such a control device and further exemplary displaying an interface signal received by the interface and a communication signal received by the internal intelligence via the internal communication;

Figure 3B Exemplary sketch representation of an exemplary embodiment of the control device according to the invention, which is connected to a mains communication device and a mains power supply, exemplary showing the connections between the components of such a control device and further exemplary displaying an interface signal

received by the interface and a communication signal received by the internal intelligence via the internal communication;

5 Figure 4A Exemplary sketch representation of an embodiment of a lighting system according to the invention, comprising an exemplary embodiment of the control device, a specific-bus device, a mains power supply, and at least one luminaire coupled to the control device, as well as multiple further control devices, which are each connected to one of the at least one luminaires;

10 Figure 4B Exemplary sketch representation of an embodiment of a lighting system according to the invention, comprising an exemplary embodiment of the control device, a mains communication device, a mains power supply, and at least one luminaire coupled to the control device, as well as multiple further control devices, which are each connected to one of the at least one luminaires;

25 Figure 5 Exemplary illustration of an exemplary method performed by an embodiment of a control device for checking whether a conflict exists with respect to the bus power supply unit and the external communication device connected to the interface of such a control device;

30 Figure 6 Exemplary schematic illustration of an embodiment of a control device according to the invention with its components, whereas the internal intelligence is integrated in the bus power supply unit of the control device.

[0033] Figures 1 and 6 show different exemplary embodiments of a control device 100 according to the invention, whereas in Figures 2A, 2B, 3A, 3B, 4A and 4B the integration and interconnection of the control device 100 with other devices, and in particular devices of a respective lighting system, is shown in more detail.

[0034] Each of the displayed control devices 100 hereby comprise an input mains power supply device 101, an interface 110, a bus power supply unit 120, an internal intelligence 130, a signalling unit 140, and a luminaire communication interface 102.

[0035] The therein displayed exemplary embodiments of a lighting system according to the invention each comprise at least one luminaire 600 and a control device 100 according to any one of the herein presented embodiments, wherein at least one of the at least one luminaire 600 is coupled to the control device 100, and wherein the lighting system further comprises an external communication device 300, 400 coupled to the interface 110 of the control device 100.

[0036] Figures 2A, 3A and 4A each deal with the scenario in which a specific-bus device 300 is connected to the interface 110 of the control device 100 - and thus no conflict is present.

[0037] Figures 2B, 3B and 4B, on the other hand, each show the scenario in which no specific-bus device 300 but another control device (and in particular a mains communication device 400) is connected to the interface 110 of the control device 100, so that - when the bus power supply unit 120 of the control device 100 is active - a conflict is detected by the internal intelligence 130, and the control device 100 reacts accordingly.

[0038] The input mains power supply device 101 is configured to be externally connected to mains power 900 supplied by a mains power supply 500. The power received via the mains power supply device 101 is hereby used to power the components of the control device 100. Furthermore, the interface 110 of the control device 100 is used for connecting the control device 100 to an external communication, whereby the interface 110 is adapted to detect an interface signal 200 at the interface 110 and configured to send and receive communication via the interface signal 200. The interface 110 is thus connected to an external communication device 300, 400, which may be a specific-bus communication device 300 or an other communication device (e.g. a mains communication device 400).

[0039] The bus power supply unit 120 is configured to supply power to a specific-bus when active, whereas the specific-bus may be connected with the control device 100 via the interface 110. The operation of this bus power supply unit 120, i.e. the power supply at the output of the interface 110, leads to problems if anything but the specific-bus, e.g. a DALI bus, is connected at the interface 110 and the bus power supply unit 120 is active, whereas these problems are addressed herein.

[0040] Further, the control device 100 is further equipped with an internal intelligence 130, which is configured to control at least the bus power supply unit 120. Hereby the internal intelligence 130 is further configured to evaluate, based on the interface signal 200 retrieved via an internal communication 111 - which links the interface 110 and the internal intelligence 130 - whether the detected interface signal 200 is a specific-bus signal 210, which is characteristic of a connected specific-bus communication device 300, or an other control signal (e.g. a mains communication protocol signal 230, which is characteristic for a connected mains communication device 400, or an other control device not compatible with the respective specific-bus). Additionally the internal intelligence 130 is configured to detect a conflict when an other control signal is evaluated and the bus power supply unit 120 is active, whereas upon detection of the conflict, the internal intelligence 130 initiates an output of a signal and/or deactivates the bus power supply unit 120. This reaction to the detection of the conflict eases the installation of the control device 100 and further eases prevention of damages to the components of the control

device (e.g. thermal and/or electronic damages).

[0041] By issuing a signal, which may be a visual or audible feedback, a user (e.g. an installer) is alerted to the conflict, while the direct and immediate automatic shutdown of the bus power supply unit 120 resolves the conflict itself. The signal can be provided (if it is at least partially an optical signal) by a corresponding light emission of the at least one luminaire 600 connected to the control device or by the activation of a corresponding LED, which is for example part of the signalling unit 140. In the case of signal emission, it would be conceivable that initially only the corresponding feedback of the presence of the conflict is provided, which then prompts the installer accordingly to either manually deactivate the integrated bus power supply unit 120 or to select another type of control (i.e. another external communication device 300, 400). It would also be conceivable for the control device 100 to deactivate itself altogether after it has generated an appropriate feedback. Hereby, it is provided that the control device 100 itself has an integrated safety/protection mechanism which ensures that the integrated bus power supply unit 120 is and/or remains only active when the interface 110 is actually used for specific-bus communication.

[0042] In all cases, it is crucial that the control device 100 itself recognizes in some way that there is a conflict with normal use of the integrated bus power supply unit 120 due to the selected control of the control device 100 (i.e. the connected external communication device 300, 400). The integrated bus power supply unit 120 shall only remain active, when the supply of a bus power to the specific-bus is required, which is the case, when the specific-bus is present at the interface 120.

[0043] Hereby the interface 110 may further be configured to extract a communication signal 201 from the detected interface signal 200, wherein the communication signal 201 is provided to the internal intelligence 130 via the internal communication 111. This is illustrated in Figures 3A and 3B, exemplary showing that the signal present at the internal communication 111 differs from the interface signal 200. Furthermore in this implementation, the internal intelligence 130 is configured to evaluate, based on the communication signal 201 retrieved via the internal communication 111, whether the detected interface signal 200 is a specific-bus signal 210 or an other control signal.

[0044] In the scenario of Figure 3A (where no conflict is detected, as a specific-bus signal 210 is present at the interface 110) the internal intelligence 130 does not initiate an output of a signal (e.g. by respectively activating the signalling unit 140) and/or further does not deactivate the bus power supply unit 120 as power is to be supplied for the specific-bus via the interface 110. However, the internal intelligence 130 may further be designed to comprehend the interface signal 200, respectively the communication signal 201. Hereby, as an example, the internal intelligence 130 may control the at least one connected luminaire 600 connected to the control device 100 via

the luminaire communication interface 102 according to the received signals. Further preferably internal intelligence 130 may also communicate with a specific-bus device 300 via the interface 110 when a specific-bus signal 210 is evaluated, whereas it may put a response message on the interface signal 200.

[0045] Hereby the control device 100 may also comprise a further bus power supply unit, which may be part of the already known bus power supply unit 120, but acts independent, potentially solely supplying power to a further bus 800. Thus, the internal intelligence 130 may command the further bus power supply unit (potentially via the bus power supply unit 120) to supply the further bus 800, which links the at least one connected luminaire 600 and the control device 100, via the luminaire communication interface 102. However, it is also possible that this power supply to the further bus 800 via the luminaire communication interface 102 is active per default, whereas also scenarios are conceivable where such a power supply to the further bus 800 by the bus power supply unit 120 is not present at all.

[0046] In contrast to this, the scenario in Figure 3B shows a conflict being detected if the bus power supply unit 120 is active because a mains communication device 400 is present at the interface 110. Hereby the internal intelligence 130 does initiate an output of a signal (e.g. by respectively activating the signalling unit 140) and/or deactivates the bus power supply unit 120, such that the conflict is resolved and/or at least indicated to a user. Thus, in Figure 3B the internal intelligence 130 commands the bus power supply unit 120 to deactivate itself - or at least to deactivate the power supply to and via the interface 110, whereas the further bus power supply unit supplying power to the further bus 800 may remain active.

[0047] Figure 2A shows a lighting system in which the external communication device 300 is a specific-bus device (e.g., a DALI device) that is coupled to the interface 110 and communicates using the interface signal 200. In this scenario, the internal intelligence 130 detects that the specific-bus is present at the interface 110 as the interface signal 200 is configured accordingly as a specific-bus signal 210. In this scenario no conflict is detected by the internal intelligence 130.

[0048] Figure 2B shows a lighting system in which the external communication device 300 is not a specific-bus device, but an other control/communication device, and especially a mains communication device 400, that is coupled to the interface 110 and communicates using the interface signal 200. In this scenario, the internal intelligence 130 detects that the interface signal 200 is a mains communication protocol signal 230. In this scenario a conflict is detected by the internal intelligence 130, when the bus power supply unit 120 is active. Hereby, the bus power supply unit 120 is deactivated and/or an output of a signal, preferably via the signalling unit 140, is initiated by the internal intelligence 130.

[0049] For the analysis of the interface signal 200, respectively the communication signal 201 extracted there-

from, different variants are conceivable. Hereby, the evaluation by the internal intelligence 130 that is based on the respective signal retrieved via the internal communication 111 (i.e., the interface signal 200 or the communication signal 201) whether it is a specific-bus signal 210 or an other control signal (such as a mains communication signal 230), is performed by analysing the voltage characteristics of the respective retrieved signal. Furthermore it is conceivable, that the internal intelligence 130 compares the received signal with known communication protocols. Preferably, such relevant communication protocols are stored within the control device 100 (e.g. in a memory), whereas this data is accessible by the internal intelligence 130 for comparison with the present to be evaluated signal. Characteristics such as voltage characteristics, frequencies, spikes or peaks, etc. can be stored in these communication protocols, whereby at least parts of the stored characteristics are then compared with the signal that is actually present. A specific-bus signal (such as e.g. a DALI control command) is hereby quickly recognized, since this signal then corresponds to the requirements of the corresponding standard with regard to its voltage curve. If, on the other hand, an other control signal, such as a mains communication protocol signal 230 (e.g. SwitchDIM signal) is present that is generated by a mains communication device 400, this is detected by the internal intelligence 120, since mains communication protocol signals 230 are essentially generated by mains power, which is slightly modified by the mains communication device 400, so that it is clearly recognizable that this is not a bus-specific signal 210. In this case, the internal intelligence 130 (which may be implemented as a microcontroller) will disable the bus power supply unit 120 of the control device 100 and/or will initiate an output of a signal to avoid the problems and disadvantages described above.

[0050] A mains communication protocol signal 230 may exemplary be generated by actuating a mains communication device 400 coupled to mains power 900, which can be, for example, a corresponding pushbutton or switch, whereby the type, duration or frequency of the actuation then modulates corresponding signals (communication signals 201) to mains power 900 and passes them on as mains communication protocol signal 230 to interface 110 of control device 100, whereby interface 110 can filter out these communication signals 201 and pass them on to internal intelligence 130, which in turn understands these control or communication signals.

[0051] The bus power supply unit 120 and/ or the further bus power supply unit may be active per default.

[0052] Furthermore, implementations of the control device 100 are possible, where the further bus power supply unit is not part of the bus power supply unit 120 but is completely detached from the bus power supply unit 120 and can be completely independently controlled by the internal intelligence 130.

[0053] Moreover, it is conceivable that the internal intelligence 130 is adapted to activate the bus power supply

unit 120 if the bus power supply unit 120 is deactivated and a specific-bus device 300 is coupled to the interface 110.

[0054] The signal output by the signalling unit 140 preferably signals a user to deactivate the bus power supply unit 120 of the control device 100 or to change the connected external communication device 300, 400 to a specific-bus communication device 300. Further preferred, the signal is an optical signal (in the spectrum visible to humans) and/or an audio signal (in the spectrum audible to humans). Besides an LED the signalling unit 140 may also comprise a loudspeaker or the like for generating such audible signals, whereas it is also conceivable that the signalling unit 140 is configured to perform audible and visible signals simultaneously. The type and characteristics of a generated signal may depend on the evaluation of the interface signal 200, respectively of the communication signal 201.

[0055] As exemplary displayed in Figure 6 the internal intelligence 130 may optionally also be positioned within the bus power supply unit 120 for a faster analysis of the received signals, a more reliable detection of a conflict and a quicker reaction thereto. The shown implementation of the control device 100 have the further advantage that the safety/protection mechanism - i.e. the detection of a conflict and corresponding reaction on the part of the control device 100 - is not provided in the form of central internal intelligence 130 of the control device 100, but is integrated in the bus power supply unit 120 itself. This internal intelligence 130 immediately detects when a mains communication protocol signal 230 is present, if the signal present at the interface 110 exceeds a certain voltage threshold and may immediately switch off the bus power supply unit 120. For example, it would also be conceivable to implement this in the form of a corresponding hardware circuit. In any case, speed and thus time advantages would again be achieved in that the integrated bus power supply unit 120 would be deactivated as quickly as possible if this safety/protection mechanism is carried out by the bus power supply unit 120 itself (i.e. by the internal intelligence 130 integrated therein). In case of using a microcontroller as internal intelligence 130, the safety mechanism, respectively the signal analysis and reaction to it may be realized primarily by a corresponding software function.

[0056] Furthermore it is possible that the herein presented components of the control device 100, such as the interface 110; the bus power supply unit 120; the internal intelligence 130; and the like are integrated within one housing of the control device 100, which is exemplary illustrated in Figures 1 and 6 via the common surrounding box of the control device 100.

[0057] In this context, further control devices 700 can exist in the lighting system in addition to the control device 100 proposed herein, it being further conceivable that some of these further control devices 700 are equipped with a bus power supply unit analogous to the control device 100. It is also conceivable that all or at least some

of these control devices 100, 700 can communicate with one another via their respective interfaces, at least if they are coupled to one another via the respective specific-bus.

[0058] Figure 5 shows an exemplary embodiment of a method for detecting the conflict of a control device 100 discussed herein. The exemplary method steps listed herein are also found in the preceding description of the system or the control device 100. The method disclosed herein is performed by the control device 100.

[0059] First, an interface signal 200 is detected at the interface 110 of the control device 110 (S 1100).

[0060] In the next step, which is optional, a communication signal 201 is extracted from the interface signal 200, which may be performed by the interface 110 or later by the internal intelligence 130 (S1200).

[0061] Furthermore, if step S1200 has been performed, the communication signal 201 of the internal communication 111 is forwarded to the internal intelligence 130; if step S1200 has not been performed or has not been performed by the interface 110 (not shown in Figure 5), the interface signal 200 is forwarded to the internal intelligence 130 as received (S1300), whereas the extraction of the communication signal 201 may then be performed by the internal intelligence 130.

[0062] The forwarded signal (i.e. the communication signal 201 or the unchanged interface signal 200) is then analysed by the internal intelligence 130, determining whether the signal received by the interface 110 is a specific-bus signal 210 or not such a signal, i.e. non-specific-bus signal (e.g. a mains communication protocol signal 230), also taking into account the status (activate, inactive) of the bus power supply unit 120 (S1400).

[0063] Subsequently, a case discrimination is performed (S1500):

- if it is detected that a specific-bus signal 210 is present or that the bus power supply unit 120 is inactive (S1510), the internal intelligence 130 decides that no conflict is present, i.e. that the bus power supply unit 120 is not to be deactivated (S1610);
- if it is detected that no specific-bus signal 210 is present - i.e. another control signal, such as a mains communication protocol signal 230 - and the bus power supply unit 120 is also active (S1520), the internal intelligence 130 decides that a conflict is present, i.e. the bus power supply unit 120 is to be deactivated or an output of a signal is to be initiated (S1620).

[0064] In particular the steps S1400, S1500, S1510, S1520, S1610, 1620 or at least parts of these steps may be performed by the internal intelligence 130, whereas potentially these method steps may be implemented on a microcontroller via a software function.

[0065] In this respect, a control device, or a lighting system with such a control device, is disclosed, which has a significant improvement in terms of installation ef-

fort, and potentially unfavourable energy consumption and operational safety.

100:	control device	
101:	input mains power supply device	5
102:	luminaire communication interface	
110:	interface	
111:	internal communication	
120:	bus power supply unit	
130:	internal intelligence	10
140:	signalling unit	
200:	interface signal	
201:	communication signal	
210:	specific-bus signal	
230:	mains communication protocol signal	15
300, 400:	external communication device	
300:	specific-bus device	
400:	mains communication device	
500:	mains power supply	
600:	at least one luminaire	20
700:	further control device	
800:	further bus	
900:	mains power (signal)	

Claims

1. A control device (100) comprising:

- an interface (110) for connecting to an external communication; 30
 - a bus power supply unit (120) that is configured to supply power to a specific-bus via the interface (110) when active;
 - an internal intelligence (130), which is configured to control at least the bus power supply unit (120); 35
- wherein the interface (110) is connected to an external communication device (300, 400), which is a specific-bus communication device (300) or an other communication device, and 40
- wherein the interface (110) is adapted to detect an interface signal (200) at the interface (110), wherein the interface signal (200) is provided to the internal intelligence (130) via an internal communication (111), 45
- wherein the internal intelligence (130) is configured to evaluate, based on the interface signal (200) retrieved via the internal communication (111), whether the detected interface signal (200) is a specific-bus signal (210), which is characteristic of a connected specific-bus communication device (300), or an other control signal, 50
- wherein the internal intelligence (130) is configured: 55

- to detect a conflict when an other control

signal is evaluated and the bus power supply unit (120) is active, and
 - upon detection of the conflict, to initiate an output of a signal and/or to deactivate the bus power supply unit (120).

2. Control device according to claim 1,

wherein the interface (110) is further adapted to extract a communication signal (201) from the detected interface signal (200), wherein the communication signal (201) is provided to the internal intelligence (130) via the internal communication (111),
 and wherein the internal intelligence (130) is configured to evaluate, based on the communication signal (201) retrieved via the internal communication (111), whether the detected interface signal (200) is a specific-bus signal (210) or an other control signal.

3. Control device according to claim 2, wherein the internal intelligence (130) is further designed:

- to comprehend the communication signal (201);
- and preferably when a specific-bus signal (210) is evaluated, to put a response message on the interface signal (200) via the interface (110).

4. Control device according to any one of the preceding claims, wherein the evaluation by the internal intelligence (130) that is based on the respective signal retrieved via the internal communication (111) whether the detected interface signal (200) is a specific-bus signal (210) or an other control signal, is performed by analysing the voltage characteristics of the respective retrieved signal.

5. Control device according to any one of the preceding claims,

wherein the other communication device is a mains communication device (400),
 wherein the other control signal is a mains communication protocol signal (230), which is characteristic of a connected mains communication device (400),
 wherein preferably the internal intelligence (130) is configured:

- to detect a conflict when a mains communication protocol signal (230) is evaluated and the bus power supply unit (120) is active, and
- upon detection of the conflict, to initiate an

- output of a signal and/or to deactivate the bus power supply unit (120).
6. Control device according to any one of the preceding claims,
 wherein the signal signals a user to deactivate the bus power supply unit (120) of the control device (100) or to change the connected external communication device (300, 400) to a specific-bus communication device (300).
7. Control device according to any one of the preceding claims,
 wherein the control device (100) further comprises a signalling unit (140) for outputting the signal,
 whereas preferably the signal is an optical signal and/or an audio signal,
 whereas further preferred the optical signal is in the spectrum visible to humans and/or the audio signal is in the spectrum audible to humans,
 whereas preferably the signal is generated by the internal intelligence (130) driving an LED of the control device (100) and/or by the internal intelligence (130) driving a loudspeaker of the control device (100).
8. Control device according to any one of the preceding claims,
 wherein the internal intelligence (130) is further configured:
 - upon detection of the conflict, to deactivate the whole control device (100) after causing the control device (100) to output the signal.
9. Control device according to any one of the preceding claims,
 wherein per default the bus power supply unit (120) is active, and/or
 wherein the bus power supply unit (120) is also designed to supply power to a further bus (800) to which at least one luminaire (600) is connected.
10. Control device according to any one of the preceding claims,
 wherein the internal intelligence (130) is integrated in the bus power supply unit (120).
11. Control device according to any one of the preceding claims,
 wherein the internal intelligence (130) is a controller,
 whereas preferably the internal intelligence (130) is implemented as a microcontroller, whereby the evaluation of the respective signal retrieved via the internal communication (111), the detection of a conflict, and the corresponding generation of control commands will be realized primarily by a corresponding software function; wherein alternatively or supplementary the internal intelligence (130) is realized as a corresponding hardware circuit.
12. Control device according to any one of the preceding claims,
 wherein the control device (100) further comprises an input mains power supply device (101) which is externally connected to mains power (900).
13. Control device according to any one of the preceding claims,
 wherein components of the control device (100), such as the interface (110) the bus power supply unit (120), the internal intelligence (130), are integrated within one housing of the control device (100).
14. A lighting system comprising at least one luminaire (600) and a control device (100) according to any one of the preceding claims 1 to 13,
 wherein at least one of the at least one luminaire (600) is coupled to the control device (100), wherein the lighting system further comprises an external communication device (300, 400) coupled to the interface (110) of the control device (100).
15. Lighting system according to claim 14,
 wherein the at least one luminaire (600) is coupled to the control device (100) via a luminaire communication interface (102), wherein preferably if the external communication device (300, 400) is a mains communication device (400), the external communication device (300, 400) is further connected to mains power (900), whereas further preferred the mains communication device (400) is a communication device which modulates a respective communication signal upon a mains power signal (900), whereas further preferred the mains communication device (400) is a switch device, wherein if the external communication device (300, 400) is a specific-bus device (300), the bus power supply unit (120) supplies power to the specific-bus to which the specific-bus device (300) is connected,
 wherein preferably the bus power supply unit (120) supplies power to a further bus (800) to which at least one of the at least one lights (600) is connected,

and wherein preferably the lighting system further comprises multiple luminaires (600) and further control devices (700), which each are coupled with different luminaires (600).

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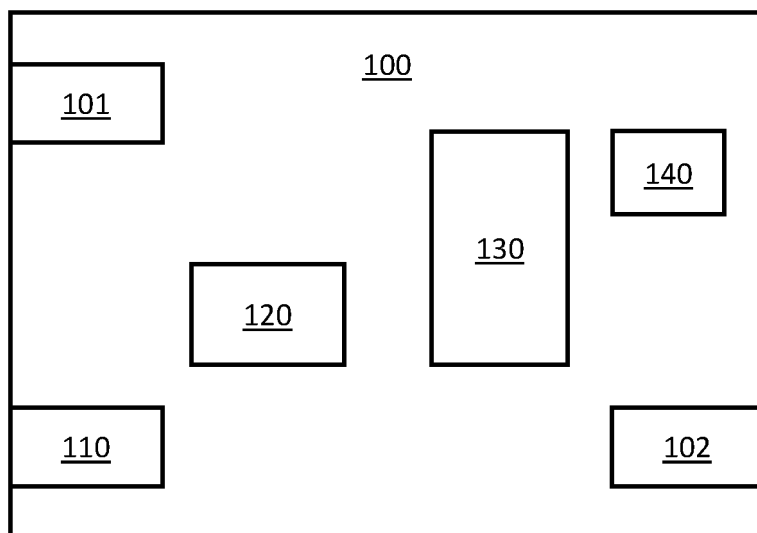


Fig. 1

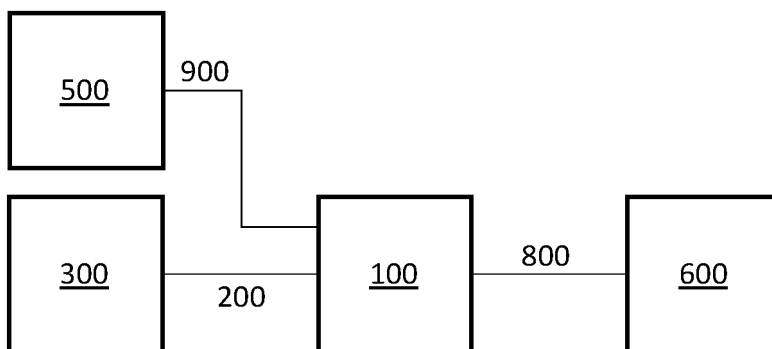


Fig. 2A

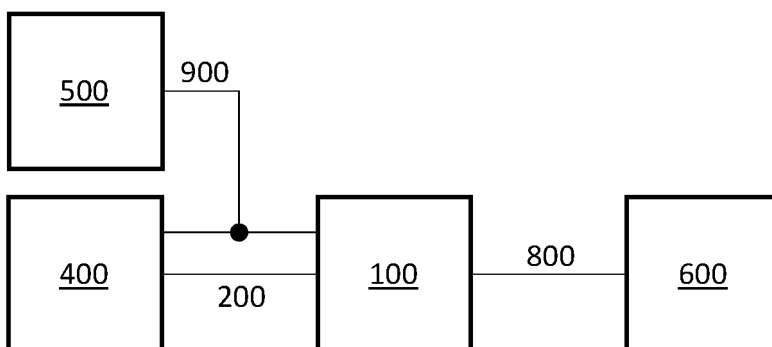


Fig. 2B

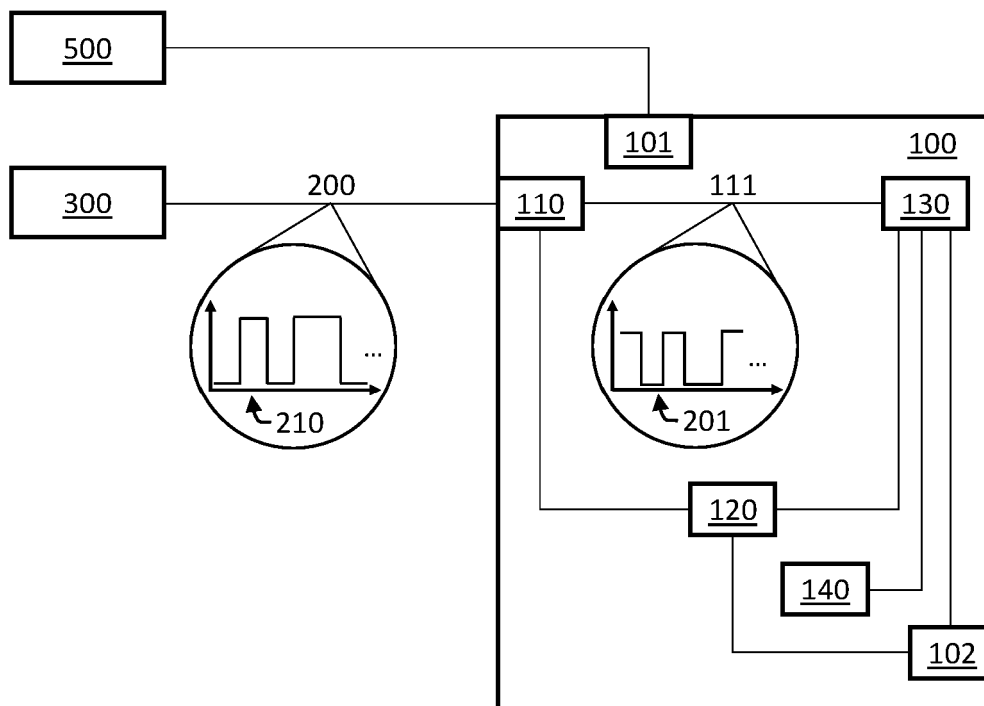


Fig. 3A

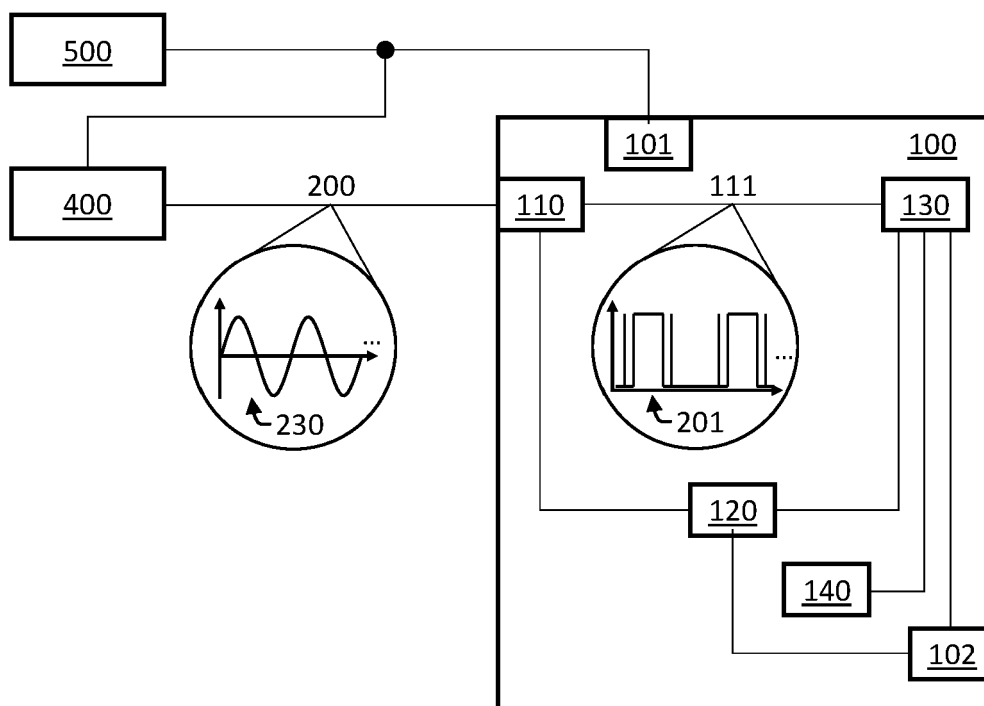


Fig. 3B

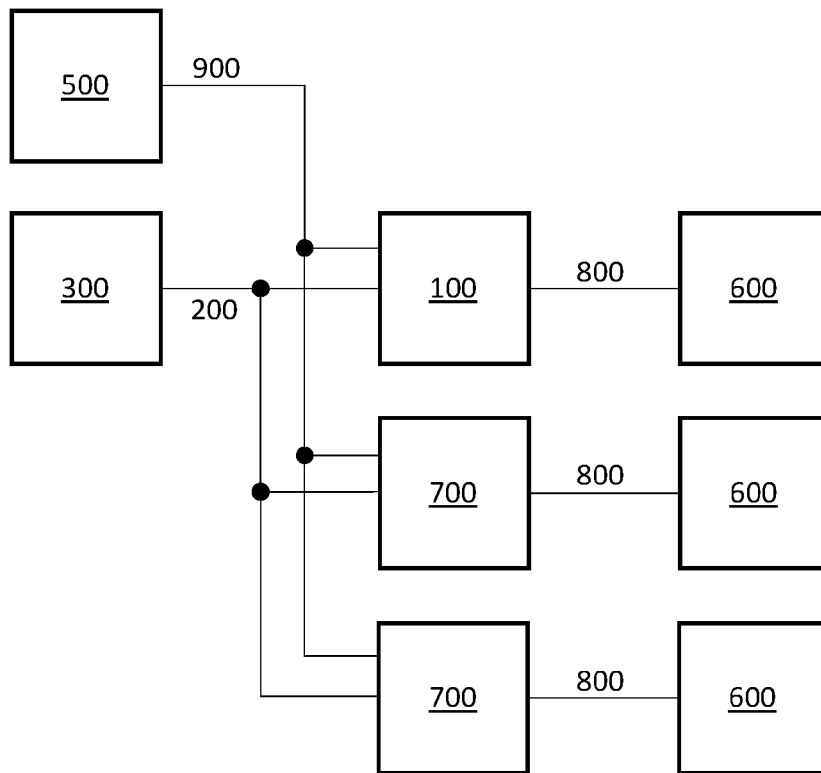


Fig. 4A

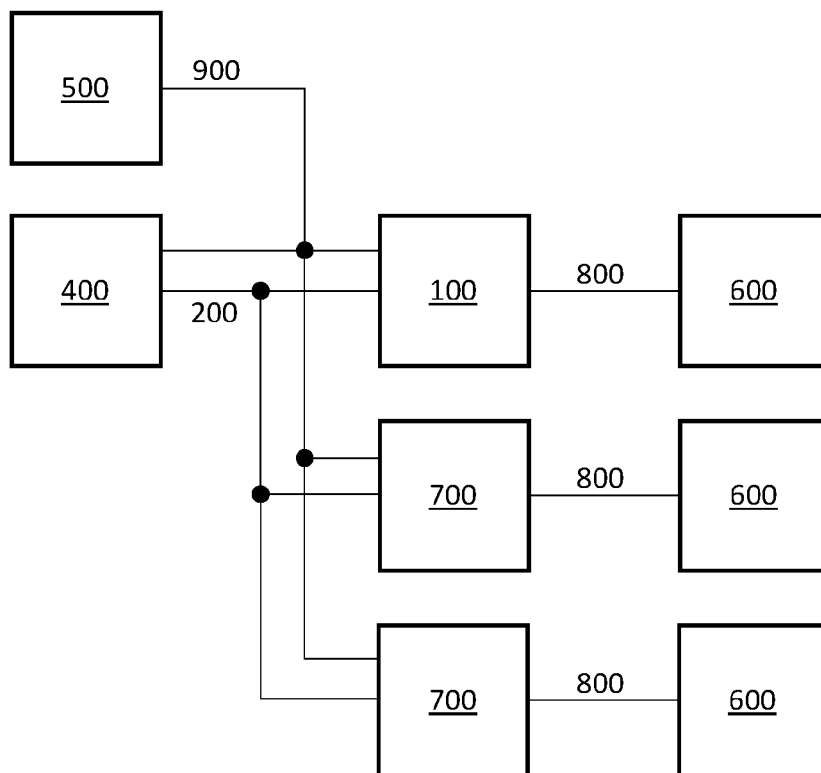


Fig. 4B

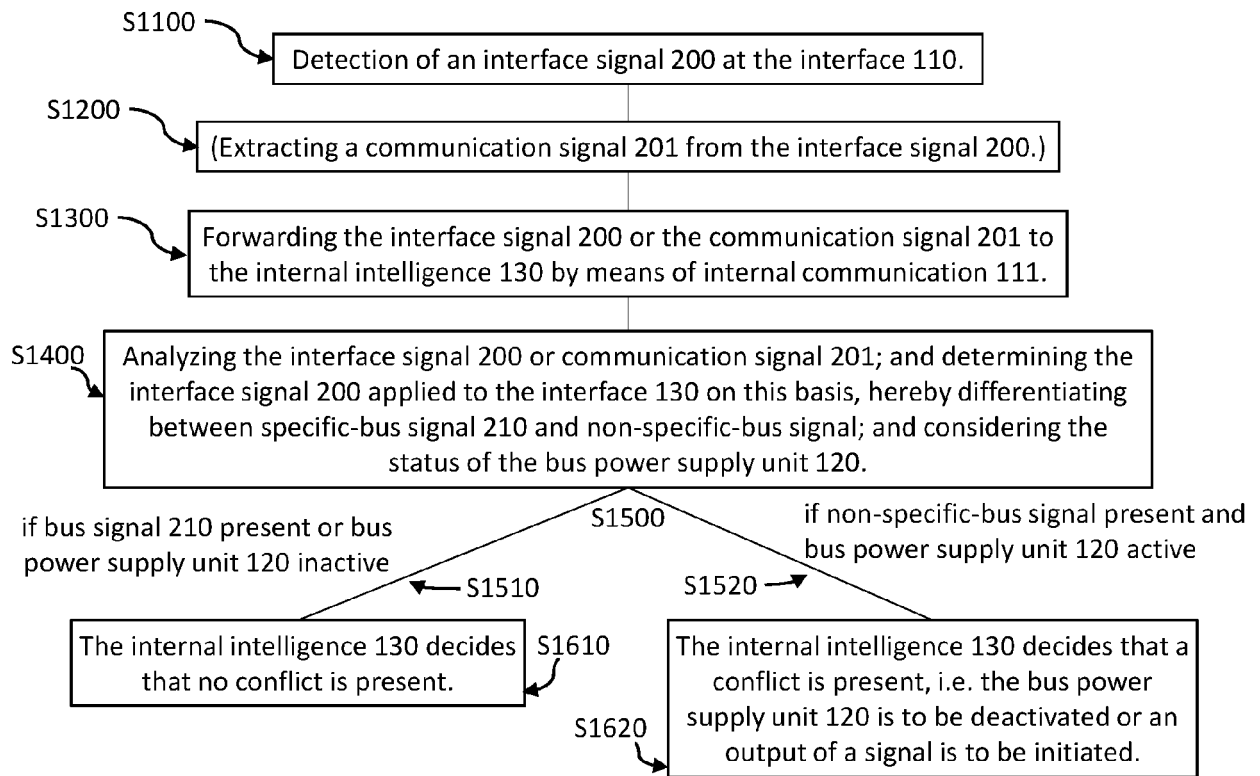


Fig. 5

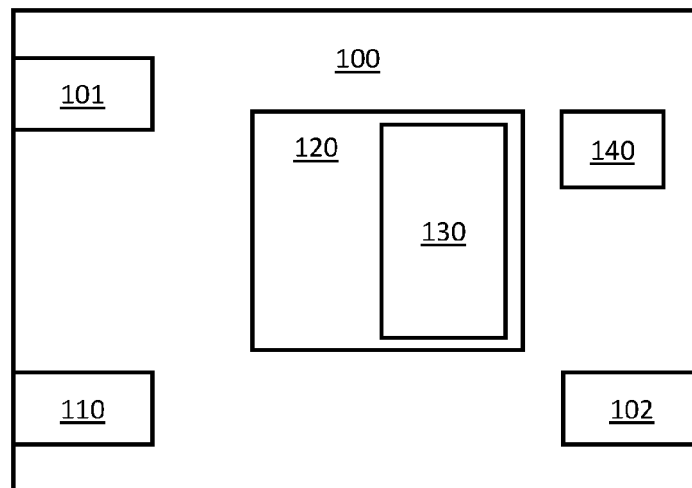


Fig. 6



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Application Number

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Place of search Munich		Date of completion of the search 28 April 2023	Examiner Brosa, Anna-Maria
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