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(54) Title: INTELLIGENT CONNECTOR MODULE AND BUS CONTROL SYSTEM

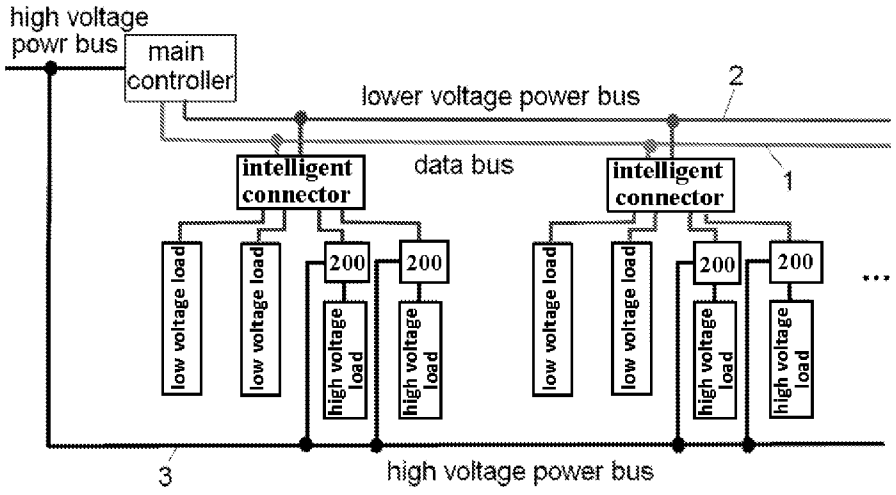

Fig.1

(57) Abstract: An intelligent connector module includes: an intelligent connector adapted to connect a low voltage load in an electrical equipment to a low voltage power bus; and an electrical control switch module adapted to connect a high voltage load in the electrical equipment to a high voltage power bus. The electrical control switch module is connected to the intelligent connector and controls the power supply to the high voltage load according to a switch control signal from the intelligent connector. The number of the high voltage loads may be simply changed by increasing or reducing the number of the electrical control switch modules. In addition, the position of the high voltage load may be easily changed by adjusting the installation position of the electrical control switch module. Thereby, the intelligent connector module has good expansibility and universality.

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[Continued on next page]

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INTELLIGENT CONNECTOR MODULE AND BUS CONTROL SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Chinese Patent Application No.CN201610872448.1 filed on September 29, 2016 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

Embodiments of the present invention relates to an intelligent connector module adapted to couple a bus with a load in an electrical equipment, as well as a bus control system comprising the intelligent connector module.

Description of the Related Art

In the prior art, a household appliance (e.g., washing machine, refrigerator, etc.) mostly adopt a centralized control system, which comprises only a single controller. In this case, all peripheral execution components and/or sense components (e.g., valves, sensors, motors, etc.) are directly connected to the single controller. In such centralized control system for the household appliance, all control switches and sensor circuits are integrated on a main control board and directly connected to all the loads in a star mode. For some complicated and centralized control components, such as a variable frequency motor control interface and a user display control interface, they are usually controlled by function modules and communicated via serial ports. However, these function modules still are connected in a star mode.

For the centralized control system of the household appliance, its expansibility and versatility are poor, and it can only control and detect the predetermined loads, once the type, quantity or position of the load is changed, it is necessary to redesign the main control board.

Furthermore, for the centralized control system of the household appliance, once an electronic component is damaged, the entire main control board must be replaced, resulting in high maintenance cost.

SUMMARY OF THE INVENTION

The present invention has been made to overcome or alleviate at least one aspect of the above mentioned disadvantages.

According to an aspect of the present invention, there is provided an intelligent connector module, comprising: an intelligent connector adapted to connect a low voltage load in an electrical equipment to a low voltage power bus; and an electrical control switch module adapted to connect a high voltage load in the electrical equipment to a high voltage power bus. The electrical control switch module is connected to the intelligent connector and controls the power supply to the high voltage load according to a switch control signal from the intelligent connector.

According to an exemplary embodiment of the present invention, the electrical control switch module comprises a driver connected to the intelligent connector and a switch element connected between the high voltage power bus and the high voltage load; the driver is configured to drive the switch element to be closed or opened according to the switch control signal from the intelligent connector, so as to control the power supply to the high voltage load.

According to another exemplary embodiment of the present invention, the intelligent connector comprising: a data bus interface adapted to be connected to a data bus; a low voltage power bus interface adapted to be connected to the low voltage power bus; a low voltage load interface adapted to be connected to the low voltage load; and a micro control unit connected to the data bus interface, the low voltage power bus interface and the low voltage load interface.

According to another exemplary embodiment of the present invention, the driver of the electrical control switch module is connected to the low voltage load interface of the intelligent connector, the switch control signal is transmitted to the driver of the electrical control switch module via the low voltage load interface of the intelligent connector.

According to another exemplary embodiment of the present invention, the low voltage load interface of the intelligent connector comprises a plurality of low voltage load connection ports, the electrical control switch module is adapted to connect any one of the plurality of low voltage load connection ports of the intelligent connector, the low voltage load is adapted to connect any one of the plurality of low voltage load connection ports of the intelligent connector.

According to another exemplary embodiment of the present invention, the electrical control switch module is an individual electrical device separated from the intelligent connector.

According to another exemplary embodiment of the present invention, the electrical control switch module is adapted to be mounted on the high voltage load in a pluggable manner and electrically connected to the low voltage load interface of the intelligent

connector via a wire.

According to another exemplary embodiment of the present invention, the electrical control switch module is adapted to be mounted on a fixation frame in a pluggable manner and electrically connected to the low voltage load interface of the intelligent connector and the high voltage load, respectively, via wires.

According to another exemplary embodiment of the present invention, the intelligent connector is adapted to be mounted on the data bus in a pluggable manner.

According to another exemplary embodiment of the present invention, the low voltage power bus is a low voltage DC power bus, the high voltage power bus is an AC power bus or a high voltage DC power bus.

According to another exemplary embodiment of the present invention, the electrical control switch module is an electromagnetic relay.

According to another aspect of the present invention, there is provided a bus control system comprising a data bus, a low voltage power bus, a high voltage power bus, a main controller, a plurality of low voltage loads, a plurality of high voltage loads, and a plurality of intelligent connector modules as mentioned above. The main controller is connected to the data bus, the low voltage power bus and the high voltage power bus; the intelligent connectors of the plurality of intelligent connector modules are connected in parallel to the data bus and the low voltage power bus; the electrical control switch modules of the plurality of intelligent connector modules are connected in parallel to the high voltage power bus, and connected to the intelligent connectors, respectively; the plurality of low voltage loads are connected to the intelligent connectors, respectively; the plurality of high voltage loads are connected to the electrical control switch modules, respectively.

In the above various exemplary embodiments of the present invention, the number of the high voltage loads may be simply changed by increasing or reducing the number of the electrical control switch modules. In addition, the position of the high voltage load may be easily changed by adjusting the installation position of the electrical control switch module. Thereby, the intelligent connector module has good expansibility and universality.

In addition, in the above various exemplary embodiments of the present invention, if one intelligent connector module fails, it only needs to replace the failed intelligent connector module, without the need to replace the main controller and other intelligent connector modules. Therefore, the bus control system is easy to maintain and its maintenance cost is very low.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features of the present invention will become more apparent by describing in detail exemplary embodiments thereof with reference to the accompanying drawings, in which:

Fig.1 is a schematic diagram of a bus control system for an electrical equipment according to an exemplary embodiment of the present invention;

Fig.2 is a schematic diagram of an intelligent connector module shown in Fig.1; and

Fig.3 is a schematic diagram of an electrical control switch module shown in Fig.2.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE IVENTION

Exemplary embodiments of the present disclosure will be described hereinafter in detail with reference to the attached drawings, wherein the like reference numerals refer to the like elements. The present disclosure may, however, be embodied in many different forms and should not be construed as being limited to the embodiment set forth herein; rather, these embodiments are provided so that the present disclosure will be thorough and complete, and will fully convey the concept of the disclosure to those skilled in the art.

In the following detailed description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

According to a general concept of the present invention, there is provided an intelligent connector module, comprising: an intelligent connector adapted to connect a low voltage load in an electrical equipment to a low voltage power bus; and an electrical control switch module adapted to connect a high voltage load in the electrical equipment to a high voltage power bus. The electrical control switch module is connected to the intelligent connector and configured to control the power supply to the high voltage load according to a switch control signal from the intelligent connector.

Fig.1 is a schematic diagram of a bus control system for an electrical equipment according to an exemplary embodiment of the present invention.

As shown in Fig.1, the bus control system mainly comprises a data bus 1, a low voltage power bus 2, a high voltage power bus 3, a main controller, a plurality of low voltage loads 10, a plurality of high voltage loads 20, and a plurality of intelligent connector modules (to be described later in detail).

As shown in Fig.1, the main controller is connected to the data bus 1, the low voltage power bus 2 and the high voltage power bus 3.

Fig.2 is a schematic diagram of an intelligent connector module shown in Fig.1; and Fig.3 is a schematic diagram of an electrical control switch module 200 shown in Fig.2.

As shown in Figs.1-3, in an embodiment, the intelligent connector modules each mainly comprises an intelligent connector 100 and at least one electrical control switch

module 200. The intelligent connector 100 is adapted to connect the low voltage load 10 in the electrical equipment to the low voltage power bus 2. The electrical control switch module 200 is adapted to connect the high voltage load 20 in the electrical equipment to the high voltage power bus 3.

In an embodiment, as shown in Figs.1-3, the electrical control switch module 200 is connected to the intelligent connector 100 and configured to control the power supply to the high voltage load 20 according to a switch control signal from the intelligent connector 100.

As clearly shown in Figs.2-3, in an embodiment, the electrical control switch module 200 mainly comprises a driver (or a driving circuit) 210 and a switch element 220. The driver 210 is connected to the intelligent connector 100. The switch element 220 is connected between the high voltage power bus 3 and the high voltage load 20. The driver 210 is configured to drive the switch element 220 to close or open according to the switch control signal from the intelligent connector 100, so as to control the power supply to the high voltage load 20.

In an embodiment, as shown in Figs.1-3, the intelligent connector 100 mainly comprises a data bus interface 110, a low voltage power bus interface 120, a low voltage load interface 140, and a micro control unit 130. The data bus interface 110 is adapted to be connected to a data bus 1. The low voltage power bus interface 120 is adapted to be connected to the low voltage power bus 2. The low voltage load interface 140 is adapted to be connected to the low voltage load 10. The micro control unit 130 is connected to the data bus interface 110, the low voltage power bus interface 120 and the low voltage load interface 140.

In an embodiment, as shown in Figs.1-3, the driver 210 of the electrical control switch module 200 is connected to the low voltage load interface 140 of the intelligent connector 100, and the switch control signal is transmitted to the driver 210 of the electrical control switch module 200 via the low voltage load interface 140 of the intelligent connector 100.

In an embodiment, as shown in Figs.1-3, the low voltage load interface 140 of the intelligent connector 100 comprises a plurality of low voltage load connection ports, for example, low voltage load connection pins. The electrical control switch module 200 is adapted to connect any one of the plurality of low voltage load connection ports of the intelligent connector 100. The low voltage load 10 is adapted to connect any one of the plurality of low voltage load connection ports of the intelligent connector 100.

In an embodiment, as shown in Figs.1-3, the electrical control switch module 200 is an individual electrical device separated from the intelligent connector 100.

In an embodiment, as shown in Figs.1-3, the electrical control switch module 200 is adapted to be mounted on the high voltage load 20 in a pluggable manner and electrically connected to the low voltage load interface 140 of the intelligent connector 100 via a wire.

In another embodiment, as shown in Figs.1-3, the electrical control switch module 200

is adapted to be mounted on a fixation frame (not shown) in a pluggable manner and electrically connected to the low voltage load interface 140 of the intelligent connector 100 and the high voltage load 20, respectively, via wires.

In yet another embodiment, as shown in Figs.1-3, the electrical control switch module 200 is adapted to be mounted on a PCB (not shown) in a pluggable manner and electrically connected to the low voltage load interface 140 of the intelligent connector 100 via a conductive trace printed on the PCB.

In an embodiment, as shown in Figs.1-3, the intelligent connector 100 is adapted to be mounted on the data bus 1 in a pluggable manner.

In an embodiment, as shown in Figs.1-3, the intelligent connector 100 may be integrated on a PCB or adapted to be mounted on a PCB in a pluggable manner.

In an embodiment, as shown in Figs.1-3, the low voltage power bus 2 comprises a low voltage DC power bus; and the high voltage power bus 3 comprises an AC power bus or a high voltage DC power bus. The low voltage load 10 may comprise a low voltage DC load; and the high voltage load 20 may comprise an AC load or a high voltage DC load.

Please be noted that, in the present invention, the power supply voltage of the high voltage power bus 3 shall be much larger than the power supply voltage of the low voltage power bus 2, and the rated operation voltage of the high voltage load 20 shall be much higher than the rated operation voltage of the low voltage load 10.

In an embodiment, as shown in Figs.1-3, the electrical control switch module 200 may be an electromagnetic relay.

In the bus control system shown in Fig.1, the single main controller is connected to the data bus 1, the low voltage power bus 2 and the high voltage power bus 3. The intelligent connectors 100 of the plurality of intelligent connector modules are connected in parallel to the data bus 1 and the low voltage power bus 2. The electrical control switch modules 200 of the plurality of intelligent connector modules are connected in parallel to the high voltage power bus 3, and connected to the intelligent connectors 100, respectively. The plurality of low voltage loads 10 are connected to the intelligent connectors 100, respectively; and the plurality of high voltage loads 20 are connected to the electrical control switch modules 200, respectively.

Please be noted that, in the present invention, the term "connection" is not limited to wired physical electrical connection, but also wireless electrical connection.

In the above various exemplary embodiments of the present invention, the number of the high voltage loads 20 may be simply changed by increasing or reducing the number of the electrical control switch modules 200. In addition, the position of the high voltage load 20 may be easily changed by adjusting the installation position of the electrical control switch module 200. Thereby, the intelligent connector module has good expansibility and universality.

In addition, in the above various exemplary embodiments of the present invention, if one intelligent connector module fails, it only needs to replace the failed intelligent connector module, other than replace the main controller and other intelligent connector modules. Therefore, the bus control system is easy to maintain and its maintenance cost is very low.

It should be appreciated for those skilled in this art that the above embodiments are intended to be illustrated, and not restrictive. For example, many modifications may be made to the above embodiments by those skilled in this art, and various features described in different embodiments may be freely combined with each other without conflicting in configuration or principle.

Although several exemplary embodiments have been shown and described, it would be appreciated by those skilled in the art that various changes or modifications may be made in these embodiments without departing from the principles and spirit of the disclosure, the scope of which is defined in the claims and their equivalents.

As used herein, an element recited in the singular and proceeded with the word "a" or "an" should be understood as not excluding plural of said elements or steps, unless such exclusion is explicitly stated. Furthermore, references to "one embodiment" of the present invention are not intended to be interpreted as excluding the existence of additional embodiments that also incorporate the recited features. Moreover, unless explicitly stated to the contrary, embodiments "comprising" or "having" an element or a plurality of elements having a particular property may include additional such elements not having that property.

What is claimed is,

1. An intelligent connector module, comprising:

an intelligent connector (100) adapted to connect a low voltage load (10) in an electrical equipment to a low voltage power bus (2); and

an electrical control switch module (200) adapted to connect a high voltage load (20) in the electrical equipment to a high voltage power bus (3),

wherein the electrical control switch module (200) is connected to the intelligent connector (100) and configured to control the power supply to the high voltage load (20) according to a switch control signal from the intelligent connector (100).

2. The intelligent connector module according to claim 1,

wherein the electrical control switch module (200) comprises a driver (210) connected to the intelligent connector (100), and a switch element (220) connected between the high voltage power bus (3) and the high voltage load (20); and

wherein the driver (210) is configured to drive the switch element (220) to be close or open according to the switch control signal from the intelligent connector (100), so as to control the power supply to the high voltage load (20).

3. The intelligent connector module according to claim 2,

wherein the intelligent connector (100) comprises:

a data bus interface (110) adapted to be connected to a data bus (1);

a low voltage power bus interface (120) adapted to be connected to the low voltage power bus (2);

a low voltage load interface (140) adapted to be connected to the low voltage load (10); and

a micro control unit (130) connected to the data bus interface (110), the low voltage power bus interface (120) and the low voltage load interface (140).

4. The intelligent connector module according to claim 3,

wherein the driver (210) of the electrical control switch module (200) is connected to the low voltage load interface (140) of the intelligent connector (100), and the switch control signal is transmitted to the driver (210) of the electrical control switch module (200) via the low voltage load interface (140) of the intelligent connector (100).

5. The intelligent connector module according to claim 4,

wherein the low voltage load interface (140) of the intelligent connector (100) comprises a plurality of low voltage load connection ports,

wherein the electrical control switch module (200) is adapted to be connected with any one of the plurality of low voltage load connection ports of the intelligent connector (100), and

wherein the low voltage load (10) is adapted to connect any one of the plurality of low voltage load connection ports of the intelligent connector (100).

6. The intelligent connector module according to claim 1,

wherein the electrical control switch module (200) is an individual electrical device separated from the intelligent connector (100).

7. The intelligent connector module according to claim 6,

wherein the electrical control switch module (200) is adapted to be mounted on the high voltage load (20) in a pluggable manner and electrically connected to the low voltage load interface (140) of the intelligent connector (100) via a wire.

8. The intelligent connector module according to claim 6,

wherein the electrical control switch module (200) is adapted to be mounted on a fixation frame in a pluggable manner and electrically connected to the low voltage load interface (140) of the intelligent connector (100) and the high voltage load (20), respectively, via wires.

9. The intelligent connector module according to claim 6,

wherein the intelligent connector (100) is adapted to be mounted on the data bus (1) in a pluggable manner.

10. The intelligent connector module according to claim 1,

wherein the low voltage power bus (2) comprises a low voltage DC power bus, and the high voltage power bus (3) comprises an AC power bus or a high voltage DC power bus.

11. The intelligent connector module according to claim 1, wherein the electrical control switch module (200) comprises an electromagnetic relay.

12. A bus control system comprising a data bus (1), a low voltage power bus (2), a high voltage power bus (3), a main controller, a plurality of low voltage loads (10), a plurality of high voltage loads (20), and a plurality of intelligent connector modules according to claim 1,

wherein the main controller is connected to the data bus (1), the low voltage power bus

(2) and the high voltage power bus (3);

wherein the intelligent connectors (100) of the plurality of intelligent connector modules are connected in parallel to the data bus (1) and the low voltage power bus (2);

wherein the electrical control switch modules (200) of the plurality of intelligent connector modules are connected in parallel to the high voltage power bus (3), and connected to the intelligent connectors (100), respectively; and

wherein the plurality of low voltage loads (10) are connected to the intelligent connectors (100), respectively; and the plurality of high voltage loads (20) are connected to the electrical control switch modules (200), respectively.

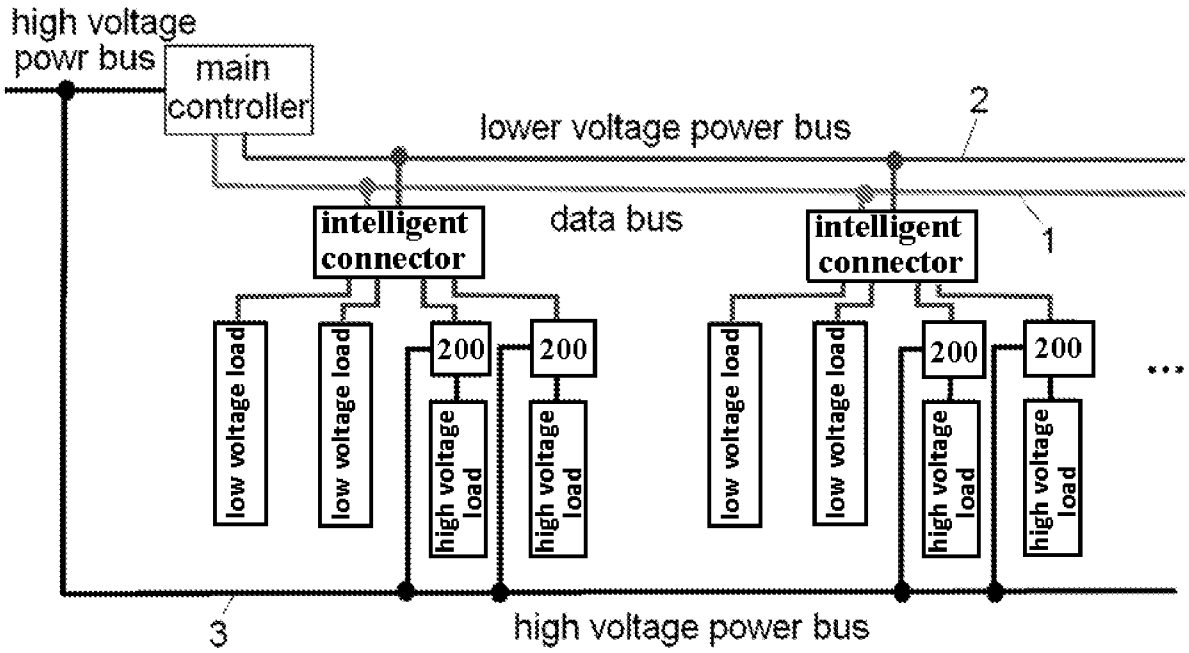
high voltage
powr bus
main
controller
lower voltage power bus
2
data bus
1
intelligent
connector
intelligent
connector
low voltage load
low voltage load
200
200
high voltage
load
high voltage
load
low voltage load
low voltage load
200
200
high voltage
load
high voltage
load
...
3
high voltage power bus

Fig.1

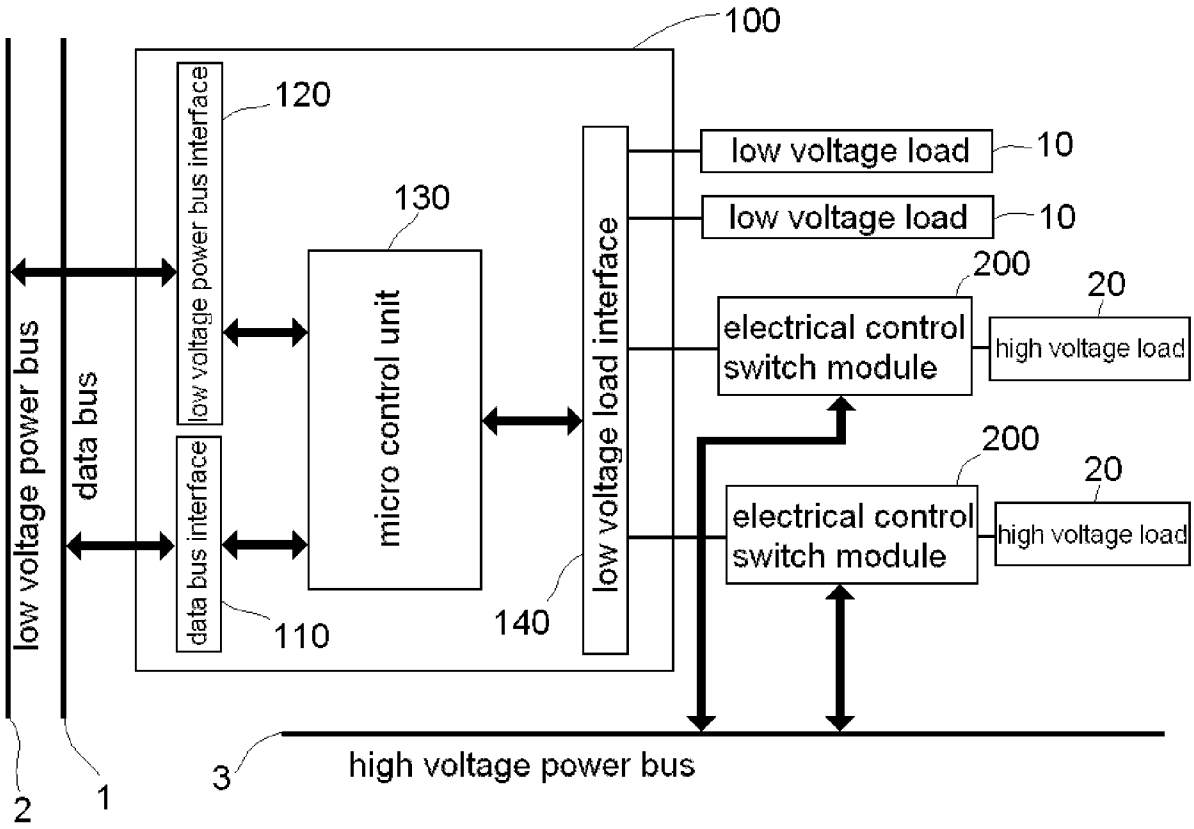
100
120
low voltage power bus interface
130
micro control unit
data bus interface
110
140
low voltage load interface
low voltage load
10
low voltage load
10
200
20
electrical control switch module
high voltage load
200
20
electrical control switch module
high voltage load
low voltage power bus
data bus
2
1
3
high voltage power bus

Fig.2

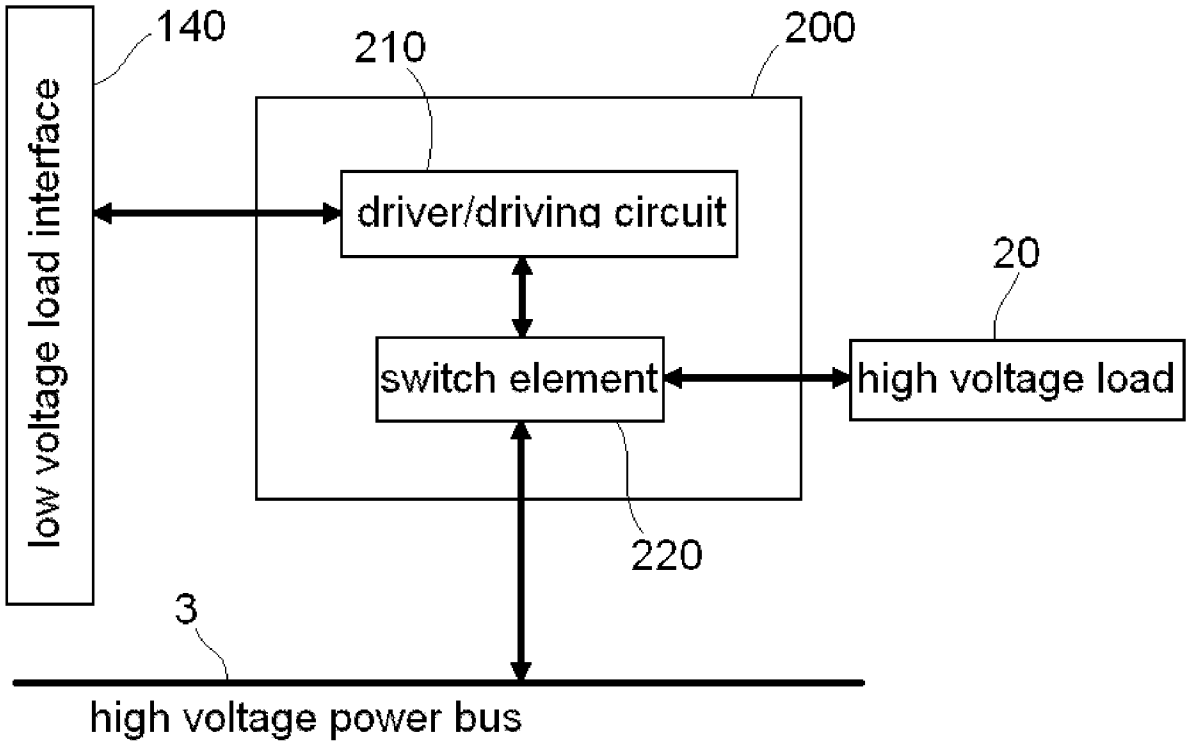
140
210
200
low voltage load interface
driver/driving circuit
20
switch element
high voltage load
220
3
high voltage power bus

Fig.3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/055957

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L12/10 H04L12/40
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04L G06F G05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 205 091 605 U (TYCO ELECTRONICS SHANGHAI CO LTD) 16 March 2016 (2016-03-16) the whole document & WO 2017/055982 A1 (TYCO ELECTRONICS CO LTD [CN]; TYCO ELECTRONICS LTD UK [GB]) 6 April 2017 (2017-04-06) abstract figures 2,3 page 1, line 14 - line 36 page 1, line 6 - line 35 page 3, line 11 - line 34 page 4, line 28 - line 34 page 5, line 13 - line 31 page 5, line 37 - page 6, line 10 page 6, line 27 - line 29 page 7, line 1 - line 3 page 7, line 14 - line 23 -----	1-12

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 November 2017	27/11/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Martinozzi, A

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2017/055957

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 967 929 A2 (HONEYWELL INT INC [US]) 10 September 2008 (2008-09-10) figure 1 paragraph [0023] paragraph [0033] paragraph [0036] paragraph [0038] -----	1-12
A,P	US 2017/155526 A1 (LI JIN-FENG [CN]) 1 June 2017 (2017-06-01) abstract figure 2 paragraph [0001] - paragraph [0004] paragraph [0021] - paragraph [0024] -----	1-12

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2017/055957

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