



- (51) **International Patent Classification:**
H01H 47/22 (2006.01) H01H 47/32 (2006.01)
H01H 47/24 (2006.01)
- (21) **International Application Number:** PCT/IB2016/050781
- (22) **International Filing Date:** 15 February 2016 (15.02.2016)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:** 201510084102.0 15 February 2015 (15.02.2015) CN
- (71) **Applicant: TYCO ELECTRONICS (SHANGHAI) CO. LTD.** [CN/CN]; Sections F and G, Level 1, Building 15, No. 999 Yinglun Road, Pilot Free Trade Zone, Shanghai (CN).
- (71) **Applicant (for MG only): TYCO ELECTRONICS UK LTD** [GB/GB]; Faraday Road, Dorcan, Swindon Wiltshire SN3 5HH (GB).
- (72) **Inventor: FAN, Mingjie;** c/o Tyco Electronics (Shanghai) Co. Ltd., Sections F and G, Level 1, Building 15, No. 999 Yinglun Road, Pilot Free Trade Zone, Shanghai (CN).
- (74) **Agent: KEANE, David;** Murgitroyd & Company, Scotland House, 165-169 Scotland Street, Glasgow Strathclyde G5 8PL (GB).
- (81) **Designated States** (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).
- Published:**
— with international search report (Art. 21(3))

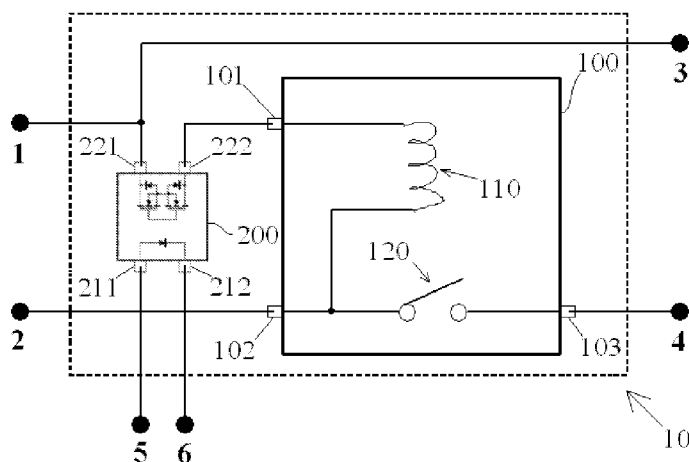
(54) **Title:** CIRCUIT CONTROLLER AND INTERNET OF THINGS

Fig. 1

(57) **Abstract:** A circuit controller 10 includes a mechanical bistable electromagnetic switch 100 and a normal open optocoupler relay 200. A pair of second input ends 211, 212 of the optocoupler relay 200 are respectively connected to a pair of control signal input terminals 5, 6. One of second output ends 221 of the optocoupler relay is connected to one of power input terminals 1 and one of power output terminals 3 of the circuit controller, and the other of second output ends 222 of the optocoupler relay is connected to one of first input ends 101 of the mechanical bistable solenoid switch 100; the other of first input ends 102 of the mechanical bistable solenoid switch is connected to the other of power input terminals 2 of the circuit controller, and the first output end 103 of the mechanical bistable solenoid switch is connected to the other of power output terminals 4 of the circuit controller. The normal open optocoupler relay 200 is employed to control the ON/OFF switching of the mechanical bistable electromagnetic switch 100. Therefore, the power consumption of the circuit controller is substantially reduced, and it is possible to obtain a control node for an Internet of things which is powered by a button battery.



CIRCUIT CONTROLLER AND INTERNET OF THINGS

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of Chinese Patent Application No. 201510084102.0 filed on February 15, 2015 in the State Intellectual Property Office of China, the whole disclosure of which is incorporated herein by reference.

Field of the Invention

Embodiments of the present disclosure relate to a circuit controller, especially to a circuit controller with extremely low power consumption.

Description of the Related Art

In recent years, there is a rapid development in the Internet of things. However, in the current application of the Internet of things, power consumption of an AC or DC load controller based on a relay or a thyristor is too high, which becomes a technical bottleneck in a further development of the Internet of things. Normally it will take more than 400mW DC power consumption to turn on a relay, and it will also take more than 10mW DC control power consumption to turn on a thyristor. Therefore, it usually requires an additional AC/DC circuit to supply power to the control loop. In this connection, it will not only increase the cost, but also add an additional power consumption of around 100mW. This is undoubtedly a huge waste of energy for the number of one billion or ten billion Internet equipments.

SUMMARY OF THE INVENTION

The purpose of the present disclosure is intended to solve at least one aspect of the above issues and faults in the prior art.

It would be advantageous to provide a circuit controller with extremely low power consumption.

According to an aspect of the present disclosure, there is provided a circuit controller, which comprises a mechanical bistable electromagnetic switch having a pair of first input ends and a first output end; and a normal open optocoupler relay having a pair of second input ends and a pair of second output ends. The circuit controller comprises a pair of power input terminals to be connected to power supply lines, a pair of power output terminals to be connected to a load, and a pair of control signal input terminals to be connected to a control signal source; the pair of second input ends of the normal open optocoupler relay are respectively connected to the pair of control signal input terminals; one of second output ends of the normal open optocoupler relay is connected to one of power input terminals and one of power output terminals of the circuit controller, and the other of second output ends of the normal open optocoupler relay is connected to one of first input ends of the mechanical bistable solenoid switch; the other of first input ends of the mechanical bistable solenoid switch is connected to the other of power input terminals of the circuit controller, and the first output end of the mechanical bistable solenoid switch is connected to the other of power output terminals of the circuit controller.

According to an exemplary embodiment of the present invention, when a pulse input signal is applied to the mechanical bistable solenoid switch through the pair of first input ends, the mechanical bistable solenoid switch is switched from one of an open state and a close state to the other; and when a control signal is applied to the normal open optocoupler relay through the pair of second input ends, the pair of second output ends of the normal open optocoupler relay are electrically connected with each other.

According to another exemplary embodiment of the present invention, the mechanical bistable electromagnetic switch comprises an electromagnetic coil and a switching element; and one end of the electromagnetic coil is connected to one of first input ends of the mechanical bistable solenoid switch, and the other end of the electromagnetic coil is connected to the other of first input ends of the mechanical bistable solenoid switch; and one end of the switching element is connected to the other of first input ends of the mechanical bistable solenoid switch, and the other end of the switching element is connected to the first output end of the mechanical bistable solenoid switch.

According to another exemplary embodiment of the present invention, the electromagnetic coil generates an electromagnetic field, which drives the switching element to switch from one of the open state or the close state to the other, when a pulse input signal is applied to the mechanical bistable solenoid switch through the pair of first input ends.

According to another exemplary embodiment of the present invention, the pair of power input terminals of the circuit controller are adapted for being connected to AC power supply lines, and the pair of control signal input terminals of the circuit controller are adapted for being connected to a DC control signal source.

According to another exemplary embodiment of the present invention, the pair of power input terminals of the circuit controller are adapted for being connected to DC power supply lines.

According to another exemplary embodiment of the present invention, one of power input terminals of the circuit controller is adapted for being connected to a fire line of the AC power supply lines; the other of power input terminals of the circuit controller is adapted for being connected to a zero line of the AC power supply lines; one of power output terminals of the circuit controller is adapted for being connected to a positive electrode end of the load; and the other of power output terminals of the circuit controller is adapted for being connected to a negative electrode end of the load.

According to another exemplary embodiment of the present invention, the pair of power input terminals of the circuit controller are adapted for being connected to AC power supply lines of 220V.

According to another aspect of the present disclosure, there is provided an Internet of things, which comprises a circuit controller mentioned above; a load and power supply lines. The pair of power input terminals of the circuit controller are connected to AC power supply lines, the pair of power output terminals of the circuit controller are connected to the positive electrode end and the negative electrode end of the load, respectively, and the pair of control signal input terminals of the circuit controller are connected to a DC control signal source.

According to an exemplary embodiment of the present invention, the DC control signal source is powered by a button battery.

In the circuit controller according to respective exemplary embodiment of the present invention, the normal open optocoupler relay is employed to control the ON/OFF switching of the mechanical bistable electromagnetic switch, and the mechanical bistable electromagnetic switch is not driven by an additional DC power source, but is driven directly by a load power source. As the power consumption of the normal open optocoupler relay is normally no more than 2mW, and the mechanical bistable electromagnetic switch is not driven by any additional DC power, the power consumption of the circuit controller is substantially reduced. It is possible to provide a control signal (power supply) to the optocoupler relay with a button battery, and obtain a control node for an Internet of things which is powered by a button battery.

Other characteristics and advantages of the present disclosure will be made clear by the following detailed description, the comprehension of which will be facilitated by reference to the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a principle circuit diagram showing a circuit controller according to an exemplary embodiment of the present invention; and

Fig. 2 is a principle circuit diagram showing an Internet of things according to an exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

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 disclosure, there is provided a circuit controller, including a mechanical bistable electromagnetic switch having a pair of first input ends and a first output end; and a normal open optocoupler relay having a pair of second input ends and a pair of second output ends. The circuit controller comprises a pair of power input terminals to be connected to power supply lines, a pair of power output terminals to be connected to a load, and a pair of control signal input terminals to be connected to a control signal source. The pair of second input ends of the normal open optocoupler relay are respectively connected to the pair of control signal input terminals. One of second output ends of the normal open optocoupler relay is connected to one of power input terminals and one of power output terminals of the circuit controller, and the other of second output ends of the normal open optocoupler relay is connected to one of first input ends of the mechanical bistable solenoid switch; the other of first input ends of the mechanical bistable solenoid switch is connected to the other of power input terminals of the circuit controller, and the first output end of the mechanical bistable solenoid switch is connected to the other of power output terminals of the circuit controller.

Fig. 1 is a principle circuit diagram showing a circuit controller 10 according to an exemplary embodiment of the present invention; and Fig. 2 is a principle circuit diagram

showing an Internet of things according to an exemplary embodiment of the present invention.

In an exemplary embodiment of the present invention, a circuit controller 10 is disclosed. As shown in Fig. 1, the circuit controller 10 mainly comprises a mechanical bistable electromagnetic switch 100 and a normal open optocoupler relay 200.

As shown in Figs. 1 and 2, in the illustrated embodiment, the mechanical bistable electromagnetic switch 100 has a pair of first input ends 101, 102 and a first output end 103. The normal open optocoupler relay 200 has a pair of second input ends 211, 212 and a pair of second output ends 221, 222.

In an exemplary embodiment of the present invention, as shown in Figs. 1 and 2, the circuit controller 10 comprises a pair of power input terminals 1, 2 to be connected to power supply lines L1, L2, a pair of power output terminals 3, 4 to be connected to a load 300, and a pair of control signal input terminals 5, 6 to be connected to a control signal source (not shown).

Further refer to Figs. 1 and 2, in the illustrated embodiment, the pair of second input ends 211, 212 of the normal open optocoupler relay 200 are respectively connected to the pair of control signal input terminals 5, 6. One of second output ends 221 of the normal open optocoupler relay 200 is connected to one of power input terminals 1 and one of power output terminals 3 of the circuit controller 10. The other of second output ends 222 of the normal open optocoupler relay 200 is connected to one of first input ends 101 of the mechanical bistable solenoid switch 100. The other of first input ends 102 of the mechanical bistable solenoid switch 100 is connected to the other of power input terminals 2 of the circuit controller 10. The first output end 103 of the mechanical bistable solenoid switch 100 is connected to the other of power output terminals 4 of the circuit controller 10.

As shown in Figs. 1 and 2, in the illustrated embodiment, the mechanical bistable solenoid switch 100 comprises a housing (not shown), an electromagnetic coil 110 received in the housing, a switching element 120 and some other mechanical parts. As the mechanical bistable solenoid switch 100 is a well-known product, the specific constructions thereof will not be described in detail for sake of brevity. Below, principle of operation of the mechanical bistable solenoid switch 100 is briefly presented.

As shown in Figs. 1 and 2, in the illustrated embodiment, when an input signal, for example, an AC pulse signal with 220V voltage and 10ms pulse width, is applied to the mechanical bistable solenoid switch 100 through the pair of first input ends 101, 102, the electromagnetic coil 110 of the mechanical bistable solenoid switch 100 generates an electromagnetic field, under effect of which, the switching element 120 is switched from one of the open state and the close state to the other (that is, the mechanical bistable solenoid switch 100 performs an action of ON/OFF switching).

As the normal open optocoupler relay 200 is also a well-known product, the specific constructions thereof will not be described in detail for sake of brevity. Below, principle of operation of the normal open optocoupler relay 200 is briefly presented.

As shown in Figs. 1 and 2, in the illustrated embodiment, when a control signal, for example, a DC pulse control signal with 1mA current and 10ms pulse width, is applied to the normal open optocoupler relay 200 through the pair of second input ends 211, 212, the pair of second output ends 221, 222 of the normal open optocoupler relay 200 are mutually conducted. When applying the control signal to the pair of second input ends 211, 212 of the normal open optocoupler relay 200 is stopped, the pair of second output ends 221, 222 of the normal open optocoupler relay 200 are mutually disconnected.

As shown in Figs. 1 and 2, in the illustrated embodiment, one end of the electromagnetic coil 110 is connected to one of first input ends 101 of the mechanical bistable solenoid switch 100, and the other end of the electromagnetic coil 110 is connected to the other of first input ends 102 of the mechanical bistable solenoid switch 100. One end of the switching element 120 is connected to the other of first input ends 102 of the mechanical bistable solenoid switch 100, and the other end of the switching element 120 is connected to the first output end 103 of the mechanical bistable solenoid switch 100.

In the illustrated embodiment, as shown in Figs. 1 and 2, when it is required to supply power to the load 300, merely a control signal, for example, a DC pulse control signal with 1mA current and 10ms pulse width, is needed to be provided to the normal open optocoupler relay 200 through the pair of second input ends 211, 212, thus the pair of second output ends 221, 222 of the normal open optocoupler relay 200 are electrically connected with each other. Once the pair of second output ends 221, 222 are electrically connected with each other, both ends of the electromagnetic coil 110 of the mechanical bistable solenoid switch 100 are electrical connected to the power supply lines L1, L2, then the power supply lines L1, L2 provide an input signal, for example, an AC pulse signal with 220V voltage and 10ms pulse width, to the mechanical bistable solenoid switch 100 through the pair of first input ends 101, 102, then the electromagnetic coil 110 of the mechanical bistable solenoid switch 100 generates an electromagnetic field, under effect of which, the switching element 120 is switched from the open state to the close state. Once the switching element 120 is switched to the close state, the positive electrode end 301 and the negative electrode end 302 of the load 300 are electrically connected to the power supply lines L1, L2 and the power supply lines L1, L2 supply power to the load 300.

In the illustrated embodiment, as shown in Figs. 1 and 2, when it is required to stop the power supply to the load 300, also merely a control signal is needed to be provided to the normal open optocoupler relay 200 through the pair of second input ends 211, 212, thus the switching element 120 of the mechanical bistable solenoid switch 100 is switched from the close state to the open state, disconnecting the load 300 from the power supply lines L1,

L2.

In an exemplary embodiment of the present invention, as shown in Figs. 1 and 2, the pair of power input terminals 1, 2 of the circuit controller 10 are adapted for being connected to AC power supply lines L1, L2; and the pair of control signal input terminals 5, 6 of the circuit controller 10 are adapted for being connected to a DC control signal source.

In an exemplary embodiment of the present invention, as shown in Figs. 1 and 2, the pair of power input terminals 1, 2 of the circuit controller 10 are suitable for being connected to AC power supply lines L1, L2 of 220V. However, please be noted that the present invention is not limited to the illustrated embodiment, the pair of power input terminals 1, 2 of the circuit controller 10 are also suitable for being connected to DC power supply lines

Further refer to Fig. 2, in the illustrated embodiment, one of power input terminals 1 of the circuit controller 10 is connected to the fire line L1 of the AC power supply lines L1, L2; the other of power input terminals 2 of the circuit controller 10 is connected to the zero line L2 of the AC power supply lines L1, L2; one of power output terminals 3 of the circuit controller 10 is connected to the positive electrode 301 of the load 300; and the other of power output terminals 4 of the circuit controller 10 is connected to the negative electrode 302 of the load 300.

In an exemplary embodiment of the present invention, the DC control signal source connected to the pair of control signal input terminals 5, 6 of the circuit controller 10 is powered by a button battery.

In the circuit controller 10 according to respective exemplary embodiment of the present invention, the normal open optocoupler relay 200 is employed to control the ON/OFF switching action of the mechanical bistable electromagnetic switch 100, and the mechanical bistable electromagnetic switch 100 is not driven by an additional DC power source, but is driven by a load power source (i.e. the AC power supply lines L1, L2 shown in the Figures). As the power consumption of the normal open optocoupler relay 200 is normally no more than 2mW, and the mechanical bistable electromagnetic switch 100 is not driven by any additional DC power, the power consumption of the circuit controller 10 is substantially reduced.

As shown in Fig.2, a pair of power input terminals 1, 2 of the circuit controller 10 are connected to AC power supply lines L1, L2. The pair of power output terminals 3, 4 of the circuit controller 10 are connected to the positive electrode 301 and the negative electrode 302 of the load 300, respectively. The pair of control signal input terminals 5, 6 of the circuit controller 10 are connected to a DC control signal source.

In an exemplary embodiment of the present invention, the DC control signal source is configured to output a DC pulse control signal with a current less than 1mA.

The circuit controller disclosed by the respective embodiment of the present invention

(hereinafter called a combined circuit controller) has at least the advantages as follows:

1. Extremely low driving power consumption

The driving power of a normal bistable relay is required no less than 400mW, while the driving power of the combined circuit controller of the exemplary embodiment of the present invention is no more than 2mW (including associated current limiting and voltage limiting power consumption, provided that the circuit controller of the exemplary embodiment of the present invention is turned on/off 100 times per day with 10ms per time of ON/OFF, then the average power consumption will be merely 0.023uW.

2. A simple interface

A normal bistable relay needs two or three control signals, as the current is relative larger, usually it is needed no less than 300mA (power supply of 3V), the pins of the conventional single-chip microcontroller cannot output such a large current, it needs a driving circuit having an additional full bridge or two triodes to achieve such control signals. Further, such a large current in the normal bistable relay has a high requirement to the button battery as well as type selection thereof. The combined circuit controller of the exemplary embodiment of the present invention only needs to provide a pulse current of 1mA through I, O pins (that is, the pair of second input ends 211, 212 of the circuit controller 10), which may be electrically connected with the pins of a conventional single-chip microcontroller directly.

3. Excellent anti-interference ability

As a mechanical electromagnetic switch is employed, a relative larger power is needed to drive the ON/OFF state, any common interference cannot trigger the ON/OFF action. When the load is powered by AC power supply lines, the AC signal and the DC signal are electrically isolated, reducing negative effects on the system by the noise in the AC line.

4. Supporting a switch of a device having large power

A mechanical switch may support an AC load with no less than 16A.

5. Low cost and environmental friendly

There is no standby consumption and cost of the AC/DC module.

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 exemplary embodiments of the present disclosure is described in detail with reference to the attached drawings, the present disclosure may 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.

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. A circuit controller, comprises:

a mechanical bistable electromagnetic switch having a pair of first input ends and a first output end; and

a normal open optocoupler relay having a pair of second input ends and a pair of second output ends;

wherein the circuit controller comprises a pair of power input terminals to be connected to power supply lines, a pair of power output terminals to be connected to a load, and a pair of control signal input terminals to be connected to a control signal source;

wherein the pair of second input ends of the normal open optocoupler relay are respectively connected to the pair of control signal input terminals;

wherein one of second output ends of the normal open optocoupler relay is connected to one of power input terminals and one of power output terminals of the circuit controller, and the other of second output ends of the normal open optocoupler relay is connected to one of first input end of the mechanical bistable solenoid switch;

wherein the other of first input end of the mechanical bistable solenoid switch is connected to the other of power input terminals of the circuit controller, and the first output end of the mechanical bistable solenoid switch is connected to the other of power output terminals of the circuit controller.

2. The circuit controller according to claim 1, wherein,

when a pulse input signal is applied to the mechanical bistable solenoid switch through the pair of first input ends, the mechanical bistable solenoid switch is switched from one of an open state and a close state to the other; and

when a control signal is applied to the normal open optocoupler relay through the pair of second input ends, the pair of second output ends of the normal open optocoupler relay are electrically connected with each other.

3. The circuit controller according to claim 2, wherein,

the mechanical bistable electromagnetic switch comprises an electromagnetic coil and a switching element; and

one end of the electromagnetic coil is connected to one of first input end of the mechanical bistable solenoid switch, and the other end of the electromagnetic coil is connected to the other of first input ends of the mechanical bistable solenoid switch; and

one end of the switching element is connected to the other of first input ends of the mechanical bistable solenoid switch, and the other end of the switching element is connected to the first output end of the mechanical bistable solenoid switch.

4. The circuit controller according to claim 3, wherein,
when a pulse input signal is applied to the mechanical bistable solenoid switch through the pair of first input ends, the electromagnetic coil generates an electromagnetic field, which drives the switching element to switch from one of the open state and the close state to the other.

5. The circuit controller according to claim 1, wherein, the pair of power input terminals of the circuit controller are adapted for being connected to AC power supply lines, and
the pair of control signal input terminals of the circuit controller are adapted for being connected to a DC control signal source.

6. The circuit controller according to claim 1, wherein, the pair of power input terminals of the circuit controller are adapted for being connected to DC power supply lines.

7. The circuit controller according to claim 5, wherein,
one of power input terminals of the circuit controller is adapted for being connected to a fire line of the AC power supply lines;
the other of power input terminals of the circuit controller is adapted for being connected to a zero line of the AC power supply lines;
one of power output terminals of the circuit controller is adapted for being connected to a positive electrode end of the load; and
the other of power output terminals of the circuit controller is adapted for being connected to a negative electrode end of the load.

8. The circuit controller according to claim 7, wherein, the pair of power input terminals of the circuit controller are adapted for being connected to AC power supply lines of 220V.

9. An Internet of things, comprises:
a circuit controller according to claim 1;
a load; and
power supply lines,
wherein the pair of power input terminals of the circuit controller are connected to AC power supply lines,
wherein the pair of power output terminals of the circuit controller are connected to the positive electrode end and the negative electrode end of the load, respectively, and
wherein the pair of control signal input terminals of the circuit controller are connected to a DC control signal source.

10. The Internet of things according to claim 9, wherein the DC control signal source is powered by a button battery.

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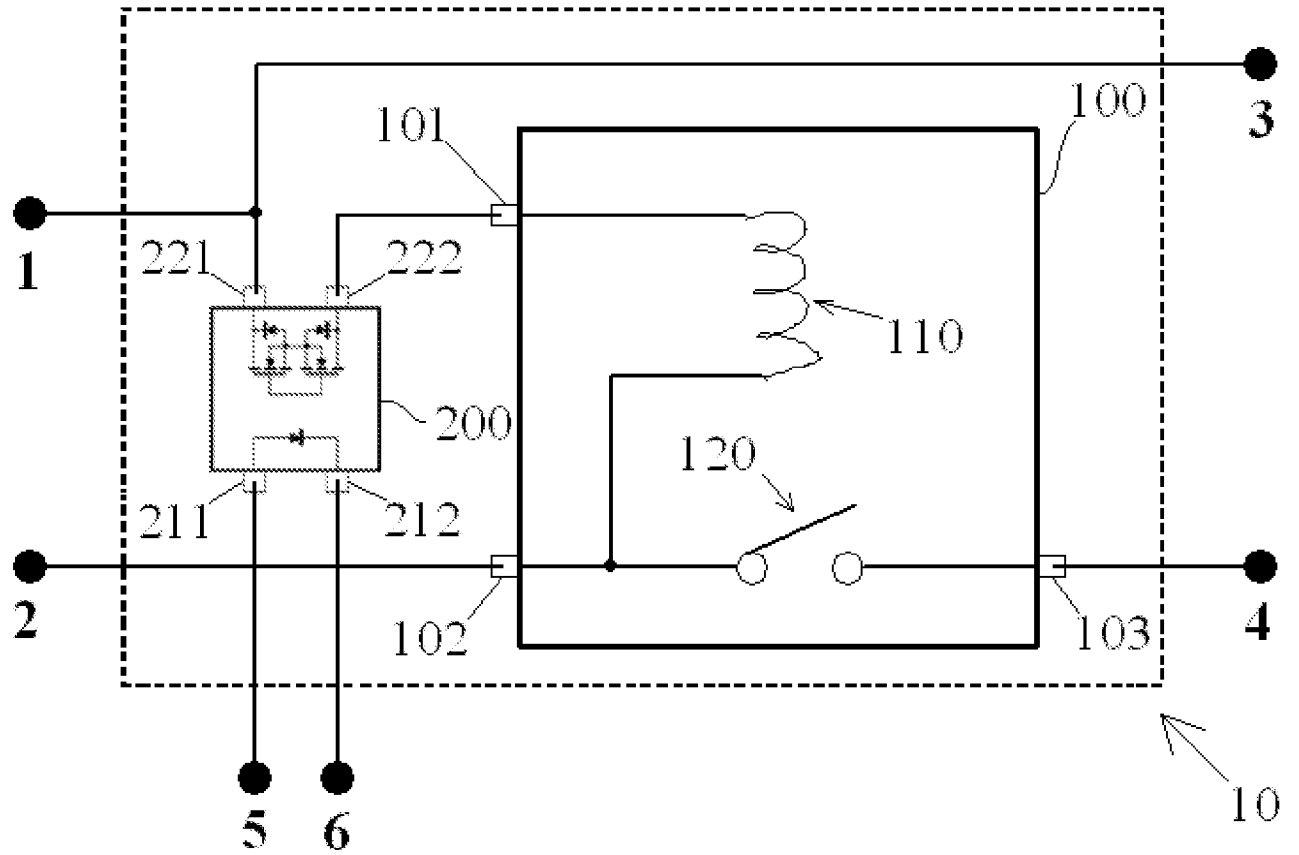


Fig. 1

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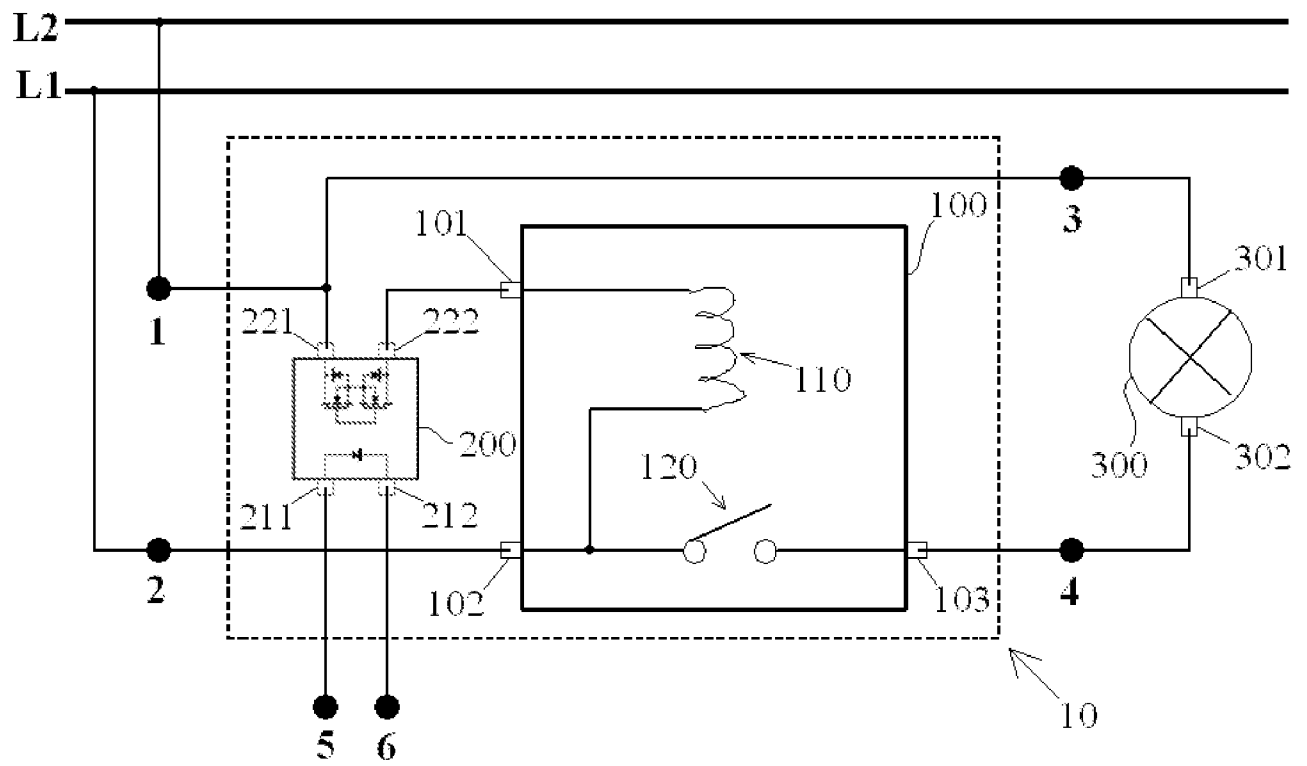


Fig. 2

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2016/050781

A. CLASSIFICATION OF SUBJECT MATTER

INV. H01H47/22 H01H47/24
 ADD. H01H47/32

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)
 H01H

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	WO 2009/098385 A2 (RAVAUT JEAN-PIERRE [FR]) 13 August 2009 (2009-08-13) page 1, lines 8-19 page 2, lines 4-16 page 6, lines 11-33 figure 5	1,2,4-10
A	----- US 2014/285031 A1 (LI YI-LIANG [CN] ET AL) 25 September 2014 (2014-09-25) paragraphs [0015] - [0016] figure 3 -----	1-10



Further documents are listed in the continuation of Box C.



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

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Date of the actual completion of the international search

29 April 2016

Date of mailing of the international search report

11/05/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
 NL - 2280 HV Rijswijk
 Tel. (+31-70) 340-2040,
 Fax: (+31-70) 340-3016

Authorized officer

Glaman, C

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2016/050781

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009098385 A2	13-08-2009	FR 2924265 A1 WO 2009098385 A2	29-05-2009 13-08-2009
US 2014285031 A1	25-09-2014	CN 104062929 A TW 201437799 A US 2014285031 A1	24-09-2014 01-10-2014 25-09-2014