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• **Castells Moreno, Jordi**

08950 Esplugues de Llobregat, Barcelona (ES)

• **Schatz, Paul**

Bradenton, FL Florida 34202 (US)

• **Becker, Donald**

Bradenton, FL Florida 34202 (US)

(71) Applicant: **UTC Fire & Security EMEA BVBA**
1831 Diegem (BE)

(74) Representative: **Stiebe, Lars Magnus et al**
Balder

Paseo de la Castellana 93

28046 Madrid (ES)

(72) Inventors:

• **Vidal Puente, Javier**

08950 Esplugues de Llobregat, Barcelona (ES)

(54) **Fire system loop mapping based on embedded isolators**

(57) A method including receiving, by a plurality of devices, a first command to activate a first isolator of a first device included in the devices; measuring, by the devices, a first set of applied voltages at each of the de-

vices when the first isolator is activated; communicating, by the devices, first status regarding the measured first set of applied voltages to a controller.

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Description

BACKGROUND

[0001] Conventionally, in a system in which a fire panel is connected to multiple devices (e.g., detectors or sensors), isolators are used in an effort to isolate a first device from one or more additional devices. The isolators are frequently implemented as a switch or relay that is opened when a short circuit is detected in the system. Those devices that are not impacted by the short circuit or opening of the isolator may continue to operate or function.

[0002] In conventional systems, a mapping of the system may be performed based on a signature mapping algorithm. For example, a mapping command may be broadcast to all the devices, where the mapping command instructs a specific device (e.g., a first device) to draw current through the communication line. The other devices measure the current and respond to the panel with a value for what those other devices measured.

[0003] The signature mapping algorithm may result in large voltage drops. Such voltage drops are due to the use of a mapping resistor and base resistor coupled with high currents in systems that include high consumption devices. Such large voltage drops may be further experienced in systems where a single pair of wiring is used for power supply or communication purposes.

BRIEF SUMMARY

[0004] An exemplary embodiment is directed to a method including receiving, by a plurality of devices, a first command to activate a first isolator of a first device included in the devices; measuring, by the devices, a first set of applied voltages at each of the devices when the first isolator is activated; communicating, by the devices, first status regarding the measured first set of applied voltages to a controller.

[0005] Another exemplary embodiment is directed to an apparatus including at least one processor; and memory having instructions stored thereon that, when executed by the at least one processor, cause the apparatus to: issue a first command to a plurality of devices that causes a first isolator of a first device included in the devices to be activated; and receive first status regarding a first set of applied voltages measured at each of the devices when the first isolator is activated

[0006] Another exemplary embodiment is directed to a system including: a control panel; and a plurality of devices each comprising an isolator coupled to the control panel, wherein the control panel is configured to issue a first command to the devices that causes a first isolator of a first device included in the devices to be activated, and wherein the first device is configured to activate an isolator based on receiving the first command, and wherein each of the devices is configured to measure an applied voltage when the first isolator is activated, and

wherein the control panel is configured to receive status from each of the devices regarding the applied voltage measured by the device, and wherein the status indicates whether the device experienced a voltage drop in an amount greater than a threshold when the first isolator is activated.

[0007] Additional embodiments are described below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The present disclosure is illustrated by way of example and not limited in the accompanying figures in which like reference numerals indicate similar elements.

FIG. 1 is a schematic block diagram illustrating an exemplary computing system;

FIG. 2 illustrates an exemplary block diagram of a system in different states in order to populate a table; and

FIG. 3 illustrates a flow chart of an exemplary method.

DETAILED DESCRIPTION

[0009] It is noted that various connections are set forth between elements in the following description and in the drawings (the contents of which are included in this disclosure by way of reference). It is noted that these connections in general may be direct or indirect and that this specification is not intended to be limiting in this respect. In this respect, a coupling between entities may refer to either a direct or an indirect connection.

[0010] Exemplary embodiments of apparatuses, systems, and methods are described for mapping devices (e.g., detectors or sensors) included in a system, such as a fire detection system. In some embodiments, a mapping of a device may include identifying or determining a location of the device in relative terms. In some embodiments, a device may include one or more components, such as an isolator. The isolator may be implemented using a metal oxide semiconductor field-effect transistor (MOSFET). In some embodiments, a state of the isolator may be controlled. The state of the isolator may be selected as part of the mapping.

[0011] Referring to FIG. 1, an exemplary computing system 100 is shown. The system 100 is shown as including a memory 102. The memory 102 may store executable instructions. The executable instructions may be stored or organized in any manner and at any level of abstraction, such as in connection with one or more applications, processes, routines, procedures, methods, etc. As an example, at least a portion of the instructions are shown in FIG. 1 as being associated with a first program 104a and a second program 104b.

[0012] The instructions stored in the memory 102 may be executed by one or more processors, such as a proc-

essor 106. The processor 106 may be coupled to one or more input/output (I/O) devices 108. In some embodiments, the I/O device(s) 108 may include one or more of a keyboard or keypad, a touchscreen or touch panel, a display screen, a microphone, a speaker, a mouse, a button, a remote control, a joystick, a printer, a telephone or mobile device (e.g., a smartphone), a sensor, a detector, etc. The I/O device(s) 108 may be configured to provide an interface to allow a user to interact with the system 100.

[0013] The system 100 is illustrative. In some embodiments, one or more of the entities may be optional. In some embodiments, additional entities not shown may be included. For example, in some embodiments the system 100 may be associated with one or more networks, such as one or more computer or telephone networks. In some embodiments, the entities may be arranged or organized in a manner different from what is shown in FIG. 1.

[0014] Turning now to FIG. 2, an exemplary block diagram of a system 200 in accordance with one or more embodiments is shown. The system 200 is shown in FIG. 2 as including seven devices, denoted as devices numbered (#) 1-7. The devices #1-7 may include a sensor or detector, such as a fire or smoke detector. Each of the devices #1-7 may include its own isolator. The devices #1-7 may each be associated with a unique address, such that commands may be issued by a controller (e.g., a loop controller or panel) that directs a particular device to act in a certain manner or fashion. The controller may be implemented using a computing system 100 as described with reference to FIG. 1.

[0015] The system 200 is shown in FIG. 2 as operating in eight different states, denoted as steps #1-8 in FIG. 2. One or more of the states may include selectively activating or opening an isolator, as described in further detail below. In some embodiments, the activating/opening of an isolator may also be associated with enabling a discharge circuit in order to guarantee a fast loop capacitance discharge

[0016] The states may be executed in sequence in order to map the devices #1-7 in the system 200. The controller may be responsible for sequencing the states, controlling the timing of a given state, and controlling the timing between states. The controller may receive feedback from one or more of the devices #1-7 regarding whether a particular device measured a voltage drop in an amount greater than a threshold. Such feedback may be the subject of one or more polling operations initiated by the controller. Other communication techniques may be used by the controller for receiving the feedback.

[0017] In a preliminary state (not shown in FIG. 2), the loop controller may command or cause isolators associated with each of the devices #1-7 to be in a deactivated or closed state. In some embodiments, the isolators may be configured to be deactivated or closed in the absence of a command, such that an execution of the preliminary state might not be needed.

[0018] In state #1, the loop controller may command device #1 to activate its isolator. Based on the command, the device #1 may open its isolator for a period of time and then close the isolator. Based on the arrangement of the devices #1-7 in the system 200, device #2 and device #6, which are downstream from the device #1 relative to the loop controller, may be denied or lack access to power. Accordingly, device #2 and device #6 may measure or detect a voltage drop in an amount greater than a threshold when the isolator associated with device #1 is activated/opened. The other devices (e.g., device #3, 4, 5, and 7) might not detect the voltage drop in the amount greater than the threshold because those other devices may continue to receive power when the isolator associated with device #1 is activated/opened.

[0019] In state #2, the loop controller may command device #2 to activate its isolator. Based on the command, the device #2 may open its isolator for a period of time and then close the isolator. Based on the arrangement of the devices #1-7 in the system 200, device #6, which is downstream from the device #2 relative to the loop controller, may be denied or lack access to power. Accordingly, device #6 may measure or detect a voltage drop in an amount greater than a threshold when the isolator associated with device #2 is activated/opened. The other devices (e.g., device #1, 3, 4, 5, and 7) might not detect the voltage drop in the amount greater than the threshold because those other devices may continue to receive power when the isolator associated with device #2 is activated/opened.

[0020] In state #3, the loop controller may command device #3 to activate its isolator. Based on the command, the device #3 may open its isolator for a period of time and then close the isolator. Based on the arrangement of the devices #1-7 in the system 200, the devices #1, 2, and 4-7 might not detect the voltage drop in the amount greater than the threshold when the isolator associated with device #3 is activated/opened, as the devices #1, 2, and 4-7 may continue to receive power when the isolator associated with device #3 is activated/opened.

[0021] In state #4, the loop controller may command device #4 to activate its isolator. Based on the command, the device #4 may open its isolator for a period of time and then close the isolator. Based on the arrangement of the devices #1-7 in the system 200, device #3, which is downstream from the device #4 relative to the loop controller, may be denied or lack access to power. Accordingly, device #3 may measure or detect a voltage drop in an amount greater than a threshold when the isolator associated with device #4 is activated/opened. The other devices (e.g., device #1, 2, and 5-7) might not detect the voltage drop in the amount greater than the threshold because those other devices may continue to receive power when the isolator associated with device #4 is activated/opened.

[0022] In state #5, the loop controller may command device #5 to activate its isolator. Based on the command, the device #5 may open its isolator for a period of time

and then close the isolator. Based on the arrangement of the devices #1-7 in the system 200, the devices #1-4, 6, and 7 may be denied or lack access to power when the isolator associated with device #5 is activated/opened. The devices #1-4 and devices #6-7 may detect a voltage drop in an amount greater than a threshold when the isolator associated with device #5 is activated/opened.

[0023] In state #6, the loop controller may command device #6 to activate its isolator. Based on the command, the device #6 may open its isolator for a period of time and then close the isolator. Based on the arrangement of the devices #1-7 in the system 200, the devices #1-5 and 7 might not detect the voltage drop in the amount greater than the threshold when the isolator associated with device #6 is activated/opened because the devices #1-5 and 7 may continue to receive power when the isolator associated with device #6 is activated/opened.

[0024] In state #7, the loop controller may command device #7 to activate its isolator. Based on the command, the device #7 may open its isolator for a period of time and then close the isolator. Based on the arrangement of the devices #1-7 in the system 200, the devices #1-4 and 6 may be denied or lack access to power when the isolator associated with device #7 is activated/opened. The devices #1-4, and 6 may detect a voltage drop in an amount greater than a threshold when the isolator associated with device #7 is activated/opened. The device #5 might not detect the voltage drop in the amount greater than the threshold because device #5 may continue to receive power when the isolator associated with device #7 is activated/opened.

[0025] As part of each of the states #1-7, the controller may receive feedback from one or more of the devices #1-7 regarding whether the particular device detected a voltage drop in an amount greater than a threshold. The controller may aggregate the feedback, potentially as part of a table as shown in state #8 of FIG. 2. The table of state #8 presents information regarding the activation of an isolator associated with a particular device on the vertical axis and the status of whether a voltage drop (in an amount greater than a threshold) is detected, where a '1' in the table illustratively signifies that a voltage drop is detected and a '0' illustratively signifies that a voltage drop is not detected. The table of state #8 may be analyzed by, e.g., the controller to determine how the devices #1-7 are arranged or mapped in the system 200. In this manner, the controller might not need or require advance knowledge as to the locations of the devices #1-7 (in relative terms) in order to determine how the system 200 is mapped or configured.

[0026] Referring now to FIG. 3, a flow chart of a method 300 is shown. The method 300 may be executed by, or tied to, one or more components, devices or systems, such as those described herein. The method 300 describes the mapping process.

[0027] In block 304, a broadcast command may be issued by a controller to indicate which device should ac-

tivate or open its associated isolator. As part of block 305, the command may be received by all devices.

[0028] In block 306 every device checks if the address issued by the controller command is its address or not.

[0029] In block 307, only the device with the address issued by the controller command will open its isolator for a short period of time and then close its isolator.

[0030] In block 310, all the devices which have a different address than the issued by the controller command will measure the voltage in the loop.

[0031] In block 311, all the devices which have a different address than the issued by the controller command will communicate the measurement status to the controller.

[0032] In block 312, a portion (e.g., a row) of a table or map (e.g., the table in state #8 of FIG. 2 described above) may be populated based on the status provided in block 311.

[0033] The method 300 may be executed once for each device in the system, where the referenced role of the "the device with the address issued by the controller command" may be alternated or sequenced with each execution of the method 300. Once the method 300 has been executed for each device in the system, a mapping of the system may be obtained based on an analysis of the constructed/populated table.

[0034] The method 300 is illustrative. In some embodiments, one or more of the blocks or operations (or portions thereof) may be optional. In some embodiments, additional operations not shown may be included. In some embodiments, the operations may execute in an order or sequence different from what is shown.

[0035] The timing associated with the method 300, or the operations thereof, may be a function of one or more parameters. For example, a length (or other characteristics) of wire or cabling coupling the devices to one another and the controller, input capacitance associated with the devices, and the extent to which power may be stored at or by a device when applied input power is removed from the device may be taken into consideration. In some embodiments, the parameters associated with the isolators that are used might dominate a timing analysis, such that the other parameters may have a negligible impact on the operations.

[0036] As described herein, when mapping or activating (an isolator associated with) a device closest to a controller, any devices downstream from that closest device may be impacted by that mapping or activation in terms of applied power. Similarly, when mapping or activating (an isolator associated with) a device furthest downstream from a controller, any devices upstream from that furthest device might not be impacted by that mapping or activation in terms of applied power.

[0037] As described herein, in some embodiments a device may check to see if an applied voltage drops below a threshold value or amount. The device may also check to see if the applied voltage is subsequently restored, and if so, if the applied voltage is restored in a timely

manner. Such a check may be used to ensure that devices are operational or functional, potentially in accordance with one or more quality measures or standards.

[0038] Embodiments of the disclosure might not include a series resistor on the negatives of the devices as are present in conventional environments. Thus, large voltage drops may be avoided while still enabling both mapping and isolation to be provided.

[0039] Some of the examples described herein related to fire or smoke detection. Aspects of the disclosure may be implemented in other applications or environments, such as security control systems.

[0040] As described herein, in some embodiments various functions or acts may take place at a given location and/or in connection with the operation of one or more apparatuses, systems, or devices. For example, in some embodiments, a portion of a given function or act may be performed at a first device or location, and the remainder of the function or act may be performed at one or more additional devices or locations.

[0041] Embodiments may be implemented using one or more technologies. In some embodiments, an apparatus or system may include one or more processors, and memory storing instructions that, when executed by the one or more processors, cause the apparatus or system to perform one or more methodological acts as described herein. Various mechanical components known to those of skill in the art may be used in some embodiments.

[0042] Embodiments may be implemented as one or more apparatuses, systems, and/or methods. In some embodiments, instructions may be stored on one or more computer program products or computer-readable media, such as a transitory and/or non-transitory computer-readable medium. The instructions, when executed, may cause an entity (e.g., an apparatus or system) to perform one or more methodological acts as described herein.

[0043] Aspects of the disclosure have been described in terms of illustrative embodiments thereof. Numerous other embodiments, modifications and variations within the scope and spirit of the appended claims will occur to persons of ordinary skill in the art from a review of this disclosure. For example, one of ordinary skill in the art will appreciate that the steps described in conjunction with the illustrative figures may be performed in other than the recited order, and that one or more steps illustrated may be optional.

Claims

1. A method comprising:

receiving, by a plurality of devices, a first command to activate a first isolator of a first device included in the devices;
measuring, by the devices, a first set of applied voltages at each of the devices when the first

isolator is activated;

communicating, by the devices, first status regarding the measured first set of applied voltages to a controller.

2. The method of claim 1, wherein the first status indicates, for each of the devices, whether an applied voltage for a respective device dropped in an amount greater than a threshold when the first isolator is activated.

3. The method of any preceding claim, wherein the first isolator comprises a metal oxide semiconductor field-effect transistor.

4. The method of any preceding claim, further comprising:

receiving, by the devices, a second command to activate a second isolator of a second device included in the devices;

measuring, by the devices, a second set of applied voltages at each of the devices when the second isolator is activated; and

communicating, by the devices, second status regarding the measured second set of applied voltages to the controller.

5. The method of claim 4, wherein the first status and the second status are configured to be stored by the controller for mapping a location of the devices relative to one another.

6. The method of any preceding claim, wherein each of the devices communicates a respective portion of the first status to the controller based on a polling command.

7. The method of any preceding claim, wherein each of the devices is associated with a unique address, and wherein the first command includes a first address associated with the first device.

8. The method of any preceding claim, further comprising:

measuring, by the devices, a second set of applied voltages at each of the devices when the first isolator is deactivated subsequent to the first isolator being activated; and

communicating, by the devices, second status regarding the measured second set of applied voltages to the controller.

9. The method of any preceding claim, wherein the devices are associated with at least one of: a fire detection system, a smoke detection system, and a security control system.

10. An apparatus comprising:

at least one processor; and
memory having instructions stored thereon that,
when executed by the at least one processor,
cause the apparatus to:

issue a first command to a plurality of de-
vices that causes a first isolator of a first
device included in the devices to be activat-
ed; and
receive first status regarding a first set of
applied voltages measured at each of the
devices when the first isolator is activated.

11. The apparatus of claim 10, wherein the first status indicates, for each of the devices, whether an applied voltage for a respective device dropped in an amount greater than a threshold when the first isolator is activated.**12. The apparatus of any preceding claim, wherein the instructions, when executed, cause the apparatus to:**

issue a second command to the devices that
causes a second isolator of a second device in-
cluded in the devices to be activated; and
receive second status regarding a second set
of applied voltages measured at each of the de-
vices when the second isolator is activated.

13. The apparatus of claim 12, wherein the instructions, when executed, cause the apparatus to:

map a location of the devices relative to one an-
other based on the first status and the second
status.

14. The apparatus of claim 13, wherein the instructions, when executed, cause the apparatus to:

determine that a third device included in the de-
vices is faulty based on the mapped location of
the devices; and
issue a third command to the devices that caus-
es a third isolator of the third device to activate
based on the determination that the third device
is faulty.

15. The apparatus of any preceding claim, wherein each of the devices is associated with a unique address, and wherein the first command includes a first address associated with the first device.**16. The apparatus of any preceding claim, wherein the instructions, when executed, cause the apparatus to:**

receive second status regarding a second set

of applied voltages measured at each of the de-
vices when the first isolator is deactivated sub-
sequent to the first isolator being activated.

17. A system comprising:

a control panel; and
a plurality of devices each comprising an isolator
coupled to the control panel,
wherein the control panel is configured to issue
a first command to the devices that causes a
first isolator of a first device included in the de-
vices to be activated, and
wherein the first device is configured to activate
an isolator based on receiving the first com-
mand, and
wherein each of the devices is configured to
measure an applied voltage when the first iso-
lator is activated, and
wherein the control panel is configured to re-
ceive status from each of the devices regarding
the applied voltage measured by the device, and
wherein the status indicates whether the device
experienced a voltage drop in an amount greater
than a threshold when the first isolator is acti-
vated.

18. The system of claim 17, wherein the control panel is configured to map a location of the devices relative to one another based on a sequencing of activating each of the isolators one at a time.

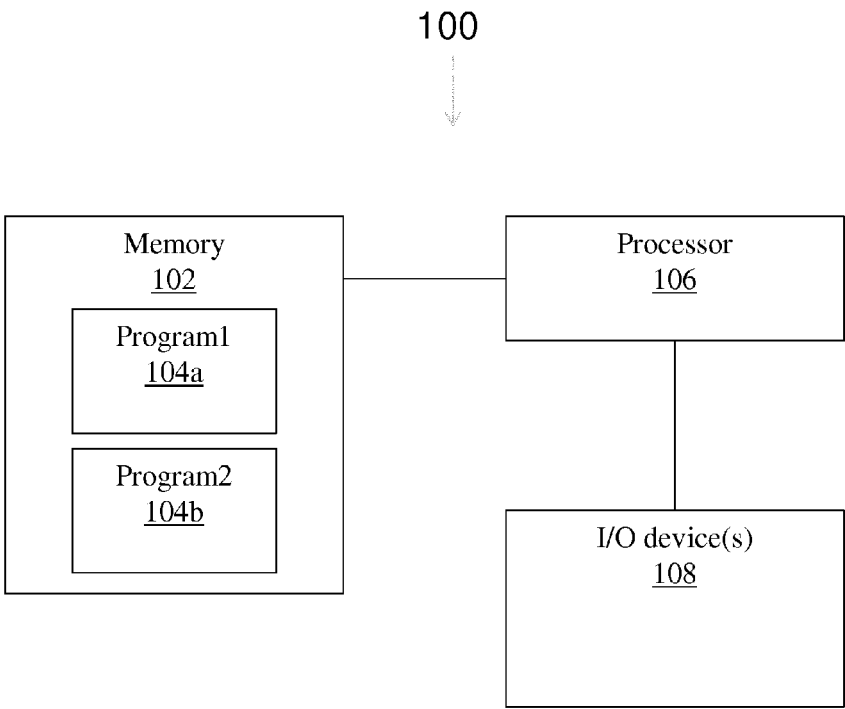


FIG. 1

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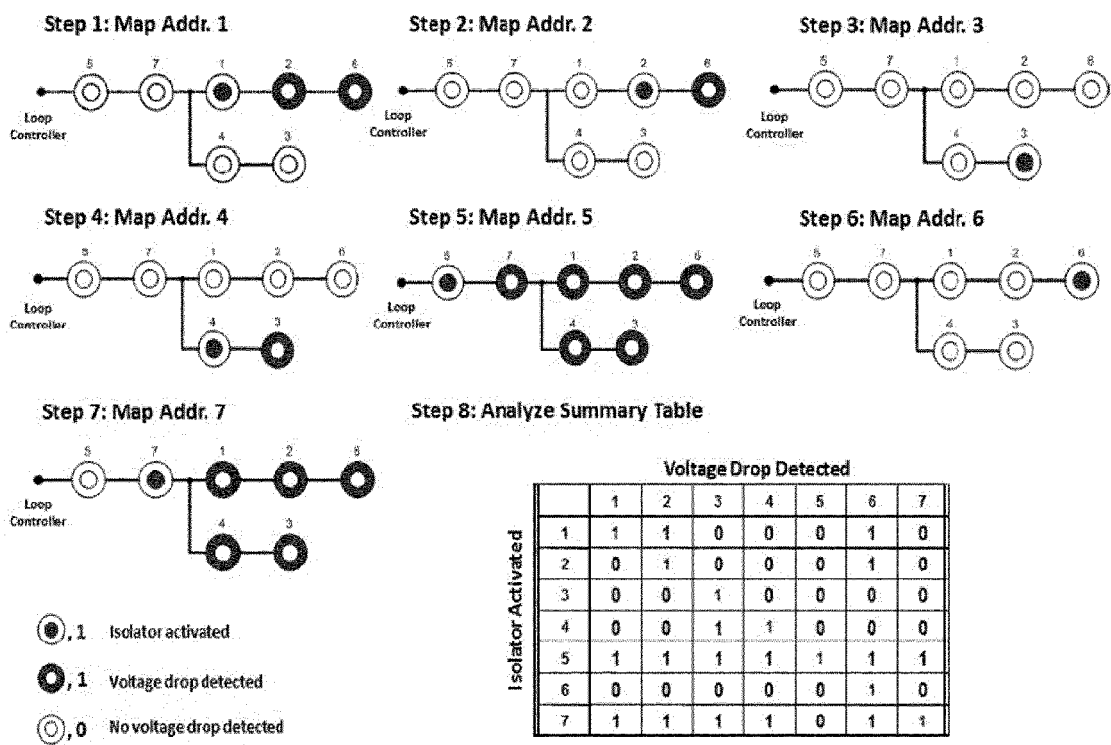


FIG. 2

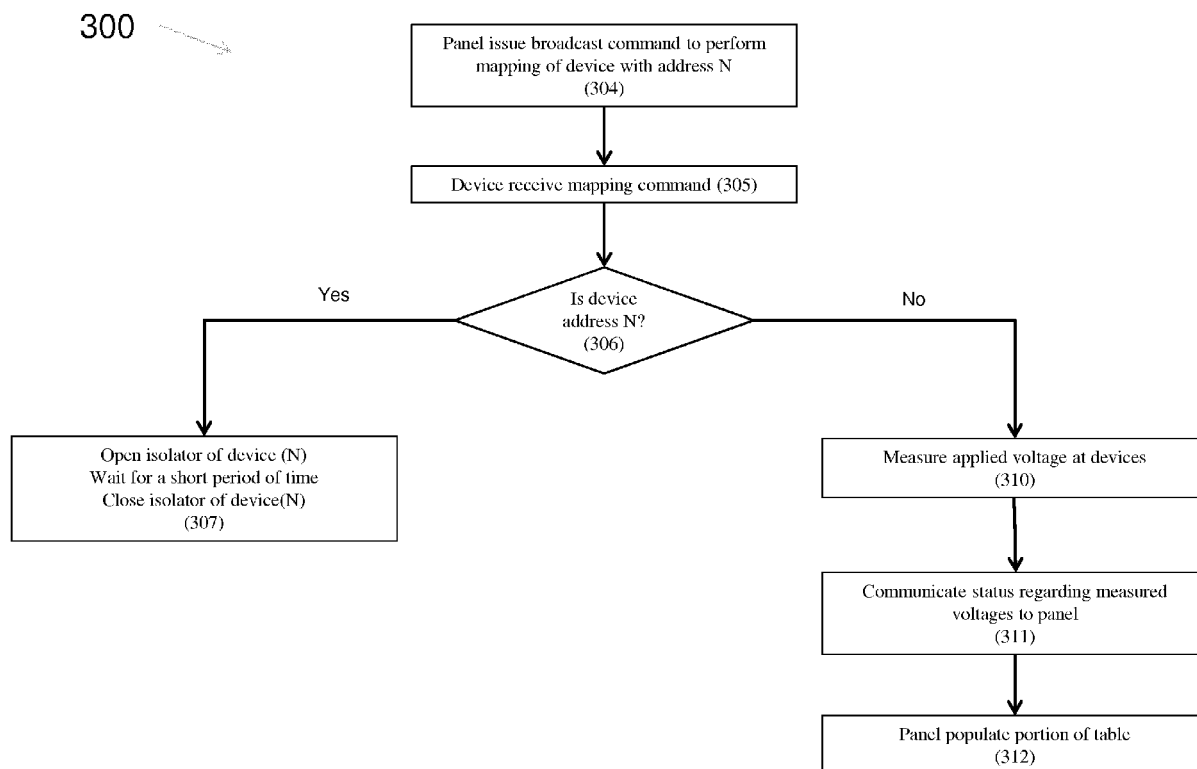


FIG. 3



EUROPEAN SEARCH REPORT

Application Number
EP 14 38 2245

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 484 288 A (THORN SECURITY [GB]) 11 April 2012 (2012-04-11)	1-3,6,7, 9-11,15, 17	INV. G08B25/04
A	* abstract * * figure 1 * * claims 3,28 * * page 2, lines 1-21 * * page 3, lines 26-34 * * page 6, lines 19-29 * * page 9, lines 29-31 * -----	4,5,8, 12-14, 16,18	
			TECHNICAL FIELDS SEARCHED (IPC)
			G08B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 12 December 2014	Examiner Coffa, Andrew
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