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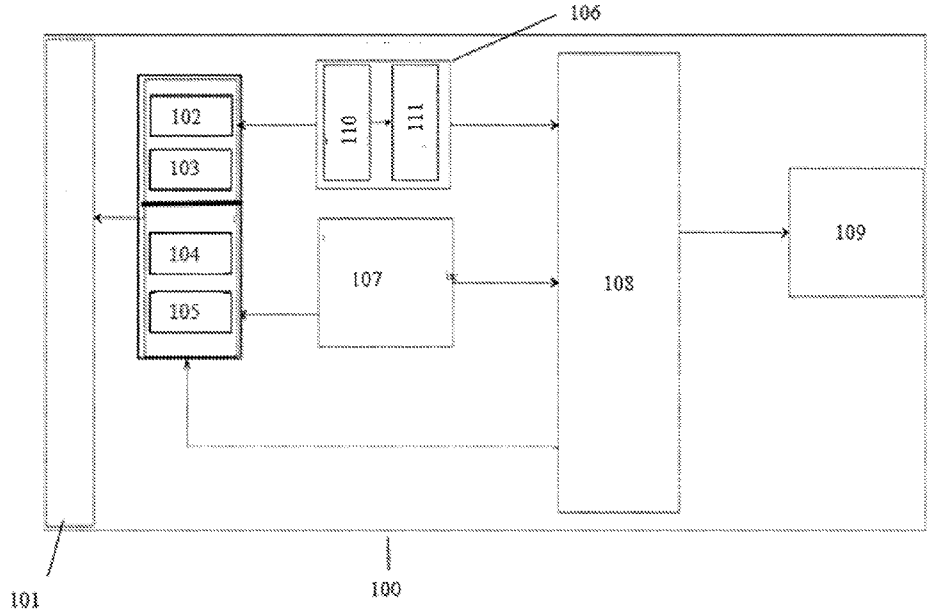

Fig.1

(57) Abstract: The present subject matter relates automatic wiring harness tester (100) for testing continuity and short between wires using multiplexers (102,103,104,105). The continuity circuit block (106) have a constant current source (110) and a difference amplifier (111). The short between wires detecting circuit (107) have at least one multiplexer i.e. third multiplexer and fourth multiplexer (104,105). The present subject matter eliminates the manual intervention while testing the wiring harness (101). Hence, the present invention provides an automatic, reliable, simple, and less time consuming system for testing wiring harness.

[Continued on next page]

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AN AUTOMATIC WIRING HARNESS TESTER

TECHNICAL FIELD

[0001] The present subject matter relates generally to an automatic wiring harness tester. More particularly but not exclusively the present subject matter relates to an automatic wiring harness tester for an automotive vehicle.

BACKGROUND

[0002] In general, an automobile will always have some level of wiring which connects sensors and actuators of the vehicle. At times it is required to test the wires to check continuity and short between wires especially during maintenance and diagnostics. Typically, such testing is done using a multi-meter connected with ECU. Often the service engineer needs to quickly determine the fault and attend to the same to be able to bring the vehicle back to normal condition in a short span of time. Service mechanics often use tools including dedicated plug-in devices to performs diagnostics for a vehicle and determine the fault. Often vehicle display units are configured to indicate faults identified through on-board diagnostics which help the service engineer to identify the problem and attend the same. Fault codes are referred in service manuals to identify the fault and / or carry out further step-wise diagnostics. Accessing inside components and wiring harness to detect faults is a typical challenge associates with such diagnostic tests.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The same numbers are used throughout the drawings to reference similar features and components.

[0004] Figure 1 exemplarily illustrates a block diagram of an automatic wiring harness tester.

[0005] Figure 2 (a) exemplarily illustrates the circuit diagram of the automatic wiring harness tester.

[0006] Figure 2 (b) exemplarily illustrates the circuit diagram of the continuity circuit block.

[0007] Figure 2 (c) exemplarily illustrates the circuit diagram of the short circuit detection block.

[0008] Figure 3 exemplarily illustrates block diagram for testing continuity of the wiring harness.

[0009] Figure 4 exemplarily illustrates block diagram for testing continuity of the wiring harness with continuity.

[00010] Figure 5 exemplarily illustrates block diagram for testing continuity of the wiring harness without continuity.

[00011] Figure 6 exemplarily illustrates block diagram for testing short between the wiring harness without short circuit.

[00012] Figure 7 exemplarily illustrates block diagram for testing short between the wiring harness with short circuit.

[00013] Figure 8 exemplarily illustrates flowchart of the automatic wiring harness tester.

DETAILED DESCRIPTION

[0001] Wiring harness is a part of any automotive vehicle which connects sensors and actuators. At the time of serviceability the wiring harness of the vehicle needs to be tested for continuity and short circuit. Conventionally, the testing of the wiring harness is done manually using multimeters which requires continuous manual monitoring. If the connection is found faulty, then whole setup is exchanged with the new set of wires. This leads of unnecessary additional cost every time there is a fault in the wiring harness. Also, continuous manual monitoring involves more man hour, more time and energy requirements. Additionally, when there is more manual intervention there is always more chances of mishandling and human error. The conventional methods involve checking the continuity by end-to-end checks, which does result in showing desired results if the wire is cut and grounded on the other end, thereby establishing connectivity. The complete conventional method of testing the wiring harness is complex in operation and handling as such a method of testing requires end to end checking of wires. Thus, there is a requirement of a system which test the wiring harness without manual intervention and manual error,

and also which is simple and easy to operate. Hence, to obviate the said problems an improved system is required to test the wiring harness which overcomes all problems cited above and other problems of known art.

[0002] An objective of the present invention is to provide an improved wiring harness tester for a vehicle to facilitate the testing of the vehicle wiring harness which is simple and reliable. The present subject matter is described using an exemplary block diagrams and circuit diagrams. The claimed subject matter is applicable to any automotive vehicle, with required changes and without deviating from the scope of invention. The present invention discloses an automatic wiring harness tester primarily comprising of a harness to be tested, a set of 4 multiplexers, at least two circuit blocks i.e. one continuity circuit block and other a short-circuit detection block, a controller and an output module. The controller is connected to both the circuit blocks i.e. continuity circuit block and the short-circuit detection block through a set of multiplexers. As per an embodiment, the multiplexers can be 16 pin or 32 pin multiplexer as per the requirement on case to case basis. The connection between the controller and the two circuit blocks are such that the output from the circuits i.e. whether the circuit is continuous or not and whether there is short between wires and which wire is short is communicated through an output module either through one or more of a display screen and sound notification or any other kind of notification easily recognized by a user. The display screen can be on-board LCD / LED screen or any handheld device with its application platform.

[0003] As per an aspect of the present subject matter, the continuity circuit block is configured with a constant power source, a load point A being connected to the constant power source and a difference amplifier being connected to the load point A. The difference amplifier is further connected to the controller to send output.

[0004] As per an aspect of the present subject matter, the harness is connected to the continuity circuit block through the load point A.

[0005] As per an aspect of the present subject matter, the power supplied by the constant power source is minimal below a threshold power such that the load point A is prevented from operating.

[0006] As per an aspect of the present subject matter, the controller communicates continuity of the wiring harness through the output module when the controller detects a voltage through the difference amplifier of the continuity circuit block which is higher or equal to a predetermined range of voltage value. .

[0007] As per an aspect of the present subject matter, the controller communicates no continuity by the output module when the controller detects a voltage range less than the predetermined value of voltage range through the difference amplifier of the continuity circuit block.

[0008] As per an aspect of the present subject matter, the output from the output module can be an LCD /LED display screen, sound notification, integrated with the handheld device with application platform or any other kind of notification easily recognized by the user.

[0009] As per an aspect of the present subject matter, the harness connected to the continuity circuit block is governed by the logic table which controls or operates the at least one multiplexers.

[00010] As per an aspect of the present subject matter, the short circuit detection block is configured with at least a second multiplexer such that the second multiplexers monitors voltage across all the wiring harness connected to the short circuit detection block .

[00011] As per an embodiment of the present subject matter, the at least one multiplexers of short circuit detection block is a demultiplexer.

[00012] As per an aspect of the present subject matter, the short circuit detection block detects the voltage at a set of harness not attached to the continuity circuit block such that if voltage at any of the harness not attached to the continuity circuit block is detected the controller receives low signal to communicate short between wires.

[00013] As per an aspect of the present subject matter, the controller communicates no short between the wires by the output module when no voltage is detected by the controller through the short circuit detection block .

[00014] As per an aspect of the present subject matter, the controller communicates short between the wires by the output module when voltage is detected by the controller through the short circuit detection block .

[00015] As per an aspect of the present subject matter, the controller detects the short wire when voltage is detected at the set of harness not attached to the continuity circuit block and the wire connected to the continuity circuit block.

[00016] As per an aspect of the present subject matter, a switch is provided to enabling switching between the ground level of the vehicle to the ECU level.

[00017] The present subject matter is further described with reference to accompanying figures. It should be noted that the description and figures merely illustrate principles of the present subject matter. Various arrangements may be devised that, although not explicitly described or shown herein, encompass the principles of the present subject matter. Moreover, all statements herein reciting principles, aspects, and examples of the present subject matter, as well as specific examples thereof, are intended to encompass equivalents thereof.

[00018] Fig.1 exemplarily illustrates a block diagram of an automatic wiring harness tester. The automatic wiring harness tester (100) comprises of a harness block (101) which is connected to two circuits; a short circuit detection block (107) and a continuity circuit block (106) through at least a multiplexer (102,103,104,105). The first and second multiplexer (102, 103) are connected to the continuity circuit block (106) while the at least second and third multiplexer (104, 105) are connected to short circuit detection block (107). The multiplexer (102,103,104,105) can be any 'N' pinned multiplexer (102,103,104,105) where the 'N' can be any pin number as per user requirement, for example the multiplexers can be either 32 pin or 16 pin as required. Multiplexer (102,103,104,105) is operated through the controller. The harness block (101) to be tested for continuity is defined or governed by the logic table which controls or operates the Multiplexer. For example, consider the below logic table of the 16 pin multiplexer.

Logic table:

0 0 0 0	C0 active C1 to C15 inactive
0 0 0 1	C1 active other 15 pins inactive

0 0 1 0 C2 active Other 15 pins inactive

.....

An inverter (not shown) is incorporated at pin of the first multiplexer (102) and the second multiplexer (103) to keep one multiplexer enabled at a time. For example in a 16 Pin multiplexer which is connected to 16 wires, all the wires will get tested as per this logic table. In other words, all the wires of the wiring harness block (101) will get connected to point A as per the logic table. The user can add any number of multiplexers as per requirement, thereby providing for tailoring flexibility as required. The continuity circuit block (106) comprises of a constant current source (110) and a difference amplifier (111). A controller (108) is configured to receive an input from both the circuits i.e. continuity circuit block (106) and short circuit detection block (107). The output received from the controller (108) is notified to the user using an output module (109). The output module can be any form of communicating notification platform, either LED/LCD display screen, sound notification or any other mobile platform or any hand held device.

[00014] Fig.2 (a) exemplarily illustrates an embodiment of the circuit diagram of the automatic wiring harness tester with one or more 16 pin multiplexers (102,103,104,105). The complete circuit diagrams shows that the first and second multiplexer (102,103) connects load point A of the continuity circuit block (106) to the first set of 16 wires and second set of 16 wires of the wire harness block (101) respectively. The third and fourth multiplexer (104,105) being connected to the first set of 16 wires and second set of 16 wires of the wiring harness block (101) respectively such that the combination of all the multiplexers (102,103,104,105) connects all 32 wires in the harness. The automatic wiring harness tester (100) schematically shown in Fig. 1 is powered by an external DC constant power source (110). This simple automatic wiring harness tester (100) serves as a full proof and quicker tool for checking the harness of the vehicle in an effective manner. Since, the present wiring testing is automatic, the wiring harness tester (100) carries out the diagnostic checks. Once the wiring harness tester (100) is plugged in and the check mode is ON, the wiring harness tester (100) displays the results on a dedicated screen of an output module (109). The automatic wiring harness tester

(100) eliminates manual interference and displays results with respect to continuity of the connected wiring harness block (101) and detects short between wires. The tool and method as per known art for checking wire connectivity involve use of a digital/analog multimeter or a continuity tester which has limitations on indicating the desired result when multiple wires are short. A toggle switch (201) is provided to switch the load point A of the continuity circuit block (106) to ECU level to ground level of the vehicle. A 9V battery (110) is the primary power source for this application. A voltage regulator (202) is used to derive 5V required for all other sections. As per an embodiment of current invention, voltage regulator 7805 (202) has been illustrated. The constant power source (110) provides a constant current and constant voltage for a range of load which as per an embodiment can be from 0 Ohm to 5 Megaohms. A difference amplifier (111) is incorporated to amplify the voltage drop across a resistance R3 when current flows through it. When load point A is connected to a load in the range 0 Ohm to 5 Megaohms then constant current flows through the resistance R3 and the same is amplified by the difference amplifier (111) and a high signal is given to the microcontroller. For any load above 5 Mega ohm no currents flows through the resistance R3 and a low signal will be given to the microcontroller (108).

[00015] Fig. 2 (b) and Fig. 2(c) exemplarily illustrates circuit diagram of continuity circuit block (106) and short circuit detection block (107) respectively. In Fig. 2(b) the continuity circuit block (106) includes a constant power source (110), such as a 9V battery. The continuity circuit block (106) is further connected to a load point A (303) and includes a difference amplifier (111). The voltage regulator 7805 (202) is used to derive 5v required for other sections of the circuit. The constant power source (110) provides constant current of a range of 0 ohm to 5 Megaohm to load A, thereby a constant current flows through a resistor R3. A diode D1 (203) provide the reverse voltage protection across the circuit. A Zener diode D2 (204) of 6v is used to derive a voltage which is less than 5V at load point A (303). A power of 6 v is used as power source from a 9v battery so that remaining 3v is used to drive a PNP transistor. By this configuration, Zener diode D2 ensures voltage at load point A (303) is less than 5v throughout testing stage. The voltage output from the load

point A (303) is amplified by a difference amplifier (111), and the amplified voltage is sent to the controller (not shown). The Fig. 2(c) illustrates a circuit for detecting short between the wires. The first multiplexer (102) and second multiplexer (103) are used to connect the output from the load point A (303) to the respective pins on the wiring harness block (101). The selection of the pins of the wiring harness block (101) are done based on the selected line on the multiplexers. Only one multiplexer among the first multiplexer (102) and second multiplexer (103) are enabled at a time using an inverter (not shown). The third and fourth multiplexers (104,105) are used to read the status of individual pins connected to the wiring harness block (101). Only one multiplexer among the third and fourth multiplexer (104,105) are enabled at a time using an inverter IC. When the continuity of a pin is being measured, then the third and fourth multiplexers (104,105) are used to read the status of other pins one by one. In case, the voltage applied on the pin being tested for continuity appears on any other pin then the pins are shorted. **Fig.3** exemplarily illustrates block diagram of continuity circuit block (106) for testing continuity of the wiring harness. The continuity circuit block (106) includes a constant power source (110), such as a 9V battery. The continuity circuit block (106) is further connected to a load point A (303) and includes a difference amplifier (111). The constant current source (110) will send power to the load point A (303), the feedback received from the load point A (303) after receiving the constant current is further amplified by the difference amplifier (111) and then the output from the difference amplifier (111) is the amplified voltage which is sent to the microcontroller (108). The purpose of the constant current is to prevent the loads from operating during the testing stage. There are certain loads such as sensors which when operated during testing stage, share output or feedback to microcontroller (108) which can potentially misguide the purpose of the tool/system. Hence a constant source of current is kept very minimal or below a predetermined threshold value to eliminate such errors. A low current as configured in continuity circuit bock (106) in the present invention will neither operate the load nor harm the load The load point A (303) operates when one of said output signal

i.e. constant current source (110) and constant voltage source is equal to or more than the threshold value.

[00016] Fig. 4 exemplarily illustrates block diagram for testing continuity of a wiring harness which has its continuity intact i.e., no defect. The harness block (101) is connected to the continuity circuit block (106) through load point A. The Pin 1 (501) is a supply line and the Pin 2 (502) is a ground line. A power of constant current source (110) of 9V is stepped down to minimum current and voltage such as a theoretical value of 2.2 V and sent to the load point A (303), e.g. wire 1 of harness block (101). In case said 2.2 v is directly sent to the controller (108), the controller (108) will not detect the voltage, hence the difference amplifier (111) is used to amplify the voltage sent by the load and then amplified voltage is received by the microcontroller (108). If the microcontroller (108) receives the amplified voltage at a predetermined value range which is recognizable by the microcontroller (108), say a range of 3 to 5 V, the microcontroller (108) indicates there is continuity in the circuit through the output module (109). In place of constant current battery, vehicle battery can also be used.

[00017] Fig. 5 exemplarily illustrates block diagram for testing continuity of the wiring harness which is without continuity i.e., having defect. In said arrangement the microcontroller (108) receives no output from the difference amplifier (111), thus indicating NO continuity in the circuit through the output module (109). Thus in the continuity circuit block (106), the microcontroller (108) effectively checks that the loop of the circuit is closed at all the points. If the output received from the difference amplifier (111) by the microcontroller (108) is in the range of a predetermined range of voltage which is recognizable by the microcontroller (108), a notification of continuity will be communicated to the user though the output module (109), else no continuity is communicated.

[00019] Fig. 6 exemplarily illustrates block diagram for testing short between the wiring harness which is without a short circuit. The short circuit detection block (107) comprises of the third and fourth multiplexer (104,105) that are used to test the short between wires. The third and fourth multiplexer (104,105) monitors voltage across the wires. For illustration, consider a case where wires termed as

W1, W2, W3, and W4 (not shown)) are 4 different wires in the harness. The third and fourth multiplexer (104,105) are demultiplexers which monitor voltage across all the wires simultaneously. When the continuity circuit block (106) is connected to the multiplexers (102,103) for testing the continuity with respect to W1 (not shown), the third and fourth multiplexer (104,105) will monitor the voltage at each of W2, W3 and W4 (not shown). If there is no voltage at W2, W3, w4 , the third and fourth multiplexers (104,105) will give HIGH voltage input to controller, i.e the controller receives HIGH voltage indicating that there is no short between the wires. If there is no short, a constant HIGH voltage is always received at controller meaning No shorting between wires and the same is conveyed to the user as Short – NILL, through output module (109).

[00020] Fig.7 exemplarily illustrates block diagram for testing short between the wiring harness which is with a short circuit. Considering the example same as that in para 00019, in case if there is any voltage at W3, the controller will receive a LOW voltage e.g. 2.2 V, indicating there is short between W1 and W3. Since the voltage when there exists a short and as received by the third and fourth multiplexers (104,105) is around 2.2v or voltage equivalent to the wire connected to the continuity circuit block (106), it is used to drive the transistor so that it gives LOW voltage input to the microcontroller (108) indicating that there is a short circuit between the wires. If there is no short circuit, a constant HIGH voltage of predetermined volt is always received at controller meaning No shorting between the wires. The third and fourth multiplexers (104,105) will check for short among all the wires which are not connected to the continuity circuit block (106). As per an embodiment of the present invention, the wiring harness block may include harness for a sensor e.g., a Throttle Position Sensor (TPS) or one or more other harness of loads of the vehicle.

[00021] Fig. 8 exemplarily illustrates the flowchart of working of the automatic wiring harness tester (100) as per present invention. A constant current and constant voltage as indicated in step (801) being passed by the constant current source (110) to the load point A (303). Load point A (303) being connected to wiring harness block (101) through one or more first multiplexers (102,103) as shown in step (802).

The output voltage from Load point A (303) being amplified as shown in step (803) by the difference amplifier (111). The output from the difference amplifier (111) is sent to a controller (108). The controller (108) determines if the input received from the difference amplifier (111) is more than the predetermined value as shown in step (804). The controller (108) communicates continuity of harness as shown in step (805) through an output module (109) if the input received by the controller (108) is more than the predetermined value of voltage range. The controller (108) communicates No continuity of harness as shown in step (806) through an output module (109) if the input received by the controller (108) is less than the predetermined value of voltage range.

[00022] The present invention diagnose short circuit between wires. The load point A (303) being connected to the wiring harness block (101) as shown in step (802). One or more second multiplexers (104,105) detects voltage across other set of wires not attached to the continuity circuit block (106) as shown in step (807). The One or more second multiplexers (104,105) sends signal to the controller (108) as shown in step (808). The One or more second multiplexers (104,105) sends low voltage signal than a predetermined voltage to the controller (108) in case voltage being detected at the set of wires not attached of the continuity circuit (106). The controller determines if the signal received from the one or more second multiplexers (104,105) is less than predetermined voltage as shown in step (809). The controller (108) communicates short between the wires as shown in step (810) connected to the continuity circuit block (106) and wire having voltage by a through an output module (109) in case low voltage being determined by the controller (108). The controller (108) communicates no short between the wires as shown in step (811) connected to the continuity circuit block (106) and wire having voltage by a through an output module (109) in case low voltage being determined by the controller (108). Many other improvements and modifications may be incorporated herein without deviating from the scope of the invention.

List of Reference numerals

100: Automatic harness tester

101: A wiring harness block

102: First Multiplexer

103: Second Multiplexer

104: Third Multiplexer

105: Fourth Multiplexer

106: Continuity circuit block

107: Short circuit detection block

108: Microcontroller

109: Output module

110: Constant power source

111: Difference amplifier

201: Toggle switch

202: Voltage regulator

203: Diode D1

204: Zener diode D2

303: Load point A

501: Pin 1

502: Pin 2

801-811: Flow chart steps

We claim:

1. An automatic wiring harness tester (100) for a vehicle wherein the automatic wiring harness tester (100) comprises of :
   a wiring harness block (101), said wiring harness block (101) comprising of plurality of wires;
   one or more multiplexer,
   a short circuit detection block (107);
   a continuity circuit block (106);
   an output module (109);
   and a controller (108) connected to said continuity circuit block (106) and said short circuit detection block (107)
   wherein said controller (108) communicates an output from the one or more of the short circuit detection block (107) and the continuity circuit block (106) to the output module (109).
2. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the continuity circuit block (106) comprises of :
   one of a constant power source and a constant voltage source (110);
   a load point A (303) connected to said constant power and constant voltage source (110);
   a difference amplifier (111) connected to said load point A (303) wherein the difference amplifier (111)being further connected to the controller (108) further wherein the difference amplifier (111) supplies output signal to the said controller (108).
3. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the harness block (101) is connected to the continuity circuit block (106) through the load point A (303).
4. The automatic wiring harness tester (100) for a vehicle as claimed in claim 2 , wherein said one of the constant power source and a constant voltage source (110) being below a predetermined threshold value wherein the load point A (303) operates when one of said output signal is equal to or more than the threshold value.

5. The automatic wiring harness tester (100) for a vehicle as claimed in claim 2 , wherein the constant current flows through a resistance R3 and the difference amplifier (111) amplifies the voltage drop across the resistance R3.
6. The automatic wiring harness tester (100) for a vehicle as claimed in claim 2, wherein a Zener diode D2 (204) allows only a predetermined range of voltage to load point A (303).
7. The automatic wiring harness tester (100) for a vehicle as claimed in claim 2 , wherein the controller (108) communicates continuity of harness by the output module (109) on a predetermined value of voltage range being detected by the controller (108) through the difference amplifier (111) of the continuity circuit block (106).
8. The automatic wiring harness tester (100) for a vehicle as claimed in claim 2 , wherein the controller (108) communicates no continuity of harness to the output module (109) on the output voltage received by the controller through the difference amplifier (111) of the continuity circuit block (106), being outside the predetermined value of voltage range . The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the output module (109) can be one of a LCD, a LED display screen , a sound notification , integrated with the handheld application platform on a mobile device or any other kind of notification easily recognized by a user.
9. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the harness block (101) connected to the continuity circuit block (106) being governed by the logic table which controls or operates one or more of a first multiplexer and second multiplexer(102,103).
10. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the short circuit detection block (107) comprises of one or more of a third multiplexer (104) and fourth multiplexer (105) wherein said one or more third multiplexer and fourth

multiplexer (104,105) monitors voltage across all the wiring harness (101) connected to the short circuit detection block (107) to diagnose a short circuit condition.

11. The automatic wiring harness tester (100) for a vehicle as claimed in claim 9 , wherein the one or more of a third multiplexer and fourth multiplexer (104,105) being an inverted multiplexer.
12. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the short circuit detection block (107) detects the voltage at a set of a harness not attached to the continuity circuit block (106) wherein on detection of voltage at any of the harness not attached to the continuity circuit block (106) by the controller (108), said controller (108) receives low signal to indicate short circuit condition..
13. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the controller (108) communicates no short between the wires to the output module (109) on no voltage being detected by the controller through the short circuit detection block (107).
14. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the controller (108) communicates short between the wires by the output module (109) on voltage being detected by the controller through the short circuit detection block (107).
15. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein the controller (108) detects the short between wires on voltage being detected at the set of harness not attached to the continuity circuit block (106) and the wire connected to the continuity circuit block (106).
16. The automatic wiring harness tester (100) for a vehicle as claimed in claim 1, wherein a toggle switch (201) being provided to switch sensors between ECU level to ground level of the vehicle.

17. A method to diagnose continuity in a wire harness block (101) comprising steps of:

passing constant current (801) and constant voltage through a load point A (303) connected to continuity circuit block (106);

amplifying the voltage output (803) from the load point A (303) through a difference amplifier (111);

communicating continuity (805) of harness by a controller (108) through an output module (109) if a predetermined value of voltage range being detected by the controller (108) through the difference amplifier (111) of the continuity circuit block (106);

communicating no continuity (806) of harness by a controller (108) through an output module (109) if a predetermined value of voltage range not being detected by the controller (108) through the difference amplifier (111) of the continuity circuit block (106)

18. The method as claimed in claim 18, wherein the constant current and constant voltage being limited by a Zener diode D2 (204).

19. A method to diagnose short circuit between wires comprising steps of :

connecting (802) load point A (303) to the wiring harness block (101) through one or more first multiplexers (102,103);

detecting (807) voltage across other set of wires not attached to the continuity circuit block (106) by one or more second multiplexers (104,105);

sending signal (808) to controller by the one or more second multiplexers (104,105);

communicating short circuit (810) between the wires by the controller (108) through an output module (109) if controller detects low voltage signal than a predetermined voltage;

communicating no short circuit (811) between the wires by the controller (108) through an output module (109) if controller detects high voltage signal than a predetermined voltage.

20. The method as claimed in claim 20, wherein one multiplexer is enabled at a time.

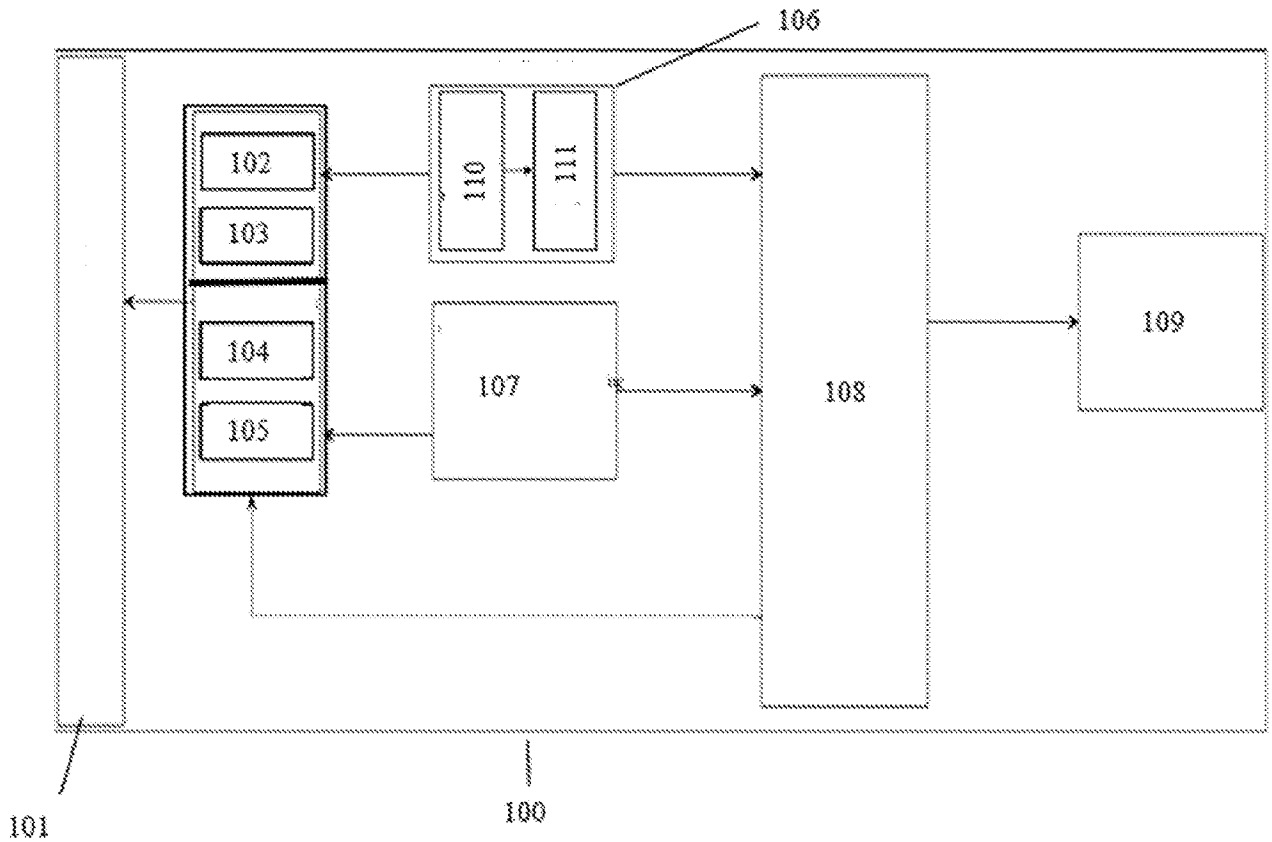

Fig.1

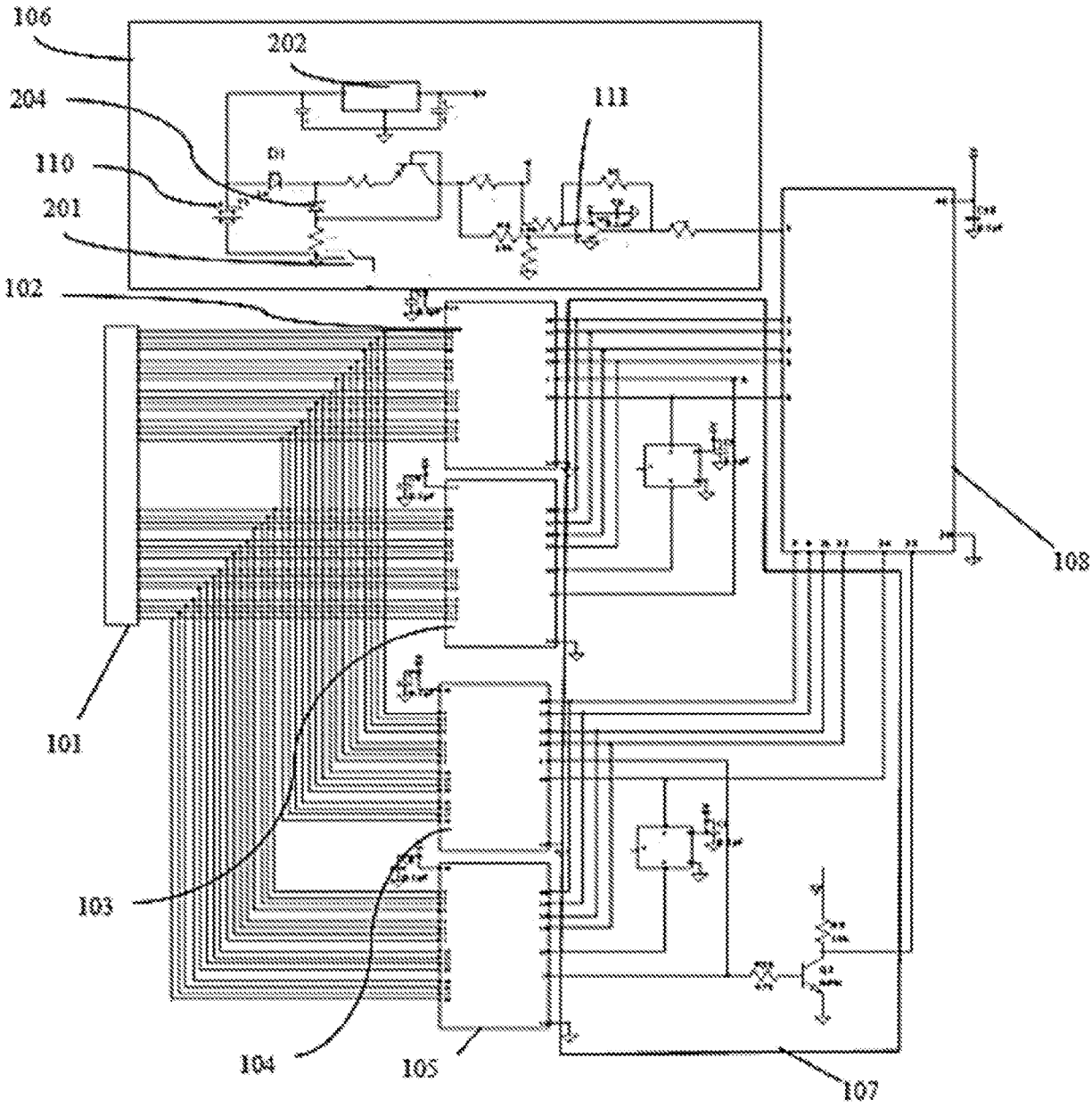

Fig.2 (a)

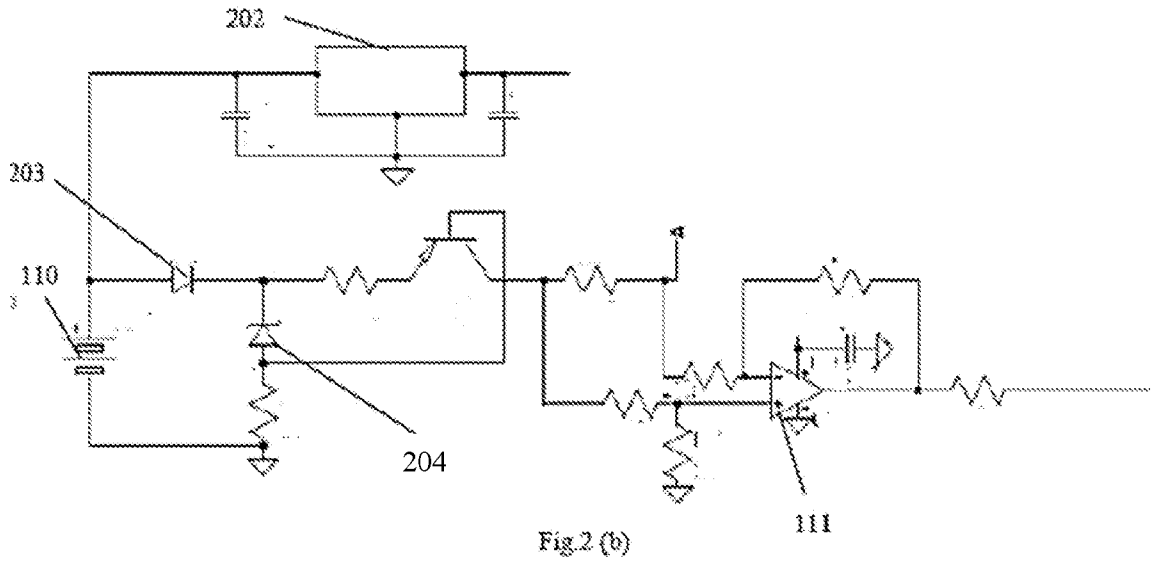

Fig.2 (b)

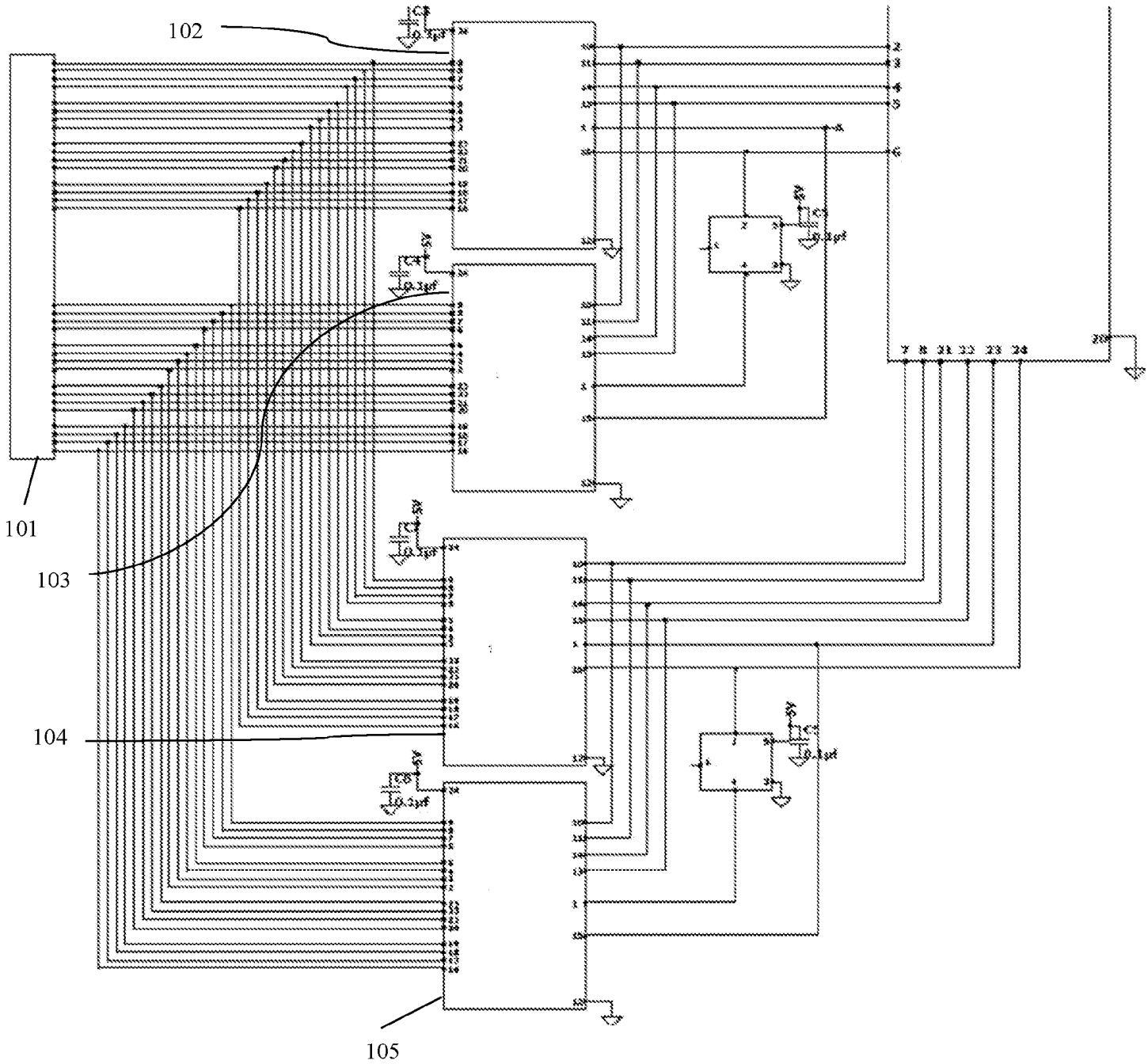

Fig.2 (c)

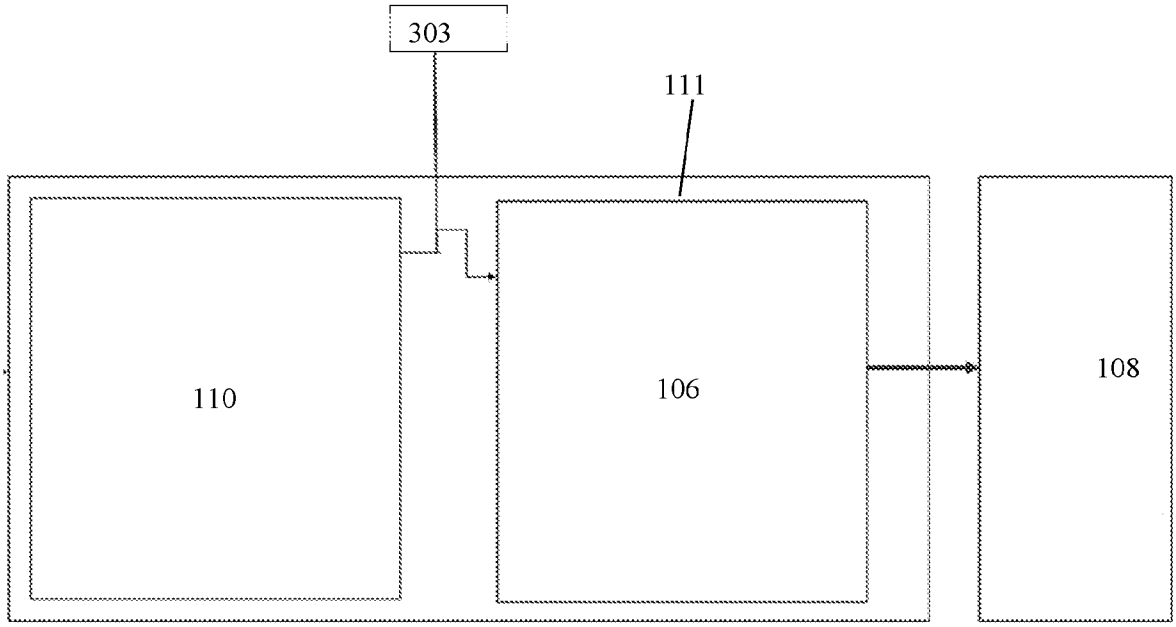

Fig.3

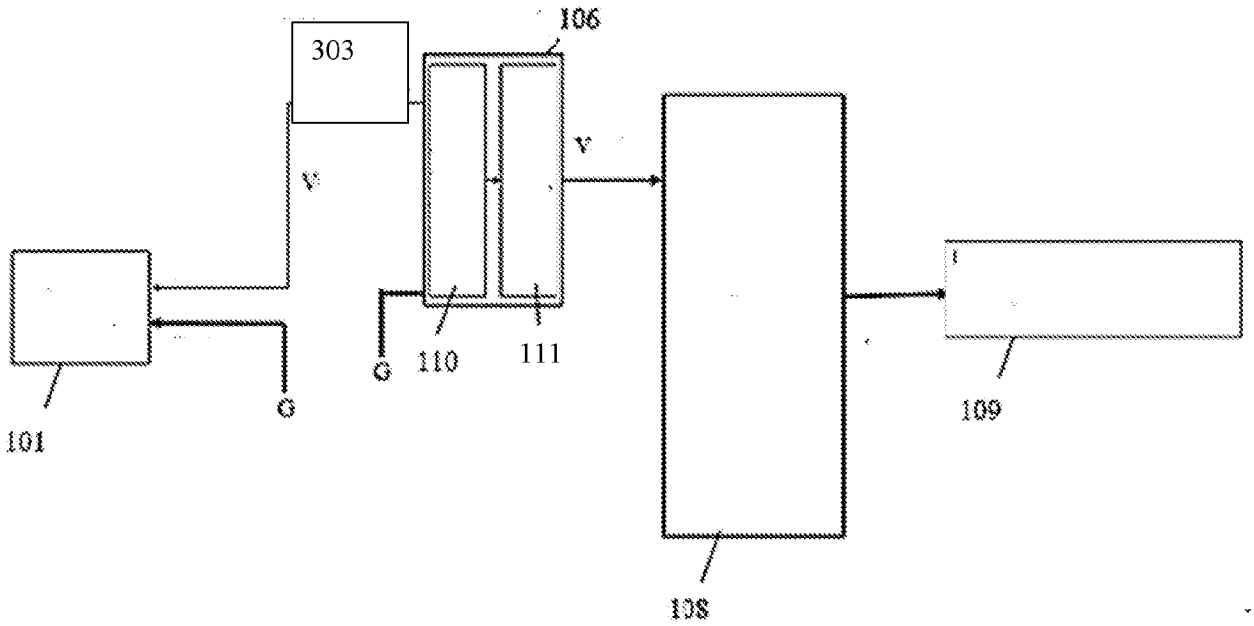

Fig.4

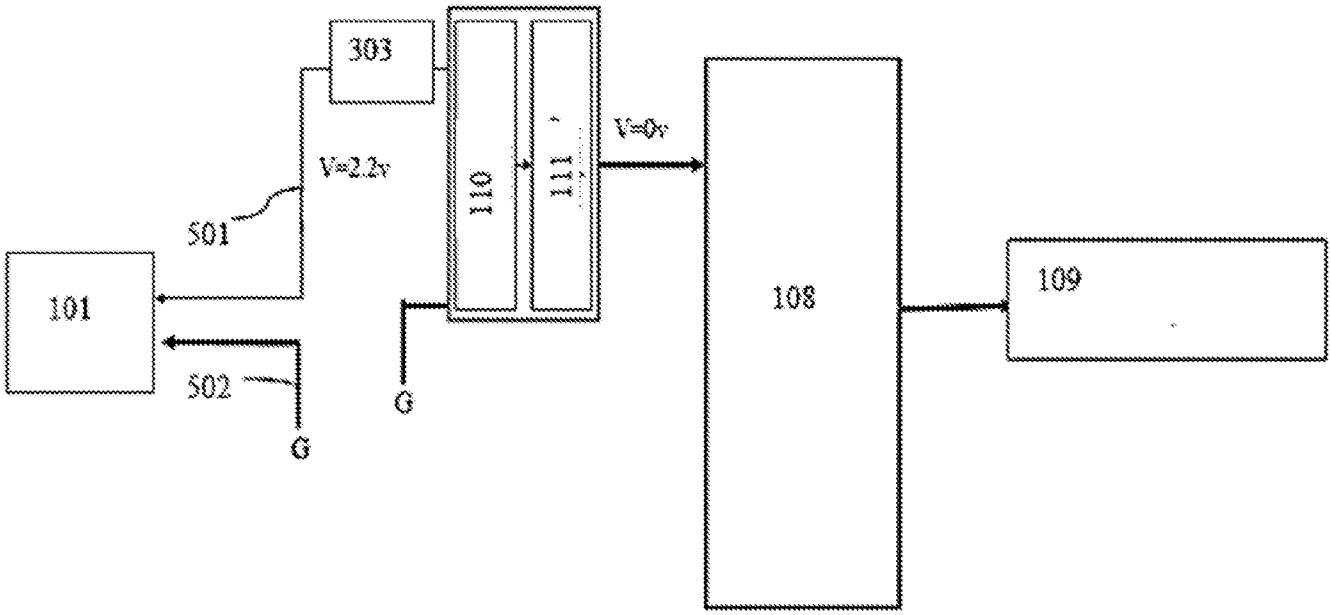

Fig.5

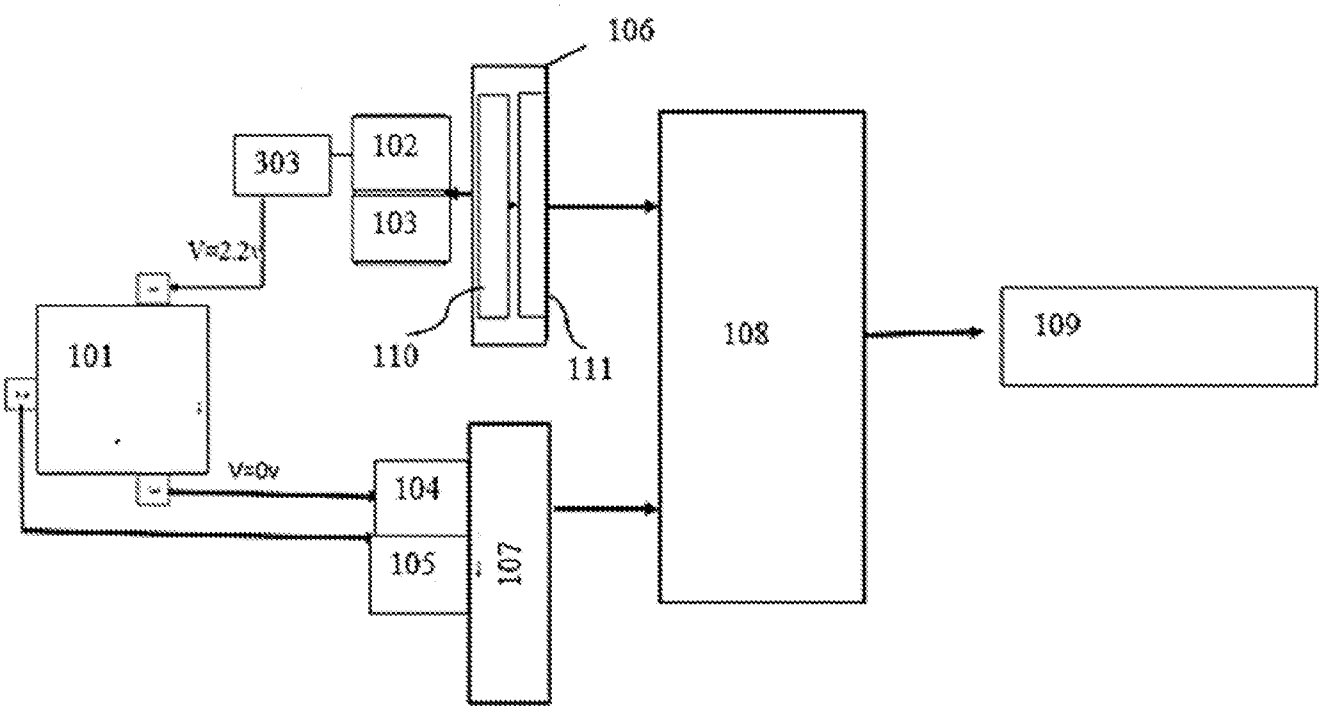

Fig.6

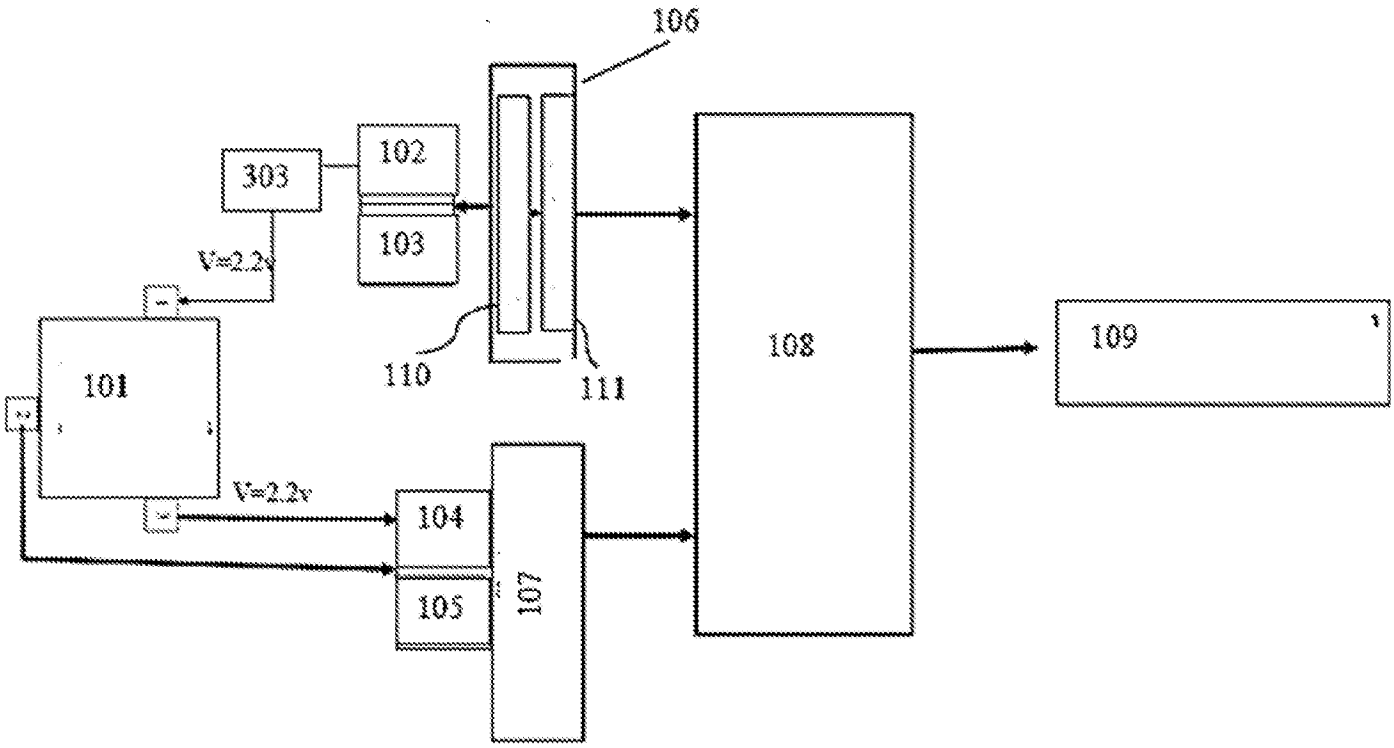

Fig.7

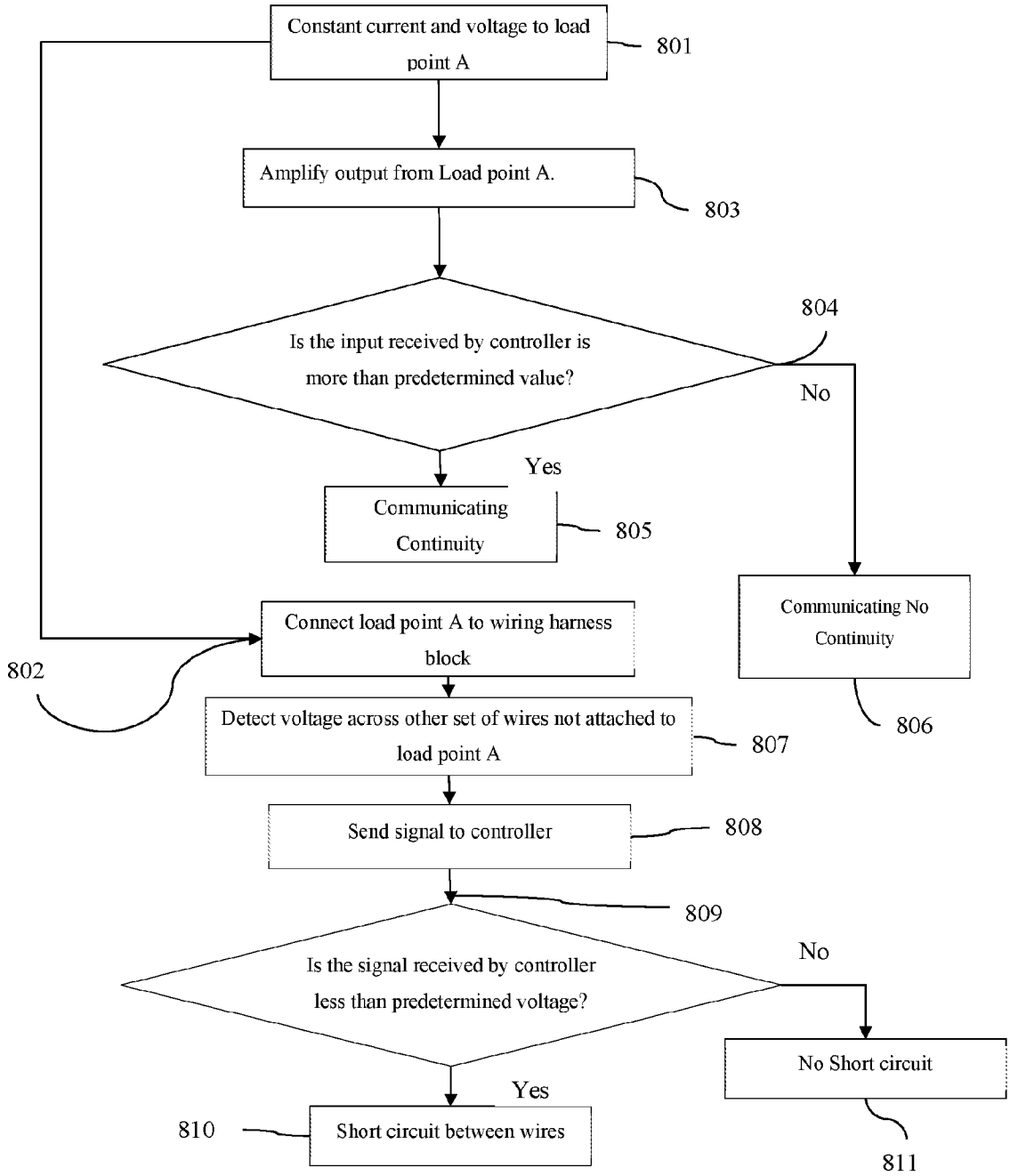
Constant current and voltage to load point A
801
Amplify output from Load point A.
803
Is the input received by controller is more than predetermined value?
804
No
Yes
Communicating Continuity
805
Communicating No Continuity
806
Connect load point A to wiring harness block
802
Detect voltage across other set of wires not attached to load point A
807
Send signal to controller
808
809
Is the signal received by controller less than predetermined voltage?
No
Yes
No Short circuit
811
Short circuit between wires
810

Fig.8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2022/050052

A. CLASSIFICATION OF SUBJECT MATTER
G01R31/00,G07C5/08 Version=2022.01

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)

G01R, G07C

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)

Databases- PatSeer, IPO Internal Database
Keywords- Automatic, Harness, Multiplexer, Short, Vehicle

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 107505326 A (TIANJIN SIBOKE TECH DEVELOPMENT CO LTD) 22 DECEMBER 2017 (22.12.2017) Abstract, Description(Entire), Claims 1-7, Fig. 1	1-20
Y	US 9658268 B2 (VITESCO TECHNOLOGY GMBH) 23 MAY 2017 (23.05.2017) Abstract, Description(Paragraphs 5-48), Claims 1-13, Fig. 1-5	1-20

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"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
06-05-2022	06-05-2022

Name and mailing address of the ISA/	Authorized officer
Indian Patent Office Plot No.32, Sector 14,Dwarka,New Delhi-110075 Facsimile No.	Arindam Poddar Telephone No. +91-1125300200

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/IN2022/050052

Citation	Pub.Date	Family	Pub.Date
US 9658268 B2	23-05-2017	DE 102012212123 A1	16-01-2014
		WO 2014009207 A1	16-01-2014
		CN 104583787 A	29-04-2015