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(57) An alarm system comprises a plurality of alarm devices (10) interconnected by an interconnect wire (IC), and a remote control unit (1). The remote control unit (1) modulating remote control signals on an interconnect wire (IC) linking the alarm devices (10), and the alarm device control circuits (50) perform operations in response to said signals. The remote control unit (1) applies to the interconnect wire (IC) a higher voltage level than that of alarm device interconnect signals. A switch (3) causes the high-voltage signal to be delivered on the

interconnect wire (IC) by connecting the mains supply to the interconnect wire (IC) via a capacitor (C1, C2) and a diode (CR2). The alarm device control circuits (50) operate in response to a remote control signal to test or hush, the associated devices or to suppress low-battery beeps. Also, a remote control unit (1) switch (2) and a circuit (4) operate in response to a user input to short the interconnect wire (IC) to a low voltage, so that interconnect signalling of the alarm devices (10) is prevented and only a device sensing an alarm condition sounds.



## Description

### INTRODUCTION

#### Field of the Invention

**[0001]** The invention relates to control of alarm devices such as heat, CO, or smoke alarm devices.

#### Prior Art Discussion

**[0002]** In recent years there have been increasing numbers of smoke alarms, heat alarms and carbon monoxide alarms installed. This is partly in response to legislation requiring up to four or more alarms, all interconnected, in new or significantly re-furbished properties. It is also due to the greater appreciation of the risks that fire and toxic CO gas pose. This has led to users wanting more control (including more accessible control) over the systems for tasks such as:

- testing the system regularly - recommended weekly,
- hushing the units if there are non emergency alarms,
- quickly locating which unit is in alarm, and
- suppressing low battery beeps for 12 hours.

**[0003]** Up to now some manufacturers have done this by running a separate wire from the alarm (a remote control "R" wire) and connecting this to 0 Volts at a remote switch at a convenient location on a wall. This is illustrated in Fig. A. This has a number of problems. For example, the alarm has to be modified mechanically to provide an extra terminal. This can require a special junction box, a "pattress" as shown, to connect it. This makes the unit much bulkier from a cosmetic point of view than it otherwise needs to be. Also, the installer has to run an extra wire, along with the mains wires and the interconnect wire (four wires not including earth). These alarms use non-isolated supplies - this means that all of the wiring between alarms has to be mains rated. This has led to the non-trivial problem of what colour wire to use for the remote control - ideally it should be of a different colour from the live, neutral and earth wires, to meet the regulations and also be readily available. This has led to at least one country (The Netherlands) to require an orange cable, simply for smoke alarm wiring purposes. This is generally more expensive than other wires and is not readily available in all electrical wholesalers.

**[0004]** The invention is directed towards providing improved remote control of alarm devices.

### SUMMARY OF THE INVENTION

**[0005]** According to the invention, there is provided an alarm system comprising a plurality of alarm devices interconnected by an interconnect wire and each having an environmental condition sensor and a control circuit, and a remote control unit, characterized in that the remote

control unit comprises means for modulating remote control signals on the interconnect wire linking the alarm devices, and each alarm device control circuit comprises means for performing operations in response to said signals.

**[0006]** In one embodiment, the remote control unit comprises means for modulating remote control signals according to voltage level.

**[0007]** In one embodiment, the remote control unit applies to the interconnect wire a higher voltage level than that of alarm device interconnect signals.

**[0008]** In one embodiment, the remote control unit comprises a switch for causing said high-voltage signal to be delivered on the interconnect wire.

**[0009]** In one embodiment, said switch connects a high voltage derived from the mains supply to the interconnect wire.

**[0010]** In one embodiment, the switch connects the mains supply to the interconnect wire via a capacitor and a diode.

**[0011]** In one embodiment, there are at least two capacitors in parallel.

**[0012]** In one embodiment, the alarm device control circuits comprise means for operating in response to a remote control signal to test the associated devices.

**[0013]** In one embodiment, the alarm device control circuits comprise means for operating in response to a remote control signal to hush the associated devices.

**[0014]** In one embodiment, the alarm device control circuits comprise means for operating in response to a remote control signal to suppress low-battery beeps.

**[0015]** In one embodiment, the remote control unit comprises a switch and a circuit for operating in response to a user input to short the interconnect wire to a low voltage, so that interconnection signalling between the alarm devices is prevented and only a device sensing on alarm condition sounds.

**[0016]** In one embodiment, said switch is spring-biased to a default position at which the interconnect wire is not pulled to a low voltage.

**[0017]** In one embodiment, the circuit applies a turn-on voltage to a transistor to link the interconnect wire to ground when the switch is pressed.

**[0018]** In one embodiment, said voltage is applied by a capacitor and the circuit charges said capacitor from the interconnect line when it is high due to some smoke alarm being in alarm.

**[0019]** In one embodiment, the transistor turn-on voltage is prevented if a test or hush operation is required.

**[0020]** In one embodiment, a test or hush switch of the remote control unit, when pressed, shorts the capacitor.

**[0021]** In one embodiment, sensors are smoke or heat sensors.

## DETAILED DESCRIPTION OF THE INVENTION

### Brief Description of the Drawings

**[0022]** The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 shows interconnected smoke alarms connected by three wires to a wall-mounted remote control unit;

Fig. 2 is a circuit diagram of a remote control unit of the invention; and

Fig. 3 is a circuit diagram of circuitry of a smoke alarm device of the invention for interfacing with the remote control unit.

### Description of the Embodiments

**[0023]** Smoke alarm devices typically have an interconnect line that is already wired. The invention provides an alarm system including a remote control unit and interfaces in the alarm devices which handle remote control signals on the interconnect line. This means that alarm systems can be readily provided with remote control by simply sliding the existing alarm devices off their mounting plates and replacing them with alarm devices of the invention, and fitting the control units.

**[0024]** A remote control unit 1 is shown in Figs. 1 and 2. It fits into a conventional two-switch mains box similar to that used for lighting in houses. The unit 1 has a Locate switch 2 and a Test/Hush switch 3. An alarm system is completed by alarm devices 10 having circuitry 50 shown in Fig. 3 for remote control processing, and wiring 20.

**[0025]** In summary, the unit 1 may be wall-mounted at a convenient location such as where a light switch would be located. When the user presses the Test/Hush switch 3 a higher-than-normal voltage (15V) is delivered to the alarm devices 10 via the interconnect line. The interface circuit 50 (Fig. 3) performs test or hush operations as appropriate in response to the received 15V. When the user presses the switch 2, the interconnect line is pulled to ground, thus stopping devices from alarming with the exception of that which has detected smoke.

**[0026]** The devices 10 use the interconnect line for signals to all other devices 10 to alarm. For clarity, only two alarm devices are shown in Fig.1, however in practice there are typically several more than this number. The devices 10 use a voltage in the range of 4 Volts up to the alarm DC supply voltage, typically about 11 Volts for interconnect signalling. In the invention, this same wire is used by the remote control unit 1 to cause the devices 10 to test themselves by checking their chambers. This is done by putting a 15 Volts signal on the interconnect line to trigger the device's circuit, which has a 13 Volt

threshold. The 15 volts DC is readily generated by the unit 1 from the 230VAC mains circuit. This has a further benefit as it checks that the mains is present, as the unit 1 will not trigger the devices 10 if the mains is off, as the 15 Volts DC will not be generated.

**[0027]** In more detail, referring to Figs. 2 and 3, the 15 Volts DC is generated when the switch 3 connects the mains to mains dropping capacitors C1 and C2, a power-limiting resistor R1, a rectifier diode CR2, and a zener diode CR1. This 15 Volts on the interconnect line is delivered to the smoke alarm devices 10.

**[0028]** A Locate circuit 4 is also included in the unit 1. The (spring loaded) Locate switch 2 by default connects the interconnect line (which will have about 8 volts on it when any interconnected device 10 on it is in alarm) to charge an electrolytic capacitor C3. When the switch 2 is pressed, against the spring bias, this voltage is applied to the gate of an FET Q1, through R5, turning Q1 on. Q1 therefore shorts the interconnect line to Neutral, bringing it to almost 0 volts, thus silencing all of the interconnected devices 10 apart from the device 10 sensing smoke/fire/CO. The user can then hear just the device which is sounding and so immediately locate the source of the alarm and take appropriate action. After about 10 minutes, the resistors R5 and R6 will discharge the capacitor C3 and so the FET Q1 will turn off thus restoring the system to normal standby.

**[0029]** A possible problem with the circuit 4 is that with C3 charged, then the interconnect will not operate when the Test/Hush switch 3 is pressed. The user may then think the system is defective. However, when the Test/Hush switch 3 is pressed, a transistor Q2 is turned on through a diode CR3 and a resistor R3, and it discharges C3, thus removing the short from the interconnect line. A diode CR2 and a resistor R1 ensure that there is sufficient voltage to turn on Q2 with the FET Q1 on.

**[0030]** From Fig. 3 it can be seen that the 15 Volts delivered by the unit 1 turns on a transistor Q53 and this along with R51 provides a suitable pull down voltage for smoke alarms with ionisation smoke chambers. A 12 Volt zener diode CR6 prevents a transistor Q53 from turning on unless the voltage is above about 13 Volts - preventing the combined Test/Hush feature from being activated with an interconnect signal, which only goes to 10 Volts. Q53 also turns on Q52 and this provides a pull up voltage to first test ionisation devices and then after the switch is released to put the devices into hush mode for 10 minutes, by pulling the relevant smoke IC pin high.

**[0031]** For smoke alarm devices with optical chambers just Q52 turning on is all that is needed, as this activates the combined test and hush button input pin on the smoke I.C.

**[0032]** To avoid clamping the 15 Volts, thus preventing it turning on transistor Q53 and not allowing it to work, a high resistor (R51, about 10,000 ohms) limits the current in series on the interconnect line. However, this high resistance would also very significantly reduce the current, normally over 5mA, from the I.C. used to turn on other

interconnect alarms. This problem is overcome by adding a diode CR52 across the resistor R51.

**[0033]** A further feature that can be activated by the remote control unit 1 is the suppression of low battery beeps for 12 hours. Smoke alarm devices with replaceable batteries often start giving low battery beeps at about 5.00am in the morning as this is when the house is typically coolest and the battery voltage lowest - much to the annoyance of the awakened user. The remote control unit of the invention activates the Test/Hush mode, and so pressing the Test/Hush switch will also suppress the low battery beeps for 12 hours on these types of alarms. This is far easier than going around to all the ceiling mounted units (there could be twelve units or more) in the system and pressing all their buttons. Pressing the remote Test/Hush switch 3, which is connected to all the devices, will do this easily with just one button press.

**[0034]** The invention is not limited to the embodiments described but may be varied in construction and detail. For example, the interconnect line may be used for Test and Hush with separate voltage levels rather than a combined single level. Also, in an alternative embodiment signals may be modulated with frequency or pulsing control rather than intensity levels as described above.

#### Claims

1. An alarm system comprising a plurality of alarm devices (10) interconnected by an interconnect wire (IC) and each having an environmental condition sensor and a control circuit, and a remote control unit (1), **characterized in that** the remote control unit (1) comprises means (2, 3, 4) for modulating remote control signals on the interconnect wire (IC) linking the alarm devices (10), and each alarm device control circuit comprises means (50) for performing operations in response to said signals.
2. An alarm system as claimed in claim 1, wherein the remote control unit (1) comprises means for modulating remote control signals according to voltage level.
3. An alarm system as claimed in claim 2, wherein the remote control unit (1) applies to the interconnect wire (IC) a higher voltage level than that of alarm device interconnect signals.
4. An alarm system as claimed in claim 3, wherein the remote control unit (1) comprises a switch (3) for causing said high-voltage signal to be delivered on the interconnect wire (IC).
5. An alarm system as claimed in claim 4, wherein said switch (3) connects a high voltage derived from the mains supply to the interconnect wire (IC).
6. An alarm system as claimed in claim 5, wherein the switch (3) connects the mains supply to the interconnect wire (IC) via a capacitor (C1, C2) and a diode (CR2).
7. An alarm system as claimed in claim 6, wherein there are at least two capacitors (C1, C2) in parallel.
8. An alarm system as claimed in any preceding claim, wherein the alarm device control circuits comprise means (50) for operating in response to a remote control signal to test the associated devices.
9. An alarm system as claimed in any preceding claim, wherein the alarm device control circuits comprise means (50) for operating in response to a remote control signal to hush the associated devices.
10. An alarm system as claimed in any preceding claim, wherein the alarm device control circuits comprise means (50) for operating in response to a remote control signal to suppress low-battery beeps.
11. An alarm system as claimed in any preceding claim, wherein the remote control unit (1) comprises a switch (2) and a circuit (4) for operating in response to a user input to short the interconnect wire (IC) to a low voltage, so that interconnection signalling between the alarm devices (10) is prevented and only a device sensing on alarm condition sounds.
12. An alarm system as claimed in claim 11, wherein said switch (2) is spring-biased to a default position at which the interconnect wire (IC) is not pulled to a low voltage.
13. An alarm system as claimed in claims 11 or 12, wherein the circuit (4) applies a turn-on voltage to a transistor (Q1) to link the interconnect wire to ground when the switch (2) is pressed.
14. An alarm system as claimed in claim 13, wherein said voltage is applied by a capacitor (C3) and the circuit (4) charges said capacitor from the interconnect line when it is high due to some smoke alarm being in alarm.
15. An alarm system as claimed in claim 14, wherein the transistor (Q1) turn-on voltage is prevented if a test or hush operation is required.
16. An alarm system as claimed in claim 15, wherein a test or hush switch (3) of the remote control unit, when pressed, shorts the capacitor.
17. An alarm system as claimed in any preceding claim, wherein the sensors are smoke or heat sensors.

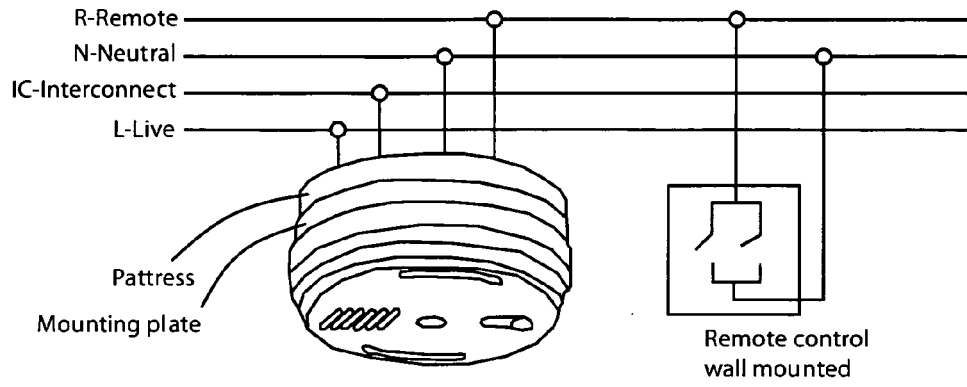


Fig. A Prior Art

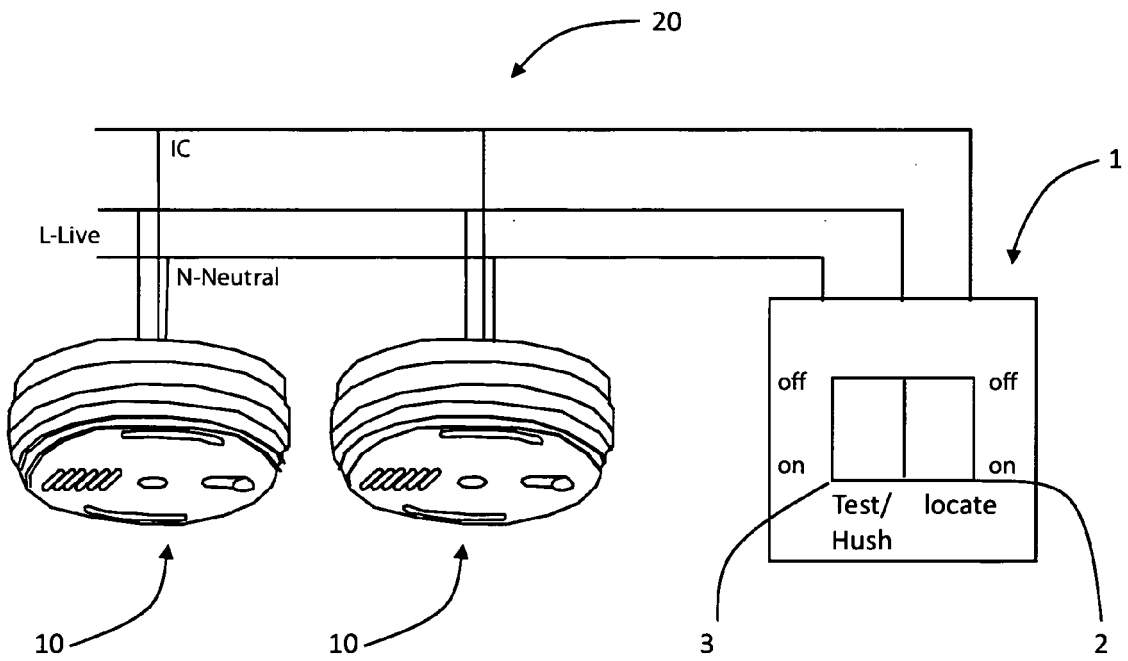


Fig. 1

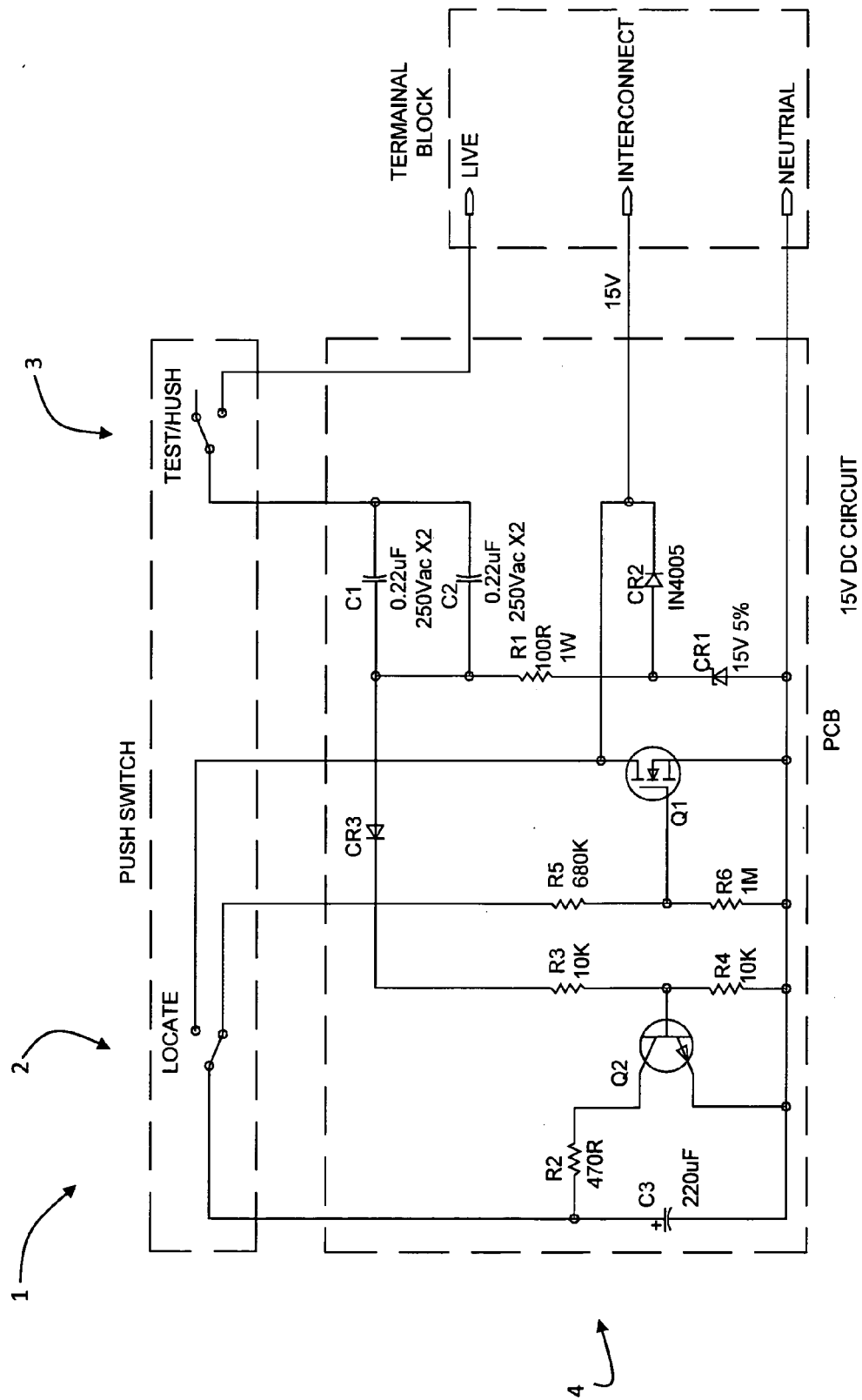


Fig. 2

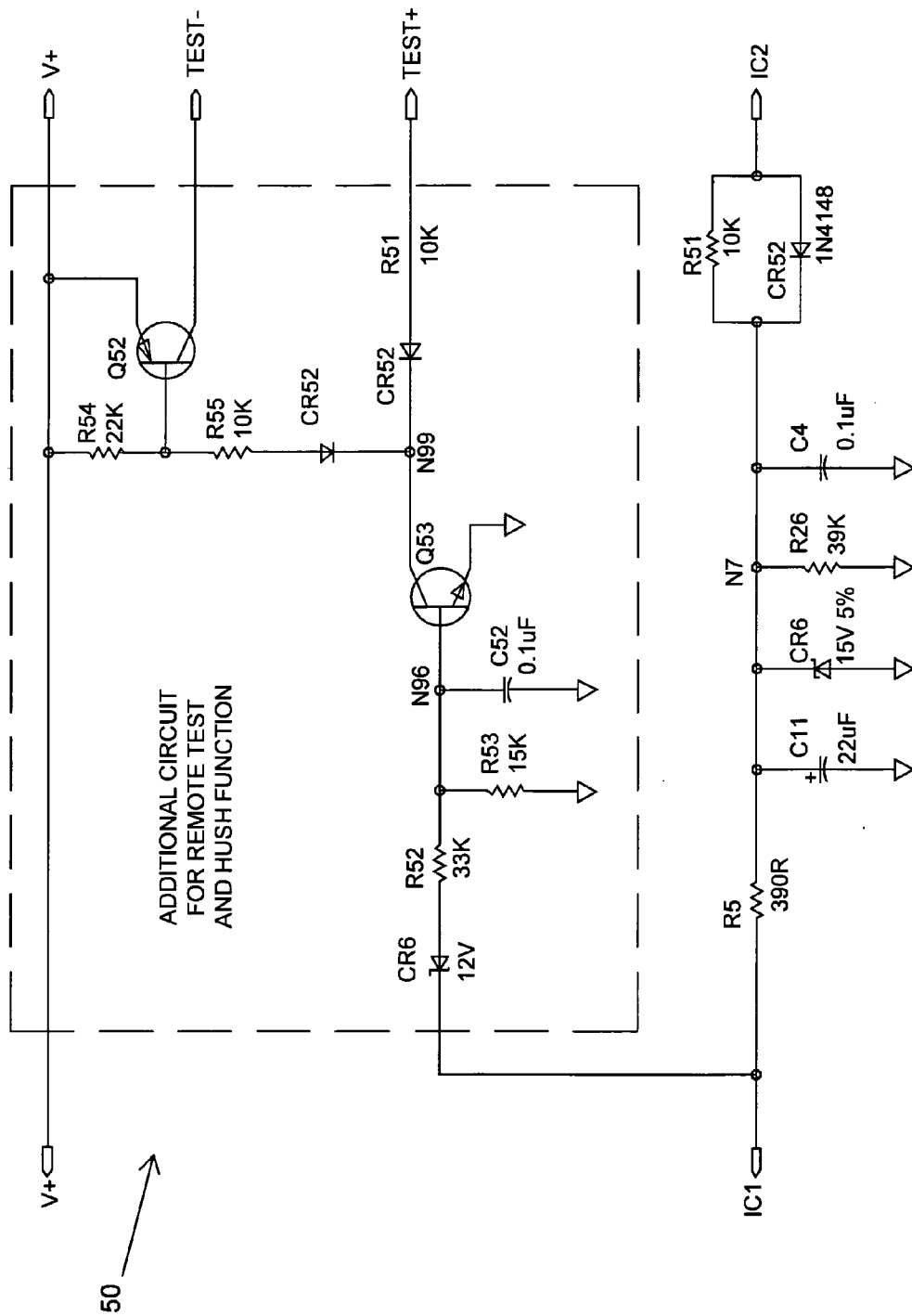


Fig. 3