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(52) UK CL (Edition J)
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H2H HLL3 H22G H23G H24B H25G H25Q

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) H2F FSC FSX FXS FXX, H2H HLL3
INT CL⁴ H02M, H03K, H05B

(54) Signal conditioning device

(57) A triac in the supply line from an ac source to a load is triggered by the use of two series back-to-back zener diodes from the supply source. The triac may be replaced by equivalents such as two SCRs or their respective transistor equivalents. The zener diodes have a resistor in series with them, and have breakdown voltages in the range 2 volts to 250 volts. A varistor is across the output. The circuit is applied to powering LEDs, which may be flashed.

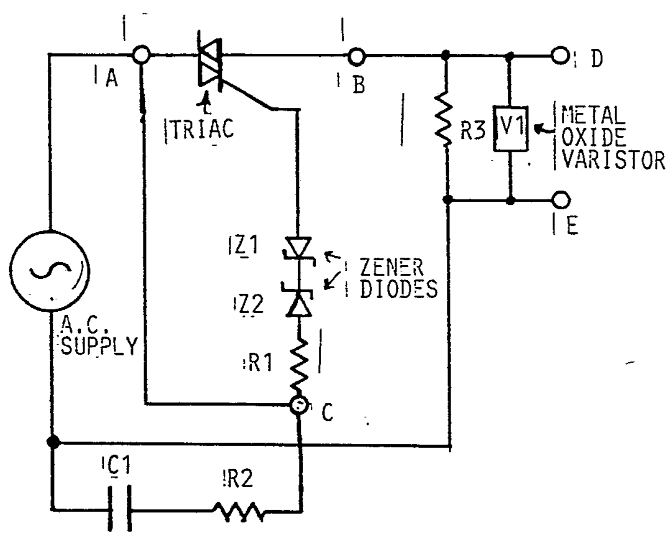

FIGURE 1

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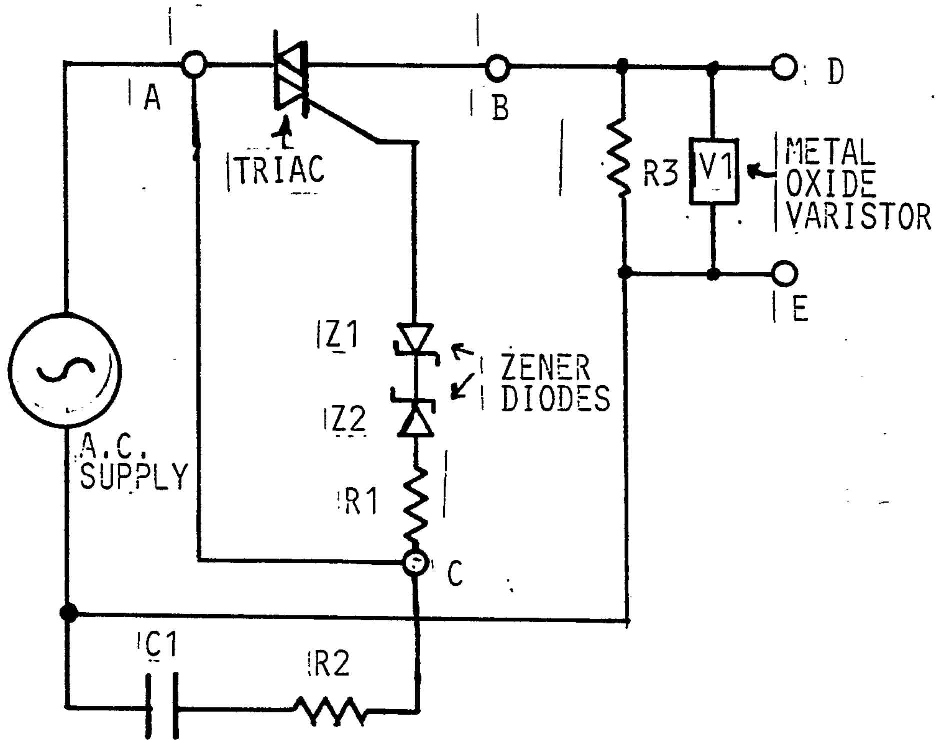


FIGURE 1

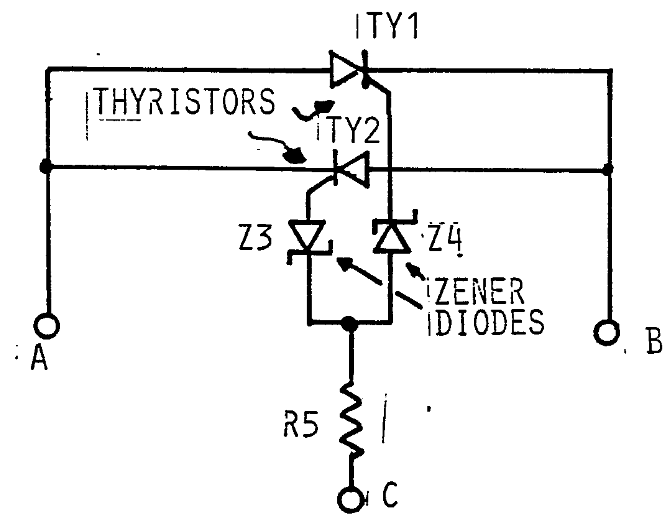


FIGURE 1A

2220533

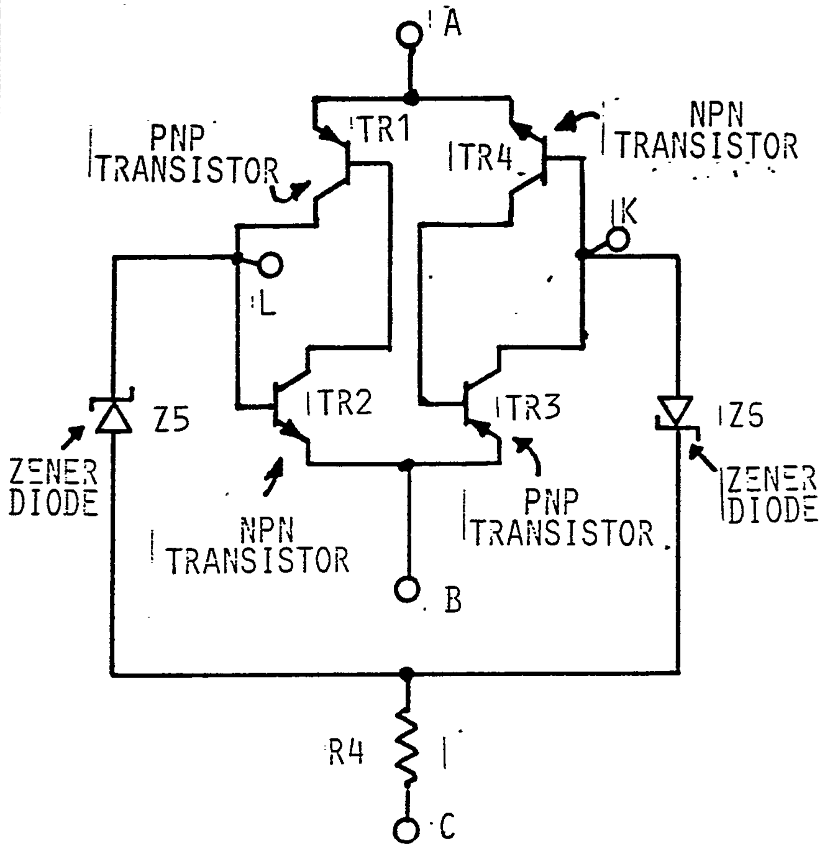


FIGURE 1B

DRAWING 2 OF 7

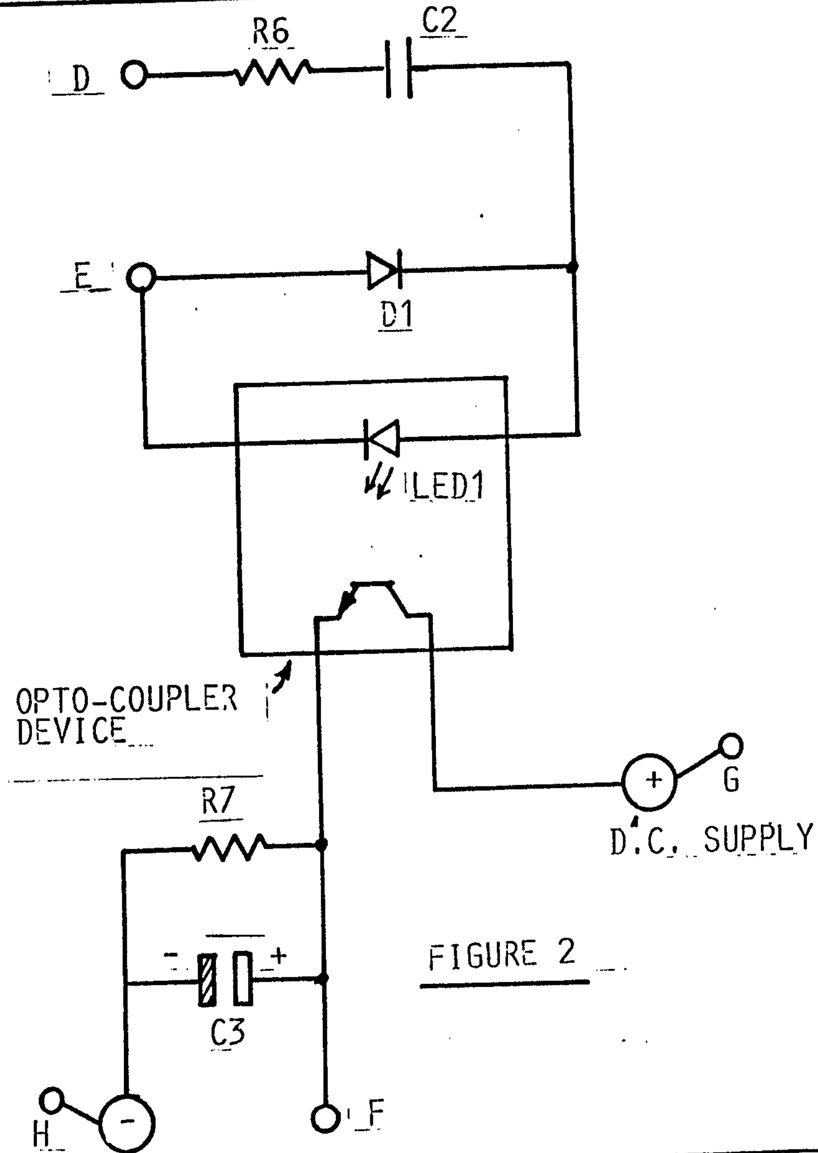


FIGURE 2

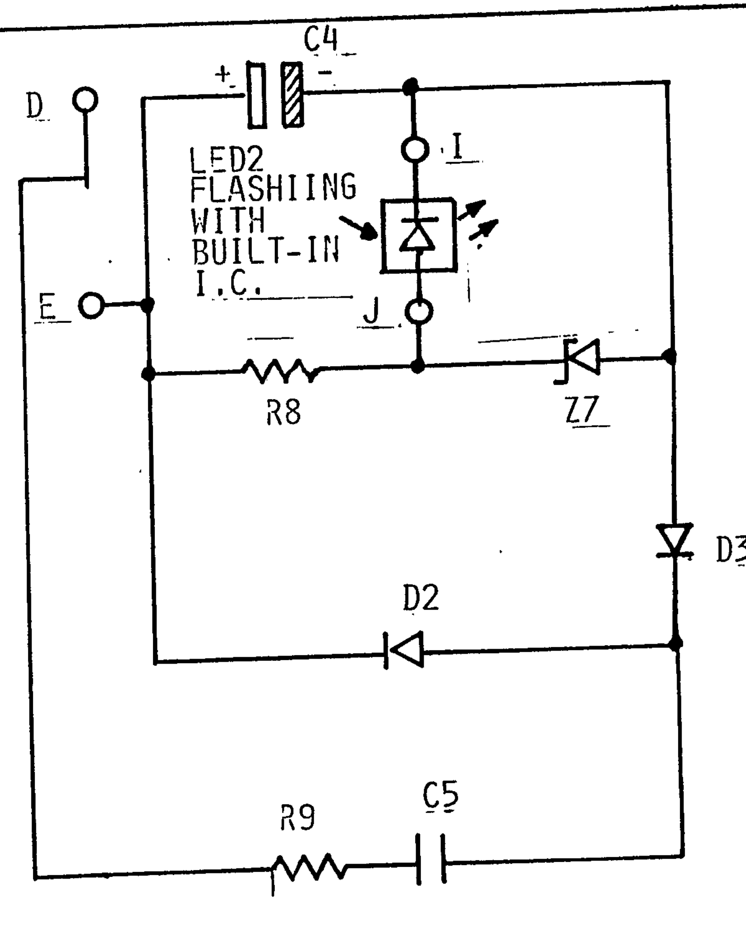


FIGURE 3

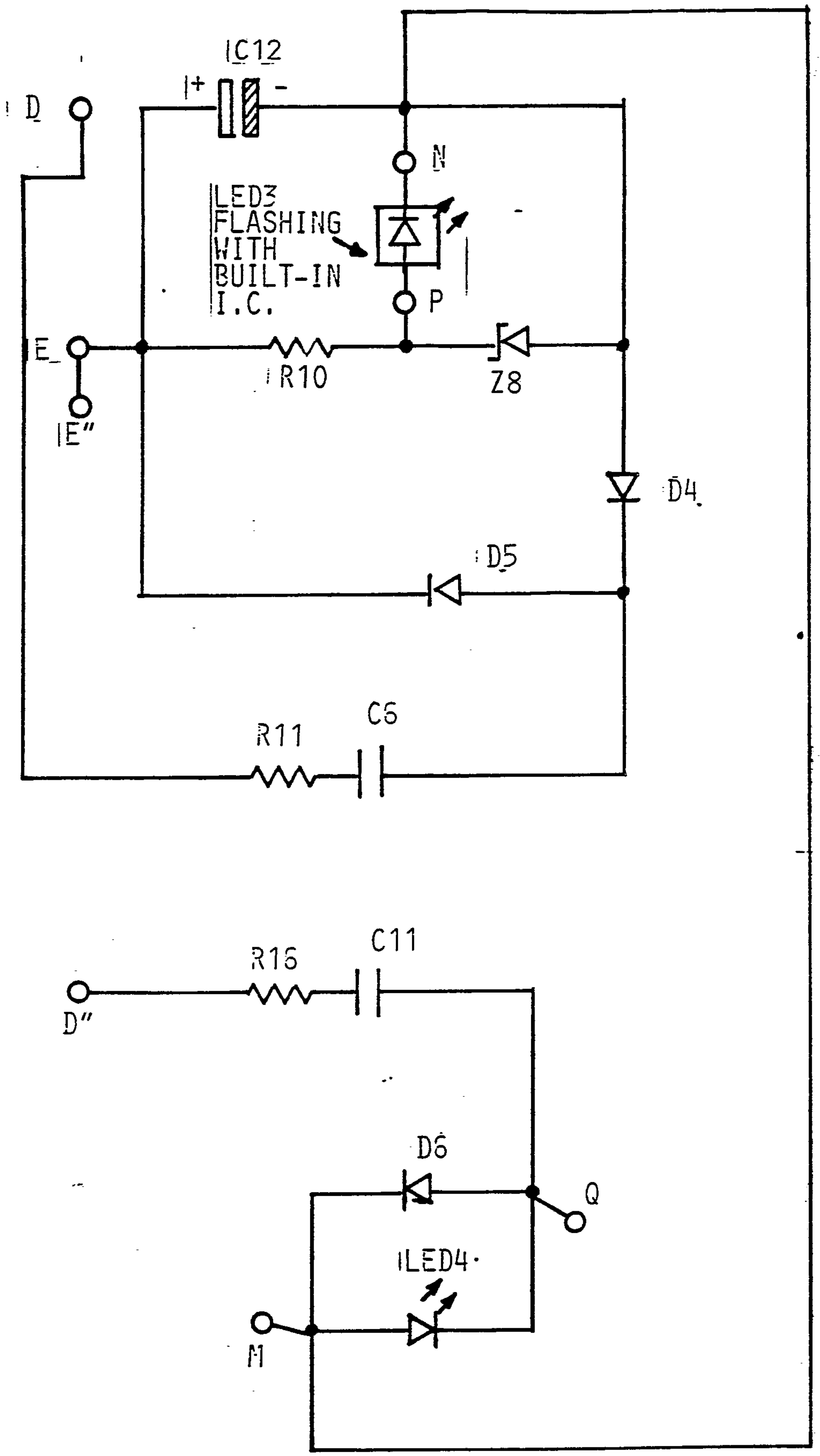

IC12
+
-
D
N
LED3
FLASHING
WITH
BUILT-IN
I.C.
P
E
R10
Z8
E"
D4
D5
R11
C6
R16
C11
D"
D6
Q
LED4
M

FIGURE 4

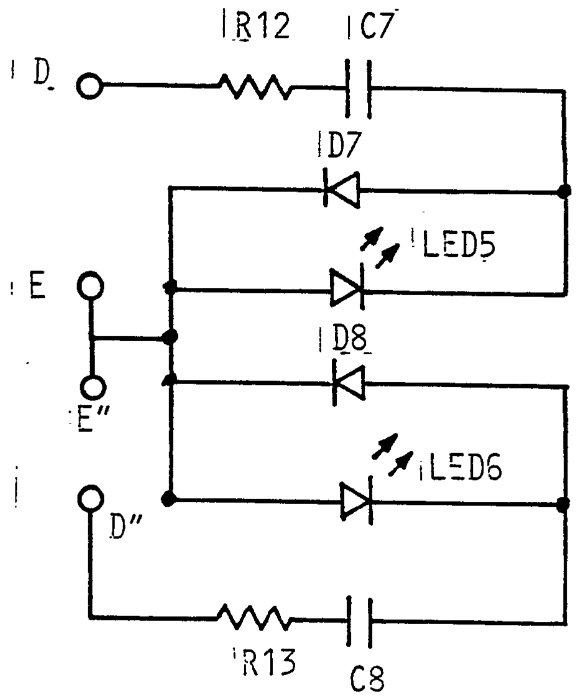


FIGURE 5

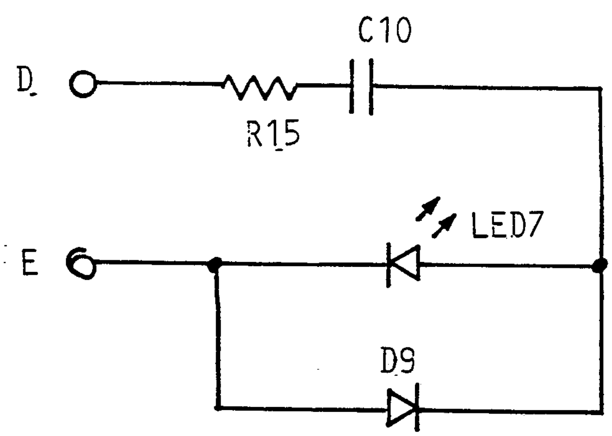
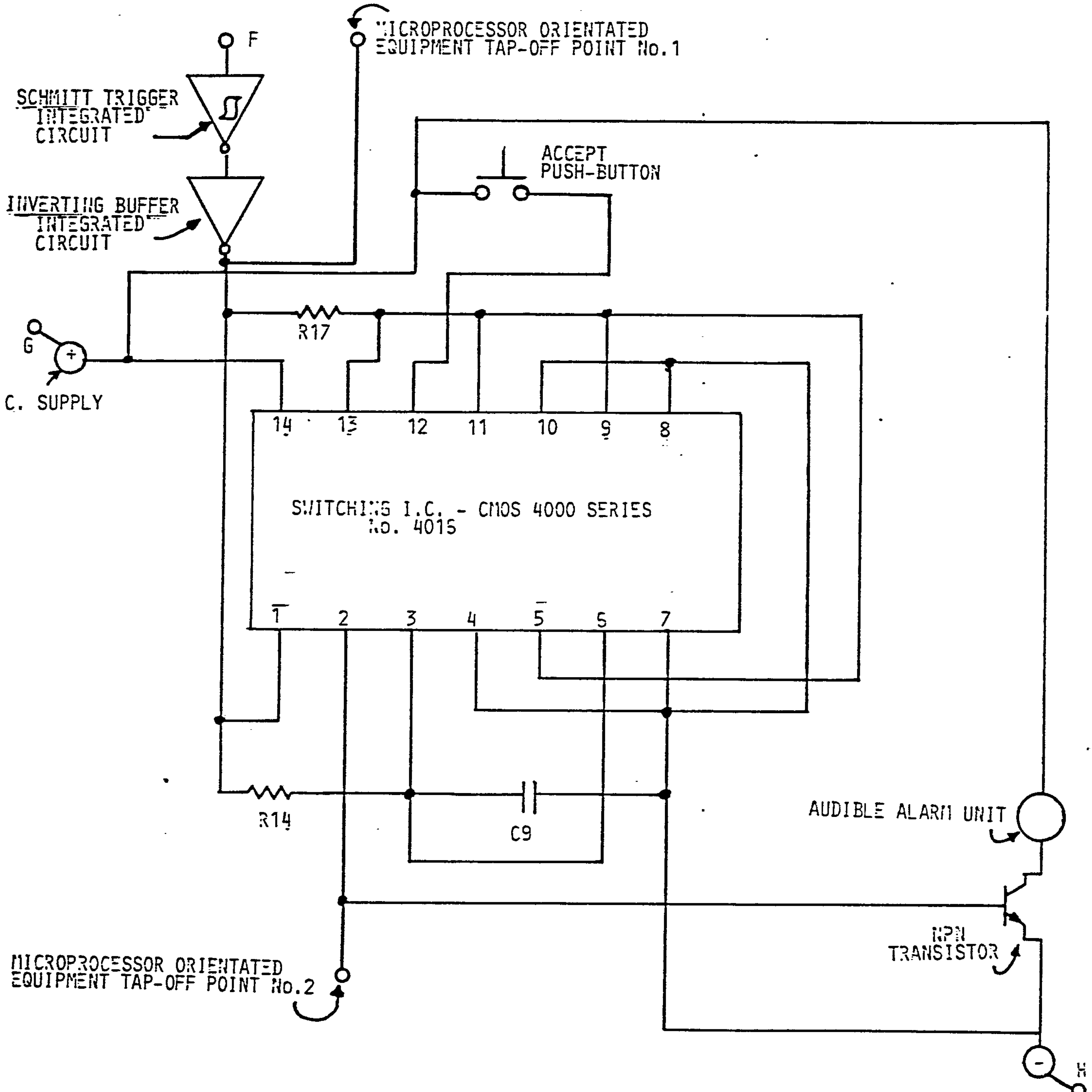


FIGURE 6



DRAWING 6 OF 7 FIGURE 7

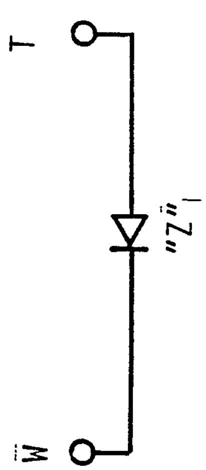


FIGURE 8

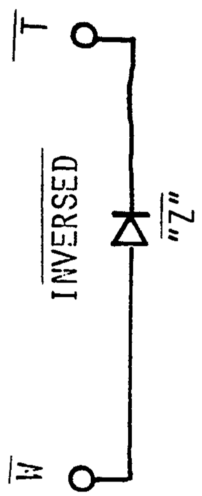


FIGURE 8A

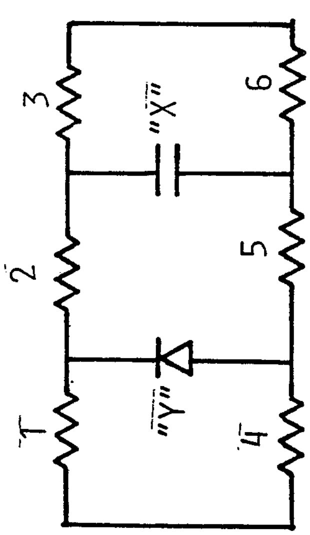


FIGURE 9

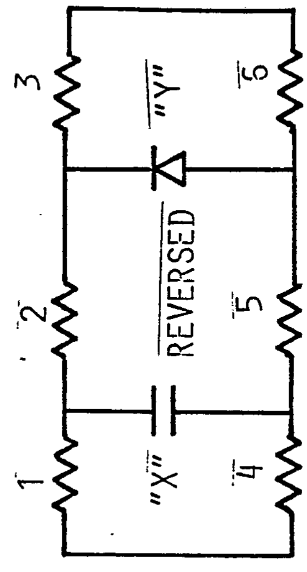


FIGURE 9A

This invention relates to a signal conditioning device for electric-reactively driving in a practical manner a family of semiconductor devices commonly known as LIGHT EMITTING DIODES, (hereinafter referred to as LED´s), by means of an alternating current and voltage, (hereinafter referred to as a.c. or a.c. power sources, or the mains), and operating with electrical pressures of upto 250 Volts.

If electric-reactive fed LED devices are to be driven in a practical manner from a.c. sources then it is important to provide a device which is able to condition and act upon the various forms and types of a.c. signals and power sources which may present themselves as inputs with the eventual aim of driving LED devices in an electric-reactive manner.

According to the present invention there is provided a signal conditioning device to operate at a.c. voltages of upto 250 Volts and comprising a triac, two zener diodes, a suppression type 250 V a.c. capacitor, three resistances and a metal oxide varistor suppression device configured and arranged in accordance with figure 1.

The various types of LED devices for which the present invention operates upon are as described as follows:

1. An LED contained within an opto coupler device, which is a semiconductor device which contains an LED and a light sensitive circiut electrically isolated from the LED. The light sensitive circuit reacts accordingly to the active or passive state of the LED.

2. An LED which contains within its body an integrated circuit which is inserted to innovate control of the active or passive state of the LED, commonly known as flashing LED´s.

3. An LED which, as above, is a flashing LED but which also incorporates within its body a second independent, LED, usually operating at a different electromagnetic radiation wavelength, (a different colour). The second LED may or may not have common electrical connection points with the first

flashing LED. Both LED´s may operate concurrently.

4. A tricolour LED comprising of two LED´s operating independently and at different wavelengths and contained within the same body and where both LED´s may operate concurrently. The two LED´s may or may not have a common electrical connection point.

5. Ordinary LED´s of various brightness.

6. LED´s similar in construction to 1 to 5 above but operating at various different wavelengths

According to the present invention the salient points of the various circuits described are as follows:

1. The circuits which surround and interact electrically and optically with the signal conditioning device.

2. The identification of critical connection points or nodes.

3. The orientation and bias of certain key components.

4. Substitute sub-circuits which may be introduced into the existing sub-circuits of the signal conditioning device.

The specific embodiment of the invention will now be described by way of conventional circuit diagrams where for each circuit a description of its function is given in addition to its inter-connection, direct or indirectly through another circuit, to the signal conditioning device.

Figure 1 shows the signal conditioning circuit with electrical nodes A, B, C, D & E. The sub-circuit formed by the bounding nodes A, B & C comprise the triac, the two zener diodes and the resistance R1 which will henceforth be referred to as sub-circuit No. 1.

Figure 1a. and 1b. show alternative sub-circuits which may be inserted in place of sub-circuit No. 1 in figure 1. In both figures 1a. and 1b. the electrical nodes A, B & C are shown which denote their connections to similarly lettered electrical nodes in figure 1 when substituted for sub-circuit No. 1.

Figure 2 shows the basic connection to an optocoupler device. Electrical nodes D & E denote the connection points to similarly labelled electrical nodes at the signal conditioning device in figure 1.

Figure 3 shows the basic connection to a single flashing LED with a built in integrated circuit to cause the device to oscillate between its various states. Electrical nodes D & E denote the connection points to similarly labelled electrical nodes at the signal conditioning device in figure 1.

Figure 4 shows the basic connection to a flashing LED which in addition to a built in integrated circuit also contains a second LED within its body. Electrical nodes D & E denote the connection points to similarly labelled electrical nodes at the signal conditioning device in figure 1. Electrical nodes D" & E" denote the connection points to similarly positioned electrical nodes as those shown in the signal conditioning device in figure 1 but in a second signal conditioning device.

Figure 5 shows the basic connection to a tricolour LED. Electrical nodes D & E denote the connection points to similarly labelled electrical nodes at the signal conditioning device in figure 1. Electrical nodes D" & E" denote the connection points to similarly positioned electrical nodes as those shown in the signal conditioning device in figure 1 but in a second signal conditioning device.

Figure 6 shows the basic connection to an ordinary LED. Electrical nodes D & E denote the connection points to similarly labelled electrical nodes at the signal conditioning device in figure 1.

Figure 7 shows the basic connection to an audible alarm unit. Electrical nodes F, G & H denote the connection points to similarly labelled electrical nodes at the opto-coupler connection diagram in figure 2.

1. A signal conditioning device to operate at a.c. voltages of upto 250 Volts and comprising a triac, two zener diodes, a suppression type 250 V a.c. capacitor, three resistances and a metal oxide varistor suppression device configured and arranged in accordance with figure 1.

2. A signal conditioning device as claimed in claim 1 wherein the breakdown voltage of the zener diodes depicted in figure 1 may range from 2 Volts to 250 Volts and rated upto 2,500 Watts or the zener diodes may be substituted for other diodes using the zener principle and such diodes as Epitaxial reference diodes or Silicon planer zener diodes or Encapsulated alloy junction silicon planer reference diodes all with similar breakdown voltages and power ratings; and/or the connection of the zener diodes shown in figure 1 are anode connected to anode and the combination remain connected to one end of the resistance R1 and the gate connection of the triac.

3. A signal conditioning device as claimed in claim 1 or claim 2 wherein the relative positions of the resistance R1 and the two zener diode combination are reversed; and/or the connections of MT1 and MT2, with respect to the triac, are inversed.

4. A signal conditioning device as claimed in claim 1 or claim 2 or claim 3 wherein the relative positions of the resistance R2 and the capacitor C1 are reversed; and/or the capacitor C1 may be short-circuited or the resistance R2 may be short-circuited.

5. A signal conditioning device as claimed in claim 1 or claim 2 or claim 3 or claim 4 wherein the relative positions of the resistance R3 the metal oxide varistor are reversed.

6. A signal conditioning device as claimed in claim 1 wherein the circuit described in figure 1a is substituted for the triac, the two zener diode combination and the resistance R1

in the circuit described in figure 1 and the means of the substitution being where the nodes A, B & C described in figure 1a are connected to the nodes A,B & C described in figure 1 and the breakdown voltage of the zener diodes depicted in figure 1a may range from 2 Volts to 250 Volts and rated upto 2,500 Watts or the zener diodes may be substituted for other diodes using the zener principle and such diodes as Epitaxial reference diodes or Silicon planer zener diodes or Encapsulated alloy junction silicon planer reference diodes all with similar breakdown voltages and power ratings.

7. A signal conditioning device as claimed in claim 6 wherein referring to figure 1a the zener diode Z3 has its cathode connected to the gate terminal of thyristor TY2 and the zener diode Z4 has its anode connected to the gate terminal of thyristor TY1; and/or a separate resistance is supplied to be connected between node C and zener diode Z3 and a separate resistance is supplied to be connected between node C and zener diode Z4 or if the resistance R5 is left in place then the connection of the two separate resistances being to one side of R5 instead of node C; or a separate resistance is supplied to be connected between the gate terminal of thyristor TY2 and zener diode Z3 and a seperate resistance is supplied to be connected between the gate terminal of thyristor TY1 and zener diode Z4 with or without the resistance R5 left in place; and/or the relative positions of nodes A & B as shown in figure 1a are reversed.

8. A signal conditioning device as claimed in claim 1 wherein the circuit described in figure 1b is substituted for the triac, the two zener diode combination and the resistance R1 in the circuit described in figure 1 and the means of the substitution being where the nodes A, B & C described in figure 1b are connected to the nodes A,B & C described in figure 1 and the breakdown voltage of the zener diodes depicted in figure 1b may range from 2 Volts to 250 Volts and rated upto 2,500 Watts or the zener diodes may be substituted for other diodes using the zener principle and such diodes as Epitaxial reference diodes or Silicon planer

zener diodes or Encapsulated alloy junction silicon planer reference diodes all with similar breakdown voltages and power ratings.

9. A signal conditioning device as claimed in claim 8 wherein referring to figure 1b the relative positions of the zener diode Z5 and the zener diode Z6 are reversed; and/or a separate resistance is supplied to be connected between node C and zener diode Z5 and a separate resistance is supplied to be connected between node C and zener diode Z6 or if the resistance R4 is left in place then the connection of the two separate resistances being to one side of R4 instead of node C; or a separate resistance is supplied to be connected between node L and zener diode Z5 and a separate resistance is supplied to be connected between node K and zener diode Z6 with or without the resistance R4 left in place; and/or the relative positions of nodes A & B as shown in figure 1b are reversed.

10. A practical a.c. electric-reactive fed LED within an opto-coupler device incorporating the signal conditioning device as claimed in claim 1 or claim 2 or claim 3 or claim 4 or claim 5 or claim 6 or claim 7 or claim 8 or claim 9 wherein referring to figure 2 the nodes D & E are connected to similarly lettered nodes in figure 1 and where the circuit described in figure 2 combine with the circuit described in figure 1; and/or as modified with any of the claims 2 through to 9 to form a practical a.c. electric-reactive fed LED within an opto-coupler device.

11. A practical a.c. electric-reactive fed LED within an opto-coupler device as claimed in claim 10 wherein referring to figure 2 the relative position of C2 and R6 are reversed; and/or the relative position of D1 and LED1 are reversed.

12. A practical a.c. electric-reactive fed LED within an opto-coupler device as claimed in claim 10 or claim 11 wherein referring to figure 2 capacitor C3 can take any value from the range of values possible which results, for the C3 & R7 combination, in a time constant range of between 1

millisecond and 1,000 seconds where R7 can take any value between 30 ohms and 10 million ohms and to operate within the voltage range as set by the applied d.c. voltage across nodes G & H; and/or where a resistance is placed between C3 & node F then that resistance can take any value between 30 ohms and 10 million ohms; and/or where a resistance is placed between C3 & node H then that resistance can take any value between 30 ohms and 10 million ohms; and/or where any additional capacitor-resistance network is placed at the emitter terminal of the opto-coupler device then that combination shall have a time constant range of anything between 1 millisecond and 1,000 seconds; or referring to figure 2 C3 and R7 are removed and node H is connected to the emitter terminal of the opto-coupler device and a resistance is placed between node G and the collector terminal of the opto-coupler device and a second resistance is connected to the collector terminal of the opto-coupler device and connected in series to a capacitor the other end of the capacitor being connected to node H and where node F is now connected to the collector terminal of the opto-coupler device and where the time constant of the capacitor and second resistance, (that resistance which is in series with the capacitor), is anything between 1 pico-second and 1,000 seconds. In the case where an opto-coupler device of the kind which has no defined "collector" and "emitter" terminals, such as the GE H11F1, (RS No. 650-790), is employed in the circuit of figure 2 and where the outputs of the said device can be considered as an analogue switch then the two outputs comprising the analogue switch can be considered in either configuration or manner as the equivelant emitter and collector terminals in the context of this claim, (ie. either terminal can be the collector while the remaining terminal becomes the emitter).

13. A practical a.c. electric-reactive fed flashing LED device incorporating the signal conditioning device as claimed in claim 1 or claim 2 or claim 3 or claim 4 or claim 5 or claim 6 or claim 7 or claim 8 or claim 9 wherein referring to figure 3 the nodes D & E are connected to similarly lettered nodes in figure 1 and where the circuit described

in figure 3 combine with the circuit described in figure 1; and/or as modified with any of the claims 2 through to 9 to form a practical a.c. electric-reactive fed flashing LED device. Referring to figure 3 the device connected across the nodes I & J is an LED with a built in integrated circuit which causes the LED to flash on & off at a given frequency.

14. A practical a.c. electric-reactive fed flashing LED device as claimed in claim 13 wherein referring to figure 3 the connections of capacitor C4 are inversed the connections of the zener diode Z7 are inversed and the relative positions of the zener diode Z7 and the resistance R8 are reversed and the connections of both diodes D2 & D3 are inversed; and/or the relative positions the resistance R9 and the capacitor C5 are reversed.

15. A practical a.c. electric-reactive fed flashing LED with a second non flashing LED combined device incorporating the signal conditioning device as claimed in claim 1 or claim 2 or claim 3 or claim 4 or claim 5 or claim 6 or claim 7 or claim 8 or claim 9 wherein referring to figure 4 the nodes D & E are connected to similarly lettered nodes in figure 1; and/or as modified with any of the claims 2 through to 9; and where the nodes D" & E" are connected to another, (second), similar signal conditioning device whose circuit is constructed identically to that circuit shown in figure 1; and/or as modified with any of the claims 2 through to 9 to form a practical a.c. electric-reactive fed flashing LED with a second non flashing LED combined device. Referring to figure 4 the device connected across the nodes N & P is an LED with a built in integrated circuit which causes the LED to flash on & off at a given frequency and the device connected across the nodes M & Q is the second non flashing LED built into the body of the first flashing LED.

16. A practical a.c. electric-reactive fed flashing LED with a second non flashing LED combined device as claimed in claim 15 wherein referring to figure 4 the connections of capacitor C12 are inversed the connections of the zener diode Z8 are inversed and the relative positions of the

zener diode Z8 and the resistance R10 are reversed and the connections of both diodes D4 & D5 are inversed; and/or the relative positions the resistance R11 and the capacitor C6 are reversed; and/or the connections of D6 and LED 4 are inversed; and/or the relative positions of D6 and LED 4 are reversed; and/or the relative positions of the resistance R16 and capacitor C11 are reversed; and node M is connected to node P.

17. A practical a.c. electric-reactive fed tri colour LED device incorporating a signal conditioning device as claimed in claim 1 or claim 2 or claim 3 or claim 4 or claim 5 or claim 6 or claim 7 or claim 8 or claim 9 wherein referring to figure 5 the nodes D & E are connected to similarly lettered nodes in figure 1; and/or as modified with any of the claims 2 through to 9; and where the nodes D" & E" are connected to another, (second), similar signal conditioning device whose circuit is constructed identically to that circuit shown in figure 1; and/or as modified with any of the claims 2 through to 9; to form a practical a.c. electric-reactive fed tri colour LED device.

18. A practical a.c. electric-reactive fed tri colour LED device as claimed in claim 17 wherein referring to figure 5 the relative positions of the resistance R12 and the capacitor C7 are reversed; and/or the connections of the diode D7 and the LED 5 are inversed; and/or the relative positions of the diode D7 and the LED 5 are reversed; and/or the connections of the diode D8 and the LED 6 are inversed; and/or the relative positions of the diode D8 and the LED 6 are reversed; and/or the relative positions of the capacitor C8 and the resistance R13 are reversed.

19. A a practical a.c. electric-reactive fed LED device incorporating a signal conditioning device as claimed in claim 1 or claim 2 or claim 3 or claim 4 or claim 5 or claim 6 or claim 7 or claim 8 or claim 9 wherein referring to figure 6 the nodes D & E are connected to similarly lettered nodes in figure 1 and where the circuit described in figure 6 combine with the circuit described in figure 1;

and/or as modified with any of the claims 2 through to 9 to form a practical a.c. electric-reactive fed LED device.

20. A practical a.c. electric-reactive fed LED device as claimed in claim 19 wherein referring to figure 6 the relative positions of the resistance R15 and the capacitor C10 are reversed; and/or the connections of diode D9 and LED 7 are inversed; and/or the relative positions of diode D9 and LED 7 are reversed.

21. An audible alarm system incorporating a practical a.c. electric-reactive fed LED within an opto-coupler device as claimed in claim 10 or claim 11 or claim 12 wherein referring to figure 7 the nodes G, F & H are connected to similarly lettered nodes in figure 2 to form an audible alarm system

22. An audible alarm system as claimed in claim 21 wherein the case of where the node F in figure 2 having been shifted to the collector terminal of the opto-coupler device as claimed in claim 12 then the inverting buffer integrated circuit, as shown in figure 7 is short-circuited.

23. A signal conditioning device with an incorporated family of circuits for electric-reactive fed LED devices and an incorporated circuit for an audible alarm system and substantially as described herein with reference to figures 1-7 of the accompanying drawings.

NOMENCLATURE

A. In the context of the above claims the term "The connections of the "Z" are <u>inversed</u>" has the meaning depicted in figure 8 & 8a. Figure 8 shows the original connections of "Z" and figure 8a. shows the connections of "Z" after it has been inversed.

B. In the context of the above claims the term "The relative positions of "X" and "Y" are reversed" has the meaning depicted in figure 9 & 9a. Figure 9 shows the original positions of "X" and "Y" and figure 9a. shows the positions of "X" and "Y" after reversal.

C. In the context of the above claims and the rest of this application the term "Electric-reactive" is to be interpreted in the Electrical Engineering or as defined in Physics manner, that is to say as one would discuss "real" power and "reactive" power. The word "electric" as used in the term "electric-reactive" merely serves to emphasise the use of the word "reactive" in the Electrical Engineering or Physics domain and to give the word "reactive" its Electrical Engineering or Physics meaning.

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