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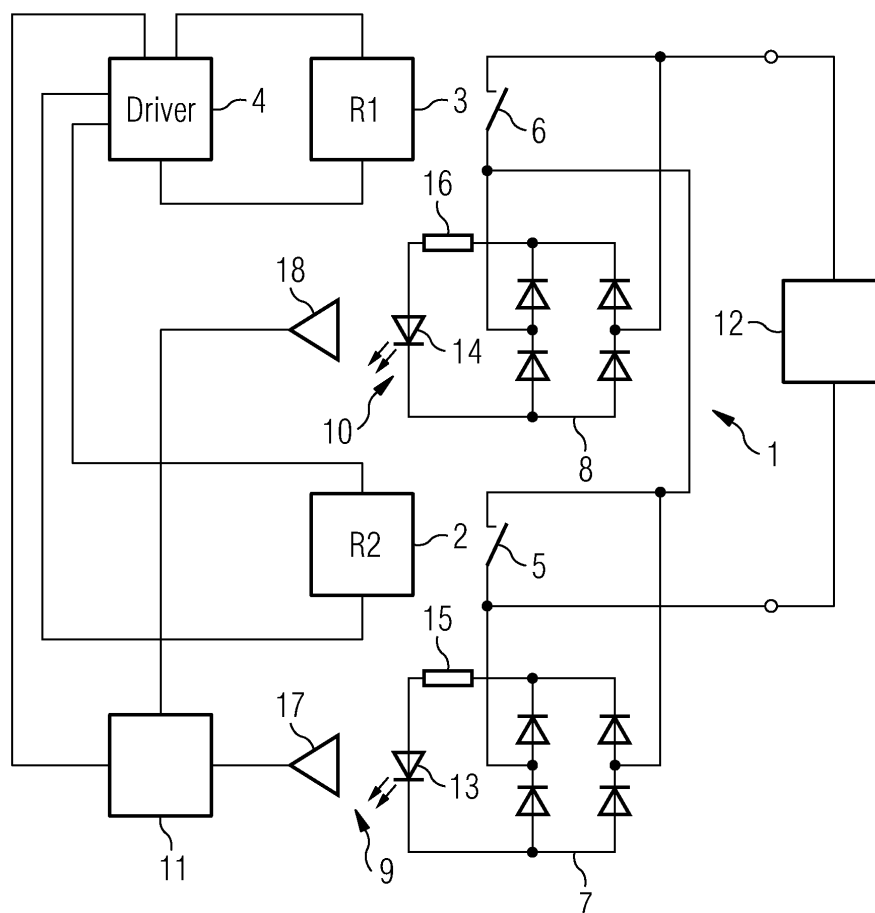
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(54) **Relay circuits**

(57) A relay circuit is provided with an isolation device

which indicates the relay state. The device is powered by a rectifier circuit when the relay contacts are closed.

FIG 2



Description

[0001] This invention relates to relays for providing isolated safe digital outputs from electronic equipment.

[0002] It is desirable to be able to monitor the status of such relays and this is done by means of an auxiliary contact which is used to determine the switching state of the relay. For some applications, a pair of relays is used and it is desirable to determine that they are operating correctly. This may be done by observing the state of the auxiliary contacts when a switching command is applied to one of the relays. If the auxiliary contacts fail to open when commanded to do so then it is assumed that the relay has failed and the control system then opens both relays and signals a fault.

[0003] An example of a prior art arrangement is shown in figure 1. It will be seen that the upper relay R1 operates contact set A and the lower relay R2 operates contact set B. For circuit C to operate both contact sets have to be closed as they are connected in series. The contact sets include auxiliary contacts which are connected to a relay status monitor M which determines when the contacts are open or closed. If it determines that a fault has occurred in one relay, say the upper one R1, it will issue a command to the relay controller to open both relays. The lower relay will then break the connection to the circuit C.

[0004] It will be appreciated that the prior art arrangement relies upon the auxiliary contacts operating in tandem with the primary contacts in order to infer from them the state of the primary contacts. It is however possible for the primary contacts to fail in such a way that the auxiliary contacts continue to function as expected (for example, if the primary contacts become oxidised no current will flow even though they are brought together). Not all faults are therefore detectable in the prior art.

[0005] The present invention arose in an attempt to provide a more reliable relay arrangement that avoids or at least mitigates the possibility of undetectable faults.

[0006] According to the invention there is provided a relay circuit having a set of contacts to be actuated to in use to be connected to a circuit to be operated and a relay status indicating circuit energised by closure of the contacts to provide an indication of the relay status.

[0007] By providing a circuit that is energised by the closure of the contacts to provide the indication of the status of the relay which is directly dependent on the contacts the requirement for a set of auxiliary contacts is avoided. This eliminates false errors created by the use of secondary contacts.

[0008] In the preferred embodiment, the relay status indicating circuit comprises an isolating coupling device which connects the circuit to a relay monitor. This ensures good electrical isolation although other ways of coupling a signal providing an indication of the relay status may be used. An opto-coupler is preferred but other types of coupler may be used such as capacitive or inductive couplers

[0009] The relay monitor is preferably coupled to a relay driver to provide a signal thereto indicating a condition of the relay. In the event that the condition is that the relay is faulty then the driver will switch the relay to an off state.

[0010] Advantageously, a pairing of relays as earlier described is provided in series connection such that by breaking the contacts in one relay disconnects both sets of contacts from another item of electronic equipment.

[0011] A specific embodiment of the invention will now be described with reference to the drawings in which:

Figure 1 shows a prior art arrangement of relays; and

Figure 2 shows an arrangement of two relays in accordance with the invention coupled to an electronic device.

[0012] As is shown in figure 2, a relay circuit 1 comprises a pair of relays 2 and 3; a relay driver 4 connected to the relays 2, 3; respective relay contacts 5 and 6 for the relays 2 and 3 respectively; a rectifier circuit 7 and 8 connected across each set of contacts; opto-couplers 9 and 10 powered by the rectifier circuits and a relay monitor 11. A circuit 12 is shown in the figure connected to the output of the relay circuit 1.

[0013] It will be seen that the relay contacts 5 and 6 are arranged in series and thus both have to be closed by their respective relays in order that the output is closed for the circuit 12.

[0014] The rectifiers 7 and 8 are coupled across each of the contacts such that when both are closed they provide power to a diode 13 and 14 via resistors 15 and 16. The diodes 13 and 14 are light emitting diodes and when powered, the light is propagated over a gap to a respective detector 17 and 18. The gap provides the electrical isolation. The detectors 17 and 18 provide outputs to the relay monitor 11. The relay monitor 11 provides a control signal to the relay driver 4 and also receives a signal indicating whether or not the driver has activated the relays. In the event that the relay monitor does not receive a signal from the optical - couplers, when the driver is switching the relays on, a fault condition is determined. The relay monitor 11 then sends a signal to the relay driver 4 to switch the relays 2 and 3 off.

Claims

1. A relay circuit having a set of contacts to be actuated to, in use, be connected to a circuit to be operated and a relay status indicating circuit energised by closure of the contacts to provide an indication of the relay status.
2. A relay circuit as claimed in claim 1 wherein the relay indicating circuit comprises an isolating coupling device which connects the circuit to a relay monitor.

3. A relay circuit as claimed in claim 2 wherein the isolating coupling device is one of an opto-coupler, a capacitive coupler or an inductive coupler.
4. A relay circuit as claimed in claim 3 or 2 wherein the relay monitor is coupled to a relay driver driving the closing or opening of the relay contacts such that when a fault condition is determined the relay driver is signalled to open the contacts.
5. A relay circuit as claimed in claim 4 wherein the relay driver provides a signal to the relay monitor indicating that the relay has been driven to an open or a closed state.
6. A relay circuit as claimed in claim 5 wherein the relay monitor indicates a fault when the relay driver indicates that the relay state is closed and the relay status indicating circuit indicates that the relay status is open.

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FIG 1

PRIOR ART

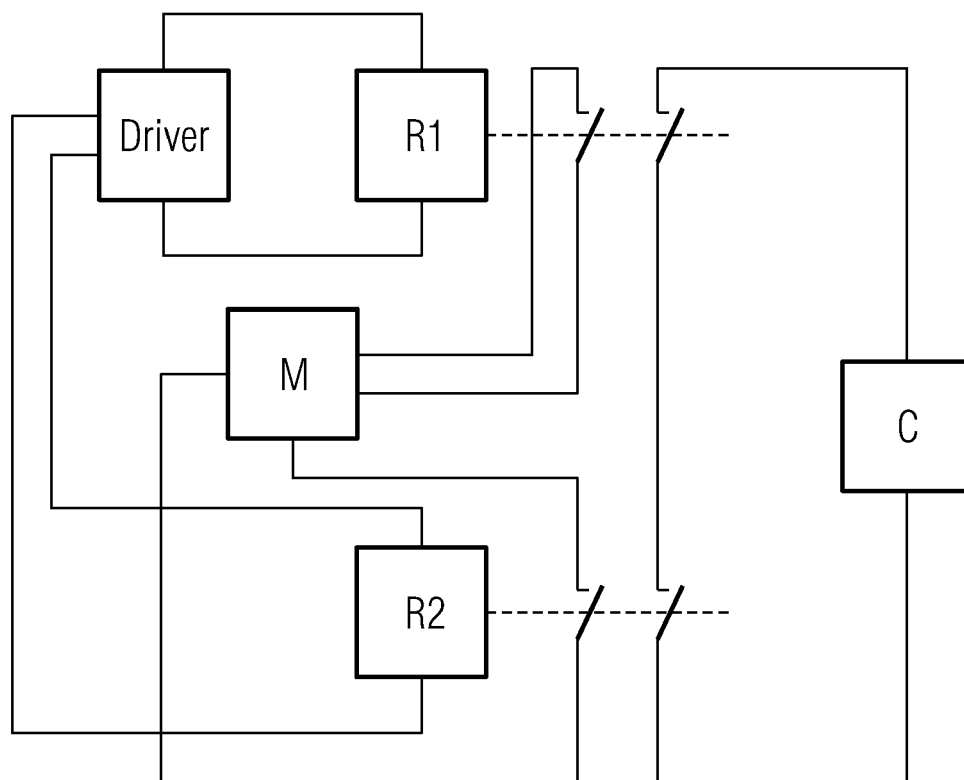
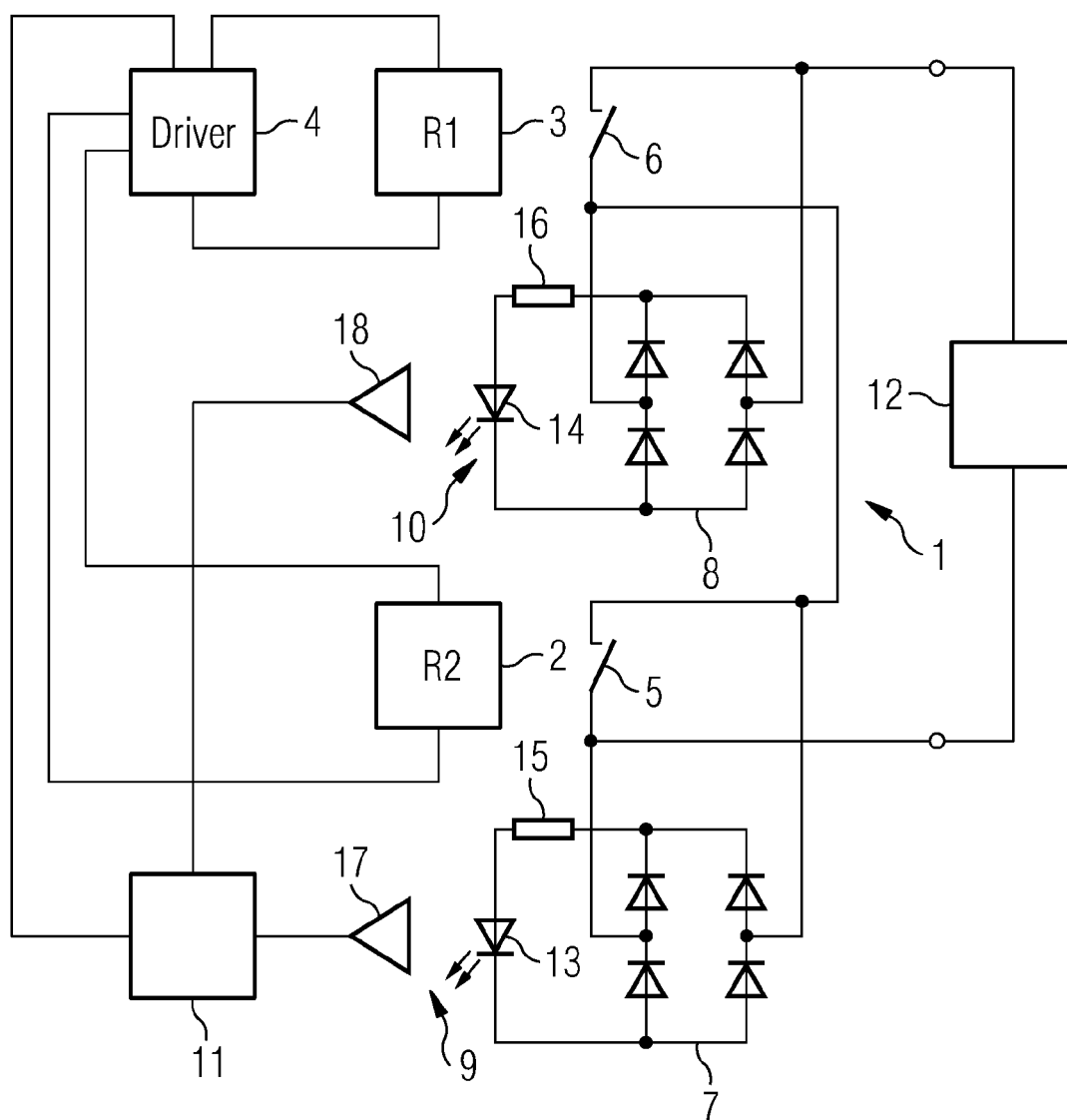


FIG 2





EUROPEAN SEARCH REPORT

Application Number
EP 08 10 5717

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	EP 0 694 937 A2 (SIEMENS AG [DE]) 31 January 1996 (1996-01-31) * column 4, lines 6-23; figures 2,4 * * column 6, line 3 - column 7, line 48 *	1-6	INV. H01H47/00
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X	ANONYMOUS: "SPER 1B1 C4, SPER 1C1 and SPER 1C2 Supervision relay" ABB USER'S MANUAL AND TECHNICAL DESCRIPTION, [Online] 22 March 2007 (2007-03-22), XP002520582 ABB, VAASA, FINLAND Retrieved from the Internet: URL: http://library.abb.com/global/scot/scot229.nsf/veritydisplay/6c7b646e455aa8ecc12572aa004955e5/\$File/FM_SPER1_1_750231_Ene.pdf * page 3, last paragraph; figures 1-3,10 *	1-3	TECHNICAL FIELDS SEARCHED (IPC) H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 23 March 2009	Examiner Mäki-Mantila, M
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 10 5717

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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