(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 318 748 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
24.08.2005 Bulletin 2005/34

(21) Application number: **01971315.5**

(22) Date of filing: **21.09.2001**

(51) Int Cl.[7]: **A61B 5/00**

(86) International application number:
PCT/US2001/029774

(87) International publication number:
WO 2002/024066 (28.03.2002 Gazette 2002/12)

(54) **INTERCONNECT CIRCUIT BETWEEN NON-COMPATIBLE OXIMETER AND SENSOR**

VERBINDUNGSSCHALTKREIS ZWISCHEN NICHTKOMPATIBLEM OXIMETER UND SENSOR

CIRCUIT DE CONNEXION ENTRE UN OXYMETRE ET UN CAPTEUR NON COMPATIBLES

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR

(30) Priority: **21.09.2000 US 668032**

(43) Date of publication of application:
18.06.2003 Bulletin 2003/25

(73) Proprietor: **MALLINCKRODT INC.**
Hazelwood, MO 63042 (US)

(72) Inventors:
- **FEIN, Michael, E.**
Mountain View, CA 94040 (US)
- **CHEW, Bradford, B.**
San Ramon, CA 94583 (US)

(74) Representative: **Rees, Alexander Ellison et al**
Urquhart-Dykes & Lord LLP
30 Welbeck Street
London W1G 8ER (GB)

(56) References cited:
US-A- 5 758 644
US-A- 5 995 855
US-A- 6 023 541

EP 1 318 748 B1

Description

BACKGROUND OF THE INVENTION

[0001] This invention relates in general to optical oximeters and relates more particularly to an adapter that enables an optical oximeter probe, that is designed/configured to be utilized on an associated oximeter/monitor, to be used on a different oximeter/monitor that utilizes a different probe configuration.

[0002] Because of the importance of oxygen for healthy human metabolism, it is important to be able to measure the oxygen content of a patient's blood. The monitoring of a patient's arterial hemoglobin oxygen saturation during and after surgery is particularly critical.

[0003] Noninvasive oximeters have been developed that direct light through a patient's skin into a region, such as a finger, containing arterial blood. This light typically contains two or more primary wavelengths of light. Examples of such oximeters are disclosed in U.S. patent 5,209,230 entitled "Adhesive Pulse Oximeter Sensor With Reusable Portion" issued to Swedlow, et aL and in U.S. patent 4,700,708 entitled "Calibrated Optical Oximeter Probe" issued to New, Jr. et al., both assigned to the assignee of the present invention.

[0004] The oximeter in the patent by New, Jr. et al. includes a probe that contains a resistor having a resistance that can be measured by a monitor to which the probe is attached. The measured value of this resistance is indicative of the wavelengths of the light directed from the light emitting diodes (LEDs) through the patient's epidermis. The monitor uses this information and the measured intensities of light detected at those wavelengths to calculate the blood arterial oxygen content of the patient. The LEDs are typically activated in non-overlapping temporal intervals, so that the amount of absorption of light at each of these two wavelengths is usually measured separately.

[0005] Oftentimes, an oximeter sensor may be made by one manufacturer, and a monitor by another manufacturer. Accordingly, adapters may be necessary if the sensor and the oximeter/monitor are not compatible. Alternately, the sensor itself can be configured so that it can be used with different oximeters. For example, U.S. Patent No. 5,249,576, entitled "Universal Pulse Oximeter Probe" issued to Goldberger et al., allows the leads of the sensor to be connected in alternate configurations. Examples of adapters are set forth in U.S. Patent No. 5,807,247, assignee Nellcor Puritan Bennett, Inc., and in U.S. Patent No. 5,818,985, also assigned to Nellcor Puritan Bennett, Inc. Yet another adapter is set forth in copending application number 09/040,218, filed March 17, 1998, entitled "Active Optical Oximeter Probe Adapter", Adnan Merchant et al., also assigned to Nellcor Puritan Bennett, Inc.

[0006] In one type of oximeter sensor, set forth in Masimo Corporation Patent No. 5,758,644, separate leads on the sensor for connecting to a coding resistor are eliminated. Instead, the coding resistor is connected in parallel with the light-emitting diodes (LEDs) of the sensor: The coding resistor can be read by providing a low voltage at which the LEDs will not conduct substantial current. For example, a voltage of 0.5 volts will accomplish this. Thus, in a configuration mode, a low voltage can be driven to the LED leads, and the resistance can be read. Subsequently, higher voltages can be used for driving the LEDs in an operational mode. Clearly, oximeter sensors without such a resistance across the LED leads will not be compatible with such an arrangement. In one embodiment of the Masimo sensor, the resistor does not provide a coding fimction at all, but rather modifies the characteristics of the LEDs.

[0007] Another known type of oximeter sensor is disclosed in US-A-5995855. This discloses an oximeter sensor adaptor having input lines connectable to oximeter LED drive output lines and output lines connectable to oximeter LED drive input lines. The adaptor further comprises to sensing circuit coupled to the first and second oximeter input lines and arranged to detect whether a voltage cross the input lines is below a threshold.

[0008] In a first aspect the invention provides an oximeter sensor adapter, comprising:

a pair of first and second oximeter input lines connectable to oximeter LED drive output lines;
a pair of sensor output lines connectable to LED drive input lines of an oximeter sensor; and characterized by further comprising:

a sensing circuit, coupled to said first and second oximeter input lines, to detect when a signal across said first and second input lines exceeds a first predetermined level or a second predetermined level;
a coding element; and
a switching circuit, having a control input connected to said sensing circuit, having a first pair of switch inputs coupled to said first and second oximeter input lines, a first pair of switch outputs connected to said sensor output lines, a second pair of switch outputs coupled to said coding element, and being configured to switch between said first and second pairs of switch outputs in response to a signal on said control input.

[0009] In a second aspect, the invention provides an oximeter system comprising:

(a) an oximeter including

an LED drive circuit, with a pair of LED drive output lines;
a photodetector sensor circuit, connected to a photodetector input line; and

(b) an oximeter sensor adapter, including

a pair of first and second oximeter input lines connectable to oximeter LED drive output lines; a pair of sensor output lines connectable to LED drive input lines of an oximeter sensor; and characterized by further comprising:

a sensing circuit, coupled to said first and second oximeter input lines, to detect when a signal across said first and second input lines exceeds a first predetermined level or a second predetermined level;
a coding element; and
a switching circuit, having a control input connected to said sensing circuit, having a first pair of switch inputs coupled to said first and second oximeter input line, a first pair of switch outputs connected to said sensor output lines, a second pair of switch outputs coupled to said coding element, and being configured to switch between said first and second pairs of switch outputs in response to a signal on said control input.

[0010] Thus, the present invention in essence fools the oximeter into thinking that there is a resistor connected in parallel with the LEDs, when in fact there is not. It allows a sensor without a resistor across its LED leads to work with an oximeter expecting such a resistor.

[0011] For a further understanding of the nature and advantages of the invention, reference should be made to the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a block diagram of an oximeter system with an adapter according to the present invention.
Fig. 2 is a more detailed diagram of one embodiment of voltage sensor 6, switching logic 8 and the sensing circuit 10 of the adapter of Fig. 1.

DESCRIPTION OF THE SPECIFIC EMBODIMENTS

[0013] Fig. 1 is a block diagram of one embodiment of an adapter according to the present invention in an oximeter system. Shown in Fig. 1 is a pulse oximeter 1, an adapter 3, and a sensor or probe 16. The sensor includes LEDs 17 for directing light into the patient, typically red and infrared. The LEDs are driven by an oximeter LED drive circuit 5 in oximeter 1. This drive signals onto lines 2 and 4 through adapter 3. Lines 2 and 4 are connected through a switching circuit 10 to contacts 11 which are connected to the LEDs 17. This is the normal, operational configuration of the system.

[0014] When it is desired to read a resistance upon calibration, oximeter drive circuit 5 will put out a low voltage signal which is too low to produce any significant current through LEDs 17. Typically, this voltage will be around 0.5 volts. This low voltage is sensed by a voltage sensing circuit 6. Circuit 6 then provides a signal through switch logic 8 to switching circuit 10 to cause the switch to move to contacts 12 from contacts 11. Contacts 12 put lines 2 and 4 across resistor 14. Thus, the 0.5 volt signal from LED drive circuit 5 will be applied across resistor 14, and the value of resistor 14 can be read by the oximeter. Once the reading is completed, and the oximeter desires to drive the LEDs in the normal mode, a higher voltage signal will appear across lines 2 and 4. This will also be detected by sensor 6, which will cause switch logic 8 to switch switching circuit 10 back to contacts 11.

[0015] The oximeter sensor also has a photosensor 20 for detecting light transmitted through or reflected from the patient. Sensor 20 is connected through adapter 3 through an optional signal conditioning circuit 22 and then provided to a detection circuit 24 in oximeter 1.

[0016] Fig. 2 is a more detailed diagram of one embodiment of voltage sensor 6, switching logic 8 and switching circuit 10 of Fig. 1. In this example, a voltage sensor causes the switch to disconnect the 11K coding resistor if the IR LED forward voltage exceeds 1.0V, (connecting the IR LED) and if the Red LED forward voltage exceeds 1.5V, (connecting the Red LED).

[0017] OpAmps U1A and U1B function as differential amplifiers, where V(U1A) = V(2) - V(4), and V(U1B) = V(4) - V(2). The outputs of U1A and U1B are compared to their threshold voltages at comparators U2A (IR threshold at 1.0V) and U2B (Red threshold at 1.5V). Both comparators have open collector outputs, so if either V(U1A) or V(U1B) exceeds its threshold, the output is pulled low, activating optical switches LS1 and LS2, connecting both LEDs to lines 2 and 4. If U2A or U2B pull their common line low, transistor Q1 turns off, which turns off optical switches LS3 and LS4 and disconnects resistor 14 from lines 2 and 4.

[0018] If the oximeter tries to measure resistor 14 with the 0.5 volt signal, both V(U1A) and V(U1B) will be below threshold and comparator outputs of U2A and U2B will be pulled high by resistors R12 and R13, deactivating optical switches LS1 and LS2, disconnecting both LEDs from lines 2 and 4. This also turns on transistor Q1, which turns on optical switches LS3 and LS4, and connects resistor 14 to lines 2 and 4.

[0019] Optional signal conditioning circuit 22 of Fig. 1 is used to change the photo-detected signal to correspond to the type of sensor 16 actually used. For example, the relationship between R (the ratio of ratios) and SpO_2 may be altered by varying the photo-detected signal level. An example of such a circuit is set forth in copending application number 09/040,218, filed March 17, 1998, referenced above.

[0020] Referring back to Fig. 1, in other embodiments, instead of a resistor 14, another element may be used to convey information or unlock the oximeter to allow use of the sensor. For example, a semiconductor chip providing digital data may be used to provide more complex coding information than a simple resistor can provide. Such a chip could be a two lead memory chip, such as is available from Dallas Semiconductor.

[0021] The adapter itself may have its separate power supply, or may operate off the power provided by oximeter 1. For the calibration mode, the adapter could store energy from the LED drives.

[0022] As will be understood by those of skill in the art, the present invention may be embodied in other specific forms without departing from the essential characteristics thereof. For example, a three lead connection for the LEDs in the sensor could be used, with the voltage sensing and switching logic modified accordingly. The adapter could convert from a 3 lead oximeter to a 2 lead sensor, or vice-versa. Accordingly, the foregoing description is intended to be illustrative, but not limiting, of the scope of the invention which is set forth in the following claims.

Claims

1. An oximeter sensor adapter (3), comprising:

a pair of first and second oximeter input lines connectable to oximeter LED drive output lines;
a pair of sensor output lines connectable to LED drive input lines of an oximeter sensor (16); and
characterized by further comprising:

a sensing circuit (6), coupled to said first and second oximeter input lines, to detect when a signal across said first and second input lines exceeds a first predetermined level or a second predetermined level;
a coding element (14); and
a switching circuit (10), having a control input connected to said sensing circuit, having a first pair of switch inputs coupled to said first and second oximeter input lines, a first pair of switch outputs (11) connected to said sensor output lines, a second pair of switch outputs (12) coupled to said coding element, and being configured to switch between said first and second pairs of switch outputs in response to a signal on said control input.

2. The oximeter sensor adapter of claim 1 wherein said coding element is a resistor.

3. The oximeter sensor adapter of claim 2 wherein said signal on said first input line is a signal below a predetermined voltage.

4. The oximeter sensor adapter of claim 3 wherein said predetermined voltage is 0.5 volts.

5. The oximeter sensor adapter of claim 2 wherein said sensing circuit provides an activating signal to said switching circuit when a voltage on said oximeter input lines is 0.5 volts or less, said activating signal causing said switching circuit to switch to said resistor.

6. The oximeter sensor adapter of claim 2 wherein said resistor has a value related to a value of an LED (17) in an attached sensor.

7. The oximeter sensor adapter of claim 1 wherein said coding element is a semiconductor chip.

8. The oximeter sensor adapter of claim 1 wherein said sensing circuit comprises:

at least one differential amplifier (U1A, U1B) coupled to said input lines; and
at least one comparator (U2A, U2B) coupled to an output of said differential amplifier.

9. The oximeter sensor adapter of claim 1 wherein said switching circuit comprises:

at least first and second optical switches (LS1, LS2).

10. The oximeter sensor adapter of claim 1 further comprising:

a conditioning circuit (22), coupled between a sensor detector line and an oximeter detector line, for varying a photodetected signal level.

11. An oximeter system comprising:

(a) an oximeter (1) including

an LED drive circuit (5), with a pair of LED drive output lines;
a photodetector sensor circuit (24), connected to a photodetector input line; and

(b) an oximeter sensor adapter (3), including

a pair of first and second oximeter input lines connectable to oximeter LED drive output lines;
a pair of sensor output lines connectable to LED drive input lines of an oximeter sensor (16); and **characterized by** further comprising:

a sensing circuit (6), coupled to said first and second oximeter input lines, to detect when a signal across said first and second input lines exceeds a first predetermined level or a second predetermined level;
a coding element (14); and
a switching circuit (10), having a control input connected to said sensing circuit, having a first pair of switch inputs coupled to said first and second oximeter input line, a first pair of switch outputs (11) connected to said sensor output lines, a second pair of switch outputs (12) coupled to said coding element, and being configured to switch between said first and second pairs of switch outputs in response to a signal on said control input.

Patentansprüche

1. Oximeter-Sensor-Adapter (3), bestehend aus:

einem Paar von ersten und zweiten Oximeter-Eingangsleitungen, anschließbar an Oximeter-LED-Antrieb-Ausgangsleitungen;
einem Paar von Sensor-Ausgangsleitungen, anschließbar an LED-Antrieb-Eingangsleitungen eines Oximeter-Sensors (16); und **gekennzeichnet dadurch, dass** er weiter aus Folgendem besteht:

einem Abfühlkreis (6), gekoppelt mit den ersten und zweiten Oximeter-Eingangsleitungen, zum Erfassen, wenn ein Signal zwischen den ersten und zweiten Eingangsleitungen einen ersten vorbestimmten Pegel oder einen zweiten vorbestimmten Pegel überschreitet;
einem Codierelement (14); und
einem Umschaltkreis (10), dessen Steuerungseingang mit dem Abfühlkreis verbunden ist, dessen erstes Paar von Schalteingängen mit den ersten und zweiten Oximeter-Eingangsleitungen verbunden ist, einem ersten Paar von Schaltausgängen (11) verbunden mit den Sensor-Ausgangsleitungen, einem zweiten Paar von Schaltausgängen (12) gekoppelt mit dem Codierelement und derart konfiguriert, dass als Reaktion auf ein Signal am Steuerungseingang zwischen den ersten und zweiten Paaren von Schaltausgängen umgeschaltet wird.

2. Oximeter-Sensor-Adapter nach Anspruch 1, wobei das Codierelement ein Widerstand ist.

3. Oximeter-Sensor-Adapter nach Anspruch 2, wobei das Signal in der ersten Eingangsleitung ein Signal unterhalb einer vorbestimmten Spannung ist.

4. Oximeter-Sensor-Adapter nach Anspruch 3, wobei die vorbestimmte Spannung 0,5 Volt beträgt.

5. Oximeter-Sensor-Adapter nach Anspruch 2, wobei der Abfühlkreis ein Aktivierungssignal zum Umschaltkreis bereitstellt, wenn eine Spannung an den Oximeter-Eingangsleitungen 0,5 Volt oder weniger beträgt, und das Aktivierungssignal bewirkt, dass der Umschaltkreis zum Widerstand umschaltet.

6. Oximeter-Sensor-Adapter nach Anspruch 2, wobei der Widerstand einen Wert aufweist, der zu einem Wert eines LED (17) in einem angebrachten Sensor in Beziehung steht.

7. Oximeter-Sensor-Adapter nach Anspruch 1, wobei das Codierelement ein Halbleiterchip ist.

8. Oximeter-Sensor-Adapter nach Anspruch 1, wobei der Abfühlkreis aus Folgendem besteht:

mindestens einem Differenzialverstärker (U1A, U1B), gekoppelt mit den Eingangsleitungen; und
mindestens einem Komparator (U2A, U2B), gekoppelt mit einem Ausgang des Differenzialverstärkers.

9. Oximeter-Sensor-Adapter nach Anspruch 1, wobei der Umschaltkreis aus Folgendem besteht:

mindestens ersten und zweiten optischen Schaltern (LS1, LS2).

10. Oximeter-Sensor-Adapter nach Anspruch 1, weiterhin bestehend aus:

Anpassungskreis (22), angekoppelt zwischen einer Sensor-Detektorleitung und einer Oximeter-Detektorleitung, zum Verändern eines fotoerfassten Signalpegels.

11. Oximetersystem, bestehend aus:

(a) Oximeter (1) einschließlich

eines LED-Antriebskreises (5), mit einem Paar von LED-Antrieb-Ausgangsleitungen;
eines Fotodetektor-Sensor-Kreises (24), verbunden mit einer Fotodetektor-Eingangsleitung; und

(b) Oximeter-Sensor-Adapter (3), einschließlich

einem Paar von ersten und zweiten Oximeter-Eingangsleitungen, anschließbar an Oximeter-LED-Antrieb-Ausgangsleitungen;
einem Paar von Sensor-Ausgangsleitungen, anschließbar an LED-Antrieb-Eingangsleitungen eines Oximeter-Sensors (16); und **gekennzeichnet dadurch, dass** er weiter aus Folgendem besteht:

einem Abfühlkreis (6), gekoppelt mit den ersten und zweiten Oximeter-Eingangsleitungen, zum Erfassen, wenn ein Signal zwischen den ersten und zweiten Eingangsleitungen einen ersten vorbestimmten Pegel oder einen zweiten vorbestimmten Pegel überschreitet;
einem Codierelement (14); und
einem Umschaltkreis (10), dessen Steuerungseingang mit dem Abfühlkreis verbunden ist, dessen erstes Paar von Schalteingängen mit der ersten und zweiten Oximeter-Eingangsleitung verbunden ist, einem ersten Paar von Schaltausgängen (11) verbunden mit den Sensor-Ausgangsleitungen, einem zweiten Paar von Schaltausgängen (12) gekoppelt mit dem Codierelement und derart konfiguriert, dass als Reaktion auf ein Signal am Steuerungseingang zwischen den ersten und zweiten Paaren von Schaltausgängen umgeschaltet wird.

Revendications

1. Adaptateur de capteur d'oxymètre (3), comprenant :

une paire de première et deuxième lignes d'entrée d'oxymètre pouvant être connectées à des lignes de sortie de commande de DEL d'oxymètre ;
une paire de lignes de sortie de capteur pouvant être connectées à des lignes d'entrée de commande de DEL d'un capteur d'oxymètre (16) ; et **caractérisé par le fait qu'**il comprend en outre :

un circuit de détection (6), couplé auxdites première et deuxième lignes d'entrée d'oxymètre, afin de détecter le moment où un signal aux bornes desdites première et deuxième lignes d'entrée dépasse un premier niveau prédéterminé ou un deuxième niveau prédéterminé ;
un élément de codage (14) ; et
un circuit de commutation (10), ayant une entrée de commande connectée audit circuit de détection, ayant une première paire d'entrées de commutation couplées auxdites première et deuxième lignes d'entrée d'oxymètre, une première paire de sorties de commutation (11) connectées auxdites lignes de sortie de capteur, une deuxième paire de sorties de commutation (12) couplées audit élément de codage, et étant configuré pour commuter entre lesdites première et deuxième paires de sorties de commutation en réponse à un signal sur ladite entrée de commande.

2. Adaptateur de capteur d'oxymètre selon la revendication 1, dans lequel ledit élément de codage est une résistance.

3. Adaptateur de capteur d'oxymètre selon la revendication 2, dans lequel ledit signal sur ladite première ligne d'entrée est un signal inférieur à une tension prédéterminée.

4. Adaptateur de capteur d'oxymètre selon la revendication 3, dans lequel ladite tension prédéterminée est 0,5 volts.

5. Adaptateur de capteur d'oxymètre selon la revendication 2, dans lequel ledit circuit de détection fournit un signal d'activation audit circuit de commutation quand une tension sur lesdites lignes d'entrée d'oxymètre est de 0,5 volts ou moins, ledit signal d'activation forçant ledit circuit de commutation à commuter sur ladite résistance.

6. Adaptateur de capteur d'oxymètre selon la revendication 2, dans lequel ladite résistance a une valeur liée à une valeur d'une DEL (17) dans un capteur raccordé.

7. Adaptateur de capteur d'oxymètre selon la revendication 1, dans lequel ledit élément de codage est une puce semi-conductrice.

8. Adaptateur de capteur d'oxymètre selon la revendication 1, dans lequel ledit circuit de détection comprend :

au moins un amplificateur différentiel (U1A, U1B) couplé auxdites lignes d'entrée ; et
au moins un comparateur (U2A, U2B) couplé à une sortie dudit amplificateur différentiel.

9. Adaptateur de capteur d'oxymètre selon la revendication 1, dans lequel ledit circuit de commutation comprend :

au moins des premier et deuxième commutateurs optiques (LS1, LS2).

10. Adaptateur de capteur d'oxymètre selon la revendication 1, comprenant en outre :

un circuit de conditionnement (22), couplé entre une ligne de détecteur de capteur et une ligne de détecteur d'oxymètre, pour faire varier un niveau de signal photodétecté.

11. Système d'oxymètre comprenant :

(a) un oxymètre (1) comportant

un circuit de commande de DEL (5), avec une paire de lignes de sortie de commande de DEL ;
un circuit de capteur à photodétecteur (24), connecté à une ligne d'entrée de photodétecteur ; et

(b) un adaptateur de capteur d'oxymètre (3), comportant

une paire de première et deuxième lignes d'entrée d'oxymètre pouvant être connectées à des lignes de sortie de commande de DEL d'oxymètre ;
une paire de lignes de sortie de capteur pouvant être connectées à des lignes d'entrée de commande de DEL d'un capteur d'oxymètre (16) ; et **caractérisé par le fait qu'**il comprend en outre :

un circuit de détection (6), couplé auxdites première et deuxième lignes d'entrée d'oxymètre, afin de détecter le moment où un signal aux bornes desdites première et deuxième lignes d'entrée dépasse un premier niveau prédéterminé ou un deuxième niveau prédéterminé ;
un élément de codage (14) ; et
un circuit de commutation (10), ayant une entrée de commande connectée audit circuit de détection, ayant une première paire d'entrées de commutation couplées auxdites première et deuxième lignes d'entrée d'oxymètre, une première paire de sorties de commutation (11) connectées auxdites lignes de sortie de capteur, une deuxième paire de sorties de commutation (12) couplées audit élément de codage, et étant configuré pour commuter entre lesdites première et deuxième paires de sorties de commutation en réponse à un signal sur ladite entrée de commande.

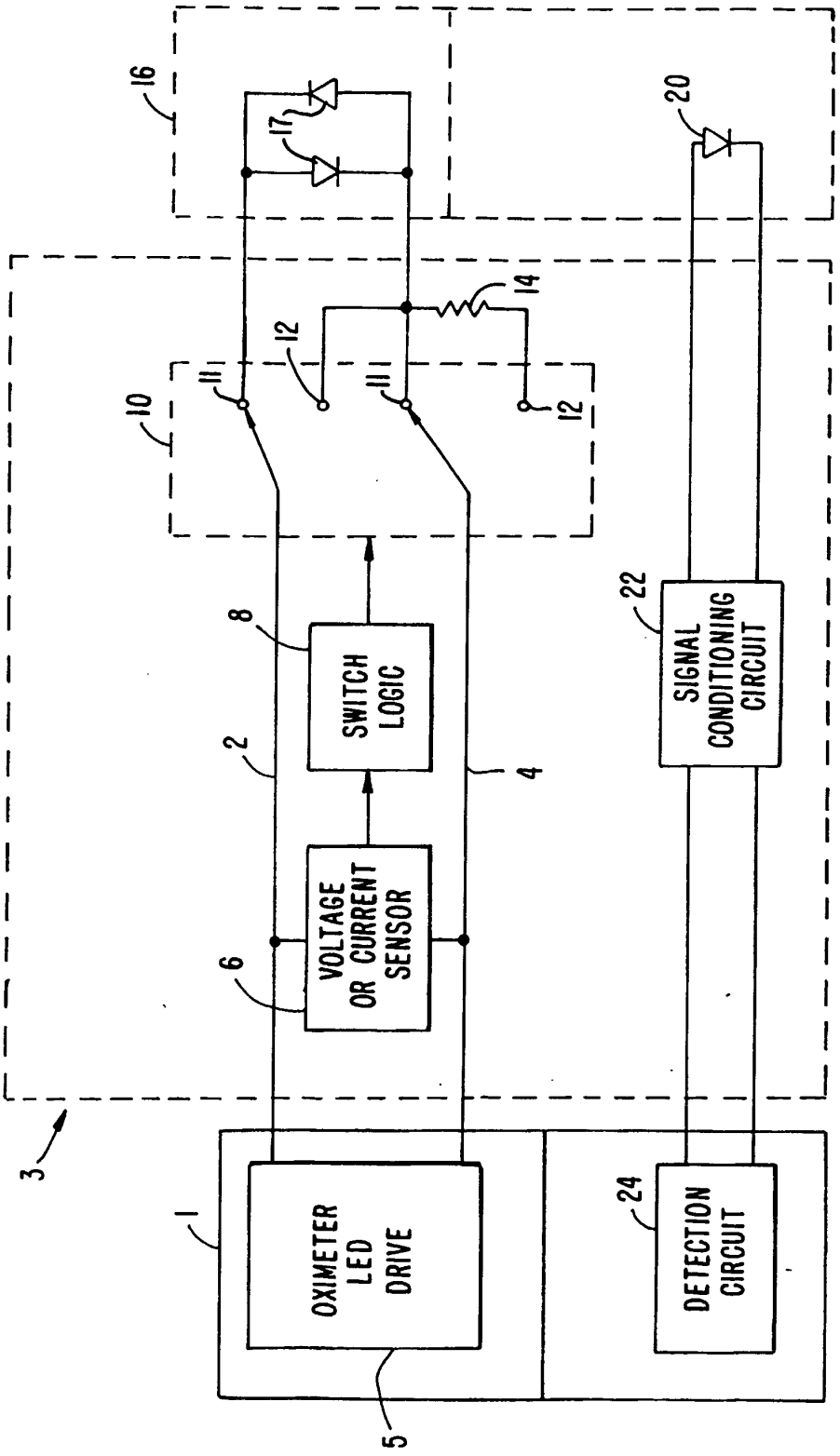
16
17
20
14
12
11
10
12
8
SWITCH LOGIC
22
SIGNAL CONDITIONING CIRCUIT
2
4
VOLTAGE OR CURRENT SENSOR
6
3
1
OXIMETER LED DRIVE
24
DETECTION CIRCUIT
5

FIG. 1.

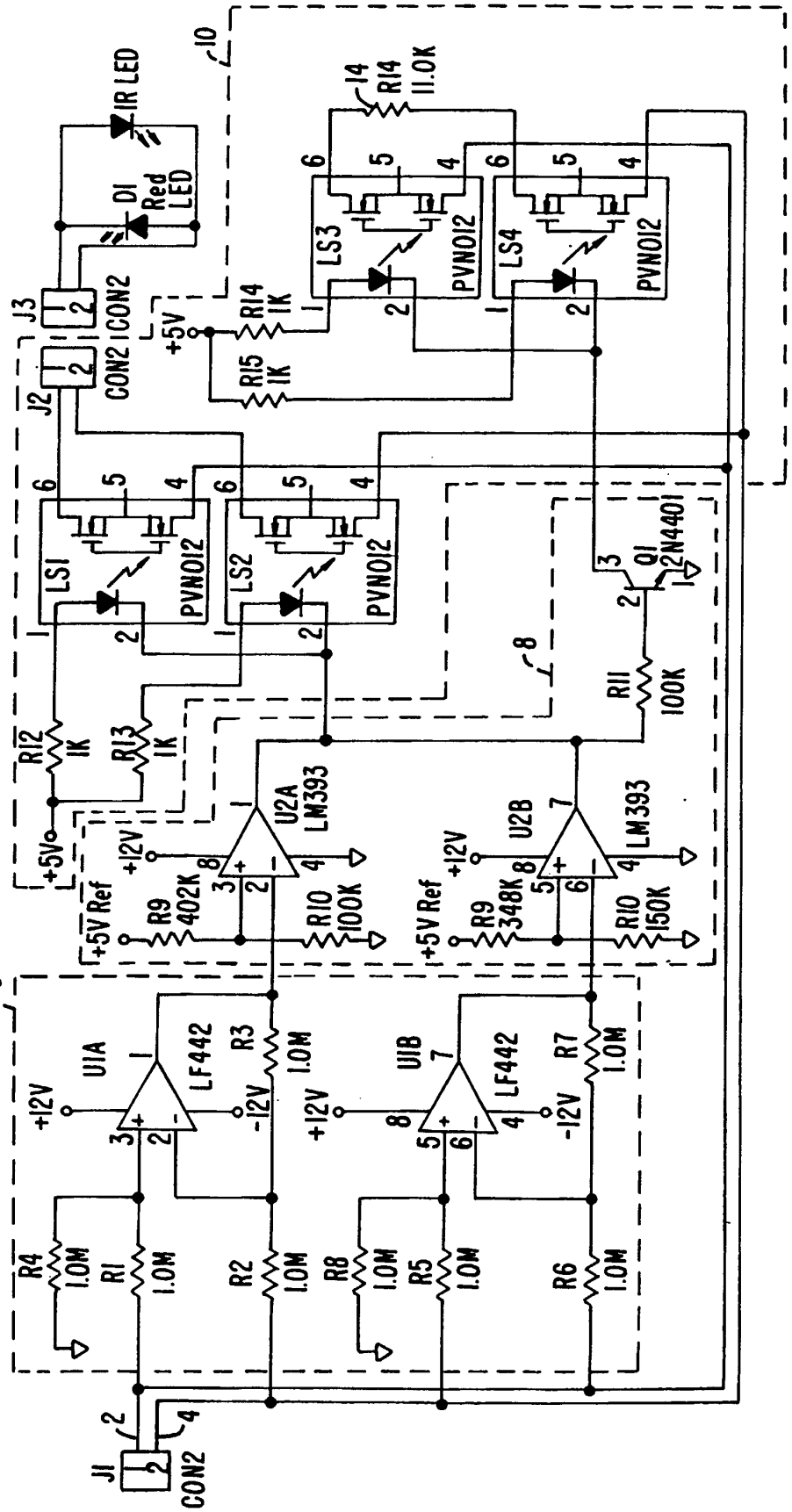
IR LED
D1
Red LED
J3
CON2
J2
CON2
+5V
R14 1K
R15 1K
14
R14 11.0K
LS3
LS4
PVN012
LS1
LS2
PVN012
Q1 2N4401
R11 100K
R12 1K
R13 1K
U2A LM393
U2B LM393
+12V
+5V Ref
R9 402K
R10 100K
R9 348K
R10 150K
U1A
U1B
LF442
-12V
R3 1.0M
R7 1.0M
R4 1.0M
R1 1.0M
R2 1.0M
R8 1.0M
R5 1.0M
R6 1.0M
J1
CON2
10
8
6

FIG. 2.

专利名称(译)	非兼容血氧计和传感器之间的互连电路		
公开(公告)号	EP1318748B1	公开(公告)日	2005-08-24
申请号	EP2001971315	申请日	2001-09-21
[标]申请(专利权)人(译)	马林克罗特公司		
申请(专利权)人(译)	马林克罗特INC.		
当前申请(专利权)人(译)	马林克罗特INC.		
[标]发明人	FEIN MICHAEL E CHEW BRADFORD B		
发明人	FEIN, MICHAEL, E. CHEW, BRADFORD, B.		
IPC分类号	G01N21/35 A61B5/00 G01N21/27		
CPC分类号	A61B5/14551 A61B5/14552 A61B2560/045		
优先权	09/668032 2000-09-21 US		
其他公开文献	EP1318748A1		
外部链接	Espacenet		

摘要(译)

血氧计传感器适配器允许没有电阻器的传感器与其LED并联，以使用血氧计与期望这样的电阻并联。适配器具有开关电路，其具有连接到血氧计的LED驱动输出的输入。开关电路有两对输出，一对连接到传感器的LED驱动线，另一对连接到适配器本身的电阻。开关电路由检测电路控制，该检测电路检测输入线上的信号何时下降到低于预定电平，例如0.5伏。响应于低电压（对应于尝试与LED并联地读取电阻器），感测电路将向开关电路提供信号。开关电路将电阻器切换到输入线上，以便可以读取。当更高的电压返回到输入线时，开关电路切换回LED本身。

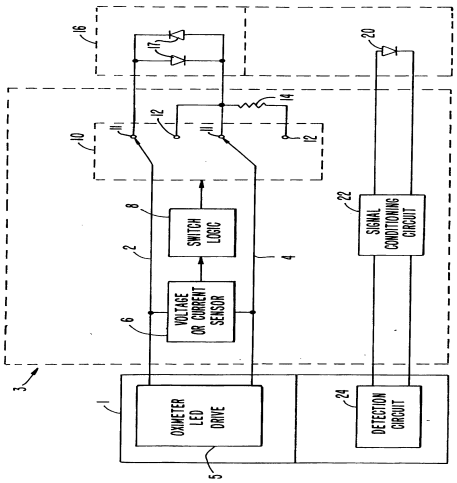

FIG. 1.