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(54) **OXIMETER SENSOR WITH DIGITAL MEMORY ENCODING PATIENT DATA**

OXIMETERSENSOR MIT EINEM DIGITALSPEICHER ZUR KODIERUNG VON PATIENTENDATA

CAPTEUR OXYMETRE EQUIPE D'UNE MEMOIRE NUMERIQUE POUR LE CODAGE DES DONNEES D'UN PATIENT

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EP 1 315 446 B1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to oximetry sensors and, in particular, pulse oximetry sensors which include coded information relating to patients.

[0002] Pulse oximetry is typically used to measure various blood flow characteristics including, but not limited to, the blood-oxygen saturation of hemoglobin in arterial blood, the volume of individual blood pulsations supplying the tissue, and the rate of blood pulsations corresponding to each heartbeat of a patient. Measurement of these characteristics has been accomplished by use of a non-invasive sensor which passes light through a portion of the patient's tissue where blood perfuses the tissue, and photoelectrically senses the absorption of light in such tissue. The amount of light absorbed is then used to calculate the amount of blood constituent being measured.

[0003] The light passed through the tissue is selected to be of one or more wavelengths that are absorbed by the blood in an amount representative of the amount of the blood constituent present in the blood. The amount of transmitted light passed through the tissue will vary in accordance with the changing amount of blood constituent in the tissue and the related light absorption. For measuring blood oxygen level, such sensors have been provided with light sources and photodetectors that are adapted to operate at two different wavelengths, in accordance with known techniques for measuring blood oxygen saturation.

[0004] An encoding mechanism is shown in U. S. Patent No. 4,700,708, the disclosure of which is incorporated herein by reference. This mechanism relates to an optical oximeter probe which uses a pair of light emitting diodes (LEDs) to direct light through blood-perfused tissue, with a detector picking up light which has not been absorbed by the tissue. The operation depends upon knowing the wavelength of the LEDs. Since the wavelength of LEDs can vary, a coding resistor is placed in the probe with the value of the resistor corresponding to the actual wavelength of at least one of the LEDs. When the oximeter instrument is turned on, it first applies a current to the coding resistor and measures the-voltage to determine the value of the resistor and thus the value of the wavelength of the LED in the probe.

[0005] U. S. Patent 5,259,381 recognizes that the coded value of the wavelength of the red LED provided by a coding resistor may be inaccurate, since the actual wavelength can vary with temperature. Accordingly, this patent teaches including a temperature sensor in the oximeter probe to measure the actual temperature. With the actual temperature, and the coded wavelength value, a look-up table can be consulted to determine the actual LED wavelength for that temperature.

[0006] Another method of storing coded information regarding the characteristics of the LEDs is shown in U. S. Patent No. 4,942,877 assigned to Minolta. This patent discloses using an EPROM memory to store digital information, which can be provided in parallel or serially from the sensor probe to the remote oximeter. The memory is described as storing coefficients for the saturation equation, wavelength, subwavelength (where 2 peaks for LED), half-width of wavelength spectrum emitted by LED, intensity of LEDS or ratio, and on time of LEDS (written by the processor).

[0007] Other examples of coding probe characteristics exist in other areas. Multiple calibration values are sometimes required, with this making the circuitry more complex or requiring many leads. In Patent No. 4,446,715, assigned to Camino Laboratories, Inc., a number of resistors are used to provide coded information regarding the characteristics of a pressure transducer. Patent No. 3,790,910 discloses another pressure transducer with a ROM storing characteristics of the individual transducer. Patent No. 4,303,984 shows another probe with digital characterization information stored in a PROM, which is read serially using a shift register.

[0008] Typically, the coding element is mounted in the probe itself. For instance, U. S. Patent No. 4,621,643 shows the coding resistor mounted in the probe element itself In addition, U. S. Patent No. 5,246,003 shows the coding resistor being formed with a printed conductive material on the probe itself.

[0009] In some devices, an electrical connector coupled by a cable to a device attached to a patient may include a coding element. For example, U. S. Patent No. 3,720,199 shows an intra-aortic balloon catheter with a connector between the catheter and a console. The connector includes a resistor with a value chosen to reflect the volumetric displacement of the particular balloon. U. S. Patent No. 4,684,245 discloses a fiberoptic catheter with a module between the fiberoptic and electrical wires connected to a processor. The module converts the light signals into electrical signals, and includes a memory storing calibration signals so the module and catheter can be disconnected from the processor and used with a different processor without requiring a recalibration.

[0010] Patent No. 5,645,059 teaches using a modulated signal to provide the coded data to a remote analyzer. Patent No. 5,429,129 shows using a voltage regulator to produce a specific voltage value in response to an attempt to read by the analyzer.

[0011] Hewlett-Packard Company Patent No. 5,058,588 teaches an oximeter sensor with an encoding element that could be resistor, ROM, or customized integrated circuit. The encoding element encodes the type of sensor (in particular, type indicating area of placement on body-finger, ear, foot, arm; also, the type of sensor can indicate transmission/reflection type, or adult/neonate {indicating correction to be performed on theoretical oxygen saturation, allow switching between physiological limits such as minimum/maximum pulse rates for adults/neonates}; the maximum driving current may be adapted according to type of sensor, and contact of sen-

sor with tissue can be tested by means of an attenuation measurement if sensor type is known).

[0012] Nellcor Patent No. 5,645,059, the disclosure of which is hereby incorporated herein by reference, teaches coding information in sensor memory used to provide pulse modulated signal, to indicate the type of sensor (finger, nose), the wavelength of a second LED, the number of LEDs, the numerical correction terms to the standard curves, and an identifier of the manufacturer.

[0013] A number of catheter patents also discuss encoding information in the catheter. Sentron Patent No. 4,858,615 teaches encoding the type of sensor, type number, serial number, date of production, safe use life of the sensor, correction data for non-linearity, pressure sensitivity, offset, and temperature sensitivity.

[0014] Interflo Medical Published PCT Application No. PCT/US92/08263, Publication No. WO 93/06776 teaches encoding patient specific data, size, manufacture date, batch number, sterilization date, expiration date, transducer number and type, manufacturer's name and address, thermistor heating element resistance, filament efficiency, program segments or patient historical data., format version for the calibration data, trademark information, catheter unique serial number, ship date, other date and time information, security code to identify manufacturer, thermal mass, filament composition, coefficient of resistance, layout byte, checksum, copyright, number of seconds since a certain date, patient weight, patient height, timestamp of Ist CO data point, and a count of all CO data points in EEPROM.

[0015] Dulex-Ohmeda of Boulder, Colorado markets an oximeter sensor product that encodes data into resistor values representing pointers to a lookup table containing coefficients (as in U. S. Patent No. 4,700,708) as well as indicating a range of LED drive current to use with the sensor. The LEDs are driven with a higher or lower drive currents depending upon the value of the resistor in a particular sensor.

[0016] Honeywell Patent No. 4,303,984 (expires 12-14-99) describes a memory which stores characterization information, such as linearization information for a pressure sensor. Alnor Instrument Patent No. 5,162,725 describes storing both calibration and ID information in a sensor memory. Seimans Patent No. 5,016,198 describes a coding memory in a sensor with data for defining sensor's characteristic curve. McBean Patent No. 5,365,462 describes a date code in a sensor memory. Honeywell Patent No. 4,734,873 describes a pressure sensor with a PROM storing coefficients for a polynomial. Robert Bosch Patent No. 4,845,649 describes a PROM in a sensor storing correcting data.

[0017] McBean Patent No. 5,371,128 relates to EEPROM in sensor with sensor type code and calibration data. McBean Patent No. 5,347,476 describes an accuracy code. Otax Patent No. 5,528,519 shows a PROM in a connector for oximeter.

[0018] Square D Company Patent No. 5,070,732 shows calibration data in a sensor memory. Baxter Patent No. 5,720,293 talks about different calibration information for a catheter, including a security code (encryption is discussed), serial number, model number, ID data such as calibration, manufacture, sterilization and ship date or other date and time information, a software program segment, security code for identifying whether sensor made by same manufacturer as monitor manufacturer, filament or transducer resistance, heat transfer coefficient, thermal mass, filament composition and coefficient of resistance, layout byte, copyright notice, checksum, random data bytes. Porsche Patent No. 5,008,843 describes a sensor with EEPROM ID and characteristics data. US 5,987,343 discloses a sensor including a memory. However, the memory is merely used for calibration purposes and for administrative purposes such as recording the cumulative hours of usage to determine whether the sensor will produce reliable data and, thus, can still be used. US 5,660,163 discloses a system which provides for recording historical data generated by a sensor. However, no memory device is provided within the sensor itself. US 6,044,283 discloses a sensor device which includes a memory exclusively used for calibration of the sensor. WO97/29678 discloses a sensor system similar to the one disclosed in US 5,987,343 which allows for recording the time of usage in a memory device located within the sensor to determine availability of the sensor.

BRIEF SUMMARY OF THE INVENTION

[0019] It is, therefore, an object of the present invention to provide a sensor and a method for operating a sensor that allows for integrated monitor and control functions assigned to the specific sensor. This and other objects can be achieved by a method and apparatus as defined in the independent claims. Further enhancements are defined in the dependent claims. The present invention provides a memory chip for use in an oximeter sensor, or an associated adapter or connector circuit. The memory chip allows the storing of patient related data, such as patient trending data or a patient ID, to provide enhanced capabilities for the oximeter sensor. In addition to providing unique data to store in such a memory, the present invention include unique uses of the data stored in such a memory as defined in the independent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

FIG. 1 is a block diagram of a pulse oximeter system in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0021] FIG. 1 is a block diagram of a pulse oximeter system incorporating a calibration memory element 56 according to the invention. In one embodiment, memory

element 56 is a two-lead semiconductor digital memory chip. The calibration element is part of the sensor 50 which also includes red and infrared LEDs 52 as in the prior art, along with a detector 54. If desired, LEDs 52 may be replaced with other light emitting elements such as lasers.

[0022] The oximeter includes read circuit 60, drive circuit 66, look-up tables 62 and 63, controller 64, amplifier 72, filter 74, and analog-to-digital converter 76. Read circuit 60 is provided for reading multiple coded values across the two leads 51,53 connected to calibration element 56. One value is provided to a look-up table 62 to determine appropriate wavelength dependent coefficients for the oxygen saturation calculation, as in the prior art. The other value (s) are then provided to another look up table (s) 63 which provides input (e. g., coefficients) to other calculations performed by controller 64. These additional calculations may enhance the performance and/or safety of the system. Controller 64 provides signals to a drive circuit 66, to control the amount of drive current provided to LEDs 52.

[0023] As in the prior art, detector 54 is connected through an amplifier 72 and a filter 74 to an A/D converter 76. This forms a feedback path used by controller 64 to adjust the drive current to optimize the intensity range of the signal received. For proper operation the signal must be within the analog range of the circuits employed. The signal should also be well within the range of A/D converter 76. For example, one rule that may be applied is to adjust LED drives and amplifier gains so that both red and IR signals fall between 40% and 80% of full scale reading of converter 76. This requires correct and independent settings for both the red and infrared LEDs.

[0024] In an embodiment of the present invention, patient-specific data such as trending data or patient monitoring parameters can be actively stored in the memory of memory chip 56. As the patient and sensor travel from ward-to-ward of the hospital, and consequently plug into different oximeters, the patient-specific data can be read from memory 56 of the patient's dedicated sensor and displayed on a display screen for viewing or used by the oximeter monitor for other purposes. Memory 56 may, for example, be implemented as a random access memory(RAM), a FLASH memory, a programmable read only memory (PROM), an electrically erasable PROM, a similar programmable and/or erasable memory, any kind of erasable memory, a write once memory, or other memory technologies capable of write operations. Examples of patient specific data that can be stored in memory 56 are now discussed.

[0025] Patient trending data regarding the history of a patient's blood oxygen saturation(SpO2) level, pulse rate, pulse amplitude, perfusion data, and other patient data over a period of time can be recorded in memory chip 56. The oximeter monitor can continuously or periodically store a patient's current trend data into memory 56 to maintain a historical data for the patient. The patient trend data can be erased from memory 56 each time a sensor is used on a new patient (e. g., each time the oximeter monitor is turned off or when user input to the monitor indicates a new patient). Alternatively, the data encoded into memory 56 can be permanent and non-erasable. Further details of a Method and Circuit for Storing and Providing Historical Physiological Data are discussed in U. S. Patent Application No. 09/520,104 to Swedlow et al., filed March 7, 2000 published as US Patent 6,463,310.

[0026] As another example, the lowest and/or highest blood oxygen saturation level, pulse rate, pulse amplitude value, temperature data, blood pressure, perfusion data, or any other patient data during the monitored time may be stored in memory 56 by the oximeter monitor. If desired, the lowest/highest values of these patient parameters over a past specified monitoring time (e. g., 2 hours, 1 day, etc.) may be recorded in memory 56.

[0027] Expected ranges for patient parameters (such as pulse rate, pulse amplitude, and blood oxygen saturation level) that are specific to a particular patient may also be recorded in memory 56 by a clinician. This can be a desirable feature, because the expected patient trending data can vary significantly for each patient. The oximeter monitor can compare the expected range for the patient stored in memory 56 with the monitored patient trending data to determine if the patient's pulse and blood oxygen levels are within the expected range for that patient. If the monitored patient parameter varies outside the patient-specific range recorded in memory 56, a warning message may be displayed on the oximeter monitor or alarm signal may be sounded. If desired, any variations in the monitored patient parameters from the expected ranges may be recorded in memory 56 along with a time stamp.

[0028] If desired, portions of a patient's medical chart and/or past medical history can be digitally encoded and stored in memory 56 (if sufficient memory space is available) so that this information is maintained with the patient as he is moved around and can be easily accessed and displayed using an oximeter monitor if the patient transferred to a different room or hospital.

[0029] The pulse oximeter can keep track of how long a particular patient has been monitored by the pulse oximeter and can periodically store that time interval in memory 56 by checking the elapsed time on a counter. The counter may be a circuit element in the oximeter monitor that is reset each time the oximeter monitor begins to receive data signals from a sensor or each time that the oximeter monitor is turned off. The time period that a patient has been monitored by the oximeter sensor may be displayed on a display screen for viewing.

[0030] The pulse oximeter monitor may also include a digital clock that keeps track of the current date and time. The date and time that the oximeter monitor was turned on and the date and time that the oximeter monitor was turned off may be encoded into the sensor in memory 56. When the oximeter monitor is turned back on again, the monitor can display the date and time that it was last

turned on and off. It may be desirable for medical personnel to know the last time that patient's vital signs were monitored by the oximeter.

[0031] The oximeter monitor instrument may also write the alarm limits used with a particular patient into memory chip 56. Alarm limits are values that represent maximum or minimum values of patient trending data tracked by the oximeter (such as blood oxygen saturation, pulse rate, pulse amplitude, etc.) that will trigger an alarm, because they are considered to be dangerous levels. The alarm limit values may be encoded in memory 56 by the manufacturer or by a clinician through the oximeter monitor prior to operation.

[0032] The oximeter monitor periodically checks the patient's monitored trending data against the alarm limit values. When one of the monitored patient parameters reaches the alarm limit value stored in memory 56, the oximeter monitor triggers an alarm which alerts medical personnel that a problem may exist. The present invention also allows patient-specific alarm values to be set by medical personnel through the oximeter and stored in memory 56 so that as the patient moves from monitor-to-monitor (while the sensor stays with the patient), the appropriate alarm limits need not be reset each time on the new monitor. Instead, the alarm limits only need to be programmed once, or at a later time, whenever the clinician adjusts alarm limits.

[0033] One of more of the patient trending data including blood oxygen saturation, pulse rate, and pulse amplitude can be written to memory 56 along with a time of occurrence whenever an alarm threshold is crossed. Additional information, such as the readings for a predetermined time prior to an alarm occurrence can also be stored, and/or periodic values during the alarm breach can also be stored in memory 56.

[0034] Currently sensors are placed on patients at one hospital site and stay with the patient from hospital site-to-site. It would therefore be desirable to have a patient identification code (patient ID) such as a unique number carried along in the sensor so that the record keeping, which occurs at each site, can link the recorded information with the patient. Without a patient ID stored in the sensor itself, the tracking has to be done manually. This method is prone to mistakes and increases the labor involved in managing the patient.

[0035] Thus, in a further embodiment of the present invention the oximeter monitor can store a patient ID in memory 56 of sensor 50. The oximeter has an input device such as a keyboard, touch screen, or scanner that allows a patient ID to be entered and reentered into the oximeter so that it can be stored in sensor memory 56. With patient trending information being stored in memory 56 of the sensor as discussed above, it is also desirable to have the patient 1D stored in memory 56 so that as the patient goes from hospital location to location, the new location's staff can verify that old trending information stored in memory 56 was indeed obtained from that particular patient. Medical personnel can check that the patient ID stored in sensor 50 matches the patient ID on the patient's chart and other paper documentation to verify that these medical records correspond to the correct patient. If desired, the oximeter sensor can be interfaced with a hospital computer network that maintains a database of patient ID numbers to verify the identify of the patient and to obtain medical records and other information for the patient stored on hospital databases. The patient ID stored in memory 56 provides assurance that any data read from memory 56 of the sensor is correlated with the patient they are receiving.

[0036] The pulse amplitude of the measured photoplethysmogram is an indirect measure of blood perfusion (flow) in the local tissue, changes in blood pressure, vascular tone, vasoconstriction or dilation, for example, all have an effect on the pulsatile signal strength observed with a pulse oximeter.

[0037] The measured modulation, or other measurement of perfusion, can be stored in memory 56 for patient trending purposes. The oximeter can compare current modulation and perfusion data with older data from memory 56 to determine patient trends over time. The patient's pulse amplitude deteriorating over time may reflect a serious condition that demands attention. Therefore, it is desirable to store and monitor changes in a patient's perfusion over time. Also, a maximum or minimum perfusion limit may be stored in memory 56 that represents the maximum or minimum value that the patient's measured perfusion can reach before the sensor needs to be moved, repositioned, or adjusted in some other way. The oximeter can trigger a warning signal or light when a perfusion limit has been reached or a significant change has occurred.

Claims

1. A method for using an oximeter sensor adapted for mobile use with a patient, the method comprising:

   - emitting light from a light emitting element (52);
   - detecting light from the light emitting element (52) using a light detecting element (54);
   - storing alarm limit values in a memory device (56) in the sensor (50), wherein the alarm limit values include minimum or maximum values of patient data tracked by an oximeter that trigger an alarm signal;
   - comparing the alarm limit values stored in the memory device (56) with monitored patient data, wherein the monitored patient data is calculated from a signal from the light detecting element (54); and if the monitored patient data reaches one of the alarm limit values, triggering the alarm signal.

2. The method according to claim 1, wherein the alarm limit values include blood oxygen saturation data

specific to a patient.

3. The method according to claim 2, wherein said memory device encodes a highest and a lowest blood oxygen saturation level monitored during a period of time.

4. The method according to one of the preceding claims, wherein the alarm limit values include pulse rate data specific to a patient.

5. The method according to one of the preceding claims, wherein said memory device (56) encodes a duration of time that a patient parameter decoded from signals received from said light detecting element exceeded or fell below one of the alarm limit values.

6. The method according to one of the preceding claims, wherein the alarm limit values include pulse amplitude data for a patient.

7. The method according to one of the preceding claims, wherein storing the alarm limit values in the memory further comprises storing expected blood perfusion data for the patient in the memory (56).

8. The method according to one of the preceding claims, further comprising storing monitored patient trending data received from the photodetector (54) in the memory (56) after one of the alarm limit values has been reached.

9. The method according to one of the preceding claims, further comprising storing a time that one of the alarm limit values was breached.

10. An oximeter system comprising:

- an oximeter sensor (50) for mobile use with a patient, the oximeter sensor (50) comprising a light emitting element (52), a light detecting element (54), and a memory device (56) suitable for storing digital data, the memory device forming part of the sensor (50), said digital data comprising in use oximeter alarm limit values that are patient-specific, wherein the alarm limit values include minimum or maximum values of patient data that trigger an alarm signal; and
- an oximeter monitor comprising a read circuit (60) for retrieving said stored data, the oximeter monitor being designed to compare the alarm limit values stored in the memory device with monitored patient data, wherein the monitored patient data is calculated from a signal from the light detecting element (52), and wherein the oximeter monitor is designed to trigger the alarm signal if the monitored patient data reaches one of the alarm limit values.

11. The oximeter system according to claim 10, wherein the alarm limit values include a maximum or minimum blood oxygen saturation level.

12. The oximeter system according to claim 10 or 11, wherein the alarm limit values include a maximum or minimum pulse rate.

13. The oximeter system according to one of claims 10 to 12, wherein said memory device (56) encodes patient trending data after an alarm limit value has been reached.

14. The oximeter system according to claim 13, wherein said patient trending data comprises perfusion data.

15. The oximeter system according to claim 13, wherein said patient trending data comprises blood oxygen saturation levels.

16. The oximeter system according to one of the claims 10 to 15, wherein said memory device (56) encodes patient trending data periodically before an alarm limit value has been reached.

17. The oximeter system according to claim 16, wherein said patient trending data comprises blood oxygen saturation levels.

18. The oximeter system according to claim 16, wherein said patient trending data comprises blood perfusion data.

19. The oximeter system according to one of the claims 10 to 18, wherein said memory device (56) encodes a time that an alarm limit was initially breached.

Patentansprüche

1. Verfahren zur Verwendung eines Oximetersensors, angepasst für eine mobile Verwendung mit einem Patienten, wobei das Verfahren umfasst:

- Emittieren von Licht von einem lichtemittierenden Element (52);
- Detektieren von Licht vom lichtemittierenden Element (52) mittels eines lichtdetektierenden Elements (54);
- Speichern von Alarmgrenzwerten in einer Speichervorrichtung (56) im Sensor (50), wobei die Alarmgrenzwerte Minimal- oder Maximalwerte von Patientendaten, verfolgt durch ein Oximeter, umfassen, die ein Alarmsignal auslösen;
- Vergleichen der in der Speichervorrichtung

(56) gespeicherten Alarmgrenzwerte mit überwachten Patientendaten, wobei die überwachten Patientendaten von einem Signal vom lichtdetektierenden Element (54) berechnet werden; und wenn die überwachten Patientendaten einen der Alarmgrenzwerte erreichen, Auslösen des Alarmsignals.

2. Verfahren nach Anspruch 1, bei welchem die Alarmgrenzwerte Blutsauerstoffsättigungsdaten speziell für einen Patienten umfassen.

3. Verfahren nach Anspruch 2, bei welchem die Speichervorrichtung ein höchstes und ein niedrigstes Blutsauerstoffsättigungsniveau, überwacht während einer Zeitdauer, codiert.

4. Verfahren nach einem der vorherigen Ansprüche, bei welchem die Alarmgrenzwerte Pulsratendaten speziell für einen Patienten umfassen.

5. Verfahren nach einem der vorherigen Ansprüche, bei welchem die Speichervorrichtung (56) eine Zeitdauer codiert, während der ein Patientenparameter, decodiert von Signalen, die vom lichtdetektierenden Element empfangen werden, einen der Alarmgrenzwerte überschritten oder unterschritten hat.

6. Verfahren nach einem der vorherigen Ansprüche, bei welchem die Alarmgrenzwerte Pulsamplitudendaten für einen Patienten umfassen.

7. Verfahren nach einem der vorherigen Ansprüche, bei welchem das Speichern der Alarmgrenzwerte im Speicher ferner das Speichern der erwarteten Blutperfusionsdaten für den Patienten im Speicher (56) umfasst.

8. Verfahren nach einem der vorherigen Ansprüche, ferner umfassend das Speichern von überwachten Patiententendenzdaten, die vom Photodetektor (54) empfangen werden, im Speicher (56), nachdem einer der Alarmgrenzwerte erreicht wurde.

9. Verfahren nach einem der vorherigen Ansprüche, ferner umfassend das Speichern einer Zeit, während der einer der Alarmgrenzwerte durchbrochen war.

10. Oximetersystem, umfassend:

- einen Oximetersensor (50) für eine mobile Verwendung mit einem Patienten, wobei der Oximetersensor (50) ein lichtemittierendes Element (52), ein lichtdetektierendes Element (54) und eine Speichervorrichtung (56), geeignet zum Speichern von digitalen Daten, umfasst, wobei die Speichervorrichtung einen Teil des Sensors (50) bildet, wobei die digitalen Daten bei der Verwendung Oximeteralarmgrenzwerte umfassen, die patientenspezifisch sind, wobei die Alarmgrenzwerte Minimal- oder Maximalwerte von Patientendaten umfassen, die ein Alarmsignal auslösen; und
- eine Oximeterüberwachungsvorrichtung, umfassend eine Leseschaltung (60) zum Abrufen der gespeicherten Daten, wobei die Oximeterüberwachungsvorrichtung entworfen ist, um die in der Speichervorrichtung gespeicherten Alarmgrenzwerte mit überwachten Patientendaten zu vergleichen, wobei die überwachten Patientendaten von einem Signal vom lichtdetektierenden Element (52) berechnet werden, und wobei die Oximeterüberwachungsvorrichtung entworfen ist, um das Alarmsignal auszulösen, wenn die überwachten Patientendaten einen der Alarmgrenzwerte erreichen.

11. Oximetersystem nach Anspruch 10, bei welchem die Alarmgrenzwerte ein maximales oder minimales Blutsauerstoffsättigungsniveau umfassen.

12. Oximetersystem nach Anspruch 10 oder 11, bei welchem die Alarmgrenzwerte eine maximale oder minimale Pulsrate umfassen.

13. Oximetersystem nach einem der Ansprüche 10 bis 12, bei welchem die Speichervorrichtung (56) Patiententendenzdaten codiert, nachdem ein Alarmgrenzwert erreicht wurde.

14. Oximetersystem nach Anspruch 13, bei welchem die Patiententendenzdaten Perfusionsdaten umfassen.

15. Oximetersystem nach Anspruch 13, bei welchem die Patiententendenzdaten Blutsauerstoffsättigungsniveaus umfassen.

16. Oximetersystem nach einem der Ansprüche 10 bis 15, bei welchem die Speichervorrichtung (56) Patiententendenzdaten periodisch codiert, bevor ein Alarmgrenzwert erreicht wurde.

17. Oximetersystem nach Anspruch 16, bei welchem die Patiententendenzdaten Blutsauerstoffsättigungsniveaus umfassen.

18. Oximetersystem nach Anspruch 16, bei welchem die Patiententendenzdaten Blutperfusionsdaten umfassen.

19. Oximetersystem nach einem der Ansprüche 10 bis 18, bei welchem die Speichervorrichtung (56) eine Zeit codiert, zu der ein Alarmgrenzwert anfänglich durchbrochen wurde.

Revendications

1. Procédé d'utilisation d'un capteur d'oxymétrie adapté pour être utilisé de manière mobile avec un patient, le procédé comprenant :

   - une émission de lumière depuis un élément électroluminescent (52) ;
   - la détection de la lumière provenant de l'élément électroluminescent (52) en utilisant un élément de détection de la lumière (54) ;
   - le stockage de valeurs limite d'alarme dans un dispositif de mémoire (56) dans le capteur (50), où les valeurs limite d'alarme comprennent des valeurs minimum ou maximum de données de patient suivies par un oxymètre qui déclenchent un signal d'alarme ;
   - la comparaison des valeurs limite d'alarme stockées dans le dispositif de mémoire (56) avec des données de patient surveillées, où les données de patient surveillées sont calculées à partir d'un signal provenant de l'élément de détection de lumière (54) ; et, si les données de patient surveillées atteignent l'une des valeurs limite d'alarme, le déclenchement du signal d'alarme.

2. Procédé selon la revendication 1, dans lequel les valeurs limite d'alarme comprennent des données de saturation d'oxygène dans le sang spécifiques à un patient.

3. Procédé selon la revendication 2, dans lequel ledit dispositif de mémoire encode un niveau de saturation d'oxygène dans le sang supérieur et inférieur surveillé pendant une période de temps.

4. Procédé selon l'une des revendications précédentes, dans lequel les valeurs limite d'alarme comprennent des données de rythme cardiaque spécifiques à un patient.

5. Procédé selon l'une des revendications précédentes, dans lequel ledit dispositif de mémoire (56) encode une période de temps pendant laquelle un paramètre de patient décodé à partir de signaux reçus de la part dudit élément de détection de lumière a dépassé ou a chuté au-dessous de l'une des valeurs limite d'alarme.

6. Procédé selon l'une des revendications précédentes, dans lequel les valeurs limite d'alarme comprennent des données d'amplitude d'impulsions pour un patient.

7. Procédé selon l'une des revendications précédentes, dans lequel le stockage des valeurs limite d'alarme dans la mémoire comprend en outre le stockage de données de perfusion sanguine prévues pour le patient dans la mémoire (56).

8. Procédé selon l'une des revendications précédentes, comprenant en outre le stockage de données de tendances surveillées d'un patient reçues de la part du photodétecteur (54) dans la mémoire (56) après que l'une des valeurs limite d'alarme ait été atteinte.

9. Procédé selon l'une des revendications précédentes, comprenant en outre le stockage d'un moment auquel l'une des valeurs limite d'alarme a été dépassée.

10. Système d'oxymètre comprenant :

    - un capteur d'oxymétrie (50) destiné à être utilisé de manière mobile avec un patient, le capteur d'oxymétrie (50) comprenant un élément électroluminescent (52), un élément de détection de lumière (54) et un dispositif de mémoire (56) convenant pour stocker des données numériques, le dispositif de mémoire faisant partie du capteur (50), lesdites données numériques comprenant, lors de l'utilisation, des valeurs limite d'alarme qui sont spécifiques à un patient, où les valeurs limite d'alarme comprennent des valeurs minimum ou maximum de données du patient qui déclenchent un signal d'alarme ; et
    - un moniteur d'oxymètre comprenant un circuit de lecture (60) destiné à rechercher lesdites données stockées, le moniteur d'oxymètre étant conçu afin de comparer les valeurs limite d'alarme stockées dans le dispositif de mémoire avec des données surveillées du patient, où les données surveillées du patient sont calculées à partir d'un signal provenant de l'élément de détection de lumière (52), et où le moniteur d'oxymètre est conçu afin de déclencher le signal d'alarme si les données surveillées du patient atteignent l'une des valeurs limite d'alarme.

11. Système d'oxymètre selon la revendication 10, dans lequel les valeurs limite d'alarme comprennent un niveau de saturation d'oxygène dans le sang maximum ou minimum.

12. Système d'oxymètre selon la revendication 10 ou 11, dans lequel les valeurs limite d'alarme comprennent un rythme cardiaque maximum ou minimum.

13. Système d'oxymètre selon l'une des revendications 10 à 12, dans lequel ledit dispositif de mémoire (56) encode des données de tendances d'un patient après qu'une valeur limite d'alarme ait été atteinte.

14. Système d'oxymètre selon la revendication 13, dans lequel lesdites données de tendances d'un patient

comprennent des données de perfusion.

15. Système d'oxymètre selon la revendication 13, dans lequel lesdites données de tendances d'un patient comprennent des niveaux de saturation d'oxygène dans le sang.

16. Système d'oxymètre selon l'une des revendications 10 à 15, dans lequel ledit dispositif de mémoire (56) encode des données de tendances d'un patient de manière périodique avant qu'une valeur limite d'alarme ne soit atteinte.

17. Système d'oxymètre selon la revendication 16, dans lequel lesdites données de tendances d'un patient comprennent des niveaux de saturation d'oxygène dans le sang.

18. Système d'oxymètre selon la revendication 16, dans lequel lesdites données de tendances d'un patient comprennent des données de perfusion sanguine.

19. Système d'oxymètre selon l'une des revendications 10 à 18, dans lequel ledit dispositif de mémoire (56) encode un moment auquel une valeur limite d'alarme a été initialement dépassée.

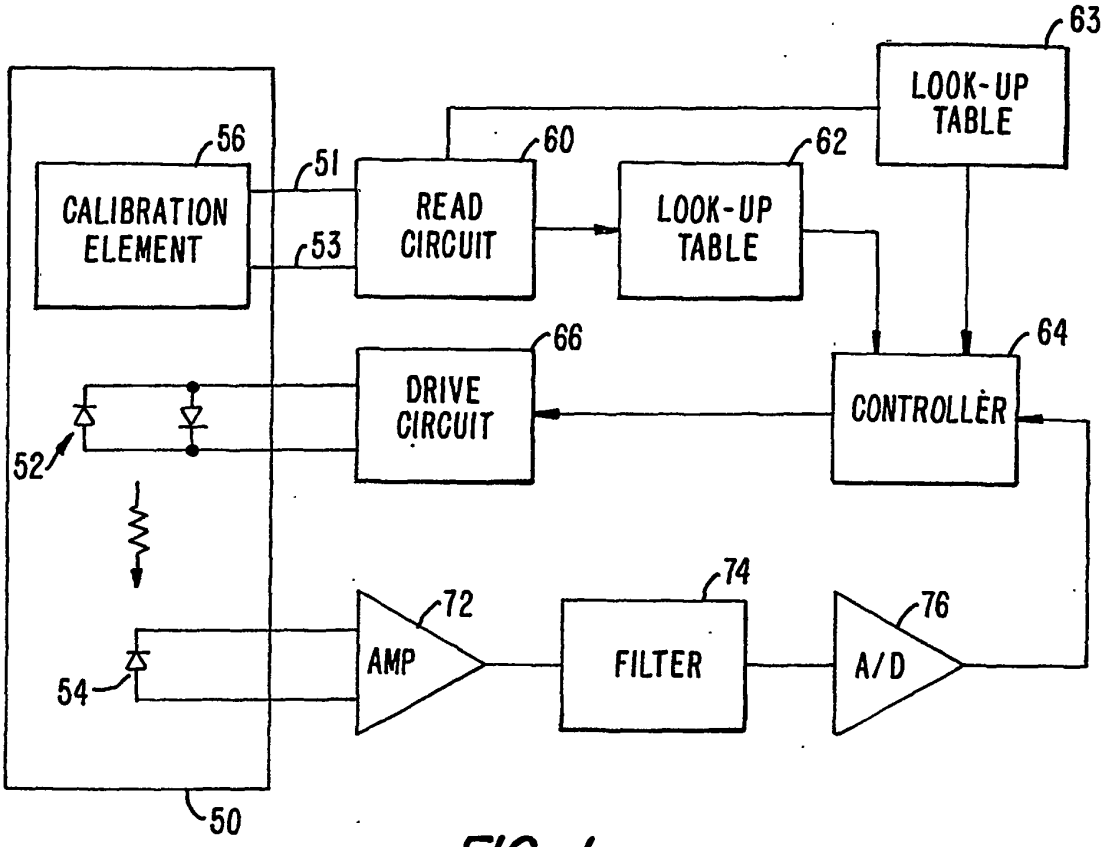
63
LOOK-UP TABLE
56
CALIBRATION ELEMENT
51
53
60
READ CIRCUIT
62
LOOK-UP TABLE
66
DRIVE CIRCUIT
64
CONTROLLER
52
54
72
AMP
74
FILTER
76
A/D
50

FIG. 1

REFERENCES CITED IN THE DESCRIPTION

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专利名称(译)	血氧计传感器，数字记忆编码患者数据		
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代理机构(译)	GRUBERT，ANDREAS		
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外部链接	Espacenet		

摘要(译)

本发明提供一种用于血氧计传感器或相关适配器或连接器电路的存储器芯片。存储器芯片允许存储患者相关数据，例如患者趋势数据或患者ID，以为血氧计传感器提供增强的能力。除了提供存储在这种存储器中的唯一数据之外，本发明还包括存储在这种存储器中的数据的独特用途。

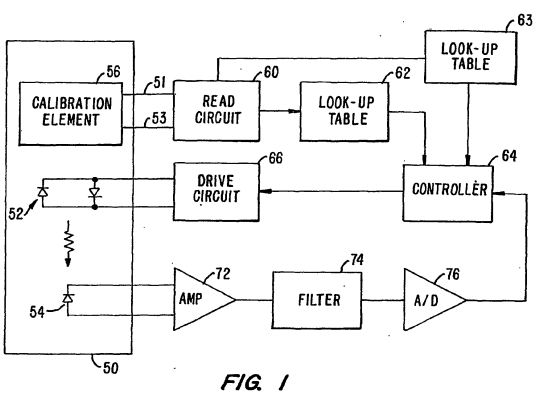

FIG. 1