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AN OPTOELECTRONIC DEVICE THAT NONINVASIVELY MEASURES BLOOD OXYGEN SATURATION.

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Annotatsiya: Malumki, konning oxygenga tuyingganligini aniklashning photometric usuli ikki hil tulqinlikga ega bo'lgan erug' manbalaridan yuk tashishni talab qiladi. Bu holat, konstruksiyadagi gemoglobin va oxyhemoglobinning yorug'likning turli xil uzunliklari uchun turli xil hil yutilish koeffitsienti egaligi bilan bog'liq. Khullas, 660 nm tulqin energiya (spectrning qizil sohasi) yes gemoglobin oxyhemoglobin karaganda 10 yillik kwproq eruglik yutilishiga ega buladi. 940 nm (infraqizil nurlar sohassi) tulqinda esa, aks hol ruy beradi, yani oxyhemoglobin gemoglobin nisbatan kwproq eruglik yutadi. Shu tufaili, ikkita farqli yorug'lik manbaidan ishonchli gemoglobinning nisbiy kiymati haqida ma'lumot olish mumkin.

Kalit so'zlar: fotometrik, optoelektronik, diagnostika, fotoelektrik, monoxromatik, diodli, lazerli, gemoglobin, oksigemoglobin, fotodiod.

Annotation: It is known that the photometric method of determining blood oxygen saturation requires the use of light sources with two different wavelengths. This is due to the fact that hemoglobin and oxyhemoglobin in the blood have different absorption coefficients for different wavelengths of light. So, at a wavelength of 660 nm (the red part of the spectrum), hemoglobin has 10 times more light absorption than oxyhemoglobin. At the wavelength of 940 nm (infrared rays), the opposite happens, that is, oxyhemoglobin absorbs more light than hemoglobin. Because of this, it is possible to obtain information about the relative value of hemoglobin using two different light sources.

Keywords: photometric, optoelectronic, diagnostics, photoelectric, monochromatic, diode, lasers, hemoglobin, oxyhemoglobin, photodiode.

Аннотация: Известно, что фотометрический метод определения насыщения крови кислородом требует использования источников света с двумя разными длинами волн. Это связано с тем, что гемоглобин и оксигемоглобин в крови имеют разные коэффициенты поглощения для разных длин волн света. Так, при длине волны 660 нм (красная часть спектра) гемоглобин имеет в 10 раз большее светопоглощение, чем оксигемоглобин. При длине волны 940 нм (инфракрасные лучи) происходит обратное, то есть оксигемоглобин поглощает больше света, чем гемоглобин. Благодаря этому можно получить информацию об относительном значении гемоглобина, используя два разных источника света.

Ключевые слова: фотометрик, оптоэлектроник, диагностика, фотоэлектрик, монохроматик, диод, лазерлар, гемоглобин, оксигемоглобин, фотодиод.

In intensive care units, clinical monitoring and control of gas content of the patient's blood, in particular monitoring of blood oxygen saturation, is an important process in the diagnosis and treatment of patients. The level of blood oxygen saturation directly reflects the physical and physiological state of the patient's body. Such a diagnosis allows measuring the value of the level of saturation of hemoglobin with oxygen and carbon dioxide in arterial and venous blood flows in percentages. Currently, there are many optoelectronic diagnostic methods for measuring these parameters, each of which has its own advantages and disadvantages.[1].

The principle of operation of the photometric method of blood oxygen content is based on the absorption of light emitted from the outside in the blood passing through a certain part of the human body. (Figure 1) A photoelectric measuring device consists of a light source and a light-sensing photodiode. http://randomstar.org/uploads/posts/2011-04/1301968847_05-05-00.jpg

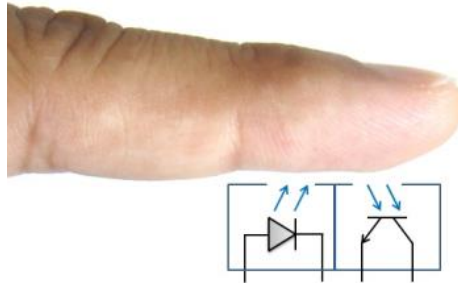


Figure 1 http://randomstar.org/uploads/posts/2011-04/1301968847_05-05-00.jpg

This method has a number of advantages. These include the portability and simplicity of the devices used, as well as the non-invasiveness and speed of the measurement methods used.

At the same time, the following problems are encountered during the measurements:

- the need to provide the researched sample with directed and constant radiation. It requires the use of limited and discrete spectrum radiation sources (monochromatic light-emitting diodes and lasers);
- elimination of radiation losses and other sources of radiation that can cause significant errors and destruction in the measurement process;
- the need to achieve a clear output signal for visualization as a graphical or digital end result.[2].

To solve the above problems, we have analyzed all possible electronic and optoelectronic components and determined the best option for implementing this measurement method.

It is known that the photometric method of determining blood oxygen saturation requires the use of light sources with two different wavelengths. This is due to the fact that hemoglobin and oxyhemoglobin in the blood have different absorption coefficients for different wavelengths of light. So, at a wavelength of 660 nm (the red part of the spectrum), hemoglobin has 10 times more light absorption than oxyhemoglobin. At the wavelength of 940 nm (infrared rays), the opposite happens, that is, oxyhemoglobin absorbs more light than hemoglobin. Because of this, it is possible to obtain information about the relative value of hemoglobin using two different light sources[3].

For example, this concept can be implemented on the basis of two light-emitting diodes with different wavelengths, and based on the received signals, the ratio of hemoglobin and oxyhemoglobin can be estimated in relative units, and finally, it will be possible to estimate the level of oxygen saturation of the blood sample accordingly. A red light-emitting diode with a wavelength of 640 nm and an infrared light-emitting diode with a wavelength of 940 nm provide the difference between the required absorption. However, there are many types of light-emitting diodes, and it is necessary

to choose the suitable one for the measuring device according to photoelectric and physical parameters and based on the results of blood samples.

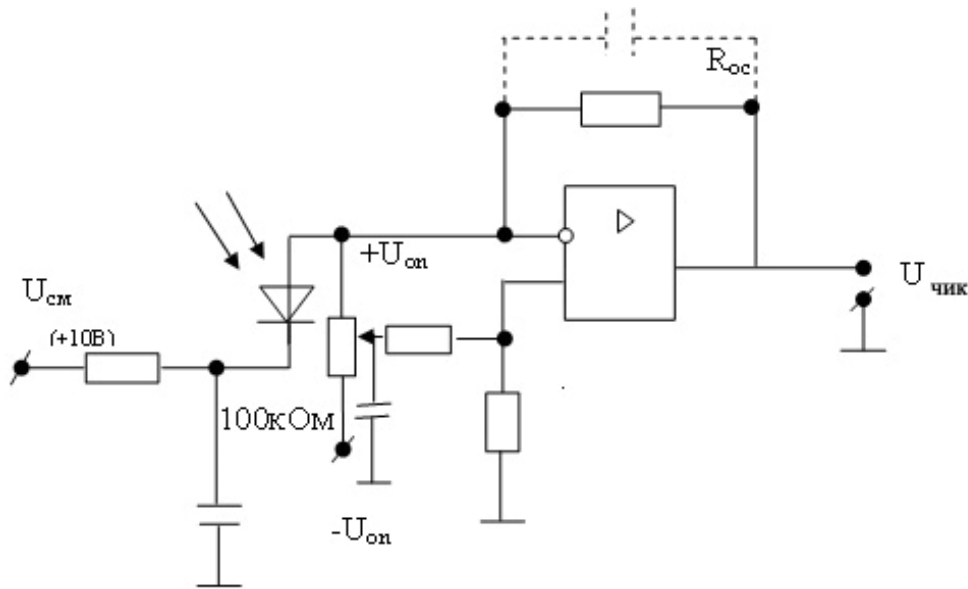


Figure 2. Functional block diagram of an optoelectronic meter.

The results of light transmitted through the blood must be recorded with high resolution and transmitted for visualization. If the level of the output signal is low, it will be very difficult to get rid of defects and errors in the measurement results using standard measuring tools. This, in turn, leads to the application of additional schematic solutions and perfects the principle scheme of the device.

To solve this problem, it is possible to use a single integrated circuit capable of receiving light in a sufficiently wide spectral range. It consists of a photodiode and a transimpedance amplifier with a variable resistance and a feedback element (Fig. 2). This chip has a high stable gain-shift gain and requires a low power supply.

The use of the above-mentioned integrated circuit in the creation of the measuring system allows to solve two problems at the same time:

- As long as an element capable of receiving light in a wide spectrum is selected (Fig. 3), then one simple photodetector is used to receive radiation in the red and infrared wavelength range, which simplifies the structure and schematic design of the device;

- Using the built-in operational amplifier also simplifies the receiving part of the device and increases the reliability of the meter's information channel. As a result, it is not necessary to amplify the output signal and it can be read immediately, for example, through an analog-to-digital converter (ADC).

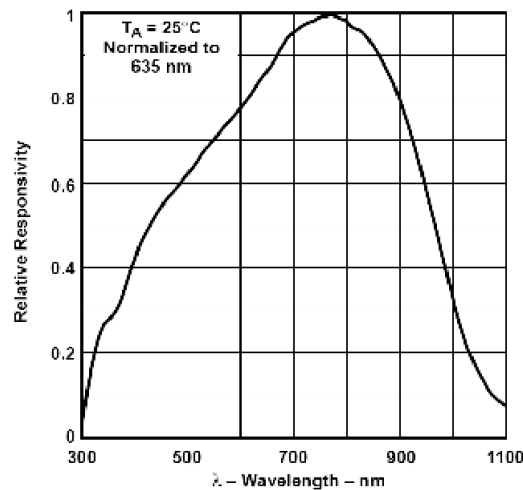


Fig. 3. Measuring sensor - spectral sensitivity of the photodetector.

The main parameter of the system under study is the output voltage of the measurement sensor - photodetector. In this case, the amount of the output signal reflects the level of oxygen saturation of the blood sample under investigation and is synchronized with its change[4].

In order for the incident light intensity to be constant, the light diode must be supplied with a stable energy source, that is, the amount of current passing through the light diode must be constant. This problem is solved using the following techniques and methods:

- by using independent power sources (accumulator and batteries). In this case, the influence of uneven loading of other components of the device on the energy source over time is eliminated, because in this case some errors may occur in the measurements;

- by using an integrated voltage regulator that maintains the potential difference across the light emitting diode in a specific way. This eliminates the dependence of the system on the self-discharge of the accumulator or battery;

- the use of an indicator showing the decrease of the battery charge and its replacement. In this, serious errors are eliminated and stable measurement results are achieved.

Thus, the above-mentioned measurement principle allows to create an optoelectronic device that allows to measure the level of oxygen saturation of the patient's blood in a non-invasive way. The use of a light-emitting diode (or laser), an integrated circuit, and a wide-bandwidth photodetector allow for a compact and compact device[5]. The entire measuring system of this instrument can be placed in a single and tightly closed box.

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ЎЛЧАШ ВОСИТАЛАРИНИ КАЛИБРЛАШ ЖАРАЁНИНИ АВТОМАТЛАШТИРИШНИНГ АҲАМИЯТИ ВА АФЗАЛЛИКЛАРИ

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IMPORTANCE AND ADVANTAGES OF AUTOMATION OF MEASURING INSTRUMENTS CALIBRATION PROCESS

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Аннотация. Ушбу мақолада метрологик хизматнинг асосий қисми бўлган ўлчаши воситаларини калибрлаш жараёнини автоматлаштириши ва унинг афзалликлари кўриб чиқилган.

Калит сўзлар: Ўлчаши воситалари, калибрлаш, автоматлаштириши, дастурий таъминот, процедура, маълумотлар базаси, калибрлаш ҳисоботи.

Аннотация. В данной статье рассматривается автоматизация процесса калибровки средств измерений, которая является ключевой частью метрологической службы, и ее преимущества.

Ключевые слова: средства измерений, калибровка, автоматизация, программное обеспечение, процедура, база данных, отчет о калибровке.

Annotation. This article discusses the automation of the calibration process of measuring instruments, which is a main part of the metrological service, and its advantages.

Keywords: Measuring tools, calibration, automation, software, procedure, database, calibration report.

Калибрлаш лабораторияларида пайдо бўладиган энг типик муаммолар иш ҳажми ва хилма-хиллигини ошириш, техник мутахассислар сонини камайтириш ва сифат стандартлари рўйхатини кенгайтириш кабиларни ўз ичига олади. Бундан ташқари, харажатларни камайтириш учун ҳар доим талаб бор. Калибрлаш жараёнларини автоматлаштириш дастурлари калибрлаш вазифаларини юқори даражада янада самарали ҳал қилишга ёрдам беради [1].

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