Circuit Design for Development of pH-Sensors

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Abstract – **A circuit design of pH-sensors based on polyaniline films is proposed.**
Keywords – **polyaniline films, pH-sensor, circuit design.**

I. INTRODUCTION

In spite of the fact that precision semiconductor elements have a number of advantages, organic conductor materials are getting more and more widely used. One of such materials is polyaniline.

However during making a sensing device there arise some difficulties related to obtaining a fine film on of the optically transparent material [1]. Characteristics of such sensor have poor reproducibility and require additional correction of measurement [2].

The work proposes a circuit design of an input component of a pH-sensor, which contains a polyaniline film as a sensing device.

II. RESULTS

In order to provide high measurement accuracy it was proposed to use a microcontroller combined with sensing devices. The microcontroller should provide programmed correction of the obtained values according to the temperature and other parameters of the environment being investigated.

A block diagram of a pH-meter is shown in Fig. 1. The device contains a light source implemented on the basis of a IR light-emitting diode controlled by a microcontroller over PWM. The beam reflected from the test sample falls on the photodiode and forms a voltage which is to be amplified by the programmable amplifier. Then the ADC converts the voltage into a digital code which agrees with the strength of the photodetector's input signal. With the view of temperature measurement a sensitive semiconductor temperature sensor with a digital input was used. The microcontroller performs a complex processing of input signals and shows the measurement results on a three-digit LED-indicator with seven segments.

Before the device's start of work a self-calibration process is to be performed. This process assume the light beam intensity level to be set using PWM.

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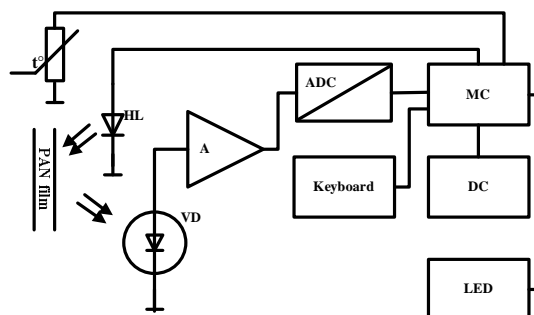
Fig.1. A block diagram of the device's input part

On the basis of the proposed device's block diagram we've developed a device model using a microcontroller of ADuc 8xx family produced by Analog Device [2,3]. Microcircuits of this type are notable for high performance and low power consumption which are important for development of small-size multifunctional devices with a self-contained power supply.

On the basis of the developed model it was carried out an investigation into the environment's acidity using 5 sensing elements of polyaniline films.

Upon the investigation results it was formed arrays of correcting values and, as a result, it was achieved the identity of the measured parameters at the reference values of pH.

III. CONCLUSION

The proposed block diagram takes into account the temperature and other parameters of the measured environment and can be used for development of high-sensitive sensors for controlling pH sensors and sensors of other physical quantities.

IV. REFERENCES

[1] O. I. Aksimentyeva, V. M. Beluh, D. O. Poliovyi, V. V. Cherpak, P. Y. Stakhira, D. Y. Volynyuk, Properties of Polyaniline Thin Films // *Mol. Cryst. Liq. Cryst.*, 2007.-Vol. 467, pp. 143–152.

[2] Глушик І.П., Стахіра П.Й, Аксіментьєва О.І., Микитюк З.М., Фечан А.В., Черпак В.В. Оптичні спектри поліаніліну в середовищі: з різним водневим покажчиком // *Вісник Нац. ун-ту "Львівська політехніка". "Електроніка".* - 2005. –№532. - с.81-85.

[3] Килочек Д. Проектирование на программируемых системах на кристалле PSoC // *Компоненты и технологии.* 2006.№4.