OPTOELECTRONIC SENSORS

Andijan machine building institute, Faculty of Electrical Engineering,
Department of alternative energy sources
Assistant ***Xakimov Temur***
Andijan Mechanical Engineering Institute,
Faculty of Electrical Engineering,
Student of the 3rd stage of "Energy saving and energy audit"
Toshtemirov is the son of Shohruh Uktam

Abstrackt: Examples of fiber optic applications include environmental and atmospheric monitoring, earth and aerospace sciences, industrial processing and biotechnology, digital imaging, and other fields. Optical fiber sensors differ in their small size and long-term operation. At the same time, the electromagnetic interference, multiplexing capability and high sensitivity of optical fibers also include the aerospace field. We will consider that fiber optic sensors also provide a wide range of applications for addressing electrical and electronic sensors and performing high-level sensing tasks. This article shows that the use of optical fiber sensors is effective.

Keywords: Source of radiation, elecktrical insulation, radio engineering ,semiconducktor devices, electroluminescent, light emitting diode and lazer diode illuminators.

Optron devices are semiconductor devices that have a radiation source and a receiver (a light emitter and a photoreceptor) that increase the interaction in one way or another.

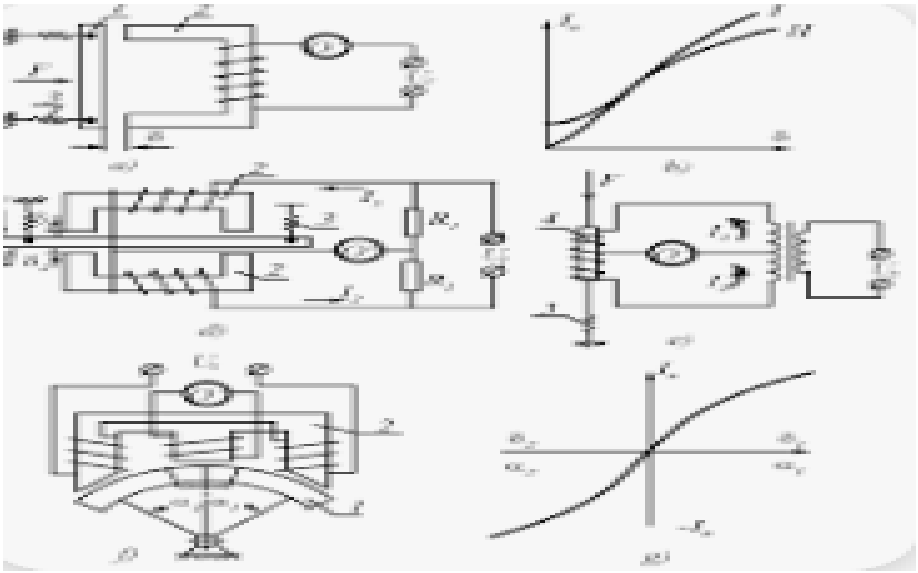
The principle of operation of any optocouplers is based on the following. In the illuminator, the electrical signal energy is converted into light, and in the photoreceptor, the light signal is converted into an electrical signal. Commonly used are optocouplers, which have a direct optical connection from the emitter to the photoreceptor, and there are no electrical connections of any kind between the elements. The presence of an optical connection provides electrical isolation between the input (radiator) and output (photoreceiver). Thus, such a device functions as a communication element in electronic circuits, while the input and output electrical (galvanic) solution is implemented.

The use of optoelectronic devices is quite diverse: for the connection of hardware blocks, which have a large potential difference between them; for protection of input circuits of measuring devices from surges and adjustment of high-voltage circuits, optical, non-contact control, power thyristors, starting triacs, control of electromechanical relay devices.

The creation of "long" optrons (long thin optical fiber devices as an optical channel) opened up the use of optron equipment in a completely new direction - remote communication over optical fiber.

Optoelectronic devices are used in modulation of radio engineering circuits, automatic gain control, etc. Here, as a result of the effect on the optical channel, to switch the circuit to the optimal mode, to adjust the contactless mode, and the like are used.

Conventional graphic designations of the main types of optrons are given in Figure 1



1-Fig.Optron electron pairs: a-diode-diode, b-diode-transistor, v-diode-transistor base, g-diode pair hybrid microcircuit

Optoelectronic devices are divided into classes according to the following characteristics.

Optocouplers depending on the type of illuminator used:

Lamps based on miniature heater bulbs. Optocouplers with such daughter resistors are inert, and currently not used in practice, but are used in optocouplers with resistors.

In neon light bulbs, which gas neon - argon mixture gas is used to emit an electric discharge. Such irradiators are not very high in radiation, resistant to mechanical impact, large in size, not compatible with integrated technology. However, separate types of optocouplers are used.

Electroluminescent light cells. Electroluminescent cells have a low activity of converting electricity into light, a short operating time, and complexity of control. The main advantage of these illuminators - constriction with photoresistors - technological compatibility, mainly because of this, it is possible to create multi-functional and multi-element optron structures. Currently, its availability is limited.

Light-emitting diode and laser diode illuminators. The most important of the used optocouplers is the light-emitting diode from the universal illuminators - the semiconductor injection light-emitting diode. It has several advantages: the high value of FIK in converting electricity into electricity; the spectrum of radiation is short, closing the width of the spectral range of different light-emitting diodes; direction of radiation; high speed; the value of the supply voltage and current is small; compatibility with transistors and integrated circuits; simplicity of radiation power modulation by changing direct current; the possibility of working in pulse and continuous mode; linearity of the watt-ampere characteristic in a wide range of input currents; high durability and long-term operation; small size; includes technological compatibility with microelectronic products.

Optrons depending on the type of photoreceptor used:

Optrons based on photoresistors, the properties of which change according to a complex law given by illumination, which allows for mathematical modeling and step-by-step creation of functional optoelectronics. However, optrons with photoresistors are inversion.

Optrons based on photodiode;

Optrons based on phototransistors;

Optrons based on photothyristors.

The last three are the most universal photodetectors, working with an open p-n junction.

In most cases, they are made on the basis of silicon, and their maximum spectral sensitivity is close to $\lambda = 0.7 \ldots 0.9$ μm.

Optocouplers are divided according to the type of use of the optical channel:

Optocouplers with open optical channels. In such optocouplers, the emitter and photoreceptor are separated by an air gap. They are widely used for synchronizing the number of rotations of rotating shafts, moving mechanical systems as position sensors, and others. Open-channel optocouplers are divided into optocouplers that work in return and transfer

Closed optical channel optrons. In this case, the optical channel is protected from any external influences. Such optocouplers are used for galvanic connection of inputs and outputs of electrical circuits. If powerful power devices (thyristors, circuit breakers, MOSFET field transistors) are used in output circuits, such optocouplers are called solid-state relays. Currently, such relays are an alternative to electromagnetic relays, and their technology is constantly being improved.

"Long" optical channel optocouplers. In such optocouplers, the emitter and photoreceiver can be placed at a certain distance from each other. In this case, the optical channel connecting the emitter and the photoreceiver is a light fiber. Such optoelectronic devices are widely used for information transmission in cellular networks of EHM.

According to the spectral range of the optical channel, optocouplers are divided into:

Optical radiation with a wavelength of 0.4 to 0.75 μm visible range optrons.

IR optical radiation with a wavelength of 0.8 to 1.2 μm is near-diaphason optrons. The open channel is effective for optoelectronic devices if such radiations are detected.

Optrons are divided into the following according to their structural and technological features:

Elementary optocouplers, which consist of one emitter and one elementary photoreceptor. Depending on the type of photoreceptor used, they can be resistive, diode, thyristor, transistor, etc.

Optoelectronic integrated microcircuits, in which the elementary optron contains additional electronic devices: amplifiers, comparators, logic circuits, etc.

Special type optocouplers: differential optocouplers, which are several emmiters and photereceiwers ;there will be optoelectronic sensors.

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