

Relevance and Application of Reed Contacts with Magnetic Parameters, Which are the Most Important and Relevant in the Field of Automation

N. A Jurayeva

Tashkent state technical university, Tashkent, 10093, Uzbekistan

red_knight94@mail.ru

Abstract: According to the International Federation of Robotics, the number of industrial robots installed in factories increased 60% in 2024. This rapid rise means that more than ever, industrial designers will need components that can provide the necessary speed, reliability, operational life, and varied switching abilities robotics require. If you visit a modern factory and observe the amazing electronics at work in an assembly cell, you'll see a variety of sensors on display. Most of these sensors have separate wires for positive voltage supply, ground and signal. Applying power allows a sensor to do its job, whether that's observing the presence of ferromagnetic metals nearby or sending a light beam out as part of the facility's security system. The humble mechanical switches that trigger these sensors, like the reed switch, only need two wires to do their jobs. These switches activate using magnetic fields. Industrial Manufacturing and Robotics: The Benefits of Designing in Reed Switches, Relays, and Sensors reviews the structural and safety advantages that make reed technology ideal for the industrial sector. When exposed to a magnetic field (from a magnet, solenoid), oriented in a certain way, contacts made of ferromagnetic materials begin to move (close, open, switch, depending on the type of reed switch).

Keywords: schematic diagrams, metal-dielectric-semiconductor, analysis, synthesis.

Introduction

The use of modern reed sensors in automation systems is understandable and justified, both from a technical and economic point of view.

Considering the simplicity of design, unpretentiousness in operation, low cost and versatility of reed sensors, they have found their use in everyday life and in almost all areas of automation. They can be equally successfully used both as the main level sensors in control systems and in the operating algorithm in conjunction with analog sensors, leaving the reed switches to function as protective or backup sensors, and using analog sensors to monitor the actual liquid level. Thus, despite the emergence of more and more functional sensors, reed sensors, due to their advantages, still firmly occupy a leading position among other monitoring and control devices today.

A sealed magnetically controlled contact (reed contact) is an element of an electrical circuit that changes its state by mechanically closing or opening when exposed to a control magnetic field on contact parts hermetically isolated from the environment, combining the functions of sections of electrical and magnetic circuits. An electromagnetic relay with a sealed magnetically

controlled contact is called a reed relay. Structurally, the reed switch has elastic ferromagnetic contacts, soldered into a sealed glass flask. These contacts combine the functions of a current conductor, a magnetic conductor and a spring. [1]



Fig.1. It is made up a pair of flattened ferromagnetic strips (reeds) which are hermetically sealed in a tiny glass tube.

Methods

Functionally, reed switches, like regular contacts, can be either making or opening contacts. The most widely used reed switches are those with short-circuit or “normally open” contacts. Let's take a closer look at its structure and principle of operation. So, it is a glass flask containing two iron plates. Each contact is made of ferromagnetic wire with a diameter of 0.5 mm, depending on the power and size of the reed switch. The contacting surfaces themselves are coated with noble metals: gold, ruthenium, palladium, rhodium, silver and alloys based on them. This coating reduces the contact resistance and increases the corrosion resistance of the contacts.

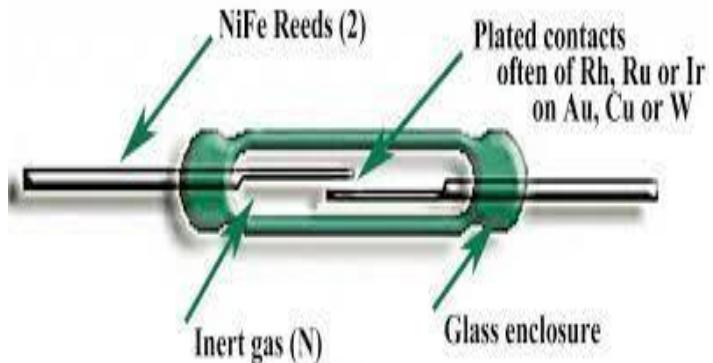


Fig.2. Diagrammatical Figures Showing Types of Reed Switch

When the external magnetic field reaches a certain threshold value, the elastic contacts of the reed switch “stick together”, closing the electrical circuit. When the external field is removed, the circuit opens due to the elasticity of the contacts. There are reed switches with a “changeover” contact. In these devices, in the absence of a magnetic field, the movable contact, due to elasticity, is in contact with a non-ferromagnetic contact; when the magnetic field exceeds the threshold, switching occurs - a short circuit with the ferromagnetic contact. [2.3]

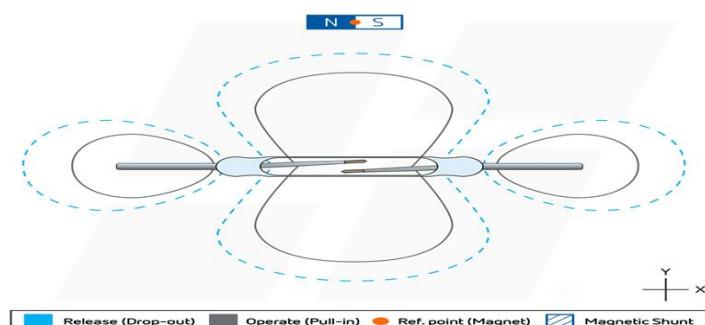


Fig.3. “Reed Switch” or switch tongue is an electrical switch activated by a magnetic field.

Reed switches are used as position sensors, limit switches, etc. The contacts in the reed switch are isolated from the harmful influence of the external environment, usually by a glass sealed housing, so the reed switch is suitable for use in conditions of increased dustiness, humidity, and aggressive environments.

A reed switch that operates to open or a “normally closed” reed switch operates in exactly the opposite way. In this case, when exposed to a magnetic field, the contacts repel each other, breaking the electrical circuit [4, 5].

Results and Discussions

Reed switches also vary in size. In recent years, there has been a trend towards the use of miniature reed switches - with a bulb length of less than 10 mm. With such dimensions, sensitivity, speed, and resonant frequency increase, and the chatter time decreases.

When comparing conventional open switching contacts with reed switches, the advantage will be on the side of the reed switches. The latter have almost a hundred times greater reliability, and the service life of some reed switches reaches 5 billion operations, which is much higher compared to conventional contacts. At the same time, reed switches are very fast - for some samples the response time does not exceed two milliseconds. A reed switch that operates to open or a “normally closed” reed switch operates in exactly the opposite way. In this case, when exposed to a magnetic field, the contacts repel each other, breaking the electrical circuit. If the reed switches are paired with an electromagnet, the design combining the reed switch and the electromagnet is called a reed switch relay. [6]

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Fig.4. In the presence of a magnetic field the reeds are attracted to each other and close to complete the magnetic and electric circuit.

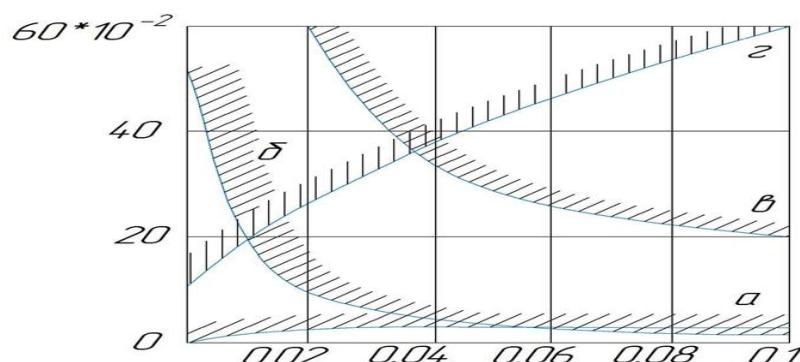


Fig.5. Curves defining the range of ratios within which reliable operation of the converter is ensured.

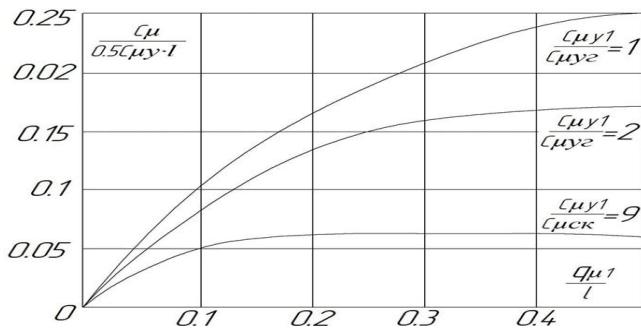


Fig.6. The dependence of the working magnetic field on the moving magnetic coordinate in relative units.

Methods for increasing the reliability of reed switches by increasing the ratio of the magnetic forces of the parts before and after the moving part using additional current windings have been studied. At the same time, an increase in the return coefficient due to the excitation of alternating current windings when switching large direct currents has also been studied.

Applications of reed relays and tips for use household appliances and telecommunication systems;

counters, limit switches, testing devices and meters, medical and industrial equipment, devices operating under water, synthesizer keyboards, various aviation and space systems. Reed Switch Characteristics Reed switch characteristics are discussed below. [8.9]

1. Reed switches are hermetically sealed within a glass tube with inert gas and do not receive any influence from the external atmospheric environment.
2. Quick response because of small mass of moving parts.
3. The structure comprises the operating parts and electrical circuits arranged coaxially. Reed switches are suited to applications in radio frequency operation.
4. Reed switches are compact and light weight.
5. Superior corrosion resistance and wear resistance of the contacts assures stable switching operation and long life.
6. With a permanent magnet installed, reed switches economically and easily become proximity switches. [10.11]

Conclusion

Reed switch proximity sensors offer a simple, cost-effective, and reliable solution for detecting the presence or position of objects in various applications. By understanding their advantages, common uses, and selection factors, you can choose the right reed switch sensor to meet your specific needs.

Over the past couple of years, the reed switch market in the Asia-Pacific region had grown rapidly, with a global share of around 45%, followed by North America and Europe. In a nutshell, automobile manufacturers are now focusing on sourcing more reliable sensors, like the reed switches that are also economically feasible.

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