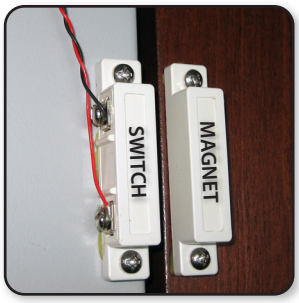
RULES OF ATTRACTION

FOR RELIABLE REED SWITCH-MAGNET APPLICATIONS



You probably know how a reed switch works. Two springy nickel-iron blades sealed in a hermetic capsule are attracted together when a magnet approaches, and when they touch, an electric circuit is completed. The magnet can be an electromagnet or a permanent one, or in some cases a combination of both. In a reed relay, the magnetic force closing the switch is generated by a wire coil with an electric current running through it. But many reed switch applications require a permanent magnet – for example, a simple security alarm with a magnet mounted on a door and a reed switch mounted on the door frame, as shown above. Open the door, the magnet moves away from the switch, it springs open, and an alarm is triggered.

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Sounds simple until you start to think about designing it. What kind of reed switch? What type of magnet? How big and strong should the magnet be? How near does the magnet have to be to the reed switch before it will close?

The physics and economics behind these choices can be surprisingly complicated. The main technical factors influencing a design are the field strength of the magnet, its distance and angle relative to the switch, and the closure sensitivity of the switch. The switch sensitivity is expressed in Amp-Turns (AT), with the switch activated in a standard electromagnetic test coil. In contrast, permanent magnet field strength is usually specified in milliTesla (mT) or Gauss. Get these four factors correct - magnet strength, distance, and angle, as well as switch sensitivity - and the application will work reliably.

Consider the choice of magnets. Rare earth magnets based on Cobalt-Samarium or Neodymium-Iron-Boron are the strongest, in the sense that their magnetic field strength is higher than other magnet types at a given distance. Older types such as Alnico (Aluminum-Nickel-Cobalt-Iron) are weaker but cheaper. Very inexpensive magnets made from ferrites in a plastic binder (e.g. a typical refrigerator magnet) are too weak for reed switch applications.

What reed switch will work for the application? It must be reliable, with platinum-group metal contacts such as rhodium or ruthenium. Cheap toy-grade reed switches – sometimes irreverently referred to as "switch factory floor sweepings" – won't cut it. It's also desirable to have the switch in a plastic encapsulated surface-mount format, for ruggedness and ease of handling.

How is the magnet going to be presented to the switch? Which pole (North or South) doesn't matter, but the direction of the magnet's axis does. If the North-South axis of the magnet is pointed perpendicular to the switch's contact gap then the switch, perhaps unexpectedly, won't close. If the magnet is pointed at either end of the switch, it will close. Slide the long axis of a magnet parallel to the switch and, typically, three positions exist where the switch closes – fine for many applications, but potentially a big problem if designing a positional sensing application – say, to register the travel of a piston in a hydraulic cylinder.

It's important to correctly specify the correct closure sensitivity for the switch (in AT) to match the magnet. Coto can help with some tables showing the expected switch closing and opening distances for different switch AT's and magnet types.

There's a lot more to specifying magnets and reed switches than can fit in a one-page note. But Coto Technology has years of experience and is here to help you make the right choice.

To find out how Coto can aid you in your design efforts, please contact us at the web address below.

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