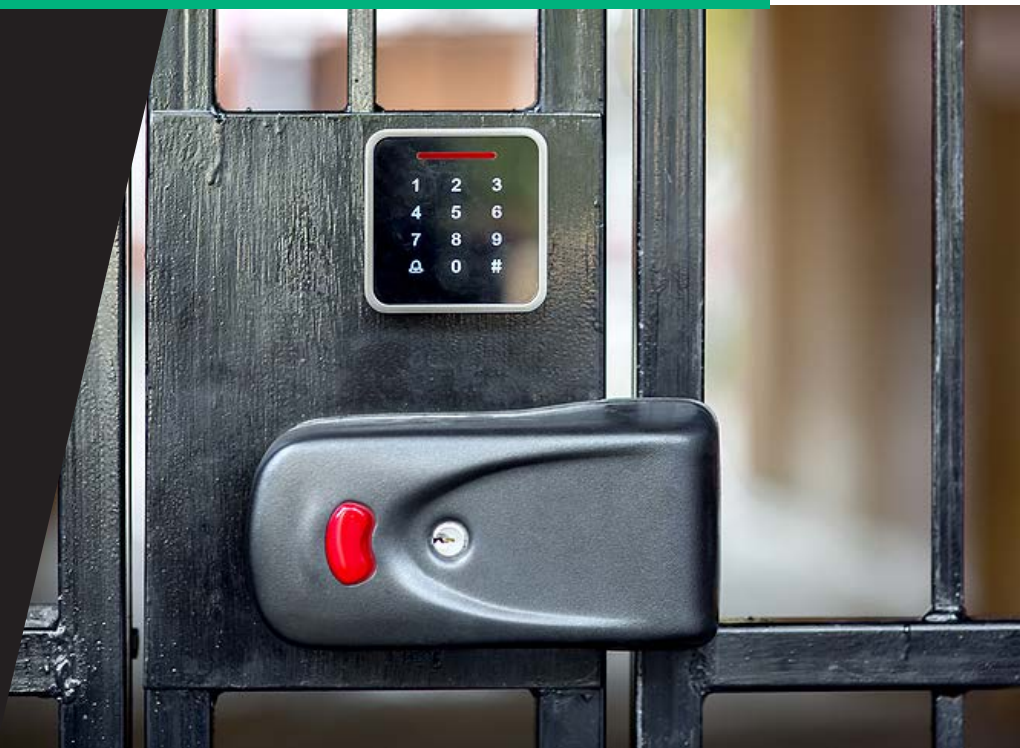


APPLICATION NOTE

MAGNETIC PROXIMITY SENSORS



Magnetic proximity sensors provide rugged and flexible options for non-contact position and proximity detection in a wide range of applications. These sensors can reliably detect magnetic fields through a variety of non-magnetic surfaces. Magnetic proximity sensors offer non-contact object detection beyond the normal limits of products such as inductive sensors. They offer long sensing ranges within a small package size, and they can be positioned in different locations through the use of a wiring harness.

BACKGROUND

Magnetic proximity sensors, also known as firecracker proximity sensors, operate in combination with a permanent magnet. Hermetically sealed reed contacts are actuated in the presence of a magnetic field, where the thin plates inside the glass flex and touch, causing an electrical contact. Because this magnetic actuation can occur across a short distance, they can provide a sensing solution without having direct contact between the actuating magnet and the sensor itself. This provides flexibility for ease of design and placement. The hermetic seal provides inherent protection from corrosion, oxidation, volatile compounds, dirt, and dust, making them an excellent choice for harsh environments.

These sensors offer many advantages, including compact size, quick and easy installation, and sealed contacts for maintenance free operation. The contacts are coated with a special surface treatment to ensure long sensor life. They offer high stability and provide exceptional resistance to shock and vibration. They provide detection through surfaces such as non-ferrous metals, stainless steel, aluminum, plastic, and wood. The contacts can be either surface mounted or recessed, depending on the needs of each particular application.

FLEXIBILITY AND RELIABILITY FOR
NON-CONTACT POSITION AND
PROXIMITY DETECTION



APPLICATIONS

Proximity sensors were originally designed for wired, in-home applications such as window and door ajar detection (i.e., home security monitoring). Magnetic proximity sensors have become the logical choice for other applications including automotive sensors and indicators, industrial sensors, factory automation equipment, and servers/storage in data centers.

A relatively new and growing practice is to extend the usage of magnetic proximity sensors to remote and/or portable applications. These applications might be in hard to reach areas, be dirty, have harsh or dangerous environments, or require monitoring of equipment against theft and/or criminal tampering.

The Internet of Things (IoT) is the connection of various devices, including industrial sensors, cameras and more, to the Internet to provide real-time data. Applications such as smart agriculture use sensors for water and soil monitoring, crop irrigation and fertilization, and livestock activity. IoT devices in smart business applications allow monitoring of the supply chain, real-time sales and emerging trends and provide for targeted advertising. Smart buildings, factories and cities can use sensors to monitor energy and water usage, intelligent lighting, system status, traffic management and building infrastructure, as a few examples. Remote access to the data allows these IoT devices to be placed almost anywhere.

Protecting IoT equipment in remote areas can be facilitated through the use of magnetic proximity sensors. Anti-tamper detection and security monitoring for storage units, remote depots, trailers, gates, warehouses, utility meter lids, traffic lights and other applications can be done by remote monitoring of this equipment by these sensors.





SOLUTIONS

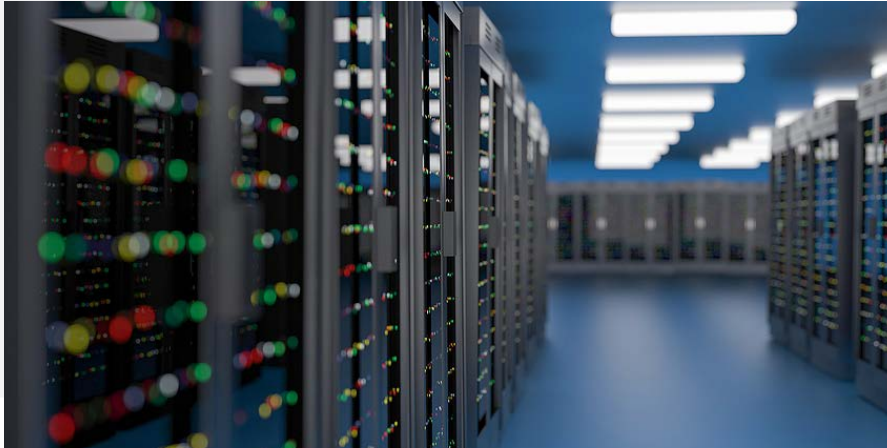
Magnetic proximity sensors provide the solution to these challenges in many of these applications. In smart automotive applications, detecting the presence or absence of an accompanying magnet allows the magnetic proximity sensor to determine if the trailer gate on a truck or the trunk of an automobile has been opened, for example. Magnetic proximity sensors can be used in factory automation equipment and robotics to perform complex movements with high precision, accuracy and repeatability. They can be used in appliances for intelligent sensing to meet regulatory requirements regarding energy and water conservation.

Providing ruggedized housings for the magnetic proximity sensors is necessary to protect them in harsh environments. The addition of a wiring harness provides flexibility of placement, so that the sensor can be positioned where it needs to be while sensitive electronics remain far away from danger in potentially dirty and corrosive locations. In remote IoT applications, the presence or absence of an accompanying magnet allows the sensor to track whether functions are performing as expected when they cannot be observed easily. Monitoring a sensor that does not behave as expected can indicate accidental or intentional damage, theft or tampering. For example, this technology can be used to determine if the lid has been removed from a utility meter, if the irrigation system for crops has malfunctioned, or even if a technician has triggered a manual override on some system.

In order to overcome the challenges outlined here and meet industry trends and certification requirements, C&K offers two products – the MPS Series of Magnetic Proximity Sensors and the MPSR Ruggedized Magnetic Proximity Sensor. The contacts on these sensors open when the damping magnet is removed from proximity to the sensor and they are held closed when the magnet is within actuation range. Using these sensors with an accompanying magnet permits the monitoring of two interfaces within an application and provides an alert if something changes with one or both of them.

The MPS Series offers a long life cycle, lasting for more than 4 million operations. The operating temperature range is -40°F to 212°F (-40°C to 100°C), permitting operation in harsh thermal environments. They are UL61058 approved. While there are similar firecracker sensors in the market, none offer the same level of ruggedized protection and supplier quality as those manufactured by C&K. Additionally, C&K offers best-in-class product quality, technical support and supplier reliability for on-time deliveries.





CHALLENGES

OEMs are faced with many challenges and design problems in these applications. One major challenge is low power sensing – many of these applications are in remote areas and rely on some form of battery power, so it is imperative to conserve as much power as possible and to know when battery reserves are getting low. Magnetic proximity sensors utilizing reed switches provide zero battery drain when the contacts are open, unlike active magnetic sensor technologies (e.g. Hall Effect, Magnetoresistive, etc...), which require a separate and always-on supply voltage to function. This also provides the inherent benefit of one less wire (2-wire vs. 3-wire), saving cost and space in tight configurations.

Protection against harsh environments in remote locations is also critical. The sensors must function reliably in high-temperature environments for some remote applications. Using IoT equipment in remote and isolated areas can leave it at risk of accidental or intentional physical damage, so careful monitoring is required. Magnetically actuated sensors are not disrupted by oils, dirt, or other contaminants that can compromise other proximity sensing technologies.

Generating flexible designs for the sensor and actuator magnet, supplying options for the sensor assembly installation, and providing customization of the housing, wires and connectors are all necessary to meet the challenges faced in certain applications. Finally, safety certifications (for example, UL) must be met for applications involving dirty, corrosive, explosive or otherwise volatile compounds.

CONCLUSION

Offering ultra-reliable non-contact proximity detection, magnetic proximity sensors are an ideal solution with power, cost, and functional benefits compared with active sensor technologies that can drain batteries or be disrupted in messy environments.

Measuring either position or presence, magnetic proximity sensors provide a warning if the behavior of a monitored device changes. They offer flexible and rugged sensing options in conditions ranging from normal to harsh environments. Magnetic proximity sensors offer a simplified solution for a wide range of use cases including traditional home security monitoring to automotive and factory automation equipment to emerging remote IoT applications.