

# Applications

◆ Electronics and Communication ◆

◆ Domestic and White Goods ◆

◆ Automotive Industry ◆

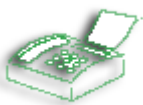
◆ Marine and Weather ◆

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# Reed Switch and Reed Sensor Applications

## Contents

Reed switches and reed sensors find applications in vast areas, from simple position sensing in doors to more complicated ones used in the military and in sophisticated cellular phone radio frequency (RF) switching electronics. Although every application cannot be listed here, the most widely used ones are explained in detail.

	<b>Reed Switch Applications Overview</b> Although reed switch applications are immense, we have broadly classified them as follows. Most applications do fall under one of these categories...
	<b>Electronics and Communication</b> Cellular phones, PDAs, Notebook computers, demand pacemakers, satellite television dishes, radio transmitters, microphones, coil winders, hands free kits, digital audio video volume controls, automatic test equipments (ATE), copiers, scanners...
	<b>Domestic Goods</b> Washing machines, dish washers, vacuum cleaners, microwave ovens, ovens, stoves, food processors, air conditioners, room heaters, rice cookers, electric tooth brushes...
	<b>Automotive</b> Doors, sunroofs, seat belt locks, power windows, hoods, trucks, defective lamp indications, engine and radiator temperature, coolant circulation, ABS, cruise control, seat belt tension, power steering, fuel and coolant levels...
	<b>Marine and Weather</b> Anchor, rudder, hatches, wind speed and direction, fuel and water levels, waste and sewage levels, rain gauge, pressure gauge, anemometers, electric wind vanes...
	<b>Construction and Security</b> Door and window security, elevators, lifts, conveyor belts, hoists, explosion proofing in mines, deep bore liquid detection, emergency lamps...
	<b>Robotics and Automation</b> Pneumatic and hydraulic cylinders, rotary actuator, safety vanes, gear tooth speed and direction, rotary and linear encoders...
	<b>Sports, Recreation, Hobbies and Toys</b> LEGO sensors, electric fishing rods, treadmills, bicycles, exercise cycles, pedometers, electronic board games, model trains and cars, electronics and science kits, dolls...

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# Types of Applications

## Overview



In a reed switch application, a magnet is used to "change" the state of the reed switch. The Sanskrit inscription on the painting is pronounced "parivartan" and means "switch" or "change".

Usage of reed switches and reed sensors is fairly straightforward provided certain guidelines and precautions listed in our usage notes are followed. Although reed switch applications are immense, we have broadly classified them into four categories. Most applications do fall under one of these.

- ◆ Position sensing
- ◆ Pulse counting
- ◆ Coil applications
- ◆ Temperature sensing

### Position sensing

When an application requires proximity sensing, end position sensing, or moving part sensing, a reed switch or a reed sensor fixed to the stationary surface and a magnet fixed to the moving surface can be used. When the moving part is away from the stationary part, the reed sensor remains un-actuated. As the moving part comes near the stationary part, the reed sensor gets actuated. This actuating distance is highly repeatable. Shock sensors, vibration sensors, inclination sensors, pressure sensors, flow sensors etc. use the basic position sensing principles to function.

As reed sensors are hermetically sealed, they are immune to dust and moisture. Therefore, reed sensors can safely be used in liquid level position sensing applications. Apart from top and bottom level sensing, the actual volume of a liquid present can also be determined by combining sensors with a simple resistance matrix to give a potentiometric, two-wire feedback. Although this can be achieved by using active devices like Hall Effect sensors, reed sensors, which are passive, have the imperative advantage of using no power at all and have no leakage current across the contacts.

### Pulse Counting

Reed switches have a very high operating frequency and this feature lends itself to high speed pulse counting applications. Mounting a magnet to a rotating wheel or an object which moves back and forth repeatedly, and a reed sensor to a stationary part will generate the pulses required. The reed sensor used for sensing the pulses can be connected to a counter. If a magnet cannot be used in an application, special packages of reed switches which sense ferro-magnetic parts are available. Liquid and gas flow meters, electricity meters, automobile ABS, and speedometers use this principle of pulse counting.

### Coil Applications

Producing a relay using a reed switch is simple compared to conventional electromechanical relays which require many moving parts. Reed switch based reed relays, made by inserting a single or multiple reed switches into a wound bobbin, are available in very small sizes and can go on for millions of operations. Current sensors find applications in almost every electronic circuit for overload protection.

### Temperature Sensing

Due to their sharp cut in, cut out bandwidth and high reliability, thermal reed switches are find applications in place of bimetallic strips, thermistors and thermostats for over-heat protection or precise temperature switching. The cut in temperature is differentiated from the cut out temperature by an abrupt and huge change in the resistance of the reed switch contact resistance of a few milli-ohms to an open circuit resistance of a few mega-ohms. In other words, a total galvanic separation occurs. Thermal reed switches can sense subzero temperatures as low as -30°C too.

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## Electronics and Communication

In the modern electronics world, the reed switch finds applications in almost every equipment and supports the growth in electronics today, which is influenced by constraints like compactness, low power consumption, and functional reliability. A few reed switch and reed sensor applications in the field of electronics and communication are listed below.

### Cellular phone, Notebook computer and PDA doors

In mobile devices with doors to protect the keypads, the power to the display or central processing unit (CPU) can conveniently be switched on or off, just by opening or closing the doors. A reed sensor can be used in these applications because it does not drain any power from the battery, irrespective of its contact state. Furthermore, when the sensor is actuated, the resistance across the contacts is so low in the order of a few milliohms, that unnecessary battery drain is avoided. Reed sensors are also used in notebook computers to trigger the CPU to sleep when the door is shut. Suitable products: **R3**, and **R2** SMD reed sensors.

### On/off switch in Microphones and Radio transmitters

In microphones and radio transmitters, unnecessary signal transients and speaker crackle can be avoided at the time of switching on or off, by using a reed sensor based on/off switch. The reed sensor is mounted on a small PCB inside the microphone, and a sliding unit with a magnet fitted to the outer casing actuates it. Unlike conventional slide switches which wear out due to repeated mechanical movements of the slide contacts, the reed sensor is actuated when the magnet is slid into place, ensures that a good contact is made, and no wear out occurs. Suitable products: **MS-10x** PCB mountable reed sensors, and goal-post formed **MM-1018**, and **RM-1318** reed switches.

### Telephone hook switches and Hands-free Kits

Reed sensors can easily switch modern telephone circuitry loads. Conventional hook switches, which are used in telephones, undergo millions of operations and fail easily. When a reed sensor is used in the place of a hook switch, it can survive millions of operations. Normally closed reed sensors can be used for such applications to save on additional components. Most telephone handsets have an inbuilt magnet in the speaker, and this field is enough to open the reed sensor contact and break the circuit. Taking the handset off the hook closes the reed sensor and enables the dial tone. The same principle can also be used in hands-free kits inside automobiles to cradle various mobile devices. Suitable products: **R2B** normally closed SMD reed sensors and **MS-10x** miniature PCB mountable reed sensors.

### Automatic dentist's drill activation

A reed sensor finds application in the tiny tip of a dentist's drill to work as a pressure sensor, which starts or stops the drilling. Only when the drill is pressed against a hard surface, like teeth, which in turn moves the spring loaded magnet closer to the reed sensor, does the drilling start. Pressing the drill against delicate organs like tongue and lips does not accidentally switch the drill on. Again, life of the reed sensor is very high as there are no mechanical parts, and a reed sensor, being hermetically sealed, is immune to liquids like saliva and other dental mouthwashes. Suitable products: **MS-212** ultra-miniature cylindrical sensors, and **UM-0018** ultra-miniature reed switches with cropped leads.

### Winding count and tension sensing and in Coil Winders

Reed sensors find an important role in closed loop tension control systems like coil winders, tape and reel machines etc. The wire, which is to be wound, is usually taken through a spring, which gives cushioning when winding on bobbins, which are not circular. A reed sensor mounted near this spring with a magnet mounted on the spring itself ensures that the optimum tension level of the wire is maintained and if exceeded, a visual indication or a slow-down or stop in the winding motor can be triggered. Apart from tension sensing, a reed sensor can also accurately count the number of turns wound on the bobbin. Suitable products: **MS-225** threaded cylindrical sensors, and **MS-324** miniature flat pack sensors.

### Relays in Modems and Fax Machines

Ultra miniature relays are manufactured by winding coils around reed switches and can be used to switch high loads with very low input voltages. Reed relays are extensively used in a number of electronics and communication equipment, especially modems and fax machines to switch the telephone line. Special reed relays which have low inductance can be used in radio frequency (RF) switching applications to ensure that there is no power loss. Suitable products: **MM-1018** and **UM-0018** ultra-miniature reed switches can be used in molded reed relays.

### Open door sensing in Copiers and Scanners

In copiers and flatbed scanners, reed sensors are used to signal the main processor if the top door is left open. This prevents wastage of toner in copiers and helps build a closed loop system which can automatically start the scanning or copying cycle when the door is closed, and the magnet actuates the reed sensor. Suitable products: **MS-10x** PCB mountable reed sensors and SMD formed **SM-1322** reed switches.

### Pacemakers and Defibrillators

Tachycardia and Bradycardia are problems in which the heart beats at a rate faster or slower than the normal human heart rate. Fibrillation is the uncontrolled beating of different parts of the heart. People with such heart problems need pacemakers or defibrillators to alter and maintain the pumping rate, or to control the beating at different parts of the heart. Implantable pacemakers and defibrillators use reed switches, so that the device mode can be altered with a magnet externally. Special reed sensors which are exclusively manufactured for use in life saving equipments are very compact and have a very high degree of reliability and precision. Suitable products: **UM-0018** ultra-miniature reed switches.

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## Electronics and Communication

### Vagus Nerve Stimulators

The Vagus nerve in the neck is one of the primary communication lines to the brain. Vagus Nerve stimulators are implantable devices which control the stimulation of impulses to the brain. When a patient senses a seizure coming, a magnet is used over the area where the stimulator is implanted to activate the reed switch inside, which in turn triggers an extra, on-demand stimulation to the Vagus nerve. In most cases, this prevents the seizure. Suitable products: **UM-0018** ultra-miniature reed switches.

### Spirometers

Lung function tests (or pulmonary function tests, PFT) evaluate how much air a person's lungs can hold, how quickly he or she can move air in and out of the lungs, and how well the lungs add oxygen to the blood and remove carbon dioxide from the blood. A spirometer is a reed switch based flow meter which is attached to the tube into which the patient blows and sucks. The pulses sensed by the reed switch are fed to the tester which charts our different graphs known as spiograms which are then compared with those of healthy individuals. Suitable products: **UM-0018** ultra-miniature reed switches.

### Over heat Protection

Electronic equipments incorporate an in-built overheat protection scheme. In general, the function of an overheat protection (OHP) device, is to alert the controller if a preset heat limit is exceeded. Unlike thermistor controlled systems, where continuous temperature monitoring and polling is required, thermal reed sensors can be used to directly cut off power, turn a cooling fan on, or interrupt the processor to do so. Suitable products: **TRS-M** thermal switches and **TRS-W** thermal reed sensors.

### Electricity and Fluid Metering

In water meters, gas meters, and electricity meters, a reed sensor can be used to count the number of turns in the dial, and with minimum logic circuits, can give digital read outs. For such applications, specially designed reed switches with high spring back forces can be used inside the reed sensor. Even if the meter is unused for periods of up to three months and the reed sensor stays closed for all this time, the contact can easily open up and continue to work once the meter dial starts turning. Suitable products: **MS-324** miniature flat pack sensors, and **MS-214** cylindrical sensors.

### Switches in weather proof electronic equipment

In weather proof walkmans, cellular phones, and CD players, conventional switches cannot be used because they are not water proof or dirt and dust proof. Hermetically sealed reed sensors are the ideal solution as they can be mounted inside the equipment, free from the external water and dirt, and tiny sliding magnets can be fitted on the outside to trigger them. These kinds of switches are also used in underwater cameras and flashes. Suitable products: **R3** miniature SMD reed sensors, and **R2** standard size SMD reed sensors.

### Satellite dish position sensing

While tuning motorized dishes, the dish motor is turned until a clear signal is received and a reed sensor is locked there. Different channels are beamed from different satellites and reed sensors are used to remember the positions so that one dish can be used for different providers. In more advanced models, the reed sensor counts the number of rotations of the dish motor and gives feedback to the satellite receiver. Suitable products: **MS-328** flat pack sensors and **MS-228** threaded sensors.

### Satellite dish position sensing

Most reed switch and reed sensor based products require contact protection when used with loads where there is a chance of inrush current. More details about contact circuits are available here. A reed sensor with a built-in resistor can be a simple choice for such applications as this saves another component. Suitable products: **MK-xxxx** sensors.

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## Domestic and White Goods

Shock and vibration, and extremes of humidity and temperature are faced by most domestic goods. Reed sensors come in packages which withstand all of the above. They also have the added advantage of directly switching 110V / 230V AC line voltage. The most widely used white goods applications are listed below.

### Commercial Coffee Machines

Commercial coffee, tea, and milk vending machines need to dispense enough milk or water for exactly one cup. This can be accomplished by filling up a secondary reservoir fitted with a float and a reed switch which comes on when the reservoir is filled up to 200 ml. This signal can then be used to trigger other solenoids or pumps which stop the main reservoir output and open the drain valve from the secondary reservoir to dispense the liquid into a cup. Using a narrow and long secondary reservoir ensures that errors in measurement do not exceed 5 ml. Suitable products: **MS-324** miniature flat pack sensors, **MS-10x** PCB mountable sensors, and **MS-216** cylindrical sensors.

### Domestic Coffee Machines

Domestic coffee machines use an inlet water hose which is triggered by a solenoid to fill up the water reservoir whenever needed. As the water drains, the float comes down and activates a reed sensor, and this signal can be used to trigger the input water solenoid. In machines without an incoming water pipe inlet, a float can be fitted on to a stem on the reservoir cap with a reed sensor mounted just outside the reservoir. This way, when the water level gets to a near low, an indication is given by the reed sensor and the reservoir can be taken out for refilling. Suitable products: **MS-401** float switches, and **SM-1322** and **IL-2022** reed switches with cropped leads, in level sensors.

### Level Sensing in Washing Machines and Dish Washers

Washing machines and dishwashers have reservoirs to hold detergent, and fabric or water softeners. A window is usually given behind the door of the appliance to check the level. With time, this window gets stained, and it is difficult to view the exact level. For such applications, a small foamed magnet on a spindle can be fixed to the reservoir cap, and a reed sensor can be mounted outside. When the reservoir reaches a near empty level, the reed sensor signals the processor which lights up an LED on the panel. Special reed sensors can be used to switch line voltages directly without the need for any step down. Suitable products: **MS-216** and **MS-214** cylindrical sensors, and **MS-10x** miniature PCB mountable reed sensors.

### Door position sensing for Appliances

In washing machines and dish washers, the processor needs to know that the door is closed, so that the automatic cycle can be started and water can be pumped into the system. In refrigerators and deep freezers, a door left slightly ajar may spoil lot of frozen goods inside. A reed sensor mounted inside the appliance and a magnet on the door can solve all these problems. In addition, the reed sensor can also be used to trigger the lights inside appliances such as refrigerators. Suitable products: **MS-328** flat pack sensors, and **MS-216-L** cylindrical sensors.

### Dish washer spray arm jam detection

When dish washers are working, the high power water spray could dislocate some of the lighter dishes in the carrier and lodge them along the spray arms path. The next time the spray arm passes, it could jam the system. Reed sensors can be mounted at the end positions of the spray arms and in strategic position along its path. The spray arm, having the magnet will trigger the reed sensors consecutively, within a specific time span which is proportional to its speed. If a jam occurs, and the set time period between two reed sensor points has exceeded, the processor can stop the machine and indicate a jam on the panel. Suitable products: **MS-216** cylindrical sensors and **MS-324** miniature flat pack sensors.

### Rice cooker heater control

After rice has cooked, rice cookers need to keep the rice warm at say, 70°C. This can be achieved by using a thermal reed switch designed to cut off at 75°C and cut in at 65°C. This opening and closing signal can be used to trigger a relay or a contactor, which directly switches the heaters. Some rice cookers also have reed sensors to detect whether the lid has been placed properly so that heater is not turned on continuously. Suitable products: **TRS-P** 60W thermal reed sensors.

### Instant Water heaters and power showers

Bathrooms appliances such as heaters and power showers use reed switch based flow sensors. As soon as the shower is turned on, the flow sensor detects this and the signal can be used to turn the heater or the shower pump on. In addition to switching on the heaters, thermal reed switches can be used to cut in and cut out the heaters to keep the water at a comfortable temperature. When the shower is turned off, the flow switch will sense this and turns the heater or the pump off. Suitable products: **MM-1018** and **RM-1318** miniature reed switches in flow sensors, and **TRS-W** 10W thermal reed sensors.

### Motor direction changing in Electric Tooth Brushes

Electric toothbrushes have to change the direction of the motor when switching from the top row of teeth to the bottom row. This can be done by mounting a reed sensor inside the electric toothbrush, with a magnet sliding in a groove on the outside. With this kind of setup, the motor direction can be changed easily with just minor tilts of the electric toothbrush which moves the magnet outside and changes the state of the reed sensor. Another use of a reed sensor is in place of the main on/off switch. Since electric toothbrushes get wet, a normal mechanical switch is not suitable and a similar mechanism like the slide switch, but only not so free sliding, can be used for this application. Suitable products: **MS-10x** miniature PCB mountable reed sensors, and **R3** miniature SMD reed sensors.

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## Domestic and White Goods

### Over current protection in Food Processors and Mixers

Mixers, food processors and grinders have an inbuilt over current protection which cuts off the power to the motor whenever the grinding blades or mechanical parts get obstructed. A reed switch can be used to build a current sensing relay which senses the exact current limit allowed to the motor. This relay operates at currents below the current limit and breaks contact at anything higher. Normally open and normally closed current sensors can be used for such applications. Suitable products: **LV-1925** and **HB-2232** reed switches in relays.

### Temperature control in deep freezers, coolers, heaters, and aquariums

In deep freezers, coolers and heaters, the temperature needs to be maintained within a precise window. Thermal reed sensors can be designed having windows as small as 2°C up to 10°C and can switch up to 60W directly. The sensor can control the switching on and switching off points of compressors in deep freezers and fans in coolers. Thermal reed switches can also be used in aquariums by switching heaters in the water to keep the temperature exactly between 25°C and 30°C. Suitable products: **TRS-M** thermal switches and **TRS-W** thermal reed sensors.

### Washing machine vibration detection

Reed switches are used in bi-directional vibration sensors. A magnet and a very precise tension spring is inserted into a cylindrical housing and sealed on both ends. Two of these cylindrical assemblies are mounted on either side of a reed switch in such a way that their magnets face opposite direction. Depending on the amplitude of the vibrations that need to be sensed, different tension springs are used. During the drying cycle, when the vibration of the washing machine drum exceeds a limit over which the washing machine itself will start to move around, the magnets actuate the reed switch. Vibration sensors can be built to detect vibrations from 1G to 10G in normally open and normally closed versions. Suitable products: **MM-1018** and **UM-0018** ultra-miniature reed switches used in shock sensors.

### Sewing machine pedals

Pedals in sewing machines use a potentiometric or a similar arrangement as a wound coil with a moving carbon brush to control speed of the stitching motor. The disadvantage of such a system is that the carbon brush wears out and the stitching speed varies over time. A reed sensor array inside the pedal housing with a magnet mounted under the pedal, actuates each of the reed sensors one by one as the pedal is depressed. The output from the reed sensors is suitably decoded and is used to control the motor speed. This way, the stitching speed remains constant with respect to the depressed position of the foot pedal and there is no chance of dirt or oil affecting the system. Suitable products: Goal post formed **MM-1018** micro-miniature reed switches and **MS-10x** miniature PCB mountable reed sensors.

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## Automotive Industry

The automobile industry has standardized power levels of 24 V DC or less. Reed switches perform exceptionally well at such low loads and consequently have very high life. Moulded and encapsulated reed sensors are specially manufactured to withstand shock and extremes of temperature and humidity. A few automobile applications are listed below.

### Impact sensors for triggering airbags

Statistics say almost 80% of automobiles use reed switch based crash sensors for triggering airbags. A ring magnet is mounted on a very precise tension spring and this assembly is slid over a reed switch. Depending on the impact which is required to trigger the reed switch, different tension springs are used. In most crash sensors, two reed switches are used instead of one as a failsafe mechanism. When a crash occurs, the mass of the magnet compresses the spring and moves closer to the reed switch, closing it. This signal is used to trigger the cylinder which inflates the airbags. Suitable products: **MM-1018** and **UM-0018** ultra-miniature reed switch in shock sensors.

### Anti-lock braking system (ABS)

In ABS control, the onboard electronics needs to apply differential hydraulic pressure to each brake to prevent the car from fishtailing and skidding. Four reed sensors are mounted near the wheels and magnets are mounted on the wheels themselves. This way, the individual rotational speed of each wheel is fed back to the onboard computer, as braking takes place, and if certain wheels are spinning faster, more hydraulic oil pressure is fed into those brakes. Suitable products: **MS-228** threaded sensors, and **MS-216-L** cylindrical sensors.

### Door, window and cap position sensing

Driver information. Instrument panel dashboards need to show more and more information for the safety of the driver and passengers. Special reed sensors which can withstand shock and vibration can be used to sense closing positions of doors, electric windows, sun roofs, trunks, engine hoods, radiator, and fuel caps. Reed sensors have the added advantage of withstanding temperatures of up to 150°C. Suitable products: **MS-10x** miniature PCB mountable reed sensors, **R2** SMD reed sensors, and **R2B** normally closed reed sensors.

### Seatbelt lock sensing

In some cars, the seat belts need to be "clicked" in, or the display flashes a message. Vane sensors are fitted inside the seatbelt locks female side, and when the seat belt lock is inserted, and comes in between, the magnetic field is shunted and the reed switch opens. Normally open (NO) vane sensors can be designed by using a normally closed reed switch on one side and a magnet on the other side which is strong enough to keep the NC reed switch open. Suitable products: **MO-1422** and **MC-1425** closed differential reed switches with cropped leads, in vane sensors.

### Hydraulic arm end position sensing in heavy vehicles

Bulldozers, earth movers, tractors, fork lifts and garbage compactor trucks use hydraulics to move cylinders and pistons to carry out various jobs. Reed sensors can be used on these pistons and cylinders to sense end position and intermediary positions for control of oil pressure to the hydraulic solenoids. Suitable products: **MS-328** flat pack sensors and **MS-228** threaded cylindrical sensors.

### Low fluid level monitoring

Wind screen wiper fluid, brake oil, power steering oil, and radiator coolant tanks can be fitted with a foamed magnet float attached to the inside stem of the cap. A reed sensor can be mounted outside the tank at the near empty level. The signal can be used to trigger an LED on the driver information panel. Because the reed sensor is mounted outside, the tanks can be removed easily for servicing without removing any connectors. Some automobile manufacturers also mount the reed sensor to sense a full tank instead of an empty tank, because it will be easier to detect a malfunction. Suitable products: **MS-324** miniature flat pack sensors and **MS-216** cylindrical sensors.

### Two wheeler applications

Motor bikes and other two wheelers use plunger type switches for detecting depression of the front and rear brake levers to switch the brake light on, and also for detecting the side stand position etc. These plunger type switches are purely mechanical, and they are likely to fail early due to environmental conditions. Reed sensors used in such applications fair well because of their inherent hermetically sealed nature and are free from moving mechanical parts. Reed sensors can also be used to sense the position of the throttle to give a signal to the processor to control the engine timing. Suitable products: **MS-324** miniature flat pack sensors, **MS-214** cylindrical sensors, and **MS-10x** miniature PCB mountable reed sensors.

### Defective lamp detection

Tail lamps and parking lamps are very vital elements and their failure can lead to adversities. Reed relays, by virtue of their small size and high life, find an important role in these applications. A reed relay and a resistor are connected across the lamp and when the lamp fuses, the reed relay energizes and the output can be used to trigger an alarm on the dash board. Although a bulb can be used instead of the reed relay, chances are that both bulbs may fail.

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## Automotive Industry

### Radiator, engine, and 4WD transmission temperature sensing

Thermal reed sensors can be mounted on the engine block to sense high temperatures and give an indication on the instrument panel. Thermal reed sensors, capable of switching loads as high as 60W, when used inside a radiator, can directly be wired to the radiator fan. When the temperature reaches a high, the fan is turned on, and after say 10°C less, the thermal reed sensor cuts off supply to the fan. They can also be mounted on the four wheel drive transmission system to check for over-heating. Thermal reed sensors can be designed to have temperature differentials as from 2°C to 10°C. Suitable products: TRS-P 30W or TRS-W 10W thermal reed sensors.

### Accurate fuel level sensing

Special reed sensors with an integrated resistor can be mounted on PCBs to give out a potentiometric feed back across two outputs as a foamed magnetic float moves along its length. The PCB tracks can be designed in such a way that a full tank gives high resistance and an empty tank gives low resistance, or vice versa. Being hermetically sealed devices, reed sensors are the best devices to use in explosive environments like fuel tanks. Suitable products: MK-xxxx reed sensors with integrated resistor, and MS-10x miniature PCB mountable reed sensors.

### Coolant flow sensing

A simple, cost effective reed switch based flow sensor can be connected in the coolant line of automobiles. As long as the coolant is flowing, the reed sensor does not actuate. If by chance, there is a block or if the coolant valve malfunctions, an indication is given on the instrument panel. Suitable products: MC-1425 and SM-1322 reed switches in flow sensors.

### Climate Control

Miniature reed relays, capable of switching high loads are used in automobile climate control circuits to switch on or switch off the heater and coolers. Thermal reed sensors can also be used to trigger these relays at required temperatures to keep the interiors a comfortable 23°C. Suitable products: TRS-M thermal reed switches.

### Tachometers, speedometers, and cruise control

A multi pole ring magnet can be attached to the speedometer actuating shaft, and a reed sensor can sense the pulses and generate a square wave. The onboard electronics can use these square pulses to calculate RPM and speed. In automobiles with cruise control, when cruise is set at say, 80kmph, and the road inclination changes, the onboard computer can adjust fuel supply to the engine to correct the cruise speed by monitoring these pulses. Suitable products: MS-225 and MS-228 threaded cylindrical sensors in shock proof casing.

### Inclination sensors for detecting rollover

Recent statistics on automobile accidents reveal that the majority of fatalities arise due to side-wise roll over. Reed switch based inclination sensors sense side-wise roll over and front and rear impact for triggering airbags. A magnet which moves like a pendulum sideways when a rollover occurs, activates multiple reed switches positioned at strategic points and trigger the airbags. A standard shock sensor combined with this inclination sensor is a complete package automobile manufacturers can use. Suitable products: SM-1322 and RM-1318 reed switches in inclination sensors.

### Door sensors for cars with electronic keys

In newer cars with electronic keys, the key code is compared with onboard computer which then sends a signal to the central locking system. Although these doors are controlled by remote also, for manual opening of the doors, reed sensors are used. The sensors are mounted on the doors, and magnets are mounted beneath the door handles. If the handle is lifted, the reed sensor detects this and sends a signal to the computer to open the doors. An added advantage is that the same reed sensors can be used as security devices to trigger alarms when the door is opened in an unlocked condition. Suitable products: R3 miniature SMD reed sensors, and MS-10x miniature PCB mountable reed sensors.

### Accidental airbag deployment prevention

When a collision occurs, accidental deployment of the airbags is prevented, by sensing whether passengers are sitting on the seats for which airbags are present. A reed sensor is mounted under the seat and a magnet fitted into the foam of the seat actuates the reed sensor whenever a passenger is present. This signal is used by the airbag deployment electronics. Suitable products: MS-324 miniature flat pack sensors, and MS-214 cylindrical sensors.

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## Marine Industry and Meteorology

Reed sensors find an important place in marine applications where they are exposed to salt water and sub zero temperatures due to their inherent corrosion resistant contact characteristics. A variety of fluid levels need to be constantly monitored in boats. The marine industry also needs weather instruments like pressure gauges, anemometers, and wind vanes for safe navigation. Reed sensors are also used in these instruments.

### Boat engine temperature

Thermal reed sensors can be mounted on the engine block to sense high temperatures and give an indication on the instrument panel. Thermal reed sensors can also be used in a variety of applications on boats to monitor oil temperature, etc. Suitable products: **TRS-P** thermal reed sensors.

### Anchor, rudder, and hatch position

Just as reed sensors are used in automobiles for end position and intermediary position sensing of sun roofs, doors, windows, bonnets and trunks, they are also used in boats and yachts to sense anchor position, hatch open and close positions, and intermediary and end positions of the rudder. Suitable products: **MS-216** and **MS-214** cylindrical sensors.

### Accurate level sensing of fluids

Special reed sensors with an integrated resistor can be mounted on PCBs to give out a potentiometric feed back across two outputs as a foamed magnetic float moves along its length. The PCB tracks can be designed in such a way that a full tank gives high resistance and an empty tank gives low resistance, or vice versa. Rainfall in mm can also be measured using this principle. For sensing fluids such as sewage, a perforated housing can be fitted outside the float assembly so that semi solids do not come near the float and obstruct its path. Suitable products: **MK-xxxx** reed sensors with resistor, and **MS-10x** miniature PCB mountable reed sensors.

### Pressure Gauges

Bourdon tube pressure gauges are fitted with a magnet on the Bourdon tube itself so that as pressure increases, the magnet moves along a circumference. A circular PCB with many reed switches mounted from centre to circumference giving a potentiometric two wire feedback can be used to accurately measure pressure. The advantage with such gauges is that multiple alarm points can be set. Suitable products: SMD formed **MM-1018** and **RM-1318** reed switches, and **R3** SMD reed sensors.

### Anemometers

Spinning cup anemometers are fitted with magnets and as the wind blows, a reed sensor can count the number of pulses which can then be used to calculate wind speed. Suitable products: **MS-214** and **MS-216** cylindrical sensors and **MS-225** threaded sensors.

### Wind Vanes

Eight reed switches are mounted radially at 22.5 degree angles making compass points on a circular PCB and the wind vane contains one long magnet which is the diameter of the PCB. The wind vane is mounted at the centre of the circular PCB. As the wind direction changes the vane actuates the corresponding reed switches and the wind direction is known. Suitable products: SMD formed **MC-1425** and **IL-2022** reed switches, and **R3** SMD reed sensors.

### Lake-bottom currents

Reed switches are used in flow meters to calculate volume of liquid. Flow meters are attached to a depth probe and insert into glacial lakes for monitoring the velocity and current of the water at various depths by environmentalists and scientists. Suitable products: **SM-1322** and **RM-1318** miniature reed switches in flow meters.

### Rowing Electronics

Reed sensors are used in water proof rowing equipment like stroke meters to count the number of strokes of the oar in kayaks, canoes, and boats. The reed sensor is mounted under the moving seat and a magnet is placed under the seat. For every stroke, the magnet moves back and forth over the reed sensor. Suitable products: **MS-10x** PCB mountable reed sensors and goal post formed **IL-2022** and **MO-1422** reed switches.

### Survival rafts

Survival rafts contain water sensors which trigger the compressed air cylinder to inflate the raft. To prevent against accidental inflation, a small magnet and reed switch is placed in the raft. The magnet needs to be pulled out of its pocket for the unit to activate when it hits the water. Reed switches are also used in emergency locator transmitters (ELT) to prevent the unit from transmitting when inside the cover. This is done by placing a magnet inside the pocket of the cover and mounting a reed switch inside the ELT. This keeps the ELT from transmitting as long as it is inside its cover. Suitable products: **MS-10x** miniature PCB mountable reed sensors, **R3** miniature SMD reed sensors.

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## Security and Construction

A reed sensor is the best choice when it comes to construction and security, due to the fact that they can work reliably in dirty environments amidst dust, grease, and oil. Unlike optic sensors, reed sensors used in dirty greasy environments are maintenance free and do not need any cleaning. A few applications are listed below.

### Deep bore liquid detection probes

Reed switch based float switches are fitted with a perforated sheet around the whole float assembly. This assembly can be used as a depth probe and lowered into narrow bores with the help of the lead wire. The perforated sheet around the moving float assembly prevents solids from activating the float, and also allows liquids to easily seep in and activate the float. Suitable products: **SM-1322** and **IL-2022** reed switches in liquid detection probes.

### Door and window Security

Magnets can be mounted on doors and windows, and reed sensors, on the fixed frames. As long as the doors or windows remain closed, the contact is not broken. Normally open (NO), or normally closed (NC) reed sensors can be used depending on the circuit logics. Special reed sensors which contain highly accurate magnets can even sense metal doors using the principal of field shunting. Suitable products: **MS-324** and **MS-328** flat pack sensors.

### Floor detection in Elevators and Lifts

Latching reed sensors can be mounted on every floor, and a magnet on the elevator or lift will actuate them as floors change. Latching reed sensors can be mounted in two ways with respect to the pole of the magnet. Reed sensors on floors above can be latched and floors below can be unlatched, or vice versa. The latched and unlatched condition of the sensors can be compared to electronic flip flops with built in driver circuits, and have the added advantage of switching higher loads. Suitable products: **R2E** latching reed sensors, **HW-5052** reed switches, and **MS-228** threaded sensors.

### End position sensing in hoists and fork lifts

Hoists and fork lifts use hydraulics to move cylinders and pistons to lift heavy weights. Reed sensors can be used on these pistons and cylinders to sense end positions and intermediary positions and the signals can be used by the proportional pressure valves for control of oil pressure to the cylinders and pistons. Suitable products: **MS-216-L** cylindrical sensors, **MS-228** threaded sensors, and **MS-328** flat pack sensors.

### Emergency lamp holders

When emergency lamps are taken off their holders, a buzzer should sound. The lamp itself can be built with a small magnet, and a normally closed reed sensor can be mounted on the holder. As long as the lamp is in its holder, the buzzer circuit remains open. Taking the lamp off the holder, closes the reed sensor and triggers the buzzer circuit. Suitable products: **R2B** normally closed reed sensors, **R2** normally open reed sensors, and **MS-10x** miniature PCB mountable reed sensors.

### Power switches for explosive areas

Reed switches, being hermetically sealed and unaffected by the atmosphere and surroundings, can be used with sliding magnets to work as on / off switches in explosive areas, for example, in mines where arcing could cause an explosion. Reed switch based reed relays are also safe devices to use in explosive areas for switching higher loads. Suitable products: **MS-10x** PCB mountable reed sensors, and goal post formed **SM-1322** and **HB-2232** reed switches.

### Magnet Extensometers

Reed switches are used in magnet extensometer probes to monitor settlement and heave in construction sites, dams, excavations, mines and tunnels. Access pipes are inserted into the earth, and magnets are provided at every joint and coupling. The reed switch probe, coupled to a measuring tape is inserted from above. Each time the probe comes near one of the magnets, an indication is given and the depth can be read off the tape. Suitable products: **HB-2232** and **LV-1925** reed switches with cropped leads, encapsulated in probes.

### Blower and Vacuum duct efficiency

In blowers and vacuum ducts, a vane with a tiny light magnet is fitted across the flow of air, inside the duct. A reed sensor is mounted outside the duct. Nominal flow of air lifts the vane and keeps it near the reed sensor. If the rate of blowing or sucking decreases due to dust collection in the filters, the reed sensor does not get actuated. This signal is used to trigger a "filter change" LED. Suitable products: **MM-1018** and **UM-0018** ultra-miniature reed switches with cropped leads, in vane sensors.

### Adjustable chairs and beds

Chairs and beds with electronic controls for adjusting tilting and height use reed sensors to sense intermediary and end positions. A magnet is mounted on the moving part with the reed sensor mounted on the stationary part. These sensing voltages are very low and therefore, there is no risk of electric shocks. Suitable products: **MS-328** flat pack sensors and **MS-216-L** cylindrical sensors.

### Tamper proof meters

Electricity meters, water meters, and gas meters use a reed sensor to prevent unauthorized opening of the panel covers. The reed sensor is mounted inside the housing with a magnet on the cover. If the meter cover is opened, the reed switch opens and shuts off the meter. Only a service person with an adapter which plugs into the system can reset the meter with an external command. Suitable products: **MS-324** miniature flat pack sensors, and **MS-214** cylindrical sensors.

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## Security and Construction

### Water tank control

Reed switch based float switches are used to control the pump, which fills an overhead water tank. Two of these float switches are fitted into the tank, at the near empty level and the full level. These signals are given to a controller, which switches the pump on when the tank level reaches the near empty point, and shuts it off when the tank gets filled up. This is particularly useful for blocks of apartments with a common water tank for all tenants. Care should be taken to protect the reed switches from the static capacitance caused by the long wires running from the float switches to the controller. Suitable products: **MS-401** float switches, and **IL-2022** reed switches with cropped leads, in level sensors.

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## Industrial Robotics and Automation

Every hydraulic or pneumatic cylinder or actuator requires a reed sensor for end position sensing. Unlike inductive sensors or Hall-effect sensors, reed sensors use no power and have a good isolation. They have high operating speeds, work with a wide range of voltages of programmable logic controllers (PLCs) and micro-controllers. When used with weak magnets, reed sensors can also detect any ferrous parts. The following applications use reed sensors.

### Safety Vane applications

Optic sensor lenses need to be exceptionally clean for vane sensing applications. A reed switch and a magnet are combined into one package with a specific distance between them to form a normally closed (NC) vane sensor. When ever a ferrous part comes between them, the magnetic field is shunted and the reed switch opens. Normally open (NO) vane sensors can be designed by using a normally closed reed switch on one side and a magnet on the other side which is strong enough to keep the NC reed switch open. Reed switch based vane sensors can work in very dirty industrial environments and grease and dust do not affect its working. Common applications are conveyor belt part sensing, industrial mixer speed sensing, etc. Suitable products: **MM-1018** and **UM-0018** ultra-miniature reed switches in vane sensors.

### End position sensing in Cylinders and Pistons

Most pneumatic cylinders, pistons, linear slides and rotary actuators are manufactured with inbuilt magnets for end position sensing. Reed sensors are used to sense end positions and intermediary positions and the signals can be used by PLCs for processing further instructions. The very high sensing speed of reed sensors work well with the high program scanning speed of PLCs. Reed sensors can also be coupled by LEDs to help with easy positioning after the piston and cylinder strokes or rotary actuator angles are adjusted. Suitable products: **MS-225** and **MS-228** position adjustable sensors.

### Ferrous part detection

Ferrous part detection sensors are built by positioning two weak magnets near the seals of reed switches. The two magnets are by themselves not strong enough to transfer the magnetic flux lines between them and close the reed switch. If this system is brought near a ferrous part, the flux lines travel through the ferrous part and enlarge the two smaller field into one big field which close the reed switch. Ferrous detection sensors can be used in a wide variety of applications in pick and place units etc. Suitable products: **SM-1322**, **MO-1422**, and **MC-1425** reed switches with cropped leads.

### Gear speed and direction sensing

Miniature ferrous part detection sensors can be positioned near gears to sense the speed of rotation. Reed switch based sensors have very high sensing speeds and can sense up to 30,000 RPM. Special ferrous part sensors which can sense gear direction are built with two reed switches and a biased magnet and combining this system with a D-Flip-flop for quadrature sensing. One of the reed switches is connected to the D input, and the other clocks the input. This way, one direction is differentiated from the other by monitoring the output Q of the D-FF. Suitable products: **SM-1322**, **MO-1422**, and **MC-1425** reed switches with cropped leads.

### Bridge control in Airports

The bridge operator needs to steer the bridge toward to airplane door for docking. When the bridge is about one metre from the door, the height of the bridge needs to be adjusted. This is accomplished by positioning reed sensors and a magnet in the bridge mechanism. The bridge operator gets feedback from the reed sensors as to exactly how much the bridge is moving up or down. After successful adjustment of the height, the bridge can then be docked with the aircraft door. Suitable products: **MS-225** and **MS-228** position adjustable threaded sensors.

### Transformer tap changers

Tap changers in transformers involve protection and control schemes and one of them is to sense if the tap changer assembly is in odd or even position. A magnet or a set of magnets mounted on the moving assembly arms trigger a reed sensor mounted on the transformer. Since this assembly will be located inside the oil tank of the transformer, special reed sensors capable of withstanding high temperature are used. Suitable products: **HW-5052** reed switches and **HW-5052** reed switch based sensors with heat withstanding body.

### Petrol and Diesel Pumps

Petrol and diesel pumps use reed switches to sense if the nozzle has been placed in the holster properly so that the last volume filled display can be reset to zero. A tiny magnet on the nozzle handle can activate a reed sensor mounted inside the holster. Reed switch based flow sensors, when used with very low level sensing loads such as 10V/10mA can operate up to a billion operations. These encoder type flow sensors are used to calculate the actual petrol pumped, and the volume can be displayed on digital panels. Suitable products: **MS-10x** miniature PCB mountable reed sensors, and goal post formed **MM-1018** and **RM-1318** reed switches.

### High voltage relays

The power industry uses many types of relays for signal switching as well as high voltage and high current switching. Special reed switches with high breakdown voltage, capable of switching high wattages are used to manufacture relays that can carry as high as 5 amps. Multiple reed switches can be used in reed relays to manufacture different contact forms, for example, two normally open contacts and three normally closed contacts which can be actuated with voltages as low as 5 volts. These kinds of relays not only save power, but can also simplify circuit switching logics. Suitable products: **LV-1925** and **HW-5052** reed switches.

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## Sports, Recreation and Hobbies

The sports and fitness industry has seen a lot of changes lately by their move from using analog instruments and gauges to intelligent electronic controllers which give the user a lot more information on calories burnt, distance run etc. Reed sensors are used in a variety of sports equipments for passing on signals to the controller which in turn do the processing and give the user intelligent outputs.

With the advent of intelligent toys and engineering kits, reed switches are also used by hobbyists to make LEGO-Mindstorms® sensors to sense rotation, position and temperature. Commercial grade reed switches can be used in dolls and toys for position sensing.

### Electric Fishing Reels

Electric fishing reels are equipped with reed sensors which generate pulse on rotation of the handle. The number of pulses generated are equated to the length of the fishing line which is also the depth of the water. The advantage of using the reed sensor is that the fishing reel once immersed into the water can be left unattended, and on a bite, the reed sensor generates a signal which turns a buzzer on. Suitable products: **MS-10x** miniature PCB mountable reed sensors, and goal post formed **MM-1018** and **RM-1318** reed switches.

### Treadmill speed and gradient sensing

The speed of the belt is determined by positioning a reed sensor near the pulley driving the belt a small flexible magnet on the belt itself. Apart from speed sensing, the gradient of the tread mill is adjusted by raising the front wheels. Locating reed sensors in a few strategic positions on the arms of the front wheels can also give information to the controller about the angle of the gradient. Suitable products: **MS-225** threaded sensors, and **MS-216** and **MS-214** cylindrical reed sensors.

### Bicycle and exercise cycle speedometers

A magnet can be attached to one of the spokes in the wheels, and a reed sensor can be mounted near the break shoe to sense the pulses and generate a square wave. The onboard electronics can use these square pulses to calculate speed of the cycling. Just as in conventional speedometers, these pulses can also be used to indicate the distance travelled on a digital meter. Suitable products: **MS-216** and **MS-214** miniature cylindrical sensors.

### Jogging and walking meters

Pedometers are waist belts which can calculate the number of paces when a person is walking or jogging. A Reed switch and a magnet is mounted inside the pedometer, and undulation of the hips causes the reed switch to pulse. These pulses are counted and displayed in the counter along with the time. Certain pedometers take inputs of the jogger's height, weight, and length between each pace etc. and use the reed switches outputs to calculate calories burnt. Suitable products: **MS-10x** miniature PCB mountable reed sensors, **R3** miniature SMD reed sensors, and goal post formed **MM-1018** reed switches.

### LEGO® Sensors

Reed switches can be built into LEGO bricks to sense position and rotation. Position sensors can be built in normally open (NO), and normally closed (NC) types. Rotational sensors can be built with two reed switch and many magnets on the rotating shaft. Pull down resistors are connected to each of the reed switches so that four different voltage level outputs can be given to the RCX. Suitable products: **UM-0018**, **MM-1018** and **RM-1318** miniature reed switches with cropped leads.

### Electronic Board Games

Computerized board games use reed switches under the boards and magnets under the pieces to trigger LEDs on each square to indicate to the players which moves are allowed and which are not. The LEDs are also used in single player mode for letting the player know which move the controller wants to make, and also for the controller to recognize the player's moves. Suitable products: **MM-1018** and **SM-1322** reed switches welded to a wire for vertical mounting.

### Lap counter in slot car racing tracks

Slot car racing tracks usually count the number of laps by having a small section of the track without power. Every time a car goes over this section, power consumption takes a dip and this is used as a lap counter. Instead of losing power to the tracks, reed sensors can be used on the track with all the cars having magnets. Suitable products: **MS-10x** miniature PCB mountable reed sensors and goal post formed **SM-1322** reed switches.

### Signalling modules in model train tracks

Reed switches are placed under train tracks near a junction and each train is fitted with one magnet. The signalling of the red and green lights can now be controlled after a train has passed the signalling point. These outputs which control the lights can also be given to reed relays to actually cut off power to a train when a red light is on. Suitable products: **MS-10x** miniature PCB mountable reed sensors and goal post formed **SM-1322** reed switches.

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## Sports, Recreation and Hobbies

### Electronics and Science Kits

Reed switches are used in many science and electronic kits for experimenting on various phenomena. In motor kits for example, a reed switch is used to demonstrate how exactly a brush less motor works. Two magnets are mounted diametrically opposite each other on the rotor shaft. A reed switch and an electromagnet with an opposite polarity than the rotor magnets are placed just near the two rotor magnets and connected in series to a power source. When one of the magnets is near the reed switch, the electromagnet is energized and repels the other magnet away which also cuts off the magnetic field to the reed switch. The momentum moves the magnet near the reed switch again and this works the motor. Suitable products: [LV-1925](#) and [IL-2022](#) standard size reed switches.

### Gliders and model Airplanes

Reed sensors are very light devices and can be used in model airplanes, helicopters and gliders. Radio controlled gliders and model planes use reed sensors in the flap areas to sense whether the flaps have been deployed properly. The same principle can also be used to check if the under carriage is down so that the model can be landed safely. Suitable products: [R3](#) miniature SMD reed sensors, and [MS-212](#) miniature cylindrical sensors.

### Musical Greeting Cards

Ultra miniature reed switches can be used in electronic greeting cards with magnets to play a tune whenever the card is opened. Compared to the additional circuitry for the musical tones and the speaker, the reed switch bulk is much less. Normally open or normally closed versions can be used. Suitable products: [MS-212](#) miniature cylindrical sensors, [R3](#) miniature SMD reed sensors, and [UM-0018](#) ultra-miniature reed switches.

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