

Help and Theory

◆ Frequently Asked Questions ◆

◆ Number of Closures ◆

◆ Magnet Approaches ◆

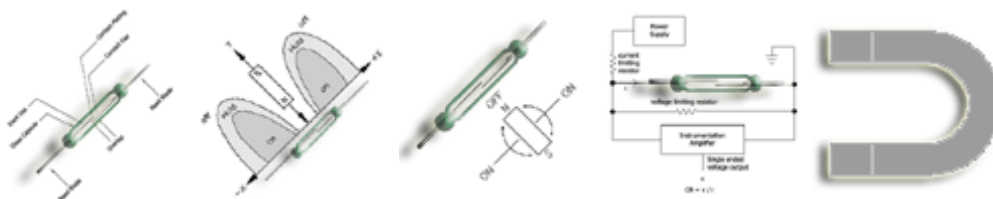
◆ Physical Modifications ◆

◆ Contact Protection ◆

◆ Glossary of Terms ◆



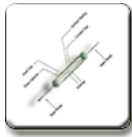
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Reed Switch Help and Theory

Contents

New to reed switches and reed sensors? This section gives detailed information right from the basics of reed switches, magnets, different ways of actuation, magnet selection etc. A glossary section with meanings to the most widely used reed switch terms is also available.



Frequently Asked Questions (FAQ)

What is a reed switch? What is a reed sensor? How does a reed switch work? What magnetic force is required to close a reed switch? What are the advantages in using reed switches? ...



Reed switch usage FAQ

How does operate AT affect actuating distance? How does release AT affect releasing distance? Should I use a high or low AT reed switch? What is the maximum rated current and voltage I can switch? ...



Types of Magnets

In general, there are four families of magnets available commercially. Factors such as operating temperature, demagnetizing effects, field strength...



Magnet Approaches

In all systems, magnet and reed switch must be brought to within a specific proximity of each other. This distance will vary in accordance with the sensitivity of the...



Operating Characteristics

When a reed switch is actuated by a permanent magnet, the ON-OFF region differs depending on the type and OAT of the switch, and size and power of the permanent magnet...



Physical Modifications

Cropping the leads of a reed switch removes low reluctance iron and introduces high reluctance air into the magnetic circuit, much the same as adding resistance to...

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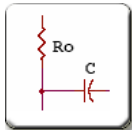
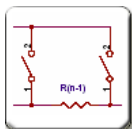
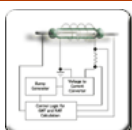
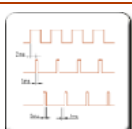
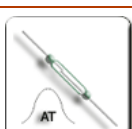
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Reed Switch Help and Theory

Contents

New to reed switches and reed sensors? This section gives detailed information right from the basics of reed switches contact protection and other example circuits, parameter testing and life testing notes etc. A glossary section with meanings to the most widely used reed switch terms is also available.

	Contact Protection Circuits When a reed switch is to be connected to an inductive load or a load where surge current or in-rush current flows (such as a capacitive load or a lamp load)...
	Level Sensing Circuits Reed Switches and Reed Sensors are used along with resistors or special reed sensors with an integrated resistor on PCBs to give out a potentiometric feed back across two outputs as a...
	Reed Switch Test Procedure Sample circuits for measurement of ampere turn values and static contact resistance of reed contacts. Test coil and reed switch should be vertical, or if horizontal, only in an east-west direction, to null the earths magnetic field...
	Life Testing and Life Expectancy Information on life testing reed switches. A life test is a destructive test conducted to ensure the reliability of reed switches for different combinations of voltage...
	Glossary Ampere turn, bounce, bounce time, carry current, differential, hysteresis, drop out, dwell, dynamic contact resistance, operate AT, operating time, operating temperature...

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Reed Switch Theory FAQ

What is a reed switch?

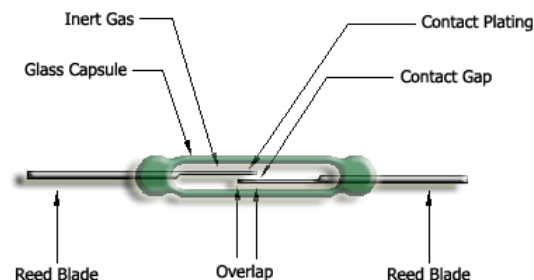
The basic reed switch consists of two identical flattened ferromagnetic reeds, sealed in a dry inert-gas atmosphere within a glass capsule, thereby protecting the contact from contamination. The reeds are sealed in the capsule in cantilever form so that their free ends overlap and are separated by a small air gap.

What is a reed sensor?

A reed sensor is a device built using a reed switch with additional functionality like ability to withstand higher shock, easier mounting, additional intelligent circuitry, etc.

How does a reed switch work?

When a magnetic force is generated parallel to the reed switch, the reeds become flux carriers in the magnetic circuit. The overlapping ends of the reeds become opposite magnetic poles, which attract each other. If the magnetic force between the poles is strong enough to overcome the restoring force of the reeds, the reeds will be drawn together.



What magnetic force is required to close a reed switch?

Minimum force - expressed in ampere-turns, which will cause the reeds to close, is called the just-operate force. Since the force between the poles increases as the gap decreases, a force of approximately half the just-operate force will maintain the operated state. Speed of operation of the reed switch is determined by the excess of operating force over the just-operate force.

What are the advantages in using reed switches?

They are hermetically sealed in glass environment, free from contamination, and are safe to use in harsh industrial and explosive environments. Reed switches are immune to electrostatic discharge (ESD) and do not require any external ESD protection circuits. The isolation resistance between the contacts is as high as 10^{15} ohms, and contact resistance is as low as 50 milliohms. Reed switches can directly switch loads as low as a few micro-watts without needing external amplification circuits, to as high as 120W. When used in combination with magnets and coils, they can be used to form many different types of relays.

What are the advantages in RRE reed switches?

RRE's reed switches are manufactured with flattened leads. This makes it easier for orienting and mounting for maximum in-group sensitivity, and no extra force is required while SMD forming and flattening. Ruthenium sputtering provides low, stable contact resistance, long life, and prevents cold welding.

What are the different types of reed switches available?

The basic reed switch is a normally open, form A contact. A normally closed, form B contact is provided by biasing the form A with a permanent magnet. A form C or a form D contact can be made by combining a form A contact and a form B contact in the same operating coil. The form B, C and D contacts made in this manner have the same characteristics as the basic form A.

Are single capsule change-over reed switches available?

Single capsule Form C reed switches are available in many configurations depending on the manufacturer. All configurations fall into two main categories, those which use a magnet bias to hold the armature against one pole, and those which have the armature mechanically preloaded against one pole. The former is polarity sensitive, while the latter has a higher contact resistance on the closed contact.

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Reed Switch Selection FAQ

How do two reed switches having different operate ampere turns (OAT) differ?

When two identical magnets approach two reed switches with different operate AT, the one with the lower operate AT, being more sensitive to magnetic fields, will close first. When an application requires a reed switch to only operate within a specific distance, and does not require a release distance, reed switches with an "L" in the ordering code, denoting low release, suit best.

How do two reed switches with different release ampere turns (RAT) differ?

When two identical magnets move away from two closed reed switches with identical operate AT but different release AT, the one with the higher release AT, being less sensitive to magnetic fields, will open first.

What are the pros and cons of using <20 ampere turn (AT) reed switches?

Pros	Cons
Very sensitive to magnetic fields	Lower resistance to shock and vibration
Can be used with inexpensive magnets	Very low contact gap acts like a capacitor
Magnet can actuate from farther away	Lower breakdown voltage
Lower operate time	Higher contact resistance

What are the pros and cons of using >20 ampere turn (AT) reed switches?

Pros	Cons
Bigger magnets can be used	Arriving at the right magnet strength takes time
Higher resistance to shock and vibration	Stronger magnets need to be used
Less receptive to stray magnetic fields	Magnet needs to be closer to actuate
Can switch higher voltage and current	Higher operate time

How is contact rating linked to switching voltage and switching current?

Switching voltage and switching current should not exceed their individual maximum ratings and the product of voltage and current should not exceed the maximum contact rating in watts.

What are the differences between reed switches and Hall Effect devices?

Reed Switches	Hall effect
Are hermetically sealed	Are susceptible to changes in the environment
Can be operated from -50°C to 150°C	Can be operated from 0°C to 70°C only
Immune to electrostatic discharge (ESD)	Requires ESD protection
Insulation resistance >1012Ω minimum	Insulation resistance >106Ω minimum
Typical breakdown voltage >250V	Typical breakdown voltage <10V
Contact resistance ~50mΩ	Contact resistance >200Ω
Does not require power for operation	Requires power for operation
No components needed to generate output signal	Requires many other components to generate output
Configurable hysteresis	Fixed hysteresis
Signal does not require any amplification	Requires amplification circuits
Switches a range of loads directly	Require external devices for switching loads
Does not drain battery in mobile devices	Constant drain of battery in mobile devices

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Magnet types and properties

In general, there are four families of magnets available commercially. Factors such as operating temperature, demagnetizing effects, field strength, environmental characteristics, and available space for movement etc. need to be considered before selecting a magnet for a reed switch or reed sensor application. An overview of each of the families of magnets is given below.

NdFeB

Highest energy product
Very high remanance and coercivity
Relatively low priced
Mechanically stronger than SmCo
Can be used up to 200°C
Not recommended in Hydrogen atmosphere
Bonded types can be machined but not tapped

SmCo

High energy product
Suitable for high performance applications
High resistance to demagnetization
Excellent thermal stability
High corrosion resistance
Most expensive magnet
Can be used up to 300°C
Prone to chipping - should not be used as a structure

AlNiCo

Cheaper than rare earth magnets
Highest working temperature of 550°C
Lowest temperature coefficient
Low coercivity when compared to other types
High induction levels

Ferrites

Brittle
Poor thermal stability
Cheapest of all types
Can be used up to 300°C
Needs grinding to meet tight tolerances
High corrosion resistance

Selection Guide

Cost	Ferrite	AlNiCo	NdFeB	SmCo
Energy	Ferrite	AlNiCo	SmCo	NdFeB
Operating Temperature	NdFeB	Ferrite	SmCo	AlNiCo
Corrosion Resistance	NdFeB	SmCo	AlNiCo	Ferrite
Resistance to Demagnetization	AlNiCo	Ferrite	NdFeB	SmCo
Mechanical Strength	Ferrite	SmCo	NdFeB	AlNiCo
Temperature Coefficient	AlNiCo	SmCo	NdFeB	Ferrite

Conversion Table

Property	CGS Unit	SI Unit	Conversion Factor
Magnetic Flux	Maxwell	Weber	1 Weber = 10^8 Lines
Flux Density (B)	Gauss	Tesla	1 Tesla = 10^4 Gauss
Magneto motive force	Gilbert	Ampere-turn (AT)	1 Gilbert = 0.796 AT
Magnetizing force field (H)	Oersted	Ampere-turn / metre	1 Oersted = 79.577 AT / m

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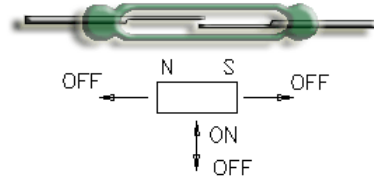
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Magnet Approaches

In all systems, magnet and reed switch must be brought to within a specific proximity of each other. This distance will vary in accordance with the sensitivity of the reed switch and the strength of the magnet. When the magnet is close enough, the normally open contacts will close or operate. When the magnet is taken away, the contacts will open or release. The relative distance for an operate is always less than that for a release. Examples of proximity motion switching are shown below.

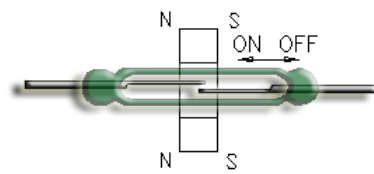
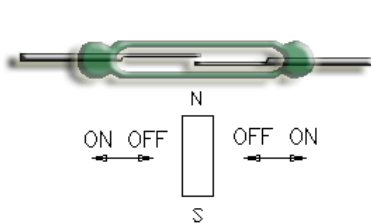
Perpendicular Motion

Provides only one closure with maximum magnet travel.



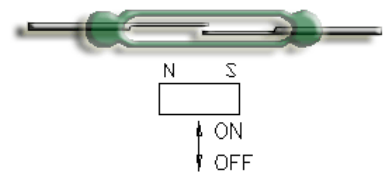
Parallel Motion

Provides as many as three closures with maximum magnet travel. Allows one closure with minimum magnet travel.



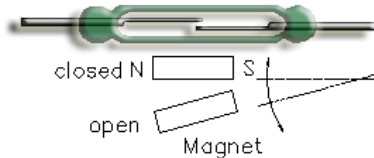
Front to back Motion

Somewhat similar to parallel motion, except magnet motion is at right angles to switch and provides only one closure with maximum magnet travel.



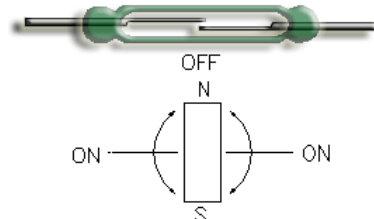
Pivoted Motion

Large angular magnet travel necessary to achieve one closure.



Rotation

Rotating the magnet or reed switch, normal to their axes, reverses magnetic polarity resulting in two closures per revolution. When these axes are parallel, the switch closes. When the axes are perpendicular, the switch opens. Although the poles reverse, they still induce the opposite poles that close the reed switch.



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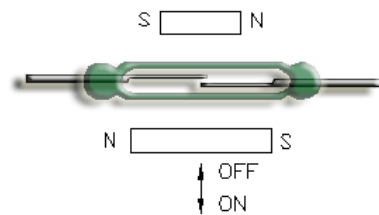
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Magnet Approaches

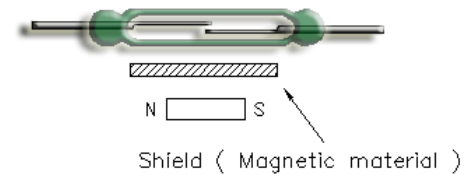
Biasing

A biasing effect is produced by placing a stationary magnet near the reed switch, to keep it normally closed. The approach of another magnet with reversed polarity cancels the magnetic lines of force, and the reed switch opens. Care should be taken not to bring the actuating magnet too close to the biased reed switch, as it could close again. Form A reed switches meant for this kind of application should be selected from an release AT group instead of from an operate AT group.



Shielding

In this type of actuation, magnet and reed switch are permanently fixed in such a position that the reed switch contacts are closed. A piece of ferromagnetic material is passed between the magnet and the reed switch, to cause drop out. The magnetic field is shunted, eliminating the attraction between the reeds. When the shield is removed, the reed switch closes.



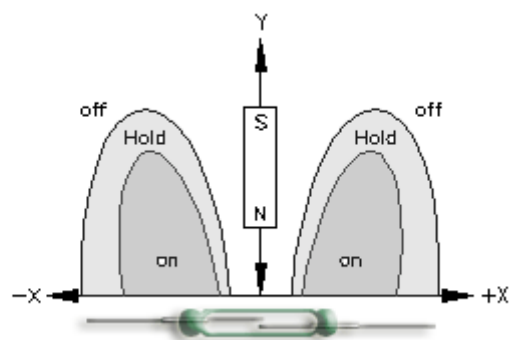
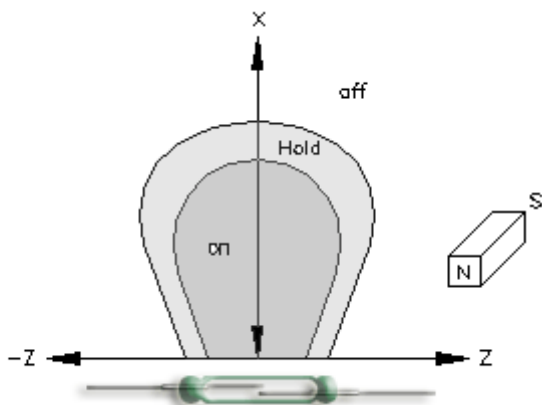
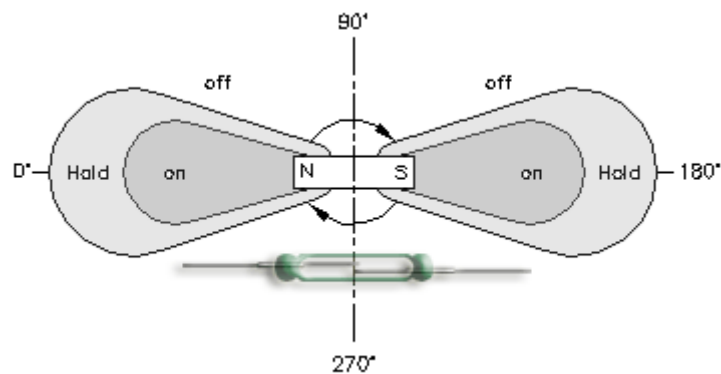
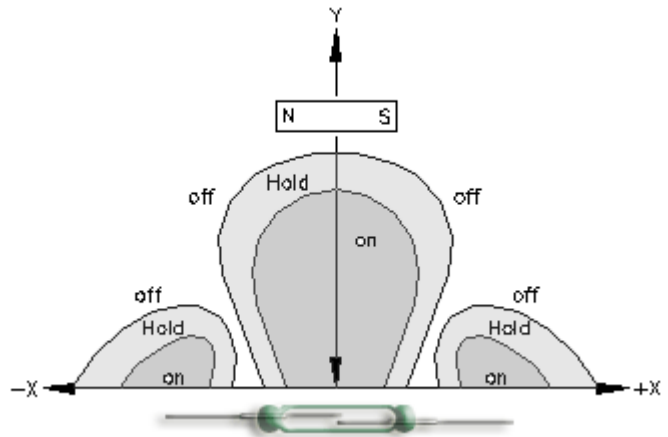
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Operating Characteristics

The following examples show typical operating characteristics of a reed switch. Generally, when a reed switch is actuated by a permanent magnet, the ON-OFF regions differ depending on the type and operate AT of the switch, and size and power of the permanent magnet. These characteristics will vary if there is any other ferro-magnetic material nearby. Each characteristic curve will be enlarged as a whole if a stronger magnet is used for actuation, or if a lower operate AT reed switch is used.



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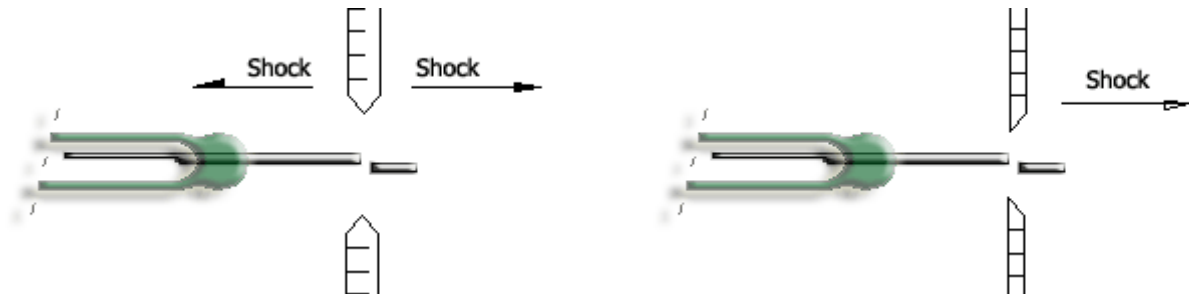
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Physical Modifications

Cropping

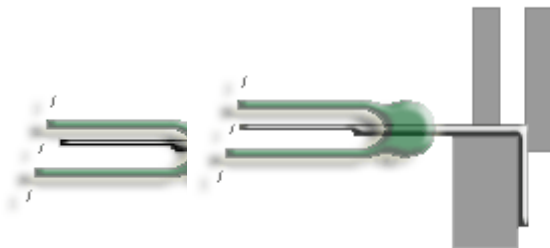
Cropping the leads of a reed switch removes low reluctance iron and introduces high reluctance air into the magnetic circuit, much the same as adding resistance to an electrical circuit. The result is that a greater number of equivalent operate AT is required to close a cropped reed switch. Cropping also increases release AT. It is recommended that end nippers be used, rather than conventional wire cutters, which may produce as much as 70-g shock in the seal area.



For miniature reed switches with glass diameter less than 2.0 mm, even end nippers may cause microscopic seal damage, and clamping the area between the seal and the cropping point is recommended before cropping.

Forming

Many of the same rules that pertain to cropping also apply to forming. Stops or guides that use the end of the seal as a reference point for forming can lead to damaged seals. Also, using the seal as a dimensional reference point invariably results in variation of the lead dimensions after forming.



The recommended practice is to use the lead ends as a reference. Support must be provided between the seal and the forming point. A clamping device is usually recommended because as the lead is bent, stress must not be transferred to the seal area. This approach also allows for normal variations in glass length and distance between seal and each lead end.

Welding and Soldering

In some instances, neither cropping nor forming can provide the required lead configuration, and welding or soldering additional material to the leads is the only answer. The leads of a standard reed switch are composed of approximately 50% nickel and 50% iron. These leads are plated after assembly with either gold or tin to improve weldability and solderability. Welding is preferred to soldering because less heat travels to the seal area. The coefficients of thermal expansion of the leads and glass are closely matched, but welding and soldering heat the wire more quickly than the glass. The result is that metal expansion can loosen or crack the glass-to-metal seal. Properly heat-sunked welding fixture and optimized welding cycles can produce strong bonds without seal degradation.

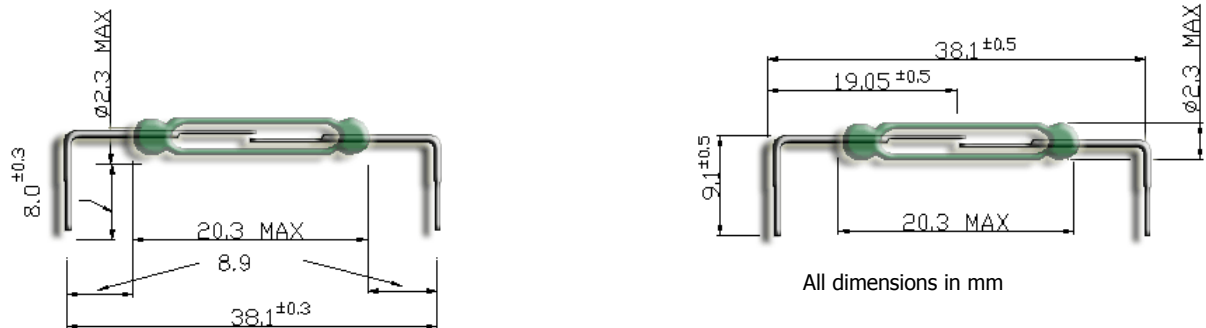
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Dimensioning

Illustrated are two methods for dimensioning the same modification. The left illustration presents an impossible situation mainly because the glass length and its position relative to the gap vary greatly between switches. Compared to the precise dimensions of the reeds, it is unadvisable to use the envelope as a reference point. A common error is stacking three dimensions to come up with a tolerated overall length. This is quite an accomplishment especially when one dimension is specified as "max".



The figure on the right has all the necessary dimensions referenced either from the air gap or the reed, both of which can be held with close tolerances. The bends are set up equally from the magnetic centre of the reed switch, which is located at the air gap. If a magnet is used for actuation, the operating point for reed switches with the same operate AT will be uniform. A switch dimensioned in this manner can have leads cut and formed in one operation. The number of measurements required to inspect the modified switch is minimized.

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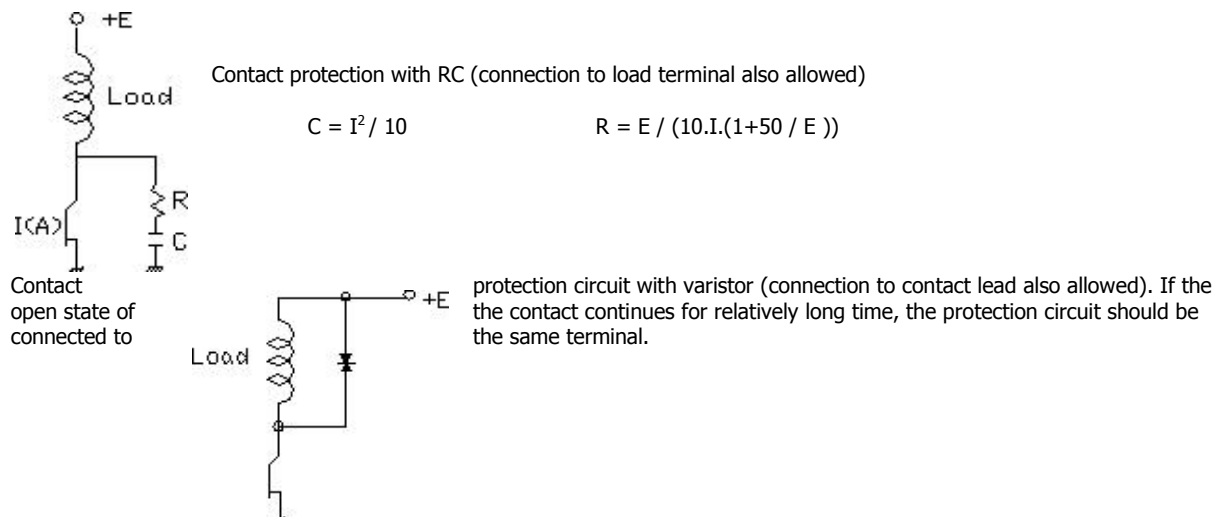
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Contact protection Circuits

When a reed switch is to be connected to an inductive load or a load where surge current or in-rush current flows (such as a capacitive load or a lamp load), the following contact protection circuits are required for the reed switch.

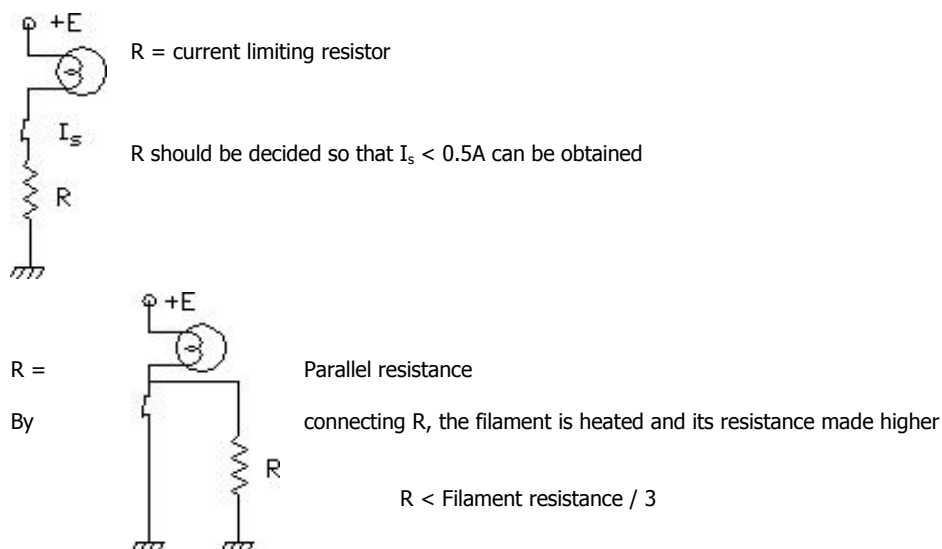
Inductive Load

When a reed switch is used with an electromagnetic relay or solenoid, the energy stored will cause an inverse voltage when the reed contacts break. The voltage, although dependent on the inductance value, sometimes reaches as high as several hundred volts and becomes a major factor to deteriorate the contacts. The following circuits provide inductive load protection for the reed switch.



Lamp Load

Specially plated reed switches are available for switching lamp loads. If in case a standard reed switch is to be used to switch a tungsten filament lamp, the resistance of the cold filament is very small before it is switched on and increases after switching on, followed by lighting with a steady-state current. The in-rush current (5 to 10 times the steady state current) will flow in the contacts immediately after the lamp is turned on, causing melting or sticking of the contacts. The following protection circuits are recommended.



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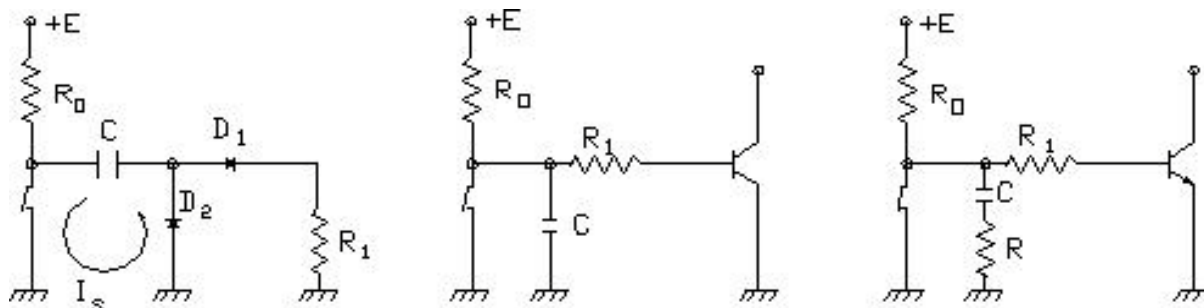
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Contact protection Circuits

Capacitive Load

In case a capacitor is connected in series or in parallel with a reed switch in a closed circuit, the in-rush current which flows during charge and discharge of the capacitor, will cause deterioration of the reed contacts. Shown below are typical examples of protection circuits to prevent the rush current.



Circuit A

Differential circuit without contact protection. The energy stored in capacitor 'C' will cause rush current (I_s) when the contact closes.

Circuit B

Circuit with capacitor 'C' for chatter protection. Rush current will also be caused as in circuit A.

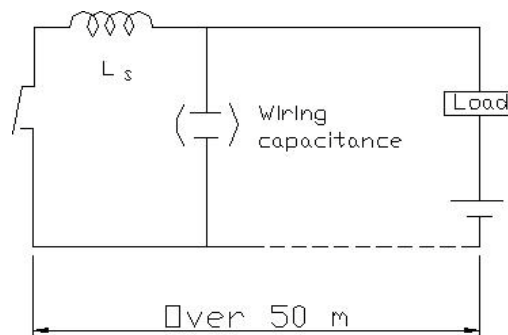
Circuit C

Circuit with resistor 'R' for contact protection, $R=50-500$ ohms.

Wiring Capacitance

In case a reed switch is connected to a load by cable, over a long distance, static capacitance caused by the cable will affect the contact characteristic of the reed switch. Although it depends on the type of cable used, it is recommended that if the cable length exceeds 50 meters, protection as per the circuit below is required for longer operating life of the reed switch.

The surge suppressor (L_s) inserted near the reed switch contacts makes the rush current flowing to the contacts to be delayed. The value of L_s can be replaced by a very small resistance (current-limiting resistor) of 10 to 500 ohms.



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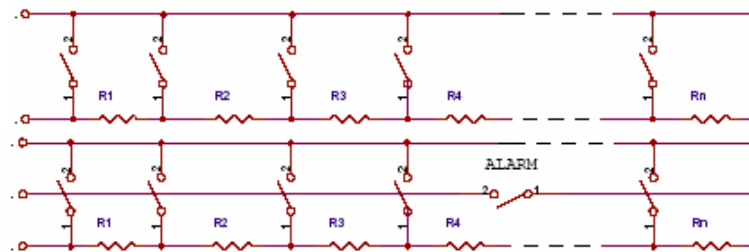
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Level Sensing Circuits

Reed Switches and Reed Sensors are used along with resistors or special reed sensors with integrated resistor to give out a potentiometric feed back across two outputs as a foamed magnetic float moves along the PCB's 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. Resistor values should be selected according to the shape of the tank. All resistors on a PCB can be of one value if the tank being used is cubical or rectangular or a vertically mounted cylindrical tank. In the case of cylindrical tanks mounted horizontally, resistor values should be highest in the center of the PCB and should decrease towards the bottom and top of the PCB to equate to the circular cross-section of the tank.

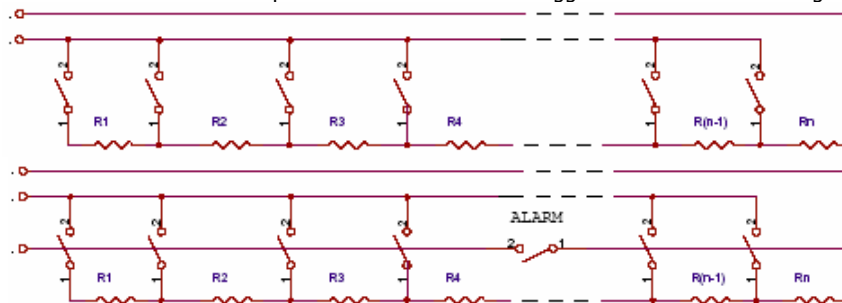
Increasing resistance as tank empties

The following circuits can be used to monitor a liquid level where a full tank gives least resistance and an empty tank gives highest resistance. The second circuit has an additional alarm point which can be used to trigger an external indicator light. The alarm point in use can be a reed switch mounted on the PCB at say 1/5th tank level.



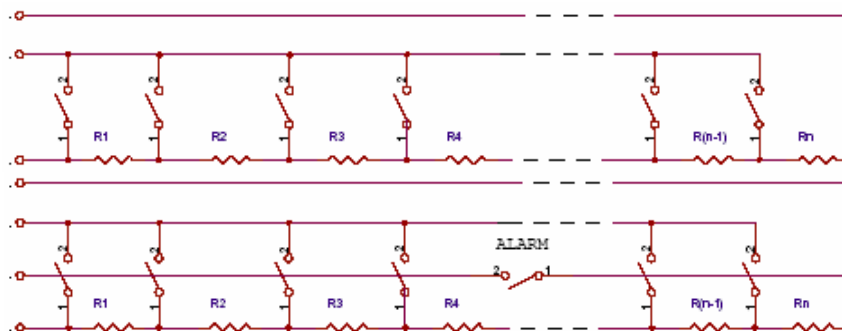
Decreasing resistance as tank empties

The following circuits can be used to monitor a liquid level where a full tank gives highest resistance and an empty tank gives lowest resistance. The second circuit is an alarm point which can be used to trigger an external indicator light.



Increasing and decreasing resistance as tank empties

The following circuits are a combination of the above circuits and can either be used to monitor a liquid level where a full tank gives least resistance and an empty tank gives highest resistance or vice versa.



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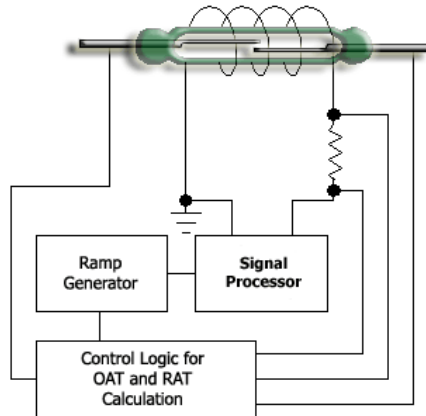


Measurements

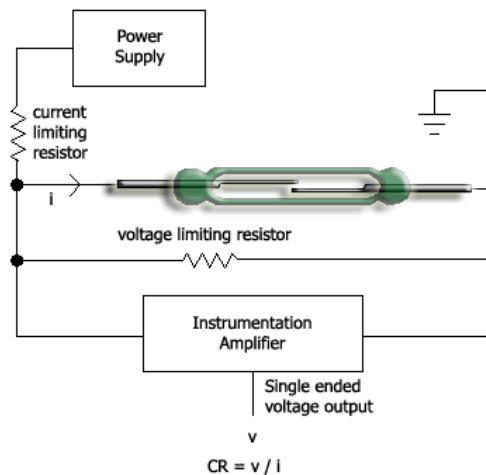
When taking measurements, care should be taken that the test coil and the reed switch are vertical, or if horizontal, only in an east-west direction, to null the earth's magnetic field. The crocodile clips used for connections should not be made of Ferro-magnetic material. All measurements should be taken with Kelvin 4-terminal measurement method. Prior to AT measurements, the coil should be saturated by applying a voltage equivalent to about 200AT for a few milli-seconds.

The current in the coil is then increased to the point where the reed switch operates, and then multiplied by the number of turns in the coil to give operate AT. Contact resistance is measured across the contacts by forcing 10 mA test current and 100 mV, after giving 10% AT more than the operate AT, which is known as over-drive AT. Release AT is measured by decreasing the coil current from the over-drive AT. Dynamic contact resistance is measured up to the switching frequency limit. All the measurements are carried out for 10 cycles.

A simple arrangement to measure the OAT, RAT and CR for the reed switches is given below.



Operate AT and release AT are calculated by measuring the voltage developed across a reference resistor, finding out the current through it, and multiplying the value by the number of turns of the test coil. Suitable compensations may be incorporated to cancel out the earth's magnetic field. The test coil may be of 5000 or 10000 turns to minimize positional errors. CR can be measured by driving a suitable test current through the reed switch and measuring the voltage developed across the reed switch. The measured voltage upon the forced current will give the CR in ohms. The test current is usually small so that no damage occurs to the reed switch and is few tenths of the rated carry current. Constant current sources should be used with care and the open voltage must be very small. Any capacitance in the driving line will destroy the contacts.



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Life Testing and Life Expectancy

A life test is a destructive test conducted to ensure the reliability of reed switches for different combinations of voltage, current, and operating frequencies. The parameters tested during a life test are OAT, RAT, CR, and operate and release times.

Measurement parameters

Test current - Rated current of the particular reed switch type.

Test voltage - Rated voltage of the particular reed switch type.

Operating time - monitored for 1 ms, 2ms from contact make

Release time - Monitored 1 ms, 1ms from contact break

Operating frequency - 1 to 25 Hz for standard size reed switches and 25 to 125Hz for miniature reed switches at 50% duty cycle

contact resistance - less than 5% of test load

coil drive - 25% overdrive

Failure Criteria

Contact resistance exceeds 5% of test load at contact make

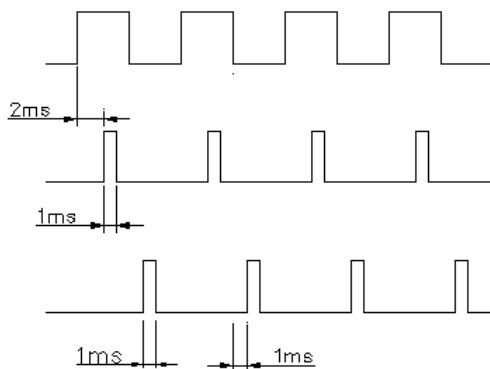
Contact resistance less than 500% of test load at contact break

Missed operation during make or break (failure to make or break)

Reed Switch weld

Windows

After the test environment is set up for the required load current and voltage, the reed switches are subject to continuous 'make' and 'break' operations. When the make operation occurs, the rated current flows through the reed switch for the 'make' time and when the break operation occurs the contacts are open and no current flows. The rated voltage continues to be present across the open contacts of the reed switch during this period.



A 'failure to make' is identified by monitoring the status of the reed switch, 2 ms after the coil is energized, continuously for 1 ms. If in the 1 ms monitor window, the reed switch 'breaks' or fails to close, then it is considered as a 'failure to make'. A 'failure to break' is identified by monitoring the status of the reed switch 1 ms after the coil is de-energized, continuously for 1 ms. If in the 1 ms monitor window, the reed switch 'makes' contact or fails to open, then it is considered as a 'failure to break'. The process is repeated through out the life test, for the expected number of operations, or until the reed switch fails. During this period the contact resistance is monitored from time to time so that the actual behaviour of the reed switch under load is understood.

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Ampere Turn (AT)

The product of the number of turns of wire in an electromagnetic coil winding and the current in amperes passing through the winding. This is a direct measure of a reed contact's sensitivity.

Bounce

Intermittent opening of closed contacts or closing of open contacts, usually implying the motion resulting from contact impact.

Bounce Time (in milliseconds)

Time taken for bounce.

Breakdown Voltage

The voltage which may be applied between insulated parts of a reed contact without damaging, arcing, causing breakdown or excessive leakage.

Carry Current (in Amps)

The maximum current that can be applied to an already closed contact.

Chatter

The undesired intermittent closure of open contacts or opening of closed contacts. It may occur either when the reed contact is operated or released or when subjected to external shock or vibration.

Close differential

A differential of minimum 70%

Coil

An assembly consisting of one or more windings on a bobbin. Used to measure AT of a reed contact.

Contact

The current-carrying parts of reed contacts that engage or disengage to open or close electrical circuits.

Contact Gap

The distance between mating reed contacts when the contacts are open.

Contact Rating (in Watts)

The maximum power, a reed contact can switch.

Contact Resistance (CR)

The electrical resistance in milli-ohms of closed contacts.

Curie temperature

Temperature at which a magnet is totally demagnetised.

Differential

The difference between operate AT and release AT. This is also expressed in % as (OAT-RAT)/OAT %.

Drop Out (DO)

See Release AT.

Dwell (for Form C and D type contacts)

For form C contacts, it is the difference, in AT, between the closing of the NO contact and the opening of the NC contact, and form D contacts, is the difference, in AT, between the opening of the NC contact and the closing of the NO contact.

Dynamic Contact Resistance (DCR)

The electrical resistance of closed contacts under load, when the contact is in continuous operation.

Form A

A normally open type of reed contact.

Form B

A normally closed type of reed contact.

Form C

A change-over type of reed contact where break happens before make.

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Form D

A change-over type of reed contact where make happens before break.

Form E

A latching, or bi-stable type of contact, which stays in the last energized state, without the need for maintaining the field.

Homogenous Materials

A homogeneous material is defined as either a raw material or a material applied during the construction of the product. For example, in reed blades plated with both Gold and a Ruthenium layer, the base metal (Nickel Iron alloy) and both layers are considered homogeneous materials and therefore must be considered separately.

Hysteresis

See differential

Insulation Resistance

The electrical resistance measured between insulated terminals.

Operate AT (OAT)

The measured value, in AT, at which a reed contact closes. This is valid for the closing operation of form A, B, and E type reed contacts and the change over operation from the normally closed contact to the normally open contact for form C and D type reed contacts.

Operating Temperature

The temperature range within which a reed contact will meet all specified operating parameters.

Operate Time

The time interval after actuation of a reed contact to the closing of the reed contact. Where not otherwise stated, the functioning time of the reed contact in question is taken as its initial functioning time, not including contact bounce.

Over-drive (in AT)

The percentage of AT given above OAT, before measurement of CR.

Pull In (PI)

See Operate AT.

Reed Switch

A reed switch is a passive device consisting of two reed contacts sealed inside a glass tube, which operates when brought near a magnetic field.

Reed Sensor

A reed sensor is a package built using a reed switch with additional functionality like ability to withstand higher shock, easier mounting, additional intelligent circuitry, etc.

Re-closure (RC)

The closure which occurs after further energization of an already energized normally closed reed contact in open condition. This is applicable to form B type reed contacts and to the un-latching operation of form E types.

Release AT (RAT)

The measured value, in AT, at which a reed contact opens. This is valid for the opening of form A, B, and E type reed contacts and the change over from the closed normally open contact to the open normally closed contact for form C and D type contacts.

Release Time

The time interval, from coil de-energization to the opening of the reed contact. Where not otherwise stated, the functioning time of the reed contact in question is taken as its initial functioning time, not including contact bounce.

Remanance

Residual induction in magnet material after being magnetized to saturation.

Resonance Frequency (in Hz)

The maximum operating frequency that a reed contact can withstand, after which it chatters, or starts sympathetic vibration.

Saturation

Magnetic saturation exists when an increase of magnetization applied to a reed contact does not increase the magnetic flux through.

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Static Contact Resistance (CR)

The electrical resistance of closed reed contacts, as measured terminal to terminal, at their associated terminals.

Switching Frequency (in Hz)

The maximum frequency at which a reed contact can operate.

Switching Voltage (in Volts)

The maximum voltage a reed contact can switch.

Switching Current (in Amps)

The maximum current a reed contact can switch.

Thermal EMF

The EMF generated by a reed contact when the reed contact unit is subjected to a temperature differential. Thermal EMF of most reed switches is in the region of 40 micro-volts / °C.

Variable Contact Resistance (VCR)

The difference in lowest and highest static CR readings out of a set of test cycles.

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