



Introduction

Dishwashers are one of the most improved appliances for the kitchen over the last few years. Upgrades include more thorough cleaning/washing cycles while still lowering water usage and energy consumption.

Like many modern appliances, dishwasher microprocessor based controllers allow the use of a variety of sensors to ensure precision cleaning, safe, and energy-efficient operation. Littelfuse's magnetic sensor products help make these appliances as reliable and efficient as ever.

Reed sensors and Hall Effect sensors are both very reliable and will operate over millions of cycles with long-term integrity when used with microprocessor electrical loads. Both reed and Hall Effect devices are operated by a magnetic field. Reed switches and sensors consume no power, while Hall Effect devices are semiconductors and will consume a small amount of current in both the activated and de-activated state.

Spray Arm Rotation

A critical function is the rotation of the spray arm for cleaning the dishes and utensils. Many machines have spray arms on both the topside and bottom side of the wash compartment. The spray arm is usually a free-turning rotary device propelled by both hot and cold high water pressure. Some higher-end machines have motor-driven spray arms. It is important that the spray arm does not become obstructed by misplaced dishes or utensils within the washer baskets. If the arm does become blocked, the spray arm only sprays the dishes at that position, while another negative effect is that the motor could burn out because the stoppage causing a higher current draw. The ultimate results are that the dishes are not as clean as desired.

A reed switch/sensor can be used in conjunction with a magnet to sense the continuous movement of each spray arm. A magnet is mounted to the rotating arm while the sensor is mounted within the body or frame of the machine.

When the spray arm rotates normally, the magnet passes under the reed switch and the magnetic field actuates the reed switch contacts. The contact re-opens after the magnet passes by the sensor. If an obstruction of the spray arm occurs the magnet no longer activates the reed switch. The microprocessor detects this non-activation; either stops the machine or activates an alarm or light on the dishwasher. Once the obstruction is removed, the dishwasher then operates normally.

The reed switch is perfect for this wet environment because of the precious metal contacts are contained within a hermetically sealed glass capsule. Moisture and fluctuating temperatures do not affect the reliable operation of the reed switch.

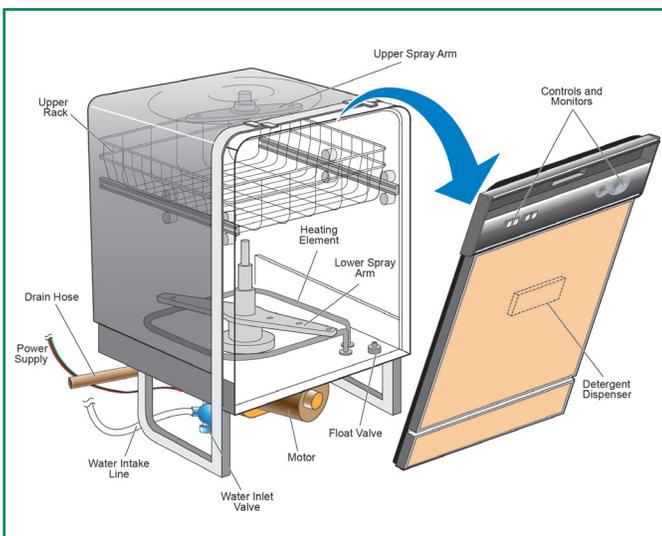


Figure 1: Components of a Dishwasher

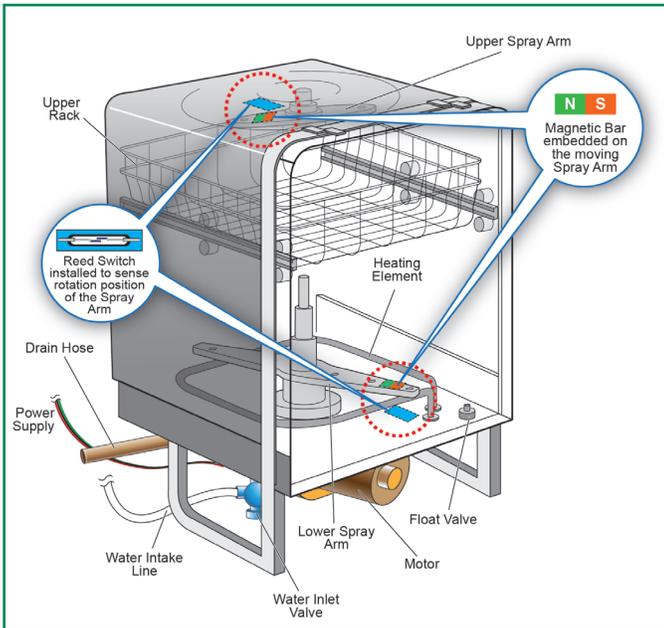


Figure 2: Spray Arm Sensor Positions

Littelfuse recommends the following products as spray arm switches and sensors:

Table 1: Suggested Products as Spray Arm Switches and Sensors

Suggested Products
MDSM-4 reed switch
59140 reed sensor
59025 reed sensor
Custom-designed sensor

Door Latch/Lock Sensor

The dishwasher door latch serves two purposes. The first purpose is to pull the door tight and keep it closed to prevent water leaks; the second is as a safety switch. A dishwasher will not run if the door is not properly latched. If the dishwasher will not run or attempts to run with the door open, there may be a faulty dishwasher door latch.

A reed or Hall Effect sensor can be used to detect proper door latching. There are various design options available or a custom package can be developed. The magnet actuator would be placed in the moving door or latch mechanism, while the sensor would be placed in the fixed machine frame.

The reed switch is perfect for this tough environment because of the hermetically sealed contacts. Neither Vibration nor shock effects from the door closure will impact the performance of the sensor in this application. A Hall Effect sensor may also be a good option for this application.

Littelfuse recommends the following products as flow switches and sensors:

Table 2: Suggested Products as Flow Switches and Sensors

Suggested Products
59165 overmolded reed switch
59140 reed sensor
55100 Hall Effect sensor
Custom-designed sensor

Water Level Sensor

Prior to the wash cycle, a small amount of water is pumped into the basin of washer, and then heated. A float type sensor is mounted at the bottom of the basin to detect if too much water is being dispensed into the basin. If there is a faulty pump, valve or drain, the water could continue to rise if undetected causing a leak or flooding of the floor.

One method to detect water level is to use a reed float level sensor. A typical float sensor consists of a reed switch housed within a tubular housing and a magnet imbedded into a float.

Once the float mechanism rises to the point of activating the reed switch, a signal is processed and the pump would be shut down and an alarm or light activated to warn the operator of this issue.

An additional function could be performed with this level sensor, especially with micro-controllers. Adding multiple reed switches to this sensor at increments of about 6.5mm spacing, forming a reed/resistive ladder, would allow more precise monitoring of the water level. This additional functionality could save water usage or allow different amounts of water to be used during the different wash cycles.

Littelfuse can also design custom level sensor products tailored to specific applications. Sensor housings, assemblies, magnets, and sensitivities can be customized to meet the application needs.

Littelfuse recommends the following products as flow switches and sensors:

Table 3: Suggested Products as Flow Switches and Sensors

Suggested Products
59630 float sensor
59140 reed sensor
55140 Hall Effect sensor
Custom-designed sensor

Soap and Water Softener Tray

Some high end residential and commercial dishwashers have large reservoirs that contain liquid soap and/or water softener. These reservoirs usually contain level sensors for warning the operator when the liquid is low and should be refilled. The location of these can be within the door or on the bottom of the dishwasher.

A reed float level sensor can be added to the soap and/or water softener dispenser reservoirs. A magnet is imbedded in a float that rises and falls with the amount of fluid within this reservoir. A reed switch is mounted on a PCB, or a reed sensor can be mounted to chassis of the dishwasher. The reed switch or sensor activates when the soap drops to the low-level limit. When this happens, a light on the outside panel will begin to flash or a beeper alerts the user to fill the water softener fluid reservoir and return to normal operation.

Littelfuse recommends the following products as soap and water softener tray switches and sensors:

Table 4: Suggested Products as Soap and Water Softener Tray Switches and Sensors

Suggested Products
59630 level reed sensor
59165 over-molded reed switch and custom float
Custom-designed float and level sensor

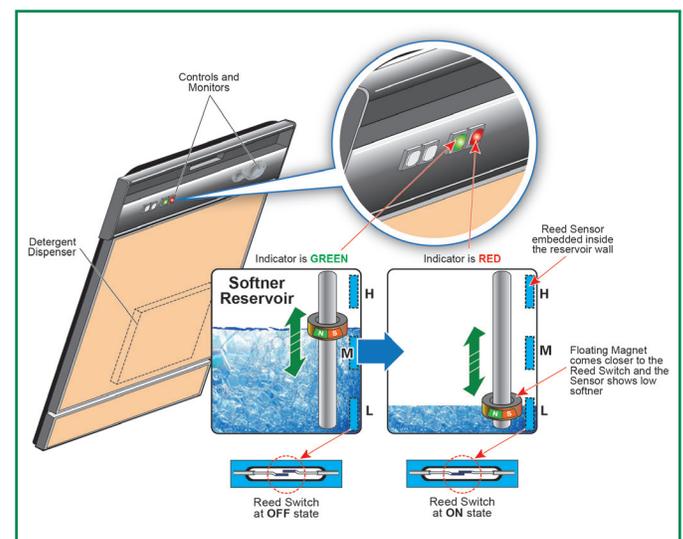


Figure 3: Water Softener/Detergent Level Sensing in a Dishwasher

Sprayer Diverter Sensor

Many machines today use a diverter valve to selectively divert liquid flowing within the spray arm or between the spray arms within the wash chamber. The purpose of the diverter system is for optimizing the cleaning function of the dish washer in each area of the chamber such as the utensils, dishes or bowls.

Length of wash period, water temperature and pressure are variables that the diverter system can control through the microprocessor network. Cleaning and resource usage may be optimized by spraying wash liquid only in areas occupied by utensils, or very dirty dishes or bowls. This promotes both water savings and minimizes electricity usage while obtaining optimum cleansing.

The diverter system can be enabled with placing a reed switch or sensors along with an actuator to monitor at which position the diverter is in during the cycle.

The Littelfuse recommends the following products as flow switches and sensors:

Table 5: Suggested Products as Flow Switches and Sensors

Suggested Products
59025 reed sensor
MDSM-4 reed switch
59165 over-molded reed switch
Custom-designed sensor

FEATURES AND BENEFITS OF REED SWITCHES

- Switch activation does not require physical contact
- Switch contacts are within a hermetically sealed capsule
- Resistant to moisture, dust, and other foreign objects
- Wide operating temperature range
- Reliable switching
- Long lifetime

Why to Use Reed or Hall Sensor

A reed switch is a magnetically operated switch that in most situations are normally open when there is no magnetic field present. When a magnetic field is present in proper alignment and of sufficient strength, the contacts of the reed switch will close and complete the circuit.

Reed switches and Hall Effect sensors are magnetic switching devices, sometimes called 'contactless'; that is because the actuator/magnet does not make physical contact to the switch, to change the state, unlike a Micro-switch, or a Mechanical switch.

Reed switches are perfect technology for switching microprocessor electrical loads of 1-12Vdc and small milli-amps of current. Reed switches have precious metal contacts, hermetically sealed within a glass envelop and filled with nitrogen gas. The switching cycles can last up to many millions of operations with no degradation of contact wear, because of this inherent reed switch design.

A digital Hall Effect is a semiconductor with unlimited life when driven by the proper voltage and current. Reed and Hall Effect devices are long-lasting and very reliable within very humid and varying temperature applications.

FEATURES AND BENEFITS OF HALL EFFECT SENSORS

- No physical contact required to operate the sensor
- Wide operating temperature range adequate for use in cold and hot temperatures
- Encapsulated sensors provide additional protection against mechanical stresses and vibration
- Digital output signal is used to compute speed and direction with high accuracy
- Effective for high-speed applications
- Long lifetime and reliable sensing for millions of operations

Beyond Sensing, Littelfuse Offers Circuit Protection Solutions

In addition to sensor products, Littelfuse offers the world's broadest and deepest portfolio of circuit protection and power control solutions.

Littelfuse recommends the following products for use in these applications:

Table 6: Circuit Protection and Power Control Solutions

Application Example	Product Series
Power Control	
Safety Latch Drying Fan Valve Control Heater Element AC Motor	Q60xx Triac
Circuit Protection	
AC Mains	TMOV, LA, C-III MOV, UltraMOV Varistors
	3AG, 5x20mm Fuses
	Holders, Blocks, Clips
Control Board	TR5/TE5 Fuse
	SMD PTC
	P4KE/SMAJ TVS
Touch Screen/Display Panel	SP1001, SP1003, SP1006 Diode Arrays
	Multilayer Varistors

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