

■ Capacitive Sensors - Introduction

Capacitive sensors are often successfully used in applications which cannot be solved with other sensing techniques. Capacitive sensors respond to a change in the dielectric medium surrounding the active face and can thus be tuned to sense almost any substance. Capacitive sensors can also sense a substance through a layer of glass, plastic or thin carton.

Full encapsulation, solid state switching and the absence of any moving parts on DETECHTOR capacitive sensors provide superior performance, durability and safety compared to mechanical float switches in level control applications.

Some typical applications for capacitive sensors are listed below:

- Level control of non-conductive liquids (oil, alcohol, fuel).
- Level control of granular substances (flour, wheat, sugar).
- Sensing substances through a protective layer (eg. glass, plastics).

The fact that capacitive sensors respond to most substances, necessitates some care during the installation, adjustment and long term operation of the sensor.

The sensitivity of capacitive sensors is affected by the moisture content and the density of the substance to be sensed.

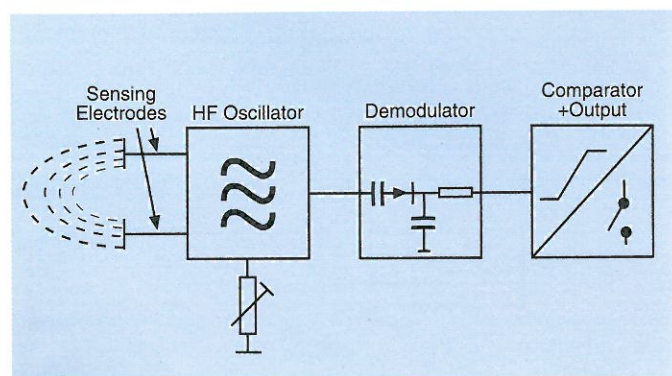
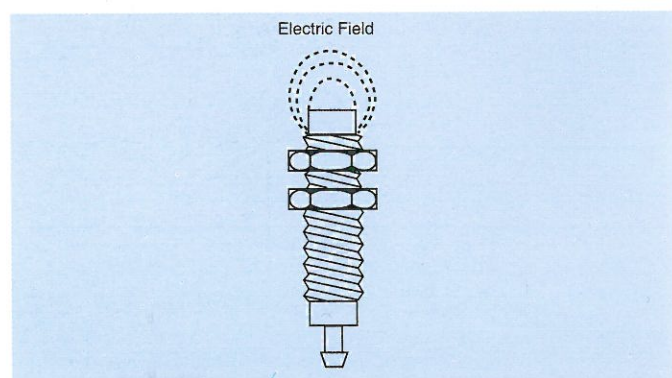
Deposits of excessive dust and dirt on or around the sensing face of the sensor, cause erratic response and hence the sensor may require periodic cleaning if used in a polluted environment.

PRINCIPLE OF OPERATION

Capacitive sensors respond to any substance with a high dielectric constant (water, oil, fuel, sugar, paper) without making physical contact. They are less suitable for polystyrene and similar low density substances.

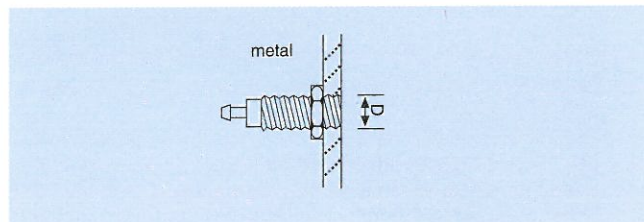
Operation is based on an internal oscillator with two capacitive plate-electrodes, tuned to respond when a substance approaches the sensing face.

When the target is sensed, the output switch will either close to activate a load for a normally open option or the switch will open to de-activate the load for a normally closed option. The LED will illuminate when the output switch closes.



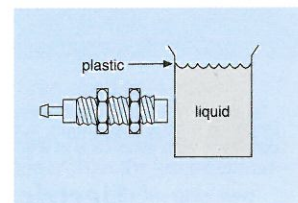
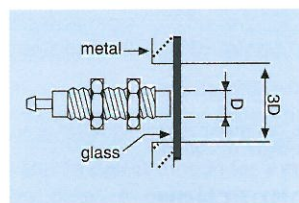
FLUSH INSTALLATION

Sensors with the metal tube covering the full length of the body can be installed flush with metal or other material. However, the contact of metal or material with the metal tube will influence the sensitivity of the sensor and therefore the sensitivity should be re-adjusted *after* installation.



SENSING THROUGH GLASS OR PLASTIC

Capacitive sensors can sense substances through the wall of containers. However, the thickness and material of the wall affects the sensitivity of the sensor. Ideally the wall should be as thin as possible. On steel containers with a small glass window, the diameter of the window (3D) should exceed three times the diameter (D) of the sensor.



SENSING DISTANCE

The sensor should be positioned in such a way that the substance passes well within the sensing distance (S_n) of the sensor.

Sensitivity of the sensor can be adjusted to tune out the effects of unwanted substances in the vicinity of the sensor (dirt, foam, dust, etc.).

Sensitivity depends on the composition, density and moisture content of the target substance. The nominal sensing distance applies to a steel plate with a diameter 3 times that of the sensor. For various materials the following correction factor for S_n applies:

Approximate Correction factor for S_n :	Approximate Dielectric constants [K] at 25°C
Steel plate	1.0
Water	1.0
PVC	0.4
Oil	0.4
Glass	0.2
Flour/Grain	0.5
Wood	0.6
Sugar	0.6
Carbon	0.9
Benzene	0.2

■ Capacitive Sensors - Sensitivity Adjustment

INFLUENCES OF ENVIRONMENTAL CONDITIONS

Temperature variations will cause the sensing distance of capacitive sensors to vary by up to 25%. This factor becomes important when detecting a low dielectric material through, for example, glass (see table of dielectric constants).

Earthing of metal targets causes an increase in effective sensing distance.

Humidity, dew, dust, etc. can also affect the reliable operation of capacitive sensors. It is advisable to mount the sensors in such a way that these factors have minimal effect.

To minimise the effects of environmental conditions, all Rhomberg capacitive sensors come with a multi-turn potentiometer to adjust the sensing distance. When adjusting the sensor, the sensitivity should be set between the minimum and maximum operational points. In applications where materials of a low dielectric need to be detected without coming into contact with the sensor, a PTFE separation is recommended. If there is any doubt, then it is advisable to verify the suitability of the sensor for the application by in-field testing. (Rhomberg sales representatives are qualified to assist in this regard.)

SENSITIVITY ADJUSTMENT

The sensitivity adjustment screw at the rear of the sensor facilitates fine tuning for the particular application. If, for example, the sensor is being utilised to sense a fluid through a glass window on a container, the sensor can be tuned to ignore the effect of the glass but respond to the liquid behind the glass. Similarly the sensor can be tuned to ignore the froth on top of a liquid. Sensitivity of the sensor increases when the multi-turn adjustment screw at the rear is turned clockwise. 15 turns of the screw will tune the sensor from minimum to maximum sensitivity. If turned to maximum (15 turns clockwise), the sensor becomes over sensitive and responds even if no target substance is present. If turned to a minimum (15 turns anti-clockwise), it will ignore any substance.

LED INDICATION

- For normally Open (NO) sensors a ● red LED illuminates when a target is sensed.

- For normally Closed (NC) sensors a ● green LED is extinguished.

Note: For NAMUR sensors, which are always NC, the ● green LED illuminates when no target is present.

ENVIRONMENTAL CONDITIONS

Submersion-proof and Dust-proof to IP 67

Operating Temperature: -20° C to + 70°C

