CAPACITIVE SENSOR

PRODUCT INTRODUCTION

Operating Principle

The active element is formed by two metallic electrodes positioned much like an " opened " capacitor (Fig.1). Electrodes A and B are placed in a feedback loop of a high frequency oscillator. When no target is present, the sensor'scapacitance is low, therefore the oscillation amplitude is small. When a target approaches the surface of the sensor. It increases the capacitacne. This increase in capacitance results in an increased amplitude of oscillation. The amplitude of oscillation is measured by an evaluating circuit that generates a signal to turn on or off the output(Fig.2).

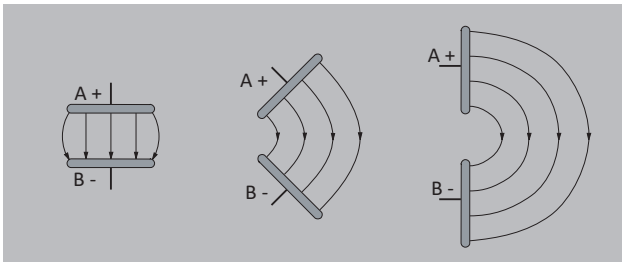


Fig.1 Sensing surface

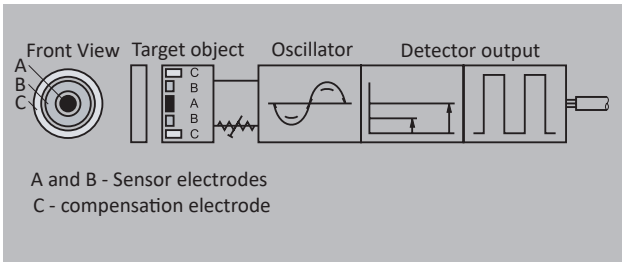
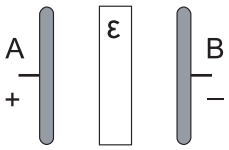


Fig.2 Capacitive Sensing - Operating principle

Switching Distance and Dielectric Constants

The switching distance of capacitive sensors is different. The maximum switching distance can be obtained by detecting metallic conductor (metal). When the metal is detected with a capacitive sensor, the attenuation coefficient for different metals is contrary to that of the inductive sensor. The switching distance of dielectric depends on the dielectric constant. The larger the dielectric constant. The larger the dielectric constant of the object is, the longer switching distance is obtained.

The switching distance (Sr) is dependent on the dielectric constant (εr) of the target object. The maximum switching distance (100%) is achieved with metallic objects while it is reduced with other materials in proportion to the dislsctric constant of the target object.



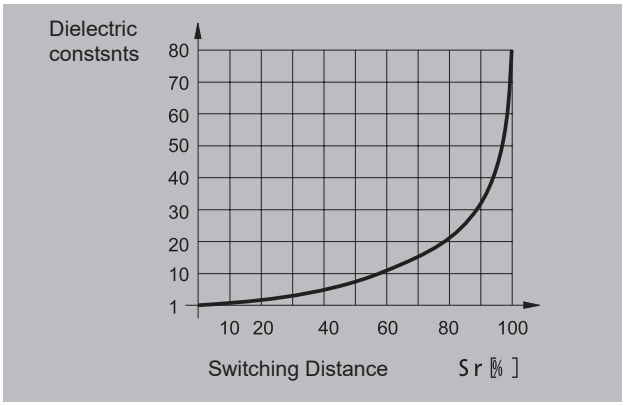


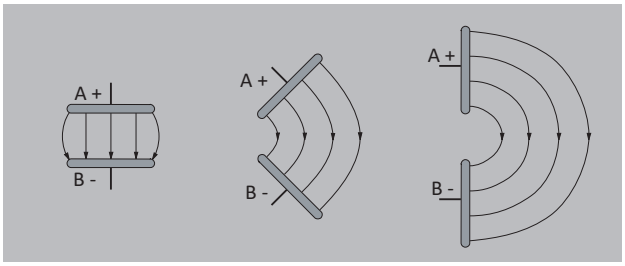
Table 1 (below) shows the dielectric constants of some important materials. As a result of the high dielectric constant value of water, wood exhibits relatively large fluctuations. Damp wood is therefore considerably better detected hy capacitive sensors than dry wood.

电容传感器

产品介绍

工作原理

电容式传感器的感应面由两个同轴金属电极构成，很像“打开的”电容器的电极（图1）电极A和B链接在高频振子的反馈回来中。该高频振子无测试目标时不感应，当测试目标接近传感器表面时，他就进入里有这两个电极构成的电场，引起A,B之间的后和电容增加，电路开始振荡。每一振荡的振幅均由一数据分析电路测得，并形成开关信号（图2）。



图一 感应面图

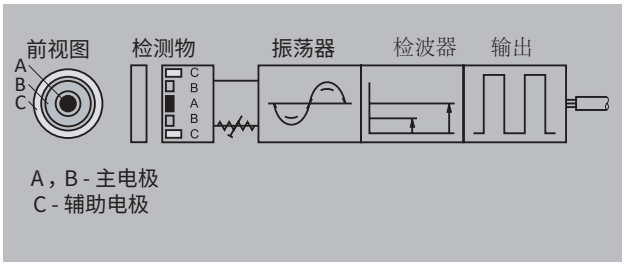
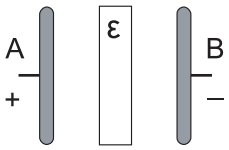


图2 电容式传感器-工作原理

开关距离和介电常数

电容式传感器的检测距离是不一样的。通过检测导体材料（如金属）可获得最大的开关距离。当和电容式开关检测金属时，对于不同金属的衰减系数同常规电感式传感器相反的。
非导体材料的开关距离取决于介电常数，检测五的介电常数越大，获得的开关距离越大。
由图可以看出开关距离（Sr）取决于物体介电常数（εr），通过检测金属物体时，可以获得最大的开关距离（100%）对于其他材料物体开关距离会被减少。



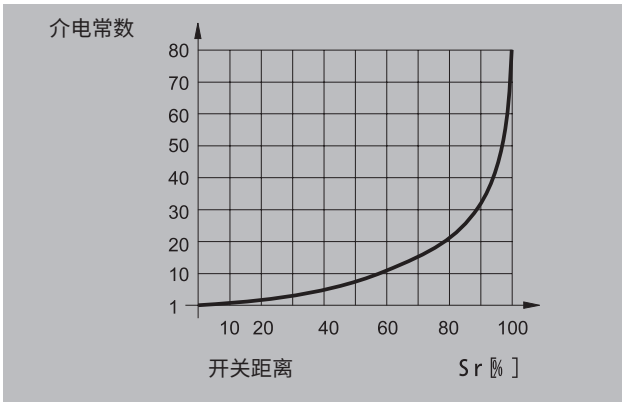


表1列出了一些重要材料的介电常数，由于水的介电常数很高，而木材的含水量不同，故不同木材的介电常数时不一样的，检测湿木材较干木材容易。

CAPACITIVE SENSOR

Table 1

Material	Dielectric constants
Air. vacuum	1
Teflon	2
Wood	2...7
Paraffin	2.2
Terpentine oil	2.2
Transformer oil	2.2
Paper	2.3
Polyethylene	2.3
Polypropylene	2.3
Cable compound	2.5
Soft rubber	2.5
Silicone rubber	2.8
PVC	2.9
Polystyrene	3
Celluloid	3
Perspex	3.6
Araldite	3.6
Bakelite	3.6
Quartz glass	3.7
Hard rubber	4
Oiled paper	4
Pressboard	4
Porcelain	4.4
Laminated paper	4.5
Quartz sand	4.5
Glass	5
Polyamide	5
Mica	6
Marble	8
Alcohol	25.8
Water	80

Housing material

Plastic and metal housing

Target Object

Capacitive sensors are used for non-contact and detection of metals (metallic conductor) and nonmetals.

Types of interaction

Capacitive sensors are actuated by both conductive and non-con ductive objects. Objects made of conductive materials form a counter-electrode to the sensor's active face. This forms two capacities, CA and CB connected in series, with the electrode surfaces A and B (Fig.3). The capacity of this serial connection is always greater than the capacity of the uncovered electrodes A and B. Metals achieve the highest switching distances due to their very high conductivity. Reduction factors for differing metals – like those of inductive sensors – must be taken into account. Actuation byobjects made of non-conductive materials (insulators): when one places an insulator between the electrodes of a condenser the capacity increases with the dielectric constant ε (Fig.4) of the insulator. The dielectric constant of all solids and liquids is greater than air (εair = 1; see table 2). Similarly, objects made of non-conductive materials have an effect on the active face of a capacitive sensor by increasing the coupling capacity. Materials with greater dielectric constants achieve longer switching distances. When scanning organic materials (wood, grain, etc.) it should be noted that the achievable switching distance is very strongly influenced by the water content (εwater=80!)

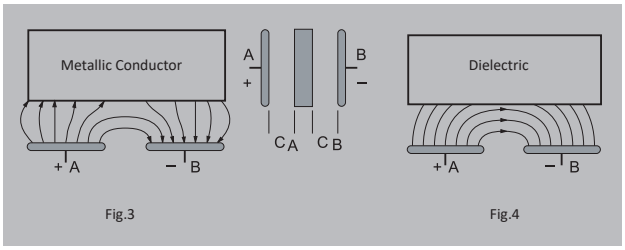


Fig.3 Fig.4

电容传感器

表一

材料	介电常数
空气	1
特氟龙	2
木材	2...7
石蜡	2.2
汽油	2.2
松节油	2.2
纸	2.3
聚乙烯	2.3
聚丙烯	2.3
电缆胶皮化合物	2.5
软橡胶	2.5
硅	2.8
PVC	2.9
聚苯乙烯	3
赛璐珞	3
有机玻璃	3.6
环氧树脂粘合剂	3.6
电木	3.6
石英玻璃	3.7
硬橡胶	4
油纸	4
纸板压制的碎屑	4
陶瓷	4.4
硬纸	4.5
石英砂	4.5
玻璃	5
聚酰胺	5
云母	6
大理石	8
酒精	25.8
水	80

外壳材料

标准的塑料和金属外壳。

检测物

电容式传感器用作非接触和无损耗的检测金属（导体）。

影响因素

电容式传感器既能被导体目标感应，也能被非导体目标感应。以导体为材料的测试目标对传感器的感应面形成一个反电极，由极板A和极板B构成了串联电容CA和CB（图3）。该串联电容的电容量总是大于无测试目标时由电极A和B所构成的电容量。因为金属具有高传导性，所以金属测试目标可获得最大开关距离。在使用电容式传感器时不必像使用电感式传感器那样，对不同金属采用不同的校正因数。以非导体绝缘体为材料的测试目标可用以下方式感应其开关。将一块绝缘体放在电容器的电极A和B之间（图4），使其电容量增加，增加量取决于介电常数。表1同时列出了普通的固体材料和流体材料，这些材料的介电常数均大于空气的介电常数（空气的介电常数=1）
一般而言，材料的介电常数越大，可获得的开关距离就越大，测试有机材料时，开关距离在很大程度上取决于其含水量（水含量=80！）。

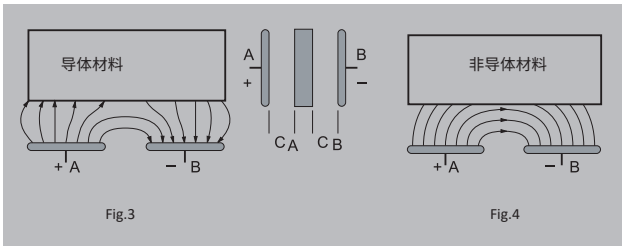


Fig.3 Fig.4

CAPACITIVE SENSOR

Switching distance adjustment

Almost all ELCO capacitive sensors can be adapted to specific applications by adjusting the potentiometer.

电容传感器

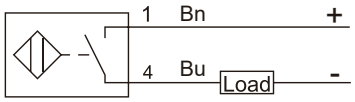
开关距离的调整

几乎所有ELCO的电容式传感器都可以通过调节（电位器）来适应特定的应用。

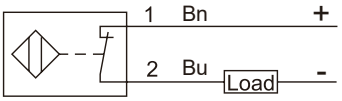
CAPACITIVE SENSOR

WIRING DIAGRAMS (Note: 1 / 2 / 3 / 4 connector and terminals pin number Bn / Bu / Wh / Bk cable color)

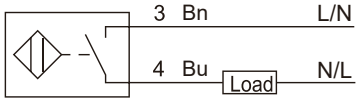
WD1 DC 2-wire NO



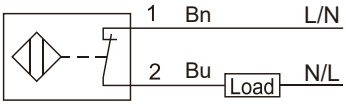
WD2 DC 2-wire NC



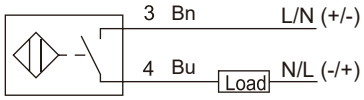
WD3 AC 2-wire NO



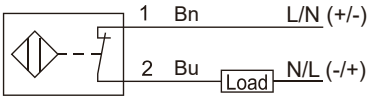
WD4 AC 2-wire NC



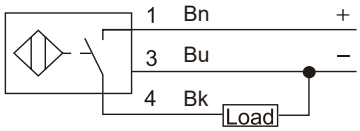
WD5 AC / DC 2-wire NO



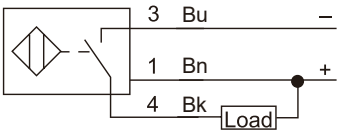
WD6 AC / DC 2-wire NC



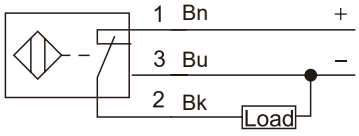
WD7 DC 3-wire PNP NO



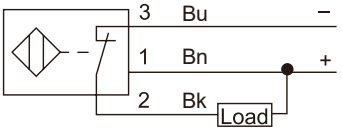
WD8 DC 3-wire NPN NO



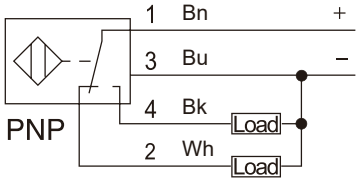
WD9 DC 3-wire PNP NC



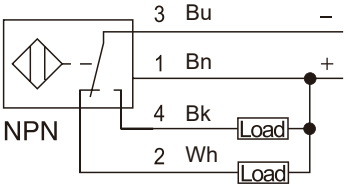
WD10 DC 3-wire NPN NC



WD11 DC 4-wire PNP NO + NC



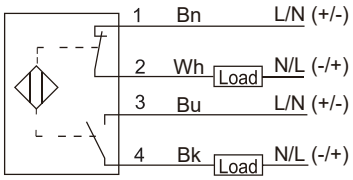
WD12 DC 4-wire NPN NO + NC



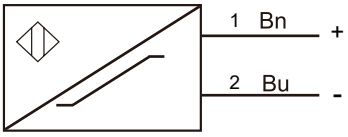
CAPACITIVE SENSOR

WIRING DIAGRAMS (Note: 1 / 2 / 3 / 4 connector and terminals pin number Bn / Bu / Wh / Bk cable color)

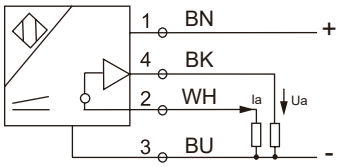
WD13 AC/DC 4-wire NO+NC



WD14 NAMUR 2-wire NC



WD15 DC 4-wire 0-10V+0-20mA



CAPACITIVE SENSOR

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