Selecting A Temperature Sensor

Choosing a temperature sensor can often be very straightforward, sometimes tricky, but always worth doing well. That's because these sensors, especially in science and engineering uses, can spell the difference between repeatable results and nonsense numbers. The name of the game in measurement is to measure with an amount of inaccuracy or uncertainty that is acceptable. So, the first thing you need to know is how well you need to know the value of the temperature numbers you expect to get. A simple series of questions, when answered, will usually get you started.

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The three things that we need to keep in mind when selecting temperature sensor:

1-) What is the desired temperature range, the tolerable limit to the error in measurement and the conditions under which the measurement is to be performed?

2-) Is it possible to touch the object and if so would the sensor or the temperature of the object be likely to be seriously affected by the contact?
If the answer is yes, then a non-contact temperature sensor is needed.
If no, then the answer probably lies with one of the other sensor types.

3-) If a contact sensor appears satisfactory, then questions revolve more a[illegible]suring range, satisfying the conditions of use and mee[illegible]le error allowance.

Comparisons

PEAK SENSORS LTD temperature measurement & control	Thermocouple	Resistance Thermometer (RTD)	Thermistor	Infrared
Stability (Drift)	Reasonable for limited lifetime	Good	Good	Good
Repeatability	Reasonable	Good	Good	Good
Hysteresis	Excellent	Good	Good	Good
Vibration	Very Resistant	Less Resistant	Good	Tolerant
Measurement Area	Single Point	Whole RT Element	bead (Small)	Varies
Diameter	Small Sizes (to 0.25mm)	Larger (3.0mm min)	(0.5mm min)	Varies
Linearity	Not Linear	Reasonably Linear	Not Linear	Reasonably Linear
Reference Junction	Required	Not Required	Not Required	Not Required
Lead Wire Resistance	No Problem	Must be Considered	No Problem	Not Required
Contact Required	Yes	Yes	Yes	No
Response	Fast	Slower	Medium	Fast

Displacement transducers

- Capacitive transducer
- Inductive transducer
- Variable inductance transducer

Capacitive transducers

- The capacitance of a parallel-plate capacitor is given by

$$C = \frac{\varepsilon \varepsilon_o A}{d}$$

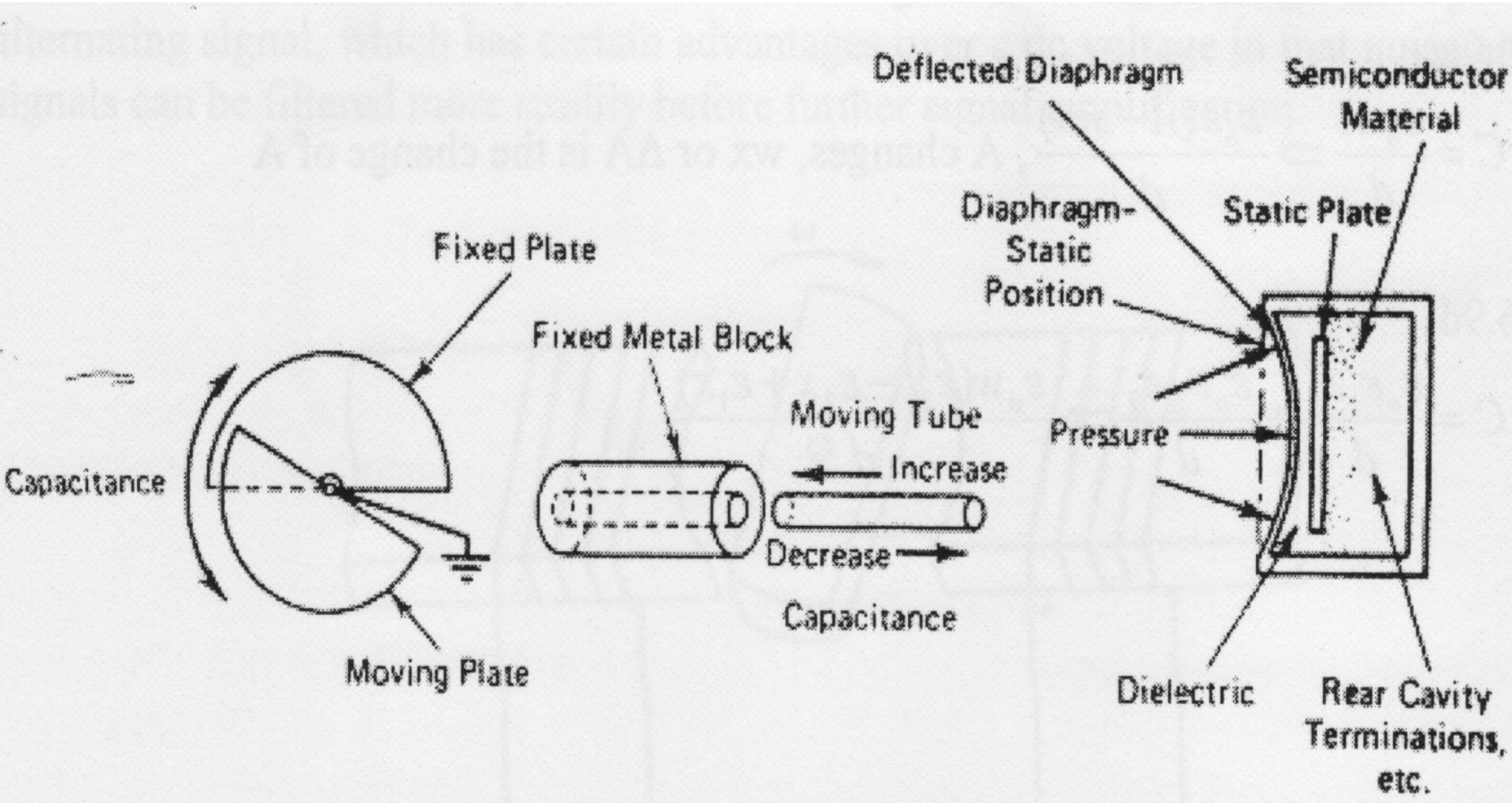
ε = dielectric constant

ε_0 = 8.854 x 10^{-12}, in farad per meter

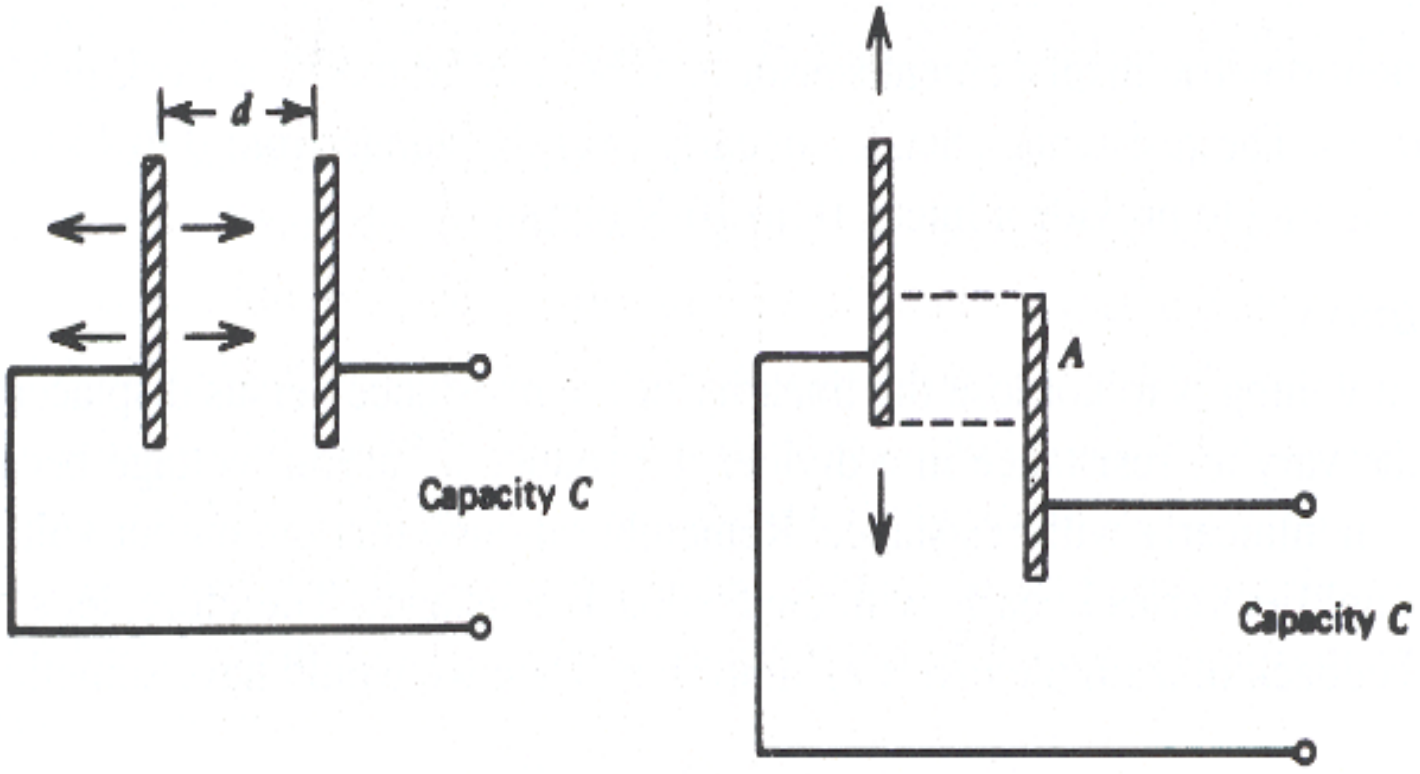
A = the area of the plate, in square meter

d = the plate spacing in meters

Capacitive transducers – physical design



Capacitive transducers



Capacity varies with the distance between the plates and the common area. Both effects are used in sensors.

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