

**Usp** *Esalq*

**Ezequiel Saretta**

**Transdutores:  
aplicações para Engenharia de  
Biossistemas**

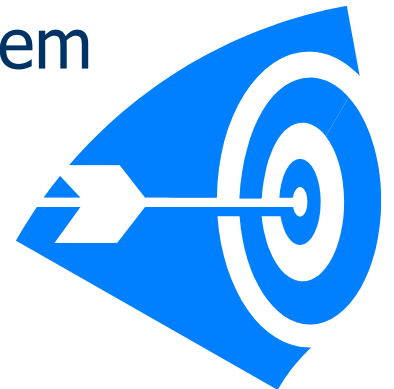
# Sensores e transdutores

Medidor = SENSOR + TRANSDUTOR

**SENSOR** detecta uma variável física de interesse,  
por exemplo:

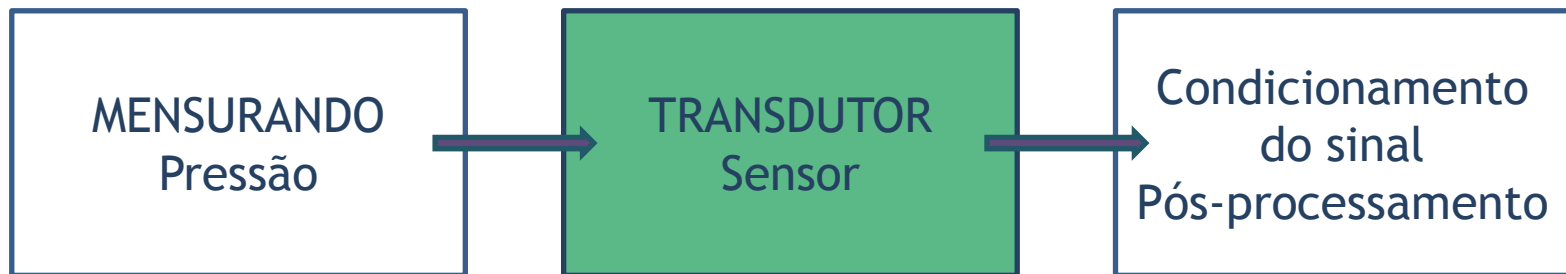
- pressão, temperatura, força

**TRANSDUTOR** transforma essa variável em  
outra fácil de ser medida



**Sensor** é um dispositivo que adquire um parâmetro físico e proporciona em um sinal que pode ser processado por um sistema

Muitas vezes a parte ativa do sensor é chamada de transdutor



# Classificação de Sensores

Mecânicos  
Elétricos  
Magnéticos  
Ópticos  
Acústicos  
Químicos  
Biológicos



Leis ou princípios da física – Ohm,  
Coulomb, Newton – Projeto de  
sensores e transdutores

# Sensores elétricos

Mensurando é transformado em d.d.p. devido à variação de:

Resistência elétrica

Capacitância

Indutância

Carga elétrica

**Ativos**

Termoelétrico

Piezoelétrico

Fotoelétrico

**Passivos**

Resistivos

Indutivos

Capacitivos

A resistência elétrica varia com a quantidade medida

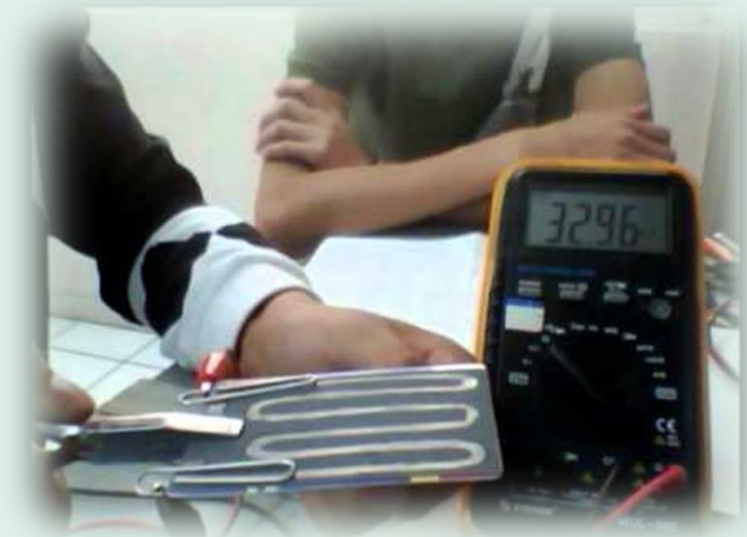
$$R = \frac{\rho l}{A}$$

## *Extensômetros*

O tensionamento físico é transformado numa variação de resistência

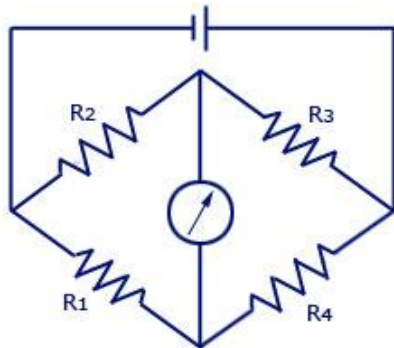
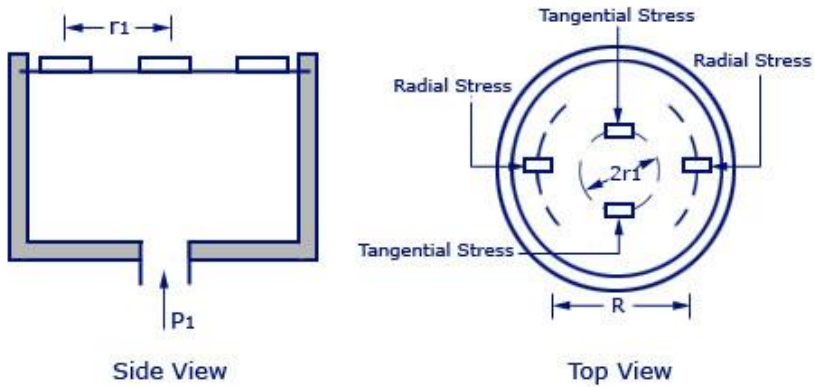
# Fita extensiométrica – diafragma

<b>Denominação</b>	<b>Constituição (Liga)</b>	<b>Faixa de temperatura</b>
Constantan	Cobre – níquel	+10 ~ 204 °C
Karma	Cobre – níquel aditivado	Até 427 °C
479 Pt	Platina – tungstênio	Até 649 °C
Nichrome V	Níquel – Cromo	Até 649 °C



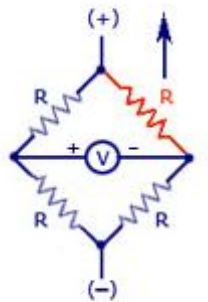
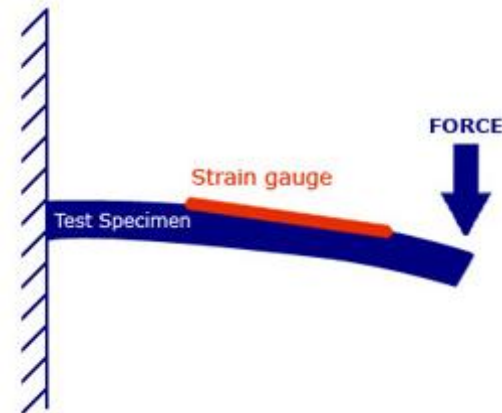
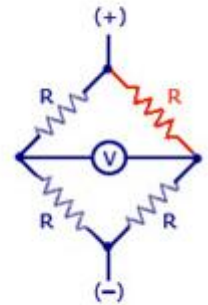
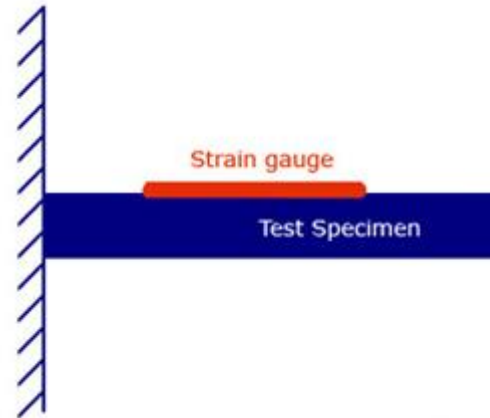
# Wheatstone bridge

Pressure Measurement With Strain Gauges on Diaphragm



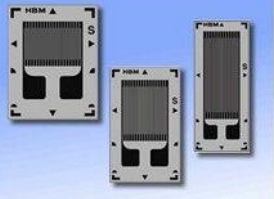
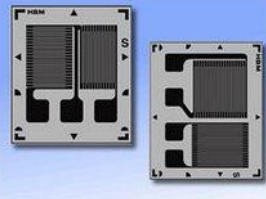

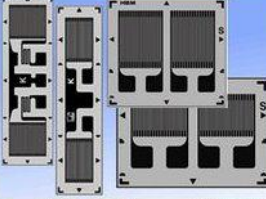

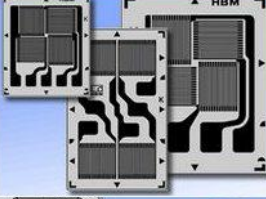
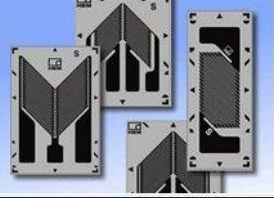
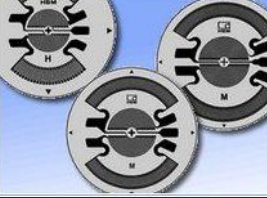
Bridge Circuit

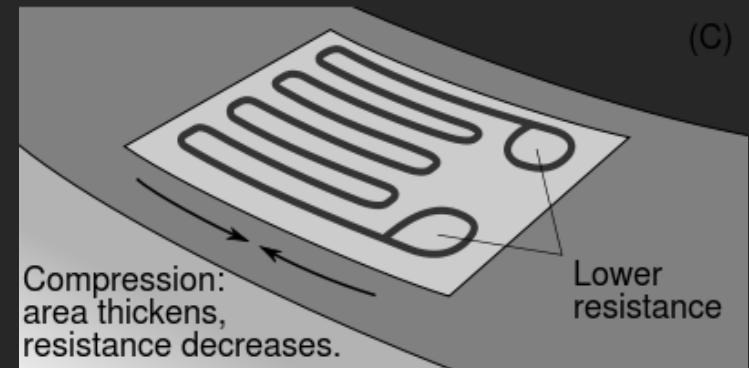
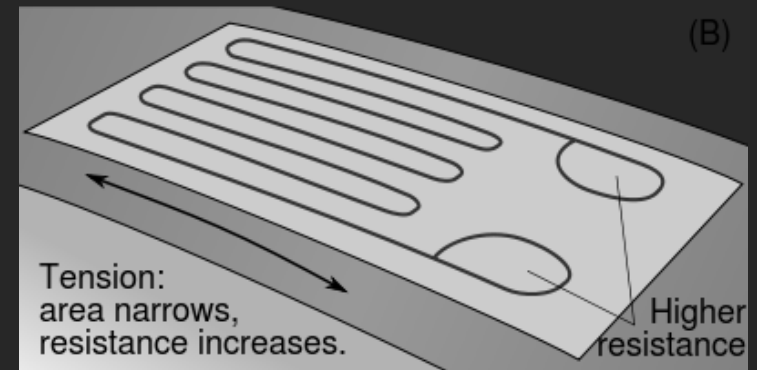
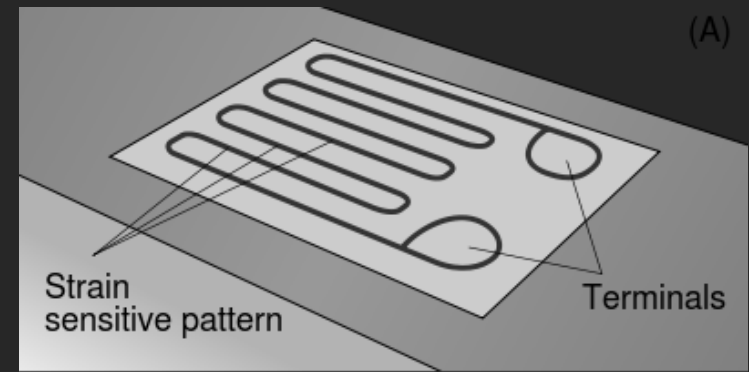
[www.InstrumentationToday.com](http://www.InstrumentationToday.com)



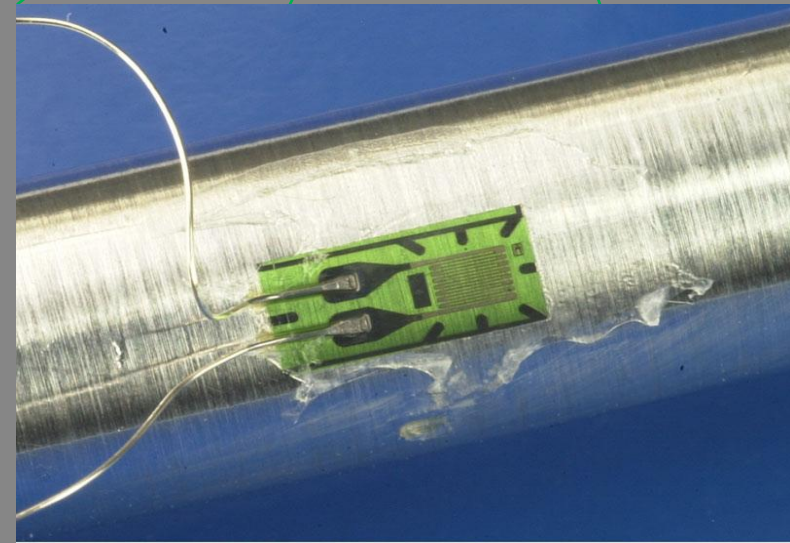
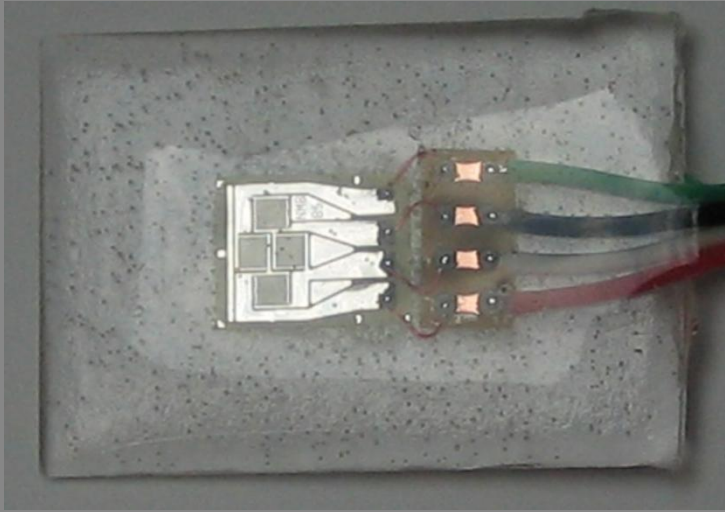
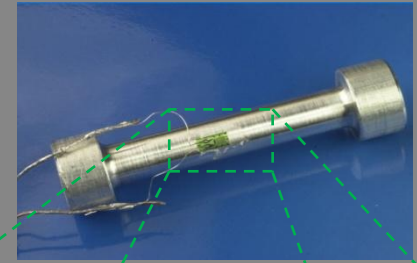


# Strain gauge: Exemplos de extensômetros

<p>LINEAR</p> 		<p>T ROSETTES</p> 
<p>DOUBLE LINEAR</p> 		<p>HALF BRIDGE</p> 
<p>SINGLE SHEAR</p> 		<p>FULL BRIDGE</p> 
<p>DOUBLE SHEAR</p> 		<p>MEMBRANE ROSETTES</p> 



# Strain gauge: Aplicações



# Strain gauge

