

# Fundamentals of Physical Computing

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Instructor: Rob Faludi

# Plan for Today

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- Imagined Physical Computing
- Analog Input
- Sensors
- Basic Analog Output
- Math
- Readings & Assignments

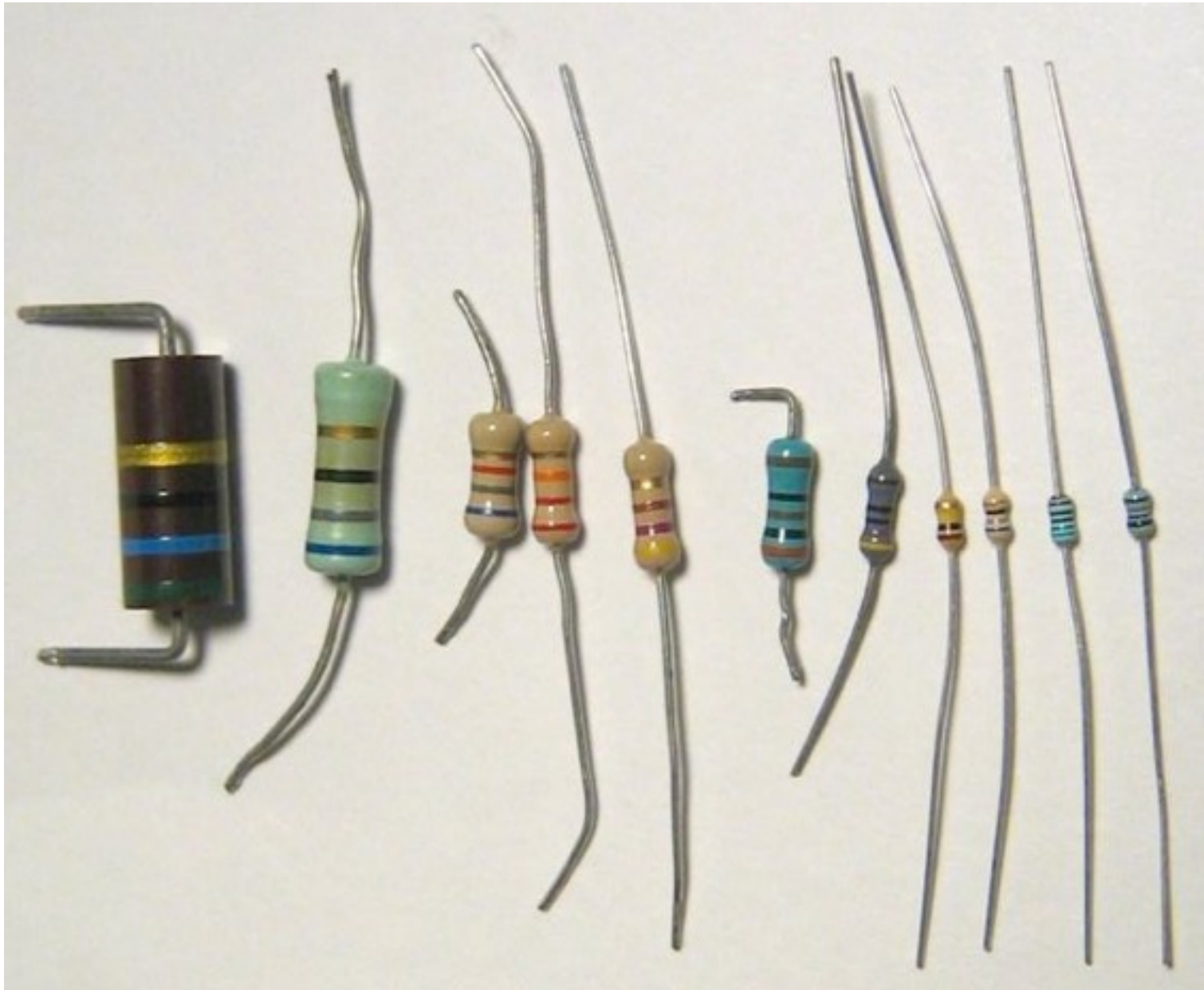
# Imagined Physical Computing

Analog Input



# Resistors

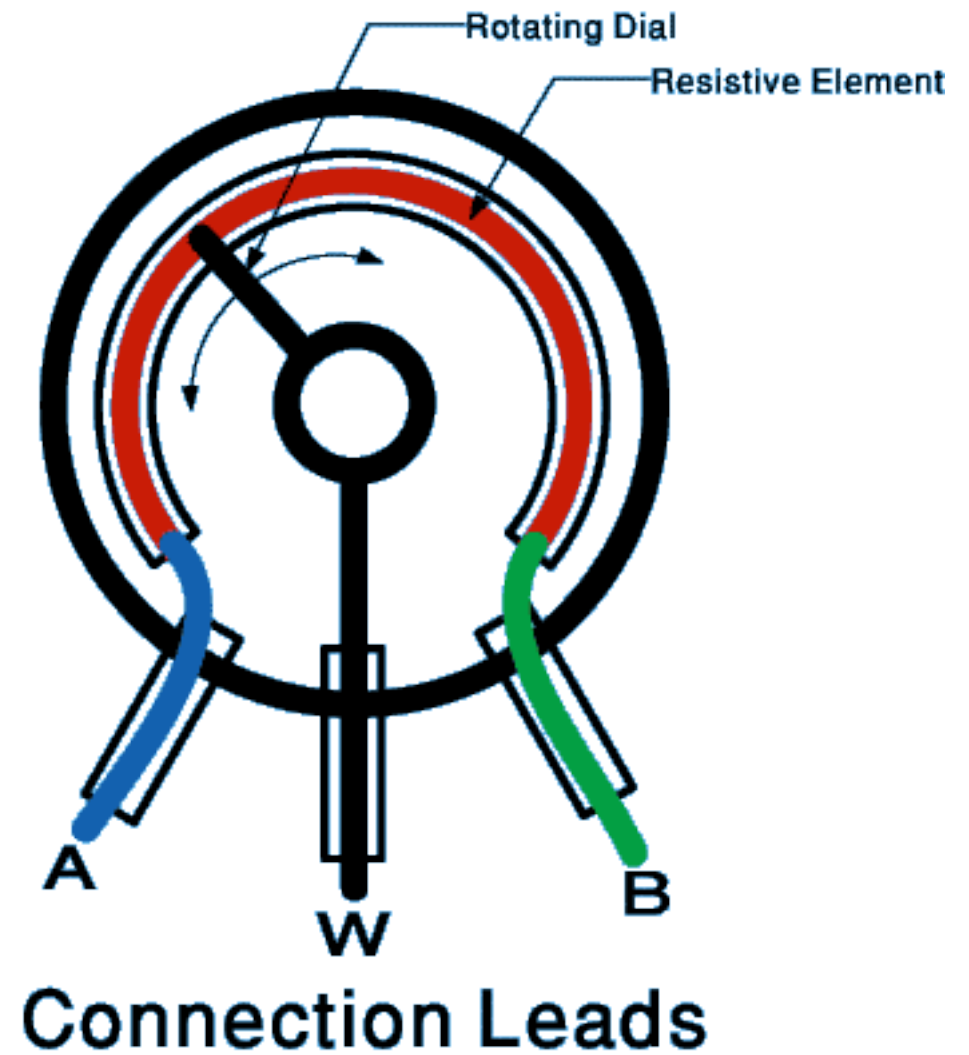
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# Variable Resistors

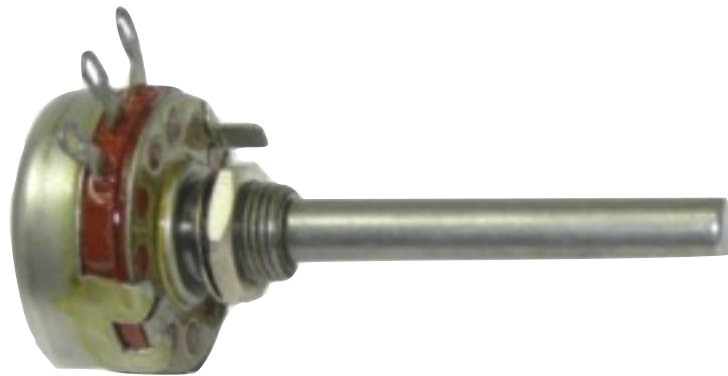
# Potentiometer

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# Potentiometers

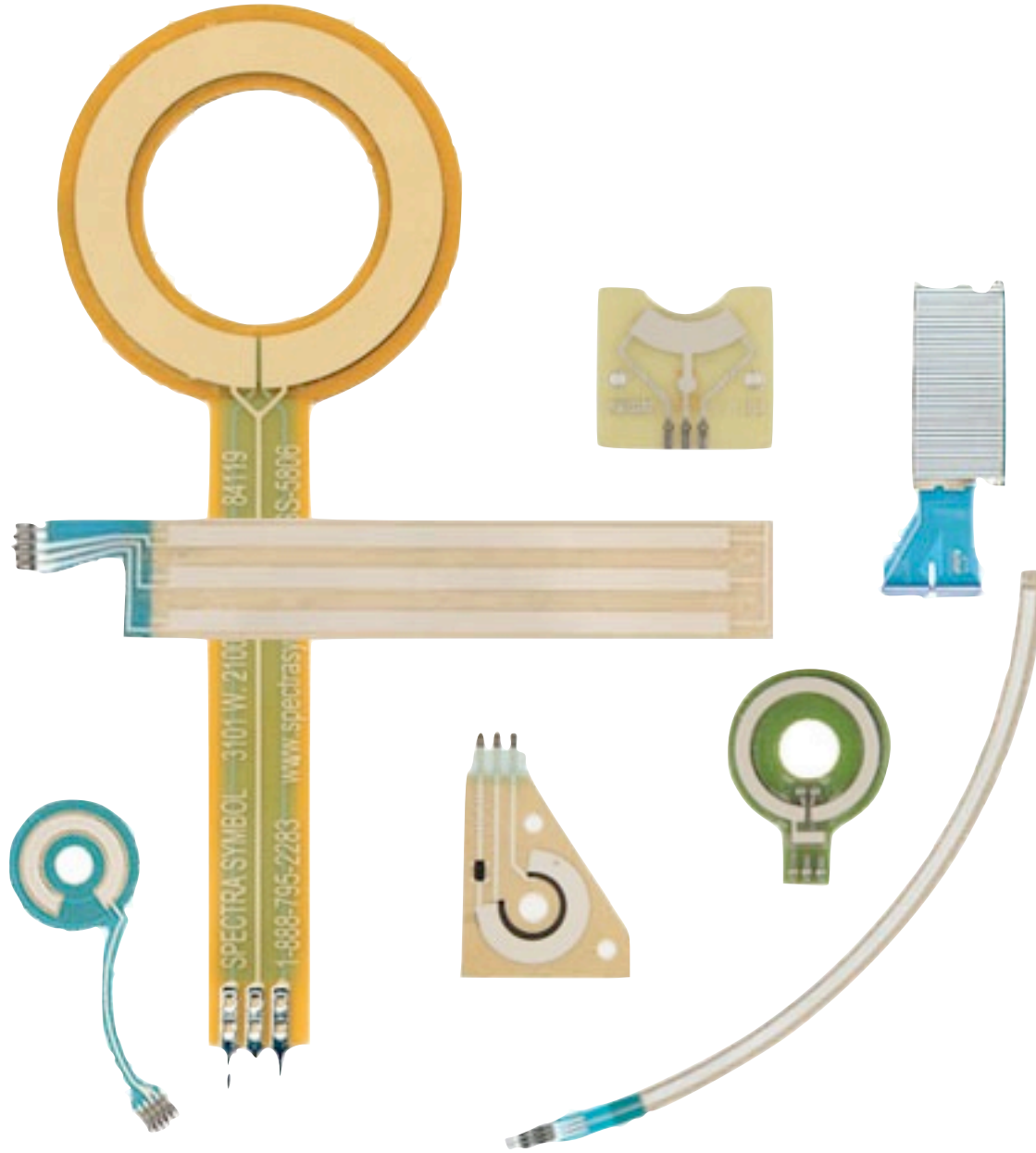
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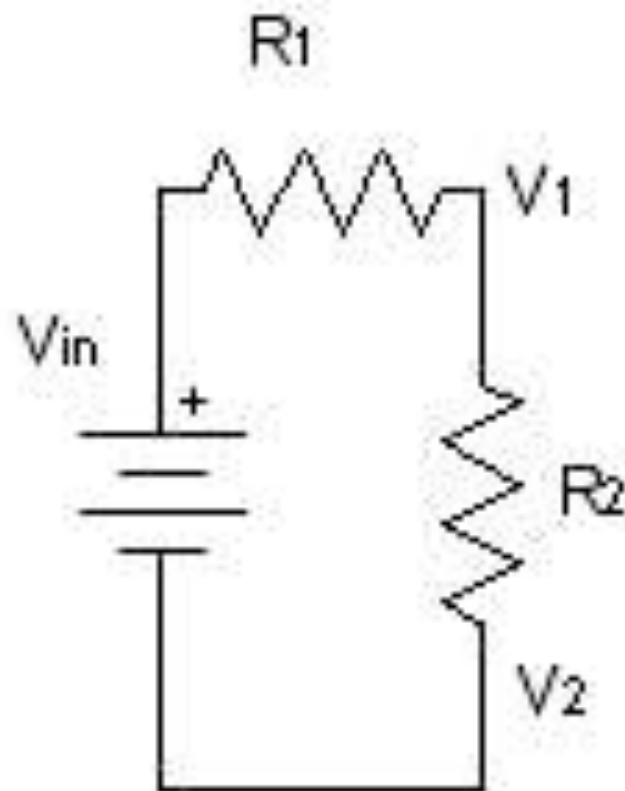
# Soft Potentiometers

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# Series

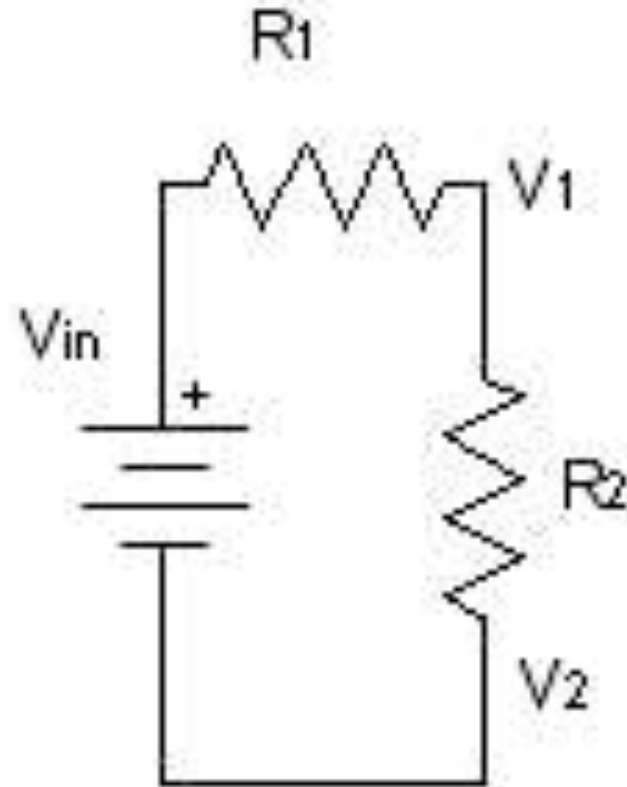
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# Voltage Dividers

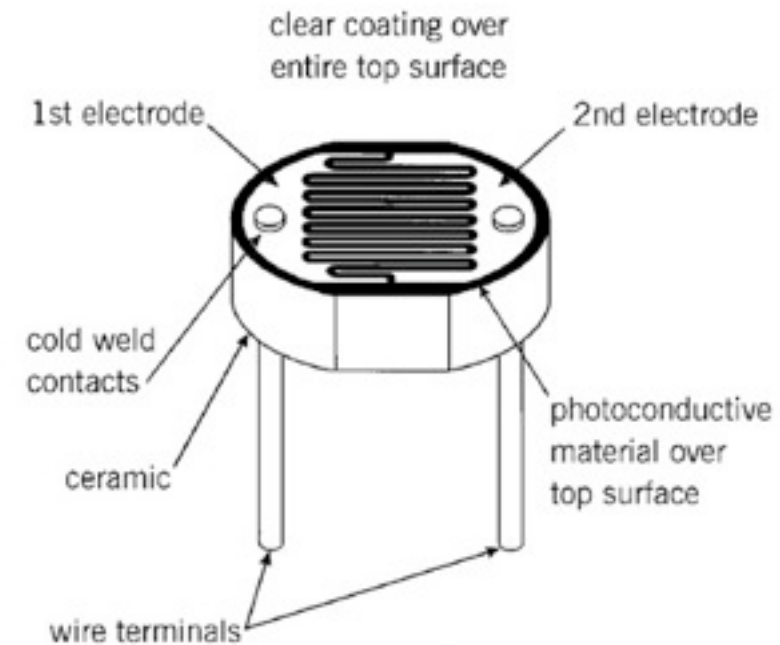
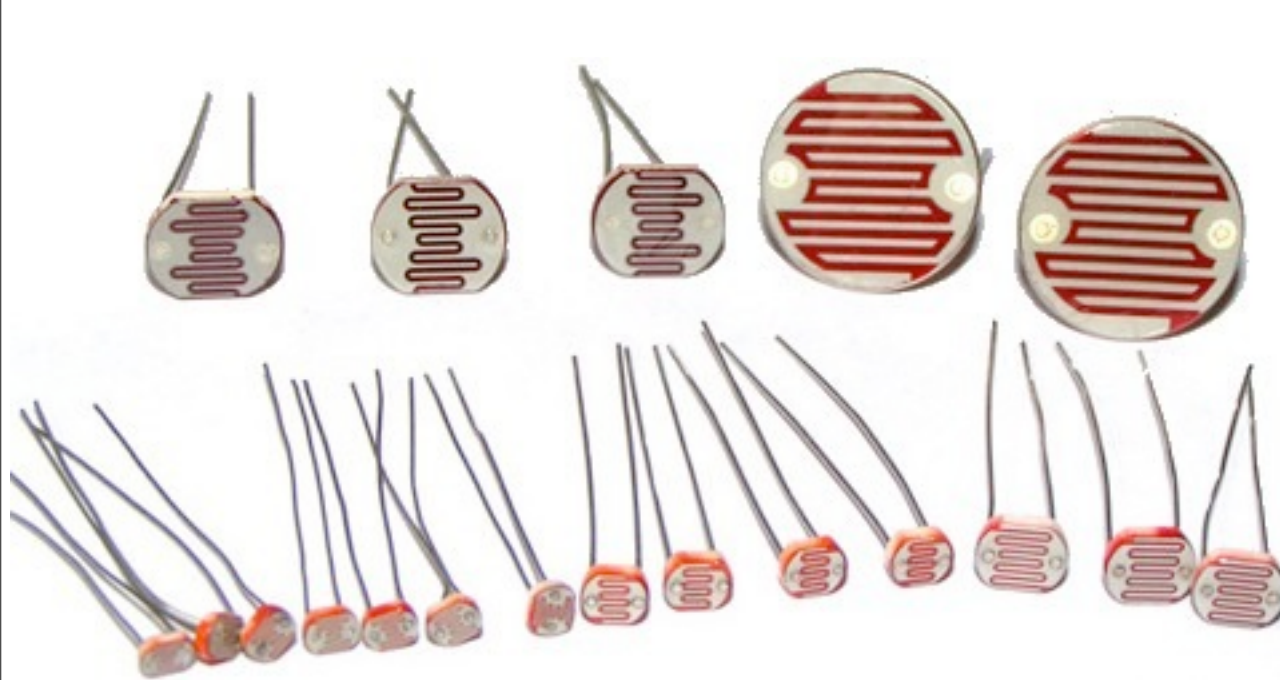
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- $R_t$  is the total of all the resistors
- Voltage at  $V_1 = V_{in} * R_1/R_t$



# Photoresistors (LDRs)

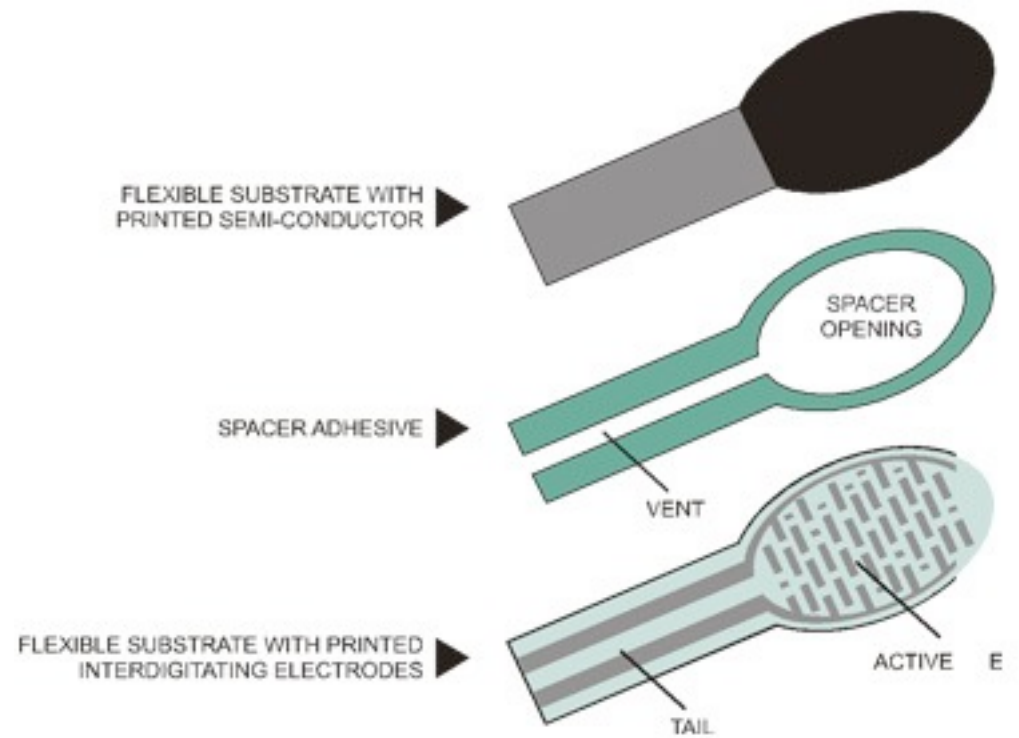
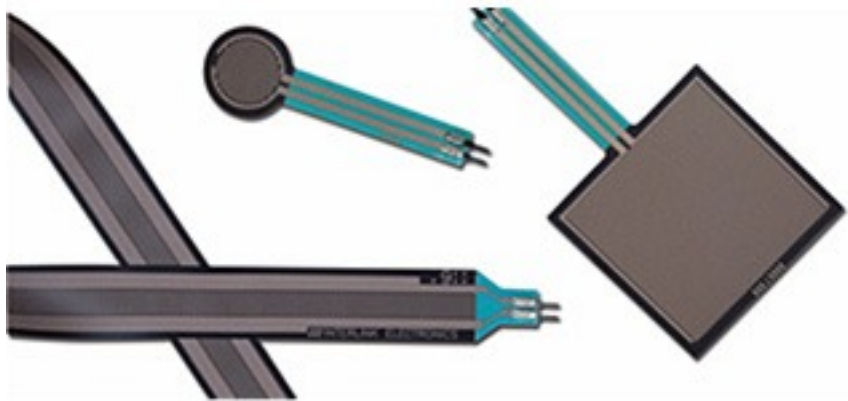
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**Figure 3**  
Typical Construction of a Plastic Coated Photocell

# Force Sensing Resistors (FSRs)

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# Thermistors

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# Flex Sensors

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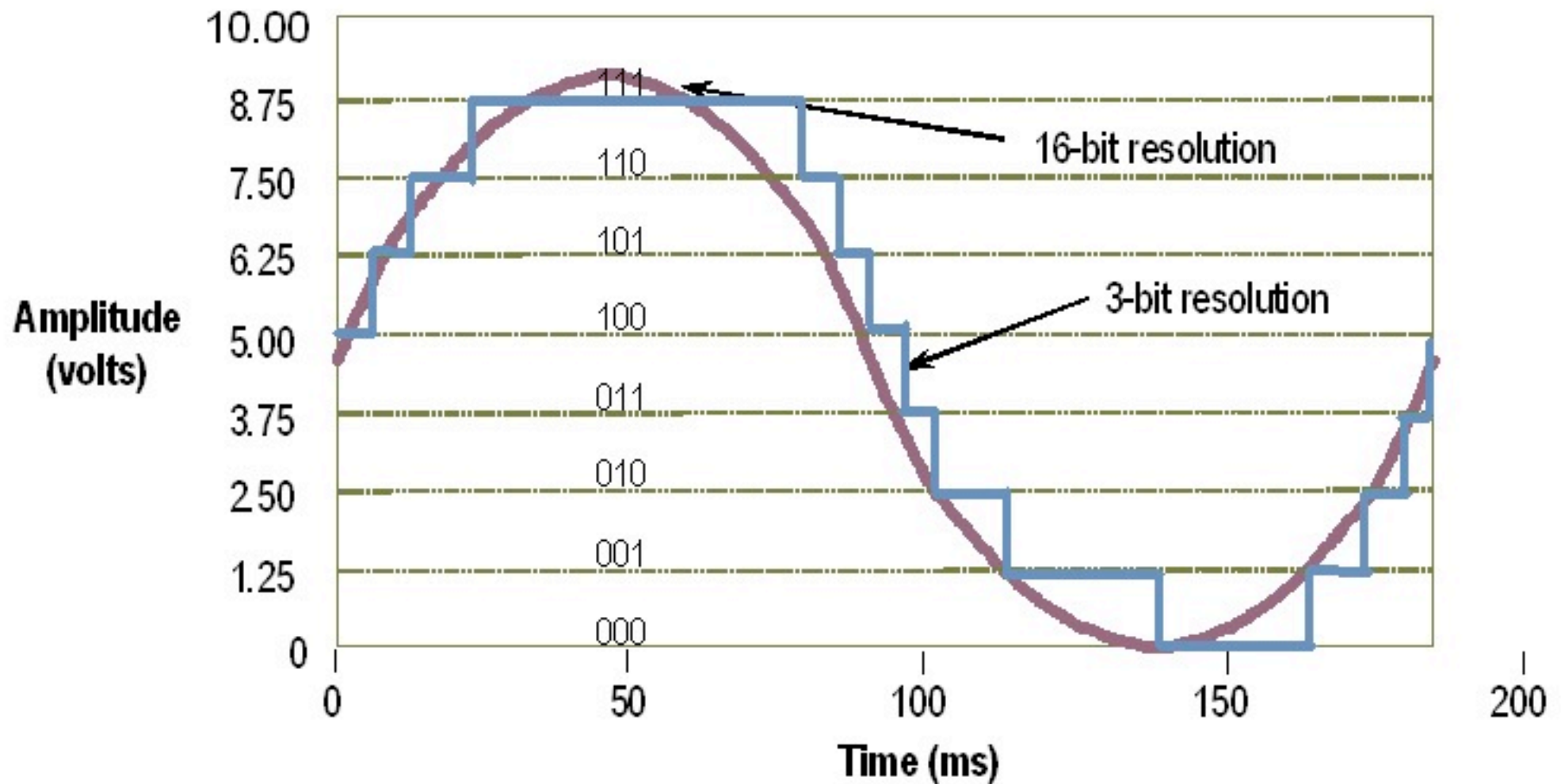
# Stretch Sensors

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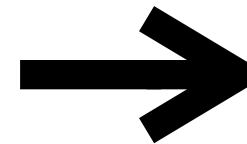
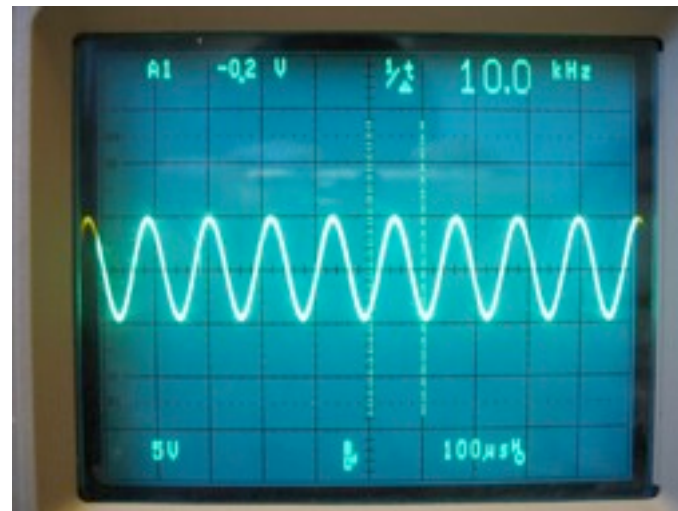
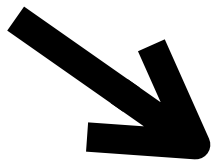


# Analog Digital Conversion (ADC)

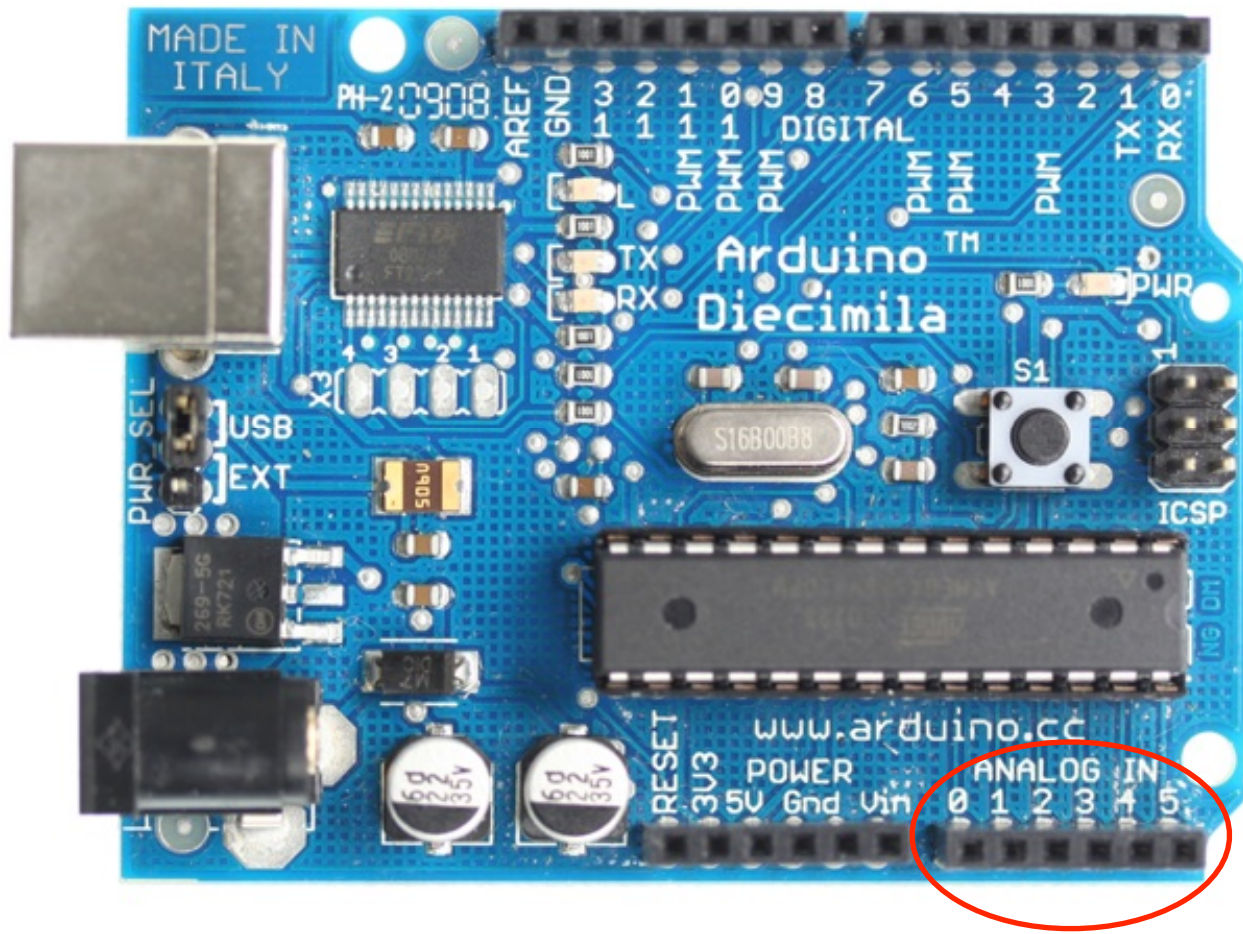


# Analog Digital Conversion (ADC)

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10000100  
10000110  
10000110  
10000101  
10000011  
10000001  
10000100  
10000110  
10000110  
10000101  
10000011  
10000001



MADE IN ITALY

PH-20908

AREF GND 3 2 1 0 9 8 7 6 5 4 3 2 1 0  
DIGITAL TX RX

Arduino Diecimila

S1680088

PWR\_SEL  
USB  
EXT

X3

505U

S1

1

ICSP

269-56  
MK721

RESET  
3V3  
POWER  
5V Gnd Vin

www.arduino.cc

ANALOG IN

0 1 2 3 4 5

# Other Analog Sensors

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- accelerometers
- proximity sensors
- capacitive sensors
- current transformers
- infrared
- magneto
- (motion)



Analog Output



# Getting Analog from Digital

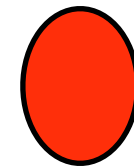
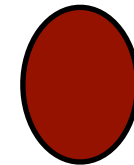
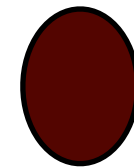
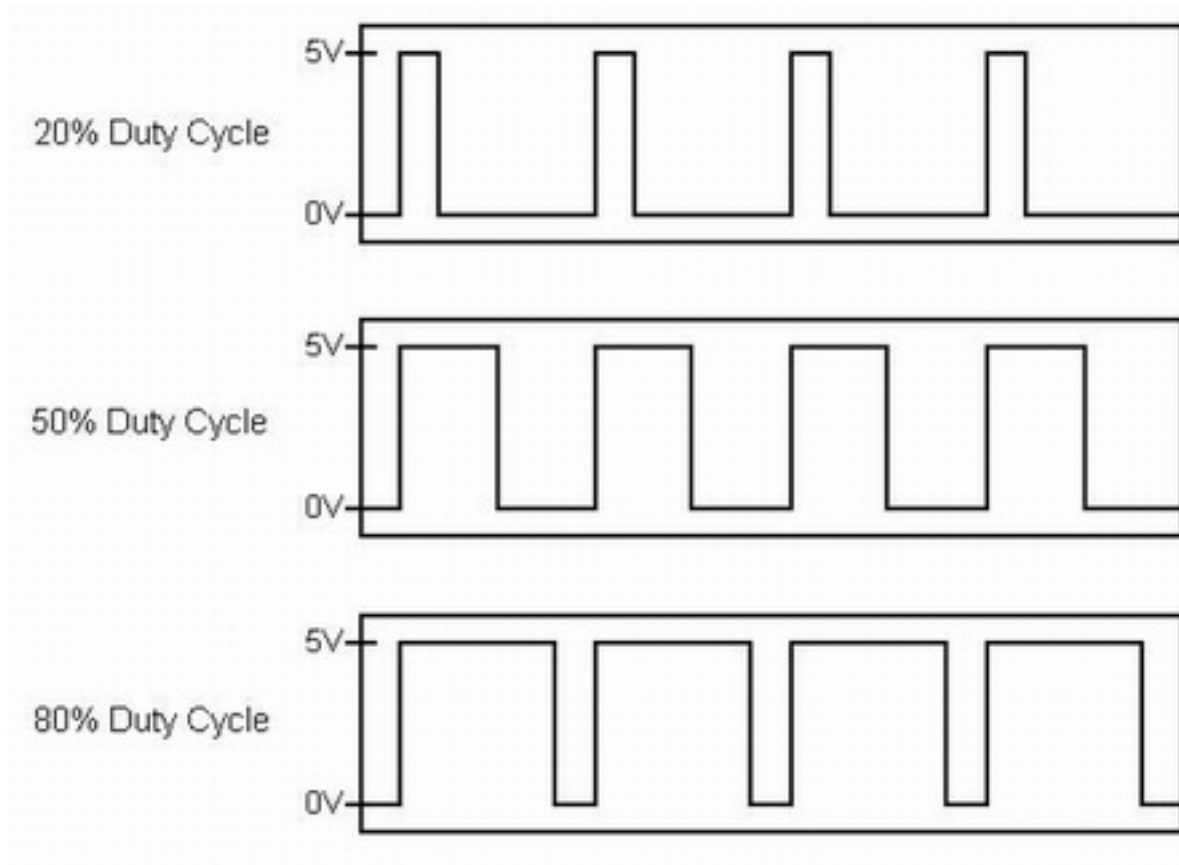
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vroom....vroom...vroom

# Pulse Width Modulation (PWM)

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# Programming Analog in Arduino

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- `myvariable = analogRead(pin);`
  
- `analogWrite(pin, value);`



# Variables for ADC

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- 10 bit input
  - 0 to 1023 (which variable type?)
- 8 bit output
  - 0 to 255 (which variable type?)

Math



# Computer Math

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- Binary, Decimal, Octal, Hexadecimal
  - Why?
    - Understanding computers
    - Programming helper, communications essential
  - What?
    - It's all notation

# Decimal

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- Place system
- Powers
- Adding and carries
- Finger counting, but is that base 10?

# Binary

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- Place system
- Notation: %010 010b 0b10
- Powers
- Adding and carries
- Finger counting!

# Readings and Assignments

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- Readings
  - Physical Computing, chapters 6 & 11
  - Arduino, chapter 5
- Assignment
  - Analog Input Lab