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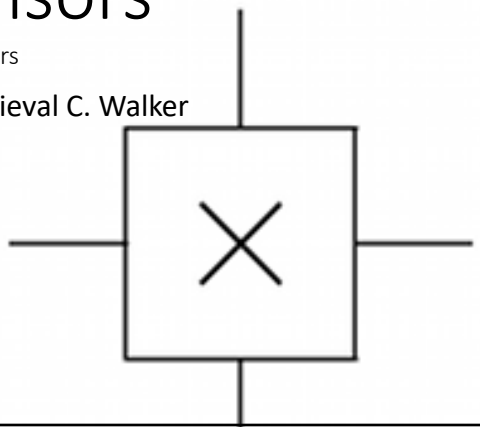
Magnetic Sensors

Including Hall Effect Sensors

Sydney Peck, David Rodman, Donnieval C. Walker



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Questions?

Please hold them until the end.

Thank you.

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Magnetic sensors: What are they?

- Instruments that measure a magnetic field (Polarity, changes in magnitude, flux)

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Main Modes of Operation

- Sensors that measure the vector components
- Sensors that measure the total magnetic field

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Types of Sensors

- Coil (Inductive Loop)
- Fluxgate
- Nuclear Magnetic Resonance (NMR) (MRIs)
- SQUID
- Hall-effect
- Many more

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Low Field Sensors

- Low field sensors are magnetic sensors th ry low effect fields. These sensors operate in Gauss range.

Gauss: Unit of measurement of magnetic flux density. Other units include Tesla and Gamma.

I am Gauss btw

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Earth Field Sensors

- Earth Field magnetic sensors are sensors that employ the earth's magnetic field. This sensitive range of these sensors is from 1 µG to 10 G. (Think navigation system)

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Bias Magnet Field Sensors

- Bias magnetic field sensors are used to sense larger magnetic fields. These sensors are used to sense the enormous magnetic fields over 9000 mG. These sensors often use permanent magnets like a source of the analyzed field.

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Hall Effect Sensor

- Measures the hall effect
- Lorentz Force
- Sensor “activated” by an external magnetic field (Biasing)
- Output voltage based on flux density

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Lorentz Force Equation

Charge of Particle

$$F_L = q(v \times B)$$

Velocity of Particle

Magnetic Field

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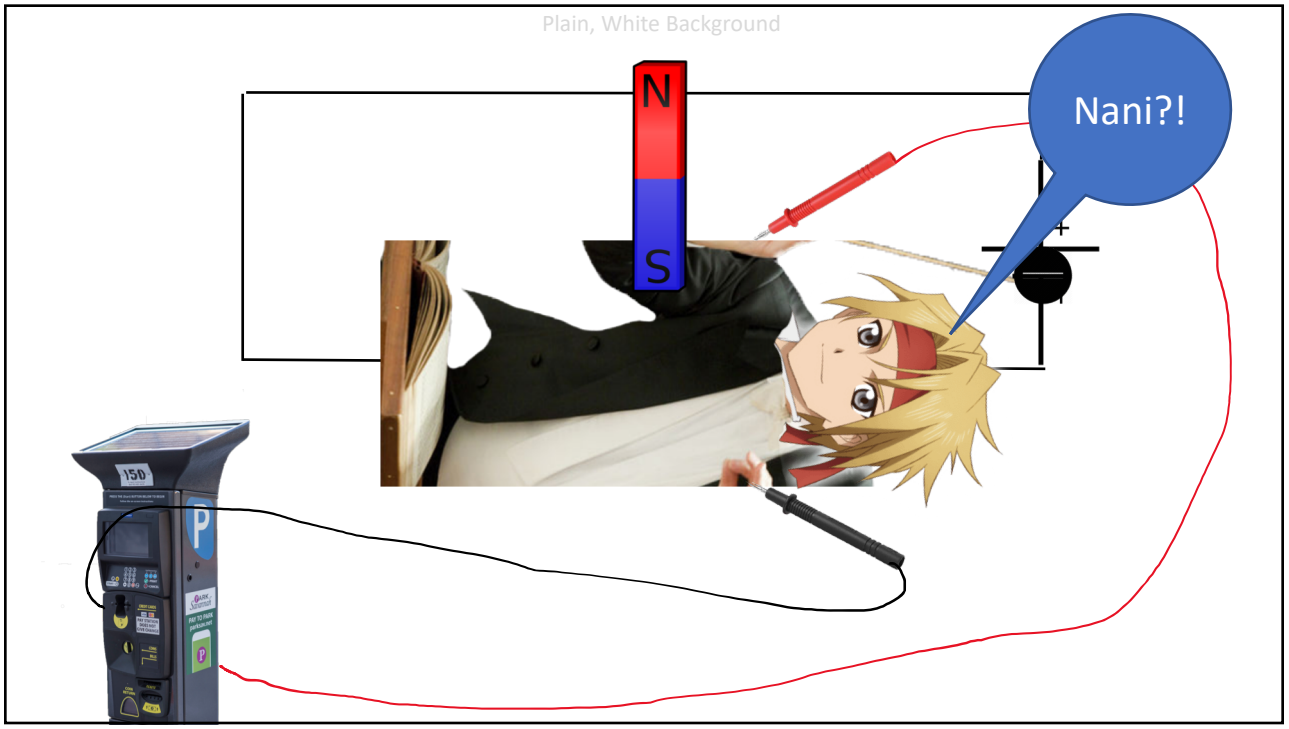
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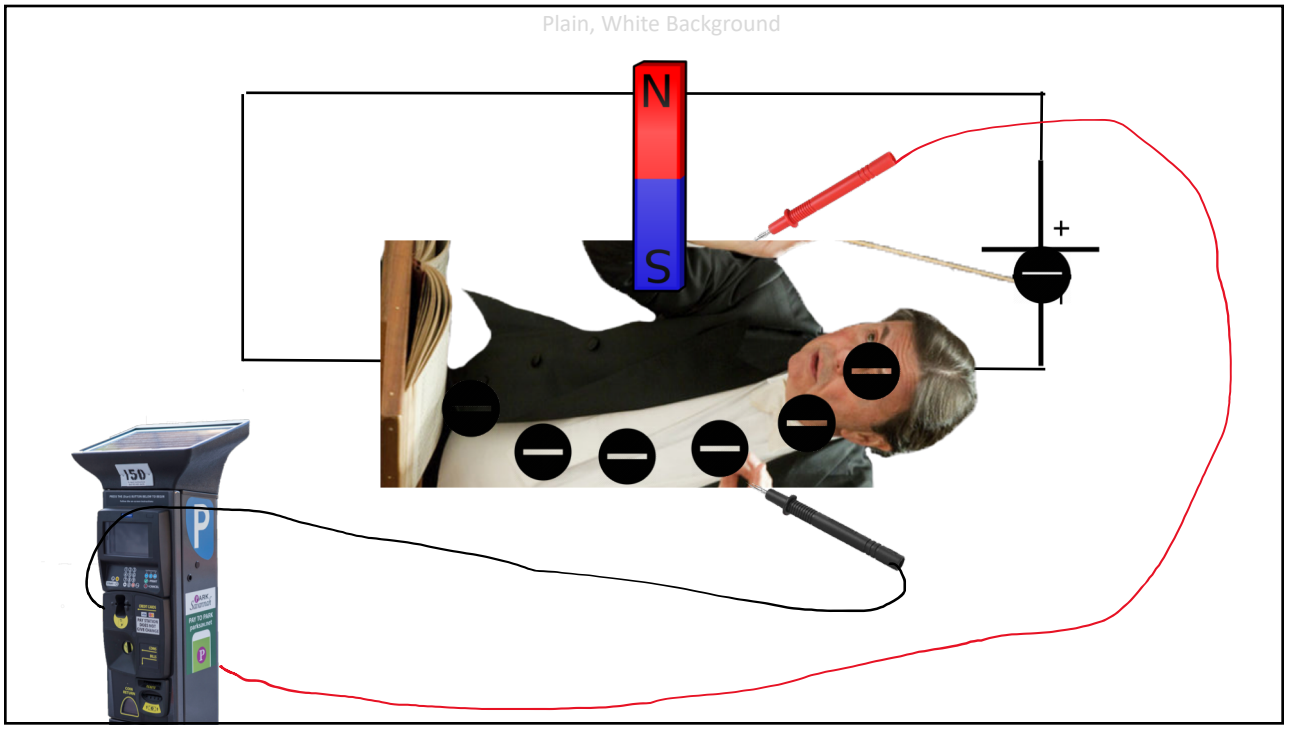
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Applications

- Power Distribution Units (PDU's)
- Robotics and Factory Automation
- Green Energy & Oil/gas
- Biomedical
- Military & Security
- Automotive & aerospace
- Industries use magnetic sensors in
  - contactless current sensing,
  - linear and angular position,
  - and rotation sensing

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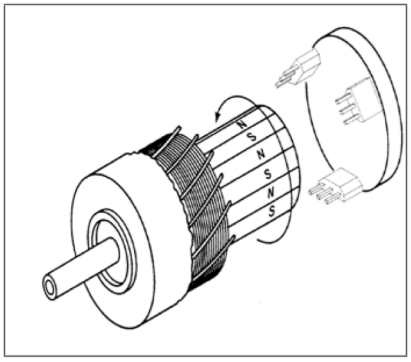
Position Sensor

- Brushless DC motors
- Permanent magnetic materials are mounted on rotor shaft itself which operates the sensors.
- Magnetic field generated by the windings rotates and reacts rotor's permanent magnets' fields which develops the required torque



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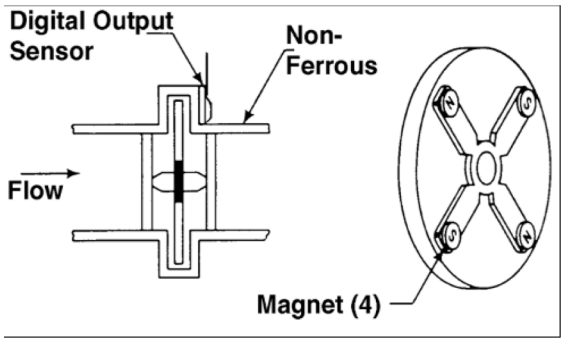
Flow Rate Sensor

- Sensor and magnets mounted to an impeller can measure flow rate for a water softener
- Softener can be auto recharged on demand
- Demand determined by measuring the water passing through softener.



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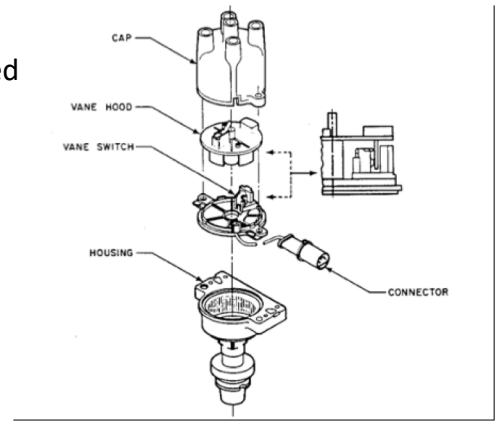
Ignition Sensor

- Distributor Mounted Ignition Sensor
- Distributor can be replaced by a vane operated sensor.



Advantages – Hall Effect

- Suitable in harsh environments
- Highly reliable
- Offer pre-programmable electrical angles and outputs
- High speed operation

Disadvantages – Hall Effect

- Provide a much lower measuring accuracy than fluxgate magnetometers or magnetoresistance-based sensors
- Drift significantly which requires compensation
- Noisy
- Low sensitivity
- High consumption.

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Questions