

Sensors and Actuators

What are Sensors and Actuators?

- Electronic sensors and actuators are components that enable interaction between the physical world and electrical circuits.
- A **sensor** converts a physical phenomenon into an electrical signal for processing.
- An **actuator** converts a processed electrical signal to a physical phenomenon.

Sensors



Sensors

- Are used to explore the (changes in) the environment.
- Provide direct information on physical parameters
 - light, pressure, temperature, magnetic field, etc.
- Provide indirect information on related parameters
 - human emotions, comfort, health.

Actuators



Actuators

- Convert processed electrical signal to a physical phenomenon.
- Can have both continuous and discrete values
 - switch light on/off or use a dimmer
- Actuators are all around us:
 - speakers, electric motors, heating elements, light sources, etc.

Why Sensors and Actuators?

- Design products that act/react in context
- Extend the sensing beyond human senses
 - hearing range 20 Hz – 20 kHz
 - temperature range ??
 - visible light range

A Central Heating System

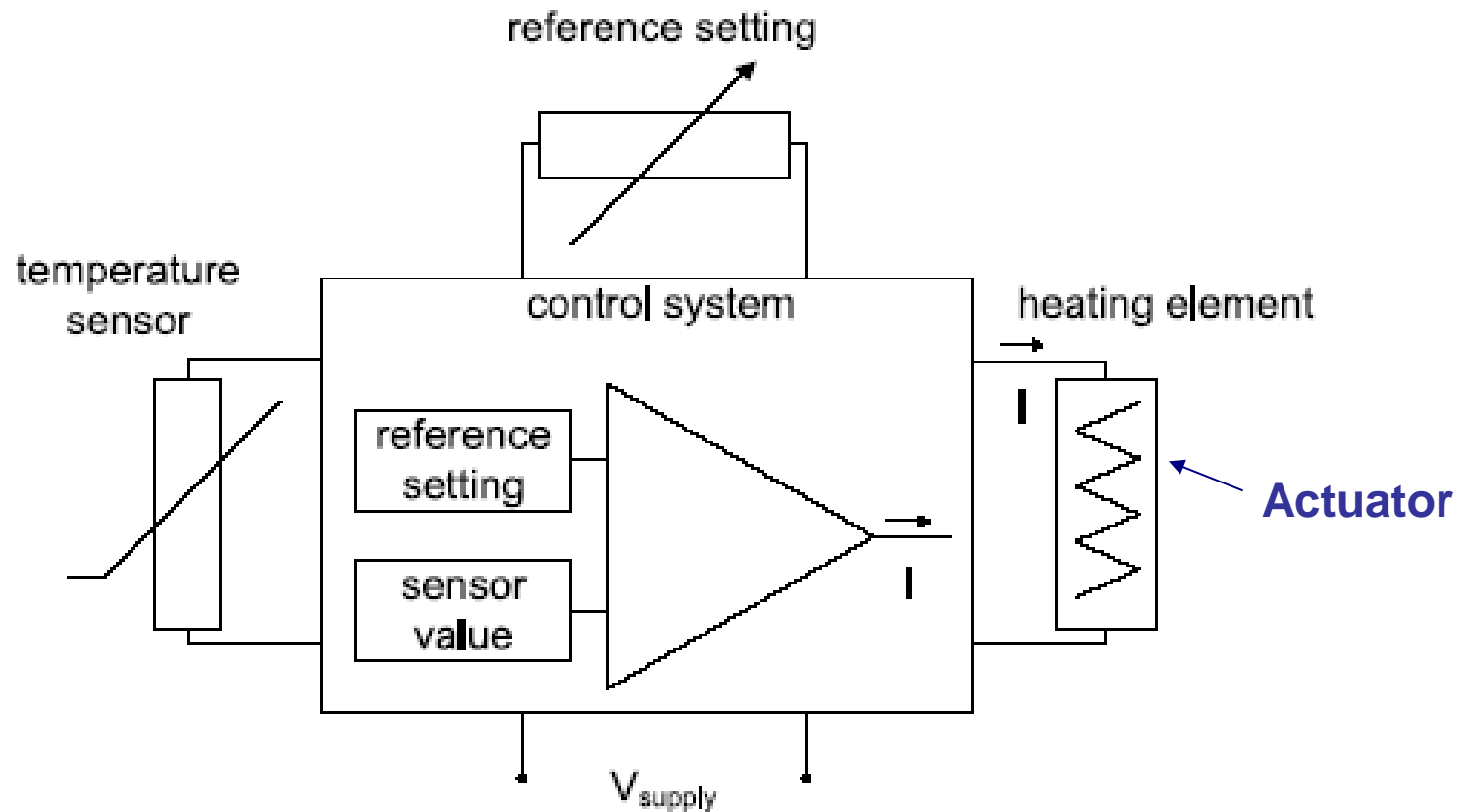


Figure 11.1: *Closed-loop temperature control system.*

Temperature - sensitive: NTC and PTC

- **NTC**: Resistance value decreases when temperature increases.
- **PTC**: Resistance value increases when temperature increases.

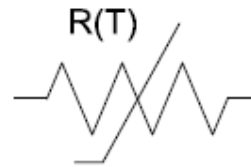
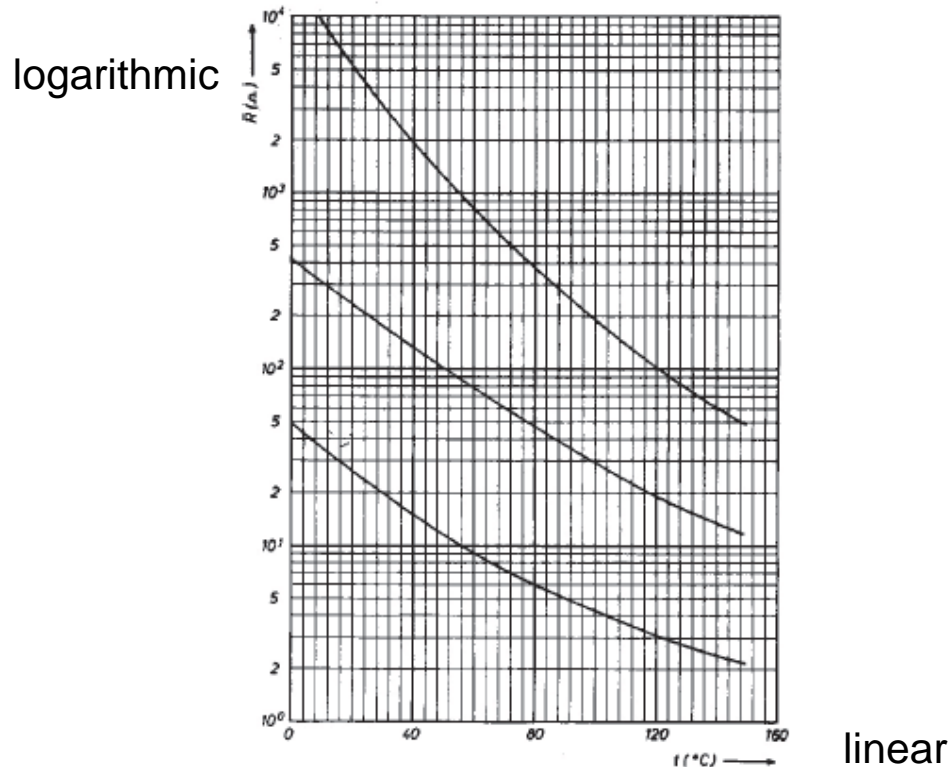


Figure 11.8: *Schematic symbol for NTCs and PTCs.*

Temperature - sensitive: NTC and PTC

- **NTC**: Resistance value decreases when temperature increases.
- **PTC**: Resistance value increases when temperature increases.



Resistance vs. temperature for three different NTCs.