Overview

• Temperature to resistance relation
• Pure metal
Wire Wound RTD

- Most Accurate
- Fragile
- Slower Response Time

Coiled Element RTD

- Fairly Accurate
- Sturdy
- Good Response Time
Thin Film RTD

Least Accurate
Cheap
Best Response Time

In-Depth
Sensor Connections

Temperature Calculation
Temperature Calculation

Resistance Ratio:

$$\frac{(R @ 100°C) - (R @ 0°C)}{(R @ 0°C)}$$

- Metals with higher resistance ratios and higher resistances at 0°C give greater accuracy

Error:

$$\text{Lead wire resistance} / \left[ (R @ 100°C) - (R @ 0°C) \right]^{0.01}$$

- Select material based on necessary error for application

Temperature Calculation

- Resistance Ratio defines the average slope of the curve relating resistance and temperature from 0°C to 100°C
- Often, for other ranges, the curve is no longer linear (produces error calculation)
- Use resistance ratio to calculate approximate value, then use error to calculate tolerance range
- Range of linearity defines the class of RTD
- Tables and graphs give accurate values for reference
- Callendar Van Dusen Equations give greater accuracy
Materials

- At high temperatures, the resistivity of some materials can change.
- Must make design considerations at high temperatures such as protecting it with a probe made of a ceramic.
Applications

RTD Pros and Cons

<table>
<thead>
<tr>
<th></th>
<th>RTD</th>
<th>Thermocouple</th>
<th>Thermistor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp. range</td>
<td>-260 to 850°C (-436 to 1562°F)</td>
<td>-270 to 1800°C (-454 to 3272°F)</td>
<td>-80 to 150°C (-112 to 302°F) (typical)</td>
</tr>
<tr>
<td>Sensor cost</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>System cost</td>
<td>Moderate</td>
<td>High</td>
<td>Moderate</td>
</tr>
<tr>
<td>Stability</td>
<td>Best</td>
<td>Low</td>
<td>Moderate</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Moderate</td>
<td>Low</td>
<td>Best</td>
</tr>
<tr>
<td>Linearity</td>
<td>Best</td>
<td>Moderate</td>
<td>Poor</td>
</tr>
<tr>
<td>Specify for:</td>
<td>• General purpose sensing • Highest accuracy • Temperature averaging</td>
<td>• Highest temperatures</td>
<td>• Best sensitivity • Narrow ranges (e.g. medical) • Point sensing</td>
</tr>
</tbody>
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Questions?