

## Digital Thermometer Project

### *General Description:*

To develop a digital thermometer for use with an RTD (Resistance Temperature Detector) sensor to measure and display the temperature at the sensor location. The input signal to the digital thermometer is the resistance variation of the RTD sensor. The digital thermometer will operate off of 230V AC, 50Hz power and will utilize a standard enclosure, available off the shelf. The thermometer will be used routinely indoors and wall mounted. The temperature will be displayed on three seven-segment red LEDs. The accuracy should be within  $0.5^{\circ}\text{C}$  over a maximum range of  $0^{\circ}\text{C}$  to  $100^{\circ}\text{C}$ .

### *Performance Specifications:*

- Rated conditions:  
Ambient temperature =  $25^{\circ}\text{C}$   
Power Voltage = 230V AC
- Indication accuracy:  $\pm 0.25\%$  of the  $100^{\circ}\text{C}$  range.

### *Enclosure Specifications:*

- Size: Maximum size of 15cm x 10cm x 5cm
- Shape: The enclosure will be a purchased component from standard enclosures available on the market. A simple rectangular volume is preferable.
- Material: Plastic preferred. Metal acceptable.
- Human engineering aspects: The following is a list key requirements:
  1. The device shall be easily installed and connected.
  2. It should be fail safe if connected incorrectly.

### *Environmental Specifications:*

- Ambient temperature:  
Operation:  $0^{\circ}\text{C}$  to  $50^{\circ}\text{C}$   
Storage:  $-35^{\circ}\text{C}$  to  $50^{\circ}\text{C}$
- Humidity: 10% to 90% relative humidity, noncondensing
- Vibration: The digital thermometer shall be operable in a vibration environment with a vibration frequency from 0.3Hz to 100Hz with amplitudes as high as 0.2g.
- Shock: The digital thermometer shall be capable of withstanding shock that will most likely occur during shipment and must therefore meet the requirements of appropriate ICC specifications.
- EMI immunity: The digital thermometer shall be capable of operation in an environment as follows:
  - Radiated electrical fields:  
1V per meter from 150kHz through 25MHz  
10V per meter from 25MHz to 1GHz
  - Induced magnetic field:  
13A at 50Hz into the enclosure
- Power line:  $\pm 500\text{V}$ , 50ns duration over  $360^{\circ}$
- EMI emissions: This design will meet the FCC Class B specifications for emissions.

### *Input Power:*

230V AC, 50Hz,  $\pm 10\%$  in amplitude. Current draw a maximum of 100mA.

**Operation:** The digital thermometer has no real operational requirements other than the requirement for sensor break protection. The sensor break protection will flash the display when the sensor is out of range. The digital thermometer will simply display the temperature when sufficient power is applied. When the signal is out of range, the display will flash.

**Agency Approval Requirements:** EN 61010-1 and equivalent CSA specifications.

**Special Considerations:** None

***Digital Thermometer Cost Estimates:***

- Project Cost: \$10,000
- Manufacturing cost goal:
  - Purchased parts: \$95
  - Labour costs: \$45
  - Manufacturing overhead: \$15
  - Annual volume: 1500 units