

Improving Temperature Measurement Accuracy by Matching PRT to Transmitter

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One method to eliminate 85% of the interchangeability error in a measurement system is to use a PRT in conjunction with a transmitter that has matching capability. Transmitters with matching capability allow a specific R vs. T relationship to be entered into the transmitter software. In the case of an analog transmitter, the potentiometers for zero and span are adjusted to match the unique PRT resistance at the end points of the range. This method will nearly eliminate the interchangeability error, however, errors due to calibration and some external influence effects will still be present.

When the matched calibration option is specified there is no need to select a PRT with a tight interchangeability because the actual R vs. T relationship, which is determined by a comparison calibration, is used to calibrate the transmitter. A less expensive Grade B sensor can be specified. The table below shows the improvement in accuracy that can be achieved using this method.

Example of system accuracy for a process with a critical temperature of 121°C using a transmitter with .10°C accuracy.

	Grade B Sensor ²	Grade A Sensor ²	Calibrated Sensor
Sensor Tolerance at 121°C	± 0.76°C	± 0.34°C	± 0.05°C
Transmitter Accuracy	± 0.10°C	± 0.10°C	± 0.10°C
Combined System Accuracy ¹	± 0.77°C	± 0.35°C	± 0.11°C

Note 1: Errors are combined using an RSS method: Combined Accuracy = [Sensor Accuracy² + Trans accuracy²]^{1/2}

Note 2: Grade A and B as defined by IEC 60751 or ASTM E1137 standards.

As you can see, the matched sensor and transmitter accuracy of ± 0.11°C is over three times better than a standard grade A sensor with ± 0.35°C accuracy and seven times better than the grade B sensor. This differential gets larger as the temperature increases or decreases from 0°C.

If you need high accuracy in your process measurement a matched calibration of PRT and transmitter is certainly a method to consider.