

A measurement-accuracy analysis of the Badger Model 340 Programmable Energy Transmitter can be divided into these areas:

- Systematic Errors in the Model 340
- Temperature Sensor Errors
- Flow Sensor Errors

Systematic Errors in the Model 340

An overall description of general Btu meter accuracy with a detailed look at Data Industrial Btu meter systematic error is provided in the *Data Industrial Technical Bulletin 73* article, "Data Industrial BTU Meter Accuracy."

The article examines: errors introduced by ignoring pressure differences, improvements from incorporating thermal density changes, errors introduced by analog/digital converter truncation error and system clock induced error.

This analysis of systematic meter error applies to the Model 340, and will not be repeated here.

Using the analysis techniques described in the *Bulletin*, the instrument error of the Model 340 Programmable Energy Transmitter is at ± 0.48 percent.

Temperature Sensor Error

Data Industrial 10,000 thermistors exhibit an absolute error of ± 1.01 percent in expected resistance at 32° Fahrenheit, decreasing to ± 0.78 percent at 122° Fahrenheit. Data Industrial's calibration technique, however, yields a very small error in measured temperature difference even with slightly mismatched thermistor temperature sensors.

The Model 340 provides a temperature difference accuracy of $\pm 0.02^\circ$ Fahrenheit. Error in BTU measurement will be determined by the ΔT error and the magnitude of ΔT (temperature difference between input and output). With a larger ΔT , you can expect a smaller BTU measurement error. For example, a ΔT measurement of 20° Fahrenheit will be subject to an error of $\pm 0.02/20$ or ± 0.1 percent. This results in an error of ± 0.1 percent in the reported values of BTU/minute.

Flow Sensor Error

Data Industrial flow sensors are delivered with an expected flow measurement error of ± 1 percent in the flow range of interest.

As the instrument and sensor errors will be uncorrelated, the total error is calculated by adding individual errors in quadrature. The total error for the Model 340 and sensors with a heat exchange medium temperature drop or rise of 20° Fahrenheit will be ± 1.1 percent or an accuracy of 98.9 percent.

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