

HVA 240
Principles of Process Control
Assignment 2
September 8, 2006

Solve the following problems on a separate sheet of paper. In the case of problems requiring computation, show the steps in your work to obtain your answer. Remember to reference the source of your data.

1. It is a known fact that sensor repeatability (precision) is more important than accuracy. How can this be true?
2. A manufacturer provides an RTD temperature sensor with a corresponding transmitter. The transmitter is rated to provide an output of 4 ma to 20 ma over a temperature range of 150 °F to 250 °F. Furthermore, the transmitter is specified accurate to within 1% of reading or 2% of span, whichever is greater.
 - a. The sensor is immersed in a fluid with a known temperature of 175 °F. What range of readings might one expect from the transmitter (expressed in degrees).
 - b. The sensor is immersed in a fluid with a known temperature of 225 °F. What range of readings might one expect from the transmitter (expressed in degrees).
3. A pressure transmitter accepts an input pressure range of -0.25 in w.g. to 1.75 in w.g. The output signal is 4ma to 20ma.
 - a. If properly calibrated, what is the current output, in milliamps, of the transmitter if the pressure being sensed is zero?
 - b. While in operation, you've observed the following data.

Pressure (in w.g.)	Current (ma)
0.95	11.8
1.43	14.92

Is this sensor properly calibrated?

4. A flow sensor/transmitter is tested for accuracy and repeatability. The transmitter accepts a pulse input from 0 to 1000 pulses producing an output of 4ma to 20ma. The sensor outputs 0 to 1000 pulses for a flow rate of 0 to 100 gpm. During this test, the flow is varied from 0 to 100 gpm then back to 0 gpm. As the flow is increased, it is held constant at a known value of 50 gpm and a reading is taken. It is then increased to 100 gpm. Once the test reaches 100 gpm, the flow is decreased. When the flow reaches 50 gpm, it is again held constant and another reading is taken. This process is repeated six times. The data collected is tabulated below.

Sensor Calibration at 50 GPM

Pulses (decreasing flow)	Pulses (increasing flow)
503	497
504	496
505	494
504	496
503	497
505	496
504	496

- Taking ALL readings, what is the observed accuracy of this sensor?
- What is the observed accuracy when flow is increasing?
- What is the observed accuracy when flow is decreasing?
- What is the observed precision when flow is increasing?
- What is the observed precision when flow is decreasing?
- Question Deleted

5. A schematic of a tank level monitoring system is as follows:



The manufacturer's stated error specification for each element is as follows:

LE-1	LT-1	LY-1	LI-1
± 0.5%	± 0.25%	± 0.75%	± 0.40%

- Determine the algebraic error and probable error of this indicating loop.
- Based on the stated designations, what does each element do?