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4-20 ma Current Loop Experiments

Purpose

The purpose of the 4-20 ma demonstrators is to demonstrate how current loops work, demonstrate the response of different transmitters, and demonstrate that it is possible to do data logging on a pneumatic control system if you have the right equipment

Experiment 1 – Trace Out a Current Loop

Current loops are literally a loop of wire that carries a current that varies from 4-20 ma as variable measured by the transmitter varies. For instance, a 4-20 ma transmitter serving a 0-100°F temperature transmitter would have a current that varied linearly from 4 ma at 0°F to 20 ma at 100°F. The loop consists of:

- A power supply of some sort to drive the process. For the loops in the experiment, a 24 vdc power supply is used.
- A transmitter that varies the current as a function of the measured variable. For the experiments, the transmitters vary current as a function of temperature, static pressure, and pneumatic control system pressure.
- A load resistor that converts the current to a voltage for use by the control system. For the experiment, the load resistor is part of a cable that is plugged into the Hobo data logger. The blue and yellow wires are connected to a load resistor, that is hidden under the gray insulation. The voltage it generates is input to the Hobo logger via the jack that when the cable is plugged into the logger input. The wiring diagram provided with the power supply panels illustrates the details of this connection.

As a starting point for the experiment, try to trace out the current loop, from the power supply to the transmitter, to the load resistor, and back to the power supply.

For more details on current loops, see the www.Av8rdas.Wordpress.com blog posts starting in April of 2009.

Experiment 2 – Position Sensitivity

One of the dc power supply panels is connected to a Dwyer static pressure transmitter. With nothing connected to the transmitter, pick it up and rotate it from horizontal to vertical, and then past vertical. Observe the output of the transmitter in the indicator that is part of the package.

What happens to the output?

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Why does this happen?

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Experiment 3 – Thermal Response

1. Deploy the data logger for the DC power supply panel serving the static pressure and temperature transmitters so that it logs data as quickly as possible.
2. Take the temperature transmitter, and, with no thermowell in place, heat it up with the hair dryer for 15 seconds.
3. Allow the transmitter to cool back down for 5 minutes.
4. Insert the transmitter in a cup of water to fully cool it for 1 minute.
5. Place the transmitter in the stainless steel or brass thermometer well.
6. Heat the well up with the hair dryer for 15 seconds.
7. Allow the transmitter to cool back down for 5 minutes.
8. Pull data from the data logger and compare the thermal response of the temperature sensor with and with out a well. Do you think any differences observed could impact the control system and its ability to achieve tight control?

Experiment 4 – Logging a Pneumatic Signal

1. Deploy the data logger for the DC power supply panel serving the pneumatic pressure transmitters so that it logs data at least once every 5 seconds.
2. Connect the 0-20 psig transmitter inputs to one of the pneumatic demonstrators in the adjacent area so that it is monitoring pressure to one of the lines to an actuator.
3. Allow the data logger to record the variations in pressure as the group working with the pneumatic demonstrator cycles the actuator.
4. Pull data from the logger and observe your results. Do you think that just because you are working with a pneumatic control system it is impossible to log data?

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