Sensor Electronics: Power, grounding, and wiring Tues, 09:00

Bob Strand

- I. Electrical vs. Electronic...
- II. Circuits
 - A. Electron Potential Voltage Source
 - B. Electron Flow Current Source
 - C. The consequences of Ohm's Law
 - D. Power
 - 1. AC
 - 2. DC
 - 3. AC/DC conversion and conversion efficiency
- III. Power Sources
 - A. DC
- 1. Battery
- 2. Regulator
- 3. Rectified AC
- 4. Solar?
- B. AC
- 1. Generator
 - a) Fuel
 - b) Noisy output
- 2. Inverter
 - a) Simulated sine wave via square step approximation
 - b) Output quality improves as load increases
 - c) True sine wave devices available for \$\$\$
- C. We are assessing use of an auxiliary power unit for the ALARC tractor
- IV. Sensors
 - A. Supply power
 - 1. Power generally supplied via DC voltage
 - a) Note whether device requires regulated supply voltage or has builtin regulator
 - 2. DC Self-powered current loops
 - 3. Some require no power passive devices
 - B. Sensor Outputs
 - 1. Analog Converting outputs to binary values
 - a) Voltage output
 - i. Voltage more universal A-D conversion typically voltage-
 - ii. Single-ended and Differential measurements
 - iii. Varying ranges; e.g. +/- 2.5, 0-1, and 0-5 volts
 - iv. Disadvantage Voltage drop over long cable lengths

- b) Current output
 - Current usually converted to voltage for A-D, internally or externally – Ohm's law
 - ii. Two and three wire devices
 - iii. How did the 4-10 mA standard arise?
- c) Both susceptible to noise
- 2. Frequency output
- 3. Digital
 - a) Serial Varying data formats and formatting protocols over
 - i. RS-232
 - ii. TTL
 - iii. RS-485
 - b) Ethernet
 - i. Again, data formats and protocols vary
 - c) Pulse Width Output
- V. Wiring and layout
 - A. Common DC Ground
 - 1. Helps eliminate ground loops
 - B. Isolation
 - 1. Important in industrial systems
 - a) Subject to power surges
 - b) Require redundancy for continuous operation
 - 2. Required for HTP?
 - C. Fuse sizing and location
 - D. DIN rail for mounting wiring and power components
 - 1. Power supplies
 - 2. Circuit breakers
 - 3. Relays
 - 4. Terminal blocks
 - E. Terminal connectors
 - 1. Solder-only give best electron transfer, but can fracture with vibration and poor solder joint
 - 2. Crimp-only are typically robust, but can loosen
 - 3. Combination version available with a shrink wrap protector as well
 - F. Coaxial, and multi-conductor connectors
 - 1. Extensive range of brands and models available
 - 2. Typically require one or more unique proprietary tools costing \$\$\$
 - 3. Consider field serviceability
 - G. Neatness counts
 - 1. Facilitates component replacement as well as the addition of new components