



## Small-Signal Wiring Practices

Beyond complexity to simplicity.™

- 1) Analog level sensors are often available with one of two output styles:
  - a) mADC (e.g. 4-20 mADC output over the sensor's pressure range)
  - b) Voltage (e.g. 0.5-4.5 VDC output over the sensor's pressure range)Typically, the 4-20 mADC output is the preferred selection.  
[Reason: It is more difficult to induce noise in a mADC signal. Therefore, such sensors are preferred over the sensors with a VDC output.]
- 2) Use a twisted shielded pair of conductors for all small-signal wiring (i.e. wiring that carries analog signals from instrumentation such as level sensing or flow sensing transducers).
- 3) Small signal wiring (i.e. analog signal and low voltage DC wiring):
  - a) Only ground a shielded cable at one end (e.g. at the controller)
  - b) Separate "small-signal" wiring from AC wiring.
  - c) Do not run "small signal" wiring in parallel with AC (alternating current) wiring.
  - d) If analog signal lines must be run in parallel with AC wiring, provide as much separating distance as possible between the parallel circuits.
  - e) If analog signal lines must cross AC lines the crossing should be infrequent and the "small signal" wires should cross the AC lines at 90 degrees.

- f) Run small-signal analog wiring in **grounded metallic conduits**. (PVC/plastic conduits offer no electrical/noise protection.) **Again, do not run AC wiring in the same conduit as the "small-signal" wiring.**
- 4) **Input** and **Output** connections to a process controller should be kept as short as possible.  
Wiring may act as an antenna. Thus, longer runs of wiring carry larger amounts of spurious noise to the process controller.  
Long runs to input/output points should be isolated by interposing (i.e. intermediate) relays. In turn, the relay's contact should be wired to the process controller. The interposing relays provide a barrier that helps to isolate the control equipment from external problems.
- 5) Ground the panel using a sufficient grounding connector. (Refer to NEC.) Test and periodically re-test the earth-ground connections.
- 6) Use lightning arrestors / surge protectors on all control-power and small signal wiring.
- 7) Periodically check and tighten all screws.

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Contegra Inc.  
8160 County Road 42 West  
Suite 300-405  
Savage, MN 55378  
Phone 651.905.0900  
Eagan, MN 55123  
FAX 651.454.4665  
[www.contegra.com](http://www.contegra.com)  
Dwg: 10417-0001-02

