Precision Digital Presents

Loop vs Line Power; Understanding 2, 3, & 4 Wire Signals
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Objectives & Takeaways

- Understand the fundamentals and differences between 2, 3, and 4 wire connections
- Determine the best choice for your application
- Make the best decision for your instruments and meters
Agenda

1. Definitions
   - Ohm’s Law V = IR
   - 2 wire
   - 3 wire
   - 4 wire

2. Pros and cons of each type

3. Essentials you need to know
Getting to know you

• Where are you located?
• What is your industry?
• What is your level of expertise?
Definitions
Ohm’s Law – why it matters

\[ V = IR \]

Voltage = Current \times Resistance
Each of these configurations produces a 4-20 mA current signal

Most installations include a power supply local to the transmitter or receiver
2 wire, current loop and loop power

- 2 wire means there are only 2 wires involved in the connection between the transmitter, power, and output device.
- The transmitter or receiver typically provide the power to the loop via a built-in power supply.
- Some use a separate power supply as shown here.

[Diagram showing 2 wire system with transmitter, receiver, power supply, and current loop.]
4 wire connections, power and signals

- Transmitter and receiver float
- Separate power leads power the transmitter outside the current loop
- AC or DC power
  - 24 VAC is common
3 wire connections, power and signals

- Transmitter and receiver share a common ground with power.
- 3rd wire used to connect transmitter to power outside of the current loop.
- Caution: may appear as 4 wire.

![Diagram showing 3 wire connections, power, and signals.]

- **wire 1**: TRX to COMMON
- **wire 2**: COMMON to PWR
- **wire 3**: PWR to RCV

Legend:
- TRX: Transmitter
- RCV: Receiver
- PWR: Power supply
- COMMON: Common ground
Getting to know you

• What is your primary application?
• Please enter your questions in the ‘Questions’ window – on the tab at the bottom of your control panel on the right side of your screen.
Pros & Cons
2 wire pros & cons

**Pros**
- Simple and easy display for 4-20 mA transmitter
- Low cost solution for display
- Agency approvals
- Local power not required

**Cons**
- Limited output options
- Very low power
  - Does not support relays
  - Does not support LEDs
4 wire pros & cons

Pros

• More capabilities than 2 wire
  • Relays
  • LEDs
  • Serial communications
• Easier to understand the wiring
  • No need to worry about voltage drop
• Excellent isolation
  • Power from input/outputs

Cons

• Requires a separate local power supply
• Generally more expensive
• More wiring requirements
• Limited hazloc options
3 wire pros & cons

**Pros**
- Lower cost than 4 wire
- Easier to wire (fewer connections)

**Cons**
- No isolation
  - Very susceptible to ground loops
- May be confusing to wire
The Essentials
These are the ‘must know’ points

- 4 wire or 3 wire require separate power supply
- 3 wire works – be aware of isolation requirements first
- 2 wire – be aware of voltage drop
- Rule of thumb
  - 2 wire is much less expensive (than 3 or 4 wire)
  - 3 wire is slightly less expensive (than 4 wire)
- Some devices are not available as 2 wire
2 wire example
4 wire example
3 wire example

24 VDC POWERED LEVEL TRANSMITTER

POWERED TRANSMITTER OUTPUT

GRADE LEVEL DISPLAY (PD6000-6H7)

120 VAC TO 24 VDC SUPPLY

AC POWER RAIL
Summary

1. Definitions
   - Ohm's Law $V = IR$
   - 2 wire
   - 3 wire
   - 4 wire

2. Pros and cons of each type

3. Essentials you need to know
Getting to know you

• How often do you specify digital displays?
Q & A

• Please enter your questions in the ‘Questions’ window – on the tab at the bottom of your control panel on the right side of your screen.

• Apologies if we do not get to your question today. We’ll contact you offline with a response as soon as possible.
Stay tuned for information on our next webinar series

Let us know what topics we should cover
Helping you become more proficient with process signals connections and communications.

Your source for:
- Loop Powered Meters
- Digital Panel Meters
- Explosion-Proof Instruments
- Large Display Meters
- And more
thank you