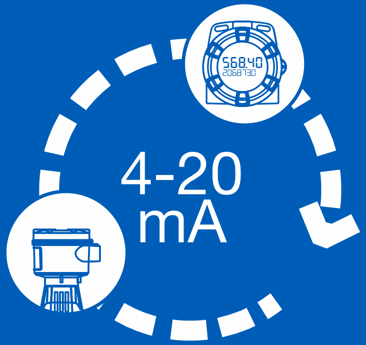

Precision Digital Presents

The Fundamentals of 4-20 mA Current Loops

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Webinar Organizers

Joe Ryan

Product Manager,
Expert Presenter

Precision Digital
Corporation

Ryan Shea

Applications Specialist,
Webinar Moderator

Precision Digital
Corporation

Don Miller

Support Specialist,
Chat Moderator

Precision Digital
Corporation

Objectives & Takeaways

Understand the fundamentals of 4-20 mA current loops

Be able to choose the correct devices and instruments

Is the 4-20mA current loop right for your situation?

Agenda

1. Definition of the 4-20mA current loop
2. Description of the components that make up the 4-20 mA loop
3. Pros and cons of the 4-20 mA current loop
4. Essentials you need to know about the 4-20 mA current loop.

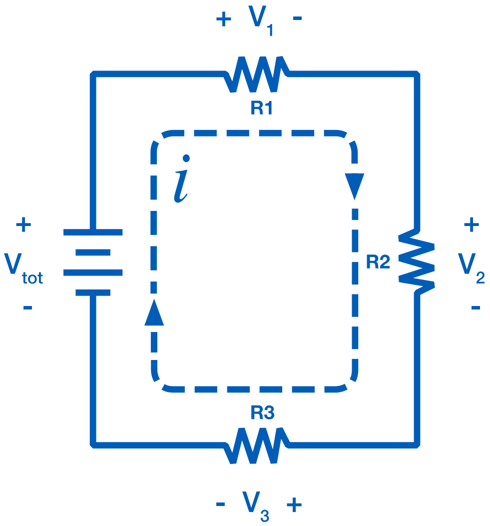
Getting to know you

- Where are you located?
- What is your industry?
- What is your level of expertise?

What is the 4-20 mA current loop?

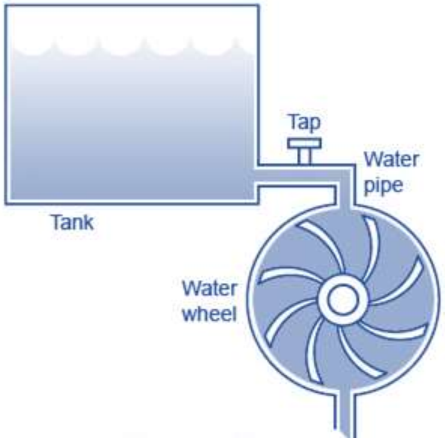
$$V = IR$$

Voltage = Current x Resistance



Basic Current Loop

- Vtot = Power Supply
- Multiple Resistances/Loads (R1, R2, R3
- Multiple Voltage Drops (V1, V2, V3)
- Current the Same Everywhere



Flow Analogy

- Voltage => Pressure
- Loads => Flow Restrictions
- Current = Flow

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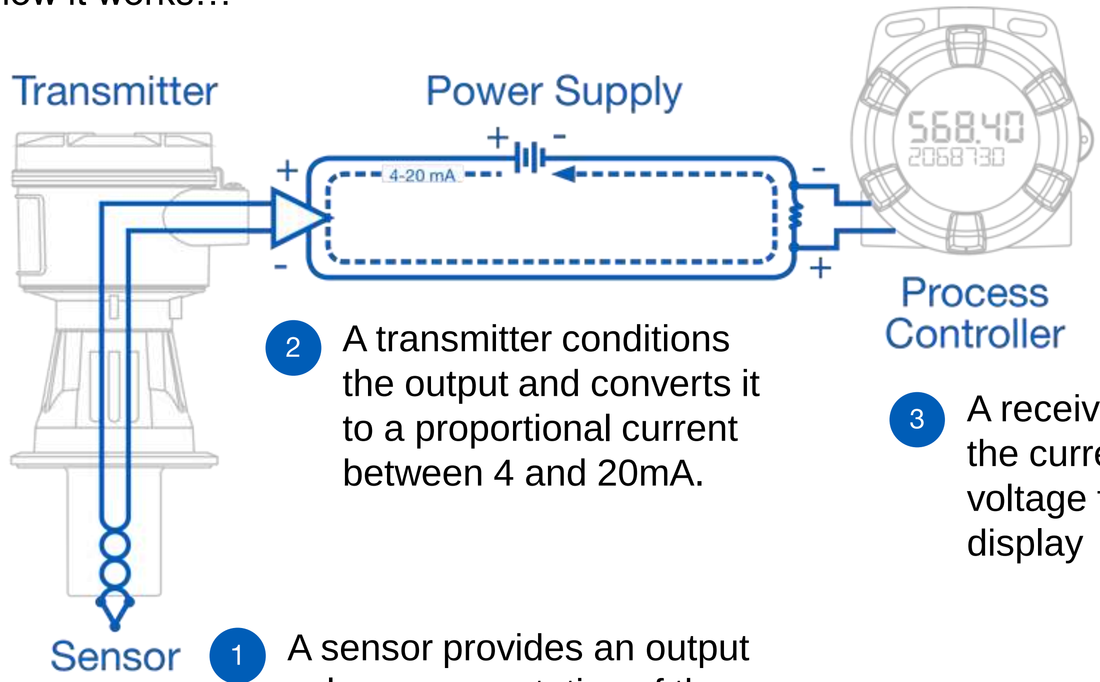
A little bit of history…

- First appeared in process environments in the 1950s
- Influenced by the previously most common control signal – compressed air [using 3 to 15psi as the signal range]
- A true ‘0’ is not practical
- The industry specification for Compatibility of Analog Signal for Electronic Industrial Process Instruments is ISA 50.00.01-1975 (R2012)

What is the 4-20 mA current loop?

Here's how it works…

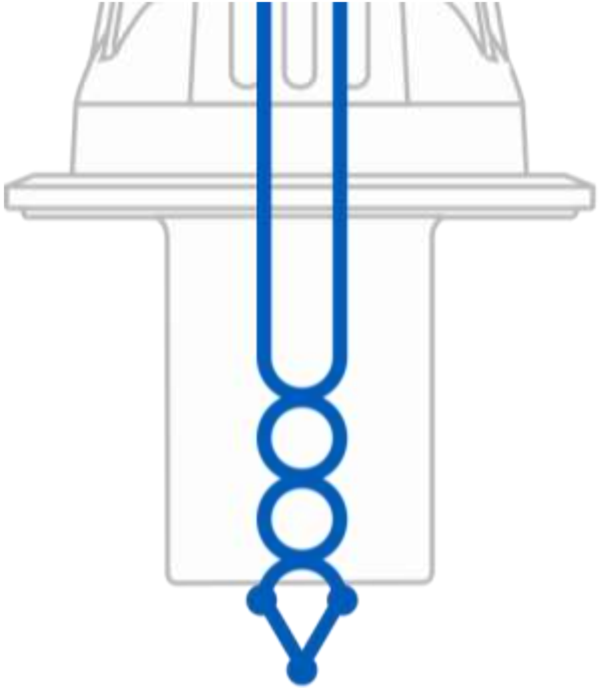


1 A sensor provides an output value representative of the parameter being measured.

2 A transmitter conditions the output and converts it to a proportional current between 4 and 20mA.

3 A receiver converts the current to a voltage for use in a display

Components – The Sensor



- Measures the actual parameter; temperature, flow, pressure, etc.
- Some sensors output a voltage proportional to the level of the parameter being measure. Difficult to use directly due to issues such as noise, cable length, etc.
- Others are unusable due to signal complexity, such as radar level readings, optical encoders, low signal mV pulses

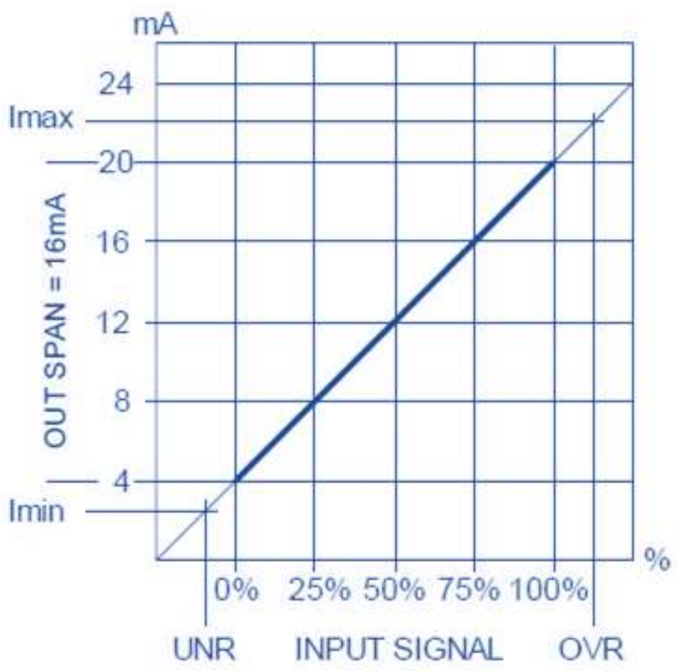
Components – The Transmitter

- Converts the variable signal from the sensor to a current
- The current output by the transmitter is proportional to the parameter being measured
  - 4 mA represents the 0% measurement
  - 20 mA represents a 100% measurement

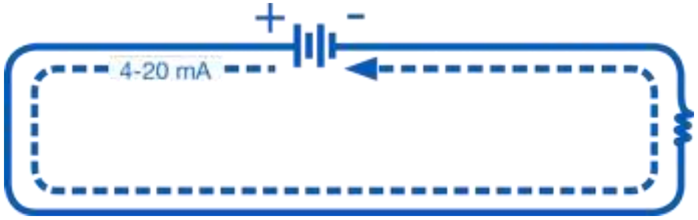
Scaling Example:

Linear Scaling (2 Point) for a 100 foot level xmitter.

Scale Pt	Input Value (mA)	Parameter (ft)
1	4.00	0
2	20.00	100 ft



Components – The Power Supply



- DC power only (usually 24VDC)
- Commonly 9, 12, 15 or 36V DC
- Must be at least higher than the sum of
  - Maximum required for transmitter
  - IR drop in all receivers
  - IR drop in wire

! In most installations, power is built in to transmitter or receiver

Components – The Receiver

- Receives the current signal, internally converts the current back to a voltage and outputs the result of the measurement
- Output to a remote display, actuator valve, speed controller, PLC, etc.

Components – The Wire

Wire AWG	DIAMETER (mils)	OHMS Per 1000 Feet
10	101.90	1.018
12	80.80	1.619
14	64.10	2.575
16	50.80	4.094
18	40.30	6.510
20	32.00	10.35
22	25.30	16.46
24	20.10	26.17
26	15.90	41.62
28	12.60	66.17
30	10.00	105.2
32	8.00	167.3
34	6.30	266
36	5.00	423
38	3.97	673
40	3.14	1070

- Wire will add resistance to the loop at long distances (well over 1000')
- Wire resistance and voltage drop is negligible for short distances
- Could affect voltage signal accuracy over long distances
- Current is identical throughout the loop, so this will not affect accuracy of the 4-20 mA signal

Getting to know you

- What is your primary application?

Questions?

- Please enter your questions in the ‘Questions’ window

Pros and Cons of 4-20mA Current Loop

Pros

- Simple to wire and configure
- Uses less wire and connections – reduce installation costs
- Longer distances are OK without losing signal as opposed to voltage output signals
- Low sensitivity to electrical noise
- Easy to detect loss of signal or power

Cons

- One parameter transmission
- Susceptibility to ground loops
- Isolation requirements

Essentials You Need to Know

INTELLIGENT
MONITORING & CONTROL

Is it right for you?

- It's the Industrial standard

Considerations when choosing your devices

- Loop drop/power options
- Isolation
- Number of parameters

When you cannot use 4-20 mA

- Pulse, temperature or pressure devices without additional transmitters

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Summary

1. Definition of the 4-20mA current loop
2. Description of the components that make up the 4-20 mA loop
3. Pros and cons of the 4-20 mA current loop
4. Essentials you need to know about the 4-20 mA current loop.

Getting to know you

- How often do you specify digital displays?

Q & A

- Please enter your questions in the 'Questions' window
- Apologies if we do not get to your question today. We'll contact you offline with a response as soon as possible.

Next Webinar – June 30th

Introduction to Thermocouples, RTDs, and Temperature Transmitters

An introductory class for those who have to deal with common temperature devices and are not electrical engineers or field experts. After attending this webinar:

1. Know what thermocouples and RTDs are, and how they work
2. Understand what a temperature transmitter is, and why they are used
3. Be able to specify the temperature monitoring or control device that is best for your application

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