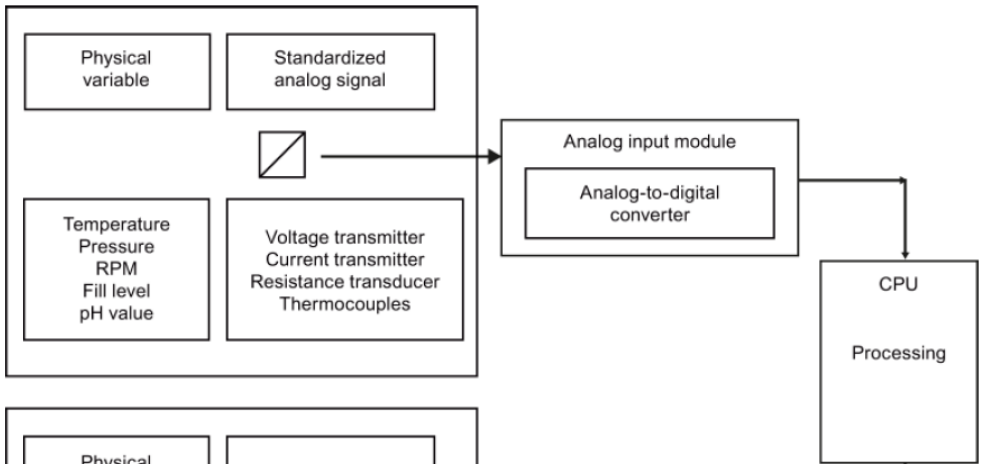
Tutorial 8

ET0917 / ET0817 / ET0832

ANALOGUE I/O

Learning Outcome
Analogue IO

- Identify scenarios where analogue devices are required
- Describe the common analogue standards used in the industry
- Explain the operation of DAC and ADC conversions
- Perform scaling and ranging of analogue values



Q1 - MCQ

Why would an analog input module of a PLC require Analog to Digital Converter (ADC).

a) ADC allow the conversion of the analog input module to read digital I/O

b) ADC converts digital output signal from the PLC program to analog signal

c) PLC is only able to process analog signal ADC converts digital signal to analog

d) PLC is only able to process digital signal, ADC converts analog signal to ‘1’ and ‘0’ (digital signal)

Q2 - MCQ

Which is NOT a common range of analog signal to interface with PLC?

a) 4 – 20mA

b) 0 – 10V

c) 0 – 24V

d) 0 – 20mA

Q3 - MCQ

The ultrasonic level transmitter is far away from the PLC requiring long cables for connection. What is the ideal interface with PLC?

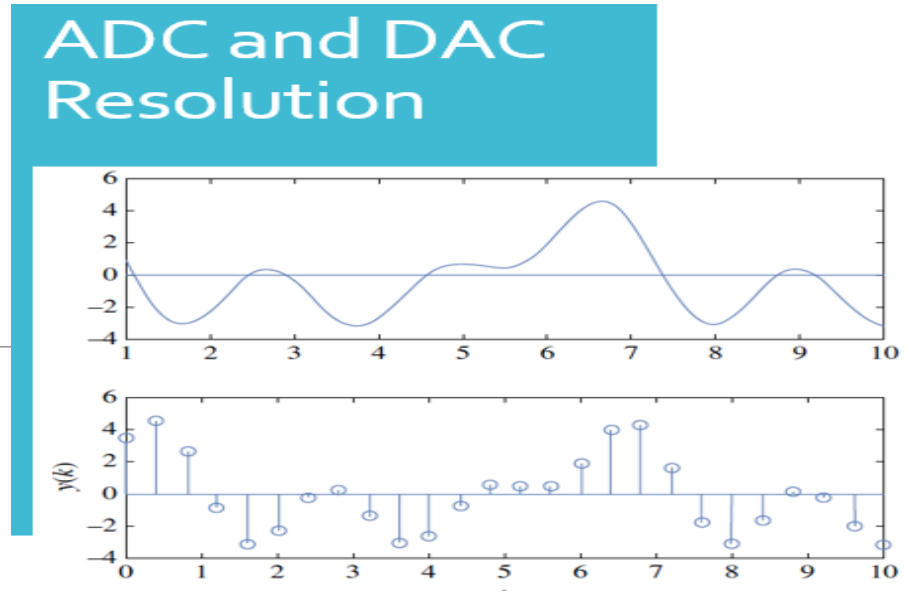
a) 0 to 5V - lower voltage results in lower voltage drop error

b) 0 to 10V – higher voltage has less impact on voltage drop error

c) 4 to 20mA – current analog signals do not suffer from voltage drop error

d) 4 wire transducer – the external power source would provide more power for the circuitry to function

Q4 - MCQ



ADC or DAC resolution = $\frac{full\ scale\ range}{2^N}$ (N is ADC resolution in bits). What is the significance of high resolution?

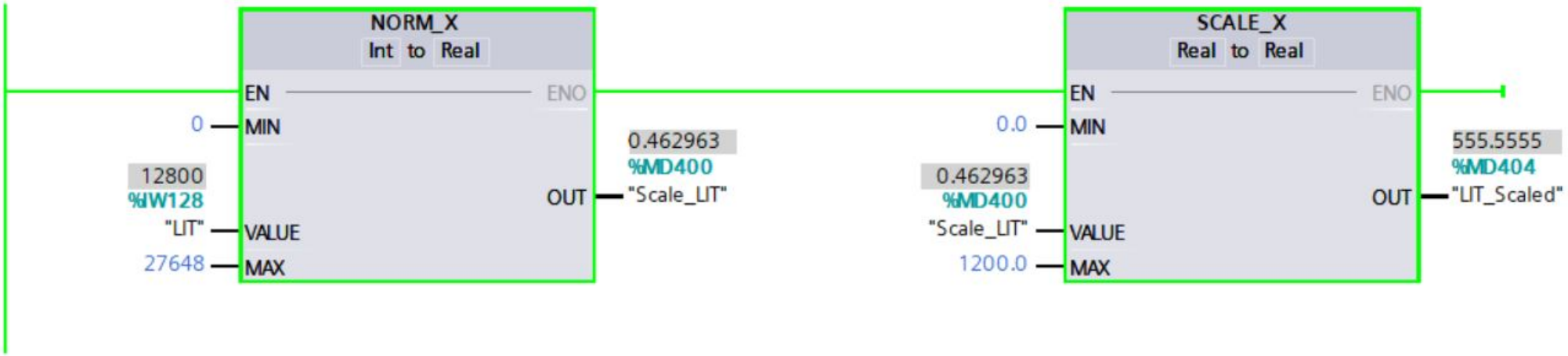
a) High resolution results in shorter response time

b) High resolution results in longer response time

c) High resolution provides larger step change of analog value

d) High resolution provides smaller step change of analog value

Q5 MCQ



S7-1500 PLC has 16-bits ADC for the analog input module. The signed INT range is $2^{\wedge 16}$, -32768 to 32767. Why is the max set to 27648?

a) This value is wrong

b) The scaled output is 0 to 27648

c) The analog sensor manufacturer specified 0 to 27648 range

d) Values greater than 27648 is catered for overrange (measured analog value greater than configured value)

Q6 - MCQ

What would be the reason for analog instruments to require 4-wires? Select the correct answer.

a) It is designed to enable easy wiring to PLC

b) When instrument requires more power for the circuitry to work, where 4mA is insufficient to be loop powered (2-wire)

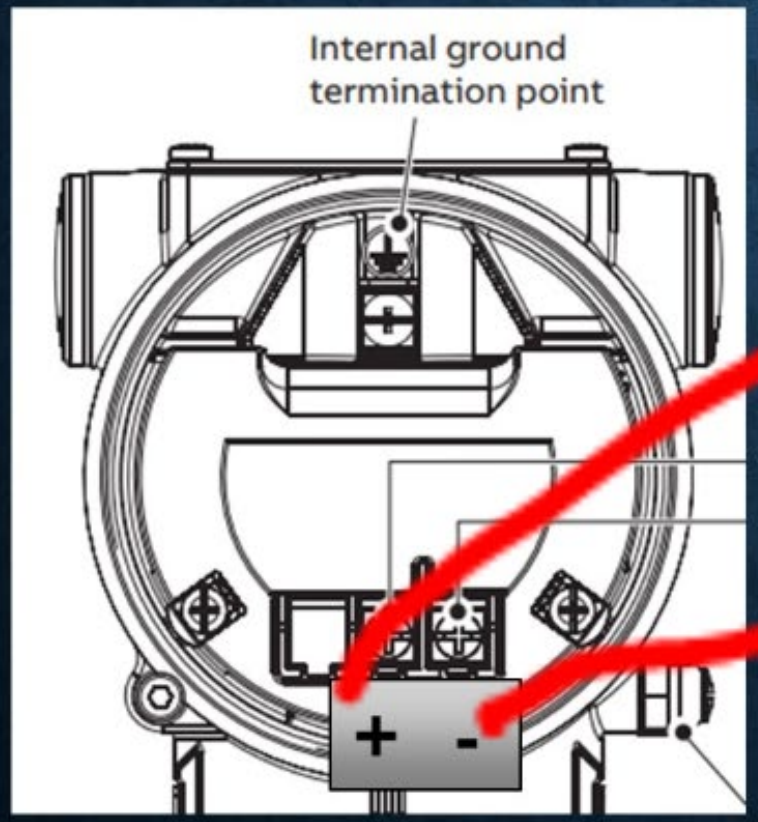
c) Hazardous zone requires low power instruments, hence 4-wires design would meet this requirement

d) Every instrument needs power to work, **all** instruments need to be 4-wires type. 2-wires to power the device, 2 wires for anlog signal

Q7 – Slide Drawing

Instruments providing analog signal are typically 2-wire or 4-wire type.

How would you wire a 2-wire, loop powered pressure transmitter?



Power Supply

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PLC

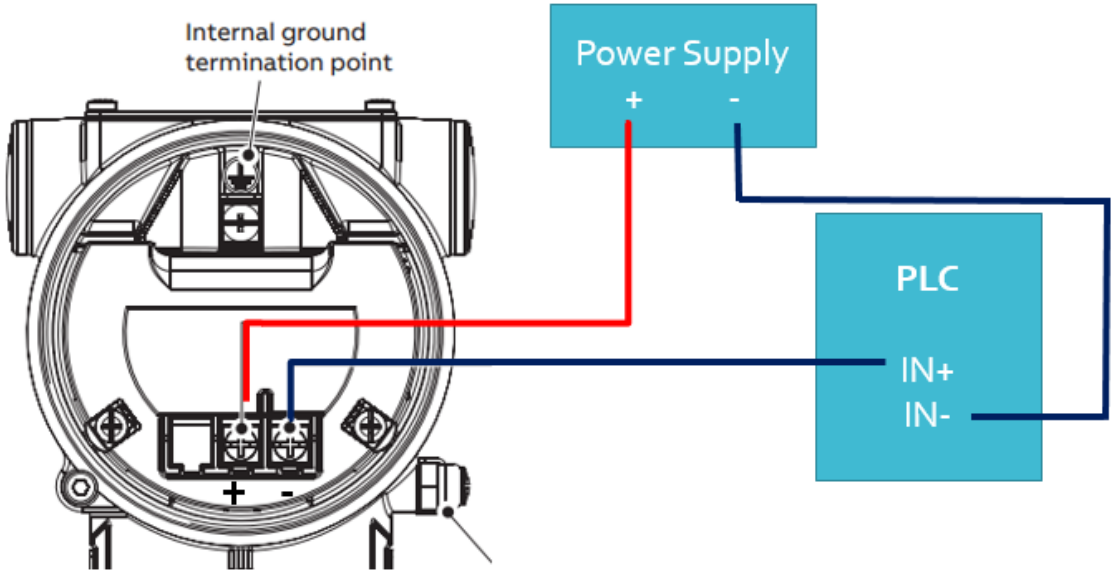
IN+

IN-

Q7 – Reference

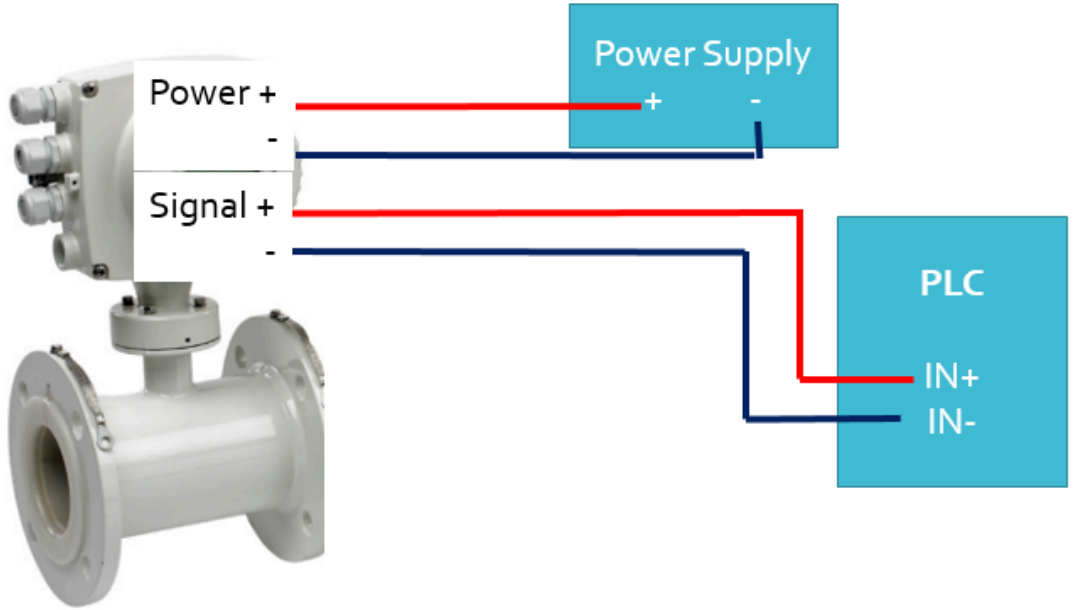
2-Wire

- Most low powered transmitters are 4-20mA, loop-powered type
- Such as: Pressure, Temperature, Ultrasonic level Transmitter
- Loop-powered transmitter is referred to as 2-Wire transmitter
- The power is supplied by external source which carries the signal current to controller as a close loop



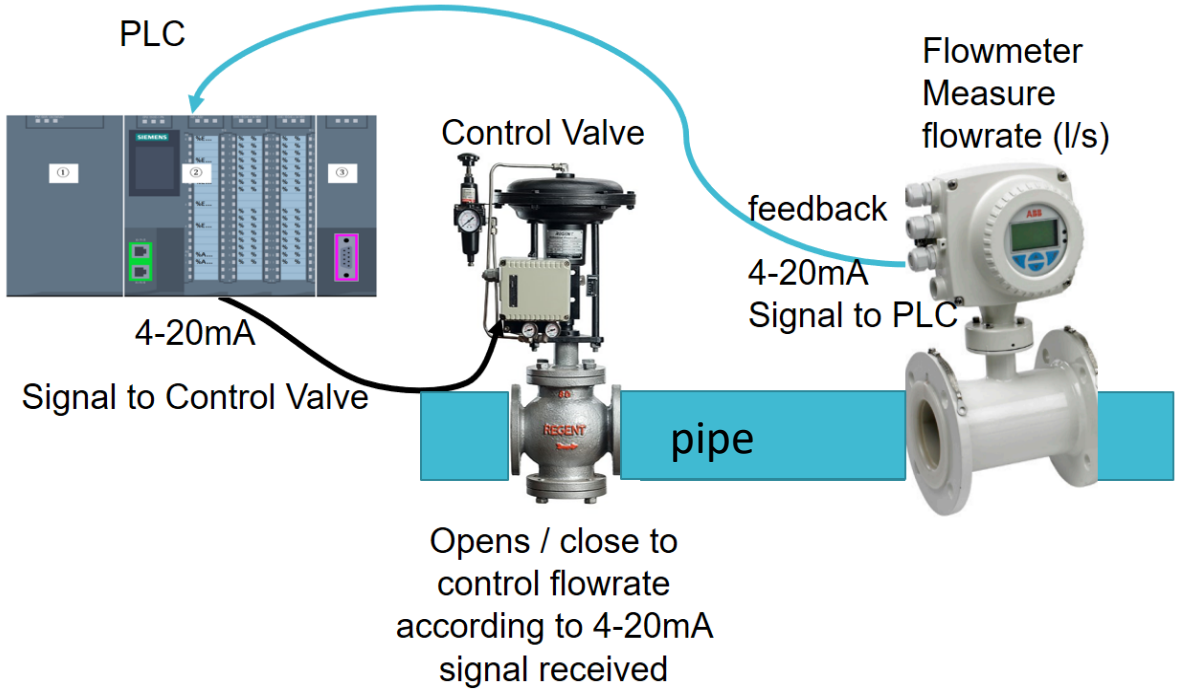
4-Wire

- Instruments that require more power need to be powered independently, referred to as 4-wire transducer.
- Flowmeter is a typical instrument that require more power to the circuitry to function. 4mA, 12Vdc is insufficient
- 2-wire for power to supply to transmitter
- 2-wire for signal to connect to PLC or other controllers
- Typically output of 4-20mA



Q8 - MCQ

A process would require to control the flowrate of water in the pipe. Select the option of how the control valve should work when the measured(actual) flowrate is lower than the desired(setpoint) flowrate?



a) Do nothing

b) Cut off power to control valve

c) Decrease analog output to close valve till flowrate reaches required

d) Increase analog output to open valve till flowrate reaches required