Application Note: Minimum supply voltage for 4…20mA current loops

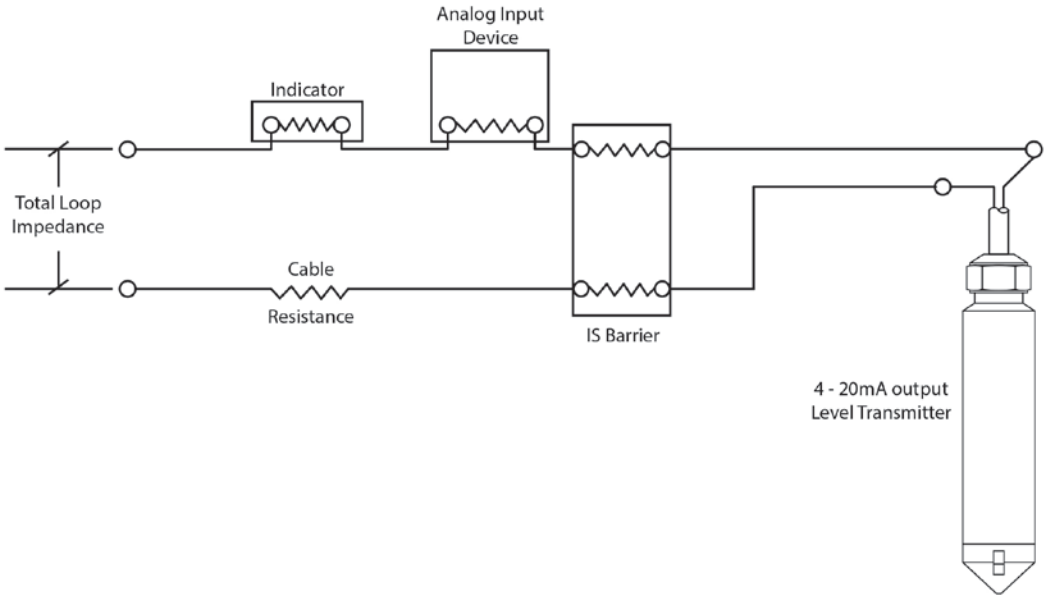
Adequate supply voltage is critical to ensure proper operation of 4-20 mA pressure and level transmitters. Without the minimum required voltage available at the transmitter, the transmitter will not output the correct analog value.

Many analog transmitters will *appear* to operate properly even when the supply voltage is not adequate to power the loop when the transmitter should be outputting 20 mA. For example, a 10 volt supply may *appear* to be enough to power an analog transmitter when it is outputting 4 mA with zero pressure applied, but as the transmitter's output increases with increasing pressure, voltage drops across other devices in the loop (analog input devices, cable and/or external barrier devices) may reduce the supply voltage to the transmitter and prevent it from providing the correct output above a certain input pressure/level threshold.

Keller America's 4-20 mA pressure and level transmitters feature microprocessor-based signal conditioning. During power up, the circuit performs a check sequence which determines whether there is sufficient supply voltage to power all devices on the loop, by setting the output to ~110% of the maximum value, i.e., ~22.5mA. If the supply voltage is not sufficient to supply 22.5 mA to the circuit, then the maximum *possible* current will be seen on the analog output, e.g., 17 mA, and the transmitter will not initiate normal operation.

The benefit of this technology is that total loop impedance is accounted for prior to placing the equipment into service, preventing false indications when the voltage supply is insufficient to support the loop with maximum pressure applied.

Most current loops contain analog input devices, indicators or other components having input impedances which must be considered when calculating the supply voltages needed. For example an analog input device with a 250 Ohm Input Impedance will require an additional voltage of 5.5 VDC (250 x 0.022 = 5.5) in addition to the minimum supply voltage necessary for the transmitter to operate properly over the entire range.



The calculations below are useful in identifying the minimum supply voltage needed for a current loop with additional line impedances or conversely, the maximum current loop impedance allowed for a given supply voltage.

Minimum supply voltage with lightning protection option installed: 11 VDC + (Total loop impedance x 0.022)

Minimum supply voltage without lightning protection option installed: 8 VDC + (Total loop Impedance x 0.022)

Maximum allowable loop impedance with lightning protection option installed = (Supply VDC – 11 VDC) / 0.022

Maximum allowable loop impedance without lightning protection option installed = (Supply VDC – 8 VDC) / 0.022