

MP406 Cabling - Differential vs. Single-Ended

Measurement Modes

A differential measurement is taken as the voltage difference between two wires, signal positive (HI) and signal negative (LO). A single ended (SE) measurement is the voltage between signal positive (HI) and power negative (LLGND). The MP406 is an active voltage sensor that contains separate leads for signal negative and power ground. When connected to a data logger in differential measurement mode, cable lengths of 500 meters can be achieved.

Differential vs Single-ended Measurements

A problem with long cable runs using single ended measurements is increased resistance. This increased resistance results in voltage drop along the power ground cable that can affect the accuracy of the measurement as the sensor positive signal is referenced to power ground.

Using differential mode overcomes this as the voltage drop occurs across both the signal positive and the signal negative cancelling each other out resulting in a net 0 of voltage drop across the 2 wires. Another benefit of differential measurement mode is noise rejection. Noise is added/subtracted to both signal positive and signal negative, and is then filtered out by common mode rejection due to the overall voltage difference remaining the same.



On single ended measurement mode the voltage fluctuations only occur on the signal positive and results can be seen in sensor measurements. Single ended measurement mode does however enable more sensors to be connected and are suitable for shorter cable runs of less than 20 meters.

See below the test results showing the differences between differential and single ended measurements with an MP406 over varying cable lengths (0m, 100m, 500m):

Signal +/Signal - Voltage in Air	Differential	Single Ended	Sensor Excitation
MP406 0m (Cable Length) From Data Logger	0.011V	0.064V	12.39V
MP406 (Cable Length) 100m From Data Logger	0.011V	0.018V	12.30V
MP406 (Cable Length) 500m From Data Logger	0.011V	0.000V	11.94V
Signal +/Signal - Voltage in Water	Differential	Single Ended	Sensor Excitation
MP406 0m (Cable Length) From Data Logger	1.113V	1.173V	12.39V
MP406 (Cable Length) 100m From Data Logger	1.113V	1.128V	12.30V
MP406 (Cable Length) 500m From Data Logger	1.113V	0.948V	11.94V

Cable resistance

100m	4.2 Ohms
500m	21 Ohms

