Kam® Simple Precision™

KAM OWD WATER CUT METER

Theory of Operation

There are two main distinctions between the KAM OWD Oil Water Detector and other microwave meters. The first is the OWD's ability to measure oil continuous and water continuous phases simultaneously and to electronically transition between the two. The second is its ability to measure complex permittivity rather than high frequency capacitance.

Oil Continuous and Water Continuous

Traditional microwave technologies suffer from inaccuracies or the inability to measure water percentages in water continuous phase. This is because frequencies will overload at high water percentages due to higher conductivity. To compensate, manufacturers reduce the conductivity of the antenna, usually by coating it. However, this creates a loss in accuracy at low water concentrations.

The KAM OWD solves this issue with a patented multi-antenna design. One antenna operates at an optimized microwave frequency for oil-continuous flow. The second antenna operates at an optimized frequency for water-continuous flow. It is the equivalent of two instruments operating in parallel.

In addition, one antenna emits a DC signal which shorts out when the phase shifts from oil continuous to water continuous. This allows the electronics to instantly adjust to the change in phase and upload new curves.

Both antennas operate simultaneously offering true 0-100% measurement.

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Measuring Permittivity

The OWD emits 2 separate locked frequencies within the microwave range, one for oil continuous and one for water continuous. Water has a different conductivity than oil and will change the frequencies of the signals passing through the fluid. Most microwave meters simply measure this change in frequency and calculate the change in capacitance in order to determine water concentrations. The OWD measures permittivity: a measure of the ability of a material to resist the formation of an electric field within it. It does so by changing the voltage required to maintain a constant frequency in the fluid. This change in voltage is directly related to the permittivity of the fluid. Multiple microwave signals allow the OWD to calculate the complex permittivity (real and imaginary) of the fluid– the real part of which is a higher order of the dielectric constant. This is what allows the OWD to measure with such high accuracy.

One additional factor that increases KAM OWD accuracy is that by using two antennas, the OWD also uses two separate crystal oscillating circuits. A single crystal cannot operate stably over a 0-100% water range. Using two crystals and appropriate lengths of coaxial cable allows the OWD to operate each circuit in a region that consumes minimum current, increasing the stability of measurement and minimizing electronics drift.