



Weatherford®

Red Eye® Multiphase Water-Cut Meter



Water-cut measurements in multiphase flow.

Red Eye Multiphase Water-Cut Meter



Weatherford has redefined the water-cut meter market by addressing many of the difficulties in accurately measuring water cut in flowing lines. The revolutionary *Red Eye* 2G water cut meter was the first device to work with varying salinity levels, a wide-range of water-cut levels and entrained gas. It ignores changes in salinity, provides accurate measurements from 0 to 100% water-cut levels and can handle up to 20% gas volume fractions (GVF).

The *Red Eye* multiphase water-cut meter extends this unparalleled performance to a full range of GVF. Designed to work in full three-phase flow (oil, water and gas), the multiphase meter measures relative water and oil concentrations in streams with up to 99.5% GVF.

At GVF levels above 99.5% this meter can be used for water onset detection. Using strong water absorption wavelengths in the near infrared (NIR), the multiphase meter can clearly detect water at or below 0.25 BBL/MMSCF.

The meter also has the ability to differentiate methanol or similar alcohol based hydrate inhibitors. By measuring five key wavelengths in the NIR spectrum, the multiphase water-cut meter can distinguish four components (gas, water, methanol and condensate) in three phases (gas, liquid hydrocarbon and aqueous).

Applications

The *Red Eye* multiphase water-cut meter is designed to work with vastly different types of flow. It works in continuous liquid and gas flow streams. These new design elements have been incorporated with the existing capabilities developed for our earlier water-cut meter, creating a tool that performs beyond the industry standards in a wide breadth of situations.

Applications include:

- Individual well production monitoring
- Water onset detection
- Undersized test separators
- Optimized injection of hydrate inhibitors

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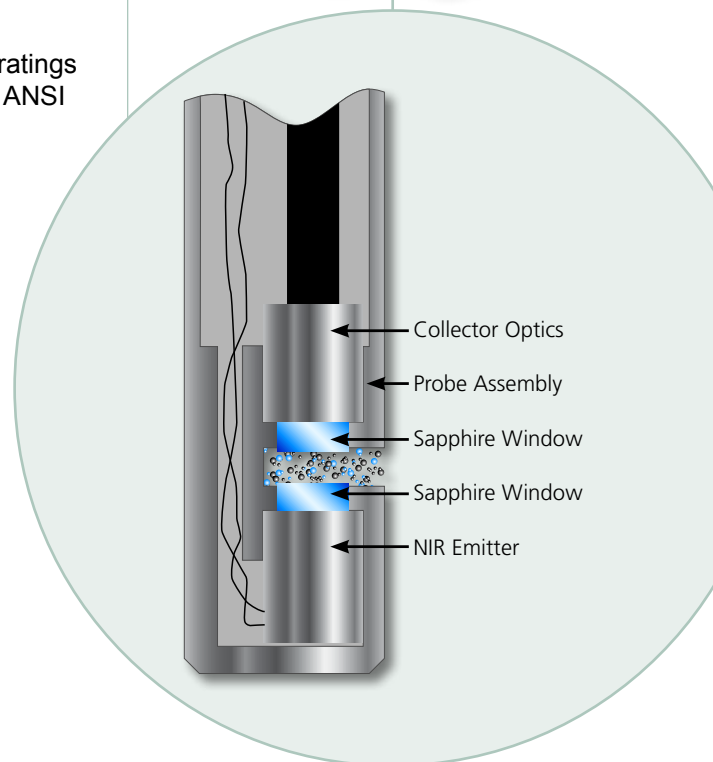
Features

The *Red Eye* multiphase water-cut meter uses a simple design that promotes longevity and accurate measurements for the life of the unit. The wetted end consists of a flange mounted or threaded insertion style probe. The probe has permanently sealed high-strength sapphire windows to isolate the process stream. The optoelectronics are mounted directly on the measurement probe, limiting field wiring to power and output signal cables. Key features include:

- Easy installation and configuration
- Non nuclear
- Compact and robust
- Low power
- Independent of typical phase density changes
- Salinity independent
- Slug frequency calculation

The meter offers both real-time water-cut measurement plus a liquid weighted average over a user-specified time period. This is especially useful when slug flow is occurring.

The meter is available for line sizes from 2 to 24 in. and pressure ratings up to ANSI 1500#. It is also available in a hot tap configuration for ANSI 600# applications.



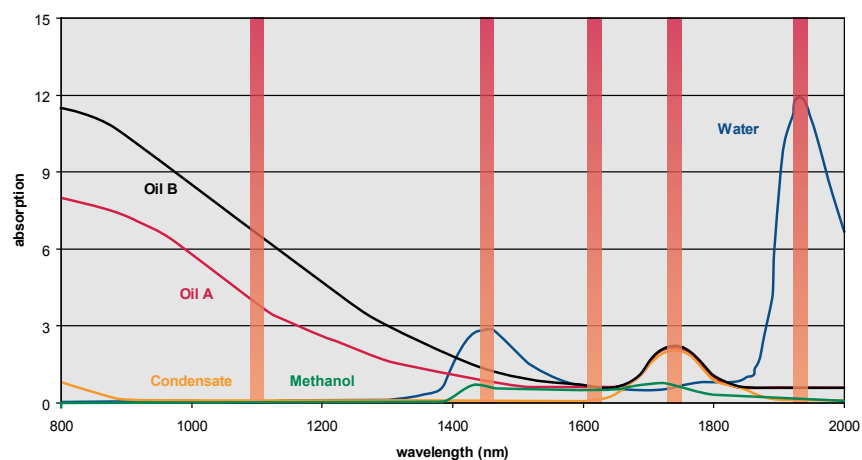
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How it Works

The measurement is based on near-infrared absorption spectroscopy where water, oil, natural gas and hydrate inhibitors, like methanol, all have unique absorption profiles. Near-infrared is particularly well suited to detect and quantify hydrocarbons and water due to the overtone absorption bands for O-H and C-H bonds. Furthermore, since the signal is based on the water molecule itself, there is no sensitivity to water chemistry issues like salinity.

In the *Red Eye 2G* water-cut meter, four wavelength bands were measured simultaneously to make the measurement. The new multiphase water-cut meter adds a fifth wavelength band for added water sensitivity and to enable four component differentiations (oil, water, gas and methanol). The figure shows the typical wavelength bands measured but these can be optimized for various applications.

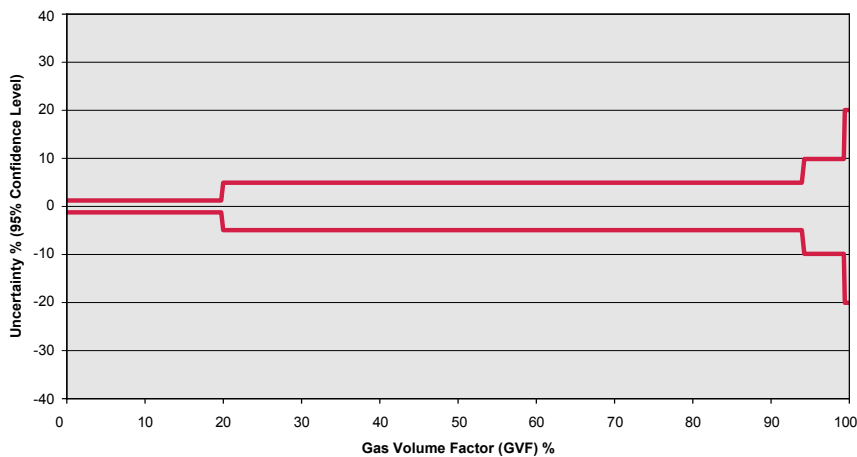


Using sophisticated chemometrics, internal algorithms calculate relative concentrations based on individual component calibrations. For low pressure, less than 500 psi (34.47 bar), the absorption profile for natural gas can be assumed to be 0 for all channels. At higher pressures, gas absorbance starts to play a role but it is linear with pressure and easy to accommodate. Typical changes in gas composition do not affect the measurement.

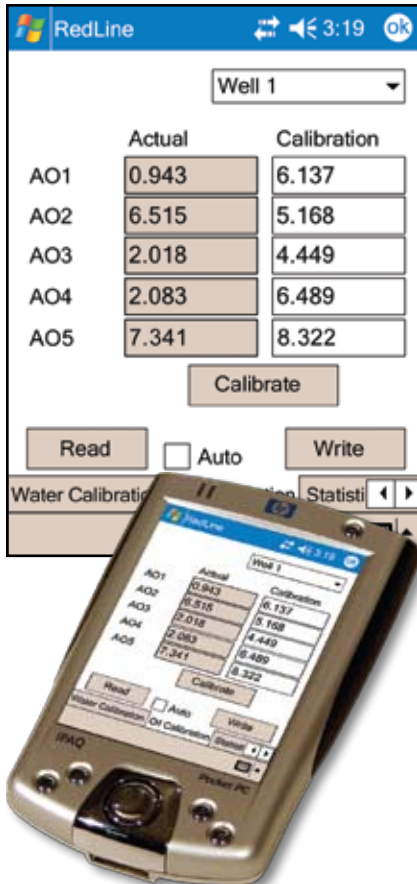
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In high GVF streams the liquid tends to flow along the pipe wall. By positioning the sensor gap at the pipe wall, the *Red Eye* multiphase water-cut meter can accurately characterize that liquid even when the concentration is low relative to the gas content.

Water-liquid ratio calculations are equal or better than those of expensive multiphase metering systems with integrated water-cut measurement. More importantly, calibrations are robust and need not be repeated for modest density changes in the phases.



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Configuration

The meter includes **RedLine™** configuration software designed for pocket PCs. The software allows the user to configure communications, perform one-button fluid calibrations and check system diagnostics. The connection can be done through either of the meter's communication ports.

Simplified Installation and Calibration

The insertion style design reduces installation costs, particularly in large line sizes. The electronics are mounted directly on the measurement probe, limiting field wiring requirements to power and output signal cables.

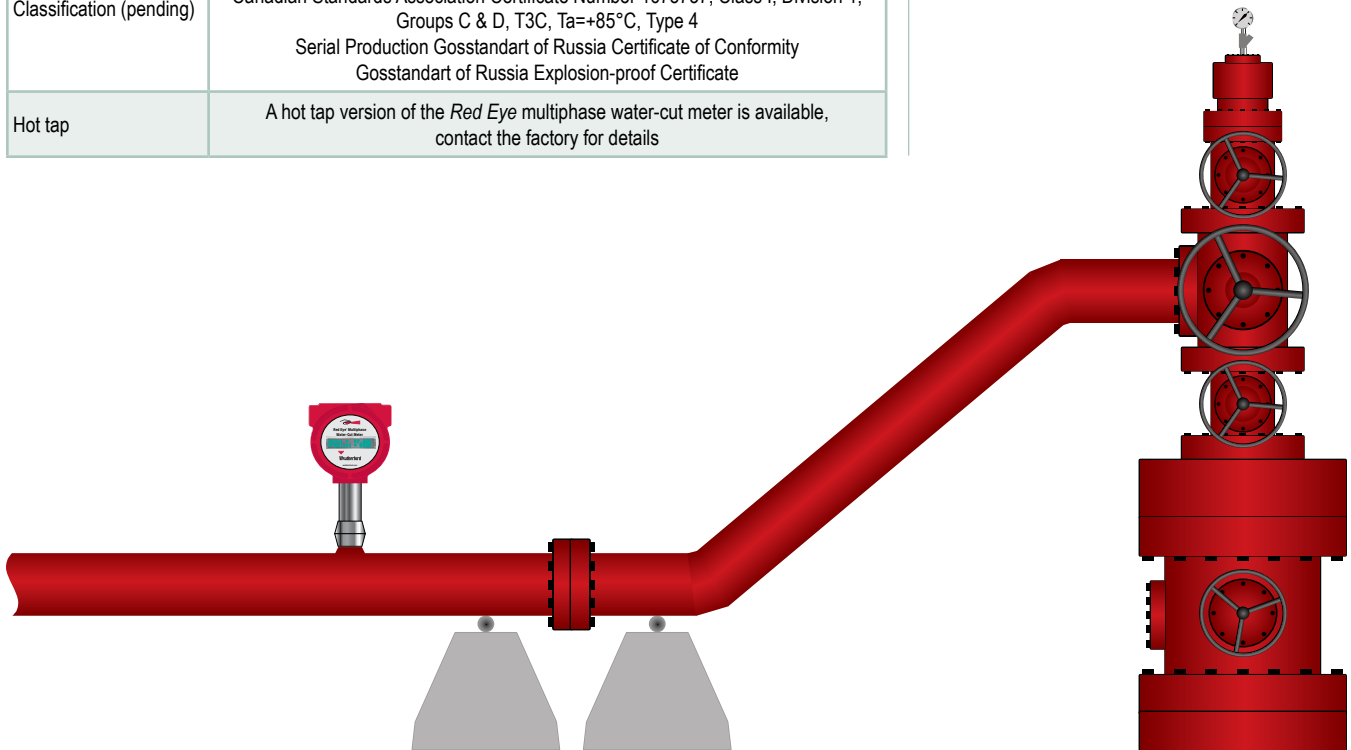
Simplified Calibration

All that is needed is a small, 50 ml, sample of dry oil at atmospheric conditions. The operator puts dry oil from the well to be tested in the sensor slot and pushes one button to calibrate. That's it!

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Specifications

| | |
|---|--|
| Power | 10 to 30 Vdc, 8 W |
| Wetted parts | 316 L SS or Hastelloy C 276 with sapphire windows |
| Operating temperature (°F/°C) | 32 to 302 (0 to 150) (standard) process fluid -40 to 149 (-40 to 65) (standard) ambient temp |
| Operating pressure | Equal to carbon steel ANSI pressure rating |
| Process connection (in./cm) | 1 (2.54) NPT for pipe sizes 2 to 10 (5.08 to 25.4) 1.5 (3.81) RF flange ANSI 600 for pipe sizes 2 to 24 (5.08 to 60.96) 1.5 (3.81) RF flange ANSI 900/1500 for pipe sizes 2 to 24 (5.08 to 60.96) 2 (5.08) RTJ flange ANSI 900/1500 for pipe sizes 3 to 8 (7.62 to 20.32) |
| Sour service | NACE MR0175/ISO 15156 |
| Accuracy | Refer to plot |
| Communication ports | RS232 and RS485 |
| Display | 2-line, 16-character vacuum fluorescent display (LCD available) |
| Output | 4 to 20 mA water cut |
| Communications | Modbus® RTU (standard) |
| Hazardous Area Classification (pending) | Factory Mutual Approvals Project I.D. 3022805 XP Class I, Division 1, Groups C & D, T3C, Ta=+85°C, CSA Sira Certification Services Certificate SIRA 05ATEX1138 EEx'd IIB T3 Ta=+85°C, IP66 Canadian Standards Association Certificate Number 1675737, Class I, Division 1, Groups C & D, T3C, Ta=+85°C, Type 4 Serial Production Gosstandart of Russia Certificate of Conformity Gosstandart of Russia Explosion-proof Certificate |
| Hot tap | A hot tap version of the Red Eye multiphase water-cut meter is available, contact the factory for details |



Typical installation.

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