



PRODUCTION

Red Eye® Series of Water-Cut Meters

Consistently accurate water-cut measurements in tough oilfield conditions.



Optimize your wells with advanced water-cut accuracy and real-time convenience.

Near-infrared technology gives you a clearer view.

Although water cut is one of the most important parameters to determine reservoir characteristics and well behavior, it can be the most difficult to measure accurately. Even when you're using the most expensive multiphase meters, variations in salinity, solids, and gas volume fraction (GVF) can wreak havoc on your water-cut measurements. So, as the production stream changes over time, you would normally need to continually recalibrate your equipment just to keep up. However, with the Red Eye® water-cut meter from Weatherford, you have a better option. The only meter of its kind, this revolutionary device puts cost-effective, reliable, and accurate measurements at your fingertips.



Red Eye MP water-cut meter



Red Eye MP water-cut meter offshore installation

The Red Eye series of water-cut meters uses patented optical-sensor technology to provide real-time measurements across the full range of water cut (0 to 100 percent) in a production stream. This provides you with an easy and economical way to measure water cut, detect water breakthrough, provide a redundant water-cut measurement to multiphase meters, directly measure hydrate-inhibitor concentration, or trend water behavior in the reservoir. Applications range from traditional use on two-phase separators or custody-transfer lines to wellhead use in full three-phase (oil, water, and gas) flow streams. Red Eye meters can be used downstream of a two-phase separator, at an individual wellhead, or as part of a wet-gas or multiphase meter.

Red Eye sensor technology is based on near-infrared (NIR) absorption spectroscopy, which is unique in its insensitivity to salinity and its ability to handle free gas. By measuring key wavelengths in the NIR spectrum, these remarkably sensitive meters can easily distinguish water, methanol, and liquid hydrocarbon. The Red Eye 2G series is designed to work with process streams of up to 20 percent gas-volume fraction (GVF). The Red Eye MP series can handle GVF up to 99.9 percent. The Red Eye subsea series features the same GVF capabilities as the MP model, and it is protected by ruggedized and marinated hardware to accommodate stringent subsea requirements.



Red Eye subsea water-cut meter

Highly capable and versatile in a variety of challenging applications

Applications

- Well testing with the Red Eye meter on the liquid leg of a two-phase separator or on the oil leg of a three-phase separator
- Individual well monitoring with the Red Eye meter at the wellhead
- Group production monitoring with the Red Eye meter at the production header
- Truck loading and unloading with the Red Eye meter either on the tank discharge line or on the truck
- Multiphase metering with the Red Eye meter as part of a Weatherford Alpha VSR or VSRD multiphase meter

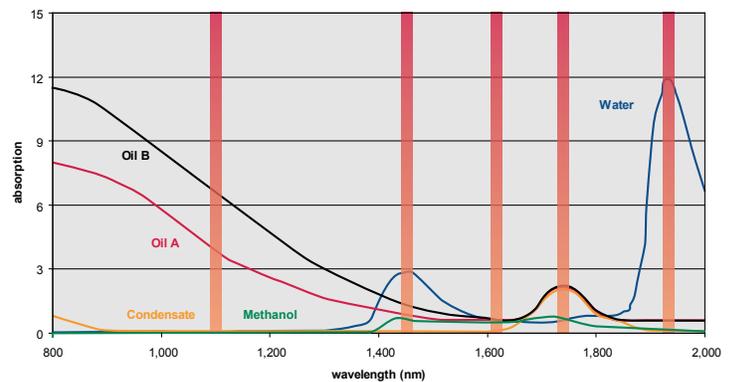
Features and benefits

- Near-infrared absorption technology provides unmatched water-cut accuracy that is unaffected by emulsions and insensitive to salinity.
- Robust, compact construction with insertion-style probe makes the unit easy to install, configure, and service.
- Low power draw provides cost-efficient operation.
- Ability to measure accurate water cut in high-gas streams (up to 99.9 percent GVF) delivers better performance in multiphase and wet-gas flows.
- Net-oil-computing capability enables well testing when using the Red Eye meter with a liquid flowmeter.
- Hot-tap models enable insertion and retraction in a flowing pipeline.
- MP models use liquid-weighted water-cut averaging to provide accurate measurement in slugging flows.

How it works

The measurement is based on NIR-absorption spectroscopy, in which water and oil have unique absorption profiles that make them easily distinguishable. Furthermore, since water absorption is based on the water molecule itself, there is no sensitivity to water chemistry, such as salinity.

In the Red Eye 2G model, four wavelength bands are measured simultaneously to deliver accurate readings. The MP model has a fifth wavelength band for added water sensitivity. These wavelength bands can be optimized for various applications.



Typical wavelength bands measured by a Red Eye meter



WATER-CUT RANGE

Real-time measurements across the full range of water cut

0 to 100%



GVF RANGE

Measure accurate water cut in high-gas streams

0 to 99.9%



ACCURACY

Measurement uncertainty as low as

±0.2%

Technology highlights

GVF effects: The Red Eye MP is the only device on the market that can measure water cut in high-gas streams (up to 99.9 percent GVF). As long as there is at least some liquid in the sensor slot, the meter can provide an accurate water-cut measurement. In high-GVF streams, the liquid tends to flow along the pipe wall in an annular flow regime, so the sensor gap can be positioned at the pipe wall to provide accurate liquid characterizations.

Emulsion and sand effects: The Red Eye water-cut meter is effective in wells with emulsions and/or sand. Although emulsions and sand cause scattering of the optical signal, the effect is equal at all wavelengths, so the meter simply nulls the scattering effect with no impact on water-cut measurement.

Water-salinity effects: Salinity levels have no effect on accuracy of measurements, because water absorption is based on the water molecule, not on dissolved salts.

H₂S and CO₂ effects: H₂S and CO₂ levels have no effect on measurement.

Crude-oil types: The meter works with all crude densities and types (heavy, medium, and light). The calibrations are robust and do not need to be repeated for modest changes in crude viscosity or specific gravity.

Performance

Flow Regime		Red Eye Performance	
GVF Range	Water-Cut Range	Water-Cut Uncertainty	Water-Cut Repeatability
0 to 5%	0 to 10%*	±0.2%*	±0.05%*
	0 to 100%	±1%	±0.1%
5 to 20%	0 to 10%*	±1%*	±0.1%*
	0 to 100%	±2%	±0.2%
20 to 98%	0 to 100%	±4%	±1%
98 to 99.9%		±10%	±3%

*For 2G "B" filter-set models and MP models

Notes:

Uncertainty numbers are absolute, not relative.

Resolution for all models is 0.01%.

Response time for all models is 1 second.

User-friendly configuration software

RedLine™ configuration software enables the user to configure communications, perform one-button fluid calibrations, and check system diagnostics from a PC.

Simple installation

The insertion-style design reduces installation costs, particularly in large lines. And to simplify field-wiring requirements, electronics are integrated within an enclosure mounted directly on the measurement probe.

Easy calibration

Calibration requires only a small 0.7-oz (20-ml) oil sample at atmospheric conditions. The operator simply puts the sample into the sensor gap and pushes one button to calibrate.



A variety of models to handle your most demanding applications.

Subsea model

Featuring the same precision-measurement capabilities as the Red Eye MP meter, the subsea model has ruggedized, protective housing and components to withstand the harsh subsea environment.

High-temperature model

Standard models have a maximum process temperature of 302°F (150°C). The high-temperature model has a maximum process temperature of 392°F (200°C), which is well suited for steam-flooding applications.

Low water-cut model (with “B” filter set)

Configuring the meter with the “B” optical filter set provides optimized accuracy at low water cuts ($\leq 10\%$).

Hot-tap model

The Red Eye hot-tap system enables insertion and retraction of a water-cut meter in a flowing pipeline. A complete hot-tap system consists of a Red Eye hot-tap meter, a packing spool, and an insertion-and-retraction (I&R) tool. The meter is a Red Eye 2G model with a special probe-shaft extension. The packing spool—which includes a pressure bleeder valve and internal packing material—is installed on a 2-in. (5.08-cm), full-port ball valve (not included) that has been installed beforehand on a flowing pipeline. The I&R tool is actuated using a manual hand crank.



Red Eye hot-tap system

Red Eye 2G and MP Specifications¹

Process connection	1-in. (2.54-cm) NPT Flanged [ANSI Class 600, 1500 or 2500; 1.5 in. (3.81 cm) or 2 in. (5.08 cm); RF or RTJ] Flanged hot tap [available in ANSI Class 600 and 900; 2-in. (5.08 cm); RF]
Wetted parts	Stainless steel 316/316L or Hastelloy® C276 (with sapphire windows)
Maximum process temperature	302°F (150°C) standard models 392°F (200°C) high-temperature models
Maximum working pressure	Equal to ANSI rating of flange (NPT models carry ANSI 600 rating)
Applicable process line size	Various probe lengths are available to suit practically any line size
Applicable crude-oil type	Various sensor-gap sizes are available to suit practically any crude-oil type
Erosion protection	Optional tungsten-carbide sleeve is available
Electronics housing	Aluminum or stainless steel
Power	24-Vdc nominal (10 to 30 Vdc), 8 W maximum
Communication	RS485 to Modbus® host (provides access to all parameters) 4 to 20 mA (water-cut output and well-selection input) RS232 and Bluetooth® ports (for diagnostic purposes)
Flowmeter input	Pulse (5-V TTL or 24-V) or analog (4- to 20-mA) input (Flowrate is passed through via a Modbus register)
Display	Two-line LCD (standard on 2G models) Two-line vacuum fluorescent display (optional on 2G models) Multiline graphics display with Bluetooth (standard on MP models)
Ambient temperature ²	-4 to +149°F (-20 to +65°C)
Hazardous area classifications and other certifications ^{2,3}	ATEX/IECEX Zone 1: II 2 G Ex d IIB T6, -20°C ≤ Ta ≤ +65°C, CE marked North American Class 1 Div 1 Groups C, D T6, -20°C ≤ Ta ≤ +65°C North American Class 1 Zone 1 Group IIB T6, -20°C ≤ Ta ≤ +65°C Canadian Registration (CRN): Alberta and Saskatchewan GOST-R explosion-proof and Certificate of Conformity Electromagnetic Compatibility (EMC) Ingress Protection: IP66 (NEMA 4) Single-Seal Device (per ISA 12.27.01)



Red Eye 2G water-cut meter

¹For specifications of the Red Eye subsea and hot-tap water-cut meters, please contact your Weatherford representative.

²Minimum ambient temperature (Ta) is -34°C for certain models.

³Not all models carry all certifications listed above. Contact your Weatherford representative for model-specific information.

With approximately 1,350 locations across the globe, Weatherford offers production-optimization solutions for all types of wells, in any reservoir, anywhere in the world. To find out more about our flow measurement tools or any of our production-optimization solutions, contact us at **PO-Info@weatherford.com** or visit **weatherford.com**.



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