Installation & Maintenance Instructions

SURE-CUT®
WATER CUT METERS

Hi / Lo

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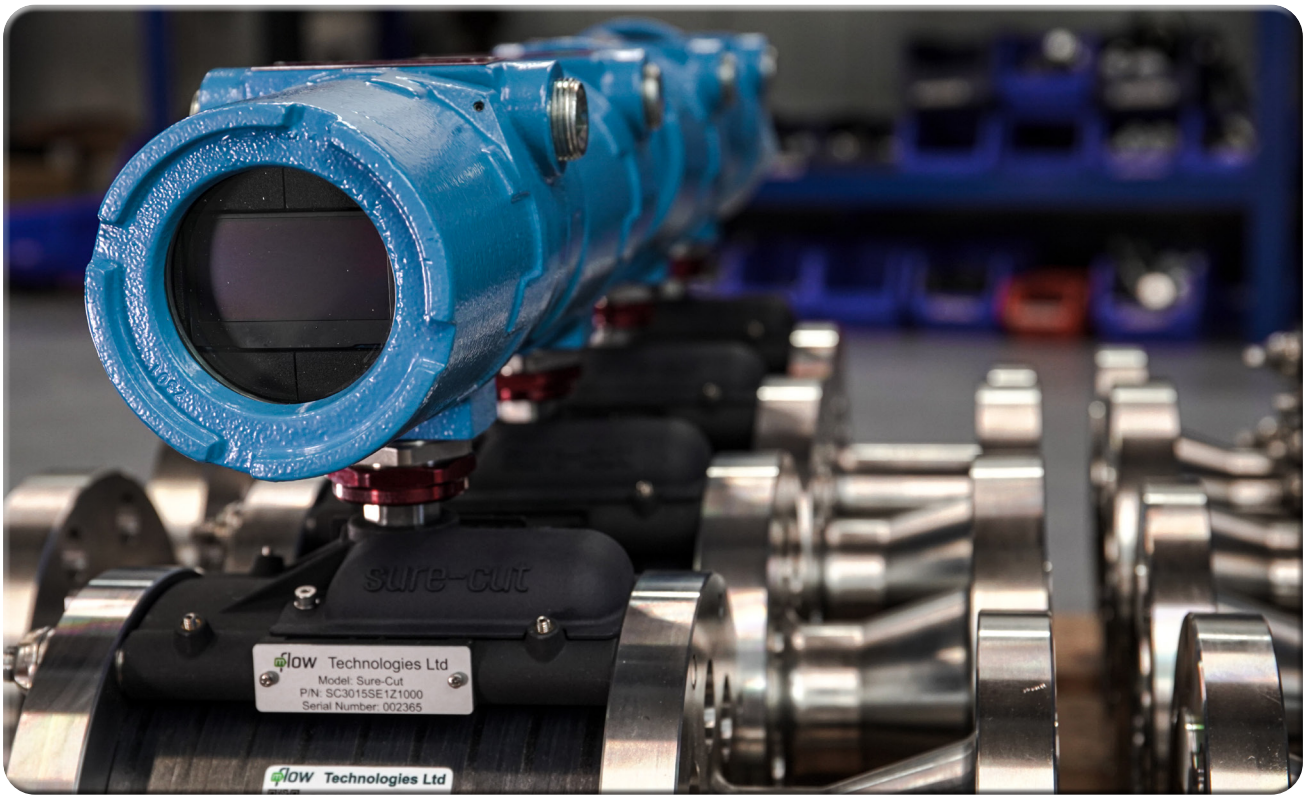
Sure-Cut® Water Cut Meters



Applications Guide

Sure-Cut®

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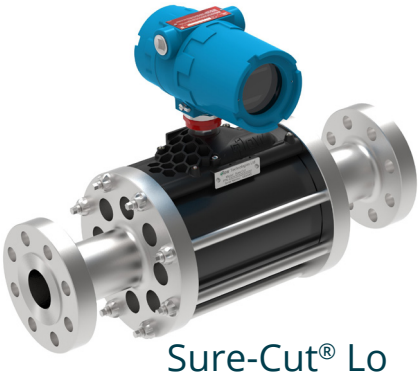
The M-Flow Sure-Cut® family of Water Cut measurement systems benefit from **digital microwave sensing** coupled with **enhanced composite materials** to provide a **full pipe cross sectional measurement**, without requirement for routine recalibration or maintenance.

Meanwhile, smart connectivity ensures **real-time analysis of process fluids, available 24/7**.



Sure-Cut® Lo

Sure-Cut® Hi

The Sure-Cut® family offers multiple microwave measurement solutions:

- Sure-Cut® Lo offering direct measurement of low water cut, oil continuous flows.
- Sure-Cut® Hi for high water cut water continuous flows.

They offer separate or integrated solutions covering part or all of the 0-100% range driven by application.

Application Overview

M-Flow Sure-Cut® meters are installed in a variety of applications where quality-critical measurement of light and heavy oils, condensates and water is required.

Upstream
- Exploration
- Field Development
- Production Operations

Midstream
- Transportation
- Processing
- Storage & Distribution

Downstream
- Refining
- Wholesale & Marketing
- Distribution

Applications
- Separator outlet
- Custody transfer
- Sampling systems
- Pipeline
- Disposal well
- Marine Flaring Governance

Applications
- LACT / Custody Transfer
- Heater treater
- Tanker loading
- Disposal well
- Pipeline

Applications
- Process monitoring
- Refined product loading - rail, truck, marine
- Pipeline

Ranges

Sure-Cut Lo Standard Measurement Range

Measurement Range

0% | Inversion Point | 100%

All Sure-Cut Lo devices measure across the full oil continuous range, offering very high accuracy for custody transfer applications and process monitoring. Optimal accuracy is obtained with an external feed of temperature and line density data.

Sure-Cut Lo Extended Measurement Range

Measurement Range | Extended Measurement Range

0% | Inversion Point | 100%

Standard measurement range is also extended beyond inversion point when used with density and temperature inputs (using our Boss-Cut algorithm) to determine water cut of process slugs to 100%.

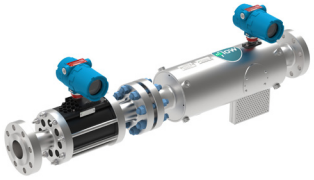
Sure-Cut Hi Measurement Range

Measurement Range

0% | Inversion Point | 100%

High measurement range is available for oil in water applications anywhere in the process train. Direct measurement gives functionality in heavy and viscous oils as well as moderate gas break out.

Sure-Cut Full Measurement Range



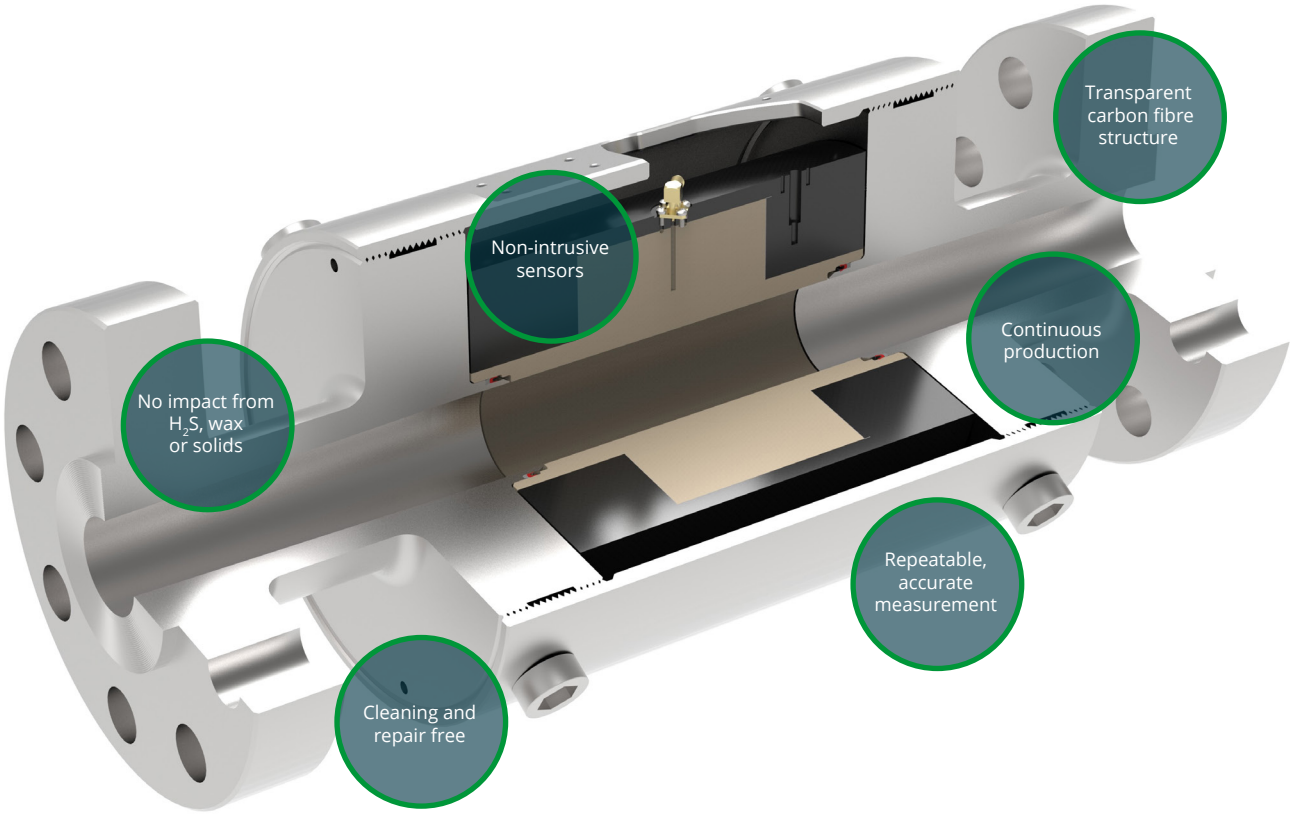
Measurement Range | Measurement Range

0% | Inversion Point | 100%

By combining Sure-Cut Lo and Sure-Cut Hi capability, direct microwave measurement from 0-100% is available in a single instrument.

Sure-Cut® Features and Benefits

Features	Benefits
Microwave measurement	High accuracy
Composite Carbon Fiber Pipe with non wetted sensors and non-intrusive measurement	No coating or damage to sensing components by harsh, waxy or sour fluids means zero maintenance and recalibration
Full pipe measurement of process stream	Full cross-sectional evaluation of water cut, not point or partial section probe localized measurement
Graphical user interface for set-up, data download, calibration and diagnostics	Easy, intuitive set-up and monitoring at site with limited training
Local Display	At a glance data and status information
Digital Output	Seamless integration into Flow Computer DCS, smart diagnostics
Wired or Wireless connectivity	Mobile worker connectivity



High Performance Composite Construction

M-Flow's unique pipe design utilises a composite carbon fibre / PEEK construction.

The PEEK polymer core allows the transmission of microwave energy through the pipe walls, enabling sensors to be embedded in the carbon fibre wrap around the core, not in the pipe itself. This delivers:

- Complete Pipe integrity / no penetrations
- No contact with fluids / non-wetted sensors
- No damage or fouling of sensors, meaning no cleaning or repair
- No calibration drift driven by sensor surface changes from erosion or corrosion.

Additional benefits include:

- Eliminates the need for ongoing field calibration
- Minimised field maintenance
- Confidence that the measurement system is stable and repeatable, providing continual accuracy and measurement confidence.

Measurement Technology

M-Flow Sure-Cut® systems use microwave technology to measure the electrical permittivity of the oil and water mix flowing through them.

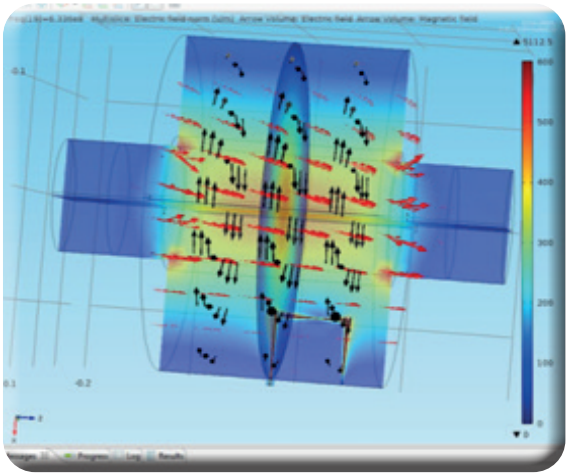
Microwave measurement is recognised as the highest accuracy method of water cut measurement. It is a direct measure, and the higher frequency (compared to capacitance or conductance) offers high resolution with predictable variation to standard process parameters such as oil density, pressure and temperature.

Full Bore Continuous Measurements vs Spot Measurement

Embedding the sensors outside the pipe allows Sure-Cut® to measure the entire flow, unlike most probe water cut meters which only measure the flow next to the probe itself.

This means the Sure-Cut®

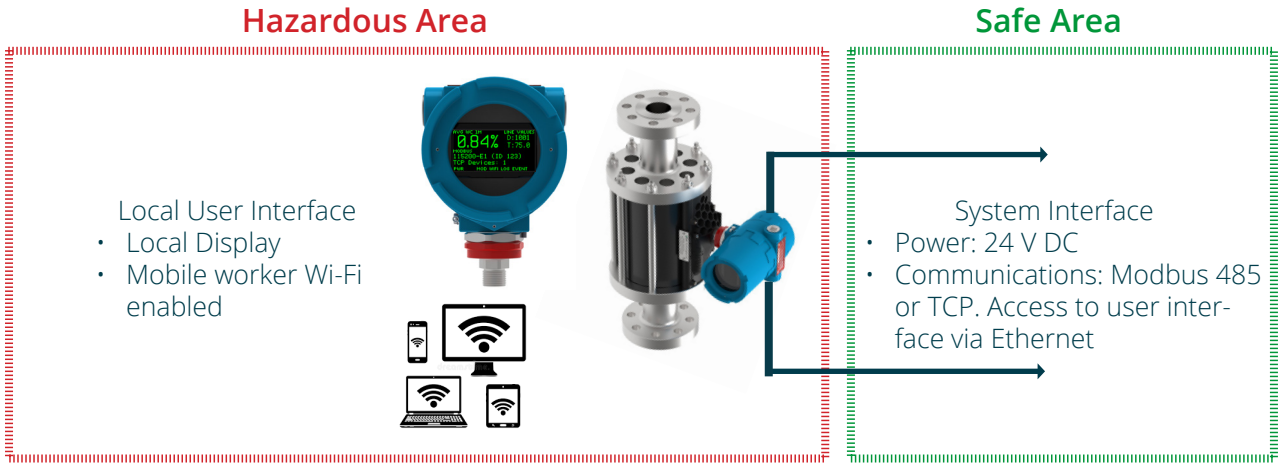
- Increases the measurement sample size, improving accuracy
- Does not need a highly mixed flow to measure accurately, giving a broader operating envelope



Sure-Cut® Installation Requirements

Sure-Cut® has basic installation requirements. The flow is required to be reasonably mixed to ensure no stratified separation of oil and water. No fixed upstream or downstream piping lengths are required, and it can be close coupled with other instrumentation such as Coriolis meters.

In the correct circumstances, Sure-Cut® can be installed horizontally or vertically. Typically, mixing requires velocities over 1 m/s. Around or below this velocity, M-Flow would recommend vertical installation to ensure mixing. Alternatives of static mixers or blind-Ts may also be considered for difficult flow.



Meter set-up and calibration

Sure-Cut® is delivered with a standard Factory Calibration unless otherwise requested. A static calibration using known hydrocarbon is carried out as part of the factory acceptance test.

An in-situ in-line calibration can be periodically carried out comparing the meter to a representative sample taken from the process fluid.

Screening and sizing require typical process information:

- Minimum and maximum water cut
- Minimum and maximum flow rates
- Oil and water density ranges
- Nature of flow (e.g. generally low/high water cut, evolution of time / typical high/low regime with water / oil slugging
- Potential presence of small amounts of gas
- Design pressure and temperature
- Operating pressure and temperature

Technical Specification information can be found in the individual Sales Brochures for Sure-Cut® Hi and Sure-Cut® Lo.

Please contact your sales representative or email info@m-flow-tech.com if you would like a copy of these.

For more information: www.m-flow-tech.com

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