

▶ Gain control of your
fuel consumption



KROHNE
Marine

EcoMATE®

Product overview | Systems for monitoring
of fuel consumption and bunkering





KROHNE Marine

Welcome to KROHNE Marine. Through more than 50 years in marine business, we have gained extensive knowledge regarding what it takes to deliver high quality products to demanding ship operators and yards. Systems have been installed on all kinds of vessels, from the smallest product tankers to the most complex chemical tankers and VLCCs.

We offer a wide variety of solutions and instruments for monitoring liquids onboard ships. Different instruments and measurement techniques may be combined in one system to obtain the highest versatility and redundancy.

We are the Marine Centre within the KROHNE Group, taking care of all business related to ship systems and solutions.

Ever since KROHNE were established in 1921, the name KROHNE has stood for innovation and reliability. It ranks among the world's leading companies involved in the development and production of innovative and reliable process measuring technology, providing solutions for all sectors around the globe.

KROHNE has unique expertise when it comes to flow measurement and hold over 1.000 patents relating to flow products. The product range covers a wide variety of flow measurement technologies. In 1952 the first electromagnetic flowmeter for industrial measurement was developed. In 1987 the first single tube mass flow meter was developed and in 1994 the first straight tube Coriolis meter hit the market, introduced by KROHNE.

▶ Payback through reliable and accurate measurements

Dependable measurements can give potential for significant savings in fuel consumption. Additional parameters such as measurement errors, leakage, pressure loss and maintenance should also be taken into consideration to achieve increased efficiency.

Gain control of your fuel consumption

The EcoMATE® system is offering reliability in measurement accuracy, as well as maintenance free operation during a long life onboard. Software provides easy-to-understand monitoring and automated reporting functions.

EcoMATE® is your reliable everyday tool for fuel consumption and bunkering monitoring.



 **EcoMATE®**

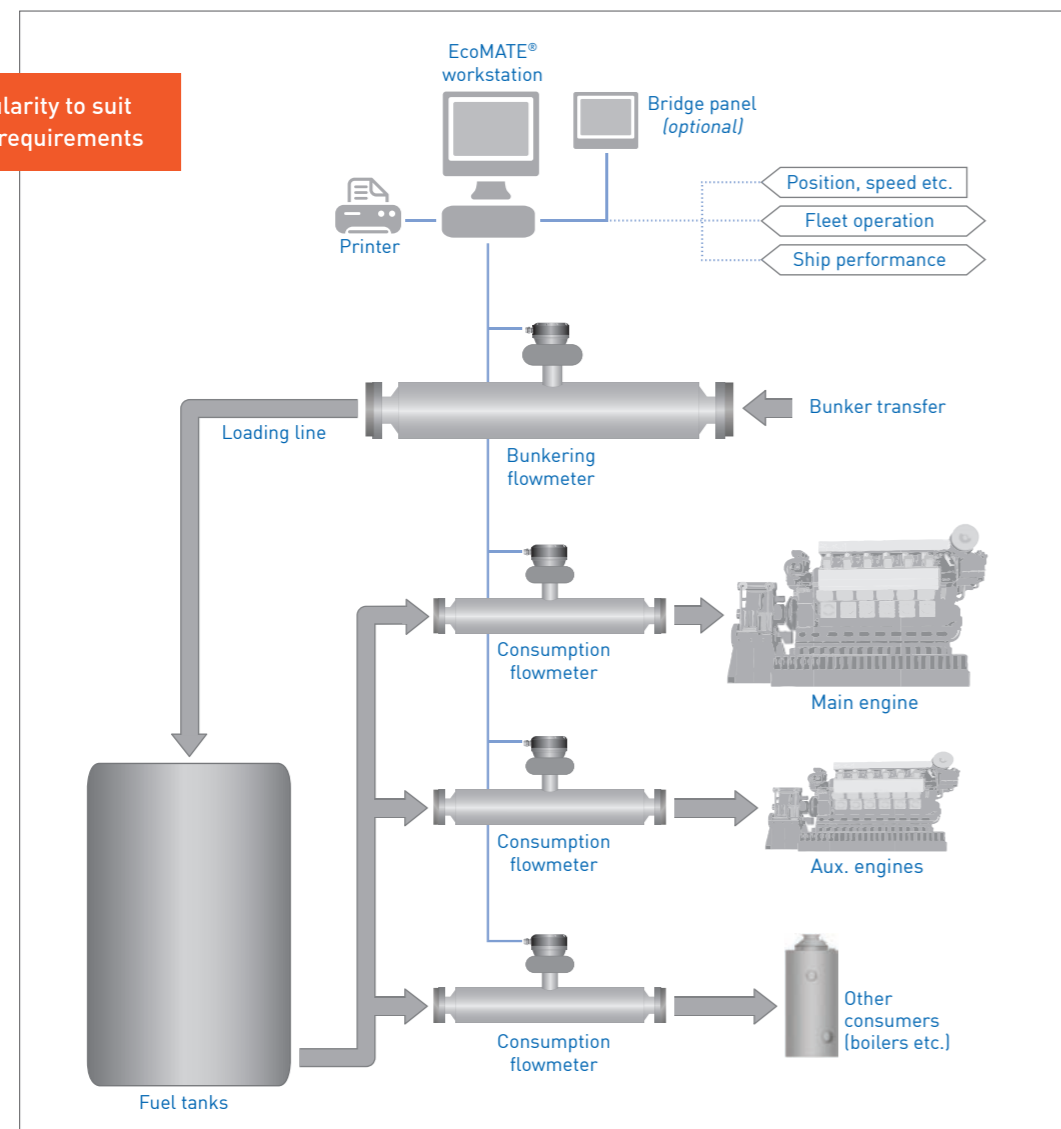
What can the EcoMATE® system do for you?

An EcoMATE® system can be set up for monitoring of fuel consumption and/or bunkering onboard ships. Based on our robust and accurate flowmeters we can offer:

- **Fuel consumption monitoring**
Monitoring and reporting of fuel consumption measured in the supply (and return) line to main engine and other consumers onboard
- **Bunkering verification**
Monitoring and reporting of bunker quantities received, measured in loading line

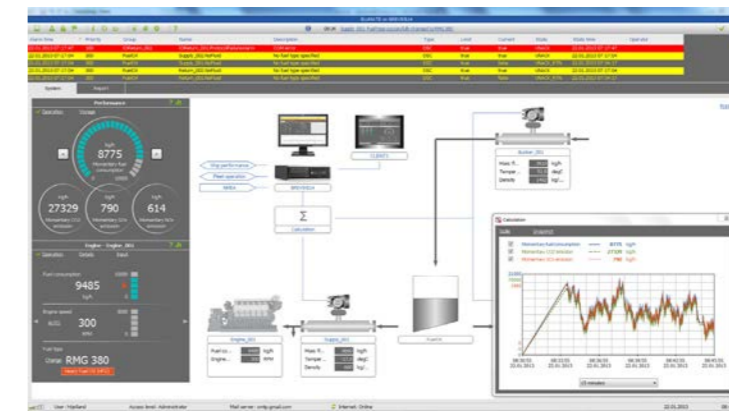
A basic setup will consist of one or several flowmeters, mounted inline with the fuel supply line or bunkering line. KROHNE offers superior straight and bent tube design mass flowmeters in all sizes. The EcoMATE® software will take care of data acquisition, logging, calculations, monitoring and reporting.

Intelligent modularity to suit needs and fulfil requirements



EcoMATE® software

The EcoMATE® software provides easy to understand monitoring and reporting of consumption of fuel and bunker received. All relevant data is logged and stored in the system database. At any time, the operator may view trends or print data in pre-defined reports. Reports can be exported as data files or emails transmitted to an office on shore.



The EcoMATE® software offers good visualisation and control of the process

Reporting module

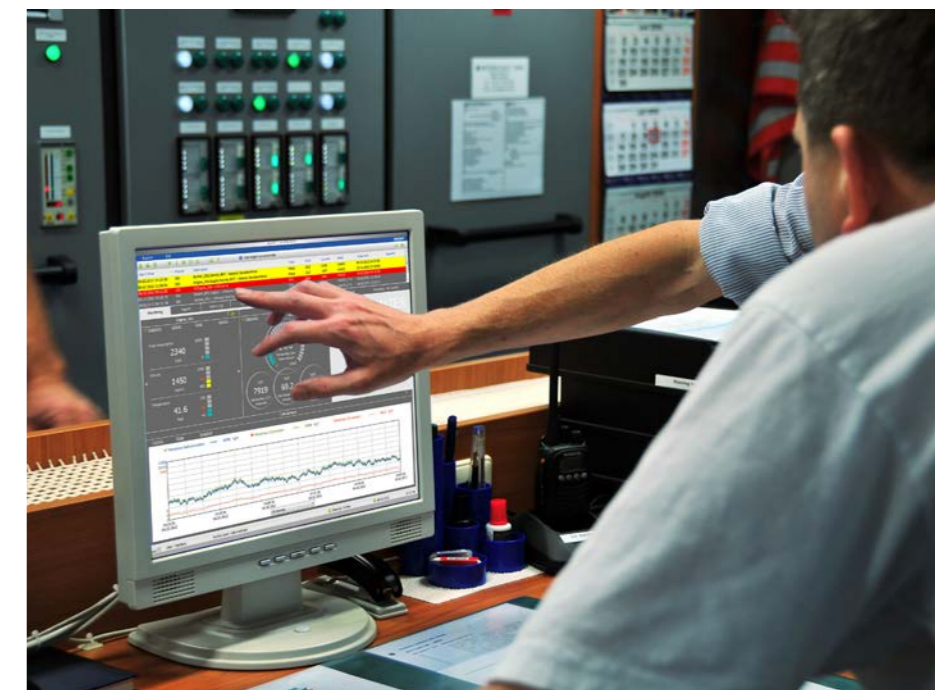
User configurable reports for fuel consumption and bunkering

Distribution:

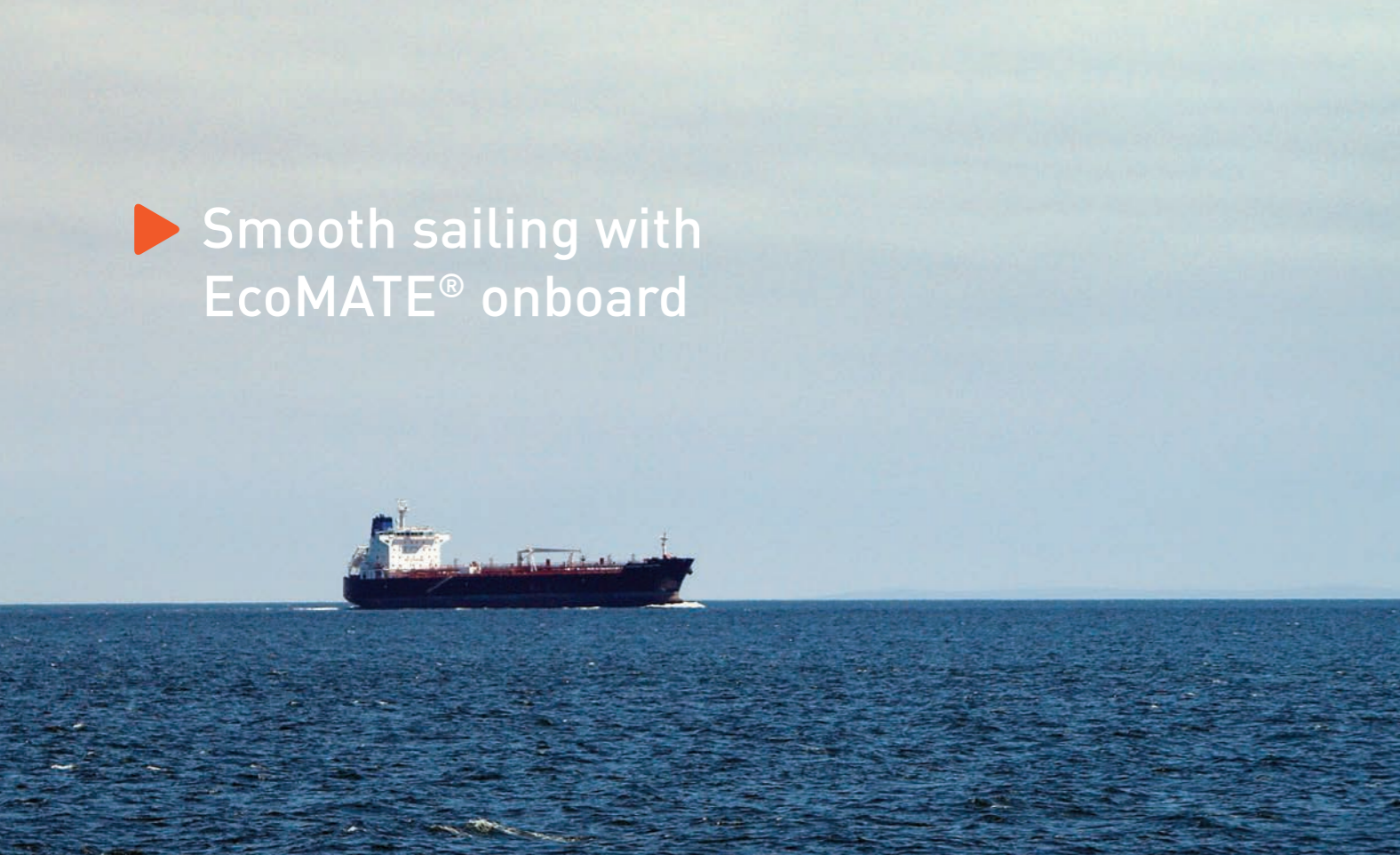
- Print on paper
- Via email
- To external systems via Modbus
- Full remote access from shore via IP-protocol

EcoMATE® and integration

An EcoMATE® system is module based and offer a high degree of customization to meet a wide variety of requirements and needs. It may for example be set up to communicate with an onboard performance monitoring system or a fleet reporting system on shore, to be part of the total performance monitoring of the fleet. Reports may be programmed to fit existing standards.



▶ Smooth sailing with EcoMATE® onboard

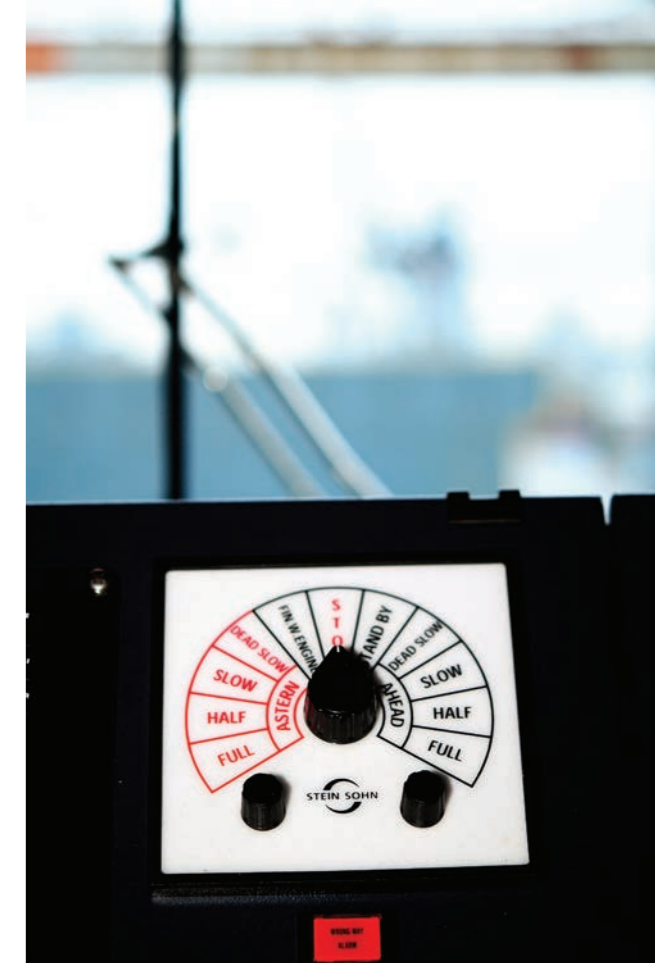


Fuel consumption monitoring at a glance

- Monitoring of momentary fuel consumption
- Monitoring of momentary fuel consumption pr. distance, longitudinal water speed
- Momentary CO2 and SOx emissions
- Accumulated total fuel consumption and emissions for current voyage

Shift-over detection:

The OPTIMASS flowmeters will automatically measure and report a change in liquid density and temperature. This may be used for documenting a shift-over from HFO (sulphuric) to MDO/MGO.



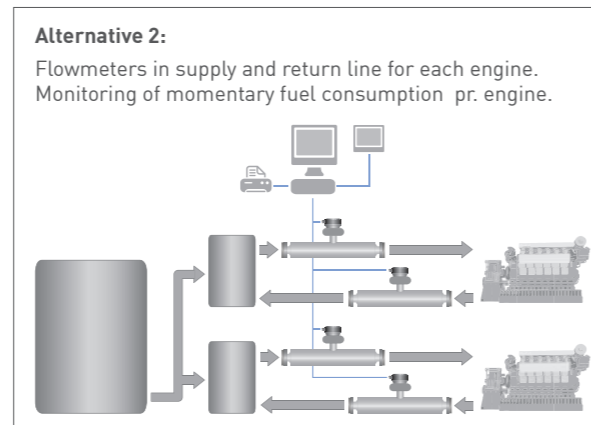
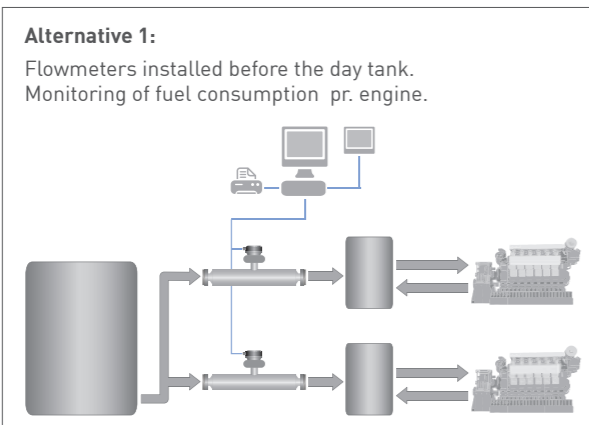
EcoMATE® - Fuel consumption monitoring

Accurate measurements and monitoring of your fuel consumption is crucial to obtain full control over the use of your fuel. The EcoMATE® system monitors and stores detailed information about fuel usage and generates reports that allow you to see the real detailed picture.

By benchmarking consumption between ships, optimizing will be on everybody's agenda. Benchmarking based on emissions may also be part of the future for charterers choosing shipping companies. The EcoMATE® is designed to fulfil coming requirements from IMO or other authorities.

System layout

Depending on fuel system, flow meters may be placed in various ways for optimal measuring conditions.



OPTIMASS 1000 - Mass flowmeter for measurement of fuel consumption

- Temperature range: -40°C to +142°C
- High accuracy: 0.2% of actual flow
- Twin straight measuring tubes with optimised flow divider for minimum pressure loss
- Fully welded maintenance free measuring tubes with no moving parts



OPTIMASS 1000

OPTIMASS 6000 - The high end option for demanding operations

- Temperature range: -200°C to +400°C
- High accuracy: 0.1% of actual flow, accurate even at very low flow
- Twin V-tube design with optimised flow divider for minimum pressure loss
- Fully welded maintenance free measuring tubes with no moving parts



OPTIMASS 6000

▶ Quantity and quality is always under control



Bunkering verification at a glance

- Verification of total amount (mass) and density of bunker received through the bunker line
- Trend for mass flow, density and temperature
- Density deviation alarm

Warning messages:

The system can generate warnings and alarms when a certain proportion of gas bubbles is exceeded.



EcoMATE® - Bunkering verification

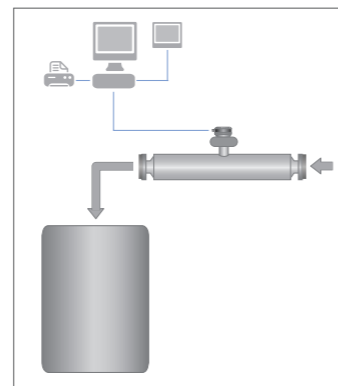
Fuel oil costs represent the biggest share of a vessel's total operating cost. To verify the amount of fuel oil delivered during a bunkering operation, you need accurate and reliable measurements.

The EcoMATE® system measures the flow in your bunkering line. During the bunkering process trend graphs gives you a good overview of all values. Reports showing total bunker quantities received can be printed and emailed to a shore station.

Bunker quantities measured by volume are dependent on temperature, density and possible contents of air. The EcoMATE® system utilizes Coriolis mass flowmeters which offers continuous monitoring of mass flow rate, density and temperature throughout the entire bunkering operation. Measuring mass directly secures high accuracy and a more efficient bunkering process.

System layout

A basic EcoMATE® bunkering verification system will consist of a flowmeter mounted in the bunkering line linked to an EcoMATE® workstation, usually located in the control room. On the EcoMATE® monitor, operators may follow the exact amount of fuel oil taken onboard. Reports confirming the total quantity of fuel oil received and verification of density can be printed out. Linked to the bunkering mass flowmeter, the EcoMATE® software takes care of data acquisition, logging, calculations and monitoring. All relevant data is logged and stored in the system database.



OPTIMASS 2000 - The first choice for verifying bunkering operations

- Direct measurement of fuel mass flow, density and temperature
- High accuracy: 0.1% of actual flow
- Easy installation - patented straight tube designed flowmeter
- Maintenance free, fully welded measuring tubes with no moving parts
- Twin straight measuring tubes with optimised flow splitter for minimum pressure loss
- Bi-directional flow measurement - same instrument can be used for loading and delivery
- Multiproduct capabilities - measurement of residual and heavy fuel oil in the same pipe
- Measuring Instruments directive (MID) 2004/22/EC Certificate available



Patented straight tube design

OPTIMASS 2000

Highlights OPTIMASS flowmeters

- One flowmeter allows multiple measured values: mass flow - density - temperature
- The mass of a product does not change with pressure, temperature or viscosity
- The measurement is not affected by flow profile - no requirement for straight inlet/outlet sections
- High accuracy
- Fully welded maintenance free measuring tubes in stainless steel

OPTIMASS Coriolis mass flowmeters

Coriolis mass flowmeters have significant advantages over other flow measurement methods as they directly measure mass flow, liquid density and process temperature independently of each other. Mass flow and density combine to calculate volume flow if required.

Just how accurate and reliable a mass flowmeter actually is becomes obvious when constant parameters undergo sudden changes. The OPTIMASS series from KROHNE sets the standard. The OPTIMASS picks up the flow quickly and accurately even with quick changes in the medium, such as temperature shifts or density jumps.

All our flowmeters are designed using open tube measuring principles, with no moving parts or internal obstructions. This ensures almost no maintenance at all during the complete lifecycle of the instrument. In addition, pressure loss over the instrument is minimal. Our flowmeters will provide reliable readings and potentially save maintenance costs.

Calibration at KROHNE

Every flowmeter that leaves one of our factories is thoroughly tested and wet calibrated beforehand. The accuracy of the KROHNE calibration stations is generally 10 times better than that of the flowmeters to be tested and they are fully certified and traceable to international standards. For our customers, this not only means a maximum degree of certainty, but also guarantees the accuracy of all flowmeters under reference conditions.



KROHNE has continuously invested significantly in new technologies, facilities, human resources and quality procedures. Calibration is carried out on the world's most accurate calibration systems.



OPTIMASS 1000
Standard device with an excellent price-performance ratio



OPTIMASS 6000
High end option for high temperature operations



OPTIMASS 2000
First choice for bulk flows

Converters

Compatible with the complete range of OPTIMASS flowmeters, our converters offer high performance with air entrainment, excellent zero stability and advanced density measurement.



MFC 010 C
Compact version (modbus output signal) mounted on the flow sensor

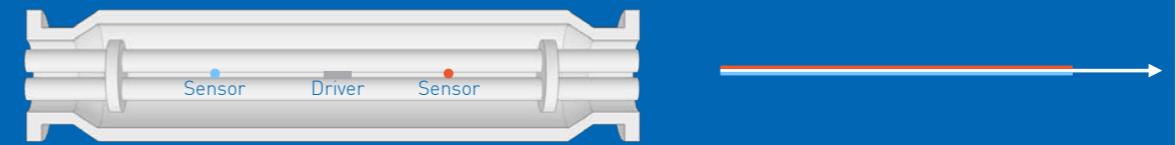


MFC 300/400 F
For mounting in non-controllable environments (IP66/67)

Coriolis measuring principle

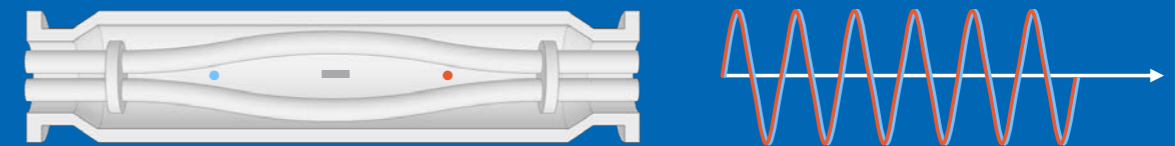
The function of mass flowmeters is based on the Coriolis principle. The mass flow rate of liquids and gases can be calculated from the deformation of the measuring tube caused by the flow. The media density can also be derived from the resonance frequency of the oscillating tube.

Flowmeter with no vibration and no flow



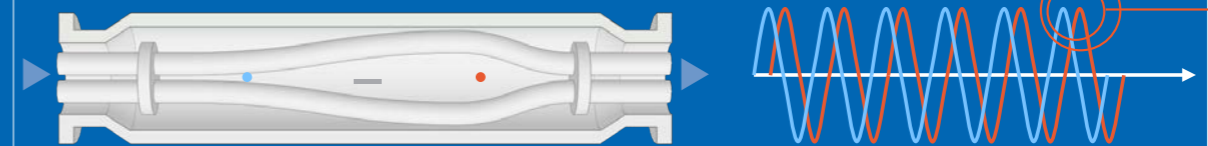
A Coriolis twin tube mass flowmeter consists of two measuring tubes, a driver and two sensors that are positioned either side of the driver.

Flowmeter with vibration but no flow



When the meter is energised, the driver vibrates the measuring tubes causing them to oscillate and produce a sine wave. The sine wave is monitored by the two sensors.

Flowmeter with vibration and flow



When a fluid or gas passes through the tubes, the Coriolis effect causes a phase shift in the sine wave that is detected by the two sensors. This phase shift is directly proportional to the mass flow.

As flow rate increases, time shift increases



The Coriolis mass flowmeter is a bi-directional instrument



▶ KROHNE Marine's world wide network of support



For more information and offers/quotes,
do not hesitate to contact us

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Service Stations and Sales Agents

The current list of all KROHNE Marine Service Stations and Sales Agents can be found at: www.krohne-marine.com



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