

CARGOMASTER®

Onboard tank monitoring and
valve remote control system



KROHNE
Marine

- Proven system, compliant with relevant marine regulations
- System software and instrumentation adapted to individual vessel applications
- Complete solution from engineering and documentation to on-site commissioning
- Flexible integration into other systems and online remote service





KROHNE Marine – The Marine centre of excellence

Many marine companies around the world chose to work with KROHNE Marine due to its **extensive references**, providing certified products, measurement solutions and services since 1957.

Through long-term and close partnerships with our customers we have gained comprehensive knowledge, allowing us to deliver high quality products and solutions to ship owners, managers and yards. Our systems are installed in all kinds of vessels, from inland to largest seagoing ships.

KROHNE Marine based in Norway, Brevik is certified ISO 9001 and ISO 14001, committing to quality and environmental policy requirements.

We offer a **wide range** of intelligent solutions and instrumentations for monitoring liquids on-board, including CARGOMASTER® – your reliable everyday tool for liquid cargo handling.

CARGOMASTER® – Onboard tank monitoring and valve remote control system

Operators of marine vessels depend on reliable and accurate data transmission and alarms from tank monitoring systems on board to maintain ship stability and safety. Malfunctions in cargo handling systems can result in costly delays and bring operations to a halt if redundancies are not available.

With CARGOMASTER®, KROHNE Marine has developed an integrated solution for these tasks: an onboard tank monitoring and valve remote control system. It provides readings from all tanks and offers valve control in a user-friendly graphical interface.

Combined with our high precision OPTIWAVE Marine cargo radar (FMCW) level transmitters and pressure sensors, CARGOMASTER® offers unique benefits for tanker operators. In addition to tank monitoring, the system enables the monitoring of pumps and cargo lines as well as integration with other systems onboard.

Highlights:

- 60 days logging of critical data and spectrum recording during operations
- Advanced remote capabilities
- Intuitive and user-friendly interface
- Multiple configurations possible for redundancy and distribution of information
- Easily interfaced to ship automation systems, vessel management systems, loading calculators etc.
- Valve and pump management control systems for integrated liquid cargo and ballast handling
- Extensive reporting functions

Alarm

- Level
- Independent level
- Temperature
- Pressure
- System failure

Reports

- Loading
- Discharge
- System
- Service



Cargo handling

- Ullage/level
- Volume
- Loading/discharging rate
- Weight and cargo density
- Inert gas pressure
- Tank temperature
- Cargo manifold pressure
- Draft, trim and list
- Valve control

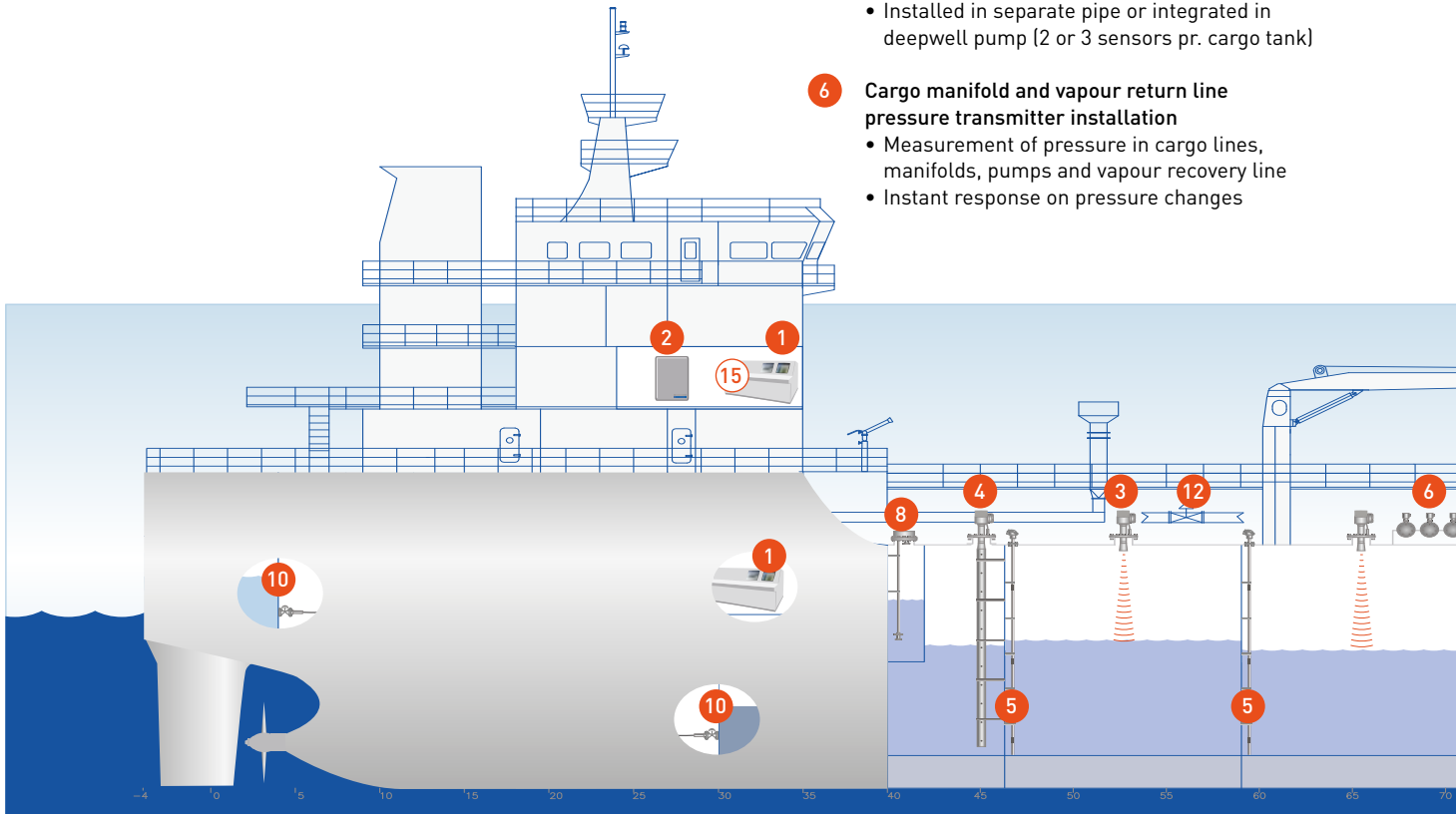
Service

- Remote
- Commissioning
- Attendance/Docking
- Radar/Sensor

CARGOMASTER® – The complete solution

- 1 CARGOMASTER® Computer Unit (CCU)**
 - Workstation with CARGOMASTER® monitoring and alarm software
 - For redundancy, the system may be set up in multiple configurations
- 2 CARGOMASTER® Signal Control Unit (SCU)**
 - Main cabinet with electronics for handling all sensor signals and communication to other systems

- 3 Cargo radar level transmitter installation**
 - Measurement of cargo ullage/level
 - Inert gas pressure (IGP) transmitter mounted on radar flange
- 4 Stillwell installation with cargo radar level transmitter**
 - Measurement of level in narrow tanks
- 5 Cargo temperature transmitter installation**
 - Measures average cargo temperature and cargo temperature from individual transmitters
 - Installed in separate pipe or integrated in deepwell pump (2 or 3 sensors pr. cargo tank)
- 6 Cargo manifold and vapour return line pressure transmitter installation**
 - Measurement of pressure in cargo lines, manifolds, pumps and vapour recovery line
 - Instant response on pressure changes

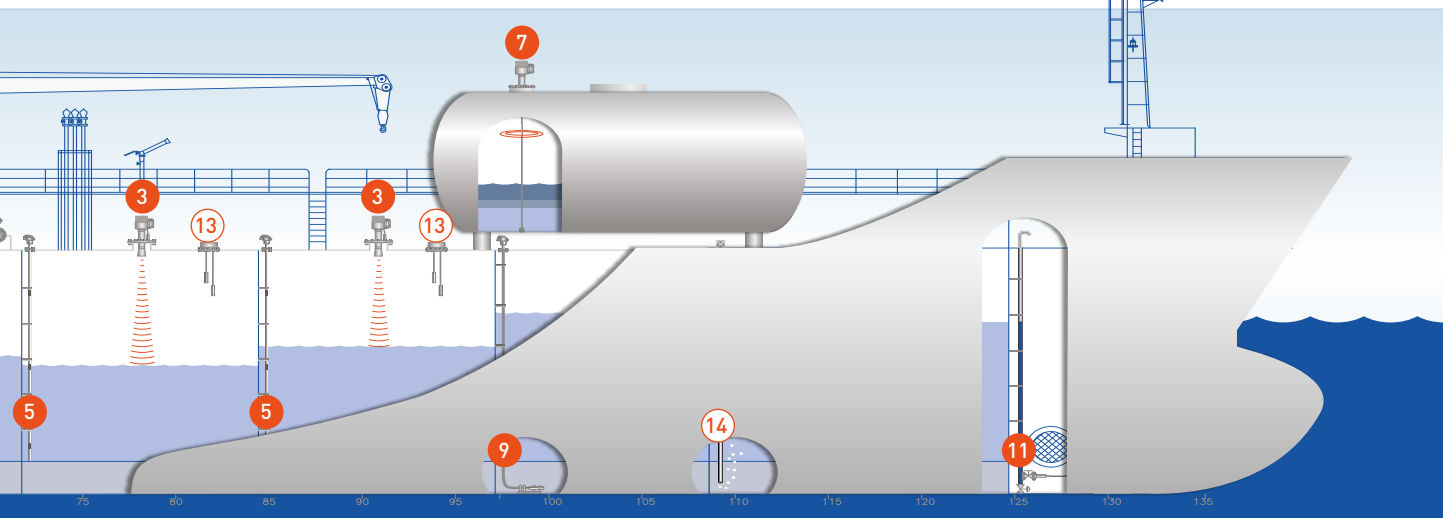


- 7 Guided radar level transmitter installation**
 - Alternative to cargo radar level transmitter for measurement of level in tanks with challenging radar wave reflection (e.g. slop, residual and LPG)
 - Measurement of oil/water interface
- 8 Pressure transmitter installation**
 - Measurement of cargo tank level, IGP and temperature
 - Robust and accurate pressure transmitters with integrated temperature transmitters
 - Inert gas pressure (IGP) transmitter mounted in deck junction box
- 9 Submerged pressure transmitter installation**
 - Measurement of level in ballast tanks
 - Transmitter clamped to bracket close to tank bottom

- 10 Sidemounted pressure transmitter installation**
 - Measurement of level in ballast, fuel, freshwater and similar tanks
 - Sensor mounted outside the tank, optionally with isolation valve
- 11 Draught pressure transmitter installation**
 - For draught, trim and list measurement
 - Sensor mounted on draught valve, with isolation valve

Sub systems:

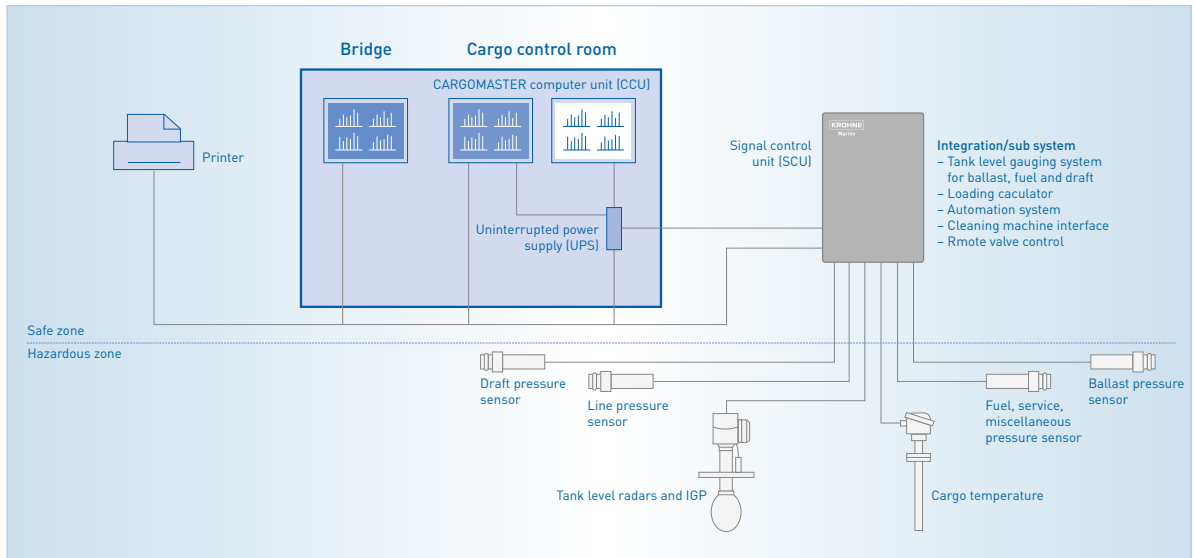
- 12 Independent high level system**
 - For overfill (98%) and high level (95%) alarm
 - Magnetic float or solid state based
- 13 Air purge ballast system**
 - Alternative system for measurement of ballast, fuel and draught levels
- 14 Loading calculator**



Quick adaptation to individual system needs

Based on over 60 years of experience in the marine industry we can tailor each CARGOMASTER® to specific vessel types and operational challenges, integrating separate systems into a unified solution to ease day-to-day performance and long-term asset management.

The layout of each CARGOMASTER® system varies depending upon the application and vessel. The cargo monitoring system is scalable and can be tailored to individual operational needs.



Example of system layout that utilises numerous available CARGOMASTER® options



Intelligent tank monitoring software – Streamline your operations on standard marine computers

Ease of maintenance

Designed to be easily maintained. Configuration options for the tank overview screen include a plethora of reporting functions that can be selected manually or automatically. In addition we have VDR output options, as well as trending and historical data for analysis. We also have advanced remote capabilities such as valve and pump control, mimic option, radar access, spectrum analysis, and recording that can be done while operations are running. Remote access to the empty tank spectrum, parameterizing, and other tank level radar configurations is also available.

Fully remote services

The system is based on Microsoft Windows, as an operator friendly service. This enables the crew to perform service and maintenance themselves, with our service engineers available online for quick and easy assistance. Minimise operation costs and downtime in remote areas by utilizing our online diagnostic support through system status and analysis.

User friendly Interface

Flexible and simple to use, conveniently configure cargo groups, other tanks, and various views thanks to an easy integration with other ship systems, a modern design and customizable layouts. View historical inert gas, pressure, temperature, ullage, and draft data logging. Furthermore, alarms will notify the operator automatically in the event of an unforeseen event. There are several configurations available for full redundancy and information distribution, as well as automatic backup to external USB.



Ballast tank view



Cargo tank view

Superior instrumentation – KROHNE transmitters for level and pressure measurement

OPTIWAVE-M Series – Marine cargo radar (FMCW) level transmitters

The OPTIWAVE-M cargo radar level transmitters is a highly accurate and reliable instrument for measuring the ullage/level. With its heavy duty stainless steel housing, it is designed to withstand the roughest conditions on deck. It also has a backup display for redundant indication.

State of the art technology

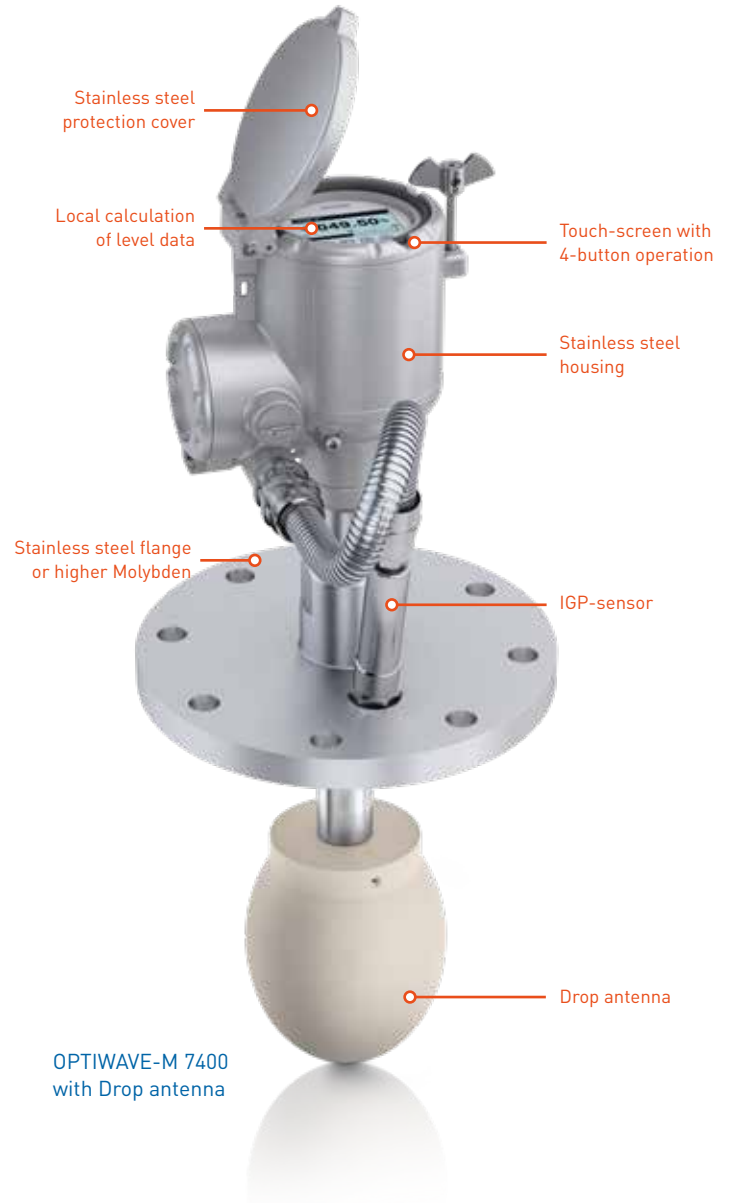
The OPTIWAVE-M series utilises the proven 24 GHz radar technology in the marine sector. It provides an excellent signal-to-noise-ratio, securing the radar's ability to see actual tank contents under the most difficult conditions.

The antenna design of the OPTIWAVE-M series minimises the effect of fog, foam, movements, sloshing, disturbances and low reflection, giving you the accurate ullage even under the worst conditions.

The 80 GHz ultra narrow beam version completes the portfolio for special requirements.

Joint development

The OPTIWAVE-M series was developed in collaboration with KROHNE's radar research and development expert centers in Germany and France as a highly modern and cost-effective radar level transmitter series on the market. Incorporating operational benefits, time, and money into daily routines.



Bring ease to your daily work

OPTIWAVE-M 7400 is unique when it comes to redundant indication, closed tank cleaning and closed tank service. With these three operational benefits, the level transmitter will save operational costs.



Redundant ullage display for tank monitoring

Even when a central component in the monitoring system fails, ullage will be obtainable on the OPTIWAVE-M 7400 display on deck. The level transmitter calculates and displays all level data locally before transmitting to CCR.



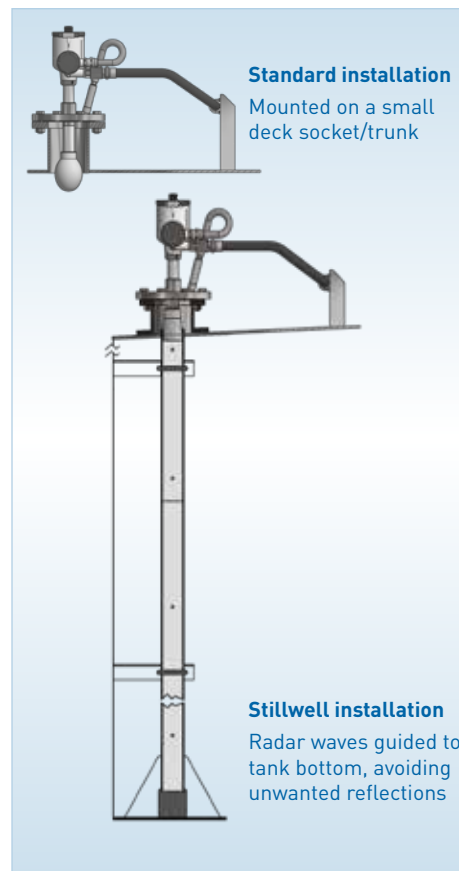
Easy and thorough cleaning of the antenna

The antenna on the OPTIWAVE-M 7400 is easily cleaned by tank cleaning machines using the antenna cleaning nozzle. The cleaning connection is protected by a ball valve, enabling effective cleaning inside the antenna. Tanks can be kept closed during cleaning, saving time, effort and protecting the ship's crew from cargo vapours.



Radar head replacement without external support

The radar head can be replaced without opening the tank to protect against escaping vapours. Replacement can be performed at any time, even during cargo operations.



Pressure transmitters for tank level monitoring of liquids on ships

KROHNE Marine has been perfecting transmitter technology in collaboration with our transmitter manufacturers for over 40 years. All our transmitters are carefully tested to withstand demanding environments onboard ships.



P-130 Titanium
pressure transmitter

Tank level monitoring

The P-130 has successfully been installed in various tanks. Made in high grade Titanium, it is highly resistive to corrosive warm ballast water. The P-130 offers high repeatability, providing good level readings in the long run. We offer various installation methods, allowing the sensor to be installed in a variety of liquids except acids and corrosive chemicals.

Typical marine applications:

- Measurement of level in various tanks (e.g. ballast, FW, fuel, lub oil and sludge)
- Draught measurement








P-140 cargo manifold and
pump pressure transmitter

Manifold and pump pressure monitoring

The P-140 has a robust design suitable for deck mounting. Mounted on cargo lines, the sensor will monitor pressure during cargo operations. The sensor installation is designed for easy maintenance.

Typical marine applications:

- Cargo lines, manifolds and pump pressure
- Vapour recovery line pressure

	Radar (FMCW) level transmitters for liquids and solids			Pressure transmitters for liquids and vapours	
	OPTIWAVE-M 7400	OPTIWAVE-M 7400	OPTIWAVE-M 7500	P-130	P-140
					
	Horn antenna: Suitable for small/medium tankers with closed cleaning	Drop antenna: Ideal for sticky/contaminating liquids or dustladen atmospheres	Lens antenna: Narrow beam. Suitable for large oil tankers and narrow tanks	Extremely robust and accurate tank gauging sensor	For cargo lines, manifolds and pump pressure monitoring
Measuring principle	Frequency Modulated Continuous Wave (FMCW), 24 GHz	Frequency Modulated Continuous Wave (FMCW), 24 GHz	Frequency Modulated Continuous Wave (FMCW), 80 GHz	Absolute pressure (no vent tube)	Ceramic capative
Measuring/pressure range	0...40 m/0-132 ft	0...40 m/0-132 ft	0...40 m/0-132 ft	0.7...2.0 bar/10...30 psi 0.7...3.5 bar/10...50 psi 0.7...5.0 bar/10...80 psi	0-400 psia
Media	Level measurement of liquids and solids	Level measurement of liquids and solids	Level measurement of liquids and solids	Measurement of gases and liquids	Measurement of gases and liquids
Ex approval	Intrinsically safe according to IEC Ex	Intrinsically safe according to IEC Ex	Intrinsically safe according to IEC Ex	EEx ia IIC T4...T6	EEx ia IIC T4
Type approval	All major IACS members	All major IACS members	All major IACS members	All major classification societies	DNV
Highlights	<ul style="list-style-type: none"> • Cargo radar level gauge designed to operate in rough marine conditions • 2-wire, loop-powered, with HART® 7 • With rugged stainless steel (1.4404/316L) housing and display protection • Redundant display: ullage/level shown locally • Inert gas pressure sensor (IGP) integral part of radar flange • Horn antenna option comes with built-in antenna purging system for cleaning without opening the tank 	<ul style="list-style-type: none"> • Cargo radar level gauge designed to operate in rough marine conditions • 2-wire, loop-powered, with HART® 7 • With rugged stainless steel (1.4404/316L) housing and display protection • Redundant display: ullage/level shown locally • Inert gas pressure sensor (IGP) integral part of radar flange • Drop antenna (DN80 /3" or DN100 /4"): PP or PTFE • Ideal for sticky/contaminating liquids or dust-laden atmospheres 	<ul style="list-style-type: none"> • The 80 GHz technology presents a highly focused beam with a smaller diameter compared to lower frequency radars, ideal for dusty atmospheres, narrow tanks or low reflective media • 2-wire, loop-powered, with HART® 7 • Flush-mounted PEEK or PTFE Lens antennas (no tank intrusion) • Impervious to deposit • Small dead zone and beam angle (4° with DN70/2¾" Lens antenna) • PEEK or PTFE flange plate protections as well as a PEEK thread protection for corrosive media • 112 mm/4.4" antenna extension for long nozzles 	<ul style="list-style-type: none"> • Titanium pressure transmitter • Absolute gauging technique – transmitter completely sealed • Made in high grade Titanium, highly resistive to corrosive warm ballast water • Semi flush diaphragm and low movement – reading is not affected by sludge or wet sediments 	<ul style="list-style-type: none"> • Cargo manifold and pump pressure transmitter • Absolute gauging technique – transmitter completely sealed • For vapour recovery line pressure • Robust design for deck mounting (IP68) • Semi flush diaphragm for easy maintenance

KROHNE Marine provides full in-house expertise

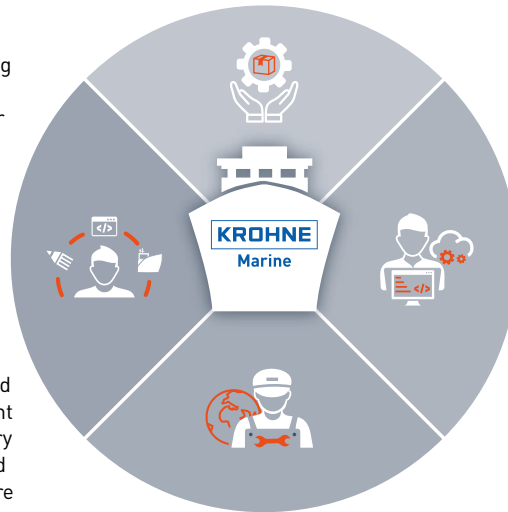
KROHNE Marine offers advise on a variety of solutions based on the customers needs and operational requirements worldwide. We provide complete turnkey solutions with our own R&D, engineering & system design, production, service & spare parts, sales and marketing.

Full scope supplier

We produce instruments ensuring high quality delivery, tailored to fit all types of vessels, retro-fit or new builds.

Marine System Engineering

Our skilled engineers are involved in the entire solution development process and provide input at every stage, from consulting, design and maintenance to service. No off-hire is required for installation.



Marine Software Development

Our developers handle integration of various systems. We are aware our clients have individual requirements. We stay up-to-date by constantly evolving our technology.

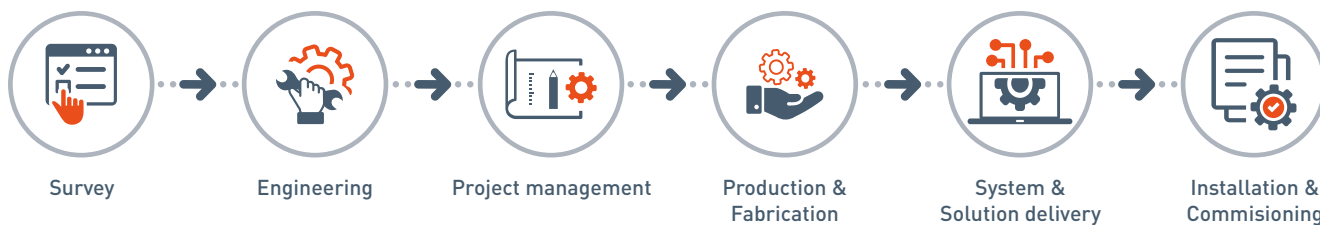
Global Marine Service

To support you and your operations, our network of service stations worldwide is ready to provide you high quality support at any time.



Full service concept

For the CARGOMASTER® we offer a comprehensive service portfolio. Our full service concept guarantees smooth and continuous operation of the system in the field. The services can extend from consultancy & engineering and on-site support, up to maintenance and trainings.



Upgrades

KROHNE Marine has supplied level gauging products for many years and we take pride in maintaining our installations on-board for the lifetime of your ship. When, an overhaul or exchange of old computers or electronics may be necessary.

We can offer tailored upgrading kits that will prolong the lifetime of the system, at a minimum cost.

Retrofits

KROHNE Marine is experienced in retrofit projects. We are able to offer complete solutions including all necessary service.

We work closely with the ship's crew to find the most effective solution for your installation and reduce your cost.



Service engineers, only a phone call away

To support you and your operations, our world wide network of service stations is trimmed to provide you with high quality support at any time. Our first priority is a remote solution, guiding your own crew. We have service personnel and spare parts available worldwide, should our attendance become necessary.

Our team of service engineers receives regular training, both in the latest technology and sailing installations. By contacting KROHNE Marine, we ensure you that our engineers and application technicians, follow your case for a successful result.

Best practice – 2 examples of more than 1000 successful installations



CARGOMASTER® for the tank level monitoring on chemical tankers

Norwegian ship-owner Rederiet Stenersen AS specialises in chemical tanker transport. The company operates a fleet of 16 purpose-built chemical carriers, including the most modern tankers MT Sten Odin and the MT Sten Tor. Both feature a capacity of 17,500 dwt and are the first tankers to be driven by hybrid electric propulsion. Given their critical loading and unloading operations, a full overview of cargo tanks is vital.

The ship-owner and the Chinese shipyard decided to go for CARGOMASTER®. Decision factors were previous experience with KROHNE Marine and their extensive

references. KROHNE Marine delivered a complete solution, including the system software as well as instrumentation, adapted to the individual vessel applications of Stenersen.

Over 150 monitoring points were installed for the monitoring of tank levels, inert gas pressures, temperatures, bilge switches in void spaces and pump and manifold pressures. The implementation of CARGOMASTER® involved a comprehensive project management from engineering to documentation and commissioning.



KROHNE Marine's world wide network of support

Since 1980 in use – now retrofitted with latest CARGOMASTER® version

Utkilen AS is a fully integrated shipping company with headquarters in Bergen, Norway. The company, with a history back to 1916, was founded in 1967 and owns and operates 22 chemical tankers ranging from around 6 000 to 20 000 dwt. in size. Utkilen and KROHNE Marine have a long history together, with the first CARGOMASTER® delivered already in 1980 to M/T Saltstraum and sister vessel M/T Sydstraum. It was at the time the very first computer based cargo monitoring system in the world.

Through the decades all versions of CARGOMASTER® have been fitted to Utkilen newbuilds. Latest was a series

of four 10,500 DWT Chemical carriers, built at AVIC Dingheng in China; M/T Mostraum, M/T Vikstraum, M/T Saltsstraum and M/T Sydstraum. These were originally installed with the system have been retrofitted with latest software.

Decision to upgrade to the latest iteration of the system, was motivated by improved capabilities on remote trouble shooting, online tank spectrum analysis and sensors configuration, as well as improvements in user interface. In addition to monitoring all Cargo, Draft, Ballast and Fuel Tanks, the system is also set up to handle visualisation and remote control of valves.



Learn more about CARGOMASTER®

Solution website



krohne.link/cargomaster-en

Marine industry website



krohne.com/marine

KRÖHNE Marine
Strømtangveien 21
NO-3950 Brevik
Norway

Tel.: +47 35 56 12 20
Fax: +47 35 56 12 21
marine@krohne.com
www.krohne-marine.com

KRÖHNE