TANKERS

SUPPORTING SAFE AND RELIABLE OPERATIONS
OUR MISSION
We shall earn the respect and recognition for our dedication to provide innovative and reliable marine electronics that ensure optimal operation at sea. By utilising and integrating our technology, experience and competencies in positioning, hydroacoustics, communication, control, navigation, simulation, and automation, we aim to give our customers The Full Picture. The Full Picture yields professional solutions and global services that make a difference enabling you to stay ahead of the competition.

OUR PHILOSOPHY
Our success depends on the success of our customers. Actively listening to our customers and truly understanding their needs, and then translating these needs into successful products and solutions is central to achieving our goal. Our people are the key to our success and we empower them to achieve. Working together in a global network of knowledge, guided by our values, engenders innovation and world class performance. Every day we have to think a little differently, because every client is unique. We aspire to translate the imagination and dedication of our staff into successful technologies and solutions. Our commitment is to add value to your operations by providing you with The Full Picture.

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KONGSBERG SYSTEM PHILOSOPHY

Supporting safe and reliable operations
The KONGSBERG Tanker Management System offers an integrated solution that supports operational excellence. The integrated system solution provides modular functionalities for enhanced safety and efficiency – qualities that are essential for safe and reliable operations.

Robust solutions
KONGSBERG system philosophy is based on a distributed and open system design that employs a system-wide standardized communication network. The network facilitates the free flow of information from all sub-systems, with vessel-wide information available on multi-function workstations. A common base technology and user interface for all products ensures a safe, efficient and reliable operational environment.

• Remote control of valves and pumps
• Level gauging of all tanks
• Automated cargo and ballast operations
• Vessels strength and stability calculations
• Machinery automation
• Propulsion control
• Navigation

Designed for operation
Decades of real-life operational experience and knowledge lie behind KONGSBERG System Technology designs, ensuring user-friendly functionality that simplify and speed up tanker operations.
Reliability in operation
In combination, KONGSBERG tank management, automation, propulsion control and navigation subsystems enhance and improve the operation of tankers. The ultimate solution is attained when the subsystems work together in an integrated control system that includes a fully backed-up, system-wide communication network.

Essential components such as deck sensors and radar tank gauges yield the best results that technology has to offer in terms of reliability, accuracy and durability. By utilizing the HART® Field Communications protocol for deck and tank instrumentation, installation costs are reduced and the quality of data processing enhanced.

By adding the functionalities available for automated cargo monitoring and control, cargo operations can be executed both safely and efficiently.

On track with K-Bridge
The IMO standard for integrated bridge requires consistent information across all systems. K-Bridge meets these standards by allowing own-ship data, such as system internal heading, speed, position and drift to be calculated and distributed to all sub-systems, therefore avoiding inconsistent presentation.

Modular architecture - reliable flow of information
Fast and reliable data exchange is guaranteed by the high speed data communication network – the redundant configuration principle utilized – providing unmatched performance, which has helped it become the preferred choice.

AutoChief
– the industry standard
The AutoChief propulsion control system provides complete control of the propulsion plant. High fidelity control strategies ensure optimum operation with minimum fuel consumption, while constant fuel mode reduces wear and tear of the main engine. The AutoChief is approved and recommended by all the major engine manufacturers.

K-Gauge for operational excellence
K-Gauge tank management enables monitoring, planning, validation and execution of cargo and ballast handling operations – a powerful tool for safe and efficient operations. It is scalable from monitoring and remote control through to a fully automated system.

K-Chief
– outstanding reliability
The distributed technology provides outstanding system reliability and availability. Unique operational functionalities enable optimum operation of the machinery, which therefore reduces fuel consumption.

Multifunctional Operator Stations – easy and unambiguous operation
Even though operator stations normally have dedicated functions for e.g. cargo monitoring and control, automation, radar; cross-over information and views are available for operators. With the same user interface across all systems, unambiguous operation is provided for so the number of dedicated operator stations can be reduced.
Complete instrumentation - a sharp eye on tank contents

Complete instrumentation for cargo and ballasting is provided for. Radar based tank gauges for the cargo tanks and level gauging by pressure transmitters for the ballast and service tanks enables high accuracy level gauging. Additionally, purpose designed temperature and pressure sensors ensure reliable process monitoring. With modern communication and data distribution, installation and cabling costs are significantly reduced.
Chemical tanker

Minimize port turnaround times
Handling large numbers of cargoes with different chemical and physical properties on a single voyage means a busy workload for the crew. To minimize port turnaround times and to streamline cargo-handling operations, KONGSBERG provides modern parcel tankers with highly automated cargo control and monitoring systems, either as stand alone or fully integrated with the navigation and machinery automation systems.

Trustworthy treatment of hazardous liquids
Radar based level gauges and independent high level and overflow alarms are utilized. Additional essential equipment includes multi-level temperature and vapour pressure monitoring devices, all carefully designed with cleaning aspects and the challenges caused by chemical deposits in mind.
Product tanker

Certify volumes transported
Complete instrumentation for cargo and ballasting is available. Radar based tank gauges purposely designed for large cargo tanks ensure precise gauging over the range. The measuring of draft, ballast- and service tank levels by pressure transmitters provides high accuracy readings, purpose designed temperature and pressure sensors ensure reliable process monitoring.

Specialized and sophisticated operation
K-Gauge tank management ensures a uniform, intuitive user interface, enabling operators to develop professional skills in cargo operation, reducing the risk of human error and enhancing operational efficiency. The system integrates monitoring, planning, validation and execution of cargo and ballast handling operations – a powerful tool for safe and efficient operations.

Remote support
Provisions for linking the tanker management system to your company administration and communication networks are also available from KONGSBERG.
The KONGSBERG Tank Management concept is an investment for safe and efficient cargo operations, an investment that will make you more competitive and thus pay profitable dividend.
A powerful environment for tanker operation, with built-in features for easy information access. For viewing alarms, detailed process information or the load condition, the common user interface is both consistent and intuitive.
Operate with confidence
The K-Gauge tank management concept consists of several applications modules, ranging from tank instrumentation to fully automated tank management. Thus, the concept is fully scalable and can be tailored to individual vessels and operational needs.

The tank management concept utilizes multifunction operator stations, providing monitoring and control facilities, with remote operation of pumps and valves. Graphical process views provide the operators with a full picture of the cargo and ballast system as well as for the loading condition. Additionally, color coding distinguishes pressurized from non-pressurized pipelines to assist in providing clear presentation of critical information.

The extended features of the tank management system include:
- Discharge of cargo with related ballasting
- Loading of cargo with related de-ballasting
- Exchange of ballast water
- Cargo planning and line-up
The modular concept

The KONGSBERG tank management concept is based on a modular design, where the various modules can be configured and combined to suit individual operational needs. The system can be configured from basic tank gauging and cargo instrumentation, to remote control of valves and pumps, and to a fully automated tank management system.

All modules are fully compatible and therefore provide seamless information sharing and a consistent operational environment. The functionalities have been developed in closed co-operation with maritime professionals, to ensure system functionalities that work safely and effectively in real life operations.

The KONGSBERG tank management concept in general and the individual modules specifically, utilize open standards, which provides for interfaces to e.g. different pump and valve manufacturers’ equipment.

Automated tank management

Pre-defined or previously stored loading operations are available for the operator and the system will guide the operator through planning and validation during preparation for new loading operations.

Once the plan has been validated, the loading can be executed. The operator starts by lining up the first tank in the plan to seaside as in manual mode for gravity run out. When the conditions have been reached, the auto execution can be initiated.

The auto execution will end when all the tanks in the plan have reached final level:
• Full loading computer functionality for calculation of floating position, intact and damage stability and longitudinal strength.
• Planning of discharge, loading and water ballast exchange operations, with user guidance and restrictions.
• Simulation and detailed validation of loading plans.
• Automatic execution of validated loading plans - operator controlled with facilities for manual take over.
• Operator guidance messages to help during operations, and to assist during unwanted conditions.
• Remote operation of valves and pumps.
• Global monitoring and alarm functionality.
• Interlock functions to prevent incorrect usage of equipment and avoid unsafe conditions.

Operation from multifunctional operator stations allows for flexibility and customization, with typically one operator station for cargo operation, one for the loading computer applications and one for ballasting.
Operational excellence
The K-Gauge cargo monitoring and control module is available as an integrated application in the K-Gauge tank management concept or as a stand-alone module. The module comprehends several autonomous sub-modules, all of which can be configured and combined individually to suit specific operational requirements. Each module is fully compatible with the others and provides seamless interaction and consistent real-time operation.

Operating with confidence
Modular design provides for flexibility in configuration of the cargo monitoring and control system, covering the whole range from basic alarm and monitoring to advanced remote control. With the loading computer integrated in the operator workstations, the operator can remotely execute loading and discharge operations with confidence, according to the planned operation.

The following real-time applications outline the main sub-modules available:
- Remote control of pumps and valves
- Cargo tank level monitoring
- Cargo tank pressure monitoring
- Cargo tank temperature monitoring
- Ballast tank level monitoring
- Overfill protection
- Service tank level monitoring
- Draft, Trim and list monitoring
- Handling of alarms and failures
- Logging of History/Trend
Safe loading
The KONGSBERG ShipLoad loading computer utilizes 3-D models of the vessels’ hydrostatic – a full geometric definition of the vessels – as basis for the calculation of e.g. loading conditions, floating position, and stability and longitudinal strength.
There are no pre-computed tables, no simplifications or assumptions, but only a precise description of the actual loading condition. Thus, what you see is exactly what you have – no dead-freight or overload.
By utilizing the full geometrical definition of the vessel as basis for the computation, additional applications have been developed to improve the load planning and condition handling, e.g. water ballast distribution, water ballast exchange, damage stability and grounding scenarios to name a few.

The KONGSBERG ShipLoad is available as a stand-alone solution or fully integrated into the KONGSBERG Tanker Management System. When integrated, applications for planning and automated execution of loading and discharge operations are available.

Basic version
The basic version includes all the required functions with extended options like:
• Interface to and reading of tank level and trim and list data
• Integration to ballast control system for automated water ballast operations, including planning and automated water ballast exchange functions
• Integration to cargo control system for automated cargo operations

Additional applications
Damage Stability computation, based on the actual vessel geometry and according to regulations:
• Strength method, advanced hull calculations
• Emergency Response Version, a tool for user-specified damage cases
RADAR BASED TANK GAUGING

Reliability and accuracy that can be trusted
The Radar Tank Gauge GLA 300 – with its unique parabolic antenna design is used for all types of tank. The parabolic antenna design and the high centre frequency make for a small antenna with a very narrow radar beam. The excellent signal to noise ratio performance of the radar and signal processing ensures accurate and reliable readings with high repeatability - RMS accuracy of 2mm, with measuring range from 0 to 50m.

Principle of operation
The measurement principle is based on the Frequency Modulated Continuous Wave (FMCW), where the distance (ullage) is derived from the time delay of the reflected signal. The received reflected signal is detected by the radar electronics. There is one signal processing unit dedicated for each radar sensor, providing a robust and fault tolerant solution, with excellent system availability and up-time.

The radar electronics includes patented systems that ensure optimum signal fidelity (measuring accuracy).

Easy access
The tank radar unit is installed on a socket on top of the tank, with provision for a vapour pressure sensor. While the vapour pressure sensor is installed inside the radar unit, the temperature sensors are located in a separate deck mounted box.

The temperature sensors are, however, connected to the radar unit for signal processing and utilize the same network for data transmission. The sensor and radar electronics are fully accessible for maintenance and change, from the deck under closed tank conditions.

Easy to maintain
Special attention has been given to robustness, easy maintenance and low life cycle costs. The tank radar gauge electronics are fully moulded and thus easy to replace if needed. The vapour pressure sensor is likewise available from the tank radar gauge unit and can also be replaced under closed tank conditions.

With the parabolic antenna reflector tilted inclined – drip off design – moisture and sediment will drain off and thereby reduce the need for maintenance that would interrupt operations.
Easy to install
The Radar Tank Gauge is simple to install and the narrow radar beam makes location less critical in tanks with complex internal structures or deep and narrow shapes. With the tank radar sensors, vapour pressure and temperature sensors connected in a network, installation and cabling costs are significantly reduced.
**LEVEL GAUGING AND INSTRUMENTATION**

**Sensors of accomplishment**
In close co-operation with shipyards and engine, gear and pump manufactures, KONGSBERG has created a range of sensors and accessories uniquely designed for marine applications. All sensors, transmitters and transducers produced at our own premises, utilize only quality materials, ensuring high reliability and a long troublefree life. A variety of temperature and pressure sensors are available to meet different applications onboard, such as:
- Ballast and service tank measurement
- Cargo temperature
- Vapour pressure
- Line and manifold temperature and pressure
- Vessel trim, list and draught measurement

**Cargo tank high level alarm system**
The KONGSBERG Overfill Protection System’s measuring principle is based on capacitive level switches. Different system configurations including single or double level switches are available, all according to the IMO requirements.

**Temperature sensors**
Temperature sensors designed for marine applications include resistance (Pt100/Pt1000), thermocouple (NiCr/NiAl), thermistor elements (NTC), and our unique wireless temperature sensors based on a Surface Acoustic Wave (SAW) elements

**Ballast and service tanks - draft and trim**
The pressure transmitter, which is designed to be submerged in ballast and service tanks, is available in AISI 316 or titanium. When used to measure draft and trim, installation of one transmitter fore and preferably two aft is recommended. List are preferably measured by inclinometer or using two pressure transmitters mounted aft. (alternatively mid-ships). The transmitters are installed after an approved closing valve connected to the ship’s hull, with a venting pipe installed above the ship deck.
Made to last – sensors tailored for the marine environment.
**Machinery plant watch-keeping**
The K-Chief automation system improves watch-keeping of the machinery plant. From operator stations in the engine control room the engineer on watch has excellent overview of the power plant, propulsion machinery and other auxiliary machinery systems.

**Modular and scalable concept**
The heart of the system is our family of distributed processing units. These communicate with each other on a fully redundant high capacity process bus. All monitoring and control functions are carried out by the distributed processing units, while the operator stations provide the system interface.

Fast and reliable data exchange is guaranteed by the high speed data communication network. Each subsystem utilizes its own dedicated network segment, with controllers preventing failures in one system from spreading to another system.

Systems may easily be extended by adding additional hardware units such as operator stations and distributed control units.

**Meets the highest availability requirements**
To enhance system availability and uptime, redundancy is available throughout the system. The level of redundancy is always tailored to the redundancy inherent in the physical plant as well as to operational requirements. This includes communication structures, distributed process controllers and power supply systems. Comprehensive self-diagnostics report any malfunctions such as system component fault, communication fault, instrument fault and earth leakages.

**Ease of operation**
K-Chief provides a safe, uniform, intuitive user interface, enabling operators to develop professional skills in system operation, which reduces the risk of human error whilst enhancing operational efficiency. Process data are presented both graphically and in tabular forms for quick and easy interpretation. Local operation panels are available for fixed installation in engine rooms and on switchboards.
Optimizing vessel performance
Tools for data recording, trending, reporting and analysis are available. The engineers may combine historic data from machinery systems and compare different operational conditions to analyse power consumption and fuel optimization.

Efficient power generation
K-Chief power management system is a complete switchboard and generator control system. It handles various configurations of generators driven by diesel engine, steam turbine and main engine in combination with switchboards of various complexities. The K-Chief power management system ensures that the power capacity is in line with demand at any time, avoiding black-outs and minimizing fuel consumption.
Reliable and efficient propulsion
Based on decades of experience in the control of diesel engines and electrical powered propulsion, AutoChief offers control solutions that optimize propulsion prime movers to operate cost effectively, reliably, and with minimum exhaust emission.
With more than 2500 systems installed on currently sailing vessels, AutoChief has become the benchmark for safe and efficient propulsion monitoring and control. AutoChief is a complete control and safety system for slow and medium speed propulsion systems with fixed and controllable pitch propellers, available both for single and double propulsion lines:
- Remote control system
- Engine safety system
- Engine telegraphs
- Digital governor
- Manoeuvring Recorder
- Thruster control

Technology that cuts cost
Utilizing distributed processing units, installed directly on the main engine, significantly reduces installation and cabling costs. All signals to and from the engine are transmitted on dual redundant CAN lines (bus on engine). All non-essential sensors can be shared with the K-Chief 500 alarm and monitoring system, requiring only one interface to the main engine. In systems with shaft generators, the K-Chief 500 Power Management System can communicate with the AutoChief system for smooth operation.

Reduced wear and tear
High fidelity control strategies ensure optimum operation at minimum fuel consumption, while constant fuel mode reduces wear and tear of the main engine. The AutoChief is approved and recommended by all the major engine manufacturers.

Reduced installation costs
Install distributed processing units close to sensors and actuators in switchboards, valve cabinets, pump starters or machinery skids to reduce cabling costs. Further savings of time, material and labour costs are obtained by the on-site commissioning tools.
Condition monitoring of crank-train bearings in two-stroke diesel engines

The KONGSBERG Bearing Wear Monitoring (BWM) system measures and displays the combined physical wear of crosshead-, crank- and main bearings, providing early bearing seizure warnings if problems occur during engine operation. The sensors are specifically designed to provide reliable and accurate measurements over years of operation inside the engine.

The BWM system uses two sensors mounted in each cylinder compartment, measuring every time the crosshead passes Bottom Dead Centre. The KONGSBERG BWM sensors perform individual compensations for engine speed, engine crank case temperature and engine deflections due to vessel manoeuvring or cargo loading.

Avoiding all types of bearing damage

Bearing seizures are known to appear in many different forms and are caused by a wide variety of reasons. Combining the KONGSBERG BWM system with KONGSBERG’s wireless temperature monitoring system (SENTRY®) reduces the risk of bearing damages to an absolute minimum.
CAN communication of BWM allowing easy add-on of other Engine Monitoring Systems.
INTEGRATED NAVIGATION

The next level in ship handling
The feel aboard a KONGSBERG designed bridge is being in control. Whether the officers are comfortably seated with information and controls at their finger tips or operates in an open bridge environment, certainty in all circumstances is provided for. Scalable solutions with smart functionality enable you to increase efficiency, without ever compromising crew safety and comfort. With focus on human factors and the complete working environment, we enable the officers to consistently act with precision and certainty in difficult conditions.

Integrated navigation and traffic surveillance
Consistent information and intuitive presentation is crucial. The K-Bridge integrated navigation system utilizes a dual redundant controller and interface unit to collect data from all sensors such as gyro, position sensors, speed logs and weather sensors. The data is processed and alarms are given if inconsistency occurs. The processed own ship data (e.g. filtered heading, speed and position) is distributed to multifunctional operator stations. Thus, a true distributed system approach, which provides for compliance with IMO guidelines for safe return to port.

Multifunctionality
The multifunctional operator stations can be dedicated to one function, or they can be configured as multifunctional radar/ARPA, ECDIS and conning stations. The radar/ARPA has extensive chart functions, and the ECDIS can display radar video. On multifunctional operator stations, even radar video gain and anti-clutter can be adjusted in ECDIS mode. When integrated in the Cruise Vessel Management System, multiple views and process information is available from other sub-systems.

Docking assist
A customized docking display is available; integrating chart view with a distance to quay calculator, own ship data presentation, engine, rudder and thrusters feedback, with CCTV information on top.

The weather forecast can be used to predict areas where unfavourable conditions will develop and the sailing routes adjusted to obtain favourable sailing conditions.
ELECTRONIC LOG BOOKS AND SHIP TRACKING

Approved by authorities
K-Log electronic logbooks provide an electronic alternative for recording key navigation, engine watch, port calls and other operational activities as required by IMO, SOLAS and flag states. As an integrated part of KONGSBERG Tanker Management System, relevant data is automatically transferred and combined with data and information manually inserted. The recording of data and information is further eased by predefined text templates.

The Fleet Data Manager is an application that enables remote access to vessels’ electronic logbooks and the Ship Tracker application enables remote tracking of vessels, with position presented in an electronic chart.

• **Deck Logbook** – Navigational events related to the voyage and onboard operations
• **Dynamic Positioning Logbook** – Logging related to DP operations
• **Engine Logbook** – Engine and machinery operation
• **Oil Record Book Part I** – Oil and dirty water as required by IMO’s MARPOL convention
• **Operational Log** – Typically cargo handling and maritime operations, customized to owners requirement and trade
• **Radio Logbook** – Radio traffic as required by IMO and the flag states

Modern era maritime business involves an ever increasing amount of information flowing between vessels, shore offices, and regulatory authorities. Digital technology can assist to make this process more manageable.
LIFE CYCLE SUPPORT

Designed to purpose – maintained to last
Our life cycle management service will assist our customers throughout all the phases, from design to commissioning and during the operational life time. Solid in-house competence, both in system design and user competence enables us to provide solutions that are fit to purpose and thus yields efficiency in operation.
Our common base technology provides robust designs, with few and reliable parts, an excellent foundation to maximize the output at competitive costs.
The distributed and open system design employs an industry standard communication network. Standard hardware components used for various applications and the open network approach results in:

- Increased reliability
- Competitive life-cycle support
- Easy up-grade solutions

Evergreen
We offer continuous hardware and software upgrade to keep your vessel at maximum efficiency. Our system is designed with consistent boundaries between individual systems and control segments. This design strategy makes it easy to add new functionality or complete new control segments thus enable us to offer up-grades step by step to keep your system evergreen.

Training
Qualified personnel are one of your major assets in efficient and safe operations. Thus, we offer modular training courses for all major subjects – from operator training to technical training that keeps your crew fit on the job.

Supported by professionals
Our systems are easy to install and maintain – supported by professionals either on-site or through remote connectivity. They are designed for optimal operational availability and allow for favourable lifecycle expenditure.
We are always there, wherever you need us. Kongsberg customer services organisation is designed to provide high-quality, global support, whenever and wherever it is needed. We are committed to providing easy access to support and service, and to responding promptly to your needs. Support and service activities are supervised from our headquarters in Norway, with service and support centres at strategic locations around the globe – where you are and the action is.

As part of our commitment to total customer satisfaction, we offer a wide variety of services to meet individual customers’ operational needs. Kongsberg support 24 is a solution designed to give round-the-clock support. For mission-critical operations, Kongsberg support 24 can be extended to include remote monitoring. We can adapt the level of support needs by offering service agreements, on-site spare part stocks and quick on-site response arrangements.

Global and local support
We provide global support from local service and support facilities at strategic locations world wide. Service and support work is carried out under the supervision of your personal account manager, who will ensure that you receive high-quality service and support where and when you need it.

Your account manager will ensure continuity and work closely with your personnel to improve and optimise system availability and performance. Under the direction of your account manager, and with a local inventory of spare parts, our well qualified field service engineers will be able to help you quickly and effectively.

GLOBAL CUSTOMER SUPPORT

Call +47 815 35 355
E-mail: km.support@kongsberg.com

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