K-CHIEF

ALL CONTROL REQUIREMENTS FULFILLED – IN A UNIFORM SYSTEM
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 TECHNOLOGY

**Individual systems – one solution**

KONGSBERG System Technology approaches ship operation more intelligently. With better technology, functionality and life cycle support, KONGSBERG System Technology further safe efficient operations, reduces the overall costs of ownership, and is scalable to suit individual customer needs. With our pledge to total excellence KONGSBERG System Technology is comprehensive, secure, scalable, integrated and completely reliable.

KONGSBERG System Technology yields a distributed and open system design, utilizing a system wide standardized communication network. The network facilitates for easy integration of other vessel systems and free flow of information from all subsystems, with vessel wide information available on multi-functional workstations. Common base technology and user interface provide for a safe and an efficient operational environment, with consistent operation and increased reliability.

KONGSBERG System Technology extends further than a traditional integrated and distributed system. With decades of real life operational experience and knowledge translated into our functionalities, KONGSBERG System Technology enables us to continue providing our customers with system solutions that make a huge difference to operations.

**Solutions that make a difference**

Applications and functions are always developed in close co-operation with experienced users, with clear business benefits in mind. By integrating high user competence with technological excellence, we provide solutions that make a difference. A wide range of standard and application specific functions are available, all designed to optimize the marine performance.

**Added values**

KONGSBERG Technology ensures a uniform, intuitive user interface, enabling operators to develop professional skills in system operation, reducing the risk of human error and enhance the operational efficiency.

With different functions applied on the same hardware platforms, the amount of onboard spare parts can be reduced and savings made. In addition, excellent maintainability and simple upgrading solutions reduces overall life cycle costs.

Technical and economical benefits are further added when our dynamic positioning and navigation systems are fully integrated with the automation system to form a full scale vessel management system.
Ease of operation
The K-Chief provides a safe, uniform, intuitive user interface, enabling operators to develop professional skills in system operation. The risk of human errors is reduced and operational efficiency enhanced. The multifunctional operator stations are self contained and process independent though operational access is limited by command control and password protection. Process data are presented both graphically and in tabular forms for quick and easy interpretation. The operator station supports multi-screen and large screen functionality. Local operation panels are available for fixed installation in engine rooms and switchboards.

Modular and scalable concept
Systems may easily be extended by adding additional hardware units such as operator stations, controllers and input/output units. Similar, the control application is built by software algorithms, function blocks, that represent single field elements such as instruments, motors and valves. To add a new sensor, simply pick a new function block from the embedded configuration system, make a connection to a free I/O channel and you are all set!

Autonomous control of different process plants and machinery is ensured by utilizing dedicated network segments and/or process controllers for each autonomous system. Although autonomous the various subsystems communicate freely over the system-wide communication network. All information is available on any operator station. The KONGSBERG System Technology offers signal acquisition and processing units for distribution in machinery areas or built directly on equipment such as diesel engines and electric panels. Even units for installation in hazardous areas are available. Processing algorithms are executed within the local acquisition units or in the powerful controller units. By distribution and segregation the consequences of a system fault is reduced and may even be eliminated.
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, process controllers, input/output units and power supply systems. Comprehensive self-diagnostics report any malfunctions such as system component fault, communication fault, instrument fault and earth leakages. Fail-safe responses ensure that process equipment enter safe condition in the event of a fault. Industry standard communication mechanisms such as OPC, ODBC, CAN, ProfiBus, ModBus and NMEA are available ensuring trouble free communication with external systems.

Solutions tailored to your needs
K-Chief automation system is a highly flexible concept, providing competitive solutions for all types of vessels. The concept covers the whole range from basic alarm system for unmanned machinery area operation, to fully integrated automation systems for machinery, propulsion and cargo operations. Powerful embedded system tools are available assisting daily operations, maintenance and system modifications.

Safety first!
Safety of personnel and protection of vessel and equipment are key design criteria for all our products. K-Chief is a robust, fault-tolerant and fail-safe control system fit for any shipboard application. It meets all relevant requirements for usage in maritime environments and holds type approval certificates from all major classification societies.

Technology that cuts costs
Due to high distribution of signal acquisition units, also in hazardous areas, considerable savings in cable installations are made possible. Further saving of time, material and labour cost is gained by pre-commissioning of remote I/O units and local controllers mounted on machinery skids, in switchboards, etc., prior to installation onboard. The use of our local controllers reduces the need for additional PLCs, optimises vessel operation and provides correct time stamping and simplified maintenance.

Innovative solutions – for professional users
K-Chief is supported with a wide range of standard and operational specific functions all developed by professionals, for professionals. New applications and functions are constantly developed in co-operation with vessel operators to solve operational challenges and establish new business possibilities.
**Vessel plant monitoring**
An alarm system shall provide all relevant information without overloading the user with irrelevant or spurious alarms, in particular in a critical situation. Further the alarm system shall present the information in a clear way, guiding the operator's attention to the condition with the highest priority.

The K-Chief alarm and monitoring system features alarm filtering and suppression mechanisms developed to eliminate spurious alarms. Advanced functions such as “first up” alarm, identifying the first occurring alarm in a group, and aggregated alarms (combination of alarms and process conditions) makes the K-Chief a true intelligent alarm system.

Using the alarm filter function presentation of alarm lists and historic logs is tailored to the actual operational need. All alarms and process events are stored in a database and may be called up in historic log view for analysis. With local processing, fast and consistent response time is achieved, providing time stamp of alarms and events with milliseconds accuracy.

The built-in self-diagnostic system alerts the operator should any failure be detected.

This may be any component or communication failure within the system itself, or in case of field instrument failures. Loop monitoring of input signals and output signals is available, as well as detection of earth fault leakages.

**Watch calling**
During unmanned engine room operation (UMS/EO), alarms are transferred to the bridge, the duty engineer's cabin and to the public quarters. Engineers’ calling system and safety (“dead man”) systems are functionally integrated with the watch call system.

The watch call panels may be combined with extension of cargo alarms as well.

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**ALARM MANAGEMENT**

A small alarm system may consist of a Midi Operator station and distributed processing units.
Power management system
From traditional low voltage power plants to complex high voltage systems, the K-Chief power management system (PMS) controls power generation and distribution including multiple switchboards and ring bus systems. It is designed to handle electric propulsion plants as well as configurations that include steam and gas turbines and dual fuel engines.

The PMS will ensure that the power capacity is in line with the demand at any time. It ensures that the load of main consumers does not overload the plant capacity – even if a generator shuts down unexpectedly. The PMS will control the restoring of power and auxiliary systems in the unlikely event of a blackout.

In a vessel with multiple engine rooms the PMS configuration will mirror the power plant with one autonomous PMS per switchboard. When the switchboards are interconnected, it works as a single PMS by interchanging information via the high speed communication network. The PMS may include hot standby controllers, redundant communication buses and power supply units.

Auxiliary machinery
The K-Chief machinery control system ensures optimal operational conditions improving the operational reliability and lifetime of equipment. K-Chief pump controls include standby start, restart after blackout and hour/ lap counters.

Service tank level gauging are standard. The PID controller solves complex control requirement. Algorithms for automatic bilge control, air compressor control, boiler control, ventilation and HVAC control etc. are available.

Automatic establishment of vessel operational mode
The Mode Control function eases safe operation by utilizing predefined and prequalified operational modes with respect to machinery, propulsion and cargo equipment. Operational modes include manoeuvring, transit and harbour modes, in addition to special modes such as station keeping, loading/offloading and drilling.

The mode control system will automatically start/stop equipment according to pre-programmed sequences. When a mode is established, the Mode Supervision function will alert the operator in case any abnormal equipment condition should occur, including standby equipment and control systems.
Seamless integration
The Integrated Vessel Management concept supports seamless integration of all vessel control systems. Bridge systems, that is navigation, manoeuvring, propulsion and thruster controls, are linked to machinery and cargo automation and safety systems by means of system-wide communication highway. The system-wide communication network enables free flow of information within the Integrated Vessel Management System. All operator stations, controllers and interface units are linked together via the redundant communication network. In order to segregate the different parts of the Integrated Vessel Management System, advanced network segmentation switches are applied. These isolate internal data traffic within the segment to avoid overloading, and also isolate electrically the different segments. Each subsystem of the Integrated Vessel Management forms an autonomous system which is not affected by a failure in other subsystems.

Common technology
– prepared for the future
All bridge and automation products share common KONGSBERG System Technology which ensures seamless information sharing, consistent operation environments and reduces spare parts and training requirements. The flexibility is not only characterized by the open system architecture, horizontal/vertical integration and communication, but also by the software structure and data exchange interfaces. Thus, KONGSBERG System Technology can easily be combined with components from other vendors, and integrated into existing infrastructures.

The distinct part of the integrated solution
Autonomous sub-systems each consisting of operator stations, process controllers and input/output units are interconnected via the system-wide process network. All process information is available from multifunctional operator stations. The system-wide network may be further expanded for integration with bridge systems such as navigation, DP/joystick systems and propulsion and thruster controls. Processing algorithms are executed within the local acquisition units or in the powerful controller units. The signal acquisition and processing units can be distributed in the machinery areas or built directly on equipment such as diesel engines and electric panels. Units for installation in hazardous areas (zone 1 and 2) are also available.
Integrated Vessel Management System

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System-wide communication

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Optimize your cargo operations
Integrated cargo monitoring and control furthers safe and efficient operation. The officers enjoy complete overview of the cargo and ballasting operation, with tank level gauging and remote operation of pumps and valves. Also auxiliary systems such as inert gas, nitrogen and hydraulic power are operated from the system. The integrated load and stability calculator calculates vessel's stability, trim, list and hull stress.

The K-Chief cargo and ballast control solutions for oil, chemical and product tankers, liquefied gas carriers and offshore supply vessels offer a number of special functions, such as:
- Automated sequences for Cargo loading/offloading
- Capacity control of cargo pumps including tank stripping
- Control of LNG/LPG compressors with anti-surge protection
- Automatic exchange of ballast water in transit
- Colour coding distinguishing pressurised from none-pressurised pipelines
- Automatic filling and discharging of ballast tanks
- Automatic trim and heel control
- Automatic tank level compensation for trim and heel, and calculation of volumes and weight
- Cargo reports

The K-Gauge radar tank gauging – our new family of radar tank gauges – in combination with K-Chief cargo automation system offers the very best in monitoring and control of liquid and liquefied cargos. High reliability, ease of operation and easy maintenance combined with unmatched accuracy is the answer to today's and tomorrow's tanker operations. We provide the full suite of radar tank gauges, intrinsically safe pressure transmitters, temperature sensors and overfill alarm detection for all type of tankers, from crude oil, product, chemical and bitumen to LPG, LNG and FPSOs. The K-Gauge radar tank gauging system is connected directly to the process data network for seamless integration with the K-Chief cargo control system.
SAFETY SYSTEM

Managing critical situations
K-Safe safety management system gathers all relevant information and presents in a clear and structured way. Such information may be fire detectors, fire doors and dampers, ventilation fans, flooding and bilge sensors, watertight doors, shell doors, etc. The system may also show location of fire and rescue teams, life saving apparatus, and hazardous material, stability condition and other safety related information.

Clear and logic presentation of safety information is crucial in an emergency situation. All information is presented in vessel general arrangement views. Information from CCTV-system may be presented on the operator stations. Seamless integration of safety and automation systems enables information flow between the systems and the safety system may utilize information from the automation system, and vice versa. All workstations are able to present both safety and general automation information.

The K-Safe safety management system is designed for maximum reliability and availability, and certified in compliance with IEC 61508. Applications in accordance with safety integrity levels SIL 1 to 3 are available in accordance with the requirements to degree of redundancy and monitoring of field sensors and actuators.

Fire and gas protection
For operations involving hydrocarbons on deck, fire and gas protection system is mandatory. The K-Safe safety management system is developed to meet the stringent requirements for safety protection of oil and gas production vessels, as well as drilling and well intervention vessels. It monitors gas detectors on deck, in ventilation intakes, etc. in addition to fire detectors, and will automatically take actions in accordance with project specific cause and effect diagrams. Fire extinguishing systems are automatically activated.

Emergency shutdown
The K-Safe emergency shutdown system (ESD) is a high integrity safety system. ESD panels are interfaced to dedicated ESD controllers that shut down equipment such as ventilation, power systems, fuel supply, etc. when activated. K-Safe emergency shutdown systems are conforming to the stringiest safety integrity level and features dual controllers and single or dual I/O units, including extensive monitoring of field loops.

Online cause and effect diagrams
Project cause and effect diagrams and fire protection data sheets are developed based on risk analysis, and documented by means of our safety tools. The cause and effect diagrams are used for automatic configuration of the safety shutdown system, and are available online in the system and may be used for system documentation, verification and fault tracing.
Safe journey with fully integrated vessel management KONGSBERG System Technology facilitates seamless integration of manoeuvring and navigation systems with automation and safety plants. Our long experience in supplying propulsion and thruster control systems, dynamic positioning, joystick systems and integrated navigation systems has taught us to design vessel-wide solutions tailored to the specific operational demands. Well proven solutions have demonstrated excellent capabilities in complex manoeuvres and easy ship handling. The new generation K-Pos dynamic positioning and K-Joy joystick systems provides the best of automatic positioning and manoeuvring. Both are autonomous control systems, however functionally fully integrated with the automation and navigation systems and based on the same core technology.

The K-Bridge integrated navigation system takes full benefit from the integrated vessel management concept by sharing conning information directly with the DP and joystick systems and machinery information with the automation system, all without any special interfacing. Similarly, the DP and Joystick system may also take care of autopiloting. To reduce interfacing DP and navigation systems are sharing common navigation sensors and interfaces.

"ELECTRONIC ANCHORING" WITH ENVIRONMENTAL FRIENDLY GREENDP®
Extending the manoeuvring capabilities
From decades of experience with control of diesel engine and electrical powered propulsion and thrusters systems, we offer control solutions that ease ship handling and help propulsion prime movers to operate cost effectively, efficiently, reliably, and with minimum exhaust emission. With more than 2500 systems installed on-board sailing vessels, KONGSBERG propulsion and thruster control has become the benchmark for safe and efficient propulsion monitoring and control.

Our unique integrated vessel manoeuvring concept – formed by seamless integration of our DP/joystick and propulsion control systems – spans from manual control by the vessel’s officers to completely automatic vessel operation. All operations and transitions between operational modes are logic – guaranteeing safe operation of the vessel.

The K-Thrust AC is a complete control and safety system for slow and medium speed propulsion systems with fixed and controllable pitch propellers. The system is available for single and double propulsion lines, with the following main components:
- Remote control system
- Engine safety system
- Engine telegraphs
- Digital governor
- Actuator

The K-Thrust thruster control system provides remote control of electric propulsion systems, azimuth propulsion and side thrusters. Each propeller is controlled by an autonomous control system, with full functional integration allowing manual as well as automatic control. The electronic K-Bridge ST steering control system is based on KONGSBERG common technology platform, and provides remote control of steering gears.
INFORMATION MANAGEMENT

**Makes everyday routines easier**
The K-Chief Marine Automation's suite of embedded tools assists the user in the daily work. The powerful tools support operation, logging and reporting functionalities as well as plant analysis and optimization. Tools for system maintenance and software/hardware modification are part of standard deliveries. The trend and report tools allow for user defined trend displays and reports, with any combination of process variables and utilizing various templates for easy configuration. The trend system supports history trends as well as x/y-trends for performance monitoring. Typical reports are shift reports, engine and cargo logs, voyage reports, hour-counters report and various performance reports. The K-Chief history station records process parameters (as time series of any length) as well as all alarms and events that are generated. The recorded data is used for trending and incident analyses. Historic data export, facilitated by means of communication standards OPC-DA/HDA/AE and ODBC, is used for instance to transfer hour counters to maintenance system. FleetMaster® Electronic Logbook replaces all the traditional mandatory logbooks and provides electronic logging in accordance to the SOLAS V requirements. The onshore application FleetMaster® Fleet data manager provides complete and controlled access to the electronic logbook data from all the vessels in your fleet. Online user manual is available within the K-Chief system, assisting operators whenever an operational question arises. Electronic documentation such as system as-built documentation and maintenance procedures are online in the system.

**Embedded Configuration System**
All application software such as input/output configuration, alarm settings, parameters, control logic and VDU displays may be modified by using the built-in configuration system. Thus the control system may easily be modified or expanded to fit new requirements which occur during installation and operation. System configuration is performed from the operator stations and is password protected. All modifications are logged by the system and it is possible to return to previous configurations. System configuration may be viewed online at screen and printed for documentation.

**Saves engineering workload**
KONGSBERG continuously strives to develop engineering and documentation tools in order to simplify the design of the automation and safety plant. Such tools include instrument/alarm database, field loop documentation, offline configuration tools and process mimic editor. For safety shutdown systems tools for definitions of cause and effect matrices and fire protection data sheets are available.
We are always there, wherever you need us. Kongsberg’s 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.

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