



# K-GAUGE CLS

## TANK MONITORING SYSTEM FOR OIL & CHEMICAL TANKERS

K-Gauge CLS is a modern and flexible tank monitoring system suitable for use in a wide range of tanker designs. The purpose built and high performance instrumentation are applicable for use on tankers of all sizes and cargoes; from ULCCs, to Product Tankers, Chemical Tankers and Bitumen Tankers. Modern technology combined with more than 30 years experience in tank monitoring offers solutions that meet the demands of quality focused ship builders and ship owners.

### Functional description

K-Gauge CLS offers cost effective solutions that can be tailored to individual operational needs. Modular design allows flexibility in configuring the system to individual requirements, covering the whole range from cargo tank gauging and tank instrumentation, and to a full tank management system. Integrated sub-systems include:

- Cargo and slop tank gauging
- Cargo tank overfill protection
- Cargo pumps & manifold pressure monitoring
- Vapour pressure monitoring
- Draft measurements, trim and list
- Ballast and service tank gauging

The field instrumentation are designed for marine applications and fulfills the requirements set in relevant ISO standards for instrumentation used for construction and equipment ships carrying dangerous chemicals in bulk.

KONGSBERG system technology consists of a library of software- and hardware modules, communicating through dual (redundant) process buses and networks. The heart of the system is a specially designed Radar Tank Gauge (RTG).

A family of Distributed Processing Units (DPUs) handle the monitoring functions locally, while the multifunctional Operator Stations facilitates for user interaction.

The system automatically logs all tank data and present instant status on the Operator Station through dedicated mimics. Alarm settings are available for all parameters in order to maintain safe operation.

All components in the K-Gauge CLS tank monitoring system are designed for marine use and type approved by the major classification societies. The intrinsically safe apparatus are certified Ex ia according to ATEX and IECEx.

# BUILDING BLOCKS

## Radar Tank Gauge (RTG)

The KONGSBERG Radar Tank Gauge (RTG), GLA-300, is designed to measure level in tanks containing liquid cargoes. The unique radar design combined with the high centre frequency offers a small antenna with a narrow radar beam and high accuracy combined with reliable performance. The small size antenna is easy to install and the narrow beam makes location less critical in tanks with complex internal structures or deep and narrow shape. The radar tank gauges are installed on a tank socket on top of the tank.

The antenna is designed to emit a frequency sweeping microwave signal (FMCW), and combined with high signal to noise ratio and powerful signal processing offers accurate and reliable readings in any condition.

The unique off-set parabolic antenna, GLA-300/P, provides self-cleaning abilities and require limited maintenance while set in operation. A horn type antenna, GLA-300/H, with the horn integrated in the radar housing is specially designed for use in chemical tanks where cleaning is of great importance.

## Signal Processing Unit (SPU)

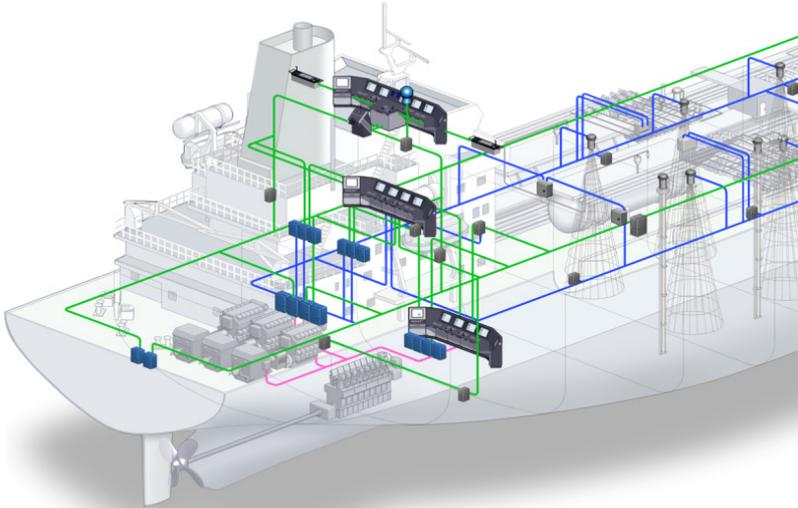
Each RTG is connected to a dedicated processing unit. The GLK-300 Signal Processing Unit (SPU) is located in safe area and provides necessary communication and intrinsically safe power barriers to the instrumentation located in hazardous area. The SPU employs powerful processing of the data from the Radar Tank Gauge, Cargo Temperature Unit and pressure transmitter. Communication with the Segment Controller Unit (SCU) is done by dual high speed Ethernet. The SPU is equipped with LEDs in the front for easy condition monitoring by crew.

## Cargo Temperature Unit (CTU)

Temperature measurement is a crucial parameter for correct volume calculation of the cargo. KONGSBERG Cargo Temperature Unit (CTU) are delivered in a AISI 316L stainless steel connection box, designed for installation on deck. The built-in temperature converter connects up to 3 temperature sensors.

## Cargo temperature sensors

KONGSBERG temperature sensors are marine approved, designed for accurate measurements of temperature in liquid cargo. Resistance type (Pt100/Pt1000) temperature elements offers high quality measurements with reliable accuracy. The sensors are produced with a AISI316 metal sheathed cable in customized lengths for installation inside the tank.



## Tank pressure

KONGSBERG pressure transmitters are marine approved pressure transmitters, designed for accurate measurements of tank pressure. The cargo tank pressure sensor are mounted inside the radar head, and is delivered ready connected to the terminal board of the Radar Tank Gauge.

## Tank Overfill Protection System

KONGSBERG overfill protection system, K-Gauge HLA 600, is designed and approved according to the IMO requirements concerning "Cargo Tank Overfill Protection Systems". KONGSBERG capacitive level switch is designed for high level and overfill alarm detection in cargo tanks offering continuous monitoring and no moving parts. The independent Overfill Protection System is based on Kongsberg's system technology, and can be integrated to the K-Gauge CLS system to provide extended information sharing and operation from the multifunctional operator stations. See K-Gauge HLA 600 Product Sheet, KM doc. ID 390749 for details.

## Sensors and instrumentation

KONGSBERG produces a range of sensors and instrumentation for marine applications. A variety of temperature and pressure sensors are available to meet different applications, such as:

- Vessel draft, trim and list



Figure 1: Radar Tank Gauge GLA-300/P



Figure 2: Signal Processing Unit GLK-300

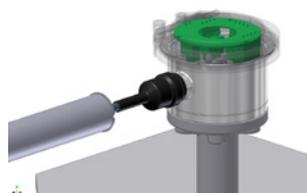
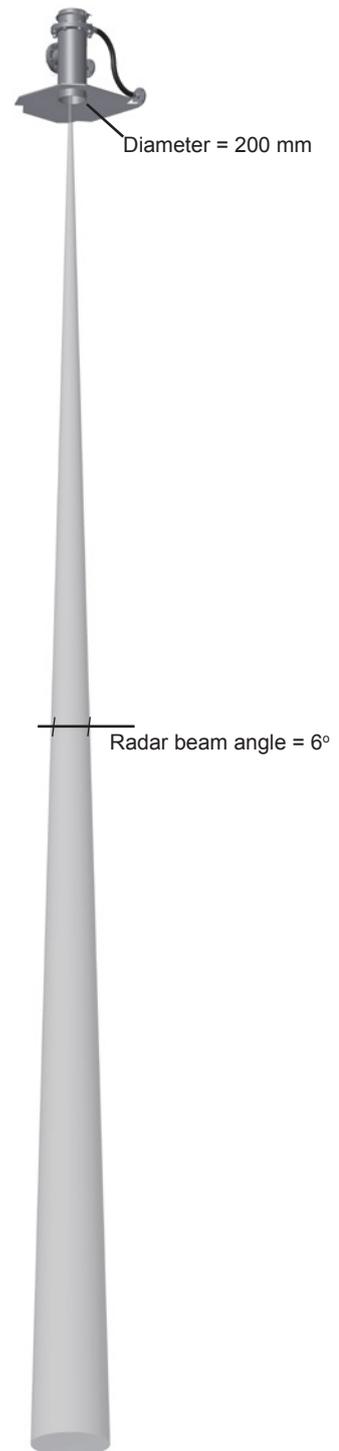
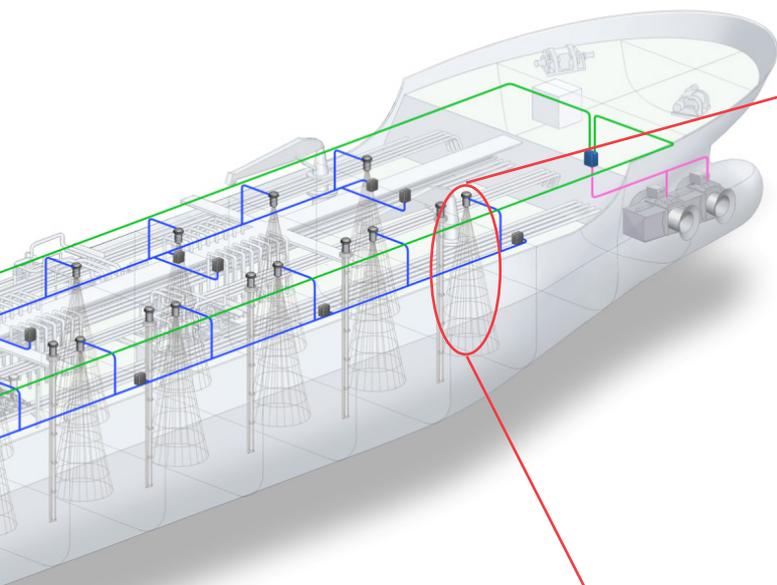


Figure 3: Cargo Temperature Unit GC-300



Figure 4: Cargo Temperature sensor MN-1535



- Ballast and service tank measurement
- Cargo temperature
- Vapour pressure
- Line and manifold temperature
- Line and manifold pressure
- Pump pressure
- Level switches

All sensors and transmitters from KONGSBERG are constructed using high quality materials, ensuring high reliability and a long trouble-free life.

**Draft, ballast & service tanks**

The pressure sensor designed to be submerged in ballast and service tanks is available in AISI316L or Titanium materials. When used to measure draft and trim, installation of one sensor fore and aft is recommended. List is preferably measured by inclinometer. KONGSBERG ballast and service tank monitoring offers a wide range of installation kits for flexible installation.

All transmitters from KONGSBERG are certified Ex ia IIC, and are constructed with special care for installation in harsh environment.

Transmitter barriers, signal converters and installation material in AISI316L steel are typically a part of the K-Gauge delivery.

Figure 9: RTG installation on tank socket (example), indicated with free-range radar beam (+/- 3°)



Figure 5: Tank pressure transmitter GT-450



Figure 6: Level alarm switch GL-7B/2



Figure 7: Pressure transmitter for submerged applications GT403



Figure 8: Cargo line and manifold pressure transmitter GT404

### Operator Station

A number of computers can be connected in a network to provide redundancy and the possibility to arrange control stations at several locations onboard. The Operator Stations consist of marine approved HP computers running Windows 7, a choice of 22", 24" or 27" wide screen monitors and a set of user friendly mimics for presentation of:

- Liquid levels.
- Liquid volumes
- Cargo temperatures (average liquid and individual).
- Tank pressures.
- Draft, Trim and List readings.
- Level alarms (HiHi, Hi, Lo, LoLo).



Figure 10: Tank monitoring system mimic (example)

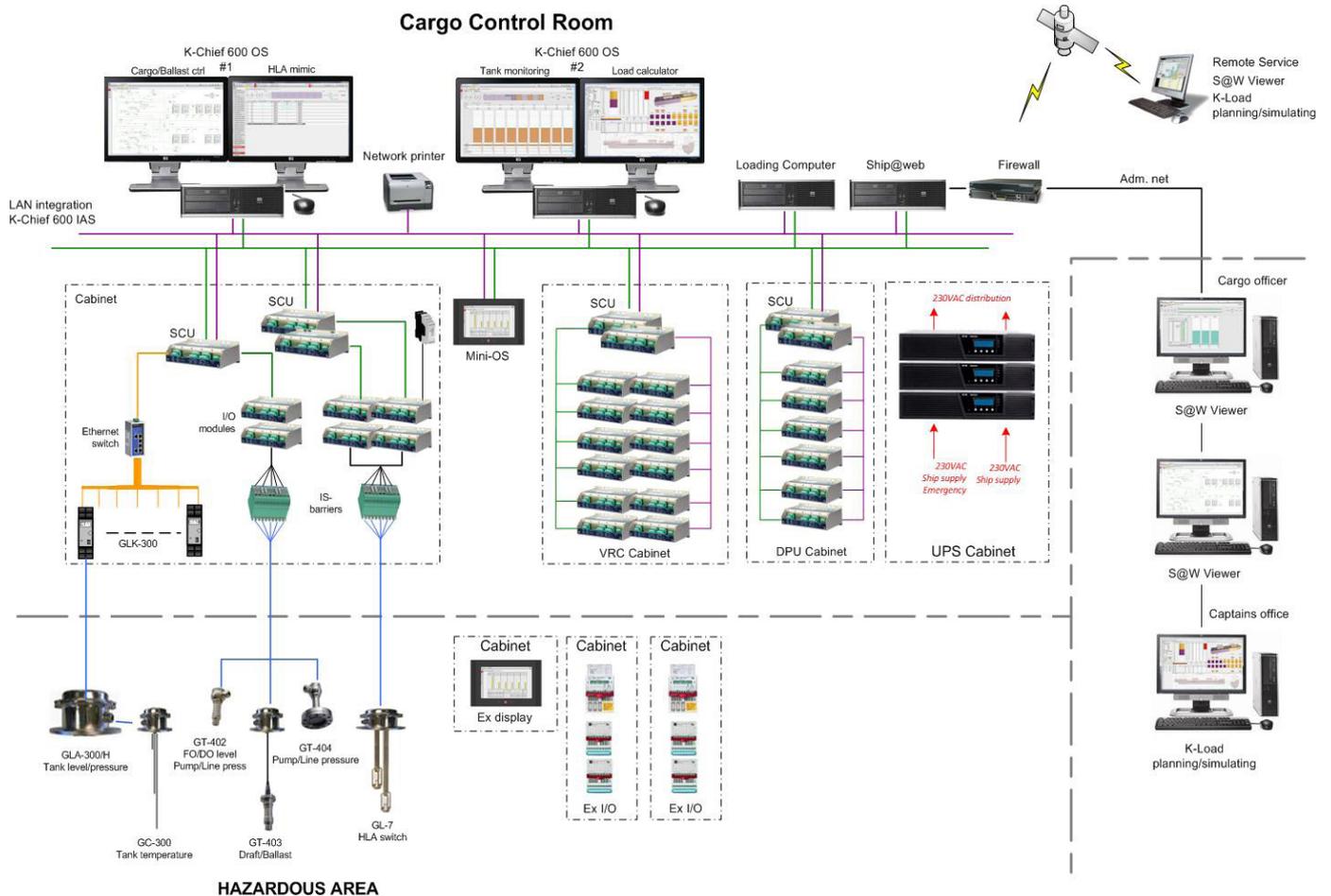
### KONGSBERG integrated systems

With an integrated K-Chief 600 cargo and machinery system, tools for data recording, trending, reporting and analysis are available on all operator stations. The operator may combine historical data from machinery and cargo systems, and compare different operational conditions to e.g. analyse power consumption and fuel optimisation.

With operator stations available in the central places on the ship the operator has full control of the integrated cargo and machinery system.

KONGSBERG integrated systems uniform operator environment will reduce the need for training of operators and lower the threshold for safe operating the whole vessels automation system.

## TOPOLOGY DRAWING



Specifications subject to change without any further notice.

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