

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 (total, individual and group).
- Cargo temperatures (average liquid, average vapour, individual).
- Tank vapour pressures.
- Trim and List readings.
- Level alarms (HiHi, Hi, Lo, LoLo).
- Master Clock indications.

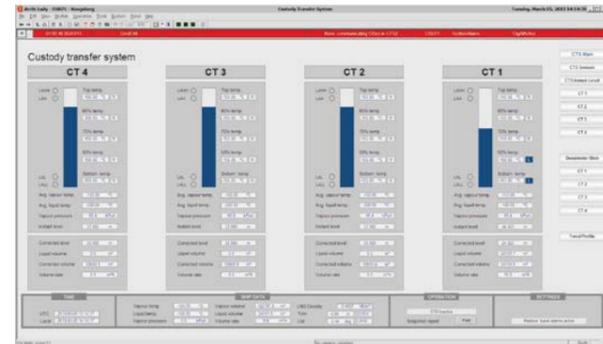


Figure 9: CTS overview mimic picture (example)

Custody Transfer report

An official transfer document is automatically generated and printed. The flexible report generator offers an easy way to adapt the printed reports to the changing requirements on the spot market and/or changes in SPA. The function allows changing both report layout format and CTS parameters, incl.:

- Implementation of Trim/List correction.
- Number of decimals for certain parameters.
- Ship cargo average temperature calculation.
- Selectable temperature used for CTS calculation.
- Selection of pressure unit, mbar or kPa.
- Calculation method for one cargo operation can be stored for later use.
- Calculation method for volume transferred.

Filtering function

The level filter function will ensure accurate reading of the cargo level when operating in a rolling condition. The function utilizes the following features in the system:

- Mechanical filtering by the standpipe and the AutoCAL® reference markers.
- Dual sweep FMCW technology that eliminates the Doppler effect caused by cargo movement.
- Simultaneous filtering of Trim/List values for level corrections. With the filtering function enabled, the same accuracy is achieved as for steady conditions at port.

Density measurement function

The density measurement function provides an online tool for monitoring of LNG density, LNG aging and the profile of density in the cargo down the tank. See K-Gauge DPMS Product

Sheet, KM doc. ID 376818 for details.

REFERENCE PICTURES



Figure 10: Side penetration with dual radar configuration (example)



Figure 11: Dual radar antenna inside tank (example)

Specifications subject to change without any further notice.

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PRODUCT SHEET

K-GAUGE CTS

REFIT OF OLD LEVEL GAUGING SYSTEMS

The K-Gauge CTS unique and flexible system design allows to replace the old level gauging systems without making new penetrations into the cargo tanks. Up to three radar level gauges per tank as well as two sets of six temperature sensors each, can be directed through the existing tank penetration. The installation concept can be applied for all tank designs, such as spherical (MOSS), membrane (GTT) and SPB type tanks (IHI).

Functional description

K-Gauge CTS is a complete tank monitoring and Custody Transfer Measurement System, designed in accordance to GIIGNL guidelines and the relevant ISO standards for instrumentation and calculation of LNG transferred.

The calculations are based on the methods stated in the International Standard ISO 10976. The system automatically logs tank data by use of Kongsberg calibrated instruments, calculates the tank volume during the loading-/unloading operation and generates a CTS volume report; the official document used for input to the overall energy transfer calculation.

The report layout is flexible and offers functionality for the operator to alter the report layout, as well as change decimals and units. A snapshot report can be printed on demand at any time, providing a quick overview of the current status of all the parameters relevant of the CTS calculations. The snapshot report can also be scheduled at certain intervals.

The radar level gauges require no active elements inside the tanks, and with no moving parts the risk for any float trap or tape cutting is eliminated. The powerful radar processing also facilitates for level filtering functions required for ship-to-ship transfer.

KONGSBERG unique verification function, AutoCAL®, simplifies the periodical reclassification process significantly.

All components in the K-Gauge CTS tank monitoring and Custody Transfer Measurement 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.

357418 Rev. B

BUILDING BLOCKS

Radar Tank Gauge (RTG)

The KONGSBERG Radar Tank Gauge (RTG), GLA-310/5, is designed to measure level in tanks containing liquefied gases. Accurate measurement is possible regardless of the tank atmospheric conditions.

The RTG consists of a horn antenna and an electronic unit. The electronic unit includes a sophisticated signal detection method that ensures optimum performance, which combined with its superb signal-to-noise ratio, offers the highest measurement reliability and accuracy.

The horn antenna is mounted inside the tank and designed to emit a frequency sweeping microwave signal through a 50 mm standpipe. The standpipe is considered as an integrated part of the level gauge, and comes in sections adjusted to match the total tank height.

The RTG is specially designed to withstand the severe mechanical and physical conditions in a maritime environment. Only AISI 316L acid-resistant steel is used.

"4-in-2" multifunction dual radar concept

The K-Gauge CTS multifunction system with dual radars offers Automatic Tank Gauging and Tank Overfill Protection by using two separate RTGs, connected to the Custody Transfer calculation system. Flexible hardware and software modules provides both primary and secondary level gauging functions. At the same time, one RTG is dedicated for the independent overfill protection sensor (TOP RTG). In normal operation, the TOP RTG covers two functions; overfill protection and back-up level gauging.

Signal Processing Unit (SPU)

Each RTG is connected to a dedicated processing unit. The GLK-300/LNG 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 vapour pressure transmitter.

Communication with the Remote Controller Unit (RCU) is done by dual high speed Ethernet. The SPU is equipped with LEDs in the front for easy condition monitoring by crew.

AutroCAL®

AutroCAL® is a unique calibration and verification function in the KONGSBERG system. Gas vapour density and mixture of gases influence the propagation speed of the radar signal, thus the accuracy of the measurement. By using pipe joint reference markers, AutroCAL® continuously compensates for the changes caused by the differences in the propagation speed.



Figure 1: Radar Tank Gauges GLA-310/5-R



Figure 2: Signal Processing Unit GLK-300/LNG

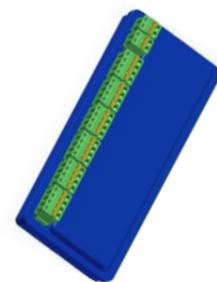


Figure 3: Cargo Temperature Unit GC-306



Figure 4: Cargo temperature sensor



Figure 5: Radar electronics, CTUs and temperature sensor installation (example)



Figure 6: Remote Controller Unit RCU502

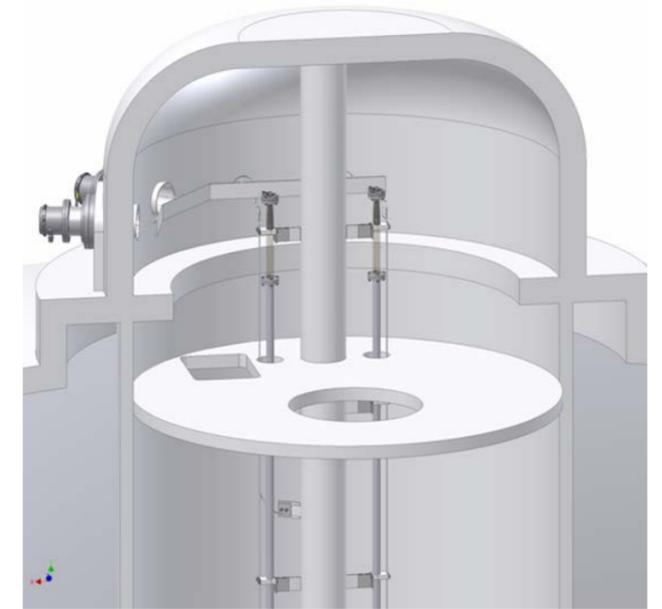
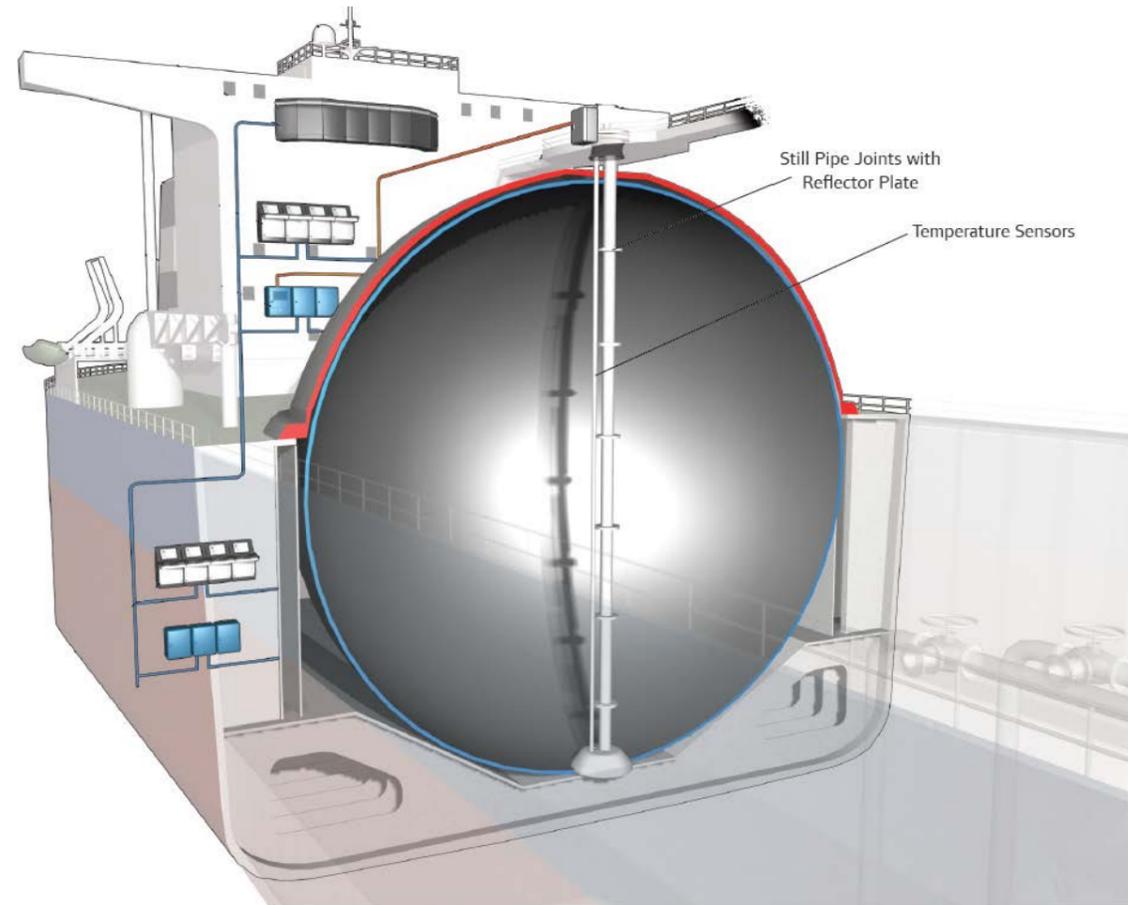


Figure 7: Tank installation, using existing penetration in tank dome (example)

Each pipe section is supplied with flanges prepared with reference markers. The liquid level and the markers are measured simultaneously, hence the system automatically verifies itself at every measurement. By careful calibration of the pipe section lengths before installation, the position of the markers are recorded and stored in the system. By comparing the liquid echo with the reference marker echo, a continuous auto-calibration of the measurement is done.

AutroCAL® ensures high accuracy over the whole measurement range, independent of the gas mixture, pressure and temperature.

Cargo Temperature Unit (CTU)

KONGSBERG Cargo Temperature Unit (CTU), GC-306, is a marine approved multi-channel signal converter. The CTU is designed for installation on deck and to accurately transform and transmit temperature measurements from up to six sensors installed inside cargo tanks onboard liquefied gas carriers.

Cargo temperature sensors

KONGSBERG temperature sensors are specially designed for accurate temperature measurements, manufactured to meet the requirements set in the governing international standards for Custody Transfer Systems. Calibrated Pt-100 1/10 elements are used for optimum performance. Each sensor is delivered with a unique serial number and a calibration certificate.

Vapour pressure transmitter

The pressure transmitter is used for accurate measurement of vapour pressure, specially calibrated to ensure the highest accuracy. The pressure transmitter comes with a 3-way control valve.



Figure 8: Standpipe installation with marker