Sensors and Automation systems
Product Catalogue
Introduction

API Marine is a designer and manufacturer of integrated automation systems and sensors for LPG/LNG carriers, oil & chemical tankers, offshore vessels & oil rigs.

With research center in St.Petersburg, Russia and production headquarters in Aalborg, Denmark, API Marine is able to accomplish - in the shortest possible time limit - any order for sensors and automation systems for tankers, offshore FSO & FPSO, oil & gas terminals, as well as for such complex objects as offshore drilling platforms, ice-breakers, offshore stand-by vessels.

A well-established service network worldwide enables API Marine to deliver and service sensors and systems around the globe.

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Integrated Automation System (IAS) - TSS/Control™ provides centralized control and monitoring, emergency alarm and status alarm for the following equipment:

- Main engine
- Diesel-generator
- Electric power station
- Remote automated control
- ER auxiliary equipment (boilers, separators, etc)
- On-line monitoring of loading, stability and floatability
- General alarm
- Engineer call system
- Bridge navigational watch alarm system
- Deadman alarm system
- Visual & audio alarms in ER (light columns)

As well as control over:

- Cargo and ballast operations
- Pumps & valves of ballast and cargo systems
- Other equipment

For improved reliability, data transfer between subsystems of the TSS/Control™ system, is carried out via Turbo Ring network.

TSS/Control™ is an open system with possibility to integrate other manufacturers’ equipment into it. API Marine also manufactures a set of sensors and switches for IAS, which can be supplied both as a part of the system and separately.

Designations

1. Power cable 2x2.5
2. Cable nx1
3. ETHERNET cable 2x2x0.5 in screen
**TSS/Cargo™**

**Cargo Control System for Tankers**

Cargo control system for oil & chemical tankers TSS/Cargo™ is designed for monitoring all types of oil, oil products & chemicals in the cargo tanks and provides remote monitoring of the following parameters in the cargo and slop tanks:

- Cargo level
- Cargo temperature (up to 3 points)
- Inert gas pressure
- Pressure & vacuum in the cargo tanks
- High & high-high alarms (in addition to stand-alone TSS/Alarm™ system)
- Manifold pressure monitoring
- Draft, heel and trim monitoring
- Level in the ballast tanks
- Remote valve control

TSS/Cargo™ measurement accuracy is based on the use of high-precision level (GLF™ technology), temperature and pressure measurement instruments combined in one deck sensor - TGD™ with digital output, which allows to reduce deck cabling.

TSS/Cargo™ meets all IMO and classification societies’ requirements for oil carriers and enables to calculate volume of stored and transferred cargo with high accuracy. During cargo operations TSS/Cargo™ system provides on-line cargo information. Information from sensors is transmitted to the cargo computer MasterLoad™, where loading, strength, and stability are calculated on-line, and safety of operation parameters in the current loading condition is being controlled. Preliminary preparation of cargo plan is also possible.
TSS/Alarm™
High Level Alarm System for Tankers

API Marine manufactures TSS/Alarm™ - 95%/98% Level Alarm System, which is used for high and high-high level detection in oil & chemical tankers, FSO & FPSO, LPG & LNG carriers, oil barges.

TSS/Alarm™ provides level control in one or two control points in each cargo or slop tank.

The system provides sound and light signals when critical level is reached. Light and sound alarms are provided on the alarm panel and on deck.

When reaching the critical filling level, alarm is activated and yellow light-emitting diode sends signals to the alarm panel. Simultaneously, sound signals are sent to the alarm panel, horn and yellow flashing lamp.

When pressing the acknowledgement button, the sound alarm is switched off, the corresponding light indicator changes from blinking to continuous flashing.

When emergency level is reached, the process is repeated with sending a light signal to the red light-emitting diode and red flashing lamp.

Operational reliability of TSS/Alarm™ system is provided by a special deck sensor - TLA™ with the following features:

- Built-in self-test
- Test buttons for “manual” test before loading/unloading
- Stainless steel housing and rods
- IP67 protection

Since TLA™ level switches are located in explosion hazard zone, commutation is carried out along spark-proof circuits through spark protection barriers.

TSS/Alarm™ can be supplied separately or as a part of Integrated Automation Control System (IAS) - TSS/Control™ (see page 4).

**Technical characteristics of TSS/Alarm™ system**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cargo/slop tanks</td>
<td>unlimited</td>
</tr>
<tr>
<td>Cabinets protection level</td>
<td>IP44</td>
</tr>
<tr>
<td>Main power supply</td>
<td>220 VAC/24 VDC</td>
</tr>
<tr>
<td>Backup power supply</td>
<td>220 VAC/24 VDC</td>
</tr>
</tbody>
</table>

**Technical characteristics of TLA™ level switch**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of alarm points</td>
<td>2 points</td>
</tr>
<tr>
<td>Power supply</td>
<td>24 VDC</td>
</tr>
<tr>
<td>Material</td>
<td>stainless steel AISI 316L</td>
</tr>
<tr>
<td>Explosion protection</td>
<td>Ex ia IIC T6</td>
</tr>
</tbody>
</table>
TSS/Alarm-T™
Temperature Monitoring and Measurement System in Cargo Tanks & Holds

TSS/Alarm-T™ is designed for cargo temperature measurement at a given level in cargo tank and sending warning signal to the operator when reaching and exceeding the set temperature value.

TSS/Alarm-T™ provides:
- Temperature measurement in tanks and cargo holds
- Actual tank/hold temperature value indication
- Actuation of warning light (LED indicator) and sound (buzzer) signal when temperature reaches the set upper control value (overheating)
- Warning signal acknowledgement by pressing the corresponding button on the alarm panel
- Power supply to temperature sensors UTT™; if sensors are located in explosion hazard zones, power should be supplied through explosion-proof circuits
- Diagnostics of communication line with level switches for disconnection or short circuit
- Alarm test (LED lamps and buzzer efficiency) by pressing the corresponding button
- Direct regulation of lamp and temperature indicator brightness (dimmer)

Additional functions
The system can be supplied with extended features:
- In addition to overheat alarm, it is possible to provide alarm of lower limit of average temperature range of cargo in the tank
- It is possible to include horn and flashing lamp to the scope of supply of the system
- Power supply is possible both from 220 VAC feeder (main) and from 24 VDC (backup)
- When reaching temperature setting values (both “overheat” and “cooling”), emergency-alarm signal is sent to the external system of equipment control.

This allows making cargo heating process automatic

TSS/Alarm-T™ consists of UTT™ temperature sensors (according to the number of tanks), local technological station and alarm panel.

<table>
<thead>
<tr>
<th>Technical characteristics of TSS/Alarm-T™ System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of control points</td>
</tr>
<tr>
<td>System power supply voltage</td>
</tr>
<tr>
<td>Power supply of UTT™ temperature sensors</td>
</tr>
<tr>
<td>Spark-proof circuit</td>
</tr>
<tr>
<td>Power consumption of one measurement channel</td>
</tr>
<tr>
<td>Protection level of UTT™ sensors</td>
</tr>
<tr>
<td>Local Technological Station LTS9</td>
</tr>
</tbody>
</table>

Temperature sensors UTT™ are placed so that the sensitive element is at the level where temperature should be measured in cargo tank. Sensitive element is placed in the thermowell of corresponding length. The thermowell represents a steel pipe with the bottom that isolates sensitive element from the contact with cargo. Since UTT™ temperature sensors are located in explosion hazard zone, power is supplied through spark-proof circuits via explosion protection barriers. Explosion protection barriers are located in LTS9 cabinet; they supply 24 V voltage power to the UTT™ sensors and provide signal processing from UTT™ sensors.

Alarm panel is located on cabinet door of LTS9. The status of level switches is displayed on the alarm panel.

Indication and control channel consists of UTT™ sensor, explosion protection barrier, pointer indicator with adjustable scale lighting, LED indicator, buzzer, and acknowledgement button. The pointer indicator of temperature in tank indicates temperature in the tank of operator’s choice by rotating the tank selector switch to the required position. The buzzer and acknowledgement button are common for all channels. Brightness of temperature indicator lighting and all panel lamps is regulated with the direct control handle (dimmer).

Under standard conditions temperature in the tank does not exceed the set control value (“overheating”). In this case the corresponding tank indicator on the alarm panel and sound alarm are not activated.

When tank temperature reaches set value (overheating temperature value) the corresponding relay is actuated, its contacts are closed. LED indicator on the alarm panel starts flashing, sound alarm is actuated, which attracts operator’s attention.

When “Acknowledgement” button is pressed, sound alarm is switched off, LED indicator changes to continuous flashing. When tank cargo temperature becomes lower than the set value, LED indicator goes out.

If one of the control channels fails (breakage or short circuit of communication cable with UTT™ sensor), a warning signal is actuated and a corresponding LED indicator lights up on the alarm panel.

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TSS/BMS4™
Electro Pneumatic System for Measuring Level in Ballast and Service Tanks, Cargo Density, Vessel Draught

TSS/BMS4™ is the next generation of electro-pneumatic systems for level, density and draught measurement, developed by API Marine, featuring improved modular design, enhanced capabilities and reduced costs.

TSS/BMS4™ is designed to measure level in ballast and service tanks, cargo density in cargo tanks and vessel’s draught. The system can also be used for level and density measurement in onshore storage tanks.

Level measurement principle of TSS/BMS4™ is based on periodic purging of compressed air from the system to the tank bottom through an air tube and measurement of the settled air pressure in the tube. For draught measurement the air tube is led out to the bottom of the vessel. Density measurement principle of the system is based on measuring pressure difference in two air tubes, mounted in the tank and the known distance between these tubes.

TSS/BMS4™ consists of:
- Multi-point Electro-pneumatic Level Transmitter - a combined, integrated unit for air purging into the tubes, providing pressure measurement and calculation of level/draught/density, with pressure sensors for up to 12 measurement channels per single unit
- Air Handling Unit - a unit for preparation of compressed air according to the required parameters

Level transmitters, air handling unit and adapter unit can be combined into a single cabinet of the TSS/BMS4™ system.

Main advantages of the system:
- Adaptive pulse operation - minimum air consumption
- Built-in periodic zero self-calibration of pressure sensors
- Automatic monitoring for leaks
- Adaptive sequence measurement
- Recurrent automatic purging of air tubes for protection from contamination and freezing
- Equipped with a back-up pressure sensor for continuous operation even if the main sensor fails

Technical characteristics of TSS/BMS4™

<table>
<thead>
<tr>
<th>Number of measurement channels</th>
<th>12 channels per Level Transmitter, number of Level Transmitters - unlimited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range - pressure</td>
<td>0 – 1.8 bar</td>
</tr>
<tr>
<td>Measurement range - level</td>
<td>0 – 18 m</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>0.25%</td>
</tr>
<tr>
<td>Measurement rate</td>
<td>5 – 30 sec</td>
</tr>
<tr>
<td>Power consumption</td>
<td>5 W or less</td>
</tr>
<tr>
<td>Power supply</td>
<td>24 VDC (220V, 50Hz - optional)</td>
</tr>
</tbody>
</table>
**TSS/Cargo LPG™**

**Cargo Control System for LPG Carriers**

TSS/Cargo LPG™ - Cargo control and cargo volume/mass calculation system for LPG gas carriers is based on unique non-contact measurement principle - GLF™ (Guided Low Frequency wave).

Cargo control system designed by API Marine has no moving parts in cargo tanks and deck containers and provides ship-owner with the following advantages:

- Stable and accurate measurements of liquefied gas level (+/–2 mm) based on low-frequency acoustic wave both in cargo tanks and in deck containers
- Possibility of level measurement of stratification of different gases (e.g. nitrogen/butane)
- Possibility of bending the waveguide to avoid obstacles inside the cargo tank or deck container.

**Overflow Protection**

Ultrasonic level switches of TLA™/UTS™ type provide secure filling alarm and protection from overflow for different levels for example 86% and 95%. Ultrasonic level switches are manufactured based on technology patented in EU, Japan and USA, and provide high accuracy of level switching (+/–1 mm). Only fixed metal rods are lowered into a tank, which increases reliability and simplifies maintenance of the level switches.

**Temperature Measurement**

Temperature sensors TGD-T™/UTT™ can provide temperature measurement in 15 points inside the tank and transfer information on every point, as well as calculate temperature “profile” inside the tank.

API Marine supplies the following equipment package for LPG carriers:

- TSS/Control™ - integrated Automation System (IAS)
- TSS/Cargo LPG™ - Cargo Control System
- BMS4™ - Draught and Level Measurement System in Ballast Tanks
- MasterLoad™ - Cargo Computer with On-line Data Transfer

**Set of Sensors for LPG Carrier**

<table>
<thead>
<tr>
<th>TGD™ - Level measurement</th>
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<tbody>
<tr>
<td>Accuracy</td>
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<td>Cargo temperature</td>
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<tr>
<td>Ambient temperature</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TLA™/UTS™ - Overflow protection/Filling alarm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
</tr>
<tr>
<td>Cargo temperature</td>
</tr>
<tr>
<td>Ambient temperature</td>
</tr>
</tbody>
</table>

LPG carrier equipped with TSS/Cargo LPG™ system.
TSS/CTS LNG™
Custody Transfer System for LNG Carriers

TSS/CTS LNG™ System is designed according to the NKKK and Caleb Brett-KIMSKO requirements and is used for automatic measurement of level, temperature (up to 12 points in each tank) and pressure in cargo tanks of LNG carriers.

Based on the measured data, TSS/CTS LNG™ system calculates volume of liquefied gas and generates an auto report on loaded/unloaded gas amount, which represents the main official commercial document for liquefied gas transportation.

Main Advantages of the TSS/CTS LNG™ System:

- One deck sensor - TGD™ (Tank Gauging Device) for level, temperature and pressure measurement
- Single-pass in the tank
- 6 pairs of thermo-sensors ensure double reliability
- Information transfer by digital HART® protocol through 2 wires - less cabling
- Possibility of bending the waveguide to avoid obstacles inside the cargo tank or deck container
- Self-calibration

TGD™ sensor can be installed on one flange together with ultrasonic level switch TLA™ to provide independent tank overfill alarm.

In addition, TSS/CTS LNG™ system can be connected to the Cargo computer for calculation of stability, strength and floatability in on-line mode.

Interfaces for information output to Voyage Data Recorder (VDR), Emergency Shutdown System (ESD), and integration with level measurement system in ballast tanks and with draught measurement system are also provided.

TSS/CTS LNG™ system is supplied either stand-alone or as a part of Integrated Automation System (IAS - TSS/Control™ (see page 4).
TSS/Watch Alarm™
Bridge Navigational Watch Alarm System

TSS/Watch Alarm™ is designed for monitoring the status of the bridge operations and efficiency of the mate-on-watch.

TSS/Watch Alarm™ consists of two panels.

Start-up and mode selection panel is used for:
- System activation and selection of operation mode
  - manual or automatic
- Selection of inactivity period - 6 min, 9 min, 12 min
- Adjustment of brightness of the visual alarm panels
  (1st level light alarm)
- System failure indication
- 1st level visual and sound alarm
- 1st level visual and sound alarm check
- Acknowledgement of visual and sound alarm

TSS/Watch Alarm™ panel is used for:
- 1st level light and sound alarm

The panel is installed in ship’s cabins and public rooms. Face side of the panel consists of: visual alarm lamp, buzzer and lamp and buzzer test button. Panel’s back side has connectors for cable connection.

TSS/Watch Alarm™ system can operate in one of the three operation modes:
- The system is off
- The system is on
- Automatic operation mode

In “Automatic” operation mode the system is automatically activated on AUTOPILOT activation and is shut down when AUTOPILOT is switched off.

Change in the operation mode from one position to another can only be performed by the Captain or Mate-on-watch, using a key.

Depending on the selected time interval of 3, 6 or 12 minutes, light alarm starts blinking red on the start-up and mode selection panel and on the alarm and acknowledgement panel.

TSS/Watch Alarm™ signal is confirmed by pressing the acknowledgement button, which is located on the start-up and mode selection panel as well as using acknowledgement buttons located on all alarm and acknowledgement panels of the system.

If the light signal is not acknowledged within 15 seconds, the system automatically activates the 1st level sound alarm, which is located on the start-up and mode selection panel and on all alarm and acknowledgement panels.

The 2nd level alarm is activated 15 seconds after the 1st level sound alarm activation, if the Captain or the Mate does not acknowledge the signal. The 2nd level alarm includes light and sound alarm activation in all rooms, where TSS/Watch Alarm™ panels are installed.
**TSS/Docking™**

**Floating Dock Monitoring and Control System**

Floating dock monitoring and control system TSS/Docking™ provides measurement and calculation of dock draft, heel, trim and sagging, ballast mass, load on dock structures, control over pumps and gate valves of ballast systems.

**TSS/Docking™ ensures maximum safety during dock operations and provides:**

- Remote measurement and indication of:
  - Level in ballast tanks
  - Drafts
  - Temperature in “dry” compartments
  - Water presence in “dry” compartments

- Remote control and indication of operation/position of:
  - Valves, shutters
  - Pumps

- Warning signal when the operating limit is reached by one of parameters
- Ship positioning in the dock using laser range-finders
- On-line calculation of longitudinal strength and bending moments
- Planning of the dock operations
MasterLoad™
Cargo Computer/Strength Monitoring System

MasterLoad™ is a software package for calculation of load, stability, strength, floatability for tankers, gas carriers, dry bulk cargo ships, container carriers, sea-river vessels, general cargo vessels, floating drilling platforms, floating dry docks, floating cranes and other types of floating structures.

MasterLoad™ allows to:

• Create loading and ballasting plan of the vessel in on-line mode and save it in the Database
• Develop a ballasting scheme for the vessel (floating platform), based on specified draft
• Calculate trim/heel, stability and strength of undamaged vessel in the current load status
• Create a virtual model of emergency situation and calculate trim and stability when specified compartments are flooded
• Calculate dock operations (arrangement of ships in the dock, ballasting and strength calculation)
• Arrange integration of separate modules of the floating object with calculation of trim-stability at each step of enlargement

MasterLoad™ Screen Examples:

MasterLoad™ is certified by international classification societies as an onboard strength monitoring device. It has a simple user-friendly interface, allows data input to the calculation program directly from sensors installed in cargo, ballast or service tanks (on-line mode), which ensures accuracy of trim, stability, strength calculations. Off-line mode allows compiling preliminary loading and ballasting scheme and automatically generating output documents “for sailing/for arrival”.

Information on ship’s load condition can be transferred through mobile networks (satellite/cellular) to the shore center or ship-owner.

The program has interface for communication with the Emergency Response Centre for immediate information transmission about emergency situations.

Modules for Different Types of Ships

Tankers
• On-line communication with sensors in cargo tanks
• Automatic calculation of the amount of loaded/unloaded cargo
• Drafts correction

LNG and LPG Carriers
• On-line communication with sensors in cargo tanks
• Calculation of free surface influence during cargo evaporation
• Calculation of acceleration from displacement of cargo masses

Bulk Carriers
• Special transportation features for bulk cargo (SF-factor)
• Drafts correction
• On-line communication with level sensors in ballast and service tanks

Sea-river vessels
• Cargo plan for different types of cargo
• Calculation of trim for passage under bridges
• SQUAT effect calculation

Container Ships
• Automatic distribution of containers
• Sorting by loading/unloading ports
• Windage calculation adjusted for deck containers

General Cargo Vessels
• Cargo arrangement in hold in on-line mode
• Shallow-water effect calculation
• Special transportation features for timber cargo

Floating Cranes
• Prior calculation of suspended cargo effect
• Calculation of heel, trim and stability

Offshore Floating Drilling Platforms
• Stability calculation in transition modes
• Trim calculation in emergency modes
• Automation of ballasting operations
UTS™
Universal Level Switch UTS™ has extended operating temperature range from –200°C to +450°C and is designed for level detection in cargo holds, wells & service tanks in sea and river ships, oil tanks, chemical tankers, gas carriers, offshore drilling platforms.

Ultrasonic Tank Switch UTS™ is made of stainless steel and is used for level detection of liquids in vessel tanks, storage tanks, bilge water tanks, cofferdams as well as for control of water ingress to vessel’s compartments.

The operating principle of UTS™ is based on a breakthrough patented acoustic wave technology, providing outstanding results in extreme operating temperatures. Accuracy of measurement is ensured regardless of shape of tank, type of liquid or liquid temperature.

UTS™ is installed outside the tank/pipe with only a metal rod inside the tank/pipe. Acoustic waves in the metal rod created by piezo-electric transducer ensure transmission of signals. When liquid in the tank reaches the probe on the rod, the emission of sound waves is muffled. This change is picked up by the piezo-electric transducer and a signal is transmitted to the corresponding alarm. Having only the metal rod inside the tank and no mechanical or moving parts means no maintenance is required.

UTS™ can be easily installed in vertical, horizontal or any inclined position and is tested for operation in a wide range of media, such as water, oil, petroleum, petrochemicals, acids, wastewater as well as many others. Made of high-grade stainless steel, UTS™ can also be used in tanks and reservoirs with food products.

UTS™ can be installed indoors as well as outdoors, including explosive environments and harsh arctic conditions.

**UTS™ Technical Characteristics**
- **Length**: 65mm/115mm/or any on request
- **Housing material**: stainless steel AISI 316L or on request
- **Input**: 18 to 30 VDC
- **Output**: 4-20 mA current loop or relay
- **Explosion protection**: Ex ia IIC T6
- **Operating temperatures**: ambient: -55°C...+85°C product: -200°C...+450°C
- **Pressure**: up to 200 bar

UTS™ is characterized by high resistance to sticky products, high robustness and shock resistance and increased reliability under dynamic load and vibrations due to reinforced rod and electronic unit of new generation. UTS™ is also supplied in a special “Arctic” version, for applications in harsh environments with ambient temperature of down to -60°C without heating the device.

**API UTS™ Features**
- Any type of liquid
- Only steel rod inside the tank (electronics and connections outside)
- Fully welded construction
- No moving parts
- Extended temperature range
- No maintenance required
- Automatic self-test
- No calibration needed
- Explosion proof
- Pre-adjustable alarm points
- No sensitivity to foam
- More than 300 possible variations

**UTS™ Coding Sheet**

**Housing type**
- Protection level IP67: 6 7
- Protection level IP68: 6 8
- Compact IP68: M 8

**Length of the switch**
- Minimum length 65 mm: 0 0 6 5
- Standard length 115 mm: 0 1 1 5
- Length on request (specify in mm): X X X X

**Type and size of connection**
- Metric straight thread M27x1.5: M 2 7
- Straight pipe thread 1 inch: 0 1 G
- Flange DN25 PN10-40: F 2 5
- On request: X X X

**Output signal**
- Current 14 mA (“dry”)/7 mA (“wet”): C 1
- Current 7 mA (“dry”)/14 mA (“wet”): C 2
- Namur*: N A
- Dry contact: open (“dry”)/closed (“wet”): R 1
- Dry contact: open (“wet”)/closed (“dry”): R 2

**Cable input, cable length**
- PG 13: P 1 3
- M24x1.5 internal: M 2 4
- Special for IP68, specify cable length in meters: X X X

**Temperature range of controlled liquid**
- Standard (–55°C...+100°C): L
- High temperature 1 (–55°C...+200°C): M
- High temperature 2 (–55°C...+325°C): N
- High temperature 3 (–55°C...+450°C): H
- Low-temperature (–200°C...+100°C): C

**Explosion protection**
- Standard type: N
- Ex type: I

**Temperature range of controlled liquid**
- Standard (–55°C...+100°C): L
- High temperature 1 (–55°C...+200°C): M
- High temperature 2 (–55°C...+325°C): N
- High temperature 3 (–55°C...+450°C): H
- Low-temperature (–200°C...+100°C): C

**Explosion protection**
- Standard type: N
- Ex type: I

**Additional certification - if not needed, this section is left out**
- Russian Maritime Register of Shipping (RMRS): M
- Russian River Registry (RRR): R
- Det Norske Veritas (DNV): D
- Germanischer Lloyd (GL): G
- Lloyd’s Register (LR): L
- Bureau Veritas (BV): B
- American Bureau of Shipping (ABS): U
- Registro Italiana Navale (RNA): I
- Other: X

UTS™ codes ver.08.12.08
*Currently unavailable*
TLA™ - Tank Level Alarm is used for detection of high (95%) and high-high (98%) levels in tanks. TLA™ is installed on the deck of tankers, gas carriers, floating storages, FSO, FPSO, onshore storage tanks for oil, petroleum products and liquefied gases.

Built on the same patented acoustic wave technology as UTS™, TLA™ features high level of accuracy, reliability and customizability.

TLA™ represents a two-point level switch with alarm levels defined by length of rods, which are produced on request. Built-in test buttons are used for performing functionality test before filling in the liquid, in accordance with requirements of classification societies. Being highly adjustable to customer’s requirements, TLA™ can also be supplied as a three-point version.

Scope of supply consists of a flexible metal hose 0.5 m for connection to the metal pipe, in which cable routing is laid on the deck.

TLA™ Features
- Works with any type of liquid and liquefied gas
- Easy installation
- No maintenance
- No moving parts
- No electronics inside the tank
- No sensitivity to vapor, moisture and foam
- Automatic self test
- Lengths on request
- Only steel rod inside the tank (electronics and connections outside)

TLA™ Technical Characteristics

<table>
<thead>
<tr>
<th>Length</th>
<th>on request</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing material</td>
<td>Stainless steel AISI 316L</td>
</tr>
<tr>
<td>Input</td>
<td>18 to 30 VDC</td>
</tr>
<tr>
<td>Output</td>
<td>4-20 mA current loop or relay</td>
</tr>
<tr>
<td>Explosion protection</td>
<td>Ex ia IIC T6</td>
</tr>
<tr>
<td>Protection level</td>
<td>IP67</td>
</tr>
<tr>
<td>Operation temperature range</td>
<td>ambient: -55°C...+85°C</td>
</tr>
<tr>
<td>Number of alarm points</td>
<td>2 (optional 3)</td>
</tr>
<tr>
<td>Built-in test buttons</td>
<td>2 (optional 3)</td>
</tr>
</tbody>
</table>

TLA™ Coding Sheet

Connection
- Flange DN50 PN10-16: F 5 0
- Other: X X X

Product pressure
- Standard (below 0.1 MPa): 0
- Pressure above 0.1 MPa: 1

1st switch point
- Length of 1st rod in mm L2 (min. 150 mm): X X X X

2nd switch point
- Length of 2nd rod in mm L2 (min. 150 mm): X X X X

Output signal
- Current 14 mA (“dry”)/7 mA (“wet”): C 1
- Current 7 mA (“dry”)/14 mA (“wet”): C 2
- Current: upper C1, lower C2 (upper – the shorter rod): C 3
- Current: upper C2, lower C1: C 4

Additional certification – if not required, this section is left out
- Russian Maritime Register of Shipping (RMRS): M
- Russian River Registry (RRR): R
- Det Norske Veritas (DNV): D
- Germanischer Lloyd (GL): G
- Lloyd’s Register (LR): L
- Bureau Veritas (BV): B
- American Bureau of Shipping (ABS): U
- Registro Italiana Navale (RINA): I
- Other: X

TLA™ codes ver.08.02.08
TGD™ - Tank Gauging Device - a multifunctional deck sensor is designed for simultaneous measurement of level, temperature (up to 15 points), pressure and density (option) in cargo tanks of tankers, gas carriers, floating storages, FSO, FPSO, offshore drilling and fixed platforms, onshore oil, petroleum products and liquefied gas storage tanks.

Depending on the application type, TGD™ can be supplied as a 1-channel (level or temperature measurement), 2-channel (level + temperature; temperature + density), 3-channel (level, temperature and pressure/density) or 4-channel version (level, temperature, pressure and density).

Operation principle of TGD™ is based on the patented principle of Guided Low Frequency (GLF™) wave propagation, which allows equally precise measurements along tank height with any shape of tank and type of liquid.

**Principle and Advantages of GLF™ Technology**
- GLF™ technology measures difference in density between air and liquid
- Tank geometry and objects inside the tank, such as ladders, heating pipes, etc. do not affect the signal
- GLF™ technology secures equal measurement accuracy of the whole tank – from top to bottom
- Automatic calibration with accuracy of 1 mm every 2 seconds
- GLF™ technology is not affected by foam
- GLF™ technology allows a reduced number of sensors to be installed in tank
- Flexible solution with possibility for waveguide to be bent/curved

### TGD™ Features
- Automatic calibration
- High level of accuracy
- Less cabling - only 2 wires
- No moving parts - longer lifetime
- Flexible and easy installation
- Explosion proof

### TGD™ Technical Characteristics
- **Housing material**: Stainless steel AISI 316L
- **Electrical connection**: 2-wires line (HART™)
- **Explosion protection**: Ex ia IIC T6/T5
- **Output**: 7-14 mA current loop or relay
- **Protection level**: IP67
- **Operating temperature range**: -55°C...+85°C

### TGD™ Measurement Channels
- **L - level measurement**
  - Measurement range: 0...30 m
  - Measurement accuracy: +/- 2 mm
  - Product temperature range: -200°C...+150°C
- **T - temperature measurement**
  - Number of measurement points: up to 15 points
  - Measurement accuracy: 0.15°C
  - Measurement range: -200°C...+150°C
- **S - density measurement**
  - Accuracy: 500-1500 kg/m³
  - Measurement range: 0.1% of measured range

### TGD™ Coding Sheet

<table>
<thead>
<tr>
<th>Model type</th>
<th>Industrial application</th>
<th>Marine application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P</td>
<td>M</td>
</tr>
</tbody>
</table>

### Length of probe
- **Nominal length of probe, waveguide**
  - **Length in meters**: X X X

### Cable input
- **Type**: 
  - A
  - B
  - C
  - D
  - E
  - F
  - On request: X

### Flange connection: nominal diameter DN
- **DN 50**: A
- **DN 65**: B
- **DN 80**: C
- **DN 100**: D
- **DN 200**: E
- **Thread M28x1**: F

### Flange connection: version
- **Type 1**: 1
- **Type 2**: 2
- **Type 3**: 5
- **Thread connection**: 0

### Section: L - level sensor / Excess pressure above product
- **Below 0.1 MPa**: 0
- **Above 0.1 MPa**: 1

### Flange connection
- **Type**: 
  - A
  - B
  - C
  - D
  - E
  - F
  - On request: X

### Section: T - temperature sensor
- **Number of measurement points**: from 2 to 15, with “W” from 2 to 14
  - **Length in meters**: X X X

### Flange connection: nominal diameter DN
- **DN 50**: A
- **DN 65**: B
- **DN 80**: C
- **DN 100**: D
- **DN 200**: E
- **Thread M28x1**: F

### Coding principles
- TGD code consists of the following sections:
  - General section - general characteristics of the sensor
  - **Section L - level sensor specification**
  - **Section T - multilevel temperature sensor specification**
  - **Section S - differential pressure sensor for measurement of density**
  - **Section W - level sensor for bottom water**

If any of the sensors is not required, the corresponding section is left out. Section W is required only in presence of section T. If length is less than 10 meters, the first length position to be indicated as zero.
**UPT™ Universal Pressure Transmitter**

**UPT™** - Universal Pressure Transmitter is used for measurement and detection of pressure in tanks and pipeline installations onboard or ashore, for level measurement (hydrostatic method) in service, ballast and slop tanks as well as for draught measurement.

Housing and membrane of UPT™ are made of stainless steel. UPT™ can be supplied with various types of flange and thread connections, including a special extension for installation on top of tanks and reservoirs.

Special attention has been given to meeting demands for a high level of enclosure, robust, compact construction and resistance to shock and vibration where conditions of high overload and temperature variation are common.

UPT™ can be specially designed for IP68 applications and it meets the highest standards and extended requirements for arctic and cold climate operations within industrial equipment, marine and off-shore applications.

**UPT™ Features**
- General purpose pressure transmitters
- Easy installation
- Customized solutions
- Superior performance
- Application versatility
- Plug-in electronic module

**UPT™ Technical Characteristics**

<table>
<thead>
<tr>
<th>Housing material</th>
<th>Stainless steel AISI 316L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>18 to 30 VDC</td>
</tr>
<tr>
<td>Output</td>
<td>4-20 mA, 2-wire, HIART™</td>
</tr>
<tr>
<td>Linearity</td>
<td>0.2% of measured range</td>
</tr>
<tr>
<td>Hysteresis effect and repeatability</td>
<td>0.1% of measured range</td>
</tr>
<tr>
<td>Calibration accuracy</td>
<td>0.25% of measured range</td>
</tr>
<tr>
<td>Zero thermal drift</td>
<td>0.25%/10°C (-10°C...80°C)</td>
</tr>
<tr>
<td>Load resistance, maximum</td>
<td>600 Ù at 24 VDC</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-40°C...+80°C</td>
</tr>
<tr>
<td>Temperature limit</td>
<td>-55°C...+125°C</td>
</tr>
</tbody>
</table>

**UPT™ Features**

<table>
<thead>
<tr>
<th>Range Code</th>
<th>Range Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 0.10 bar</td>
<td>0 B 1 0 0… 1.0 wcm 0 1 W 0</td>
</tr>
<tr>
<td>0 ... 0.16 bar</td>
<td>0 B 1 6 0… 1.6 wcm 0 1 W 6</td>
</tr>
<tr>
<td>0 ... 0.25 bar</td>
<td>0 B 2 5 0… 2.5 wcm 0 2 W 5</td>
</tr>
<tr>
<td>0 ... 0.40 bar</td>
<td>0 B 4 0 0… 4.0 wcm 0 4 W 0</td>
</tr>
<tr>
<td>0 ... 0.60 bar</td>
<td>0 B 6 0 0… 6.0 wcm 0 6 W 0</td>
</tr>
<tr>
<td>0 ... 1.0 bar</td>
<td>0 1 B 0 0… 10 wcm 0 1 0 W</td>
</tr>
<tr>
<td>0 ... 1.6 bar</td>
<td>0 1 B 6 0… 16 wcm 0 1 6 W</td>
</tr>
<tr>
<td>0 ... 2.5 bar</td>
<td>0 2 B 5 0… 25 wcm 0 2 5 W</td>
</tr>
<tr>
<td>0 ... 4.0 bar</td>
<td>0 4 B 0 0… 40 wcm 0 4 0 W</td>
</tr>
<tr>
<td>0 ... 6.0 bar</td>
<td>0 6 B 0 0… 60 wcm 0 6 0 W</td>
</tr>
<tr>
<td>0 ... 10 bar</td>
<td>0 1 0 B</td>
</tr>
<tr>
<td>0 ... 16 bar</td>
<td>0 1 6 B</td>
</tr>
<tr>
<td>0 ... 23 bar</td>
<td>0 2 3 B</td>
</tr>
<tr>
<td>0 ... 40 bar</td>
<td>0 4 0 B</td>
</tr>
<tr>
<td>0 ... 60 bar</td>
<td>0 6 0 B</td>
</tr>
<tr>
<td>0 ... 100 bar</td>
<td>0 1 0 0 B</td>
</tr>
<tr>
<td>0 ... 160 bar</td>
<td>0 1 6 0 B</td>
</tr>
<tr>
<td>0 ... 250 bar</td>
<td>0 2 5 0 B</td>
</tr>
<tr>
<td>0 ... 400 bar</td>
<td>0 4 0 0 B</td>
</tr>
<tr>
<td>0 ... 600 bar</td>
<td>0 6 0 0 B</td>
</tr>
<tr>
<td>0 ... 1000 bar</td>
<td>0 1 0 0 0 B</td>
</tr>
<tr>
<td>0 ... 1600 bar</td>
<td>0 1 6 0 0 B</td>
</tr>
<tr>
<td>0 ... 2500 bar</td>
<td>0 2 5 0 0 B</td>
</tr>
<tr>
<td>0 ... 4000 bar</td>
<td>0 4 0 0 0 B</td>
</tr>
</tbody>
</table>

**Connection type**

<table>
<thead>
<tr>
<th>Thread BSP 1/2&quot;-M</th>
<th>0 1 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thread BSP 1/2&quot;-M</td>
<td>0 1 3</td>
</tr>
<tr>
<td>Flange DN 25 PN16-40</td>
<td>0 2 5</td>
</tr>
<tr>
<td>On request</td>
<td>X X X</td>
</tr>
</tbody>
</table>

**Type of membrane**

<table>
<thead>
<tr>
<th>Normal</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical resistant</td>
<td>C</td>
</tr>
</tbody>
</table>

**Cable input or cable length**

| PG 13 | P 1 3 |
| PG 24 X 5 | X X X |

**Explosion protection**

<table>
<thead>
<tr>
<th>Standard type</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ex type</td>
<td>1</td>
</tr>
</tbody>
</table>

**Additional certification - if not needed, this section is left out**

| Russian Maritime Register of Shipping (RMRS) | M |
| Russian River Registry (RRR) | R |
| Det Norske Veritas (DNV) | D |
| Germanischer Lloyd (GL) | G |
| Lloyd’s Register (LR) | L |
| Bureau Veritas (BV) | B |
| American Bureau of Shipping (ABS) | U |
| Registro Italiano Navale (RINA) | I |
| Other | X |

UPT codes ver.08.02.08
UTT™
Universal Temperature Transmitter

Universal Temperature Transmitter UTT™ is used for temperature measurement of various media - water, oil, petrochemicals, acids, alkalis, gases and steam. UTT™ is characterized by a reinforced housing manufactured in stainless steel and a possibility of open-air installation.

Possibility of ordering the sensor with required probe length, with or without a thermowell, in explosion-proof or standard construction, with any thread or flange connection - makes UTT™ the most convenient solution for most ship applications.

UTT™ Features
• General purpose temperature transmitter
• Easy installation
• Customized solutions
• Resistant to aggressive media
• Resistant to temperature drop
• Easy connection to most interfaces

UTT™ Technical Characteristics

<table>
<thead>
<tr>
<th>Housing material</th>
<th>Stainless steel AISI 316L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>18 to 30 VDC</td>
</tr>
<tr>
<td>Output</td>
<td>4-20 mA, 2-wire, HART®</td>
</tr>
<tr>
<td>Explosion protection</td>
<td>Ex ia IIC T4-T6</td>
</tr>
<tr>
<td>Measurement range</td>
<td>-200°C...+400°C</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>± ± 0.15°C</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>55°C...+85°C</td>
</tr>
</tbody>
</table>

UTT™-67 temperature sensor with thread connection

UTT™-68 submersible temperature sensor

UTT™-67 temperature sensor with thread connection

UTT™-68 submersible temperature sensor

UTT™-67 temperature sensor with thread connection

UTT™-68 submersible temperature sensor

UTT™-67 temperature sensor with thread connection

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UTT™-67 temperature sensor with thread connection

UTT™-68 submersible temperature sensor
Ultrasonic level switch UTS™
Main advantages

- With rigid extension rod up to 6m
- With flexible extension rod up to 20m
- P up to 200 bar
- Actuation point is raised to avoid false switching
- Ultrasonic wave remains inside the rod
- No sensitivity to foam
- High accuracy (repeatability)

Advantages of GLF™ (Guided Low Frequency wave)
Method of level measurement in cargo tanks

- Wave emission is localized inside the waveguide. There is no disturbance from the ladders, heating pipelines and other equipment inside the tank.
- The waveguide can be bent and inserted into the pump well for dry tank cleaning.
- Number of sensors and port holes on the deck are reduced by placing a thermowell next to the waveguide.
- TGD™ can be installed near the aft bulkhead for level gauging when vessel is down by the stern.
- During loading/unloading, when the turbulence is high, reflection from the surface inside the waveguide remains stable.
- Measurement accuracy is not affected by the foam formation.

- Wide length range
- Possibility to bend
- Resistance to sticking
- Wide temperature and pressure range
- High reliability - no moving parts
- Reliable construction ensures safe application in harsh environments
- Wave emission is localized inside the waveguide.
- No sensitivity to foam
- High accuracy (repeatability)

Current or relay output
With state-of-the-art technology we bring efficiency to our customers

API Marine is a house of competence, where development, design and production processes are united in unique solutions for advanced tank control. Entire liquid cargo control systems can be supplied - from sensors in the tank and operators’ stations to the calculation software, all fulfilling IMO requirements. API Marine is certified according to ISO 9001 and our products carry the ATEX PQAN approval.

We set new standards for tank measuring technology by bringing proven measurement technologies of the 21 century into use on tank installations within marine and industry. The unique state-of-the-art patented methods provide outstanding level of accuracy and reliability in tank measurements providing onboard safety and efficiency.

We want to contribute to our customer’s profitability supplying high quality products, excellent service and state-of-the-art high-tech solutions, where reliability and durability are key-words!