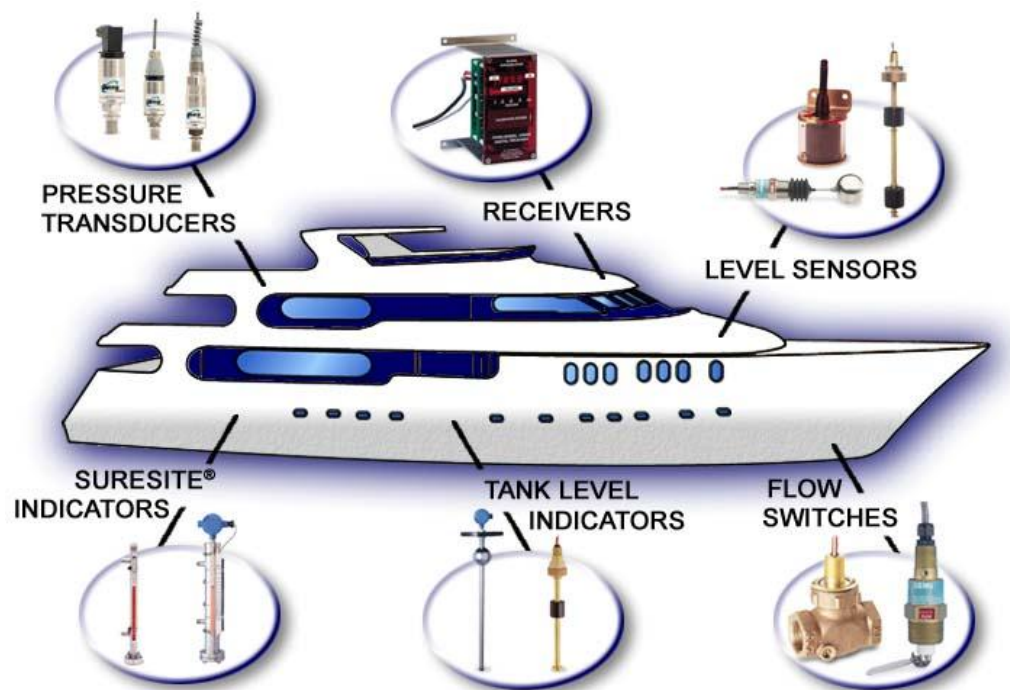


## Sea Sense – How Gems Sensors Provides Solutions for the Shipbuilding Industry

*Achieving maximum efficiency in marine operations means minimising maintenance and extending machine life – and that means applying some of the impressive, innovative devices used today for sensing pressure, level and flow.*

Pressure, level and flow are all essential criteria that have to be measured in a wide range of shipboard systems, from bilges, fuel and water tanks, to alarm, hydraulic and diesel equipment. The sensors used to measure these criteria have to be extremely robust, yet provide high levels of accuracy under often extremely demanding environmental and mechanical conditions. In addition, the ever growing need for ship operators to reduce costs means that machine systems need to run for longer, with less maintenance, so long term reliability combined with factors such as low hysteresis and zero drift have become essential.



The latest developments in flow, level and pressure sensor construction have yielded excellent results and ensured that these components function accurately over extended periods, overcoming such challenges as contamination and extremes of temperature. Pressure transducers, for example, are currently used to perform a wide variety of tasks throughout the marine sector, offering dependable operation in particularly aggressive conditions. Today's pressure transducers can withstand everything from high pressure hydraulic spikes originating from pumps and valves to extremes of temperature, mechanical shock and vibration. Key to the ability of pressure transducers to work reliably and accurately under such a wide range of marine operating conditions is the way in which sensor diaphragms and electronics packages are constructed.



## Pressure Transducers

A pressure transducer converts pressure, typically that of fluid or gas, into an electrical signal and delivers a continuous output of electrical signals that correspond to the precise pressure status. Pressure sensors contain a thin sealed sensing element or diaphragm that is in direct contact with the pressure media. Displacement of the diaphragm thus causes the strain gauge to flex, either in compression or under tension, with the electrical output being directly proportional to the pressure or vacuum applied. Output from the sensor is connected to on-board electronics, with the entire unit being contained in a compact and sealed stainless steel housing.

One highly effective method of producing sensors suitable for marine applications is sputtered thin film technology, a technique whereby a solid target material is bombarded by energised particles, causing it to release atoms. These are then deposited onto a sensing structure in a thin film and to a defined sensor pattern. The application of the sputtered thin film layer during manufacture results in a sensitive, robust sensor that is suitable for direct contact with almost all liquids, oils and gases.

Chemical vapour deposition (CVD) has offered another highly effective technology that can be used in the manufacture of pressure transducers. CVD sensors can also be manufactured economically, since they are produced on wafers in large batches, using polysilicon deposited on a stainless steel substrate, with the strain gauge patterns being chemically milled. The wafer is then divided to produce individual sensor beams, which are laser-welded to a stainless steel summing diaphragm and pressure port, before being connected to internal electronics for signal conditioning and amplification.

Couple with an ASIC electronics package, the performance and functionality of each transducer can be tuned to meet the specific requirements of individual customers. As with CVD, the benefits of ASIC technology have also brought reductions in manufacturing costs, which can only lead to an even greater presence of pressure sensors in marine applications. Statistically, the result of combining extremely sensitive pressure sensing elements with a sophisticated electronics package has resulted in some impressive statistics; responses to changes in pressure have been measured at 1m/sec or less, while sensor accuracy has shown almost zero drift over time. What's more, this level of performance can be maintained over long periods; transducers can now offer an operating life in excess of 100 million cycles, offering sensor technology at a low price and with little or no need for maintenance.

Gems Sensors and Controls manufactures a range of highly versatile, resilient and submersible pressure transducers using CVD, including the 2600 Series. These devices can be used in water applications and offer stability and accuracy in a variety of enclosure options rated at IP65 and above. For contact with grey and black water, the 5000 Series offers a robust option with an open face construction that allows the transducer to deliver accurate results in presence of viscous liquids and solids without clogging.

## Level Sensing

Level sensing can also deliver a valuable level of defence for shipboard systems provided the design addresses the specific needs of the application. For example, level sensing components for the bilges require robust resistance to contamination in compact form. The best of today's components have protective housings that



maintain reliable operation even if there is solid matter in the bilge water. These components can now be obtained with vulcanized cables, offering level switches with an ingress protection rating of IP67 for use as submersibles. These switches deliver a powerful solution for marine engineers when point level sensing is required in inaccessible areas of tanks. The LS-270 level sensor from Gems Sensors and Controls provides all of the qualities described above plus a float that pivots with changing liquid levels, displacing a shuttle that magnetically actuates a hermetically sealed switch within the unit.



Exceptional durability is also available in flow switches for marine applications. The large flow paths now designed into flow sensors keep pressure drop low; they also enable detection to be effectively carried out where liquids, including oil, are being handled in high volumes, such as within lubrication, cooling or process applications. To enable switch actuation at the desired flow rate, flow paddles can be trimmed during installation; this allows the paddle of the switch to pivot and move out of the liquid path as flow increases, keeping pressure drop to a minimum regardless of pipe size.



For easy to view liquid level indication that is both accurate and nearly indestructible, nothing beats SureSite® Indicators. They are already used in a wide variety of marine applications where quick visual communication of tank contents is paramount. SureSite® Indicators operate without power, in temperatures to 750°F (399°C) and pressure to 4200 psi (290bar); they are unaffected by extreme thermal changes. It's obvious that SureSite® Indicators offer a safer and more efficient alternative to cloudy, hard to read sight glasses. SureSite® Indicators feature brilliantly colored flags that provide clearly visible indication at more than 100 feet. Intrinsically safe because they operate without electricity, SureSite® Indicators are easily mounted to the exterior of tanks, regardless of shape or size.

Float technology also offers many advantages for shipboard operation. Transmitters measure the actual fluid surface position. Unlike sensors that extrapolate level from other measurements, Gems transmitters are unaffected by changes in pressure, temperature or specific gravity; these common changes often require recalibration and compensation in other sensor technologies. These float type transmitters can easily monitor the interface between liquids, including the emulsions and slurries that sometimes form between them. By adjusting the specific gravity of the magnetic float, the transmitter can be adapted to monitor the interface of a broad range of media. Used with level alarms, or automatic controllers, transmitters will help assure that only the “correct” liquid is pumped from a tank, and that hazardous fluids are not introduced to the environment.



The fact that today's pressure, level and flow devices can cope with constant shipboard vibration, yet continue to give accurate readings, is impressive, particularly when you consider the sensitivity of these components and the accuracy of the measurements they can provide. Indeed, it is the successful combination of sensitivity and resilience that has enabled pressure, level and flow devices to offer such reliable and accurate performance.

**For more information about how Gems Sensors & Controls finds solutions for the shipbuilding industry, please contact us by phone 1.800.378.1600, email [info@gemssensors.com](mailto:info@gemssensors.com) or visit our website [www.GemsSensors.com](http://www.GemsSensors.com).**