



# PRR

SIGNALS THE BEST

## Marine

Robust Solutions for the Marine Sector

A complete range of signal conditioning devices with universal AC/DC supply, high galvanic isolation and high EMC immunity, supplemented by DNV/GL and Ex approvals.

# Full Steam Ahead

with PR electronics' Signal Conditioning Products



## Navigating the choppy waters

From the Leviathan, to Homer's Sirens, Charybdis and Scylla or the legendary Hydra and Kraken, man has long been wary of the perils of the sea. While the mythology of the sea will always be a romantic part of the maritime tradition, today's practical challenges are in meeting the extremes that the marine environment presents.

Extremes of temperature from the Arctics to the Tropics, extremes of weather from the Doldrums to typhoons and hurricanes, extremes of shipping congestion from the Strait of Dover to the vast expanses of the Pacific and extremes of cargo from passengers to potentially explosive petrochemicals. Today's maritime industry has to meet these extremes along with tighter safety controls and ever increasing environmental regulation.

***PR has the products and experience in helping you rise to these challenges making sure that you are not left all at sea!***



### **"STATEMENT"**

***Jens Lintrup, Manager Maintenance & Modification, Wilhelmsen Technical Solutions A/S, Denmark***

*Many older ships use 0...10 VDC, where newer systems use 4...20 mA. Since our customers operate world wide and we often do not know the exact control system before we get onboard, or there are changes during a project, flexibility is crucial.*

*Therefore we have chosen PR electronics primarily because of the high flexibility and short delivery time.*



## Steer dead ahead

The marine industry inherently demands reliability. If you have process or control problems in the middle of the Pacific there is no quick (and practicable) courier solution to obtain that spare part you desperately need to get you under way. While redundancy is one, sometimes necessary, strategy, reliability is the key when procuring products for the marine industry.

PR has over 35 years of experience of developing signal conditioning devices, more importantly we are in charge of all development and production and are therefore in complete control of quality. Our processes have been tuned to accommodate the most stringent Full Assessment method of SIL approvals; therefore reliability is the cornerstone of our product portfolio.

Not only do we offer rapid delivery and free, competent advice before and after sales, we also support all of our products with a 5 years' guarantee.

**Buy it... Install it... Forget about it!**  
**Our 5 year guarantee means worry free!**



## Make headway

PR electronics has a history of innovation with our product characteristics of reliability, accuracy, flexibility and user friendliness. As one would expect many of our devices have DNV or GL approvals, as well as ATEX and SIL.

The product range offers:

- Temperature transmitters, universal devices, isolators, I.S. interfaces, displays and much more.
- Programmable devices with universal power supply and universal input and up to four independent relays for process surveillance and control.
- DIN rail or Power Rail, 11-pole socket and Form B head-mounted devices.
- DNV and GL marine approval.
- The I.S. approvals IECEx, ATEX, CSA, FM, GOST and UL.
- SIL 2-certified devices (Full Assessment according to IEC 61508).
- Uniquely high galvanic isolation (up to 3.75 kVAC) and EMC immunity.
- Easy configuration via front display or PC.
- Alarms in case of cable and sensor errors.
- Individually tested devices with a 5-year guarantee.
- Protocols: 4...20 mA, HART®, PROFIBUS® and FOUNDATION Fieldbus.
- Competitive prices.



All backed up with a network of sales subsidiaries and distributors ensuring global access to PR electronics' wide range of analogue and digital signal conditioning devices.

## Set sail in safe hands

To meet the harsh demands of the marine environment, we test our marine products to the requirements of Det Norske Veritas (DNV) and/or Germanischer Lloyd (GL) standards. Our safety standards do not stop there! You will find an extensive I.S. range including I.S. interfaces, 2-wire transmitters, displays, bus and HART® transmitters with approvals such as IECEx, ATEX, for gas and dust atmospheres, CSA, FM, GOST and UL. All I.S. interfaces from PR electronics are intrinsically safe isolation barriers ensuring low installation costs (no grounding necessary), maintenance-free operation and the prevention of ground loops and asymmetrical noise effects.



PR electronics was one of the first electronics manufacturers in the world to be certified as a developer of signal conditioning devices for SIL 2 applications in accordance with the Functional Safety standard IEC 61508.

Some of our latest products use the strictest certification according to Full Assessment which certifies not only the product but also the design procedures. Unlike some of our competitors we never use the "Proven in-use" approach.

## Green production of red devices

PR electronics' production is 100% lead-free, and we were one of the first companies in the business to comply with the RoHS directive aiming to protect the environment.





PR's range of signal conditioning devices is ready to face the harsh environments, varied signal types and demands found in the marine sector.

Our products are built to provide reliability and accuracy combating electrical noise, vibrations, and temperature fluctuations backed up by a range of approvals including DVN, GL, ATEX, SIL etc.

In addition to the products described in these pages, we also manufacture pulse/frequency devices, limit switches, power supplies and devices for special functions.



## Temperature Transmitters

PR electronics' range of reliable and accurate temperature transmitters covers every application requiring conversion of RTD and TC sensor signals to mA, V, HART®, PROFIBUS® PA and FOUNDATION™ Fieldbus communication. The range of transmitters for head, DIN rail and 11-pole socket mounting offers advanced features such as automatic switch between PROFIBUS® PA and FOUNDATION™ Fieldbus, PID control and LAS or Basic functionality with FOUNDATION™ Fieldbus.

Other features such as extended EMC specifications, fast response times, RTD cable compensation, automatic CJC, auto-calibration, sensor error detection including NAMUR, linearisation and complete programmability are the norm rather than the exception.

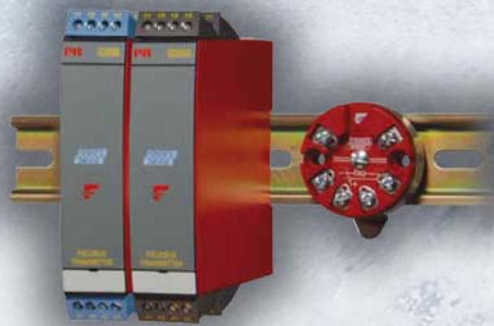


## Universal Transmitters

These versatile devices with universal supply handle all commonly used types of industrial signals allowing a small number of product variants to cover hundreds of applications. They are ideally suited for signal isolation, conversion, scaling, amplification, surveillance, and control and also function as interfaces, limit switches with set-points and windows, and simple calibration. The transmitters are easily configured with a PC or the detachable front display 4501.

All tasks are performed with high reliability, backed up by features and approvals such as DNV, SIL2, NE43 (sensor error), LVD and UL 508. NAMUR 21 (burst) is also a key demand to counter environments with high levels of electrical noise.

Programming is made easy with the detachable 4501 display available on the 4000 and 9000 series products featuring scrolling help texts in seven languages allowing you to copy the configuration to other devices, display process and output values and easily gain access to a large number of advanced functions. When used with the 4590 adaptor, the 4501 can upload its configuration to a PC for archiving purposes, or have configurations downloaded directly to it.



# Red Process





## I.S. Interfaces

When it comes to safety PR electronics does not take short cuts. We work closely with Test and Approvals houses to ensure that you will be in safe hands when using our products, offering FULL ASSESSMENT on many of our SIL-certified products. We comply with the strictest requirements for measurements in hazardous areas with gas and dust, with all of our I.S. interfaces using intrinsically safe isolation barriers. We can offer you a wide range of user-friendly universal products for nearly every application, involving analogue, digital or HART® signals, including the 4501 detachable front display and Power Rail on the 9000 series.

The interface range carries IECEx, ATEX, CSA, FM, GOST and UL approvals, as well as DNV thus facilitating world-wide application.



## Isolators

PR electronics' range of accurate isolators covers all forms of signal isolation, involving analogue, digital or HART® signals.

Our isolators can offer extremely high isolation levels of up to 3.75 kVAC and exceptional EMC immunity, utilising our patented STREAM SHIELD technology to provide high basic accuracy and maximum protection against noise.

With support for active or passive signal conditioning, loop supply and protection on inputs and outputs our signal isolators provide built-in flexibility.

Our product range also features isolators with 2-wire supply as well as isolators with external supply and includes both 11-pole socket, DIN rail and Power Rail mounted modules with the 6 mm wide 3000 series offering exceptionally fast response times, with DNV and GL approvals.



## Displays

The universal nature of our displays with 8 languages and scrollable help text leads to hundreds of applications with just a few variants. Features include universal supply, universal input, wide range of sensor support, easy programming and the options for linearisation, offset, special input ranges and advanced relay setting, e.g. delay.

Universally approved for use in Europe (CE), the USA (UL) as well as in the marine industry (DNV), the displays are also backed up with a high degree of galvanic isolation, IP65 seals and optional splash proof covers for the harsh environments.



***"With our global network of sales departments and distributors we can deliver to just about any port in the world usually within 2 days so that you are not left high and dry!"***



# Promoters

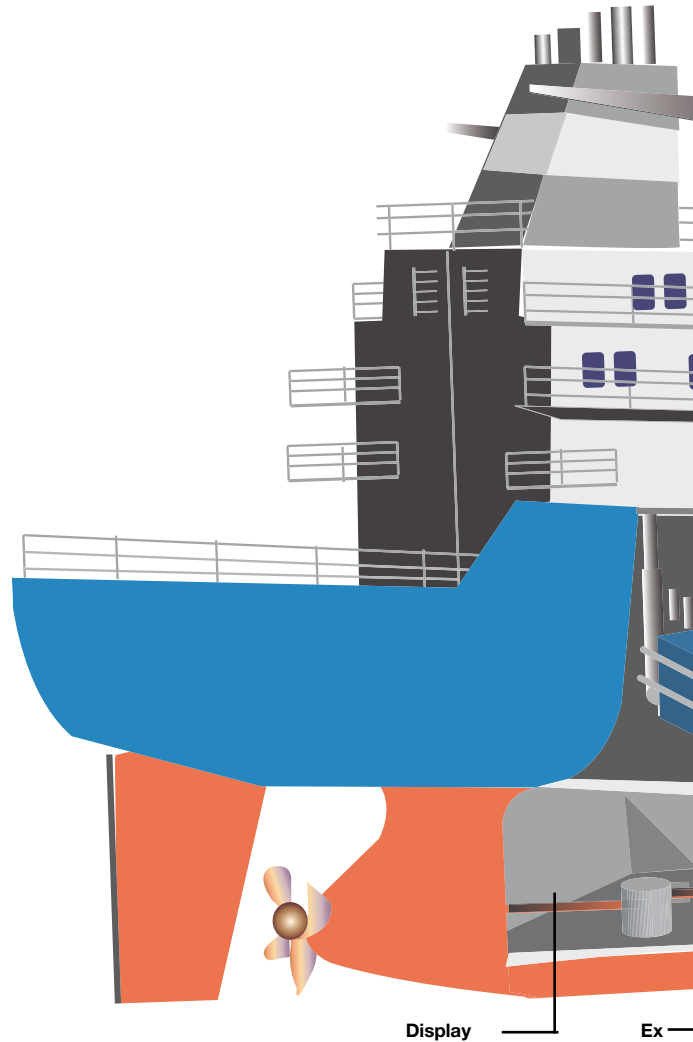


# Propulsion System

*The heart of any modern ship is its Engine Room. This can be a vast cavernous space in large ships or may be split up into several spaces housing various type of equipment such as the main engines (prime movers), auxiliary engines and generators and their associated oil, air, exhaust and cooling systems as well as the gearing for the propeller.*

*Strict rules and regulations govern this harsh environment of heat and vibration, due to the potentially hazardous nature of the fuels and exhausts coming into and exiting the area. This can mandate the inclusion of ESD protection systems, positive pressure systems, ATEX zones, gas detection systems to name but a few. Emission limits enforced after 2016 when operating inside SECA (NOx) areas means much attention is being focused on cleaner burning but potentially more flammable dual/tri fuel systems and gas turbine technologies.*

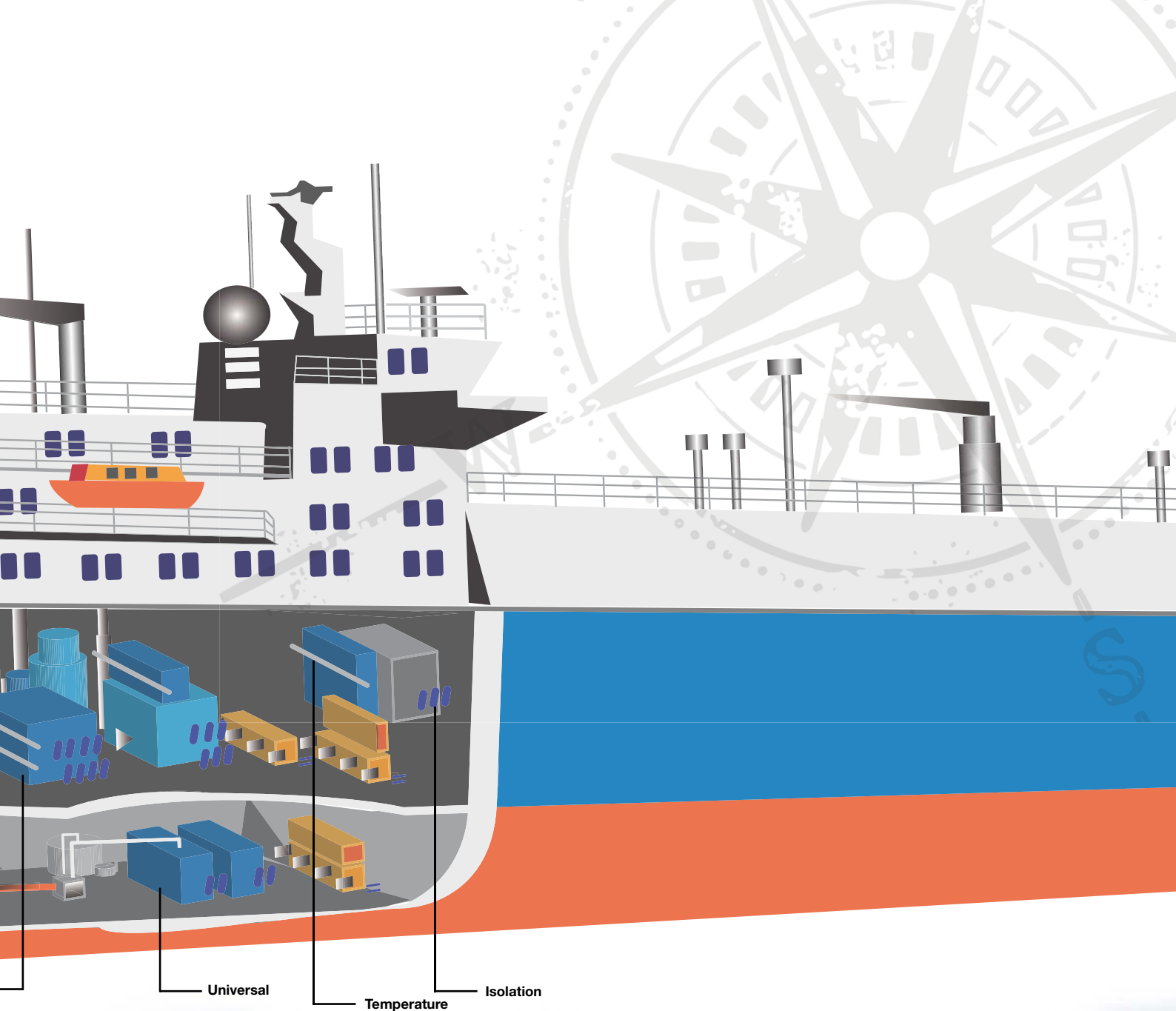
*PR has a portfolio of reliable, certified products that can be readily installed in this area, with DNV, GL and Ex approvals and superior isolation.*



## Isolation

In the electrically noisy environment of the machine room galvanic isolation, signal conversion, elimination of ground loops, scaling of process values, potential separation and noise filtration are key demands. These come as standard in PR's products with the result being accurate signal conditioning and a minimised risk of operational errors related to the transmission of signals from sensors and transmitters to PLC and DCS systems.





Universal

Temperature

Isolation

Ex

### I.S. interfaces

In an environment with fuels which can be highly combustible or have combustible vapours present, safety is paramount. PR's I.S. devices with zone 0 approvals and SIL assessments provide the documented assurance needed for your safety assessments along with a broad portfolio of functionality for your process needs.

°C

### Temperature

Many diesel marine engines can be several stories high and longer than a couple of double decker busses. This high investment piece of machinery has hundreds of sensors measuring numerous parameters with temperature being a key area. Bussed systems such as HART® are often used to reduce the wiring around the many temperature transmitters. PR's HART® range of temperature transmitters are a perfect fit for this application.

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### Display

Local displays in the engine room are used as a supplement to the central control room measuring just about every process imaginable. PR's universal displays can be used in conjunction with isolated splitters and converters to provide the capability of local and remote displaying of information.

# Propulsion System

## "STATEMENT"

*Jesper Hansen, Project Manager EI & Automation, Wilhelmsen Technical Solutions A/S, Denmark*

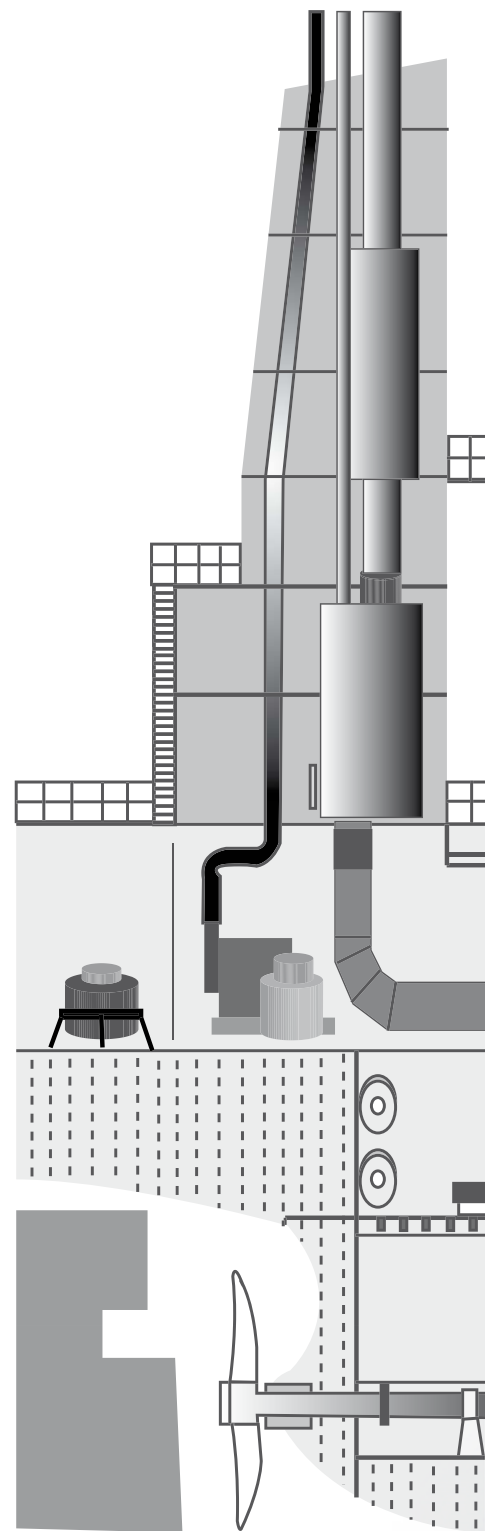
*We have successfully used PR relays as Ex barriers for numerous tanker projects for the Arctic region because of the great flexibility, allowing customers to change the configuration where necessary when navigating in areas where it is difficult to obtain service.*



### Engine cooling system

The high temperature system used to cool cylinder heads and the low temperature system for cooling air and lubricating oils can be monitored with the 5333 or 5334 TC/RTD temperature transmitters. Its flow, controlled by the thermostatic valve position, can be relayed using the 5725 f/l converter display configured with a contact input.

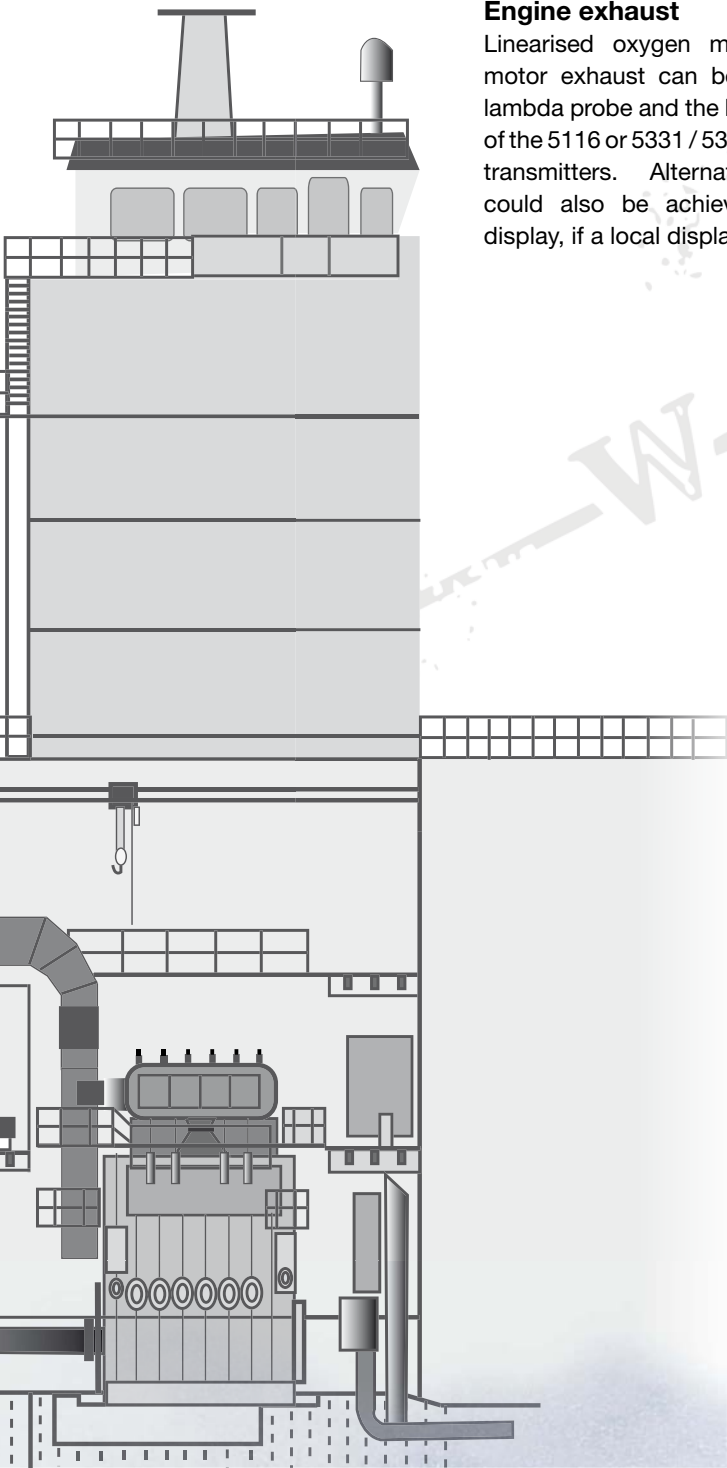
The temperature of the fresh water in the central cooling system, cooled by using seawater via a central heat exchanger, can be measured using the 5331 temperature transmitter along with a 5104 repeater and 5714 display if required.



### Propulsion bearings

Measuring the temperature of the shaft and/or thrust bearings with a 5333 or 5334 temperature transmitter allows for detection of early signs of wear or misalignment in preventative maintenance schemes.





### Engine exhaust

Linearised oxygen measurement in the motor exhaust can be achieved using a lambda probe and the linearisation features of the 5116 or 5331 / 5335 (HART®) universal transmitters. Alternatively, linearisation could also be achieved with the 5715 display, if a local display is required.

### Engine air system

The pressure of starting air compressors and receivers can be monitored using the 4114 or 4116 universal transmitters via a pressure sensor.

The turbocharger air temperature can be measured with a 5331 temperature transmitter (or 4116 universal transmitter if a latch control/alarm indication is required) to keep it between 15°C and 35°C.

### LNG / dual/tri fuel motors

Provide Ex isolation and local monitoring of the LNG boil off gas compressor pressure in conjunction with a pressure sensor, before and after compression, via a 9113 Ex temperature/mA converter, prior to being used for injection into the motor.

Monitor supply of gas with flow or pressure sensors using a 9116 Ex universal converter to provide Ex isolation and raise an alarm when the supply is interrupted to allow an auto switch to diesel only.

### Engine fuel oil system

Oil pressure can be displayed locally with the 5714 display, either connected in series to the PLC or acting also as an isolator using its mA output. For redundant solutions, the use of the 3108 splitter in conjunction with the 5714 display is recommended.

Heavy fuel oil preheater temperature can be measured using the 4114 and/or controlled with the 4116 / 4131 universal transmitters.

### Gas turbine

Icing detection of the turbine inlet may be monitored using temperature transmitters such as the 5331.

Monitoring the frequency of rotation of the turbine can be achieved using the 5725 f/l converter display.

Provide redundancy in measuring the temperature of the input of the recuperator, used to recover the energy lost in the gas turbine exhaust to preheat the combustion air, using two temperature sensors with a 5115A universal signal calculator.

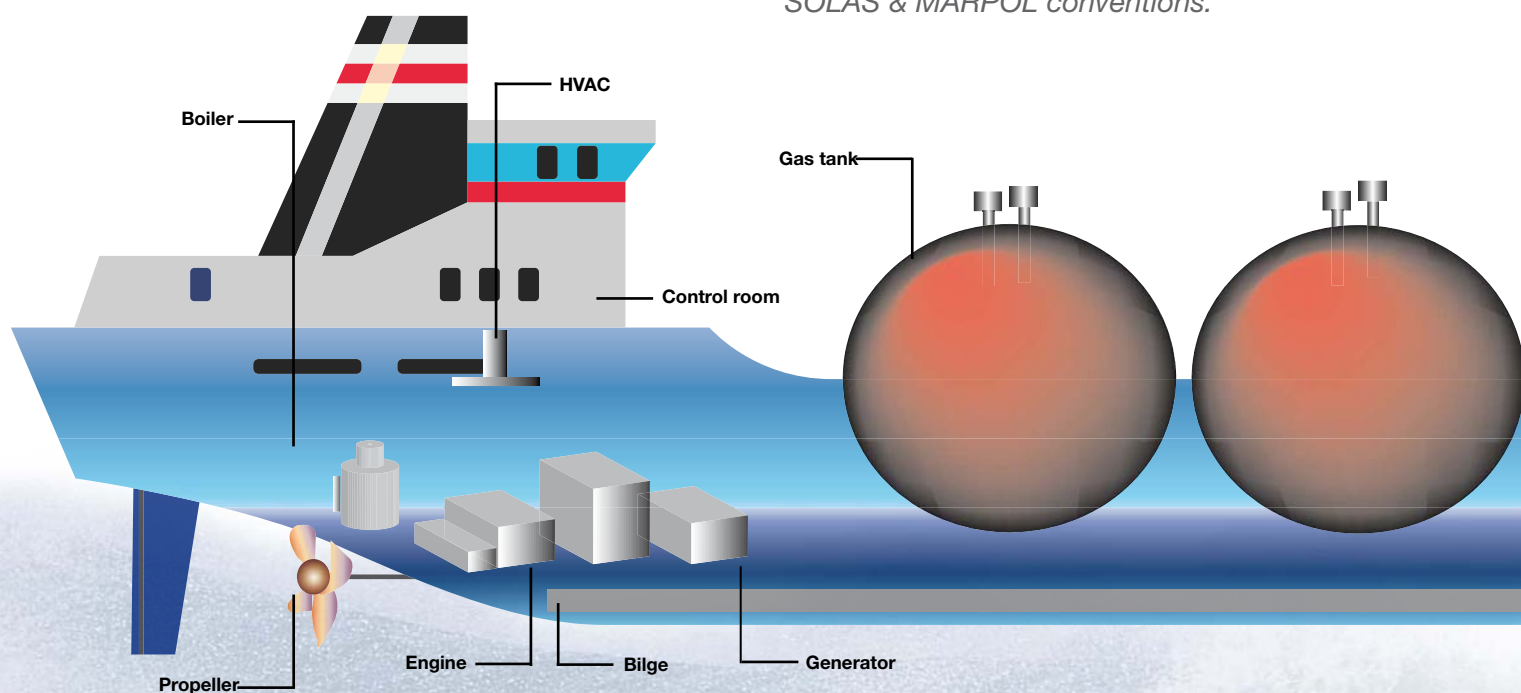
# Control Systems

Though the types of ship and marine vessels vary widely dependent upon their application, there are many common systems that need to be monitored and controlled centrally, often complemented with remote stations.

Tank level indication, various motor and pump control, HVAC, electrical and water systems are examples typically found on the majority of vessels.

To avoid long, expensive and complicated multi-cable runs, particularly on large vessels, bus systems such as HART®, PROFIBUS® or Foundation™ Fieldbus are often employed in the control and monitoring systems. The multiplexed nature of a bus system can save material costs and offer quicker installation and configuration over non-bussed systems.

PR has a range of products to support these systems and which can also help you meet the ever increasing environmental and safety demands typified in the SOLAS & MARPOL conventions.



## Universal

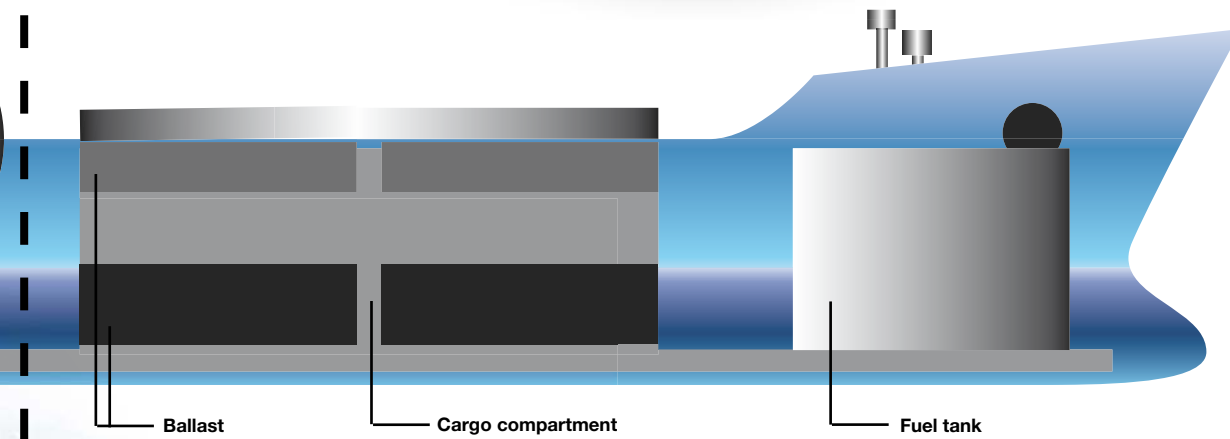
Many of our universal products have advanced features such as linearisation allowing the output of nonlinear sensors to be linearised with the use of custom linear interpolation, polynomial or loaded point linearisation options. This feature is especially useful for marine applications such as tank level gauging or oxygen levels in flue gas. Other features including latches with hysteresis can be used for a number of switching or alarm functions to give early warnings of potential problems. For example when monitoring the cleaning process for ballast water before it is discharged, thus helping to protect the aquatic ecosystems from ecological damage from non-native species which can be transferred in ballast water.



## Isolation

PR has a range of isolators with up to 3.75 kVAC galvanic isolation, amongst the highest on the market. Our range also extends across the various signal types that you are likely to encounter in the marine industry including digital, analogue and HART® transparent repeaters which are especially important in bussed systems often found on marine vessels.





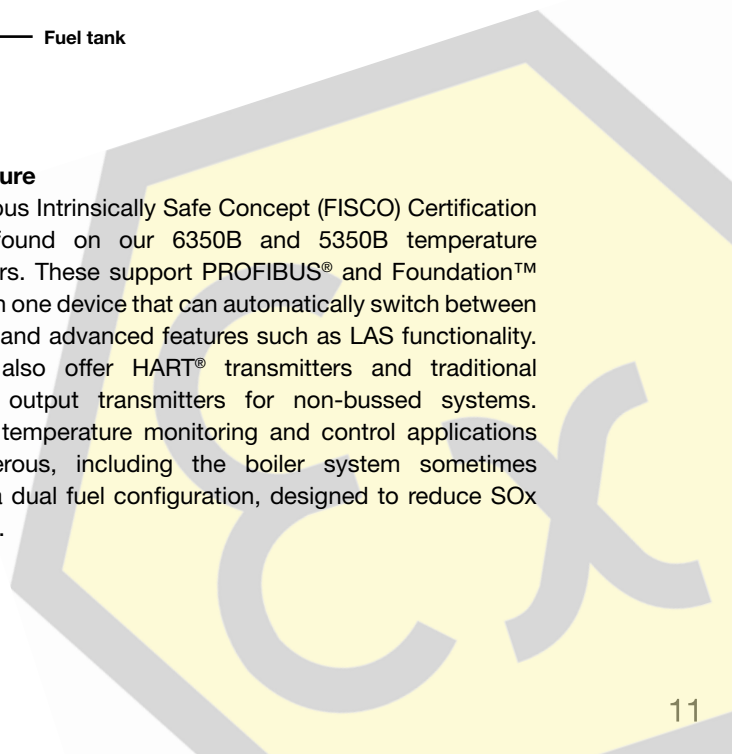
**I.S. Interfaces**

Rather than use inferior Zener barriers, all I.S. interfaces from PR electronics are intrinsically safe isolation barriers, providing high galvanic isolation and high immunity to electrical disturbances as well as built-in safety concepts such as hardware monitoring. With numerous features and a wealth of approvals you can safely use our products for areas such as fuel tanks, and bilge tanks which have a risk of explosive fuel vapours.



**Temperature**

The Fieldbus Intrinsically Safe Concept (FISCO) Certification can be found on our 6350B and 5350B temperature transmitters. These support PROFIBUS® and Foundation™ Fieldbus in one device that can automatically switch between protocols and advanced features such as LAS functionality. We can also offer HART® transmitters and traditional analogue output transmitters for non-bussed systems. Common temperature monitoring and control applications are numerous, including the boiler system sometimes found in a dual fuel configuration, designed to reduce SOx emissions.



# Control Systems

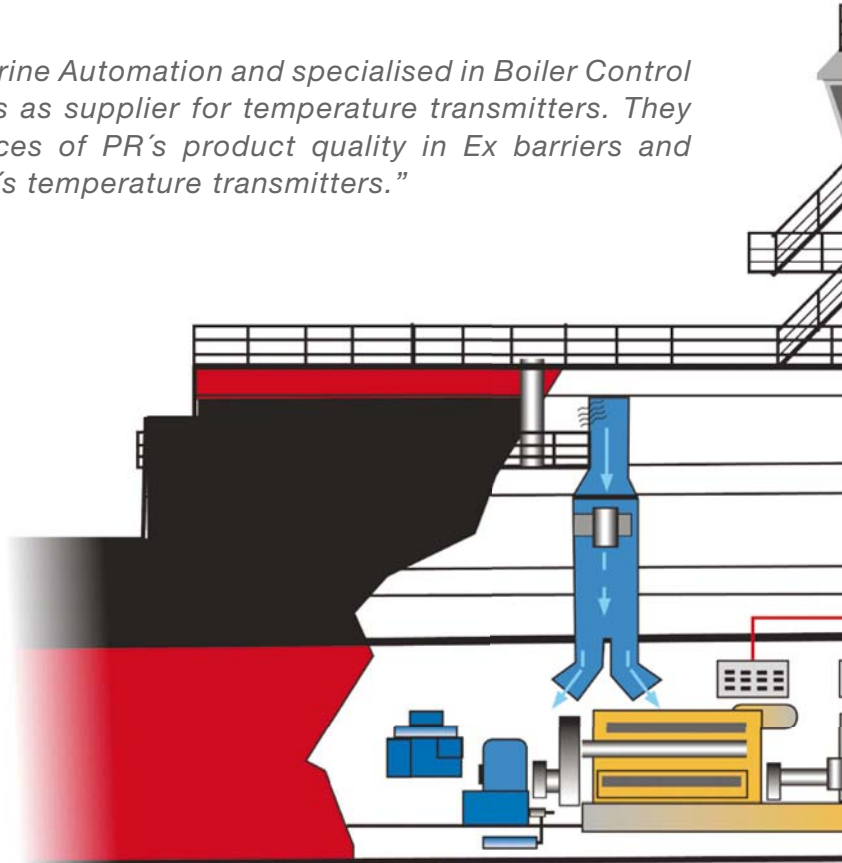
## "STATEMENT"

*Texon Automation, Sweden*

*"Texon Automation is a major player in Marine Automation and specialised in Boiler Control Systems and have chosen PR electronics as supplier for temperature transmitters. They chose PR because of positive experiences of PR's product quality in Ex barriers and isolation and for the high accuracy of PR's temperature transmitters."*

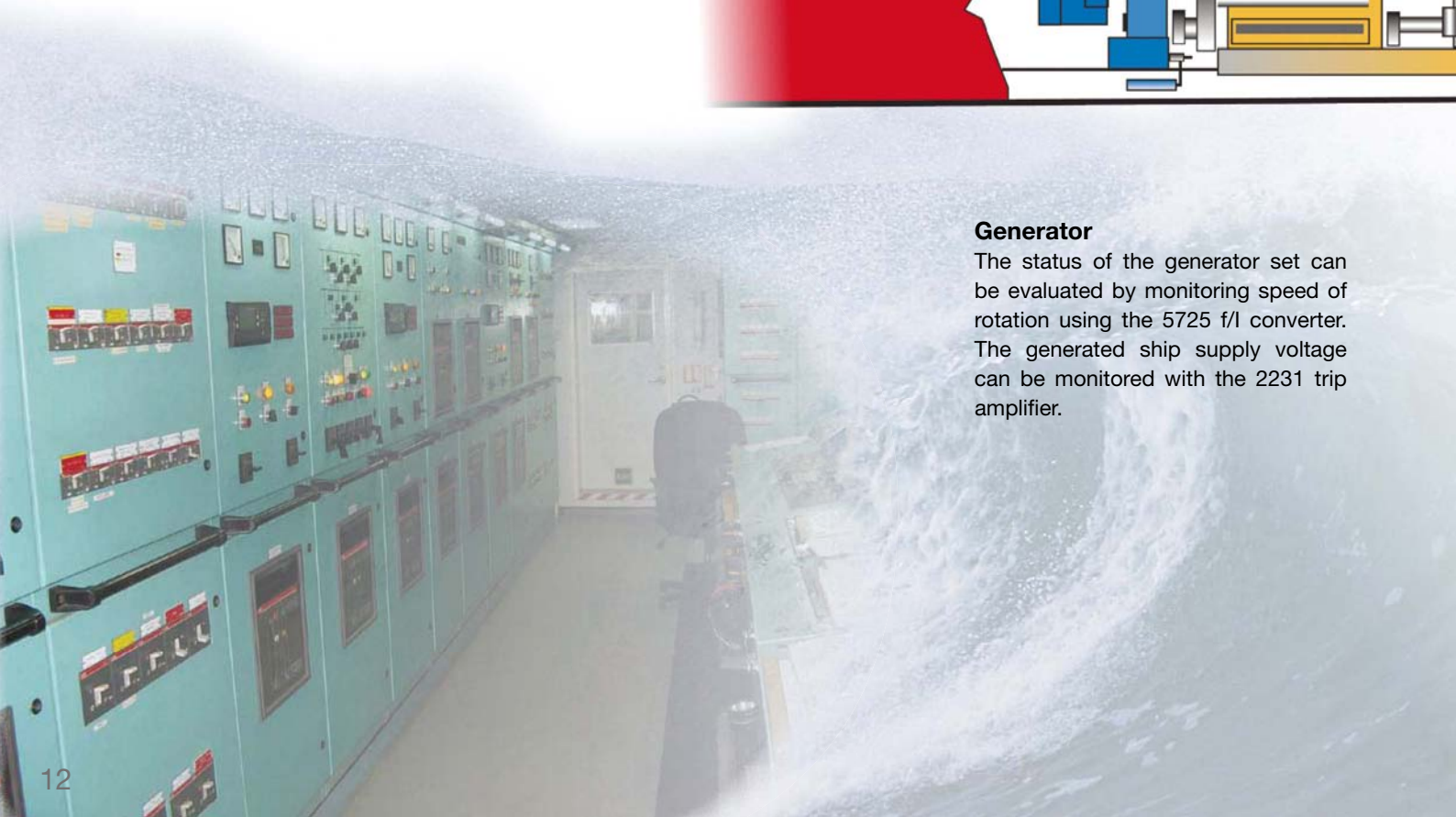
### **Fuel tank level**

For Radar tank level systems, use the 5104B or 5105B isolated repeaters and drivers for long installations through Ex zones. If HART® systems are used then the 9106 or 9107 (HART®) isolated repeaters and drivers provide the same functionality.

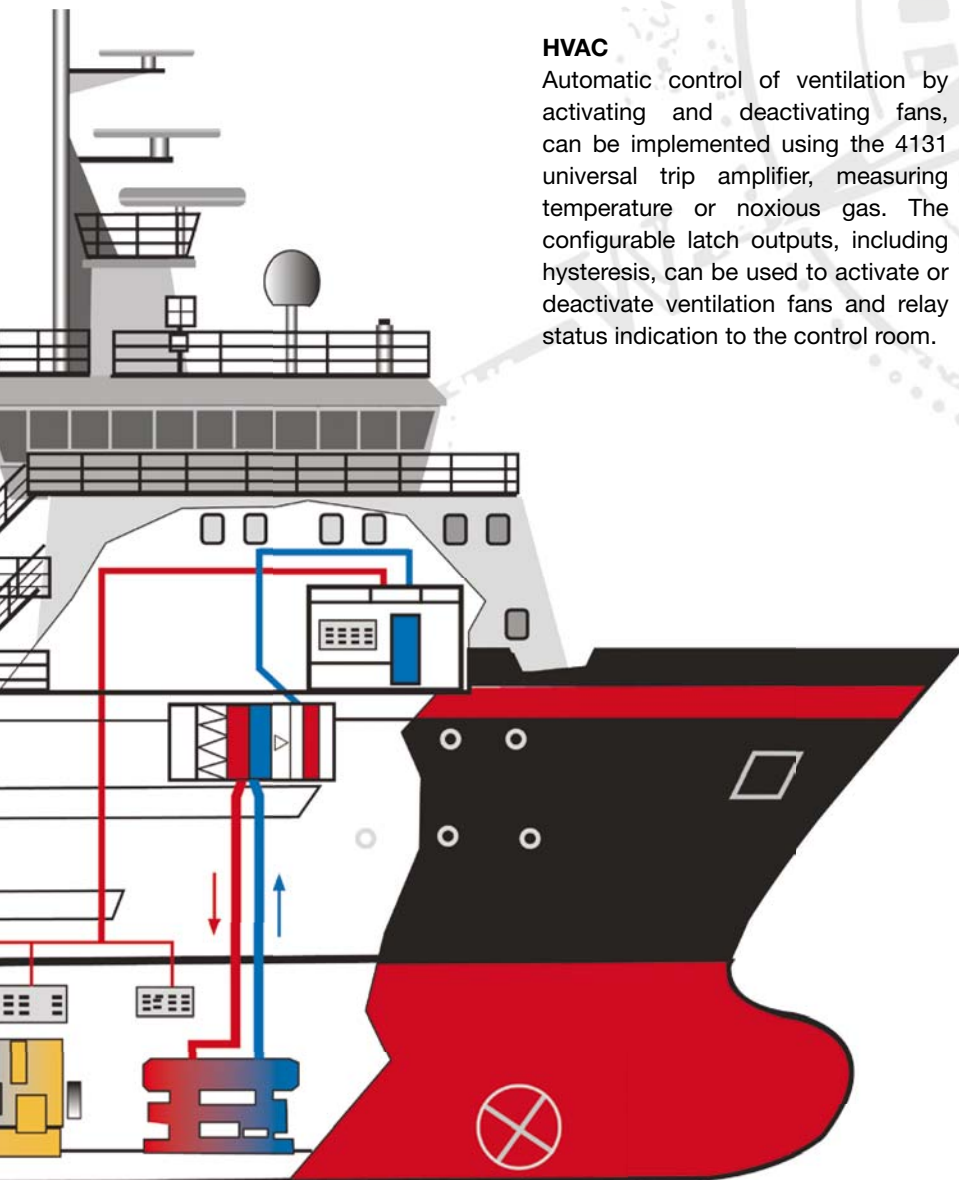


### **Generator**

The status of the generator set can be evaluated by monitoring speed of rotation using the 5725 f/l converter. The generated ship supply voltage can be monitored with the 2231 trip amplifier.







**HVAC**

Automatic control of ventilation by activating and deactivating fans, can be implemented using the 4131 universal trip amplifier, measuring temperature or noxious gas. The configurable latch outputs, including hysteresis, can be used to activate or deactivate ventilation fans and relay status indication to the control room.

**Bussed control**

Remote temperature monitoring of the propulsion system or cargo related processes using Foundation™ Fieldbus or PROFIBUS® can be achieved with the 5350 or 6350 transmitters.

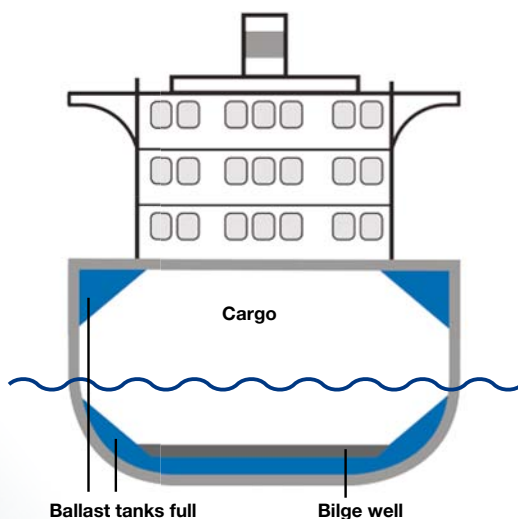
**Boiler**

Automatic start / stop of a boiler can be controlled by using the temperature inputs of a 4116 universal transmitter to monitor the temperature, and its latch outputs as an automatic switch control. This can also be adapted to switch fuel sources between gas and oil in dual fuel boilers, by monitoring the heavy fuel oil temperature.

**Ballast**

Help protect the environment by measuring the Redox potential of ballast water treatment systems using a universal transmitter such as a 4116 configured to measure mV with latch outputs used to flag alarm conditions.

Local indication of flow with a 5714 display to ensure that a certified flow rate is not exceeded within a ballast system.



**Bilge**

Use the input of 9202 pulse isolator to transfer the primary pump pulse information from an Ex zone to a 5725 display. The 5725 can monitor the status of the primary pump, triggering a latch to initiate the secondary pump. The latch output of the 5725 is fed into the input of a 9203 Ex driver so that the secondary pump also located in the Ex zone can be safely initiated.

# Marine Applications

*Marine vessels can be classified based on their use, such as military vessels, commercial vessels, fishing vessels, pleasure craft and competitive boats. These vessels perform very different tasks, however the universal nature of our products in conjunction with numerous certifications allows a small number of products to cover a wide number of applications.*

*A high proportion of marine vessels are designed to carry cargo of one type or another. In vessels such as bulk carriers these can be non-hazardous or hazardous demanding strict safety approvals. Ferries and cruise ships have a completely different type of “cargo” leading to systems usually associated with dry land relocated to the marine environment such as swimming pools.*

*The cargos of fishing vessels are the result of a working vessel rather than a “passive” carrier, with processing or factory automation type processes and machinery often found on board.*

*PR’s products are designed accurately, reliably and safely to meet the various environments and applications that are encountered in the marine industry.*



## **Universal**

The many varied applications that can be found on each vessel and across vessel types can be supported with just a few universal products, providing inherent redundancy and flexibility. Universality is a common feature of PR’s product portfolio, with examples that can be configured by direct input, easy software configuration or local displays such as the 4501. You can also find advanced features such as process calibration, linearisation and auto-diagnosis in many of our products.



## **Isolation**

Our isolation products have exceptional performance ensuring that we help you protect your passengers from your process and your process from the harsh environments found on ships. With our 3000 series of 6 mm isolators, repeaters, splitters and converters, we have a range of fast response and space saving products that can be used both in traditional ship control systems and in ships with on board processing or automation systems.



### Passenger ferry

Ensure operation of ventilation system by monitoring ventilation extractor fans on enclosed deck spaces using the 5725 f/I converter display.

### Chemical, oil & grain tankers

Reduce the risk for a vapour or dust explosion by monitoring oxygen content of chemical, oil or grain tankers with gas inertion protection systems, using an Exd certified 5116B or 9116 universal converter for SIL2 applications to raise an alarm.

### LNG tankers

The LNG temperature can be measured at various points using a 5335D Ex HART® SIL2 temperature transmitter possibly in conjunction with a 9106 Ex HART® repeater or 9107 Ex driver for HART® systems, where long distances are encountered.

### Fishing vessels

Monitor the on board fish processing machinery with the 3103, 3104 or 3105 isolated repeaters and converters powered by the 3405 power connection unit with a Power Rail. Use the 3114 universal converter to monitor the temperature of ice production and post processing cold storage of fish. Locally monitor fish processing stages with the use of 3108 or 3109 isolated splitters (repeater and converters) in conjunction with locally mounted 5714 displays.

### Tanker gauging

Provide an independent method of gauging level of tanks during cargo loading using a 5114B Ex programmable transmitter to safely relay linearised tank level information from an Ex zone.

### Cruise ships

In swimming pool control systems you can ensure that isolation is maintained by using an isolated temperature transmitter such as the 5331 or if a local display is needed, the 4114 universal transmitter in conjunction with the 4501 display or 5714 universal display.



### I.S. interfaces

Unlike many of the suppliers on the market today which offer Hardware Assessed or “Proven In Use” SIL products, we are amongst the first suppliers to also provide FULL ASSESSMENT on many of our SIL rated products such as our flagship 9000 series, thus verifying all of our processes associated with designing, producing and supplying our products. When combined with global Ex and FISCO certifications, our products are ideal for hazardous zone applications such as the various cargo and operational tanks found on ships.



### Temperature

PR offers a range of accurate and reliable temperature transmitters with support for a wide selection of RTD and TC sensors. With support for mA, V, HART®, PROFIBUS® PA and FOUNDATION™ Fieldbus communication, our temperature transmitters can be found in a plethora of marine installation systems and applications. Our temperature transmitters are also available in Ex versions with SIL approvals for use in hazardous locations such as LNG temperature measurement.

