



Measurement & Analytics | Measurement made easy

# Measurement and analytical Products, solutions and services for the marine industry

Power and productivity  
for a better world™



# Measurement made easy

## In space, on the ocean floor and everywhere in between

To operate any process efficiently, it is essential to measure, actuate, record and control. In selecting ABB you are choosing a partner who is offering the best measurement and analytical solution for your needs, enabling maximum return on your investment. When investing in ABB's measurement and analytical solutions you are receiving the best technology, reliability and service in the business.

ABB's measurement and analytical products provide worldclass measurement solutions from standard products to fully integrated systems. Latest innovations deliver technological solutions resulting in products that are easy to configure, easy to integrate, and easy to maintain. This helps to make your vessel operation more efficient.

#### ABB's measurement & analytics product portfolio:

- Analytical measurement
- Flow measurement
- Natural gas measurement
- Valve automation
- Pressure measurement
- Temperature measurement
- Recorders and controllers
- Level measurement
- Device management
- Force measurement
- Service



# Marine measurement solutions

## Optimizing ship performance and operation cost



"You cannot improve it, if you cannot measure it" (Lord Kelvin)

### Shipping industry has to maneuver through increasing challenges

- Comply to increasing legislation demands for lowering emissions and reducing CO<sub>2</sub>
- Optimize fuel costs over varying operation profiles
- Minimize maintenance cost by keeping maximum of availability and safety
- Improve the efficiency of technical management with minimum staff costs

Today and future ship operation requires instant access to reliable information of nautical, technical and administrative aspects to be competitive in the market. ABB is meeting the increased demand on measurement and information technology onboard ships.

ABB offers a comprehensive portfolio of measurement and analytical products for the marine industry

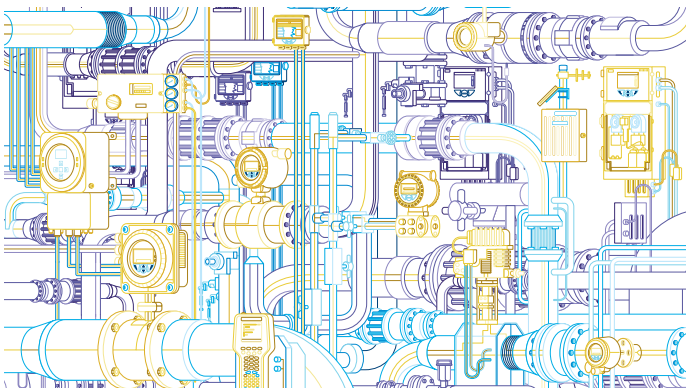
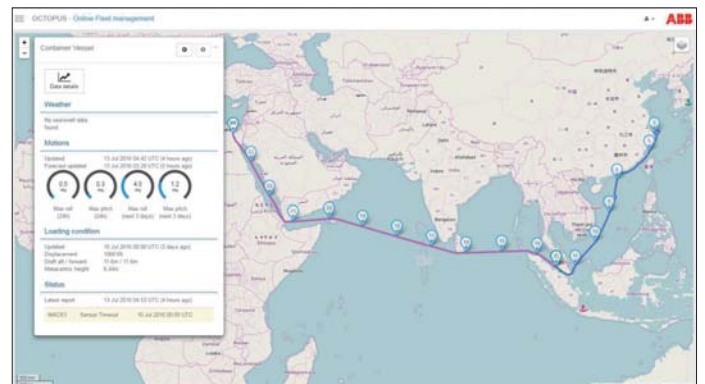


ABB Marine Advisory system enables better and faster operation decisions for the fleet management. Ship operation data, processed and visualized on board, is shared with the shore office.





# Flowmeter solutions for the marine industry

For more than 100 years, ABB's flow measurement products have delivered reliability, accuracy, repeatability and easy maintenance to customers worldwide. ABB offers one of the world's largest and most innovative product ranges, unrivalled in its breadth and scope. Getting the best levels of efficiency and performance from your ship plant requires reliable, accurate flow measurement.

## Application solutions using our flowmeters:

- Consumption measurements of fuels, gases and lubrication oil with CoriolisMaster
- Bunkering flow meters with large diameters using CoriolisMaster
- Ballast water flow measurement with ProcessMaster
- Energy measurement of steam on board with SwirlMaster

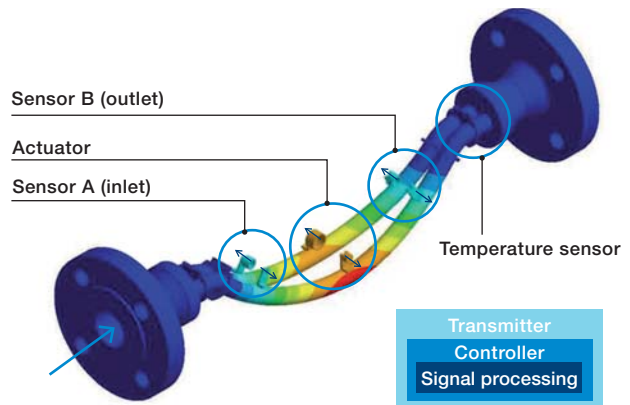
## Measuring massflow, volumeflow, density, concentrations and temperature – over a wide range of flow rates:

- Available nominal diameters from DN15 to DN150 for flowrates from 8 up to 860 t/h

ABB flowmeters are in compliance with and certified for marine class standards and can withstand high vibrations levels and tough electromagnetic environments.

## Application benefits CoriolisMaster:

- Reliable and highly accurate mass measurement: 0.1% accuracy
- No in- or outlet sections and inlet filters required
- Direct mass measurement eliminates pressure temperature compensation
- Real time density measurement for fuel quality control
- Minimum pressure drop through the meter
- Maintenance free: no moving parts in the fluid
- No recalibration in service; black-out safe



# Monitoring and optimizing fuel efficiency

## Reliable fuel consumption measurement

With high fuel costs and tight regulations on greenhouse gas emissions, fuel efficiency is a major concern for the marine business. In order to manage fuel consumption responsibly, considering ecologic, economic and legal aspects, it needs innovative fuel management systems based on reliable, highly accurate and durable mass flow sensors.

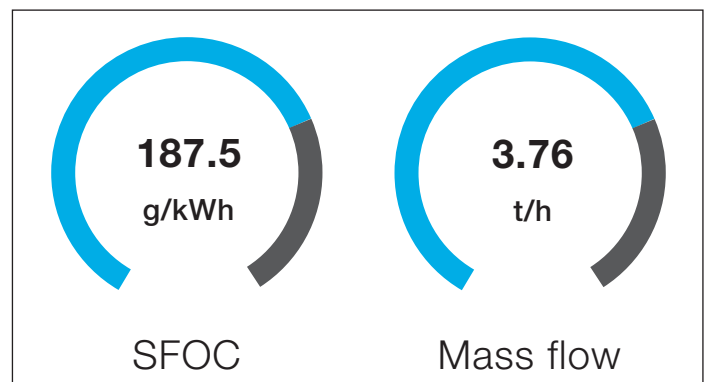
### Marine fuel consumption measurement in accordance to SEEMP\* guidelines with ABB CoriolisMaster mass flow meter

- Unrivalled measurement turn down ratio with zero point stability
- SensorApplicationMemory storing all sensor and application data

- VeriMass simplifies verification and recalibration in the field
- Common operating concept with Easy Set-up
- Type approved for tough environment in marine applications



Seamless integration into vessel energy efficiency systems for providing online monitoring of SFOC on main engines, auxiliary engines and boiler



# Bunker Transfer Monitoring System (BTMS)

## Customized concept for newbuilds and retrofit

The monitoring system for the fuel transfer bunkering process features a unique combination of leading ABB technologies. This BTMS solution delivered transparency of quality and costs of the fuel bunkering process for ship operator and charterer.

### CoriolisMaster mass flow rate, pressure, temperature, valve control, certified flow computer and remote operation panel – a complete solution made by ABB

- Flexible vertical or horizontal mounting into existing environment
- Twin train CoriolisMaster sensors up to 1200 t/h HFO fuel transfer rate
- Optional one train CoriolisMaster sensor for MDO/other fuel measurement
- Heat mattress wrapped around CoriolisMaster to support HFO fuel temperature/viscosity
- System cabinet to control the complete system

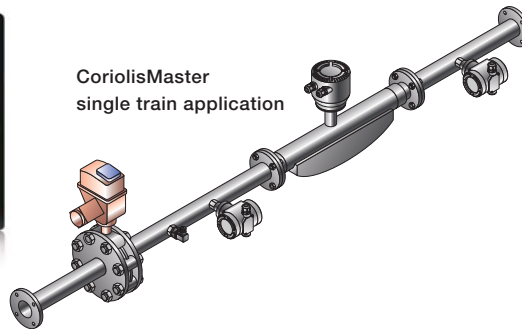
### Remote monitoring and control display

- Flexible 17" touchscreen display for mounting in ECR, ship bunker station or ship bureau
- Fully operation control of system
- Bidirectional interface to integrate to ship IT
- Customizable print layouts; optional ticket printer or paperless transfer in the ship information system

Remote operation panel



CoriolisMaster single train application



Flow computer



# Ballast water management system

## Trusted solutions for ballast water treatment applications

New regulations in the marine industry have driven the need for ballast water treatment and measurement. Traditional mechanical flowmeters are negatively affected by ballast water due to the presence of mussels, sand and other particles. This limits the lifespan of the meter and results in increased maintenance and replacement cost.

ABB is the trusted supplier of electromagnetic flowmeters for well known manufacturers of ballast water treatment and ballast water trim systems.

ABB's ProcessMaster electromagnetic flowmeter has no rotating parts reaching into the pipe that cause wear and pressure loss. A highly abrasion resistant sensor liner material makes ProcessMaster ideal for this application. Integral or remote electronics are available and sensor sizes from 3 to 2000 mm (1/8" to 80").

Ballast water in ships is carrying thousands of species of aquatic animals and plants. These invasive organisms are creating problems for the marine environment and human health, threatening the economies that depend on healthy aquatic ecosystems. ABB is a preferred supplier for ballast water treatment applications.

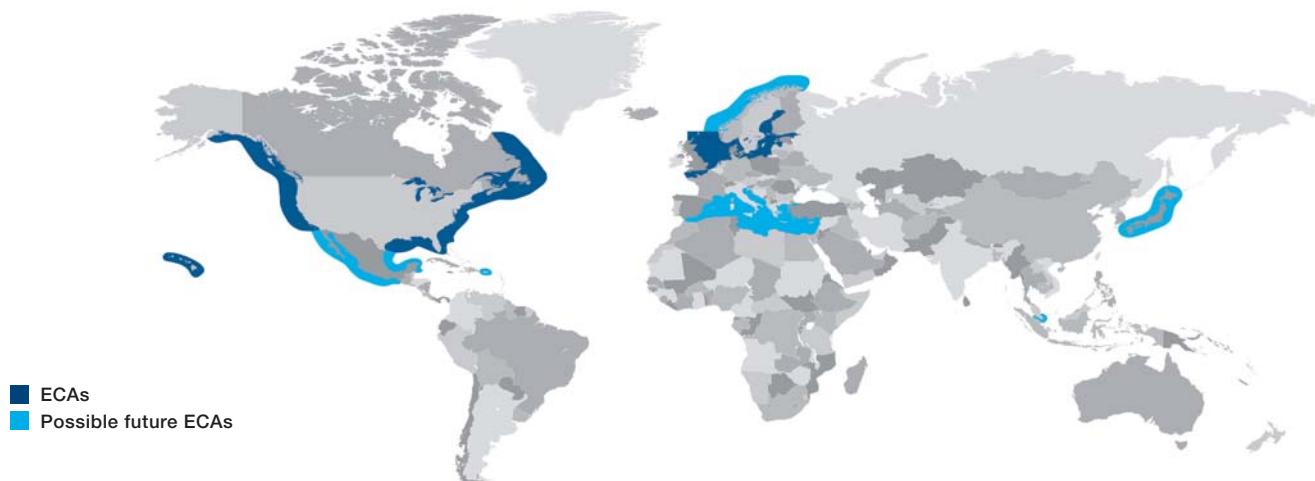
ProcessMaster type approved for marine application





# Continuous emission monitoring

## Meeting regulations of today and tomorrow



The International Maritime Organization (IMO), has introduced regulations to prevent air pollution from vessels both globally and within designated sea areas, known as Emission Control Areas (ECAs). These regulations require control on SO<sub>2</sub>, CO<sub>2</sub> and NO<sub>x</sub> emissions.

The new set limits in the ECAs can be achieved only by switch over to expensive clean fuels or adopt new technologies such as exhaust gas cleaning systems (EGCS). ABB is meeting the demand of ship yards, ship owners and marine ECGS manufacturers to equip vessels with continuous gas analyzers for Continuous Emission Monitoring (CEM). These measure all the regulated pollutants (SO<sub>2</sub>, CO<sub>2</sub>, NO<sub>x</sub>) and optimize fuel consumption (CO, O<sub>2</sub>) on board at the same time.

### We are on your wavelength!

ABB's continuous gas analyzers are approved for applications in marine industry. We support you to meet environmental compliance and optimizing fuel cost.

#### AO2000-Uras26

- CO<sub>2</sub>
- SO<sub>2</sub>
- SO<sub>2</sub>/CO<sub>2</sub>

Further components:

- CO
- CH<sub>4</sub>

AO2000-Uras26: Non Dispersive InfraRed (NDIR)  
IMO referenced technology for CO<sub>2</sub> and SO<sub>2</sub>



#### AO2000-Limas21 UV: measures nitrogen oxides with no need of any auxiliary equipment

- NO
- NO<sub>2</sub>
- NO<sub>x</sub>

Internal adjustment cells, filled with reference gas lead to an extended calibration interval of up to one year.

AO2000-Limas21 UV: UV Resonance Absorption Spectroscopy  
Approved Equivalence to IMO reference technology





# Continuous emission monitoring

## Analytical measuring system designed for marine applications



### GAA330-M – Smart CEM solution for the marine industry

GAA330-M is an analysis system for continuous gas measurement particularly designed for maritime applications. The GAA330-M is an integrated turn-key solution including all analyzer modules and sample conditioning components in one cabinet.

- The modular concept of GAA330-M allows for high flexibility
- GAA330-M is able to continuously measure the samples of up to two measuring points in parallel
- The system design ensures a reliable measurement even under harsh conditions
  - CO<sub>2</sub> – via NDIR analyzer
  - SO<sub>2</sub>/CO<sub>2</sub> ratio – via NDIR analyzer
  - NO, NO<sub>2</sub> and NO<sub>x</sub> – via NDUV analyzer
- Easy Maintenance is ensured by automatic calibration concept without test gas bottles
- Easy data reporting by integrating CEMS into on-board systems, e.g. advisory system (optional)
- As an approved CEMS by DNV/GL acc.to MEPC184(59) and MEPC177(58), the GAA630-M allows for compliance with marine regulations

Smart CEM solution GA330-M



### GAA630-M – Advanced CEM solution for the marine industry

The analysis system for continuous gas analysis GAA630-M provides an advanced solution for marine industry. It integrates sample conditioning and analyzer modules in two separate housings.

- GAA630-M is able to continuously measure the samples of up to two measuring points in parallel and is flexible in installation locations
- It measures and reports:
  - CO<sub>2</sub> – via NDIR analyzer
  - SO<sub>2</sub>/CO<sub>2</sub> ratio – via NDIR analyzer
  - NO, NO<sub>2</sub> and NO<sub>x</sub> – via NDUV analyzer
- Further components can be easily added on request
- Type Approval:  
Lloyd's Register Marine Environmental Category ENV2

Advanced CEM solution GAA630-M



# Diesel engine performance optimization

## Combustion under control

Today's electronically controlled 2-stroke engines feature automatic tuning and controlling of the combustion pressures stroke-by-stroke. By means of online cylinder pressure measurement the electronically controlled timing of fuel injection and exhaust valves are individually optimized. Operators benefit in saving fuel costs and optimized performance under varying ambient conditions and/or fuel quality. Cylmate pressure sensors used on electronically controlled diesel engines provide improved energy efficiency and lower the risk for off-hire costs.

### **Cylmate pressure sensor, with five-year warranty**

The unique and reliable Cylmate pressure sensor has proven its maintenance- and calibration-free performance during years of continuous operation. The measuring accuracy is not influenced by any clogging or heat flash from the combustion gases, which is a common problem of membrane-based pressure sensors. For the Cylmate pressure sensor ABB offers a warranty period of 5 years.



### **Market leading reliability for optimization of 2-stroke diesel engine performance**

Engine builders and ship operators benefit from these Cylmate pressure sensor features: optimized engine performance, reduced fuel cost, enhanced availability and ease of compliance with environmental legislation.

### **Technical benefits**

- Long life time – MTBF of more than ten years
- Maintenance free – blow through design
- Re-calibration free
- High accuracy and repeatability

### **Customer value**

- Investment safety and low life-cycle cost
- Unique 5-years warranty
- Better working environmental for the crew
- Pay back by reduced fuel consumption



# Cylmate systems

## Increased engine availability and operation cost savings

ABB's Cylmate System is a comprehensive system for continuous engine performance measurement and monitoring. A unique combination of measurements of cylinder pressure and crank shaft position in combination with advanced mathematical modeling of the engine provides very accurate, real-time data for monitoring and diagnostic analysis. The quality of the data enables very significant benefits from improved reliability, reductions in operating costs and minimizing off-hire costs.

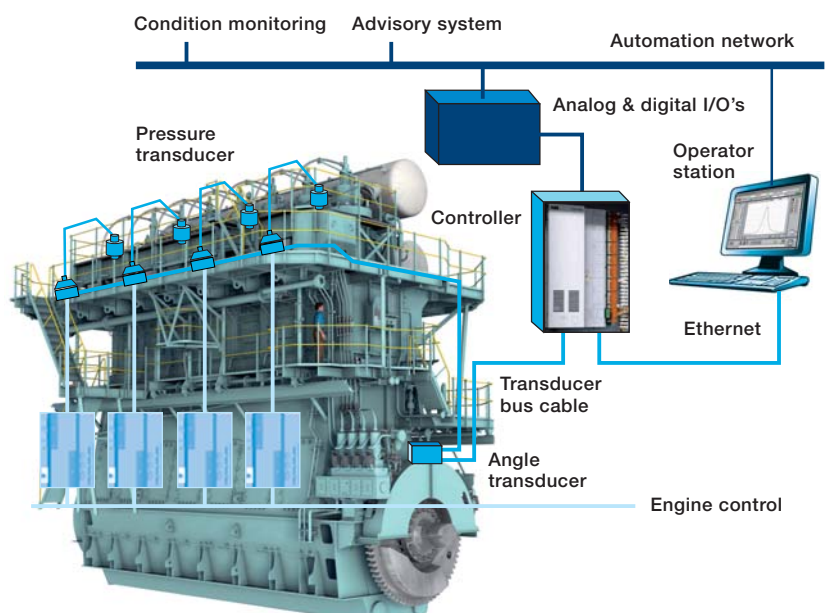
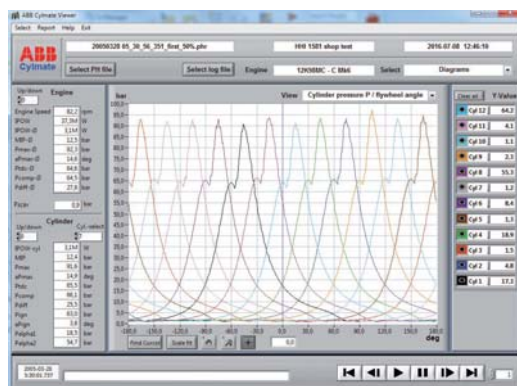
### Powerful system functions deliver indispensable benefits

- Operates 24/7 at all engine loads and rough sea
- Alarm functions warns of dangerous conditions
- Highest accuracy and long term reliability
- Performance and fuel economy monitoring
- Trend data recording and report generator
- Maintenance optimization information
- Fuel costs and maintenance saving

The Cylmate system solution covers stand-alone or various integration solutions. Proven benefits, verified pay back time and easy installation making retrofit installations very attractive.

- Alarm monitoring
- Visual diagnostic
- Performance monitoring
- Fuel economy monitoring
- Trend data recording
- Engine report generator
- Automation interface

Real time monitoring of the thermodynamic process of each cylinder





# Pressure measurement

Reliable pressure measurement is often a key for safe and efficient process control in marine plants. ABB's 2600T family of pressure transmitters and sensors is available in a wide variety of configurations. The all-stainless steel versions are field-proven in off-shore applications and offer unique features such as through the glass operation, built-in back-up configuration storage, easy to change electronics modules and plugged impulse line detection.

## Key features of ABB's pressure transmitter type 266

- Marine approved
- High accuracy
- Ten years stability
- Optionally change the electronic and main board during operations
- Enhanced diagnostic features such as plugged impulse line
- Easy to operate through Easy Set-up menu guiding the operator



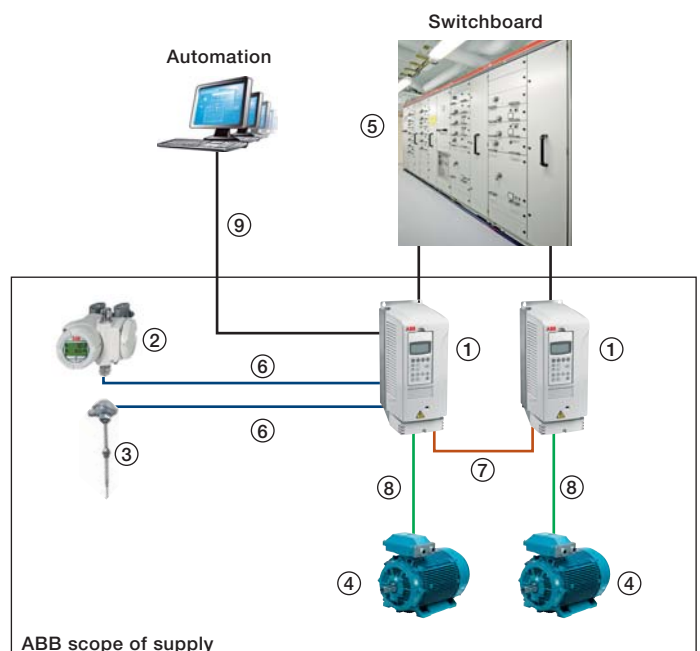
## Customer benefits of optimization with VFD



## Pressure measurement at optimization with Variable Frequency Drives (VFD)

Benefit from instant energy savings when the pump or fan always run at the correct speed to meet flow and pressure demands. Up to 40% energy savings may be achieved by applying VFD together with ABB's patented Intelligent Pump Control to the existing software cooling process.

- 1 ABB frequency converter | 2 Gauge pressure sensor  
 3 Temperature sensor | 4 ABB motor (optional) | 5 Protection modification  
 6 Instrument cable for sensors | 7 Opticalfiber | 8 Marine EMC power cable  
 9 Instrument cable for AS (optional)



# Temperature measurement

With innovative temperature sensors and transmitters from ABB, you benefit from low investment costs and standardized modules with impressive long-term stability. The versatile family of temperature measurement products is based on a modular design principle allowing for the utmost flexibility. From standard products to tailor made solutions for system integrators – a full range of reliable temperature measurement products customized to serve marine industry applications.

## Class approved for various marine applications

- Exhaust gas after cylinder and turbocharger
- Cooling water, fuel and lub oil, scavenging air system

The WirelessHART temperature sensor TSP300-W with Energy Harvester is the world's first self-powered wireless measurement device requiring no wiring, no external power supply and ideally no battery replacement.



Reliable exhaust gas temperature measurement before and after turbocharger is crucial for safe operation



Temperature measurement



# Continuous water analysis

**New marine environmental legislation and process technologies extending the need of water components analysis on board ships.**

- Ballast treatment system
- Scrubber sludge water
- Desalination plant
- System cooling water
- Potable water systems

Waste water discharge is tightly regulated and needs to be continually monitored to ensure limits are maintained.

**Turbidity and Total Suspended Solids (TSS) measurement is a key indicator of effluent and waste water quality**

ATS430 Turbidity/TSS Probe: The simple, accurate and reliable suspended solids measurement solution for regulatory compliance monitoring.

## **Conductivity measurement**

AX400 transmitter is well proven with tens of thousands in operation. Wide array of stainless steel conductivity sensors suitable for harsh marine environments.

## **pH measurement**

Probe 700M is specifically designed to meet harsh marine applications.

Analogue or digital options, it is robust and long lasting with continuous accurate performance, enhance shelf life and providing predictive diagnostics.

ATS430 Turbidity/  
TSS Probe



AX400 transmitter



ABB provides customized solution for waste and freshwater monitoring



Environment protection legislation requests monitoring of waste water discharges

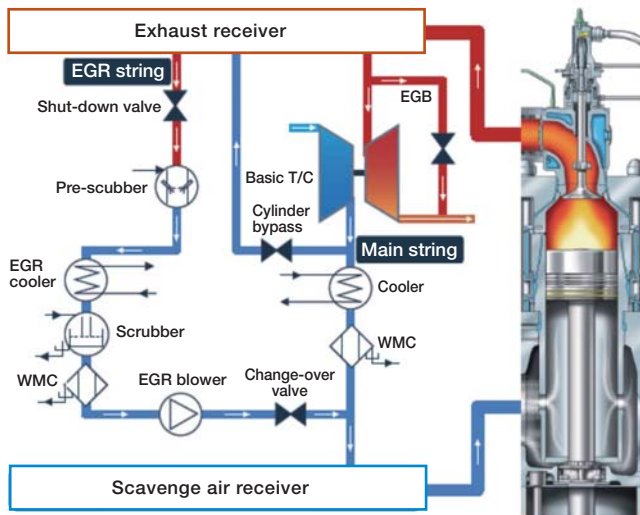




# Measurement and control of EGR

## Exhaust Gas Recirculation (EGR) fulfills new NO<sub>x</sub> emission Tier III limits. Continuous oxygen monitoring on EGR with AZ10 Marine

- Robust O<sub>2</sub> measurement to achieve compliance with IMO pollution rules
- Close coupled solution with HART communication and diagnostic



## Actuators and positioners

Valves, dampers and butterflies are essential devices in the plant. With expertise and experience built up over 100 years and countless applications worldwide, ABB provides a wide range of products to position and actuate any final control element, delivering best performance for every process in the marine industry.

- Marine approved
- Best in class shock- and continuous vibration immunity at 10 g
- Easy to operate through single button startup and autotune
- Adaptive tube function for realtime self-optimization
- Lowest air consumption in the market
- Easy to maintain through position deviation indication



Shipping has to comply with new NO<sub>x</sub> emission limits



Digital positioners in a gas distribution station



# Recording and Control

ABB manufactures a wide range of industrial recorders and controllers, from the latest easy to use, secure paperless recorders to single and dual loop controllers and indicators. ABB recorders include marine industry specific features such as a NMEA interface for recording GPS data alongside process data.

## ScreenMaster paperless recorders – more than just a recorder

Powerful, easy and cost effective recording of process data.  
Ideal for modernization and retrofit of ship plants

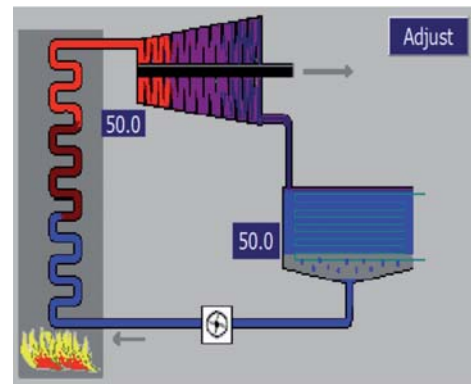
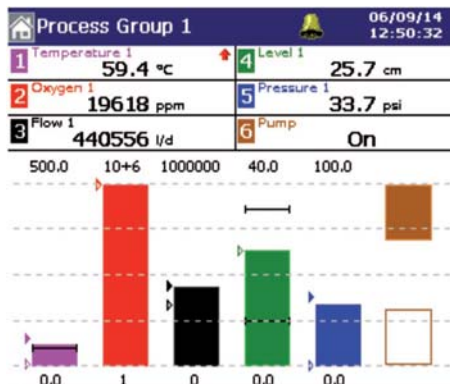
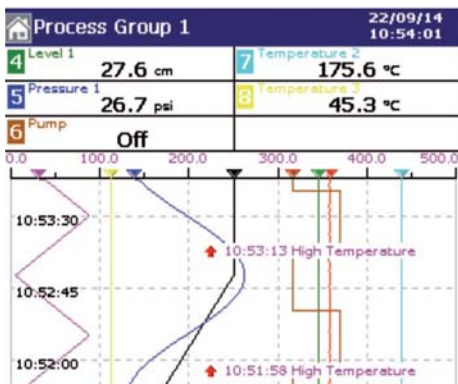
- Recording of up to 24 signals
- Panel and field mountable enclosures
- Remote access and operation via Ethernet communications
- NMEA interface for logging GPS data
- Integration to bridge supervisory systems via Ethernet

RVG200 paperless recorder  
with smart touch screen operation



SM500F field mountable  
paperless recorder

Various operator views selectable such as strip chart, bar graph or process view



# Tank level gauging

Tank level is a critical process parameter used in many marine applications around the world. ABB has the proven technology to provide solutions for the most difficult level measurement applications for both liquids and solids.

Whether an application requires a cutting-edge solution, such as the non-contact laser or ultrasonic level transmitter, or ultra high pressure magnetic level gauges, transmitters and switches, ABB has the right technology for liquid or solids level detection needs.

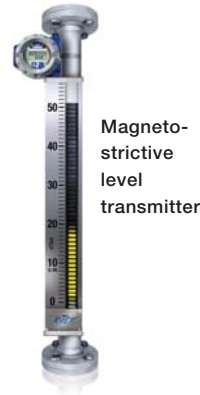
On-/Offshore oil and gas production facilities have some of the most challenging level measurement applications in the exploration industry. High pressure separators, for example, contain two separate fluids in the same vessel – as when oil floats on top of water. Both fluid levels need to be measured on a continuous basis without disrupting the operation of the oil and gas processing plant. To accurately accomplish this, a technology with interface capabilities is required.



Laser level transmitters



TX Thermal dispersion switch

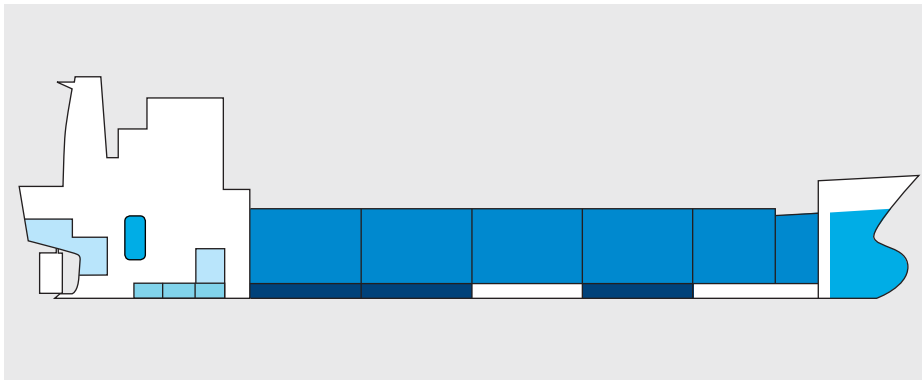


Magnetostrictive level transmitter



Guided wave radar transmitters

Level measurement on ships have a various range of application demands



Accurate level control for boiler efficiency





# On-line natural gas analyzer

## NGC 8200 gas chromatographs series

This product represents the most rugged, economical, versatile, and high-precision gas chromatographs in the industry. Designed with flow computer and chromatograph capabilities for energy metering, the NGC 8200 series provides not only best-in-class, on-site analysis, but also offers a highly versatile platform that integrates many of the functions to deliver greater productivity.

### NGC 8200 offers a wide range of measurement information

- Relative density
- Heating value
- VOS (velocity of sound)
- GPM (gallons of liquid per thousand cubic feet)
- Wobbe index
- HCDP (hydrocarbon dew point)
- H<sub>2</sub>S measurement
- API 21.1 EFM capability and AGA8 compressibility calculations



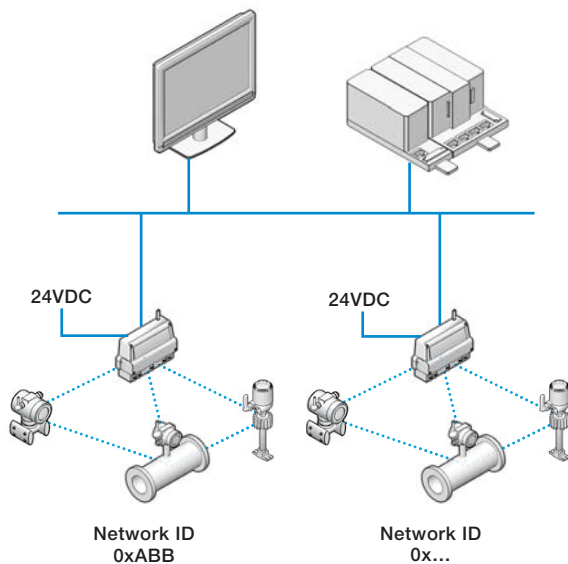
# Wireless measurement

## Measurement solutions for temperature, pressure, level and flow

Wireless instrumentation networks have the potential to significantly reduce instrumentation installation costs with savings greater than 30% and up to 60% in wires and cabling as well as in engineering and installation costs.

### Wireless measurement

A key advantage of wireless technology is the easy, fast and inexpensive addition of new measurement points on an existing installation to gather additional information that can improve processes and asset performance. Repeater functionality on each module ensures a safe communication chain in challenging environments as onboard ships.



### Steam energy measurement with Swirl technology

- High measuring spans with stable accuracy over the whole range
- Better consumption transparency because of detection of energy flow in times of lowest consumption
- Installable almost everywhere by lowest installation demands for up- and downstream sections
- Direct mass flow measurement on saturated steam possible
- Multiple signal paths for volume flow, totalization and pulse outputs
- High measuring ranges help to save costs because a second flowmeter installation is usually not needed

Wireless temperature measurements on a LNG carrier for boil-off gas HRS retrofit



Measuring steam energy consumption with SwirlMaster



# Torductor Marine: Measuring shaft torque, power and fuel efficiency

Over 50 years of experience in measuring shaft torque, power and fuel efficiency has led to the development of a brand new version of ABB's well proven solution: Torductor Marine. With the help of new technology, the main benefits of the classic Torductor are still standing, but now with much smaller dimensions in a more flexible package.

The sensor is the key component of Torductor Marine. Propulsion power is measured by ABB's unique torque transducer, a truly contactless device that requires only 25 cm (9,84 inch) of free shaft length without the need to bind any electronic devices to the shaft.

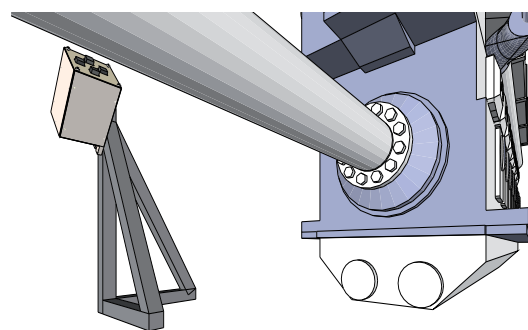
For advanced ship performance monitoring, Torductor Marine will deliver key performance indicators like propulsion power, total number of shaft revolutions and the total amount of energy developed during a voyage. In combination with ABB's Coriolis Master flowmeters the Specific Fuel Oil Consumption (SFOC) can also be delivered.

New Torductor Marine torque transducer is based on ABB's proven magneto-elastic measurement principle

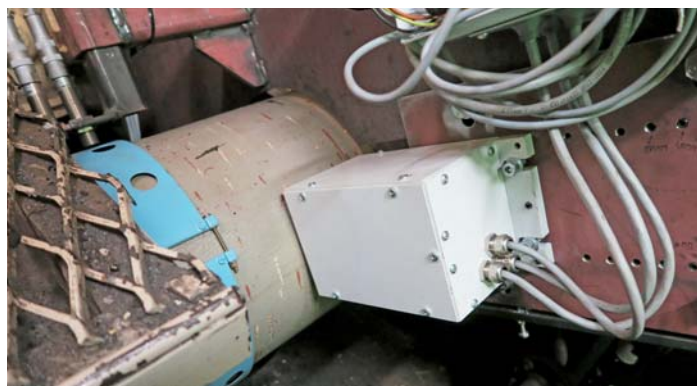


## Integration with ABB's Marine Software

Torductor Marine seamlessly integrates with ABB's onboard Software Suite for analysis and reporting. This information can be made available to vessel's owners and managers through ABB's fleet portal.



## Measuring steam energy consumption with SwirlMaster



## Torque and power measurement integrated in ABB Advisory system





# Services over the entire lifecycle

## Relying on investment safety

ABB offers a complete portfolio of services to ensure trouble-free operation and long product lifetimes. These services cover the entire life cycle, from purchase advice, through installation, maintenance and spare parts, to migration and upgrades. Local support is provided through a global network of ABB service centers and certified partners.

ABB's products, solutions and services for marine applications deliver high levels of performance and reliability in demanding conditions. Certification by leading classification societies

ensures compliance with major international standards. ABB's global network means that support is quickly available whenever and wherever it is needed.

Your partner in functional safety – minimizing risk to people, property, and environment

### On-Call

- Technical support
- 24h service

### Maintenance

- Service agreements
- Condition monitoring

### Commissioning

- Installation
- Commissioning

### Spare Parts

- Local order handling
- Worldwide shipment
- Recommendation



### Planned Repair

- Major or minor repair
- Overhauls
- Dry-Docking

### Modernization

- Retrofit

### Training

- General or advanced
- Safety
- On-board
- E-learning



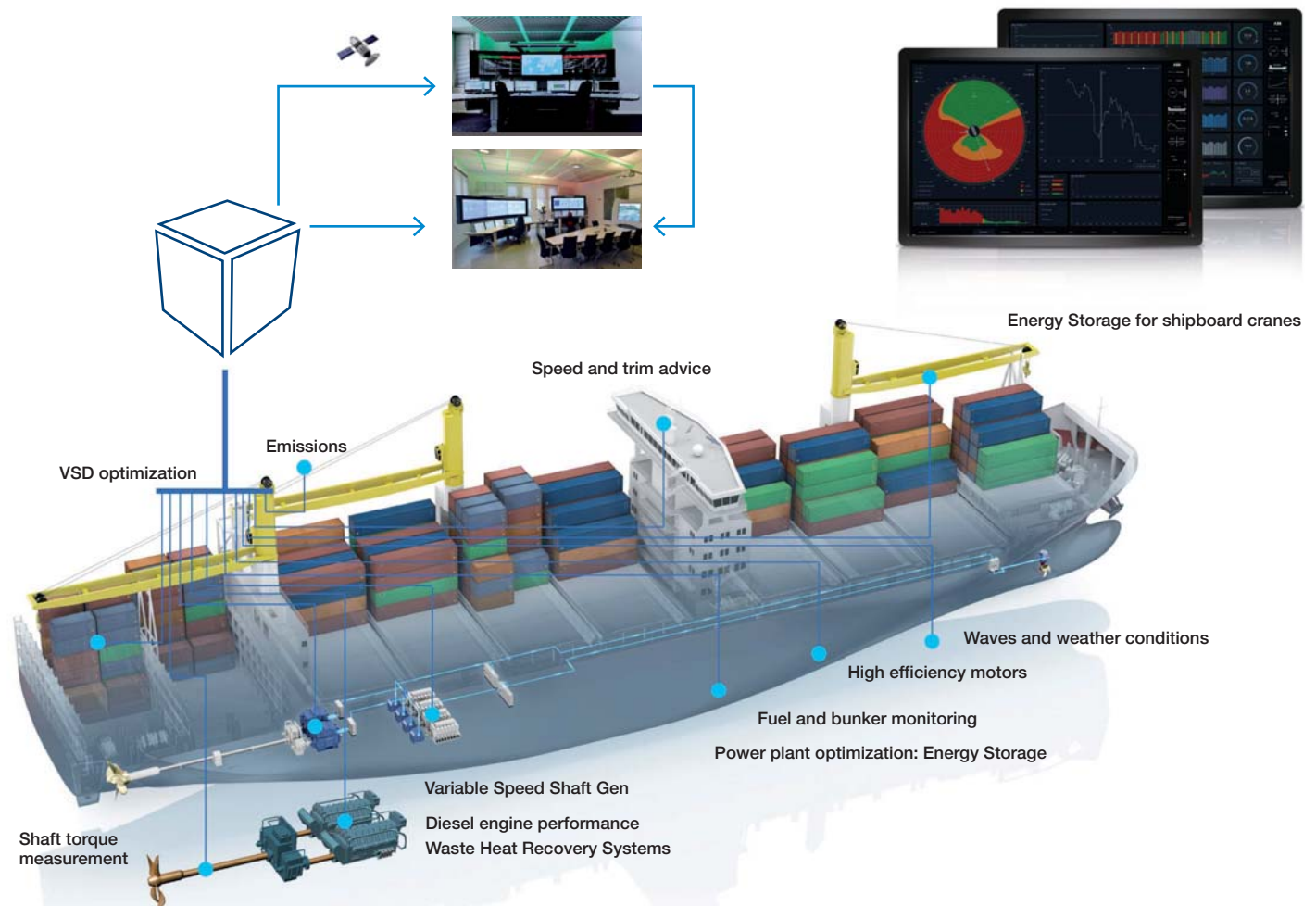
# ABB marine software systems

## Information, integration and optimization

ABB has unique expertise covering major fields of marine technology – the propulsion systems that drive vessels, the electrical systems that power them, the automation and measurement system – plus advisory systems to integrate, control and optimize them.

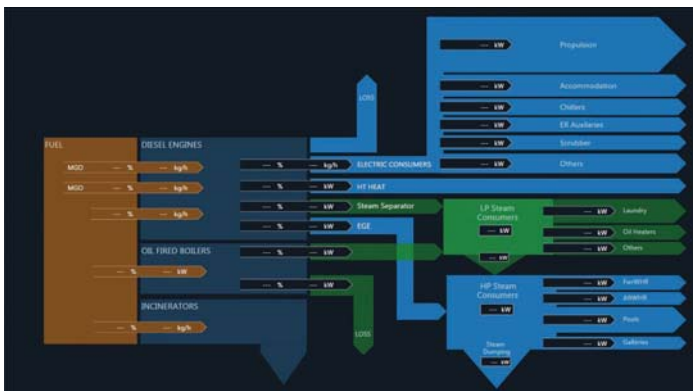
ABB offers the widest portfolio of marine software and optimization systems to the maritime market. Its performance management solution consists of a modular and comprehensive decision support toolkit to optimize the workability and safety of a ship, and to minimize the overall fuel and energy costs for a whole fleet.

- Fleet wide operational data
- Real time energy monitoring and management following SEEMP guidelines
- Real-time decision support for optimizing dynamic trim, power management, Hull Fouling



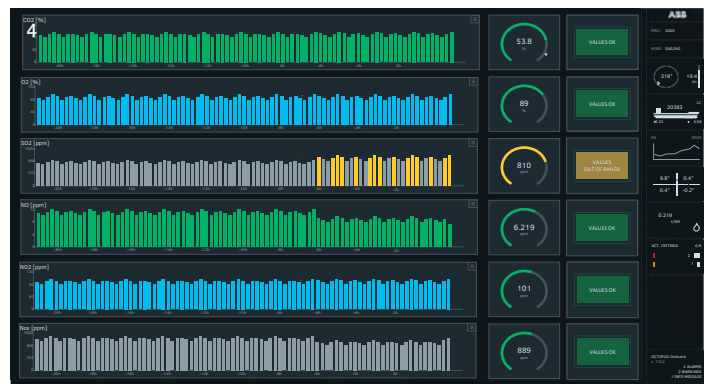
# Measurement solution integration made easy

A broad spectrum of sensors and instrumentation solutions completes ABB's offering within advisory systems solutions. A unique selection of highly developed sensors are integrated specifically for ship performance monitoring and providing crucial information for crew on board and fleet management in the office.



From the overview of vessels total energy flow operators have instant data access of details on fuel flow: from bunkering, specific consumption, engine performance up to emissions.

1 Bunker Transfer Monitoring | 2 Engine Performance Monitoring | 3 Fuel Consumption Monitoring | 4 Continuous Emission Monitoring



# Contact us

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For more product information visit:

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