
ABB MEASUREMENT & ANALYTICS

Products, solutions and services for the marine industry



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 world-class 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

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

02 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



"You cannot improve it, if you cannot measure it"

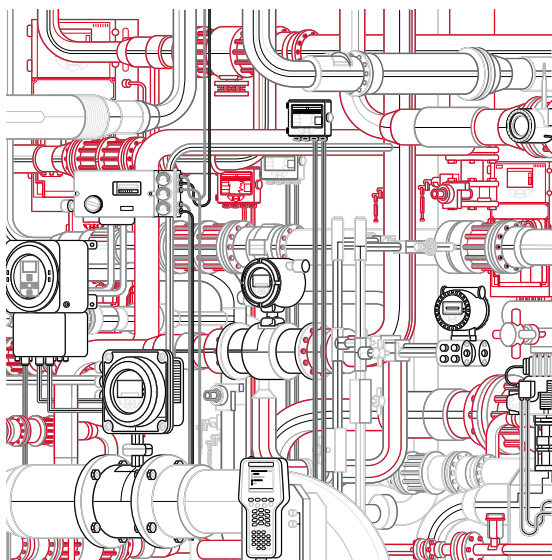
Lord Kelvin

Shipping industry has to maneuver through increasing challenges

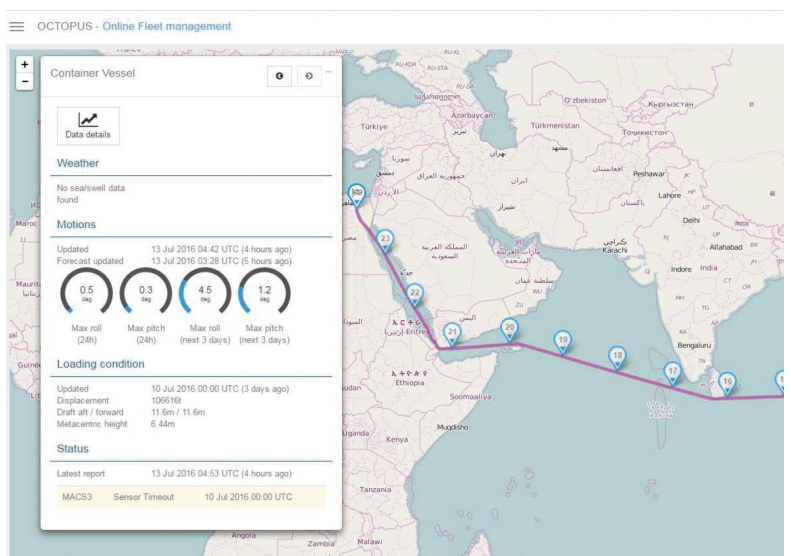
- Comply with increasing legislation demands for lowering emissions and reducing CO₂
- Optimize fuel costs over varying operation profiles
- Minimize maintenance cost by keeping maximum of availability and safety
- Improve the efficiency of technical management with minimum staff costs

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

01



02



Flowmeter solutions for the marine industry

01 CoriolisMaster
FCB meters

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 flowmeters with large diameters using CoriolisMaster
- Ballast water flow measurement with ProcessMaster
- Energy measurement of steam on board with SwirlMaster

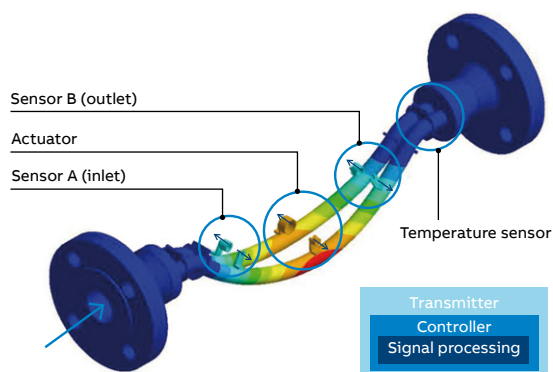
Measuring massflow, volume flow, density, concentrations and temperature – over a wide range of flow rates:

- 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

01 Remote transmitters

02 FCB400 multi-purpose meter including large varieties of communication

03 FC FCB100 – for system integration via Modbus

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

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

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

- Unrivalled measurement turndown 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 environments in marine applications
- MID/OIML R117 compliant and tested

TYPE APPROVAL CERTIFICATE

DNV·GL

Certificate No:
A-14145
File No:
892.50
Job Id:
262.1-017563-1

This is to certify:
That the Flow Transmitter

with type designation(s)
Coriolis Master FCB3 / FCH3 series, Transmitter FCT3 series

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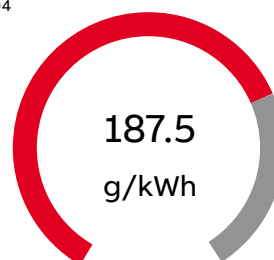
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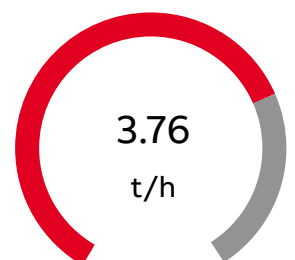
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SFOC



Mass flow



Bunker Transfer Monitoring System (BTMS)

Customized concept for newbuilds and retrofit

01 Remote operation panel

02 CoriolisMaster single train application

03 Flow computer

The monitoring system for the fuel transfer bunkering process features a unique combination of leading ABB technologies.

This BTMS solution delivers 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

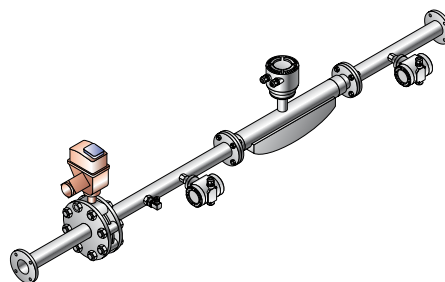
- Flexible vertical or horizontal mounting into existing environment
- Twin train CoriolisMaster sensors up to 1200 t/h HFO fuel transfer rate
- Optional one train CoriolisMaster sensor for MDO/other fuel measurement
- Heat mattress wrapped around CoriolisMaster to support HFO fuel temperature/viscosity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

Remote monitoring and control display

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



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Ballast water management system

Trusted solutions for ballast water treatment applications

—
01 ProcessMaster
type approved for
marine application

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 2400 mm ($\frac{1}{8}$ to 96 in).

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.



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Continuous emission monitoring

Meeting regulations of today and tomorrow

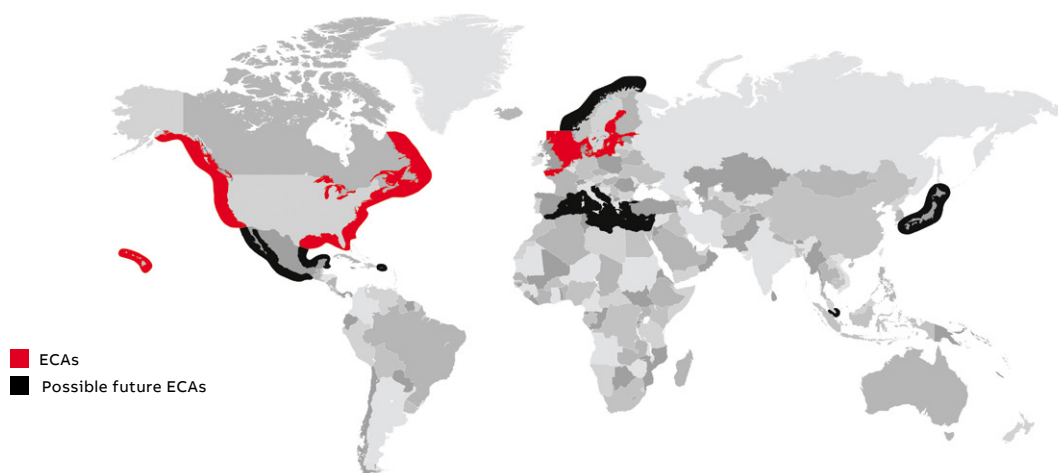
—
01 AO2000-Uras26 –
Non Dispersive
InfraRed (NDIR)
IMO referenced
technology for
CO₂ and SO₂

—
02 AO2000-Limas21
UV – UV resonance
absorption
spectroscopy
approved equivalence
to IMO reference
technology

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 of SO₂, CO₂ and NO_x emissions.

The new set limits in the ECAs can be achieved only by switch over to expensive clean fuels or by

adopting new technologies such as exhaust gas cleaning systems (EGCS). ABB is meeting the demand of shipyards, ship owners and marine ECGS manufacturers to equip vessels with continuous gas analyzers for Continuous Emission Monitoring (CEM). These measure all the regulated pollutants (SO₂, CO₂, NO_x) and optimize fuel consumption (CO, O₂) on board at the same time.



We are on your wavelength!

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

AO2000-Uras26

- CO₂
- SO₂
- SO₂/CO₂

Further components:

- CO
- CH₄

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

- NO
- NO₂
- NO_x

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

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02



Continuous emission monitoring

Analytical measuring system designed for marine applications

—
01 Smart CEM
solution GAA330-M

—
02 Advanced CEM
solution GAA630-M

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:
 - CO₂ – via NDIR analyzer
 - SO₂/CO₂ ratio – via NDIR analyzer
 - NO, NO₂ and NO_x – 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)
- Compliant with:
 - IMO MARPOL ANNEX 14 Res. MEPC 177 (58) (NTC)
 - IMO MARPOL ANNEX 9 Res. MEPC 259(68)
 - IMO MARPOL ANNEX 5 Res. MEPC 103 (49)

GAA630-M – advanced CEM solution for the marine industry

The analysis system for continuous gas analysis GAA630-M provides an advanced solution for the



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:
 - CO₂ – via NDIR analyzer
 - SO₂/CO₂ ratio – via NDIR analyzer
 - NO, NO₂ and NO_x – via NDUV analyzer
- Further components can be easily added on request
- Type Approval: Lloyd's Register Marine Environmental Category ENV2

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Diesel engine performance optimization

Combustion under control

Today's electronically controlled two-stroke engines feature automatic tuning and control 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 five years.

Cylmate pressure sensor are approved for 'MAN PMI AutoTuning' and 'WinGD/Wärtsilä Intelligent-Combustion-Control systems'.



Market leading reliability for optimization of two-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.

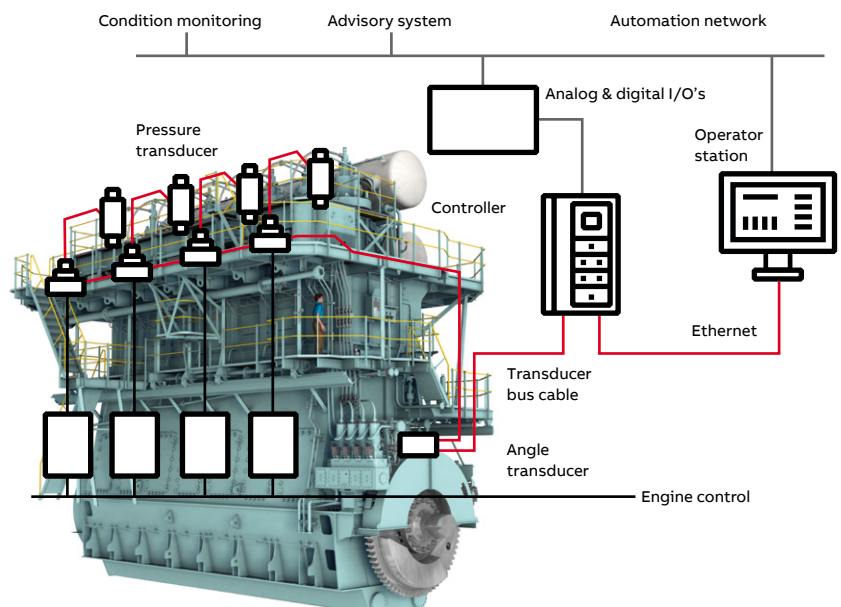
Technical benefits

- Long life time – MTBF of more than ten years
- Maintenance free – blow through design
- No need to recalibrate
- High accuracy and repeatability

Customer value

- Investment safety and low life-cycle cost
- Unique five years warranty
- Better working environment for the crew
- Payback through reduced fuel consumption





Pressure measurement

01 266 Differential pressure transmitter

02 266 Absolute pressure transmitter

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 266 pressure transmitter

- 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

Pressure measurement at optimization with Variable Frequency Drives (VFD)

Benefit from instant energy savings when the pump or fan is 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.

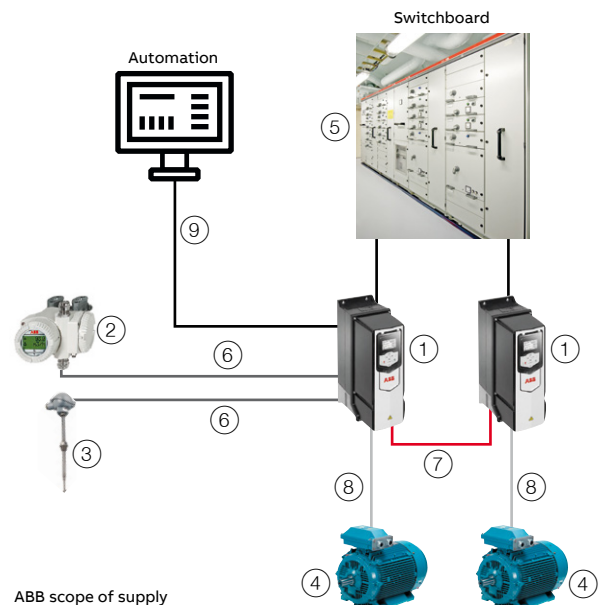


ABB scope of supply

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

Temperature measurement

01 Process temperature sensor TSP100

02 Field-mounted temperature transmitter TTF300

03 Process temperature sensor TSP300

04 Head-mounted temperature transmitter TTH300

05 High-temperature measurement with SensyTemp TSH200

06 Rail-mounted temperature transmitter TTR200

07 WirelessHART temperature sensor TSP300-W

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

09 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 lube 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.



08



09



Continuous water analysis

01 ATS430
turbidity/TSS probe

02 AX400 transmitter

03 ABB provides
customized solution for
waste and freshwater
monitoring

04 Environment
protection legislation
requests monitoring of
waste water discharges

New marine environmental legislation and process technologies extending the need of water components analysis onboard 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

The 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.

Available in a analogue or digital options and featuring predictive diagnostics, it is robust and long lasting with continuous accurate performance and enhanced shelf life.



03



04



Continuous water analysers

Reliable scrubber operation and discharge water within IMO limits

As a world leader in continuous water analysis, we provide a wide range of instruments and analysers that can help provide accurate, continuous measurement of water and wastewater in marine applications. Robust, reliable and accurate, our sensors can help you operate in a safer, more efficient and environmentally-friendly way that meets the toughest international emissions standards.

Our extensive portfolio of continuous water quality instruments and analysers provides a solution for a wide range of marine applications:

Scrubber analysis

Stringent legislation around marine diesel engine emissions makes it vital to minimise the impact of exhaust gases on the environment. Our turbidity and pH sensors offer reliable monitoring of scrubber-based exhaust gas cleaning systems (EGCS), by monitoring both the inlet and outlet of the scrubber system.

Ballast water treatment systems (BWTS)

Ballast tanks can be a breeding ground for non-native organisms that can cause serious damage if allowed to escape into new environments. Using our instruments to measure the pH of

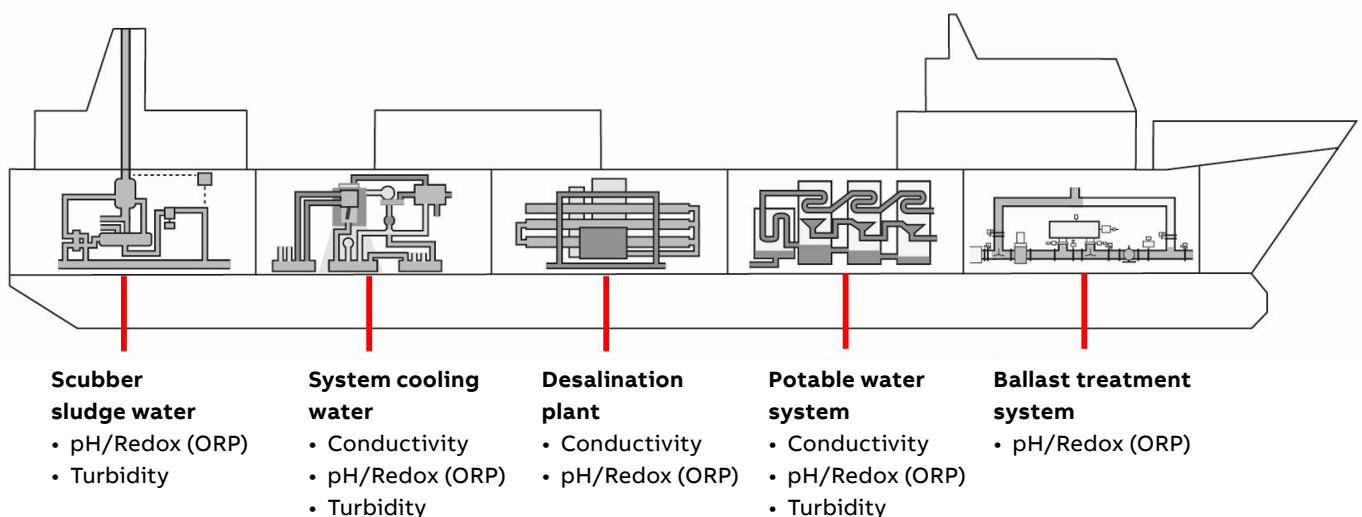
ballast water can play a key role in developing water treatment strategies that can remove potentially harmful organisms.

System cooling water

The aggressive nature of the distilled water used for engine cooling can increase the risk of engine failure caused by corrosion. Our proven range of pH and conductivity sensors can help ensure that cooling water is kept within the correct limits to minimise the risk of damage caused by corrosion.

Desalination/Potable water treatment

With instruments and analysers for measuring key parameters including conductivity, pH and turbidity, we can help you to optimise the performance of your onboard desalination plant to ensure your water meets the highest quality standards.



Actuators and positioners

—
01 Actuator Contrac
RSD linear drive series

—
02 Contrac actuator
application in harsh
environment

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.

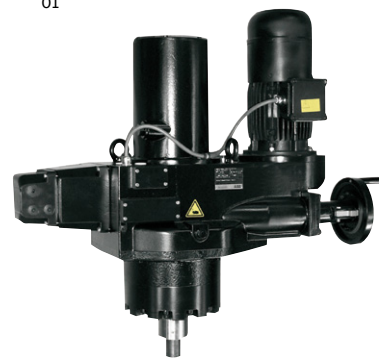
The ABB digital positioners meets the requirements providing robust design, user friendly functionality and low cost of ownership with its unique low air consumption design.

- 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

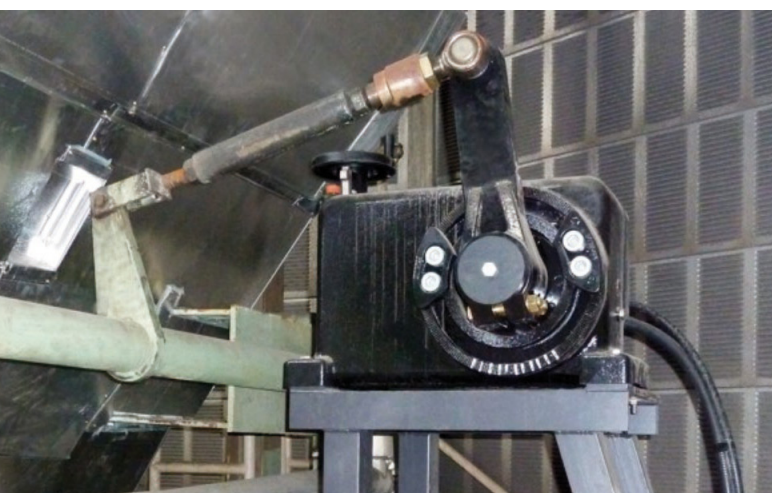
Contrac actuators

Contrac electrical actuators are designed for up to ten years of maintenance-free operation, ideal for demanding applications requiring high plant availability. By using oil-lubricated spur gears rather than the worm gear pairs, where repetitive sliding movements cause greater wearing over a shorter period of time. Contrac actuators can handle more than 3600 operating cycles per hour, without significant reduction in their lifetime.

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Valve positioners

Application solutions

01 EDP300 digital positioner

02 TZIDC digital positioner

03 EDP300 with remote sensor

04 EDP300 digital positioner with stainless steel housing

ABB's industry proven EDP300 and TZIDC positioners are DNV GL certified and suitable for any control valve applications in the marine industry.

Standard and advanced applications

Whatever the application ABB can provide the solution. The TZIDC positioner family is ideal for a wide range of standard applications with basic valve diagnostics, while the EDP300 positioner is ideal for advanced applications providing comprehensive valve diagnostic and valve health reports.

Remote mount positioners

For difficult to reach valve applications the EDP300 with remote position sensor provides the ideal solution. The sensor is mounted on the control valve while the electronics with the user access interface is located in an easy to reach location, the typical distance between the positioner and the remote sensor is 10 meters (32 ft).

For harsh and corrosive environments

The EDP300 positioner is available in a robust stainless steel housing suitable for harsh and corrosive applications. Thanks to its HART communication capability remote access is possible via the user friendly FDI PC based Field Information Manager for programming and valve health monitoring.



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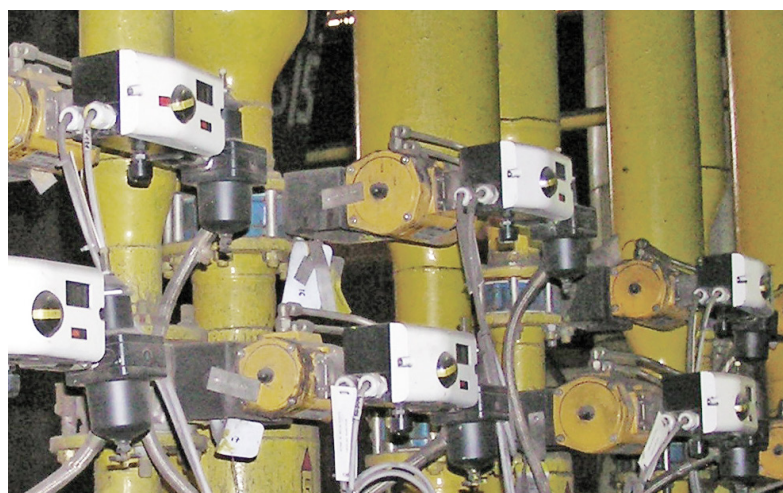
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DNV·GL

Certificate No:
TAA00001VT

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Electro Pneumatic Positioner

with type designation(s)
TZIDC/-110/-200/-210 & EDP300

Issued to
ABB Automation GmbH
Minden, Germany

is found to comply with
DNV GL rules for classification – Ships, offshore units, and high speed and light craft

Recording and control

01 SM500F field mountable paperless recorder

02 RVG200 paperless recorder with smart touch screen operation

03 | 04 | 05 Various operator views selectable such as strip chart, bar graph or process view

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 with bridge supervisory systems via Ethernet

The RVG200 is ideal for recording bilge well level, holding tank level, bilge alarm status, bilge pump status, bilge discharge and GPS coordinates of discharge.

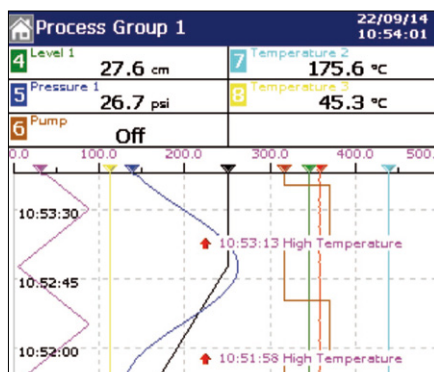
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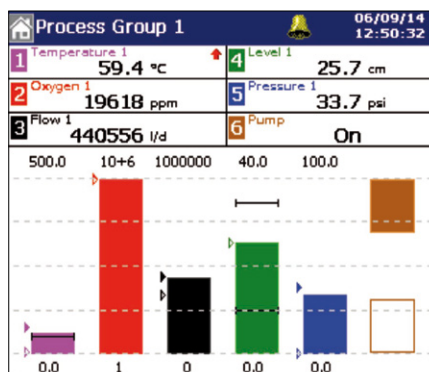
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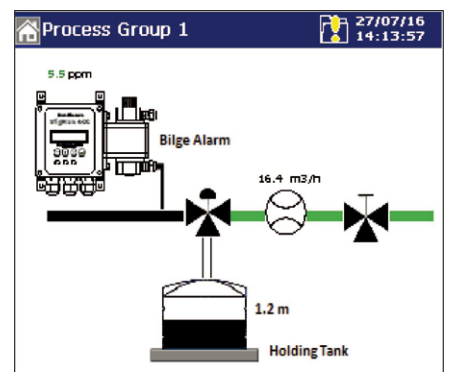
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Combustion oxygen analysers

Ensuring compliance with IMO regulations

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01 Continuous oxygen
monitoring on EGR
with AZ10 marine
sensor technology

Highly efficient, Exhaust Gas Recirculation (EGR) technology assures compliance to IMO Annex VI, Tier III NO_x emissions restrictions on 2-stroke diesel engines within emission control areas (ECAs). ENDURA AZ10 combustion oxygen analysers provide a critical role allowing EGR optimisation in marine diesel engines. Their reliable measurements help ensure regulatory compliance and engine performance optimization to reduce fuel costs.

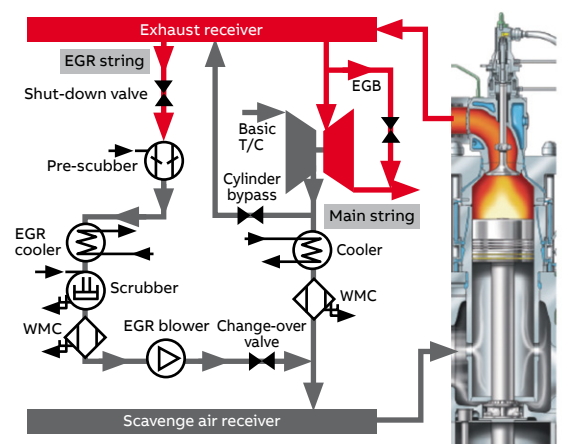
ABB supplies trusted, robust Oxygen measurement technology, proven in marine EGR systems over several years.

Marine industry benefits of ABB Endura AZ10 O₂ technology

- Marine certification- IACS E10 Rev. 5.0 2006
 - Test Specification for type approval- ABS certificate 15-LD1262098-PDA
- Minimal maintenance even in hostile environment
- Can be performed in-situ with basic tools
- Extremely low drift ABB zirconia technology
- Only needs periodic 1-point calibration with air
- Compliance with IMO and CEMS
- Remote or automatic calibration
- Assured system performance accuracy
- No operator interference of HMI
- Assured performance
- Accuracy better than $\geq 2\%$ of reading or $\pm 0.1\%$ O₂
- Proven robust design and performance
- Multi-layered electrode prolongs cell life even in harsh NO_x emissions environment
- Validated in 'normal' and 'extreme' performance tests

Exhaust Gas Recirculation (EGR) technology

Engine exhaust gas is mixed with fresh air intake and recirculated back to the combustion. The combustion temperature is reduced by replacing oxygen with carbon dioxide, which directly reduces NO_x emissions.



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01



Tank level gauging

— 01 Laser level transmitters

— 02 TX Thermal dispersion switch

— 03 Magneto-strictive level transmitter

— 04 Guided wave radar transmitters

— 05 Level measurement on ships have a various range of application demands

— 06 Accurate level control for boiler efficiency

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 a 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.

Onshore/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.

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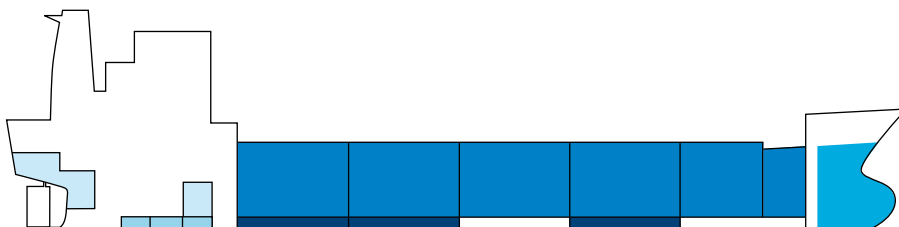
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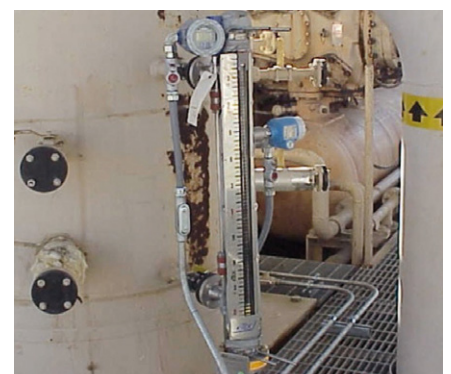
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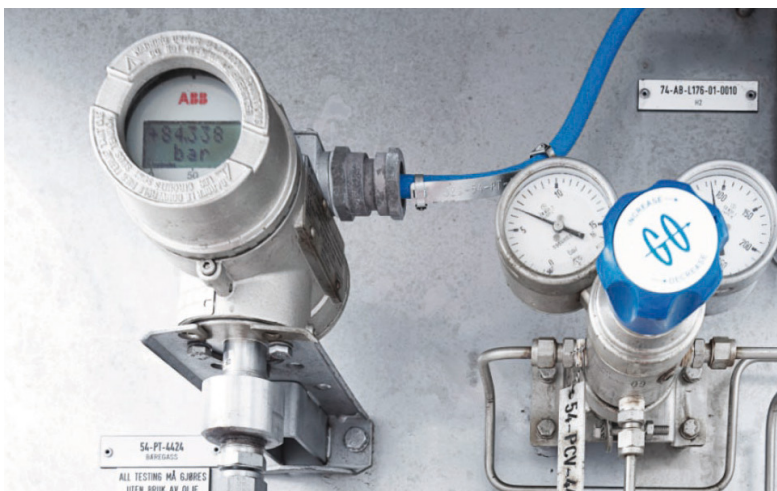
On-line natural gas analyzer

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)
- H₂S measurement
- API 21.1 EFM capability and AGA8 compressibility calculations



Wireless measurement

Measurement solutions for temperature, pressure, level and flow

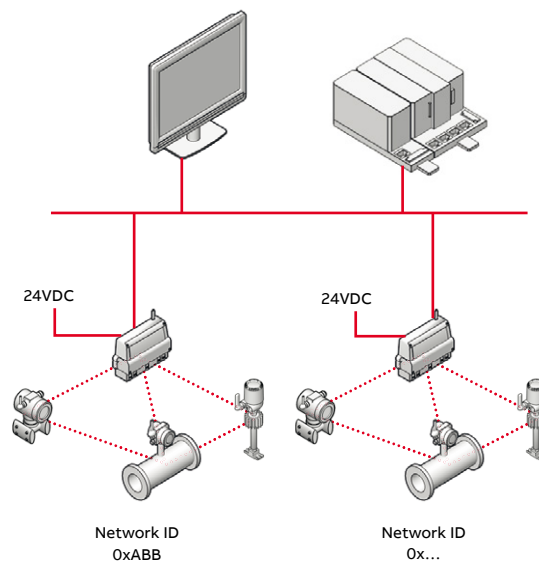
01 Wireless temperature measurements on a LNG carrier for boil-off gas HRS retrofit

02 Measuring steam energy consumption with SwirlMaster

Wireless instrumentation networks have the potential to significantly reduce instrumentation installation costs with savings greater than 30% and up to 60% in wiring 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 aboard 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 upstream 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

01



02



Torductor Marine:

Measuring shaft torque, power and fuel efficiency

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

02 Measuring shaft torque with the Torductor marine

03 Torque and power measurement integrated in ABB Advisory system

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.

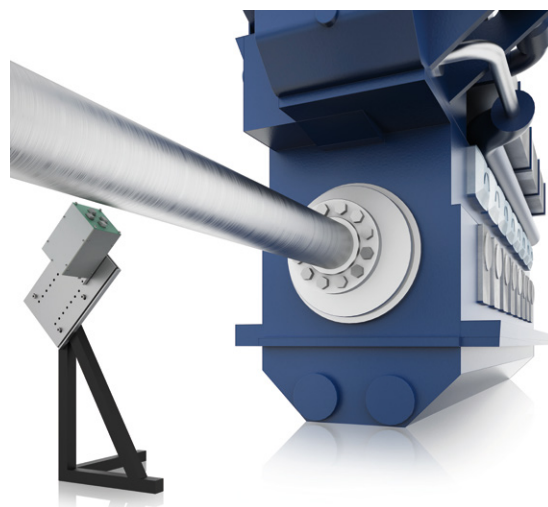
The sensor is the key component of Torductor Marine. Propulsion power is measured by ABB's unique torque transducer, a truly contactless device that requires only 25 cm (9,84 inch) of free shaft length without the need to bind any electronic devices to the shaft.

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 CoriolisMaster flowmeters the Specific Fuel Oil Consumption (SFOC) can also be delivered.

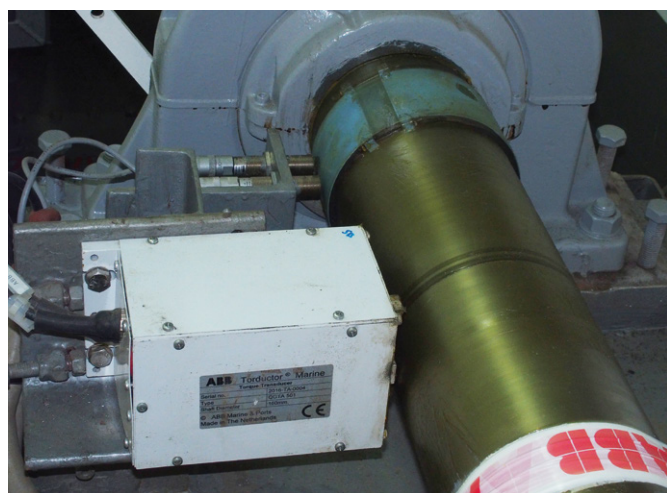
Integration with ABB's marine software

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.

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Unmatched service portfolio

World class competences for your benefits

ABB's products, solutions and services for marine applications deliver high levels of performance and reliability in demanding conditions. Certifications by leading classification societies ensures compliance and quality. ABB understands the value of accurate and reliable measurements. With our service specialists strategically located, we support all products and systems globally, wherever and whenever is needed.

Best-in-class products deserve a service strategy to secure performance at peak. ABB's service solutions span the entire product portfolio and offer range is designed to suit your needs for:

Rapid Response

Guaranteed fast service response to minimize downtime when unplanned failure occurs. Technical support, repair on vessels or at ABB repair centers, ABB Ability remote assistance, Dynamic QR Code.

Lifecycle Management

Services to optimize and extend equipment lifetime. Spare parts management, preventive maintenance, calibration, lifecycle assessment

Performance Improvement

Increased productivity through optimization of equipment and processes. ABB Ability Remote condition monitoring, predictive maintenance, ABB Ability verification

With more than 250 service technicians you can count on us to provide fast, local, reliable support; 7 days a week, 365 days a year. We take care of your assets, so you can take care of your business.



Service over the entire product lifecycle

Tailored to your needs

ABB offers a comprehensive portfolio of services to ensure rapid support and extend product lifetime through effective operations plan. From product commissioning, through maintenance up to product upgrades. Everything tailored Measurement Care service agreement.

ABB Measurement Care bundles specific services into service agreement to secure trouble-free operations and ease-of-business to:

Cut complexity

- Less time wasted, fewer hassles, simplified service interaction with a single point of contact in ABB
- Services performed safely and efficiently by our skilled service expert, advice and training available anytime

Control Cost

- Providing effective and timely solutions to minimize the downtime due to unexpected failures
- Structured maintenance approach to allow reliable budgets definition

Maximize productivity

- While regulation became tighter and globalization increases the competition, it's key to improve products, systems and processes efficiency and reduces capital outlays.
- Digital products enable better control and optimization of processes.

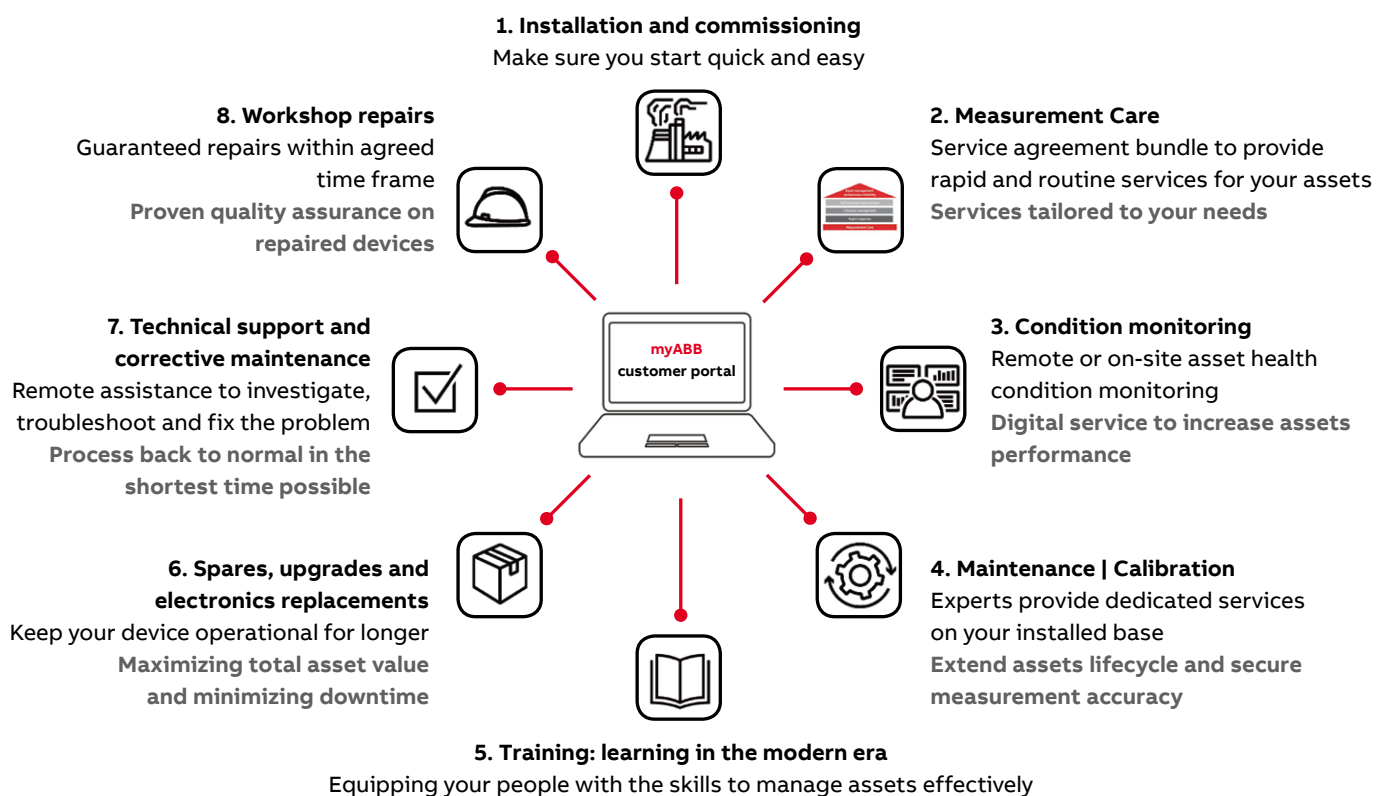


ABB Ability Marine Advisory System – OCTOPUS

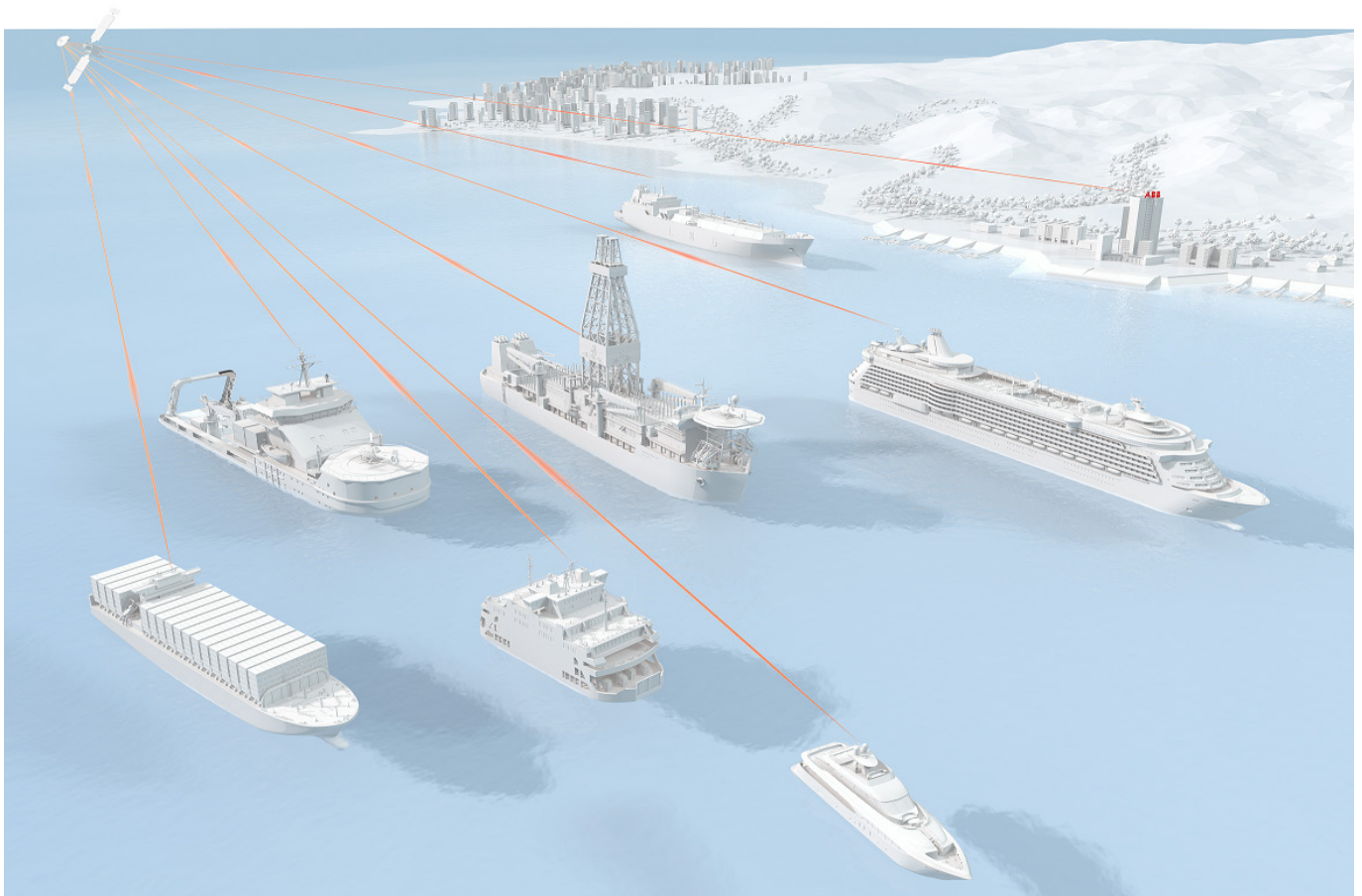
Optimizing safety and profitability of ships

The OCTOPUS system falls into the ABB Ability™ Collaborative Operations offering, where our customers profit from ABB's digital services and solutions for the maritime industry. Our offering increases shore side connectivity, reduces operating & maintenance costs, and increases safety & efficiency during operations at sea.

The OCTOPUS system consists of a modular and comprehensive decision support tool kit to optimize the workability and safety of a ship and to minimize the overall fuel and energy costs for the whole fleet. When utilized correctly, case studies have shown that a combination of OCTOPUS modules can save close to 10% in propulsion energy costs, with a corresponding system payback time just over a couple of months.

Examples of OCTOPUS modules are:

- Motion monitoring and forecasting
- DP capability forecasting
- Clean Hull module
- Energy diagram
- Power plant optimization
- SFOC monitoring
- Speed optimization

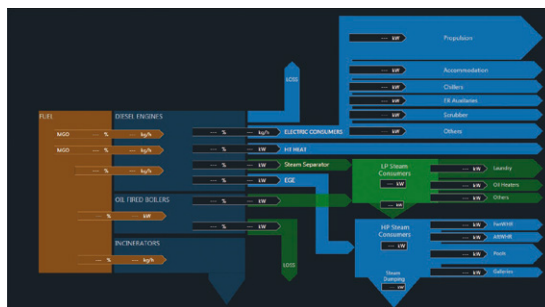


Measurement solution integration made easy

- 01 Bunker transfer monitoring
- 02 Engine performance monitoring
- 03 SFOC monitoring
- 04 Continuous Emission Monitoring

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 onboard crew and fleet management in the office.

From the overview of a vessel's total energy flow, operators have instant data access of details on fuel flow: from bunkering, specific consumption and engine performance through to emissions.



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ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information, visit:
www.abb.com/marine

