

Remote Diagnostic Services (RDS) Always onboard with you

An ABB remote service concept

Supporting our marine power and automation solutions

ABB is a leading system supplier to the marine industry and has a long track record of providing timely, high-quality service to its customers around the globe. To enhance the quality and efficiency of our services while lowering service costs, ABB offers a remote service concept, Remote Diagnostic Services.

The RDS concept

Remote Diagnostic Services (RDS) is a tried and tested ABB service concept that has been tailored to the marine segment. This standardized diagnostics and maintenance solution is functionally advanced yet secure and simple to implement. By making expert knowledge available in the shortest possible time and drastically reducing the need for costly on-site visits, RDS helps ensure safe and efficient vessel operations and contributes significantly to lower OPEX costs.

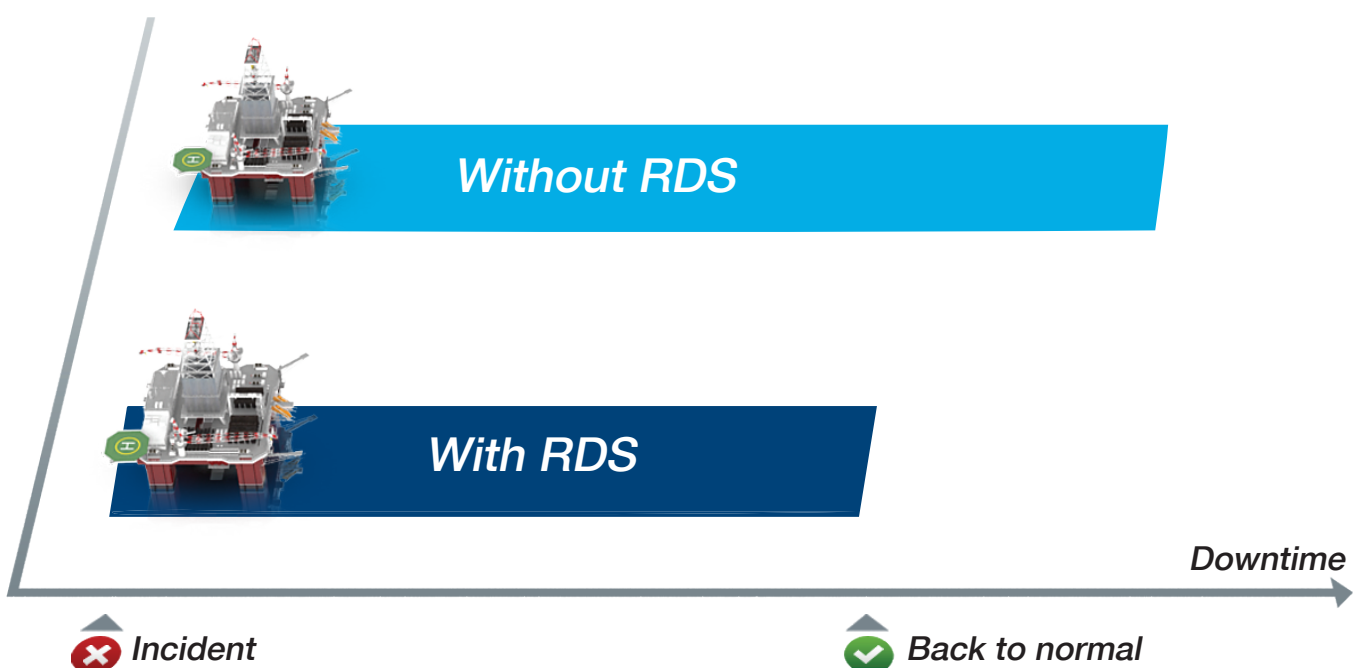
Simplifying the problem-solving process

The root causes of most technical problems onboard a vessel are often very clear. However, identifying these can be a difficult and complex process due to lack of consistency in data or poor quality of available information. To simplify this process, RDS furnishes the user – whether

a local operator or a remotely connected service engineer – with accurate and relevant information from the start of the fault-finding process. The high quality data provided by RDS greatly reduces the time required to identify and correct the source of the problem, resulting in higher vessel uptime.

The RDS concept comprises three main components:

- Remote connection
- Diagnostic solutions
- Service contracts



Diagnostic solutions

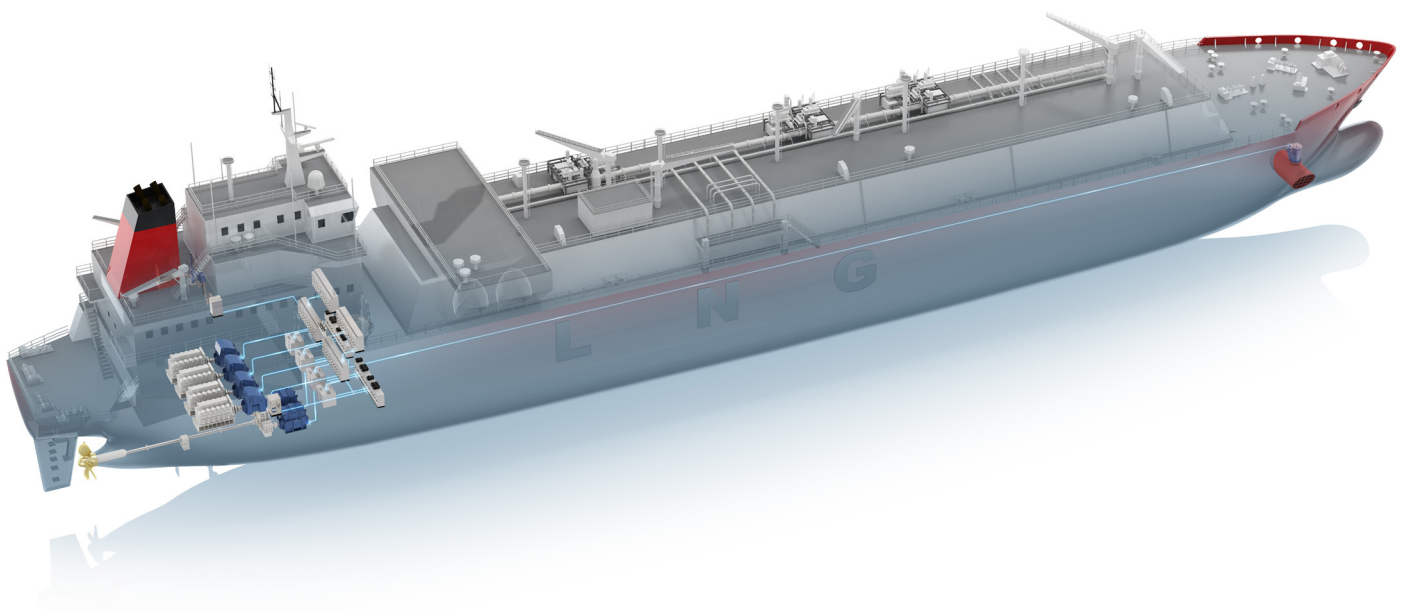
Customer case

With RDS, ABB and the crew were able to troubleshoot a technical incident in two hours. In normal circumstances, the failure would have led to sailing at reduced speeds for at least several days.

In a real case, a 100 000 DWT LNG tanker sailing from Singapore to Cape Town experienced a failure in the star-board medium-voltage (MV) frequency converter, causing an immediate loss of 50 percent of the propulsion power. The vessel did not lose any of its safety-critical maneuvering capability, but needed to reduce its speed significantly. Slower sailing means later arrival, which directly results in higher operational costs while, since part of the system's redundancy is lost, safety margins are reduced.

In normal circumstances, the failure would have led to sailing at reduced speed for at least several days, until a qualified ABB service engineer could attend at the next port of call. However, with the RDS4Marine system on board and a Global 24/7 Technical Support agreement with ABB, the crew worked with ABB staff to troubleshoot the malfunction.

Just **two hours** after the first call the entire propulsion system was back in operation. The vessel went on to Cape Town as planned, with no delays.



Remote connection

Stay in touch – wherever you are

With RDS remote connection, our marine customers can connect with a qualified ABB service engineer while at sea for remote system monitoring, analysis and troubleshooting from land.

The Global 24/7 Technical Support Center

As part of the Global 24/7 Technical Support Center, RDS operations are carried out by highly-skilled service engineers located onshore equipped with state-of-the-art technology that analyzes the incoming data from the vessel.

The Global 24/7 Technical Support Center manages all the customers' systems which can be accessed via RDS and their authorized users.

Secure remote connection

Providing a customer with personal attention remotely solves problems quickly and effectively. But when a vendor or service provider that supports a mission-critical application requires remote access, it often encounters challenges.

For example, Information Security Officers are faced with the dilemma of keeping their networks secure while at the same time receiving remote support.

To meet these requirements, ABB has deployed new technology in order to provide the most innovative remote support in the industry. The Remote Access Platform (RAP) is fully introduced and integrated into the RDS concept.

When required, an authorized ABB service engineer can log on to the Service Center and request permission to connect to the vessel's installed system. If granted access by the crew, ABB engineers can then connect to the systems onboard and carry out the maintenance or troubleshooting through the diagnostics systems.

The Global 24/7 Technical Support Center provides timely and qualified technical assistance for ABB customers via safe and secure remote communication links.



Global 24/7 Technical Support

Round-the-clock access to qualified support engineers

Our Global 24/7 Technical Support Center provides a single point of contact for vessels operating all over the world. Here you have access to our highly qualified support team, able to assist you with a wide range of operational and maintenance issues.

With increasingly advanced vessels and onboard systems, the need for expert technical support is growing. Using the new opportunities afforded by modern IT and telecommunications, ABB offers the most efficient Global 24/7 Technical Support service to its customers in the marine and offshore industry.

ABB's technical support gives you:

- Professional support for your self-maintenance strategies
- Reduced cost of maintenance, and improved asset availability and performance
- Support and advice to resolve urgent operational issues
- One point of contact to manage your case until it is resolved

High competence - on tap

All ABB engineers in the support team fully understand the value of a timely response. They are all specialists with vessel-commissioning and field experience, and are continuously updating their technical skills. ABB engineers are trained to assess a failure situation, respond with technical support to perform root cause analysis, and, where needed, mobilize resources to remedy the problem.

Clearly defined end-to-end process

ABB has a strict end-to-end process and specialized ticket management system to follow the service requests from receiving the call or e-mail until the issue has been resolved.

One person will be responsible for your case from the start, and you will receive a unique reference number when contacting Global 24/7 Technical Support. Tickets are filtered in queues and automatically given priority based on the vessel's owner's service contract levels. All activities are recorded and fully traceable, and the service history and warranty records are automatically updated in our vessel database.

Benefits for customers with RDS service contract

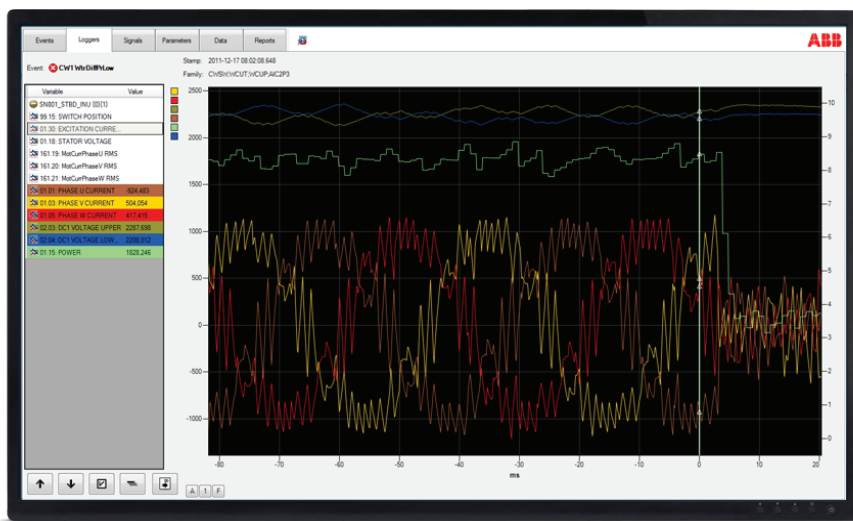
Customers with RDS service contract are entitled to priority support and guaranteed response times when accessing technical support. They also have access to a dedicated web portal for the tracking of ongoing cases. In addition they automatically receive our Service Bulletins. When a problem arises, Global 24/7 Technical Support can be critical for minimizing or eliminating off-hire breaks.

With RDS, our engineers at the Global 24/7 Technical Support Center have instant access to vessel and equipment data and all ABB resources necessary to resolve the case. This reduces the need for costly on-site service visits and improves system performance, up-time and overall vessel profitability.

RDS4Marine - Remote Diagnostic System for Marine

The system behind the service

RDS4Marine is a diagnostic tool providing troubleshooting and condition monitoring solutions for electrical and mechanical systems installed onboard with remote assistance from the Global 24/7 Technical Support Center.



RDS4Marine diagnostic platform



A key component in our Remote Diagnostic Service for the marine industry is RDS4Marine, a dedicated monitoring and diagnostics platform for collection, storage and analysis of data from individual components, sub-systems and complete system solutions.

Diagnostic solutions For complete systems

RDS4Marine solutions for individual system components are valuable in their own right, but the main benefits of this modular system becomes truly apparent when the various sub-systems are woven together in a single multi-discipline diagnostic system.

Simplified system diagnostics

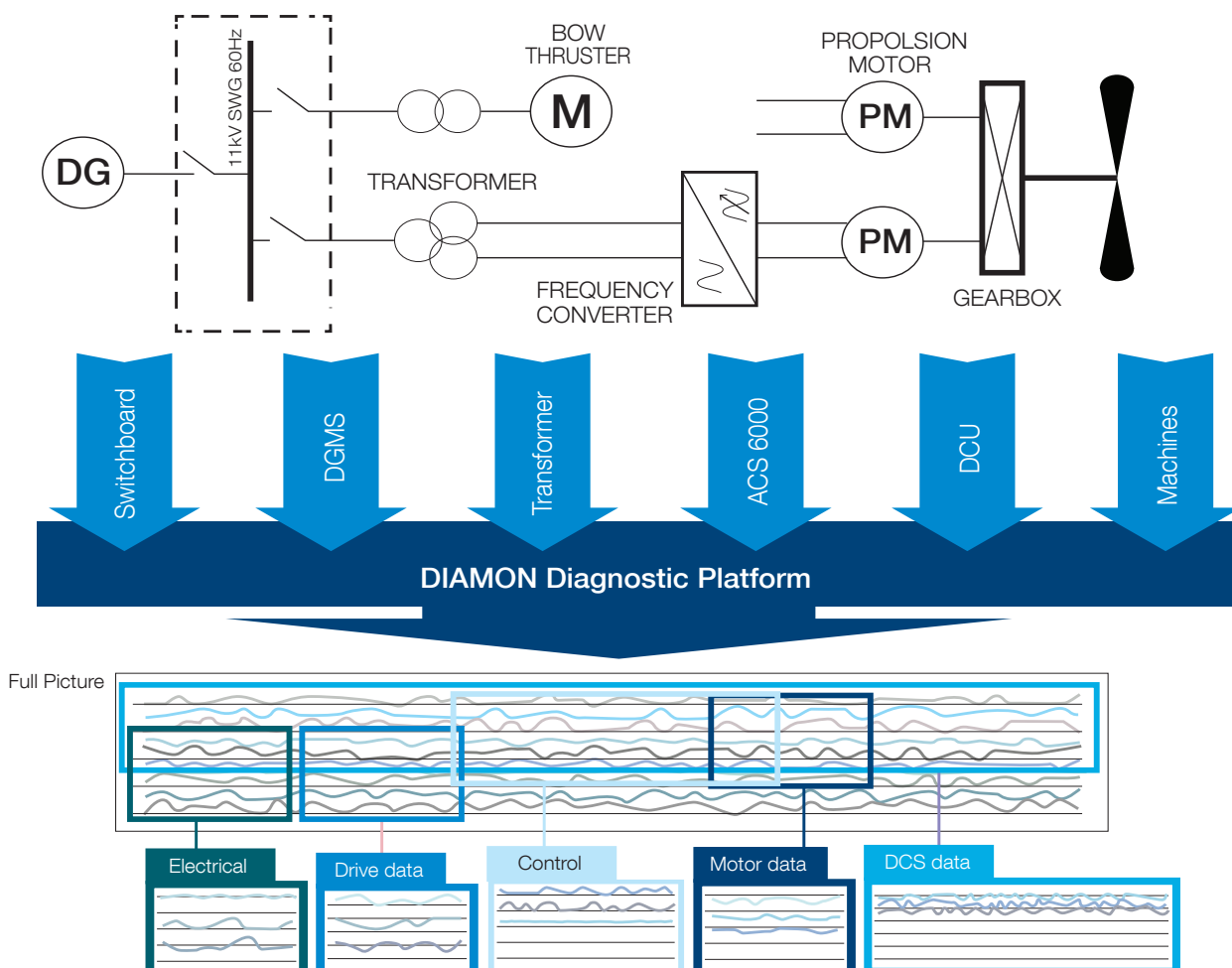
To address the individual needs of each vessel, the RDS4Marine system is completely modular. This allows for the expansion of the diagnostic capability from monitoring a few critical components or subsystems, to a fully multi-disciplinary diagnostic solution for entire vessels' equipment.

The combination of diagnostic objects can be designed to form diagnostic packages such as D4Propulsion (Diagnostics for Propulsion), D4Azipod®, D4Drilling, D4DGMS (Diesel

Generator Monitoring Systems), D4DCU (Drive Control Unit), D4Switchboard and D4Machines. The high quantity of harmonized data allows for a multitude of advanced system condition monitoring opportunities.

Entire drive train monitoring

The example shown below explains how the RDS4Marine system is used for monitoring an entire drive train – starting at the generator and ending up at the propulsion motor and gearbox.



RDS4Marine

Diagnostic solutions

System monitoring, analysis, troubleshooting and preventive maintenance for entire drive train system

When connected to a remote system, a range of specialized diagnostic solutions is available to help the operator determine the status of the equipment and, in the event of a problem, identify the problem source. To address the individual needs of each vessel or offshore facility, RDS4Marine provides a range of advanced function modules for full monitoring and diagnostics functionality for specific components and sub-systems.

Connectivity concept

The connectivity backbone between the RDS4Marine and individual components in the drive train chain is the OLE for Process Control (OPC) interface. In the majority of cases, there is no need for any extra hardware sensing and cabling. Access to the measurements is achieved either by connecting to existing OPC servers or by deploying them on RDS computers.

In addition, time synchronisation across all individual drive train components is introduced to facilitate proper and quick fault tracing analysis.

DriveMonitor™ for variable speed drives supervision

The award-winning DriveMonitor™ solution for the ABB Variable Frequency Drives (VFD) has a long and proven track record in the land-based industry and is becoming increasingly popular in marine applications. As an integral part of RDS4Marine system, DriveMonitor™ automatically collects and analyses selected signals and parameters of the drive. It generates application specific alarms and measurements and allows determining the root cause of an event in the drive.

Diagnostics for Drive Control Units

Applicable for Drive Control Unit (DCU), Drilling Drive Control Unit (DDCU), Propulsion Control Unit (PCU), Azipod® Interface Unit (AIU) modules, diagnostic solutions record all signals and events available on the control layer.

Diagnostics for Diesel Generator Monitoring System

Diagnostics for the Diesel Generator Monitoring System (DGMS) collect alarms, events and signals from the controller running the DGMS application. It may be crucial for the DGMS application engineer to look into the application performance. Therefore, alarms and internal variables are continuously monitored by RDS. In addition parameter snapshotting is implemented. This allows for quick verification of what the current parameter settings inside the DGMS are, without needing to go into debug mode in the control application

Diagnostics for switchboard

In the case of an medium voltage switchboard built on the REM/REF/RET type of relays as well as Relion® family, the RDS4Marine system collects alarms, events and transient recorders from protection relays. Such recordings are later subjected to detailed post-fault analysis. They can also be used to calculate power quality factors such as current and voltage Total Harmonic Distortion (THD) content, imbalance and crest factor.

The same transient recorders sampled with 2kHz sampling frequency and acquired from protection relay that governs direct online induction motors (eg, bow thrusters, pumps, fans) are also used for current spectra analysis to detect mechanical defects of motors such as a broken rotor bar, rotor eccentricity, etc.



DriveMonitor™ is a hardware and software solution highly customized for low and medium voltage frequency converter monitoring.

Diagnostic solutions

Modular systems

The combination of diagnostic objects can be designed to form diagnostic packages such as D4Propulsion (Diagnostics for Propulsion), D4Azipod®, D4Drilling, D4DGMS (Diesel Generator Monitoring System), D4DCU (Drive Control Unit), D4Switchboard and D4Machines.

Diagnostics for transformer

In the case of a propulsion system containing oil or dry type of transformers, the RDS4Marine obtains signals from sensors to provide entire monitoring of the propulsion transformer. Here, the focus is on recording the LV and HV side currents and hot spots and calculating oil ageing parameters and transformer load. The results of these calculations give a detailed picture of the way the transformer has been used (load) and the condition of the oil (water and gas content).

Diagnostics for Azipod®

With RDS4Marine, all vital parts of the Azipod® propulsion system are monitored. During Azipod® operations, data is gathered and stored, which can then be used for simplified troubleshooting and enhanced preventive maintenance. The entire cycle of data flow, from measurements to calculations is automatically triggered at regular intervals so that accurate assessment of, for example, main shaft bearing condition can be made. Baselining and continuous trending of analytical indicators help to detect faults at an early stage.

Condition monitoring for rotating machines

Another example of well-recognized monitoring tool integrated with RDS4Marine system is MachSense condition monitoring service. MachSense addresses the reliability of mechanical, rotating components of the drive train, including the motor, gearbox and driven load. Its role is to identify electrical and mechanical issues related to the rotor, bearings, gearbox and other components – problems which account for a major percentage of total failures.

The combination of electrical and mechanical measurements offers almost unlimited possibilities for enhanced condition monitoring. For a long time, introducing such advanced techniques was possible only with the use of an offline system equipped with a number of portable data collectors that could be temporarily installed, configured and used only by experienced service personnel travelling to the vessel. Now, the same is possible with online RDS4Marine system where the conditions for measurements are always normalized and triggered automatically according to the current operational profile well-known for the diagnostic system.

Component	ACS 6000	ACS 800 ACS 600 Stadt drive	Drive Control Unit	Transformer	Diesel Generator Monitoring System	RE_54_ RELION	Motors Generators Gearbox
Drive Unit							
Electric Propulsion	●	●	●*	●	●	●	●
Azipod®	●	●	●**	●		●	●
Drilling		●	●***	●	●	●	●

*Propulsion, Drive Control Unit

**Azipod Interface Unit

***Drilling Drive Control Unit

Service contracts

Modular Remote Diagnostic Service agreements

ABB offers an extensive scope of supply with a broad span of technologies and competencies. For fast and efficient remote support of its full marine technology portfolio, ABB has developed a single source, tri-level remote service contract concept.

Service contracts

The 3-tiered service program includes the following levels:

Troubleshooting

On demand connectivity to assist in diagnosing a specific system event or failure, via a secure remote connection.

Preventive

During scheduled ABB audits, data is collected and measured against established benchmarks. An ABB service engineer connects periodically to the remote system performs a detailed health check and advises corrective measures.

Continuous

Critical alarms and process status onboard the vessel are transmitted to the Global 24/7 Technical Support Center, enabling continuous proactive response from an ABB service engineer. Countermeasures can be launched immediately.

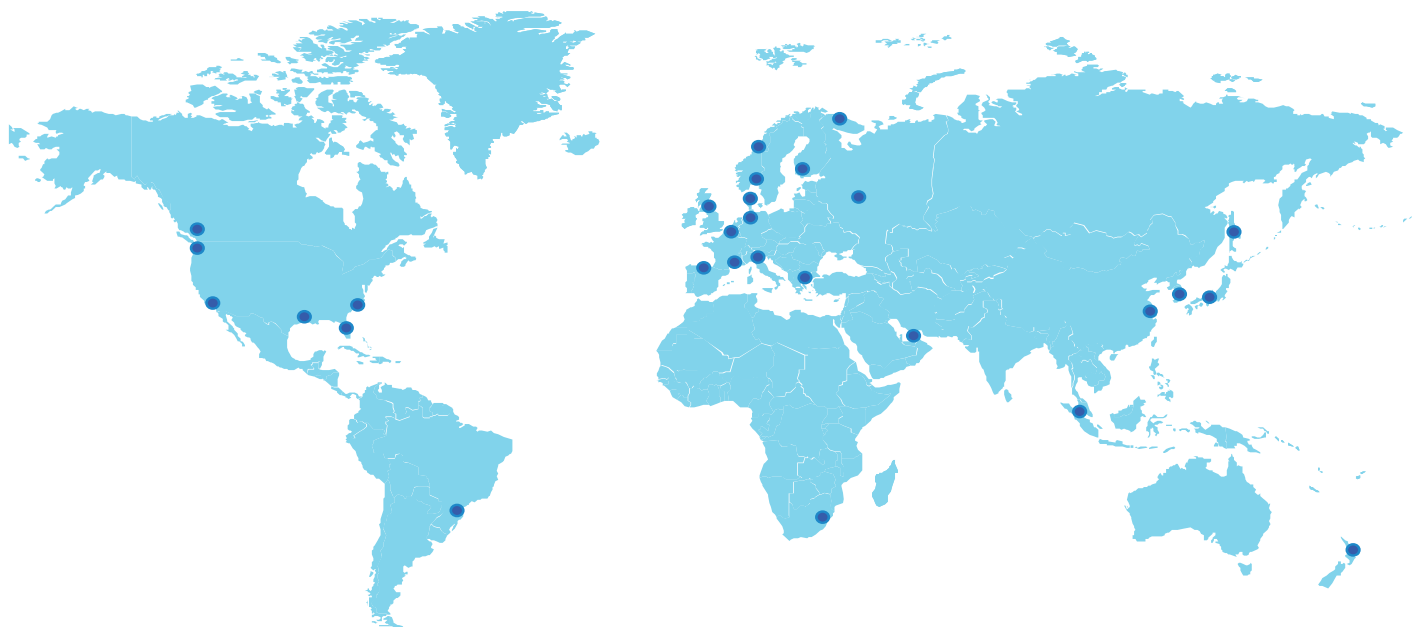
Support process

Scheduled and unscheduled cases are handled by the Global 24/7 Technical Support Center. The center is manned 24/7 and members of the RDS team are trained to support all systems included in the RDS program. All incidents and requests are logged by the RDS engineer on duty.

On call services are performed by qualified service personnel from the closest Marine Service Center. An ABB engineer will be dispatched to the vessel within a predefined, agreed time-frame to restore the equipment's normal operation.

		Continuous
		Hourly system status update
	Preventive	Automatic transfer of alarms
	Periodical system health check	Periodical system health check
	Periodical status report 24/7	Periodical status report 24/7
	Transfer and storage of historical data	Transfer and storage of historical data
	Recommendation on further actions	Recommendation on further actions
Troubleshooting	On request remote assistance	On request remote assistance
On request remote assistance	Fault tracing, guidance on corrective actions	Fault tracing, guidance on corrective actions
Fault tracing, guidance on corrective actions	Case by case report	Case by case report
Case by case report	Telephone Support 24/7	Telephone Support 24/7
Telephone Support 24/7		

The table above describes the three distinct levels of services provided by RDS service contracts.



ABB's Marine organization is present at the main maritime hubs world-wide.



The Global 24/7 Technical Support Center provides the 1st line service.



When 2nd line service is necessary, on-site personnel are dispatched from the closest Marine Service Center.

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