New perspectives for ship construction and operation ...

Totally Integrated Automation

Answers for industry.
Whether for cargo, passenger or special-purpose ships, Totally Integrated Automation meets every requirement in shipbuilding and shipping – and offers decisive advantages over the entire life of a ship.

With Totally Integrated Automation, Siemens presents a unique and integrated range of products and systems for implementing customized automation solutions – in all sectors of industry. Totally Integrated Automation can be adapted perfectly to suit the special requirements in shipbuilding and shipping – and to create the prerequisites for maximum economy, reliability and safety on board.
Safety

On the open sea, safety is of paramount importance. In order to protect passengers, the environment, the ship's equipment and its cargo, the crew must be fully aware of what is happening on the ship at all times. That is the only way to ensure that the right actions are taken or initiated every time. The prerequisite for this is: an integrated monitoring, alarm and control system on board.

Cost effectiveness

In view of the increasingly competitive situation in the shipbuilding and shipping industry, cost is becoming a more decisive factor all the time – for OEMs, system integrators, design offices and shipyards. For this reason, any possible potential for optimization must be fully exploited.

Reliability

Ships must be reliable for as long as they are on the water. Therefore, the availability of all on-board systems is of crucial importance. With this in mind, it is easy to understand why the operation of modern ships would be unimaginable without intelligent automation solutions on board.

... by continuous optimization during the entire life cycle of a ship.
Reduction of life-cycle costs

Even at the earliest stages of planning, design and engineering, Totally Integrated Automation offers countless advantages. For example, the unique level of integration and the shared hardware and software on the basis of proven international standards reduce interface costs to a minimum. In addition, solutions can be scaled perfectly and tailored to the actual needs and requirements. This rules out the possibility of over- or under-dimensioning the systems. As the hardware and software components used are subject to different cycles of innovation, we offer both partial and full migration solutions which protect all existing investments.

Raising levels of reliability

By choosing Totally Integrated Automation, you are opting for maximum reliability on board. Best example: SIMATIC® PCS 7, our distributed process control system for all tasks. SIMATIC PCS 7 allows the crew to access all relevant process data for the ship at any time – enabling them to react with extreme flexibility in the shortest possible time when the situation so demands. Another essential factor of Totally Integrated Automation: our comprehensive range of controllers from the SIMATIC S7-300 series that take on a whole range of central functions on board. They owe their leading position among all controllers worldwide not least to their outstanding performance and reliability. SIMATIC S7 controllers can be installed and operated in a wide range of ambient conditions (IP 65 + temperature).

Optimized safety

Integrated communication, a defined system characteristic of Totally Integrated Automation, is a fundamental prerequisite for the greatest possible safety on board. With SIMATIC NET we offer you everything you need to implement an open, transparent communication network on board. This not only achieves significantly greater efficiency, but also a smooth and efficient transfer of data: from the engine room to the bridge, all relevant information is available to the crew at all times. In this context, PROFINET is gaining in importance: the open and multi-vendor Industrial Ethernet standard is based on established IT standards and supports TCP/IP without restriction.

The major factor for success in shipbuilding and shipping

With its unique level of integration, Totally Integrated Automation offers a wealth of advantages over the entire life of a ship – not only for ship owners, but also for OEMs, system integrators and design offices.
Advantages of Totally Integrated Automation

**Design and engineering**
Intelligent tools support the selection of the appropriate components as well as the optimum design of the automation solution – and thereby ensure the greatest reliability at the planning stage. The system-oriented, integrated engineering minimizes the cost of configuration and commissioning. This enables automation solutions to be implemented significantly more quickly, reliably and economically.

**Installation and startup**
The consistent use of established standards – such as PROFIBUS and PROFINET – reduces interfacing costs to a minimum and simplifies installation and commissioning, allowing even the most complex plants to be implemented at considerably less expense.

**Operation**
Integrated communication ensures maximum transparency on board: The crew is able to respond much faster and more flexibly to changing requirements. In addition, efficient diagnostics concepts can be implemented – for greater availability of the automation components used. Integration also means: Standardized operation of all terminals.

**Maintenance**
Intelligent maintenance strategies allow potential sources of faults to be recognized, analyzed and cleared much sooner – even by means of remote maintenance. If modules have to be replaced, this is possible during operation (hot swapping) for many of our systems. At the same time, service personnel benefit from the standardized look and feel of our components.

**Modernization and expansion**
Existing automation solutions can be adapted to changing requirements without any difficulty – in many cases this is even possible while the system is up and running. At the same time, continuity of development of our products and systems ensures maximum security of investment in every case – by avoiding unnecessary discontinuities between systems.

**Marine safety and reliability – a global issue**
Going back at least to the origins of commercial shipping, great efforts have been made to ensure safety on board ship – for the protection of people, the environment, equipment and cargo. The safety standards that apply today have come into being during the course of centuries, and have been continuously developed over that time, worldwide.
The IMO (International Maritime Organization), responsible for standardized regulations covering all aspects of marine safety, currently has a membership of 160 countries. Special classifications provide information on whether the hull and technical equipment of a ship are perfectly seaworthy in all respects. Strict international guidelines and conditions have to be met here. These refer to the construction and running of a ship – but also to its maintenance.

The relevant certificates are checked by means of regular inspections over the entire service life of a ship. In addition, there must, of course, be continuous monitoring of all operations on the high seas. In response to the enormous pressure of global competition, the reliability of all onboard systems is gaining in importance. Against this background, it’s easy to see why intelligent automation solutions are indispensable aboard modern ships.
In response to the huge requirements, ship owners, builders and chandlers demand new solutions which open new cost saving potential, increase their investment security, and improve economic effectiveness. Drawing on more than 125 years of experience in the Maritime Industry, Siemens offers solutions that satisfy these high requirements. Our concept combines automation, drives and electrical engineering into an integrated system supplied by a single source vendor that is perfectly tailored to the sector and rounded off with competent and comprehensive support during service life.

As a global player, we are there for our customers anywhere in the world. When it comes to servicing, we are available around the clock wherever we are needed – with the shortest response times. Our modular portfolio meets all requirements, for every type of vessel. A few specific examples are described on following pages.

Specialists on the high seas – meeting stringent requirements

Modern ships are specialists that have been built for a precisely defined area of use. This specialization will increase in future: ever new maritime concepts and thus new types of vessels are created in response to the changing needs and requirements of the market, and based on a holistic analysis of the relevant requirement profile.

Cargo ships

Cargo ships dominate in all the world’s large ports – even though the breathtaking speed of loading and unloading means they usually spend only one or two days at anchor. Container ships, for example, can load and unload 10,000 tons of cargo in less than a day. The tight schedules that have to be kept make this efficiency mandatory. Modern container ships can achieve capacities in excess of 10,000 TEU. But increased size brings increasing technical demands in its wake.
In addition, the operative procedures on board these mega-carriers are subject to constant change – not least because of ever stricter international environmental regulations.

We only can run the world trade with the tankers that carry oil, gas or chemicals using the latest technology. In LNG (liquefied natural gas) tankers and LPG (liquefied petrol gas) tankers, for example, gas is liquefied by cooling to between -50 and -170 degrees in order to reduce the volume.

Time is a crucial factor for all cargo vessels: the faster they reach their destinations, the larger the profit margin. They are measured according to their payload and have to be as cost-effective and reliable as possible for their entire service life. Safety plays a key role on board – especially on tankers where even the smallest defect can have catastrophic consequences for personnel, the environment and equipment, but also for the ship owners or operators themselves.

**Passenger ships**

The priorities for shipboard passengers are comfort and relaxation. Engine noise or vibrations would disturb their feeling of well-being. Nevertheless passenger vessels need drives that guarantee the highest speeds on transit voyages and slow cruising in scenic regions. Passengers also have high expectations of onboard service; it must be first-class, prompt and modern. They demand access to the intranet, Internet, e-mail, web-based information systems, games and video-on-demand. Naturally, ship owners do everything conceivable for their passengers with regard to safety, atmosphere, entertainment and information services. An integrated service network opens up possibilities that go well beyond those listed. The use of innovative technologies contributes to the feeling of well-being on board, and at the same time reduces overall system costs. Modern service networks smooth the way to a successful future for ship owners.

**Special vessels**

Whether you’re talking semi-submersible heavy lift carriers, large yachts, cable and pipeline laying ships, etc.: special vessels are designed to perform specialized tasks. For this reason, they usually require special arrangements of machinery. They frequently need quite high levels of electrical current – such as when they operate production plants on board. No matter what the ship’s task: Based on our modular portfolio, solutions can be implemented that are perfectly tailored to individual requirements and meet the highest demands with regard to cost-effectiveness and availability, at an outstanding price-performance ratio.
On the basis of Totally Integrated Automation (TIA), we provide products and implement solutions for the entire maritime industry – solutions that are perfectly tailored to your special requirements and that stand out for their unique level of integration. This integration not only ensures significant reductions in the interface overhead, but also guarantees the highest level of transparency across all levels. TIA thus makes a significant contribution to optimizing all onboard operations.

It goes without saying that with TIA you benefit during the entire service life from your ship – from the first planning steps, through operation, up to modernization, where the level of integration in the further development of our products and systems ensures a high degree of investment security.

Benefits for shipowners
The cost-effectiveness of a ship is the top priority for shipowners. They therefore consider not only the pure acquisition costs but the total cost of ownership. Totally Integrated Automation is the basis for the following:

- Space-saving and cost-effective automation solutions from a single source – perfectly tailored to your individual requirements
- Uniform and highly reliable automation solutions – from the bow to the stern
- Products and systems with low intrinsic weight and modest space requirements
- Efficient remote diagnostics system with which downtimes can be minimized and maintenance work properly planned
- Low training costs

Benefits for shipbuilders
Their top priority is customer satisfaction. Consequently, they make high demands on the system integrators with whom they work. At the same time, they make sure of the most favorable conditions when obtaining the individual parts for building a ship. Totally Integrated Automation is the basis for the following:

- Solutions that can be integrated easily on board
- Uniform, efficient and tailor-made automation solutions
- Minimization of the complexity of the automation system
- Creating space on board
**Totally Integrated Automation on board ship**

With Totally Integrated Automation, Siemens is the only vendor to offer a comprehensive, integrated range of products and systems for automating all onboard activity – from the engine room to the bridge. TIA can be used to implement automation solutions that are perfectly tailored to individual customer requirements. Thanks to its unique level of integration, TIA makes a significant contribution towards optimizing the reliability, efficiency and cost-effectiveness of a ship. In addition, TIA offers a high level of investment security and minimizes complexity on board.

**Totally Integrated Power – energy management from a single source**

On the basis of Totally Integrated Power (TIP), we implement integrated solutions for energy distribution – from medium voltage right up to the power outlet. Equipped with the same communication standards as Totally Integrated Automation, all resources – for automation, energy distribution, energy management and cabinet automation – can be seamlessly integrated, and comprehensive solutions for the ship can be implemented.

**SISHIP – solutions for ships**

With SISHIP, Siemens offers a wide range of comprehensive solutions for the Maritime Industry – from the planning and design phase, through implementation, right up to operation on the high seas; for cargo ships or equally for passenger liners or special vessels. SISHIP is based on Totally Integrated Automation and Totally Integrated Power and has been specially developed for ships. The decades of experience that Siemens accumulated as a leading technology partner of shipowners, shipbuilders, OEMs and consultants have been channelled into this system. Comprehensive services that cover the entire service life of a ship round off this portfolio – from planning, financing, construction and start-up, right up to maintenance and modernization concepts.
Service and support – always there for you

Siemens offers you a comprehensive service and logistics concept that is perfectly coordinated to your special requirements. Whether for main drives, power supply or automation, our services for all the products, systems and plant used on board provide you with the optimal support.

Our service and support is available in more than 100 countries worldwide. The basis for this is the interaction of experienced specialists and field-proven global service and logistics processes. The decisive benefits for your economic success are obvious:

- Safety in planning
- Perfection in implementation
- Reliability in operation
- Short delivery times
- Prompt and qualified service

Support throughout the entire life cycle

Online support
- Always the first step to the solution
  - Technical support
- Call Desk and Help Desk (telephone support with fast return of call)
- Emergency services
- System and component check
- Fault analysis

Technical consulting
- Consulting for your planning and design
- Software engineering

Field service
- Corrective maintenance
- Fault correction on-site
- Spare parts and repairs
- Spare parts planning and provision
- Dispatch handling
- Provision of instruments and tools

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Benefits for OEMs

In their competitive business, price is crucial to OEMs. In addition, they have to meet a range of specifications – from the ship-owner, the shipbuilder or the system integrator. They need products and systems that are easy to install and have the relevant certification across the whole product range.

Totally Integrated Automation is the basis for the following:
- Solutions that can be integrated easily on board
- Products and systems with maritime certification in all performance classes
- Compact and highly efficient machine solutions
- Minimization of engineering and installation costs

Benefits for system integrators

System integrators are the indispensable partners of the shipbuilder: their specialist knowledge is required when it comes to onboard electrical equipment. Totally Integrated Automation is the basis for the following:
- Solutions that can be integrated easily on board
- Products and systems that can be connected with minimal interface costs
- Innovative, compact and cost-efficient products and systems – from a single source
- Minimization of engineering, installation and start-up costs

Benefits for design offices

The business of design offices is real tailor-made work. It ranges from the creation of initial drafts right up to overseeing construction, and it requires comprehensive know-how and flexibility. Totally Integrated Automation is the basis for the following:
- Products and systems with low intrinsic weight and modest space requirements
- Integrated and harmonically coordinated range of products and systems – with minimal interface costs
- Simple documentation and innovative software for writing the certification
Integrated communications – from the engine room to the bridge: SIMATIC NET

Communication plays a key role on board. It ensures improved efficiency and safe data transfer on the ship, so it creates the prerequisites for fault-free processes. This is achieved through open, transparent communication across all levels. We provide you with the technology required for this – across all levels, from the AS-Interface, through PROFINET, right up to Industrial Ethernet; with SIMATIC® NET.

The open, vendor-independent Industrial Ethernet standard: PROFINET

Ethernet, the world-leading LAN technology today for all applications offers important functions and performance features from which you benefit on board in many ways: practically unlimited communication possibilities as well as scalable performance.

SIMATIC NET expands conventional Ethernet technology for use on the high seas – through network components that are designed for harsh environments, fault-tolerant networks with redundancy, continuous monitoring, diagnostics of network components, and fast industrial cabling on-site.

PROFINET opens up new perspectives for automation on board. The open and cross-vendor standard on the basis of Industrial Ethernet enables direct and transparent access from the engine room to the bridge. PROFINET is based here on established IT standards and supports TCP/IP without restriction.

Switches for Industrial Ethernet: SCALANCE X

The SCALANCE X product family offers a graded portfolio of industrial switches: active network components from the entry level right up to high performance – optimally coordinated and designed for harsh environments. They can be used to establish high-performance networks with integration, flexibility and security.

The world’s No. 1 fieldbus: PROFIBUS

PROFIBUS, the world’s leading fieldbus is used primarily at the machine level and offers connection methods to the lower sensor and actuator level as well as to the higher level of the bridge. A standardized diagnostics mechanism makes it possible to detect and correct faults on the connected devices quickly – ideal for preventive maintenance. PROFIBUS PA has been developed especially for automation in environments subject to explosion hazard. Our range of communication products for PROFIBUS encompasses the network interfaces and the communication software that you require for establishing your network architecture. In shipbuilding, the redundant installation option of the PROFIBUS connection offers an extremely high level of availability.
Distributed automation for every application: SIMATIC ET 200

Increasing demands to save costs, reduce cabling and minimize risks make distributed solutions more and more important in modern automation. Perfect for all applications: SIMATIC ET 200. Our comprehensive range of distributed I/O systems with communication capabilities via PROFIBUS and PROFINET provides solutions with or without a control cabinet directly at the machine and for applications in hazardous areas.

Due to the modularity of SIMATIC ET 200, the systems can be perfectly configured or expanded step-by-step. Ready-to-use, integrated add-on modules reduce costs and offer a wide range of different application possibilities. Further advantages: uniform engineering, transparent diagnostics options as well as optimal interfacing to SINAMICS drives and HMI units.

Communication for sensors and actuators: AS-Interface

Sensors and actuators play an important role in automated processes. Whether it’s a question of detecting the valve position or the correct level: sensors are the core of instrumentation and control.

AS-Interface offers you a bus system with which you can connect all the automation nodes in the field to the higher-level controller – simply, safely and cost-effectively.

Systematic cabling: FastConnect

Install your network in record time – and reliably. With FastConnect, you assemble your data cable quickly and safely direct on-site, using rugged cables for every application, electrically or with fiber optic cable if it has to be absolutely interference-free and isolated.
Power generation and distribution – case in point: a container ship

The diesel engine or the gas turbine is a popular prime mover of a ship, and it is linked either directly or indirectly with synchronous generators. The current generated here supplies all loads on board. It flows from the main control cabinet to the large loads and to the ancillary and auxiliary control cabinets. Siemens offers a comprehensive and ship-shape portfolio for power generation and distribution – including the transformers that supply the different systems with medium and low voltage.

Seaworthy in all respects: Generators

The generators from Siemens cover all energy requirements on board – including the main drives. Brushless synchronous generators are used in low voltage or medium voltage. Thanks to their ruggedness, these can withstand even thermal overload. In standard versions, their performance spectrum ranges from 125 kW to 7 MW at pole numbers between 4 and 10. It goes without saying that we also implement customized designs – for ratings of 20 MW and more. Thanks to optimized windings and housing elements, brine-resistant offshore paint finish, and special vibration-proof and tilt-proof bearings, our generators are seaworthy in all respects.

Low-voltage switchboard and busbar trunking systems: SIVACON systems

Heavy seas and engine vibration ensure a constant load on the power distribution systems – a challenge that our SIVACON 8PT switchboard and SIVACON 8PS busbar trunking systems with communication capability meet without any problems. The system’s switching and protection functions are handled by the communication-enabled SENTRON circuit breakers that are connected to the engine control room (ECR) or directly to the vessel operation system (VOS) via PROFIBUS DP.

Motor protection and control device: SIMOCODE-DP

SIMOCODE-DP is our intelligent motor protection and control device. It is integrated directly into the SIVACON drawer units, and available either in a fixed-mounted or removable design. This clearly assigns the load feeder and associated SIMOCODE-DP. Drawer units can be replaced without interrupting the PROFIBUS connection.

On board ship, SIMOCODE-DP 3UFS is used in the low-voltage switchboard – as an intelligent connection between the motor feeder and the higher-level control
system. The system offers all the important control, diagnostics and communication functions for all aspects of the motor control center (MCC) and allows local control of motors. It communicates with the ship’s automation systems and enables remote transmission of diagnostics, statistical and operating data.

SIMOCODE-DP masters different control functions like direct starters, reversing starters and star delta starters and it can implement user-specific controls.

First choice for optimal voltage: SIRIUS transformers

Our single-phase and three-phase transformer series from the SIRIUS family combine all the properties of safety isolating transformers, isolating transformers, control-power transformers and mains transformers and are suitable for all applications. All system adaptation, compensator or converter transformers in accordance with DIN VDE 0532-6 and the relevant maritime classifications can be used with freely selectable input and output voltages. They comply with the highest safety guidelines, withstand ambient temperatures to 55 °C and are characterized by high short-circuit power, fuseless design and integral safety standard in accordance with EN 61558.

ALPHA distribution boards and terminal blocks

ALPHA 8HP molded plastic distribution boards are the first choice for enclosures in the low-voltage range. The molded plastic distribution system is used for accommodating different built-in units and has proved its worth in a host of applications. Our ALPHA FIX terminals are available in screw-type, spring-loaded, combination, plug-in and insulation displacement versions.

BETA low-voltage circuit protection

Whether for protection, switching, measuring or monitoring: with BETA, we offer you a wide and perfectly coordinated range of low-voltage circuit protection. As a technological leader in residual current protective devices, Siemens has the most comprehensive safety program.

Two of our innovations in this area: SIGRES, which is capable of withstanding even harsh sea air; and SIQUENCE, which can detect residual current in DC-loaded systems. Our miniature circuit-breakers range 5SY with marine approvals are characterized by safe and fast connection of the infeed cable by shifting the busbar back. Other benefits include identical terminals on both sides for optional infeed from above or below as well as standardized, freely mountable additional components such as auxiliary current switches.
Automation and monitoring systems – case in point: a cruise liner

Passengers on board cruise ships are less concerned with getting from A to B. For them, the sea voyage is an event in itself, with its onboard comfort and luxury – and, of course, safety. Essential prerequisites for this are modern automation systems that are characterized by the highest levels of efficiency and reliability, and an alarm and monitoring system (AMS) that provides the bridge and the ECR with all the important information at any time – at the press of a button. Whether as an integrated solution or a stand-alone system: the AMS makes a decisive contribution to the ship’s safety in all cases.

Vessel operation system for all onboard tasks: SIMATIC PCS 7

SIMATIC® PCS 7 is based on standardized hardware and software components. Through the use of standard interfaces with long-term stability, it is flexible, expandable and open for future innovations and further developments. The innovative system, whose openness encompasses all levels, uses the most up-to-date, powerful technologies throughout in conjunction with internationally recognized standards – and offers fully integrated function blocks for motors, valves and control equipment. It helps to minimize life-cycle costs while reducing engineering overhead. The access to all the relevant shipboard process data enables to respond quickly and highly flexibly to changed requirements. It is optimized for the integration of distributed field devices and uses PROFIBUS technology. It supports redundant and fail-safe architectures as well as online expansions, and it can be used in standard environments as well as in Ex areas.
Overview and control: Asset management standard diagnostics functions

The operator can exchange information about the diagnostics status of individual onboard areas between the overview screen and the diagnostics screens of each of the lower-level hardware layers simply and with complete clarity. If a fault is indicated in the overview screen, the officer can quickly access the diagnostics picture block of the affected component by means of “loop-in alarm.” Additional detailed information can be called up for assets described by Electronic Device Description (EDD) in accordance with IEC 61804-2. This is automatically read out of the component in the background by SIMATIC Process Diagnostics Management (PDM).

Modular and flexible: SIMATIC WinCC (SCADA) centralized control station

SIMATIC WinCC, our Windows Control Center under Microsoft Windows 2000 and XP, is the industry standard and market leader in Europe. The innovative and future-proof visualization software for all applications at the machine level offers comprehensive functionality, simple configuring, exemplary scalability and almost limitless openness and expandability. Remote operation and monitoring via the Internet also reduce maintenance costs significantly.

HMI software for all applications: SIMATIC WinCC flexible

SIMATIC WinCC flexible is our innovative HMI software for all applications at the machine level. It allows integrated configuring of all SIMATIC HMI operator panels – for significantly lower engineering and life-cycle costs.

Reliable and powerful controllers: SIMATIC S7

SIMATIC S7 controllers, number one among all controllers worldwide, handle a wide range of centralized functions such as network communication, precise and unique diagnostics functions and much more. They can be installed and operated under different environmental conditions (IP65 + temperature), and guarantee a long product service life. SIMATIC S7 complies with the following standards: DIN, EN, IEC, UL certification, CSA certification, Class FM1 Sec. 2; Group A, B, C, D, temperature group T4 (< 135 °C) and marine classifications.

• SIMATIC S7-300: modular and versatile for high-performance processes
• SIMATIC S7-400: high performance for system solutions in large plants
High-availability automation systems

With SIMATIC S7-400H (high-availability) redundant systems can be established – for highest availability. We offer two designs: single-channel with only one CPU, or fault-tolerant with a redundant CPU. Both comply with safety requirements to SIL in accordance with IEC 61508. And both perform standard functions and safety functions in the same system.

Ultracompact, rugged and maintenance-free products

With our Embedded Automation products, such as SIMATIC Microbox 420-RTX and SIMATIC Panel PC 477-HMI/RTX, we offer extremely compact DIN-rail embedded PCs. For machine-level use they are flexibly expandable and designed for continuous operations – even under extreme conditions. They are also almost maintenance-free thanks to their fan-free and disk-free operation.

For use in harsh environments:
SIMATIC Operator Panels

All SIMATIC Operator Panels are suitable for all processes on the high seas. They are extremely vibration-resistant, can be dimmed via the operating system if required, and have a secure data memory (flash). They can be operated without fans, have degree of protection IP65 on the front, and offer a high level of electromagnetic compatibility.

In addition, they can be scaled in price and performance and are open for connection to SIMATIC S7 as well as all controllers from leading vendors. All the necessary interfaces are already "on board": PROFIBUS DP, MPI or PROFINET.
Cargo handling – case in point: a chemical tanker

With cargo handling, risks must be reduced to an absolute minimum – through continuous and fully-automated monitoring of the cargo, especially during loading and unloading. The monitoring, open-loop control and closed-loop control of all processes must be integrated into the control system.

Process instrumentation

Siemens offers a comprehensive portfolio of high-precision measuring devices for the entire cargo handling system: user-friendly, compact and modular – devices in accordance with ISO 9001:2000 that are easy to install and can be integrated into the network.

Level

SITRANS LR measures levels at different temperatures and pressures and ensures highly precise results under all circumstances – even when measuring gas. Our innovative radar sensor supplies precise results even in service tanks and settling tanks despite the countless chemical components and the sticky vapors from heavy oil. The same applies for our ultrasound devices. The compact SITRANS LU probe uses innovative, noncontact ultrasound technology – ideal for high concentrations of solids and different densities in tanks for wastewater and brackish water. It is corrosion-resistant and can be easily installed thanks to its threaded connection. Ideal for limit measurement in space-restricted plants: the Pointek CLS 100, a compact, capacitive 2-core switch with wear-free and maintenance-free inverse frequency shift technology.

Pressure

With our SITRANS P family of pressure measuring devices, we cover practically all application areas on board – even in drinking water tanks. They can be flange-mounted to the tank and are equipped on the front with a membrane for fault-free, hygienic measuring results. The rugged membrane can be cleaned chemically and mechanically. SITRANS P monitors pressure round the clock because the integrated diagnostics system guarantees low-maintenance and user-friendly operation under constant use. Our hydraulic, submersible SITRANS P DSIII monitors the pressure inside the cable precisely and reliably. They are suitable for use in different materials – with a pressure of up to 16 bar (1600 kPA). The mature design of the measuring cell in the sensor is impervious to overpressure.

Drives and motors for all applications

Whether for use in areas subject to gas explosion or dust explosion, our range of marine low-voltage and high-voltage motors for on-deck use covers all explosion protection types – Ex e, Ex d, Ex n, Ex p, from just a few watts to the megawatt range. Certification in accordance with guidelines like ATEX is a matter of course.
Significant savings potential: Frequency converters

Use of a frequency converter pays off, particularly in pumps or compressors: power requirements drop by up to 50% compared to hydraulic systems and the pumping and proportioning process can be controlled more precisely and faster than with mechanical actuators. In addition, the smooth and stepless ramp-up and power down are easy on the mechanical components and the piping system. Pressure waves no longer occur. Our innovative and integrated SINAMICS family of frequency converters as well as the MICROMASTER, SIMATIC ET 200S FC and ROBICON PERFECT HARMONY converters, optimally cover the drive tasks in cargo handling. With strengthened cabinet construction and mechanically enhanced power electronics, they have been specially designed for onboard use.

The new drive family: SINAMICS

Ideal for low-voltage applications is the SINAMICS G150 – designed for converters with higher output ratings that do not require regenerative feedback. Like all SINAMICS units, it offers highest reliability. Configuring and engineering, commissioning, and the human-machine interfacing concept are standardized and simple. The same applies for SINAMICS GM150 in the medium-voltage range. All members of the SINAMICS drive family are based on one and the same core technology and have the same look & feel. This applies for all output and voltage classes as well as for all performance levels and applications.

All models are configured, started up and regulated according to the same standard throughout. This is illustrated by the engineering tools SIZER for configuring the drives, and STARTER for starting them up. The SINAMICS cabinet models for low voltage and medium voltage are equipped with an operator panel of the AOP 30 series characterized by self-explanatory menus. SINAMICS S120, ideal in restricted spaces, covers the output range between 0.12 kW and 4 MW in parallel connection and encompasses high-performance single drives as well as coordinated drives (multi-axis applications) with vector or servo functionality. It is characterized by its modularity, scalability with regard to number of axes, computing power, closed-loop control methods, and functionality. It offers unique flexibility when it comes to the connectable motors and sensor systems, and from the cooling methods and communication interfaces.
Main propulsion drives and monitoring systems – case in point: a platform supply vessel

Supply vessels are equipped with powerful machinery to defy the often adverse weather conditions. For improved maneuverability in port and at the drilling / production rig, they have several thrusters for holding their position in dynamic positioning (DP) mode. Siemens covers all the requirements of supply vessels with its range of motors. Naturally, our drive systems possess all the relevant certification for maritime use. They offer maximum performance within minimum dimensions and combine the greatest possible reliability with absolute seaworthiness.

Drives for all applications

Electrical main drive systems are highly cost-effective, environmentally friendly and reliable. Thanks to their excellent controllability, they are ideally suited to dynamic positioning (DP). Other benefits: lower vibration, noise levels, space requirements and energy requirements, since the drive power of Azimuth thrusters, for example, can be handled flexibly by variable-speed drives. Whether alternating, direct current or high-power special-purpose machines, we cover the entire range of drives. Our systems set standards in failure safety and compact dimensions. Both the system as a whole and the individual drive components are energy-efficient, low-maintenance, service-friendly and quiet. In the low-voltage range, we implement ships’ drives up to 4,000 kW through parallel switching, and in the medium-voltage range up to the high two-digit megawatt range.
Drives with liquid cooling

Where space costs money, ambient temperatures of 45 °C and higher prevail, and the air is corrosive or salty, liquid-cooled converters and motors are recommended. Drawing on more than 100 years experience of motors, we offer a complete range of liquid-jacket-cooled motors for the main drive: N-compact and H-compact, rugged and reliable asynchronous squirrel-cage motors in the low- or high-voltage range; HT-direct, permanent-magnet high-performance torque motors – ideal to implement gearless drive concepts. At power ratings above several megawatts, the H-compact PLUS and H-modyn series are used. They are cooled by an air-water heat exchanger.

Safe, compact and efficient: Frequency converters

Our range of seaworthy frequency converters covers the output range from 50 kW to 25 MW – and a voltage range between 380 V and 11 kV. Their high level of failure safety greatly increases availability on board, while also reducing running costs. Liquid-cooled versions have a footprint that is up to 60 % smaller than air-cooled versions. Other benefits: hermetically sealed cabinet concepts prevent the salty sea air from penetrating the power electronics. Also, the emitted heat does not add to the already high temperatures in the engine room, but rather is dissipated into the sea. Liquid-cooled SINAMICS S120 units are used in the low-voltage area. In the medium-voltage range, ROBICON PERFECT HARMONY, whose cell-bypass function ensures highest availability, and SINAMICS GM150 are used – for applications without regenerative feedback. If this is required, SINAMICS SM150 is recommended.

Compact and ultrasafe: GEAFOL cast-resin transformers

Our GEAFOL cast-resin transformers are made exclusively of fire-resistant and self-extinguishing material. Transformer fires on board are as good as impossible. Even under the effects of electric arcing, no poisonous gases are created. They are easy to install and have a smaller footprint than comparable products. Reduced short-circuit and idle losses increase efficiency and thus reduce operating costs, the principle of foil winding ensures high a.c. voltage endurance and surge strength. A special protective coating, mechanical vibration-tolerant reinforcing, and temperature sensors in the winches complete the comprehensive marine equipment.

Process control system for small plants: SIMATIC PCS 7 Box

The compact SIMATIC PCS 7 Box combines all the components of a classic control system on an industrial PC, and has been specially developed for small process applications and plants such as those found in shipbuilding. As a member of the SIMATIC PCS 7 family, it offers full scalability, expandability as well as networking capabilities.
Auxiliary drives and motors – case in point: an LNG tanker

Whether you’re talking Azimuth thrusters, bow thrusters or pump drives: on board ship, a host of auxiliary drive systems are used – both in S1 operating mode (continuous mode) and in S2 mode (interval mode). For all these applications, Siemens offers the right products and systems that comply with all the relevant specifications.

Compact motors and converters

We offer solutions for all conventional auxiliary drives applications: from SINAMICS G110 for basic stand-alone solutions to drives networked with PROFINET or PROFIBUS with MICROMASTER, SINAMICS or SIMATIC ET 200S. SINAMICS G150 converters are extremely compact, reliable and easy to operate – just like SIMATIC ET 200S FC, integrated into the distributed I/O. Ideal for applications with intermittent regenerative operation, for example, winches: SINAMICS S120 or S150 or SIMATIC ET 200S FC, with regenerative feedback capability. Our complete range of low- and high-voltage motors offers air- and liquid-cooled versions that are especially attractive for shipbuilding because of their compact design and low heat losses through dissipation, for example, the N-compact in its water-jacket-cooled version. Liquid-cooled motors can be operated in temperatures up to 55 °C without any loss in performance. We offer type-certified motors for standard applications in the low-watt to 200 kW power range.
Soft starters for all applications on board: SIRIUS

Soft starters steplessly control the voltage supply of the three-phase motor in the ramp-up phase. The motor is adapted to the load characteristics of the production machine: mechanical equipment is accelerated gently, operating characteristics are positively influenced, and service life is extended. Our range of soft starters in different sizes covers practically all application areas.

• SIRIUS 3RW30/31: two-phase controlled for standard applications up to 55 kW
• SIRIUS 3RW40: from 75 kW up to 250 kW, for demanding tasks
• SIRIUS RW44: for difficult start-up processes; thanks to new torque control and high functionality suitable up to 710 kW at 400 V for standard connection and up to 1200 kW at 400 V for inside-delta connection.

Star delta starters for fans, pumps and compressors: SIRIUS

Star delta starters are used primarily where a reduced start-up torque is demanded. They are a combination of system, delta and star contactors as well as time relays, and they ensure that the motor is started gently and the start-up current is reduced. SIRIUS star delta starters are available up to 75 kW as ready-mounted and tested device combinations – suitable for maritime use.

Simple configuration and detailed diagnostics: SIMATIC ET 200X motor starters

Whether as electromagnetic or electronic version: the communication-enabled motor starters of the ET 200X distributed I/O system allow flexible, efficient and machine-oriented design of the distributed signal processing and control architecture.

They have integral load feeders for switching and protecting any AC load to 5.5 kW. Sensor and actuator technology can be set up together in a distributed function unit – This reduces the overhead for signal and power cabling.

AS-Interface compact starters

With the AS-Interface compact starters, we offer a completely prewired load feeder in degree of protection IP65 – designed for switching and protecting any AC loads. The following versions are available: electromagnetic (to 5.5 kW at 400/500 V AC) and electronic (to 2.2 kW).
On-deck machinery – case in point: a drilling ship

Depending on the special task area, there will be a wide variety of machinery on-deck – from anchor winches, through water drawing pumps, right up to drilling towers (drilling ships can drill down to a depth of 2,000 meters) at locations where normal drilling platforms cannot be secured. The drive systems on-deck must be impervious to spray, flooding and icing-up. For all these applications, Siemens offers the right equipment: rugged and resistant products and systems that ensure the ship will reliably fulfill its purpose on a continuous basis.
Armed against wind and weather: Loher special motors

Loher special motors are recommended for harsh conditions on-deck: they continue to run unaffected even when the deck is flooded. The ship’s winch motors have an absolutely watertight, fan-free gray cast housing with water-repellent gills. A special offshore paint finish provides additional protection against corrosion. For those areas on-deck that are not in immediate danger of flooding, we offer motors with extended ventilator hoods that prevent the ingress of spray water. Our portfolio is rounded off by motors in ice-resistant design.

Perfect for high-dynamic applications: SINAMICS frequency converters

Operation of winches and cranes requires highly-dynamic converters that can also handle 4-quadrant operation with regenerative feedback – due to the constant changing between braking and acceleration. SINAMICS meets these requirements in all regards. SINAMICS G120 and SINAMICS S150 are our solution for single drives. Coordinated drives with several motors can be operated with SINAMICS S120, as chassis units or in our modular cabinet system. All are characterized by absolute reliability, simple operation and high control accuracy and dynamic response. Thanks to the active infeed technology of SINAMICS S120 and SINAMICS S150, used for the regulated infeed and feedback, the devices can handle 4-Q operation with regenerative feedback without restriction. Against the background of frequent braking cycles, this brings significant energy savings.

An integrated clean power filter minimizes total harmonic distortion (THD). Further benefits include imperviousness to system voltage fluctuations, and the possibility of reactive power compensation via the freely selectable power factor. Whether single drive with SINAMICS G150 or S150, or coordinated drive with SINAMICS S120: converters for winch drives are always equipped with application-specific control software. Speed and torque are thus determined as needed via the control system. The holding brakes and the ratio of braking torque to speed can also be controlled in this way. High-speed communication interfaces connect the winch drive system direct with the local operator interface, the higher-level automation system and the emergency monitoring system.

Ruggedized and refined: SIPLUS S7-300/400 and HMI

SIPLUS stands for devices that maintain the functional ability of a plant or process even under the most extreme conditions. Based on the SIMATIC S7-300/400 and HMI industrial automation system, we offer you hardened SIPLUS versions for an expandable ambient temperature range (S7: –25 to + 60 °C, HMI: –10 to +50 °C) and exceptional medial load (conformal coating).
Modern ferries carry up to 1,800 passengers and 1,000 automobiles – and they frequently reach top speeds in excess of 30 knots. They are characterized by their astonishing maneuverability, allowing them to get in and out of tight corners in port. Comfort and safety on board are, of course, top priorities. The heating, ventilation and air-conditioning (HVAC) systems play a special role in this context.

Demands on modern HVAC systems are formidable. A solution is only optimal if it guarantees low operating costs. In other words: the demand is for high efficiency and reliability over the entire service life. And the HVAC system must, of course, fit in with the ship’s design and ensure the highest levels of comfort – ideally unnoticed by passengers and crew.

On the basis of our products and systems, tailor-made HVAC systems can be implemented that meet all these requirements in full, including the relevant marine certifications.

**Drives for all HVAC requirements**

The drive engineering in HVAC systems circulates liquid or gaseous heating and cooling media and generates cold. The vacuum pumps and compressors used here have huge potential for savings. For this reason, variable-speed drives pay off in all cases.

The motors, geared motors and frequency converters we use for this already have marine certification. Without exception, they are compact, low-maintenance and reliable – properties that pay dividends at sea. The combination of our asynchronous low-voltage or geared motors from just a few watts to several hundred kilowatts, and our easy-to-operate converters of the SINAMICS G110, G120, G150, MICROMASTER and SIMATIC ET 200S FC series form a harmonically matched system.

Loher shaft ventilator motors are a special solution for ventilation systems. We supply these with the relevant certification for use on board. They are installed in the ventilator so they don’t themselves require a fan or fan hood. The cable runs radially out of the motor allowing installation direct in the ventilating pipe.
The customer’s requirements

The technology on board a supply vessel has to work smoothly, because any failure could pose a serious danger. Requirements on board platform supply vessels are constantly on the rise: ever more mature and ambitious solutions are requested that simultaneously contribute towards reducing costs on board – over the ship’s entire service life. The owners of the Chloe Candies have contracted a Siemens Solution Partner as system integrator to implement the entire onboard automation system – on the basis of Siemens products and systems.

The Siemens solution

The system integrator decided on two water-cooled drive trains with a power rating of 1,600 kW for the ship’s propulsion. Also used are two tunnel bow thrusters driven by two water-jacket-cooled motors with a rating of 745 kW. These ensure the maneuverability of the DPII-classified ship. The SENTRON based main and auxiliary switchgear panels communicate with the higher-level vessel management system (VMS) via PROFIBUS. For reasons of failsafety and availability, the controllers of the VMS have a redundant design, as does the PROFIBUS network. HMI operator panels on board ensure that the crew can respond immediately to every unforeseeable situation.

Customer benefits

The Siemens solution has paid off in every way for the ship’s owner who benefits from the fact that the entire electrical equipment on board – controllers, electrical motors, frequency converters, gears, switches, etc – are from a single vendor. The owner can standardize hardware components for use in future projects. In addition, the Siemens’ global service network ensures fast and smooth product support – regardless of the ship’s location. The intelligently integrated automation solutions, matured in every way, make control and monitoring of the ship extremely easy, with minimum manpower. At the end of the day, this all means a significant reduction in the total cost of ownership for the Chloe Candies, throughout its entire service life from the day of its launch.
The customer’s requirements

Modern chemical tankers require cargo pumps that work fast, efficiently and fault-free because they can significantly reduce loading and unloading times, as well as energy costs. They also contribute to a significant increase in availability. In other words, they ensure high profitability throughout the entire service life of the ship. The demand is for energy-efficient pumps that can be easily integrated and monitored via the cargo monitoring system and the automation system. Redundant topologies are used to ensure the highest availability. Another benefit is that the loading and unloading speed can be optimized through individual control of each pump – to move the most varied cargo, for example, or to minimize wear and tear on the systems.

The Siemens solution

To meet high customer requirements, the renowned pump vendor backs Siemens. MASTERDRIVES and SINAMICS variable-speed drives are used. Their compact design makes them the ideal solution for cargo pumps with up to twelve units with 132 kW each, and 4 units with 75 kW each. In addition, an S7-300 controller from Siemens communicates via PROFIBUS with the frequency converters and the higher-level automation system to control and monitor the pump system. Some of the control functionality is even integrated into the frequency converter.

Customer benefits

The solution based on Siemens components makes a crucial contribution towards significantly reducing the total cost of ownership for the chemical tanker. The use of variable-speed drives guarantees that the pumps always run at the optimum speed – with minimum energy requirement. Soft starting and braking of the system also reduces mechanical wear and tear to a minimum. The matrix layout of the drive system makes it possible for each pump to be operated with a different drive, keeping the system fully functional even if a converter should fail. All this significantly boosts the ship’s profitability.
The customer’s requirements

The Norwegian shipping company ResidenSea has created a ship that sets new standards in every respect. With its 165 owner-occupied and rented “apartments”, the luxury liner The World is said to be the largest private yacht and most exclusive ship in the world – with a length of 196 meters and a width of almost 30 meters. It goes without saying that the technical equipment on board must not detract in any way from this top-of-the-range luxury. It must also enable the ship to steer a course for any conceivable destination, because The World cruises nonstop around the entire globe.

The Siemens solution

The diesel engines on board enable speeds of up to 19 knots. The propulsion gearboxes of type Navilus GCE 1160 are each arranged between the main drive motor and the propellers. To structure the driving profile very flexibly with regard to possible power ratings and speeds, the gearboxes, certified by Det Norske Veritas, have been designed with two switching stages. Each one transmits a power rating of 5,520 kW at an input speed of 750 rpm and a propeller speed of 125 rpm in first gear, or 4,500 kW at 720 rpm in second gear. The gearing has been implemented as optimized single helical gearing. All gearbox shafts have been set in hydrodynamic radial friction bearings that are not subject to any calculable service life. Axial pressure bearings, integrated into the gearbox drive shafts, take the relevant propeller thrust and transmit it via the housing to the ship’s structural foundation. The pressure bearings are designed for both thrust directions. The scope of supply includes the entire oil distribution and monitoring system as well as the controls for the multidisk clutches.

Customer benefits

The optimized gearing geometry offers highest efficiency and, in addition to low heat generation, ensures smooth engine running and low vibration. The shipowner benefits from very marginal and specific loads, and from the fact that the gearing and warehouse are designed for low maintenance requirements: the gearing is characterized by a long-life design, and the hydraulic multiple-disc clutches by minimal wear and tear. Moreover, a comprehensive monitoring and surveillance system ensures highest availability.
Customer requirements

LNG tankers transport highly-explosive liquid gas. To minimize the potential danger, especially when loading and unloading at the terminal, GMB in South Korea looked for an efficient solution for emergency shutdown. The required emergency shutdown (ESD) system had to be capable of detecting emergency situations such as fire, unstable cargo states, manual shutdown etc. as they occur and transmit the emergency signal direct to the bridge and to shore for activation of the SIS.

The Siemens solution

An air pressure control panel transmits signals from the ESD system on board to shore. It transmits the signals via the air pressure system, monitors the air pressure in the pneumatic connecting cable between ship and shore and controls the ESD system depending on the air pressure. When the ship docks at the terminal, the onboard pressurized air system is linked to the shoreside system via a pneumatic connecting cable, which is then filled with the terminal-specific air pressure. With the help of the electro-pneumatic controller, the air pressure is regulated to the pressure set point received from the loading control room. The pressure sensor monitors the air pressure in the pneumatic connection and transmits an analog signal to the IAS system. To control the ESD system, the following statuses are monitored: unstable state of the cargo vapor main cable, the individual cargo tanks or the primary isolation areas, as well as cargo tank levels, current failure, unstable hydraulic oil pressure, ESD signal from the shoreside, low pneumatic pressure between ship and shore, low control-air pressure, and system failure.

Customer benefits

The innovative air pressure control board makes operation and maintenance of the system noticeably easier, personnel also gain. Our ESD system is compatible with the pressure air systems of any terminal. The result: enormous time-saving potentials. Anywhere in the world, alignment to the relevant terminal can be carried out simply in the loading control room using the (+/-) keys. The electronic pressure regulator then automatically adapts the pneumatic pressure to this set point and it can precisely regulate the pressure of the pneumatic connecting cable independently of possible pressure losses.