Optimization of plant performance.

*Automation Solutions for the Oil & Gas Industry.*
Your partner in automation

Siemens – a name recognized all over the world. A name that stands for innovation, customer orientation and a global competitive capability. Not only for 400,000 employees and millions of customers, but also for hundreds of thousands of suppliers and partners in more than 190 countries. It also stands for a unique range of products, systems and solutions.

Siemens also embodies the timeless vision of its founder, Werner von Siemens: “Progress serving mankind”.

Without oil and gas, today’s modern world would be unthinkable. Oil and gas mean energy. Whether mobility, communication, food preparation or trade and commerce, whether for the production of petrochemical products or for pleasant room temperatures, in all cases a reliable, round-the-clock energy supply is needed.

The demands on the Oil & Gas Industry are immense, particularly in the face of the rapid, inexorable rise in the world population and constantly increasing demands on environment and efficiency. In other words, a maximum yield of high-quality, environmentally friendly and safe products which fulfill the market demands of today and tomorrow combined with a minimum need for power and human resources.
Totally Integrated Automation
Oil & Gas Industry

With Totally Integrated Automation (TIA), Siemens is the only supplier of a comprehensive, integrated range of products and systems for efficient automation of the entire production workflow. TIA enables the realization of customized automation solutions to meet all individual requirements. Thanks to the unique interoperability of TIA, companies are

Totally Integrated Power – power from a single source

On the basis of Totally Integrated Power (TIP), we implement integrated solutions for power distribution across all production units in utility and industrial buildings, from medium-voltage switchgear to the switches and outlets. Equipped with the same communication standards as Totally Integrated

SISOG – complete solutions for

With SISOG, Siemens offers for the Oil & Gas Industry such a wide variety of products and services – from the component level up to complete solutions. Our extensive technological portfolio encompasses products, services and solutions from instrumentation, analytics, process control, automation engineering, based on TIA and industry-specific IT solutions to power supply systems and electrical drives.
increased productivity in the

able to optimize their production processes, accelerate time to market and reduce life cycle costs. TIA also provides a high level of investment security while minimizing overall plant complexity. The result: a significant improvement of competitive capability.

er distribution and management

Automation, all resources – for automation, power distribution, energy management and building automation – can be integrated and universal solutions can be implemented for your industry.

the Oil & Gas Industry

Our global manufacturing, logistics and consulting capabilities provide a complete offer from a single supplier. Our commitment to innovation and process optimization enables us to drive technological development and provides the basis for our business solutions.
## Content

- Your Partner in Automation ........................................ 2
- Totally Integrated Automation ................................... 4
- Comprehensive Experience ....................................... 6
- Floating-Production, Storage and Offloading ..... 7
- Liquefied Natural Gas ............................................. 8
- Gas to Liquid .......................................................... 9
- Process Control System .......................................... 10
- SCADA System ....................................................... 12
- Process Safety ....................................................... 14
- Field Devices ........................................................ 15
- Industrial Communication ......................................... 16
- Drive Systems ......................................................... 18
- Process Instruments and Analytics ......................... 20
- Industrial Controls .................................................. 22
- References ............................................................. 23
**Improve your competitiveness with Totally Integrated Automation**

With Totally Integrated Automation (TIA), Siemens is the only supplier to offer an integrated portfolio of products and systems for the implementation of automation solutions. TIA combines Siemens technology and products with an impressive and unique level of integration into an automation system. This not only reduces the number of interfaces, but also ensures maximum data transparency across all levels – from the field, through the production level to the management level. From upstream to midstream and downstream.

You benefit with TIA throughout the life cycle of your plant – from the first planning stages, through operation to modernization. We offer you a high security of investment with the unique transparency and interoperability of our products and systems – by avoiding unnecessary discontinuities in the system.

**Totally Integrated Automation in the Oil & Gas Industry**

TIA enables the realization of perfectly tailored solutions for the efficient automation of the entire processes and system levels in the Oil & Gas Industry. With TIA, you benefit from improved productivity and increased total life-cycle value. This is because of the uniquely integrated qualities of TIA – horizontally across all type of processes and vertically from field level to Enterprise Resource Planning (ERP). TIA also meets highest safety requirements in upstream, midstream and downstream applications.
The answer to growing demands

Productivity and resource efficiency, reliability and safety are the key to economic success in the production processes of plants in the Oil & Gas Industry. Only companies that successfully manage these challenges can meet the market demands for short delivery times, assured quality and prices that are always in line with the market.

You know the keys required to achieve higher productivity in your plants: a maximum degree of automation, consistent quality – and, last but not least, the highest possible availability and safety.

Advantages for plant operation

The Siemens range of products and solutions is specifically tailored to your requirements. Top priority is placed on integration, openness and asset management – in all key areas from automation to drives right up to process instrumentation. Our solutions are based on proven industrial standards and are optimized to achieve the highest possible degree of economic efficiency throughout the entire life cycle of a plant.

Advantages for system integration

Growing pressure on the production side of the end customer leads automatically to the need in an integrated and cost-efficient solution. Totally Integrated Automation is the foundation for:

- Higher system availability and flexibility
- Improved engineering quality
- Less expense for engineering and commissioning
- Overall cost savings

Advantages for the EPC

As an EPC, you must respond to a continuously rising competitive pressure. At the same time, more is being expected of your solutions all the time. The demands that you must meet are growing increasingly complex.

Totally Integrated Automation is the foundation for:

- Lower engineering and construction costs
- Complete product portfolio from a single source for an easier integration
- Shorter time-to-start-up – from planning to commissioning
- Higher productivity, flexibility and product quality

Common configuration and programming tools, a common user interface and common data management across all areas of automation reduce engineering and life-cycle costs. A common communications and network infrastructure based on standards ensures perfect integration of the field level. The core of Totally Integrated Automation is SIMATIC – a name that stands for worldwide leading products and systems for discrete and process control.
Siemens has a proven reputation for the reliable delivering of perfect solutions for the Oil & Gas Industry – upstream, midstream and downstream. With our expertise we perform today’s offshore and onshore installations, put efficiency into the pipeline and optimize processing and refining.

In order to respond to the ever-increasing need for high-quality, environmentally friendly products, the Oil & Gas Industry must take a new approach in order to get the most from existing feedstock.

On the basis of decades of experience, Siemens is constantly pushing for progress in this area. We help your company reach its goals in the best, fastest and most profitable way possible. With our solutions, we make a significant contribution toward helping you find new and fully exploit existing potential. Our solutions are based on innovative processes, and our extensive know-how allows us to implement these processes completely.
The Floating-Production, Storage and Offloading Vessels (FPSO) market is relatively new and one of the fastest growing in the offshore Oil & Gas Industry. FPSOs enable the development of fields which would be otherwise uneconomic with a traditional fixed platform. They offer a short time to first oil in comparison with a traditional fixed platform because they are often based on the conversion of an existing vessel thereby reducing the manufacturing time for the complete vessel. However, there is an increasing shortage of hulls available on the world market and therefore more and more projects are now being based on new builds where the complete vessel including the hull is specifically designed as an FPSO.

A typical FPSO has three main parts:
- Vessel, which provides the crude oil storage, accommodation and vessel services
- Turret, which is the heart of the FPSO mooring system
- Topsides, which comprise the oil, gas and water processing facilities.

The key element of an FPSO is the so-called turret. The turret is connected to risers coming from the wells on the seabed and is equipped with “swivels” which allow the ship to rotate according to the prevailing weather conditions. These swivels allow the extraction of the oil and gas and also the injection of water and gas back into the wells to assist the extraction process. The oil, gas and water mix is then separated into its constituent parts in top side processing units. The oil is stored in tanks built into the hull before being off-loaded into tankers which transport the oil to the shore for further processing. The gas is also treated and is put to several uses including:
- Gas lift to assist the extraction process
- Powering the on-board gas turbines which are used to generate electricity and also drive certain key pieces of equipment
- Export to onshore facilities for onward transport or processing.

Siemens has extensive experience in the supply of equipment to these vessels including control and automation systems complete with emergency shutdown systems, instrumentation packages based on specialist process knowledge, for example the knowledge associated with the gas drying process where gas is washed with glycol to remove all traces of water, so that it can be used to fuel the on-board gas turbines. In addition, we are in a position to supply complete packages such as “E-Houses” or “Local Equipment Rooms” which contain the electrical power distribution equipment and automation system, compressors and gas turbines either as stand-alone systems or complete process skids, telecommunication packages, the complete control room equipment including the visualization equipment.
The Liquefied Natural Gas market (LNG) is one of the key markets in the Oil & Gas Industry. The liquefaction process requires the removal of some of the non-methane components such as water and carbon dioxide from the natural gas to prevent them forming solids when the natural gas is cooled to LNG.

This is one of the processes where Siemens applications know-how comes into its own in offering equipment to maximize the efficiency of this extraction process.

The LNG Value Chain starts with Exploration and Production. The majority of the world’s gas reserves are found in or around countries that are located a long way from the major consumers such as the US and Europe.

At first, LNG Liquefaction facilities purify gas, then gas is cooled to -160 °C at which point natural gas becomes a liquid and can be stored in cryogenic tanks prior to being transported. This reduces the storage volume of the gas by a factor of 600, which makes transportation with tankers more economical.

Siemens can offer integrated optimized solutions for the liquefaction process, such as compressors and their associated drivers (complete compression trains) or an optimized power supply system with integrated energy management system.

Once the gas has been liquefied it can be transported to the customer. This is normally carried out using ships. The gas is transported at atmospheric pressure and a temperature of -160 °C in a special containment system called a cryogenic storage vessel. There are basically three types of containment system used on the ships. These are:

- The spherical (Moss) design
- The membrane design
- The structural prismatic design.

A typical tanker transports about 125,000–138,000 cubic meters of LNG which is equivalent to approx. 75 million to 83 million cubic meters of gas and costs about 170 million euros to build. Operators and shipyards are under increasing pressure to reduce building costs, to increase capacities and also to improve efficiency, thereby reducing emissions and operating costs.

This is an area where Siemens can also provide assistance by supplying such equipment as all-electric propulsion systems which can optimize the load-carrying capacity of the tanker while also reducing emissions. Such propulsion systems are being considered for the next generation of tankers.

The final stage in the process is regasification. The LNG is off-loaded from the tanker into storage tanks. The liquid gas then passes through a controlled warming process where it is transformed back to its gaseous state.

As a major renowned supplier of control and electrical equipment as well as mechanical rotating equipment, Siemens is your ideal partner for the complete LNG value chain from beginning to end.
Gas To Liquid (GTL) is not the liquefaction of gas through compression but rather the chemical conversion of carbon-adjacent hydrogen gas, for the most part natural gas, into longer-chain hydrocarbons. These exhibit a liquid state of aggregation at normal temperatures. One product of the GTL process is Diesel fuel.

GTL products are distinguished by their purity. Because natural gas is cleaned during the GTL process, GTL products are exceptionally low in sulfur. This meets enhanced environmental efforts, in particular by Europe and the U.S., halfway. Another advantage: extremely large quantities of natural gas are still available, whereas crude oil is getting in noticeably shorter supply – made particularly obvious by the price of crude.

The GTL process can be divided into three steps:

**Synthetic gas production**

In the synthetic gas production process, natural gas, which consists primarily of methane gas, is converted into a mixture of hydrogen gas (H₂) and carbon monoxide (CO).

**Fischer-Tropsch synthesis**

The heart of the system is the Fischer-Tropsch synthesis. The synthetic gas is compressed, then run to the Fischer-Tropsch reactor, where the synthetic gas, under the influence of a catalyst, is converted into a mixture of various long-chain hydrocarbons.

**Product preparation**

In the subsequent product preparation phase, the output products of the Fischer-Tropsch reactor are subject to further processing. In the end, a variety of finished products are available, for instance kerosene, gasoline, diesel, petroleum, lubricants.

Siemens offers a product and solution portfolio for each process – including power generation equipment, compressors for the air separation and last but not least Totally Integrated Automation. This covers the PCS 7 process control system, measuring instruments, drives, fans and pumps. Fully automated water treatment plants round off the list of portfolios.
SIMATIC PCS 7: distributed control system for the Oil & Gas Industry – the core of Totally Integrated Automation

The Siemens distributed control system (DCS) – SIMATIC® PCS 7, fully integrated into TIA, uses standard hardware and software components which can easily be connected to the manufacturing execution system level (MES).

Open and proven DCS

SIMATIC® PCS 7 is based on modular SIMATIC hardware and software components. Its innovative process control system is fully harmonized with TIA. It is flexible, expandable and open for future enhancements through the use of standard interfaces with long-term stability.

SIMATIC PCS 7 consistently applies state-of-the-art, powerful technologies together with internationally established industrial standards such as IEC, XML, PROFIBUS, Ethernet, TCP/IP, OPC, ISA S88 and ISA S95, to mention just a few.

The openness of SIMATIC PCS 7 covers all levels and applies equally to automation systems, process I/O and field devices as to operator and engineering systems, industrial communication networks or the MES framework. Furthermore, the system offers completely integrated function blocks for motors, valves and control devices.
Common and integrated system
Customers benefit from Totally Integrated Automation and the SIMATIC PCS 7 process control system by minimizing development, implementation and life cycle costs, the reduction of engineering resources, the facilities for process optimization, the flexibility to adapt quickly to changes in requirements, and the advantages of using standard SIMATIC components.

Complete integration of field devices
SIMATIC PCS 7 is optimized for integration of distributed field systems into the process control system, and makes use of PROFIBUS technology. It supports redundancy and safe architectures, in addition to online expansions, and can be used in standard environments or in hazardous areas. The plant can be equipped with conventional signal inputs/outputs on the SIMATIC ET 200 distributed I/O station, or with state-of-the-art, intelligent field devices.

SIMATIC PCS 7 in the Oil & Gas Industry
Highest plant availability, safety for human, plant and environment (HSE) and lowest cost for maintenance and service are the top requirements for the Oil & Gas Industry. SIMATIC PCS 7 is completely integrated in Totally Integrated Automation and fulfils these requirements in total. SIMATIC PCS 7 is scalable for more than 100,000 I/Os, as well as a high performance archive for the process values. Therefore SIMATIC PCS 7 is applicable for biggest projects in Oil & Gas such as refineries and offshore plants.

Safety and fault-tolerant systems are fully integrated in SIMATIC PCS 7. The engineering language is the same for standard and safety applications, therefore there’s no need to learn and understand a new engineering tool. The results of this are cost and time reduction as well as the need for less maintenance and service work.

The high performance alarm system and the integrated features for alarm management ensure safe operation of the process.

PCS 7 key features at a glance
- One common engineering tool PCS 7-ES for the safety and standard process – saves engineering time
- Common visualization of all data in all PCS 7 operator stations with optimized, sophisticated and integrated alarm visualization – easy and quick monitoring
- Configuration can be controlled from all operator stations – maximum flexibility
- Complete function blocks and programs, adapted to the Oil & Gas Industry simplify the configuration
- High-speed automation systems with S7-400 controller on Ethernet
- At the fieldbus level, PROFIBUS is the fieldbus No. 1 for all applications
- Fully redundant system architecture on all levels of PCS 7 keeps the process running and reduces production down-times
- Remote I/O modules ET 200iSP for installation in the hazardous area zone 1 and 2
- Operator stations based on specially protected industrial 19" rack PC
- Web-based remote operation
- Fully integrated Safety Instrumented System for process safety.
- Integrated Asset Management for easy maintenance
- Field devices are connected to the high-performance network based on PROFIBUS DP and PA
- Intelligent level meters, pressure transmitters and gas analytic devices ensure exact measurements.
MES and IT solutions

SIMATIC IT XHQ, the Operations Intelligence software solution of SIMATIC IT, taps into the silos of information you have in your plants, ERP, and operational systems to provide a uniform, integrated, and synchronized view of manufacturing performance. Armed with up-to-the-minute views of information organized in context, around your work processes and guided by key performance indicators, frontline operational employees, analysts, executives and decision makers throughout your organization have the information and knowledge at their fingertips needed to unlock hidden operational performance improvements.

Critical manufacturing information can be quickly found and analyzed, seen in real time how performance develops against plan, and navigated via views up and down the supply chain including a drill-down into supporting details. Alerting and notification services focus employees’ attention on the most critical issues preventing problems before they occur.

Efficient SCADA system
SIMATIC WinCC and telecontrol system SINAUT ST7

Siemens automation solutions with the SCADA system SIMATIC WinCC

□ SIMATIC WinCC is scalable for every solution
  • suitable for all plant sizes
  • from a single-user up to a distributed, web-based multiuser system with redundancy.
□ The flexibility and expandability of WinCC simplifies integration in existing automation systems or tele-controlled concepts, which guarantees the future investment security.
□ SIMATIC WinCC is expandable by industry- and technology-specific options and add-ons for applications in the Oil & Gas Industry due to its open standardized interfaces. Examples of WinCC add-ons are:
  • SINAUT ST7cc – for tele-controlling with SIMATIC S7
  • Packages for maintenance and service management.
□ WinCC enables you with the latest Internet and Thin Client technology to use your system from any location and independent of the platforms:
  • In the central control room: WinCC for process visualization
  • In the control cabinet: Operation via Clients or Thin Clients with panels or panel PCs
  • Mobile wireless solution at the plant: Operation via PDA or MOBIC
  • From remote stations: Operation and service via Internet.
This means one-time configuration for multiple use.
□ Safety Integrated with PROFIsafe can be implemented by a wide range of safe and fault-tolerant S7 400FH controllers.
□ ET 200pro with high degree of protection IP65, as well as ET 200IS with intrinsically safe modules for the Ex zone 1 complete the whole package of I/O modules.
□ Instrumentation can easily be controlled in any WinCC station and connected to SIMATIC controllers by a PROFIBUS PA interface module.
**Siemens automation solution with SINAUT ST7**

In the Oil & Gas Industry, stations are often widely distributed and are located in areas that are difficult to reach. A sudden cable or wire break leads automatically to a long trip to the concerned station. SINAUT ST7 has the optimum solution for this problem.

SINAUT ST7 is an innovative and versatile system for fully automatic monitoring and control of process stations that exchange data via WAN (Wide Area Network) with a control center or with one another (cross connection). The entire range of diagnostic and programming functions for WAN communication and station automation are available over normal data lines – even across a variety of network types and in both directions.

SINAUT ST7 is based on the SIMATIC S7 automation system and provides special hardware and software component enhancements. ST7cc, the newly optimized, redundant control center system based on WinCC.
A Safety Instrumented System (SIS) is defined as a system composed of sensors, logic solvers and final elements designed for the purpose of automatically taking an industrial process to a safe state when specified conditions are violated. Siemens has been a reliable partner in process safety for more than 20 years, providing safety certified products and services for SIS applications, which fulfill needed safety standards, like IEC 61508 (to SIL3), ISA S84, EN 54, NFPA 85 and IEC 61511.

System flexibility for all process safety applications
Our process safety system is designed for Emergency and Process Shutdown systems (ESD / PSD), Burner Management systems (BMS) and Fire & Gas applications (F&G).

SIMATIC Safety Integrated is a comprehensive product range of safe, fault-tolerant and highly available products for the process industries, containing safe and fault-tolerant fieldbus technology, based on PROFIBUS DP, using the certified PROFIsafe protocol. This combines modularity, fault tolerance and distributed safety I/O in one system. Our safety system is fully flexible and can be installed separated from the basic control, as independent layer of protection, or as integrated PROFIsafe solution.

Cost savings with SIMATIC Safety Integrated
An integrated PROFIsafe solution means to transfer standard and safe data on one PROFIBUS cable and to use just 1 CPU for the safe and standard automation, as well as to mix all the I/O’s in one station. This architecture saves space in the cabinet and saves money because of reduced hardware costs.

Advantages at a glance
Independent of the architecture, end-users and system integrators benefit from working with one common engineering tool for the complete automation system, including common data storage and visualization of safe and standard diagnoses on standard panels. No additional training and no additional time is needed for configuring a safety project with the SIMATIC Safety Matrix. This Cause & Effects Matrix offers an easy configuration of the project, without learning a new engineering software.

Easy integration in SIMATIC PCS 7
SIMATIC Safety Integrated is connectable to any DCS. However, in combination with SIMATIC PCS 7, you can realize powerful, flexible solutions for integrated automation and safety applications in one automation network. This provides you with a number of benefits:

- One engineering system for process control and safety applications
- User-friendly display of process information from any operator interface of SIMATIC PCS 7
- Automatic integration of safety-related diagnostics into the operator interface with time stamp
- No separate data handling between DCS and SIS.
SIMATIC and SIPLUS extreme: the complete range of field devices

SIMATIC ET 200: decentralized field devices for all demands
SIMATIC ET 200 distributed I/O modules can all be connected to the fieldbus PROFIBUS DP. SIMATIC ET 200 offers a complete product range for any application needs – ET 200M with multi-channel design, ET 200S for bit granular I/Os and function modules, ET 200iSP for applications in hazardous areas, ET 200pro for high protection in IP65/67 and ET 200eco in a cost-effective design with IP65 protection.

Advantages
Powerful functional modules provide capabilities far beyond simple I/O, including motor starters, frequency converters, standard and safety I/O, communication interfaces, CPUs and intelligent coprocessors. All modules are designed for quick maintenance to keep operator costs to a minimum. Powerful system diagnostics offer troubleshooting information at several levels: at the I/O station level including bus communication, at the module level, and at the channel level for the sensor circuit. This means that faults are immediately detected, and can be solved easily, resulting in lower service and maintenance costs.

SIMATIC ET 200S motor starters: for simple configuration and detailed diagnostics
The communication-capable motor starters of the distributed I/O system ET 200S offer integrated safety and diagnostic functions in one device. The motor starter is a pre-wired and remotely parameterized unit consisting of a circuit breaker, an electronic overload relay and a contactor or soft starter, switching the motors up to 7.5 kW. By means of PROFIBUS the motor starter reports all diagnoses, for example short-circuit, phase asymmetry, operating current or overload, to the control system.

SIMATIC S7: comprehensive range of reliable and powerful controllers
SIMATIC S7 controllers are at the heart of Totally Integrated Automation (TIA). The systems provide powerful control, network communication and IT service functionality and other functions. This is why SIMATIC S7 has become No. 1 in the world with the highest market share.

SIMATIC S7-400: powerful, for system solutions in oil and gas plants
Large memory, high quantity of I/O and with an extremely high speed, they ensure high tech combined with economical benefits for any automation solution.

SIMATIC S7-400H: high-availability processes without process stops
Controllers that keep your process running with hardware redundancy (hot standby). Redundant I/O and PROFIBUS complete the high-availability functionality.

SIMATIC S7-400FH: safe and fault-tolerant
SIMATIC S7-400FH is part of SIMATIC Safety Integrated, and offers safety and fault-tolerant functionality in one system. On the one hand, hazardous incidents lead to a safe stop of the process, on the other hand, noncritical faults keep the high-availability process running. All components are SIL 3 certified, acc. to IEC 61508.

SIPLUS extreme: tougher than the standard
With SIPLUS extreme, we offer you an automation solution that can master the most extreme conditions: ambient temperatures from –25 °C to +70 °C, condensation, increased humidity, higher levels of mechanical stress, extraordinary load due to pollutant gas or dust contamination exposure, voltage ranges differing from the standard or increased degrees of protection. Thus SIPLUS extreme is perfect for sectors with particularly “extreme” requirements – such as the Oil & Gas Industry.
The business drivers in industrial communication are improved efficiency and safe data transfer in the plant. These demands can only be met if the process in your plant works perfectly. This can be achieved by using open, transparent communication – from the process level through MES up to the ERP level.

The SIMATIC NET industrial communication products provide the technology you need to:
- Realize true distributed automation
- Enable data transparency from the field level through to the management level
- Integrate IT technologies.

**Industrial Ethernet**

Across all applications, Ethernet is number one worldwide in today’s LAN landscape. Ethernet provides important features and performance characteristics which can provide many important benefits for your application:
- Virtually unlimited communication capabilities and scalable performance
- Company-wide communication thanks to Wide Area Network (WAN) technologies.

SIMATIC NET provides important additions to traditional Ethernet technology for use in industrial environments:
- Network components designed for use in rugged industrial environments
- High-availability networks using redundancy
- Constant monitoring and diagnostics of network components
- Fast on-site industrial cable assembly.

**SIMATIC NET communications processors:**

Connecting controllers, computers and notebooks to Industrial Ethernet
- Utilize Industrial Ethernet for programming, monitoring, peer-to-peer communication, connection to IT
- Ability to function as Web and FTP server and client for communication of production information
- OPC-server included with the communications processor.

**SCALANCE W: industrial mobile communication**

Install a plant-wide Ethernet network without running any wires
- Wireless flexibility with the reliability of a wired network
- Eliminate wireless “dead zones” with active antenna diversity – the strongest signal is constantly used
- Deterministic data transmission allows time-critical connections to be realized
- Industrial WLAN adheres to the specifications defined in IEEE 802.11 and Wi-Fi 802.11 in order to enable a high degree of interoperability
- Security wizard enables Wi-Fi Protected Access (WPA) with encryption for maximum security
- Designed for industrial applications with enhanced resistance to vibration, shock, and environment (IP65, temperatures from –20°C to +60°C) with options for redundant power supply.
SCALANCE X: switches for Industrial Ethernet

This product family provides a graduated portfolio of industrial switches, some of which feature comprehensive diagnostic functions via PROFINET, SNMP and the Web, for a variety of requirements (e.g. network structure, data rate, degree of protection, number of ports). These network components are optimally tuned to one another. They have been designed for a rough industrial environment and facilitate consistent, flexible and safe structuring of high-performance networks.

PROFIBUS: the world’s leading fieldbus

PROFIBUS network technology provides rich benefits for almost any application in industrial automation. Devices such as remote I/O, drives, controllers, identification systems, motor starters, weighing & dosing systems, human machine interfaces, etc. are connected via a single cable.

PROFIBUS is primarily used at the field level with interfacing capabilities downward to the sensor/actuator level as well as upwards to the production and enterprise levels.

PROFIBUS PA was explicitly specified for process automation. It meets the demands of the Pulp & Paper Industry for:

- Use in areas where both power and communication are available over the bus
- Plug & Play instruments.

Siemens communications product range supporting PROFIBUS includes the network interfaces and communication software you need to implement your system architecture.

SIMATIC NET communications processors: connecting controllers to PROFIBUS

- Utilize PROFIBUS for connecting distributed devices, peer-to-peer communication, and programming
- Independent communications coprocessor ensures consistent scanning of distributed devices regardless of controller scan
- Multiple communication processors can be used to segment distributed devices
- Support for redundant I/Os in conjunction with redundant controller
- OPC-server included with the communications processor.
The Oil & Gas Industry faces great challenges: hazardous areas, stricter environmental regulations, greater demands on reliability, redundancy and increased maintenance intervals.

**These requirements can be met with our products, systems, concepts and solutions.**

For all oil and gas applications in upstream, midstream or downstream processes we have the right solution to meet our customers requirements. With our drives from 0.12 kW up to 100 MW we cover the complete power range within the oil & gas business. Engineering and commissioning: the SINAMICS drive family uses only one software tool. This means people from the engineering department and service all use the same language, leading to cost savings in terms of training and familiarity.

Our drives are part of Totally Integrated Automation. That means communication via PROFIBUS and/or Ethernet from one basic platform.

Over the last 30 years, oil and gas companies have increasingly turned to electric AC variable-speed drive systems to replace mechanical drive systems such as gas turbines, while high-speed drives have been used with considerable success for centrifugal pumps and compressors.

Steady progress in microprocessors and power electronics has allowed power ratings and speeds to continuously increase, so that today we can offer speed-controlled electric motor drives suitable for almost every mechanical rotating load.

We offer proven systems for all known compression loads up to 100 MW. The first completely electrical driven LNG plant of its type anywhere in the world, where variable speed drive systems drive the cooling medium compressors as part of a gas liquefaction plant close to the Norwegian city of Hammerfest, were supplied by Siemens. The drive system consists of an H-modyn synchronous motor with a power of 32 MW and two motors each with an output of 65 MW. For compressors an electrical drive is superior to the gas turbine driven compressor solution with regard to technical, operational and financial aspects. In so far as electrical power is available, an e-drive can replace in many cases a traditional mechanical drive such as a gas turbine. Turbines are only available in standard sizes – a fact which must be taken into account when designing and dimensioning the compressors and thereby the complete facility – because electrical variable speed drives can be easily adapted to the compressor load requirements. The compressors can be designed without constraints to optimize the performance of the facility. Not only this, but drives such as these have a higher availability and are more reliable.
The key success factors for electrical drives are:

- Much lower thermal and mechanical stresses (maximum operating temperatures of 130 °C and rotor circumferential speeds of 200 m/sec)
- No measurable wear and fatigue over lifetime
- Insensitive to frequent start & load cycles
- Only very few and generous clearances
- 3...5 years uninterrupted operation
- Bearings are the only items requiring attention
- Failure modes do not mean unscheduled shutdowns or severe damages and unbalances
- Condition monitoring allows prediction of incipient problems and avoidance of shutdowns
- Variable-speed motors “ride through” power line disturbances and do not contribute to fault levels.

Our customers benefit from lower capital costs and operating expenses for the rotating train, low maintenance and spare parts requirements, and high availability of the drive system.

Drive power is available instantly, is not affected by ambient conditions and fuel quality, and is delivered with an efficiency greater than 95% over a typical speed range.

In a very few words: electric motors are very robust, simple, and maintenance-free rotating machines which are insensitive to the environment and to load cycles.
Instrumentation

Intelligent level sensing for gas dehydration with capacitive level meters SITRANS LC 500

Liquid phases in natural gas commonly are a source of problems in your oil and gas facilities. Changing pressure or temperature may cause water and heavy hydrocarbons to condense, resulting in corrosion, hydrate crystals or ice blockages. Or mercury can react with alloy components in downstream equipment components to form amalgams. To prevent such problems, gas drying facilities are used to eliminate all liquid phases and all components which might condense during delivery or consumption.

Gas dehydration

Before gas can be liquefied, it must be treated to remove any water, oil or components (like CO₂, Hg and others) which can damage equipment and interfere with the liquefaction process.

A dehydration unit uses glycol to dry the wet gas when it is withdrawn from the cavern or porous layer storages. The concentrated glycol in an absorption column removes water from the gas. The glycol is regenerated in the subsequent process steps.

Siemens develops and implements cost-effective, modularly expandable solutions for the entire dehydration process, including for EX areas. Basic components of these solutions are the intelligent level sensors SITRANS LC 500. Intelligence means here that a special and patented Active Shield technology is used to increase the accuracy and reliability.

SITRANS P with gold membrane now finds special application in the petrochemical industry

For use in the petrochemical industry, the Siemens SITRANS P transmitter has received a “heart of gold”. Already 80% of all substances in the industry can be measured with the high-grade steel membrane of the SITRANS P. For “critical media” however, the Siemens transmitter is equipped with special materials such as Hastelloy C276, Monel, tantalum and even gold.

To hydrogen, a standard high-grade steel membrane seems like a piece of Swiss cheese. This gas is therefore able to diffuse through the membrane into the filling oil of the transmitter. When the pressure is relieved, for example on shutting down the process, the hydrogen is released from the oil like the carbon dioxide from a bottle of mineral water. This is bound to result in the loss of measurement characteristics and may in some cases destroy the transmitter.

In order to prevent this physical effect, the membrane has been coated with gold in a special production process. Gold has a denser material structure and, assisted by additional steps in the coating process, it prevents diffusion of the hydrogen.
Analytics

At line gas analysis with MicroSAM

One of the most common technologies for analyzing gas compositions is the technology of gas chromatography. Typical process gas chromatographs like the Siemens Maxum II are versatile tools to analyze gas mixtures in multiple streams in automatic and unattended mode. Process analyzers today are typically installed in controlled environments in centralized locations around the plant. Sample lines carry the gases to the analyzer shelters.

In case of fast process changes, a centralized multi-stream and multi-component analyzer may not be the optimum solution from a speed and cost standpoint.

State of the art micro system technology allows the reduction of the size of a chromatograph to the size of a football. These kind of analyzers can be positioned at or very close to the sampling points. Infrastructure is significantly reduced, which enables a much more favorable cost/benefit ratio. It also reduces sample lag time to a few seconds and minimizes the necessary extractive sample flow to just about 20–40 ml/min instead of the presently more common 2–5 l/min.

With its compact 14” x 9” dimensions, the new Single Analyzer Module (SAM) is the smallest process gas chromatograph from Siemens. It uses proven analytical techniques, such as capillary columns, valveless column switching systems and semi valveless injection techniques. The new explosion-proof device was developed to facilitate miniaturization while simultaneously increasing power and versatility. With extremely low power consumption of a maximum of 50 VA at 24 V DC, explosion protection for zone 1 and permissible ambient temperatures of -20 °C to +50 °C you can install MicroSAM directly at the sample extraction point. Just a sun and rain cover is needed. Cost of ownership is addressed in a favorable way, but the limited requirements of maintenance and the ease of exchangeability satisfy online process demands.

Applications using MicroSAM

The rugged natural gas specialist

MicroSAM CV has been specially developed for the natural gas market for determination of the calorific value. Further applications in the field of natural gas quality measurements include the individual determination of higher hydrocarbons (HC) up to C12 as well determination of the HC dew point.

Off-shore applications

Furthermore, its unique design makes MicroSAM suitable for even the most harsh applications, e.g. for off-shore exploration as mud logging or even for direct assembly on the pipeline.

Hydrogen analytics

Hydrogen management is of increasing importance in the refinery with the market launch of low sulfur fuels. Hydrogen is used for removing sulfur components from the process flow and to achieve “clean” fuel. The hydrogen quality and its availability in a refinery influence significantly the calorific value of the fuel, thus the output and the profitability of the refinery. Conventional hydrogen analyzers all have a certain sensitivity for hydrocarbons as well. Presence of hydrocarbons – which is strongly the case in a refinery – leads to inexact measurements with conventional analyzers. MicroSAM helps the refinery maintain its profitability by providing exact on-line measurements of hydrogen in the critical parts of the plant, e.g. in the recycle flows or around the purifiers.
More often the data of the motor feeders is also integrated into the process control system. Intelligent motor management systems, communication-capable motor starters and circuit breakers support this trend and make all relevant data available to the control system via PROFIBUS. This increases the transparency of your process and ensures a significantly greater density of information in the control system – at no extra cost. Standardized motor function blocks, for example, simplify the integration and the engineering.

**SIMOCODE pro: the flexible and modular motor management system**

SIRIUS motor management and control devices (SIMOCODE pro) are the first choice for constant speed motors in the low voltage range. SIMOCODE pro optimizes the connection between control system and motor feeder, increases the plant availability and, at the same time, achieves considerable savings in the construction, commissioning, operation and maintenance of your plant.

It also involves an extremely compact design, a straightforward and efficient service and maintenance as well as a range of graduated functions. In addition, SIMOCODE pro meets all requirements for future-proof energy management and offers advantages in all areas: in process management, operations management or in switchboards.

Some extensive features:

- Multifunctional, electronic full motor protection, independent of the automation system
- Flexible software instead of hardware for the motor control
- Detailed operating, service and diagnostics data
- Open communication via PROFIBUS DP
- Integration and monitoring of additional process values
- Detection and monitoring of power-related measurements
- ATEX-certified (overload protection of explosion-protected motors).

**SIVACON systems:**

**for customized communication solutions**

SIVACON systems are low-voltage communication-capable switchboards and busbar trunking systems with a high degree of flexibility and availability. All of these features enable a seamless integration into the automation environment.

Using switchgear and switching devices we offer a common integrated communication concept for customized solutions: e.g. with SENTRON circuit breakers, SIMOCODE motor management system and SIMATIC.

So SIMOCODE pro is likely to be used in SIVACON low-voltage Master Control Centers (MCC) and allows load feeders to be configured. Load feeders that have a higher performance and at the same time are extremely compact and able to communicate.

The high degree of modularity allows all communication components to be simply retrofitted. Innovative software products offer user-friendly parameterization, diagnostics, operator control and visualization locally via PROFIBUS DP or Ethernet/Internet.
South African liquids network modernized with process control solution

Pipeline network history
Petronet was founded in 1965 as a division of Transnet Limited. The company transports a wide variety of refined products as well as crude oil to the inland refineries.

With its length of about 3,000 km and diameters ranging from 6 to 20 inches, the Petronet high-pressure pipeline network connects all of South Africa’s important economic centers.

The network transports about 94.3 million bbl (15 billion liters) of liquids per year. It consists of 34 main transfer stations and many smaller intake and delivery stations.

Three large supply stations deliver the various products to the pipeline network. Interconnecting pipelines between the two main refined product pipelines allow for maximum flexibility in transportation.

Customer requirements
Project objectives included automating 34 pump stations and constructing a master control center in Durban.

To automate the pump stations, field instruments, actuators and programmable logic controllers (PLCs) were installed. In addition to central dispatching from the master control center, each pump station was equipped with a self-sufficient local control system, from which the station can be operated independently.

Fiscal metering is required in the transfer stations, to be processed in the local control system and then transmitted to the master control center in Durban.

To ensure smooth operation with the highest possible safety, the master control center in Durban conducts not only batch tracking but also centralized leak detecting and locating.

Siemens solution and customer benefits
The modernization resulted in a 40 percent improvement in transport and distribution by a pipeline which covers 80 percent of South African demand, thereby significantly improving the customer profits. Technician travel costs have declined because the Siemens Win CC SCADA system with SINAUT for Telecontrol was commissioned. This simplifies servicing, support and maintenance. The uniform hardware and software used in the master control center and pump stations simplifies servicing and the supply of spare parts.

Installation of the master control center in Durban for Bi-directional Crude-Oil and Multi-Product distribution along a 1,864-mile (3,000-km) pipeline network with control and monitoring functionality for all stations allows for supervision and control from one central station, reducing travel and phone costs as well as overtime. Personnel organization is also simplified.

Another benefit of the new system is that operators need to be trained on one system only, regardless of whether they work in the center or in the stations.

The integration of advanced pipeline applications into the Win CC SCADA system like batch tracking, leak detection and location, hydraulic trainer and simulation, also during slack line conditions, guarantee safe operation. Other safety-improving features are the distribution of reverse flow scenarios, redundancy of the Win CC SCADA system, dynamic line coloring in Win CC SCADA displays according to pipeline content and automation of pump stations with fault-tolerant PLCs for pump surge protection.
Demands for virtually sulfur-free fuels with low emission values as well as rising prices for light crude make the processing of heavier crude an economic necessity. Reason enough for Shell to completely modernize its refinery in Heide.

**Customer requirements**

In order to process crude oils, Shell, in addition to numerous other innovations, decided on a state-of-the-art hydrocracker which converts vacuum distillate into high-quality products. The core of the modernization must be a new and highly efficient process control system. This system is supposed to guarantee stable, disturbance-free operation, the maximum yield of high-quality products and economical production by keeping the essential cost factors like power, personnel and maintenance need as low as possible.

**Siemens solutions and customer benefits**

SIMATIC PCS 7 was preferred as process control system because of being a truly future-oriented system with integrated safety technology, redundant system architecture and PROFINET fieldbus technology. PCS 7 also stands for continuity, modular design, good scalability, on-line modification and a very high degree of user-friendliness. Thanks to PCS 7’s central engineering concept, all components, all the way down to the field level, can be configured, diagnosed and serviced in a very user-friendly way. SIMATIC PCS 7 turns the process in an optimum run mode and optimizes the overall energy consumption, as well as helps the plant operator to run the entire process very efficiently. Furthermore, the ease of use and the process visualization of PCS 7 support the employees in the control room. Thanks to its openness, PCS 7 could be easily linked to the information systems on the production and corporate levels by standardized interfaces. An OPC server is used as link to the Advanced Process Control (APC) and the IRIS refinery information system. The entire system, from the OS over the automation system and plant bus, has a redundant configuration.

One of the central highlights of the project is the use of the integrated safety technology with SIMATIC S7-400FH from Siemens. These controllers replace the existing safety hardware with the new PROFIsafe solution, based on safety software engineering. Furthermore, the new safety concept allows the installation of standard and fail-safe I/O modules in one and the same automation system and not separated any more like in the past. Additional safety systems, including complex interfaces, are not needed any more.

The complete offering encompassed besides SIMATIC PCS 7 and SIMATIC S7-400FH – PROFIsafe, also the engineering program, the Factory Acceptance Test, the installation and commissioning.

Since the plant was commissioned, the process control system has been working on time, and is fully accepted by the on-site crew. Since its conversion, the refinery in Heide is regarded as one of the most modern in Europe. Every year, approx. four million tons of crude oil are processed into fuels such as gasoline, diesel, kerosine, and a wide variety of other products at the plant in Heide. As many as 15 types of crude oil are used.

* German Technical Inspectorate
**SENTRON: power distribution**

With only a few modular components, you have the possibility of thousands of different combinations for all of your energy distribution applications. The products in the SENTRON circuit protection system tie into your automation architecture giving you the power to increase production system availability. In addition, you can further optimize the energy distribution process with a networked power management solution. Never before have circuit breakers been so versatile and so simple.

**SENTRON: optimized energy solutions**

SENTRON circuit breakers address your critical needs for less installation space, reduced operating costs, and optimized energy usage for 3VL from 16A up to 1600 A and for 3VL from 630 A up to 6300 A. Web Server – Breaker Data Adapter (BDA) is the first circuit-breaker communication device with an integrated web server to set, operate and monitor SENTRON circuit breakers. Circuit breaker data can be accessed from any device supporting an Internet browser with Java Virtual Machine. The BDA Plus incorporates an Ethernet interface for direct connection to Ethernet/Intranet/Internet. Switch ES Power, a configuration software, offers complete integration into the automation engineering environment.

The parameterization, operation and monitoring of the SENTRON circuit breakers can be done via the PROFIBUS DP network. SENTRON circuit breakers are completely integrated into the SIMATIC world and the STEP 7 engineering software. Data management, configuration and programming is integrated into the automation project SIMARIS manager – Power Management Software to manage energy distribution systems. This modular and integrated power management software is based on SENTRON circuit protection devices and Totally Integrated Automation. This not only facilitates efficient diagnosis, alarm and maintenance of SENTRON circuit protection devices as part of a Totally Integrated Power solution but also optimizes laboratory, investment, and energy supply costs through continuous analysis of energy data.
Further information:
www.siemens.com/oil-gas