Optimizing efficiency and profitability.
Automation solutions for the Mining Industry.

totally integrated

automation

SIEMENS
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.”

The world’s hunger for raw materials has increased dramatically. The result: New players have entered the field. The responsibility of supplying the global economy with raw materials reliably, just in time, 24/7 is felt by every professional in the field. All the time. On the other hand the intense pressure of global competition has forced the Mining Industry to exploit every potential for increasing productivity. In today’s environment, it’s not enough to simply optimize one area of operations. Making the best cut, reducing downtime, getting the materials to ship faster, turning them into quality products – all these steps of the flow have something in common – they’re highly demanding. Always. To ensure the smooth and economical operation of your plants you need seamlessly integrated systems in place that offer optimized control and handling of the complete materials flow from the rockface to beneficiation and shipping.

www.siemens.com/totally-integrated-automation
Totally Integrated Automation Mining Industry

With Totally Integrated Automation (TIA), Siemens is the only supplier of a comprehensive, integrated range of products and systems for efficient automation in all applications of the plant – from excavation to beneficiation, for the bulk transport and auxiliary processes like mine-dewatering, process water, laboratory, infrastructure, from the field level and control level to the ERP level. TIA enables the realization

Totally Integrated Power – power from a single source

On the basis of Totally Integrated Power (TIP), we implement integrated solutions for power distribution, from the medium-voltage supply to the outlet. Equipped with the same communication standards as Totally Integrated Automation, all

SIMINE – complete solutions for mining and transport applications

With SIMINE, Siemens offers a range of comprehensive solutions for mining, beneficiation and transport applications. Based on Totally Integrated Automation and Totally Integrated Power, SIMINE has been specifically developed for the Mining Industry, using decades of experience as a leading technological partner to mining companies, OEMs and consultants. Our portfolio covers technological functions, instrumentation,
– increased productivity in the

of customized automation solutions to meet all individual requirements. Thanks to the unique interoperability of TIA, companies are able to optimize their production, to increase throughput and reduce life cycle costs. TIA also provides a high level of investment security while minimizing overall plant complexity. The result: plants, which work reliably and produce the right quality.

for distribution and management

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

for the Mining Industry

monitoring and SIMATIC IT technology; complete plant solutions for mining, materials handling, ore preparation and beneficiation plants; automation, telecontrol and drive systems based on TIA, as well as lifecycle services from design, financing, construction and commissioning to maintenance and modernization.
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Improve your competitiveness with Totally Integrated Automation

With Totally Integrated Automation (TIA), Siemens is the only supplier to offer an integrated portfolio of products, systems and solutions 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 process level to the management level. From coal to ore, from excavation to beneficiation, Totally Integrated Automation is the foundation.

You benefit with TIA throughout the total life cycle of your plant – from the initial planning stages, through operation, to modernization. We offer you a high security in your investment with the unique development continuity of our products and systems.

Totally Integrated Automation in the Mining Industry

On the basis of Totally Integrated Automation, we implement solutions that are perfectly tailored to your special requirements in the Mining Industry and which are characterized by their excellent integration. TIA makes an essential contribution to the optimization of the mining processes.
The answer to growing demands

In the Mining Industry, high-availability of the process, transparency of material properties and automation processes and cost reduction are most important. The answer for plant operation, system integration and machine building is Totally Integrated Automation.

Advantages for operation
For you as an operator, cost efficiency and the guaranteed supply of coal or the reliable beneficiation of ores are highly prioritized. Totally Integrated Automation is the foundation for:

- Automation solutions tailored perfectly to your specific requirements
- Optimized process operation
- Long-term investment security with market-leading technology
- Reduced expenditure on the construction and maintenance of plants.

Advantages for system integration
Solutions are required, with which you can process your customers’ orders more quickly, precisely and economically – from the design to commissioning.

Totally Integrated Automation is the foundation for:

- Shorter process from the planning to the delivery
- Higher system availability and flexibility
- Improved engineering quality
- Less expenses for configuration and commissioning
- Cost savings in the whole process.

Advantages for plant and machinery construction
As a machinery constructor, you must respond to a continually growing pressure of competition. At the same time, more is expected of your solutions all the time. The demands that you must meet are increasingly complex.

Totally Integrated Automation is the foundation for:

- Higher product quality of the machine
- Complete product portfolio from a single source for easier integration
- Shorter time-to-start-up – from planning to commissioning
- Higher productivity, flexibility and product quality
- Lower engineering and construction costs.
Essentially, there are two typical processes in the Mining Industry: On the one hand, coal or ore can be mined in an open-pit mining process; on the other hand, deep deposits are accessed by underground mining. In both areas, Siemens has decades of extensive experience worldwide – from automation and plant construction to service.

**Open-pit mining**

Two-thirds of the world’s yearly mineral production is extracted by open-pit mining. This process is suitable for deposits that lie near the surface.

In continuous mining operations large-scale bucket-wheel or bucket-chain excavators are used to mine coal, sand and other soft materials. The excavators are connected to conveyor belts which transport the materials directly to the place of further processing or storage.

For digging hard rock or ore bodies, the so-called discontinuous mining method is used. It generally requires drilling and blasting before the materials can be taken off the earth by using shovels and trucks.

**Underground mining**

In case the deposit is deep or steeply inclined, access is typically made through a vertical shaft. A shaft requires hoisting equipment to raise the ore and rock to the surface, pumping equipment to dispose of any water present, and structural support for the rock and the mechanical equipment operating in the shaft. Ventilation is necessary to provide workers with fresh and cool air.

In the room and pillar system, pillars of the material must be left in a chessboard pattern in order to support the overburden. Discontinuous mining using safety-approved explosives is applied. The ore is transported to central loading points with dozers and electrically propelled shuttle cars.

In the so-called longwall mining system which is used in soft materials like coal a machine with steel teeth is raked along the seam so that the broken coal drops onto a conveyor belt. As the machine moves forward, steel supports are advanced to support the roof directly over the working face. The roof behind the coal face is allowed to collapse.

**Further processing**

Whether mining is done as surface or underground mining, the coal or ore which was recovered from the deposit must be further processed. The first step is the crushing of material to the size required. The raw product is then screened and

- Is shipped to the consumer directly (e.g. coal) or
- Undergoes a beneficiation process to increase the ore concentration by removal of foreign materials such as rock and sand.

Further process steps may not necessarily take place at or close to the mining site. In the case of iron ore, mining companies frequently operate pellet or sinter plants at harbor areas before shipping the material to the customers.
SIMATIC PCS 7: distributed control system for the Mining Industry – 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. This 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 595, 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 SIMATIC IT 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 Mining Industry**

Highest availability, safety for humans, plant and environment and lowest cost for maintenance and service are top requirements in the Mining Industry. SIMATIC PCS 7 is part of Totally Integrated Automation and fulfills these requirements in total. SIMATIC PCS 7 is scalable for more than 100,000 I/Os, as well as a high performance archive for process values. Therefore SIMATIC PCS 7 is applicable for even the biggest projects in Mining.

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 provide a safe operation of the process.

**PCS 7 key features at a glance for the Mining Industry:**

- 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 of flexibility
- Operator stations based on specially protected industrial 19” rack PC
- Web-based remote operation
- Integrated Asset Management for easy maintenance
- 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 downtimes
- 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
- Remote I/O modules ET 200iSP for installation in the hazardous area zone 1 and 2
- Integration of motors and variable speed drives
- One common engineering tool PCS 7-ES for the safety and standard process – saves engineering time
- Fully integrated Safety Instrumented System
- Complete function blocks and programs simplify the configuration.
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 distributed tele-controlled architectures, which guarantees the future investment security
- SIMATIC WinCC is expandable with industry- and technology-specific options and add-ons due to its open standardized interfaces, e.g. SINAUT ST7cc – for tele-controlling with SIMATIC S7

- 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

- Safety Integrated with PROFIsafe can be implemented by a wide range of S7-300F and S7-400F controllers as well as ET 200S and ET 200M remote I/Os. High availability by redundant S7-400H controllers
- ET 200pro with high degree of protection IP65, as well as ET 200ISFP 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 Tele-Control with SINAUT ST7

Mine sites are often widely distributed and are located in areas that are difficult to reach. A sudden malfunction leads automatically to a long trip to the associated installation. 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 in both directions and over redundant lines of communication.

SINAUT ST7 is based on the SIMATIC S7 automation system and provides special hardware and software component enhancements. ST7cc, the optimized, redundant control center system, is based on WinCC.

SIMATIC panels: comprehensive range for harsh industrial environments

All SIMATIC operator panels are suitable for all processes in harsh industrial environments – extremely vibration-resistant, and with safe data storage (cflash). They can be operated without a fan, with IP65 degree of protection on the front and high electromagnetic compatibility. Open connections to any controllers and all needed interfaces, such as PROFIBUS DP, MPI, Ethernet for multipanels are on board.
As an integral part of Totally Integrated Automation, SIMATIC IT enables optimal coordination and harmonization of business and production processes – horizontally and vertically. SIMATIC IT is the key to complete Manufacturing Execution Systems, and is compliant with the leading ISA-95 standard that represents the blueprint for further development of the MES portfolio.

As production and manufacturing processes become more complex, the significance of manufacturing execution systems (MES) is growing. Being much more than just a link between business and process levels, it also requires the ability to deal with the key businesses of the company. Siemens has developed SIMATIC IT on the basis of the ISA-95 standard. SIMATIC IT functionality is scalable according to the functional needs and specific situation of the user.

**MES – Manufacturing Execution System SIMATIC IT**

SIMATIC IT links mine operations with the business systems and increases internal visibility. Due to its modular, object-oriented, open and scalable architecture, SIMATIC IT enables customers to standardize repeatable processes at a high level while increasing flexibility at the operational level. SIMATIC IT Production Suite includes MES functionality for order management, material management, personnel management, report management and messaging and provides the graphical environment to model the production process.

**Plant performance analysis and KPI management**

SIMATIC IT Historian is a pool of software modules to collect, store and quickly retrieve process and production information for quality assurance, reporting, certifications, statistical analysis, performance monitoring, operational equipment efficiency, downtime management.

**LIMS – Laboratory Information Management Systems**

SIMATIC IT Unilab is a Laboratory Information Management System that models and manages the complete workflow of all quality data in the laboratory and on the production line, optimizing the collection, analysis, retrieval and reporting of quality data. SIMATIC IT Unilab is able to manage all types of analysis spanning multiple sites, and can be configured to the specific needs of each laboratory. SIMATIC IT Unilab enables organizations to improve throughput and obtain world-class quality.

Fast and easy access to the appropriate data is essential to support the decision-making process. SIMATIC IT Unilab enables the efficient and accurate communication of laboratory data, making it easier to share information with internal as well as external customers.
SIMATIC S7: comprehensive range of reliable and powerful controllers

SIMATIC S7 controllers provide powerful control, network communication, IT service functionality among other functions. That is why SIMATIC S7 controllers have become the PLC product with the highest global market share. SIMATIC S7 controllers can be installed and operated in different environmental conditions, such as dry tropical, low temperature, humid tropical etc. As part of Totally Integrated Automation, a long product life is insured. SIMATIC S7 controllers meet 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 classification certifications.

SIMATIC S7-400: powerful for system solutions in large-scale installations

Large memory, high quantity of I/Os 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/Os 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.

SIMATIC S7-300: modular and versatile for high-performance processes

A controller that increases productivity by reducing runtime cycles by 25–33%. Easy to use with an enhanced memory, the complete STEP® 7 package with comprehensive engineering tools, like SCL, simplifies operation, maintenance and documentation. Cost reduction is the major benefit. Reduced cabinet space requirements save money due to the smaller CPUs (reduced from 80 mm to 40 mm). High flexibility using the micro memory card, enabling quick maintenance. Program updates are easy to perform and a battery is no longer required.

SIMATIC S7-300F: fail-safe, managing standard and fail-safe automation in one system

Like the S7-400FH, the fail-safe S7-300F PLC is part of SIMATIC Safety Integrated. Therefore, Safety can be programmed with standard languages, like STEP 7 FBD or Ladder. Fail-safe data transfer using PROFIsafe runs on the standard PROFIBUS cable and just 1 CPU is able to perform both standard and fail-safe automation. This saves additional hard- and software costs. No special know-how is required to use S7-300F controllers. Furthermore, all components are SIL 3 certified, acc. to IEC 61508.

SIMATIC S7-200: simple and cost-effective

The micro controller SIMATIC S7-200 is both compact and highly powerful – especially in relation to its real-time response. It is fast, features great communications options and comes with easy-to-operate software and hardware. In addition SIMATIC S7-200 has a consistently modular design – suitable for customized solutions.
**SIMATIC TDC: technology and drives control system**

With SIMATIC TDC Siemens offers a multi-processor automation system that is used in particular for large plants in drive and process engineering. SIMATIC TDC solves complex drive, control and communication tasks with the largest quantity frameworks and the shortest cycle times on a single platform and thus represents an ideal supplement to SIMATIC S7. It is the technology and drive automation system integrated into the SIMATIC, with which the configuration and programming is performed using SIMATIC tools – and thus part of Totally Integrated Automation. SIMATIC TDC can be used, for example, for the closed-loop control of drives (torque, rpm, position, angle/angular difference, speed), in particular if several drives are to be coordinated or complex relationships exist between drives

- for regulating several/different physical variables (e.g. tension, pressure)
- for calculating process/plant variables (e.g. temperature);
  SIMATIC TDC facilitates short compute cycles (e.g. set points < 1 ms), has functional reserves and offers outstanding flexibility.

A typical application for SIMATIC TDC in mining is in drive systems for ore mills.

**SIMATIC FM 458: for complex and highly dynamic motion control**

Together with the software function blocks for motion control, the FM 458-1 DP provides all required mechatronic functions. It executes complex controller, motion control and technological tasks in the SIMATIC S7-400. In particular, complex and high-dynamic motion controls can be produced simply and conveniently. Other technological tasks are possible in addition, e.g. counting/measuring, positioning, loop control or cam control. Possible fields of application include:

- Speed-synchronous and position-synchronous operation of linear and rotary axes
- Synchronization with other axes
- Winder and hydraulic controls. Equidistant sampling intervals of 100 μs or greater provide sufficient time for dynamic control tasks, e.g. to increase the precision or the machine cycle rate.

**Advantages**

- High processing speed and computing performance, high positioning accuracy, high number of axes
- Complex control technology with extremely high cycle rates
- Highly dynamic motion control for mechatronic requirements
- More than 300 preprogrammed software function blocks.

The FM 458-1 DP is mostly used in mining to manage complex control tasks in conveyor belts and excavators.
SIMATIC ET 200: decentralized field devices for all demands

SIMATIC ET 200 distributed I/O modules can all be connected to PROFIBUS DP, some like ET 200S can be connected to PROFINET. They are used to connect various field devices in the industrial control system, such as drives, switches, sensors, push buttons, indicator lamps or valve positioners.

SIMATIC ET 200 offers a complete product range for any application needs – ET 200M with multichannel design, ET 200S for bit granular I/Os and function modules, ET 200I SP 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/Os, including
- Motor starters
- Frequency converters
- Standard and safety I/Os
- Communication interfaces
- CPUs and intelligent coprocessors.

Modules are designed for quick maintenance to keep operator costs to a minimum.

Powerful system diagnostics offer troubleshooting information at several levels depending on the modules used:
- At the I/O station level including bus communication
- At the module level
- 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 remote-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. "High-Feature" motor starters are deployed wherever failures of systems cause high downtime costs.

SIMATIC ET 200S frequency converter: completely integrated with distributed I/Os

With the ET 200S FC a completely integrated frequency converter (up to 4 kW) is available for the distributed I/O system in a standard and fail-safe version. The converter controls the speed of asynchronous motors steplessly, solves drive tasks ranging from simple frequency control through to stringent vector control.
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 communication 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 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 Mining Industry for:

- Use in explosive areas
- Use in areas where both power and communication are available over the bus
- Plug & Play instruments even in potentially explosive areas
- Use of the FISCO model so that intrinsically safe networks can be created and extended without time-consuming calculations.

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

SIMATIC NET communication 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 controllers
- OPC server included with the communications processor.

AS-Interface: communication for sensors and actuators

Sensors and actuators play an important role in automated processes. Whether it concerns the registration of valve states or the right level: sensors are the heart of the process control. AS-Interface provides you with a bus system that implements the connection of all automation nodes in the field to the higher-level controller – simply, securely and cost-effectively.
Process instruments and analytics: accurate and reliable measuring, positioning, recording and regulating

**Pressure**

SITRANS P DSIII: digital pressure transmitter
Digital pressure transmitter for mounting with remote seal on open or closed vessels, for differential or absolute pressure measurement of corrosive or noncorrosive liquids. Ideally suited for flotation cell applications.

SIPART PS2: electro pneumatic valve positioner
The number 1 electro pneumatic positioner in its field by a long margin. Offers easy integration, on-board diagnostic functions and minimum loss of process air by only using air when required. Enables operators to get cost-effective and accurate control over typical applications such as flotation cell filling.

**Temperature**

SITRANS T: temperature transmitter
The SITRANS TF range of field transmitters enables temperature measurement in even the most rugged industrial environments. It converts signals from resistance sensors, resistance-type sensors, thermocouples and voltage sensors into direct current signals, and allows for the electronics to be isolated – avoiding possible sources of vibration.

**Flow**

Transmag 2 with FM911/E sensor: magnetic-inductive flowmeter
Thanks to its pulsed alternating field system, the Transmag 2 is capable of measuring where conventional DC field technology is not – the stronger magnetic field delivers greater reliability and precision, perfect for measuring heavy mining slurries. When coupled with our patented Novolak liner, the Transmag 2 can even handle the most abrasive of media.

SITRANS FC: coriolis mass flowmeter
Siemens also offers a complete line of highly accurate, coriolis mass flowmeters, which thanks to their accuracy deliver precise information about fluids or gas passing through a pipe – ideal for dosing and blending applications.

**Level**

SITRANS LR200: 2-wire radar level measurement
The SITRANS LR200 is a 2-wire pulse radar level measurement device ideal for the measurement of liquids and slurries in process vessels or in hazardous process conditions. The LR200 deals well with high temperatures, and is ideal for monitoring fuel levels.

SITRANS LR400: high-performance radar level measurement
Benefit from the experience of a million applications when utilizing the Siemens LR400. A long range FMCW radar level measurement device, the LR400 is ideal for more difficult solids and liquid level measurement situations – such as applications with high dust levels or low dielectric liquids. This makes the LR400 great for use in applications such as coal silos.

SITRANS LU: ultrasonic level monitoring
Dependent upon the model chosen, SITRANS LU offers up to 10 ultrasonic measuring points and is therefore a cost-effective level measurement device. Coupled with appropriate transducers, the SITRANS LU is great for covering multiple flotation cells with one device.
SITRANS Probe LU: 2-wire compact ultrasonic level management
A 2-wire loop-powered ultrasonic (LU) transmitter for non-contact level/volume monitoring of liquids and solids, great for use on flotation cells and other basic level measurement applications.

SITRANS CLS 300: high-performance level switch
Capacitance level switch for detecting interfaces, solids, liquids, slurries and viscous materials in the demanding conditions of low/high pressure, high temperatures and corrosive and abrasive materials. In its digital version, it’s well-suited for applications where very accurate switching is required.

Weighing
Siemens MSI belt scale with BW500 integrator
The Siemens MSI is a heavy duty, high-accuracy single idler belt scale, ideal for mining applications such as the tracking of daily production and grinding mill feed rates. The Siemens BW500 integrator offers the optimal link into the process, and provides information about rate, totalized weight, PID, belt loading, speed, and batching.

SIWAREX
The SIWAREX weighing systems can easily be integrated into the automation structure of the process, and the SIMATIC PCS 7 process control system. In addition to electronic weighing systems and cells, you can select from an extensive range of Siemens Milltronics belt scales, weigh feeders and solids flowmeters.

Analysis
LDS 6: in-situ laser spectrometer
High-performance, in-situ process gas analysis with a unique design concept. One LDS 6 unit offers laser spectrometry at up to three measuring points, delivering extremely high levels of accuracy and speed. The unit delivers great results even in high-temperature and dusty environments – making the LDS 6 perfect for applications such as smelting and coal storage.

ULTRAMAT/OXYMAT series 6: continuous gas analyzer
The ULTRAMAT/OXYMAT series 6 analyzer is a practical combination of the ULTRAMAT and OXYMAT 6 analyzers in a single enclosure. The ULTRAMAT channel is able to measure CO, CO₂, NO, SO₂, NH₃, as well as CH₄ and other hydrocarbons. The OXYMAT channel is able to measure oxygen in gases. The unit features cleanable sample cells and corrosion-resistant materials in the gas path (option) making measurement of highly corrosive sample gases possible.
To an increasing extent, the data of the motor feeders is also integrated into the 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 PROFINET. This increases the transparency of your process and ensures a significantly greater density of information in the control system – at no extra cost. On the basis of Totally Integrated Automation all data is integrated uniformly and consistently. 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 a 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 futureproof 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 PROFINET 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 switchboard solutions**

SIVACON – Siemens low-voltage switchboards are communication-capable, flexible, have a high degree of availability and are able to be seamlessly integrated into the automation environment.

SIVACON switchboards and busbar trunking systems are fully integrated into the communication architecture of Totally Integrated Automation. Using switchgear and switching devices we offer a universal, integrated communication concept for customized solutions: e.g. with SENTRON circuit breakers and SIVACON busbar trunking systems integrated in SIVACON switchboards or with SIMOCODE motor management system and SIMATIC – the world’s leading PLC in SIVACON switchboards.

Now, using the new SIMOCODE pro with SIVACON, up to 40 communications-capable motor feeders can be integrated in a control cubicle.

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

The high degree of modularity allows all of the communication components to be simply retrofitted. Innovative software products offer user-friendly parameterization, diagnostics, operator control and visualization locally via PROFINET DP or Ethernet/Internet.
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 from 16 A up to 1600 A or from 630 A up to 6300 A, connectable to the PROFIBUS DP. The Breaker Data Adapter (BDA) is the first circuit breaker communication device with an integrated web server to parameterize, 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 handled over 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 are 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 products (i.e. controllers, network components, etc.). 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.
In mining, drive systems operate under the harshest conditions such as dust, vibrations, extreme temperature fluctuations and humidity. Drive systems used must therefore be rugged and reliable. Furthermore, for many applications, high dynamic performance and overload capability are demanded.

Siemens drive systems ensure maximum safety and availability even under extreme conditions. With these matched drive systems comprising motors of all voltages up to 30 MW and performance classes, Siemens covers all drive tasks in mining with converters of the SINAMICS and SIMOVERT families – from belt conveyor systems through breakers, bucket wheels and vertical mills, right up to mine winders.

**SINAMICS: the new family of drives**

As part of the new drive family, all of the drive systems have the same technological platform and the same "look & feel". This applies for all power and voltage classes as well as performance levels and applications. All of the versions are engineered, commissioned and controlled in the same standard and straightforward way. Two examples are the Sizer and Starter software tools which are used to engineer and commission any Siemens drive. SINAMICS versions with high power ratings for low and high voltage are equipped with the AOP 30 operator panel. This operator panel includes self-explanatory texts in the menu prompting.

**Drive systems with SINAMICS SM150: the main drives for mine winders and conveyor belts with downhill sections**

- The medium-voltage drive systems with SINAMICS SM150 cover the power range from 5,000 to 30,000 kVA
- Suitable for demanding drive tasks with regenerative feedback into the line supply
- Typical application fields:
  - Mine winder skips where the motor is integrated directly into the winding drum
  - Powerful conveyor belts that feed braking power back into the system in downhill transport sections
- The closed-loop transvector control with optimized pulse patterns ensures maximum dynamic response, minimum torque ripple, high overload capability, ruggedness with respect to critical operating situations and low noise
- The extended closed-loop transvector control with ROTOS (Reduced Optimized Task-Oriented Switching) is a technical highlight of our SINAMICS SM150. This control technique with a high dynamic response using optimized pulse patterns ensures sinusoidal currents and the best voltage utilization but at the same time low switching frequencies. The result: high efficiency and low motor stressing in operation
- SINAMICS SM150 is equipped as standard with Active Infeed for regenerative feedback into the line supply. This means that this drive unit is ideal for exchanging power between drive locations that are regenerating and motoring. Furthermore, the Active Infeed can supply capacitive reactive power to compensate other drive converters.
The medium-voltage drive systems with SINAMICS SM150 cover the power range from 5,000 to 30,000 kVA.

Ruggedness and reliability are key features of the SINAMICS GM150 converter – even under extreme conditions. This is the result of reliable power components, protective measures against ambient effects such as dust, humidity and aggressive atmospheres, control modules that are insensitive to voltage fluctuations and redundant fans or pumps for the cooling system.

Typical application fields:
- Long conveyor belt systems in open-cast mines where the variable-speed operation offloads the conveyor belt system. Variable-speed systems help improve belt wear-off and save up to 20% energy.
- Breakers, mills and pumps, e.g. for reprocessing plants. In the case of pumps, the variable-speed system makes energy savings of up to 50% possible.

In addition to simple engineering, commissioning and operation as part of the SINAMICS concept, it can also be simply integrated into overall plants, is available in all voltage classes, and has a space-saving design. Air- or water-cooled versions are also available – and the possibility of establishing the power connections at the top or bottom of the drive unit.

SINAMICS GM150 is, in addition a maintenance-intelligent product: The components automatically output a signal when maintenance is required. This means that components can be replaced or other service and maintenance work carried out at the optimum time – for example during routine inspections.

The drive systems with SIMOVERT D direct converter cover the power range from 3,000 to 30,000 kVA.

SIMOVERT D direct converters are simple, low-cost and rugged converters for slow-running applications with the highest torques and high dynamic response.

Typical application fields are primarily large vertical mills working with gearless ring motors. The gearless concept guarantees high availability making problems like gear damage, gear losses and use of oil a thing of the past.

The drive systems with SINAMICS S150/S120 cover the power range from 75 to 1,200 kW. If combined as cabinet modules overall power ratings of up to 4.5 MW can be achieved.

SINAMICS S150 cabinet units and SINAMICS S120 chassis units are designed for demanding, high-performance drive tasks in low-voltage applications. They can, as standard, regenerate into the line supply. This means it is especially suited for applications where the drives regenerate.

The fast closed-loop vector control of the SINAMICS S150 and S120 draw sinusoidal currents on the line supply – and as a result of the “Clean Power Filter”, low-frequency harmonics can almost be neglected. The drive converter is insensitive to line voltage fluctuations, which means that the drive system has an extremely high degree of availability. For SINAMICS S150/S120, the power factor can be freely selected.

Typical application areas are shovel wheel drives, scooping gear, slewing gear, hoisting gear, traveling trippers, and conveyor belts.
Drive systems with SINAMICS G150/G130: the universal drive for continuous applications such as breakers, mills, pumps and blowers

- The low-voltage drive systems with SINAMICS G150/G130 cover the power range from 75 to 1,500 kW.
- SINAMICS G150/G130 stand out for their reliability and long service life as well as ease of operation. SINAMICS G150/G130 occupy up to 70 percent less space than conventional converters – and they are especially quiet. Even cabinet units with power ratings of several 100 kW only have noise values of 69 db(A) – even when operating at full load.
- Thanks to their high energy-saving potential – especially for pumps and fans – these drive units often have payback times of just several months.
- Application areas in mining are primarily pumps, suction equipment, mills, breakers, coal cutters and pit ventilators with power ratings up to 1,500 kW.

Drive systems with SIMOREG: modernizing existing DC drives quickly and simply

- DC drives are still used in some areas of mining such as hoisting gear, running gear or shovel wheel drives.
- With the SIMOREG control modules from Siemens, existing DC drives can be digitized while the motor, mechanical components and the power section are retained.
- The installed technology then has at its disposal the full functional range of a modern drive system and can be seamlessly integrated into recent automation systems.

Motors: the base of a high plant availability

With its standard and special motors, Siemens has the optimum products for all mining applications. The low-voltage and high-voltage motors from Siemens set standards when it comes to the dimensions and weight for a particular power rating. This saves space and makes it easier to integrate the motors into the plant or system. Furthermore, these motors distinguish themselves as a result of the low noise level, vibration and operating costs. Finally, Siemens motors are characterized by the highest achievable availability. The Micalastic insulation system ensures excellent corona shielding, is insensitive to environmental and ambient effects and stands for the absolute highest endurance. All of these features are complemented by monitoring devices – included as standard – for the bearings and windings.

The power ratings range from low-voltage motors for auxiliary drives with just a few kW up to H-modyn high-voltage motors with power ratings in the two-digit Megawatt range for large crushers and mills. Special-purpose motors in mining are especially found in ore mills and mine hoists. Gearless ring motors with power ratings up to 30 MW are used for ore mills; some of these have clearly proven their reliability in the Chilean Andes at altitudes exceeding 3,000 m. The gearless concept is a reason for the high degree of availability of this drive solution. This means that gearbox damage, losses, maintenance and oil usage are a thing of the past. The special motors for mine hoists are completely integrated in the cable drum.
Mining trucks: more volume in a shorter time

Mining trucks with special drive solutions from Siemens transport more volume faster and more safely through the mine. When compared to conventional technology, these trucks increase the productivity and at the same time reduce power and operating costs.

Presently, the Siemens truck drives solution is the most powerful in the market. The diesel-electric drive concept for the mining trucks is based on two three-phase motors with power ratings up to 4,000 kW, a generator and the associated drive converter and control technology.

<table>
<thead>
<tr>
<th>drive system</th>
<th>SINAMICS GM150</th>
<th>SINAMICS SM150</th>
<th>SINAMICS G150/G130</th>
<th>SINAMICS S150/S120</th>
<th>SIMOVERT D</th>
<th>SIMOREG</th>
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<tbody>
<tr>
<td>Power range</td>
<td>500 - 25,000</td>
<td>5,000 - 25,000</td>
<td>75 - 1,500</td>
<td>75 - 1,200 (4,500)</td>
<td>3,000 - 25,000</td>
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<td>IGBT / IGCT</td>
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<td>Cyclo</td>
<td>DC</td>
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<td>Medium voltage</td>
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<td>Regenerative feedback</td>
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<td>Conveyor belts</td>
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<td>Conveyor belts with downhill transport sections</td>
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<td>Mining trucks</td>
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<td>Mine winders</td>
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<td>Breakers</td>
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<td>Mills</td>
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<td>Pit ventilators</td>
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<td>Bucket-wheel excavator</td>
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<td>Slewling gear</td>
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<td>Hoisting gear</td>
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<td>Traveling trippers</td>
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Technical characteristics:

- IGBT / IGCT
- IGBT
- Cyclo
- DC
- Special applications
Best practice examples

Los Pelambres copper mine, Chile

Los Pelambres, located 200 km north of Santiago and 45 km east of Salamanca in the Choapa province, was discovered by one of Chilean copper’s founding fathers, William Braden, in the 1920s. Today, it is the world’s fifth-largest copper mine. Equipped with Siemens technology, the world’s most advanced downhill conveyor transports copper ore from the Los Pelambres mine 3,200 m above sea level to the mine’s concentrator situated at 1,900 m. The conveyor is designed to move a maximum of 8,700 t/h bulk material and transports the copper ore on a 1.8 m wide belt at a speed of 6 m/s.

Customer requirements

World market prices for copper, gold, and other metals fluctuate continuously. To keep on top of this situation, officials at the Los Pelambres copper mine in Chile have opted for a bulk transport system that provides maximum efficiency at minimal operating cost. Siemens supplied the innovative electrical equipment for this showcase project of the Chilean copper industry.

Siemens solution

Heart of the conveyor drives are 10 three-phase squirrel cage motors with a rated power of 2.5 MW each, fed from Siemens medium-voltage converters. An innovative closed-loop control and drive concept built on Siemens automation products ensures stress-free operation of the conveyor at all times.

GTO technology and active front end (AFE), combined with a chopper, enable conveyor segments to be kept under control. An arrangement involving the redundant configuration of control and communication systems, ensures conveyor safety in all operating modes.

Customer benefits

By using a modern drive system, the transport of the copper ore from the mine to the concentrator generates approximately 19 MW of electrical power, which is fed back into the plant power network. This reduces the production costs for copper concentrate.

In selecting the drive system, particular care has been taken to ensure low-wear operation of the mechanical components while maintaining high equipment availability.

Palabora Underground copper mine, South Africa

Customer requirements

After some 20 years of open-pit mining, it became technically and financially impossible to continue mining copper using this method. The Palabora Mining Company made a decision to go “underground”. In order to achieve this, a complete underground infrastructure has been developed which includes the mechanical removal of copper or using LHDS (load, haul, dump vehicles), ore crushing stations and conveyors to move the ore to the winder loading stations. Siemens was asked to supply the complete electrical portion of the four mine winders including drive, control and auxiliary systems.
Siemens solution
Siemens, together with external engineers, developed a complete winder automation and visualization system using the latest Siemens SIMATIC PCS 7 distributed control system. An essential part of the concept were the tried and proven Siemens cyclo-converter-driven mine winders (1x 3,400 kW and 2x 6,400 kW units) as well as a 100 kW main winder.

Customer benefits
The four mine winders operate, under normal conditions, in automatic mode without human intervention. All systems, including main winder operation, headgear ventilation, brakes and hydraulics are continuously monitored. Any abnormality is immediately reported to the central control station, from which the winders can, in an emergency, be controlled manually.

RWE Power lignite mine, Germany
Customer requirements
The objective of RWE Power was to modernize the lignite coal mining operation of the Fortuna mine near Niederlaussem to meet today’s technology standards. The purpose was to achieve a high level of automation – and to increase the annual output.

Siemens solution
The technical concept is based on Totally Integrated Automation. Technological functions run on a separate server, the HMI for those are integrated in SIMATIC PCS 7. The automation structure is as follows: ET 200 Remote IO, PROFIBUS for the field level, PCS 7 controllers, S7-400 series and Industrial Ethernet and PROFIBUS for the control level and a PCS 7 multiserver/multiclient architecture as SCADA system.

In the modern control center the plant data are accessible for operators and service people as well. The integrated user administration ensures that each user gets the right view to the plant, e.g. operational data for the dispatcher, remote access to the PLCs for service people and access to the production-related data for the management.

Customer benefits
After handover of a fully integrated control and management system for the operation of the coal dispatch and delivery system Fortuna, our customer RWE Power is operating the whole equipment, consisting of two stackers, two reclaimers, two train-unloading stations and an extensive conveyor system by one operator in the control room. The annual turnover of lignite in this plant amounts to 60 Mt.

Based on the knowledge of the coal qualities and quantities for local positions, blends are produced in material flow routing from the intermediately stored coal masses which are then tailored to the specific requirements of each power plant unit.
Further information:
www.siemens.com/mining