PRECISE COLD ROLLING
Electrics and Automation
ELECTRICS AND AUTOMATION
for cold rolling mills

HOLISTIC SYSTEM EXPERTISE

Now, more than ever, the market for metallurgical plant automation demands high plant availability and quality of the end products. To meet these requirements, SMS Siemag many years ago launched its policy of supplying not only engineering, technological controls and process models, but also the entire electrics, automation, and drive technology for its plants. That makes us a one-stop-shop for all aspects of engineering, construction, and commissioning.

Acutely aware of our responsibility to you, we ensure all system components mesh perfectly. Short paths, direct communication, and the common interests of everybody involved add up to the best conditions for just that.

EXTENSIVE MODERNIZATION STRATEGIES

As an operator of metallurgical plants, you know how crucial it is to constantly add to and renew your production equipment so you retain your market standing with excellent product quality.

This kind of growth comes not only from the latest engineering solutions, but also requires integrated automation to reap the full benefit for your end products. SMS Siemag supplies seamless revamps so you benefit from technological improvement of your production across the board.

PROFESSIONAL PARTNER FOR COLD ROLLING MILLS

SMS Siemag supplies cold rolling mills for almost all products and capacities. Included here are reversing stands, continuous tandem mills, skinpass mills, and cluster stands. They cover a range of products from carbon steels, silicon steels, tinplate, stainless steels, to copper.

Our experts in electrical, automation, technological, and mechanical systems work together to ensure the plants you get are perfectly coordinated in all aspects. That’s how you can rely on intelligent, market-driven solutions with high productivity for top-quality cold strip.
X-PACT®
Electrics and Automation

The entire spectrum of automation technology from SMS Siemag is available to you under the X-Pact® brand name. That applies to all plant types, whether steelmaking or casting plants, rolling mills or strip processing lines. Central to X-Pact® for cold rolling mills are high cost-efficiency and transparency of our control technology. X-Pact® encompasses all levels of automation from Level 0 to Level 3. There has been extensive standardization of our products which means we were able to vastly improve the competitiveness of our Electrics and Automation solutions.

X-Pact® for cold rolling mills pools our special process know-how in a system oriented toward the distinct process technology required here. Additionally, because X-Pact® focuses on the cold rolling process and associated controls and regulations, we were able to simplify the application software. That enabled us to fine tune the application software at a lower outlay. What’s in it for you? The solution comes with a leaner system structure, making it much more straightforward to use.

HOMOGENEOUS SYSTEM ENVIRONMENT

Generally, when it comes to the automation of rolling mills, a distinction is made between operation and sequence controls, and fast technological process controls. Included here are not only material-tracking sequence control systems, but also controls for auxiliary machine groups, for instance hydraulic stations, cooling and lubricating systems, rolling oil and emulsion plants.

So, in X-Pact® for cold rolling mills, all regulation and control functions are preferably embedded in a hardware platform (X-Pact Embedded) and a joint programming environment (LogiCAD).

That ensures maximum availability of all system variables. Interfaces between different system platforms are no longer necessary because the reflective memory (RFM) architecture supplies all process data to all the sub-systems immediately and simultaneously. This is also how a PDA system can be integrated into the overall array using RFM.

It’s one of our principles to react flexibly to customer standards or special requirements, especially for revamps. That’s why our solutions easily integrate your existing control systems, as well as other options such as programmable logic control (PLC).

SIMPLE SYSTEM MANAGEMENT

The open architecture of X-Pact® makes it independent of proprietary solutions. That means the automation systems are entirely implemented under LogiCAD on the basis of international standard IEC61131-3. This is important for international projects and ensures our systems can be updated, maintained, and further developed by all our customers.

Using logi.CAD is the easiest thing in the world for system engineers and programmers familiar with PLC programming. The FBD (Function Block Diagram) technology in LogiCAD features the same structure and procedures as the CFC-Technik (Continuous Flow Chart) used in a PLC programming environment.
MODERN HARDWARE SOLUTIONS

HARDWARE AND SOFTWARE PLATFORM

We use state-of-the-art computer technologies for our Level 1 process control in real-time. Equally advanced, ProBAS software takes care of graphic programming and diagnosis. A typical configuration consists of:

- One or more engineering stations (MS Windows)
- An X-Pact® ProBAS development server
- One or more X-Pact® embedded automation systems

X-PACT® EMBEDDED AUTOMATION PC

X-Pact® Embedded is the SMS Siemag hardware platform for modern, sophisticated control and technological regulation systems in cold rolling. X-Pact® Embedded is based on modern Core™ 2-Duo technology from Intel® and provides the maximum computing power to all applications.

It’s an added advantage that X-Pact® Embedded hardware saves space in the control cabinet. A cover on the front of the device protects the drive bays (DVD, HDD) as well as two Compact-Flash ports. Switching between drives is made easy by the modular insertion feature. To make working with this hardware even more convenient, all ports and interfaces are located on the top of the housing. There are no protruding ports at the back which would demand extra installation depth. You can always add modules to the hardware, adjusting it to the complexity of your plant. Whatever the installation situation, you can rely on an array that makes optimal use of the space inside the control cabinet. That’s due to the different capacities of X-Pact® Embedded modules with one, two, or several card ports (for PC/PCI express cards).

ETHERNET-BASED FIELDBUS SYSTEMS

X-Pact® automation from SMS Siemag supports the latest technology in real-time-capable fieldbus systems. Here are the advantages of an Ethernet-based system over a classic fieldbus solution:

- Much higher performance
- Real-time-capability for fast process control
- Extensive diagnosis options
- Wide scale use with increasing acceptance
- Interfaces to classic bus systems

Furthermore, using this technology drastically cuts hardware engineering requirements because for the first time signals for the highly dynamic actors/sensors can be picked up close to the mill by the non-central periphery devices. That eliminates masses of cable as well as the associated adaptation of process signals.

The technological regulation systems from SMS Siemag use EtherCAT (from Beckhoff) as a real-time-capable fieldbus. All this goes to show that, with our new technology, we harness a modern, powerful and real-time-capable communication medium for our automation systems. Flexible tree structures ensure you can expand the network as you want, when you want.

DE-CENTRALIZED SYSTEM ARCHITECTURE:

- Single CPU-systems (CPC)
- Only power supply and network connected to the field area
- Real-time Ethernet as fast fieldbus
- Reduced signal- and HW-engineering
- Highly reduced complexity

An increasing number of suppliers support devices with fast Ethernet interface, e.g. new valve series from MOOG, position transducers by Heidenhain
Our Electrics and Automation Division also supplies the equipment for energy distribution and drive technology in cold rolling mills.

**SCOPE OF SUPPLY FOR ENERGY DISTRIBUTION**

Included in our supply range for energy distribution are high and medium-voltage switchgears, distributor transformers, compensation and filter systems, emergency power generators, USV plants as well as low-voltage main distributors and the associated Emergency Off strategies.

**SCOPE OF SUPPLY FOR DRIVE SYSTEMS**

Here, we supply all variable drives for cold rolling mills. Added to this are constant drives of all power classes. The bottom line for you? Low investment and operating costs due to reduced power dissipation, a smaller footprint, and low maintenance are serious advantages of our energy distribution and drive systems.

**ENERGY DISTRIBUTION FROM ONE SOURCE**

We use a single-line scheme to design your energy distribution system. You can also rely on our support in choosing the best method of connection to the integrated network. To determine the necessary filter and compensation plants, we analyze the network. This includes identifying the reactive power requirement and the level of network harmonics.

Our in-depth process know-how means we can exactly determine the diversity factors and evaluate pass schedule data. As a result, we can optimally dimension all components, from overhead line feeds to mechanical control elements.

**RELIABLE DRIVE SYSTEMS**

There are a large number of parameters that influence the design of rolling mill drives, especially in the megawatt power range. Together with renowned suppliers, we devised and optimized new foundations for these medium-voltage drives over recent years.

Intelligent switching systems are able to reduce the harmonic wave strain on the network side to such an extent that no filters are necessary on this terminal server. These power trains (medium voltage switch, converter transformer, voltage converter, motor) are dimensioned according to the actual process requirements, which can be seen from the pass schedule plans included in our scope of supply. Using an optimized transmission of the drives, we ensure you get a plant with maximum flexibility in the design of your production processes. Included in the X-Pact® process control package are the technological drive functions. They keep the interface to the drives lean and standardized.

We have developed a drive media system that controls and monitors all the media for the motors and the drive transformer. So, wherever you source your drives, they seamlessly connect with our plant automation system.
LEVEL 1 AUTOMATION

Stability, easy maintenance, no-fuss adaptation to new environments, and top technological performance – that’s what you expect from modern automation systems. This requires a simple yet powerful basis. All X-Pact® cold rolling systems are based on our uniform X-Pact® embedded platform with its modular structure. As a result, they readily adapt to different complexities in cold rolling.

What do our regulation systems mean for you?
To begin with, you can rely on excellent technology and functionality that ensure you achieve your target values with hydraulic and electrical control elements. Other stand-out features of our Level 1 systems include maximum availability plus a high degree of process automation coupled with effective service functions.

There is close coordination between our automation experts and the design department to develop and thoroughly test software modules for each mechanical unit.

CONFIGURATION OF THE CONTROL SYSTEM

Level 1 consists of various automation functions. Each function works independently and is linked electrically with the corresponding sensors and actors. Here are the main functions:
- Master Controller
- Sequence and auxiliary controls
- Drive controls
- Technological controls

Master Controller
The Master Controller coordinates the rolling process and the information exchange between the various automation systems involved in the process, e.g. the Level 2 system, the safety system, and the Level 1 automation functions.

Sequence and auxiliary controls
These functions ensure smooth operation in the different areas of the rolling mill. Included here are the material flow controls in the plant feed and run-out areas of the rolling mill as well as the controls of the media systems.

Drive controls
This is a control sector that comprises all the drives involved in transport, rolling, coiling and uncoiling the product. Essentially, they consist of the main drives, the coiler and pay-off reel drives, as well as the flatness measuring and deflector rollers. The „Speed-master“ coordinates all the drives involved in the material flow.

Technological controls
The technological controls basically comprise fast control loops for the actuators, and superordinate process control loops. Among these process control loops are e.g. thickness and flatness controls. What counts for you is that our technological controls ensure perfect product quality in terms of thickness tolerances, flatness, and minimized strip edge drop, as well as a stable rolling process and high plant availability.

THICKNESS CONTROL

To achieve the required thickness on the run-out side of the mill stand, the uneven thicknesses on the feed side must be eliminated. That’s the job of the hydraulic control element as well as the control strategies:
- monitor thickness control
- forward thickness control
- volume flow control

FLATNESS CONTROL

Tailored to the mill type and the product range to be rolled, our flatness control system covers all the control loops necessary for the mechanical actuators:
- Work roll and intermediate roll bending
- CVCplus® work roll and intermediate roll shifting
- Leveling
- Multi-zone cooling
- Eccentric adjustment (20-roll cold rolling mills)

HMI SYSTEMS

Our HMI systems link the plant and the operator. They map the production process including everything to do with materials and technology. Armed with the information from the process observation, the operator uses the latest graphical methods to manually influence process control or operation of the integrated machine groups such as media plants.

In line with our operator-centered approach, our employees work closely with your operating personnel. Involving your team in the Plug & Work tests is another effective way to prepare them for their new tasks.
LEVEL 2 AUTOMATION

INCREASED PERFORMANCE

Central to increasing the output of modern cold rolling mills is the X-Pact® Level 2 system. Specifically, it’s all about improving product quality as well as boosting both productivity and flexibility – the main aims of Level 2 systems that are based on mathematical and physical process models.

As a vital part of quality assurance, process control systems must not only optimize processes, but also ensure product and production data aggregation for the plant.

Just like other automation levels, the SMS Siemag Level 2 systems are independent of the underlying hardware structure. It enables you to distribute the individual functions over several computers, or to concentrate on one powerful computer. To do this, the system uses a CORBA-based abstraction level, the SMS Siemag CBS framework. The CBS framework features its own communication function with the external systems, e.g., multi-plant production planning, to maintain high connection flexibility.

TECHNOCAL PROCESS MODELS

Crucial for an optimal rolling process is accurate pre-setting of the roll gap. Getting this wrong can lead to production delays and longer cutting lengths.

This is where our technological process models set the optimal variables (roll bending, roll shifting, and leveling) as well as the anticipated rolling force and strip thickness. The goal is flat strip even on threading into the plant.

The process models also set the necessary strip tension and rolling speeds. Equally important is achieving the maximum production rate coupled with the desired product quality. Factors taken into account here are plant limits, current plant situation, material properties, product dimensions, and temperature.

The calculations for flatness as well as for the pass schedule are based on mathematical-physical models. Right from the start, you can also calculate useful values for new products if the material properties are known.

Differences between the pre-set values calculated and the values measured during rolling are balanced out in stages by short and long-term adaptation functions in the Level 2 system.

PRODUCTION DATA AGGREGATION AND REPORTING

Operating and product data aggregation is based on the process events of the Level 1 system. First, the Level 2 system tracks all products in the entry area of the mill stand, along with their current status. Second, this data is applied in plausibility checks for the production sequence and to generate product-specific values for the rolling and production process.

Then the relevant production and product data is saved in a database where it is available for production analyses, quality and product reports.
LEVEL 3 PRODUCTION PLANNING SYSTEMS

Today, there is a constantly growing product variety, while customers expect ever shorter delivery times for top product quality. That demands meticulous planning of your production processes. What’s more, you need close links to the production systems of suppliers and customers so you can react quickly to changes.

Development here focuses on “Real Time Enterprise” (RTE), a method that checks and responds to these changes in real time.

The restrictive factors are the technical and technological limits of the plants, which we have to take into account during program planning. That, in turn, creates a demand for comprehensive production planning systems.

MAXIMIZATION OF OVERALL PRODUCTION RATE
Planning and minimization of inventories for interim products
Uniform, multi-plant product tracking
Cumulative quality control up to final quality approval
Increase of delivery date compliance

MANUFACTURING ORDERS
You can rely on our system to convert customer orders into technically executable manufacturing projects. According to customer specifications, an extensive calculation model generates the manufacturing data for the product ordered.

- Definition of the necessary production steps and possible plant alternatives
- Definition of the dimensions and quality of the initial and intermediate products
- Planning of the output of every production stage to determine the necessary quantities of input material
- Definition of sampling and test regulations

THE FACTORY MODEL
A uniform planning system covering all areas is based on a factory model. The factory model is implemented in the planning system as an electronic planning table.

PRODUCTION PLANNING
It’s vital to determine the doable delivery dates for all manufacturing orders in advance. That’s where our capacity and deadline planning comes in, examining all the plants and plant alternatives available. As a result, you get a sequence plan for the individual plants as well as a plan of the available input materials for each manufacturing order.

QUALITY TRACKING
There is a data exchange between the Level 2 systems of the overall plant and the Level 3 system. That means Level 3 is informed at all times about every production step and the product quality after each step. Inspection and lab data add to the accuracy of the result. This forms the basis for quality approval of the final products before delivery.

BENEFITS OF X-PACT® LEVEL 3
X-Pact® Level 3 provides plant operators with all the tools necessary for planning and control of the production process in metallurgical plants and rolling mills. An effective link between the commercial side of the business and the technological process automation systems, Level 3 production planning offers you these advantages:
SAFETY STRATEGY

Improving machine and plant safety is becoming more and more important – worldwide. Legislation and standards demand the protection of people and the environment.

Essential for safe operation of our products is a coordinated approach during planning and design. Together, the engineering and electronic systems form the main elements in our safety strategy:

- Layout of the danger zone
- Risk assessment
- The electro-mechanical function „safety“
- Emergency Stop

The danger zone layout divides the plant into various danger zones. It indicates all the plant-related safety equipment as well as the plant limits. The risk assessment identifies and evaluates all the possible hazards inherent in a plant, and describes the necessary precautions. There is also an in-depth Emergency Stop plan drawn up for each plant.

Together with our customers, we worked out a practical solution with the safety control functions operating independently from the machine controls. This strategy also complies with all safety laws and standards. Better still, it reduces the time and cost of testing, documentation, and commissioning. The safety control functions are extensively tested early on, during the Plug & Work process.
### PLUG & WORK

Our long-established Plug & Work service is increasingly popular with our customers. Central to Plug & Work are production simulations that mimic reality down to the smallest detail. Today, due to our long-standing experience in engineering and process technology, we know exactly how processes behave and what regulators achieve which product qualities. Our simulation system maps this complex interplay of variables for exhaustive tests of your system.

Plug & Work starts with module tests that put the individual hardware and software components through isolated function checks. Next, integration tests examine the fault-free interaction of the modules. Unlike other suppliers who usually wrap up the pre-testing and resume only after the entire plant is finished, we use this valuable time to the benefit of our customers. Here’s how: We install the entire automation system in one of our test fields and connect it up to a simulation system. Finally, all that’s left to be done is to set up the customer-specific construction models of the plant including the kinematic and dynamic parameters of the plant behavior and the sensors. This is how we build a computer-aided simulation model to test the operating and process behavior of your plant.

The result: The operator feels he is working on the actual plant – all the operational procedures and processes are visualized in real-time. He can control production virtually, but also learn maintenance routines. Using this hands-on method, we fine-tune the automation system in advance so you benefit from smooth running and perfect operability.

The solution palpably reduces commissioning times, as well as on-site corrections. Your operators appreciate the real-life training opportunity provided during testing because it’s an ideal way for them to prepare for their future work on the plant.

### TRAINING

Intensive training of your personnel on new, complex systems is a priority for us.

First comes the theory in the classroom, where our expert employees pass on their know-how to your personnel. Also available for them is detailed training material, so if necessary they can look things up later.

We always organize an extra instruction session for the operation and maintenance of the measuring systems installed in our automation solutions. That makes sure each manufacturer’s specialists know the ropes. Second, after the basics, operator training continues during our Plug & Work process.

Only then do we follow up with on-site training at the construction location. It’s standard procedure for us to include your employees in plant commissioning, and as a result they get to know the systems and processes on the ground.

Each training module builds on the last so that by the end of commissioning your staff will be able to operate the plant reliably and independently. If faults occur, they will know how to pinpoint the cause and what to do about it.
MODERNIZATION STRATEGIES

SMS Siemag has developed a strategy that ensures production continues throughout alteration or modernization work. Compared with conventional methods, it gives you a much higher protection against failure, shorter commissioning time, steeper run-up curves, and therefore an early return on investment.

REASONS FOR REVAMPS

- Improved product properties
- Better production/productivity
- Reduced production costs
- Increased availability

SMS Siemag revamp strategies utilize all aspects of modern metallurgical automation systems:

- Integration of new process technologies
- Reproducible process sequences
- Improved ergonomics and safety technology
- Replacement of obsolete systems
- Proven quality of product properties using technological values in the entire process

PROCEDURE

These are the main steps in a revamp project:

1. Current state analysis, adaptation to plant operating procedures, conversion work planning, plant test, switch-over plan, re-commissioning, and optimization.

CURRENT-STATE ANALYSIS

The first step to successful modernization is an in-depth assessment of the current state of the automation system. Included is an examination of the sensory systems installed, to find out whether they can be re-used.

This check simultaneously determines how new sensory and measuring systems can be installed. Significant here is that the current state analysis examines all the relevant electrical and automation system components as well as the complete technological process sequence.

The second key stage is considering and selecting interfaces to the automation systems and IT infrastructure that are to stay in place. Essentially, the knowledge gained here goes into a motor and component list, a technological process description, and a documentation of the interfaces for each conversion phase.

ADAPTATION TO THE OPERATIONAL PROCEDURES

It’s quite normal that, over time, all plants develop their own standard operational procedures. These SOP need to be carefully examined during the current-state analysis. They are identified and documented on site in cooperation with the operating and maintenance crew. Taking this as a basis, SMS Siemag and the people who work on the plant develop and agree on the new procedures.

PLANNING THE CONVERSION PHASES

Together with you, we plan the phases for the major conversion stages of mechanical, media, and electrical systems. These plans are mapped out in detail prior to the individual conversion steps.

Here again you benefit because maximization of operations carried out in parallel before, during, and after production standstills minimizes overall stoppage times. Then, according to pre-defined milestones, each standstill is tracked and if necessary re-planned by expert construction managers working hand-in-hand.

Furthermore, the electronic version of the switch-over plan makes monitoring operation possible. This is how the relevant data and signals from the existing automation system are aggregated and evaluated by powerful monitoring systems. In highly critical cases, the switch-over technology is designed so that the entire plant can be switched over from the old to the new automation system without any major production interruption.

We cooperate closely with you to make sure the switchover plan is transparent, and you make the final decision, taking into account all the economic and technological aspects.

RE-COMMISSIONING

The steps described above reduce many of the risks inherent in conversions. You can rest assured that, due to our long-standing experience in commissioning metallurgical plants, we can get your plant up and running again within a minimum timeframe.

The high point of the whole project is the plant run-up after the revamp. Yet, before this happens, we team up with you to carefully plan production of the material quality and dimensions you require. The data recorded during monitoring operation is applied to pre-optimize our process models, clearing the way for immediate production start with saleable product quality.

What’s more, you can rely on comprehensive support, starting with continuous assistance during run-up, through to technology support from our development departments. Sometimes, both sides recognize the potential for joint further development and sign a cooperation agreement that might even lead to exciting innovations! Many successful projects confirm the effectiveness of our revamp strategies.
SERVICES

COMMISSIONING

Right from the start of the Plug & Work tests, our experienced engineers are on the spot in the test field. As the final stage of the Plug & Work test, when the scope of supply and functioning has been confirmed, they test the automation to make sure it’s perfectly ready for commissioning.

Essentially, commissioning on site consists of the following stages:

- Cold commissioning
- Hot commissioning
- System optimization during production
- Performance tests

Cold commissioning

Included in cold commissioning are all the activities necessary for rolling the first strip. It concludes with the first strip.

Hot commissioning

This starts with rolling the first strip. It’s the phase when all the mechanical and electrical functions are tested under load to check that the open and closed-loop controls are working properly.

Optimization of the systems during production

This is when the parameters of all the systems are adjusted to ensure the new facility achieves the required performance.

Performance tests

Finally, a test program we run through together with the customer demonstrates that the plant meets the contract specifications.

AFTER SALES SERVICE

Whenever you need us, we are always there to help – and it shows: in the form of our after sales service. This keeps you in touch with our expert know-how. Specially developed for X-Pact® Electrics and Automation, the ServicePortal SP/1 from SMS Siemag gives you special access to fast fault remedy.

Right from the start of commissioning, we set up a service portal for optimal plant support. It ensures stable, protected communication between your and our own networks. Via this portal, the SMS Siemag experts access your plant’s automation system to give you immediate support in the form of remote diagnosis and maintenance – worldwide and from day 1.

Advantages of the service portal

Some 70 percent of faults can be corrected immediately. Alternatively, faults are isolated. Take for instance faulty parts. Our experts can usually identify them online, possibly deactivate them, and send a service technician to replace them on site.

DOCUMENTATION

Central, continuous administration of project documentation

We manage the entire order documentation in an MS Excel-based spreadsheet. It comes complete with a table of contents that gives you an easy and immediate overview of the complete documentation. All the necessary documents, such as function descriptions, circuit diagrams, and operating instructions are saved in this list at one central, structured location. Also integrated are all the documents generated throughout the project. That means every documentation transfer gives you the full current status in electronic form.

The spreadsheet itself contains all the necessary information on each document, e.g. file format, print format, language, version, and life cycle. All you have to do is to go straight to the center of the program, and you’ll find the document you want very quickly, then simply click on a link to open it. This is how the operator finds his operating manuals, the maintenance employee the data sheet for a sensor, and the programmer the software details for the automation.

Furthermore, once the project is completed, you can continue the documentation yourself and administer new documents or document versions.
The information provided in this brochure contains a general description of the performance characteristics of the products concerned. The actual products may not always have these characteristics as described and, in particular, these may change as a result of further developments of the products. The provision of this information is not intended to have and will not have legal effect. An obligation to deliver products having particular characteristics shall only exist if expressly agreed in the terms of the contract.