CONTROL TECHNOLOGY ATTRACTIVE AND INTELLIGENT

Foundry ServicE GmbH
Ajax Tocco

MANUFACTURE

Foundry Service GmbH is specialized in heating, melting and holding, as well as in the construction of transport systems for molten masses. In addition to many years of experience and complex competence, a profound passion for the highly specialized craft plays an important role in the company. Constant innovations and product developments, up to the granting of patents, make Foundry Service GmbH one of the industry market leaders.

Attractive yet intelligent control systems go hand in hand with continuous innovation. Perfect implementations follow first-class concepts in new plant construction as well as in retrofitting or conversion.

In the small town of Hemer in the Sauerland region of Germany, not far from the Jüberg Tower, we live the foundry philosophy on 12,000 m² of production space: "To continue and increase our success with ever new developments and a 365-day customer service!"

Welcome to Foundry Service
Dipl.-Ing. Peter Linke, Managing Director Iraklis Papadopoulos, Managing Director

WHAT IS YOUR
PERFORMANCE LEVEL?

PERFORMANCE LEVEL

The Machinery Directive defines the Performance Level (PL) in EN ISO 13849 Parts 1 & 2. The PL is used to indicate the safety of a function or component. The higher the PL, the safer and more reliable the function under consideration. The specified value for the performance level thus also has an effect on where a particular component may be used, since the PL must always be at least as high as the risk value at the point under consideration.

"Controls must be designed and constructed in such a way that hazardous situations do not occur. They must be designed and constructed in such a way that they can withstand the expected operating stresses and external influences."

When designing the respective machine or system for safety in accordance with EN ISO 13849, two performance levels must always be calculated. On the one hand, the required PL must be determined, on the other hand the achieved PL as well.

1. The required performance level:
The risk assessment according to EN ISO 13849 works in a similar way as according to EN 954-1. It is evaluated by assessing the risk on the basis of the extent of damage, frequency and length of stay and the possibility of avoiding the hazard. Following the evaluation, the required performance level is determined.

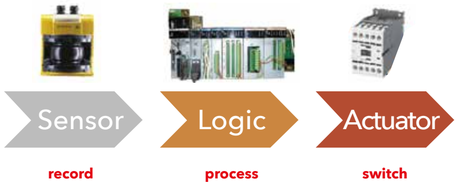
2. The performance level achieved:
To calculate the achieved performance level, the design of the control system or safety components and the hazardous situation are considered. This evaluation depends on the control categories, the MTTF values and the values for the diagnostic coverage ratio (DC).

Foundry Service guarantees the application of these regulations in accordance with the Machinery Directive for all new production, modernization or modification of control systems.

We are happy to support and advise you on questions or problems, manufacturer-independent, to determine the performance level.

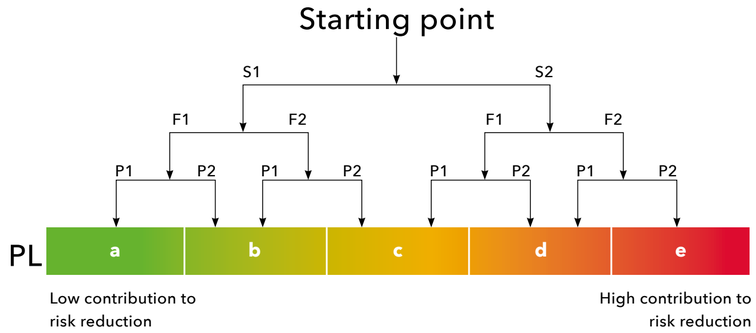
To what is a performance level applied?

Safety functions are performed by safety-related parts of a control system (SRP/CS).
Example: Purchase of finished safety components



Determining the required performance level (PLr)
The required performance level (PLr) is determined using a risk graph. It assesses the risk for a given entity against three criteria:

- **Severity of injuries:**
  S1: minor injuries
  S2: serious injuries
- **Frequency and length of stay:**
  F1: between rarely and more often
  F2: between frequent and continuous
- **Possibility of avoiding the hazard:**
  P1: possible under certain conditions
  P2: hardly possible



MODERNIZATION OF CRUCIBLE & CHANNEL FURNACE PLANTS

Foundry Service GmbH optimizes production facilities in foundries very efficiently by updating the electrical switchgear.

The use of standard components such as modern PLC modules, switchgear and measuring transducers ensures future productivity and reduces the spare parts inventory to a minimum. Additional training of maintenance staff is not required, due to the high interchangeability of standard components.

The foundry service spectrum for the modernization of control systems covers all production facilities available in foundries, such as:

- **NF/MF induction plants**
- **Ladle transport systems**
- **Cooling water and filter systems**
- **Transport and dosing systems**
- **Production data recording systems**
- **Energy management systems**
- **Heat treatment plants**
- **Forming plants**
- **Sand treatment plants**
- **Mold transport systems**

The modernization of production facilities is carried out by Foundry Service GmbH in a completely customer-oriented manner and with absolute adherence to schedules.

Modernization of channel furnace plant -holding furnace

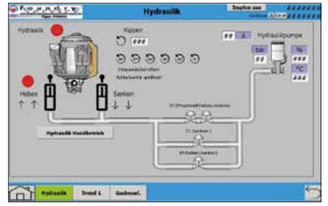
Foundry Service carried out a complete modernization of an existing holding furnace at a well-known automotive supplier within a short period of time. The customer's special requirements were:

- **Complete replacement of the control system and the compensation**
- **Completely new manufacture of the furnace controls**
- **Modernization of the existing cooling water system**
- **Modernization of the nitrogen supply system**
- **Assembly and commissioning during Christmas/New Year within 2 weeks**

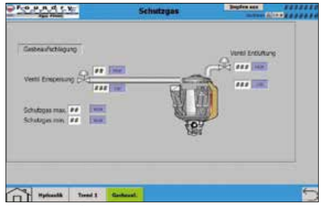
For this purpose, the complete equipment was dismantled after shutdown and all interfaces were revised. All newly manufactured components were then installed and put into operation. Additional applications were implemented for the customer in the context of the construction project. They included the following functions:

- **Automatic independent tilting of the furnace for filling the transport ladles according to the preset discharge quantity via touch panel by the operator**
- **Installation of an energy management system to avoid power peaks**

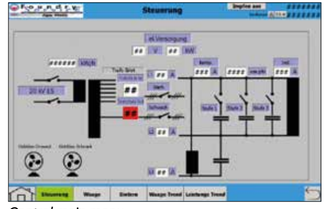
The entire project was recorded and documented in a newly created operating documentation in accordance with the EC Machinery Directive.



Hydraulics main menu



Inert gas main menu



Control main menu

APPLICATIONS FOR CRUCIBLE & CHANNEL FURNACE PLANTS

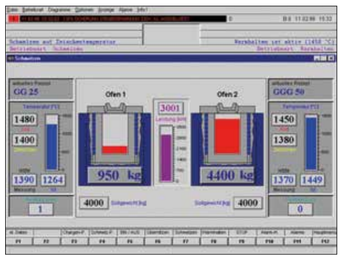
Melting processor

The melting processor is a system of hardware and software for controlling induction melting furnaces. It is suitable for retrofitting in existing furnace systems and offers the following advantages over manual furnace operation:

- **Reduction of energy demands**
- **Increase in productivity by reducing non-productive time**
- **Reproducible quality of the melt**
- **Relief of the operating staff**
- **Increase in operational reliability**
- **Increased safety against overheating of the refractory lining**
- **Documentation of operating data**

The following operating modes can be realized with the melting processor:

- **Melting**
- **Overheating**
- **Holding**
- **Cold start**
- **Sintering**

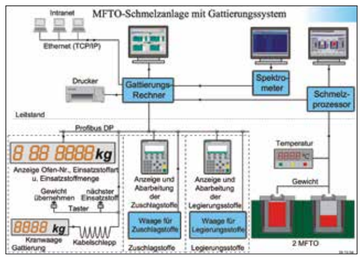


Charging system

A computer which is located e.g. in the control room and which carries out a constant data exchange with a possibly existing melting processor, the spectrometer, a central server in the company network, the crane scale as well as a text display and a platform scale each for the addition of aggregates and alloying elements is the core of the charging system.

The following illustration shows the block diagram of a typical system configuration.

The charging computer creates the recipes for the materials to be produced and compiles a sequence of recipes for a day's production. If desired, the recipe creation can also be carried out cost-optimized by the computer. The master data for the directional analyses and the input materials and aggregates form the basis for recipe creation.
Optionally, the associated data (e.g. the percentages of the individual alloying elements) can be entered and managed on the computer itself or transferred from the server in the company network from any database system (SQL server, Oracle etc.).

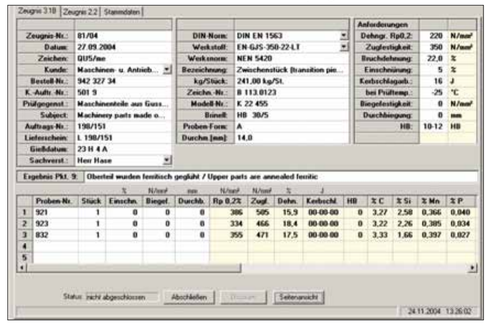


Program for the creation of works test certificates according to EN 10204

The program is used for the comfortable creation of works test certificates according to EN 10204. It automatically imports the information required for creation, such as analysis data, mechanical properties, etc., from database files into which other programs such as the melting processor, charging system, tensile specimen evaluation program, etc. have been transferred.

Such files may be located on any computer within the company network.

The following figure shows the main menu of the program:



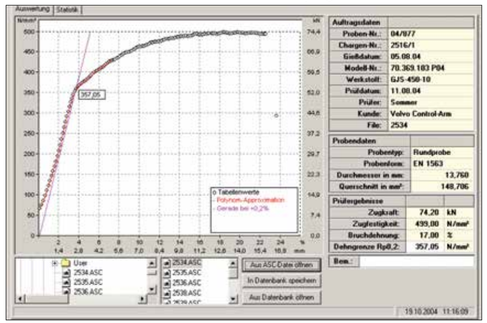
Program for the evaluation of tensile samples

The program for the evaluation of tensile specimens adopts the information on the force-extension diagrams stored in ASCII files by a tensile testing machine.
They are displayed graphically and the yield strength Rp0.2 is determined.
The data is stored in a database system and can be evaluated statically.

The program offers the following functions:

- **Determination of the yield strength Rp0.2**
- **Transfer of the data to a database system**
- **Statistical analysis**

The following figure shows the main menu of the program:



VISUALIZATION CONTROL

Control of a holding furnace

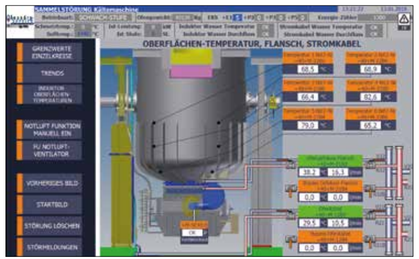
Each menu has an area with menu-specific displays. Additional buttons or displays are provided there. The following menu-specific display is shown in the start menu; it allows you to switch to all other menus.

Start menu

Operating mode / Power

Setting the surface temperatures of the furnace housing

On the furnace housing the surface temperatures are monitored at 6 points with NiCr-Ni thermocouples. The furnace flange and the furnace cables are water-cooled; each cooling circuit consists of a main line and a bypass. In the main line as well as in the bypass there are both a temperature and a flow monitoring.

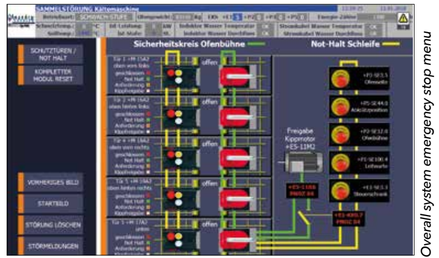


Total view temperature recording

Measuring points detail

Switching the system on again after an EMERGENCY STOP

If one of the emergency stop buttons is pressed for safety reasons, this immediately interrupts the tilting operation of the system. The power feed of the inductor remains unaffected by this.



Overall system emergency stop menu

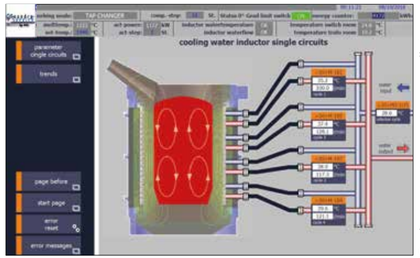
Control of a crucible furnace

The “Power“ menu displays the electrical parameters as values and bars. The operating mode can be changed here. The menu and the displayed values change depending on the selected operating mode.

Melting processor menu

Control of the furnace cooling

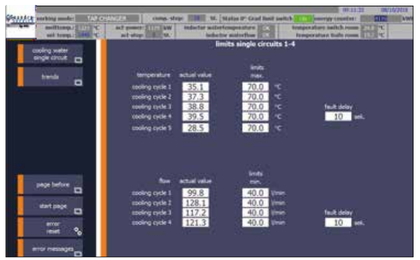
The inductor is water-cooled. The water temperatures and flow rates of the 4 circuits are monitored and displayed on the touch panel.



Cooling water temperature overall view

Temperature settings for furnace cooling

In this menu the limit values for temperature and flow rate can be set. In the event of an overtemperature fault in a single cooling circuit, the power is switched to a low level to protect the furnace. In the event of a malfunction of the flow rate in a single cooling circuit, the power is switched off to protect the furnace.



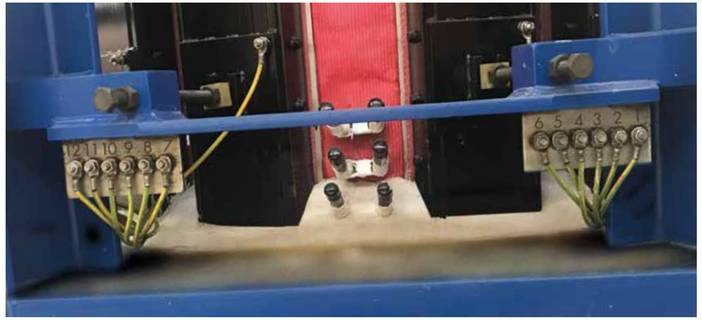
Cooling water control menu

MONITORING SYSTEMS

System for monitoring the magnet yokes for earth faults

This system, which enables the monitoring of the magnet yokes, has been successfully established on the market for over 10 years now. With the help of this system, the operator or maintenance technician can locate the damaged area by an exclusion procedure. In this system each magnet yoke is insulated from the furnace housing. However, this function is still guaranteed with an earth leakage cable, which in turn is connected to the furnace housing.

This design enables the operator and maintenance staff to separate the affected magnet yoke quickly and purposefully by individually interrupting these earth fault connections. In this way, a costly and time-consuming retraction of the magnet yokes for fault finding can be avoided.

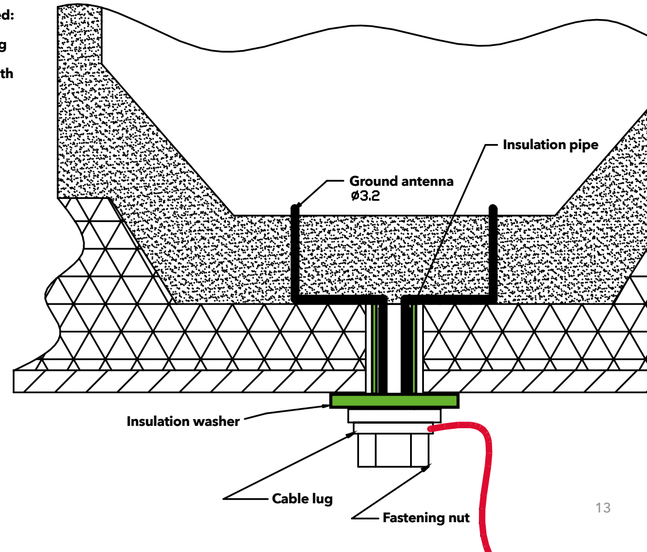


System for monitoring the molten bath

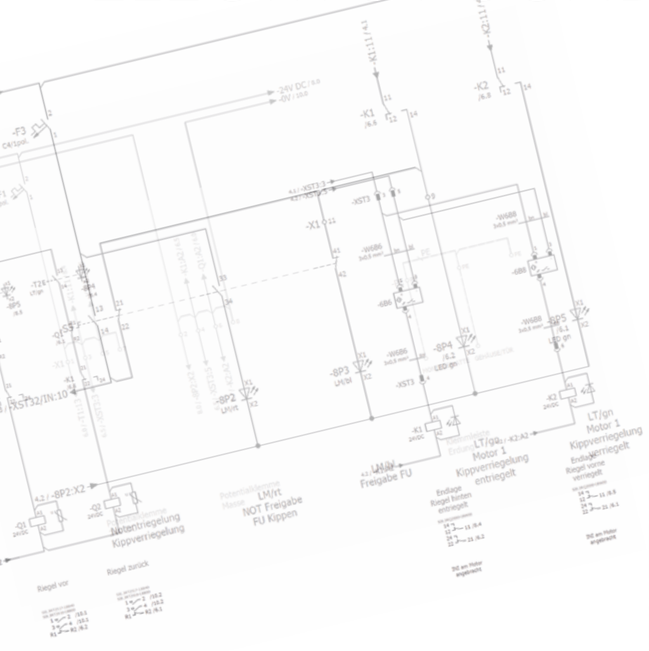
The molten bath earth monitoring is the most important safety system for foundries in a crucible furnace plant. With the help of our control technology, existing systems can be modernized and plants without a molten bath earth monitoring can be retrofitted.

The following functions are checked:

- **Permanent insulation monitoring**
- **Testing the connection of the bath antenna to the molten metal**
- **Testing of an external earthing on the furnace system**
- **Crucible breakage test**



IINTELLIGENT
ELECTRIC FOUNDRY



Electrical handling of the casting process

The electrical operation of casting ladles modernizes and optimizes your casting process. High efficiency as well as occupational safety aspects lead to a high acceptance by the operators. The additional possibilities of automation offer potential for increasing the production of castings. Parameterizable processes can reduce fluctuating reject rates by optimizing casting speeds, tailored to each casting. At the same time, a high level of occupational safety can be achieved with an increased production output. The caster is significantly relieved and can optimally contribute to the process with his valuable manpower and experience.

- **Fatigue-free handling**
- **Reproducible processes**
- **More documentable casting processes**
- **Highest level of work safety**
- **Increase in quality standards**
- **Attractive working conditions**

Electric drive systems for casting ladles

With our KAZ or I-Drive drives, you have the choice of driving your ladle as optimally as possible. For this purpose, you can choose from a variety of operating units to suit your process and the existing conditions.

We offer the possibility of wired or wireless operation. Furthermore, our drives differ in linear or proportional speeds. This means that we can relieve the caster of the casting process and limit fluctuations in casting speed with directly associated sources of error in the casting.

Regardless of whether your ladle is newly manufactured or an existing ladle is converted, you have the choice of different solutions to define the optimum process for you.

Your advantages:

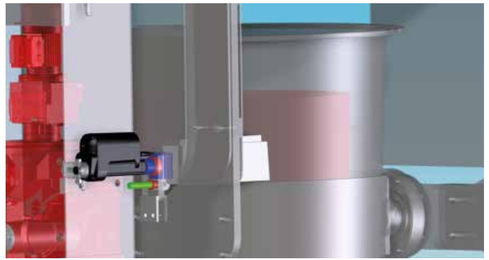
- **Direct or indirect drives**
- **Linear or proportional casting speeds**
- **Wired or radio-supported operation**
- **Motorized or manual operation through finger claw coupling with I-Drive system**

ELECTRIC CONTROL
OF CASTING AND PERIPHERAL SYSTEMS

Electrical interlocking according to requirement DIN EN1247 in radio operation

DIN EN 1247 states unequivocally, “Ladles must be equipped with safety devices to prevent ladle rotation. Such a device may only be unlocked immediately prior to pouring.“ Instead of philosophizing about the design possibilities “immediately before pouring“, we have developed an electrical locking device which makes it possible to remotely unlock the locking of the ladle even at great heights above molding boxes or casting pits which cannot be reached or reached only with difficulty. In combination with our electric ladle drive, tilting of the ladle is only possible in unlocked condition.

- **Electric linear actuator type KAZ**
- **Electrically driven locking mimic**
- **Locking point on the ladle**

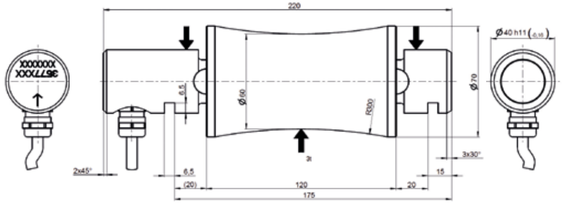


Weighing system

An exact determination of the melt weight and the transmission of the data in real time to superordinate recording systems or stationary displays are the basis of an optimal process. This data is of elementary importance for occupational safety protection and the quality of subsequent production processes.

With our weighing system in the load bolt of the ladle, you have permanent control over the weight of the ladle contents. Additional weighing systems on crane systems or forklift trucks are not required and therefore do not reduce the load capacity of the load handling system.

- **Permanent weight display in real time**
- **No reduction of the permissible total weight of the load carrying system**
- **Radio-based or wired data transmission**



Dosing and wire-feeding systems

Due to a multitude of usable sensor technologies, the fully automatic sequence of processes in an ever increasing vertical range of manufacture is possible. We use such technologies in order to provide you with an optimal resource-saving process in production areas with safety issues or in highly sensitive areas.

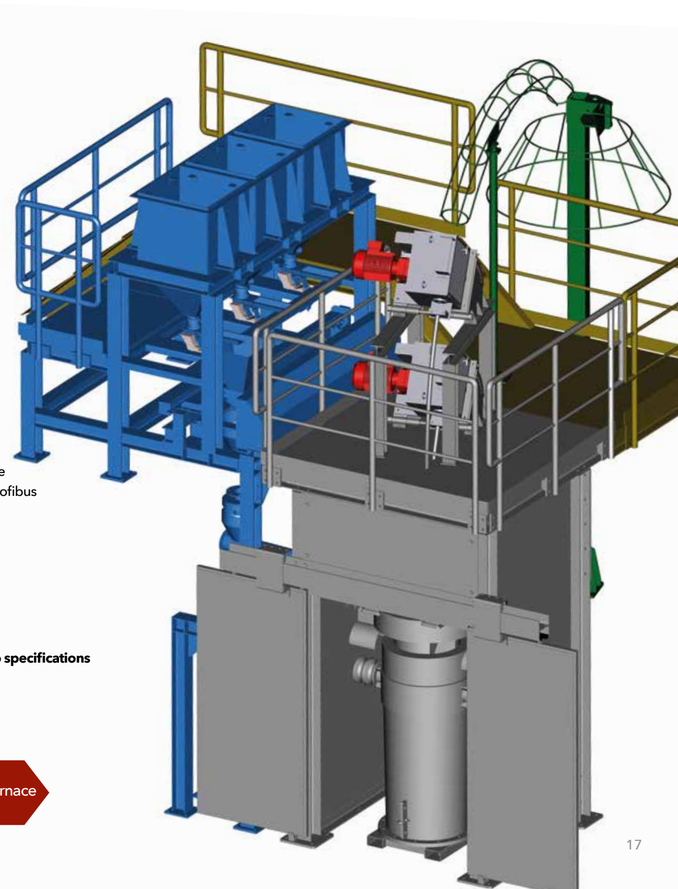
The plant shown here, which consists of a dosing system for aggregates and a wire-feeding system with two wire-feeding machines, enables automated process sequences through such links. Using the melt analysis as a basis, further processes such as melt correction and melt treatment are automatically controlled and centrally monitored.

Independent of the operator, all production relevant data is transferred to the appropriate interfaces in real time. By connecting to a central network or operating data system via profibus connections, all parameters required for the manufacturing process can be analyzed, controlled and influenced.

Benefits for the operator:

- **Real-time process monitoring**
- **Display of parameters such as melting temperature, melt analysis and weight**
- **Computer-based independent evaluation and correction of the melt according to specifications**
- **Documentation of the processes and creation of quality protocols per batch**

Induction furnace → Dosing system → Wire treatment → Casting furnace



TECHNICAL DOCUMENTATION

The technical documentation serves to inform and instruct defined target groups, to secure the manufacturer's liability, to monitor the product, to ensure traceability and reproducibility as well as for permanent or legally required archiving. When modernizing a machine/system, the existing "old" technical documentation often plays a significant role. Here the manufacturer has the duty of care to determine whether the residual risks identified in the risk assessment have already been taken into account in these documents.

In particular, safety-related components and their functions must be prepared in a comprehensible and target group-oriented manner in order to guarantee the highest possible level of safety for the persons taking action. Foundry Service creates project-oriented technical documentation in accordance with current EC directives, e.g:

- **Machinery Directive (2006/42/EU)**
- **Low Voltage Directive (2014/35/EU)**
- **Directive on electromagnetic compatibility (2014/30/EU)**

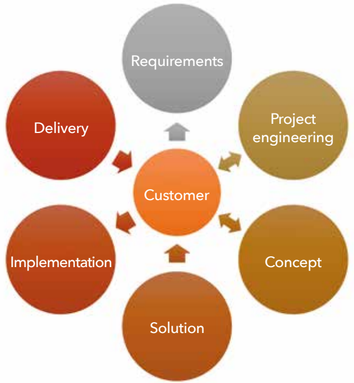
When a control system is modernized, the technical documentation usually consists of the following components:

- **Review and assessment of the existing technical documentation**
- **Risk assessment according to EN ISO 14121-1**
- **Evaluation of the performance level (PL) according to EN ISO 13849**
- **Operating or user manual**
- **Electrical documentation with circuit diagrams, item parts and spare parts lists**
- **Measurement protocols for electrical safety (e.g. protective conductor resistance, insulation resistance, high voltage test)**
- **CE conformity declaration**
- **External documentation of the installed components**

CUSTOMIZED SOLUTIONS

Individuality is the ability to stand out from others. One of our abilities is our strength in developing creative, customized and individual concepts for your unique requirements. Transparent development and production steps let you participate in the implementation and give you the opportunity to help shape the individual process steps. The use of high-quality parts and components guarantees reliability and a long-lasting product. Uncompromising time management, from concept to commissioning, is a sure guarantee that your projects will be implemented precisely.

We see ourselves as a system supplier who places you as a partner at center stage.
Your requirements are as unique as our products. Our passion for optimal solutions gives you the freedom for your individuality, which distinguishes you from others.



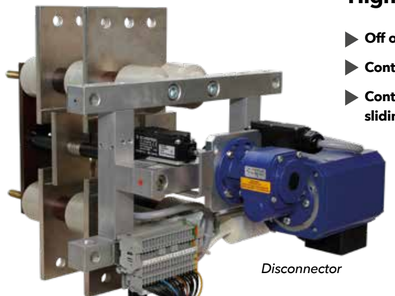
PRODUCT RANGE
POWER/CONTROL TECHNOLOGY

Foundry Service is a system supplier for all components of control and power electronics. Manufacturing and procurement are a central issue in order to keep downtimes to a minimum. By stocking various components, we can respond promptly to your requirements. Short production cycles and optimized purchasing of goods enable us to achieve short procurement times, which gives you the decisive time advantage.

- **Transformers and chokes**
- **Capacitors**
- **Power contactors, high current switches and disconnectors**
- **Rigid and flexible power connections**
- **Control cards**

Preventive measures on site help you to locate weak points in advance. Plant inspections with Foundry Service give you the opportunity to minimize breakdowns and make optimal use of scheduled plant shutdowns.

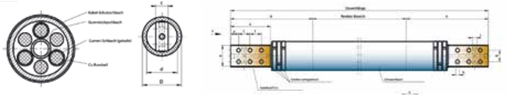
Cost and time-intensive measures can thus be avoided, which results in a resource-saving use of spare parts.



Disconnector

High current cables

- **Air and water cooled**
- **95 - 7,000 mm² cross section**
- **High quality raw materials**
- **Flat & round connections**
- **Flexible adaptation according to customer requirements**



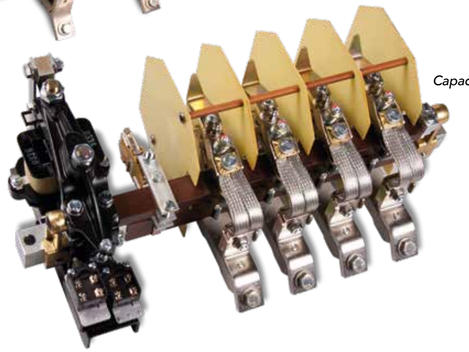
High current switches (load-free)

- **Off or changeover switch up to max. 50,000 A / 3,000 V / 0-150 kHz**
- **Control devices for controlling periodic switching operations**
- **Contact device for electroplating technology as prism and sliding contacts. Air and water cooled up to max. 20,000 A**

Feed contactor

Power contactors (under load)

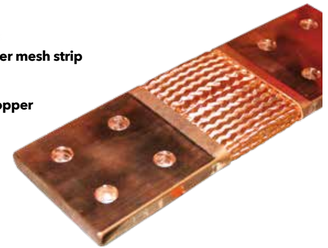
- **Direct current contactors up to max. 12,000 A / 3,000 V**
- **Medium frequency contactors up to max. 12,000 A / 3,000 V < 10 kHz**
- **Medium frequency contactors up to max. 24,000 A / 3,000 V**
- **Capacitor contactors up to max. 1,000 A / 3,000 V < 10 kHz**



Capacitor contactor

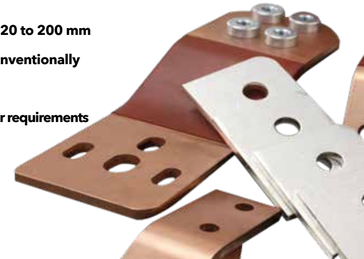
Conductor lines

- **Flexible conductor lines 25 to 4,500 mm² / copper mesh strip**
- **Pressure welded strips made of aluminum or copper**



Power rails

- **Automated production**
- **Material thickness: 5 to 15 mm / width 20 to 200 mm**
- **Other dimensions are manufactured conventionally**
- **Finishing possible**
- **Flexible adaptation according to customer requirements**
- **Shrinking tube, rivet nuts**



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