

MiRO

Controlling and Protecting Both Turbine and Generator

Replacing high- and medium-pressure parts and modernizing the low-pressure part of a steam turbine entail the replacement of automation and protection technology. MiRO uses the HIMax system from HIMA, which has been tried and tested repeatedly at the factory. It significantly simplifies MiRO's processes, provides turbine protection, and maps all functions on a single safety controller.

The Mineraloelraffinerie Oberrhein (MiRO) modernized a generator turbine at its power plant in Karlsruhe, Germany. The project was completed after 18 months. MiRO placed the order with turbine manufacturer Siemens Energy. Additionally, the plant operator decided to subcontract the modernization of the turbine train's automation technology to HIMA. The output of the generator turbine is 12.5 MW, the high/medium turbine pressure has a speed of < 10,000 1/min, while the low pressure speed is < 7,800 1/min. The generated electricity is primarily used in the refinery, while secondary steam is extracted in two pressure stages for the refining process. The turbine is now controlled, regulated, and protected using a HIMA TMC solution, while the generator protection is supplied by Siemens.

A Proven Safety Controller in Action

During the course of the project, HIMA worked closely with all commissioned companies to achieve MiRO's goals. HIMA implemented all of the necessary control functions in the steam turbine application, including overspeed protection. As a long-standing HIMA customer, MiRO was familiar with the HIMax safety controller as well as the SILworX software used to program and configure it. This simplified operation and maintenance. At the customer's request, HIMax was also used in the modernization project.

Turbine Protection Implemented via an Integrated Solution

For operators like MiRO, ensuring functional safety for turbomachinery in accordance with IEC 61508 and IEC 61511 Edition 2 is a top priority. The numerous requirements for turbine protection also include overspeed protection and emergency shutdown (ESD), which ensures the quick and safe shutdown of a turbine in an emergency. HIMA applied a solution that integrates both turbine protection, turbine regulation, and control and is implemented using HIMax. In addition to the application's safety functions, the safety controller also runs all of the calculations and algorithms to optimally align the generator turbine with power and process steam production. The HIMA solution manages the start/stop sequences and power output, rotational speed, and extraction pressure. It also automates heating processes for the high- and low-pressure steam turbines. The frequency regulator in the HIMA controller must accurately maintain the controlled variable in order to meet the strict requirements of the plant operator.

Automation of Test Routines and Test Runs Simplifies Processes

The HIMax safety controller and the X-MIO overspeed protection modules are housed in a single switch cabinet to save space. The overspeed protection modules perform cyclical self-diagnosis

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to detect potential problems. Since the generator turbine must be operated up to SIL 2, regular test routines of the hydraulic protection circuit are necessary. To this end, HIMA controller automatically performs the 2oo3 trip block test every 90 days. These automated processes mean that MiRO avoids considerable manual effort, which would otherwise be necessary for the test runs. Integrating all relevant functions into a single HIMax reduces the amount of equipment required and simplifies maintenance.



All turbomachinery functions in a single safety controller:
HIMax SIL 3 Controller

“HIMA has been a partner for many years and was able to reliably carry out the assignment. The modernization of our generator turbine’s automation technology at our Karlsruhe plant fully met our expectations, integrating all the required turbine protection functions while providing optimized regulation and control. The integrated solution from HIMA makes it much easier for us to adapt the operation mode to the refinery process. We profit greatly from the fact that all functions are mapped in a single controller.”

Sebastian Bauer
Automation Project Engineer, MiRO

About MiRO

The Mineraloelraffinerie Oberrhein (MiRO) in Karlsruhe is Germany’s largest refinery and one of the most modern and efficient refineries in Europe. For partners Phillips 66, Esso, Rosneft, and Shell, 1,000 employees refine crude oil into high-quality petroleum products such as petroleum, diesel, heating oil, propylene, and bitumen – around 14 million tons per year. MiRO is the most important source of supply for mineral oil products for south-west Germany.

Technical Details

HIMA provided the following services for the modernization project:

- One HIMA safety controller in a switch cabinet with two racks.
- Four X-MIO overspeed protection modules: Two for the high-pressure part and two for the medium/low-pressure part (one for protection and one for redundancy for maximum availability).
- Complete hardware and software engineering with SILworX.
- Software library for the turbomachinery solution.
- HMI programmed with Genesys64 and supplied with data via OPC DA and OPC A&E.
- Modbus slave communication to the controller and Modbus master communication to the monitoring system.
- HIMA lead the project under a subcontract and worked closely with the machine manufacturer Siemens Energy.
- A HIMA employee performed the commissioning on site over a six-week period.

The Benefits

- **Integrated turbomachinery solution:** MiRO benefits from the fact that all functions such as control of power, speed, extraction pressure, and all safety-relevant functions are mapped within a single HIMax.
- **Effective turbine protection:** Overspeed protection and ESD of the HIMA solution exceed the requirements of API670 and API612.
- **Less effort with engineering tools:** All functions are implemented in one controller, so everything can be programmed and configured with one engineering tool (SILworX).
- **Easier maintenance and servicing:** The use of only one controller with integrated task profile ensures quick and easy availability of spare parts.
- **Simplified processes:** Automation eliminates the need for time-consuming manual test routines, such as the weekly function test of the overspeed protection device.
- **Close coordination with all companies involved:** HIMA worked closely and purposefully with all companies commissioned by the plant operator.
- **Optimized cost ratio:** All factors resulted in an optimal, cost-effective ratio for the plant operator.



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