



Complete Burner Automation with Safety Controllers

A new solution for simple single and multi burner arrangements through to complex BMS applications, e.g. for power plants, waste incineration plants or processing plants

Burners belong to the most safety-critical and complex systems. Based on the safety-related systems *HIMatrix* and H41q/H51q, HIMA can provide a new solution: the integration of the complete burner automation into the safety controller. This solution reduces costs, increases safety and availability and meets the latest standards and guidelines.

Burners are found in different designs, applications and industries. Apart from cost-effectiveness, the adherence to numerous standards must also be considered in the planning and operation of burner systems. The safety-related automation of burner systems is tightly governed by laws, guidelines and regulations. These include national and international standards such as IEC 61508, prEN 50156 or DIN 12952/12953, which place new demands on burner automation.

Solutions for single and multi burner arrangements

Until now, BMS solutions (Burner Management Systems) for single and multi burner arrangements have been characterised by a clear separation between burner monitoring and burner control. Both functions are set up and connected independently in these solutions.

The disadvantages of this hardware solution are manifold. In addition to spending double the time and money on clarification, planning, logic design, wiring, testing, commissioning and documentation, the time and money spent on tests, commissioning and finding errors is even greater. A further flaw is the lack of transparency, the creation of additional sources of error as well as the limitation in terms of enhancements and modifications as well as in the scope of functions.

Press Contact:
HIMA Paul Hildebrandt
GmbH + Co KG
Nicole Pringal
Postfach 1261
68777 Brühl
Phone: (+49 6202) 709-405
Fax: (+49 6202) 709-123
E-Mail: n.pringal@hima.com
Internet: <http://www.hima.de>



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Integrating the safety system into the burner automation

HIMatrix compact and modular safety-related controllers from HIMA now make it possible to integrate the entire burner automation into the safety system.

The *HIMatrix* concept is universal and contains a compact PES (programmable electronic system) as well as analogue remote I/O for the implementation of analogue control loops. The features of these controllers are:

- Certified to SIL 3, Cat. 4
- Response time smaller than equal to 20 ms
- Cycle time for 1 K program approx. 0.02 ms
- Communication via **safeethernet**, Profibus, OPC, Modbus, Send&Receive TCP
- Drag and drop programming with the engineering tool ELOP II Factory

With *HIMatrix*, the entire functions of central and distributed safety applications can be implemented in the burner automation using just one system. This reduces the time and money spent on planning, wiring and documentation. The universal diagnostics via a network makes locating faults easy. Modifications and enhancements can also be carried out more easily. The *HIMatrix* systems are certified to IEC 61508, prEN 50156, EN 12067, EN 298 and NFPA and use state-of-the-art technology.

If you wish to automate a multi burner application, various safety-related networked solutions can be set up according to individual requirements using the *HIMatrix* systems. In addition to burner control and burner monitoring, boiler automation tasks such as level control and load con-

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Control can also be integrated into the systems. The result is a flexible, safety-related automation solution which meets the requirements of the latest standards.

By integrating the entire burner automation into the HIMatrix system, we have been able to:

- Eliminate conventional hardware
- Process all signals, including safety-related analogue signals, in the safety system
- Integrate non-safe I/Os e.g. via the WAGO I/O system or Phoenix INTERBUS
- Carry out programming using drag and drop software and certified function blocks
- Use displays for control, visualisation and remote diagnostics

The safety-related networking of the *HIMatrix* systems takes place via **safeethernet**. The safety bus is based on standard Ethernet technology and has TÜV/BG certification. **safeethernet** accelerates the transmission of safety-related data to 100 Mbps and now even supports the use of the entire range of Ethernet functions for setting up networked applications. *HIMatrix* systems and **safeethernet** - a combination of high-speed safety controllers and high-speed safety bus - offer a high degree of flexibility for safety-related automation process solutions. New features such as remote diagnostics via modem or Ethernet/Intranet/Internet are also possible.

Certified function blocks are available optionally for *HIMatrix*. The implicit libraries with TÜV-certified burner blocks and controller function blocks make programming easier. Proven functions meet the requirements of the latest standards and simplify the approval of the entire system. All

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functions are available in offline simulation. An online test function makes it easier to perform validation and commissioning.

For *HIMatrix* as well as for the safety-related HIMA controllers H41q/H51q, an infrared touch panel with dynamic operating images, alarm lists, help texts and trends can be delivered for controlling and monitoring the systems locally. The standard communication takes place via MODBUS RTU, MODBUS TCP, Profibus-DP, OPC as well as Send&Receive TCP.

Solutions for complex BMS applications with a central control

The concept of integrating the entire burner automation into the safety system is also provided by HIMA for complex systems in the process industry. More complex systems place increasing demands on system availability. With the H41q/H51q systems, HIMA can provide solutions for complex BMS applications such as those found in power plants, waste incineration plants or processing plants. In this type of application, the burner automation is usually an integral component of the process automation.

In order for the entire burner automation to be integrated into the safety system, it must be possible to process large amounts of I/Os and various types of signals. In addition, redundancy concepts are also required to increase system availability and communication functions must be extensive. While the distributed *HIMatrix* systems were designed especially for applications which do not require redundancy, the H41q/H51q systems are used for complex application solutions of this type.

The H41q/H51q systems were the first safety-related controllers in the world which could be used without restriction in mono configurations up to SIL 3. In addition, they are the world's first [2oo4D/QMR systems](#) to have been certified to the new international standard IEC 61508 from

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TÜV for applications up to SIL 3. The modular set-up, scalability in terms of scope and redundancy and extensive I/O range of modules for large and small systems mean that these systems can be adapted to the application-specific requirements of the process very easily. The safety-related communication takes place via safe**ethernet**, the standard communication via OPC, Profibus DP or MODBUS.

The controllers of this family are designed in 19" technology. The compact H41q systems are suitable for automation tasks with up to 208 I/O points. The modular H51q systems, which can be enhanced, are used for the safety-related automation of medium and large systems. Both systems use the same extensive safety-related range of I/O modules: analogue and digital input and output modules, counter modules as well as special I/O modules for the ex area.

H41q/H51q are characterised by the following features:

- Use of mono systems
- Up to SIL 3
- Maximum fault tolerance in a redundant configuration
- Simple, modular scalable redundancy
- The same range of I/O modules for large and small applications
- Extensive, intelligent diagnostic functions
- Modular expandability and possibility of replacing modules during operation
- Intuitive, IEC 61131-3-compliant programming
- Extensive [integration/communication functions](#)

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A practical example: safety system for new cracking furnace for OMV

A H51q system is being used in a current HIMA project in a new cracking furnaces of OMV Deutschland GmbH. OMV Deutschland GmbH, a subsidiary of the globally active, Vienna-based OMV Aktiengesellschaft, is the only integrated oil and gas enterprise in Bavaria and the largest supplier of mineral oil products to Bavaria. In Burghausen in Bavaria, OMV operates a refinery with a processing capacity of 3.531 million t of crude oil and semi-finished products. As a petrochemical refinery with an ethylene plant, Burghausen supplies the south-eastern Bavarian Chemical Triangle with ethylene and propylene for the production of plastics.

Cracking furnaces are used in the production of ethylene and propylene from intermediate products of crude oil refining. The larger hydrocarbon molecules contained in the raw gasoline (naphtha) are thermally cracked in the cracking furnaces. In the following ethylene plant, the cleavage products are separated and cleaned, so that high-purity ethylene and propylene are created. Ethylene and propylene are used as basic materials for polyethylene and polypropylene as well as for other products in the plastics industry.

By constructing the new cracking furnace for around 26 million Euro, OMV Deutschland GmbH invested in the modernisation of their petrochemical plants for the production of ethylene. It has a power load of 78 MW and - in addition to the chemical conversion - it provides an hourly rate of 48 t of steam, which can be used for energy generation. The new cracker ensures increased cost-effectiveness and safety with improved environmental compatibility. Thanks to its high capacity of 42,3 t/h, the cracker replaces three old furnaces, for which high maintenance costs would have accrued in the future. Ten cracking furnaces are currently in operation in the refinery. Due to the modern heating installation, it is

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possible to reduce not only the consumption of heating gas but also pollutant emissions, with a relatively high ethylene and propylene yield.

The operator made the decision to install the multi burner arrangement with a total of 32 burners in the final extension on a central, maximum available system. HIMA was commissioned to implement a safety-related control solution in the project. Because maximum availability of the safety functions had to be ensured in Burghausen, it was decided to use a H51q system.

The special challenge posed by this order was the strict conditions and the demands posed by the emission laws, the large dimension of the plant and the adjustment to the local circumstances and demands of the existing plant parts and used system components.

The solution consists of a H51q system with approx. 1000 inputs/outputs for the control and automation of the multi burner system, including the safety-related monitoring of the multi burner system. The HIMA system performs the following tasks:

- Activates the safety cut-offs upon detection of a critical state
- Monitors the safety devices such as flame detectors, ignition system, exhaust gas sensors etc.
- Monitors the combustion chamber conditions in terms of temperature, ventilation and pressure
- Monitors the safety times for opening and closing the actuators, for ventilation, ignition etc.
- Monitors the emission values in the chimney
- Automatic ignition devices
- Automatic monitoring of impermeability
- Automatic changeover of furnace to the decoking or cracking operation (including the monitoring of the corresponding flaps).

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The HIMA system meets the standards IEC 61508, IEC 61511, EN 298, EN 12067, EN 1643 and the established ATEX guidelines as well as the plant standard of OMV.

The high level of experience gained by HIMA in the area of burner automation was an important aspect in the decision made by the customer to go ahead with implementing the safety technology from HIMA. From the product point of view, the reliable system technology as well as its ease of maintenance, flexible utilisability and simple implementation of the demands despite the complexity of the tasks posed played a decisive role.

HIMA also maintains an on-site service office at the Burghausen refinery. Besides the H51q system, consultation regarding the creation of the concept, the realisation of the application software and the commissioning of the safety-related parts in the plant were included in the scope of delivery and services provided by HIMA. Engineering was carried out by HIMA and OMV jointly.

A special feature of the furnace is that it consists of two halves that are to be operated separately. While one furnace half is in cracking operation, the second half can be automatically decoked. The automatic changeover to decoking or cracking operation with only one furnace half, was realised including the monitoring of the cracked gas slide valve in the HIMA control.

The concept of executing the entire automation of the cracking furnace was developed and realised by HIMA together with Linde AG and OMV.

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The new cracking furnace in the Burghausen refinery was officially put into operation in February 2004. The period between the award of contract and start of production available to the experts at HIMA for implementing this burner automation was only six months.

Author: Dr. Peter Stipp, freelance editor

Figure 1: Previous solution

Figure 2: Cost-effective HIMA solution

Figure 3: H51q system for complex BMS applications

Figure 4: New cracking furnace installed at OMV Deutschland

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