



Clarity in terms of drives

Intelligent wiring system reduces downtimes in plastics production.

The Lemförde BASF plant handling system is a crucial element in the process chain that transports barrels around the facility. After an upgrade to the 25-year-old system, SmartWire-DT enables the simple power measurement of each individual drive in collaboration with Eaton motor protection switches, thereby supporting precautionary maintenance. In the event of a fault, the drives affected can be deactivated in a controlled manner before the motor protection switch triggers.

Location:

Lemförde, Germany

Challenge:

Upgrade of the automation technology of a conveyor system with the requirement of being better able to measure the currents of the individual drive for faster fault identification.

Solution:

SmartWire-DT intelligent wiring with motor-protection switch PKE and PROFINET gateway.

Results:

With the use of Eaton technology, BASF can increase its system availability. Thanks to the direct measurement of the drive current, faults can be localized and rectified more quickly. The motor-protective circuit-breaker is not triggered in the event of overload; only the associated contactor is disconnected. Instead, once the overload situation is rectified, for example a jammed barrel, the motor can be switched on again via the control unit without the maintenance personnel having to first reset the protection switch. This means that the system is back in operation more quickly.

“With SmartWire-DT and the PKE motor protection switches, we can identify and rectify faults more quickly. This reduces assignments of staff electricians.”

Thomas Büch, BASF

Background

Polyurethane (PU) is one of the most widely-used polymers in the world; the myriad applications – coatings, foams, fibers, moldings and elastomers – demonstrate its versatility. The material creates optimal cushioning in sports shoes, serves as body trim on cars, insulates cables and damps down noise through walls and roofs of buildings.

The market and technology leader for PU systems in Europe is BASF Polyurethanes GmbH, established in 1962 and based in Lemförde near Osnabrück, Germany. At this facility, 1,500+ employees generate sales of over two billion EUR.

A key section of the plant is the barrel feeding system: it transports 55-gallon (200-liter) drums filled with raw materials or finished products to and from the two production halls to the barrel warehouse.

“There is a whole chain of processes behind the system, with no buffer stock between the individual process steps. If the feeder system fails, the production process can run into problems,” says Claus Buhrmester of the plant’s Maintenance Systems team, emphasizing the system’s significance.

Challenge

After 25 years in operation, the barrel transportation system wasn’t filling modern-day requirements. Thomas Büch, a member of Site Engineering Lemförde’s Technical Team, explains: “The system was controlled by three PLCs that had to be replaced as spare parts were no-longer manufactured. The safety levels were not state-of-the-art and we had no plant visualization. Manual operation to rectify faults in the event of failure was also not possible.”

Within the framework of the upgrade project, it was decided to update the automation and safety technology. During this process, a total of 50 three-phase motors had to remain operational for the feed route and the five integrated vertical feeders.

Solution

As part of the modernization project, the barrel transportation system, consisted of three autonomously controlled systems, was now controlled centrally from the PLC. “This simplified the structure of the automation architecture and the consolidation of the three control cabinets allowed us to save valuable space,” explains Büch.



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In addition, operator panels were installed at the critical points of the system to aid visualization. Now the operator is able to identify barrels that are not removed from the transport system in 'real-time' and can see when congestion occurs. The operator panels are also important for preventive maintenance, as Buhrmester emphasizes, "The system displays the type of error that has occurred. We can distinguish, whether it is a runtime error due to an overcurrent or frequent switching on and off, for instance." As a result, the maintenance team is provided valuable information in order to act early and proactively test the drives or mechanics.

To enable this error detection, the BASF team paid close attention to the current measurements on the drives. "This was the main reason for us to wire the control cabinet with the SmartWire-DT intelligent wiring system," explains Büch. It connects the individual switchgear and drives not via point-to-point wiring with the control, but all devices are connected via an eight-pole flat cable – SmartWire-DT. This now supplies all the devices connected with power and simultaneously takes care of data communication.

"By using system tools and components, wiring errors are virtually eliminated," explains Thomas Gern, Head of the Industrial Systems Technology department at Elektro-Anlagen-Technik EAT GmbH. Based in Wallenhorst, Germany, the electro-technical service provider built the control cabinets for the BASF plant. "Routine testing of the cabinet can therefore take place within a very short time. After a brief system introduction at our end, our control cabinet makers were able to complete wiring in half the time in comparison with conventional point-to-point wiring." What's more, the system also saves space in the control cabinet. For the control of the contactors and the feedback from contactors and motor circuit breakers, no inputs or outputs of the PLC are needed. All input signals are collected via SmartWire-DT and transferred to the PLC. Output information of the controller is processed via SmartWire-DT directly in the switching device.

"The best visualization is pointless if the key information from the field is missing," says Buhrmester, summarizing what he as a maintenance technician considers to be the crucial benefit of SmartWire-DT.

The overriding advantage of the PKE motor-protective circuit-breaker compared with conventional alternatives lies in the expanded drive monitoring. The diagnostic, status or overload messages show the actual flow of current and the status of the overload trip device. Moreover, the actual motor current can be continuously displayed and analyzed via SmartWire-DT for switchgear without the need for any additional components.

"If we used a standard current measurement technology, it would have been much more expensive," adds Büch. He also mentioned another benefit, "Of particular interest in this case is the option to operate the PKE as a motor protection relay. The motor-protective circuit-breaker is not triggered in the event of overload; only the associated contactor is disconnected."

In the past, the release of the switch has required the electrician, which can leave the conveyor system at a standstill when one wasn't available. Instead, once the overload situation is rectified, for example a jammed barrel, the motor can be switched on again via the control unit without the maintenance personnel having to reset the protection switch. This also means that the PKE can be installed in locations that are not readily accessible."

During the modernization of the plant, BASF was able to divide the plant into different security areas. In the past, if an emergency-stop button was pressed, the entire system stopped and confirmation for a re-start was only possible from a central location. To optimize this outdated condition, via the power-feed modules that supply the switchgear with power in the SmartWire-DT system, safety zones have been created – one module supplies the power to the drives within its safety zone. In the event of an emergency stop, the relevant power-feed module and the high-level, redundant group contactor are switched off.

This means that the system only shuts down in this particular zone. Authorization to re-start is possible via the corresponding operator panel on site.

"In general, we mainly retrofitted the safety technology we had," says Büch. Many safety-light barriers and fence elements were installed. In addition, the system was fitted with a hand-held control panel with 'dead-man' function. This allows the operator to control the system manually for routine maintenance tasks, such as lubricating the conveyor chains or identifying an error. The entire safety technology communicates with the controller via PROFINET. For that reason, Büch connected the SmartWire-DT system with a corresponding PROFINET gateway.

Results

"Thanks to the upgrade of the system, we already avoided pulling in our 'on-call' electricians during the night time or over weekends," summarizes Büch. "Furthermore, the system is back up and running much faster after an overload situation. Slightly increased current levels, for instance in the event of mechanical faults, are identified more quickly and can be rectified in good time. In particular, for drives that are usually in operation for only a couple of minutes per conveying cycle, an early identification by a conventional motor-protection switch would be virtually impossible." Buhrmester adds: "With the information of each individual drive, the cause of a fault can be found and rectified easily."



Within the framework of the project, the automation technology of the barrel transportation system at BASF was upgraded with its 50 drives



With the use of various operator panels spread across the system, to which the SmartWire-DT system communicates the information, the employees can see when and why a fault or downtime occurs



With the use of SmartWire-DT, all motor protection switches become smart and communication-enabled components; Claus Buhrmester, BASF: "We can distinguish whether it is a runtime error due to an overcurrent or frequent switching on and off."



Via gateways, SmartWire-DT can be connected with all standard fieldbus systems, e.g. with Profinet as at BASF



Thomas Büch, BASF: "If we had used a standard current measurement technology, it would have been much more expensive."

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