



Sensor technology ensures a smooth finish at Opel

When Siemens introduced new automated sensor technology to the paint line at Adam Opel's Rüsselsheim plant the benefits were immediate. **Birgit Gottsauner** explains how Siemens' expertise helped the automaker make savings and improve efficiency

Automation has been highly valued for almost 25 years at Opel's plant in Rüsselsheim where the carmaker assembles and paints all its Vectra models and it is the paint line in particular which has most recently benefited from the latest automation technology.

Flaws such as air pockets in the paint finish of vehicles have to be removed at rework stations and the task is now automated with the latest in sensor technology from Siemens. It is a modernisation project with estimated savings over conventional technology of 15-20 per cent.

Totally Integrated Automation

With over 1 million m³ of enclosed space, the painting facility has the dimensions of a soccer stadium. Of the 3.5km of conveyor lines installed in the paint shop, 1.2km account for the connection to the body-in-white assembly and about 800m for the removal of the painted cars. In between lies a buffer for up to 426 vehicles. The facility is designed for a daily capacity of 1,495 vehicles and 108 car bodies per hour can be painted in a two-shift operation.

The touch up of paint flaws takes place at the first floor of the facility, which is why lifting equipment in addition to conventional roll conveyors, cross conveyors and chain

conveyors are in use. The interaction of these components, as well as the work and operational safety of this system, is ensured by Siemens' intelligently linked sensor modules. Siemens was also the technology partner for the implementation of the system and it represents an outstanding example of the Siemens' Totally Integrated Automation (TIA) concept giving the highest level of safety, reliability and availability.

Pilot project

"The automation and drives technology for this area was converted during the plant shutdown of the summer 2003 holidays. For us, this system represents a pilot project to validate the reliability and functionality of the latest in sensor and automation equipment and to qualify them for other applications in our company," says Albert Hoehn, Manager of Technical Services for the painting facility and the engineer responsible for the project.

"From the relay control and tele-mechanics, as well as the first Simatic S5 and S7 systems, up to the fieldbus technology and the modern Ecofast systems, we are employing all versions here," emphasises Hoehn. This favoured the planned switch to an exemplary TIA concept.

The pilot project concentrates on the transport of the car bodies to three rework stations with the subsequent return to the paint shop. After moving the car bodies from the overhead conveyor system onto skids (conveyor pallets), they are transported fully automated across two levels.

A Sicalis PMC7_CS acts as the control system, which enables the safe operation and monitoring of all processes transparently under a uniform user interface. Of particular benefit is the integrated quick and safe error detection, which is supported by the uniform operating and diagnostics capability of the Sicalis platform. A failsafe Simatic S7-416F coordinates the safeguarding systems in the form of a remote master control station.

Sensor innovations

The modernised plant offers important innovations, especially on the sensor side. Thus, a laser scanner LS4, mounted in front of the upper rolling gate of the lifting apparatus, communicates directly



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with the programmable logic controller (PLC). It does so at the Profibus DP via Profisafe, the failsafe communication profile for fieldbuses, while consequently utilising the safeguarding technology integrated in the PLC.

The scanner offers an operating field of 190°, in which exactly defined protective zones can be monitored. In doing so, even persons in dark clothing can be recognised from a distance of up to 4m. Warning signals can be emitted for persons and objects up to 15m away. In this application, the laser scanner was one of the world's first Profisafe-installed devices of this type.

Next to it, a three-beam category 4 light grid, as well as four photo sensors with IQ-Sense, provide for optimal personal safety on the conveyor route and high application flexibility. In this context, IQ-Sense means that the sensors and the control can be combined to form one system with little work. Via a two-wire cable, power and data can be transmitted simultaneously giving optimised communication on the side of the sensor/control module.

Adaptable technologies

A special advantage of the IQ-Sense technology lies in its quick and easy commissioning since the sensor can be calibrated via the IntelliTeach function to detect new objects. The settings can then be transferred to any other sensor for additional timesaving. Furthermore, IQ-Sense allows for channel-precise system diagnostics and thus provides additional safety. Wire breaks, short circuits, misalignment or failure of the sensor/module are reported automatically, assisting in the avoidance of malfunctions and the minimisation of downtimes.

Another highlight are the two optical proximity switches with IQ-Sense in the C40 form factor that are employed directly at the lifting device and control the roller grate installed there. Its motor starters are activated by the sensors once a car body has been detected. Differing from inductive proximity switches, these photoelectric proximity switches can detect objects irrespective of their composition, be it metal or other materials.

On the cross conveyor route to the rework stations, inductive proximity switches at the skids ensure their precise positioning,



Inductive proximity switches at the skids ensure precise positioning



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including the required acceleration and braking profiles. For this purpose, metallic signal ramps are installed at the conveyor line, which, when run over, are detected by the inductive alternating field of the proximity switches and trigger a corresponding notification of the PLC.

Intelligent combinations

For the distributed connection of the sensors in the field, a Simatic ET 200SF station is employed, which also communicates with the failsafe Simatic controller directly via Profisafe. Intelligent motor starters or frequency inverters from the Ecofast program control the drive motors of the conveyor units.

The electric power for the drive units comes from an energy bus, while the communication takes place via Profibus DP. In case of errors or intended switching operations, the individual groups and the primary circuits are safely deactivated via the motor starters. Opel has now also standardized this functionality for other applications.

The sensory integration into the higher-level process control takes place via the contactless operating identification system Moby I from Siemens. It has been the standard at the Opel painting facility for a long time. Each car body is clearly identified via a Moby I data medium.

A great advantage is the high IP 67 degree of protection of the components used, which enables the operation in rough industrial environments. Motor starters, for example, no longer need to be installed in control cabinets, but can be mounted directly next to the drive motors.

Of great importance for Opel, besides the technical functionality, was the outstanding service provided by the technology partner. "During the two-shift operation, we sometimes require the full support of our partner – also at unusual times," explains Hoehn. "With its commendable commitment, Siemens has contributed to raising the availability of the facility from 85 per cent to 99.85 per cent."

The Profisafe components used (S7-416F, 417F and ET 200SF) have been added to the Opel-approved components list. This paves the way for their application in other European plants such as in Gliwice in Poland and in Antwerp in Belgium. *