Smart Labels control the Production

Mercedes-Benz Plant Rastatt (Germany)

Ever since a new standard for radio frequency identification (RFID) was introduced a few years ago – enabling the use of low-cost labels over a long range – the corresponding systems have begun their triumphant advance into production and logistics applications. For the first time, a leading German carmaker is now successfully relying on the new technology for the entire production at two of its plants.

Car bodies move through the halls of the Mercedes-Benz plant in Rastatt (Germany) as if controlled by magic. Numerous variations of the new B-class and the future A-class, which customers can customize using a configurator, are produced here for the world market. For the production to remain flexible as well as efficient, Daimler has been relying on a proven aid for many years: radio frequency identification – RFID for short. RFID readers are installed at all locations in the production where information on the vehicle is needed. In this connection, transponders mounted to the car bodies carry along all the data required for manufacturing the individual vehicle. It is therefore possible for different equipment levels or colors to be run through the various production sections one after the other.

However, instead of the previously employed circulating data media, the Rastatt plant is now relying on a solution with single-use RFID labels from the RF600 product line by Siemens. These RFID labels are designed as disposable transponders and – mounted to the wheel housing of the future vehicle – accompany the car body through all production steps from the body shop to the paint shop to the final assembly.

This is the first time a German carmaker chose UHF RFID technology, which was originally designed for controlling logistics flows. The new Mercedes-Benz plant in Kecskemét (Hungary) is also employing the RF600 system right from the start.
The technology is based on the use of radio frequencies around 865 MHz, which makes possible low-cost transponders that also provide a long range. Together with Daimler, Siemens has refined this technology to meet the special requirements of industrial applications. Among the requirements are the ability to withstand high ambient temperatures, for which the innovative, heat-resistant smart labels SIMATIC RF680L were developed.

A special testing process during the label production ensures an extremely high quality. The new transponders thus withstand temperatures of up to 220 °C, encountered during the painting and drying processes, and do not require removal from the vehicle.

A second major innovation step pertains to overcoming the unfavorable radio conditions in the factory. Thanks to new algorithms, which are based on the intelligent adaptation of the transmission power and the evaluation of the reading results using statistical methods, it is now possible to realize a reliable RFID detection even in the most difficult places. For instance, in clean rooms, which are fully lined with metal, a high level of reading reliability can be achieved despite overshoots and reflections. The RFID reading devices are able to adjust to changing conditions within certain limits. Even so, the RF600 components remain fully compatible with the standards EPCglobal and ISO 18000-6C.

At the Rastatt plant, two types of RFID reading devices by Siemens are employed: the SIMATIC RF620R, which can be installed very quickly thanks to its integrated antenna, and the SIMATIC RF630R with antenna RF642A, which is particularly suitable for highly reflective sites. The readers are integrated into the existing PROFINET and PROFIBUS structures via the standard communication modules RF180C and ASM456, respectively. The RFID system is controlled by existing SIMATIC S7 PLCs and a Daimler-created visualization system. In total, over 300 RFID readers are in operation at the Rastatt plant; an additional 200 RF600 reading devices were installed at the Kecskemét plant. Daimler chose a decentralized data storage concept with the most important data being stored on the RFID label – the information required can thus be quickly retrieved without having to access a background system. All other data can be requested from the production control system if needed; for this, each label also contains a unique identification number.

With the introduction of the new system, several challenges had to be solved. For instance, the new RFID system had to be installed in parallel to the old system, since the previous vehicle generations were not to be altered until their end of production. For that reason, it was also necessary to carry out the implementation while the factory remained fully operational.

A team made up of RFID experts, programmers and plant specialists from Daimler and Siemens organized the transition and made sure that the production of the previous generations continued smoothly. The planned further developments to the firmware of the RF600 readers were closely synchronized with the project, which are now taking effect in other applications and industries as well.

The new technology offers significant advantages to the plant. Unlike in the previous system with active transponders, batteries are no longer needed. Also no longer applicable are the previously necessary transponder cleaning and in-plant return of the transponders from the final assembly to the body shop.
Siemens was selected as the partner for the implementation based on its powerful products and willingness to bear—together with Daimler—the risk of a technology change during ongoing production. After rigorous pilot tests, the Siemens readers fully met the customer requirements with regard to reliability and practical suitability. Furthermore, the experts from Siemens have, with Daimler, intensively optimized the installation of the delivered assemblies—until maximum performance and reliability were truly achieved. The combination of plant understanding, automation know-how and RFID expertise greatly determined the success of the project. The result: A reading rate that averages 99.99% in the surface finishing plant section, which is particularly critical for radio frequency identification due to its environmental condition.

The switch to SIMATIC RF600 and the heat-resistant smart labels RF680L has proven successful. The technical objective of replacing the previous RFID system was met, just like the changeover during ongoing production with minimal disruption. From a cost standpoint as well, the new solution has turned out to be beneficial. In the future, the production of each vehicle at the Rastatt and Kecskemét plants will be controlled by RFID smart labels.