Non-contact Guidance

RFID Technology coordinates smooth Manufacturing- and Data Flow in fully automated Assembly Lines

In an integrated overall concept, proven RFID technology accurately guides the components being made in different variants through various stations of fully automated assembly lines. Non-contact read/write transponders carry along the status of the assembly steps executed, the destination addresses, and – as required – also the inspection results. Very high read rates and virtually zero-defect quality are achieved here.

At fully automated assembly lines, the question almost always arising is how the automation technology correctly directs the products to be manufactured to the necessary stations, and at the same time acquires and documents the assembly progress. Especially at complex lines with diverse stations, which often also integrate multiple subassembly operations for different product variants, it is not easy to keep track of the manufacturing flow.

The business division Preh IMA Automation (PIA) of the Preh GmbH (see box) has found a reliably performing and cost-optimized solution. The company based in Bad Neustadt/Saale (on the Saale river in Germany) relies on proven RFID technology. RFID stands for radio frequency identification, i.e., the non-contact reading from and writing to mobile data storage units (transponders), which are attached to the circulating workpiece carriers. The plant constructor prefers to use end-to-end automation solutions from Siemens, which are customized to meet the requirements of the operators. Depending on the overall concept, either one central or several distributed controllers are utilized.

Modular and flexible – for a customized System Solution

Based on modules that are largely standardized with regard to mechanics and software, the PIA personnel plan and implement customized solutions that are matched to the customer requirements and the respective product quantity. Solutions range from a single manual workstation to flexibly connectable workstations (PrehFlex) to individual assembly cells (PrehCell) to complex, fully automated assembly lines. An adaptation to new product variants or changing product life cycles is possible at any time.

A current example is the fully automated assembly line for manual automobile seat adjusters. This line is intended for a well-known supplier and partner, who provides sophisticated mechatronic systems and components to the automotive industry. The assembly line is comprised of nine processing cells, which are connected with each other by means of a circumferential conveyor system. All in all, this line only occupies an area of 28 x 11 m.
After a processing step has been completed, the next destination address is written to the transponder, and the workpiece carrier will only be accepted at that station. Incorrectly performed steps result in the discharge of the component from the process and its further transport to an analysis station. There, the operator decides whether the component is repairable and can be returned to the process – or is removed for good. In the assembly line described, the components are inspected at the end of the assembly, after the correct execution of all work steps. The collected data, such as torque and rotation angle, is transmitted over the network to the master computer and archived. Furthermore, a serial number is generated, written to the transponder, and then lasered onto the component. The parts can thus be clearly identified and assigned to a batch later on.

Non-contact Identification – practically without Errors

“A decisive advantage of the non-contact reading via RFID when compared to optical systems is that the results cannot be affected by dirt on the optics, the quality of the code to be read, or changing lighting conditions. We are thus achieving extremely high read rates and an error rate close to zero,” states Klaus Rüster, head of the sales department for assembly systems and head of the marketing department at Preh Innovative Automation. “In addition, there is the possibility of writing data back onto the transponders. Depending on the task or customer requirement, we document and carry along the respective status following a processing step (OK/not OK) and/or the inspection results.” The transponders selected provide sufficient user memory for this with 8 KB of FRAM. They can be mounted directly onto metal and be read from and written to from a distance of up to 0.2 m. As a result, the demands on the guideway precision are not extremely high while still ensuring a reliable operation. The ISO 15693-compliant HF (high frequency) transponders with dimensions of 25 x 15 x 48 mm are predestined for the use in and on smaller workpiece carriers.

The connection of the RFID readers to the respective cell controller, here the Simatic S7-300 throughout, is realized via the Profibus interface module ASM 456 with plug connection. At each of these modules, two RFID readers can be hooked up – alternatively also cameras of the series SimaticMV420/MV440, which in this project was done at one location.

1) Ferroelectric Random Access Memory
Eyeing a further Cost Reduction with RFID

The RFID system Simatic RF300 from Siemens is the standard in all PIA assembly systems, where there are not only read operations, but also write operations. At present, users and supplier are together examining the possibilities of using the even more cost-efficient Simatic RF200 system for simpler applications. Solutions with screw-in and highly heat-resistant transponders from the Simatic portfolio are also being considered. A further unification and standardization could be achieved with that – associated with an additional cost reduction.

Customized Assembly and Production Lines for the World Market

The Preh business division Preh IMA Automation (PIA) develops, plans, and builds flexible and powerful assembly facilities and production lines with a staff of about 420 people. The client portfolio includes companies from sectors as diverse as automotive, electronics, medical and pharmaceutical technologies, and consumer goods. The customer-specific manufacturing solutions include manual assembly workstations and automation systems with different cycle rates as well as fully automated production facilities with integrated inspection technology and data documentation. PIA has locations in Bad Neustadt/Saale (Germany), Amberg (Germany), and Ningbo (China).

The Preh GmbH is a subsidiary of Joyson Electronics of Ningbo (China), a stock-exchange-listed company (600699: Shanghai), and within the Joyson Group represents the division automotive electronics. As a globally positioned automotive supplier with a 95-year tradition, Preh achieved sales of 520 million euro (+12.5%) in 2013. The company currently employs 3,700 people and has locations in Germany, Portugal, Romania, Mexico, the USA, and China, with headquarters in Bad Neustadt/Saale (Germany). Preh’s development and manufacturing competencies are centered around automotive climate and driver control systems, ECUs for the battery management of electric vehicles, and assembly facilities.

Additional components at this and other PIA lines include portable Simatic Mobile Panels 177 PN for the visualization and operation of the cells, and either Simatic Industrial PCs for controlling multiple stations or Simatic Panels for controlling individual stations. Furthermore, powerful Simatic Rack PCs serve as inspection computers and visualization system for the entire facility. A special feature is the torque inspection of the seat adjusters, where Simotics S-1FK7 servo motors driven by Sinamics S120 converters simulate the counter torque.

As a rule, automation solutions must guarantee a technical availability exceeding 85%. Reliability and longevity are thus always of great importance. The largely universal use of Siemens automation technology is backed by the high acceptance among automotive manufacturers worldwide, which often also specify the Siemens brand, as well as the worldwide availability of spare parts and the worldwide support.