

**The company is using RFID-tagged kanban cards to replenish parts for production lines that make diesel fuel injectors.**

By Rhea Wessel

Feb. 25, 2009—[Bosch](#), the world's largest supplier of automotive parts, is employing RFID-tagged kanban cards to trigger the replenishment of components for the diesel fuel injectors it manufactures at two separate locations in Germany. The cards contain passive high-frequency (HF) RFID tags at one site, and passive ultrahigh-frequency (UHF) RFID tags at another.

At both plants, Bosch builds diesel fuel injectors on several production lines with machinery primarily controlled by computer. Workers oversee the machines and fill them with parts, such as screws and springs, as necessary. Before radio frequency identification was implemented, it sometimes took up to two hours for parts replenishment orders to be placed. The parts are stored in bins, and when a bin was filled with parts, a kanban card—printed with a bar-code number that identified the type of parts, as well as a human-readable number—was placed on that bin. Once the bins' contents were depleted, workers removed the kanban cards, which were collected from multiple points on the production line and driven to a work station. There, an employee would manually place orders by scanning the cards' bar codes by hand—an error-ridden process, since it was easy to overlook individual cards.

With the goal of speeding up the parts replenishment process, Bosch decided to attach RFID tags to the kanban cards and test the two different types of RFID technology. Because of an existing relationship with [Brooks Automation](#), a company that manufactures HF RFID readers, Bosch opted to test HF technology at its plant in Bamberg, in Bavaria. In Homburg, in the state of Saarland, the firm implemented the UHF RFID system, since it thought it may want to interrogate large batches of tagged kanban cards, or read them with portal readers—neither of which can be done easily with HF RFID tags, due to their shorter read range.

Martin Dobler, CTO of RFID software company [noFilis](#), which was involved in the project, says Bosch began developing the concept together with software maker [SAP](#) at the beginning of 2008. Hardware was selected in April of that year, and a pilot began in Homburg in May, and in Bamberg in July. [SAP Deutschland](#) served as the software integrator for the project, with noFilis as the device integrator and local companies providing hardware implementation. Bosch hired all of the parties independently, with no single firm serving as overall project integrator.

For the Bamberg deployment, Brooks Automation is supplying HF interrogators and tags that comply with the ISO 15693 standard and operate at 13.56 MHz. Each HF tag is encoded with a unique ID number that is not an EPC Gen 2 number, but that conforms to the same format and is generated by the SAP system that supports RFID use. The UHF tags operate at 868 MHz and comply with the EPC Gen 2 standard. When the tags are encoded, both types of tags are linked in the database to specific types of parts. The cards are repeatedly reused for the same components.

In Homburg, Bosch is employing [Feig Electronic](#) UHF readers and [UPM Raflatac](#) tags capable of near-field and far-field reading. At both locations—where the process is essentially the same—Bosch utilizes a total of 2,000 to 3,000 RFID tags that are laminated onto the printed kanban cards generated by the SAP system, Dobler says.

The automotive supplier selected SAP's Auto-ID Infrastructure (All) software module to integrate data collected via RFID and noFilis' CrossTalk Control Center software, which manages the RFID readers used in the application. Bosch has already deployed a total of 80 interrogators. When the implementation is completely installed in Bamberg and Homburg, the company intends to use a total of 200 readers for the kanban cards.

According to Dobler, both the UHF and HF systems have been functioning without problems, though Bosch has slowed down the rollout, given the global financial crisis and the drastic reduction of unit sales in the automotive industry, which has put suppliers around the world under intense pressure to lower their costs. However, he says, the application will continue to be implemented, albeit at a slower pace than had originally been planned.

At production sites outfitted with radio frequency identification, the work process has not changed. Employees emptying a container of parts into a production machine take the RFID-tagged kanban card off the container and place it into a specially built mailbox-like container with a built-in RFID reader and antenna. This is the first read point for the cards. Upon placing the cards into the box, a worker sees a green light indicating their RFID tags were successfully read. The system then orders replenishment parts. The CrossTalk software manages communication between the interrogators and the local server running the SAP application.

At different intervals throughout the workday, another employee collects cards from all of the mailboxes. The cards are then brought to the receiving area where ordered parts arrive. In that location, workers match kanban cards to the newly delivered parts bins, either by visually comparing the number printed on each kanban card with that on the container of parts, or by reading the bar codes on both.

Bosch experimented with a different type of mailbox for the cards during the pilot. Project partners developed what they dubbed an intelligent mailbox that accepts kanban cards only after their tags are read. If a read is impossible, the mailbox rejects the card, much like an automated payment machine rejects banknotes. Bosch is only using five of these mailboxes, however, since it determined that their higher cost was not justified by the benefit. Instead, Dobler says, the company decided it could depend on workers to make sure the green light appears each time an RFID-tagged kanban card is placed into the regular RFID mailbox.

The advantage of the HF system is that HF interrogators are less expensive than UHF readers, though HF tags tend to be more costly. On the other hand, Dobler says, the advantage of the UHF system is that cards can be read in bulk, or at a distance of up to 16 feet from an interrogator, while HF tags have a read range of just a few inches.

According to Dobler, CrossTalk helped Bosch implement systems based on two different types of technology into the company's single SAP ERP application. "We could make it irrelevant if the technology was HF or UHF and bring all the parts together," he says, adding that the implementation was a model project, given the large number of readers that needed to be configured and controlled, and the fact that numerous types of technology were used. Each Bosch location using the RFID system, he says, runs a CrossTalk software agent that controls the devices and transfers data to the central SAP system.

The two hours per day at each plant that Bosch saves on the replenishment process will bring the company a quick return on investment (ROI), Dobler says. Because of this promise of a fast ROI, the firm plans to roll out the system to a total of eight additional sites worldwide that build the same injectors. Most likely, he says, Bosch will choose to utilize HF RFID since the company desires the shorter read range of HF tags, and because HF readers are cheaper than UHF.