

SIMATIC Ident

Precisely assigning Tool Data

Radio Frequency Identification (RFID) for monitoring Tools in Automobile Manufacturing

A global automobile manufacturer relies on radio frequency identification (RFID) for identifying and monitoring machining tools in its North American plants. The RFID chips of the toolholders store the geometric and process data. RFID readers at the machining centers acquire the data and thus ensure a clear and precise assignment of workpiece, cutting tool and machining process.

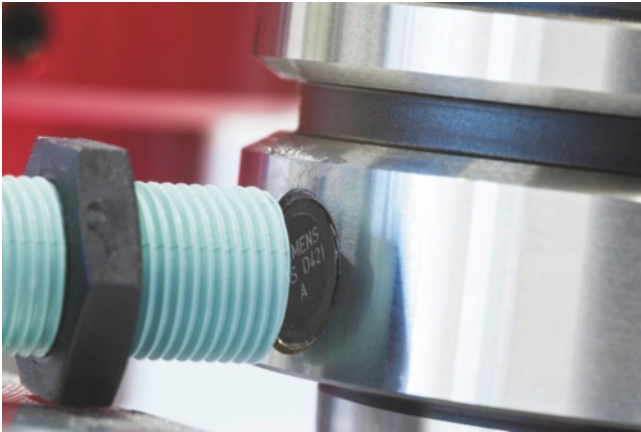
For decades, the MAPAL Dr. Kress KG has been among the leading providers of precision tools for metal machining. The more than 4100 employees of the consortium develop tool and process solutions for cubic components in close technology partnership with customers. MAPAL offers an extensive and technologically leading tool program for reaming, boring, drilling, milling, turning, actuating, clamping, setting and measuring applications. Furthermore, customers have access to a comprehensive range of services from the configuration of individual processes all the way to a cross-process tool management.

A highlight is the actuating tool TOOLTRONIC® with its fully interchangeable tool axis that enables the machining of parts, which otherwise could only be performed by special machines or tools, e.g., the machining of contours, recesses and non-cylindrical boreholes. With this mechatronic machining system, machine tools for five-axis machining gain an additional axis, which can be addressed by the machine control so that the full functionality of modern CNC controls can be utilized. For recording the tool data,

the tool can be equipped with an RFID data memory, which ensures a clear and precise assignment to the machining processes. By means of the non-contact identification, the associated machining program in the control of the CNC machine is retrieved.



For the flush installation of the data media MDS D421, holes are drilled into the tool. The read/write distance is eight millimeters.



After inserting the machining tool into the machine, it passes by the antenna. The RFID reader transmits the data to the machine control and initiates the necessary work steps.

RFID data memory the Flange of the Hollow Taper Shank (HSK)

Radio frequency identification (RFID) for identifying and monitoring machining tools has by now established itself in the automobile industry. Jochen Grundmann, vice president of operations at MAPAL USA, surmises that 99 percent of all machining tools of the automobile manufacturer in question have already been equipped with transponders. For several years, the automobile manufacturer has been employing cutting tools fitted with RFID transponders for the machining of engine blocks. The clear marking – in combination with modern software solutions – enables a gapless tool monitoring and management. As principal supplier of the RFID solutions for the worldwide production facilities, the automobile manufacturer chose Siemens. In accordance with specifications by the automaker, the data memory is permanently installed in the flange of the tool's hollow taper shank, which allows for its clear identification at the machining centers and prevents errors due to manual inputs.

The identification solution from Siemens is based on read/write devices of the series SIMATIC RF350R, which were selected because of their high performance and installed at the machining centers along the production lines. A production line includes between 20 and 30 CNC machines, which – depending on the task – are on average equipped with 50 individual tools. Since the tools wear out from continuous use and need to be replaced for servicing, a second tool set is required for an uninterrupted operation. To be on the safe side, a third set is kept in reserve.

Exact remaining Service Life thanks to mobile Data Memory

For the connection to the automation level, the SIMATIC readers feature an RS422 port. The interference-proof data transmission between the read/write stations and the mobile data media (tags) takes place via the connected circular antennas ANT 12 (alternatively, the reader RF210R could be used here). For the communication, the read/write devices are networked with PROFIBUS via the interface modules ASM 456. The distance between a transponder and the read head of the antenna is two to three millimeters.

After inserting the tool into the tool magazine of the production machine, it passes by the read head of the antenna, which thanks to its small dimensions can easily be mounted even in confined spaces. The read/write station transmits the data accompanying the tool to the CNC control, where it is saved together with the position number in the tool magazine. After completing the machining, the tool is removed from the machine and the remaining service life transmitted from the CNC memory to the transponder.

The MAPAL tools are fitted with passive data media MDS D421 by Siemens. They are designed for the tool encoding in accordance with DIN 69873 and can be used wherever small data media with exact positioning are required. For the flush installation of the ISO-15693-compatible tags, standardized, 10 mm blind holes are drilled into the flange of the tool's hollow taper shank. The storage media have a capacity of 2000 bytes and allow for up to 10^{10} read/write cycles. "This provides sufficient reserves even for growing requirements," states Grundmann.



For recording the tool data, the tools are equipped with RFID data media – ensuring a clear and precise assignment to the machining processes.

Accurate Measuring ensures High-Quality Parts

A central issue in tool management deals with the service life utilization. That is why the tools are measured in setting fixtures before going to the machines. The product-specific characteristics, which include setting parameters, service life, identification numbers and dimensions as well as cutting and wear data, are stored on the tags. The RFID reader reads this information and the CNC control points out an upcoming tool change to the operator, once the remaining service life has expired. The specification of fixed changing cycles allows planners to precisely match the tool logistics to them. Information about the remaining service life is of particular importance, if high-quality and expensive cutting tools are employed. The identification solution aids in avoiding excessive wear and tear on the tools and at the same time provides a gain in time for the service intervals.

The efficient tool management ranks among the central tasks in the CNC production. The increasing load on the production lines, however, reduces the time that a manufacturing company has for this. Here is where Siemens offers Tool Data Information (TDI). The software makes streamlining potential transparent, provides functions for the cost control and pinpoints possible savings. TDI gives an overview of the tools used and ensures that the tool data loop in the production is closed. In addition, the integration of cutting setting fixtures is possible. Grundmann continues: "The chip identification simplifies tasks such as the scheduling, storing, assembling, presetting and managing of the machining tools. Since all data related to the tool is located on the transponder, time-consuming manual inputs are no longer necessary. Furthermore, the identification solution gives an overview of the available tools and ensures that there is no interruption of the production processes due to missing tools."

MAPAL is not only a recognized tool expert, but also a specialist for the development and manufacturing of mechanical and electronic setting fixtures. After all, the

accurate measuring and setting of the cutting tools is a prerequisite for high-quality parts. The automaker employs MAPAL fixtures for the micro-precise measuring and setting of new and reground drill bits, milling cutters and reamers. Along with the RFID solution, the setting fixtures also facilitate and automate the reporting and documentation of the values measured. To save the measured data, the fixtures likewise work with RFID readers RF350R or the more compact RF210R for shorter distances, which write to the mobile data memory of the tools.

Accelerated and simplified Tool Change

"RFID greatly simplifies the tool management," ponders Jochen Grundmann. Otherwise, tool cards would have to be manually filled out and remaining service life be individually calculated. The RFID system supplies this information completely and free of errors. Additionally, tool cards recording all parameters for a clear assignment no longer get lost. The tool specialist underscores that the RFID solution not only simplifies the systematic acquisition of the data, but also accelerates the tool change. Grundmann continues: "Thanks to always updated chip data, the operator accurately knows when a tool change is due or how long a tool can still be used".

According to the operator, the RFID marking of the tools has fully met the expectations and is contributing to the reduction of the setup times. Grundmann in conclusion: "At the machining centers of the production facilities, high-quality and cost-intensive products are made. The mobile data media fitted to the tools ensure the clear assignment to the respective machining processes, which also allows the automobile manufacturer to use the tools in multiple machines. Based on the chip data, the machine control checks the plausibilities and provides for an error-free and reliable tool operation. Furthermore, the transponders document the tool life cycle and thus make any operational phase traceable."

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