



¹ Transponder in the insertion module

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RFIDS TRANSMIT SIGNALS THROUGH METAL

- **RFID TAGGING**
- **LF WIRELESS TRANSMISSION**
- **TRANSMISSION PATH THROUGH METAL**
- **READER FOR HARSH ENVIRONMENT (IP65)**
- **TRANSPONDER MEMORY 2048 BITS**

RFIDs in metal

Metal shields radiation in an excellent way – this is known by everyone who has ever tried to make a mobile call in a house made of reinforced concrete. The same problem occurs with RFID chips – small data memories, which are integrated into several objects and which transmit information to a reader. If they are integrated into a metallic object, the information does not reach the reader. However, the problem could be solved by dividing the transmission path. Now, the RFID chips are able to transmit the information to the reader, even if they are integrated into metal objects. The idea originates from the

request to achieve a clear identification of tool fixtures made of solid metal. A solution has been found to furnish insertion modules of the tool fixture with a transponder and to read it out while it is in operation.

Functional range

The system consists of a reader, an inductive transmission path and an LF transponder. The transmission path, consisting of several inductors, has been well adapted to a precision shaft of the Kelch GmbH. An insertion module, inserted into the precision shaft, is furnished with an RFID tag. The reader has got a USB interface



which can be used for the communication with a computer. If an insertion module should be readout, the computer transmits a command to the reader. Subsequently, the reader produces a signal that feeds the transponder in the insertion module with power and reads out the stored information. At the same time, the transponder possesses an internal storage whose content also can be changed over the transmission path.

Applications

During the manufacturing highest accuracy is required – every hundredth millimeter counts. Worn out cutter and drills could not offer the demanded accuracy. The employees have to measure the tools regularly, before they can be applied on the machine tool. For detecting smallest irregularities in the misalignment the tools rotate while measuring. So far, the measuring is done by hand. In doing so, the drills have to be attached with a suited adapter to a mounting, the shaft. A serial number, which is added to the adapter and the tool, and other data like the dimensions have to be copied by hand what leads to mistakes. For the first time, scientists of the Fraunhofer Institute for Microelectronic Circuits and Systems IMS in Duisburg have found, by order of Kelch GmbH, a possibility to

integrate RFID chips into metallic tools. On request, these small data memories transmit the required information to a reader outside the metallic shaft, which adjusts the tool with the adapter. From the RFID chip, which is located in the adapter, the data are firstly transmitted via cable to the interface between adapter and shaft. There, two aerial coils transmit the data wireless to the shaft – a transponder is in the insertion module, a readout coil is in the shaft. For selected customers a small series of the RFID measuring tools is already applied in devices of the Kelch GmbH. The transmission system can be used in all applications, where information has to be wireless transmitted over several paths – e.g. in robot arms which have got rotary joints.

Expertise of the Fraunhofer IMS

The expertise of the Fraunhofer IMS in the field of multifunctional transponder systems ranges from ASIC design, realisation of hard- and software components for RFID transponder and reader to the adaptation of application-specific demands. A special topic within the Kelch-project was the dimensioning of the antennas of the splitted transmission path.

Technical data

Transponder

Dimensions (cylindrical)	Ø 3,15 mm x 13 mm
Supply	passive
EEPROM memory	2048 Bit
operating temperature	-20°C up to +85°C

Reader

Supply	mains supply
Output Power	> 6,5 W
Interfaces	USB
operating temperature	-20°C up to +60°C
Antenna connector	BNC socket
Protection category	IP65