Monitoring of electrical energies in production

In addition to intelligent data processing, Industry 4.0 also requires the efficient use of resources. The permanent requirements regarding costs, increasing plant availability and other economic parameters are met by a detailed recording of energy consumption. The optimization is based on the analysis of the energy consumption of machines.
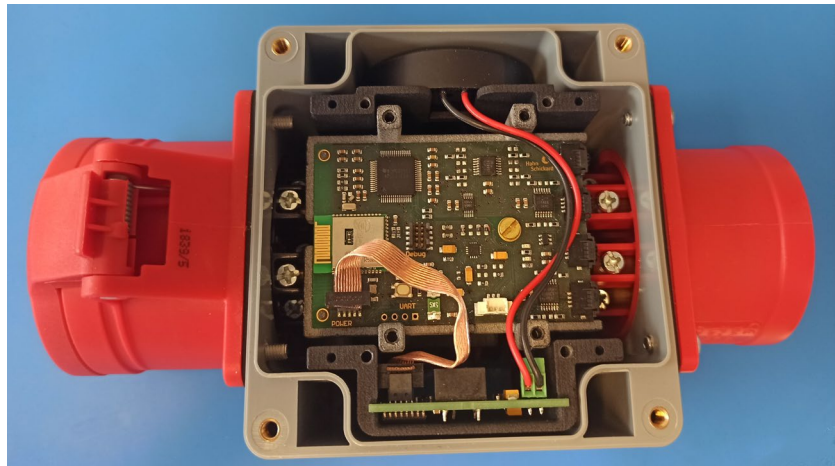

Fig. 1: Contactless TMR-based sensor to monitor energy in production e.g. for 16A applications

As part of the project, a contactless, real-time current measurement with tunnel magnetoresistance (TMR) sensors was developed. These sensors of magneto-resonance technology vary their resistance relative to magnetization in the two electrodes. Therefore, they are attached to circuit boards with a suitable amplifier circuit and spatially fixed in a custom-designed structure relative to the conductor to be measured. For three-phase current and the neutral conductor, four TMR sensors were installed in one housing. Custom-designed multilayer iron cores support the measurement by concentrating magnetic field. In order to calculate the current power values by the built-in microcontroller, the voltages on the four lines are also recorded, which shows the required cosine factor. The instantaneous current and voltage are streamed with 1600 sps (samples/s) and the power is transmitted every second.

The data measured by autonomous sensors are transmitted and visualized over Bluetooth Low Energy via gateways to an OPC-UA server. In addition to statistical purposes and the assessment by the system operator, the data are used primarily for automatic control of system components and for process monitoring. For example, significantly increased energy consumption can indicate an impending failure, i.e. energy monitoring as predictive maintenance. For such applications, collaboration with results from the other sub-projects is required, e.g. use of artificial intelligence algorithms.

Key features

- Data measuring with 8000 sps and transmitting with 1600 sps
- Contactless current measurement
- Sensors: Tunnel Magnetoresistance (TMR)
- Communication via Bluetooth Low Energy

Fields of application

- E-Meter
- Energy monitoring
- Cost allocation
- Analysing energy trends
- Predictive maintenance
- Industrial machines
- Building automation