

Precisely timed, high-resolution measurement technology for configuration and optimization of electric drives

EtherCAT-based test rig for eco-friendly electric car



→ OSCAR is a sporty, emission-free and safe city car for two people that runs on electricity and can reach speeds of up to 130 km/h (80.7 mph). With around 6 kWh of electricity, OSCAR can travel around 100 km (62 miles). This is equivalent to the amount of energy a modern car engine can extract from 1 liter of diesel. A further OSCAR advantage is that the electrical energy can be generated by renewable sources such as the sun, wind and water.

OSCAR creates zero emissions and provides energy efficiency through an innovative drive solution. It consists of a high-speed asynchronous machine (running at 25,000 rpm), an automatic two-speed gearbox, new high-energy batteries and advanced IGBT power electronics. The 1-liter car was developed by Akasol e.V., the academic solar engineering group at Darmstadt University of Technology in Germany. The test rig for configuration and optimization of the drive is controlled by Beckhoff equipment and was supplied by CuroCon GmbH, a partner company of Akasol.

Akasol validates this drive solution on a fully automated drive test rig that controls the drive train while dynamically taking into account different load cases, measures performance and other characteristics, and parameterizes it so that the drive efficiency is maximized under all driving conditions. "Key requirements are deterministic, precisely timed, high-resolution measurement technology and correspondingly fast and exact data acquisition and processing. The PC-based control platform from Beckhoff offers exactly the right solution," said Felix von Borck, director of Akasol.

EtherCAT enables sampling rates of < 1 millisecond

At the core of the control system is a Beckhoff Industrial PC C6901 with Windows XP operating system and TwinCAT PLC as the control software. EtherCAT, the Ethernet-based fieldbus, is used as bus system. In combination with the analog and digital EtherCAT input and output terminals, the test rig features sampling rates of less than a millisecond. "We were able to assemble the I/O elements required for the drive test rig from the comprehensive range of Beckhoff Bus Terminals. The openness of the system also enables convenient integration of serial interfaces (RS232) and subordinate bus systems, such as CANopen, directly into the terminal system," said Joachim Petersen, project engineer at CuroCon. "Sensor readings for temperature, motor current, switched motor voltage, speed and torque of the drive axes and the motor shaft are sampled and processed in real time."

Based on the LabView system, CuroCon developed the flexible CuroControl test rig software that controls the test rig and creates test schedules in conjunction with TwinCAT PLC software from Beckhoff. A Beckhoff Control Panel



Technical data

6 kWh/100 km
range: 100 to 300 km
max. speed: 130 km/h
length: 2.50 m
height: 1.55 m
width: 1.20 m

OSCAR, the sporty, emission-free city car for two people, only uses 6 kWh of electricity per 100 km (62 miles). This is roughly equivalent to the amount of energy a modern combustion engine can extract from 1 liter of diesel.



The electrical drive consists of high-speed, high-efficiency asynchronous motors with copper rotors and compact dimensions. The gear system is designed for high input speeds. An automated drive test rig with control equipment from Beckhoff optimizes the energy consumption of the drive system.

is used for visualization. Joachim Petersen is convinced: "The speed, modularity and flexibility of the Beckhoff hardware and software speak for themselves. The components are individually configurable, simple and practical to handle. We have no doubt that the next three test rigs will also be equipped with technology from Beckhoff."

→ Akasol e.V. www.akasol.de

→ CuroCon GmbH www.curocon.de