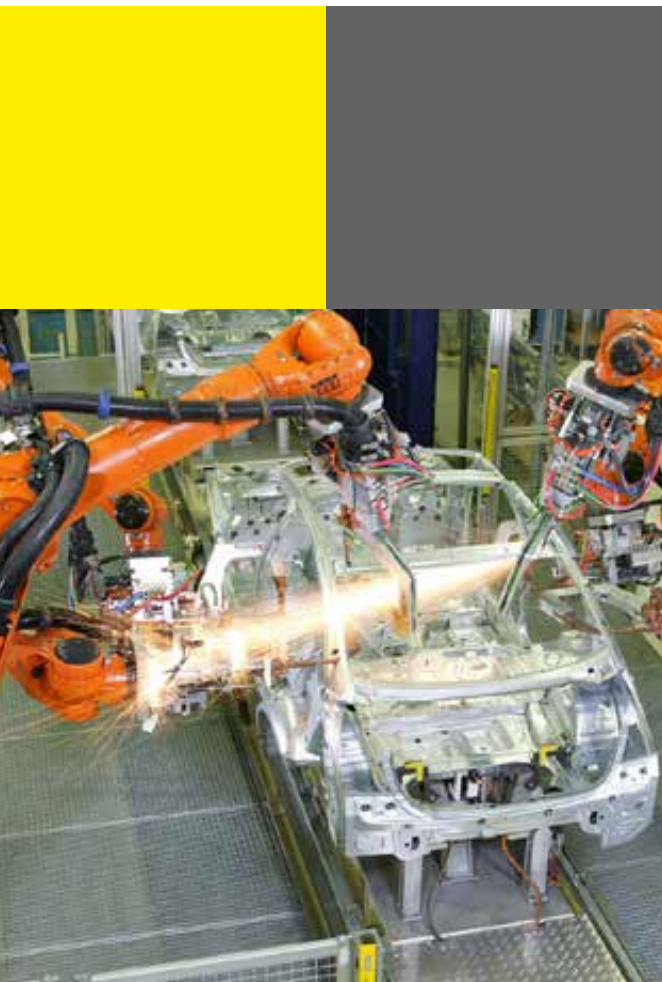


Case Study

Precision Power Scope **Helps KUKA Systems minimise robots' energy consumption**



The Yokogawa PX8000 Precision Power Scope is playing a key part in tests being carried out by KUKA Systems as part of a programme designed to minimise the energy consumption of the latest generation of industrial robots.

As a subsidiary of robotics and plant engineering company KUKA AG, KUKA Systems plans and implements automated production and assembly lines. A key focus of the company is the provision of complete solutions, including robots, for joining, assembly and handling operations in the automotive and other industries.

Energy consumption is becoming a key aspect in robotics, and KUKA is participating with around 50 other companies in a project supported by the German Ministry of Education & Research with the aim of achieving a 50% reduction of energy usage in the production of car bodies.

In order to assess the effectiveness of these measures, detailed information on the energy consumption of the components used in the production line and different robot activities are required. Some of these data are provided by the manufacturers of the system components while others are determined by appropriate measurements which allow KUKA to capture the actual energy consumption and try out various optimisation options. These tests



Tobias Zimmermann (KUKA Systems) measures the power consumption of the robot with the Yokogawa PX8000 Precision Power Scope.

include handling processes and spot welding, both of which involve very different movements.

In addition, KUKA takes into account the times when the robot is inactive, such as at night-time, by switching everything to “hibernate mode”, a state similar to the standby mode of consumer PCs, which can reduce consumption by 90%.

Each robot usually has a motor for each of the six axes, each controlled by a three-phase inverter. In the resting position a robot consumes about 700 W, which after 20 seconds at a standstill is automatically reduced to only 200 W. In the “hibernate” mode, the power consumption of the overall system is about 18 W, and in full operation it rises to peaks of about 60 kW. Added to this is the power consumption of the tools.

For measurements on the robots and other equipment KUKA Systems uses Yokogawa’s PX8000 Precision Power Scope with current clamps on all three phases on the power input of the controller. In addition to measuring power directly from the current and voltage waveforms, the instrument is also used to measure other signals.

“We deliberately chose this instrument because we wanted to capture very short pulses and spikes which typically occur in spot welding and during braking or acceleration processes”, says Matthias Paukner: “We also need to cover an enormous range, from a few thousand amperes during welding to quiescent currents of a few milliamps in hibernate mode. When searching for a suitable solution, we first used simple handheld power meters, then tried an oscilloscope and >>>

“We wanted to capture very short pulses and spikes”



KUKA robots

experimented with a modular system, but none of these solutions offered the combination of accuracy and versatility that we required.”

The PX8000 has proved particularly useful in demonstrating the effectiveness of certain measures that KUKA Systems has developed including special control programs that perform predetermined movements. In particular, the PX8000 has the ability to both record data and carry out subsequent analysis. This allows the measured values to be transmitted to a database containing data for a variety of

movement profiles from many different components of a production line. Currently about 300 different values are stored for each robot type. The measured power values then form the basis for the simulation of the energy consumption of an entire production hall.

“Our goal for energy savings is in the double-digit percentage range. The investment for the measures required for this purpose should be amortised within two to three years”, says project manager Matthias Paukner.

PX8000 Precision Power Scope

Like a power analyser, a precision power scope is capable of accurately measuring steady-state power and related variables, since they share the same input techniques and measurement principles. However, as it also shares characteristics of oscilloscopes and ScopeCorders, it is capable of capturing and measuring the power arbitrarily over any part of the power waveform using start and stop cursors. This is particularly useful for examining transient phenomena and in the design of periodically controlled equipment. The trigger functionality helps to set various trigger conditions based on the analysis of the transient phenomena to understand the behaviour of the system under test.

For more information on PX8000 Precision Power Scope, visit www.tmi.yokogawa.com/px8000



About Yokogawa Test & Measurement

Yokogawa has been developing measurement solutions for 100 years, consistently finding new ways to give R&D teams the tools they need to gain the best insights from their measurement strategies. The company has pioneered accurate power measurement throughout its history, and is the market leader in digital power analyzers.

Yokogawa instruments are renowned for maintaining high levels of precision and for continuing to deliver value for far longer than the typical shelf-life of such equipment. Yokogawa believes that precise and effective measurement lies at the heart of successful innovation - and has focused its own R&D on providing the tools that researchers and engineers need to address challenges great and small.

Yokogawa takes pride in its reputation for quality, both in the products it delivers - often adding new features in response

to specific client requests - and the level of service and advice provided to clients, helping to devise measurement strategies for even the most challenging environments.

The guaranteed accuracy and precision of Yokogawa's instruments results from the fact that Yokogawa has its own European standards laboratory at its European headquarters in The Netherlands.

This facility is the only industrial (i.e. non-government or national) organization in the world to offer accredited power calibration, at frequencies up to 100 kHz. ISO 17025 accreditation demonstrates the international competence of the laboratory.

Meet the Precision Makers at tmi.yokogawa.com

