Modular Automation System for Servo Welding Guns

The Nimak Automated Welding Technology GmbH has developed an automated control and HMI system for servo welding guns, which is capable of processing intricate parts – in particular for the automotive industry. The welding guns are driven by servo motors and possess separate, standardized servo control module boxes. In the maximum configuration level, Nimak integrates up to 30 standardized servo boxes – each one controlling six guns – in a common area control center. Their operation is monitored and visualized on a “Panel PC” from Siemens.

Connection-ready Servo Control Module Boxes

With the servo control module box (SCM), which Nimak developed for its X- and C-series welding guns, all gun functions can be set up and controlled onsite at the installation. The interface between the operator and the SCM is provided by a “Simatic OP7” operator panel, which allows the gun to be controlled manually, tolerances to be assigned and variables such as force, travel, torque, sink depth, wear-out values and motor parameters to be accessed. The force of the servo motors is programmable so that an individual force profile can be configured for each spot weld, which is then automatically executed by the gun.

The internal components communicate with each other via Profibus. The servo boxes as a whole are linked to the actual micro-controlled welding controller and the machine controller via a field-bus system. The master is usually the machine controller, which – after positioning the machine – initiates the closing of the guns and then the welding process. Each servo box can control either a fixed or – with an appropriate change system – up to six different, electronically encoded servo guns.

Compact Area Control Center

The integration of the SCMs into a higher-level area control center is carried out via the so-called multi-point interface of the PLC. The control center – running under the process visualization system “Simatic WinCC” – manages all process tags and stores them in long-term archives. It also collects system status and malfunction alarm messages for statistical analyses and process optimizations. For even more extensive tasks, multiple area control centers can be linked with each other and exchange data through various hardware channels and the TCP/IP protocol. On the hardware side, the area control center employs a “Simatic Panel PC 670” (with membrane keyboard and TFT display) that has been specifically designed for industrial applications, i.e. where increased temperatures, dust and vibration are present. Of particular note is the integrated Fast-Ethernet interface (10/100 Mbit/s), with which production and quality data can be transferred by means of TCP/IP to higher-level control systems or local as well as global company networks.

Trend towards Servo Technology

With roughly 250 employees at the German sites in Wissen and Nisterberg as well as in the United States, Great Britain, South Africa, Spain, Sweden, Italy and Australia, Nimak is trying to again deliver more than 2500 welding guns to various car manufacturers and leading automotive system houses. “There is a clear trend towards servo technology,” says sales manager Dipl.-Ing. Andreas Kölschbach. “Compared to pneumatic welding guns, servo-operated guns exhibit significantly less wear and tear and have lower operating costs.” The precisely adjustable servo motor carries out all opening and closing actions using an exact speed profile and process-optimized force.

Thanks to the greater and freely programmable travel range of the welding guns, obstacles in the process path of the machine can be bypassed more closely and flexibly, resulting in faster cycle times. The buildup of force before making a spot weld now only takes about a fifth of the previously required time. A further electronic equalization provides for a “floating” bearing of the guns, which prevents mechanical damage to the welded part and welding inaccuracies. Servo technology also stops sparking, which minimizes the burn damage to the welding caps. Other time-saving advantages of the servo technology include simple teach-in and transfer of welding positions to the controller. When servo technology is consequently employed and utilized, the costly use of compressed air can be reduced or eliminated completely, which has already become a reality in the first, fully automated servo welding operation of the German automotive industry.